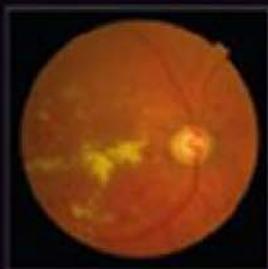
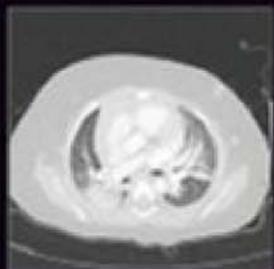




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CLINICAL ATLAS OF HUMAN ANATOMY



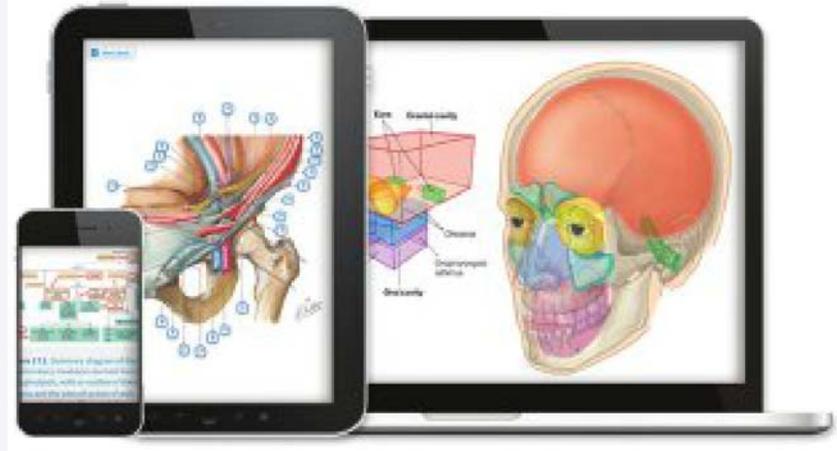
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Peter H. Abrahams
Jonathan D. Spratt
Marios Loukas
Albert N. van Schoor

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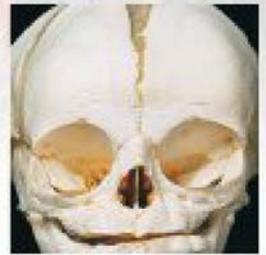
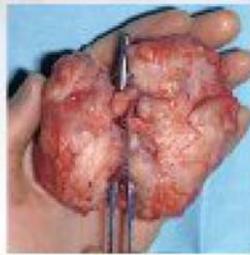
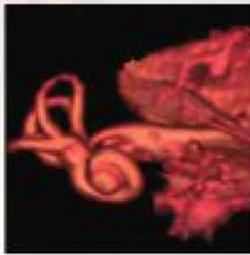


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EIGHTH EDITION

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Preface and Dedication

“To our patients and long-suffering families and spouses who do not see us enough and to our students on four continents who seem to see a bit too much of us!”

This new 8th edition based on the original McMinn Colour Atlas (1977) has now been updated and integrated with modern imaging anatomy, clinical case studies and 3D videos of most anatomical structures. Over the last 40 years (8 editions) the original book has moved with the times and benefited from the anatomical expertise of many international stars including Ralph Hutchings, Bari Logan and Professors John Pegington (UK), Sandy Marks (USA) and Hanno Boon (RSA) – all who made their own separate unique contributions (see the sixth and seventh edition dedications and prefaces in the Student Consult eBook (www.studentconsult.com)).

For over 25 years Peter Abrahams has been the driving force keeping the first ever full-colour photographic dissection atlas so relevant today; with updates on clinical practice and modern techniques, as well as the addition of numerous radiological modalities. This edition brings new coloured dissections, most of which were performed at the 3rd Hanno Boon Masterclass, held in 2016 at SGU, Grenada (see photo in the [Acknowledgements](#)). Marios Loukas from Grenada, WI and Albert van Schoor from Pretoria, RSA – two younger generation academic anatomists – have now been working with Jonathan Spratt, our consultant radiologist, to keep this atlas on the international cutting edge of anatomy as integrated into clinical medicine.

This is best illustrated by the clinical topics displayed as bullets at the bottom of each page as a guide to over 2000 clinical photographs and case vignettes plus 250+ 3D videos, all of which are in the Student Consult eBook (www.studentconsult.com). This unique feature for any anatomical dissection atlas is the combined cases from Abrahams and Spratt plus 120 clinical colleagues from across the globe – see the [acknowledgements](#) in the present edition and from the sixth and seventh edition in the Student Consult eBook (www.studentconsult.com). We are truly grateful to all our donors, patients and their doctors for this unique anatomical treasure trove from six continents spanning over 70 years. Another bonus in this 8th edition is a completely new 25-page neuroanatomy and cranial nerve section, with many new dissections and brain cross-sections matched with MR scans to show the cranial nerves in situ. Lastly, but not least, we have improved chapter 7 on Lymphatics – difficult to see in the dissection room but essential to the clinical understanding of disease, especially cancer spread. We have expanded and coloured much of the lymphatic section to illustrate this most important system clinically but which is rarely actually dissected in atlases and texts.



We, the authors – all of whom teach on a daily basis to both anatomical science students and clinical postgraduate medics – feel that the understanding of the human body is best retained by learning anatomical structures in a clinical context. Hence the inclusion on almost every dissection page of this atlas of radiology, endoscopy and real clinical cases backed up by 3D angiograms, scans and some pathological cases to emphasise the normal anatomy within its clinical context.

For additional electronic content (at www.studentconsult.com) look out for the following throughout the book:

-  Go online to view 200+ video loops and 3D rotations
-  Clinical images: Go online to view 2000+ clinical cases

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Acknowledgements

Dissections

Heartfelt thanks to all our **donors and their families** for the ultimate donation to benefit mankind and future generations of medical knowledge. This supreme gift to society educates and enriches the human experience for generations to come, for today's medical students are tomorrow's clinicians worldwide.

The production of this atlas and accompanying Student Consult eBook (www.studentconsult.com) has been a huge team effort over 5 years and has involved prosectors, professors, teachers and students from across five continents. We, the four authors, would like to thank all those who worked with us to deliver this new exciting clinical anatomy atlas and accompanying linked clinical Student Consult eBook.

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Many of the new dissections were carried out at the 3rd Hanno Boon Masterclass in Grenada in December of 2016. Those contributing their skills and in so honouring the international memory of Professor Hanno Boon (R.I.P.) were Vicky Cottrell, Paul Dansie, Maira du Plessis, Richard Tunstall, Erin Fillmore, Shiva Mathurin, James Coey, Natalie Keough assisted by Yvonne James (see photo).

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User Guide

This book is arranged in the general order 'head to toe'. The Head and Neck section (including neuroanatomy and cranial nerves) is followed by the Vertebral column and spinal cord, then Upper limb, Thorax, Abdomen and pelvis, Lower limb and finally a special section on Lymphatics. In each section, skeletal elements are shown first followed by dissections, with surface anatomy views and correlated imaging included for orientation. All structures are labelled by numbers, and these are identified in lists beside each image. Text has been limited to that needed to understand each preparation, and is not intended to be comprehensive. All clinical bullets at the bottom of most pages lead to the topics in the Student Consult eBook (www.studentconsult.com) with over 2000 images and video loops as illustration of these conditions.



The 3rd Hanno Boon memorial dissection masterclass participants, Grenada, 2016.

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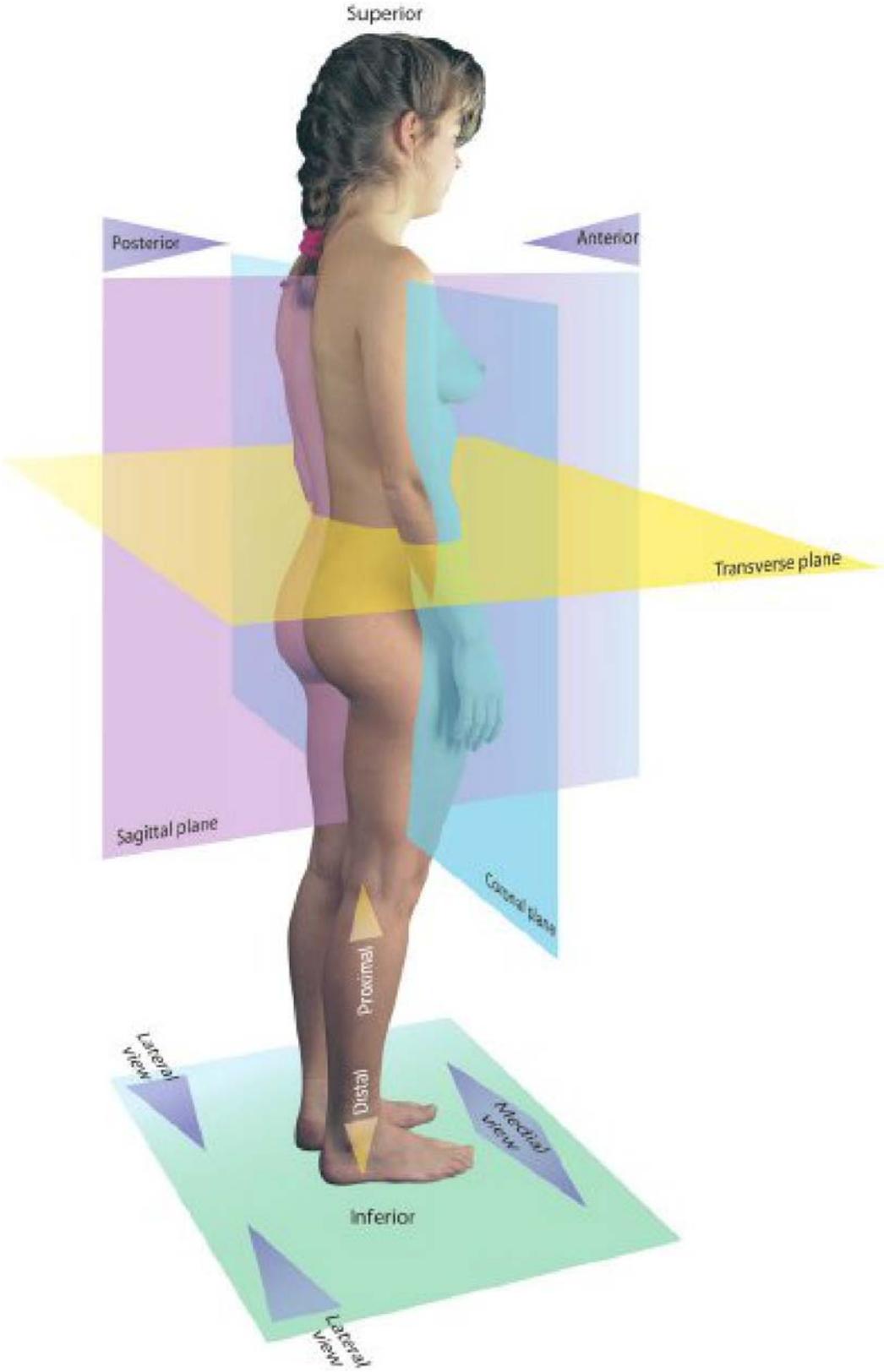
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Orientation



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Sixth-edition Acknowledgements

An atlas of this kind is not only the work of the authors but of numerous technical, scientific and clinical friends and colleagues who have been so generous of their knowledge and given permission for the inclusion of their original photographs of clinical cases. Hopefully, like the Carlsberg advert, this book and DVD are 'probably the greatest image collection of clinical anatomy cases in the world'. However, this dissection atlas would not be possible were it not for the talents of a special group of people – the prosectors and dissectors listed below.

Dissections Hanno Boon Masterclass, June 2005, Pretoria.

The following professors, doctors and students worked closely together as a team to honour the name of Professor Hanno Boon who had been their student, friend, mentor and an inspiration (see Dedication).

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Clinical cases

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Dissections

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Nkhensani Mogale, University of Johannesburg, South Africa.

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The second Hanno Boon memorial dissection masterclass participants, Grenada, 2011.

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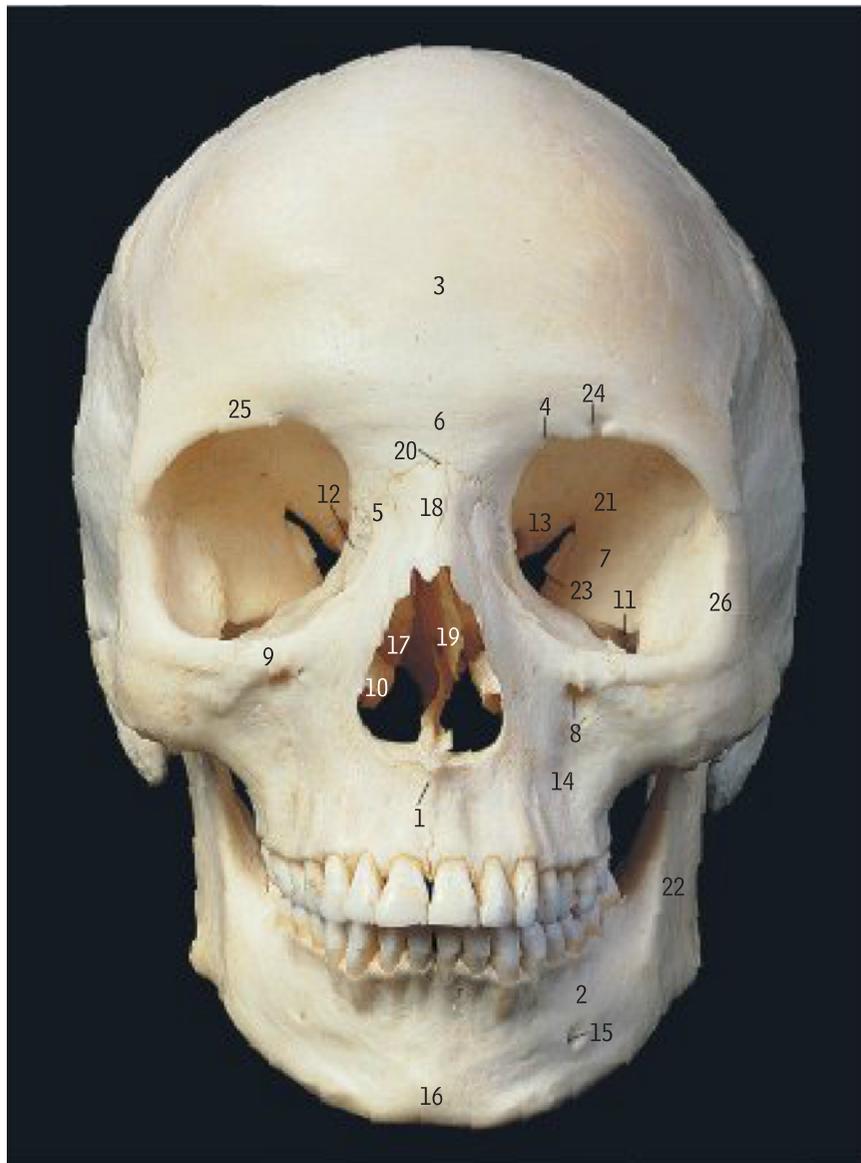
Pretoria, South Africa; Dr. PS Levay and Prof. D van Zyl, Department of Internal Medicine, Kalafong Hospital, University of Pretoria, South Africa; Dr. AK Mynhardt, University of Pretoria, South Africa; Dr. MY Gamielien, Oral & Dental Hospital, University of Pretoria, South Africa; Members of the Department of Plastic and Reconstructive Surgery, University of Limpopo (Medunsa campus), South Africa; Dr. Richard Wellings, Consultant Radiologist and Hon Associate Professor, UHCW Trust and Warwick Medical School, United Kingdom; Ms. Kavita Singh and Mr. Janos Balega, Consultant

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Head, neck and brain



Skull from the front



- 1 Anterior nasal spine
- 2 Body of mandible
- 3 Frontal bone
- 4 Frontal notch
- 5 Frontal process of maxilla
- 6 Glabella
- 7 Greater wing of sphenoid bone
- 8 Infra-orbital foramen
- 9 Infra-orbital margin
- 10 Inferior nasal concha
- 11 Inferior orbital fissure
- 12 Lacrimal bone
- 13 Lesser wing of sphenoid bone
- 14 Maxilla
- 15 Mental foramen
- 16 Mental protuberance
- 17 Middle nasal concha
- 18 Nasal bone
- 19 Nasal septum
- 20 Nasion
- 21 Orbit (orbital cavity)
- 22 Ramus of mandible
- 23 Superior orbital fissure
- 24 Supra-orbital foramen
- 25 Supra-orbital margin
- 26 Zygomatic bone



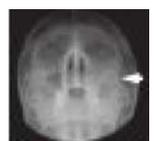
The term 'skull' includes the mandible, and 'cranium' refers to the skull without the mandible.

The calvarium is the skull (cranial vault or skull-cap) and is the upper part of the cranium that encloses the brain.

The front part of the skull forms the facial skeleton.

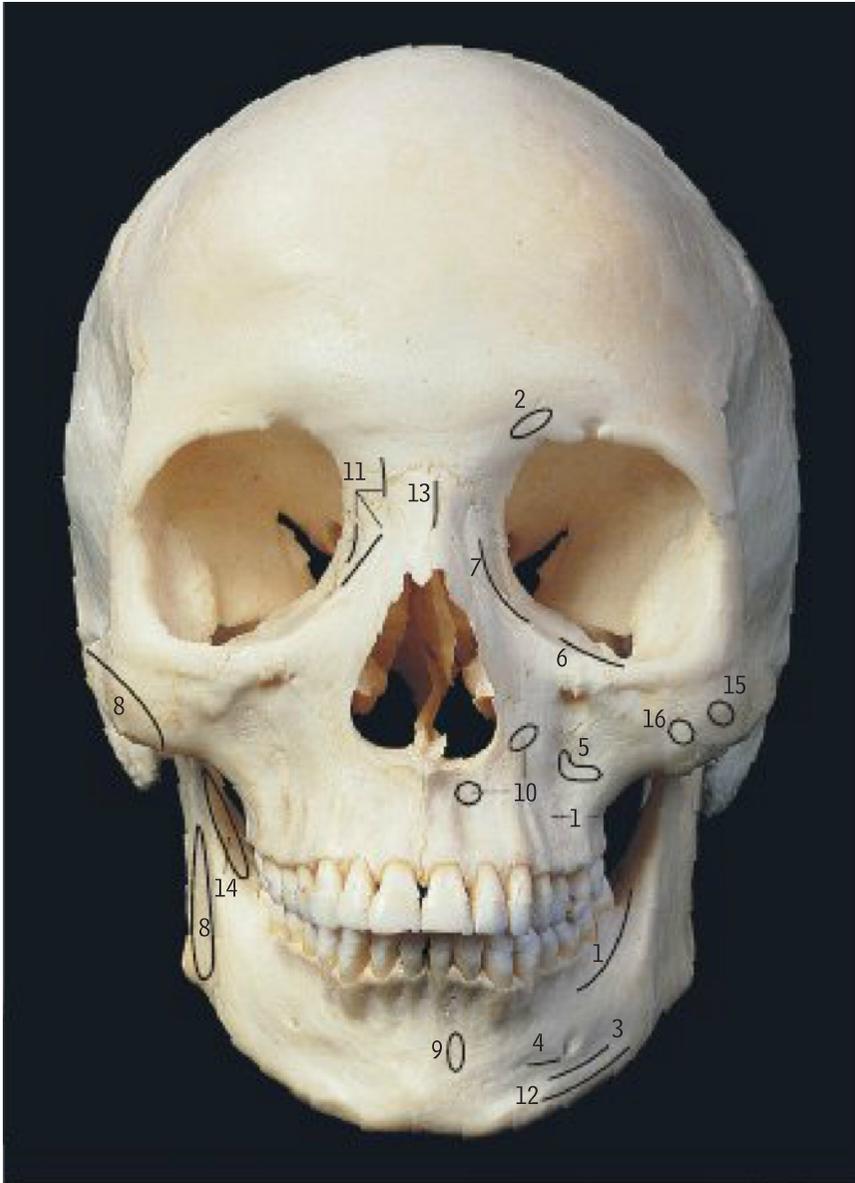
The supra-orbital, infra-orbital and mental foramina (24, 8 and 15) lie in approximately the same vertical plane.

Details of individual skull bones are given on [pages 18–27](#), of the bones of the orbit and nose on [page 12](#), and of the teeth on [pages 13 and 16–19](#).



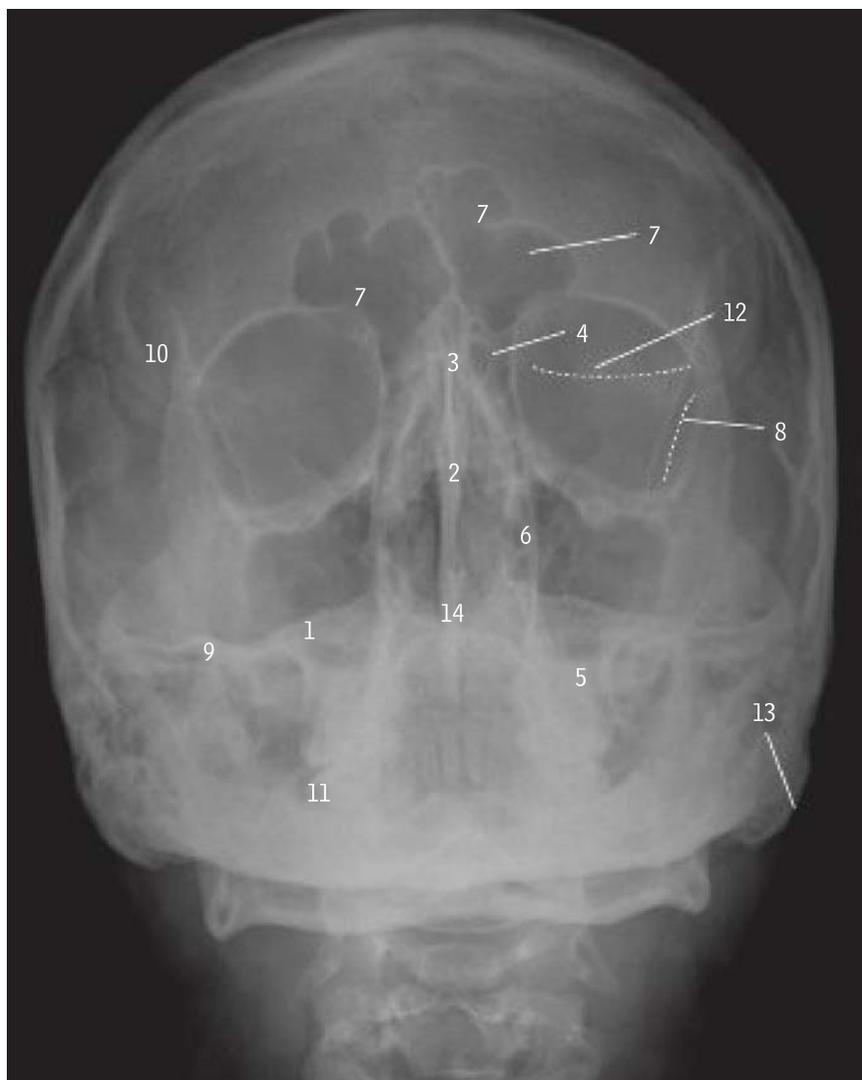
Tripod fracture

Skull muscle attachments, from the front



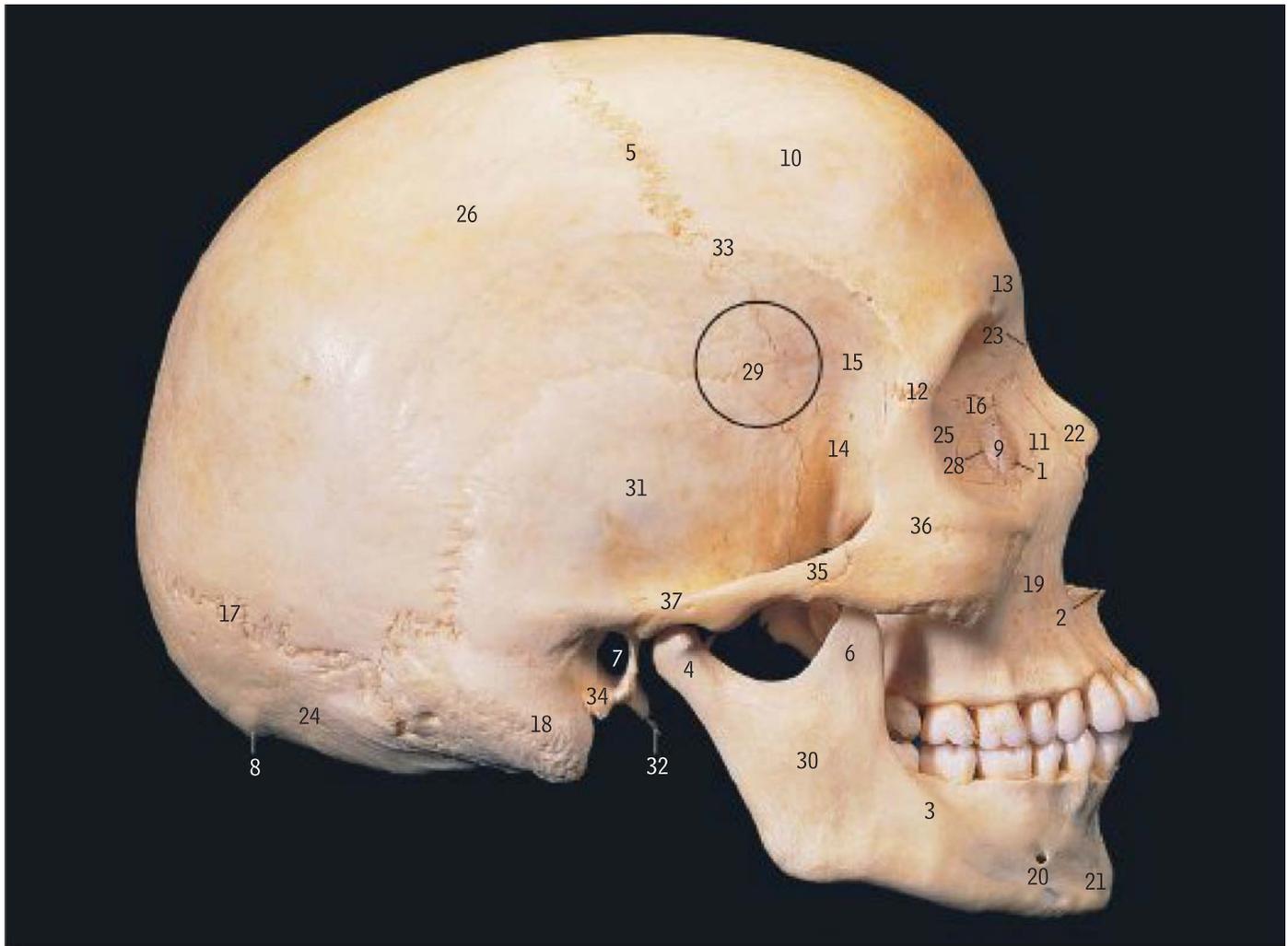
- 1 Buccinator
- 2 Corrugator supercilii
- 3 Depressor anguli oris
- 4 Depressor labii inferioris
- 5 Levator anguli oris
- 6 Levator labii superioris
- 7 Levator labii superioris alaeque nasi
- 8 Masseter
- 9 Mentalis
- 10 Nasalis
- 11 Orbicularis oculi
- 12 Platysma
- 13 Procerus
- 14 Temporalis
- 15 Zygomaticus major
- 16 Zygomaticus minor

Skull radiograph, occipitofrontal 15° projection



- 1** Basi-occiput
- 2** Body of sphenoid
- 3** Crista galli
- 4** Ethmoidal air cells
- 5** Floor of maxillary sinus (antrum)
- 6** Foramen rotundum
- 7** Frontal sinus
- 8** Greater wing of sphenoid
- 9** Internal acoustic meatus
- 10** Lambdoid suture
- 11** Lateral mass of atlas (first cervical vertebra)
- 12** Lesser wing of sphenoid
- 13** Mastoid process
- 14** Nasal septum

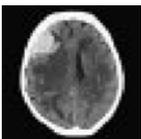
Skull from the right



- | | | | |
|---|-------------------------------------|---|---------------------------------------|
| 1 Anterior lacrimal crest | 9 Fossa for lacrimal sac | 19 Maxilla | 30 Ramus of mandible |
| 2 Anterior nasal spine with tympanic ring | 10 Frontal bone | 20 Mental foramen | 31 Squamous part of temporal bone |
| 3 Body of mandible | 11 Frontal process of maxilla | 21 Mental protuberance | 32 Styloid process of temporal bone |
| 4 Condylar process of the mandible | 12 Frontozygomatic suture | 22 Nasal bone | 33 Superior temporal line |
| 5 Coronal suture | 13 Glabella | 23 Nasion | 34 Tympanic part of temporal bone |
| 6 Coronoid process of mandible | 14 Greater wing of sphenoid bone | 24 Occipital bone | 35 Zygomatic arch |
| 7 External acoustic meatus of temporal bone | 15 Inferior temporal line | 25 Orbital plate of ethmoid bone | 36 Zygomatic bone |
| 8 External occipital protuberance (inion) | 16 Lacrimal bone | 26 Parietal bone | 37 Zygomatic process of temporal bone |
| | 17 Lambdoid suture | 27 Pituitary fossa (sella turcica) (see Figure A on page 5) | |
| | 18 Mastoid process of temporal bone | 28 Posterior lacrimal crest | |
| | | 29 Pterion (encircled) | |

Pterion (29) is not a single point but an area where the frontal (10), parietal (26), squamous part of the temporal (31) and greater wing of the sphenoid bone (14) adjoin one another.

It is an important landmark for the anterior branch of the middle meningeal artery, which underlies this area on the inside of the skull (page 17).

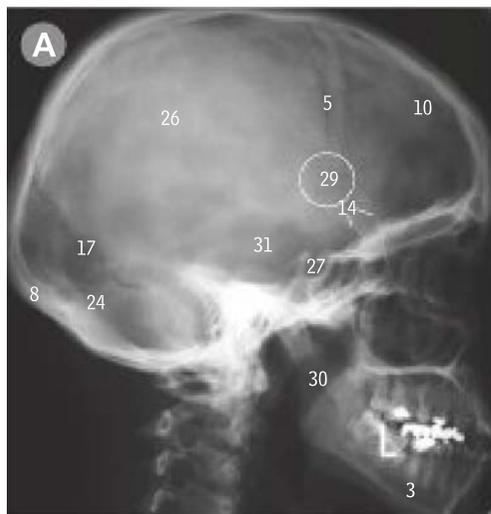


Extradural haemorrhage

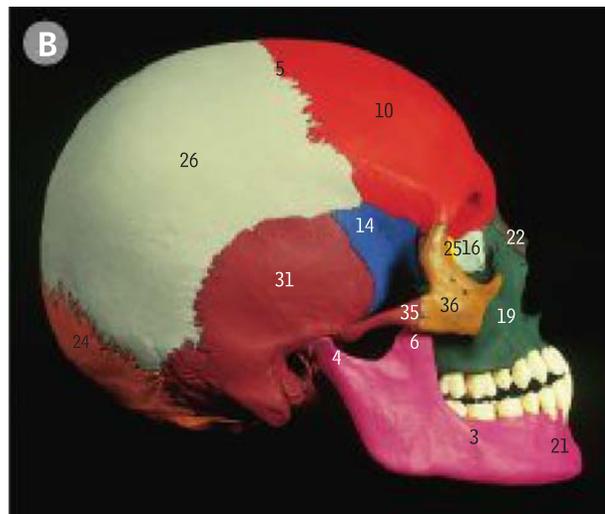


Skull

radiograph, lateral projection



coloured bones

See label list on [page 4](#) for A and B labels

scalp dissection



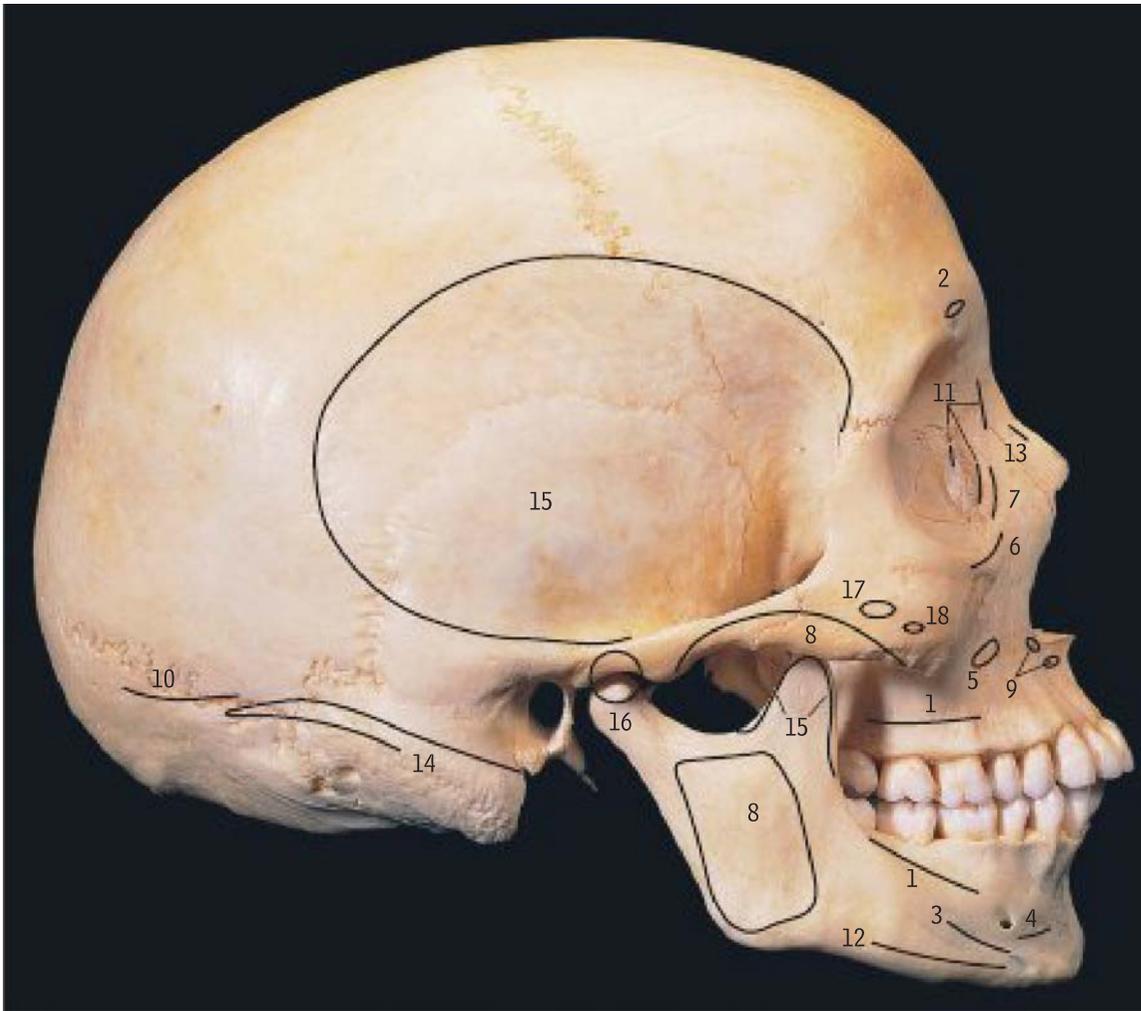
Scalp layers

S, skin; C, connective tissue; A, aponeurosis of occipitofrontalis; L, loose areolar tissue; P, periosteum.

- 1 Aponeurosis of occipitofrontalis
- 2 Dura mater
- 3 Frontalis muscle (covered by loose areolar tissue)
- 4 Loose areolar tissue
- 5 Middle meningeal artery impression on dura mater
- 6 Parietal branch of the superficial temporal artery
- 7 Periosteum
- 8 Skin
- 9 Subcutaneous tissue
- 10 Temporal bone
- 11 Temporal fascia
- 12 Temporalis muscle



Skull muscle attachments, from the right



- 1 Buccinator
- 2 Corrugator supercilii
- 3 Depressor anguli oris
- 4 Depressor labii inferioris
- 5 Levator anguli oris
- 6 Levator labii superioris
- 7 Levator labii superioris alaeque nasi
- 8 Masseter
- 9 Nasalis
- 10 Occipital part of occipitofrontalis
- 11 Orbicularis oculi
- 12 Platysma
- 13 Procerus
- 14 Sternocleidomastoid
- 15 Temporalis
- 16 Temporomandibular joint
- 17 Zygomaticus major
- 18 Zygomaticus minor

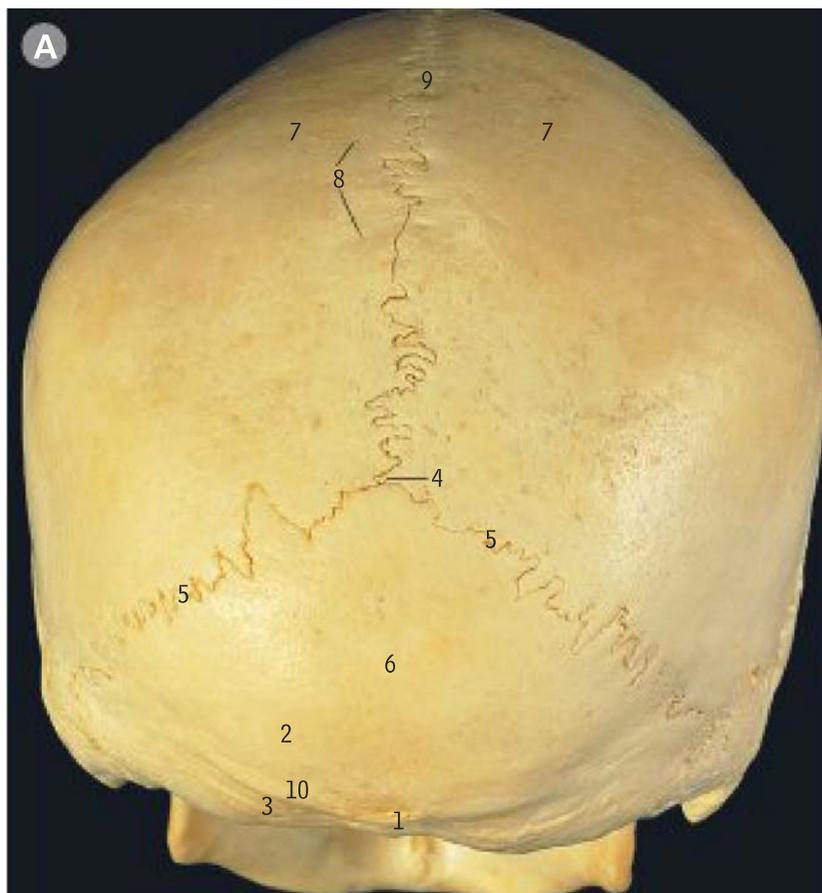
The bony attachments of the buccinator muscle (1) are to the upper and lower jaws (maxilla and mandible) opposite the three molar teeth. (The teeth are identified on [page 13](#).)

The upper attachment of temporalis (upper 15) occupies the temporal fossa (the narrow space above the zygomatic arch at the side of the skull). The lower attachment of temporalis (lower 15) extends from the lowest part of the mandibular notch of the mandible, over the coronoid process and down the front of the ramus almost as far as the last molar tooth.

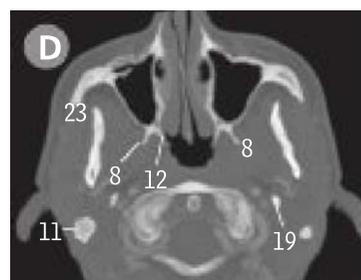
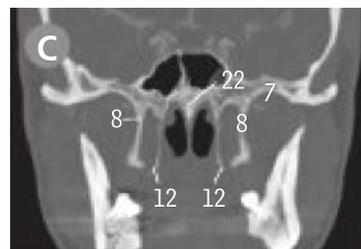
Masseter (8) extends from the zygomatic arch to the lateral side of the ramus of the mandible.



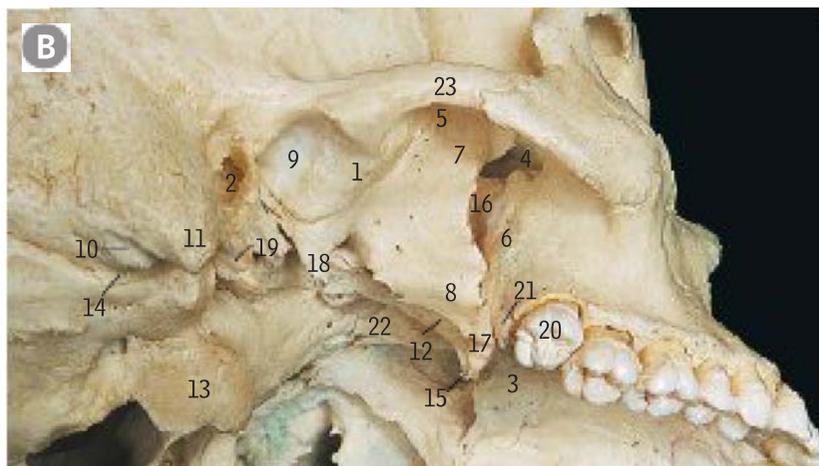
Temporomandibular joint (TMJ) dislocation

Skull from behind

- 1 External occipital protuberance (inion)
- 2 Highest nuchal line
- 3 Inferior nuchal line
- 4 Lambda
- 5 Lambdoid suture
- 6 Occipital bone
- 7 Parietal bone
- 8 Parietal foramina
- 9 Sagittal suture
- 10 Superior nuchal line



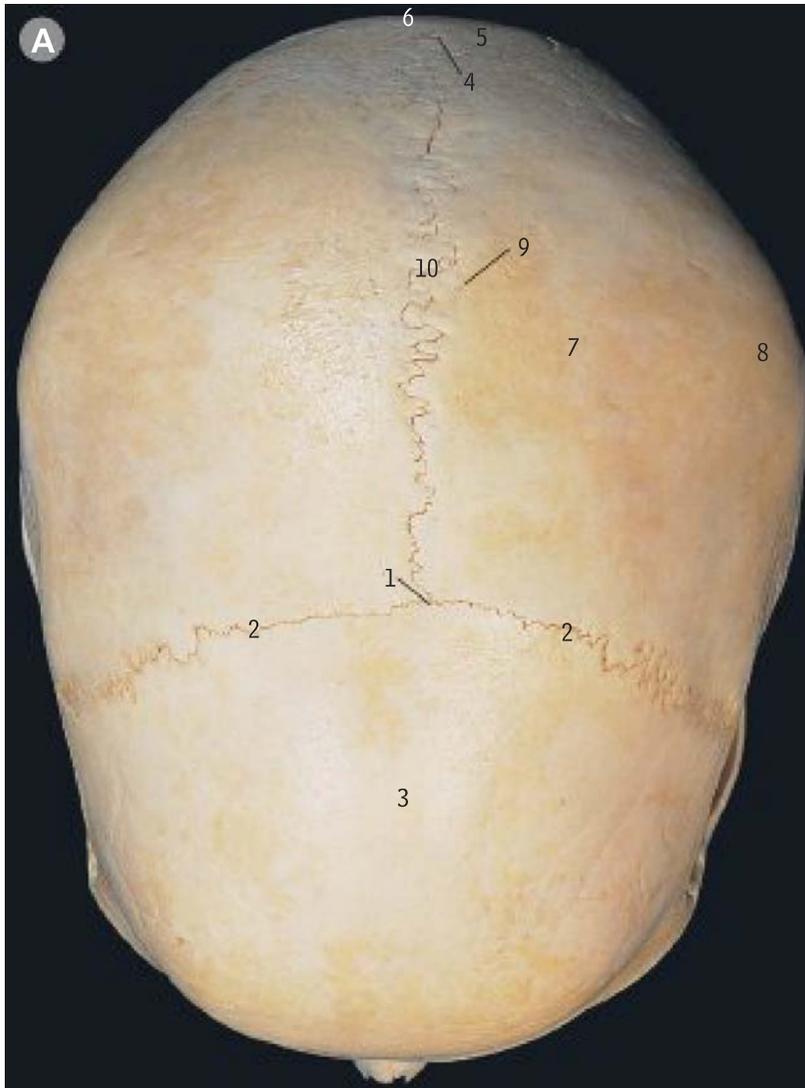
See label list below for C and D.

Skull right infratemporal region, obliquely from below

- 1 Articular tubercle
- 2 External acoustic meatus
- 3 Horizontal plate of palatine bone
- 4 Inferior orbital fissure
- 5 Infratemporal crest
- 6 Infratemporal (posterior) surface of maxilla
- 7 Infratemporal surface of greater wing of sphenoid bone
- 8 Lateral pterygoid plate
- 9 Mandibular fossa
- 10 Mastoid notch
- 11 Mastoid process
- 12 Medial pterygoid plate
- 13 Occipital condyle
- 14 Occipital groove
- 15 Pterygoid hamulus
- 16 Pterygomaxillary fissure and pterygopalatine fossa
- 17 Pyramidal process of palatine bone
- 18 Spine of sphenoid bone
- 19 Styloid process
- 20 Third maxillary molar tooth
- 21 Tuberosity of maxilla
- 22 Vomer
- 23 Zygomatic arch



Skull from above



- 1 Bregma
- 2 Coronal suture
- 3 Frontal bone
- 4 Lambda
- 5 Lambdoid suture
- 6 Occipital bone
- 7 Parietal bone
- 8 Parietal eminence
- 9 Parietal foramen
- 10 Sagittal suture

In this skull, the parietal eminences are prominent (A8).

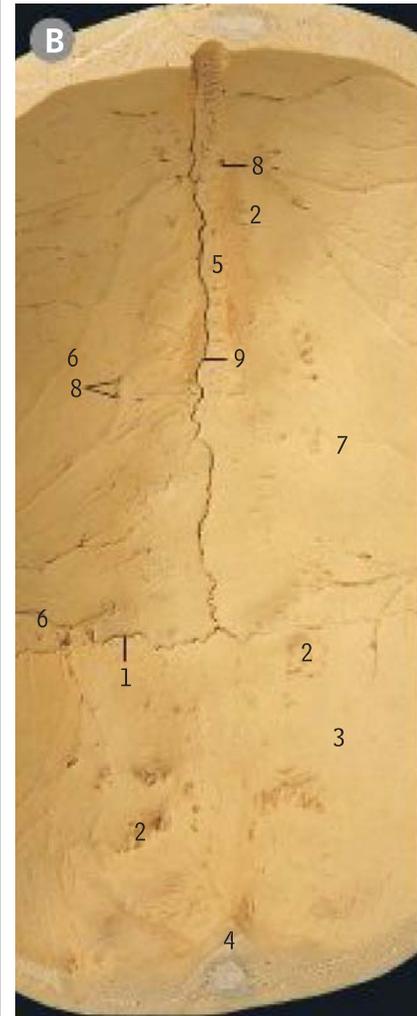
The point where the sagittal suture (A10) meets the coronal suture (A2) is the bregma (A1). At birth, the unossified parts of the frontal and parietal bones in this region form the membranous anterior fontanelle (page 14, D1).

The point where the sagittal suture (A10) meets the lambdoid suture (A5) is the lambda (A4). At birth, the unossified parts of the parietal and occipital bones in this region form the membranous posterior fontanelle (page 14, C13).

The label A3 in the centre of the frontal bone indicates the line of the frontal suture in the fetal skull (page 14, A5). The suture may persist in the adult skull and is sometimes known as the metopic suture.

The arachnoid granulations (page 62, B1), through which cerebrospinal fluid drains into the superior sagittal sinus, cause the irregular depressions (B2) on the parts of the frontal and parietal bones (B3 and 7) that overlie the sinus.

Skull internal surface of the cranial vault, central part



- 1 Coronal suture
- 2 Depressions for arachnoid granulations
- 3 Frontal bone
- 4 Frontal crest
- 5 Groove for superior sagittal sinus
- 6 Grooves for middle meningeal vessels
- 7 Parietal bone
- 8 Parietal foramina
- 9 Sagittal suture

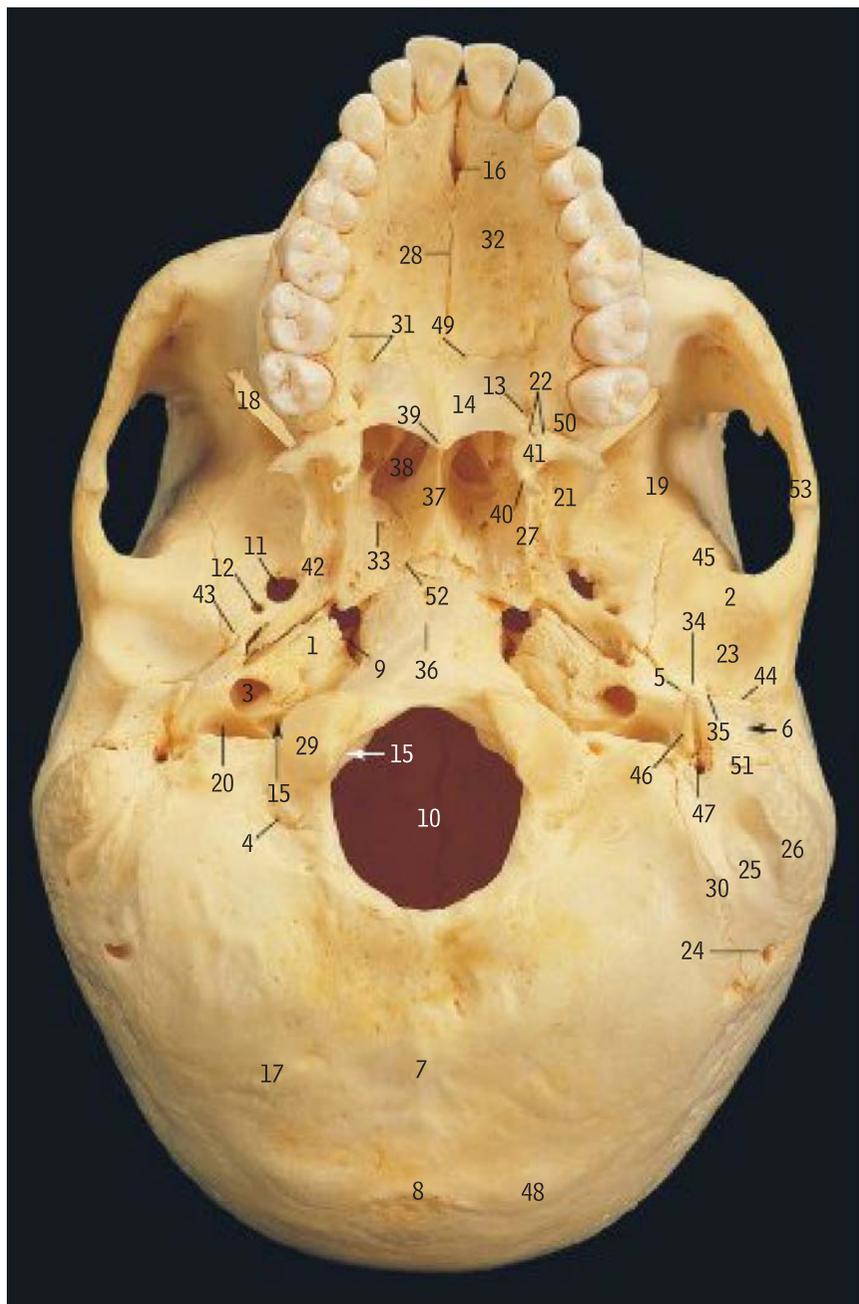


Pepperpot skull

Skull

external surface of the base

- 1 Apex of petrous part of temporal bone
- 2 Articular tubercle
- 3 Carotid canal
- 4 Condylar canal (posterior)
- 5 Edge of tegmen tympani
- 6 External acoustic meatus
- 7 External occipital crest
- 8 External occipital protuberance
- 9 Foramen lacerum
- 10 Foramen magnum
- 11 Foramen ovale
- 12 Foramen spinosum
- 13 Greater palatine foramen
- 14 Horizontal plate of palatine bone
- 15 Hypoglossal canal (proximal & distal openings)
- 16 Incisive fossa
- 17 Inferior nuchal line
- 18 Inferior orbital fissure
- 19 Infratemporal crest of greater wing of sphenoid bone
- 20 Jugular foramen
- 21 Lateral pterygoid plate
- 22 Lesser palatine foramina
- 23 Mandibular fossa
- 24 Mastoid foramen
- 25 Mastoid notch
- 26 Mastoid process
- 27 Medial pterygoid plate
- 28 Median palatine (intermaxillary) suture
- 29 Occipital condyle
- 30 Occipital groove
- 31 Palatine grooves and spines
- 32 Palatine process of maxilla
- 33 Pharyngeal canal
- 34 Petrosquamous fissure
- 35 Petrotympanic fissure
- 36 Pharyngeal tubercle
- 37 Posterior border of vomer
- 38 Posterior nasal aperture (choana)
- 39 Posterior nasal spine
- 40 Pterygoid hamulus
- 41 Pyramidal process of palatine bone
- 42 Scaphoid fossa
- 43 Spine of sphenoid bone
- 44 Squamotympanic fissure
- 45 Squamous part of temporal bone
- 46 Styloid process
- 47 Stylomastoid foramen
- 48 Superior nuchal line
- 49 Transverse palatine (palatomaxillary) suture
- 50 Tuberosity of maxilla
- 51 Tympanic part of temporal bone
- 52 Vomerovaginal canal
- 53 Zygomatic arch



The palatine processes of the maxilla (32) and the horizontal plate of the palatine bone (14) form the hard palate (roof of the mouth and floor of the nasal cavity).

The carotid canal (3), recognized by its round shape on the inferior surface of the petrous part of the temporal bone, does not pass straight upwards to open into the inside of the skull but takes a right-angled turn forwards and medially within the petrous temporal to open into the back of the foramen lacerum (9).

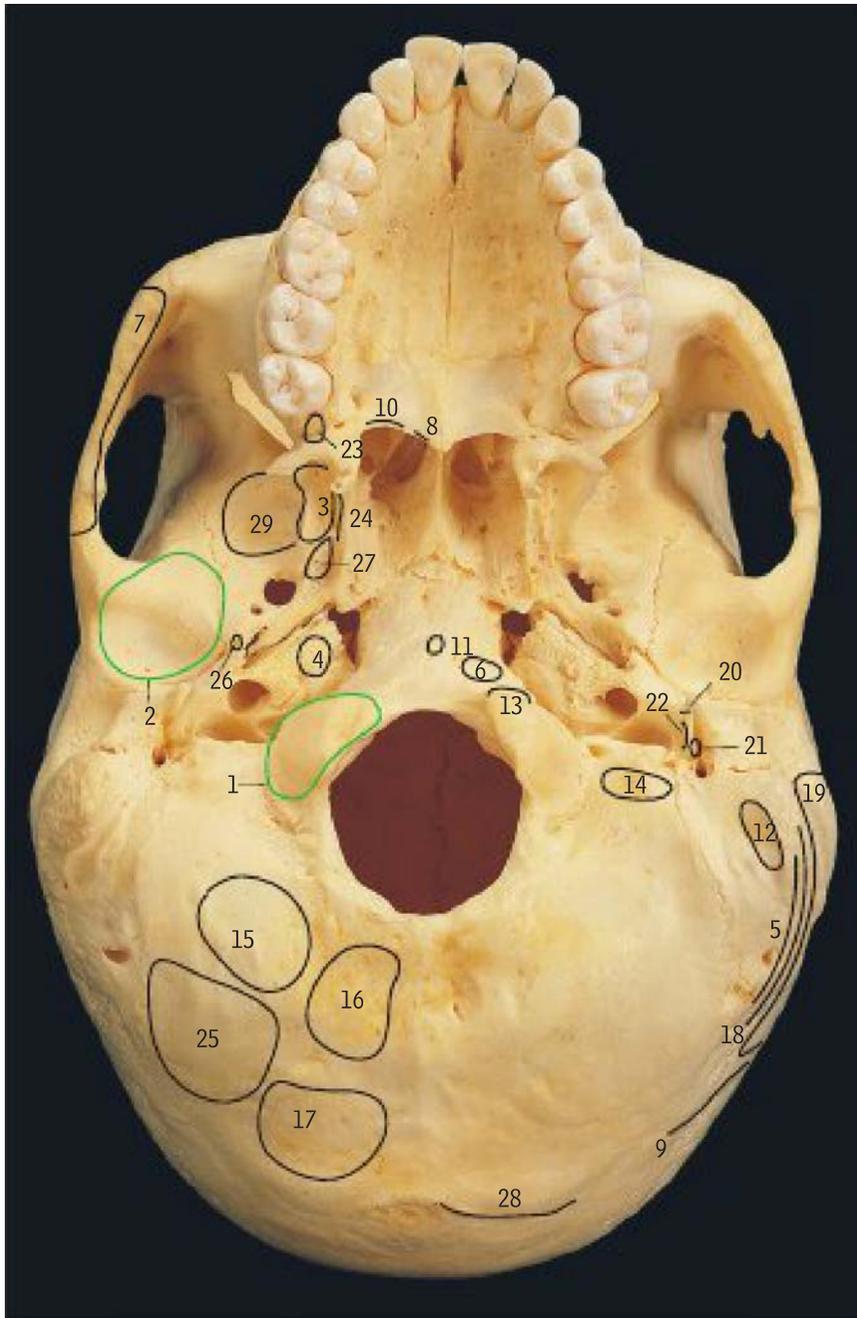


Intracranial
spread of
infection – face



Intracranial
spread of
infection
– scalp

Skull muscle attachments, external surface of the base



Green line = capsule attachments of atlanto-occipital and temporomandibular joints

- 1 Capsule attachment of atlanto-occipital joint
- 2 Capsule attachment of temporomandibular joint
- 3 Deep head of medial pterygoid
- 4 Levator veli palatini
- 5 Longissimus capitis
- 6 Longus capitis
- 7 Masseter
- 8 Musculus uvulae
- 9 Occipital part of occipitofrontalis
- 10 Palatopharyngeus
- 11 Pharyngeal raphe
- 12 Posterior belly of digastric
- 13 Rectus capitis anterior
- 14 Rectus capitis lateralis
- 15 Rectus capitis posterior major
- 16 Rectus capitis posterior minor
- 17 Semispinalis capitis
- 18 Splenius capitis
- 19 Sternocleidomastoid
- 20 Styloglossus
- 21 Stylohyoid
- 22 Stylopharyngeus
- 23 Superficial head of medial pterygoid
- 24 Superior constrictor
- 25 Superior oblique capitis
- 26 Tensor tympani
- 27 Tensor veli palatini
- 28 Trapezius
- 29 Upper head of lateral pterygoid

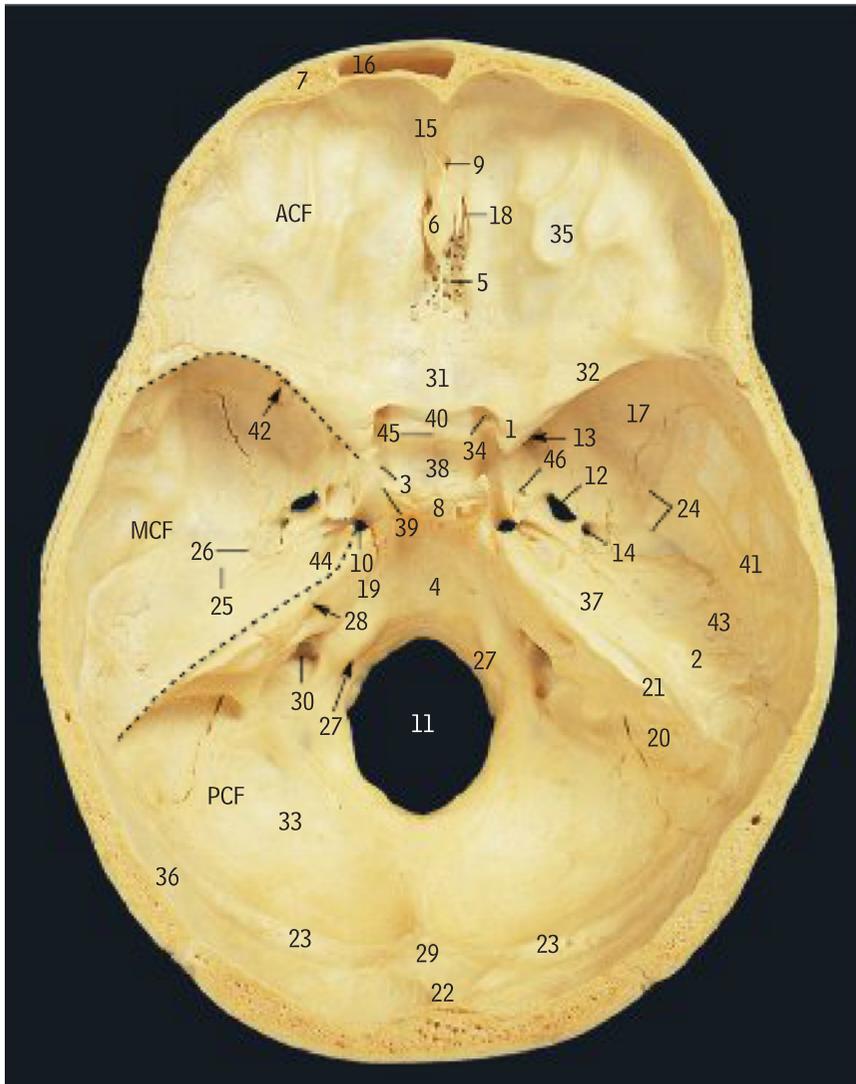
The medial pterygoid plate has no pterygoid muscles attached to it. It passes straight backwards, giving origin at its lower end to part of the superior constrictor of the pharynx (24).

The lateral pterygoid plate has both pterygoid muscles attached to it: medial and lateral surfaces, respectively (3 and 29). The plate becomes twisted slightly laterally because of the constant pull of these muscles which pass backwards and laterally to their attachments to the mandible (pages 18–19).



Skull fracture

Skull internal surface of the base (cranial fossae)



- 1 Anterior clinoid process
- 2 Arcuate eminence
- 3 Carotid groove
- 4 Clivus
- 5 Cribriform plate of ethmoid bone
- 6 Crista galli
- 7 Diploë
- 8 Dorsum sellae
- 9 Foramen caecum
- 10 Foramen lacerum
- 11 Foramen magnum
- 12 Foramen ovale
- 13 Foramen rotundum
- 14 Foramen spinosum
- 15 Frontal crest
- 16 Frontal sinus
- 17 Greater wing of sphenoid bone
- 18 Groove for anterior ethmoidal nerve and vessels
- 19 Groove for inferior petrosal sinus
- 20 Groove for sigmoid sinus
- 21 Groove for superior petrosal sinus
- 22 Groove for superior sagittal sinus
- 23 Groove for transverse sinus
- 24 Grooves for middle meningeal vessels
- 25 Hiatus and groove for greater petrosal nerve
- 26 Hiatus and groove for lesser petrosal nerve
- 27 Hypoglossal canal
- 28 Internal acoustic meatus
- 29 Internal occipital protuberance (position of confluence of sinuses)
- 30 Jugular foramen
- 31 Jugum of sphenoid bone
- 32 Lesser wing of sphenoid bone
- 33 Occipital bone (cerebellar fossa)
- 34 Optic canal
- 35 Orbital part of frontal bone
- 36 Parietal bone (postero-inferior angle only)
- 37 Petrous part of temporal bone
- 38 Pituitary fossa (sella turcica)
- 39 Posterior clinoid process
- 40 Prechiasmatic groove
- 41 Squamous part of temporal bone
- 42 Superior orbital fissure
- 43 Tegmen tympani
- 44 Trigeminal impression
- 45 Tuberculum sellae
- 46 Venous (emissary) foramen

The anterior cranial fossa (ACF) is limited posteriorly on each side by the free margin of the lesser wing of the sphenoid (32) with its anterior clinoid process (1), and centrally by the anterior margin of the prechiasmatic groove (40).

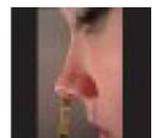
The middle cranial fossa (MCF) is butterfly-shaped and consists of a central or median part and right and left lateral parts. The central part includes the pituitary fossa (38) on the upper surface of the body of the sphenoid, with the prechiasmatic groove (40) in front and the dorsum sellae (8) with its posterior clinoid processes (39) behind. Each lateral part extends from the posterior border of the lesser wing of the sphenoid (32) to the groove for the superior petrosal sinus (21) on the upper edge of the petrous part of the temporal bone.

The posterior cranial fossa (PCF), whose most obvious feature is the foramen magnum (11), is behind the dorsum sellae (8) and the grooves for the superior petrosal sinuses (21).

For cranial dural attachments and reflections, see [pages 59–62](#).

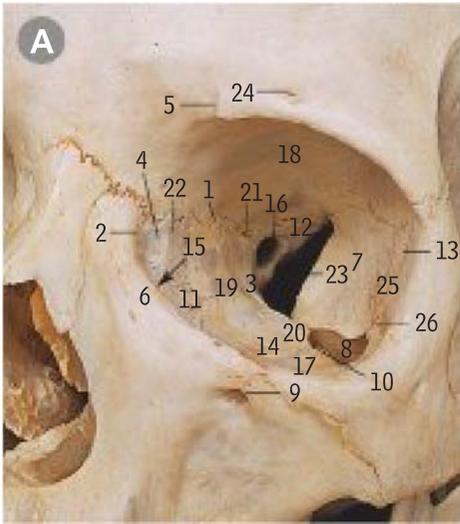


Anosmia



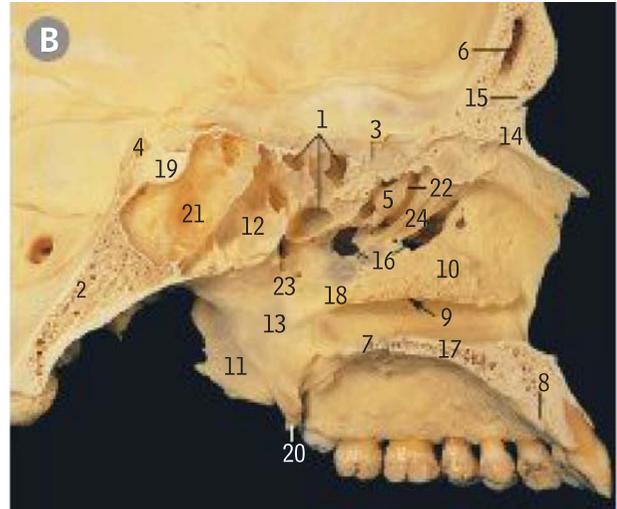
Skull base fracture

Skull bones of the left orbit



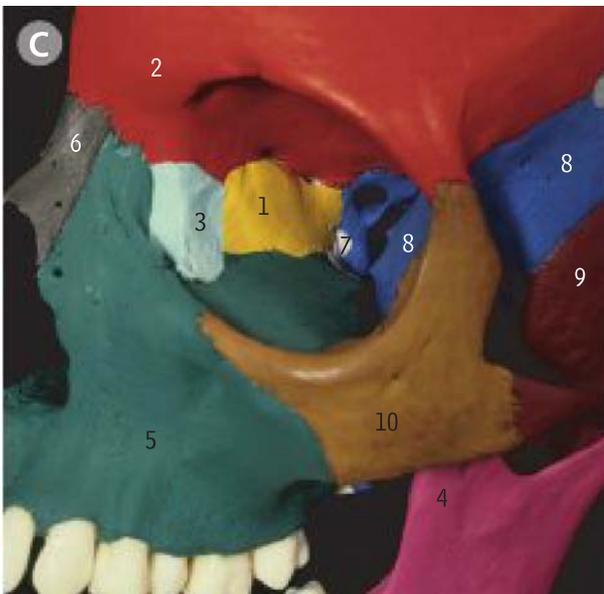
- | | |
|---|---|
| 1 Anterior ethmoidal foramen | 14 Maxilla, forming floor |
| 2 Anterior lacrimal crest | 15 Nasolacrimal canal |
| 3 Body of sphenoid bone, forming medial wall | 16 Optic canal |
| 4 Fossa for lacrimal sac | 17 Orbital border of zygomatic bone, forming floor |
| 5 Frontal notch | 18 Orbital part of frontal bone, forming roof |
| 6 Frontal process of maxilla, forming medial wall | 19 Orbital plate of ethmoid bone, forming medial wall |
| 7 Greater wing of sphenoid bone, forming lateral wall | 20 Orbital process of palatine bone, forming floor |
| 8 Inferior orbital fissure | 21 Posterior ethmoidal foramen |
| 9 Infra-orbital foramen | 22 Posterior lacrimal crest |
| 10 Infra-orbital groove | 23 Superior orbital fissure |
| 11 Lacrimal bone, forming medial wall | 24 Supra-orbital foramen |
| 12 Lesser wing of sphenoid bone, forming roof | 25 Zygomatic bone forming lateral wall |
| 13 Marginal tubercle | 26 Zygomatico-orbital foramen |

Nasal cavity lateral wall



In this midline sagittal section of the skull, with the nasal septum removed, the superior and middle nasal conchae have been dissected away to reveal the air cells of the ethmoidal sinus, in particular the ethmoidal bulla (5).

- | | |
|-------------------------------------|--|
| 1 Air cells of ethmoidal sinus | 14 Nasal bone |
| 2 Clivus | 15 Nasal spine of frontal bone |
| 3 Cribriform plate of ethmoid bone | 16 Opening of maxillary sinus (maxillary antrum) |
| 4 Dorsum sellae | 17 Palatine process of maxilla |
| 5 Ethmoidal bulla | 18 Perpendicular plate of palatine bone |
| 6 Frontal sinus | 19 Pituitary fossa (sella turcica) |
| 7 Horizontal plate of palatine bone | 20 Pterygoid hamulus |
| 8 Incisive canal | 21 Right sphenoidal sinus |
| 9 Inferior meatus | 22 Semilunar hiatus |
| 10 Inferior nasal concha | 23 Sphenopalatine foramen |
| 11 Lateral pterygoid plate | 24 Uncinate process of ethmoid bone |
| 12 Left sphenoidal sinus | |
| 13 Medial pterygoid plate | |



The roof of the nasal cavity consists mainly of the cribriform plate of the ethmoid bone (B3) with the body of the sphenoid containing the sphenoidal sinuses (B21 and 12) behind, and the nasal bone (B14) and the nasal spine of the frontal bone (B15) at the front.

The floor of the cavity consists of the palatine process of the maxilla (B17) and the horizontal plate of the palatine bone (B7).

The medial wall is the nasal septum which is formed mainly by two bones – the perpendicular plate of the ethmoid and the vomer – and the septal cartilage.

The lateral wall consists of the medial surface of the maxilla with its large opening (B16), overlapped from above by parts of the ethmoid (B1, 5 and 24) and lacrimal bones, from behind by the perpendicular plate of the palatine (B18), and below by the inferior concha (B10).

Skull Left orbit, individual bones

- | | |
|------------|--------------|
| 1 Ethmoid | 6 Nasal |
| 2 Frontal | 7 Palatine |
| 3 Lacrimal | 8 Sphenoid |
| 4 Mandible | 9 Temporal |
| 5 Maxilla | 10 Zygomatic |



Sinus pathology

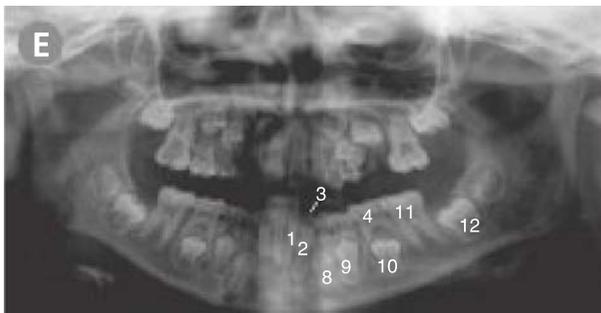


Permanent teeth from the left and in front

- | | |
|----------------------------|------------------------------|
| 1 First (central) incisor | 5 Second premolar |
| 2 Second (lateral) incisor | 6 First molar |
| 3 Canine | 7 Second molar |
| 4 First premolar | 8 Third molar (wisdom tooth) |

The corresponding teeth of the upper and lower jaws have similar names. In clinical dentistry, the teeth are usually identified by the numbers 1–8 (as listed here) rather than by name.

The third molar is sometimes called the wisdom tooth.



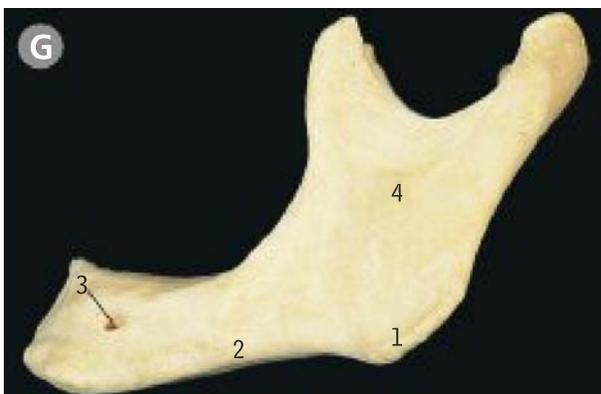
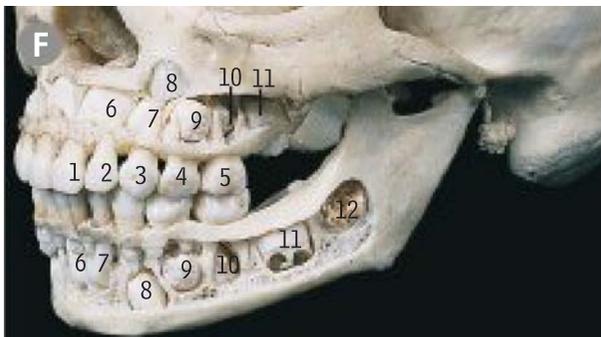
Upper and lower jaws from the left and in front

orthopantomogram in a 6-year-old child

in a 4-year-old child with erupted deciduous teeth and unerupted permanent teeth

- | | |
|---|---|
| 1 First (central) incisor of deciduous dentition | 7 Second (lateral) incisor of permanent dentition |
| 2 Second (lateral) incisor of deciduous dentition | 8 Canine of permanent dentition |
| 3 Canine of deciduous dentition | 9 First premolar of permanent dentition |
| 4 First molar of deciduous dentition | 10 Second premolar of permanent dentition |
| 5 Second molar of deciduous dentition | 11 First molar of permanent dentition |
| 6 First (central) incisor of permanent dentition | 12 Second molar of permanent dentition |

The deciduous molars occupy the positions of the premolars of the permanent dentition.



Edentulous mandible in old age, from the left

- | | |
|---------|------------------|
| 1 Angle | 3 Mental foramen |
| 2 Body | 4 Ramus |

With the loss of teeth, the alveolar bone becomes resorbed, so that the mental foramen (3) and mandibular canal lie near the upper margin of the bone.

The angle (1) between the ramus (4) and body (2) becomes more obtuse, resembling the infantile angle (as in E and F, above).



Skull of a full-term fetus



from the front

from the left and slightly below

from behind

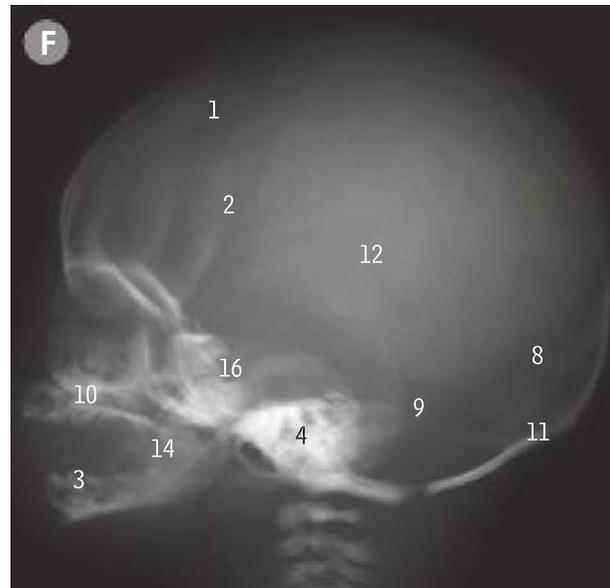
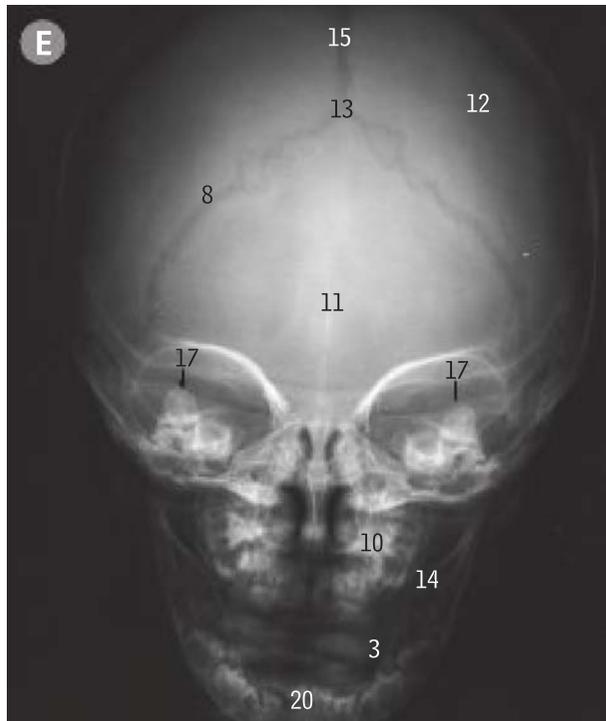
from above

- | | |
|---|----------------------------------|
| 1 Anterior fontanelle | 11 Occipital bone |
| 2 Coronal suture | 12 Parietal tuberosity |
| 3 Elevations over deciduous teeth in body of mandible | 13 Posterior fontanelle |
| 4 External acoustic meatus | 14 Ramus of mandible |
| 5 Frontal suture (metopic suture) | 15 Sagittal suture |
| 6 Frontal tuberosity | 16 Sella turcica |
| 7 Half of frontal bone | 17 Semicircular canals, superior |
| 8 Lambdoid suture | 18 Sphenoidal fontanelle |
| 9 Mastoid fontanelle | 19 Stylomastoid foramen |
| 10 Maxilla | 20 Symphysis menti |
| | 21 Tympanic ring |



Cleft lip and palate

Fetal skull radiographs

*frontal projection**lateral projection*

The face at birth forms a relatively smaller proportion of the cranium than in the adult (about one-eighth compared with one-half) because of the small size of the nasal cavity and maxillary sinuses and the lack of erupted teeth.

The posterior fontanelle (C13, E13) closes about 2 months after birth, the anterior fontanelle (A1, D1, F1) in the second year.

Owing to the lack of the mastoid process (which does not develop until the second year), the stylomastoid foramen (B19) and the emerging facial nerve are relatively near the surface and unprotected.



Resin cast of head and neck arteries *full-term fetus, from the left*

In this cast of fetal arteries, note in the front of the neck the dense arterial pattern indicating the thyroid gland (G), and above and in front of it the fine vessels outlining the tongue (T).

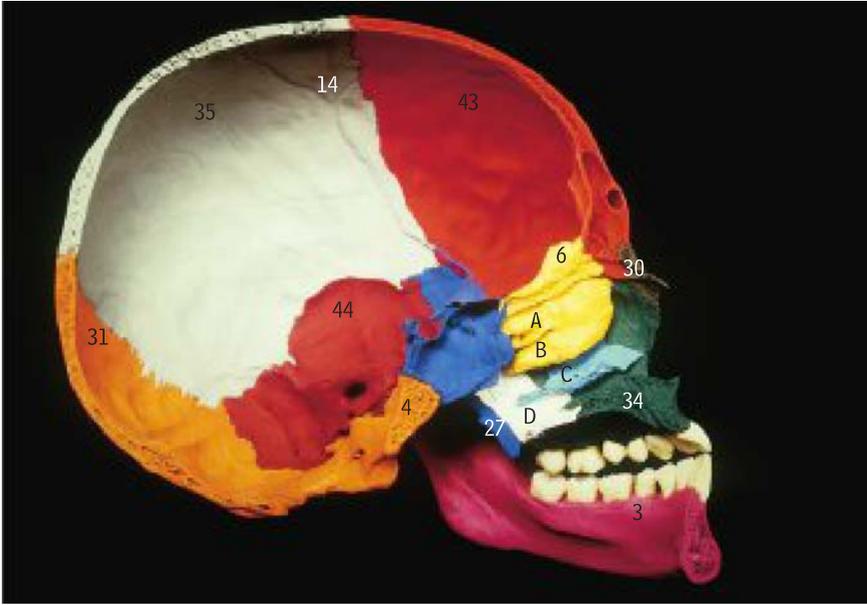


Hydrocephalus



Scalp wounds

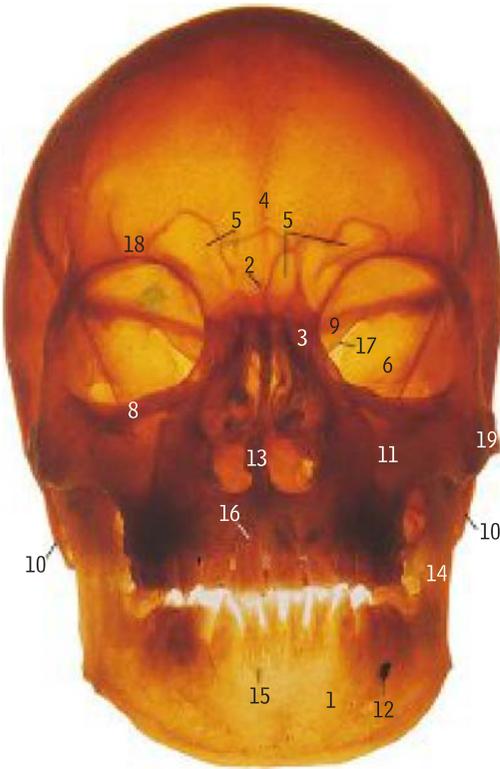
Skull coloured left half of the skull in sagittal section



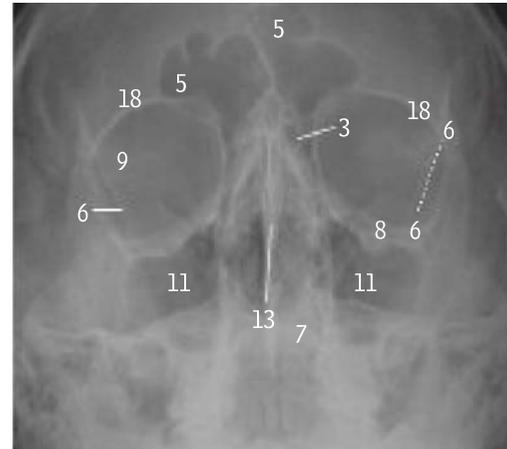
- A** Superior nasal concha
 - B** Middle nasal concha
 - C** Inferior nasal concha
 - D** Palatine bone
- See [page 17](#) for additional label numbers.

NB: The perpendicular plate of the ethmoid has been removed to expose the conchae.

cleared specimen from the front, illuminated from behind



radiograph of facial bones, occipitofrontal view



Compare with the skull on [page 1](#).

- | | |
|--|---|
| 1 Body of mandible | 10 Mastoid process |
| 2 Crista galli | 11 Maxillary sinus |
| 3 Ethmoidal air cells | 12 Mental foramen |
| 4 Frontal crest | 13 Nasal septum |
| 5 Frontal sinus | 14 Ramus of mandible |
| 6 Greater wing of sphenoid bone | 15 Root of lower lateral incisor |
| 7 Inferior nasal concha | 16 Root of upper central incisor |
| 8 Infra-orbital margin | 17 Superior orbital fissure |
| 9 Lesser wing of sphenoid bone | 18 Supra-orbital margin |
| | 19 Zygomatic arch |

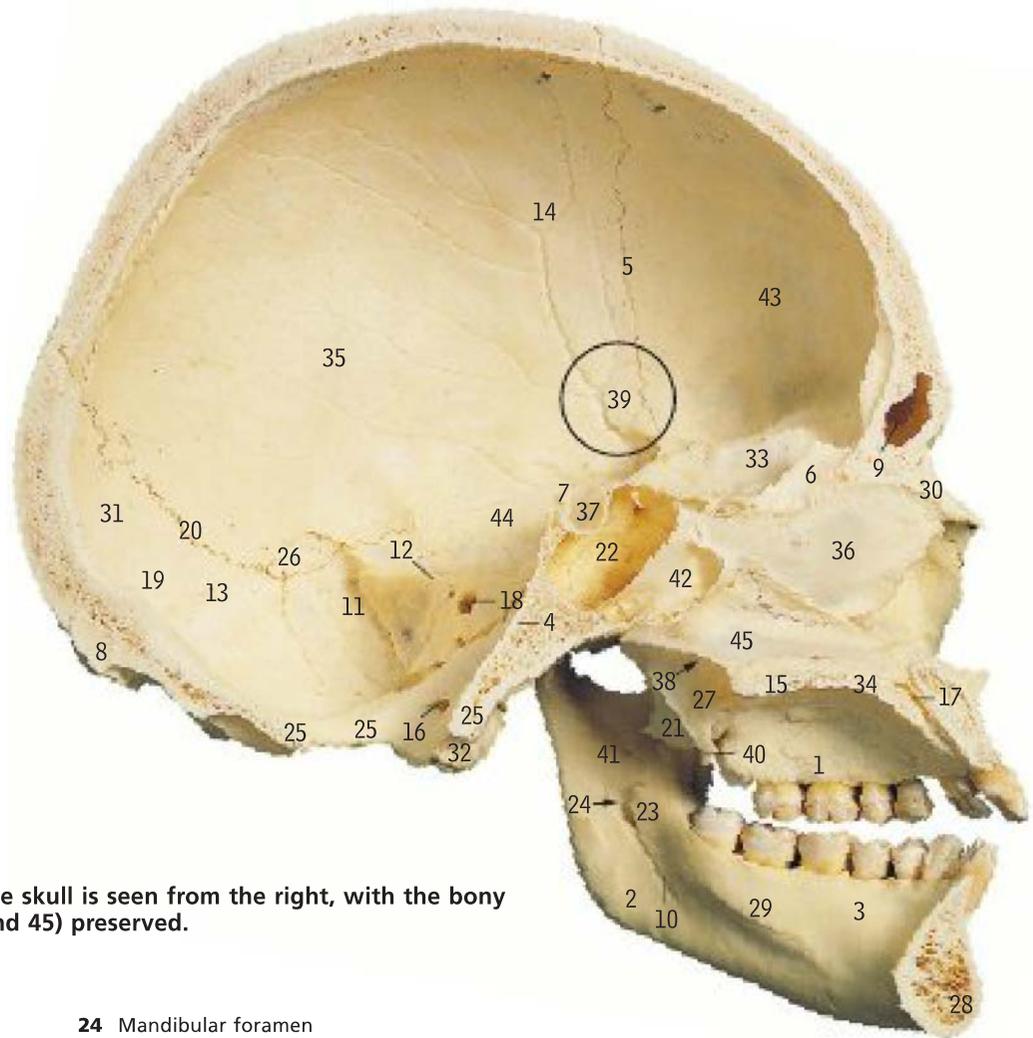


Blow-out fractures of the orbit



Mastoiditis

Skull left half of the skull in sagittal section



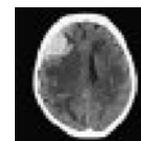
The inside of the left half of the skull is seen from the right, with the bony part of the nasal septum (36 and 45) preserved.

- | | |
|--|--|
| 1 Alveolar process of maxilla | 24 Mandibular foramen |
| 2 Angle of mandible | 25 Margin of foramen magnum |
| 3 Body of mandible | 26 Mastoid (posterior inferior) angle of parietal bone |
| 4 Clivus | 27 Medial pterygoid plate |
| 5 Coronal suture | 28 Mental protuberance |
| 6 Crista galli of ethmoid bone | 29 Mylohyoid line |
| 7 Dorsum sellae | 30 Nasal bone |
| 8 External occipital protuberance | 31 Occipital bone |
| 9 Frontal sinus | 32 Occipital condyle |
| 10 Groove for mylohyoid nerve | 33 Orbital part of frontal bone |
| 11 Groove for sigmoid sinus | 34 Palatine process of maxilla |
| 12 Groove for superior petrosal sinus | 35 Parietal bone |
| 13 Groove for transverse sinus | 36 Perpendicular plate of ethmoid bone |
| 14 Grooves for middle meningeal vessels (anterior division) | 37 Pituitary fossa (sella turcica) |
| 15 Horizontal plate of palatine bone | 38 Posterior nasal aperture (choana) |
| 16 Hypoglossal canal | 39 Pterion (encircled) |
| 17 Incisive canal | 40 Pterygoid hamulus of medial pterygoid plate |
| 18 Internal acoustic meatus in petrous part of temporal bone | 41 Ramus of mandible |
| 19 Internal occipital protuberance | 42 Right sphenoidal sinus |
| 20 Lambdoid suture | 43 Squamous part of frontal bone |
| 21 Lateral pterygoid plate | 44 Squamous part of temporal bone |
| 22 Left sphenoidal sinus | 45 Vomer |
| 23 Lingula | |

The bony part of the nasal septum consists of the vomer (45) and the perpendicular plate of the ethmoid bone (36). The anterior part of the septum consists of the septal cartilage ([pages 60 and 61](#)).

In this skull, the sphenoidal sinuses (42 and 22) are large, and the right one (42) has extended to the left of the midline. The pituitary fossa (37) projects down into the left sinus (22).

The grooves for the middle meningeal vessels (14) pass upwards and backwards. The circle (39) marks the region of the pterion, and corresponds to the position shown on the outside of the skull on [page 4](#).

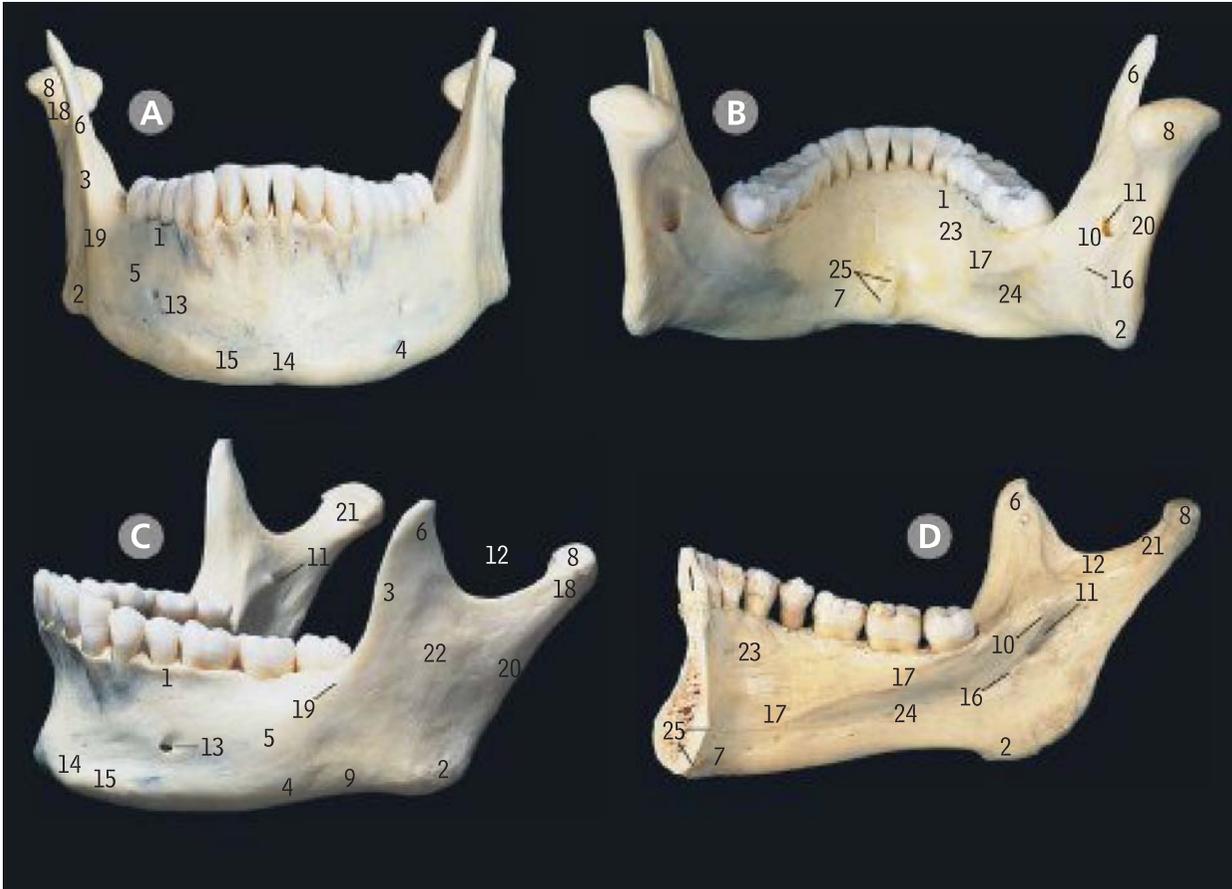


Extradural haemorrhage



Pituitary tumour

Mandible



from the front

from behind

from the left and front

internal view from the left

- | | |
|----------------------------|---|
| 1 Alveolar part | 14 Mental protuberance |
| 2 Angle | 15 Mental tubercle |
| 3 Anterior border of ramus | 16 Mylohyoid groove |
| 4 Base | 17 Mylohyoid line |
| 5 Body | 18 Neck |
| 6 Coronoid process | 19 Oblique line |
| 7 Digastric fossa | 20 Posterior border of ramus |
| 8 Head | 21 Pterygoid fovea |
| 9 Inferior border of ramus | 22 Ramus |
| 10 Lingula | 23 Sublingual fossa |
| 11 Mandibular foramen | 24 Submandibular fossa |
| 12 Mandibular notch | 25 Superior and inferior mental spines (genial tubercles) |
| 13 Mental foramen | |



Orthopantomogram

The head (8) and the neck (18, including the pterygoid fovea, 21) constitute the condyle.
 The alveolar part (1) contains the sockets for the roots of the teeth.
 The base (4) is the inferior border of the body (5), and becomes continuous with the inferior border (9) of the ramus (22).

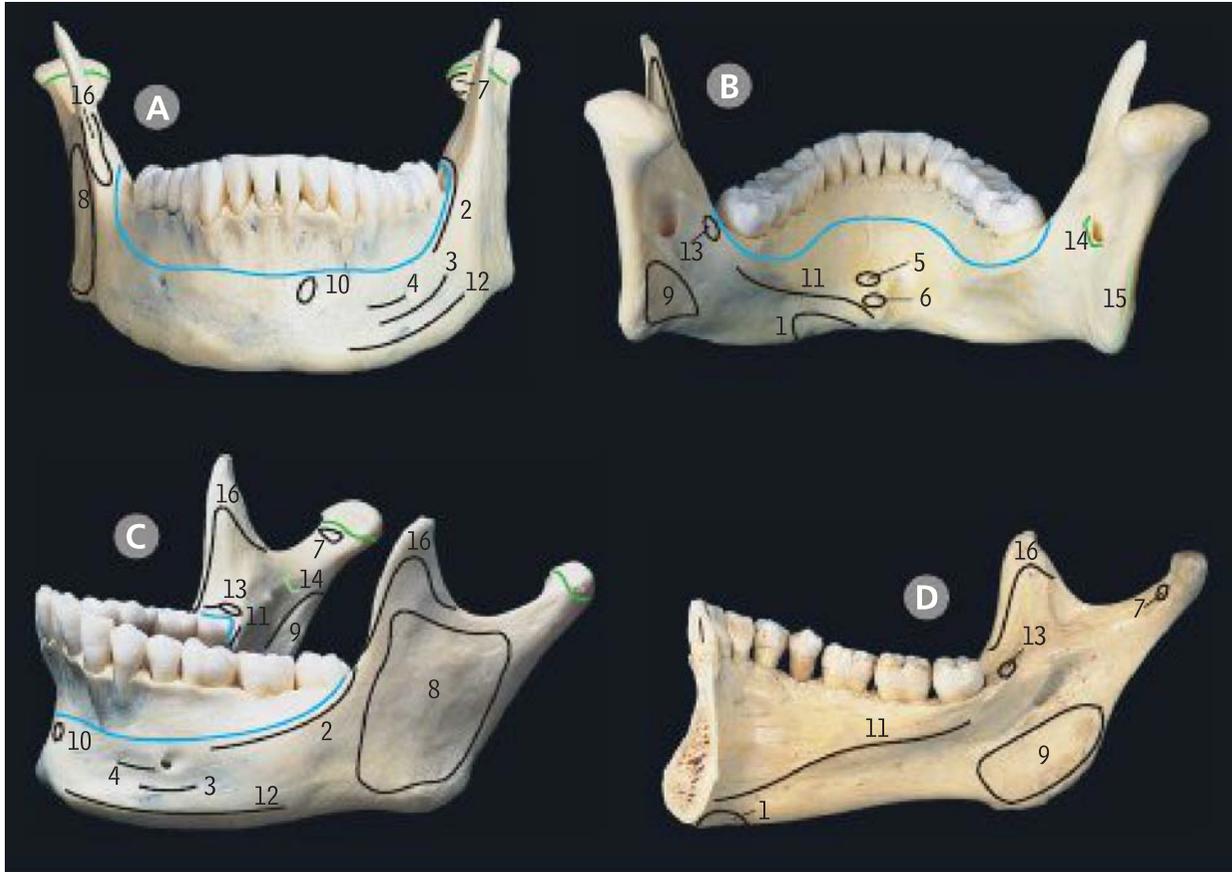


Impacted wisdom tooth



Mastoiditis

Mandible muscle attachments



from the front

from behind

from the left and front

internal view from the left

Green line = capsular attachment of temporomandibular joint; blue line = limit of attachment of the oral mucous membrane; pale green line = ligament attachment

- | | |
|-------------------------------|---|
| 1 Anterior belly of digastric | 10 Mentalis |
| 2 Buccinator | 11 Mylohyoid |
| 3 Depressor anguli oris | 12 Platysma |
| 4 Depressor labii inferioris | 13 Pterygomandibular raphe and superior constrictor |
| 5 Genioglossus | 14 Sphenomandibular ligament |
| 6 Geniohyoid | 15 Stylomandibular ligament |
| 7 Lateral pterygoid | 16 Temporalis |
| 8 Masseter | |
| 9 Medial pterygoid | |

The lateral pterygoid (A7) is attached to the pterygoid fovea on the neck of the mandible (and also to the capsule of the temporomandibular joint and the articular disc – see [page 42](#), A27, A28).

The medial pterygoid (B9, C9) is attached to the medial surface of the angle of the mandible, below the groove for the mylohyoid nerve.

Masseter (C8) is attached to the lateral surface of the ramus.

Temporalis (C16) is attached over the coronoid process, extending back as far as the deepest part of the mandibular notch and downwards over the front of the ramus almost as far as the last molar tooth.

Buccinator (C2) is attached opposite the three molar teeth, at the back reaching the pterygomandibular raphe (C13).

Genioglossus (B5) is attached to the superior mental spine and geniohyoid (B6) to the inferior mental spine.

Mylohyoid (11) is attached to the mylohyoid line.

The attachment of the lateral temporomandibular ligament to the lateral aspect of the neck of the condyle is not shown.



Fractured maxilla

Frontal bone

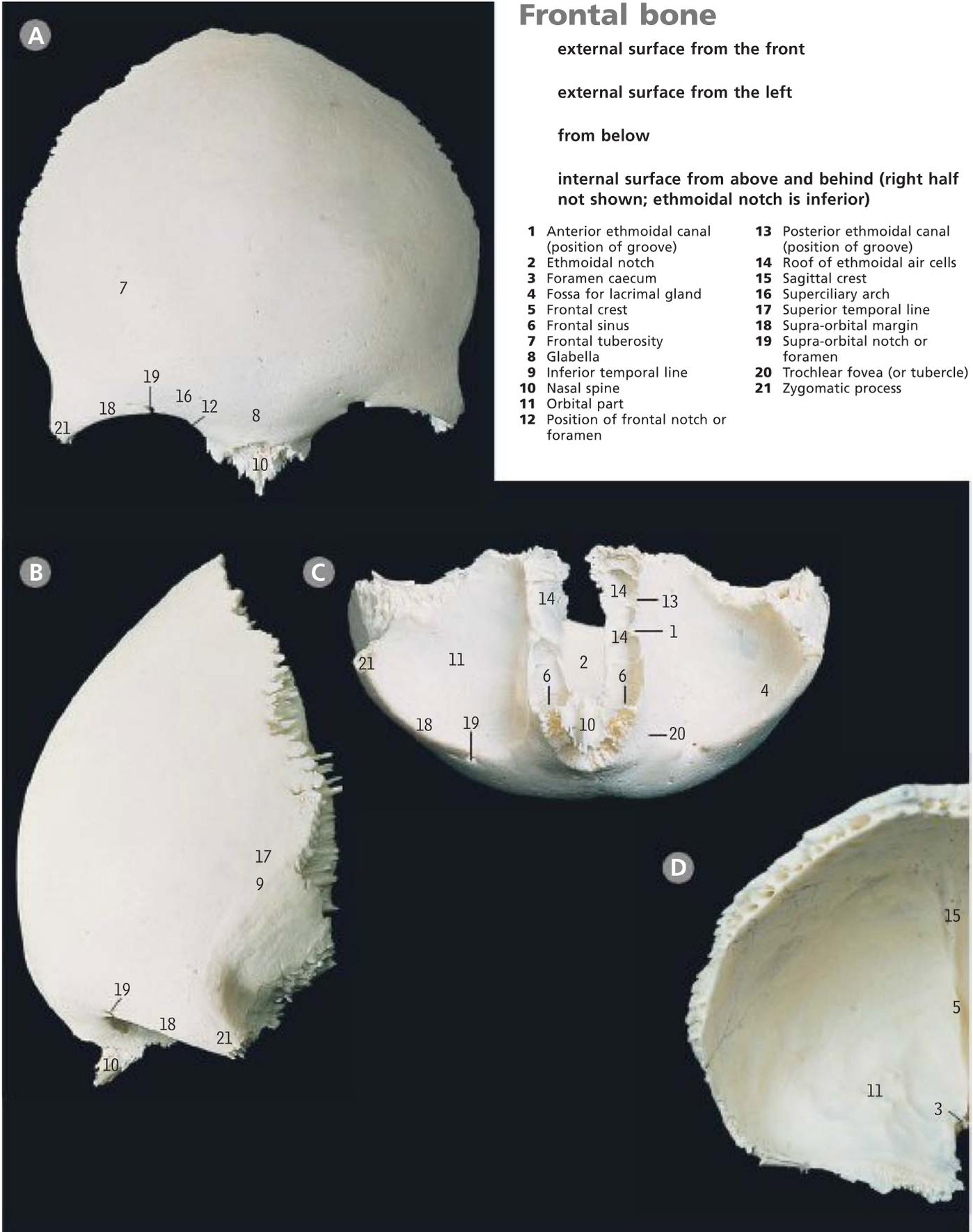
external surface from the front

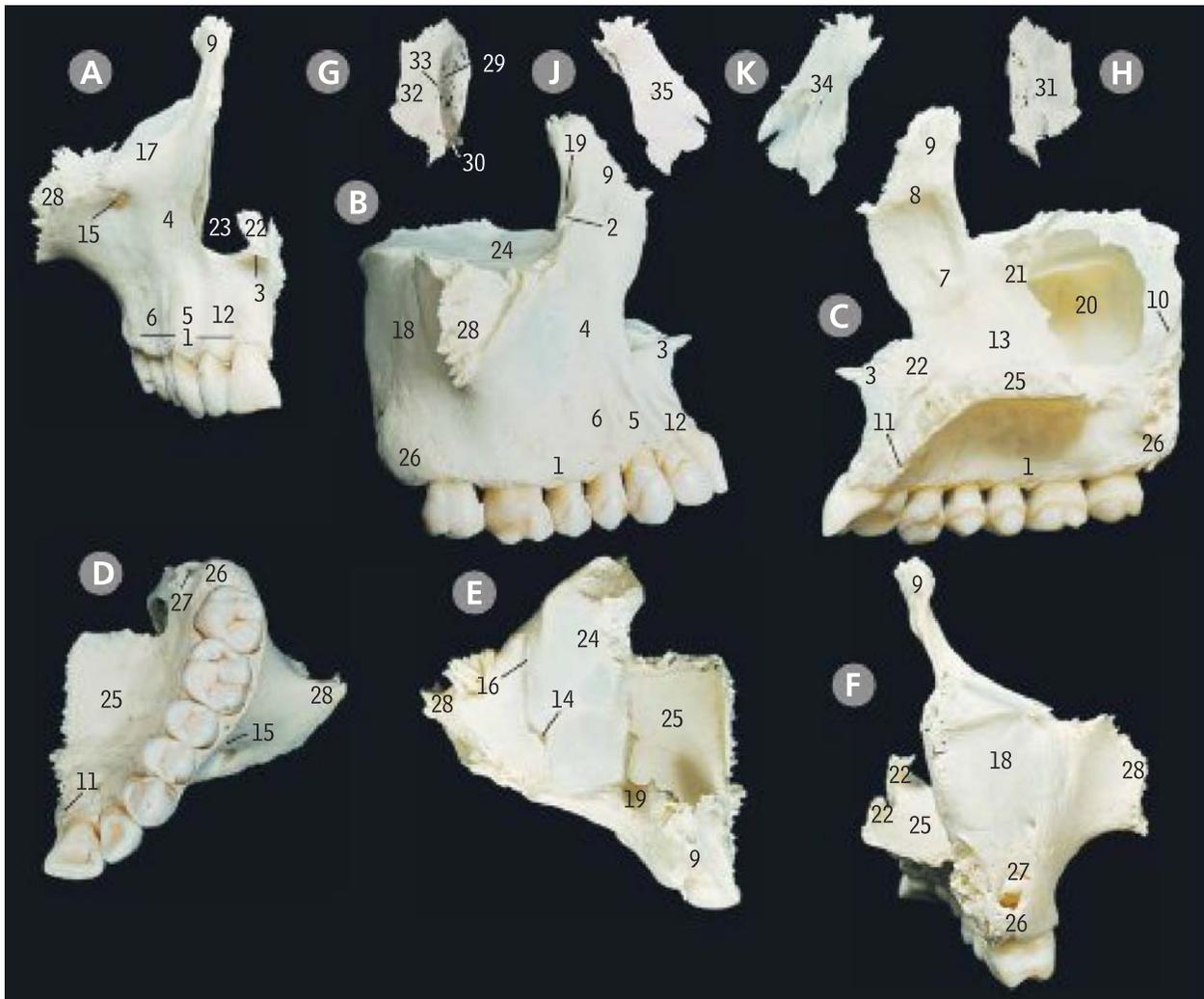
external surface from the left

from below

internal surface from above and behind (right half not shown; ethmoidal notch is inferior)

- | | |
|--|--|
| 1 Anterior ethmoidal canal (position of groove) | 13 Posterior ethmoidal canal (position of groove) |
| 2 Ethmoidal notch | 14 Roof of ethmoidal air cells |
| 3 Foramen caecum | 15 Sagittal crest |
| 4 Fossa for lacrimal gland | 16 Superciliary arch |
| 5 Frontal crest | 17 Superior temporal line |
| 6 Frontal sinus | 18 Supra-orbital margin |
| 7 Frontal tuberosity | 19 Supra-orbital notch or foramen |
| 8 Glabella | 20 Trochlear fovea (or tubercle) |
| 9 Inferior temporal line | 21 Zygomatic process |
| 10 Nasal spine | |
| 11 Orbital part | |
| 12 Position of frontal notch or foramen | |





Right maxilla

from the front

from the lateral side

from the medial side

- 1 Alveolar process
- 2 Anterior lacrimal crest
- 3 Anterior nasal spine
- 4 Anterior surface
- 5 Canine eminence
- 6 Canine fossa
- 7 Conchal crest
- 8 Ethmoidal crest
- 9 Frontal process
- 10 Greater palatine canal (position of groove)
- 11 Incisive canal
- 12 Incisive fossa
- 13 Inferior meatus
- 14 Infra-orbital canal

from below

from above

from behind

- 15 Infra-orbital foramen
- 16 Infra-orbital groove
- 17 Infra-orbital margin
- 18 Infratemporal surface
- 19 Lacrimal groove
- 20 Maxillary hiatus and sinus
- 21 Middle meatus
- 22 Nasal crest
- 23 Nasal notch
- 24 Orbital surface
- 25 Palatine process
- 26 Tuberosity
- 27 Unerupted third molar tooth
- 28 Zygomatic process

Right lacrimal bone

from the lateral (orbital) side

from the medial (nasal) side

- 29 Lacrimal groove
- 30 Lacrimal hamulus
- 31 Nasal surface
- 32 Orbital surface
- 33 Posterior lacrimal crest

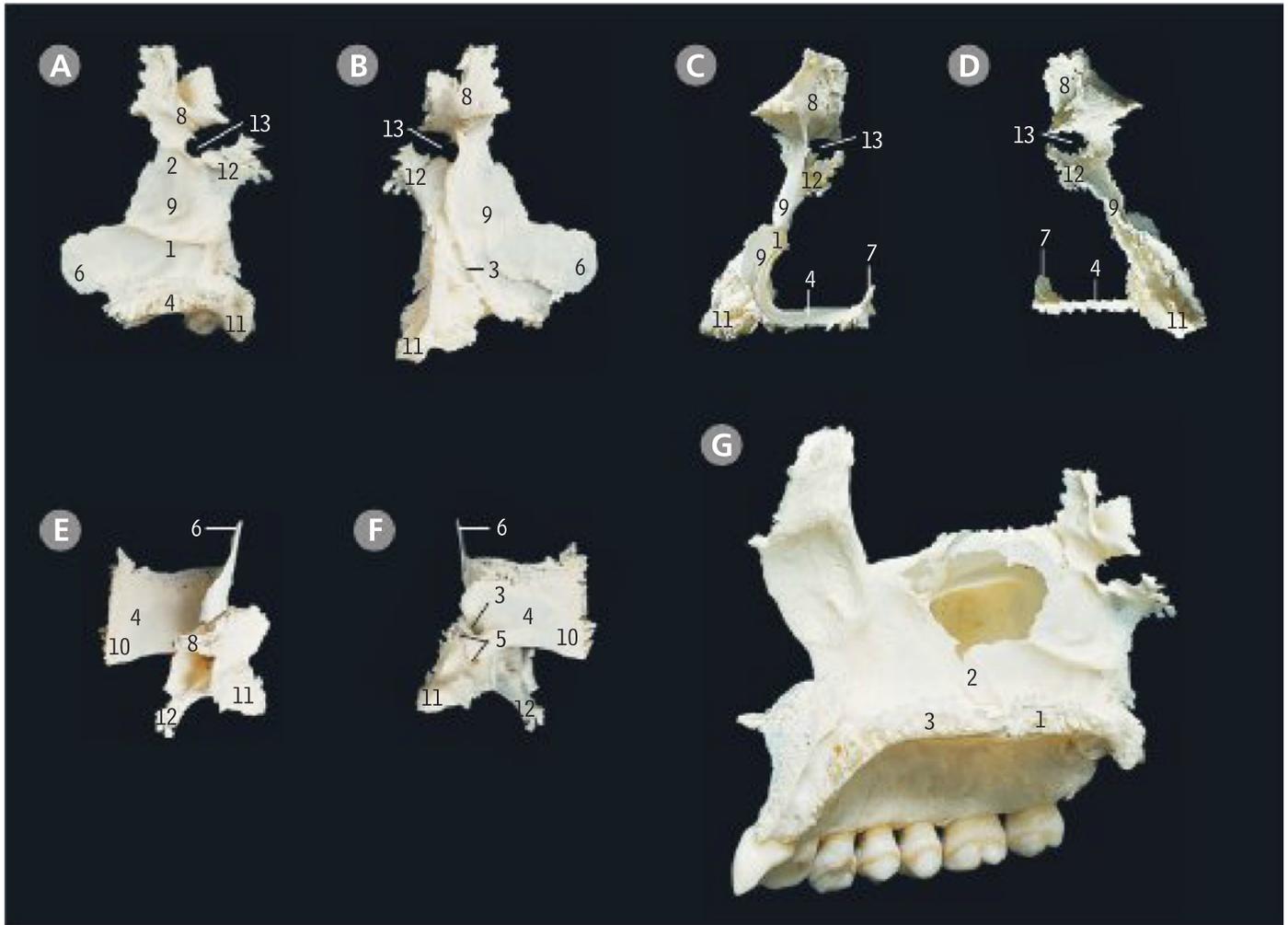
Right nasal bone

from the lateral side

from the medial side

- 34 Internal surface and groove for anterior ethmoidal nerve
- 35 Lateral surface

Right palatine bone



from the medial side

from behind

Articulation of the right maxilla and the palatine bone, from the medial side

from the lateral side

from above

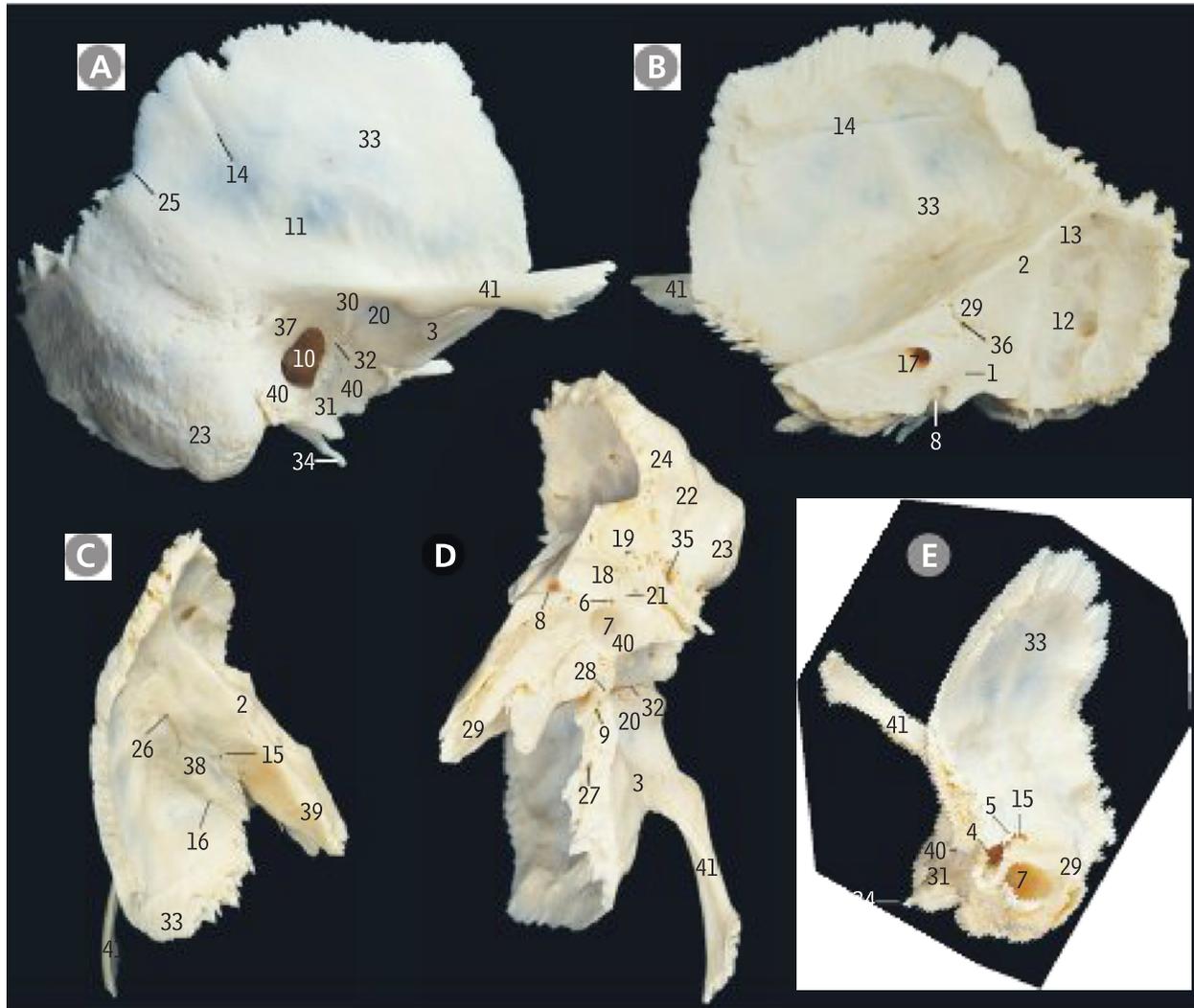
- 1 Horizontal plate of palatine
- 2 Maxillary process of palatine
- 3 Palatine process of maxilla

from the front

from below

- 1 Conchal crest
- 2 Ethmoidal crest
- 3 Greater palatine groove
- 4 Horizontal plate
- 5 Lesser palatine canals
- 6 Maxillary process
- 7 Nasal crest
- 8 Orbital process
- 9 Perpendicular plate
- 10 Posterior nasal spine
- 11 Pyramidal process
- 12 Sphenoidal process
- 13 Sphenopalatine notch

Right temporal bone



external aspect

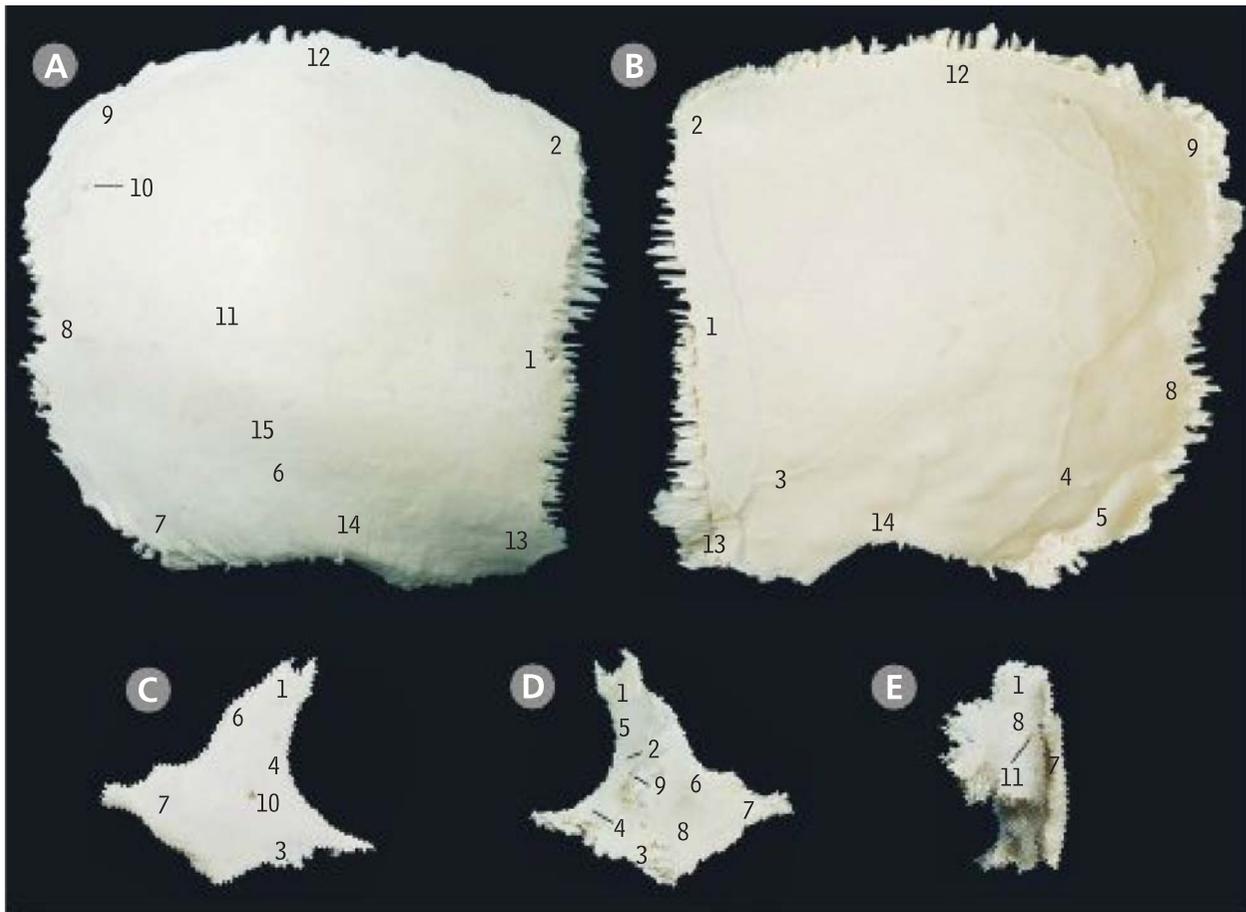
internal aspect

from above

from below

from the front

- | | | | | | |
|----|---|----|---|----|---|
| 1 | Aqueduct of vestibule | 14 | Grooves for branches of middle meningeal vessels | 27 | Petrosquamous fissure (from below) |
| 2 | Arcuate eminence | 15 | Hiatus and groove for greater petrosal nerve | 28 | Petrotympenic fissure |
| 3 | Articular tubercle | 16 | Hiatus and groove for lesser petrosal nerve | 29 | Petrous part |
| 4 | Auditory (eustachian) tube | 17 | Internal acoustic meatus | 30 | Postglenoid tubercle |
| 5 | Canal for tensor tympani | 18 | Jugular fossa | 31 | Sheath of styloid process |
| 6 | Canaliculus for tympanic branch of glossopharyngeal nerve | 19 | Jugular surface | 32 | Squamotympanic fissure |
| 7 | Carotid canal | 20 | Mandibular fossa | 33 | Squamous part |
| 8 | Cochlear canaliculus | 21 | Mastoid canaliculus for auricular branch of vagus nerve | 34 | Styloid process |
| 9 | Edge of tegmen tympani | 22 | Mastoid notch | 35 | Stylomastoid foramen |
| 10 | External acoustic meatus | 23 | Mastoid process | 36 | Subarcuate fossa |
| 11 | Groove for middle temporal artery | 24 | Occipital groove | 37 | Suprameatal triangle |
| 12 | Groove for sigmoid sinus | 25 | Parietal notch | 38 | Tegmen tympani |
| 13 | Groove for superior petrosal sinus | 26 | Petrosquamous fissure (from above) | 39 | Trigeminal impression on apex of petrous part |
| | | | | 40 | Tympanic part |
| | | | | 41 | Zygomatic process |



Right parietal bone

external surface

internal surface

- 1 Frontal (anterior) border
- 2 Frontal (antero-superior) angle
- 3 Furrows for frontal branch of middle meningeal vessels (anterior division)
- 4 Furrows for parietal branch of middle meningeal vessels (posterior division)
- 5 Groove for sigmoid sinus at mastoid angle
- 6 Inferior temporal line
- 7 Mastoid (postero-inferior) angle
- 8 Occipital (posterior) border
- 9 Occipital (postero-superior) angle
- 10 Parietal foramen
- 11 Parietal tuberosity
- 12 Sagittal (superior) border
- 13 Sphenoidal (antero-inferior) angle
- 14 Squamosal (inferior) border
- 15 Superior temporal line

Right zygomatic bone

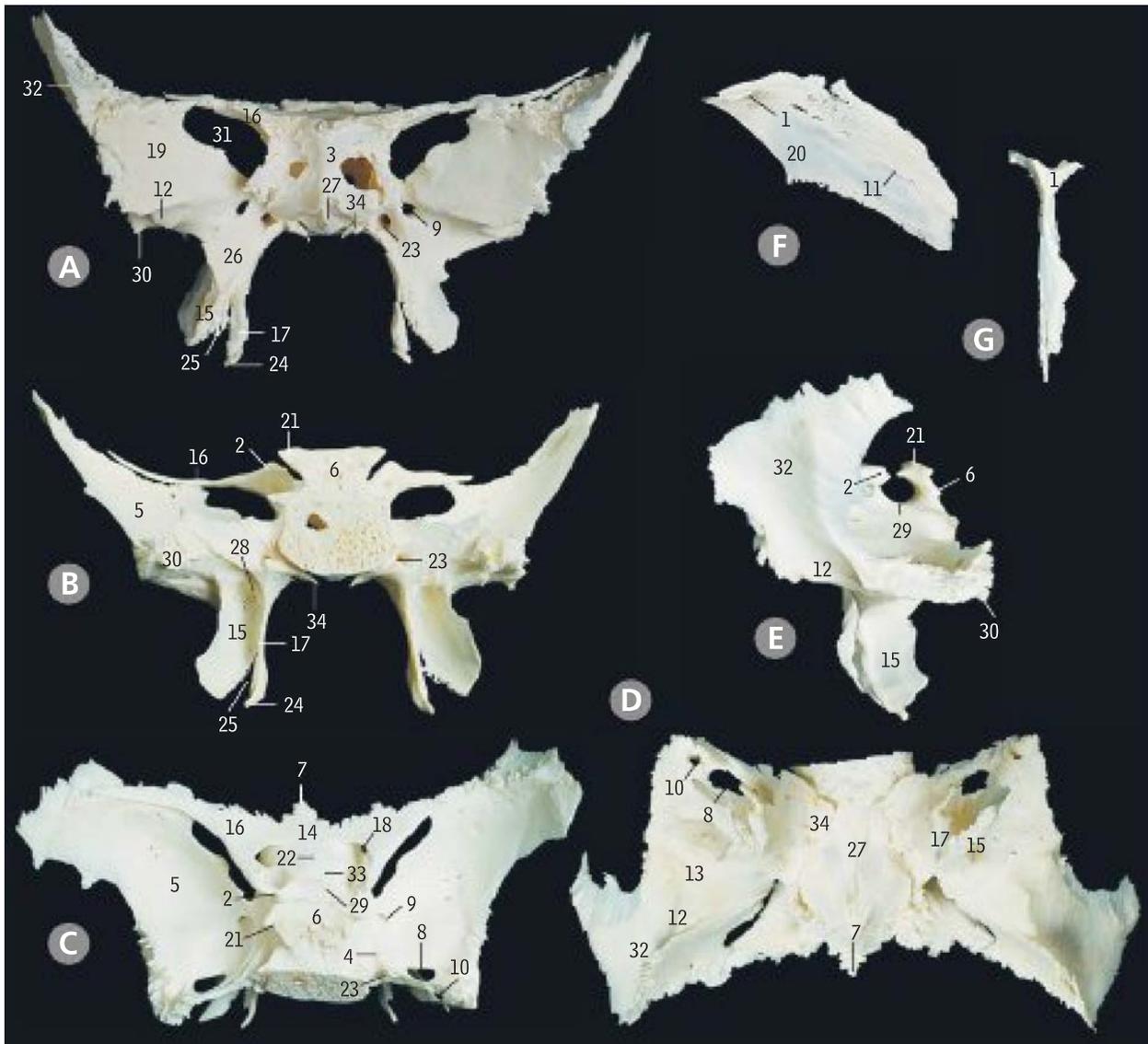
lateral surface

from the medial side

from behind

- | | |
|---------------------|-------------------------------|
| 1 Frontal process | 7 Temporal process |
| 2 Marginal tubercle | 8 Temporal surface |
| 3 Maxillary border | 9 Zygomatico-orbital foramen |
| 4 Orbital border | 10 Zygomaticofacial foramen |
| 5 Orbital surface | 11 Zygomaticotemporal foramen |
| 6 Temporal border | |

The zygomatic process of the temporal bone (page 4) and the temporal process of the zygomatic bone (C7, D7) form the zygomatic arch (page 4, 38).



Sphenoid bone

from the front

from behind

from above and behind

from below

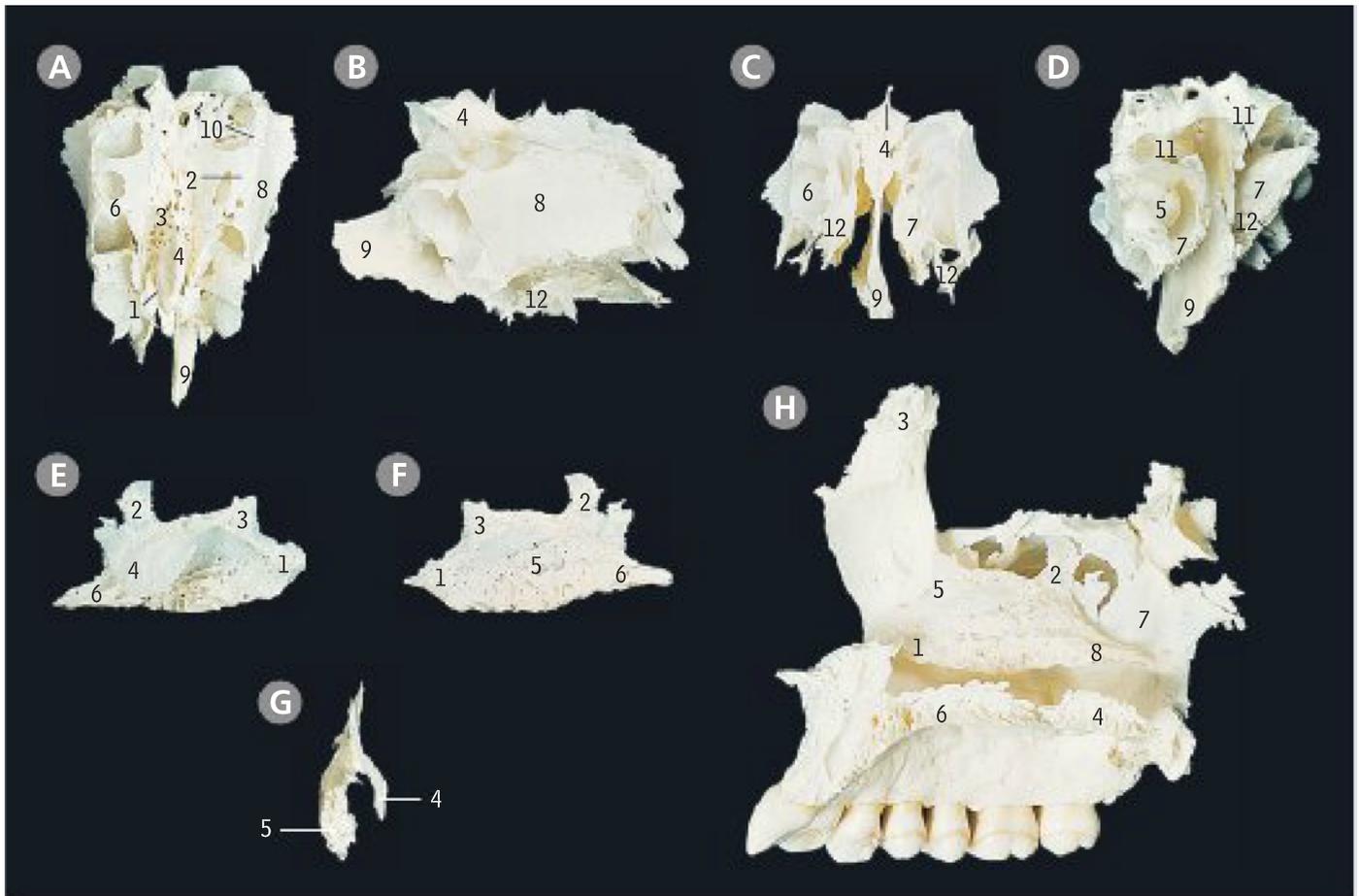
from the left

Vomer

from the right

from behind

- | | | | |
|--|--|------------------------------------|-------------------------------------|
| 1 Ala of vomer | 10 Foramen spinosum | 18 Optic canal | 28 Scaphoid fossa |
| 2 Anterior clinoid process | 11 Groove for nasopalatine nerve and vessels | 19 Orbital surface of greater wing | 29 Sella turcica (pituitary fossa) |
| 3 Body with openings of sphenoidal sinuses | 12 Infratemporal crest of greater wing | 20 Posterior border of vomer | 30 Spine |
| 4 Carotid groove | 13 Infratemporal surface of greater wing | 21 Posterior clinoid process | 31 Superior orbital fissure |
| 5 Cerebral surface of greater wing | 14 Jugum | 22 Prechiasmatic groove | 32 Temporal surface of greater wing |
| 6 Dorsum sellae | 15 Lateral pterygoid plate | 23 Pterygoid canal | 33 Tuberculum sellae |
| 7 Ethmoidal spine | 16 Lesser wing | 24 Pterygoid hamulus | 34 Vaginal process |
| 8 Foramen ovale | 17 Medial pterygoid plate | 25 Pterygoid notch | |
| 9 Foramen rotundum | | 26 Pterygoid process | |
| | | 27 Rostrum | |



Ethmoid bone

from above

from the left

from the front

from the left, below and behind

- 1 Ala of crista galli
- 2 Anterior ethmoidal groove
- 3 Cribriform plate
- 4 Crista galli
- 5 Ethmoidal bulla
- 6 Ethmoidal labyrinth (containing ethmoidal air cells)
- 7 Middle nasal concha
- 8 Orbital plate
- 9 Perpendicular plate
- 10 Posterior ethmoidal groove
- 11 Superior nasal concha (meatus)
- 12 Uncinate process

Right inferior nasal concha

from the lateral side

from the medial side

from behind

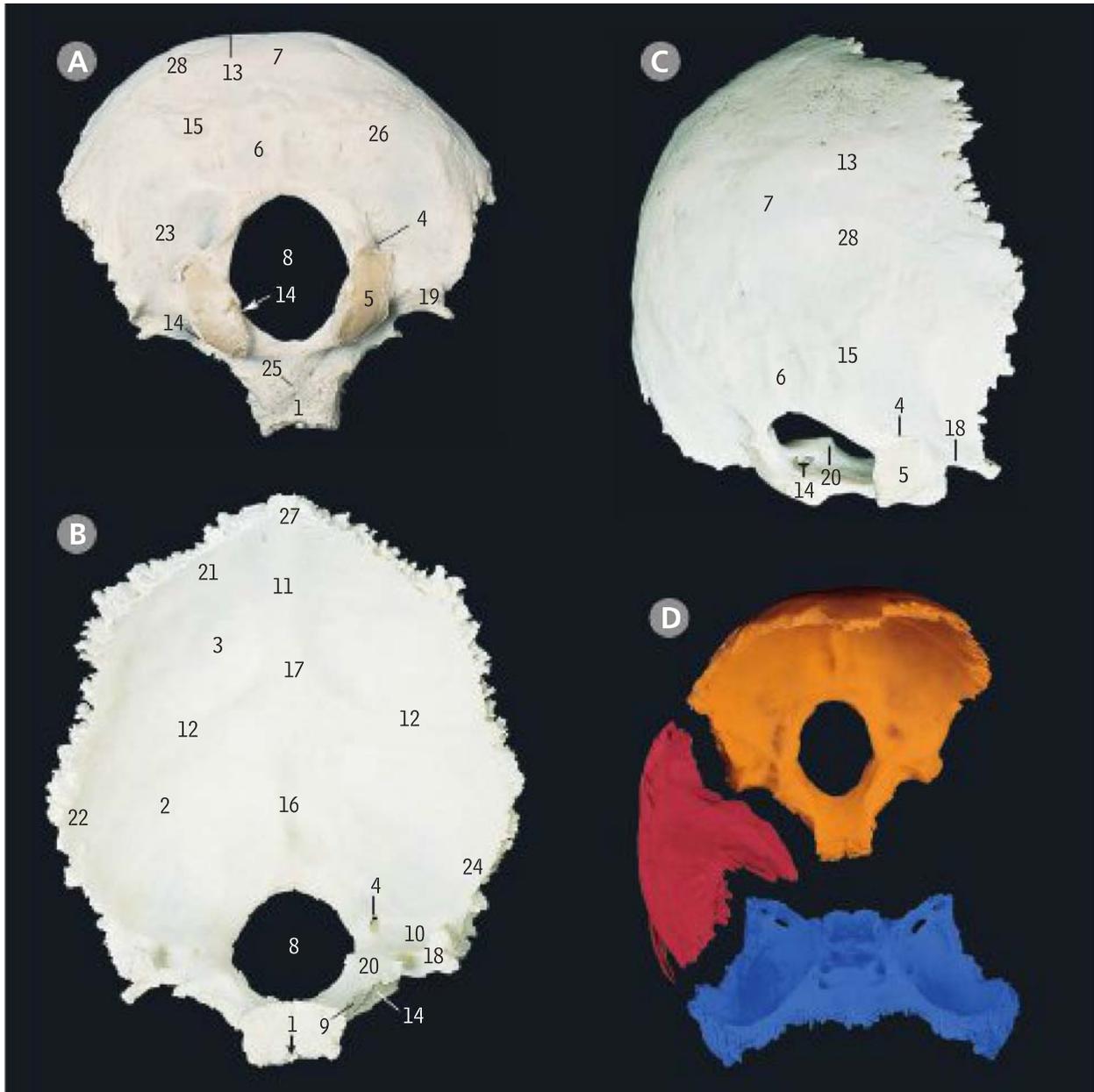
- 1 Anterior end
- 2 Ethmoidal process
- 3 Lacrimal process
- 4 Maxillary process
- 5 Medial surface
- 6 Posterior end

Maxilla

Articulation of right maxilla, palatine bone and inferior nasal concha, from the medial side

- 1 Anterior end of inferior nasal concha
- 2 Ethmoidal process of inferior nasal concha
- 3 Frontal process of maxilla
- 4 Horizontal plate of palatine
- 5 Lacrimal process of inferior nasal concha
- 6 Palatine process of maxilla
- 7 Perpendicular plate of palatine
- 8 Posterior end of inferior nasal concha

Occipital bone



external surface from below

internal surface

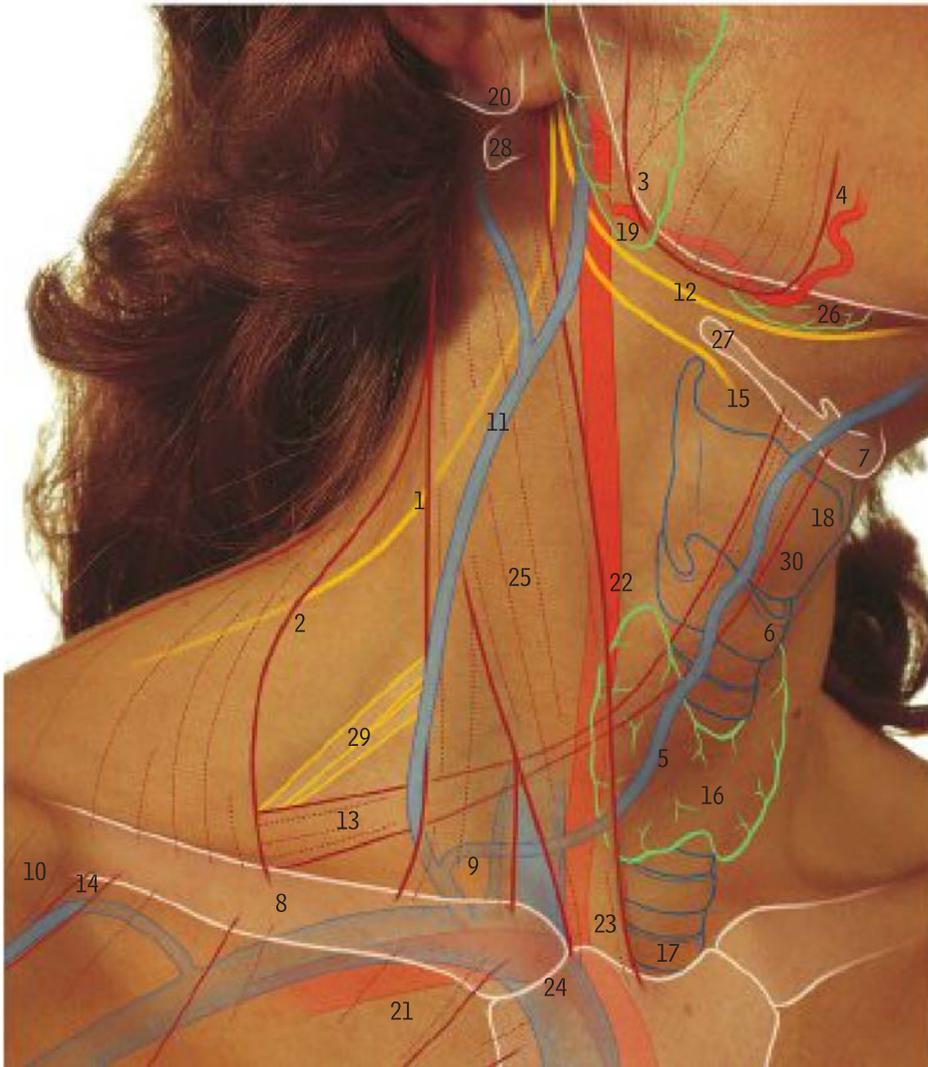
external surface from the right and below

bones of the base of the skull

orange, occipital; red, temporal; blue, sphenoid

- | | | |
|---|--|--------------------------------|
| 1 Basilar part | 10 Groove for sigmoid sinus | 20 Jugular tubercle |
| 2 Cerebellar fossa | 11 Groove for superior sagittal sinus | 21 Lambdoid margin |
| 3 Cerebral fossa | 12 Groove for transverse sinus | 22 Lateral angle |
| 4 Condylar fossa (and condylar canal in B and C) | 13 Highest nuchal line | 23 Lateral part |
| 5 Condyle | 14 Hypoglossal canal | 24 Mastoid margin |
| 6 External occipital crest | 15 Inferior nuchal line | 25 Pharyngeal tubercle |
| 7 External occipital protuberance | 16 Internal occipital crest | 26 Squamous part |
| 8 Foramen magnum | 17 Internal occipital protuberance | 27 Superior angle |
| 9 Groove for inferior petrosal sinus | 18 Jugular notch | 28 Superior nuchal line |
| | 19 Jugular process | |

Neck surface markings of the front and right side



The pulsation of the common carotid artery (22, opposite page, 8) can be felt by backward pressure in the angle between the lower anterior border of sternocleidomastoid and the side of the larynx and trachea.

The cricoid cartilage (6) is about 5 cm (2 in) above the jugular notch of the manubrium of the sternum (17).

The lower end of the internal jugular vein lies behind the interval between the sternal (23) and clavicular (9) heads of sternocleidomastoid (when viewed from the front), just above the point where it joins the subclavian vein to form the brachiocephalic vein (24).

The trunks of the brachial plexus (29) can be felt as a cord-like structure in the lower part of the posterior triangle.



- | | | |
|---|---|--|
| 1 Accessory nerve emerging from sternocleidomastoid | 10 Deltoid | 22 Site for palpation of common carotid artery |
| 2 Accessory nerve passing under anterior border of trapezius | 11 External jugular vein | 23 Sternal head of sternocleidomastoid |
| 3 Angle of mandible | 12 Hypoglossal nerve | 24 Sternoclavicular joint and union of internal jugular and subclavian veins to form brachiocephalic vein |
| 4 Anterior border of masseter and facial artery | 13 Inferior belly of omohyoid | 25 Sternocleidomastoid |
| 5 Anterior jugular vein | 14 Infraclavicular fossa and cephalic vein | 26 Submandibular gland |
| 6 Arch of cricoid cartilage | 15 Internal laryngeal nerve | 27 Tip of greater horn of hyoid bone |
| 7 Body of hyoid bone | 16 Isthmus of thyroid gland | 28 Tip of transverse process of atlas |
| 8 Clavicle | 17 Jugular notch and trachea | 29 Upper trunk of brachial plexus |
| 9 Clavicular head of sternocleidomastoid | 18 Laryngeal prominence (Adam's apple) | 30 Vocal cord position |
| | 19 Lowest part of parotid gland | |
| | 20 Mastoid process | |
| | 21 Pectoralis major | |

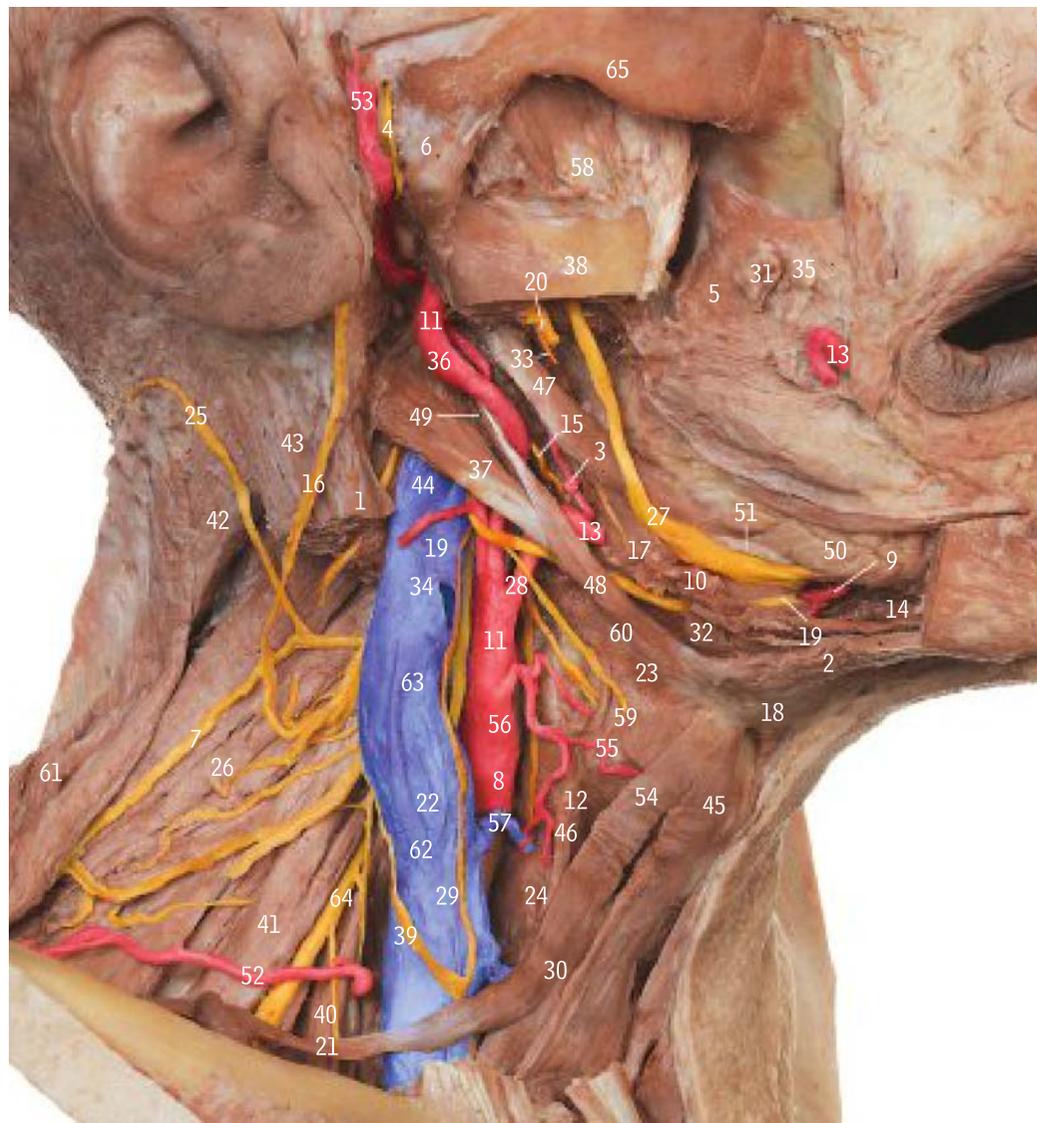


Torticollis



Varicella-zoster virus infection – head and neck

Side of the neck *right side, deep dissection*



The lingual nerve (27) lies superficial to hyoglossus (17) and at this level is a flattened band rather than a typical round nerve, with the deep part of the submandibular gland (10) below it. The nerve crosses underneath the submandibular duct (51), lying first lateral to the duct and then medial to it.

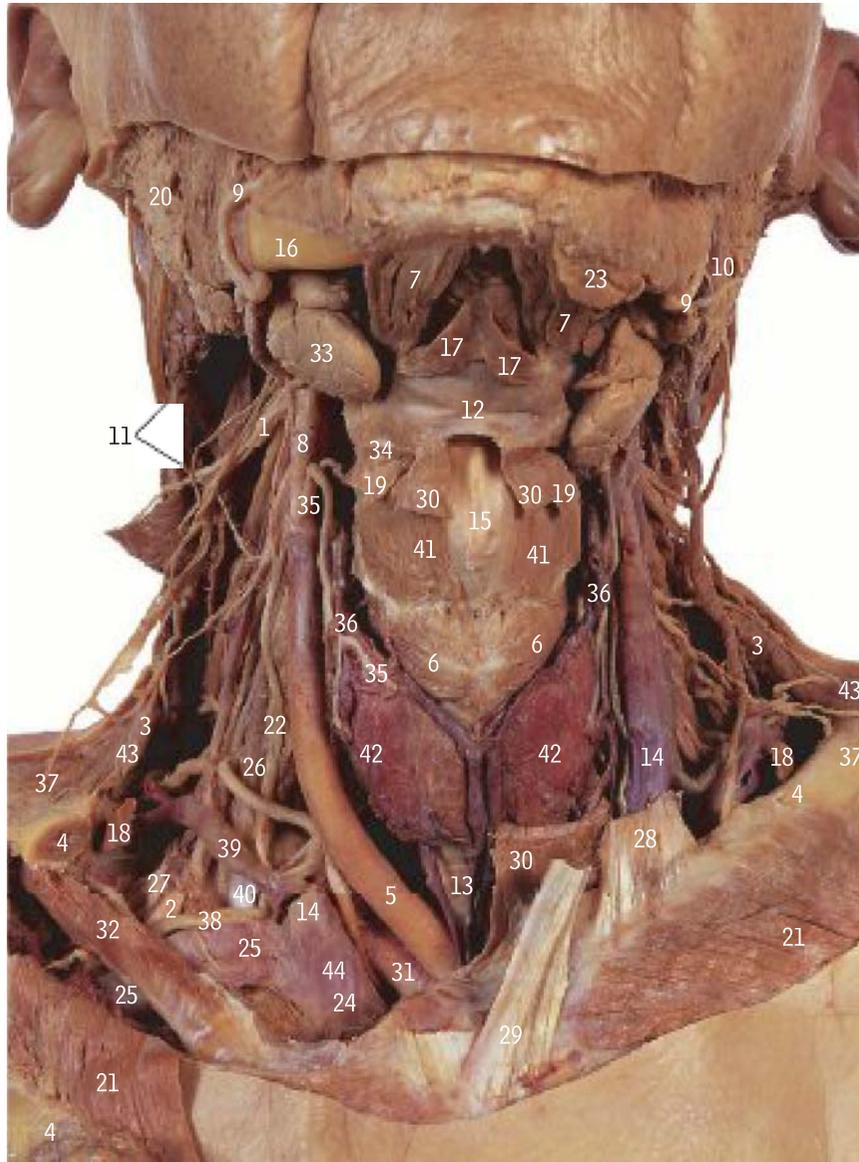
The thyrohyoid membrane (60) is pierced by the internal laryngeal nerve (23) and the superior laryngeal artery (55).

Apart from supplying muscles of the tongue, the hypoglossal nerve (19) gives branches to geniohyoid (14) and thyrohyoid (59) and forms the upper root of the ansa cervicalis (62). These three branches consist of the fibres from the first cervical nerve that have joined the hypoglossal nerve higher in the neck; they are not derived from the hypoglossal nucleus. The C1 fibres in the upper root of the ansa contribute to the supply of sternohyoid (45) and omohyoid (21, 54).



- | | | | |
|---|----------------------------------|---|---|
| 1 Accessory nerve | 16 Great auricular nerve | 34 Occipital artery | 51 Submandibular duct |
| 2 Anterior belly of digastric and nerve | 17 Hyoglossus | 35 Parotid duct | 52 Superficial (transverse) cervical artery |
| 3 Ascending palatine artery | 18 Hyoid bone | 36 Posterior auricular artery | 53 Superficial temporal artery |
| 4 Auriculotemporal nerve | 19 Hypoglossal nerve | 37 Posterior belly of digastric | 54 Superior belly of omohyoid |
| 5 Buccinator | 20 Inferior alveolar nerve | 38 Ramus of mandible | 55 Superior laryngeal artery |
| 6 Capsule of temporomandibular joint | 21 Inferior belly of omohyoid | 39 Roots of phrenic nerve | 56 Superior thyroid artery |
| 7 Cervical nerves to trapezius | 22 Internal jugular vein | 40 Scalenus anterior | 57 Superior thyroid vein |
| 8 Common carotid artery | 23 Internal laryngeal nerve | 41 Scalenus medius | 58 Temporalis |
| 9 Deep lingual artery | 24 Lateral lobe of thyroid gland | 42 Splenius capitis | 59 Thyrohyoid and nerve |
| 10 Deep part of submandibular gland | 25 Lesser occipital nerve | 43 Sternocleidomastoid (cut) | 60 Thyrohyoid membrane |
| 11 External carotid artery | 26 Levator scapulae | 44 Sternocleidomastoid branch of occipital artery | 61 Trapezius |
| 12 External laryngeal nerve | 27 Lingual nerve | 45 Sternohyoid | 62 Upper root of ansa cervicalis |
| 13 Facial artery | 28 Linguofacial trunk | 46 Sternothyroid | 63 Vagus nerve |
| 14 Geniohyoid | 29 Lower root of ansa cervicalis | 47 Styloglossus | 64 Ventral ramus of fifth cervical nerve |
| 15 Glossopharyngeal nerve | 30 Middle thyroid vein | 48 Stylohyoid | 65 Zygomatic arch |
| | 31 Molar salivary glands | 49 Stylohyoid ligament | |
| | 32 Mylohyoid and nerve | 50 Sublingual gland | |
| | 33 Nerve to mylohyoid | | |

Front of the neck deeper dissection

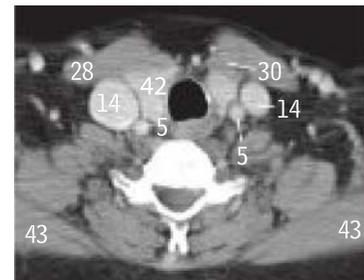


- 1 Accessory nerve
- 2 Brachial plexus (roots)
- 3 Cervical nerves to trapezius
- 4 Clavicle
- 5 Common carotid artery
- 6 Cricothyroid
- 7 Digastric, anterior belly
- 8 External carotid artery
- 9 Facial artery
- 10 Facial vein
- 11 Great auricular nerve
- 12 Hyoid bone, body
- 13 Inferior thyroid vein
- 14 Internal jugular vein
- 15 Laryngeal prominence
- 16 Mandible
- 17 Mylohyoid, anomalous fibres
- 18 Omohyoid, inferior belly (cut)
- 19 Omohyoid, superior belly (cut)
- 20 Parotid gland
- 21 Pectoralis major
- 22 Phrenic nerve
- 23 Platysma
- 24 Right brachiocephalic vein
- 25 Right subclavian vein
- 26 Scalenus anterior
- 27 Scalenus medius
- 28 Sternocleidomastoid, clavicular head
- 29 Sternocleidomastoid, sternal head
- 30 Sternohyoid (cut)
- 31 Subclavian artery
- 32 Subclavius
- 33 Submandibular gland
- 34 Superior laryngeal artery
- 35 Superior thyroid artery
- 36 Superior thyroid vein
- 37 Supraclavicular nerve
- 38 Suprascapular artery
- 39 Suprascapular vein
- 40 Tendon of scalenus anterior
- 41 Thyroid gland
- 42 Thyroid gland, lateral lobe
- 43 Trapezius
- 44 Vagus nerve

On the right hand side, the clavicle (4) has been cut and reflected inferiorly to reveal the underlying subclavius (32). Dotted line is the level of axial CT (shown on the right).



Axial CT neck



Accessory nerve palsy

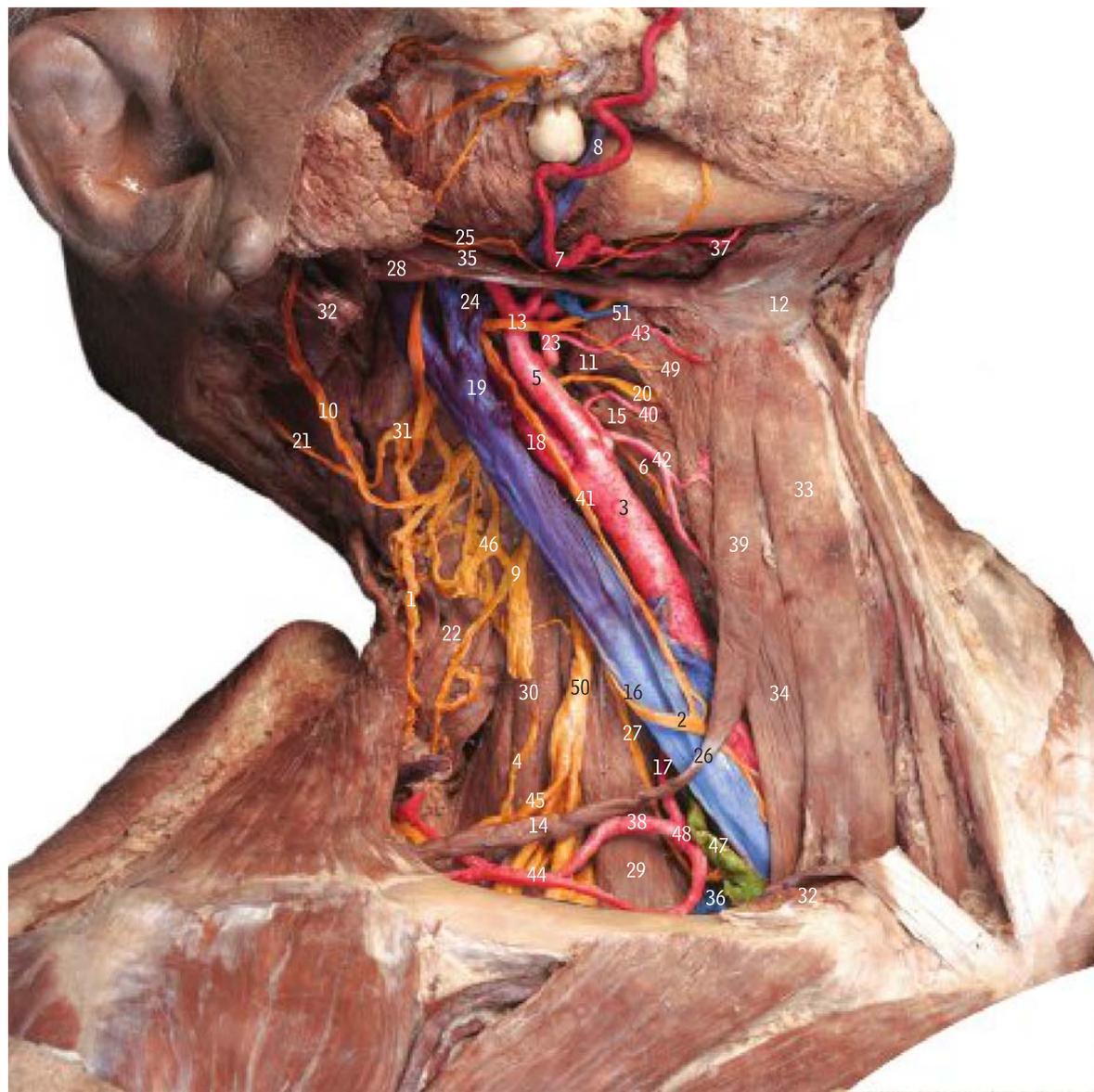


Goitre

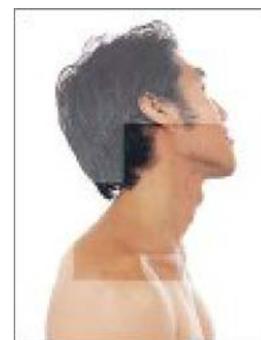


Submandibular tumour

Right side of the neck



- | | | |
|--|---|--|
| 1 Accessory nerve | 20 Internal laryngeal nerve penetrating thyrohyoid membrane | 37 Submental artery |
| 2 Ansa cervicalis | 21 Lesser occipital nerve | 38 Transverse cervical artery (superficial) |
| 3 Common carotid artery | 22 Levator scapulae | 39 Superior belly of omohyoid |
| 4 Dorsal scapular nerve | 23 Lingual artery | 40 Superior laryngeal artery |
| 5 External carotid artery | 24 Lingual vein | 41 Superior root of ansa cervicalis |
| 6 External laryngeal nerve | 25 Marginal mandibular branch of facial nerve | 42 Superior thyroid artery |
| 7 Facial artery | 26 Omohyoid tendon | 43 Suprahyoid artery on hyoglossus |
| 8 Facial vein | 27 Phrenic nerve | 44 Suprascapular artery |
| 9 Fourth cervical nerve ventral rami | 28 Posterior belly of digastric | 45 Suprascapular nerve |
| 10 Great auricular nerve | 29 Scalenus anterior | 46 Third cervical nerve ventral rami |
| 11 Greater horn of hyoid bone | 30 Scalenus medius | 47 The right lymphatic duct |
| 12 Hyoid bone | 31 Second cervical nerve ventral rami | 48 Thyrocervical trunk |
| 13 Hypoglossal nerve | 32 Sternocleidomastoid (cut) | 49 Thyrohyoid muscle and nerve to thyrohyoid |
| 14 Inferior belly of omohyoid | 33 Sternohyoid | 50 Upper trunk of brachial plexus |
| 15 Inferior constrictor of pharynx | 34 Sternothyroid | 51 Vena comitans of hypoglossal nerve |
| 16 Inferior root of ansa cervicalis | 35 Stylohyoid | |
| 17 Inferior thyroid artery | 36 Subclavian vein | |
| 18 Internal carotid artery | | |
| 19 Internal jugular vein (double at upper end) | | |

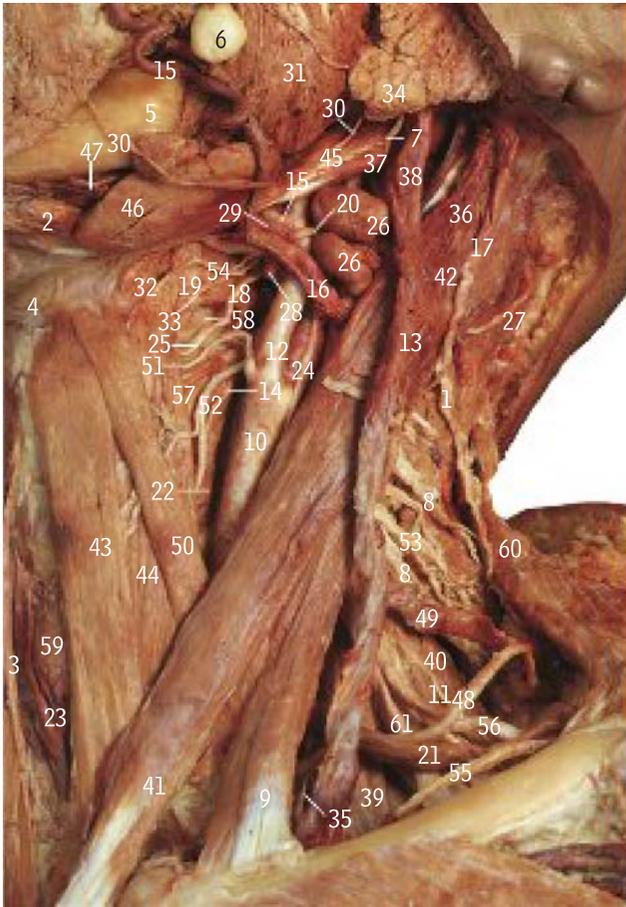


Branchial cysts



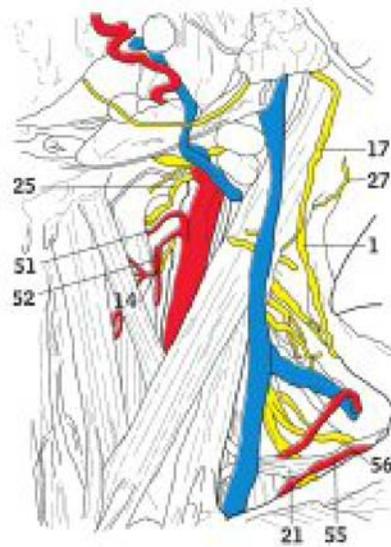
Carotid artery stenosis

Left side of the neck *from the left and front*

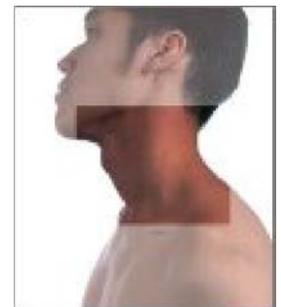


Platysma and the deep cervical fascia have been removed.

In 20% of faces, as in this specimen, the marginal mandibular branch of the facial nerve (30) arches downwards off the face for part of its course and overlies the submandibular gland (46).



- | | | | |
|---|---|---|-----------------------------------|
| 1 Accessory nerve | 20 Hypoglossal nerve | 38 Posterior branch of retromandibular vein | 55 Suprascapular artery |
| 2 Anterior belly of digastric | 21 Inferior belly of omohyoid | 39 Scalenus anterior | 56 Suprascapular nerve |
| 3 Anterior jugular vein | 22 Inferior constrictor of pharynx | 40 Scalenus medius | 57 Thyrohyoid |
| 4 Body of hyoid bone | 23 Inferior thyroid vein | 41 Sternal head of sternocleidomastoid | 58 Thyrohyoid membrane |
| 5 Body of mandible | 24 Internal carotid artery and superior root of ansa cervicalis | 42 Sternocleidomastoid | 59 Thyroid gland (left lobe) |
| 6 Buccal fat pad | 25 Internal laryngeal nerve | 43 Sternohyoid | 60 Trapezius |
| 7 Cervical branch of facial nerve | 26 Jugulodigastric lymph nodes | 44 Sternothyroid | 61 Upper trunk of brachial plexus |
| 8 Cervical nerves to trapezius | 27 Lesser occipital nerve | 45 Stylohyoid | |
| 9 Clavicular head of sternocleidomastoid | 28 Lingual artery | 46 Submandibular gland | |
| 10 Common carotid artery | 29 Lingual vein | 47 Submental artery and vein | |
| 11 Dorsal scapular nerve | 30 Marginal mandibular branch of facial nerve | 48 Superficial (transverse) cervical artery | |
| 12 External carotid artery | 31 Masseter | 49 Superficial (transverse) cervical vein | |
| 13 External jugular vein | 32 Mylohyoid | 50 Superior belly of omohyoid | |
| 14 External laryngeal nerve | 33 Nerve to thyrohyoid | 51 Superior laryngeal artery | |
| 15 Facial artery | 34 Parotid gland | 52 Superior thyroid artery | |
| 16 Facial vein | 35 Phrenic nerve (on scalenus anterior) | 53 Supraclavicular nerve (cut upper edge) | |
| 17 Great auricular nerve | 36 Posterior auricular vein | 54 Suprahyoid artery | |
| 18 Greater horn of hyoid bone (underlying 25) | 37 Posterior belly of digastric | | |
| 19 Hyoglossus | | | |



Carotid artery bruits



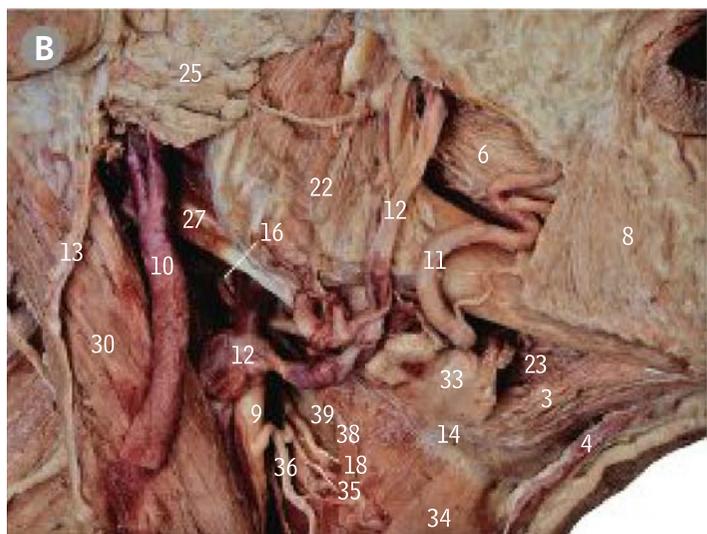
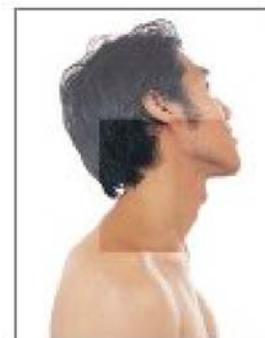
Carotid artery variants



Cervical lymph node enlargement

Right lower face and upper neck parotid and upper cervical regions

submandibular region



- | | |
|---|--|
| <ul style="list-style-type: none"> 1 Ansa cervicalis, inferior branch 2 Ansa cervicalis, superior branch 3 Anterior belly of digastric 4 Anterior jugular vein 5 Brachial plexus (roots) 6 Buccinator 7 Common carotid artery 8 Depressor anguli oris 9 External carotid artery 10 External jugular vein 11 Facial artery 12 Facial vein 13 Great auricular nerve 14 Greater horn of hyoid bone 15 Hyoid bone 16 Hypoglossal nerve 17 Internal jugular vein 18 Internal laryngeal nerve 19 Lesser occipital nerve 20 Levator scapulae 21 Mandible 22 Masseter | <ul style="list-style-type: none"> 23 Mylohyoid 24 Oblique line of the thyroid cartilage 25 Parotid gland and facial nerve branches at anterior border 26 Platysma 27 Posterior belly of digastric 28 Retromandibular vein 29 Scalenus anterior 30 Sternocleidomastoid 31 Sternohyoid 32 Sternothyroid 33 Submandibular gland 34 Superior belly of omohyoid (bifid-variation) 35 Superior laryngeal artery 36 Superior thyroid artery 37 Suprascapular artery 38 Thyrohyoid 39 Thyrohyoid membrane 40 Thyroid gland (right lobe) 41 Trapezius |
|---|--|



Mumps

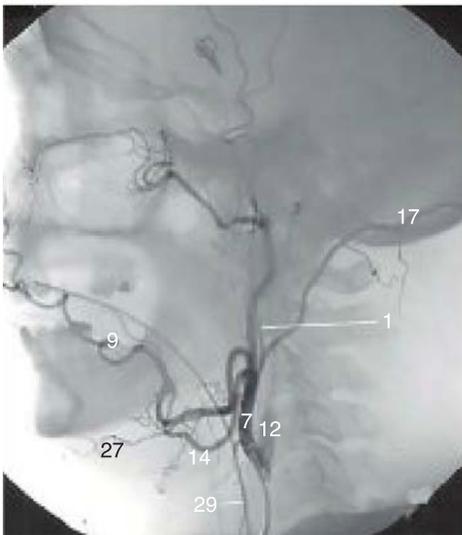
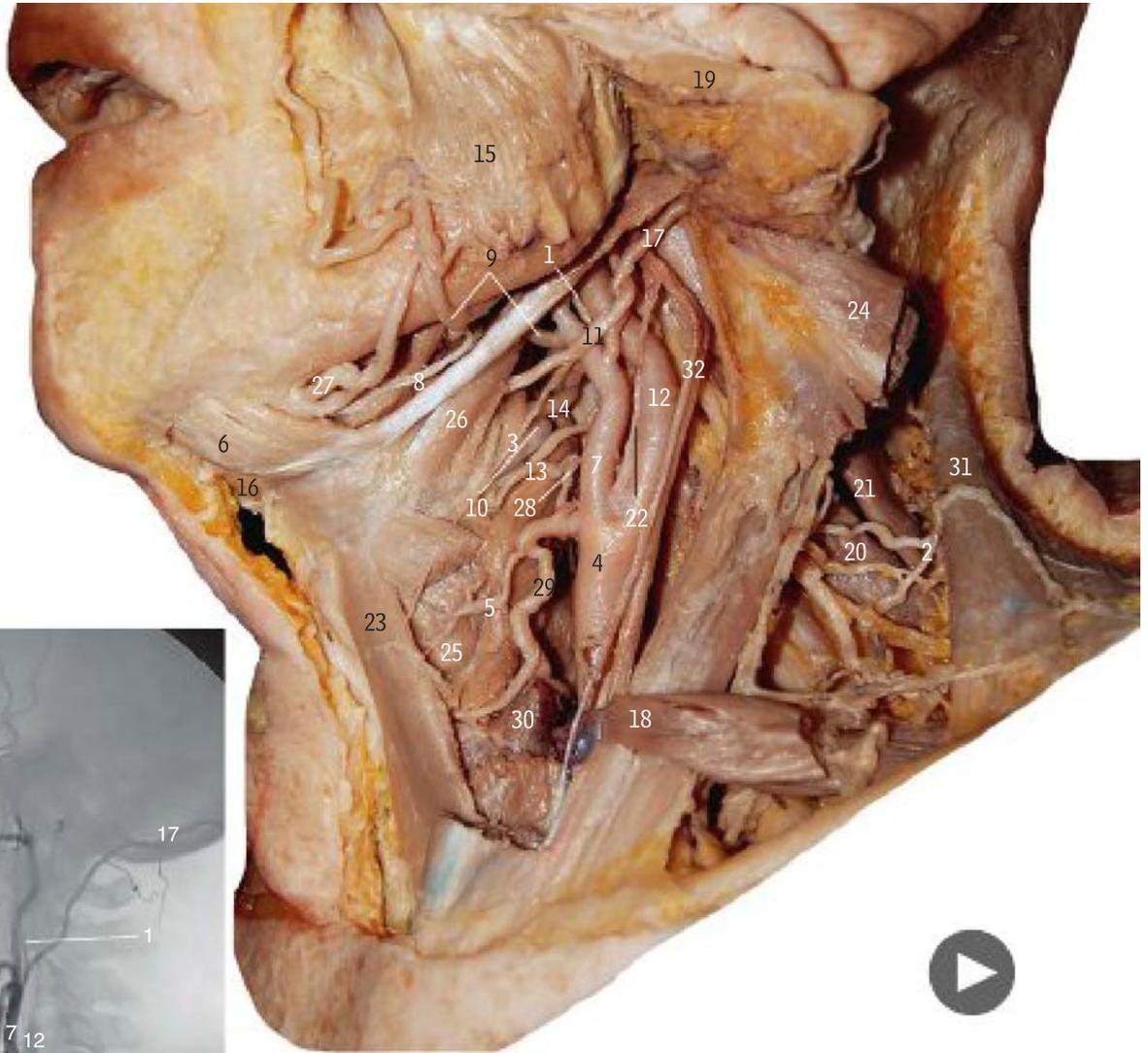


Parotidectomy



Parotid tumours

Left lower face and upper neck



Digital subtraction angiography, external carotid artery

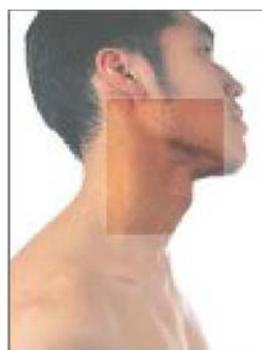
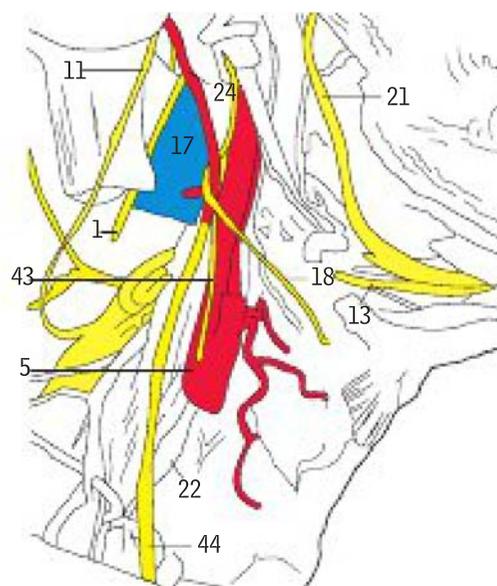
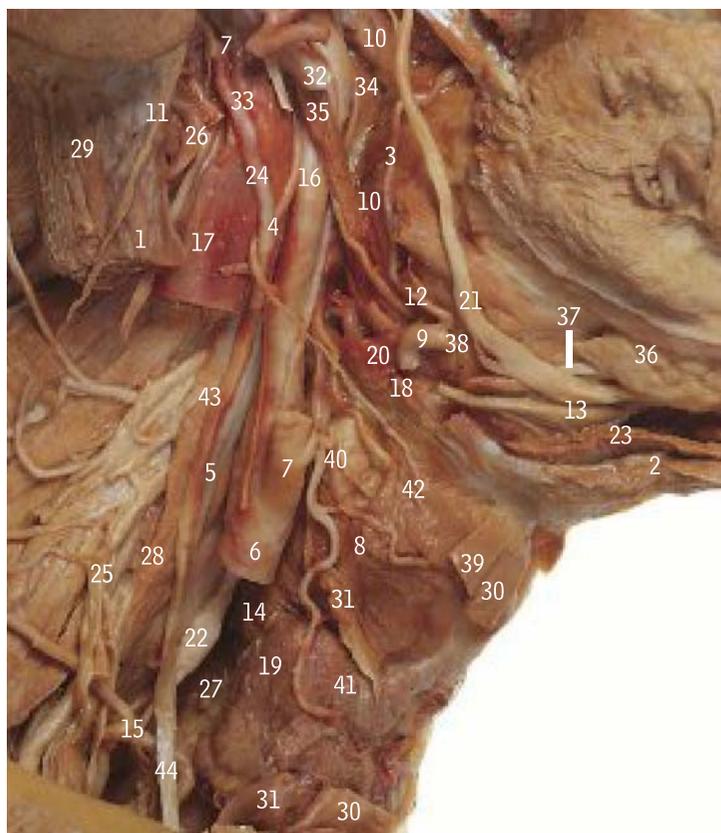


- | | | |
|---|---|---|
| <ul style="list-style-type: none"> 1 Ascending pharyngeal artery 2 Branches of cervical plexus 3 C1 (descendens hypoglossi) 4 Common carotid artery 5 Cricothyroid artery 6 Digastric muscle (anterior belly) 7 External carotid artery 8 Facial nerve, marginal mandibular branch 9 Facial artery 10 Greater horn of the hyoid bone 11 Hypoglossal nerve 12 Internal carotid artery 13 Internal laryngeal nerve | <ul style="list-style-type: none"> 14 Lingual artery 15 Masseter muscle 16 Mylohyoid muscle 17 Occipital artery 18 Omohyoid muscle (reflected) 19 Parotid gland (reflected) 20 Scalenus medius muscle 21 Scalenus posterior muscle 22 Sinus nerve to carotid sinus and body 23 Sternohyoid muscle 24 Sternocleidomastoid muscle (reflected) 25 Sternothyroid muscle (cut) 26 Stylohyoid muscle | <ul style="list-style-type: none"> 27 Submental artery 28 Superior laryngeal artery 29 Superior thyroid artery 30 Thyroid gland (lateral lobe) 31 Trapezius muscle 32 Vagus nerve |
|---|---|---|



Carotid endarterectomy

Right side of the neck *deep dissection*



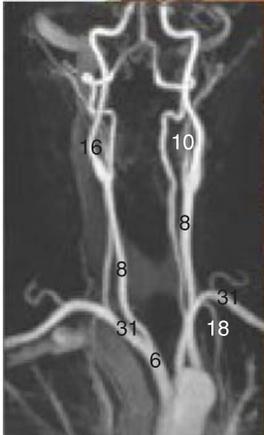
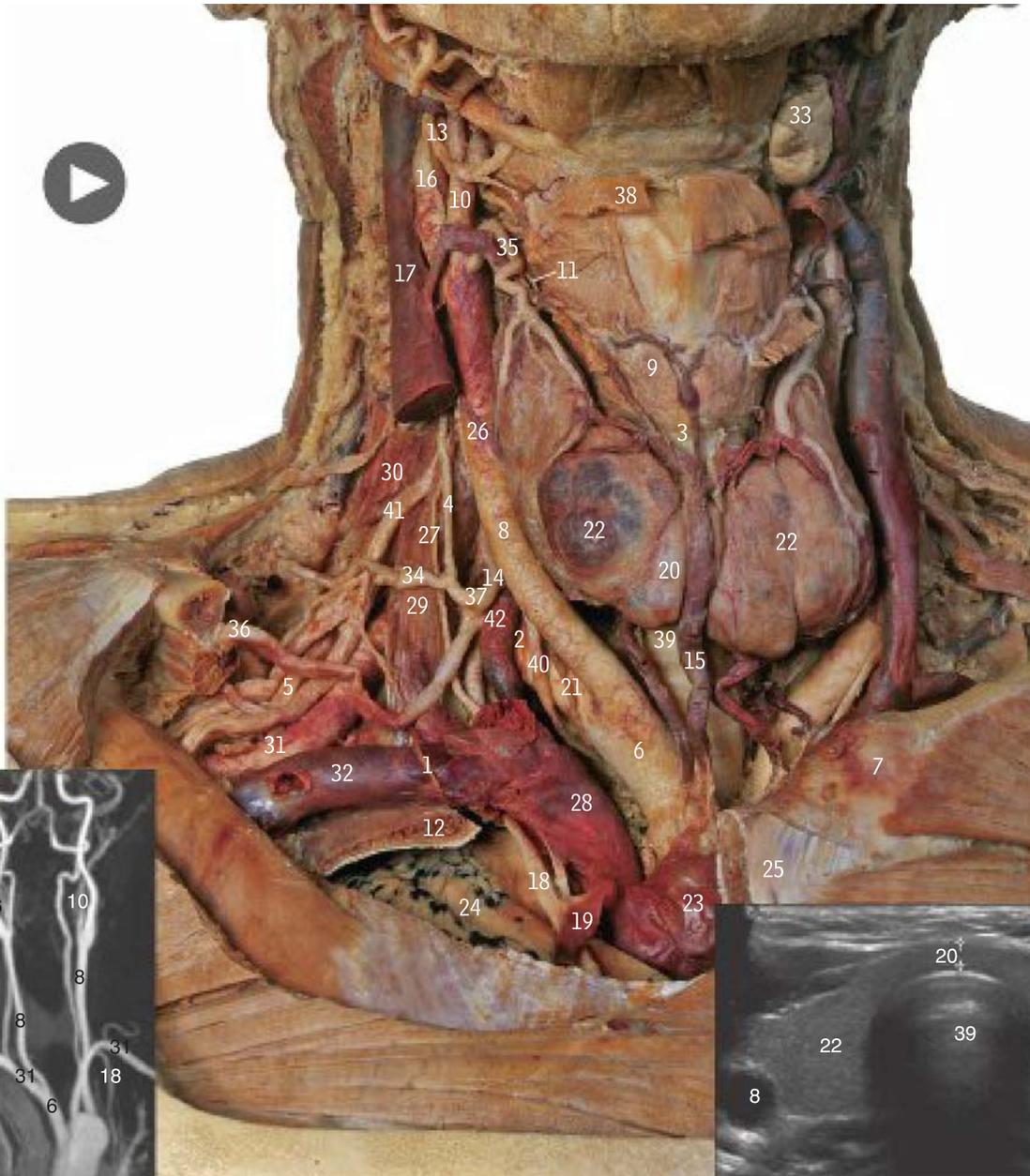
- | | |
|---|--|
| 1 Accessory nerve (cut) | 24 Occipital artery (cut) |
| 2 Anterior belly of digastric | 25 Phrenic nerve |
| 3 Ascending palatine artery | 26 Posterior belly of digastric (cut) |
| 4 Ascending pharyngeal artery | 27 Recurrent laryngeal nerve |
| 5 Carotid sinus | 28 Scalenus anterior |
| 6 Common carotid artery (cut) | 29 Sternocleidomastoid (cut) |
| 7 External carotid artery (cut) | 30 Sternohyoid (cut) |
| 8 External laryngeal nerve | 31 Sternothyroid (cut) |
| 9 Facial artery | 32 Styloglossus |
| 10 Glossopharyngeal nerve | 33 Stylohyoid (cut end displaced medially) |
| 11 Great auricular nerve | 34 Stylohyoid ligament |
| 12 Hyoglossus | 35 Stylopharyngeus |
| 13 Hypoglossal nerve (cut) | 36 Sublingual gland |
| 14 Inferior constrictor | 37 Submandibular duct |
| 15 Inferior thyroid artery | 38 Submandibular ganglion |
| 16 Internal carotid artery | 39 Superior belly of omohyoid (cut) |
| 17 Internal jugular vein | 40 Superior laryngeal artery |
| 18 Internal laryngeal nerve | 41 Superior thyroid artery |
| 19 Lateral lobe of thyroid gland | 42 Thyrohyoid and nerve |
| 20 Lingual artery | 43 Upper root of ansa cervicalis |
| 21 Lingual nerve | 44 Vagus nerve |
| 22 Middle cervical sympathetic ganglion | |
| 23 Mylohyoid | |

The hypoglossal nerve (13) passes downwards, curling around the occipital artery (24) and lying superficial to the external carotid (7) and lingual (20) arteries.

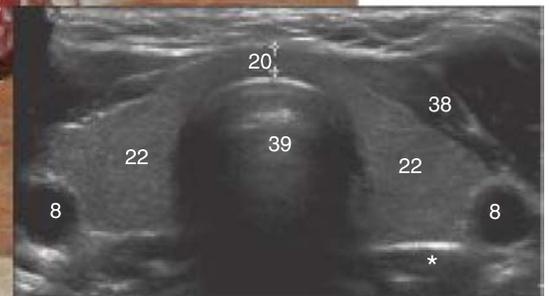
The glossopharyngeal nerve (10) passes downwards and forwards, curling round the lateral side of stylopharyngeus (35).

The removal of parts of the sternohyoid (30), omohyoid (39) and sternothyroid (31) displays the lateral lobe of the thyroid gland (19). Note the inferior thyroid artery (15) behind the lower part of the lobe, with the recurrent laryngeal nerve (27) passing deep to this looping vessel to enter the pharynx beneath the inferior constrictor (14).

Root of the neck

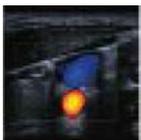


MR angiogram, neck



Thyroid ultrasound, transverse image (*longus colli deep to lateral lobe of thyroid gland).

- | | | |
|--|--|--|
| <ul style="list-style-type: none"> 1 Accessory phrenic nerve 2 Ansa subclavia 3 Arch of cricoid cartilage 4 Ascending cervical artery 5 Brachial plexus 6 Brachiocephalic artery 7 Capsule of sternoclavicular joint 8 Common carotid artery 9 Cricothyroid muscle 10 External carotid artery 11 External laryngeal nerve 12 First rib (sectioned) 13 Hypoglossal nerve 14 Inferior thyroid artery | <ul style="list-style-type: none"> 15 Inferior thyroid veins 16 Internal carotid artery 17 Internal jugular vein 18 Internal thoracic artery 19 Internal thoracic vein 20 Isthmus of thyroid gland 21 Jugular lymphatic trunk 22 Lateral lobe of thyroid gland 23 Left brachiocephalic vein 24 Lung apex 25 Manubrium of sternum 26 Middle thyroid vein 27 Phrenic nerve 28 Right brachiocephalic vein | <ul style="list-style-type: none"> 29 Scalenus anterior 30 Scalenus medius 31 Subclavian artery 32 Subclavian vein 33 Submandibular gland 34 Superficial (transverse) cervical artery 35 Superior thyroid artery and vein 36 Suprascapular artery 37 Thyrocervical trunk 38 Sternohyoid (cut) 39 Trachea 40 Vagus nerve 41 Ventral ramus of fifth cervical nerve 42 Vertebral vein |
|--|--|--|



Internal jugular vein catheterisation



Subclavian vein catheterisation

Prevertebral region

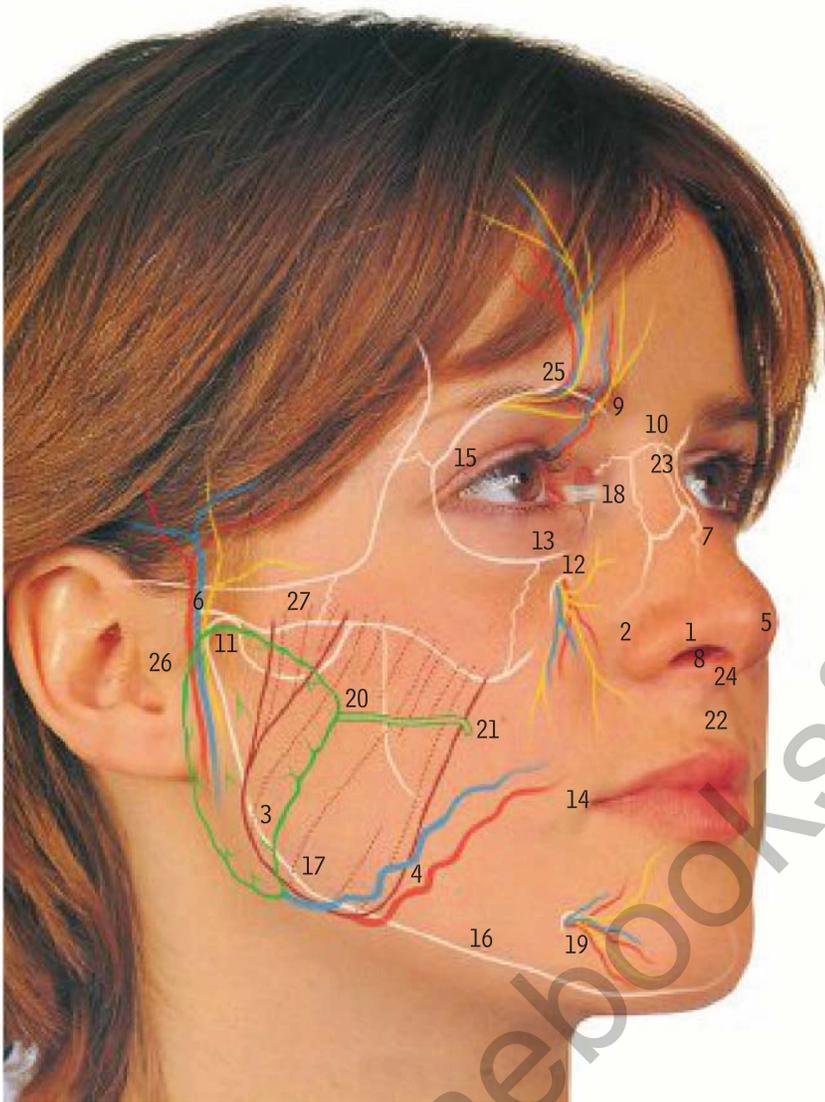


- | | | |
|---|---|---|
| 1 Accessory nerve (spinal root) | 21 Longus capitis | 39 Scalenus medius |
| 2 Anterior longitudinal ligament | 22 Longus colli | 40 Spine of sphenoid bone |
| 3 Ascending cervical artery and vein | 23 Mastoid process | 41 Sternocleidomastoid |
| 4 Ascending pharyngeal artery | 24 Mediastinal lymphatic trunk | 42 Subclavian vein |
| 5 Brachiocephalic artery | 25 Meningeal branch of ascending pharyngeal artery | 43 Superficial cervical artery |
| 6 Dorsal scapular artery | 26 Middle cervical ganglion | 44 Superior cervical ganglion |
| 7 Glossopharyngeal nerve | 27 Occipital artery | 45 Suprascapular artery |
| 8 Inferior cervical ganglion | 28 Oesophageal branch of inferior thyroid artery | 46 Sympathetic trunk |
| 9 Inferior thyroid artery | 29 Oesophagus | 47 Thoracic duct |
| 10 Inferior vagal ganglion | 30 Phrenic nerve | 48 Thyrocervical trunk |
| 11 Internal carotid artery | 31 Posterior belly of digastric | 49 Trachea |
| 12 Internal carotid nerve | 32 Rectus capitis lateralis | 50 Transverse process of atlas |
| 13 Internal jugular vein, upper end | 33 Recurrent laryngeal nerve | 51 Tympanic part of temporal bone |
| 14 Internal jugular vein, lower end | 34 Right brachiocephalic vein | 52 Upper trunk of brachial plexus |
| 15 Internal thoracic artery | 35 Left common carotid artery | 53 Vagus nerve, on left |
| 16 Jugular lymphatic trunk | 36 Right lymphatic duct | 54 Vagus nerve, on right |
| 17 Left brachiocephalic vein | 37 Right subclavian artery | 55 Ventral ramus of third cervical nerve |
| 18 Left common carotid artery | 38 Scalenus anterior | 56 Vertebral artery |
| 19 Left subclavian artery | | 57 Vertebral vein |
| 20 Levator scapulae | | |



Horner's syndrome

Face surface markings on the front and right side



- 1 Ala
- 2 Alar groove (nasolabial groove)
- 3 Angle of mandible
- 4 Anterior border of masseter and facial vessels
- 5 Apex of external nose
- 6 Auriculotemporal nerve and superficial temporal vessels
- 7 Dorsum of nose
- 8 External aperture (anterior naris)
- 9 Frontal notch and supratrochlear nerve and vessels
- 10 Glabella of nose
- 11 Head of mandible
- 12 Infra-orbital foramen, nerve and vessels
- 13 Infra-orbital margin
- 14 Lateral angle of mouth
- 15 Lateral part of supra-orbital margin
- 16 Lower border of body of mandible
- 17 Lower border of ramus of mandible
- 18 Medial palpebral ligament anterior to lacrimal sac
- 19 Mental foramen, nerve and vessels
- 20 Parotid duct emerging from gland
- 21 Parotid duct turning medially at anterior border of masseter
- 22 Philtrum
- 23 Root of nose
- 24 Septum of nose (nasal columella)
- 25 Supra-orbital notch (or foramen), nerve and vessels
- 26 Tragus
- 27 Zygomatic arch

The pulsation of the superficial temporal artery (6) is palpable in front of the tragus of the ear (26).

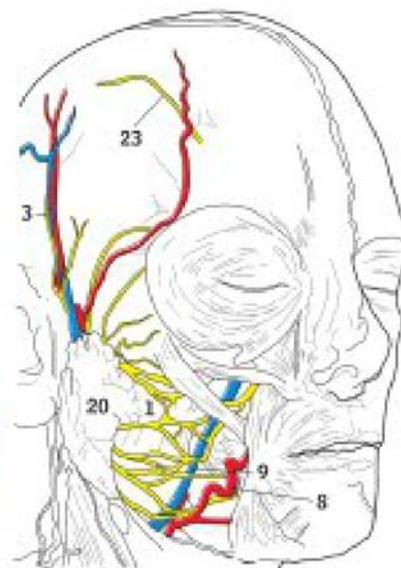
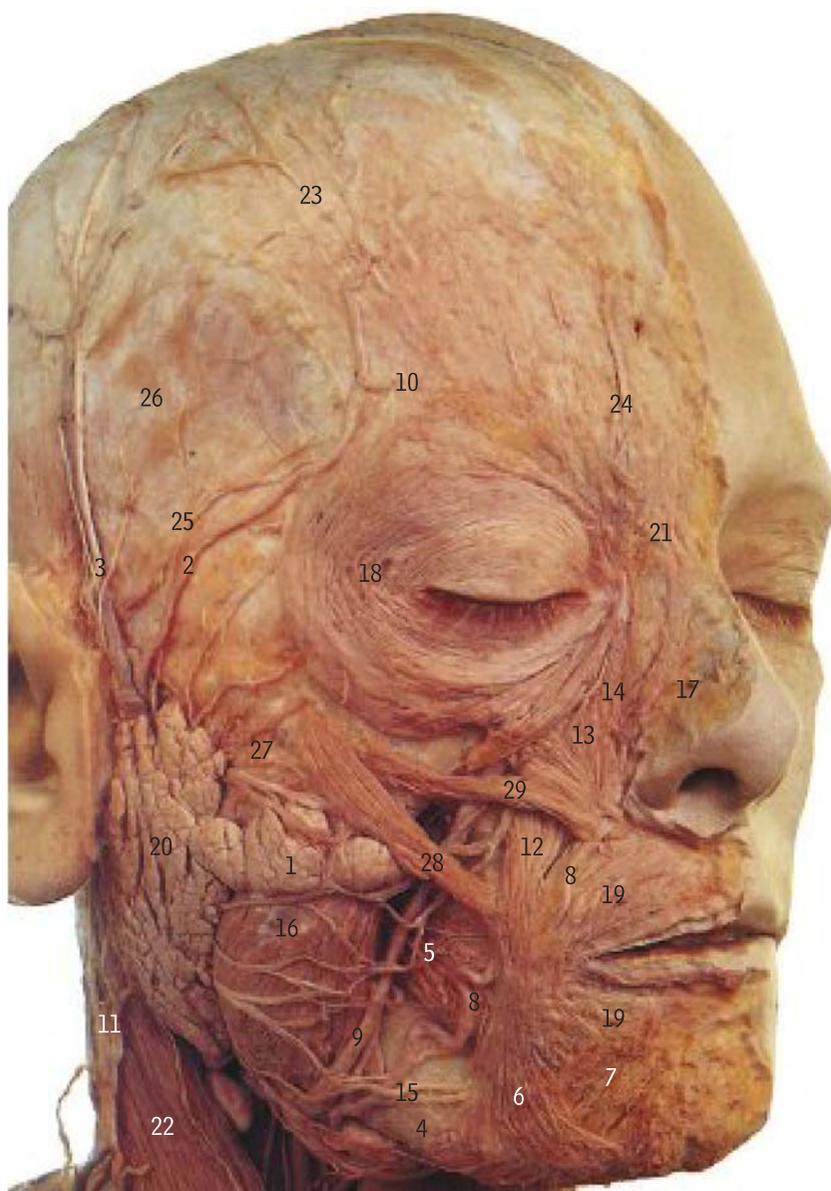
The parotid duct (20 and 21) lies under the middle-third of a line drawn from the tragus of the ear (26) to the midpoint of the philtrum (22).

The pulsation of the facial artery (4) is palpable where the vessel crosses the lower border of the mandible at the anterior margin of the masseter muscle, about 2.5 cm (1 in) in front of the angle of the mandible (3).



Ophthalmic herpes zoster

Face superficial dissection from the front and the right



- | | | | |
|--|---|--|---|
| 1 Accessory parotid gland overlying parotid duct | 7 Depressor labii inferioris | 15 Marginal mandibular branch of facial nerve | 24 Supratrochlear nerve |
| 2 Anterior branch of superficial temporal artery | 8 Facial artery | 16 Masseter | 25 Temporal branch of facial nerve |
| 3 Auriculotemporal nerve and superficial temporal vessels | 9 Facial vein | 17 Nasalis | 26 Temporalis underlying temporal fascia |
| 4 Body of mandible | 10 Frontalis part of occipitofrontalis | 18 Orbicularis oculi | 27 Zygomatic branch of facial nerve |
| 5 Buccinator and buccal branches of facial nerve | 11 Great auricular nerve | 19 Orbicularis oris | 28 Zygomaticus major |
| 6 Depressor anguli oris | 12 Levator anguli oris | 20 Parotid gland | 29 Zygomaticus minor |
| | 13 Levator labii superioris | 21 Procerus | |
| | 14 Levator labii superioris alaeque nasi | 22 Sternocleidomastoid | |
| | | 23 Supra-orbital nerve | |



Facial nerve (Bell's) palsy



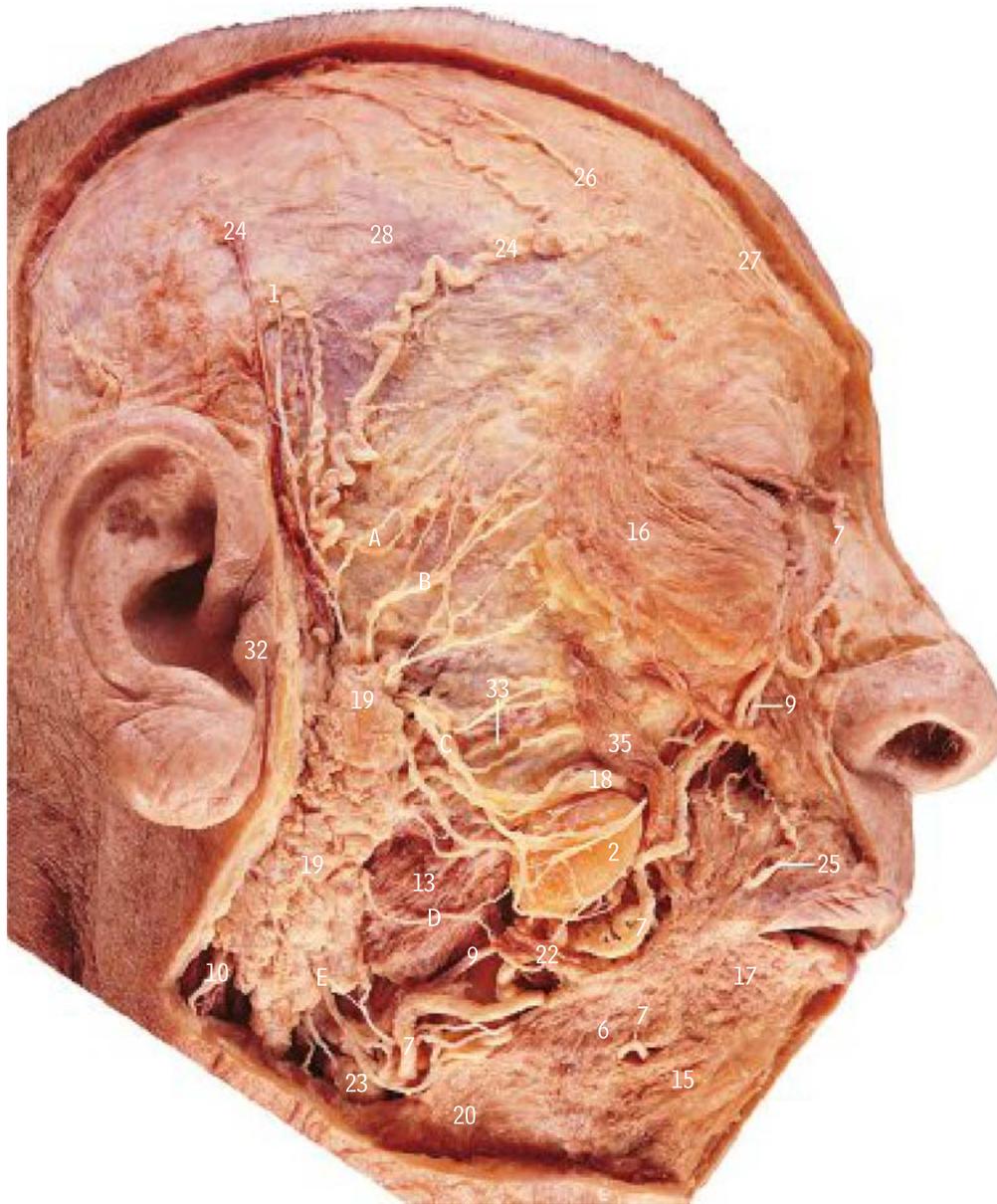
Intracranial spread of infection – face



Intracranial spread of infection – scalp



Surgical flaps of scalp

Face *superficial dissection from the right*

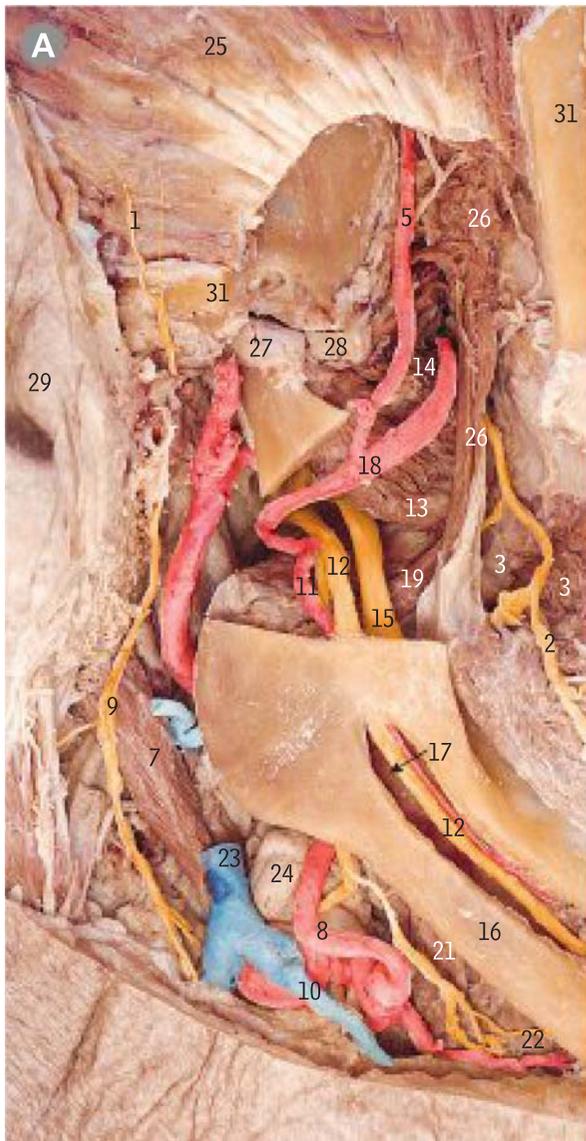
After removal of skin and some fat (A, B, C, D, E = temporal, zygomatic, buccal, mandibular and cervical branches of facial nerve, respectively).

- | | | | |
|--|--------------------------|---|-----------------------------|
| 1 Auriculotemporal nerve | 9 Facial vein | 19 Parotid gland | 28 Temporal fascia |
| 2 Buccal fat pad | 10 Great auricular nerve | 20 Platysma | 29 Temporal line, inferior |
| 3 Buccal nerve (branch of V ₃) | 11 Infra-orbital nerve | 21 Retromandibular vein | 30 Temporal line, superior |
| 4 Buccinator | 12 Mandible, body | 22 Risorius, overlying facial artery and vein | 31 Temporalis |
| 5 Capsule of temporomandibular joint | 13 Masseter | 23 Submandibular gland | 32 Tragus |
| 6 Depressor anguli oris | 14 Mental nerve | 24 Superficial temporal vessels | 33 Transverse facial artery |
| 7 Facial artery | 15 Mentalis | 25 Superior labial artery | 34 Zygomatic arch |
| 8 Facial nerve (A, B, C, D, E branches) | 16 Orbicularis oculi | 26 Supraorbital nerve | 35 Zygomaticus major |
| | 17 Orbicularis oris | 27 Supratrochlear nerve | |
| | 18 Parotid duct | | |

Right temporal fossa

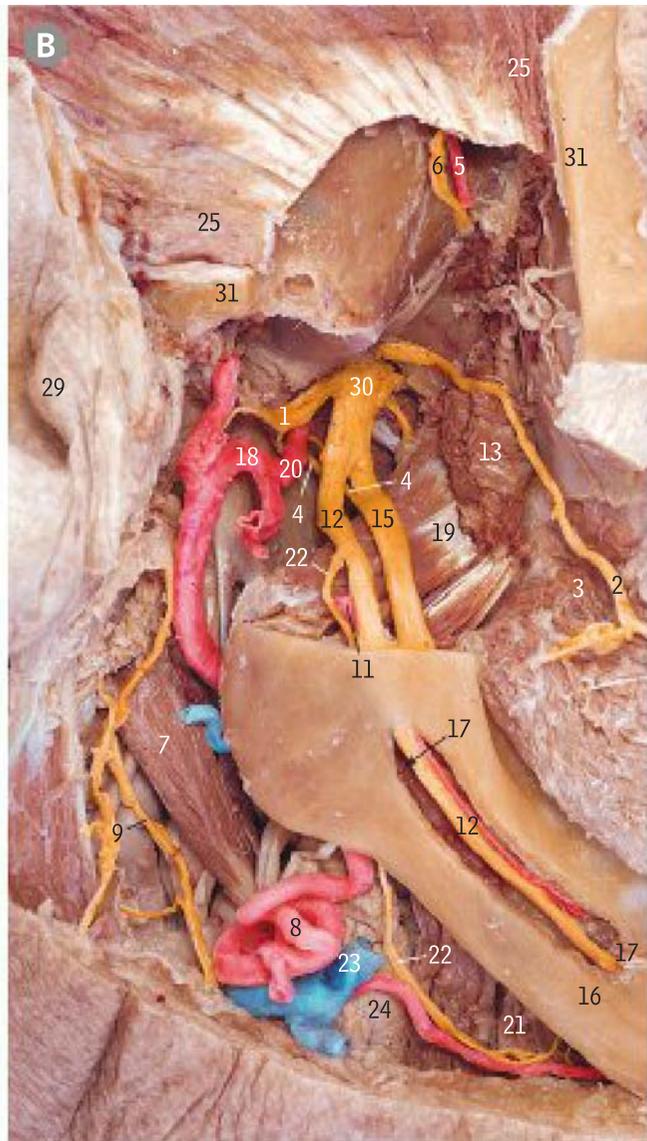


After removal of temporal fascia, parotid gland and most branches of the facial nerve. Dotted line indicates field of deeper dissections shown on next page.

Infratemporal fossa *progressively deeper dissections*

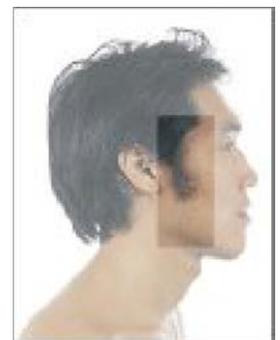
Removal of the masseter, part of the zygomatic arch, most of the superficial and inferior parts of temporalis, the superior half of the mandibular ramus (except the neck and condyle) and the pterygoid venous plexus reveals the superficial contents of the infratemporal fossa.

- | | |
|--|-------------------------------------|
| 1 Auriculotemporal nerve | 14 Lateral pterygoid, superior head |
| 2 Buccal nerve (branch of V ₃) | 15 Lingual nerve |
| 3 Buccinator | 16 Mandible, body |
| 4 Chorda tympani | 17 Mandibular canal (opened) |
| 5 Deep temporal artery | 18 Maxillary artery |
| 6 Deep temporal nerve | 19 Medial pterygoid |
| 7 Digastric, posterior belly | 20 Middle meningeal artery |
| 8 Facial artery | 21 Mylohyoid |
| 9 Facial nerve, cervical branch | 22 Nerve to mylohyoid |
| 10 Facial vein | 23 Retromandibular vein |
| 11 Inferior alveolar artery | 24 Submandibular gland |
| 12 Inferior alveolar nerve | 25 Temporalis |
| 13 Lateral pterygoid, inferior head | |

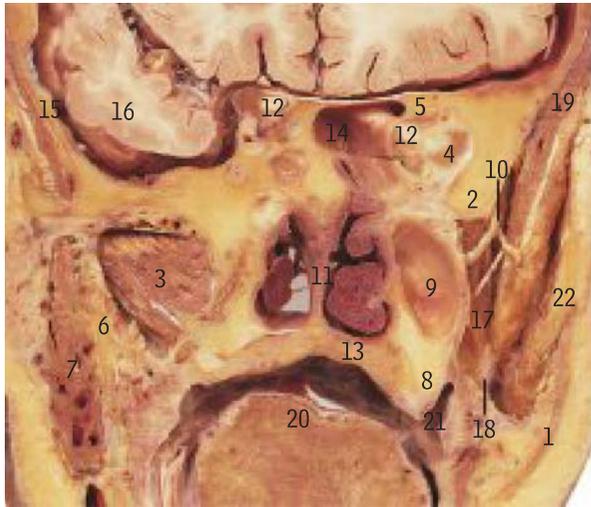


Removal of the deep head of temporalis, the lateral pterygoid and the neck and condyle of the mandible exposes the deepest structures.

- | |
|--|
| 26 Temporalis, deep head (sphenomandibularis) |
| 27 Temporomandibular joint, capsule |
| 28 Temporomandibular joint, articular disc |
| 29 Tragus |
| 30 Trigeminal nerve, mandibular division (V ₃) |
| 31 Zygomatic arch |



Coronal section of cadaveric face *temporalis heads*



- 1 Buccinator
- 2 Greater wing of sphenoid
- 3 Lateral pterygoid
- 4 Lateral rectus
- 5 Lesser wing of sphenoid
- 6 Mandible
- 7 Masseter
- 8 Maxilla
- 9 Maxillary air (paranasal) sinus
- 10 Maxillary artery, muscular branches
- 11 Nasal septum
- 12 Optic nerve
- 13 Palate
- 14 Sphenoidal sinus
- 15 Temporal bone
- 16 Temporal lobe, brain
- 17 Temporalis, deep head (sphenomandibularis – Zenker 1955)
- 18 Temporalis, insertion
- 19 Temporalis, superficial head
- 20 Tongue
- 21 Vestibule of oral cavity
- 22 Zygoma

Endoscopic view of nasal septum (choanae)

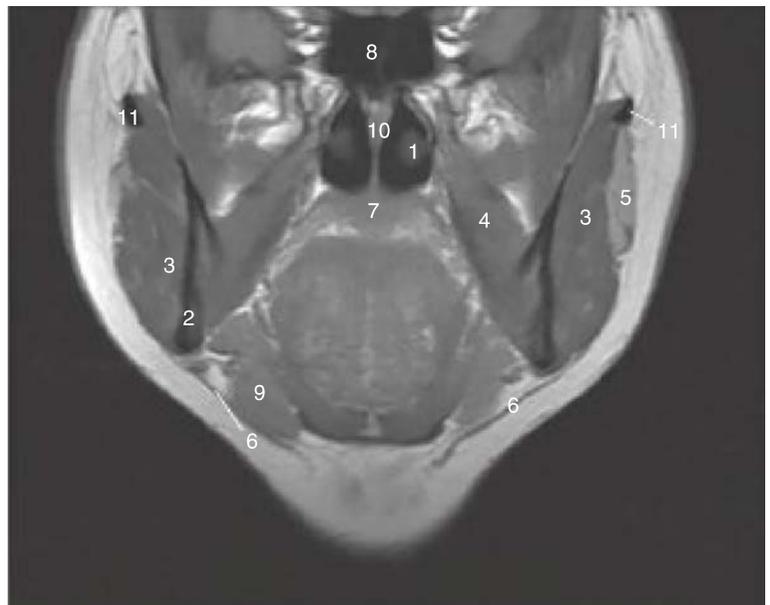


Coronal MR image of face *muscles of mastication*



Coronal MR, posterior face

- 1 Alveolar ridge, maxilla
- 2 Digastric muscle, anterior belly
- 3 Genioglossus muscle
- 4 Hard palate
- 5 Inferior concha
- 6 Mandible
- 7 Maxillary sinus
- 8 Nasal septum
- 9 Oral cavity
- 10 Platysma



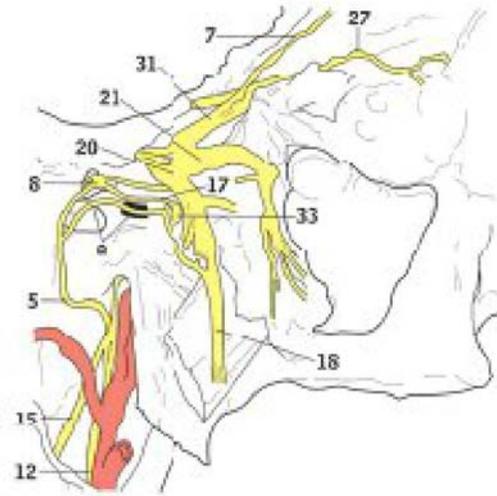
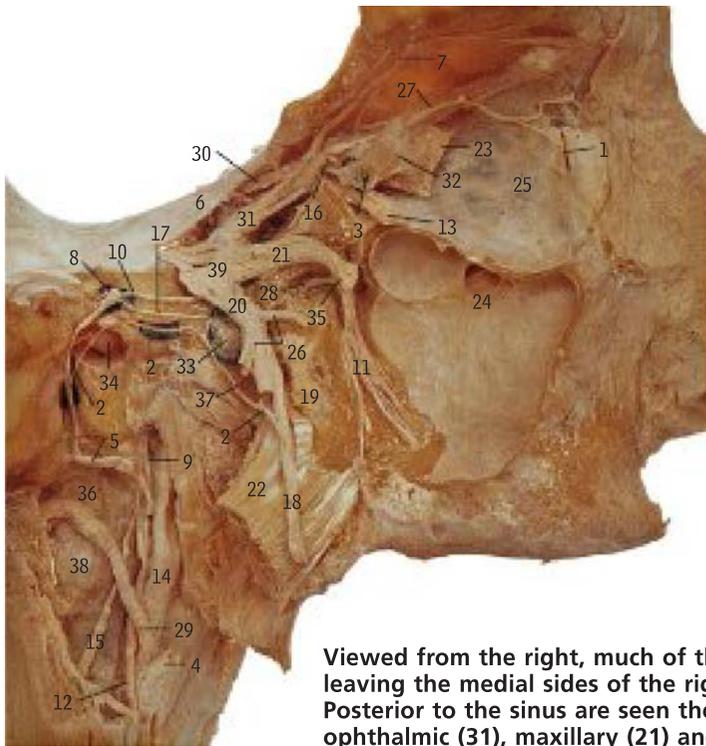
Coronal MR, face

- 1 Inferior concha
- 2 Mandible
- 3 Masseter
- 4 Medial pterygoid
- 5 Parotid gland
- 6 Platysma
- 7 Soft palate
- 8 Sphenoidal sinus
- 9 Submandibular gland
- 10 Vomer
- 11 Zygomatic arch

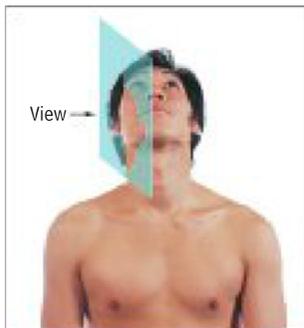


Inferior alveolar nerve block

Right trigeminal, facial and petrosal nerves with associated ganglia



Viewed from the right, much of the right side of the skull has been removed leaving the medial sides of the right orbit (25) and the maxillary sinus (24). Posterior to the sinus are seen the three branches of the trigeminal nerve: ophthalmic (31), maxillary (21) and mandibular (20).



- | | | |
|---------------------------------------|--|--|
| 1 Bristle in lacrimal canaliculus | 14 Internal carotid artery | 26 Muscular branches of mandibular nerve |
| 2 Chorda tympani | 15 Internal jugular vein and accessory nerve | 27 Nasociliary nerve |
| 3 Ciliary ganglion | 16 Lacrimal nerve | 28 Nerve of pterygoid canal |
| 4 External carotid artery | 17 Lesser petrosal nerve | 29 Occipital artery |
| 5 Facial nerve | 18 Lingual nerve | 30 Oculomotor nerve |
| 6 Free margin of tentorium cerebelli | 19 Lower head of lateral pterygoid and lateral pterygoid plate | 31 Ophthalmic nerve |
| 7 Frontal nerve | 20 Mandibular nerve | 32 Optic nerve |
| 8 Geniculate ganglion of facial nerve | 21 Maxillary nerve | 33 Otic ganglion |
| 9 Glossopharyngeal nerve | 22 Medial pterygoid | 34 Position of tympanic membrane |
| 10 Greater petrosal nerve | 23 Medial rectus | 35 Pterygopalatine ganglion |
| 11 Greater and lesser palatine nerves | 24 Medial wall of maxillary sinus and ostium | 36 Rectus capitis lateralis |
| 12 Hypoglossal nerve | 25 Medial wall of orbit | 37 Tensor veli palatini |
| 13 Inferior rectus | | 38 Transverse process of atlas |
| | | 39 Trigeminal ganglion |

The greater petrosal nerve (10) is a branch of the geniculate ganglion of the facial nerve (8) and can be remembered as the nerve of tear secretion (though it also supplies nasal glands). It carries preganglionic fibres from the superior salivary nucleus in the pons, and runs in the groove on the floor of the middle cranial fossa (page 11, 25) to enter the foramen lacerum and become the nerve of the pterygoid canal (28) which joins the pterygopalatine ganglion (35). Postganglionic fibres leave the ganglion to join the maxillary nerve and enter the orbit by the zygomatic branch which communicates with the lacrimal nerve, supplying the gland.

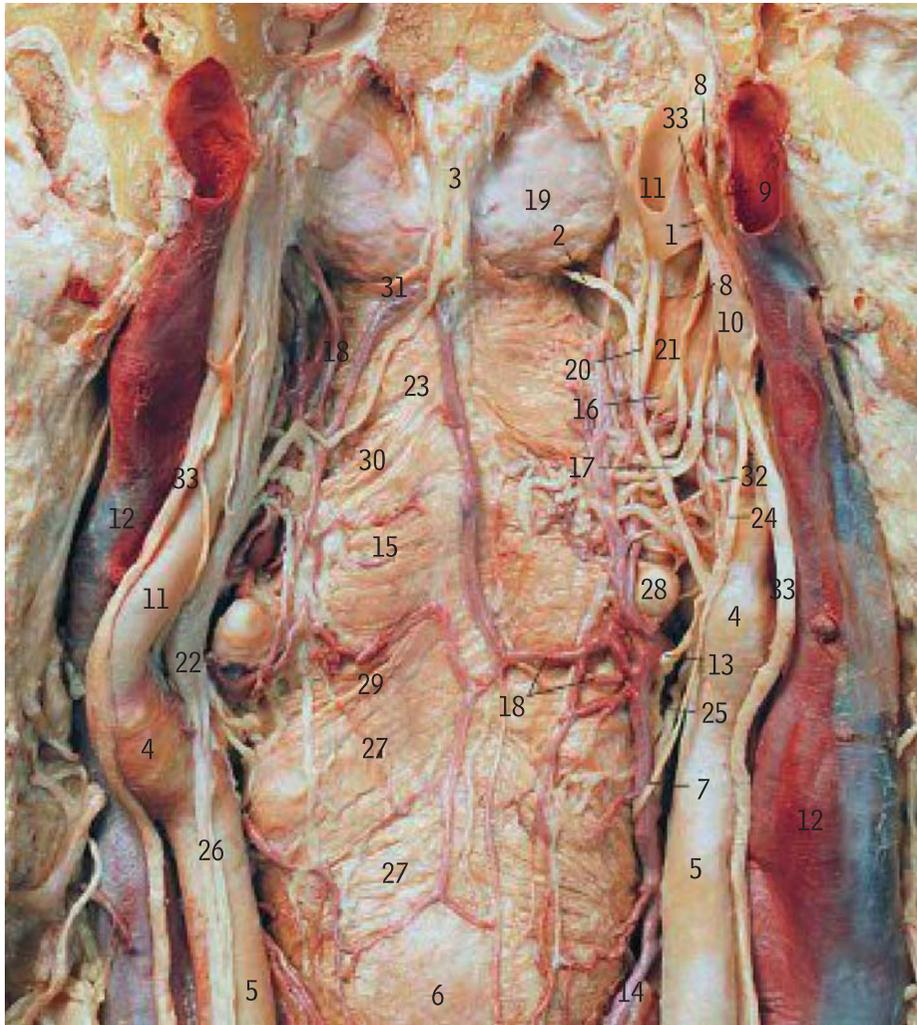
The lesser petrosal nerve (17), although having a communication with the facial nerve, is a branch of the glossopharyngeal nerve, being derived from the tympanic branch which supplies the mucous membrane of the middle ear by the tympanic plexus (page 57, C19). Its fibres are derived from the inferior salivary nucleus in the pons, and after leaving the middle ear and running in its groove on the

floor of the middle cranial fossa (17, and page 11, 26), the nerve reaches the otic ganglion (33) via the foramen ovale. From the ganglion secretomotor fibres join the mandibular nerve (20) to be distributed to the parotid gland by filaments from the auriculotemporal nerve.

The chorda tympani (2) arises from the facial nerve before the latter leaves the stylomastoid foramen (5, upper leader line). It crosses the upper part of the tympanic membrane (34) underneath its mucosal covering and runs through the temporal bone, emerging from the petrotympanic fissure (page 9, 35) to join the lingual nerve (18). It carries preganglionic fibres to the submandibular ganglion (page 56, C35) for the submandibular and sublingual salivary glands, and also taste fibres for the anterior two-thirds of the tongue.

The otic ganglion (33), which normally adheres to the deep surface of the mandibular nerve (20), has been teased off from the nerve and a black marker has been placed behind it.

Pharynx posterior surface, from behind



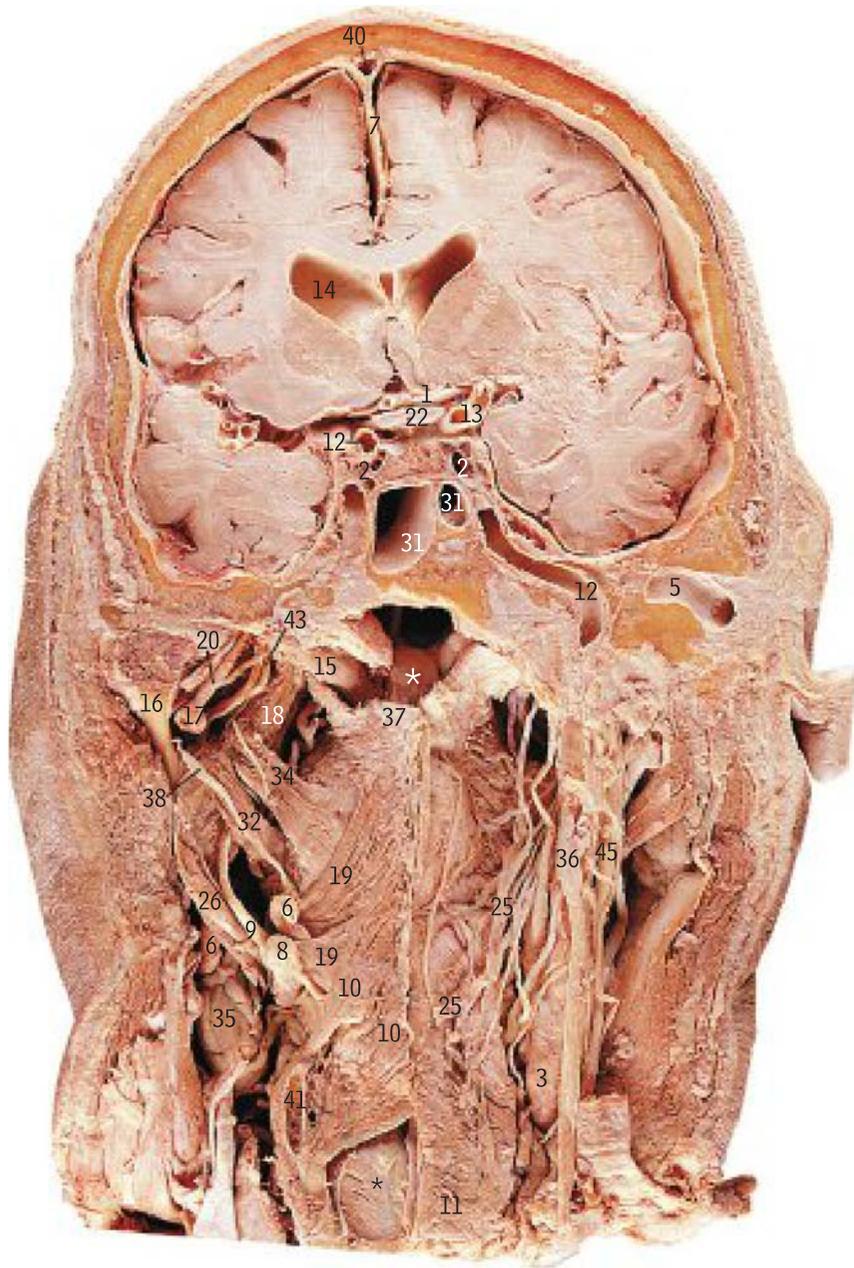
- | | |
|--|---|
| 1 Accessory nerve | 18 Pharyngeal veins |
| 2 Ascending pharyngeal artery | 19 Pharyngobasilar fascia |
| 3 Attachment of pharyngeal raphe to pharyngeal tubercle of base of skull | 20 Posterior meningeal artery |
| 4 Carotid sinus | 21 Stylopharyngeus |
| 5 Common carotid artery | 22 Superior cervical sympathetic ganglion |
| 6 Cricopharyngeal part of inferior constrictor | 23 Superior constrictor |
| 7 External laryngeal nerve | 24 Superior laryngeal branch of vagus nerve |
| 8 Glossopharyngeal nerve | 25 Superior thyroid artery |
| 9 Hypoglossal nerve | 26 Sympathetic trunk |
| 10 Inferior ganglion of vagus nerve | 27 Thyropharyngeal part of inferior constrictor |
| 11 Internal carotid artery | 28 Tip of greater horn of hyoid bone |
| 12 Internal jugular vein | 29 Upper border of inferior constrictor |
| 13 Internal laryngeal nerve | 30 Upper border of middle constrictor |
| 14 Lateral lobe of thyroid gland | 31 Upper border of superior constrictor |
| 15 Middle constrictor | 32 Vagal branch to carotid body |
| 16 Pharyngeal branch of glossopharyngeal nerve | 33 Vagus nerve |
| 17 Pharyngeal branch of vagus nerve | |

The vertebral column has been removed to reveal the carotid sheath and constrictor muscles of the pharynx.



Gag reflex

Posterior pharyngeal wall *from behind*



Slightly oblique coronal section of the head and neck in the plane of the posterior pharyngeal wall, with the right side slightly posterior to the left.

Sections of the posterior pharyngeal wall have been removed (asterisks – superiorly the pharyngobasilar fascia and inferiorly the lower border of the inferior constrictor) to reveal parts of the nasopharynx and the laryngopharynx, respectively.

Refer to the key on [page 47](#) for the numbers on this figure.

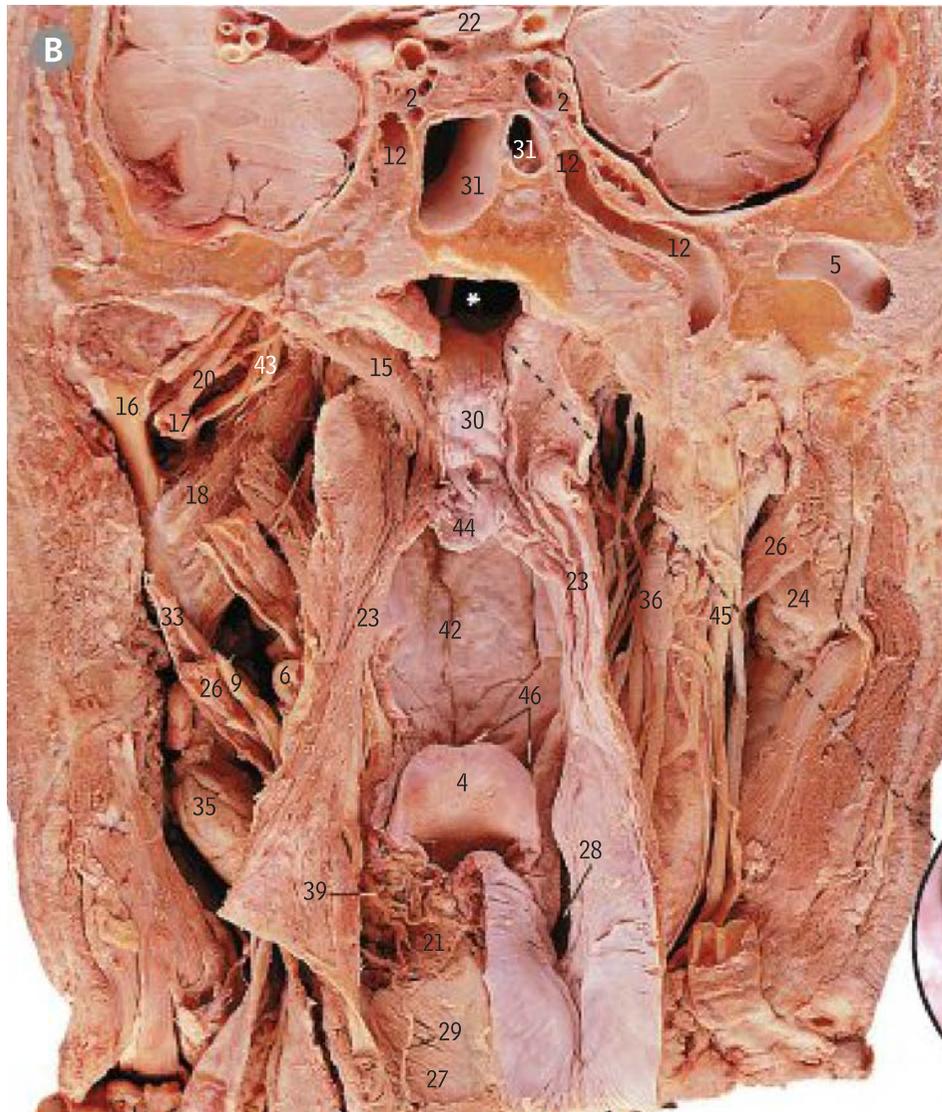


Pharyngeal pouch



Tonsillectomy

'Opened' pharynx from behind



Close-up of interior of the pharynx, after incising and reflecting posterior pharyngeal wall and removing the mucosa from the left pharyngeal walls.



- | | | |
|--|---------------------------------|---|
| 1 Anterior cerebral artery | 17 Maxillary artery | 34 Stylopharyngeus, with glossopharyngeal nerve |
| 2 Cavernous sinus | 18 Medial pterygoid | 35 Submandibular gland |
| 3 Common carotid | 19 Middle constrictor | 36 Superior cervical ganglion |
| 4 Epiglottis | 20 Middle meningeal artery | 37 Superior constrictor |
| 5 External auditory canal | 21 Oblique arytenoid | 38 Superior pharyngeal branch of vagus |
| 6 Facial artery | 22 Optic chiasm | 39 Superior laryngeal nerve, internal branch |
| 7 Falx cerebri | 23 Palatopharyngeus | 40 Superior sagittal sinus |
| 8 Hyoid – tip of greater horn | 24 Parotid gland | 41 Thyroid cartilage lamina, cut |
| 9 Hypoglossal nerve | 25 Pharyngeal plexus of veins | 42 Tongue, dorsum, posterior third |
| 10 Inferior constrictor | 26 Posterior belly of digastric | 43 Trigeminal nerve, mandibular division |
| 11 Inferior constrictor – cricopharyngeus part | 27 Posterior crico-arytenoid | 44 Uvula |
| 12 Internal carotid | 28 Piriform fossa (recess) | 45 Vagus |
| 13 Internal carotid giving off middle cerebral | 29 Recurrent laryngeal nerve | 46 Vallecula |
| 14 Lateral ventricle | 30 Soft palate, nasal surface | |
| 15 Levator veli palatini | 31 Sphenoidal sinus | |
| 16 Mandible, neck | 32 Styloglossus muscle | |
| | 33 Stylohyoid muscle | |

Endoscopic view of choanae and posterior nasal septum

NB: Nasogastric tube in situ



Pharyngitis

Hyoid bone



Laryngeal surface anatomy

from above and in front

lateral view

anterior view

with muscle attachments

- | | |
|----------------------|---------------------------|
| 1 Body | 8 Mylohyoid |
| 2 Genioglossus | 9 Omohyoid |
| 3 Geniohyoid | 10 Sternohyoid |
| 4 Greater horn | 11 Stylohyoid |
| 5 Hyoglossus | 12 Stylohyoid ligament |
| 6 Lesser horn | 13 Thyrohyoid constrictor |
| 7 Middle constrictor | |

Epiglottis

cartilage, from the front

Thyroid

cartilage, from the front

from the right, with attachments

- | |
|---------------------------------------|
| 1 Cricothyroid |
| 2 Inferior constrictor |
| 3 Inferior horn |
| 4 Inferior tubercle |
| 5 Lamina |
| 6 Laryngeal prominence (Adam's apple) |
| 7 Sternothyroid |
| 8 Superior horn |
| 9 Superior tubercle |
| 10 Thyrohyoid |
| 11 Thyroid notch |

Arytenoid cartilages

from behind

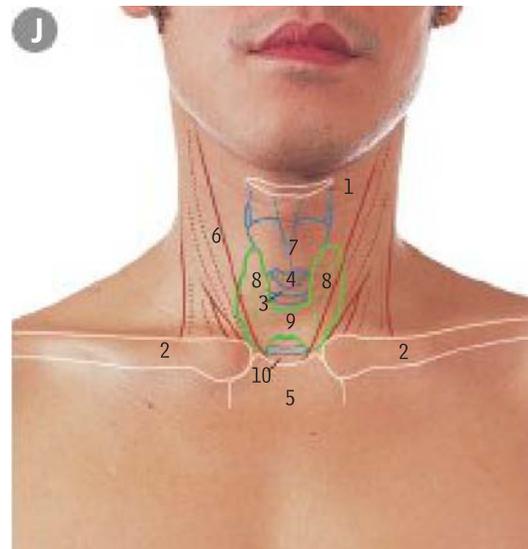
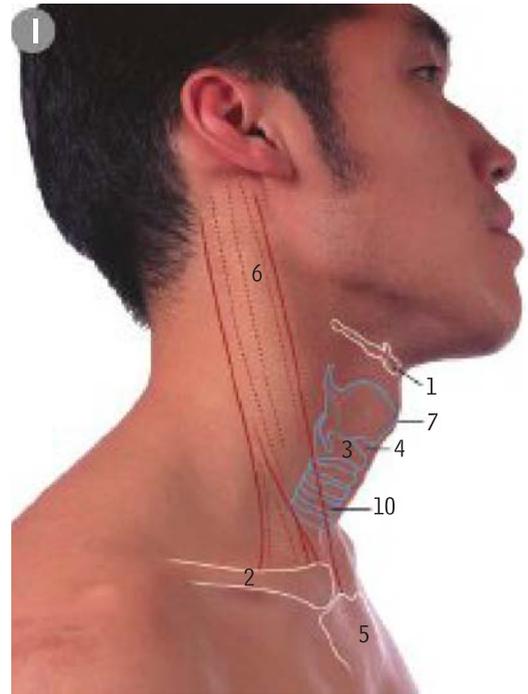
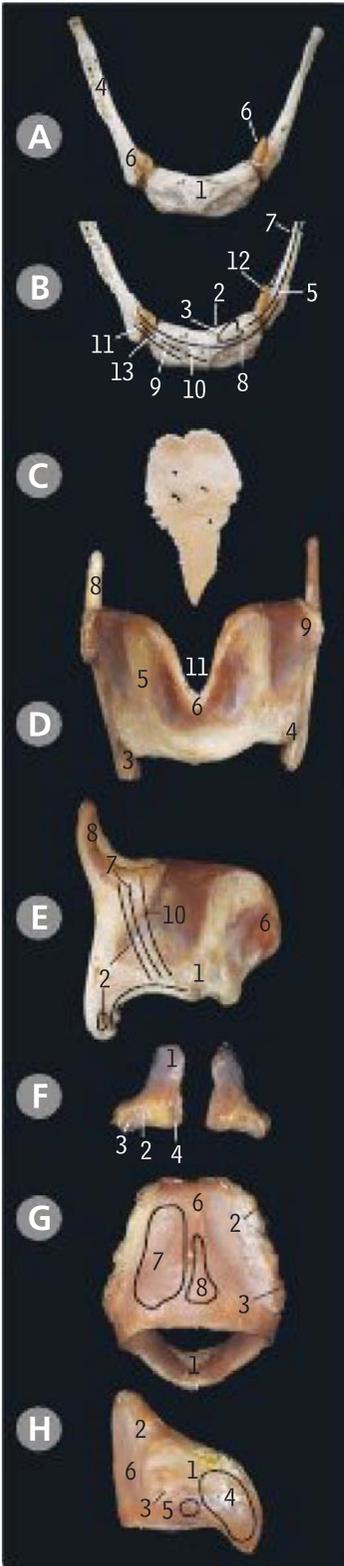
- | |
|---|
| 1 Apex |
| 2 Articular surface for cricoid cartilage |
| 3 Muscular process |
| 4 Vocal process |

Cricoid cartilage and muscle attachments

from behind and below

from the right

- | |
|--|
| 1 Arch |
| 2 Articular surface for arytenoid cartilage |
| 3 Articular surface for inferior horn of thyroid cartilage |
| 4 Cricothyroid |
| 5 Inferior constrictor |
| 6 Lamina |
| 7 Posterior crico-arytenoid |
| 8 Tendon of oesophagus |

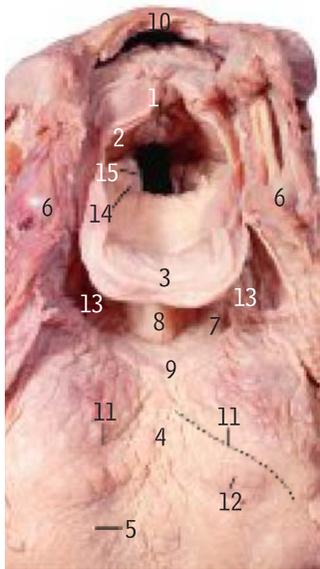


- | | |
|----------------------------------|---|
| 1 Body of hyoid bone | 7 Thyroid cartilage, laryngeal prominence |
| 2 Clavicle | 8 Thyroid gland, lateral lobe |
| 3 Cricoid cartilage | 9 Thyroid gland, isthmus |
| 4 Cricothyroid ligament/membrane | 10 Tracheal ring |
| 5 Manubrium | |
| 6 Sternocleidomastoid muscle | |



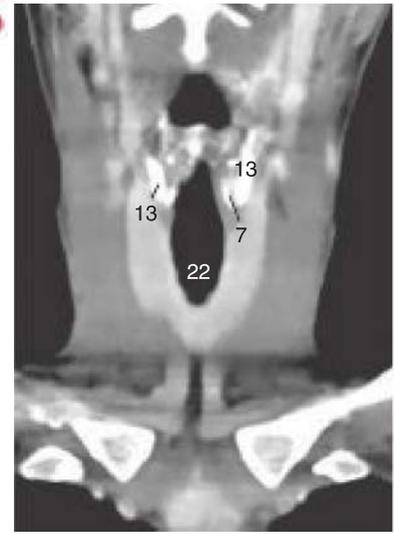
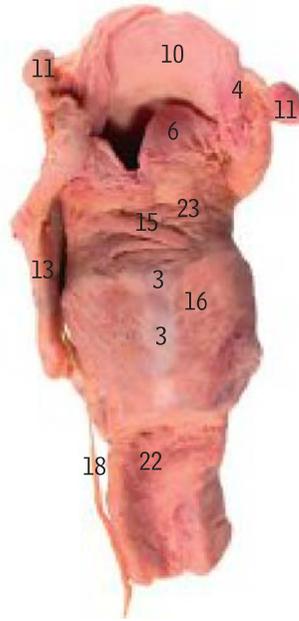
Tracheostomy

Tongue and the inlet of the larynx from above



- 1 Corniculate cartilage in aryepiglottic fold
- 2 Cuneiform cartilage in aryepiglottic fold
- 3 Epiglottis
- 4 Foramen caecum
- 5 Fungiform papilla
- 6 Hyoid, greater horn
- 7 Lateral glossoepiglottic fold
- 8 Median glossoepiglottic fold
- 9 Pharyngeal part of dorsum of tongue
- 10 Posterior wall of pharynx
- 11 Sulcus terminalis, unilaterally indicated by dashed line
- 12 Vallate papilla
- 13 Vallecula
- 14 Vestibular fold (false vocal cord)
- 15 Vocal fold (true vocal cord)

Larynx from behind

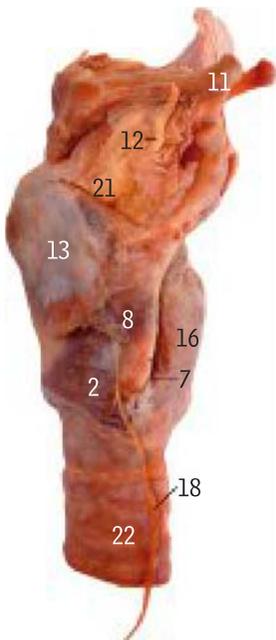


CT neck, mid coronal

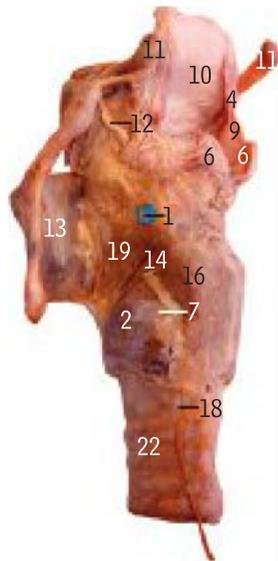
See label list below right.

Intrinsic muscles of the larynx

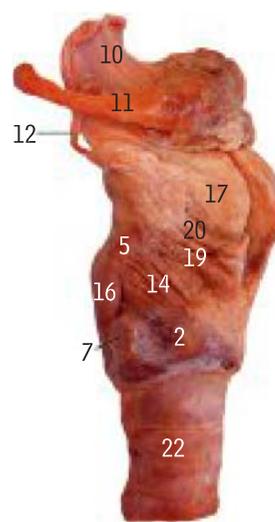
from the left



from the posterior oblique view



from the right



- 1 Anastomosis of internal and recurrent laryngeal nerves (Galen's anastomosis)
- 2 Arch of cricoid cartilage
- 3 Area on lamina of cricoid cartilage for attachment of oesophagus
- 4 Aryepiglottic fold
- 5 Aryepiglottic muscle
- 6 Corniculate cartilage
- 7 Cricothyroid joint
- 8 Cricothyroid muscle (origin from thyroid cartilage)
- 9 Cuneiform cartilage
- 10 Epiglottis
- 11 Greater horn of hyoid bone
- 12 Internal laryngeal nerve
- 13 Lamina of thyroid cartilage
- 14 Lateral crico-arytenoid muscle
- 15 Oblique arytenoid cartilage
- 16 Posterior crico-arytenoid muscle
- 17 Quadrangular ligament
- 18 Recurrent laryngeal nerve
- 19 Thyro-arytenoid muscle
- 20 Thyro-epiglottic muscle
- 21 Thyrohyoid membrane
- 22 Trachea
- 23 Transverse arytenoid muscle

In D, the thyroid cartilage has been reflected forward, and in E the right lamina of the thyroid cartilage has been removed.

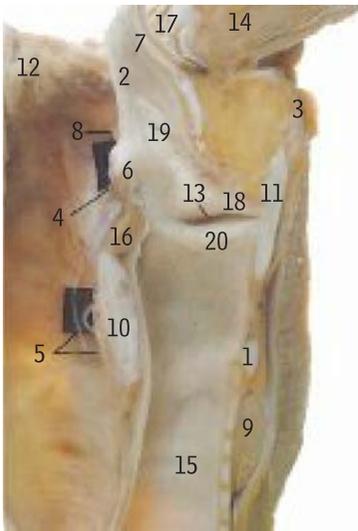


Endotracheal intubation



Recurrent laryngeal nerve palsy

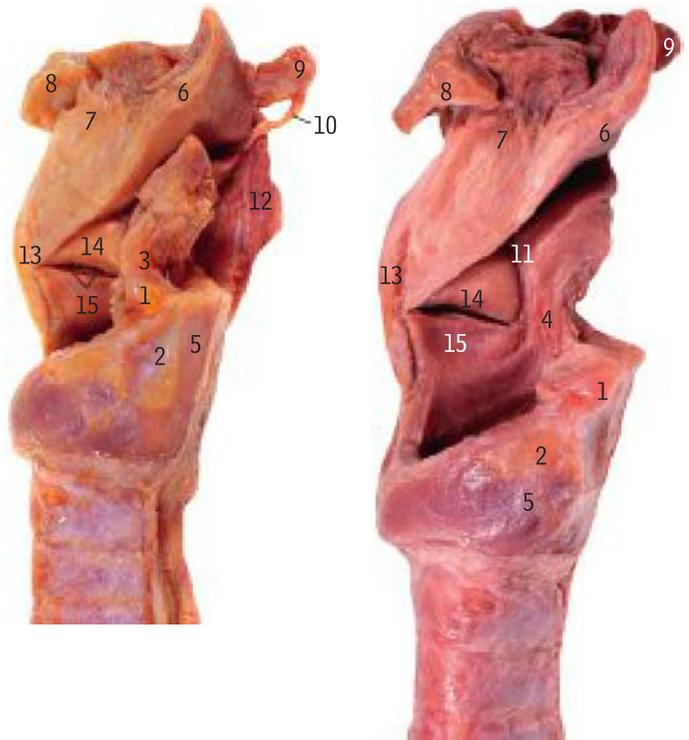
Larynx in sagittal section, from the right



Endoscopic view of cricoid and tracheal rings

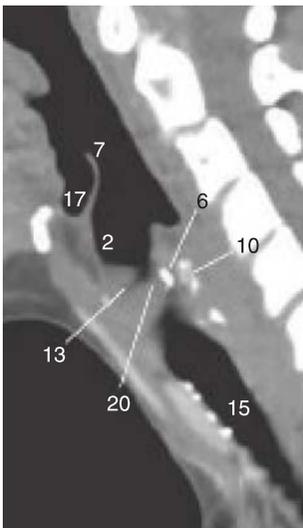


Larynx internal views



The vocal fold (vocal cord, 20) lies below the vestibular fold (false vocal cord, 18).

- | | | | |
|--|--|--|--|
| <ul style="list-style-type: none"> 1 Arch of cricoid cartilage 2 Aryepiglottic fold and inlet of larynx 3 Body of hyoid bone 4 Branches of internal laryngeal nerve anastomosing with recurrent laryngeal nerve 5 Branches of recurrent laryngeal nerve 6 Corniculate cartilage and apex of arytenoid cartilage 7 Epiglottis 8 Internal laryngeal nerve entering piriform recess | <ul style="list-style-type: none"> 9 Isthmus of thyroid gland 10 Lamina of cricoid cartilage 11 Lamina of thyroid cartilage 12 Pharyngeal wall 13 Sinus of larynx (laryngeal ventricle) 14 Tongue 15 Trachea 16 Transverse arytenoid muscle 17 Vallecula 18 Vestibular fold 19 Vestibule of larynx 20 Vocal fold | <ul style="list-style-type: none"> 1 Articular facet on cricoid for left arytenoid cartilage 2 Articular site of thyroid and cricoid cartilages 3 Arytenoid cartilage, left, lateral surface 4 Arytenoid cartilage, right, medial surface 5 Cricoid cartilage, lamina 6 Epiglottis 7 Hyoepiglottic ligament | <ul style="list-style-type: none"> 8 Hyoid arch, cross-section 9 Hyoid, greater horn 10 Internal laryngeal nerve 11 Quadrangular membrane 12 Thyrohyoid membrane 13 Thyroid cartilage, lamina, cross-section 14 Vestibular fold (false vocal cord) 15 Vocal fold (true vocal cord) |
|--|--|--|--|



Mid-sagittal CT neck

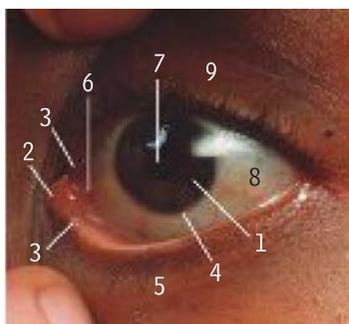
The space between the vestibular and vocal folds is the sinus of the larynx (A13), and this is continuous with the saccule, a small pouch that extends upwards for a few millimetres between the vestibular fold and the inner surface of the thyroarytenoid muscle.

The fissure between the two vestibular folds (A18) is the rima of the vestibule. The fissure between the vocal folds is the rima of the glottis.

The vestibular folds are often called the false vocal cords.

The intrinsic muscles of the larynx are supplied by the recurrent laryngeal nerve, except the cricothyroid (page 49, C8) which is supplied by the external laryngeal nerve (page 29, 12).

Left eye surface features



With the eyelids in the normal open position, the lower margin of the upper lid (9) overlaps approximately the upper half of the iris (1); the margin of the lower lid (5) is level with the lower margin of the iris (1).

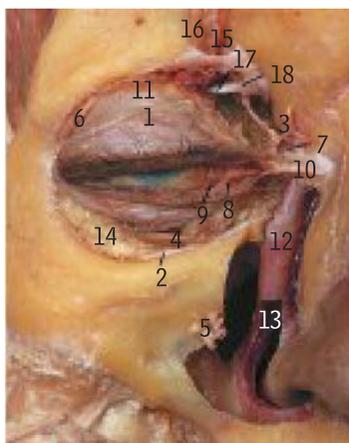
- | | |
|-----------------------------------|-----------------------|
| 1 Iris behind cornea | 5 Lower lid |
| 2 Lacrimal caruncle | 6 Plica semilunaris |
| 3 Lacrimal papilla | 7 Pupil behind cornea |
| 4 Limbus (corneoscleral junction) | 8 Sclera |
| | 9 Upper lid |

The cornea is the transparent anterior part of the outer coat of the eyeball and is continuous with the sclera (8) at the limbus (4).

The pupil (7) is the central aperture of the iris (1), the circular pigmented diaphragm that lies in front of the lens.

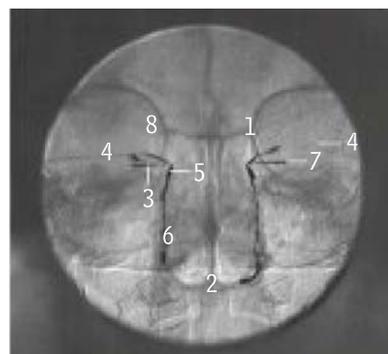
Each lacrimal papilla (3) contains the lacrimal punctum, the minute opening of the lacrimal canaliculus (B8) which runs medially to open into the lacrimal sac, lying deep to the medial palpebral ligament (B10) and continuing downwards as the nasolacrimal duct (B12) within the nasolacrimal canal.

Nasolacrimal duct



- 1 Aponeurosis of levator palpebrae superioris
- 2 Cut edge of orbital septum and periosteum
- 3 Dorsal nasal artery
- 4 Inferior oblique
- 5 Infra-orbital nerve
- 6 Lacrimal gland
- 7 Lacrimal sac (upper extremity)
- 8 Lower lacrimal canaliculus
- 9 Lower lacrimal papilla and punctum
- 10 Medial palpebral ligament
- 11 Muscle fibres of levator palpebrae superioris
- 12 Nasolacrimal duct
- 13 Opening of nasolacrimal duct (anterior wall removed) in inferior meatus of nose
- 14 Orbital fat pad
- 15 Supra-orbital artery
- 16 Supra-orbital nerve
- 17 Tendon of superior oblique
- 18 Trochlea

Macrodacryocystogram

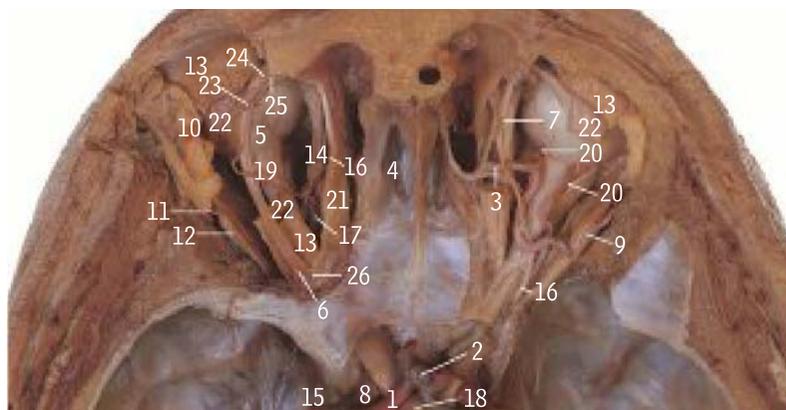


- 1 Common canaliculus
- 2 Hard palate
- 3 Inferior canaliculus
- 4 Lacrimal catheters
- 5 Lacrimal sac
- 6 Nasolacrimal duct
- 7 Site of lacrimal punctum
- 8 Superior canaliculus

In B, the facial muscles and part of the skull have been dissected away to display the nasolacrimal duct (12) opening into the inferior meatus of the nose (13).

- 1 Anterior cerebral artery
- 2 Anterior communicating artery
- 3 Anterior ethmoidal artery and nerve
- 4 Cribriform plate of ethmoid bone
- 5 Eyeball
- 6 Frontal nerve
- 7 Infratrochlear nerve and ophthalmic artery
- 8 Internal carotid artery
- 9 Lacrimal artery
- 10 Lacrimal gland
- 11 Lacrimal nerve
- 12 Lateral rectus
- 13 Levator palpebrae superioris (cut)
- 14 Medial rectus
- 15 Middle cerebral artery
- 16 Nasociliary nerve
- 17 Ophthalmic artery
- 18 Optic chiasma
- 19 Optic nerve (with overlying short ciliary nerves in left orbit)
- 20 Posterior ciliary artery
- 21 Superior oblique
- 22 Superior rectus (cut)
- 23 Supra-orbital artery
- 24 Supra-orbital nerve
- 25 Supratrochlear nerve
- 26 Trochlear nerve

Orbits from above



Central retinal artery occlusion



Corneal arcus



Corneal reflex



Meibomian cyst (chalazion)

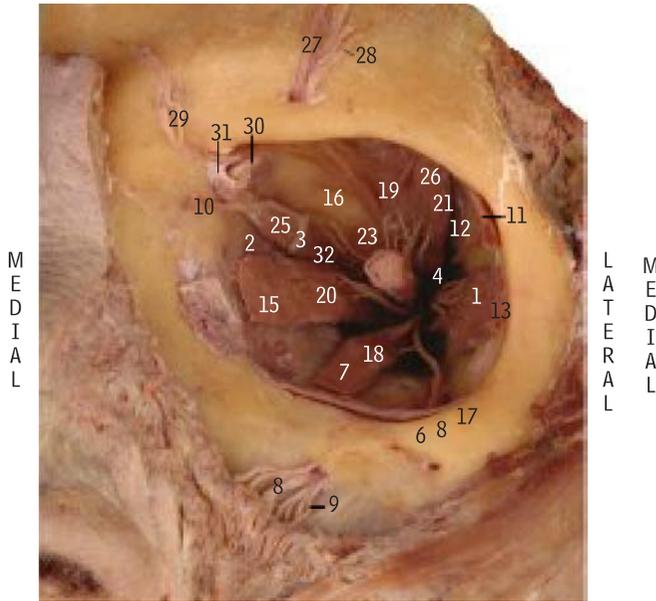


Ophthalmoscopy

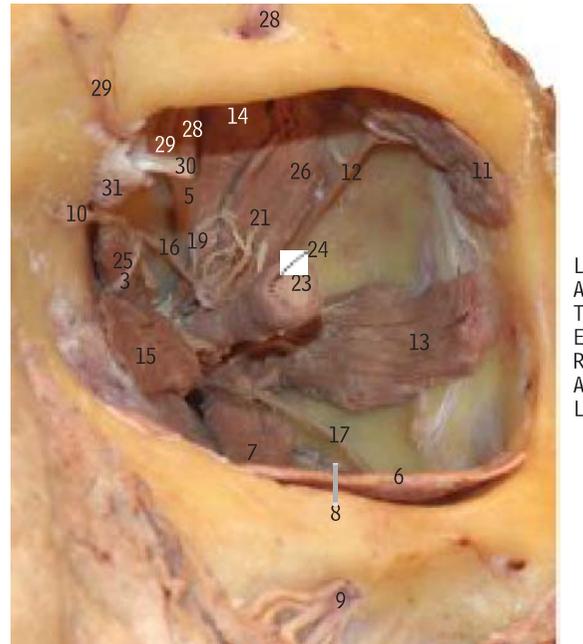


Pupillary reflex

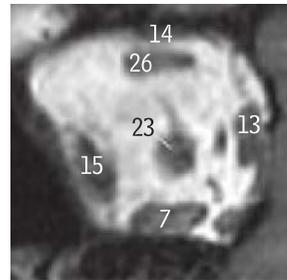
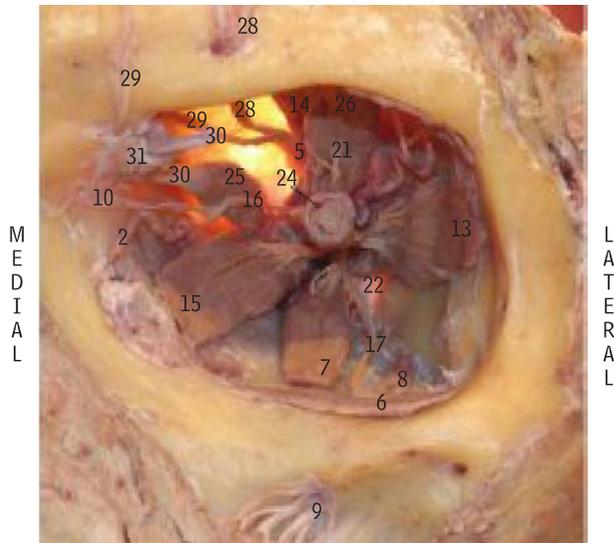
Internal view left orbit
medial wall view



lateral wall view



frontal view



Coronal MR image
right orbit

- | | |
|--|--|
| 1 Abducent nerve | 18 Nerve to inferior rectus |
| 2 Anterior ethmoidal artery | 19 Nerve to levator palpebrae superioris |
| 3 Anterior ethmoidal nerve | 20 Nerve to medial rectus |
| 4 Dural sheath of optic nerve | 21 Nerve to superior rectus |
| 5 Frontal nerve | 22 Oculomotor nerve |
| 6 Inferior oblique | 23 Optic nerve surrounding central artery of retina |
| 7 Inferior rectus | 24 Subarachnoid space |
| 8 Infra-orbital artery | 25 Superior oblique |
| 9 Infra-orbital nerve | 26 Superior rectus |
| 10 Infratrochlear nerve | 27 Supra-orbital artery |
| 11 Lacrimal gland | 28 Supra-orbital nerve |
| 12 Lacrimal nerve | 29 Supratrochlear nerve |
| 13 Lateral rectus | 30 Tendon of superior oblique |
| 14 Levator palpebrae superioris | 31 Trochlea |
| 15 Medial rectus | 32 Trochlear nerve |
| 16 Nasociliary nerve | |
| 17 Nerve to inferior oblique | |



Meibomian cyst (chalazion)

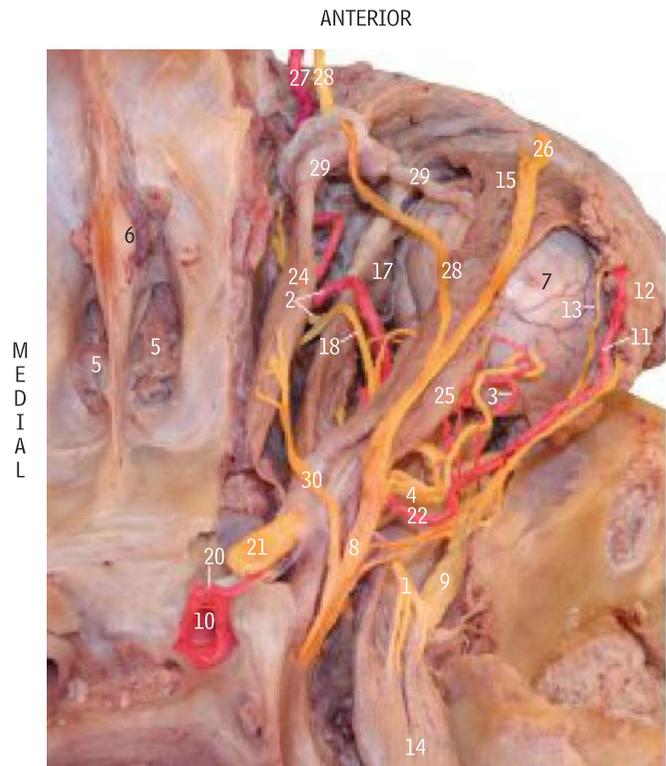


Periorbital and subconjunctival haemorrhage

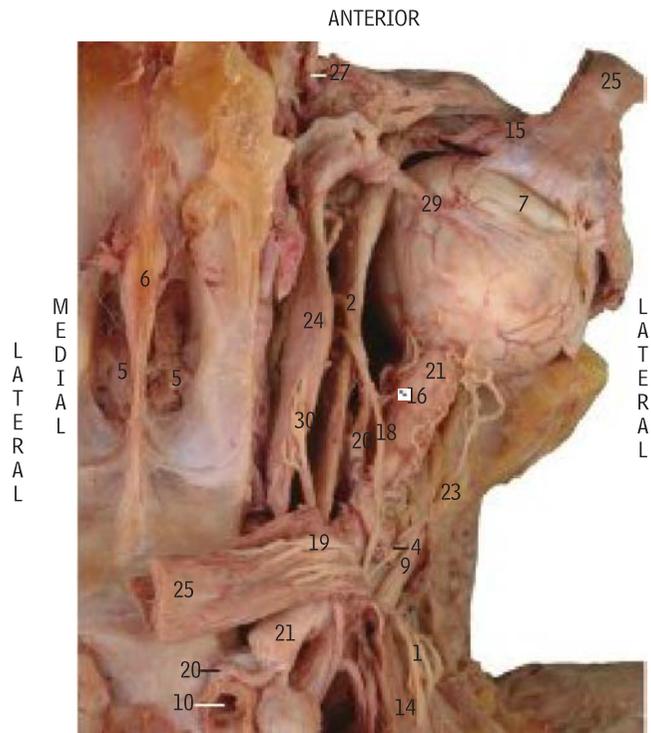


Glaucoma

Superior view of right orbit *superficial*



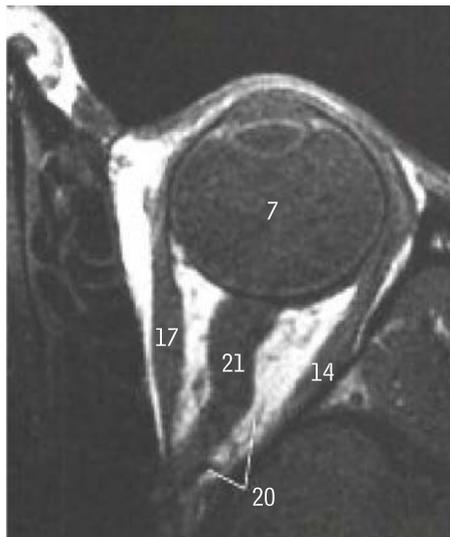
deep, with muscle reflection



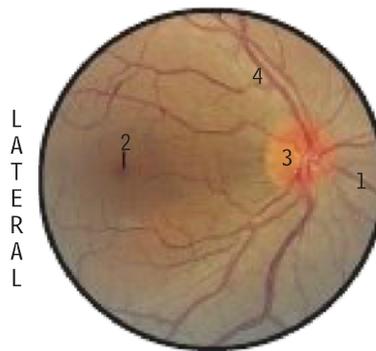
- 1 Abducent nerve
- 2 Anterior ethmoidal artery and nerve
- 3 Ciliary arteries
- 4 Ciliary ganglion
- 5 Cribriform plate of ethmoid bone
- 6 Crista galli
- 7 Eyeball
- 8 Frontal nerve
- 9 Infra-orbital nerve
- 10 Internal carotid artery
- 11 Lacrimal artery
- 12 Lacrimal gland
- 13 Lacrimal nerve
- 14 Lateral rectus (reflected)
- 15 Levator palpebrae superioris
- 16 Long ciliary nerve
- 17 Medial rectus
- 18 Nasociliary nerve
- 19 Nerve to superior rectus
- 20 Ophthalmic artery
- 21 Optic nerve
- 22 Posterior ciliary artery
- 23 Short ciliary nerves
- 24 Superior oblique
- 25 Superior rectus
- 26 Supra-orbital nerve
- 27 Supratrochlear artery
- 28 Supratrochlear nerve
- 29 Tendon of superior oblique
- 30 Trochlear nerve



Axial MR orbit



Fundus of eye *ophthalmoscopic photograph of a retina*



- 1 Inferior nasal branches of central vein and artery
- 2 Macula with central fovea
- 3 Optic disc
- 4 Superior temporal branches of central vein and artery



Abducent nerve palsy



Oculomotor nerve palsy



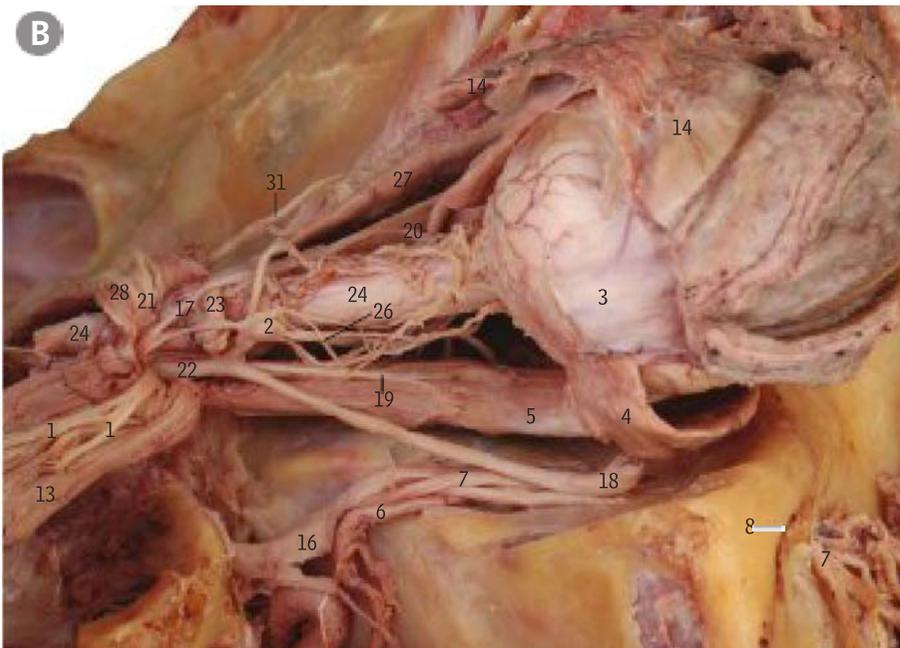
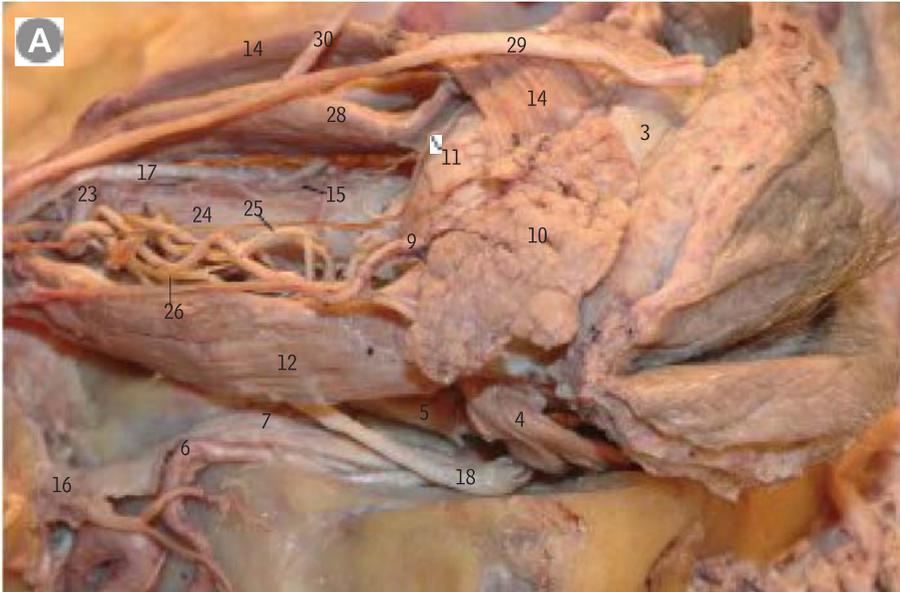
Orbital cellulitis



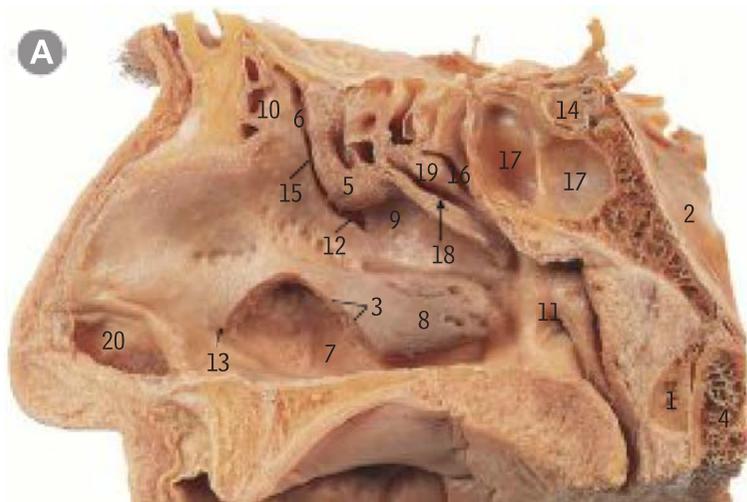
Trochlear nerve palsy

Lateral view of right orbit

superficial *deep*

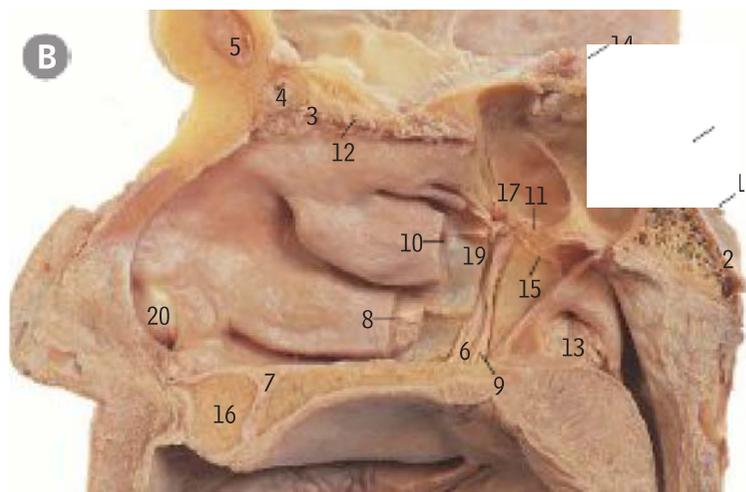


- 1 Abducent nerve
- 2 Ciliary ganglion
- 3 Eyeball
- 4 Inferior oblique
- 5 Inferior rectus
- 6 Infra-orbital artery
- 7 Infra-orbital nerve
- 8 Infra-orbital foramen
- 9 Lacrimal artery
- 10 Lacrimal gland
- 11 Lacrimal nerve
- 12 Lateral rectus
- 13 Lateral rectus (reflected backwards)
- 14 Levator palpebrae superioris
- 15 Long ciliary nerve
- 16 Maxillary branch of trigeminal nerve
- 17 Nasociliary nerve
- 18 Nerve to inferior oblique
- 19 Nerve to inferior rectus
- 20 Nerve to medial rectus
- 21 Nerve to superior rectus
- 22 Oculomotor nerve, inferior division
- 23 Ophthalmic artery
- 24 Optic nerve
- 25 Short ciliary artery
- 26 Short ciliary nerves
- 27 Superior oblique
- 28 Superior rectus
- 29 Supra-orbital nerve
- 30 Supratrochlear nerve
- 31 Trochlear nerve



Lateral wall of the right nasal cavity

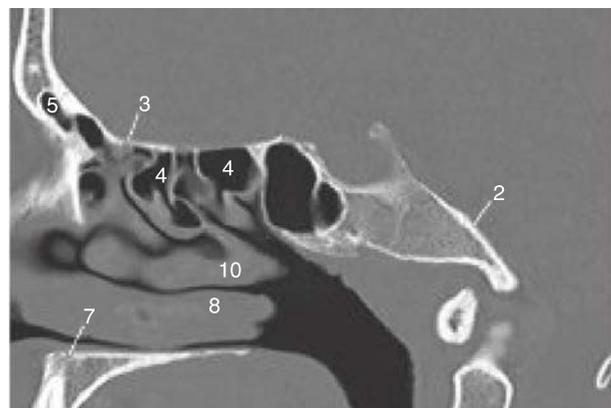
- 1 Anterior arch of atlas
- 2 Clivus
- 3 Cut edge of inferior nasal concha
- 4 Dens of axis
- 5 Ethmoidal bulla
- 6 Ethmoidal infundibulum
- 7 Inferior meatus
- 8 Inferior nasal concha
- 9 Middle meatus
- 10 Opening of anterior ethmoidal air cells
- 11 Opening of auditory tube
- 12 Opening of maxillary sinus
- 13 Opening of nasolacrimal duct
- 14 Pituitary gland
- 15 Semilunar hiatus
- 16 Sphenoethmoidal recess
- 17 Sphenoidal sinus
- 18 Superior meatus
- 19 Superior nasal concha
- 20 Vestibule



Right nasal cavity and pterygopalatine ganglion from the left

- 1 Abducent nerve
- 2 Clivus
- 3 Cribriform plate of ethmoid
- 4 Ethmoidal air cell (anterior)
- 5 Frontal sinus
- 6 Greater palatine nerve
- 7 Incisive foramen
- 8 Inferior nasal concha, cut edge of mucoperiosteum
- 9 Lesser palatine nerves
- 10 Middle nasal concha, cut
- 11 Nerve of pterygoid canal
- 12 Olfactory nerve fibres
- 13 Opening of auditory tube
- 14 Optic nerve
- 15 Pharyngeal branch to ganglion
- 16 Premaxilla
- 17 Pterygopalatine ganglion
- 18 Trigeminal nerve
- 19 Vertical plate of palatine bone
- 20 Vestibule

CT nasal cavity sagittal view



Middle ear pressure equalisation

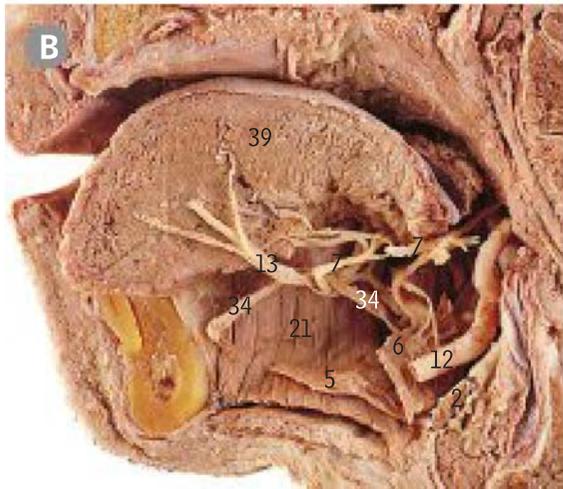
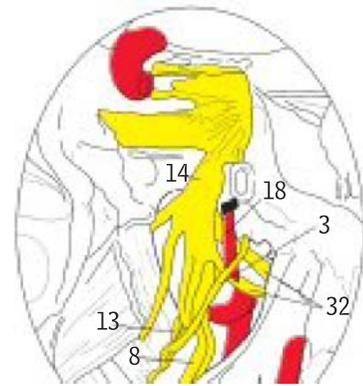
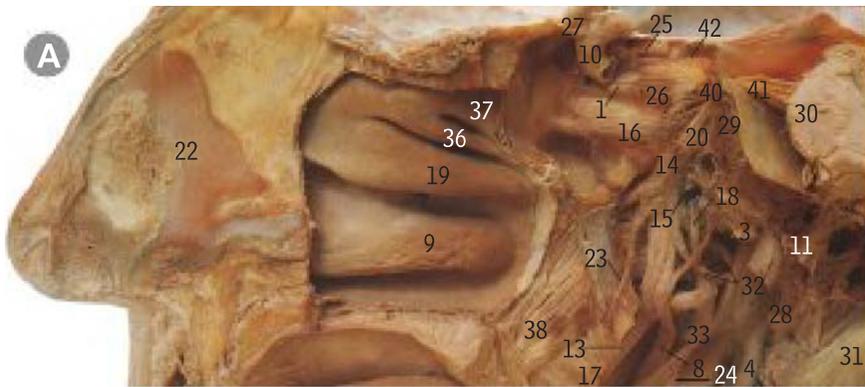


Nasal polyps



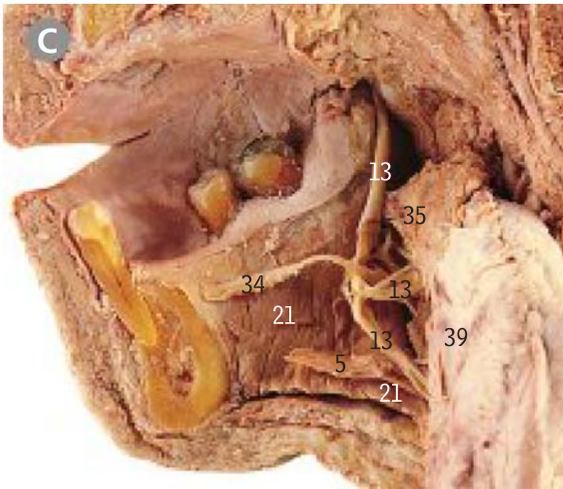
Nasogastric intubation

Right trigeminal nerve branches *from the midline*



sagittal section just left of midline

C sagittal sections just right of the midline after removal of geniohyoid muscle, sublingual gland and oral mucosa. Tongue reflected medially in C.



- 1 Abducent nerve
- 2 Body of hyoid bone
- 3 Chorda tympani
- 4 External carotid artery
- 5 Geniohyoid
- 6 Hyoglossus
- 7 Hypoglossal nerve
- 8 Inferior alveolar nerve
- 9 Inferior nasal concha
- 10 Internal carotid artery
- 11 Jugular bulb
- 12 Lingual artery
- 13 Lingual nerve
- 14 Mandibular branch of trigeminal nerve
- 15 Marker in auditory tube
- 16 Maxillary branch of trigeminal nerve
- 17 Medial pterygoid
- 18 Middle meningeal artery
- 19 Middle nasal concha
- 20 Motor root of trigeminal nerve
- 21 Mylohyoid
- 22 Nasal septum (cartilaginous part)
- 23 Nerve to medial pterygoid
- 24 Nerve to mylohyoid
- 25 Oculomotor nerve
- 26 Ophthalmic branch of trigeminal nerve
- 27 Optic nerve
- 28 Parotid gland
- 29 Petrous part of temporal bone
- 30 Pons
- 31 Posterior belly of digastric
- 32 Roots of auriculotemporal nerve
- 33 Sphenomandibular ligament and maxillary artery
- 34 Submandibular duct
- 35 Submandibular ganglion
- 36 Superior nasal concha
- 37 Supreme nasal concha
- 38 Tensor veli palatini
- 39 Tongue
- 40 Trigeminal ganglion
- 41 Trigeminal nerve
- 42 Trochlear nerve



Hypoglossal nerve palsy

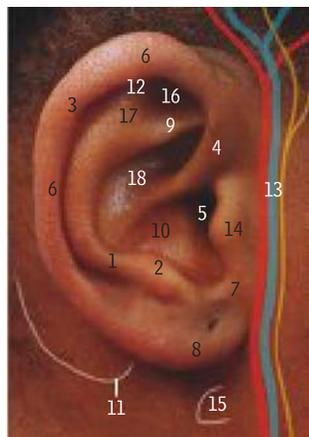


Oral pathology



Tongue carcinoma

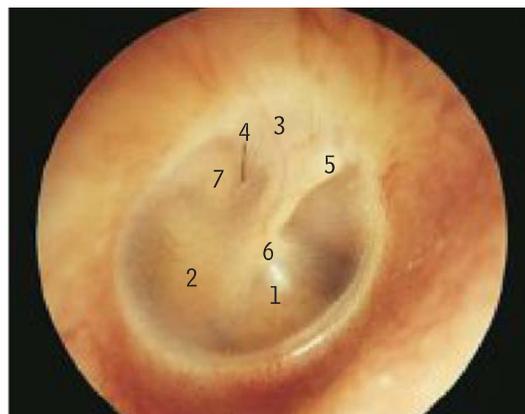
Right external ear



- 1 Antihelix
- 2 Antitragus
- 3 Auricular tubercle
- 4 Crus of helix
- 5 External acoustic meatus
- 6 Helix
- 7 Intertragic notch
- 8 Lobule
- 9 Lower crus of antihelix
- 10 Lower part of concha (conchal bowl together with 18)
- 11 Mastoid process
- 12 Scaphoid fossa
- 13 Superficial temporal vessels and auriculotemporal nerve
- 14 Tragus
- 15 Transverse process of atlas
- 16 Triangular fossa
- 17 Upper crus of antihelix
- 18 Upper part of concha (conchal bowl together with 10)

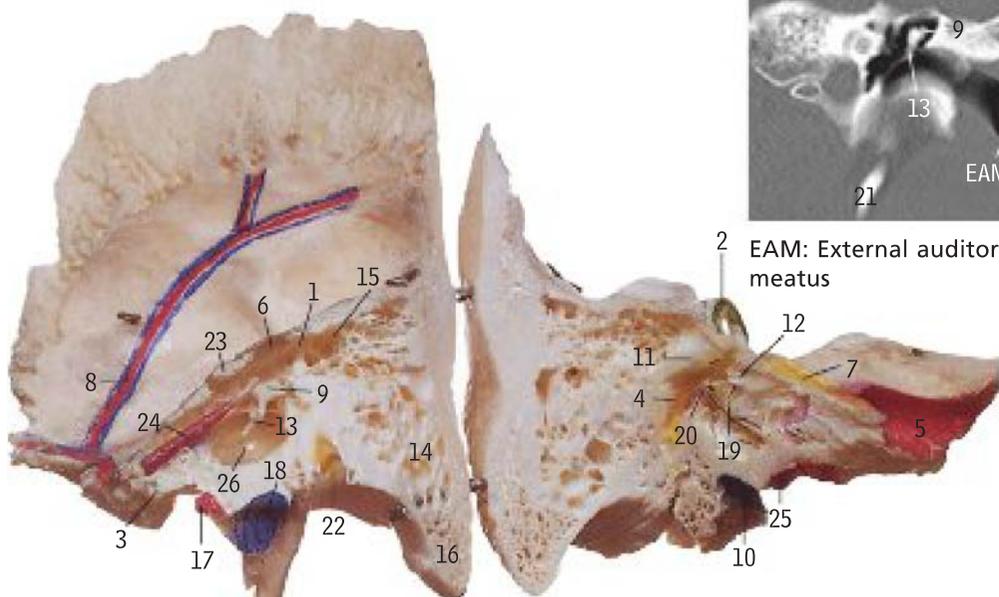
Right tympanic membrane

as seen using an auriscope



- 1 Cone of light (light reflex)
- 2 Pars tensa
- 3 Pars flaccida
- 4 Chorda tympani
- 5 Malleus, lateral process
- 6 Umbo
- 7 Incus, long process

Right temporal bone and ear



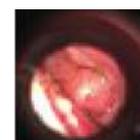
Coronal CT middle ear

The bone has been bisected and opened out like a book, with some removal of the upper part of the petrous part. The section has opened up the tympanic (middle ear) cavity. On the left side of the figure the lateral wall of the middle ear, which includes the tympanic membrane (26), is seen from the medial side, while on the right the main features of the medial wall are in view.

- 1 Aditus to mastoid antrum
- 2 Anterior (superior) semicircular canal
- 3 Bony part of auditory tube
- 4 Canal for facial nerve (yellow)
- 5 Carotid canal (red)
- 6 Epitympanic recess
- 7 Groove for greater petrosal nerve (yellow)
- 8 Groove for middle meningeal vessels
- 9 Incus
- 10 Jugular bulb (blue)
- 11 Lateral semicircular canal
- 12 Lesser petrosal nerve
- 13 Malleus
- 14 Mastoid air cells
- 15 Mastoid antrum
- 16 Mastoid process
- 17 Part of carotid canal (red)
- 18 Part of jugular bulb (blue)
- 19 Promontory with overlying tympanic plexus
- 20 Stapes in oval window and stapedius muscle
- 21 Styloid process
- 22 Stylomastoid foramen
- 23 Tegmen tympani
- 24 Tensor tympani muscle in its canal
- 25 Tympanic branch of glossopharyngeal nerve entering its canaliculus
- 26 Tympanic membrane



Hyperacusis



Perforated drum

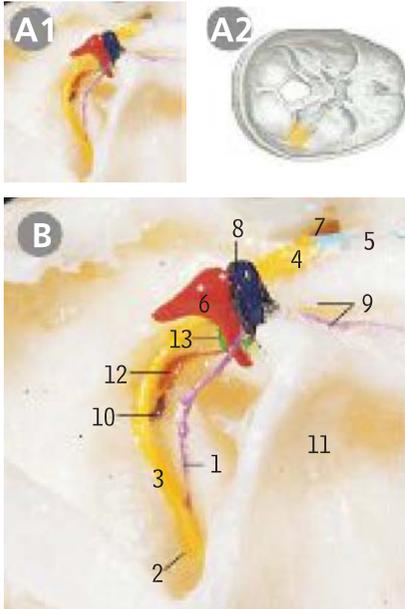


Otalgia (referred pain)

Ear right temporal bone Ear

middle ear and the facial nerve and branches

enlarged view of A

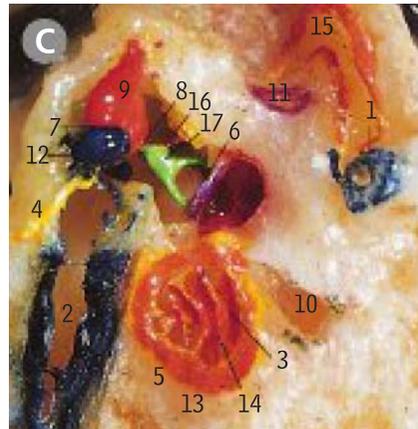


This dissection is seen from the right and above, looking forwards and medially. Bone has been removed to show the upper parts of the malleus (8) and incus (6), which normally project up into the epitympanic recess. The upper part of the facial canal (2) has been opened to show the facial nerve (3) giving off the chorda tympani (1) and the nerve to stapedius (10). The geniculate ganglion of the facial nerve (4) is seen giving off the greater petrosal nerve (5).

- 1 Chorda tympani
- 2 Facial canal leading to stylomastoid foramen
- 3 Facial nerve
- 4 Geniculate ganglion of facial nerve
- 5 Greater petrosal nerve
- 6 Incus
- 7 Internal acoustic meatus
- 8 Malleus
- 9 Margin of auditory tube
- 10 Nerve to stapedius
- 11 Paraffin wax (for support) overlying tympanic membrane
- 12 Stapedius
- 13 Stapes

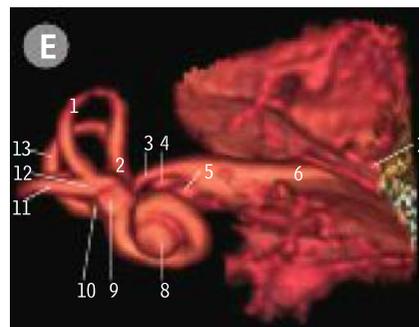
The stapedius (12) tendon emerges from a small conical projection on the posterior wall of the tympanic cavity, the pyramid (here dissected away).

right temporal bone; middle ear and inner ear, enlarged



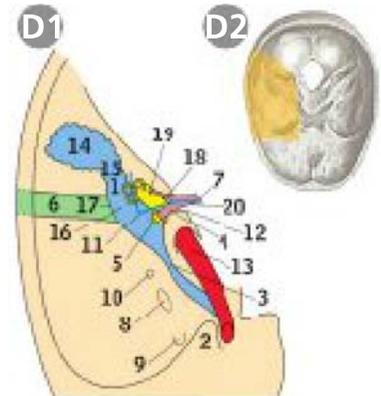
This dissection is viewed from above, looking slightly backwards and laterally. Within the cavity of the middle ear are the three auditory ossicles – malleus (12), incus (9) and stapes (17). The tympanic membrane and external acoustic meatus are not seen but lie below the label 7. The cochlea has been opened up to show its internal bony structure (3, 5, 13 and 14).

- 1 Anterior (superior) semicircular canal
- 2 Auditory tube
- 3 Bony canal of cochlea
- 4 Chorda tympani
- 5 Cupola of cochlea
- 6 Footplate of stapes in oval window of vestibule
- 7 Incudomalleolar joint
- 8 Incudostapedial joint
- 9 Incus
- 10 Internal acoustic meatus
- 11 Lateral semicircular canal
- 12 Malleus
- 13 Modiolus of cochlea
- 14 Osseous spiral lamina of cochlea
- 15 Posterior semicircular canal
- 16 Stapedius tendon
- 17 Stapes



Right ear

from above, diagram of parts



- 1 Aditus to mastoid antrum
- 2 Anterior clinoid process
- 3 Auditory tube
- 4 Cochlear nerve
- 5 Cochlear part of inner ear
- 6 External acoustic meatus
- 7 Facial nerve
- 8 Foramen ovale
- 9 Foramen rotundum
- 10 Foramen spinosum
- 11 Geniculate ganglion of facial nerve
- 12 Internal acoustic meatus
- 13 Internal carotid artery emerging from foramen lacerum
- 14 Mastoid air cells
- 15 Mastoid antrum
- 16 Middle ear
- 17 Tympanic membrane
- 18 Vestibular nerve
- 19 Vestibular part of inner ear
- 20 Vestibulocochlear nerve

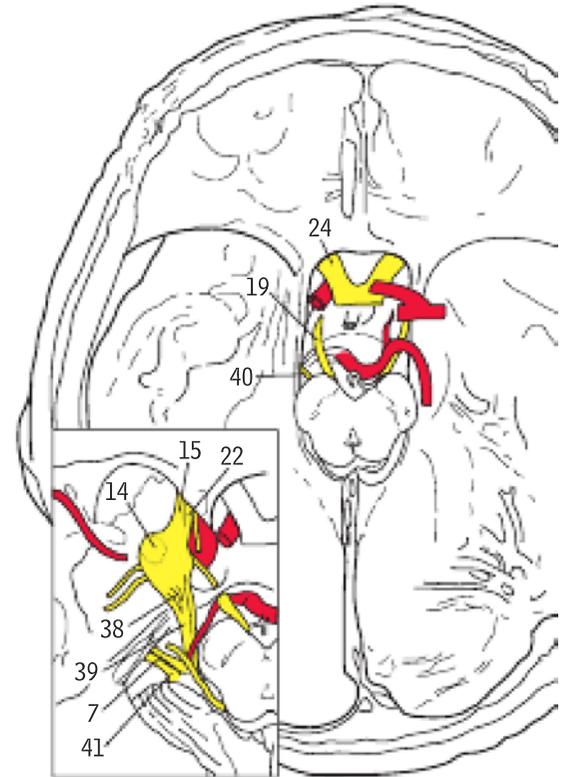
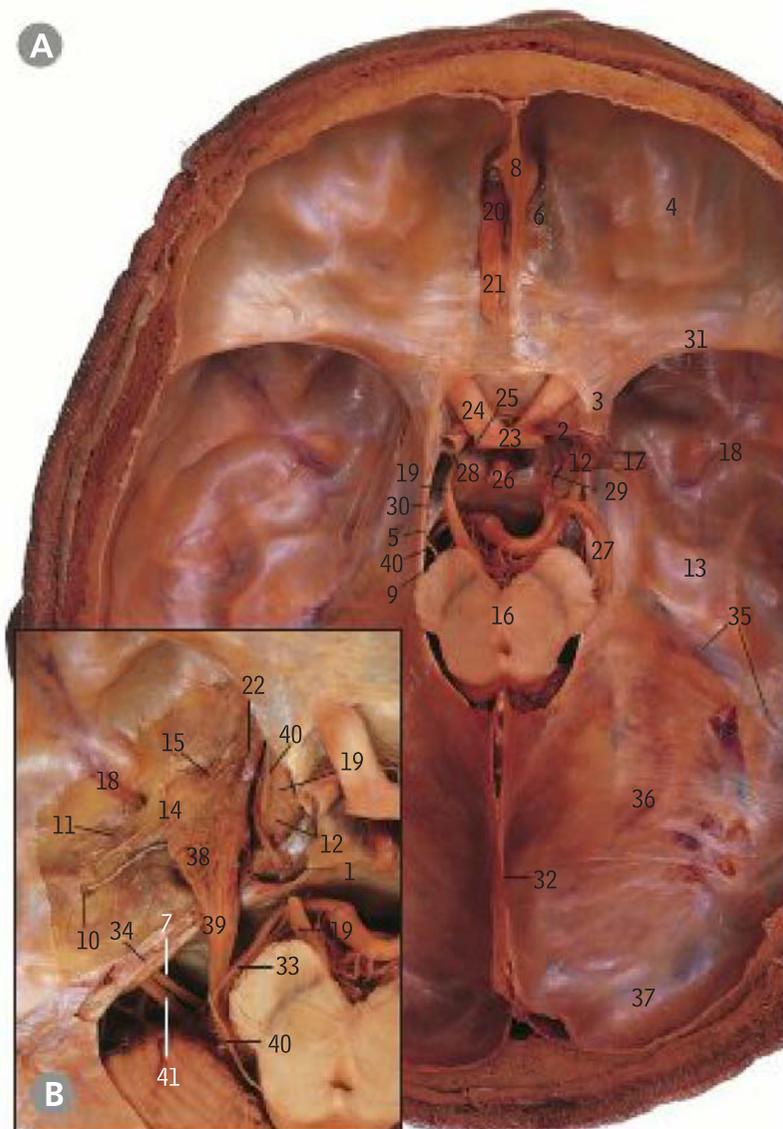
Inner ear CT (3D reconstruction)

- 1 Superior semicircular canals (SSC)
- 2 Common crus
- 3 Labyrinthine segment of facial nerve
- 4 Superior vestibular nerve
- 5 Cochlear nerve
- 6 Vestibulocochlear nerve CN VIII
- 7 Abducent nerve CN VI
- 8 Cochlea
- 9 Vestibule
- 10 Oval window
- 11 Lateral SCC
- 12 Lateral SCC, ampulla
- 13 Posterior SCC

Cranial fossae

with dura mater intact

with some dura removed

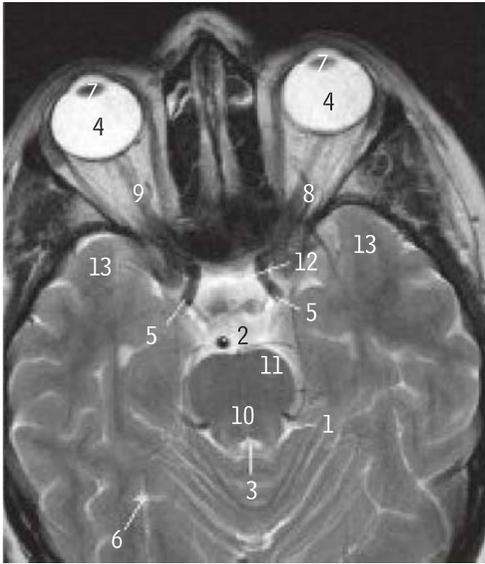


- | | | |
|---|--|--|
| 1 Abducent nerve | 16 Midbrain (superior colliculus level) | 31 Sphenoparietal sinus (at posterior border of lesser wing of sphenoid bone) |
| 2 Anterior cerebral artery | 17 Middle cerebral artery | 32 Straight sinus (at junction of falx cerebri and tentorium cerebelli) |
| 3 Anterior clinoid process | 18 Middle meningeal vessels | 33 Superior cerebellar artery |
| 4 Anterior cranial fossa | 19 Oculomotor nerve (cut) | 34 Superior petrosal sinus |
| 5 Attached margin of tentorium cerebelli | 20 Olfactory bulb | 35 Superior petrosal sinus (at attached margin of tentorium cerebelli) |
| 6 Cribriform plate of ethmoid bone | 21 Olfactory tract | 36 Tentorium cerebelli |
| 7 Facial nerve | 22 Ophthalmic nerve | 37 Transverse sinus (at attached margin of tentorium cerebelli) |
| 8 Falx cerebri attached to crista galli | 23 Optic chiasma | 38 Trigeminal ganglion |
| 9 Free margin of tentorium cerebelli | 24 Optic nerve | 39 Trigeminal nerve |
| 10 Hiatus for greater petrosal nerve | 25 Optic tract | 40 Trochlear nerve |
| 11 Hiatus for lesser petrosal nerve | 26 Pituitary stalk | 41 Vestibulocochlear nerve |
| 12 Internal carotid artery | 27 Posterior cerebral artery | |
| 13 Lateral part of middle cranial fossa | 28 Posterior clinoid process | |
| 14 Mandibular nerve | 29 Posterior communicating artery | |
| 15 Maxillary nerve | 30 Roof of cavernous sinus | |



Cavernous sinus thrombosis

Cisterns

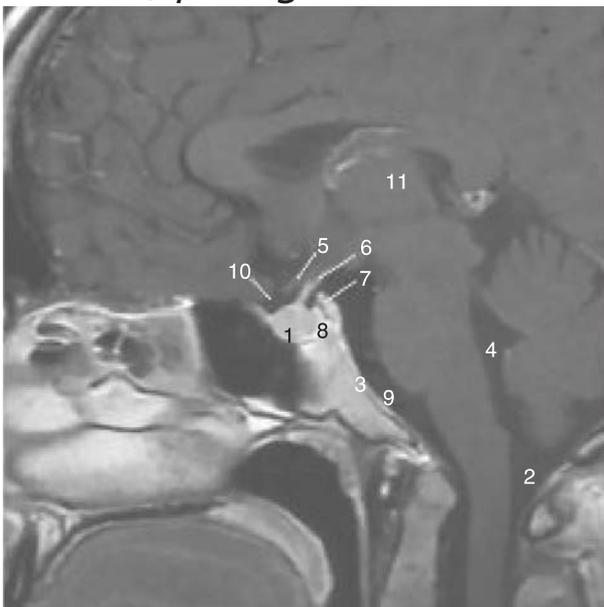


Brain

axial MR image through the superior pons

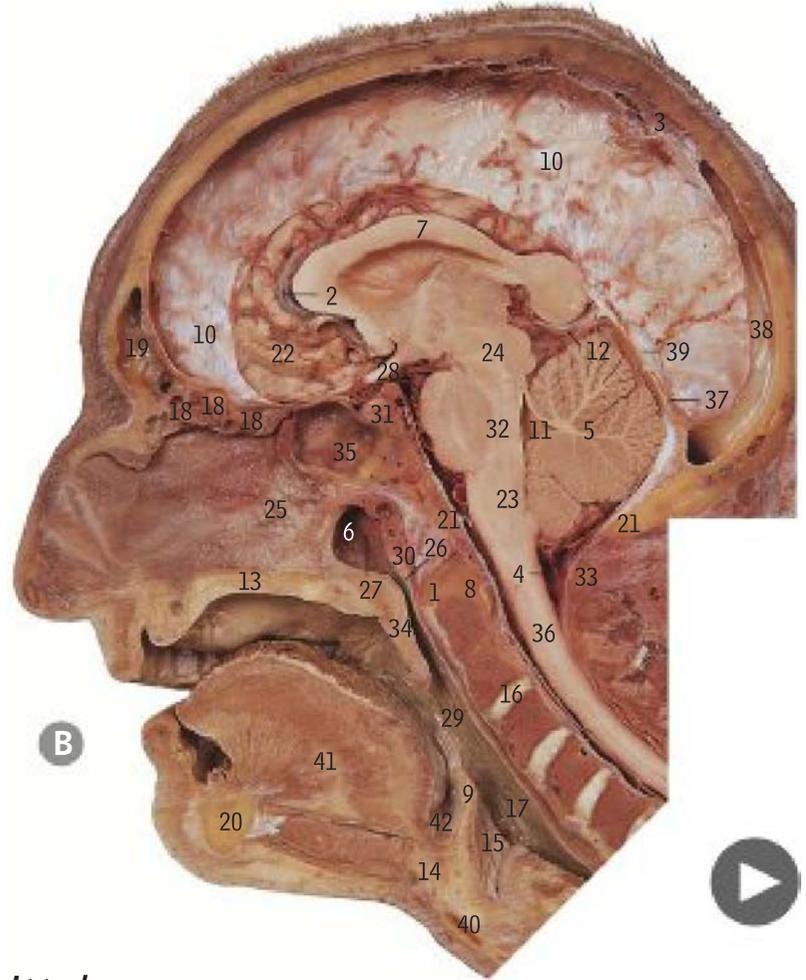
- 1 Ambient cistern
- 2 Basilar artery in prepontine cistern
- 3 Fourth ventricle
- 4 Globe (eyeball)
- 5 Internal carotid artery
- 6 Lateral ventricle
- 7 Lens
- 8 Ophthalmic artery
- 9 Optic nerve (CN II)
- 10 Pons
- 11 Pontine tegmentum
- 12 Suprasellar cistern
- 13 Temporal lobe

MR of pituitary fossa – sagittal view, post gadolinium



- 1 Anterior pituitary gland
- 2 Cisterna magna
- 3 Clivus
- 4 Fourth ventricle
- 5 Optic chiasma
- 6 Pituitary stalk
- 7 Dorsum sellae
- 8 Post pituitary gland
- 9 Prepontine cistern
- 10 Suprasellar (chiasmatic) cistern
- 11 Thalamus

Sagittal section of the head right half, from the left



- 1 Anterior arch of atlas
- 2 Anterior cerebral artery
- 3 Arachnoid granulations
- 4 Cerebellomedullary cistern (cisterna magna)
- 5 Cerebellum
- 6 Choana (posterior nasal aperture)
- 7 Corpus callosum
- 8 Dens of axis
- 9 Epiglottis
- 10 Falx cerebri
- 11 Fourth ventricle
- 12 Great cerebral vein (of Galen)
- 13 Hard palate
- 14 Hyoid bone
- 15 Inlet of larynx
- 16 Intervertebral disc between axis and third cervical vertebra
- 17 Laryngeal part of pharynx
- 18 Left ethmoidal air cells
- 19 Left frontal sinus
- 20 Mandible
- 21 Margin of foramen magnum
- 22 Medial surface of right cerebral hemisphere
- 23 Medulla oblongata
- 24 Midbrain
- 25 Nasal septum (bony part)
- 26 Nasopharynx
- 27 Opening of auditory tube
- 28 Optic chiasma
- 29 Oral part of pharynx (oropharynx)
- 30 Pharyngeal (nasopharyngeal) tonsil (adenoids)
- 31 Pituitary gland
- 32 Pons
- 33 Posterior arch of atlas
- 34 Soft palate
- 35 Sphenoidal sinus
- 36 Spinal cord
- 37 Straight sinus
- 38 Superior sagittal sinus
- 39 Tentorium cerebelli
- 40 Thyroid cartilage
- 41 Tongue
- 42 Valleculla



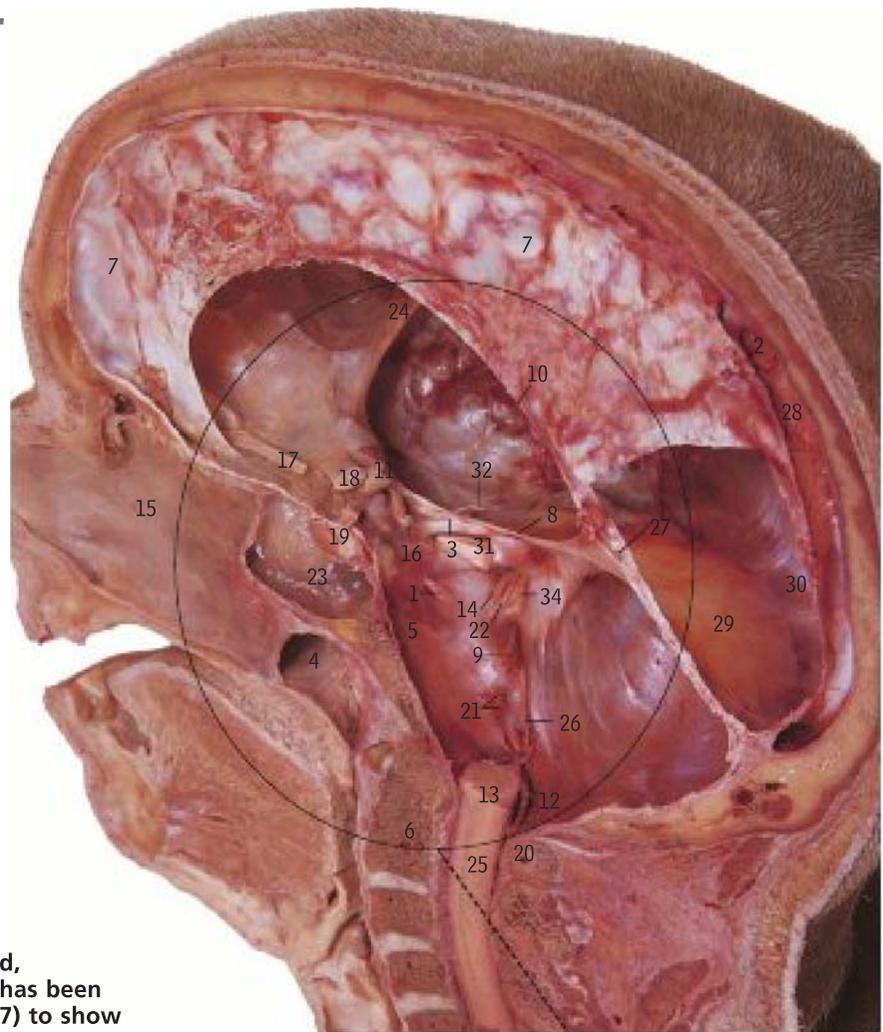
Adenoid enlargement



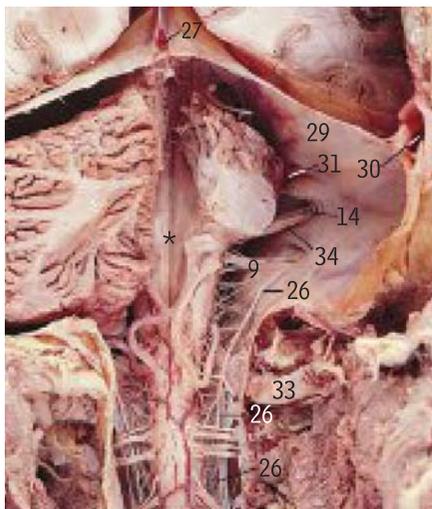
Pituitary apoplexy

Cerebral dura mater and cranial nerves

- 1 Abducent nerve
- 2 Arachnoid granulations
- 3 Attached margin of tentorium cerebelli
- 4 Choana (posterior nasal aperture)
- 5 Clivus
- 6 Dens of axis
- 7 Falx cerebri
- 8 Free margin of tentorium cerebelli
- 9 Glossopharyngeal, vagus and accessory nerves
- 10 Inferior sagittal sinus
- 11 Internal carotid artery
- 12 Margin of foramen magnum
- 13 Medulla oblongata
- 14 Motor root of facial nerve
- 15 Nasal septum
- 16 Oculomotor nerve
- 17 Olfactory tract
- 18 Optic nerve
- 19 Pituitary gland
- 20 Posterior arch of atlas
- 21 Rootlets of hypoglossal nerve
- 22 Sensory root (nervus intermedius) of facial nerve
- 23 Sphenoidal sinus
- 24 Sphenoparietal sinus
- 25 Spinal cord
- 26 Spinal part of accessory nerve
- 27 Straight sinus
- 28 Superior sagittal sinus
- 29 Tentorium cerebelli
- 30 Transverse sinus
- 31 Trigeminal nerve
- 32 Trochlear nerve
- 33 Vertebral artery
- 34 Vestibulocochlear nerve

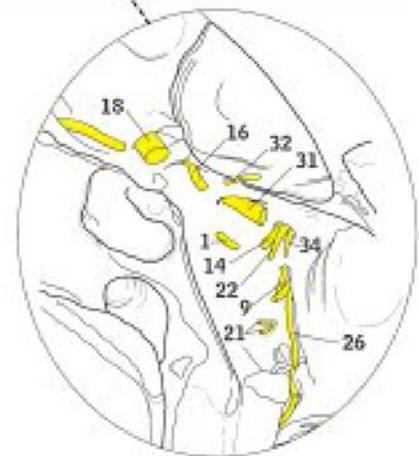


In this oblique view from the left and behind, the brain has been removed and a window has been cut in the posterior part of the falx cerebri (7) to show the upper surface of the tentorium cerebelli (29).

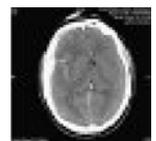


Right posterior cranial fossa viewed from behind

After removal of posterior skull, dura, upper cervical vertebral laminae, all of right cerebellar hemisphere and much of left to expose the floor of the fourth ventricle (asterisk).

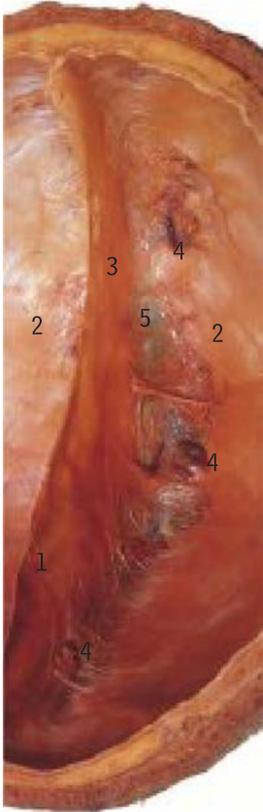


Craniotomy



Subdural haemorrhage

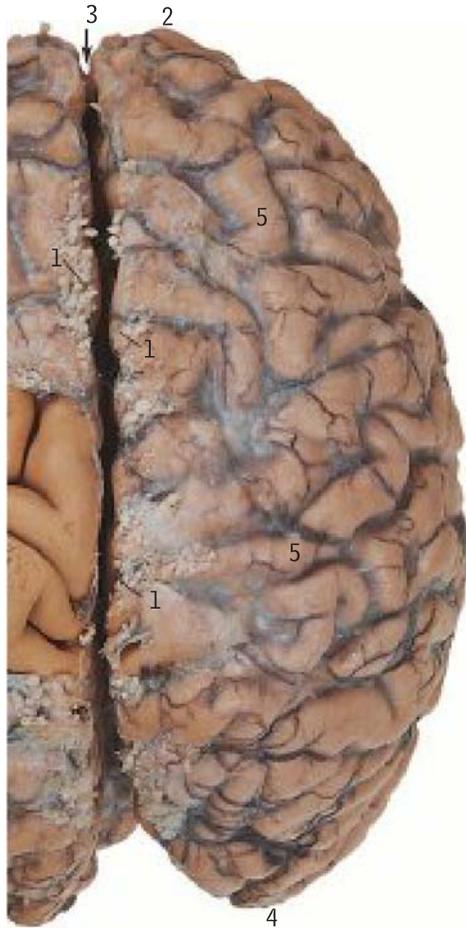
Cranial vault and falx from below



Looking up into the cranial vault from below, the falx cerebri (3) is seen to be continuous with the dura over the vault (2), and has been cut off at the back (1) from the tentorium cerebelli.

- 1 Cut edge of falx cerebri
- 2 Dura mater over cranial vault
- 3 Falx cerebri
- 4 Superior cerebral veins
- 5 Superior sagittal sinus

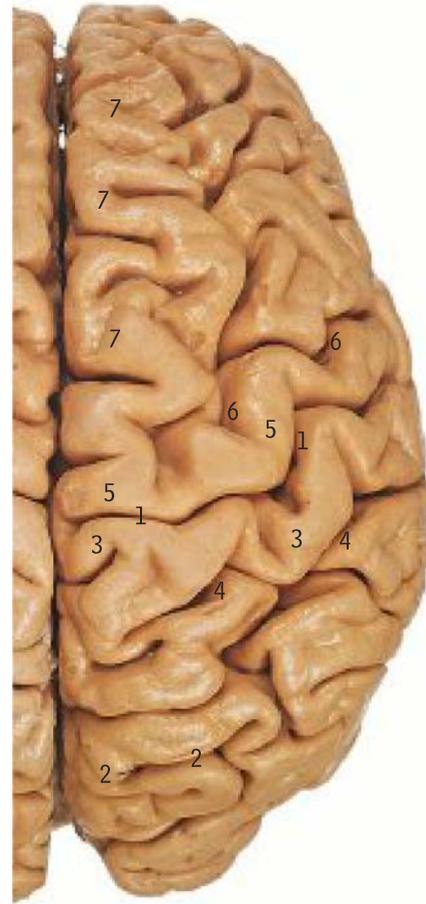
Brain from above



The right cerebral hemisphere is seen with the overlying arachnoid mater and arachnoid granulations (1) adjacent to the longitudinal fissure (3). Over the small part of the left hemisphere shown, a window has been cut in the arachnoid revealing the subarachnoid space.

- 1 Arachnoid granulations
- 2 Frontal pole
- 3 Longitudinal fissure
- 4 Occipital pole
- 5 Superolateral surface

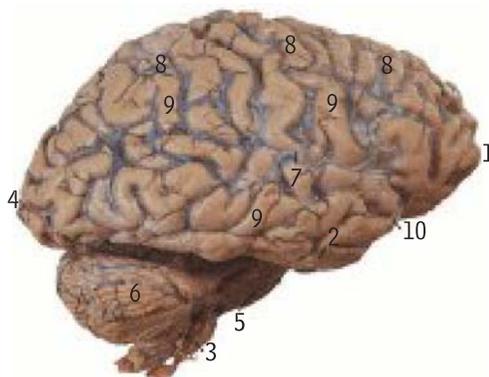
Brain right cerebral hemisphere, from above



Removal of the arachnoid and the underlying vessels displays the gyri and sulci. Only a small number are named here; the most important are the central sulcus (1) and the precentral and postcentral gyri (5 and 3).

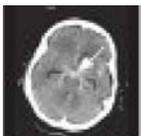
- 1 Central sulcus
- 2 Parieto-occipital sulcus
- 3 Postcentral gyrus
- 4 Postcentral sulcus
- 5 Precentral gyrus
- 6 Precentral sulcus
- 7 Superior frontal gyrus

Brain right cerebral hemisphere, from lateral



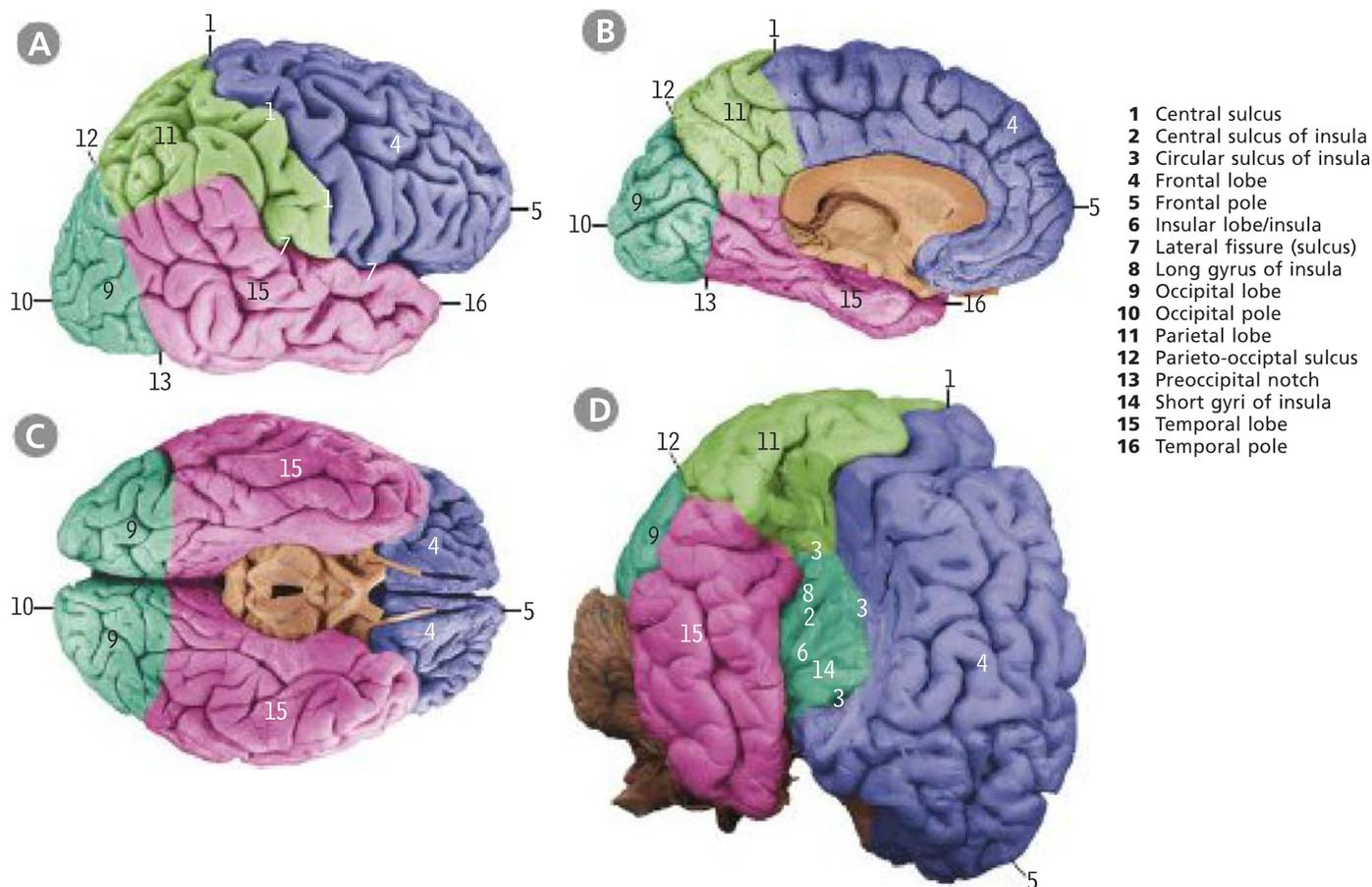
As in B (above), the arachnoid mater has been left intact and vessels are seen beneath it; the larger ones are veins (as at 7).

- 1 Frontal pole
- 2 Inferior cerebral veins
- 3 Medulla oblongata and vertebral artery
- 4 Occipital pole
- 5 Pons and basilar artery
- 6 Right cerebellar hemisphere
- 7 Superficial middle cerebral vein overlying lateral sulcus
- 8 Superior cerebral veins
- 9 Superolateral surface of right cerebral hemisphere
- 10 Temporal pole

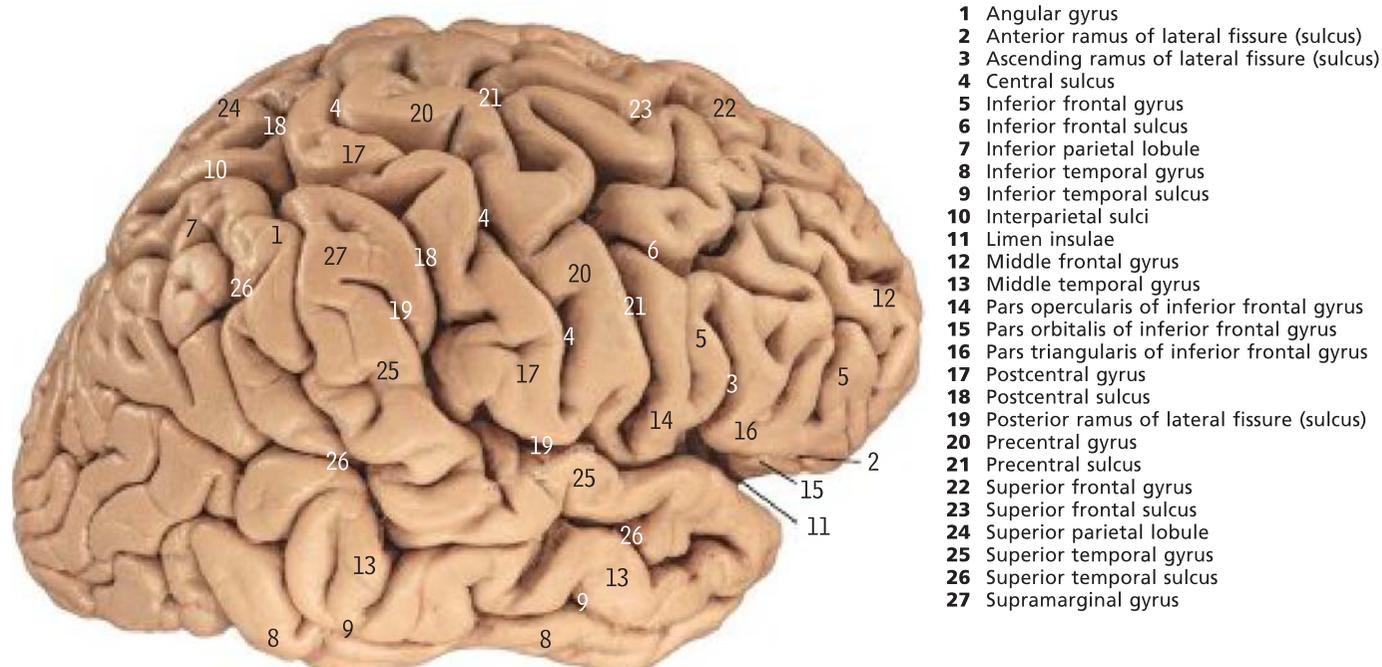


Subarachnoid haemorrhage

Lobes and brain surfaces lateral, medial, inferior, insula

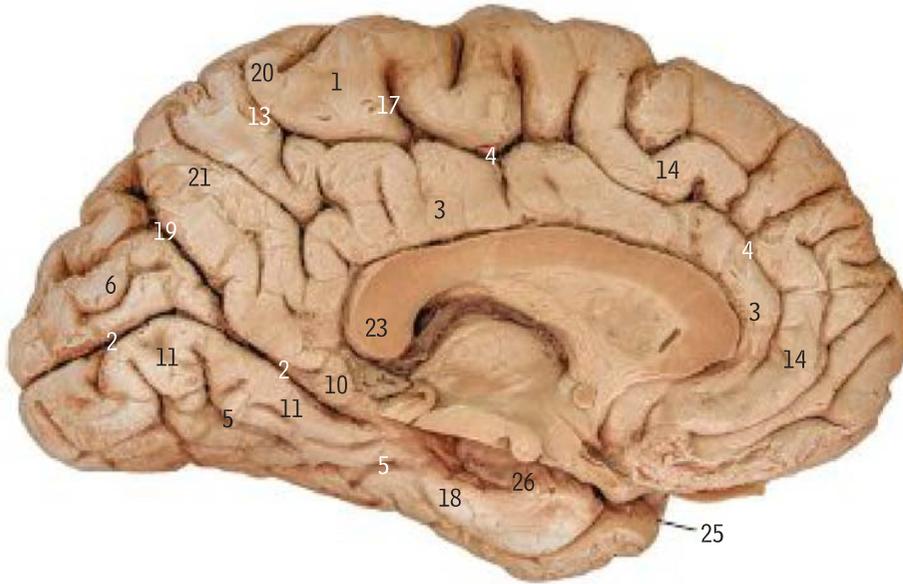


Superolateral surface



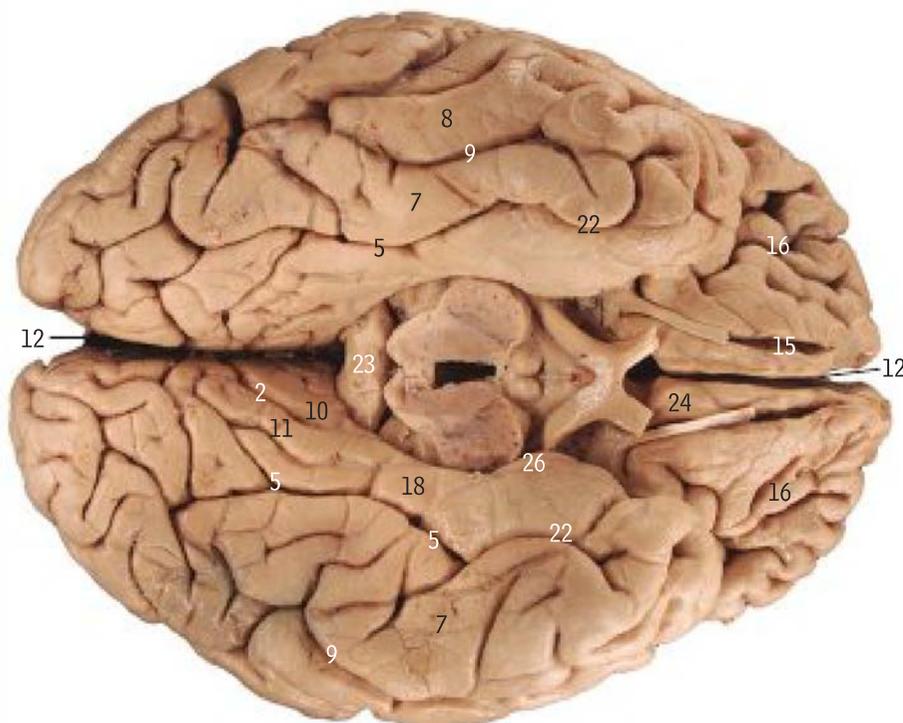
Brain surfaces

Medial surface – with brainstem removed

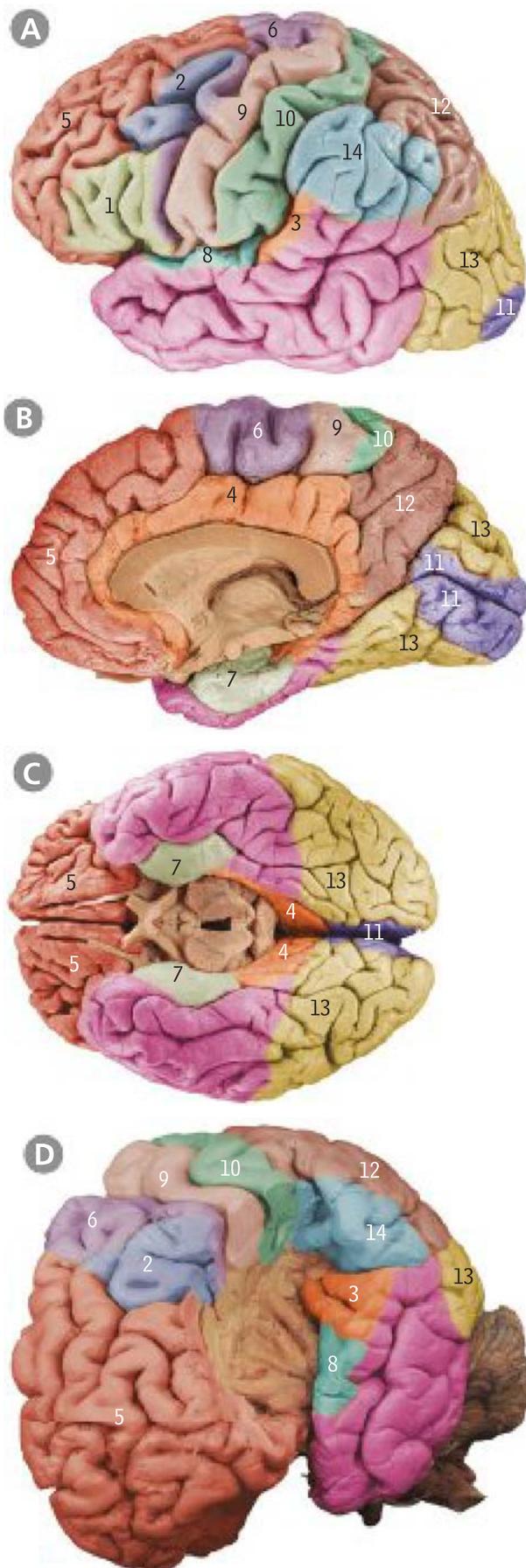


- 1 Anterior paracentral gyrus of paracentral lobule
- 2 Calcarine sulcus
- 3 Cingulate gyrus
- 4 Cingulate sulcus
- 5 Collateral sulcus
- 6 Cuneus
- 7 Fusiform (parieto-occipital) gyrus
- 8 Inferior temporal gyrus
- 9 Inferior temporal sulcus
- 10 Isthmus of the cingulate gyrus
- 11 Lingual gyrus
- 12 Longitudinal fissure
- 13 Marginal rami of cingulate sulcus
- 14 Medial frontal gyrus
- 15 Olfactory sulcus
- 16 Orbital sulci & gyri
- 17 Paracentral rami of cingulate sulcus
- 18 Parahippocampal gyrus
- 19 Parieto-occipital sulcus
- 20 Posterior paracentral gyrus of paracentral lobule
- 21 Precuneus
- 22 Rhinal sulcus
- 23 Splenium of corpus callosum
- 24 Straight gyrus
- 25 Temporal pole
- 26 Uncus

Inferior surface (base)



Functional areas of the cerebrum



Overlay of the main functional areas of the cerebrum seen on the (A) lateral, (B) medial, and (C) inferior surfaces of the cerebrum. (D) Is an oblique view of the cerebrum with the frontal and parietal opercula removed to expose the superior temporal gyrus.

- 1 Broca's motor speech area (Brodmann 44 and 45)
- 2 Frontal eye field (Brodmann 8)
- 3 Hearing association (Brodmann 22)
- 4 Limbic association area
- 5 Prefrontal cortex (Brodmann 9, 10, 11, 46 and 47)
- 6 Premotor or supplementary motor area (Brodmann 6)
- 7 Primary and association areas for smell or olfaction (Brodmann 38 and 28)
- 8 Primary hearing (audition) area (Brodmann 41 and 42)
- 9 Primary somatomotor area (Brodmann 4)
- 10 Primary somatosensory (somesthetic) area (Brodmann 3, 1 and 2)
- 11 Primary visual area (Brodmann 17)
- 12 Somatosensory association area (Brodmann 5 and 7)
- 13 Visual association area (Brodmann 18 and 19)
- 14 Wernicke's hearing association area (Brodmann 39 and 40)

The **primary somatomotor area** consists of the precentral gyrus on both the superolateral and medial (anterior aspect of the paracentral lobule) surfaces.

The **premotor or supplementary motor area** is primarily on the medial surface, anterior to the paracentral lobule and also in a thin strip of the posterior ends of the superior, middle and upper inferior frontal gyri, immediately anterior to the precentral gyrus.

The **frontal eye field** can be located at the posterior end of the middle frontal gyrus.

Broca's motor speech area is found at the pars opercularis and pars triangularis of the inferior frontal gyrus.

The **prefrontal cortex** includes the entire frontal lobe except the motor areas mentioned above.

The **primary somatosensory area** consists of the postcentral gyrus on both the superolateral and medial (posterior aspect of the paracentral lobule) surfaces.

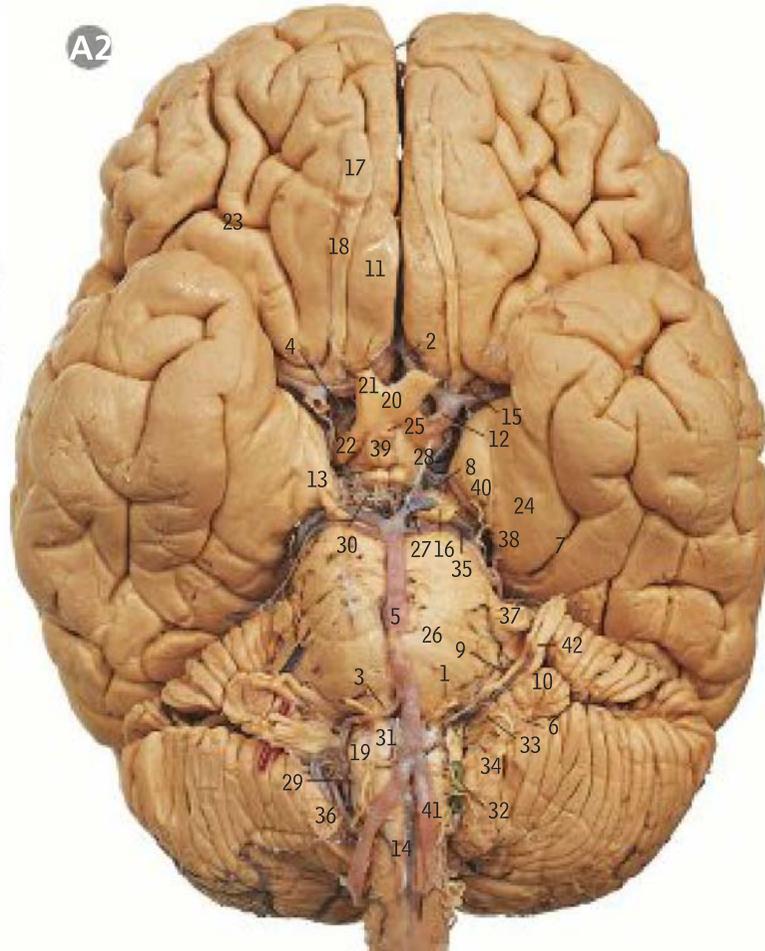
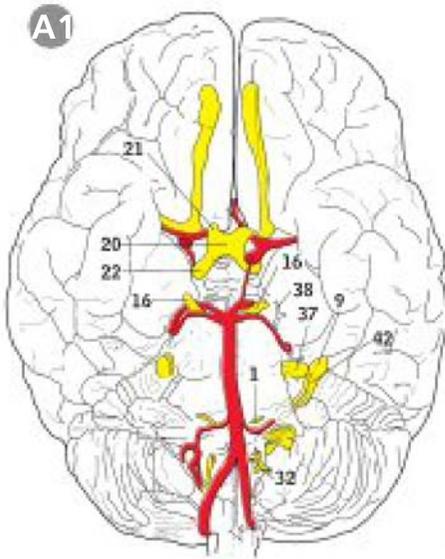
The **somatosensory association area** lies in the superior parietal lobule.

The **primary hearing (audition) area** is located in the short anterior transverse temporal gyri (Heschl's convolutions) within the lateral fissure and for a small distance onto the superior temporal gyrus. The **hearing association area** can be found in the long posterior transverse temporal gyri (planum temporale), immediately caudal to the primary auditory area.

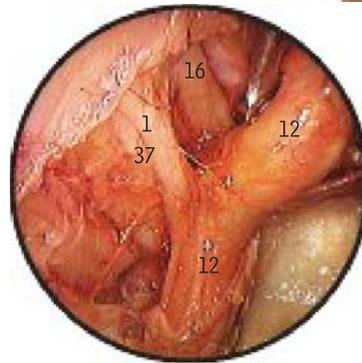
Wernicke's hearing association area includes the posterior part of the superior temporal gyrus and a major part of the inferior parietal lobule – consisting of the supramarginal and angular gyri.

The **primary visual area** is found on the medial surface of the occipital lobe adjacent to the calcarine sulcus, while the **visual association area** lies adjacent to the latter – consisting of the rest of the occipital lobe and extending into the temporal and even parietal lobes.

Brain from below



- 1 Abducent nerve
- 2 Anterior cerebral artery
- 3 Anterior inferior cerebellar artery
- 4 Anterior perforated substance
- 5 Basilar artery
- 6 Choroid plexus from lateral recess of fourth ventricle
- 7 Collateral sulcus
- 8 Crus of cerebral peduncle
- 9 Facial nerve
- 10 Flocculus of cerebellum
- 11 Gyrus rectus
- 12 Internal carotid artery
- 13 Mamillary body
- 14 Medulla oblongata
- 15 Middle cerebral artery
- 16 Oculomotor nerve
- 17 Olfactory bulb
- 18 Olfactory tract
- 19 Olive of medulla oblongata
- 20 Optic chiasma
- 21 Optic nerve
- 22 Optic tract
- 23 Orbital sulcus
- 24 Parahippocampal gyrus
- 25 Pituitary stalk (infundibulum)
- 26 Pons
- 27 Posterior cerebral artery
- 28 Posterior communicating artery
- 29 Posterior inferior cerebellar artery
- 30 Posterior perforated substance
- 31 Pyramid of medulla oblongata
- 32 Rootlets of hypoglossal nerve (superficial to marker)
- 33 Roots of glossopharyngeal, vagus and accessory nerves
- 34 Spinal part of accessory nerve
- 35 Superior cerebellar artery
- 36 Tonsil of cerebellum
- 37 Trigeminal nerve
- 38 Trochlear nerve
- 39 Tuber cinereum and median eminence
- 40 Uncus
- 41 Vertebral artery
- 42 Vestibulocochlear nerve



Endoscopy – base of brain



The oculomotor nerve (16) emerges on the medial side of the crus of the cerebral peduncle (8), and the trochlear nerve (38) winds round the lateral side of the peduncle. Both nerves pass between the posterior cerebral and superior cerebellar arteries (27 and 35).

The trochlear nerve (38) is the only cranial nerve to emerge from the dorsal surface of the brainstem.

The trigeminal nerve (37) emerges from the lateral side of the pons (26).

The abducent nerve (1) emerges between the pons and the pyramid (26 and 31).

The facial and vestibulocochlear nerves (9 and 42) emerge from the lateral pontomedullary angle.

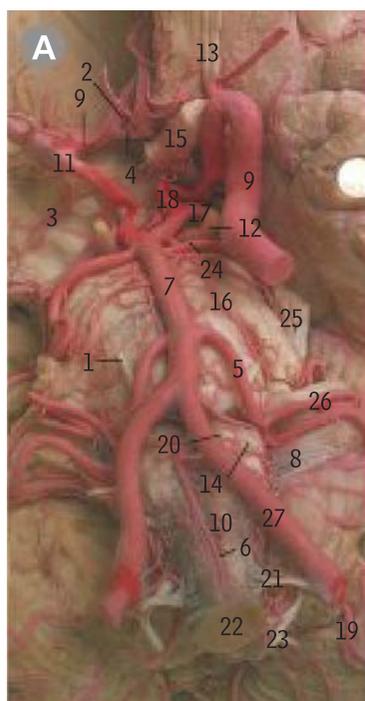
The glossopharyngeal and vagus nerves (33) and the cranial root of the accessory nerve emerge from the medulla oblongata lateral to the olive (19).

The hypoglossal nerve (32) emerges as two series of rootlets from the medulla oblongata between the pyramid (31) and the olive (19).

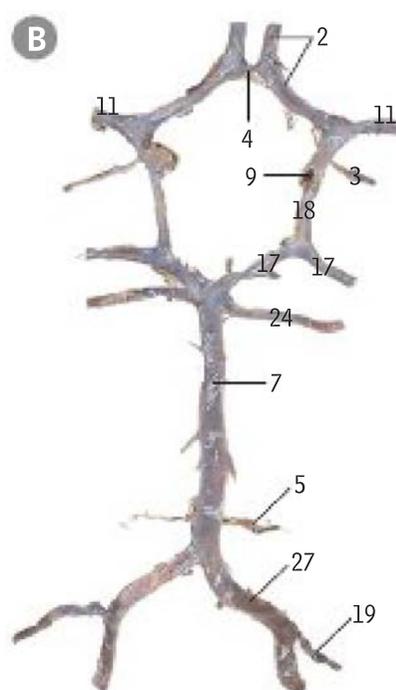
The spinal part of the accessory nerve emerges from the lateral surface of the upper five or six cervical segments of the spinal cord, dorsal to the denticulate ligament ([page 71, E5](#)).

Arteries of the base of the brain *injected arteries* arterial circle (Willis) and basilar artery

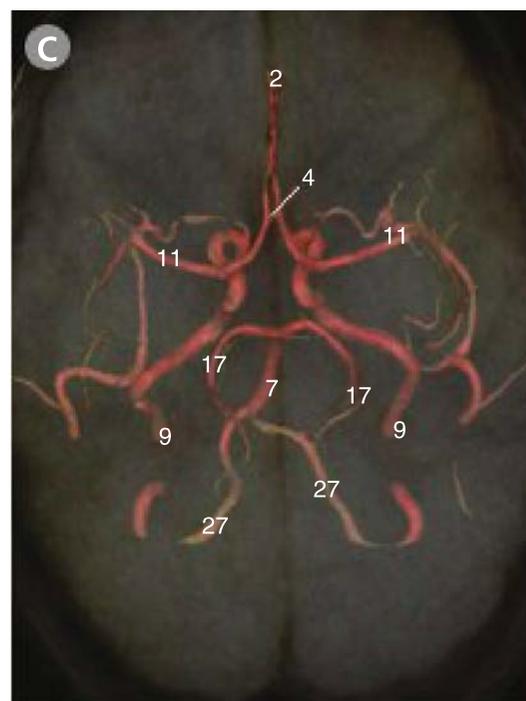
3D CT angiogram – circle of Willis



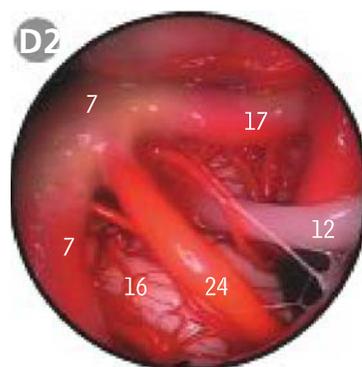
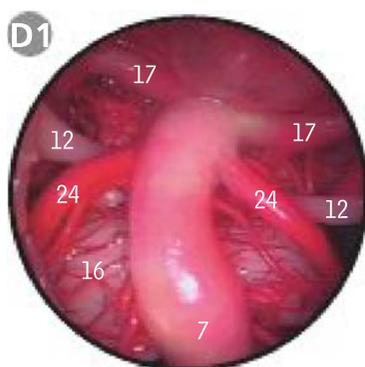
Part of the right cerebral hemisphere (on the left of the picture) has been removed to show the right middle cerebral artery (11).



The anastomosing vessels have been removed from the base of the brain and spread out in their relative positions.



Intracranial endoscopy at the base of the brain

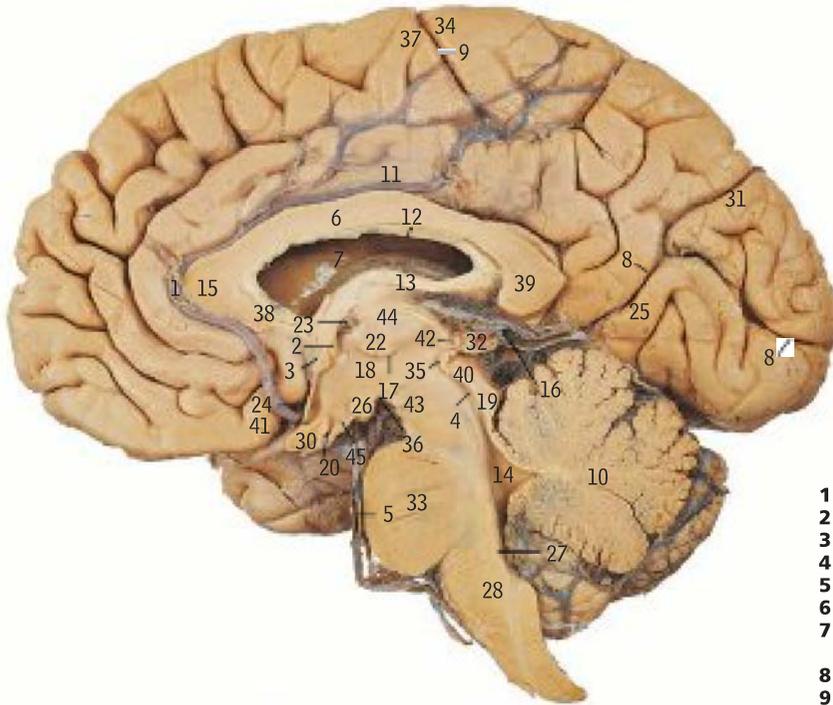


- | | | | |
|--|---|---|--|
| 1 Abducent nerve | 8 Filaments of glossopharyngeal, vagus and accessory nerves | 16 Pons | 23 Spinal part of accessory nerve |
| 2 Anterior cerebral artery | 9 Internal carotid artery | 17 Posterior cerebral artery | 24 Superior cerebellar artery |
| 3 Anterior choroidal artery | 10 Medulla oblongata | 18 Posterior communicating artery | 25 Trigeminal nerve |
| 4 Anterior communicating artery | 11 Middle cerebral artery | 19 Posterior inferior cerebellar artery | 26 Unusually large branch of 5 overlying facial and vestibulocochlear nerves |
| 5 Anterior inferior cerebellar artery | 12 Oculomotor nerve | 20 Pyramid | 27 Vertebral artery |
| 6 Anterior spinal artery | 13 Olfactory tract | 21 Rootlets of first cervical nerve | |
| 7 Basilar artery with pontine branches | 14 Olive | 22 Spinal cord | |
| | 15 Optic nerve | | |



Berry aneurysm

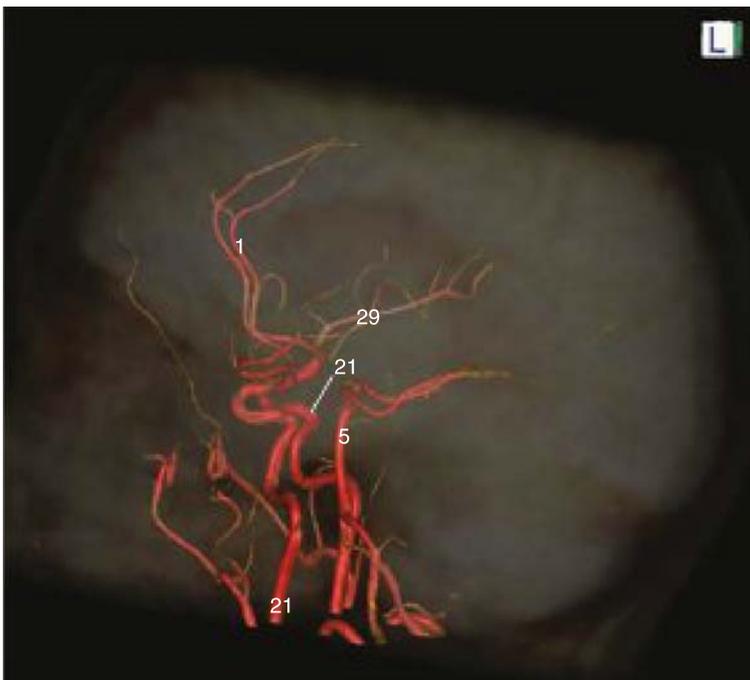
Right half of the brain *in a midline sagittal section, from the left*



In this typical half-section of the brain, the medial surface of the right cerebral hemisphere is seen, together with the sectioned brainstem (midbrain, 4, 20, 44, 47; pons, 36; and medulla oblongata, 29). The septum pellucidum, which is a midline structure and whose cut edge (12) is seen below the body of the corpus callosum (6), has been removed to show the interior of the body of the lateral ventricle (7). The third ventricle has the thalamus (48) and hypothalamus (19) in its lateral wall, while in its floor from front to back are the optic chiasma (32), the base of the pituitary stalk (21), the median eminence (49), the mamillary bodies (27), and the posterior perforated substance (40).

- | | |
|--|--|
| 1 Anterior cerebral artery | 24 Lamina terminalis |
| 2 Columns of the fornix | 25 Lingual gyrus |
| 3 Anterior commissure | 26 Mamillary body |
| 4 Aqueduct of midbrain | 27 Median aperture of fourth ventricle |
| 5 Basilar artery | 28 Medulla oblongata |
| 6 Body of corpus callosum | 29 Middle cerebral artery |
| 7 Body of caudate nucleus within lateral ventricle | 30 Optic chiasm |
| 8 Calcarine sulcus | 31 Parieto-occipital sulcus |
| 9 Central sulcus | 32 Pineal body |
| 10 Cerebellum | 33 Pons |
| 11 Cingulate gyrus | 34 Postcentral gyrus |
| 12 Cut edge of septum pellucidum | 35 Posterior commissure |
| 13 Fornix (body) | 36 Posterior perforated substance |
| 14 Fourth ventricle | 37 Precentral gyrus |
| 15 Genu of corpus callosum | 38 Rostrum of corpus callosum |
| 16 Great cerebral vein | 39 Splenium of corpus callosum |
| 17 Hypothalamic sulcus | 40 Superior colliculus of midbrain |
| 18 Hypothalamus | 41 Supra-optic recess |
| 19 Inferior colliculus of midbrain | 42 Suprapineal recess |
| 20 Infundibular recess (base of pituitary stalk) | 43 Tegmentum of midbrain |
| 21 Internal carotid artery | 44 Thalamus |
| 22 Interthalamic adhesion | 45 Tuber cinereum and median eminence |
| 23 Interventricular foramen and choroid plexus | |

3D CT angiogram *lateral view*



The third ventricle is the cavity which has in its lateral wall the thalamus (A44) and hypothalamus (A18).

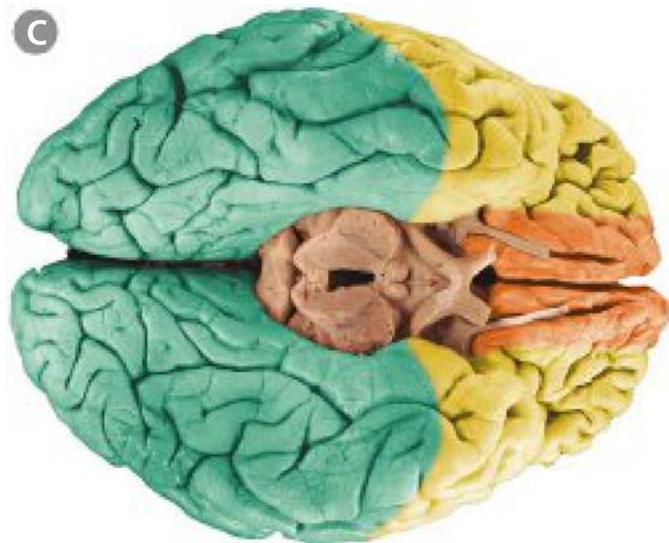
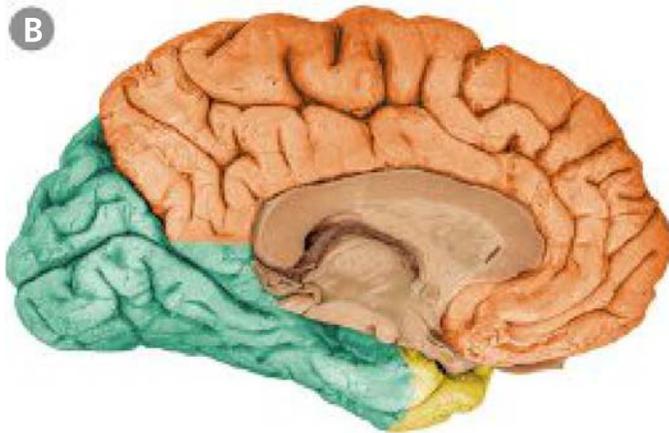
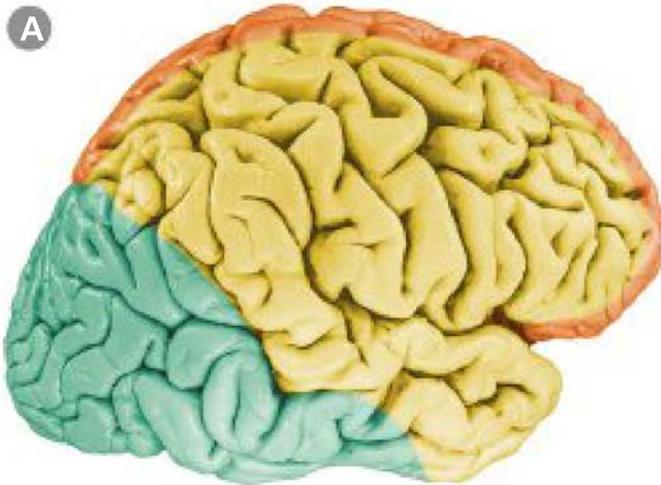
The fourth ventricle (A14) is largely between the pons (A33) and cerebellum (A10), although its lower end is behind the upper part of the medulla oblongata (A28) (see [page 61, B](#)).

The aqueduct of the midbrain (A4) connects the third and fourth ventricles; cerebrospinal fluid normally flows through it from the third to the fourth ventricle.

The interventricular foramen (A23) connects the third to the lateral ventricle, and is bounded in front by the column of the fornix (A2) and behind by the thalamus (A44).

Cortical watershed areas *blood supply of the cerebrum*

Overlay of the main areas of supply of the cerebral arteries seen on the (A) superolateral, (B) medial, and (C) inferior surfaces of the cerebrum.



It is important to realise that, just as the surface and basal vessels of the cerebral hemispheres do not anastomose, those of the anterior, middle and posterior cerebral arteries also tend to have their own areas of supply – these are the so-called cortical watershed areas.

The anterior cerebral artery (orange) supplies the medial surface of the frontal and parietal lobes, but not that of the occipital lobe. It travels over the edge of the medial surface of these lobes to supply a strip of about a finger's width on the superolateral surface of the frontal and parietal lobes and on the inferior surface of the frontal lobe.

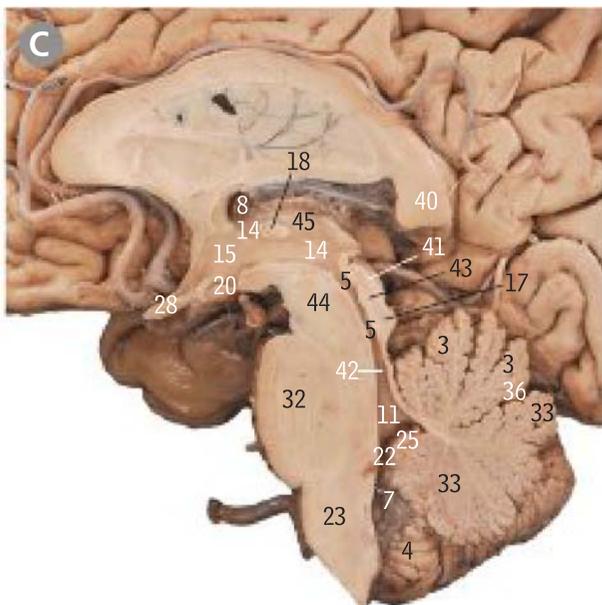
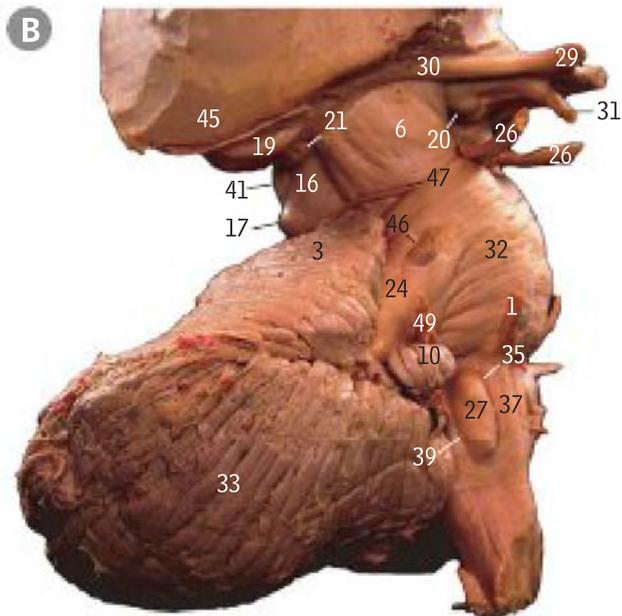
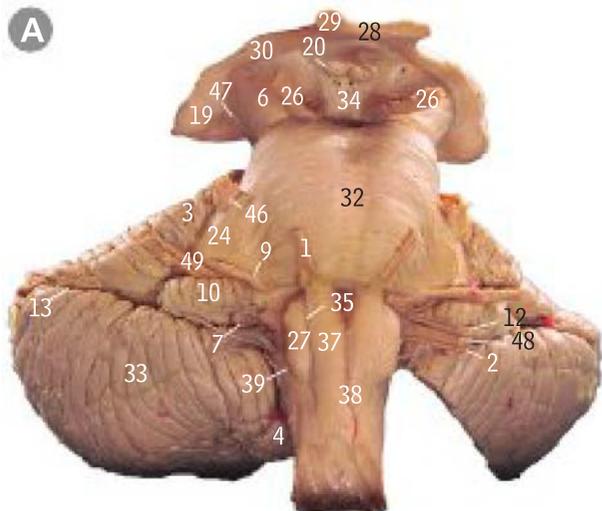
The middle cerebral artery (yellow) supplies the insula and the superolateral surface of the frontal and parietal lobes (except that supplied by the anterior cerebral artery). It also supplies the anterior pole and superior portion of the temporal lobe, but not the occipital lobe.

The posterior cerebral artery (green) supplies the entire occipital lobe up to the parieto-occipital sulcus and the remainder of the temporal lobe.



Brainstem and cerebellum midsagittal view

from anterior, from the right,

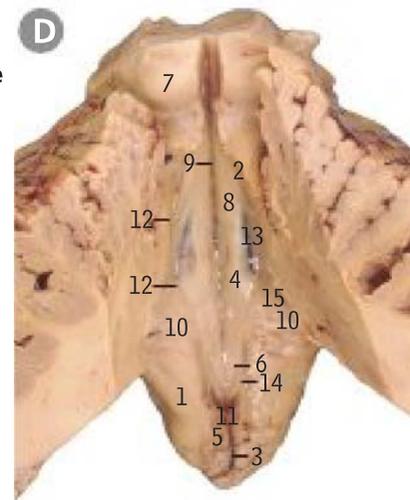


- 1 Abducent nerve (CN VI)
- 2 Accessory nerve (CN XI) (cranial part)
- 3 Anterior lobe of cerebellum
- 4 Cerebellar tonsil
- 5 Cerebral aqueduct (of Sylvius)
- 6 Cerebral peduncle
- 7 Choroid plexus of the fourth ventricle
- 8 Choroid plexus of the third ventricle
- 9 Facial nerve (CN VII)
- 10 Flocculus
- 11 Fourth ventricle
- 12 Glossopharyngeal nerve (CN IX)
- 13 Horizontal fissure of cerebellum
- 14 Hypothalamic sulcus
- 15 Hypothalamus
- 16 Inferior brachium
- 17 Inferior colliculus
- 18 Interthalamic adhesion/massa intermedia
- 19 Lateral geniculate body
- 20 Mammillary body
- 21 Medial geniculate body
- 22 Median aperture (of Magendie)
- 23 Medulla oblongata
- 24 Middle cerebellar peduncle
- 25 Nodulus
- 26 Oculomotor nerve (CN III)
- 27 Olive
- 28 Optic chiasm
- 29 Optic nerve (CN II)
- 30 Optic tract
- 31 Pituitary stalk (infundibulum)
- 32 Pons
- 33 Posterior lobe of cerebellum
- 34 Posterior perforated substance of interpeduncular fossa
- 35 Pre-olivary sulcus
- 36 Primary fissure of the cerebellum
- 37 Pyramid
- 38 Pyramidal (motor) decussation
- 39 Retro-olivary sulcus
- 40 Splenium of corpus callosum
- 41 Superior colliculus
- 42 Superior (anterior) medullary vellum
- 43 Tectum of midbrain
- 44 Tegmentum of midbrain
- 45 Thalamus
- 46 Trigeminal nerve (CN V)
- 47 Trochlear nerve (CN IV)
- 48 Vagus nerve (CN X)
- 49 Vestibulocochlear nerve (CN VIII)

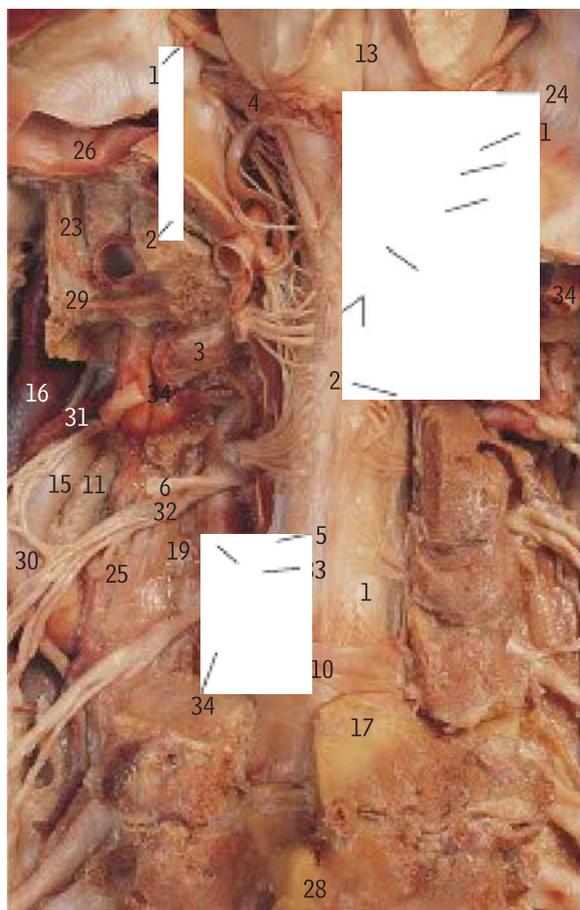
Brainstem and floor of the fourth ventricle **D**

In this view of the dorsal surface of the brainstem, it has been cut off from the rest of the brain at the top of the midbrain, just below the superior colliculi. The vermis and medial aspects of the cerebellar hemispheres has been removed to expose the floor of the fourth ventricle.

- 1 Cuneate tubercle
- 2 Cut edge of superior (anterior) medullary velum
- 3 Dorsal median sulcus
- 4 Facial colliculus
- 5 Gracile tubercle
- 6 Hypoglossal triangle
- 7 Inferior colliculus
- 8 Medial eminence
- 9 Median sulcus
- 10 Medullary striae
- 11 Obex
- 12 Sulcus limitans
- 13 Superior fovea
- 14 Vagal triangle
- 15 Vestibular area



Brainstem and upper part of the spinal cord from behind after removal of vertebrae



The posterior parts of the skull and upper vertebrae have been removed to show the continuity of the brainstem with the spinal cord, from which dorsal nerve rootlets are seen to emerge (as at 9). The spinal part of the accessory nerve (27) runs up through the foramen magnum (20) to join the cranial part in the jugular foramen (24). Ventral nerve rootlets (as at 33), ventral to the denticulate ligament (5), unite to form a ventral nerve root which joins with a dorsal nerve root (8, whose formative rootlets dorsal to the ligament have been cut off from the cord in order to make the ventral roots visible) to form a spinal nerve immediately beyond the dorsal root ganglion (7). The nerve immediately divides into ventral and dorsal rami (as at 32 and 6).

- | | |
|--|--|
| 1 Arachnoid mater | 17 Lamina of sixth cervical vertebra |
| 2 Atlanto-occipital joint | 18 Lateral mass of atlas |
| 3 Capsule of lateral atlanto-axial joint | 19 Longus capitis |
| 4 Choroid plexus emerging from lateral recess of fourth ventricle | 20 Margin of foramen magnum |
| 5 Denticulate ligament | 21 Posterior inferior cerebellar artery |
| 6 Dorsal ramus of third cervical nerve | 22 Posterior spinal arteries |
| 7 Dorsal root ganglion of fourth cervical nerve | 23 Rectus capitis lateralis |
| 8 Dorsal root of fourth cervical nerve | 24 Roots of glossopharyngeal, vagus and cranial part of accessory nerves and jugular foramen |
| 9 Dorsal rootlets of second cervical nerve | 25 Scalenus anterior |
| 10 Dura mater | 26 Sigmoid sinus |
| 11 External carotid artery | 27 Spinal part of accessory nerve |
| 12 First cervical nerve and posterior arch of atlas | 28 Spinous process of seventh cervical vertebra |
| 13 Floor of the fourth ventricle | 29 Transverse process of atlas |
| 14 Internal acoustic meatus with facial and vestibulocochlear nerves and labyrinthine artery | 30 Vagus nerve |
| 15 Internal carotid artery | 31 Vein from vertebral venous plexuses |
| 16 Internal jugular vein | 32 Ventral ramus of third cervical nerve |
| | 33 Ventral rootlets of fourth cervical nerve |
| | 34 Vertebral artery |

The lower part of the diamond-shaped floor of the fourth ventricle containing the hypoglossal and vagal triangles (D6 and 14) is part of the medulla oblongata; the rest of the floor is part of the pons.

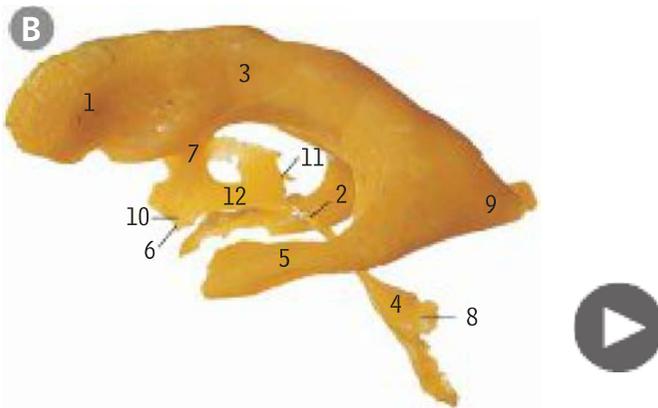
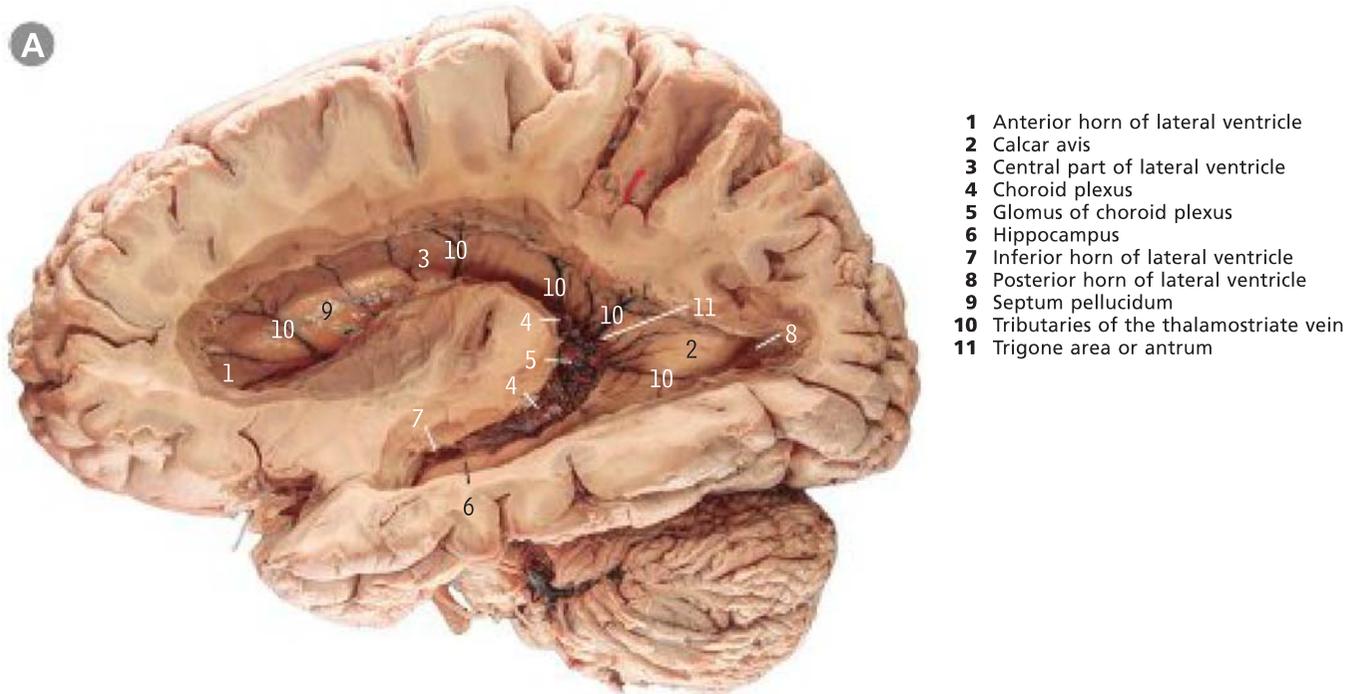
The gracile and cuneate tubercles (D5 and 1) are caused by the underlying gracile and cuneate nuclei, where the fibres of the gracile and cuneate tracts (posterior white columns) end by synapsing with the cells of the nuclei. The fibres from these cells form the medial lemniscus which runs through the brainstem to the thalamus.

The facial colliculus (D4), at the lower end of the medial eminence (D8) in the floor of the fourth ventricle, is caused by fibres of the facial nerve overlying the abducent nerve nucleus; it is not produced by the facial nerve nucleus, which lies at a deeper level in the pons.

After emerging from the foramen in the transverse process of the atlas the vertebral artery (E34) winds backwards round the lateral mass of the atlas (E18) on its posterior arch before turning upwards to enter the skull, via the foramen magnum.

Ventricles of the brain

Lateral ventricle of the left cerebral hemisphere *viewed from lateral*



The third ventricle (B12) communicates at its upper front end with each lateral ventricle through the interventricular foramen (B7). The main part of the lateral ventricle is the body (A and B3). The part in front of the interventricular foramen (B7) is the anterior horn (A and B1), which extends into the frontal lobe of the brain. At its posterior end, the body divides into the posterior horn (A8 and B9), which extends backwards into the occipital lobe, and the inferior horn (A7 and B5), which passes downwards and forwards into the temporal lobe. The lower posterior part of the third ventricle (B12) communicates with the fourth ventricle (B4) through the aqueduct of the midbrain (B2). The floor of the inferior horn consists of the hippocampus (A6 and page 73, C11) medially and the collateral eminence (page 73, C) laterally. At its junction with the posterior horn (A8, B9 and page 73, C12) the eminence broadens into the collateral trigone (page 73, C5). The collateral eminence (page 73, C) is produced by the inward projection of the collateral sulcus. In the medial wall of the posterior horn, the bulb is produced by fibres of the corpus callosum, and the calcar avis (A2) by the inward projection of the calcarine sulcus (page 68, A8).

Cast of the cerebral ventricles *from the left*

In this side view, the left lateral ventricle largely overlaps the right one.

- 1 Anterior horn of lateral ventricle
- 2 Aqueduct of midbrain
- 3 Body of lateral ventricle
- 4 Fourth ventricle
- 5 Inferior horn of lateral ventricle
- 6 Infundibular recess of third ventricle
- 7 Interventricular foramen
- 8 Lateral recess
- 9 Posterior horn of lateral ventricle
- 10 Supra-optic recess of third ventricle
- 11 Suprapineal recess of third ventricle
- 12 Third ventricle (with gap for interthalamic connexion)

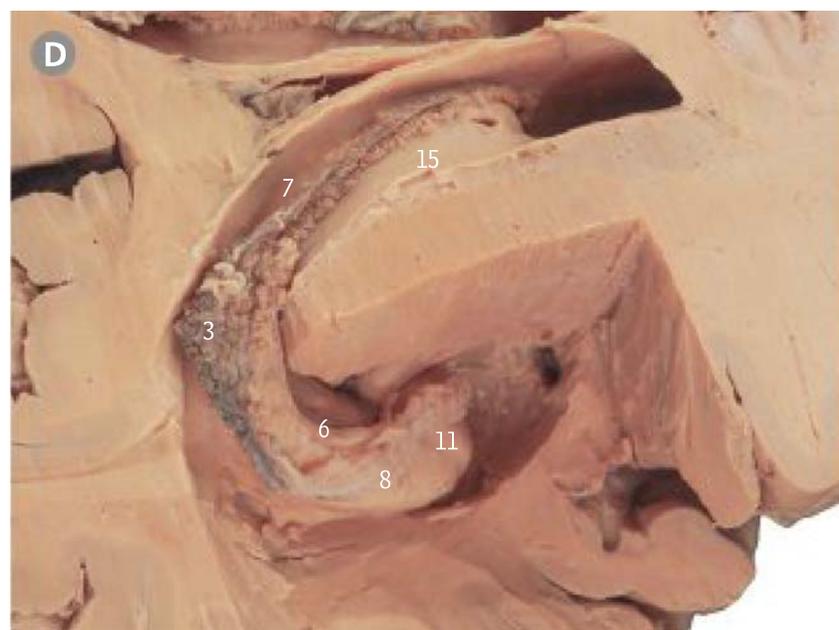
Ventricles of the brain and hippocampus



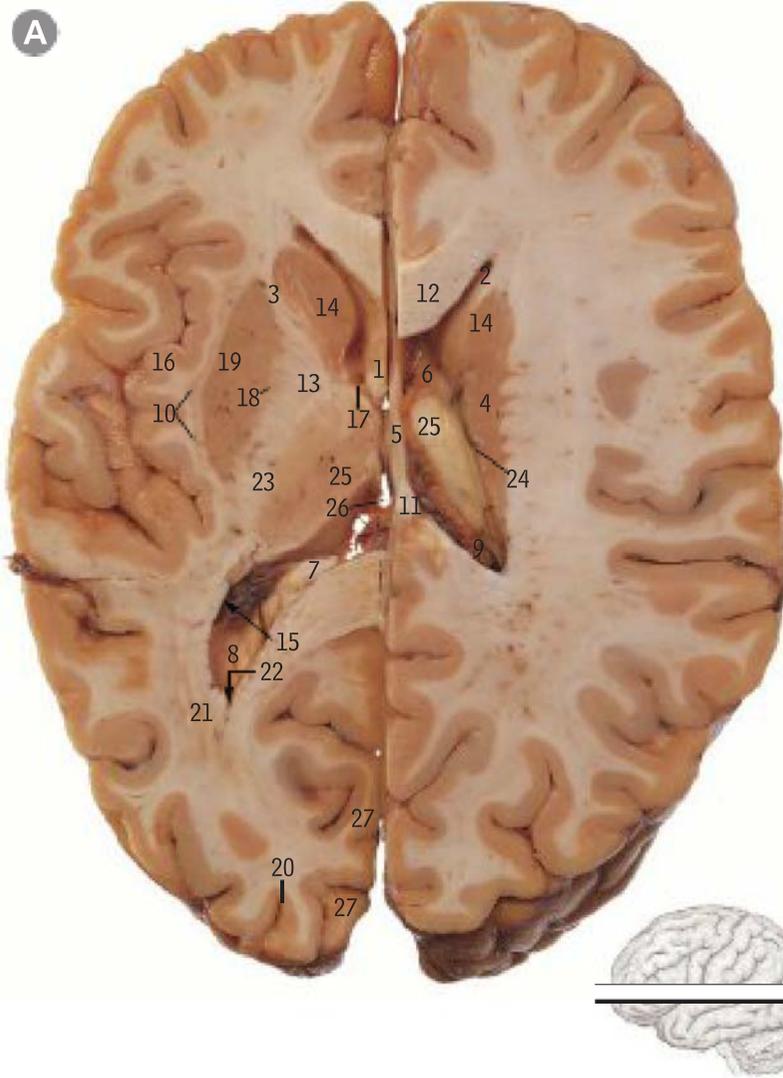
D Inferior horn of right lateral ventricle

Brain substance above the front part of the lateral sulcus has been removed, displaying the middle cerebral artery (9) running laterally over the upper surface of the front of the temporal lobe (14). Part of the temporal lobe has been opened up from above to show the hippocampus (11 and 8) in the floor of the inferior horn.

- | | |
|-----------------------------|-----------------------------------|
| 1 Anterior cerebral artery | 9 Middle cerebral artery |
| 2 Anterior choroidal artery | 10 Optic nerve |
| 3 Choroid plexus | 11 Pes hippocampi |
| 4 Collateral eminence | 12 Posterior horn |
| 5 Collateral trigone | 13 Tapetum |
| 6 Fimbria | 14 Temporal pole of temporal lobe |
| 7 Fornix | 15 Thalamus |
| 8 Hippocampus | |

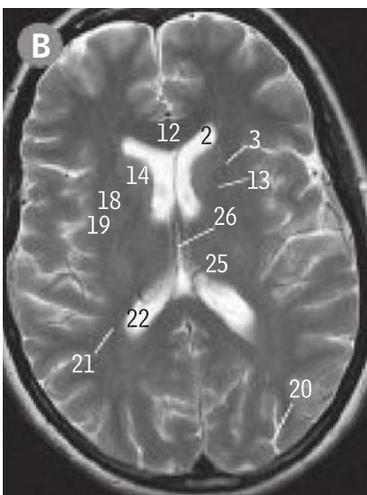


Cerebral hemispheres sectioned horizontally axial MR image



Viewed from above, the left cerebral hemisphere has been sectioned on a level with the interventricular foramen (17), and that on the right about 1.5 cm higher. The most important feature seen in the left hemisphere is the internal capsule (3, 13 and 23), situated between the caudate (14) and lentiform (18 and 19) nuclei and the thalamus (25). On the right side, a large part of the corpus callosum (11) has been removed, so opening up the lateral ventricle (6) from above and showing the caudate nucleus (14 and 4) arching backwards over the thalamus (25), with the thalamostriate vein (24) and choroid plexus (9) in the shallow groove between them.

- 1 Anterior column of fornix
- 2 Anterior horn of lateral ventricle
- 3 Anterior limb of internal capsule
- 4 Body of caudate nucleus
- 5 Body of fornix
- 6 Body of lateral ventricle
- 7 Bulb
- 8 Calcar avis
- 9 Choroid plexus
- 10 Claustrum
- 11 Corpus callosum
- 12 Forceps minor (corpus callosum)
- 13 Genu of internal capsule
- 14 Head of caudate nucleus
- 15 Inferior horn of lateral ventricle
- 16 Insula
- 17 Interventricular foramen
- 18 Lentiform nucleus: globus pallidus
- 19 Lentiform nucleus: putamen
- 20 Lunate sulcus
- 21 Optic radiation
- 22 Posterior horn of lateral ventricle
- 23 Posterior limb of internal capsule
- 24 Thalamostriate vein
- 25 Thalamus
- 26 Third ventricle
- 27 Visual area of cortex



The anterior limb of the internal capsule (3) is bounded medially by the head of the caudate nucleus (14) and laterally by the lentiform nucleus (putamen and globus pallidus, 18 and 19).

The genu of the internal capsule (13) lies at the most medial edge of the globus pallidus (18).

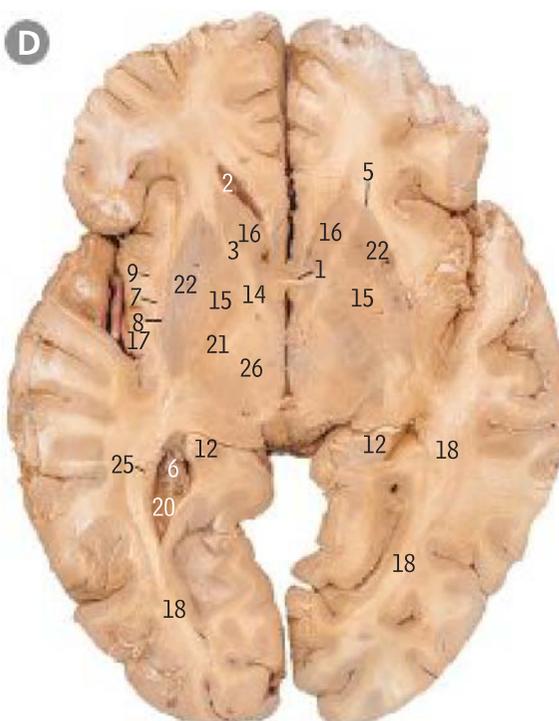
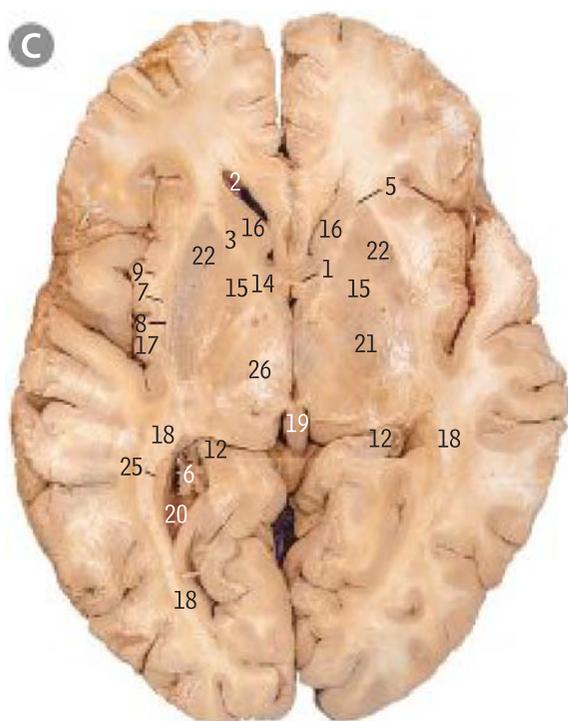
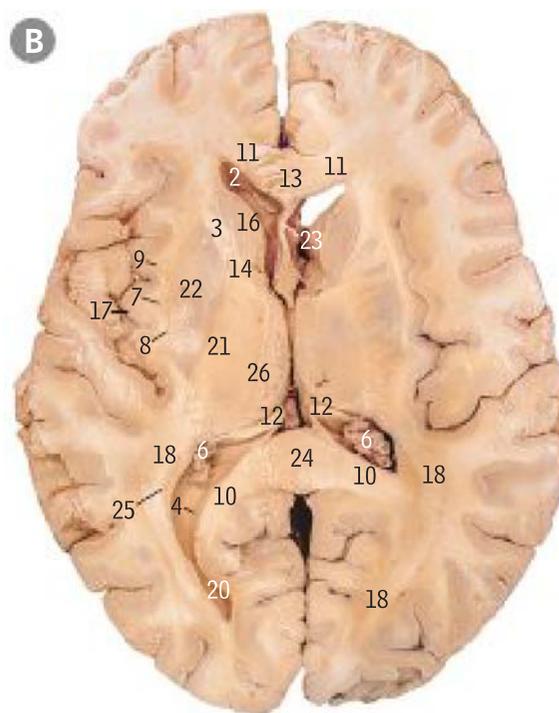
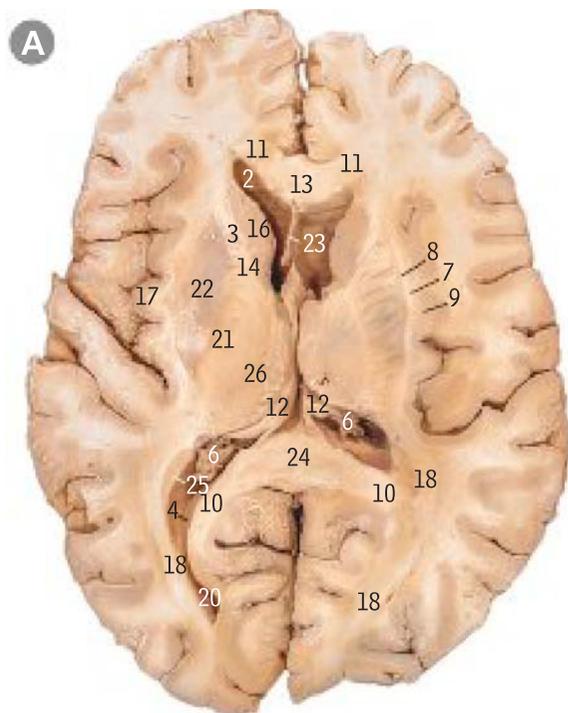
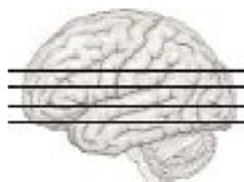
The posterior limb of the internal capsule (23) is bounded medially by the thalamus (25) and laterally by the lentiform nucleus (18 and 19).

Corticonuclear fibres (motor fibres from the cerebral cortex to the motor nuclei of cranial nerves) pass through the genu of the internal capsule (13).

Corticospinal fibres (motor fibres from the cerebral cortex to anterior horn cells of the spinal cord) pass through the anterior two-thirds of the posterior limb of the internal capsule (23).

The genu and the posterior limb of the internal capsule, supplied by the striate branches of the anterior and middle cerebral arteries and by the anterior choroidal artery, are of the greatest clinical importance as they are the common sites for cerebral haemorrhage or thrombosis ('stroke').

Axial sections of the brain - from superior to inferior

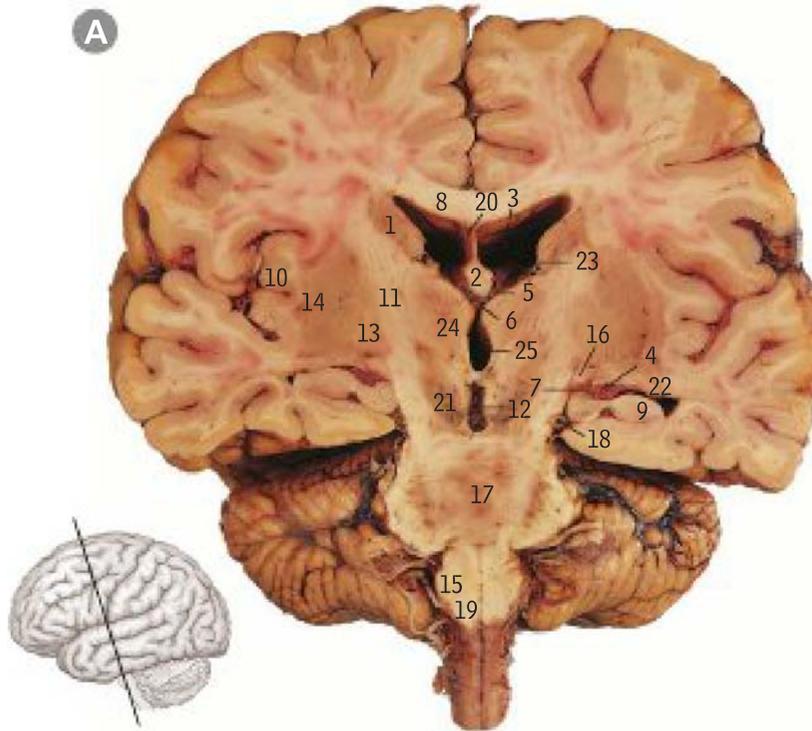


- 1 Anterior commissure
- 2 Anterior horn of lateral ventricle
- 3 Anterior limb of internal capsule
- 4 Calcar avis
- 5 Caudolenticular grey stria
- 6 Choroid plexus of lateral ventricles
- 7 Claustrum
- 8 External capsule
- 9 Extreme capsule
- 10 Forceps major
- 11 Forceps minor
- 12 Fornix (crura)
- 13 Genu of corpus callosum
- 14 Genu of internal capsule
- 15 Globus pallidus
- 16 Head of caudate nucleus
- 17 Insular cortex/insula
- 18 Optic radiation
- 19 Pineal gland
- 20 Posterior horn of lateral ventricle
- 21 Posterior limb of internal capsule
- 22 Putamen
- 23 Septum pellucidum
- 24 Splenium of corpus callosum
- 25 Tapetum
- 26 Thalamus

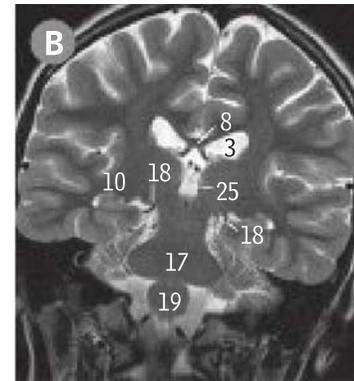
Brain

coronal section, from the front

coronal MR image



This coronal section is not quite vertical but passes slightly backwards, through the third ventricle (25) and bodies of the lateral ventricles (3) from a level about 0.5 cm behind the interventricular foramina, and down through the pons (17) and the pyramid of the medulla (19). It has been cut in this way to show the path of the important corticospinal (motor) fibres passing down through the internal capsule (11) and pons (17) to form the pyramid of the medulla (19). Compare with features in the MR image.

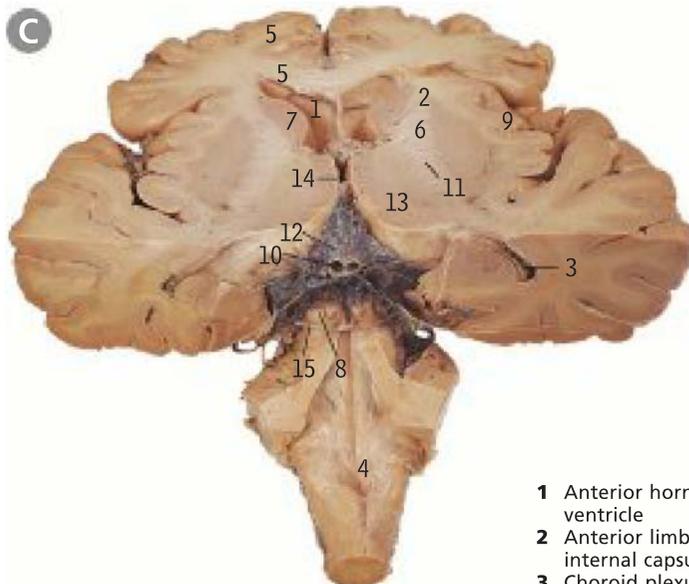


- 1 Body of caudate nucleus
- 2 Body of fornix
- 3 Body of lateral ventricle
- 4 Choroid plexus of inferior horn of lateral ventricle
- 5 Choroid plexus of lateral ventricle

- 6 Choroid plexus of third ventricle
- 7 Choroidal fissure
- 8 Corpus callosum
- 9 Hippocampus
- 10 Insula
- 11 Internal capsule
- 12 Interpeduncular cistern

- 13 Lentiform nucleus: globus pallidus
- 14 Lentiform nucleus: putamen
- 15 Olive of medulla oblongata
- 16 Optic tract
- 17 Pons
- 18 Posterior cerebral artery

- 19 Pyramid of medulla oblongata
- 20 Septum pellucidum
- 21 Substantia nigra
- 22 Tail of caudate nucleus
- 23 Thalamostriate vein
- 24 Thalamus
- 25 Third ventricle



Sectioned cerebral hemispheres and the brainstem

from above and behind

The cerebral hemispheres have been sectioned horizontally just above the level of the interventricular foramina, and the posterior parts of the hemispheres have been removed, together with the whole of the cerebellum, to show the tela choroidea (12) of the posterior part of the roof of the third ventricle and the underlying internal cerebral veins (10).

- 1 Anterior horn of lateral ventricle
- 2 Anterior limb of internal capsule
- 3 Choroid plexus and junction of inferior and posterior horn of lateral ventricle

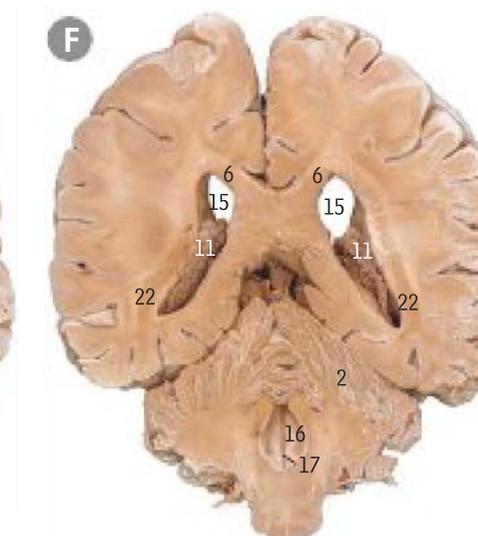
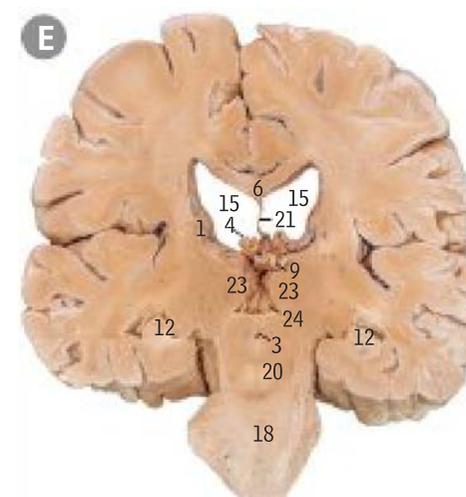
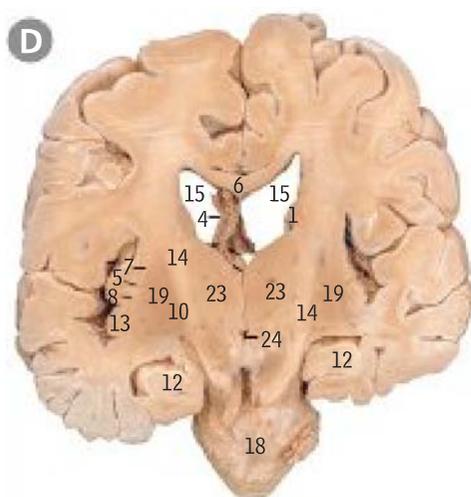
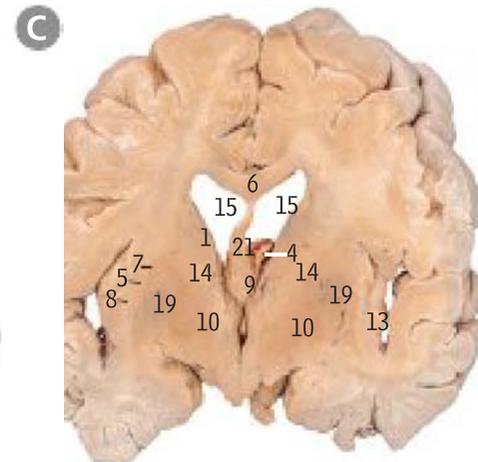
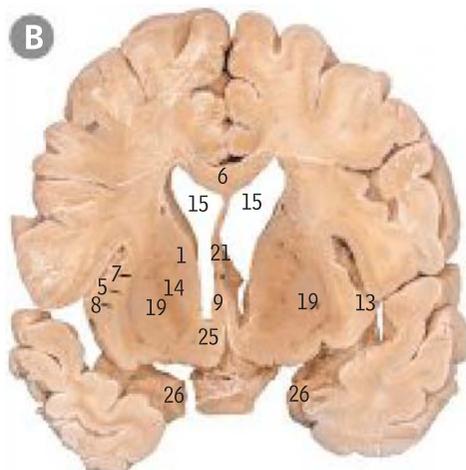
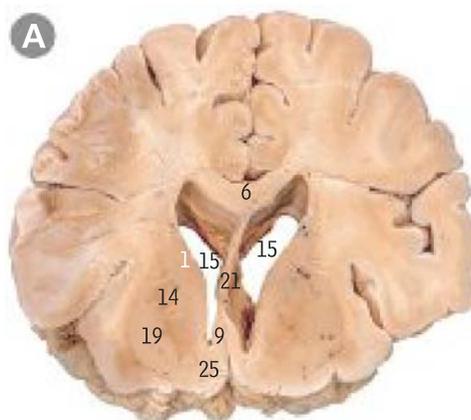
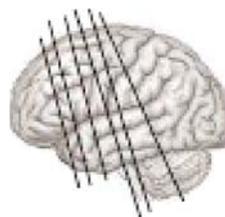
- 4 Floor of fourth ventricle
- 5 Forceps minor
- 6 Genu of internal capsule
- 7 Head of caudate nucleus
- 8 Inferior colliculus
- 9 Insula

- 10 Internal cerebral vein
- 11 Posterior limb of internal capsule
- 12 Tela choroidea of roof of third ventricle
- 13 Thalamus
- 14 Third ventricle
- 15 Trochlear nerve



Arteriovenous fistula

Coronal sections of the brain - from anterior to posterior

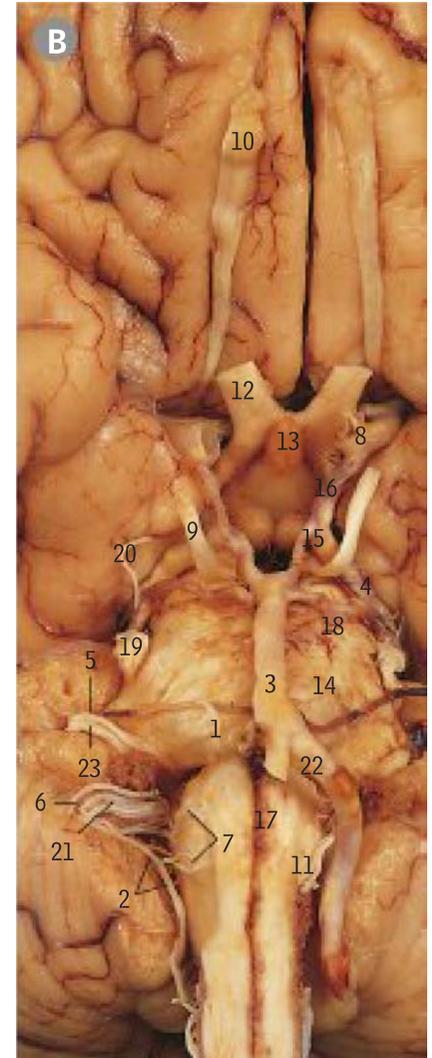
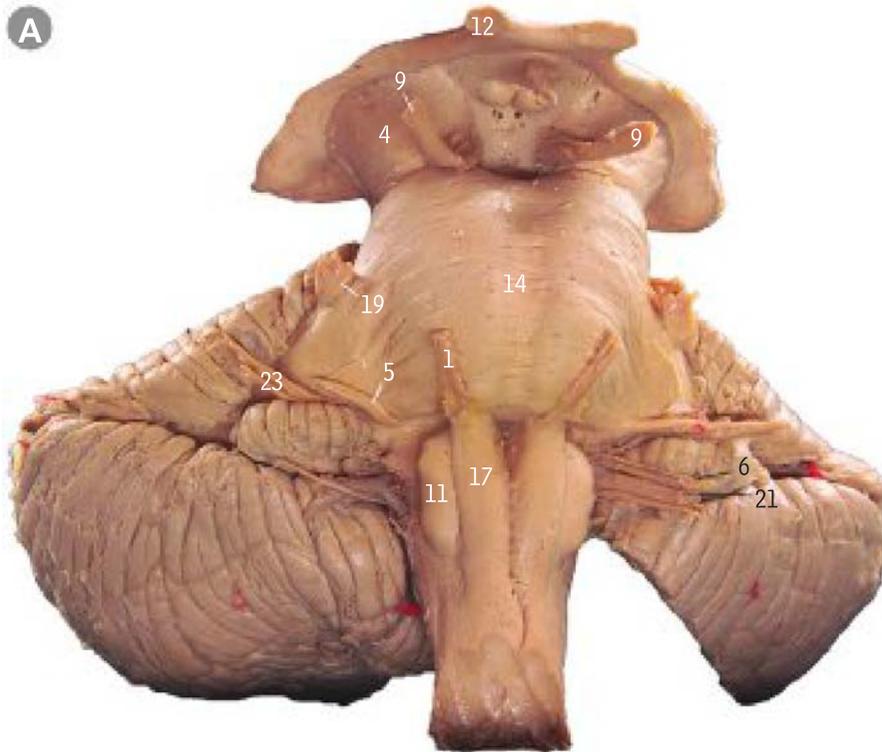


- 1 Caudate nucleus
- 2 Cerebellum
- 3 Cerebral aqueduct
- 4 Choroid plexus of the lateral ventricle
- 5 Claustrum
- 6 Corpus callosum
- 7 External capsule
- 8 Extreme capsule
- 9 Fornix

- 10 Globus pallidus
- 11 Glomus of the choroid plexus
- 12 Hippocampus
- 13 Insular cortex
- 14 Internal capsule
- 15 Lateral ventricle
- 16 Medial eminence (fourth ventricle)
- 17 Median sulcus (fourth ventricle)
- 18 Pons

- 19 Putamen
- 20 Red nucleus
- 21 Septum pellucidum
- 22 Tapetum
- 23 Thalamus
- 24 Third ventricle
- 25 Ventral pallidum
- 26 Uncus

Cranial nerves



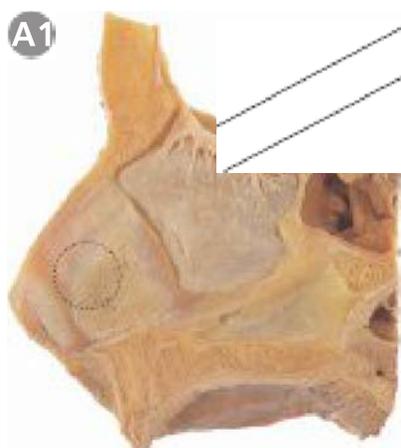
In this ventral view of the central part of the brain, the right vertebral artery (on the left of image B) has been removed almost at the junction with its fellow (B22). The filaments of the first cranial nerve (olfactory) are not seen entering the olfactory bulb (B10) as they are torn off when removing the brain. The roots forming the glossopharyngeal, vagus and accessory nerves (B6, 21 and 2) cannot be clearly identified from one another, but the spinal part of the accessory nerve (B2) is seen running up beside the medulla to join the cranial part.

- 1 Abducent nerve
- 2 Accessory nerve, spinal root
- 3 Basilar artery
- 4 Crus of cerebral peduncle
- 5 Facial nerve
- 6 Glossopharyngeal nerve
- 7 Hypoglossal nerve
- 8 Internal carotid artery

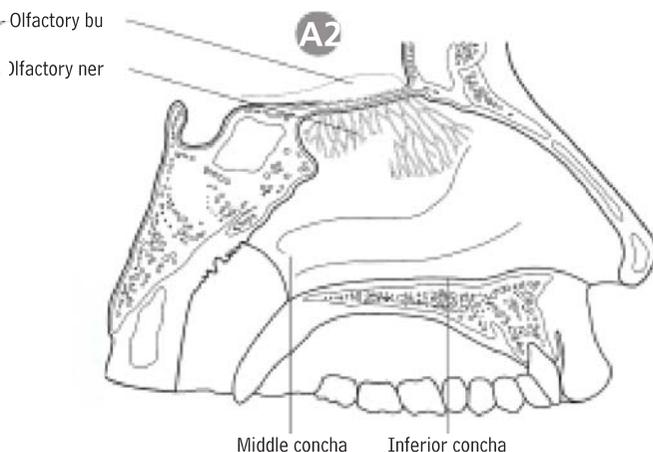
- 9 Oculomotor nerve
- 10 Olfactory bulb
- 11 Olive of medulla oblongata
- 12 Optic nerve
- 13 Pituitary stalk
- 14 Pons
- 15 Posterior cerebral artery
- 16 Posterior communicating artery

- 17 Pyramid of medulla oblongata
- 18 Superior cerebellar artery
- 19 Trigeminal nerve
- 20 Trochlear nerve
- 21 Vagus nerve
- 22 Vertebral artery
- 23 Vestibulocochlear nerve

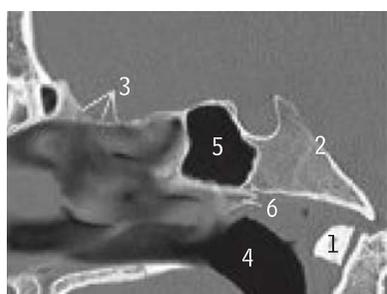
Cranial nerve I – olfactory



Dashed circle indicates Kiesselbach's plexus (Little's area)



Endoscopy of olfactory mucosa



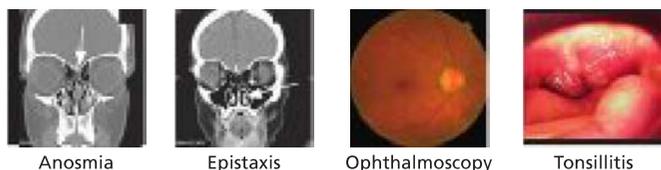
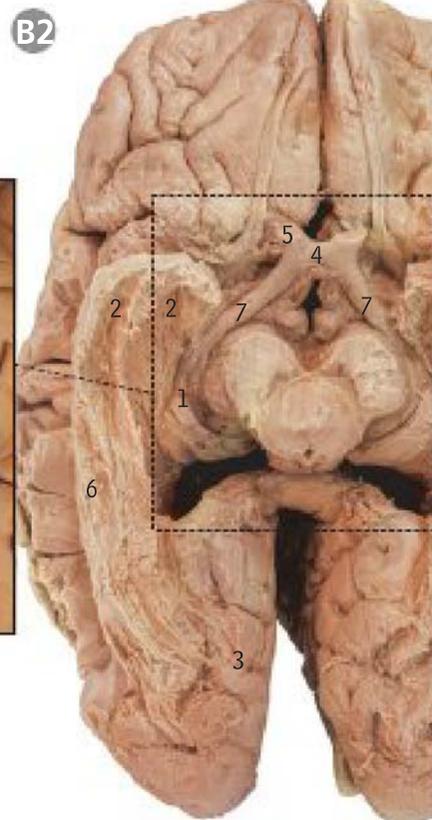
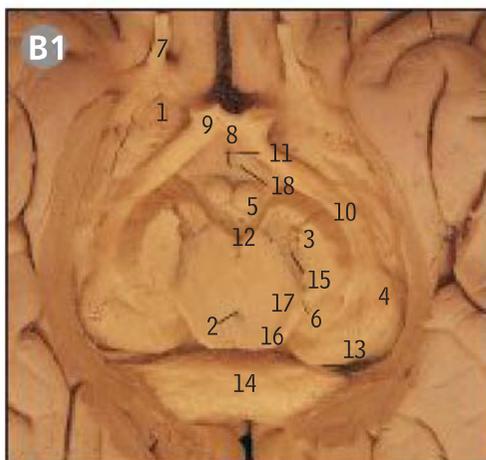
See pages 55, 66 and 78.

- 1 Anterior arch of C1
- 2 Clivus
- 3 Cribriform plate
- 4 Nasopharynx
- 5 Sphenoidal air sinus
- 6 Vomer

Optic tract and geniculate bodies from below

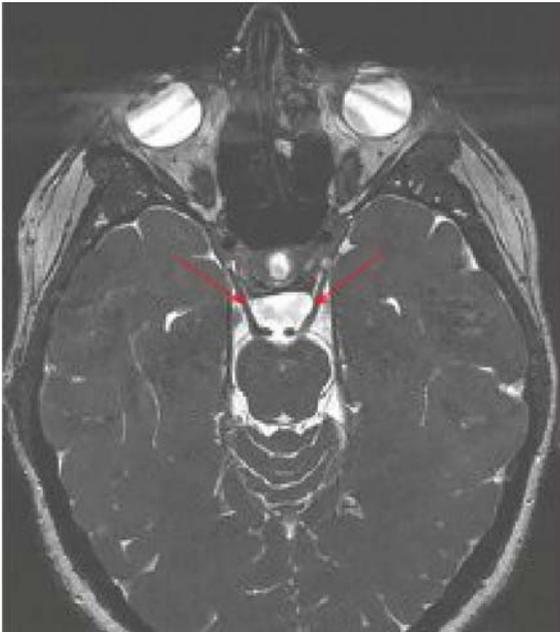
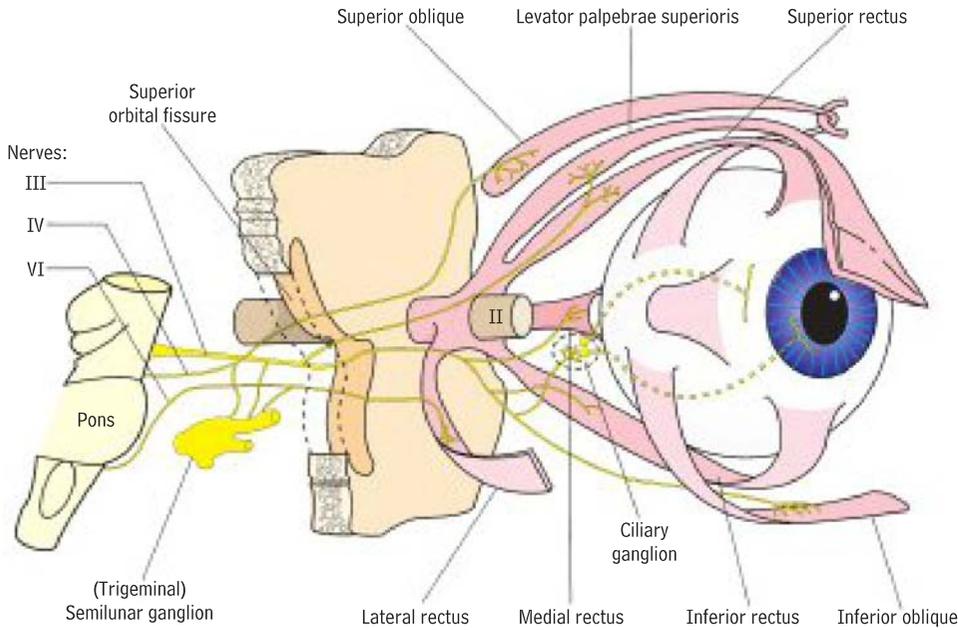
The brainstem has been mostly removed, leaving only the upper part of the midbrain. The most medial parts of each cerebral hemisphere have also been dissected away. To find the geniculate bodies (4 and 6), which are on the under-surface of the posterior part (pulvinar, 13) of the thalamus, identify the optic chiasma (8) and then follow the optic tract (10) backwards round the side of the midbrain (3).

- | | |
|---------------------------------|-----------------------------------|
| 1 Anterior perforated substance | 11 Pituitary stalk (infundibulum) |
| 2 Aqueduct of midbrain | 12 Posterior perforated substance |
| 3 Crus of midbrain | 13 Pulvinar of thalamus |
| 4 Lateral geniculate body | 14 Splenium of corpus callosum |
| 5 Mamillary body | 15 Substantia nigra of midbrain |
| 6 Medial geniculate body | 16 Tectum of midbrain |
| 7 Olfactory tract | 17 Tegmentum of midbrain |
| 8 Optic chiasma | 18 Tuber cinereum |
| 9 Optic nerve | |
| 10 Optic tract | |

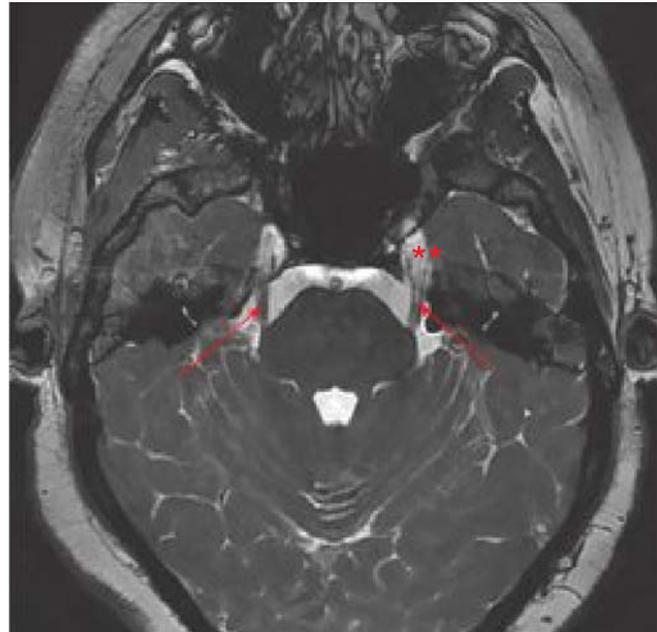


- | | |
|---|--|
| 1 Lateral geniculate body | 3 Occipital lobe and primary visual area |
| 2 Meyer's loop (fibres of the inferior division of optic radiation) | 4 Optic chiasma |
| | 5 Optic nerve (CN II) |
| | 6 Optic radiation |
| | 7 Optic tract |

Cranial nerves III – oculomotor, IV – trochlear, VI – abducent



Axial MR image – oculomotor nerve (CN III) (indicated with red arrows) exiting midbrain



Axial MR image – trigeminal nerve (CN V) (indicated with red arrows) exiting pons and becomes trigeminal ganglion in Meckel cave** (see page 81)



Abducent nerve palsy



Accommodation reflex

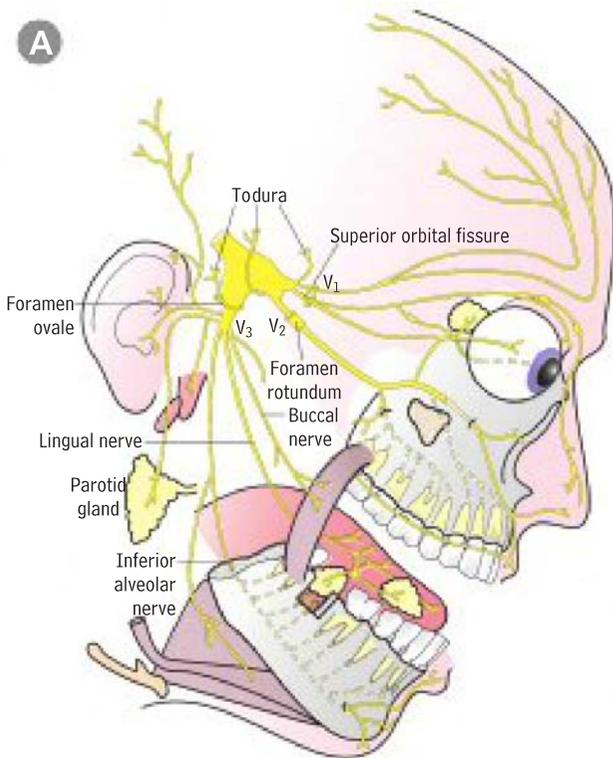


Oculomotor nerve palsy

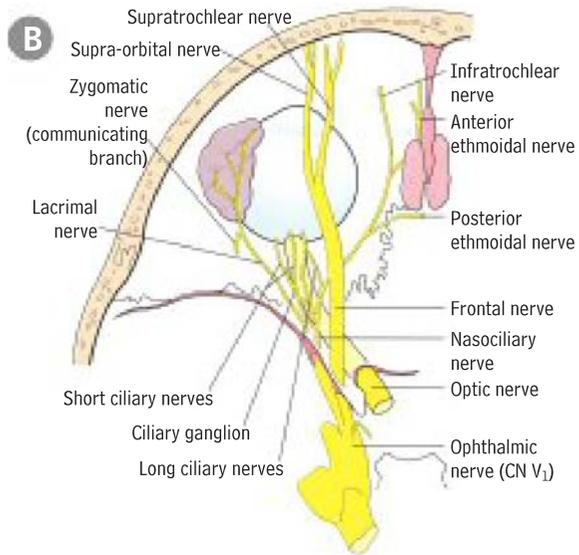


Trochlear nerve palsy

Cranial nerve V – trigeminal (overview)

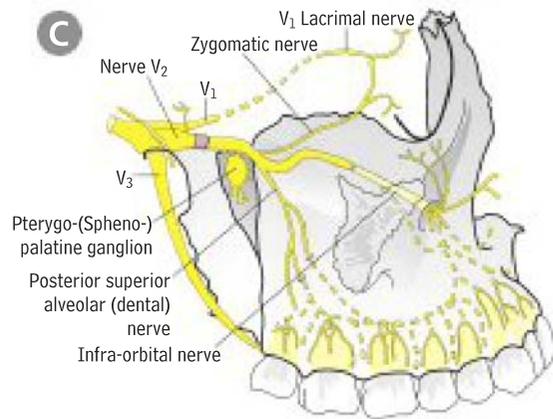


V₁ ophthalmic division of trigeminal



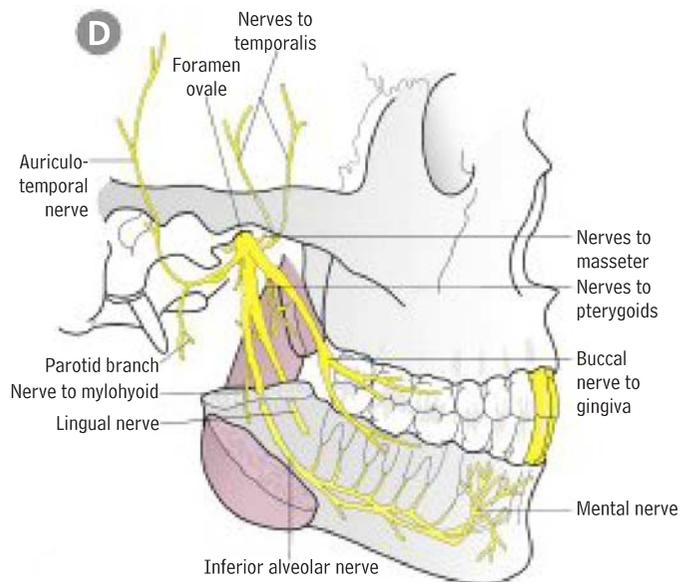
See pages 56 and 82 for V.
See pages 52–54 and 59 for V₁.

V₂ maxillary division of trigeminal

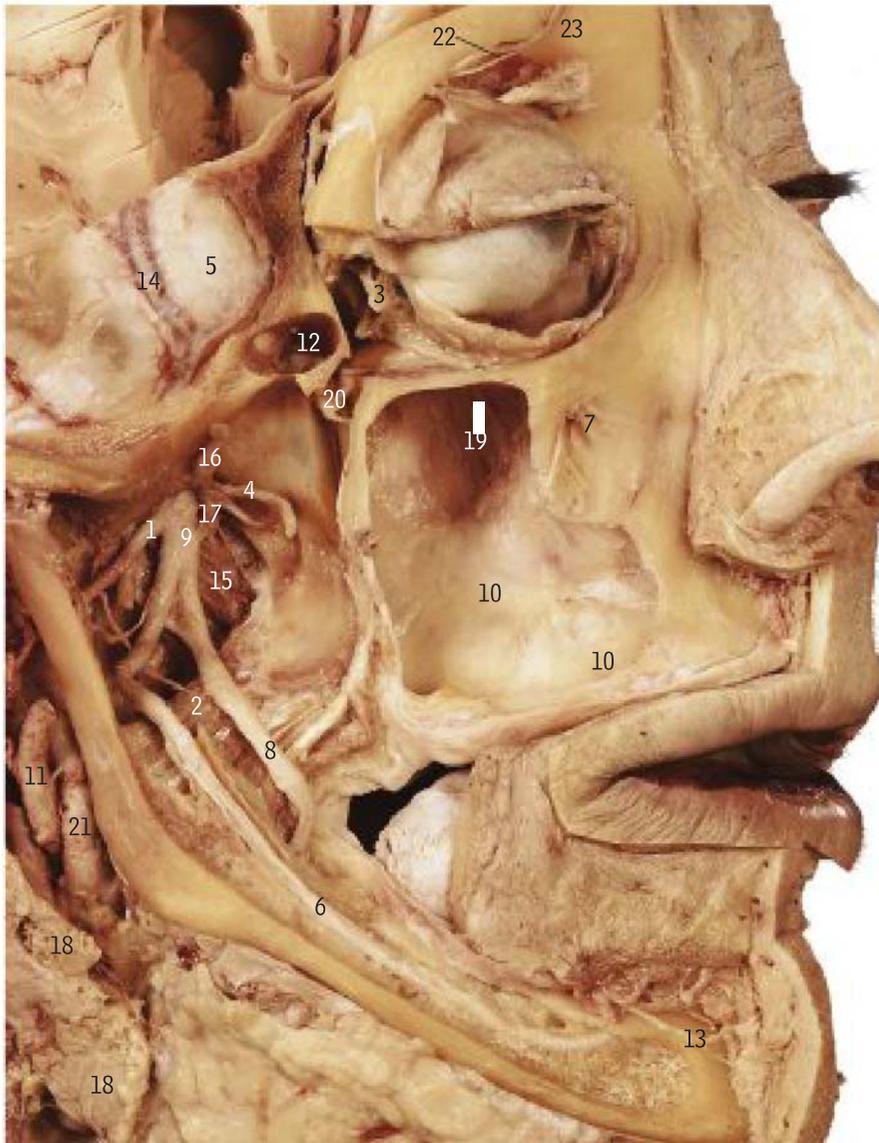


See pages 44 and 55 for V₂.
See pages 29, 35, 40 and 42 for V₃.

V₃ mandibular division of trigeminal

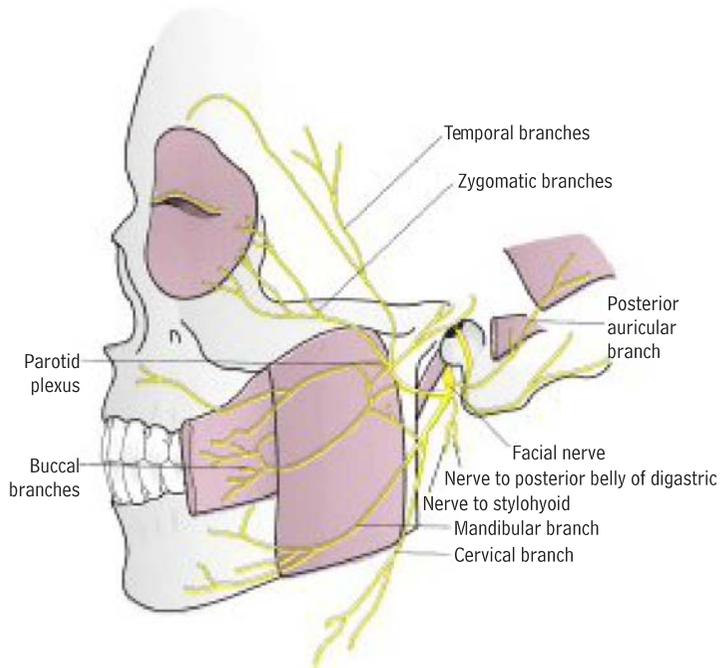


Trigeminal nerve *branches and associated parasympathetic ganglia*

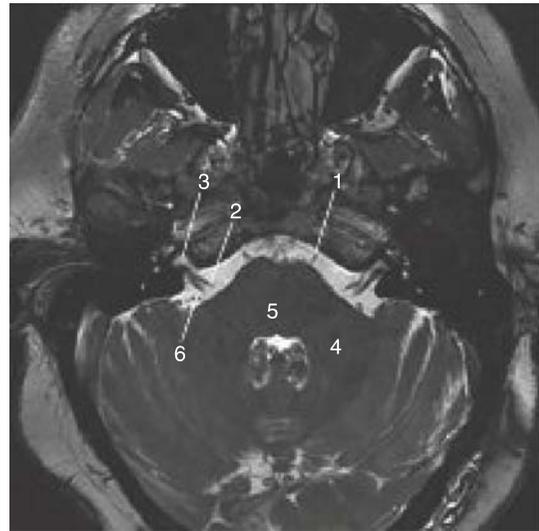


- | | |
|---|--|
| 1 Auriculotemporal nerve | 13 Mental nerve |
| 2 Chorda tympani | 14 Middle meningeal artery |
| 3 Ciliary ganglion | 15 Nerve to lateral pterygoid |
| 4 Deep temporal nerve | 16 Nerve to masseter |
| 5 Dura mater | 17 Otic ganglion |
| 6 Inferior alveolar nerve within canal | 18 Parotid gland |
| 7 Infra-orbital nerve | 19 Posterior superior alveolar nerves |
| 8 Lingual nerve | 20 Pterygopalatine ganglion |
| 9 Mandibular nerve | 21 Retromandibular vein |
| 10 Maxillary air sinus (opened) | 22 Supra-orbital nerve |
| 11 Maxillary artery | 23 Supratrochlear nerve |
| 12 Maxillary nerve | |

Cranial nerve VII – facial



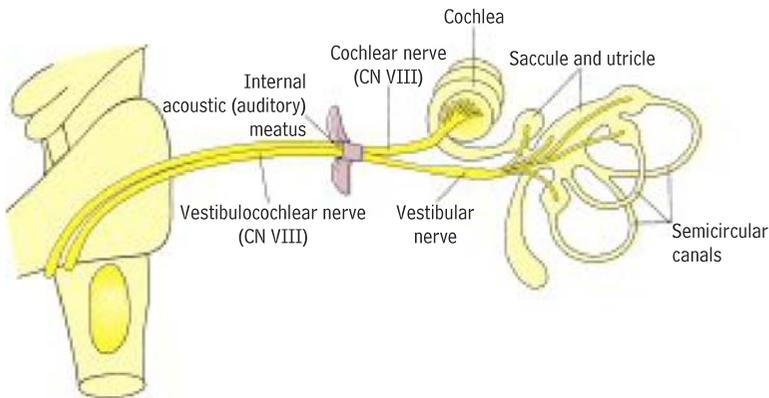
Axial MR, level of pontomedullary junction



See pages 39, 40 and 44.

- 1 Abducent nerve (CN VI)
- 2 Facial nerve (CN VII)
- 3 Internal auditory canal
- 4 Middle cerebral peduncle
- 5 Pons
- 6 Vestibulocochlear nerve (CN VIII)

Cranial nerve VIII – vestibulocochlear



See pages 66, 70, 71 and 78.



Acoustic neuroma



Facial nerve (Bell's) palsy

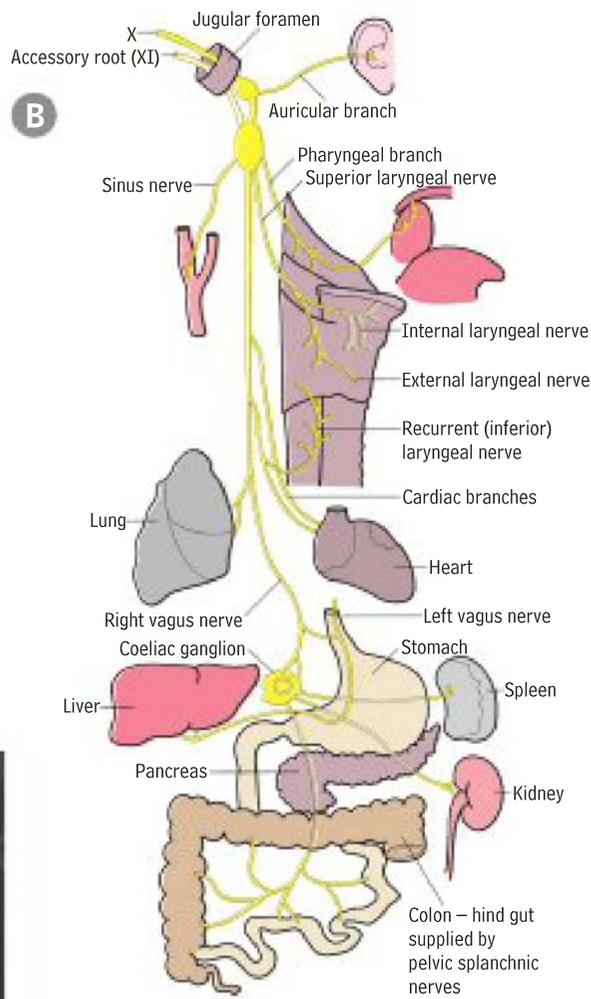
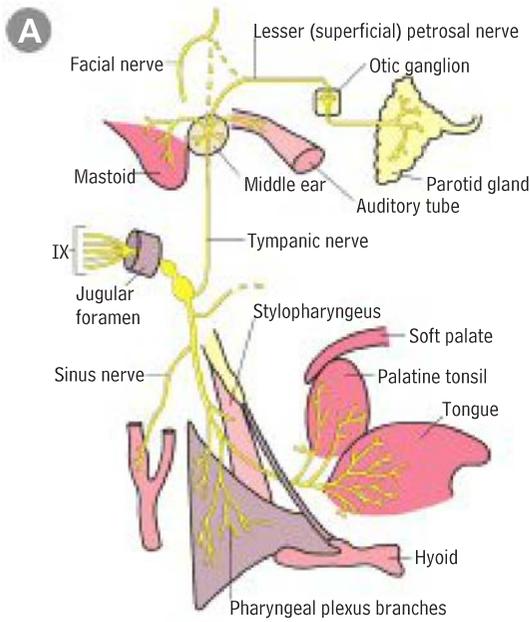


Hyperacusis

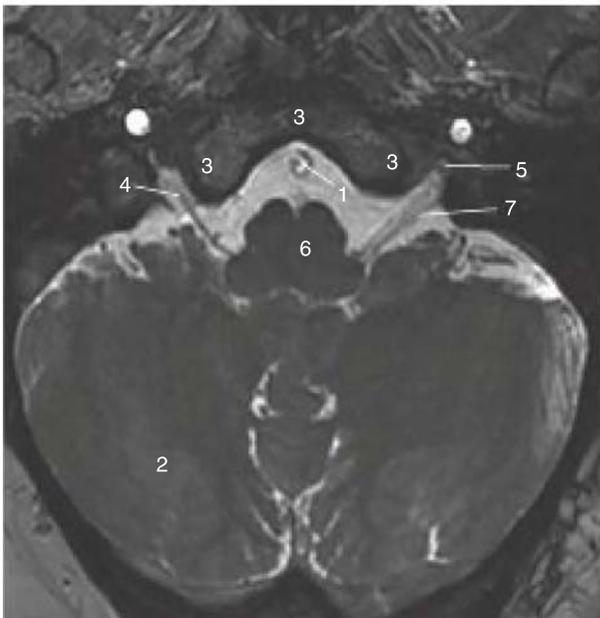


Otalgia (referred pain)

Cranial nerve IX – glossopharyngeal X – vagus



See pages 29, 35, 44–46 and 78.



Axial MR, upper medulla

- 1 Basilar artery
- 2 Cerebellar hemisphere
- 3 Clivus
- 4 Glossopharyngeal nerve (CN IX)
- 5 Jugular foramen
- 6 Medulla
- 7 Vagus nerve (CN X)



Parotid tumours



Recurrent laryngeal nerve palsy

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Vertebral column and spinal cord

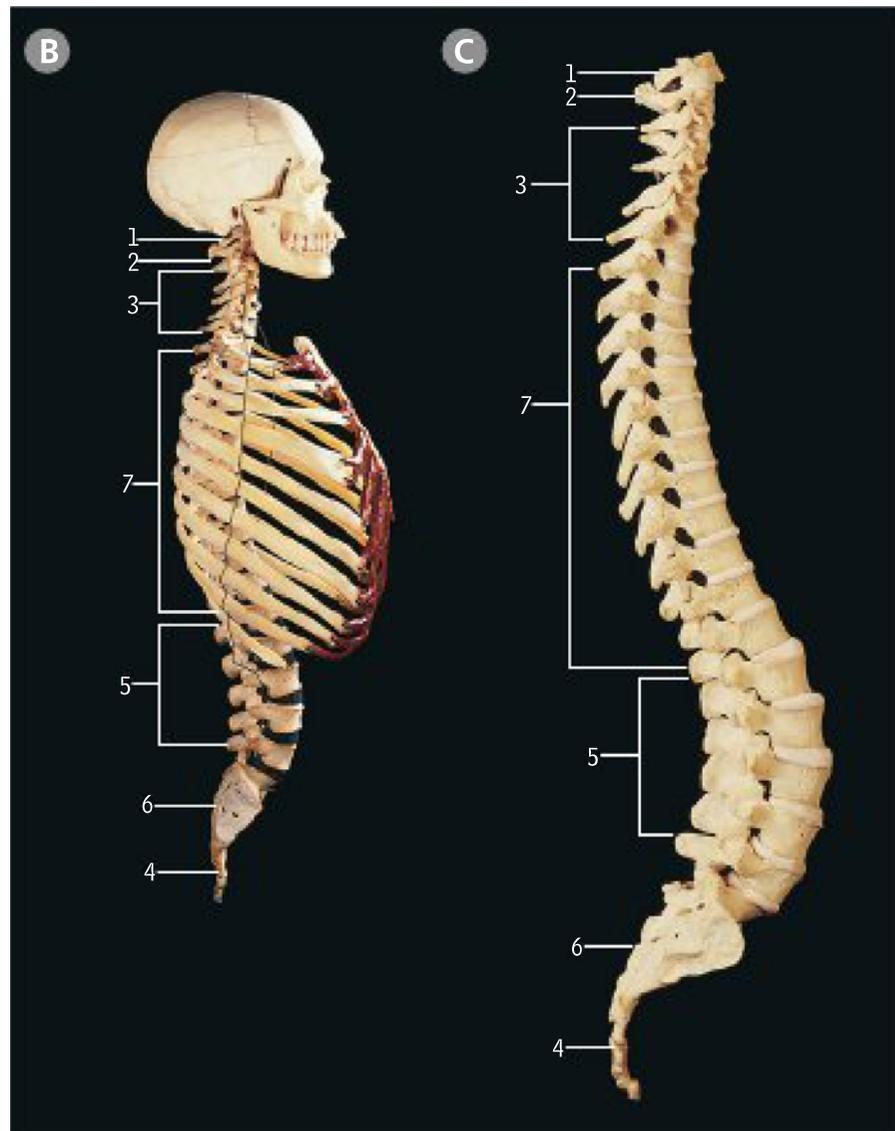
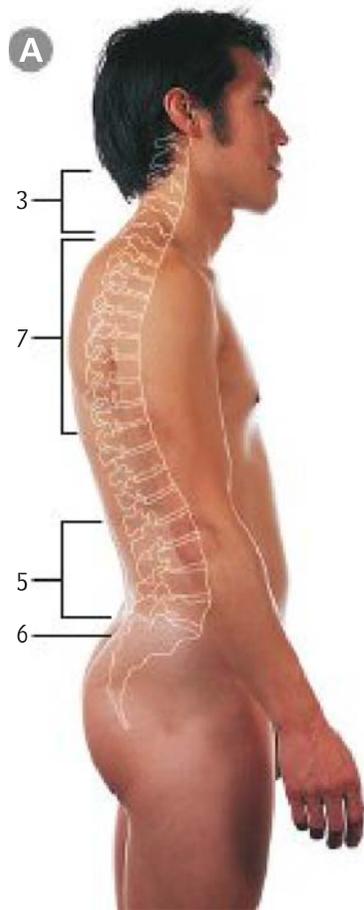


Back and vertebral column

surface anatomy

axial skeleton

vertebral column

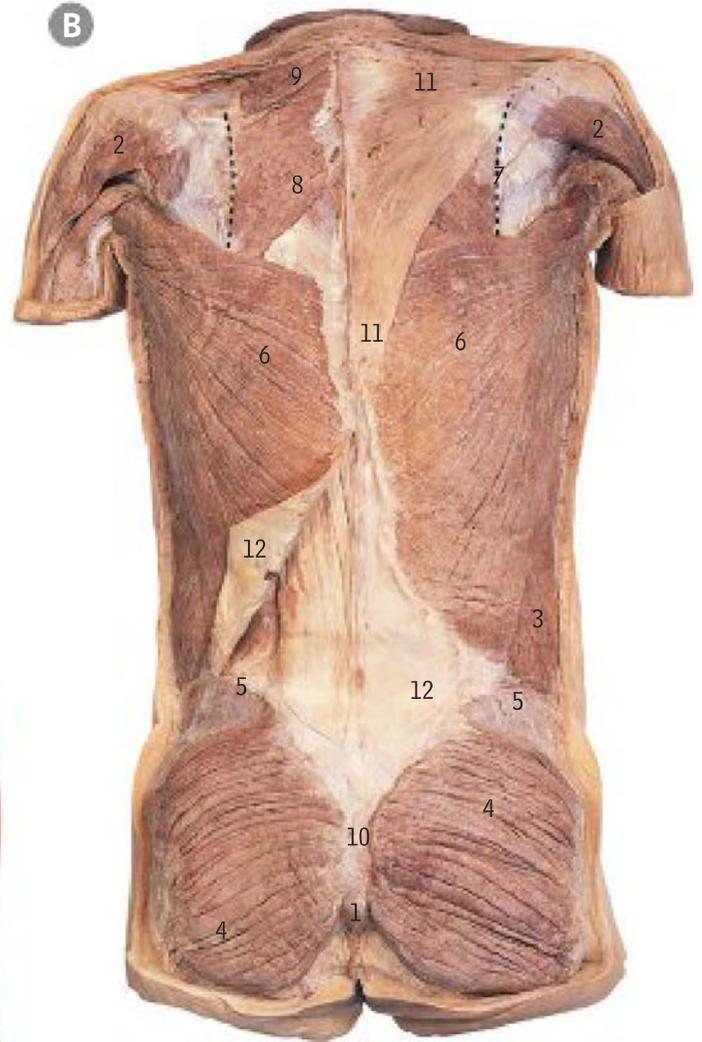


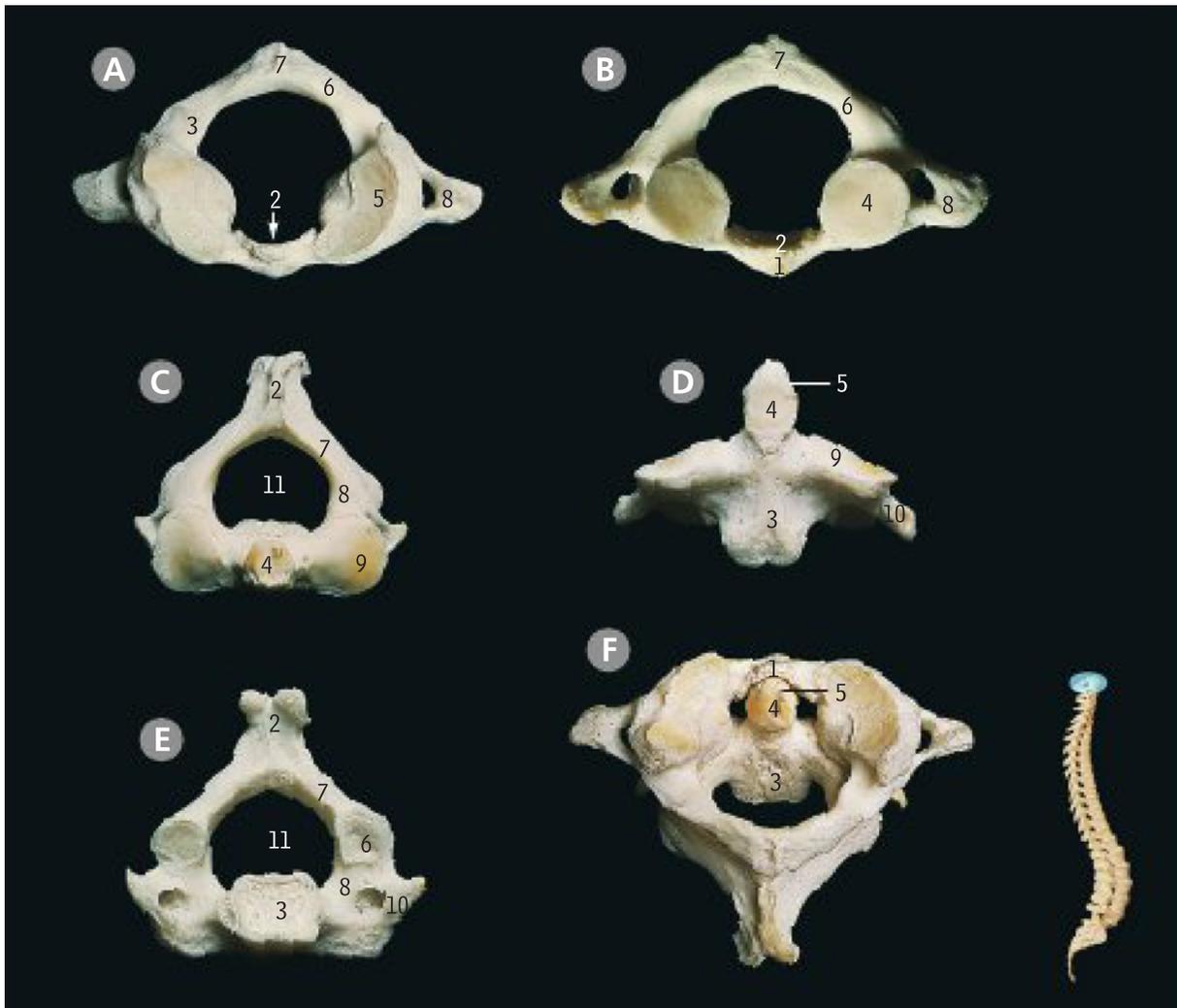
- 1 Atlas vertebra
- 2 Axis vertebra
- 3 Cervical vertebrae, lordosis
- 4 Coccyx
- 5 Lumbar vertebrae, lordosis
- 6 Sacrum
- 7 Thoracic vertebrae, kyphosis



Back and shoulder surface anatomy muscles

- | | |
|---------------------------|---|
| 1 Coccyx | 7 Medial border scapula (dotted) |
| 2 Deltoid | 8 Rhomboid major |
| 3 External oblique | 9 Rhomboid minor |
| 4 Gluteus maximus | 10 Sacrum |
| 5 Iliac crest | 11 Trapezius |
| 6 Latissimus dorsi | 12 Thoracolumbar fascia |





First cervical vertebra *atlas*

from above

from below

- | | |
|--|--|
| 1 Anterior arch and tubercle | 5 Lateral mass with superior articular facet |
| 2 Facet for dens of axis | 6 Posterior arch |
| 3 Groove for vertebral artery | 7 Posterior tubercle |
| 4 Lateral mass with inferior articular facet | 8 Transverse process and foramen |

The superior articular facets (5) are concave and kidney-shaped. The inferior articular facets (4) are circular and almost flat. The anterior arch (1) is straighter and shorter than the posterior arch (6) and contains on its posterior surface the facet for the dens of the axis (2). The atlas is the only vertebra that has no body.

Second cervical vertebra *axis*

from above

from the front

from below

articulated with the atlas, from above

- | | |
|--------------------------------|-----------------------------------|
| 1 Anterior arch of atlas | 7 Lamina |
| 2 Bifid spinous process | 8 Pedicle |
| 3 Body | 9 Superior articular surface |
| 4 Dens (odontoid peg) | 10 Transverse process and foramen |
| 5 Impression for alar ligament | 11 Vertebral foramen |
| 6 Inferior articular facet | |

The axis is unique in having the dens (4) which projects upwards from the body, representing the body of the atlas.



Odontoid peg fracture

Fifth cervical vertebra

a typical cervical vertebra

from above

from the front

from the left

- 1 Anterior tubercle of transverse process
- 2 Bifid spinous process
- 3 Body
- 4 Foramen of transverse process
- 5 Inferior articular process
- 6 Intertubercular lamella of transverse process
- 7 Lamina
- 8 Pedicle
- 9 Posterior tubercle of transverse process
- 10 Posterolateral lip (uncus)
- 11 Superior articular process
- 12 Vertebral foramen

Seventh cervical vertebra

vertebra prominens

from above

- 1 Anterior tubercle of transverse process
- 2 Body
- 3 Foramen of transverse process
- 4 Intertubercular lamella of transverse process
- 5 Lamina
- 6 Pedicle
- 7 Posterior tubercle of transverse process
- 8 Posterolateral lip (uncus)
- 9 Spinous process with tubercle
- 10 Superior articular process
- 11 Vertebral foramen

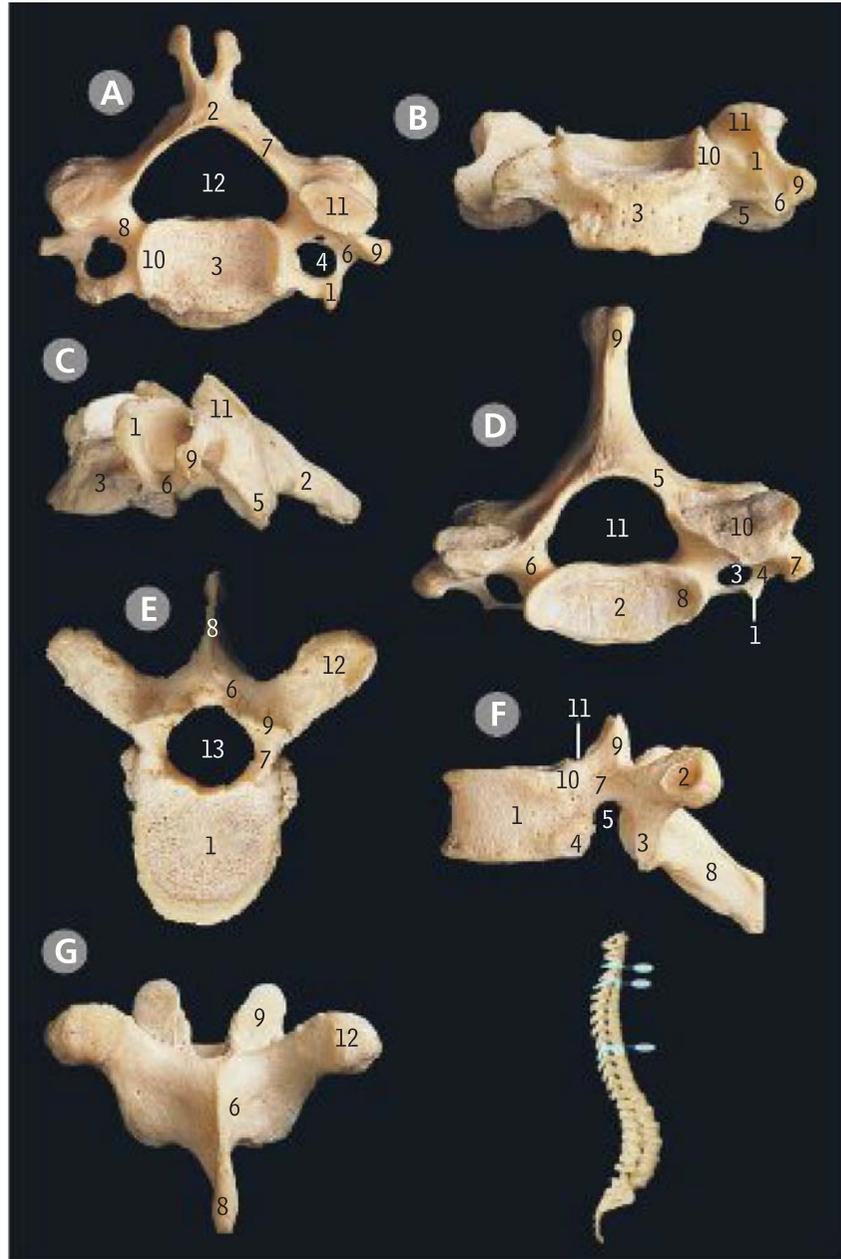
All cervical vertebrae (first to seventh) have a foramen in each transverse process (as A4).

Typical cervical vertebrae (third to sixth) have superior articular processes that face backwards and upwards (A11, C11), posterolateral lips on the upper surface of the body (A10), a triangular vertebral foramen (A12) and a bifid spinous process (A2).

The anterior tubercle of the transverse process of the sixth cervical vertebra is large and known as the carotid tubercle.

The seventh cervical vertebra (vertebra prominens) has a spinous process that ends in a single tubercle (D9).

The rib element of a cervical vertebra is represented by the anterior root of the transverse process, the anterior tubercle, the intertubercular lamella (with its groove for the ventral ramus of a spinal nerve) and the anterior part of the posterior tubercle (as at D1, 4 and 7).



Seventh thoracic vertebra

typical

from above

from the left

from behind

- 1 Body
- 2 Costal facet of transverse process
- 3 Inferior articular process
- 4 Inferior costal facet
- 5 Inferior vertebral notch
- 6 Lamina
- 7 Pedicle
- 8 Spinous process
- 9 Superior articular process
- 10 Superior costal facet
- 11 Superior vertebral notch
- 12 Transverse process
- 13 Vertebral foramen

Typical thoracic vertebrae (second to ninth) are characterised by costal facets on the bodies (F10, 4), costal facets on the transverse processes (F2), a round vertebral foramen (E13), a spinous process that points downwards as well as backwards (F8, G8) and superior articular processes that are vertical, flat and face backwards and laterally (E9, F9, G9).



Ankylosing spondylitis



First thoracic vertebra

from above

from the front and the left

- 1 Body
- 2 Inferior articular process
- 3 Inferior costal facet
- 4 Lamina
- 5 Pedicle
- 6 Posterolateral lip (uncus)
- 7 Spinous process
- 8 Superior articular process
- 9 Superior costal facet
- 10 Transverse process with costal facet
- 11 Vertebral foramen



Tenth and eleventh thoracic vertebrae

tenth thoracic vertebra, from the left

eleventh thoracic vertebra, from the left

- 1 Body
- 2 Costal facet
- 3 Inferior articular process
- 4 Inferior vertebral notch
- 5 Pedicle
- 6 Spinous process
- 7 Superior articular process
- 8 Transverse process

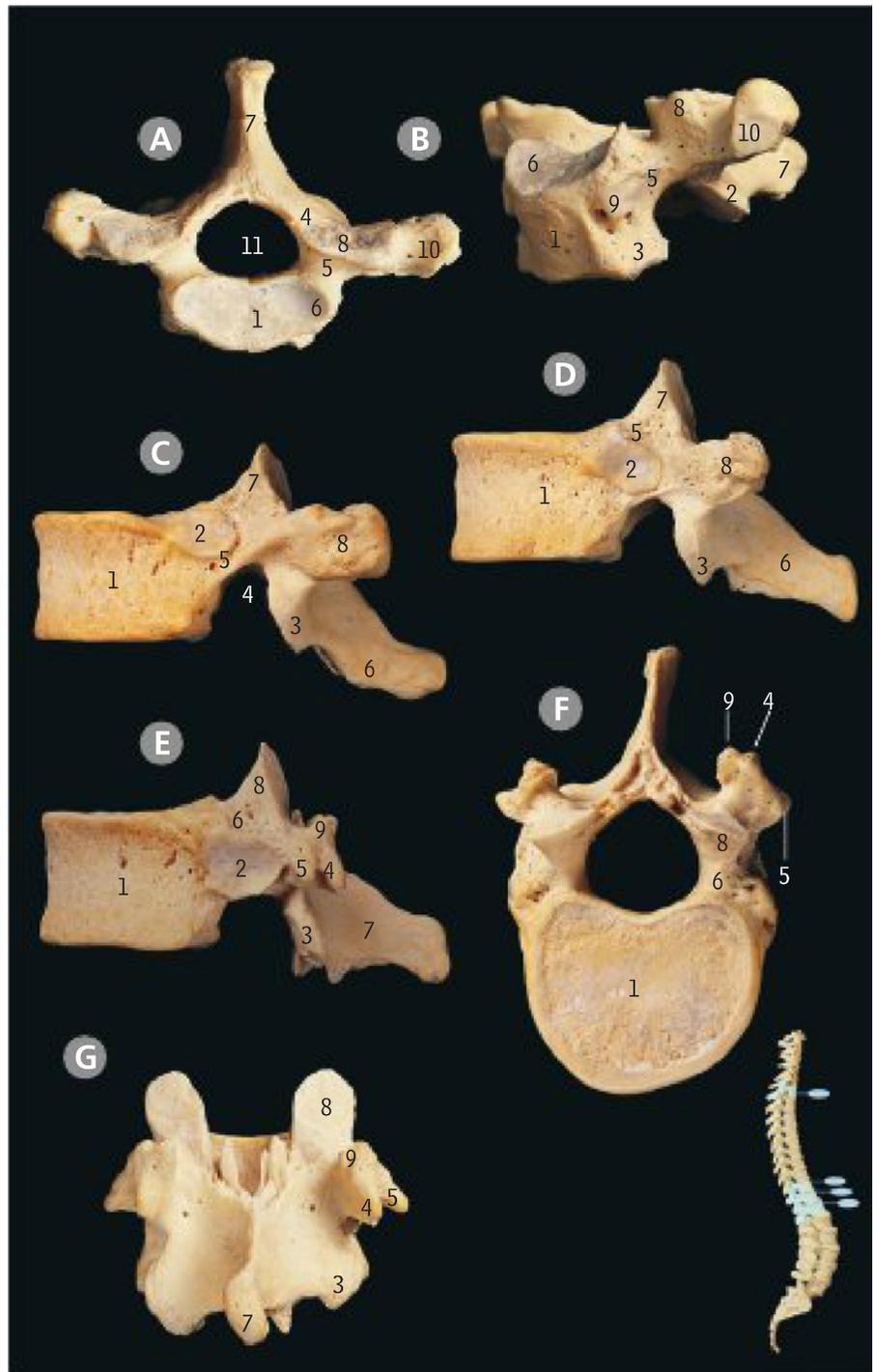
Twelfth thoracic vertebra

from the left

from above

from behind

- 1 Body
- 2 Costal facet
- 3 Inferior articular process
- 4 Inferior tubercle
- 5 Lateral tubercle
- 6 Pedicle
- 7 Spinous process
- 8 Superior articular process
- 9 Superior tubercle



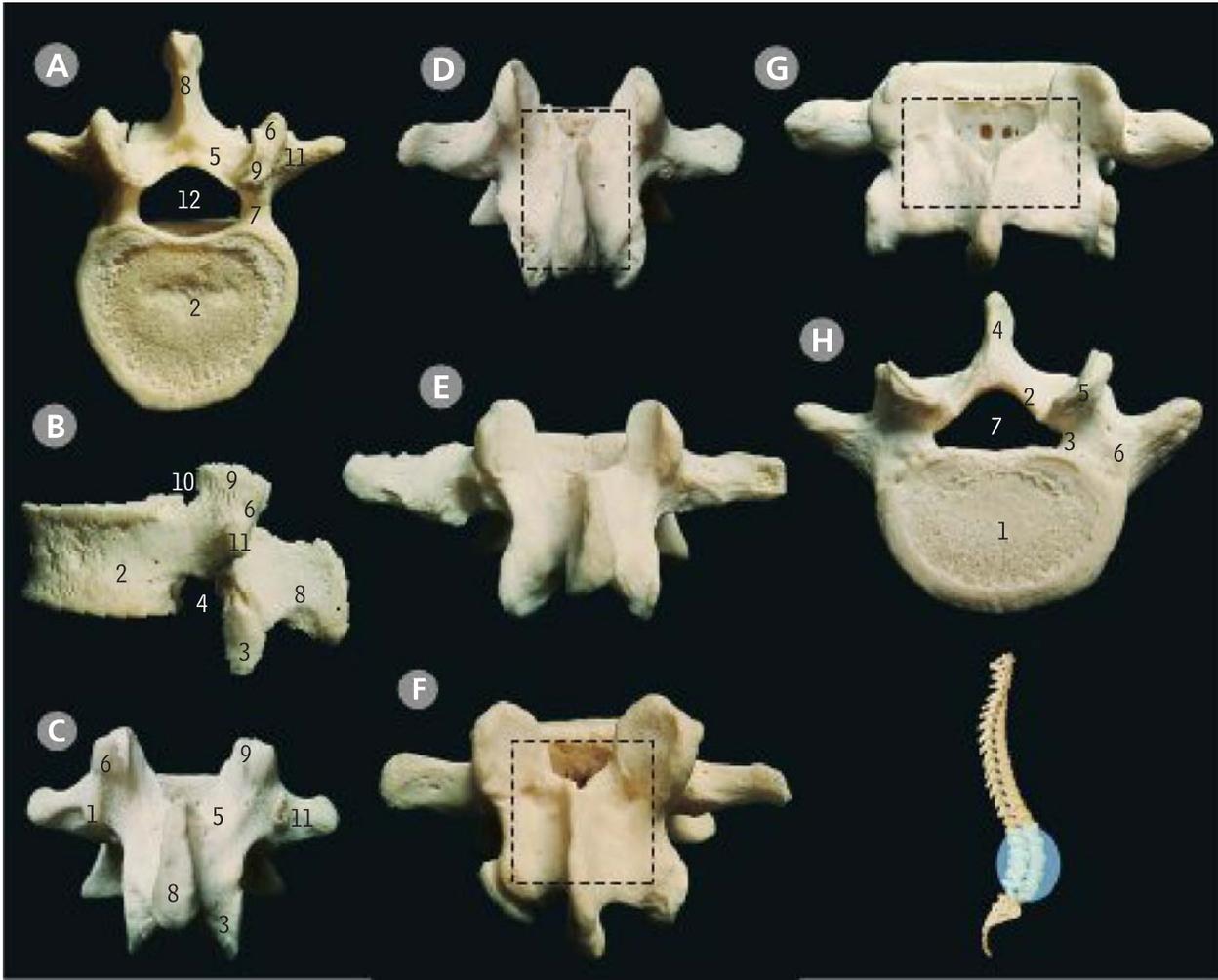
The atypical thoracic vertebrae are the first, tenth, eleventh and twelfth.

The first thoracic vertebra has a posterolateral lip (A6, B6) on each side of the upper surface of the body and a triangular vertebral foramen (features like typical cervical vertebrae), and complete (round) superior costal facets (B9) on the sides of the body.

The tenth, eleventh and twelfth thoracic vertebrae are characterised by a single complete costal facet on each side of the body that in successive vertebrae comes to lie increasingly far from the upper surface of the body and encroaches increasingly onto the pedicle (C2, D2 and E2). There is also no articular facet on the transverse process.



Spondylolisthesis



First lumbar vertebra

from above

from the left

from behind



- 1 Accessory process
- 2 Body
- 3 Inferior articular process
- 4 Inferior vertebral notch
- 5 Lamina
- 6 Mamillary process
- 7 Pedicle
- 8 Spinous process
- 9 Superior articular process
- 10 Superior vertebral notch
- 11 Transverse process
- 12 Vertebral foramen

Lumbar vertebrae are characterised by the large size of the bodies, the absence of costal facets on the bodies and the transverse processes, a triangular vertebral foramen (A12), a spinous process that points backwards and is quadrangular or hatchet-shaped (B8) and superior articular processes that are vertical, curved, face backwards and medially (A9) and possess a mamillary process at their posterior rim (A6).

The rib element of a lumbar vertebra is represented by the transverse process (A11).

The level at which facet joint orientation changes between the thoracic and lumbar regions is variable.

Posterior view

second lumbar vertebra

third lumbar vertebra

fourth lumbar vertebra

fifth lumbar vertebra

Viewed from behind, the four articular processes of the first and second lumbar vertebrae make a pattern (indicated by the interrupted line) of a vertical rectangle; those of the third or fourth vertebra make a square, and those of the fifth lumbar vertebra make a horizontal rectangle.

View from above

fifth lumbar vertebra

- 1 Body
- 2 Lamina
- 3 Pedicle
- 4 Spinous process
- 5 Superior articular process
- 6 Transverse process fusing with pedicle and body
- 7 Vertebral foramen

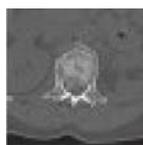
The fifth lumbar vertebra is unique in that the transverse process (H6) unites directly with the side of the body (H1) as well as with the pedicle (H3).



Laminectomy



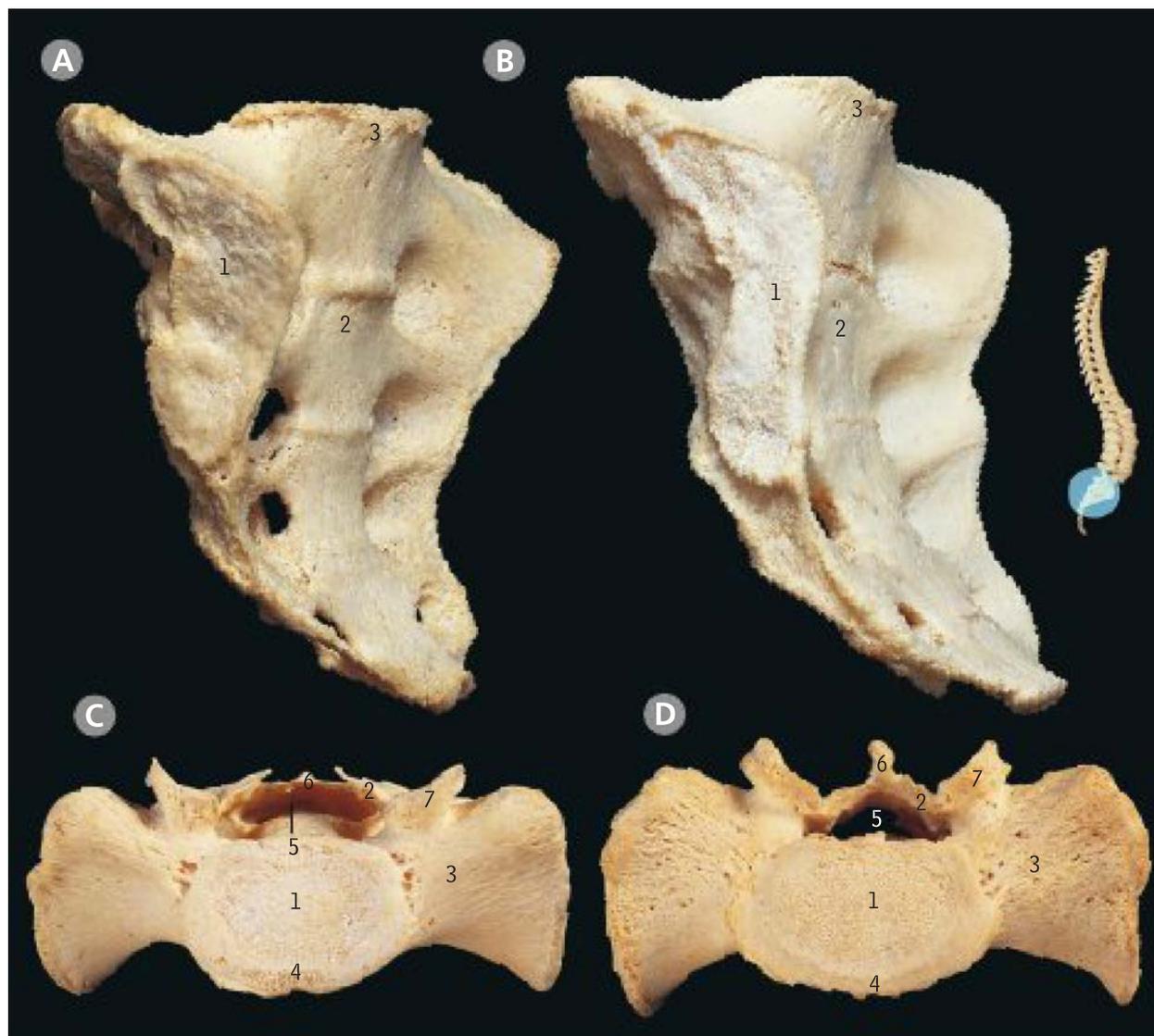
Lumbar stenosis



Vertebral fracture



Vertebral lumbar fracture



Sacrum from the front and the right

in the female

in the male



- 1 Auricular surface
- 2 Pelvic surface
- 3 Promontory

In the female, the pelvic surface is relatively straight over the first three sacral vertebrae and becomes more curved below. In the male, the pelvic surface is more uniformly curved.

The capsule of the sacro-iliac joint is attached to the margin of the auricular (articular) surface (A1, B1).

Base of the sacrum upper surface

in the female

in the male

- | | |
|---------------------------------|---|
| 1 Body of first sacral vertebra | 5 Sacral canal |
| 2 Lamina | 6 Spinous tubercle of median sacral crest |
| 3 Lateral part (ala) | 7 Superior articular process |
| 4 Promontory | |

In the male, the body of the first sacral vertebra (judged by its transverse diameter) forms a greater part of the base of the sacrum than in the female (compare D1 with C1).

In C, there is some degree of spina bifida (non-fusion of the laminae, 2, in the vertebral arch of the first sacral vertebra). Compare with the complete arch in D.



Sacralisation

Sacrum and coccyx



pelvic surface

- 1 Coccygeal cornu
- 2 Facet for coccyx
- 3 First coccygeal vertebra
- 4 Fused second to fourth vertebrae
- 5 Intermediate sacral crest
- 6 Lateral part
- 7 Lateral sacral crest
- 8 Median sacral crest
- 9 Promontory
- 10 Sacral canal

dorsal surface

- 11 Sacral cornu
- 12 Sacral hiatus
- 13 Second pelvic sacral foramen
- 14 Site of fusion of first and second sacral vertebrae
- 15 Superior articular process
- 16 Third dorsal sacral foramen
- 17 Transverse process
- 18 Upper surface of lateral part (ala)

The sacrum is formed by the fusion of the five sacral vertebrae. The median sacral crest (B8) represents the fused spinous processes, the intermediate crest (B5) the fused articular processes, and the lateral crest (B7) the fused transverse processes.

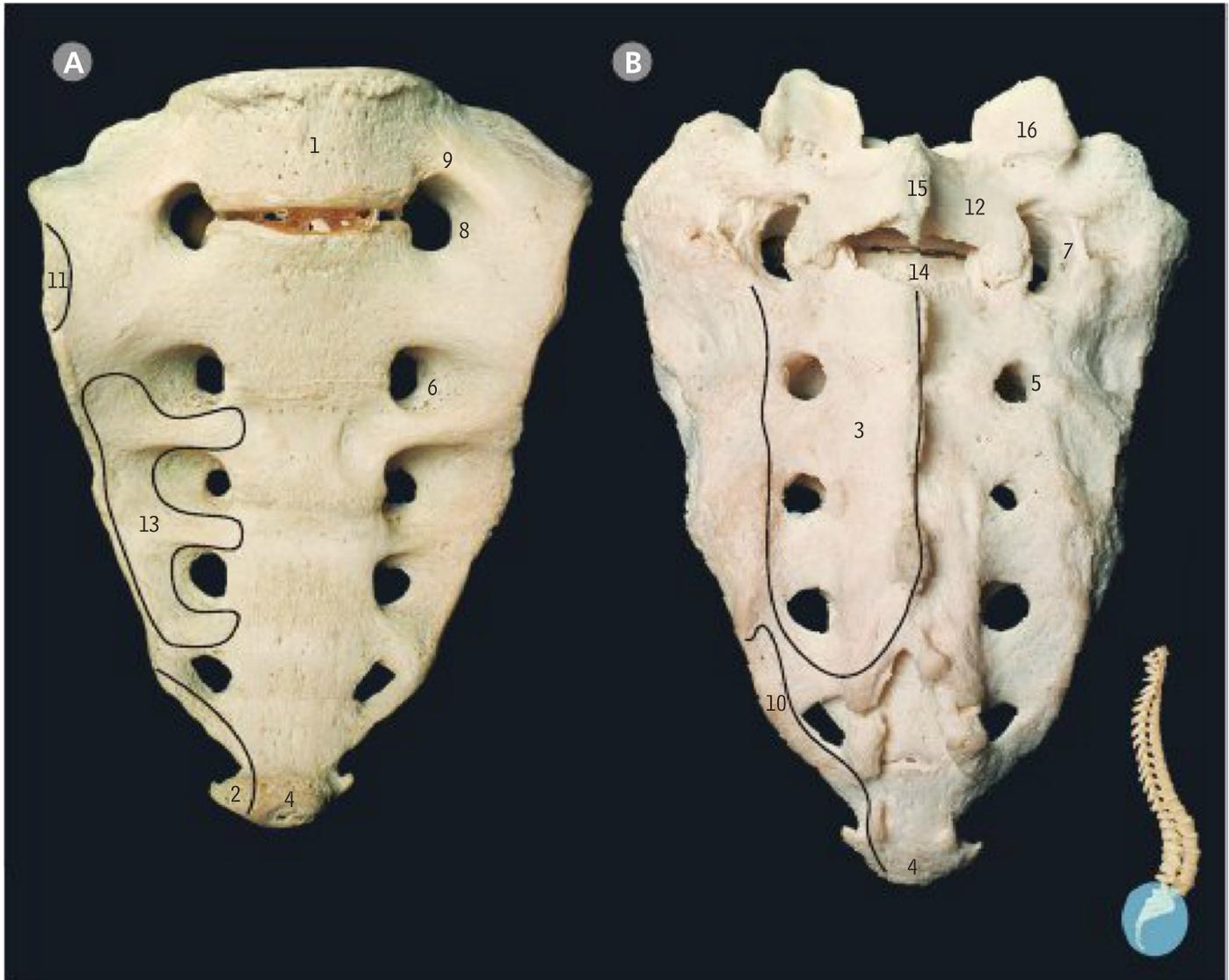
The sacral hiatus (B12) is the lower opening of the sacral canal (B10).

The coccyx is usually formed by the fusion of four rudimentary vertebrae but the number varies from three to five. In this specimen, the first piece of the coccyx (3) is not fused with the remainder (4).



Coccydynia

Sacrum with sacralisation of the fifth lumbar vertebra



pelvic surface

dorsal surface, and sacral muscle attachments

- | | |
|--|---|
| 1 Body of fifth lumbar vertebra | 9 Fusion of transverse process and lateral part of sacrum |
| 2 Coccygeus | 10 Gluteus maximus |
| 3 Erector spinae | 11 Iliacus |
| 4 First coccygeal vertebra fused to apex of sacrum | 12 Lamina |
| 5 First dorsal sacral foramen | 13 Piriformis |
| 6 First pelvic sacral foramen | 14 Sacral canal |
| 7 Foramen for dorsal ramus of fifth lumbar nerve | 15 Spinous process of fifth lumbar vertebra |
| 8 Foramen for ventral ramus of fifth lumbar nerve | 16 Superior articular process of fifth lumbar vertebra |

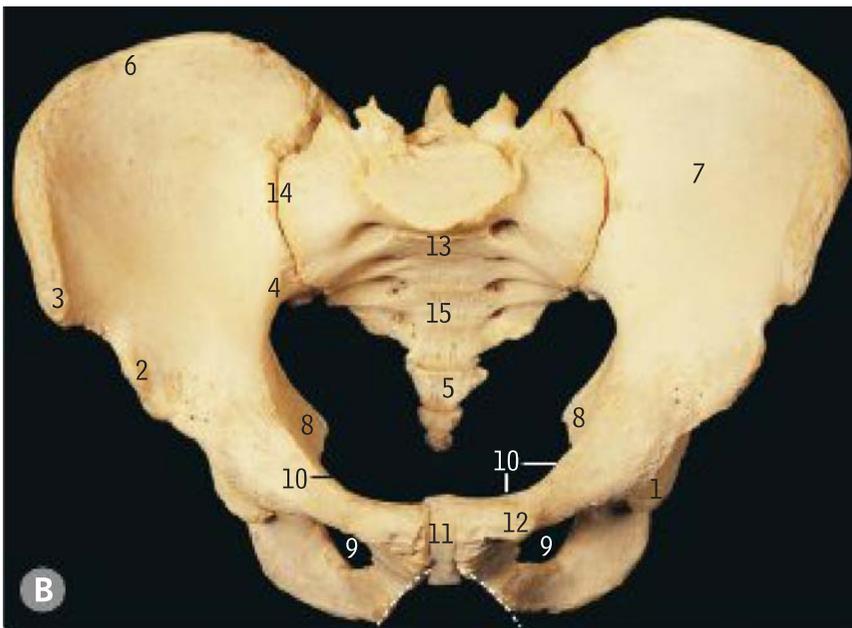
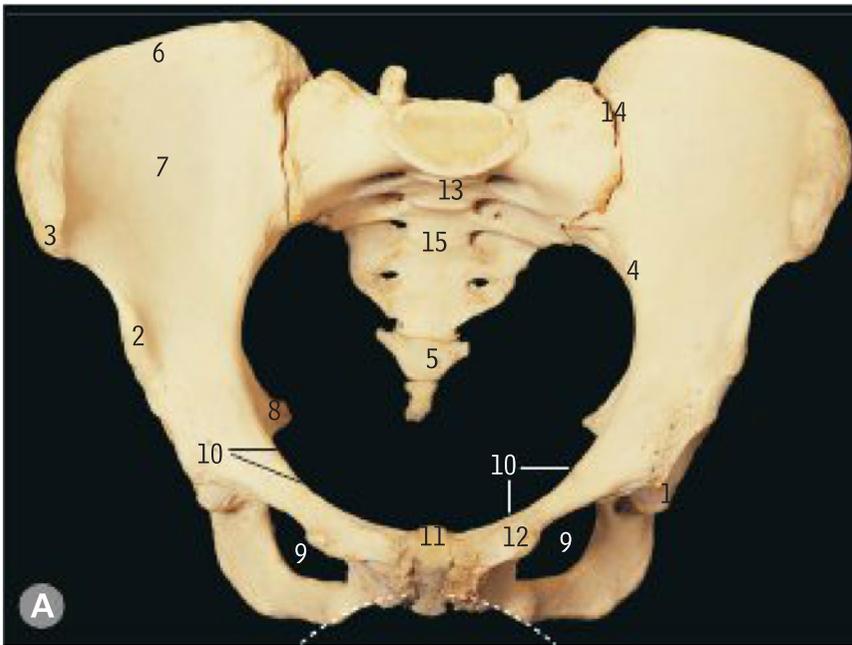
In sacralisation of the fifth lumbar vertebra, that vertebra (A1) is (usually incompletely) fused with the sacrum. In the more rare condition of lumbarization of the first sacral vertebra (not illustrated) the first piece of the sacrum is incompletely fused with the remainder.

In this specimen, as well as fusion of the fifth lumbar vertebra with the top of the sacrum, the body of the first coccygeal vertebra (4) is fused with the apex of the sacrum.



Caudal anaesthesia

Bony pelvis from in front and above



female

male

from the front

- 1 Acetabulum
- 2 Anterior inferior iliac spine
- 3 Anterior superior iliac spine
- 4 Arcuate line
- 5 Coccyx
- 6 Iliac crest
- 7 Iliac fossa
- 8 Ischial spine
- 9 Obturator foramen
- 10 Pectineal line
- 11 Pubic symphysis
- 12 Pubic tubercle
- 13 Sacral promontory
- 14 Sacro-iliac joint
- 15 Sacrum

The pelvic inlet (brim) is bounded by the sacral promontory (13), arcuate and pectineal lines (4 and 10), the crest of the pubic bones and anteriorly the pubic symphysis (11).

The female brim is more circular, the male more heart-shaped.

The female sacrum (15) is wider, shorter and less curved.

The female ischial spines (8) are further apart.

The female subpubic angle (white dotted line on A) is wide (90–120°) and the male subpubic angle (white dotted line on B) only 60–90°.



Vertebrae, ribs and sternum ossification

typical vertebra in a 6-month fetus

at 4 years of age

D during puberty

atlas at 4 years of age

axis, primary and secondary centres

typical rib, secondary centres

sternum at birth, with primary centres

A typical vertebra, which is first cartilaginous, ossifies in early fetal life from three primary centres – one for most of the body (the centrum, A2) and one for each half of the neural arch (A1). The part of the adult body to which the pedicle is attached (B4) is part of the centre for the arch; the site in the developing vertebra where they meet is the neurocentral junction (B5). The two halves of the arch and the neurocentral junctions unite at variable times between birth and 6 years. Ossification spreads into the transverse processes and spine which grow out from the arch, but secondary centres (B3) appear at their tips during puberty and become fused at about 25 years of age. (Lumbar vertebrae have similar additional secondary centres for the mamillary processes.) There are also ring-like epiphyses on the periphery of the upper and lower surfaces of the vertebral bodies (C6 and D6).

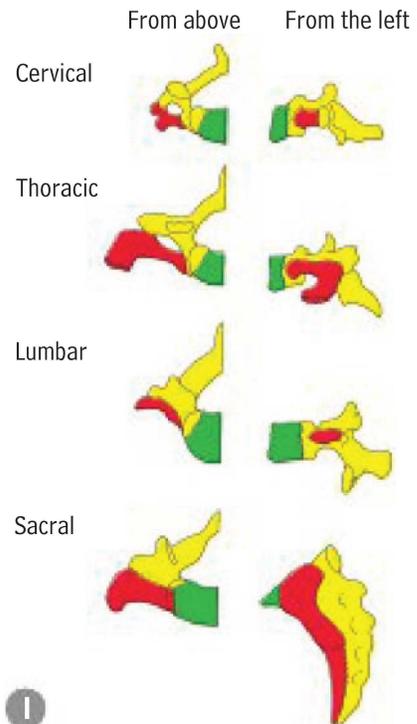
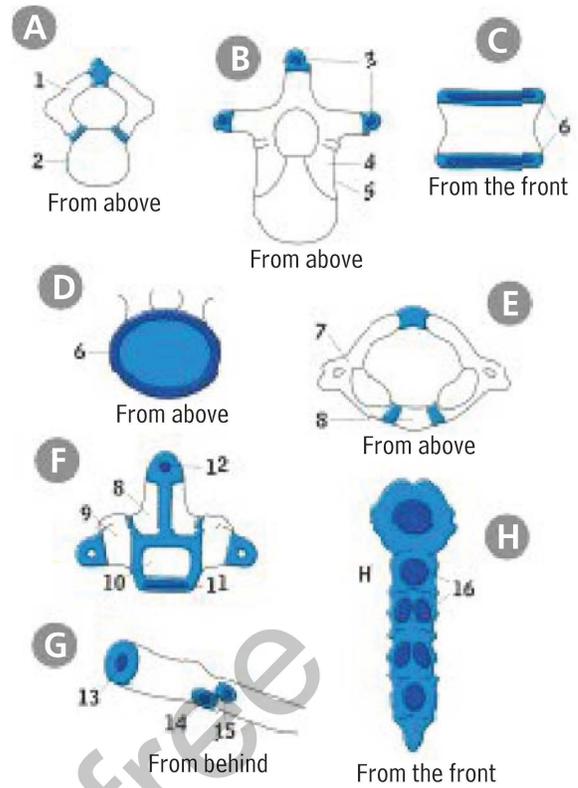
The atlas has a primary centre (E7) for each lateral mass and the adjacent half of the posterior arch, and one for the anterior arch (E8). Fusion is complete by about 8 years.

The axis has five primary centres – one for most of the body (F10), one for each lateral mass (F9), and one for each half of the dens and adjacent part of the body (F8). They should all fuse by about 3 years. There are secondary centres for the tip of the dens (F12, appearing by about 2 years and fusing at 12 years) and the lower surface of the body (F11, appearing during puberty and fusing at about 25 years).

The sacrum, representing five fused sacral vertebrae, has many ossification centres, corresponding to the centrum, neural arch halves and costal elements of each vertebra, as well as ring epiphyses for the vertebral bodies and for the auricular surfaces. Most have fused by about 20 years, but some not until middle-age or later.

A typical rib has a primary centre for the body with secondary centres for the head (G13) and the articular and non-articular parts of the tubercle (G14 and 15), appearing during puberty and uniting at about 20 years.

The sternum has a variable number of primary centres (H16), one or two in the manubrium and in each of the four pieces of the body. Fusion occurs between puberty and 25 years of age. 'Bullet holes' in the sternum (sternal foramina) may occur when fusion is incomplete.



Vertebrae developmental origins

Red, costal elements; green, centrum; yellow, neural arch

Parts of the cervical, lumbar and sacral vertebrae represent the ribs that articulate with thoracic vertebrae. These costal elements are indicated here in red.

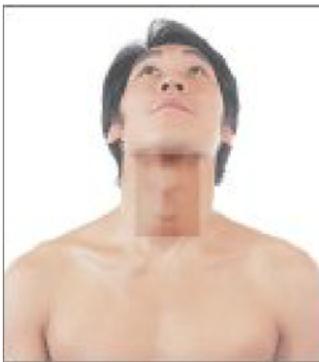
Cervical: anterior and posterior tubercles and the intertubercular lamella.

Thoracic: the true rib articulates with the vertebra.

Lumbar: the anterior part of the transverse process.

Sacral: the lateral part, including the auricular surface.

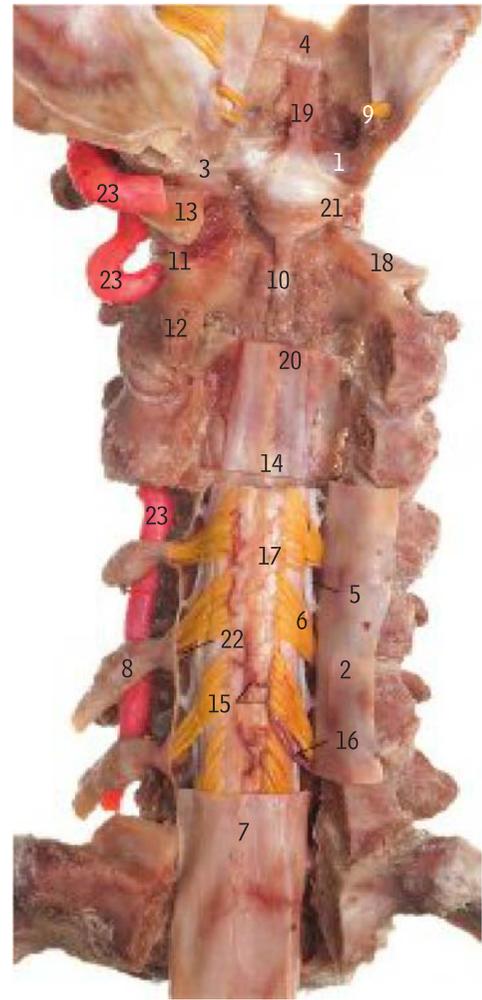
Vertebral column and spinal cord cervical region, from the front



The vertebral artery (14) is seen within foramina of cervical transverse processes.

- 1 Anterior longitudinal ligament
- 2 Anterior tubercle of transverse process
- 3 Axis
- 4 Body of the fifth cervical vertebra
- 5 Cut edge of the pleura
- 6 Intertubercular lamella of transverse process
- 7 Intervertebral disc
- 8 Joint of head of first rib
- 9 Lateral mass of atlas
- 10 Posterior tubercle of transverse process
- 11 Scalenus anterior muscle
- 12 Transverse process of atlas
- 13 Ventral ramus of fourth cervical nerve
- 14 Vertebral artery

cervical region, from behind



Much of the skull, the vertebral arches, brainstem and the upper part of the spinal cord have been removed to show the cruciform, transverse and alar ligaments (19, 10, 21 and 1). Lower down, the arachnoid and dura mater (2) have been reflected to show dorsal and ventral nerve roots (as at 6 and 22).

- | | |
|---|---|
| 1 Alar ligament | 12 Pedicle of axis |
| 2 Arachnoid and dura mater (reflected) | 13 Posterior arch of atlas |
| 3 Atlanto-occipital joint | 14 Posterior longitudinal ligament |
| 4 Basilar part of occipital bone and position of attachment of tectorial membrane | 15 Posterior spinal arteries |
| 5 Denticulate ligament | 16 Radicular artery |
| 6 Dorsal rootlets of spinal nerve | 17 Spinal cord |
| 7 Dura mater | 18 Superior articular surface of axis |
| 8 Dural sheath over dorsal root ganglion | 19 Superior longitudinal band of cruciform ligament |
| 9 Hypoglossal nerve and canal | 20 Tectorial membrane |
| 10 Inferior longitudinal band of cruciform ligament | 21 Transverse ligament of atlas (transverse part of cruciform ligament) |
| 11 Lateral atlanto-axial joint | 22 Ventral rootlets of spinal nerve |
| | 23 Vertebral artery |

Vertebral column and spinal cord

cervical and upper thoracic regions, from the right

Ventral and dorsal rami of spinal nerves (as at 16 and 4) are seen emerging from intervertebral foramina (as at 7).

- | | | |
|--|--|---|
| 1 Anterior tubercle of transverse process of fifth cervical vertebra | 6 First rib | 13 Spinous process of seventh cervical vertebra |
| 2 Body of first thoracic vertebra | 7 Intervertebral foramen | 14 Transverse process of atlas |
| 3 Body of seventh cervical vertebra | 8 Lateral atlanto-axial joint | 15 Tubercle of first rib |
| 4 Dorsal ramus of first cervical nerve | 9 Lateral mass of atlas | 16 Ventral ramus of sixth cervical nerve |
| 5 First cervical nerve | 10 Posterior arch of atlas | 17 Vertebral artery |
| | 11 Eighth cervical nerve | 18 Zygapophyseal joint |
| | 12 Spinous process of second cervical vertebra | |

The first and second spinal nerves pass, respectively, above and below the posterior arch of the atlas.

cervical region, from the left

Soft tissue has been removed to show the boundaries of intervertebral foramina (as at 5). Compare with the cleared specimens of thoracic vertebrae on page 102, A.

- | | |
|--|-----------------------------------|
| 1 Anterior tubercle of transverse process of fifth cervical vertebra | 2 Body of third cervical vertebra |
| 3 Intertubercular lamella of transverse process of fifth cervical vertebra | 4 Intervertebral disc |
| 5 Intervertebral foramen | 6 Pedicle |
| 7 Posterior tubercle of transverse process of fifth cervical vertebra | 8 Zygapophyseal joint |

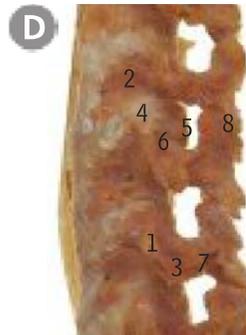
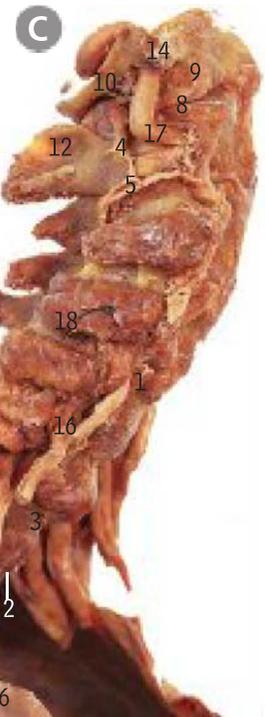
Each intervertebral foramen (as at D5) is bounded in front by a vertebral body and intervertebral disc (D2 and 4), above and below by pedicles (D6), and behind by a zygapophyseal joint (D8).

In the thoracic and lumbar regions there are the same number of pairs of spinal nerves as there are vertebrae (twelve thoracic and five lumbar), and spinal nerves are numbered from the vertebra beneath whose pedicles they emerge. In the cervical region, there are seven cervical vertebrae and eight cervical nerves. The first nerve emerges between the occipital bone of the skull and the atlas, and the eighth below the pedicle of the seventh cervical vertebra.

lower cervical and upper thoracic regions, from behind

The vertebral arches and most of the dura mater and arachnoid have been removed, to show dorsal nerve rootlets (5) emerging from the spinal cord (9) to unite as a dorsal nerve root and enter the dural sheath (as at 7). Ventral nerve roots do the same from the ventral aspect of the cord but are not seen in this view as they are obscured by the dorsal roots.

- | | |
|---|--|
| 1 Angulation of nerve roots entering dural sheath | 5 Dorsal rootlets of eighth cervical nerve |
| 2 Dorsal ramus of fifth thoracic nerve | 6 Dura mater |
| 3 Dorsal root ganglion of eighth cervical nerve | 7 Dural sheath of second thoracic nerve |
| 4 Dorsal root ganglion of second thoracic nerve | 8 Pedicle of first thoracic vertebra |
| | 9 Spinal cord and posterior spinal vessels |
| | 10 Ventral ramus of fifth thoracic nerve |



Vertebral column and spinal cord cervical and upper thoracic regions, from the left

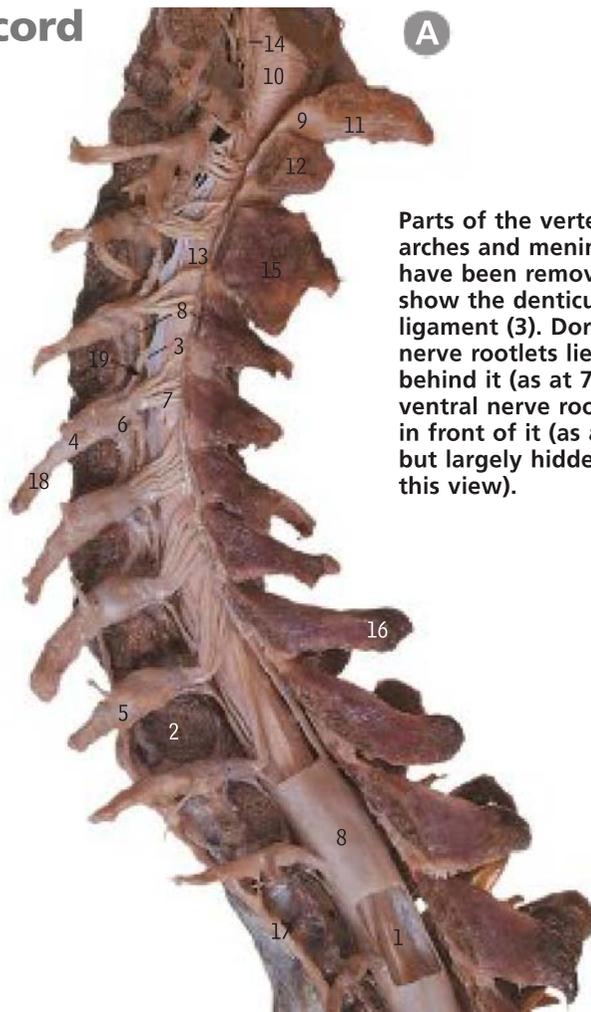
- | | |
|---|---|
| 1 Arachnoid mater | 11 Occipital bone |
| 2 Body of first thoracic vertebra | 12 Posterior arch of atlas |
| 3 Denticulate ligament | 13 Spinal cord |
| 4 Dorsal ramus of fifth cervical nerve | 14 Spinal part of accessory nerve |
| 5 Dorsal root ganglion of eighth cervical nerve | 15 Spinous process of axis (abnormally large) |
| 6 Dorsal root ganglion of fifth cervical nerve | 16 Spinous process of seventh cervical vertebra |
| 7 Dorsal rootlets of fifth cervical nerve | 17 Sympathetic trunk |
| 8 Dura mater | 18 Ventral ramus of fifth cervical nerve |
| 9 Foramen magnum | 19 Ventral rootlets of fifth cervical nerve |
| 10 Medulla oblongata | |

Each spinal nerve is formed by the union of ventral and dorsal nerve roots.

Each nerve root is formed by the union of several rootlets (as at A7).

The union of ventral and dorsal nerve roots to form a spinal nerve occurs immediately distal to the ganglion on the dorsal root (as at A6), within the intervertebral foramen, and the nerve at once divides into a ventral and a dorsal ramus (formerly called ventral and dorsal primary rami) (as at A18 and 4). The spinal nerve proper is thus only 1–2 mm in length, but is often so short that the rami appear to be branches of the ganglion itself.

The lowest cervical and upper thoracic nerve roots become acutely angled in order to enter their dural sheaths.



Parts of the vertebral arches and meninges have been removed to show the denticulate ligament (3). Dorsal nerve rootlets lie behind it (as at 7) and ventral nerve rootlets in front of it (as at 19 but largely hidden in this view).

Spinal cord

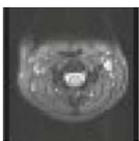
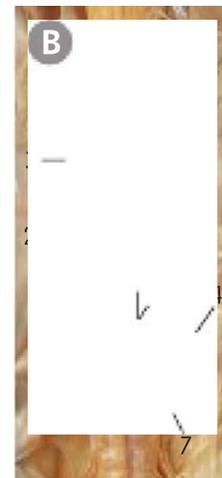
cervical region, from the front

For this ventral view of the upper part of the spinal cord (6), the dura and arachnoid mater have been incised longitudinally and turned aside (2) to show the ventral nerve rootlets and roots (as at 7) passing laterally in front of the denticulate ligament (3) to enter meningeal nerve sheaths with dorsal roots (as at 4) and form a spinal nerve. On some roots, branches of radicular vessels (as at 5) are seen anastomosing with anterior spinal vessels (1).

- | | |
|---------------------------------------|--|
| 1 Anterior spinal vessels | 5 Radicular vessels |
| 2 Arachnoid and dura mater | 6 Spinal cord |
| 3 Denticulate ligament | 7 Ventral root of seventh cervical nerve entering dural sheath |
| 4 Dorsal root of sixth cervical nerve | |

The denticulate ligament (B3) is composed of pia mater. The ventral and dorsal nerve roots pass, respectively, ventral and dorsal to the ligament, which extends laterally from the side of the cord and is attached by its spiky denticulations (as at B3) to the

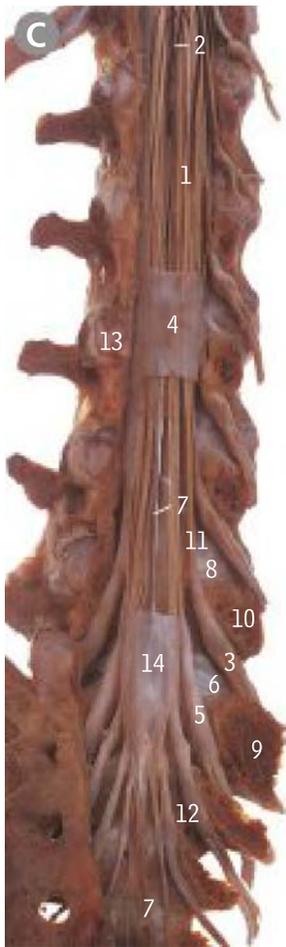
arachnoid and dura mater in the intervals between dural nerve sheaths. The highest denticulation is above the first cervical nerve and the lowest below the twelfth thoracic nerve.



Transverse
myelitis

Vertebral column and spinal cord

lumbar and sacral regions, from behind



Parts of the vertebral arches and meninges have been removed, to show the cauda equina (1) and nerve roots entering their meningeal sheaths (as at 11), outlined as linear bands by contrast medium in the radiculogram.

- | | |
|--|--|
| 1 Cauda equina | 9 Lateral part of sacrum |
| 2 Conus medullaris of spinal cord | 10 Pedicle of fifth lumbar vertebra |
| 3 Dorsal root ganglion of fifth lumbar nerve | 11 Roots of fifth lumbar nerve |
| 4 Dura mater | 12 Second sacral vertebra |
| 5 Dural sheath of first sacral nerve roots | 13 Superior articular process of third lumbar vertebra |
| 6 Fifth lumbar (lumbosacral) intervertebral disc | 14 Thecal sac |
| 7 Filum terminale | |
| 8 Fourth lumbar intervertebral disc | |

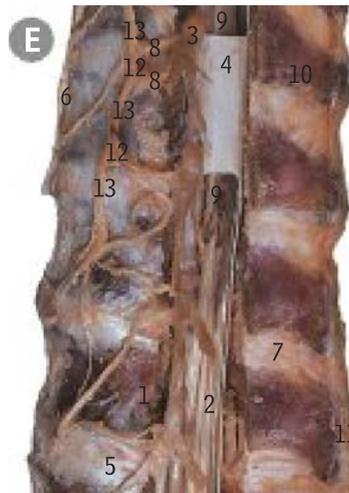
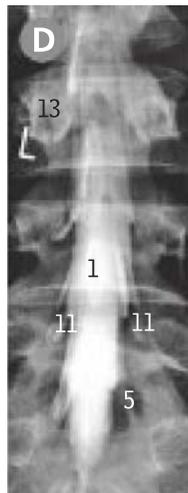
The spinal cord usually ends at the level of the first lumbar vertebra.
 The subarachnoid space ends at the level of the second sacral vertebra.
 The conus medullaris (C2) is the lower, pointed end of the spinal cord.

The cauda equina (C1) consists of the dorsal and ventral roots of the lumbar, sacral and coccygeal nerves. Note that it is nerve roots which form the cauda, not the spinal nerves themselves; these are not formed until ventral and dorsal roots unite at the level of an intervertebral foramen, immediately distal to the dorsal root ganglion (as at C3).

lumbar radiculogram

lower thoracic and upper lumbar regions

The specimen is seen from the left with parts of the vertebral arches and meninges removed, to show (at the front) part of the sympathetic trunk (13) on the vertebral bodies and (at the back) the spinous ligaments (7 and 11).



- | |
|--|
| 1 Body of first lumbar vertebra |
| 2 Cauda equina |
| 3 Dorsal root ganglion of tenth thoracic nerve |
| 4 Dura mater |
| 5 First lumbar intervertebral disc |
| 6 Greater splanchnic nerve |
| 7 Interspinous ligament |
| 8 Rami communicantes |
| 9 Spinal cord |
| 10 Spinous process of tenth thoracic vertebra |
| 11 Supraspinous ligament |
| 12 Sympathetic ganglion |
| 13 Sympathetic trunk |

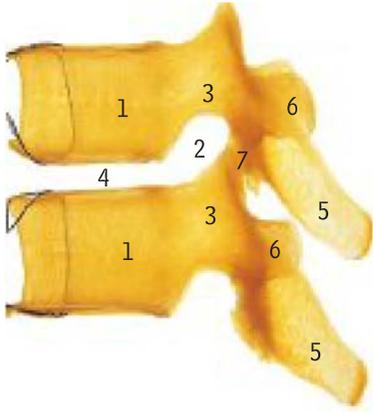


Epidural anaesthesia



Spinal anaesthesia

Thoracic vertebrae *cleared specimens*



The pairs of vertebrae are seen from the side and articulated to show the boundaries of an intervertebral foramen (2).

- 1 Body
- 2 Intervertebral foramen
- 3 Pedicle
- 4 Space for intervertebral disc
- 5 Spinous process
- 6 Transverse process
- 7 Zygapophyseal joint

The intervertebral foramen (A2) is bounded in front by the lower part of the vertebral body (A1) and the intervertebral disc (A4), above and below by the pedicles (A3), and behind by the zygapophyseal joint (A7).

The posterior longitudinal ligament is broad where it is firmly attached to the intervertebral discs, but narrow and less firmly attached to the vertebral bodies, leaving vascular foramina patent and allowing the basivertebral veins which emerge from them to enter the internal vertebral venous plexus.

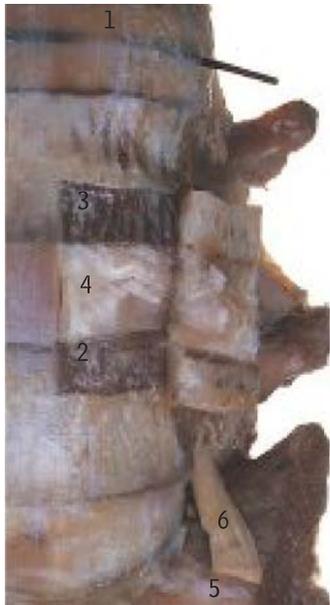
The anterior longitudinal ligament (B1) is uniformly broad and firmly attached to discs and vertebral bodies.

Vertebral column

lower lumbar region, from the front

At the top the anterior longitudinal ligament (1) has a marker behind it, and part of it lower down has been reflected off an intervertebral disc (4) and vertebral bodies (2 and 3).

- 1 Anterior longitudinal ligament
- 2 Body of fifth lumbar vertebra
- 3 Body of fourth lumbar vertebra
- 4 Fourth lumbar intervertebral disc
- 5 Lateral part of sacrum
- 6 Ventral ramus of fifth lumbar nerve

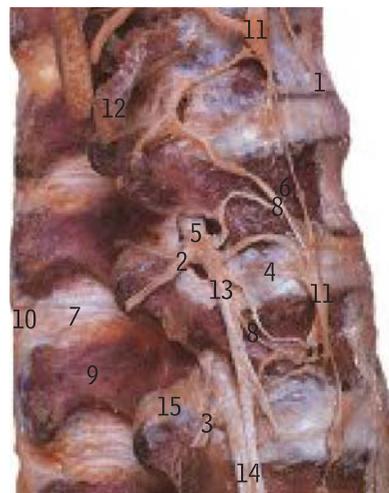


Vertebral column

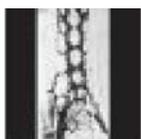
upper lumbar region, from the right

The side view shows lumbar nerves emerging from intervertebral foramina (as at 5).

- 1 Anterior longitudinal ligament
- 2 Dorsal ramus of first lumbar nerve
- 3 Dorsal ramus of second lumbar nerve
- 4 First lumbar intervertebral disc
- 5 First lumbar nerve emerging from intervertebral foramen
- 6 First lumbar vertebra
- 7 Interspinous ligament
- 8 Rami communicantes
- 9 Spinous process of second lumbar vertebra
- 10 Supraspinous ligament
- 11 Sympathetic trunk ganglion
- 12 Twelfth rib
- 13 Ventral ramus of first lumbar nerve
- 14 Ventral ramus of second lumbar nerve
- 15 Zygapophyseal joint



Compression of spinal nerve



Vertebral venous plexus

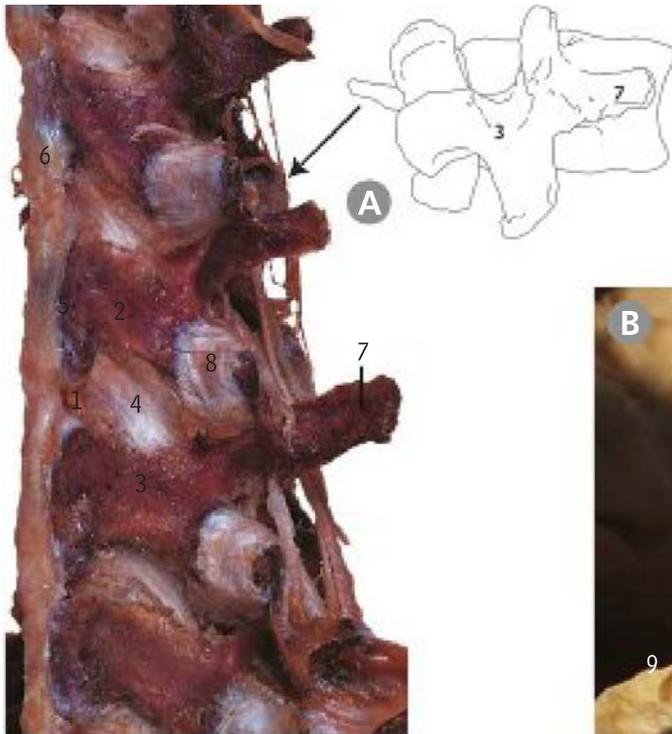


Vertebral column

lumbar region, from the right and behind

This posterolateral view of the right side of some lumbar vertebrae shows ligamenta flava (as at 4), which pass between the laminae of adjacent vertebrae (as at 2 and 3).

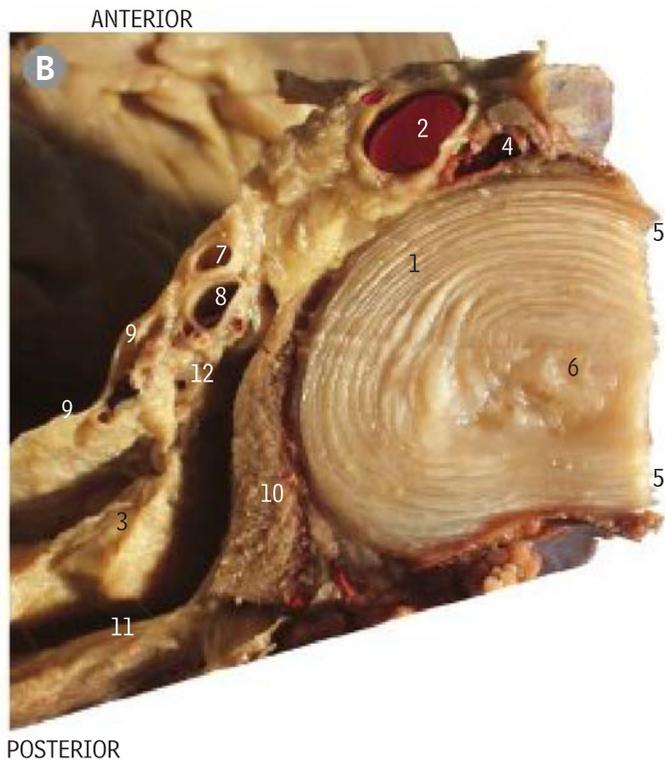
- 1 Interspinous ligament
- 2 Lamina of second lumbar vertebra
- 3 Lamina of third lumbar vertebra
- 4 Ligamentum flavum
- 5 Spinous process of second lumbar vertebra
- 6 Supraspinous ligament
- 7 Transverse process of third lumbar vertebra
- 8 Zygapophyseal joint



The lumbar intervertebral disc from above, in situ

- 1 Annulus fibrosus
- 2 Aorta
- 3 Extraperitoneal fat
- 4 Inferior vena cava
- 5 Laminations of annulus
- 6 Nucleus pulposus
- 7 Gonadal artery
- 8 Gonadal vein
- 9 Peritoneum, posterior abdominal wall
- 10 Psoas major muscle
- 11 Thoracolumbar fascia, anterior layer
- 12 Ureter

The nucleus pulposus of an intervertebral disc represents the remains of the notochord.
The annulus fibrosus of an intervertebral disc is derived from the mesenchyme between adjacent vertebral bodies.

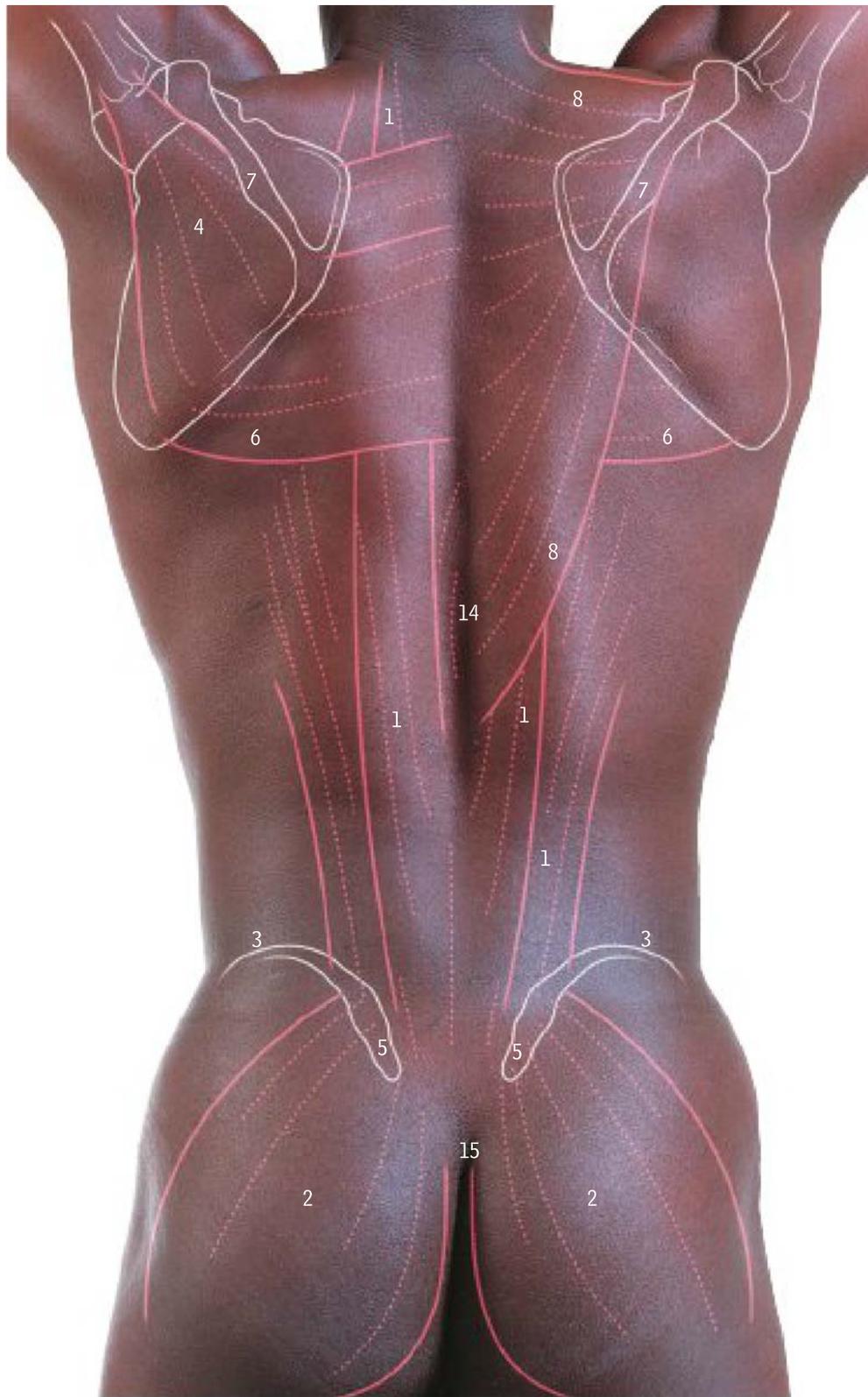


Lumbar puncture



Spinal malformations (meningocele)

Back surface anatomy

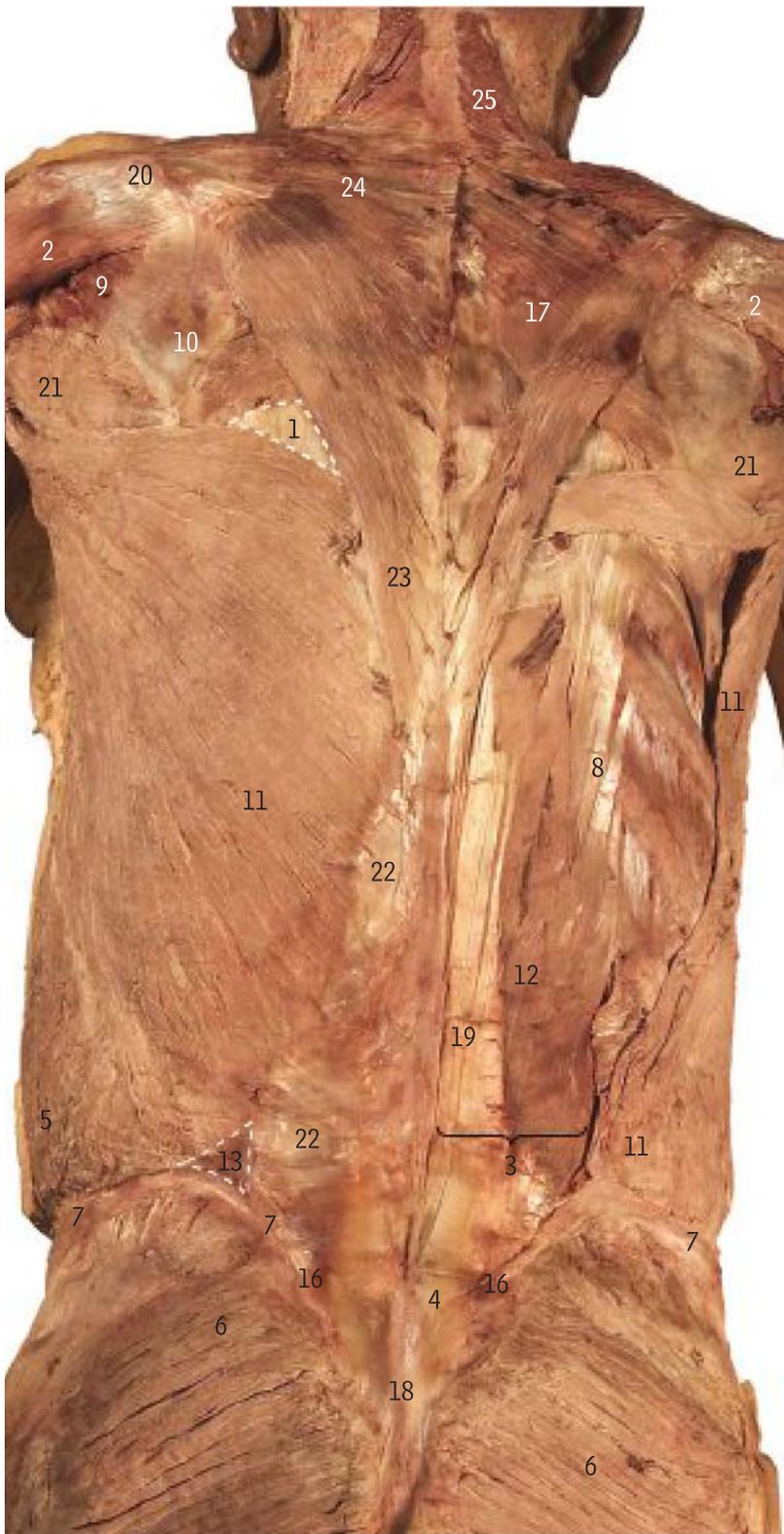


- 1 Erector spinae
- 2 Gluteus maximus
- 3 Iliac crest
- 4 Infraspinatus
- 5 Posterior superior iliac spine
- 6 Rhomboids
- 7 Spine of scapula
- 8 Trapezius



Back

Superficial musculature on left, deeper dissection on right.



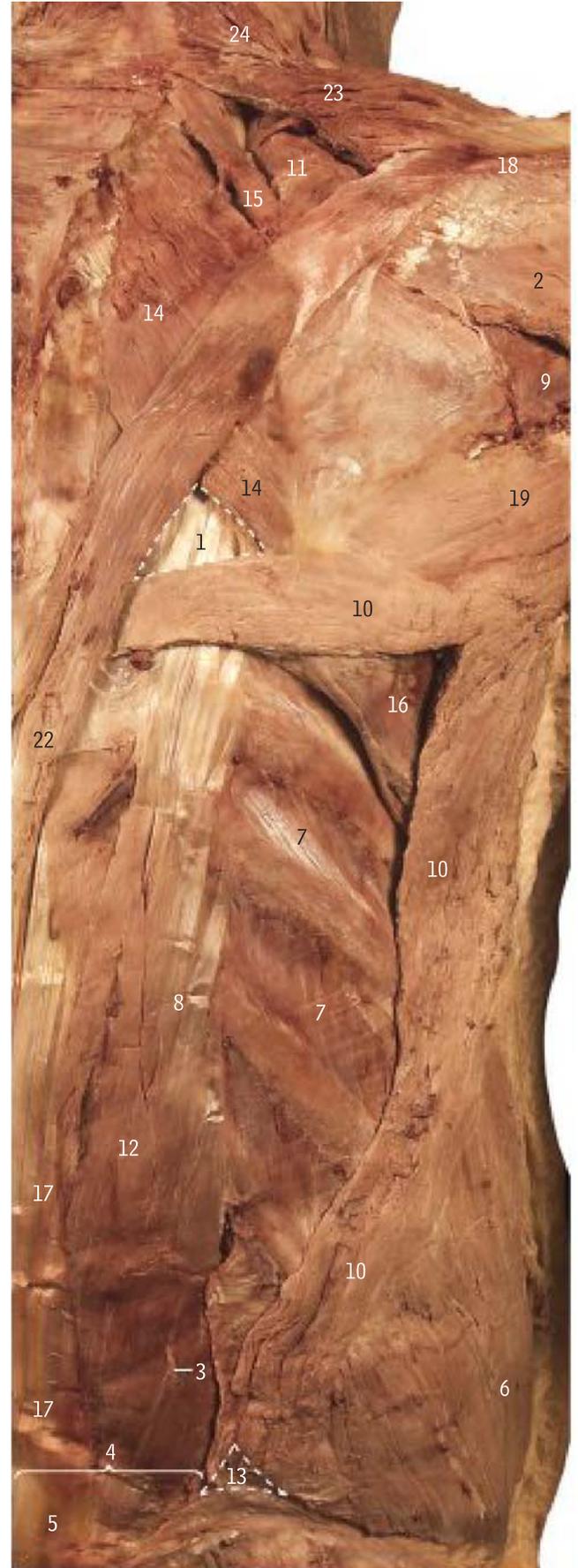
- 1 Auscultation triangle
- 2 Deltoid
- 3 Erector spinae
- 4 Erector spinae, tendon
- 5 External oblique muscle of the abdomen
- 6 Gluteus maximus
- 7 Iliac crest
- 8 Iliocostalis
- 9 Infrapinatus
- 10 Infrapinatus fascia
- 11 Latissimus dorsi
- 12 Longissimus
- 13 Lumbar triangle (of Petit)
- 14 Median furrow – see surface
- 15 Natal cleft – see surface
- 16 Posterior superior iliac spine
- 17 Rhomboid major
- 18 Sacrum
- 19 Spinalis
- 20 Spine of scapula
- 21 Teres major
- 22 Thoracolumbar fascia
- 23 Trapezius, lower fibres
- 24 Trapezius, middle fibres
- 25 Trapezius, upper fibres

Back

close up left side



close up right side



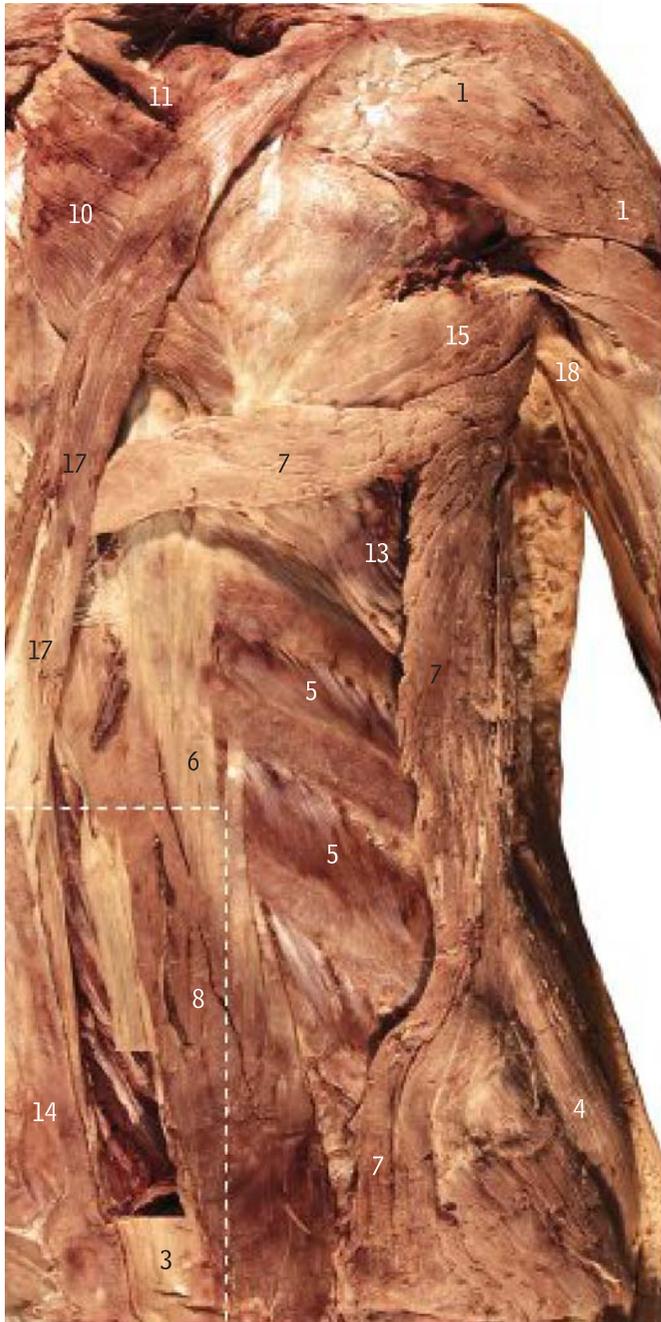
Windows cut in latissimus dorsi and trapezius muscles to reveal deeper layer of back musculature.

- | | |
|---|------------------------------------|
| 1 Auscultation triangle | 13 Lumbar triangle |
| 2 Deltoid | 14 Rhomboid major |
| 3 Dorsal ramus, lumbar spinal nerve | 15 Rhomboid minor |
| 4 Erector spinae | 16 Serratus anterior |
| 5 Erector spinae, tendon | 17 Spinalis |
| 6 External oblique muscle of the abdomen | 18 Spine of scapula |
| 7 External intercostal | 19 Teres major |
| 8 Iliocostalis | 20 Teres minor |
| 9 Infraspinaus | 21 Thoracolumbar fascia |
| 10 Latissimus dorsi | 22 Trapezius, lower fibres |
| 11 Levator scapulae | 23 Trapezius, middle fibres |
| 12 Longissimus | 24 Trapezius, upper fibres |
| | 25 Triceps, long head |

Back

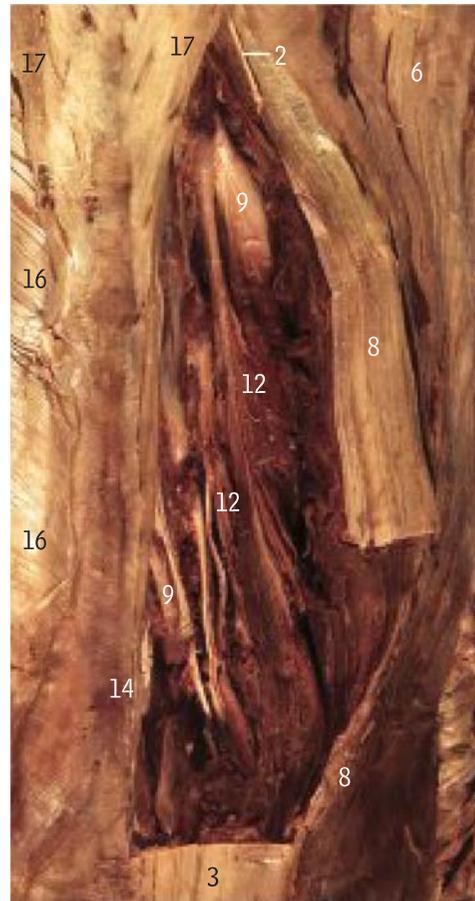
close up right side

Note windows cut in latissimus dorsi and trapezius.



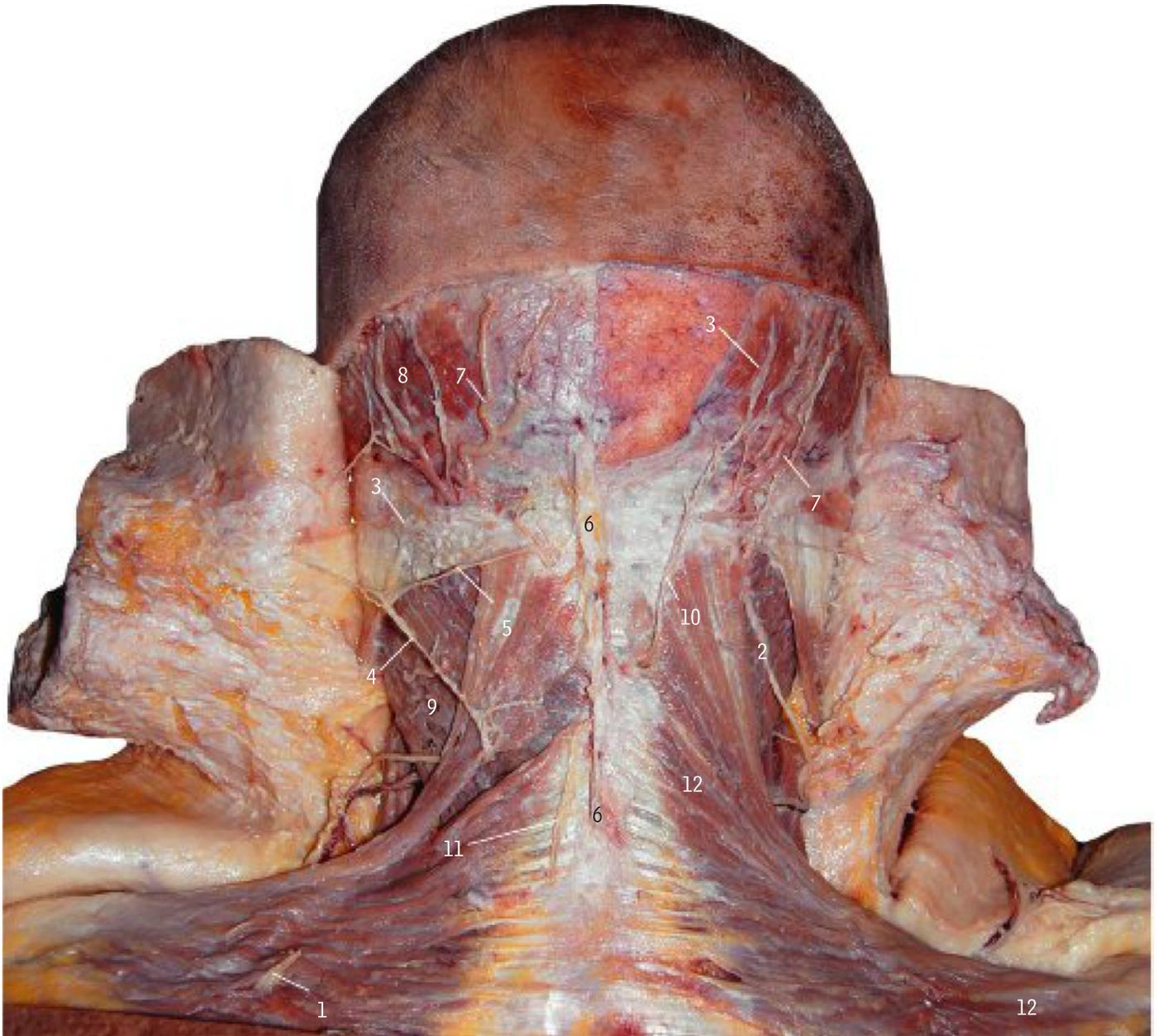
close up right side

Note resection of upper lumbar and lower thoracic spinalis and part of longissimus muscles to reveal the transversospinalis group of muscles – the deepest components of erector spinae.



- | | |
|--|----------------------------|
| 1 Deltoid | 9 Multifidus |
| 2 Dorsal ramus, thoracic spinal nerve | 10 Rhomboid major |
| 3 Erector spinae, tendon | 11 Rhomboid minor |
| 4 External oblique muscle of the abdomen | 12 Semispinalis |
| 5 External intercostal | 13 Serratus anterior |
| 6 Iliocostalis | 14 Spinalis |
| 7 Latissimus dorsi | 15 Teres major |
| 8 Longissimus | 16 Thoracolumbar fascia |
| | 17 Trapezius, lower fibres |
| | 18 Triceps, long head |

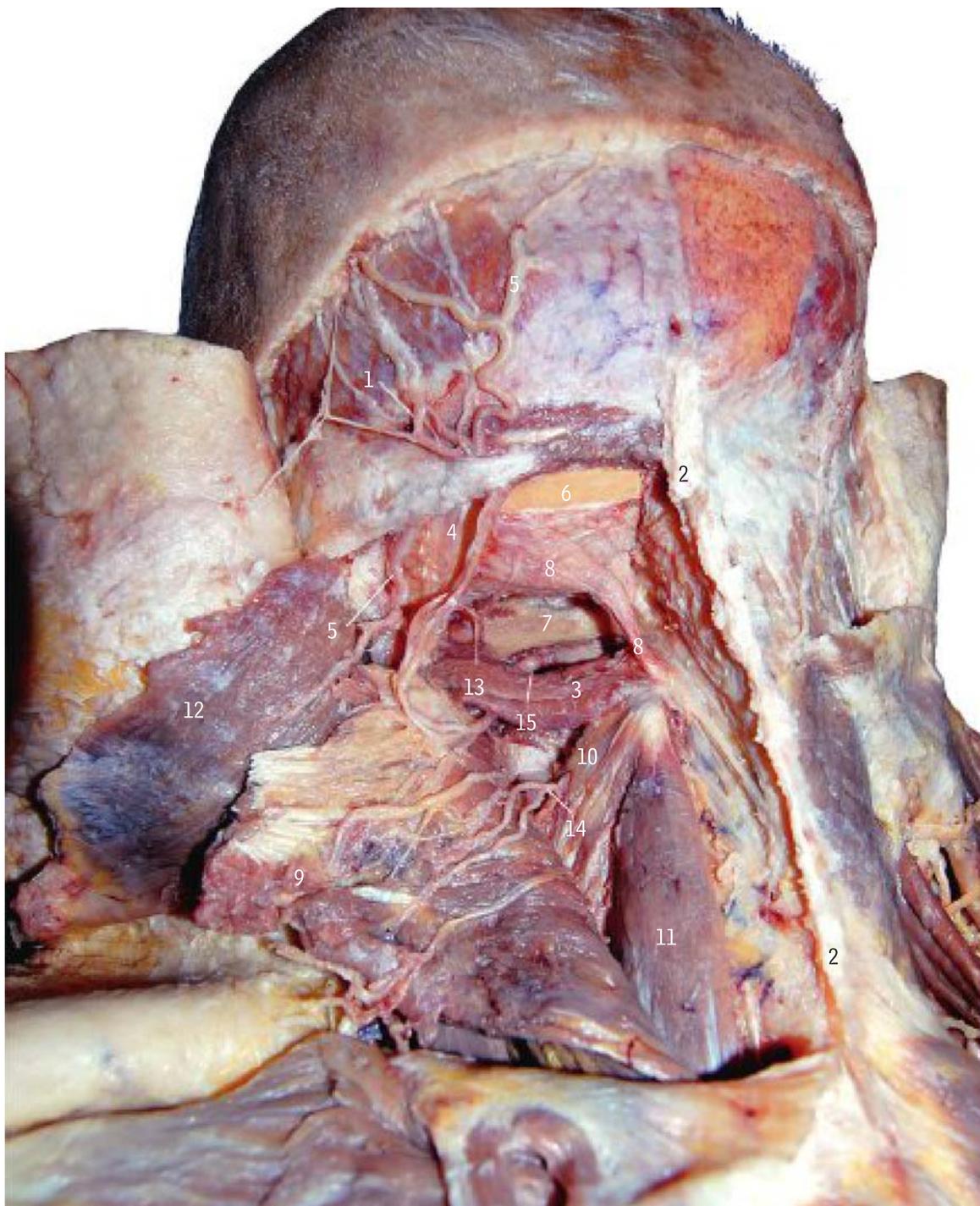
Sub-occipital triangle *superficial dissection*



- | | |
|--|--|
| 1 Dorsal cutaneous branch, spinal nerve | 7 Occipital artery |
| 2 Great auricular nerve | 8 Occipital belly (occipitalis) of occipitofrontalis muscle |
| 3 Greater occipital nerve | 9 Splenius capitis muscle |
| 4 Lesser occipital nerve | 10 Third occipital nerve |
| 5 Lesser occipital nerve anastomosis with third occipital nerve | 11 Third occipital nerve reflected |
| 6 Ligamentum nuchae | 12 Trapezius muscle |



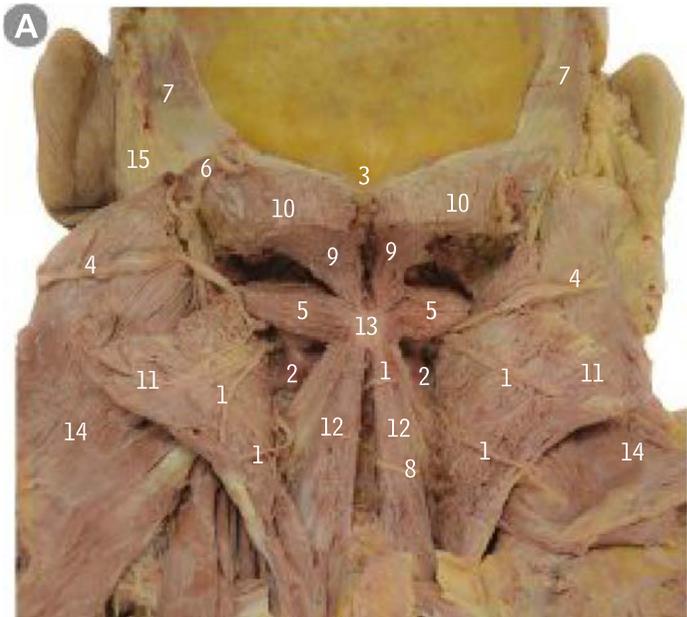
Sub-occipital triangle *deep dissection*



- 1 Greater occipital nerve
- 2 Ligamentum nuchae
- 3 Obliquus capitis inferior muscle
- 4 Obliquus capitis superior muscle
- 5 Occipital artery
- 6 Occipital bone
- 7 Posterior arch of C1 vertebra
- 8 Rectus capitis posterior major muscle

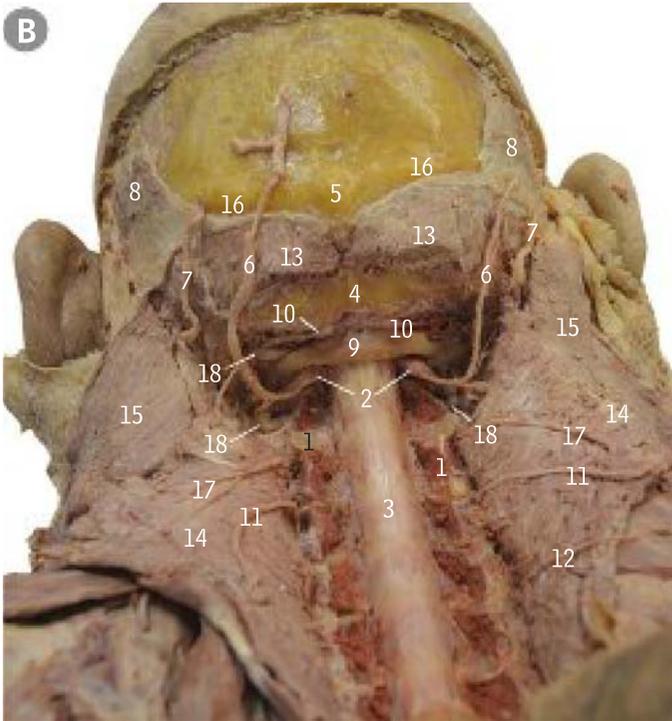
- 9 Semispinalis capitis muscle (reflected)
- 10 Semispinalis cervicis muscle
- 11 Spinalis cervicis muscle
- 12 Splenius capitis muscle (reflected)
- 13 Suboccipital nerve
- 14 Third occipital nerve
- 15 Vertebral artery

Sub-occipital triangle

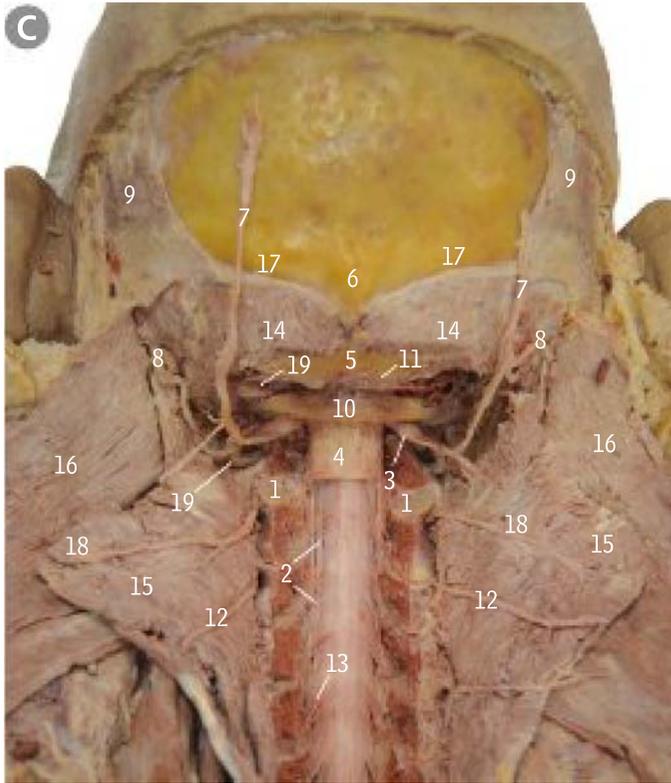


- 1 Branches of third occipital nerve
- 2 C3 vertebra
- 3 External occipital protuberance
- 4 Greater occipital nerve
- 5 Obliquus capitis inferior muscle
- 6 Occipital artery
- 7 Occipital belly of occipitofrontalis muscle
- 8 Posterior cutaneous branches of C4
- 9 Rectus capitis posterior major muscle
- 10 Semispinalis capitis muscle (cut)
- 11 Semispinalis capitis muscle (reflected)
- 12 Semispinalis cervicis muscle
- 13 Spinous process of axis (C2 vertebra)
- 14 Splenius capitis muscle (reflected)
- 15 Sternocleidomastoid muscle

Sub-occipital triangle *deeper dissection*

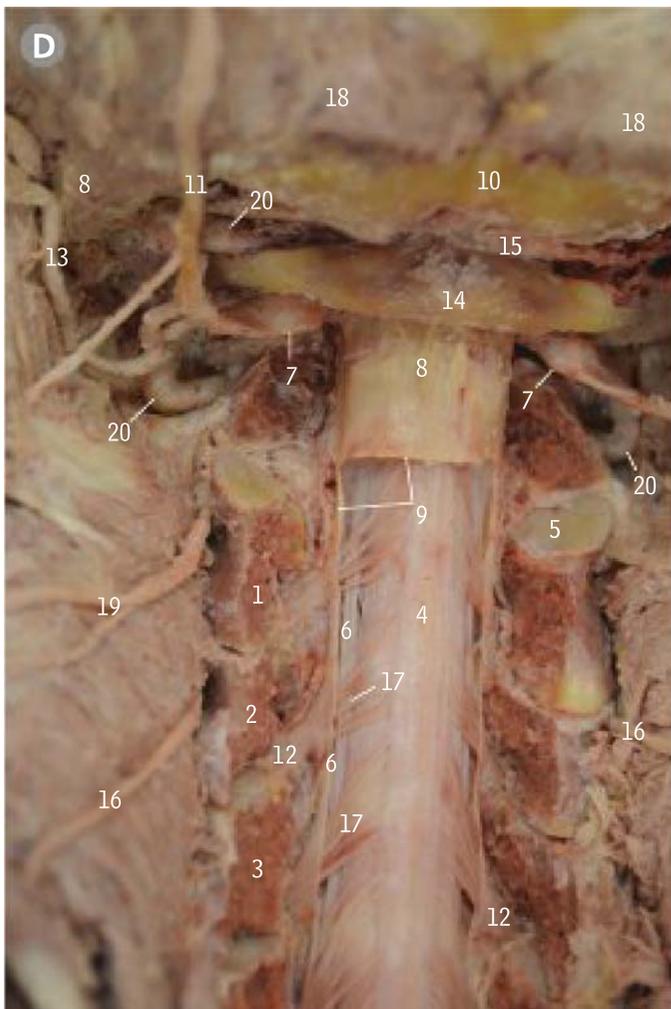


- 1 Axis (cut edge)
- 2 Dorsal root ganglion of C2
- 3 Dura mater
- 4 External occipital crest
- 5 External occipital protuberance
- 6 Greater occipital nerve
- 7 Occipital artery
- 8 Occipital belly of occipitofrontalis muscle
- 9 Posterior arch of atlas
- 10 Posterior atlanto-occipital membrane
- 11 Posterior cutaneous branches of C4
- 12 Posterior cutaneous branches of C6
- 13 Semispinalis capitis muscle (cut)
- 14 Semispinalis capitis muscle (reflected)
- 15 Splenius capitis muscle (reflected)
- 16 Superior nuchal line
- 17 Third occipital nerve
- 18 Vertebral artery



Sub-occipital triangle *upper cervical nerves*

- 1 Axis (cut)
- 2 Denticulate ligament
- 3 Dorsal root ganglion of C2
- 4 Dura mater
- 5 External occipital crest
- 6 External occipital protuberance
- 7 Greater occipital nerve
- 8 Occipital artery
- 9 Occipital belly of occipitofrontalis muscle
- 10 Posterior arch of atlas
- 11 Posterior atlanto-occipital membrane
- 12 Posterior cutaneous branches of C4
- 13 Rootlets of dorsal root
- 14 Semispinalis capitis muscle (cut)
- 15 Semispinalis capitis muscle (reflected)
- 16 Splenius capitis muscle (reflected)
- 17 Superior nuchal line
- 18 Third occipital nerve
- 19 Vertebral artery

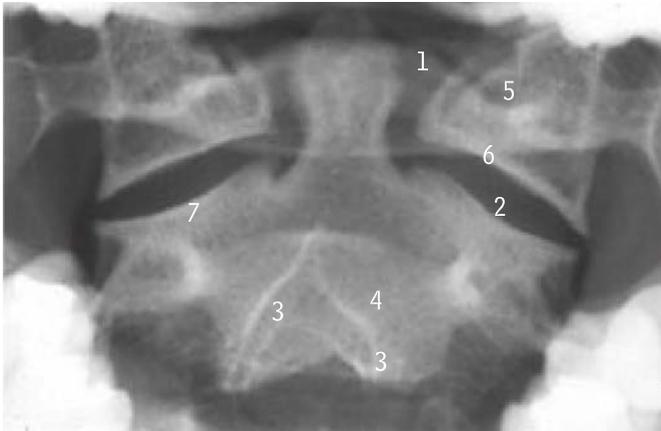


Sub-occipital triangle *atlas and axis*

- 1 3rd cervical vertebra (cut)
- 2 4th cervical vertebra (cut)
- 3 5th cervical vertebra (cut)
- 4 Arachnoid mater
- 5 Axis (cut)
- 6 Denticulate ligament
- 7 Dorsal root ganglion of C2
- 8 Dura mater
- 9 Dura mater (cut)
- 10 External occipital crest
- 11 Greater occipital nerve
- 12 Meningeal sheath covering dorsal root ganglion
- 13 Occipital artery
- 14 Posterior arch of atlas
- 15 Posterior atlanto-occipital membrane
- 16 Posterior cutaneous branches of C4
- 17 Rootlets of dorsal root
- 18 Semispinalis capitis muscle (cut)
- 19 Third occipital nerve
- 20 Vertebral artery



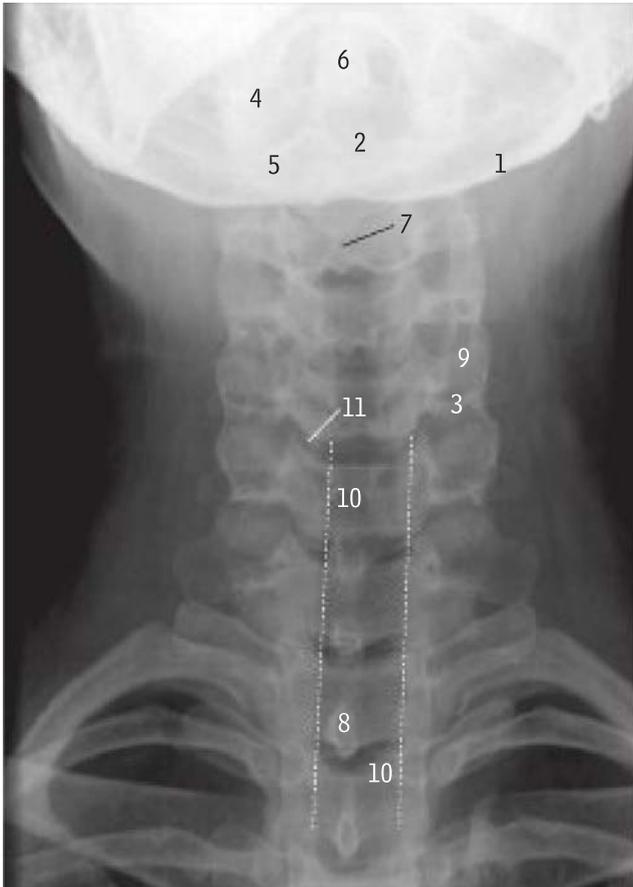
Upper cervical vertebrae *intraoral* view



This is a standard radiographic view of the axis and its dens. The correct angle must be chosen with the mouth open to avoid overlying shadows of the teeth and jaws. The surfaces of the lateral atlanto-axial joints (6 and 7) do not make bony contact because the hyaline cartilage which covers the bony surfaces is not radiolucent (this applies to any synovial joint). The outlines of the arches of the atlas are seen faintly between the sides of the shadow of the dens and the lateral masses of the atlas (5).

- 1 Arch of atlas
- 2 Atlanto-axial joint (lateral)
- 3 Bifid spinous process
- 4 Body of axis
- 5 Lateral mass of atlas
- 6 Inferior articular process of atlas
- 7 Superior articular process of axis

Lower cervical and upper thoracic vertebrae



Note the tracheal shadow produced by the translucency of its contained air.

- 1 Basi-occiput
- 2 Body of axis
- 3 Inferior articular process
- 4 Lateral mass of atlas
- 5 Lateral mass of axis
- 6 Odontoid peg (dens)
- 7 Spinous process of third cervical vertebra
- 8 Spinous process of first thoracic vertebra
- 9 Superior articular process
- 10 Trachea
- 11 Uncovertebral joint (Lushcka)



Atlanto-axial instability

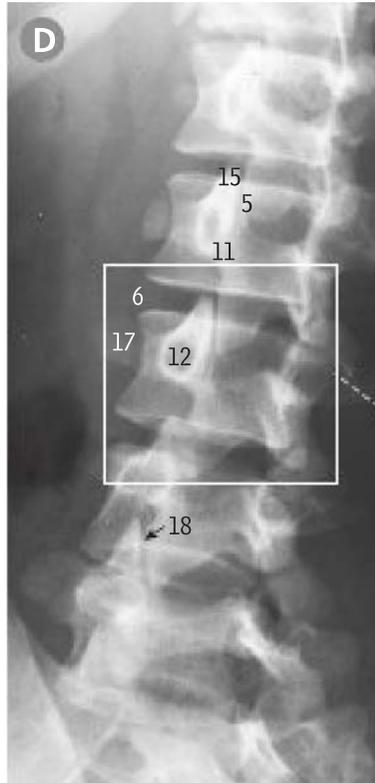
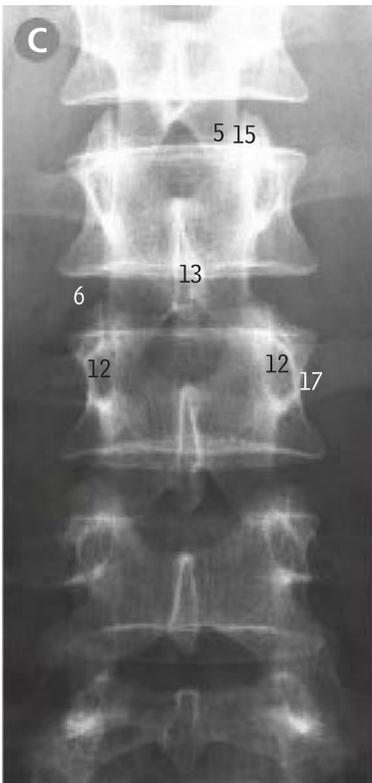


Cervical spinal immobilisation

Spine



- 1 Anterior arch of atlas
- 2 Dens of axis
- 3 First rib
- 4 Hyoid bone
- 5 Inferior articular process of first lumbar vertebra
- 6 Intervertebral disc space L2/3 level
- 7 Lamina of sixth cervical vertebra
- 8 Larynx
- 9 Lateral atlanto-axial joint
- 10 Lateral mass of atlas
- 11 Pars interarticularis of second lumbar vertebra
- 12 Pedicle of third lumbar vertebra
- 13 Spinous process of second lumbar vertebra
- 14 Spinous process of seventh cervical vertebra
- 15 Superior articular process of second lumbar vertebra
- 16 Trachea
- 17 Transverse process of third lumbar vertebra
- 18 Zygapophyseal (facet) joint

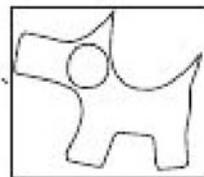


cervical spine, lateral projection

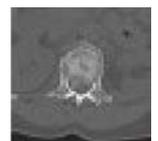
cervical spine, lateral projection

lumbar spine, anteroposterior projection

lumbar spine, oblique projection



The Scottie dog is seen on the oblique projection lumbar spine. The nose (17) is the transverse process, the ear (15) is the superior articular process, the eye (12) is the pedicle and the neck (11) is the pars interarticularis which may be incomplete in spondylolysis.



Vertebral fracture

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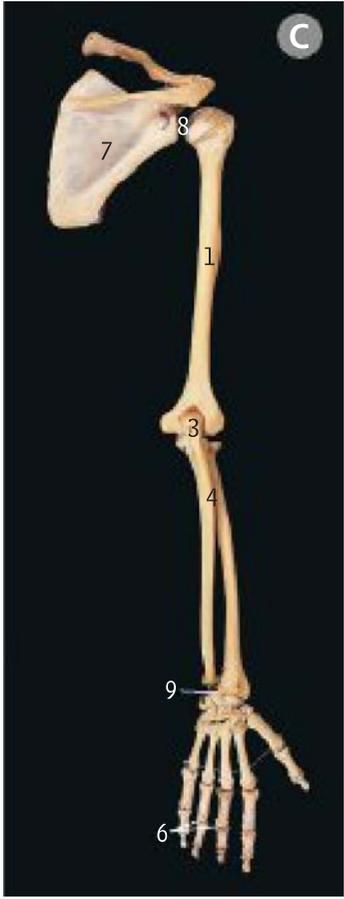
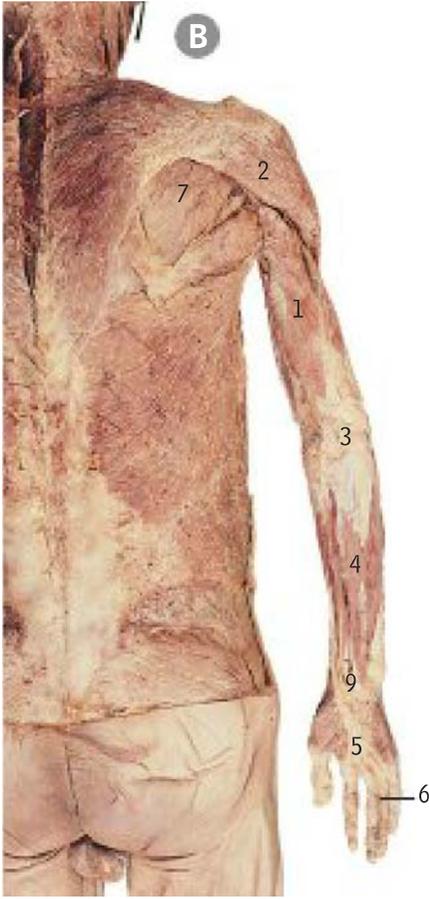
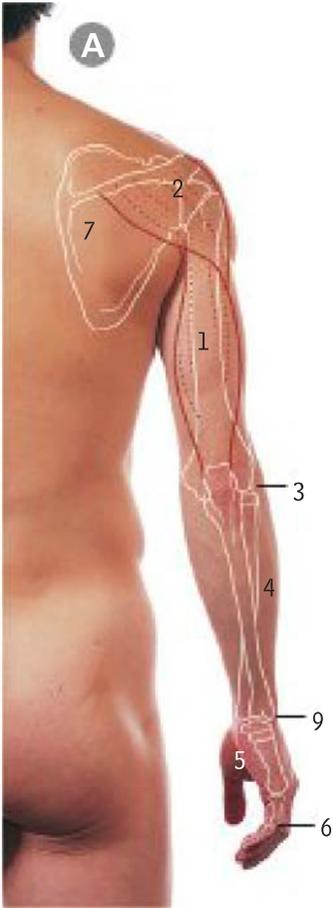
Upper limb



Upper limb surface anatomy

muscles

bones



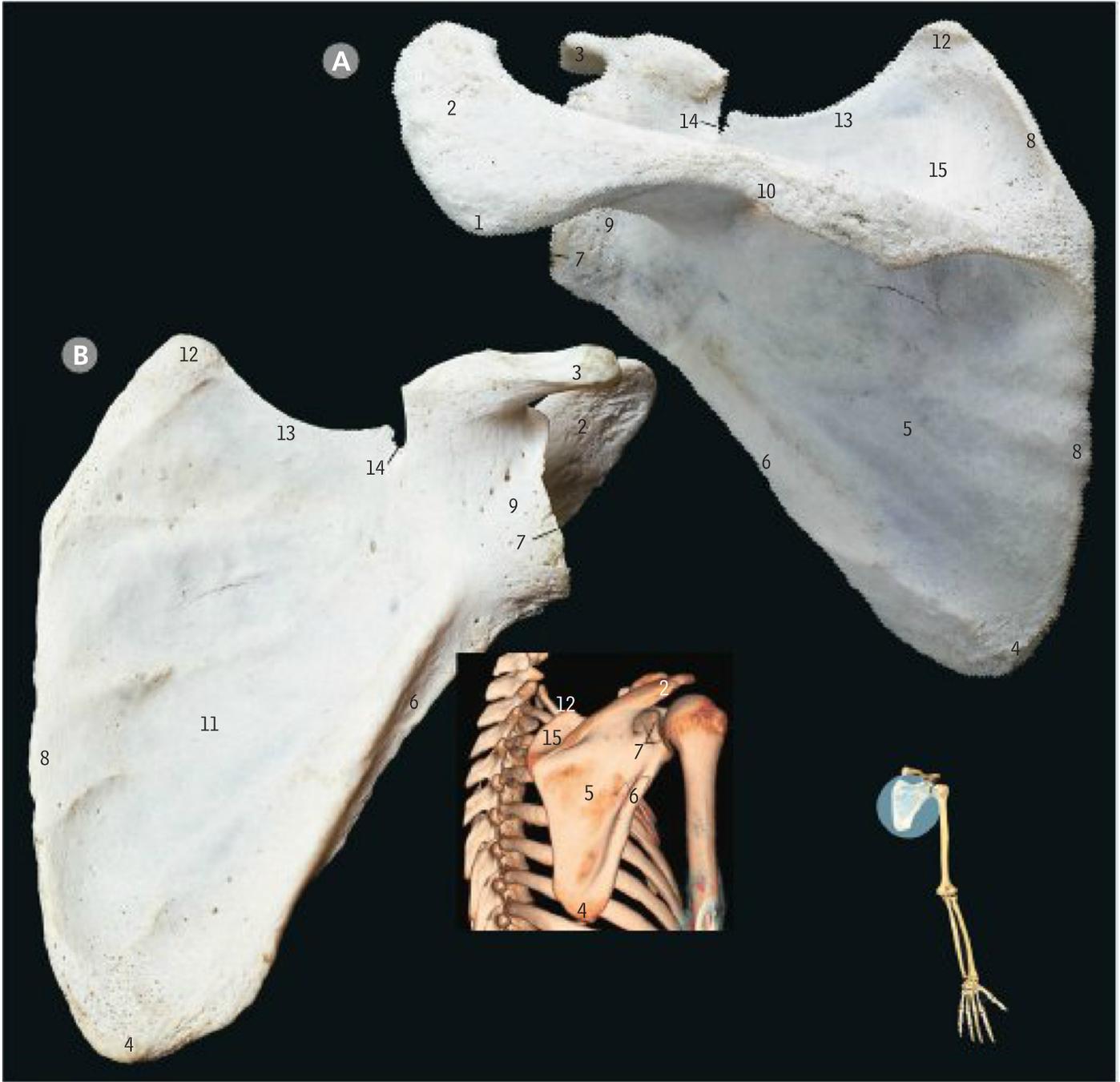
- 1 Arm
- 2 Deltoid
- 3 Elbow joint
- 4 Forearm
- 5 Hand

- 6 Interphalangeal joint
- 7 Scapula
- 8 Shoulder joint
- 9 Wrist joint



Accessory ossicles

Left scapula



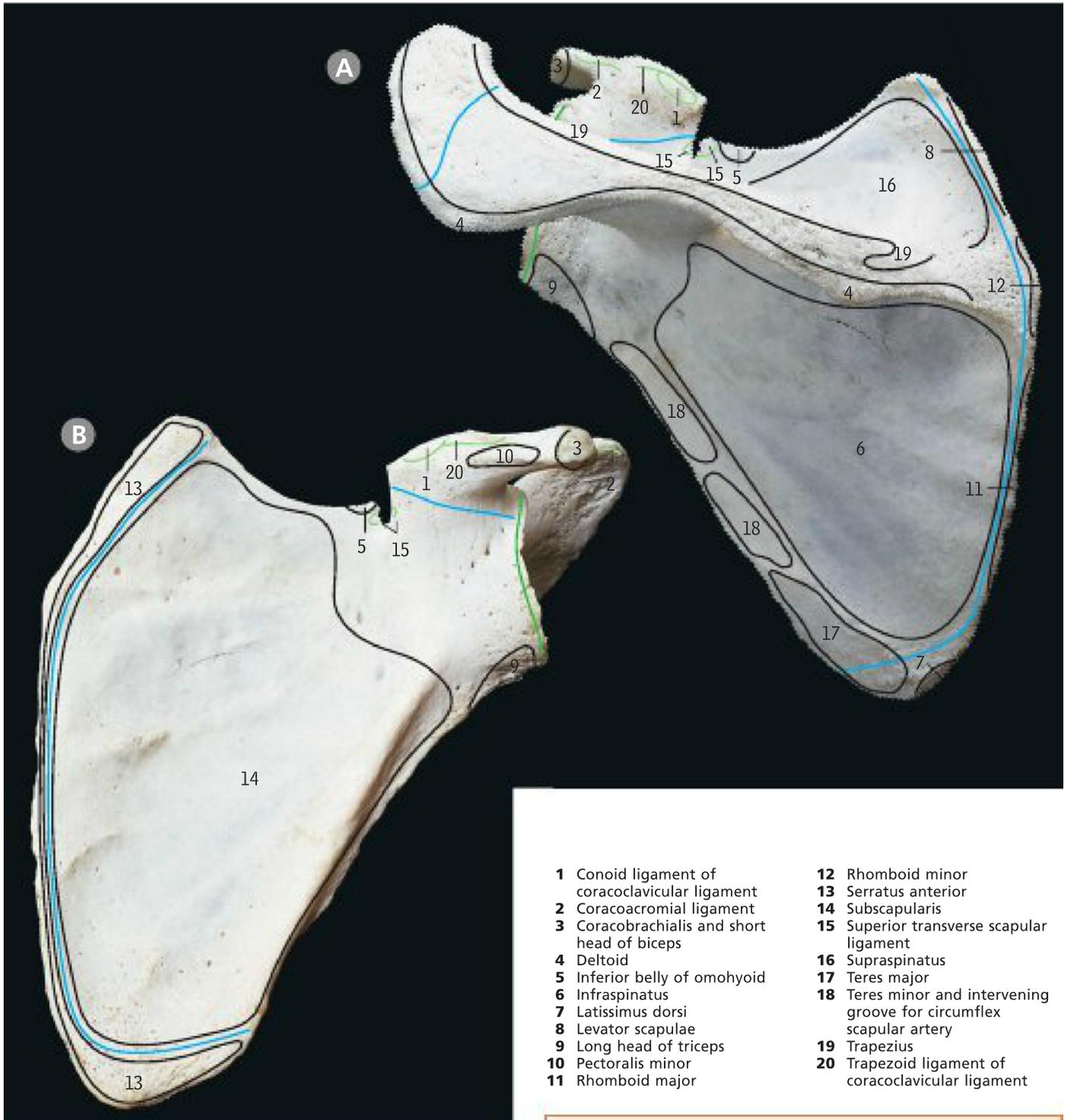
dorsal surface

costal surface

- 1** Acromial angle
- 2** Acromion
- 3** Coracoid process
- 4** Inferior angle
- 5** Infraspinous fossa
- 6** Lateral border
- 7** Margin of glenoid cavity
- 8** Medial border
- 9** Neck (and spinoglenoid notch on dorsal surface)
- 10** Spine
- 11** Subscapular fossa
- 12** Superior angle
- 13** Superior border
- 14** Suprascapular notch
- 15** Supraspinous fossa

The spine (A10) of the scapula projects from its dorsal surface with the acromion (A2) at the lateral end of the spine.



Left scapula *attachments*

- | | |
|---|---|
| 1 Conoid ligament of coracoclavicular ligament | 12 Rhomboid minor |
| 2 Coracoacromial ligament | 13 Serratus anterior |
| 3 Coracobrachialis and short head of biceps | 14 Subscapularis |
| 4 Deltoid | 15 Superior transverse scapular ligament |
| 5 Inferior belly of omohyoid | 16 Supraspinatus |
| 6 Infraspinatus | 17 Teres major |
| 7 Latissimus dorsi | 18 Teres minor and intervening groove for circumflex scapular artery |
| 8 Levator scapulae | 19 Trapezius |
| 9 Long head of triceps | 20 Trapezoid ligament of coracoclavicular ligament |
| 10 Pectoralis minor | |
| 11 Rhomboid major | |

The suprascapular notch is bridged by the superior transverse scapular ligament (15).

The conoid (1) and trapezoid (20) ligaments together form the coracoclavicular ligament, which attaches the coracoid process of the scapula to the under-surface of the lateral end of the clavicle.

The coracoacromial ligament (2) passes between the coracoid process and the acromion, forming with these bony processes an arch above the shoulder joint.

dorsal surface

costal surface

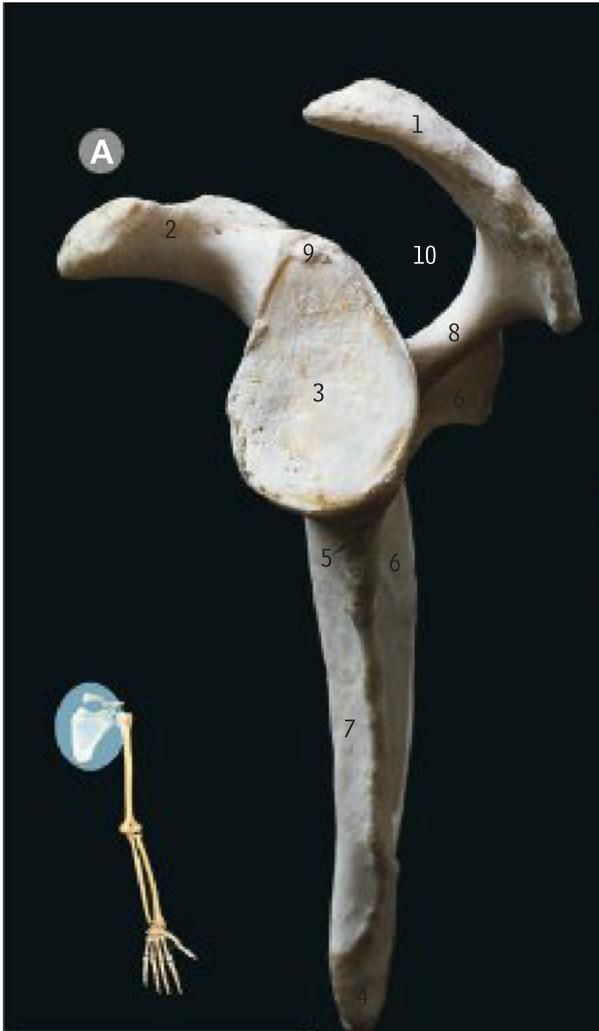
Blue lines, epiphysial lines (physis); green lines, capsular attachments of shoulder joint; pale green lines, ligament attachments

Left scapula *from the lateral side*

- | | |
|-------------------------|-------------------------|
| 1 Acromion | 6 Infraspinous fossa |
| 2 Coracoid process | 7 Lateral border |
| 3 Glenoid cavity | 8 Spine |
| 4 Inferior angle | 9 Supraglenoid tubercle |
| 5 Infraglenoid tubercle | 10 Supraspinous fossa |

Left scapula and clavicle *articulation, from above*

- | | |
|----------------------------|---------------------------|
| 1 Acromial end of clavicle | 5 Shaft of clavicle |
| 2 Acromioclavicular joint | 6 Spine of scapula |
| 3 Acromion | 7 Sternal end of clavicle |
| 4 Coracoid process | 8 Supraspinous fossa |



Left clavicle *from below*

- 1 Acromial end with articular surface (arrow)
- 2 Conoid tubercle
- 3 Groove for subclavius muscle
- 4 Impression for costoclavicular ligament
- 5 Sternal end with articular surface (arrow)
- 6 Trapezoid line

The sternal end of the clavicle (B7, C5) is bulbous; the acromial end (B1, C1) is flattened. The shaft is convex towards the front in its medial two-thirds, and the groove for the subclavius muscle is on the inferior surface (C3).



Acromioclavicular separation

Left scapula attachments, from the lateral side

Blue lines, epiphysial lines (physis); green lines, capsular attachments of shoulder joint; pale green lines, ligament attachments

- | | |
|---|---|
| 1 Coracoacromial ligament | 7 Long head of triceps |
| 2 Coracobrachialis and short head of biceps | 8 Serratus anterior |
| 3 Coracohumeral ligament | 9 Subscapularis |
| 4 Deltoid | 10 Teres major |
| 5 Infraspinatus | 11 Teres minor (with intervening groove for circumflex scapular artery) |
| 6 Long head of biceps | |

Left scapula and clavicle articulation, from above

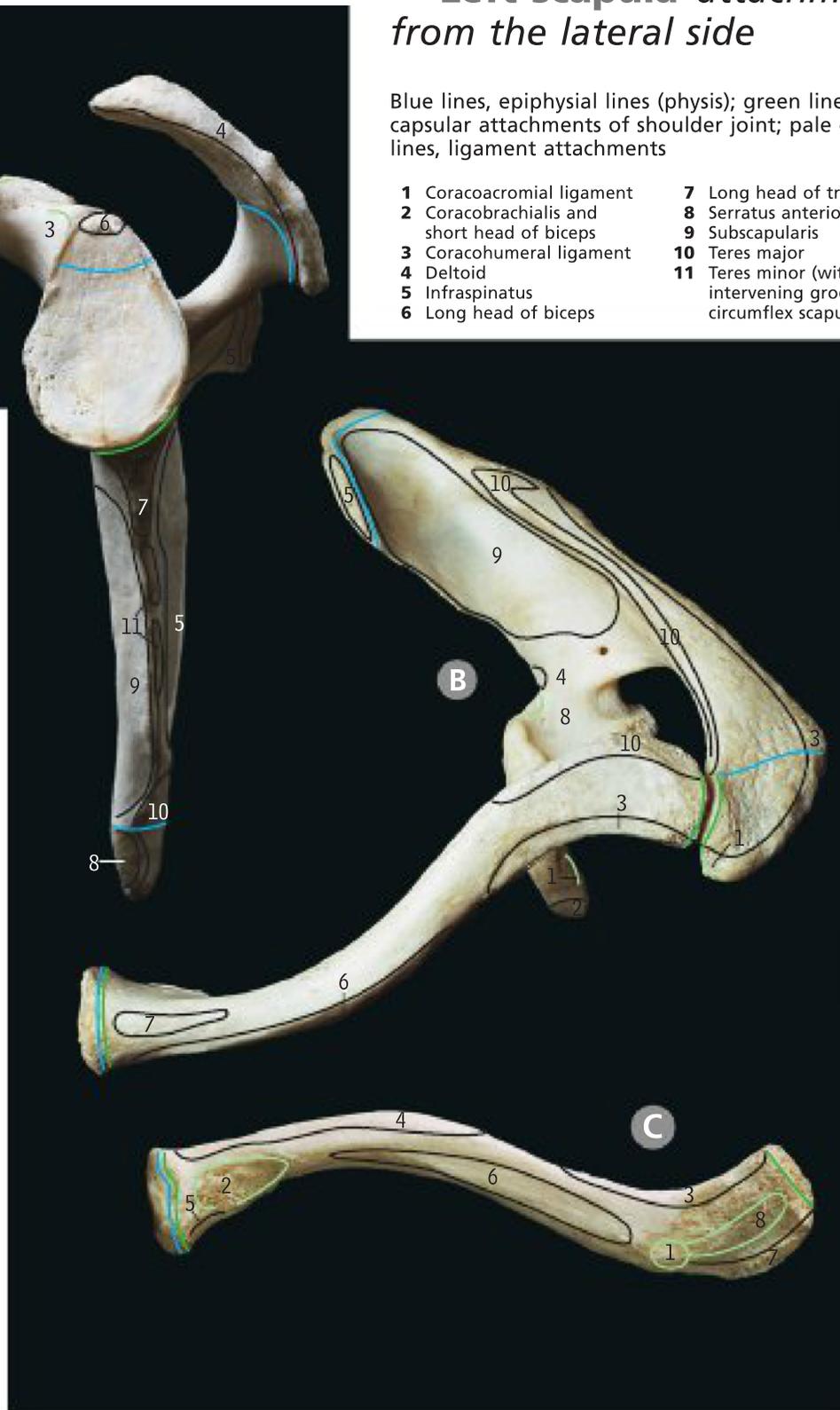
Blue lines, epiphysial lines (physis); green lines, capsular attachments of sternoclavicular and acromioclavicular joints; pale green lines, ligament attachments

- | |
|---|
| 1 Coracoacromial ligament |
| 2 Coracobrachialis and short head of biceps |
| 3 Deltoid |
| 4 Inferior belly of omohyoid |
| 5 Levator scapulae |
| 6 Pectoralis major |
| 7 Sternocleidomastoid |
| 8 Superior transverse scapular ligament |
| 9 Supraspinatus |
| 10 Trapezius |

Left clavicle attachments, from below

Blue lines, epiphysial lines (physis); green lines, capsular attachments of sternoclavicular and acromioclavicular joints; pale green lines, ligament attachments

- | |
|---------------------------------------|
| 1 Conoid ligament |
| 2 Costoclavicular ligament |
| 3 Deltoid |
| 4 Pectoralis major |
| 5 Sternohyoid |
| 6 Subclavius and clavipectoral fascia |
| 7 Trapezius |
| 8 Trapezoid ligament |

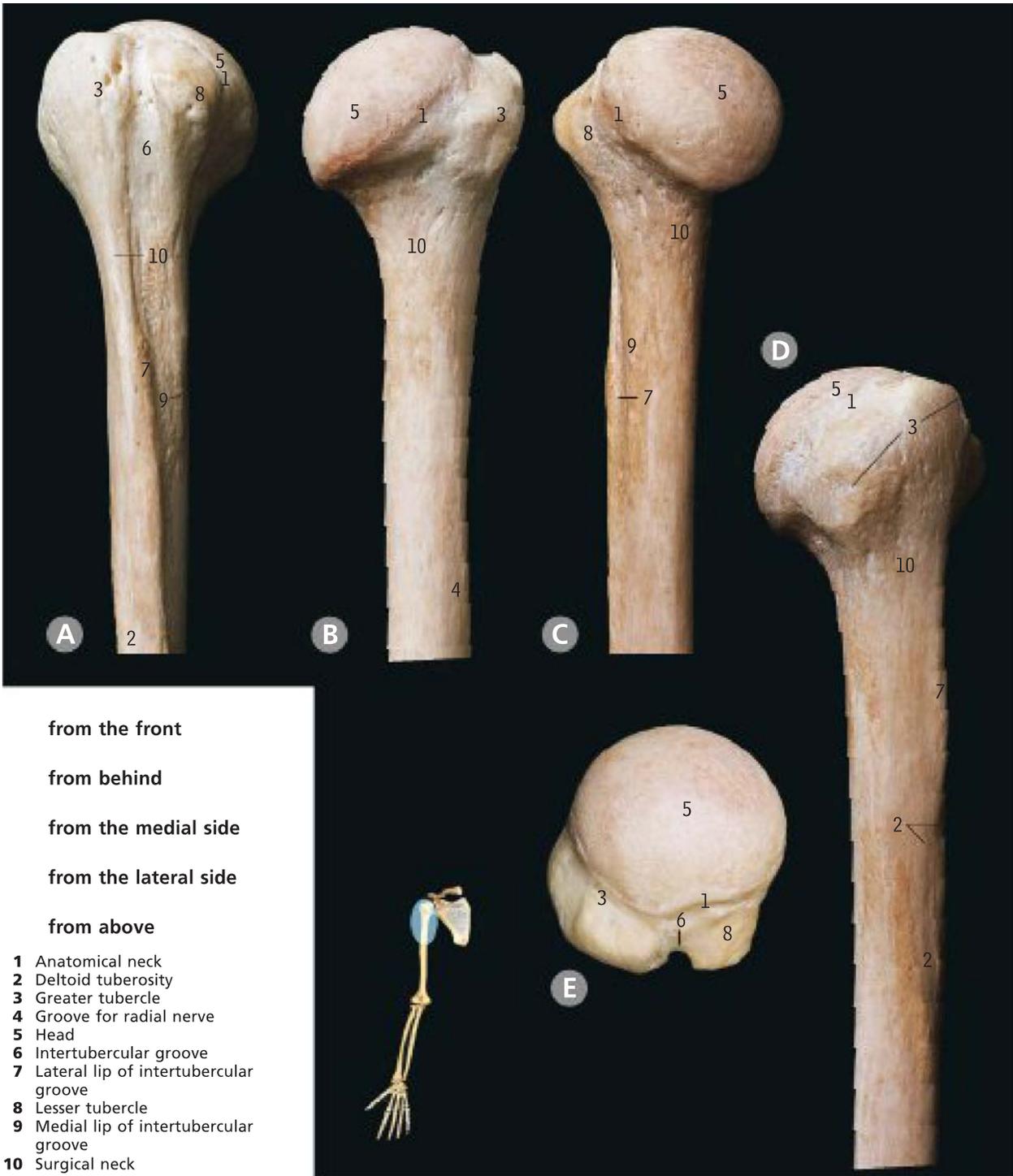


Fractured clavicle



Fractured scapula

Right humerus *upper end*



from the front

from behind

from the medial side

from the lateral side

from above

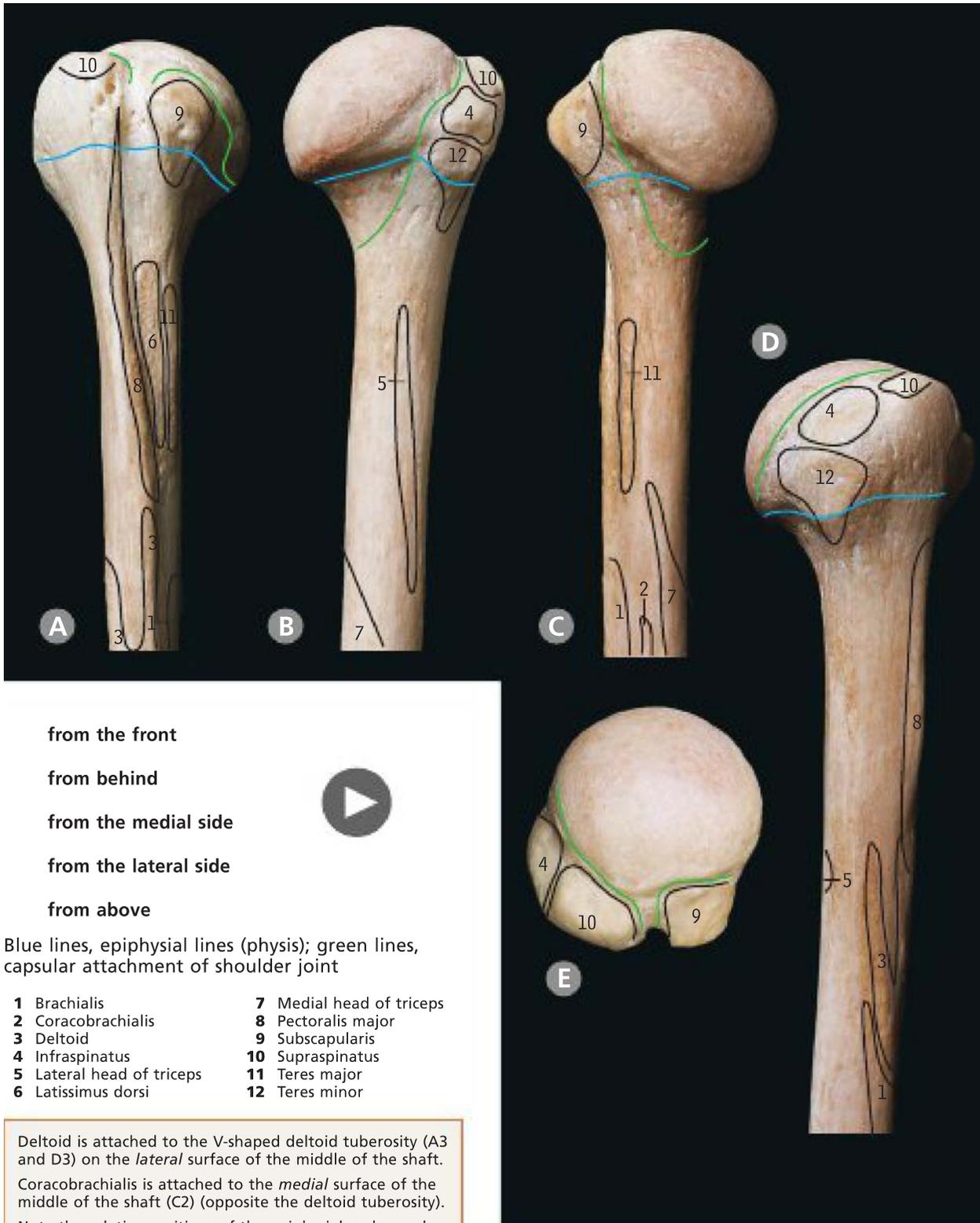
- 1 Anatomical neck
- 2 Deltoid tuberosity
- 3 Greater tubercle
- 4 Groove for radial nerve
- 5 Head
- 6 Intertubercular groove
- 7 Lateral lip of intertubercular groove
- 8 Lesser tubercle
- 9 Medial lip of intertubercular groove
- 10 Surgical neck

The intertubercular (bicipital) groove (A6) is on the front of the upper end and is occupied by the tendon of the long head of biceps. (For attachments see [page 121.](#))



Dislocation of humerus

Right humerus attachments, upper end



from the front

from behind

from the medial side

from the lateral side

from above

Blue lines, epiphysial lines (physis); green lines, capsular attachment of shoulder joint

- | | |
|---------------------------|--------------------------|
| 1 Brachialis | 7 Medial head of triceps |
| 2 Coracobrachialis | 8 Pectoralis major |
| 3 Deltoid | 9 Subscapularis |
| 4 Infraspinatus | 10 Supraspinatus |
| 5 Lateral head of triceps | 11 Teres major |
| 6 Latissimus dorsi | 12 Teres minor |

Deltoid is attached to the V-shaped deltoid tuberosity (A3 and D3) on the *lateral* surface of the middle of the shaft.

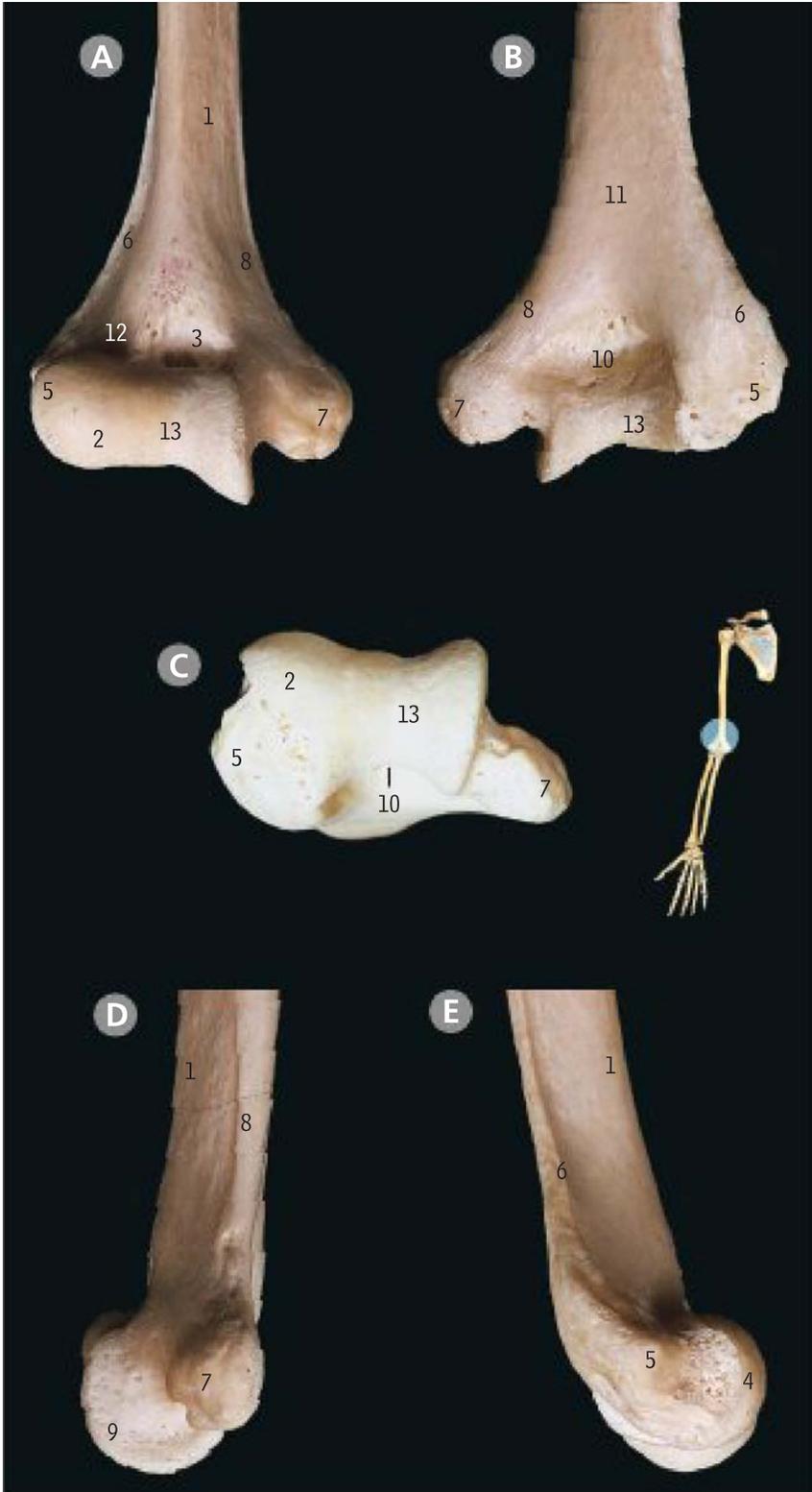
Coracobrachialis is attached to the *medial* surface of the middle of the shaft (C2) (opposite the deltoid tuberosity).

Note the relative positions of the epiphysial and capsular lines: the epiphysis is partly intracapsular and partly extracapsular at the upper end of the humerus.



Intrasosseous vascular access

Right humerus *lower end*



from the front

from behind

from below

from the medial side

from the lateral side

- 1 Anterior surface
- 2 Capitulum
- 3 Coronoid fossa
- 4 Lateral edge of capitulum
- 5 Lateral epicondyle
- 6 Lateral supracondylar ridge
- 7 Medial epicondyle
- 8 Medial supracondylar ridge
- 9 Medial surface of trochlea
- 10 Olecranon fossa
- 11 Posterior surface
- 12 Radial fossa
- 13 Trochlea

The medial epicondyle (7) is more prominent than the lateral (5).
 The medial part of the trochlea (13) is more prominent than the lateral part.
 The olecranon fossa (10) on the posterior surface is deeper than the radial and coronoid fossae on the anterior surface (12 and 3).



Avulsion medial epicondyle



Supracondylar spur

Right humerus *attachments, lower end*

from the front

from behind

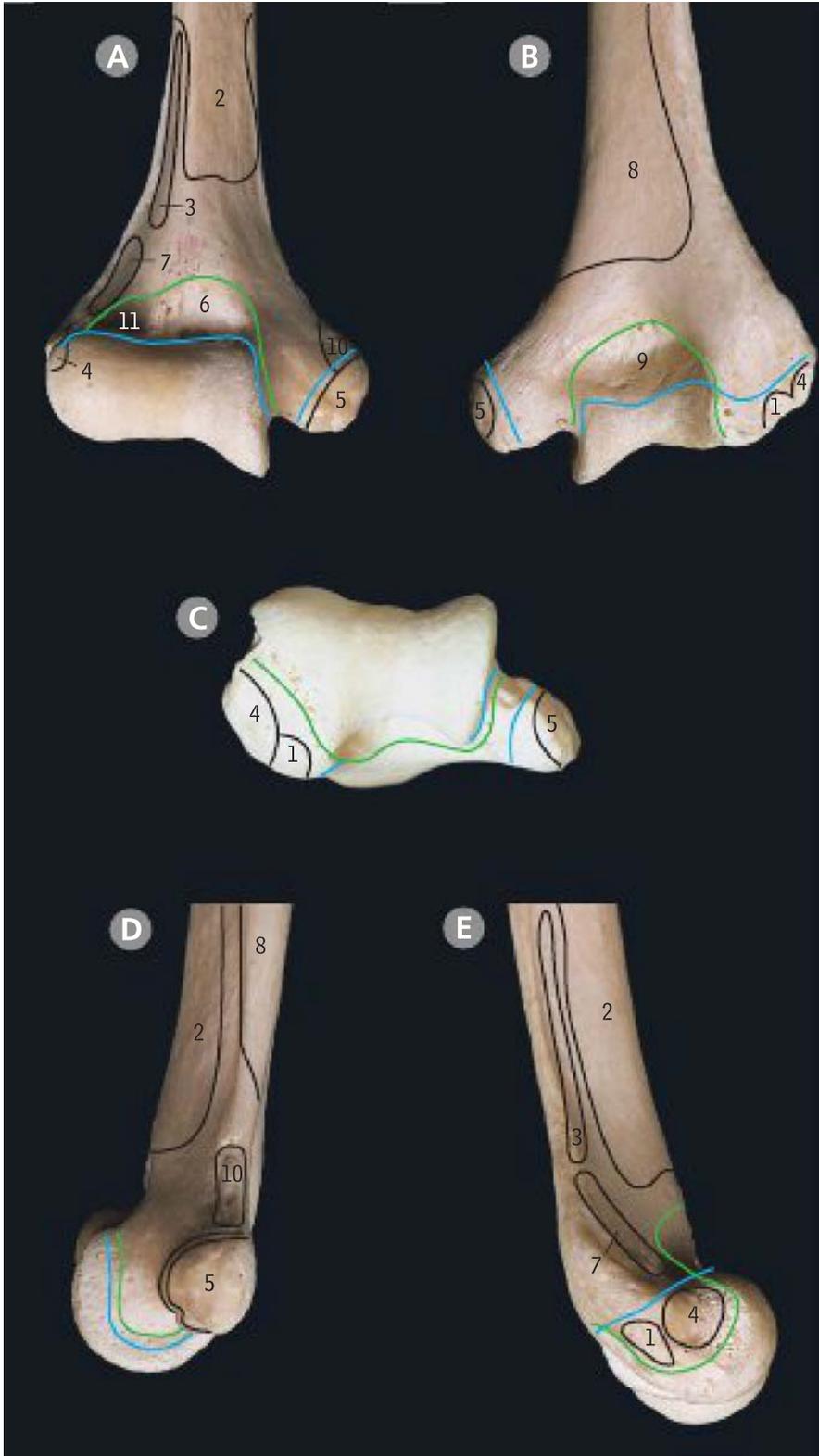
from below

from the medial side

from the lateral side

Blue lines, epiphysial lines (physis);
green lines, capsular attachments of
elbow joint

- 1 Anconeus
- 2 Brachialis
- 3 Brachioradialis
- 4 Common extensor origin
- 5 Common flexor origin
- 6 Coronoid fossa
- 7 Extensor carpi radialis longus
- 8 Medial head of triceps
- 9 Olecranon fossa
- 10 Pronator teres, humeral head
- 11 Radial fossa





Right radius
upper end

- from the front
- from behind
- from the medial side
- from the lateral side

- 1 Anterior border
- 2 Anterior oblique line
- 3 Anterior surface
- 4 Head
- 5 Interosseous border
- 6 Lateral surface
- 7 Neck
- 8 Posterior border
- 9 Posterior surface
- 10 Rough area for pronator teres
- 11 Tuberosity

Right radius
lower end

- from the front
- from behind
- from the medial side
- from the lateral side

- 1 Anterior surface
- 2 Dorsal tubercle
- 3 Groove for abductor pollicis longus
- 4 Groove for extensor carpi radialis brevis
- 5 Groove for extensor carpi radialis longus
- 6 Groove for extensor digitorum and extensor indicis
- 7 Groove for extensor pollicis brevis
- 8 Groove for extensor pollicis longus
- 9 Interosseous border
- 10 Lateral surface
- 11 Posterior surface
- 12 Styloid process
- 13 Ulnar notch

The lower end of the radius is concave anteriorly (at the lower label 1 in E), with the ulnar notch medially (G13) and the dorsal tubercle on the posterior surface (F2).



Right ulna *upper end*

from the front

from behind

from the medial side

from the lateral side

- 1 Anterior border
- 2 Anterior surface
- 3 Coronoid process
- 4 Interosseous border
- 5 Medial surface
- 6 Olecranon
- 7 Posterior border
- 8 Posterior surface
- 9 Radial notch
- 10 Supinator crest
- 11 Trochlear notch
- 12 Tuberosity

The trochlear notch (11) faces forwards, with the radial notch (9) on the lateral side.

Right ulna *lower end*

from the front

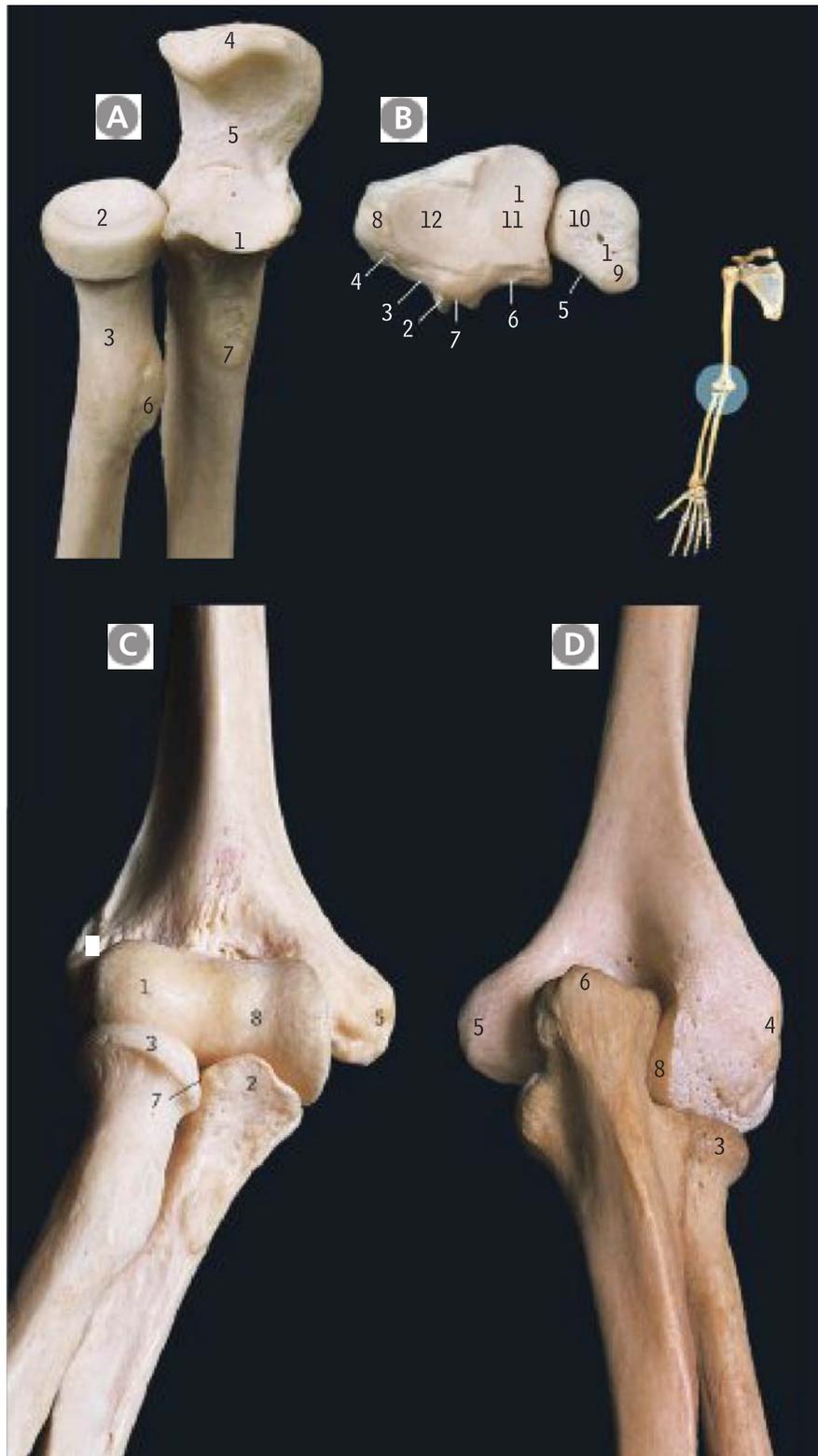
from behind

from the medial side

from the lateral side

- 1 Anterior surface
- 2 Groove for extensor carpi ulnaris
- 3 Head
- 4 Interosseous border
- 5 Medial surface
- 6 Posterior surface
- 7 Styloid process





Right radius and ulna upper ends, from above and in front

- 1 Coronoid process of ulna
- 2 Head of radius
- 3 Neck of radius
- 4 Olecranon of ulna
- 5 Trochlear notch of ulna
- 6 Tuberosity of radius
- 7 Tuberosity of ulna

Right radius and ulna lower ends, from below

- 1 Attachment of articular disc
- 2 Dorsal tubercle
- 3 Groove for extensor carpi radialis brevis
- 4 Groove for extensor carpi radialis longus
- 5 Groove for extensor carpi ulnaris
- 6 Groove for extensor digitorum and extensor indicis
- 7 Groove for extensor pollicis longus
- 8 Styloid process of radius
- 9 Styloid process of ulna
- 10 Surface for disc
- 11 Surface for lunate
- 12 Surface for scaphoid

Right humerus, radius and ulna articulation

from the front

from behind

- 1 Capitulum of humerus
- 2 Coronoid process of ulna
- 3 Head of radius
- 4 Lateral epicondyle of humerus
- 5 Medial epicondyle of humerus
- 6 Olecranon of ulna
- 7 Radial notch of ulna
- 8 Trochlea of humerus

The elbow joint and the proximal radio-ulnar joint share a common synovial cavity.



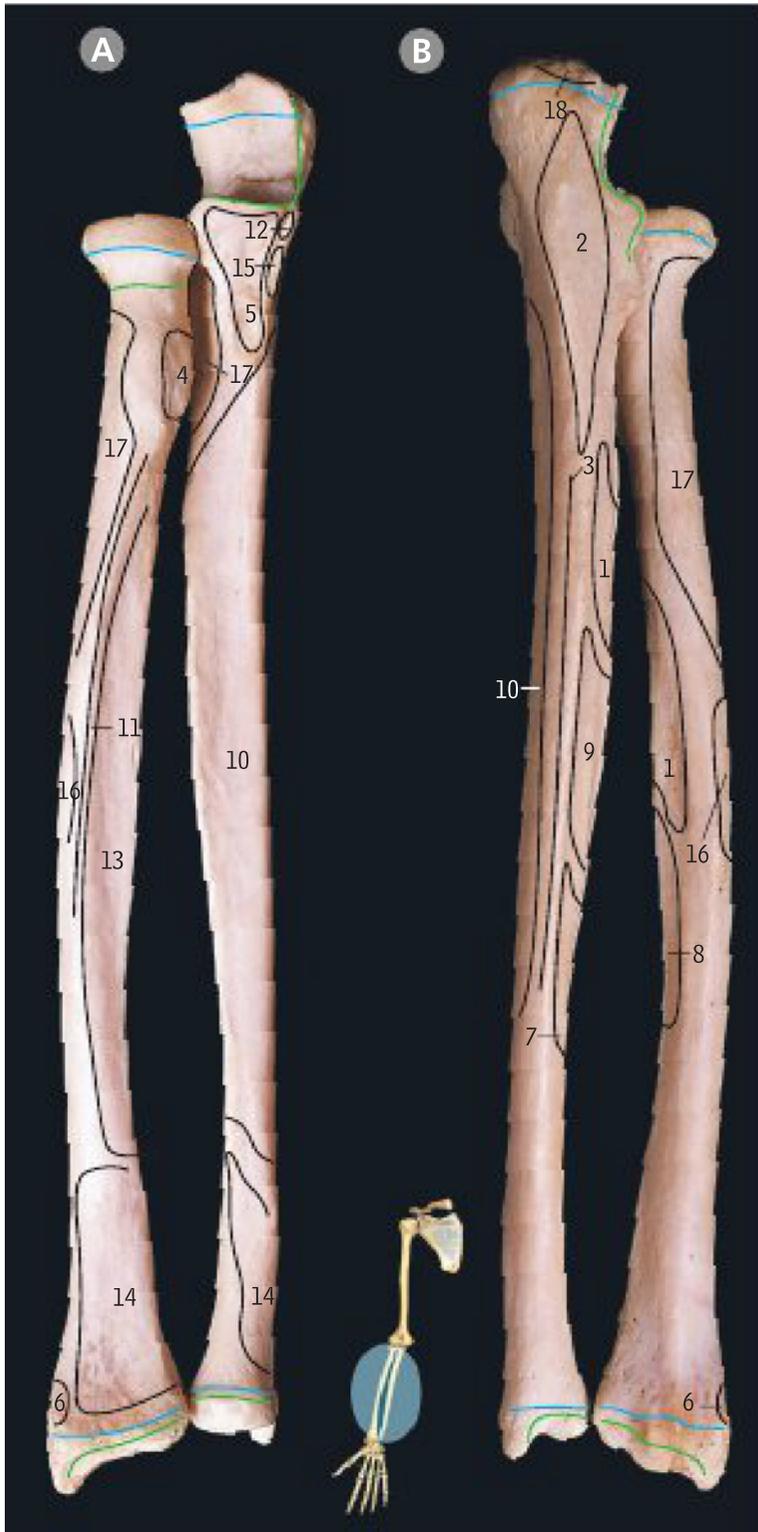
Dislocation of the elbow



Supracondylar fracture of the humerus



Right radius and ulna *attachments*



from the front

from behind

Blue lines, epiphysial lines (physis); green lines, capsular attachments of elbow and wrist joints

- 1 Abductor pollicis longus
- 2 Anconeus
- 3 Aponeurotic attachment of flexor digitorum profundus, flexor carpi ulnaris and extensor carpi ulnaris
- 4 Biceps
- 5 Brachialis
- 6 Brachioradialis
- 7 Extensor indicis
- 8 Extensor pollicis brevis
- 9 Extensor pollicis longus
- 10 Flexor digitorum profundus
- 11 Flexor digitorum superficialis, radial head
- 12 Flexor digitorum superficialis, ulnar head
- 13 Flexor pollicis longus
- 14 Pronator quadratus
- 15 Pronator teres, ulnar head
- 16 Pronator teres
- 17 Supinator
- 18 Triceps

Abductor pollicis longus (1) and extensor pollicis brevis (8) are the only two muscles to have an origin from the posterior surface of the radius (although both extend on to the interosseous membrane and the abductor also has an origin from the posterior surface of the ulna). These muscles remain companions as they wind round the lateral side of the radius (page 161) and form the radial boundary of the anatomical snuffbox (pages 162 and 176).

In the young subject, the radius sometimes fractures across the lower epiphysis following an injury to the wrist. In the adult the term "Colles' fracture" (page 129) refers to a transverse break across the lower radius within about 2.5 cm of the lower end of the bone. The ulnar styloid process is also often fractured.



Traction of forearm fractures

Bones of the right hand



palmar surface

from the lateral side

hamate from the medial side

scaphoid, palmar surface



The scaphoid, lunate, triquetral and pisiform bones form the proximal row of carpal bones.

The trapezium, trapezoid, capitate and hamate bones form the distal row of carpal bones.

The tubercle (33) and waist (35) are the non-articular parts of the scaphoid and therefore contain nutrient foramina. A fracture across the waist may therefore interfere with the blood supply of the proximal pole of the bone and lead to avascular necrosis (see [page 173](#)). The waist of the scaphoid lies in the anatomical snuffbox; the tubercle may be palpated in front of the radial boundary of the snuffbox.

- | | |
|---|--|
| 1 Base of fifth metacarpal | 18 Proximal phalanx of index finger |
| 2 Base of first metacarpal | 19 Proximal phalanx of little finger |
| 3 Base of middle phalanx of middle finger | 20 Proximal phalanx of thumb |
| 4 Base of proximal phalanx of ring finger | 21 Scaphoid |
| 5 Capitate | 22 Shaft of second metacarpal |
| 6 Distal phalanx of ring finger | 23 Shaft of fifth metacarpal |
| 7 Distal phalanx of thumb | 24 Shaft of first metacarpal |
| 8 Groove for deep branch of ulnar nerve | 25 Shaft of middle phalanx of middle finger |
| 9 Hamate | 26 Shaft of proximal phalanx of ring finger |
| 10 Head of fifth metacarpal | 27 Surface for capitate |
| 11 Head of first metacarpal | 28 Surface for lunate |
| 12 Head of middle phalanx of middle finger | 29 Surface for triquetral |
| 13 Head of proximal phalanx of ring finger | 30 Trapezium |
| 14 Hook of hamate | 31 Trapezoid |
| 15 Lunate | 32 Triquetral |
| 16 Palmar surface, hamate | 33 Tubercle of scaphoid |
| 17 Pisiform | 34 Tubercle of trapezium |
| | 35 Waist of scaphoid |

Bones of the right hand *dorsal surface*



- 1 Base of first metacarpal
- 2 Capitate
- 3 Distal phalanx of middle finger
- 4 Distal phalanx of thumb
- 5 Fifth metacarpal
- 6 Hamate
- 7 Head of first metacarpal
- 8 Lunate
- 9 Middle phalanx of middle finger
- 10 Proximal phalanx of middle finger
- 11 Proximal phalanx of thumb
- 12 Scaphoid
- 13 Shaft of first metacarpal
- 14 Styloid process of radius
- 15 Styloid process of ulna
- 16 Third metacarpal
- 17 Trapezium
- 18 Trapezoid
- 19 Triquetrum

The wrist joint (properly called the radiocarpal joint) is the joint between (proximally) the lower end of the radius and the interarticular disc which holds the lower ends of the radius and the ulna together, and (distally) the scaphoid, lunate and triquetrum bones.

The midcarpal joint is the joint between the proximal and distal rows of carpal bones (see the note on [pages 173 and 177](#)).

The carpometacarpal joint of the thumb is the joint between the trapezium and the base of the first metacarpal.



Bar room fracture



Colles' fracture

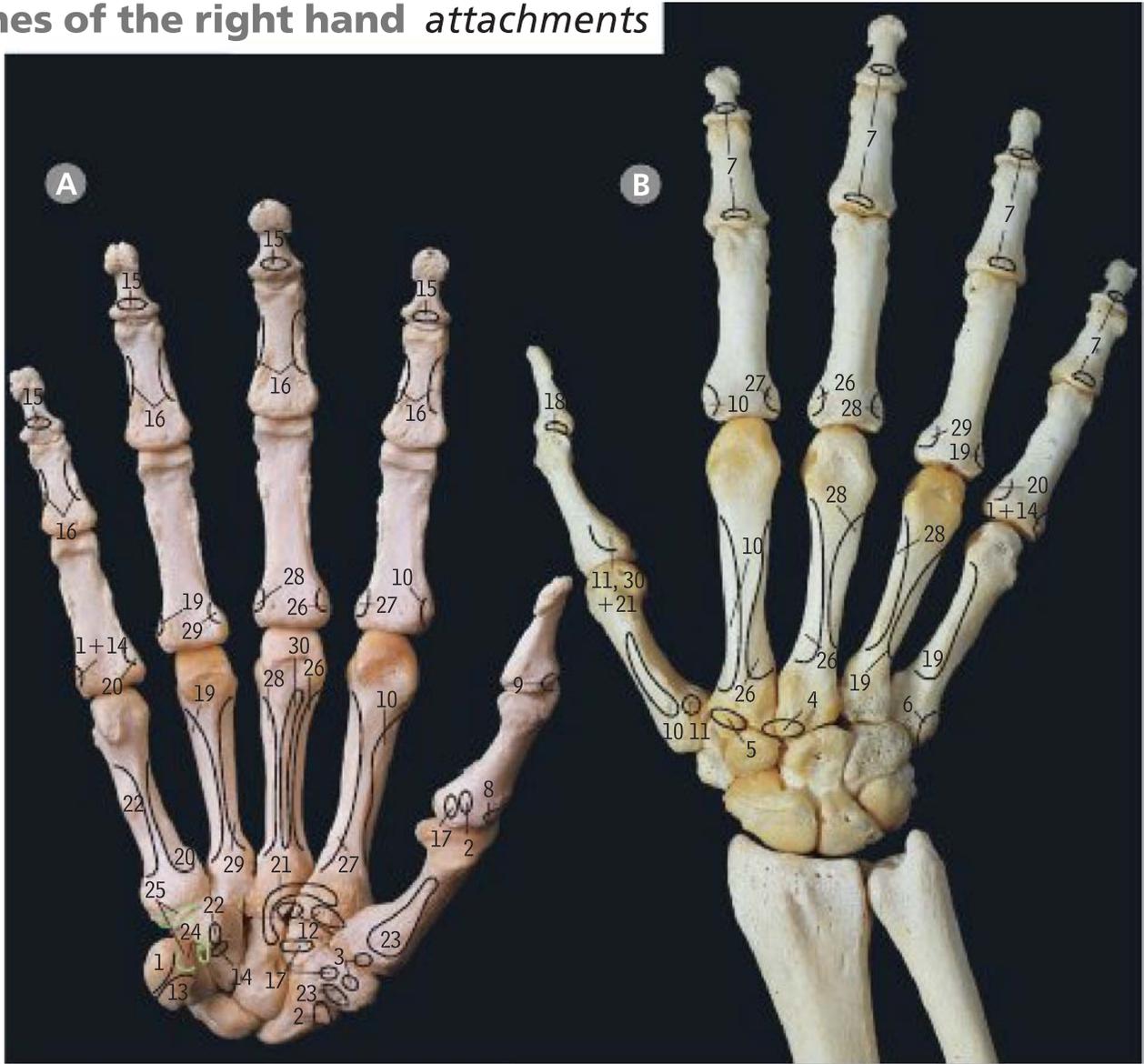


Dislocation of the finger



Smith's fracture

Bones of the right hand attachments



palmar surface

dorsal surface

Pale green lines, ligament attachments

- | | |
|-----------------------------------|---|
| 1 Abductor digiti minimi | 17 Flexor pollicis brevis |
| 2 Abductor pollicis brevis | 18 Flexor pollicis longus |
| 3 Abductor pollicis longus | 19 Fourth dorsal interosseous |
| 4 Extensor carpi radialis brevis | 20 Fourth palmar interosseous |
| 5 Extensor carpi radialis longus | 21 Oblique head of adductor pollicis |
| 6 Extensor carpi ulnaris | 22 Opponens digiti minimi |
| 7 Extensor expansion | 23 Opponens pollicis |
| 8 Extensor pollicis brevis | 24 Pisohamate ligament |
| 9 Extensor pollicis longus | 25 Pisometacarpal ligament |
| 10 First dorsal interosseous | 26 Second dorsal interosseous |
| 11 First palmar interosseous | 27 Second palmar interosseous |
| 12 Flexor carpi radialis | 28 Third dorsal interosseous |
| 13 Flexor carpi ulnaris | 29 Third palmar interosseous |
| 14 Flexor digiti minimi brevis | 30 Transverse head of adductor pollicis |
| 15 Flexor digitorum profundus | |
| 16 Flexor digitorum superficialis | |

The metacarpophalangeal joints are the joints between the heads of the metacarpals and the bases of the proximal phalanges.

The interphalangeal joints are the joints between the head of one phalanx and the base of the adjoining phalanx.

The pisiform is a sesamoid bone in the tendon of flexor carpi ulnaris and is anchored by the pisohamate and pisometacarpal ligaments (24 and 25).

Dorsal interossei arise from the sides of two adjacent metacarpal bones (as at 26, from the sides of the second and third metacarpals); palmar interossei arise only from the metacarpal of their own finger (as at 27, from the second metacarpal). Compare with dissection B on page 176 and note that when looking at the palm, parts of the dorsal interossei can be seen as well as the palmar interossei, but when looking at the dorsum of the hand (as on page 176) only dorsal interossei are seen.

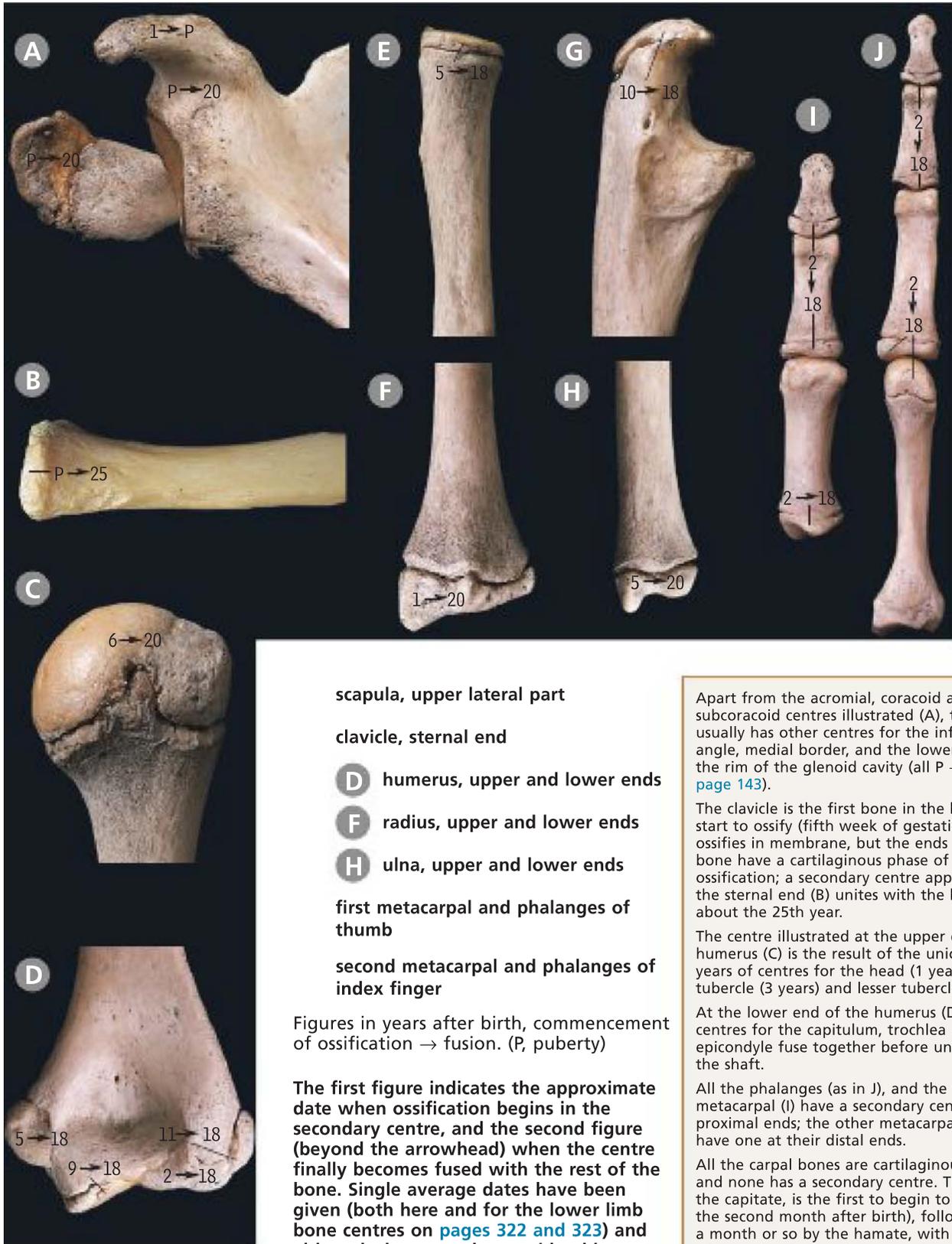


Digital development abnormality



Fractured hamate

Right upper limb bones *secondary centres of ossification*



scapula, upper lateral part

clavicle, sternal end

D humerus, upper and lower ends

F radius, upper and lower ends

H ulna, upper and lower ends

first metacarpal and phalanges of thumb

second metacarpal and phalanges of index finger

Figures in years after birth, commencement of ossification → fusion. (P, puberty)

The first figure indicates the approximate date when ossification begins in the secondary centre, and the second figure (beyond the arrowhead) when the centre finally becomes fused with the rest of the bone. Single average dates have been given (both here and for the lower limb bone centres on [pages 322 and 323](#)) and although there may be considerable individual variations, the 'growing end' of the bone (when fusion occurs last) is constant. The dates in females are often a year or more earlier than in males.

Apart from the acromial, coracoid and subcoracoid centres illustrated (A), the scapula usually has other centres for the inferior angle, medial border, and the lower part of the rim of the glenoid cavity (all P → 20; see [page 143](#)).

The clavicle is the first bone in the body to start to ossify (fifth week of gestation). It ossifies in membrane, but the ends of the bone have a cartilaginous phase of ossification; a secondary centre appearing at the sternal end (B) unites with the body at about the 25th year.

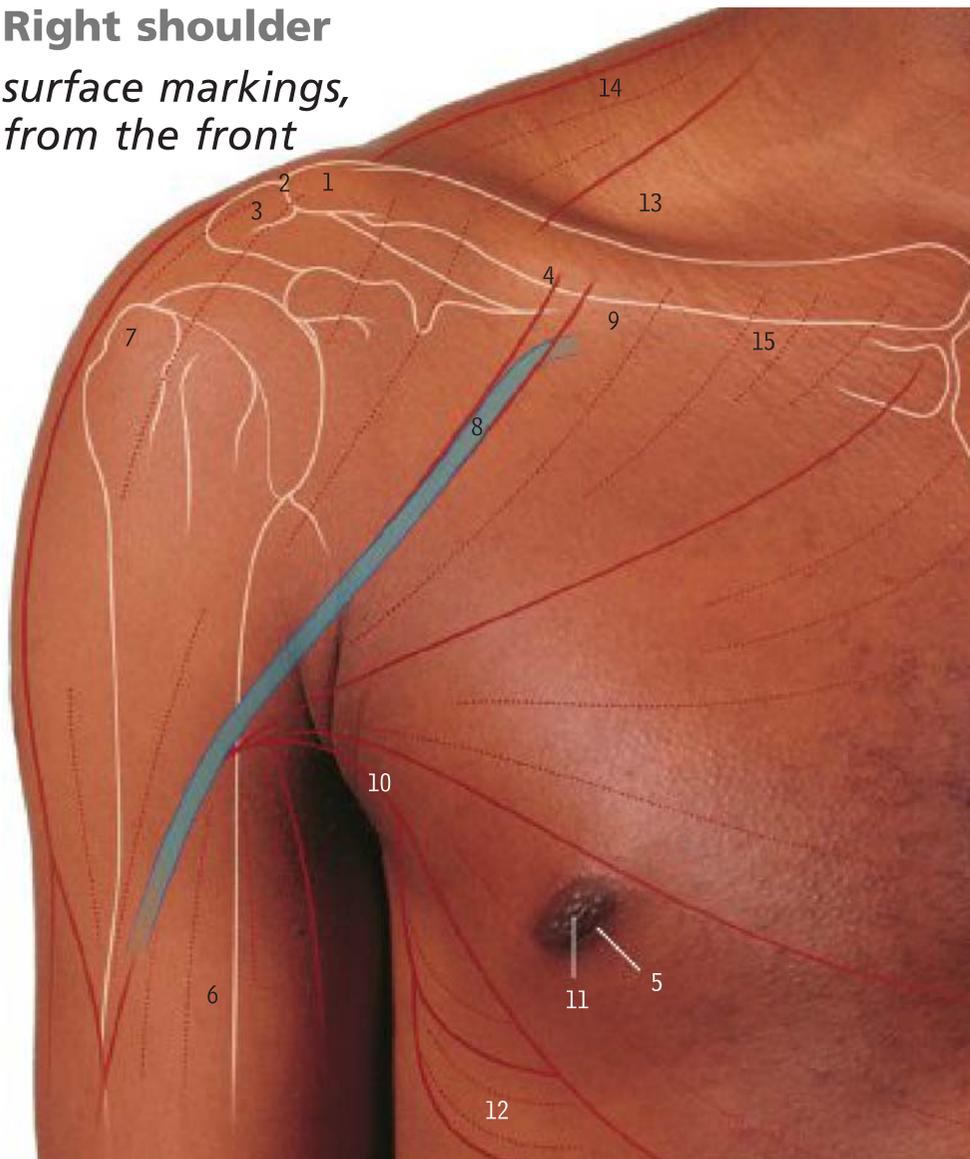
The centre illustrated at the upper end of the humerus (C) is the result of the union at 6 years of centres for the head (1 year), greater tubercle (3 years) and lesser tubercle (5 years).

At the lower end of the humerus (D) the centres for the capitulum, trochlea and lateral epicondyle fuse together before uniting with the shaft.

All the phalanges (as in J), and the first metacarpal (I) have a secondary centre at their proximal ends; the other metacarpals (as in J) have one at their distal ends.

All the carpal bones are cartilaginous at birth and none has a secondary centre. The largest, the capitate, is the first to begin to ossify (in the second month after birth), followed in a month or so by the hamate, with the triquetrum at 3 years, lunate at 4 years, scaphoid, trapezoid and trapezium at 5 years and the pisiform last at 9 years or later. There are often variations in the above common pattern.

Right shoulder surface markings, from the front



- 1 Acromial end of clavicle
- 2 Acromioclavicular joint
- 3 Acromion
- 4 Anterior margin of deltoid
- 5 Areola
- 6 Biceps
- 7 Deltoid overlying greater tubercle of humerus
- 8 Deltopectoral groove and cephalic vein
- 9 Infraclavicular fossa
- 10 Lower margin of pectoralis major
- 11 Nipple
- 12 Serratus anterior
- 13 Supraclavicular fossa
- 14 Trapezius
- 15 Upper margin of pectoralis major

The nipple in the male (11) normally lies at the level of the fourth intercostal space.

The lower border of pectoralis major (10) forms the anterior axillary fold.

Note that the most lateral bony point in the shoulder is the greater tubercle (7).

The clavicle is subcutaneous throughout its length. Its acromial end (1) at the acromioclavicular joint (2) lies at a slightly higher level than the acromion of the scapula (3). At the most lateral part of the shoulder, the deltoid overlies the humerus; the acromion of the scapula does not extend so far laterally. Compare the positions of the features noted here with the dissection on the next page.

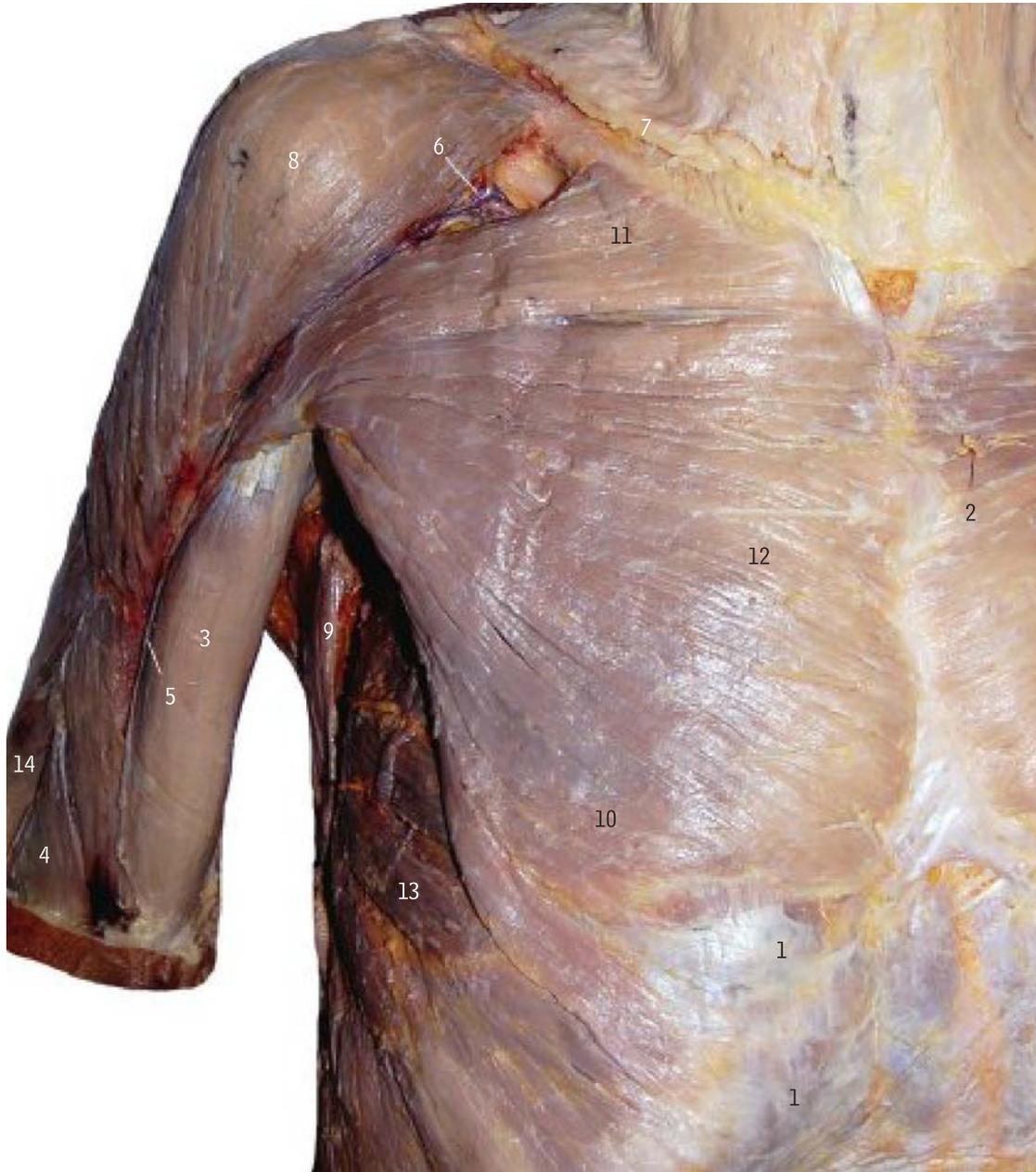


Dislocation of humerus



Sternoclavicular dislocation

Right shoulder *superficial dissection*



Removal of skin and fascia displays the anterior musculature of the shoulder and thoracic wall.

- | | |
|---|---|
| 1 Anterior layer of rectus sheath | 8 Deltoid muscle |
| 2 Anterior perforating branches of intercostal neurovascular bundle | 9 Latissimus dorsi muscle |
| 3 Biceps brachii muscle (long head) | 10 Pectoralis major muscle, abdominal head |
| 4 Brachioradialis muscle | 11 Pectoralis major muscle, clavicular head |
| 5 Cephalic vein | 12 Pectoralis major muscle, sternal head |
| 6 Cephalic vein in deltopectoral groove | 13 Serratus anterior muscle |
| 7 Clavicle | 14 Triceps brachii muscle (lateral head) |



Intraosseous vascular access

Right shoulder superficial dissection, from the front

Removal of skin and fascia displays branches of the supraclavicular nerve (6) crossing the clavicle (9), and the cephalic vein (7) lying in the deltopectoral groove between deltoid (13) and pectoralis major (11).



- 1 A superficial venous plexus
- 2 Accessory nerve
- 3 Acromial end of clavicle
- 4 Acromioclavicular joint
- 5 Acromion of scapula
- 6 Branches of supraclavicular nerves
- 7 Cephalic vein
- 8 Cervical nerve to trapezius
- 9 Clavicle
- 10 Clavicular head of sternocleidomastoid
- 11 Clavicular part of pectoralis major
- 12 Clavipectoral fascia
- 13 Deltoid
- 14 Sternal head of sternocleidomastoid
- 15 Sternocostal part of pectoralis major
- 16 Trapezius

The position of the acromioclavicular joint (4) is indicated by the small 'step down' between the acromial end of the clavicle (3) and the acromion (5); compare with the surface feature 2 on [page 132](#). This is the normal appearance; when the joint is dislocated, with the acromion being forced below the end of the clavicle, the 'step' is much exaggerated.

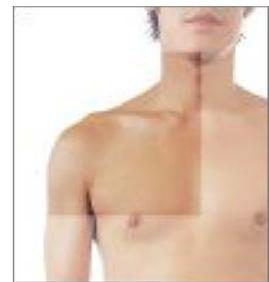
The cephalic vein (7) runs in the deltopectoral groove between deltoid (13) and pectoralis major (11) and pierces the clavipectoral fascia (12) to drain into the axillary vein.

Right shoulder deeper dissection, from the front



- 1 Anterior circumflex humeral artery and musculocutaneous nerve
- 2 Axillary lymph nodes (enlarged)
- 3 Axillary vein
- 4 Branches of medial pectoral nerve
- 5 Branches of lateral pectoral nerve
- 6 Cephalic vein
- 7 Clavicle
- 8 Coracobrachialis
- 9 Coracoid process and acromial branch of thoracoacromial artery
- 10 Deltoid
- 11 First rib
- 12 Inferior belly of omohyoid (displaced upwards)
- 13 Intercostobrachial nerve
- 14 Internal jugular vein
- 15 Lateral thoracic artery
- 16 Long thoracic nerve (to serratus anterior)
- 17 Median nerve
- 18 Nerve to sternothyroid
- 19 Pectoral branch of thoracoacromial artery
- 20 Pectoralis major
- 21 Pectoralis minor
- 22 Phrenic nerve overlying scalenus anterior
- 23 Scalenus medius
- 24 Short head of biceps
- 25 Sternohyoid
- 26 Sternothyroid
- 27 Subclavian vein
- 28 Subclavius
- 29 Subscapularis
- 30 Suprascapular nerve
- 31 Tendon of long head of biceps
- 32 Trapezius
- 33 Trunks of brachial plexus

Most of deltoid (10) and pectoralis major (20) have been removed to show the underlying pectoralis minor (21) and its associated vessels and nerves. The clavipectoral fascia which passes between the clavicle (7) and the upper (medial) border of the pectoralis minor (21) has also been removed to show the axillary vein (3) receiving the cephalic vein (6) and continuing as the subclavian vein (27) as it crosses the first rib (11).



Shoulder arthroscopy



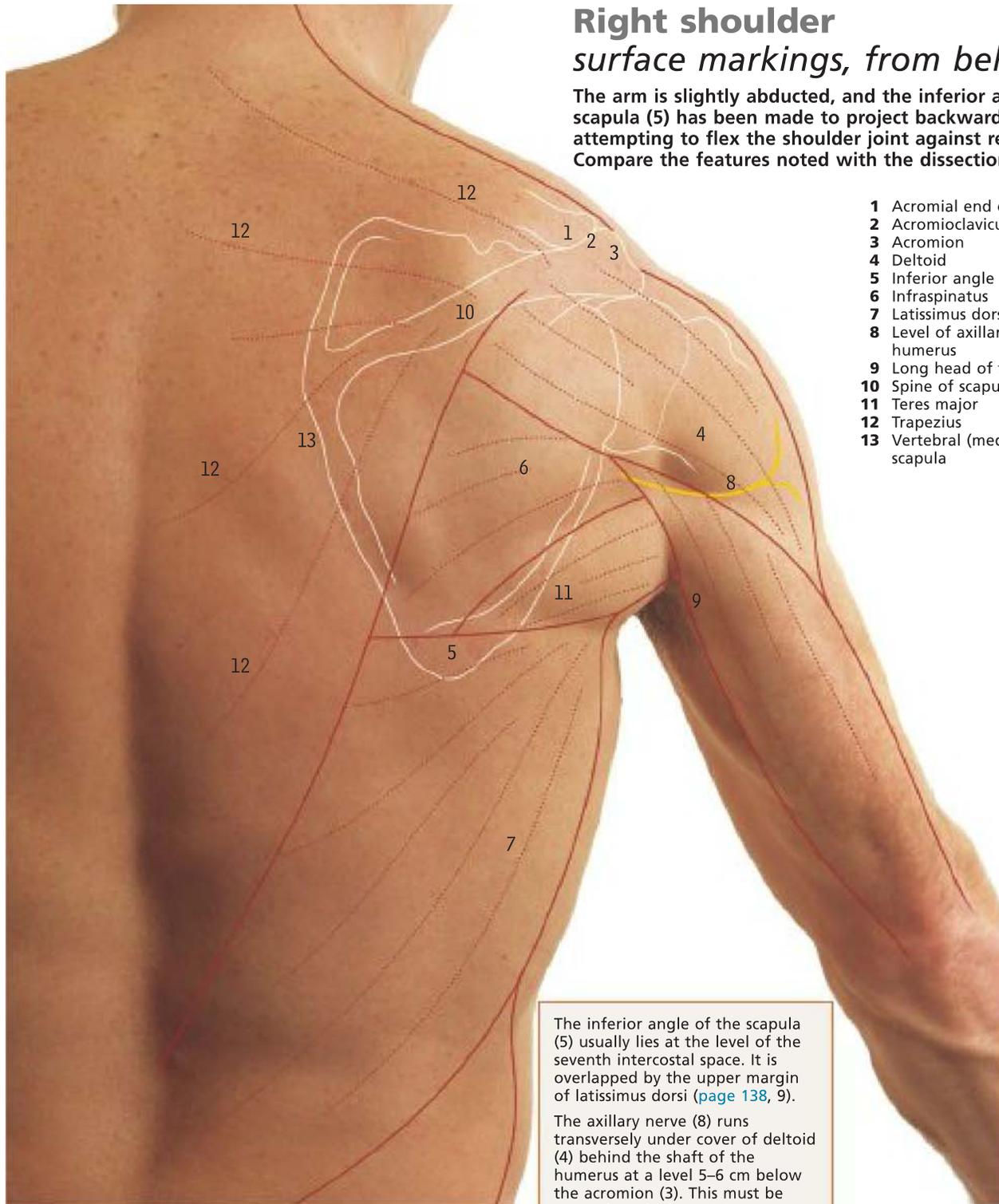
This shows the arthroscopic view of the right shoulder seen from behind. The supraspinatus tendon and the long head of biceps is in pristine condition. The anterior edge of the glenoid labrum shows some wear.



Klumpke's paralysis

Right shoulder surface markings, from behind

The arm is slightly abducted, and the inferior angle of the scapula (5) has been made to project backwards by attempting to flex the shoulder joint against resistance. Compare the features noted with the dissection opposite.



- 1 Acromial end of clavicle
- 2 Acromioclavicular joint
- 3 Acromion
- 4 Deltoid
- 5 Inferior angle of scapula
- 6 Infraspinatus
- 7 Latissimus dorsi
- 8 Level of axillary nerve behind humerus
- 9 Long head of triceps
- 10 Spine of scapula
- 11 Teres major
- 12 Trapezius
- 13 Vertebral (medial) border of scapula

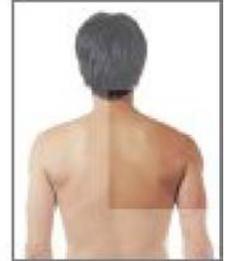
The inferior angle of the scapula (5) usually lies at the level of the seventh intercostal space. It is overlapped by the upper margin of latissimus dorsi (page 138, 9).

The axillary nerve (8) runs transversely under cover of deltoid (4) behind the shaft of the humerus at a level 5–6 cm below the acromion (3). This must be remembered when giving intramuscular injections into the deltoid.

Latissimus dorsi (7; page 138, 7) and teres major (11; page 138, 16) form the lower boundary of the posterior wall of the axilla.

Right shoulder *superficial dissection, from behind*

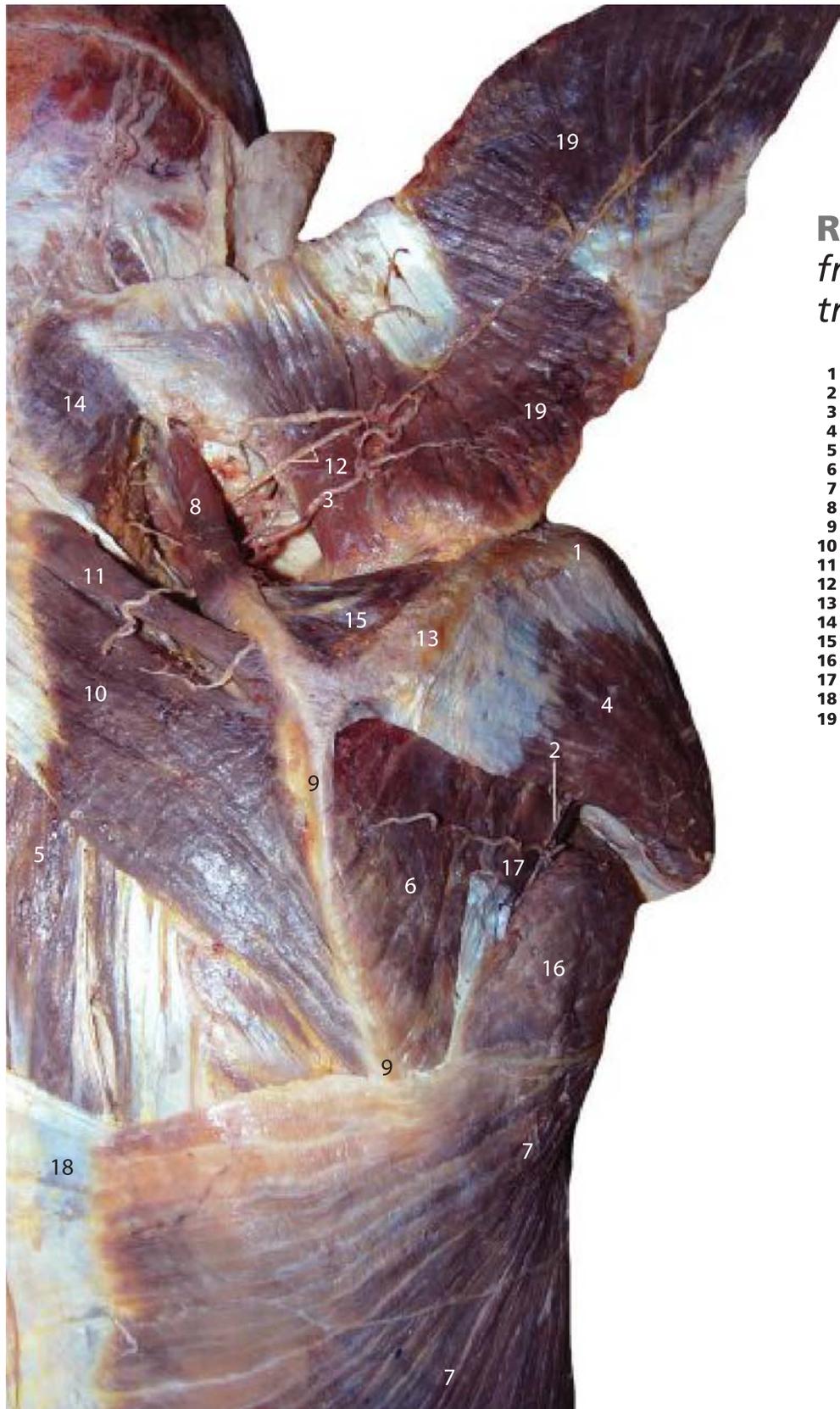
The triangle of auscultation (12) is bounded by the trapezius, latissimus dorsi and the medial border of the scapula; its floor is partly formed by rhomboid major. If the arms are brought forwards, the sixth intercostal space becomes available for auscultation.



- 1 Acromion
- 2 Branches of circumflex scapular artery
- 3 Deltoid muscle
- 4 Infraspinatus fascia
- 5 Lateral cutaneous branches of dorsal rami of thoracic nerves
- 6 Latissimus dorsi muscle
- 7 Long head of triceps brachii muscle
- 8 Posterior cutaneous nerve to the arm
- 9 Teres major muscle
- 10 Teres minor muscle
- 11 Trapezius muscle
- 12 Triangle of auscultation

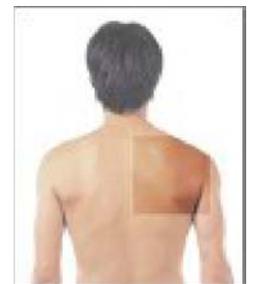


Intramuscular injection – deltoid



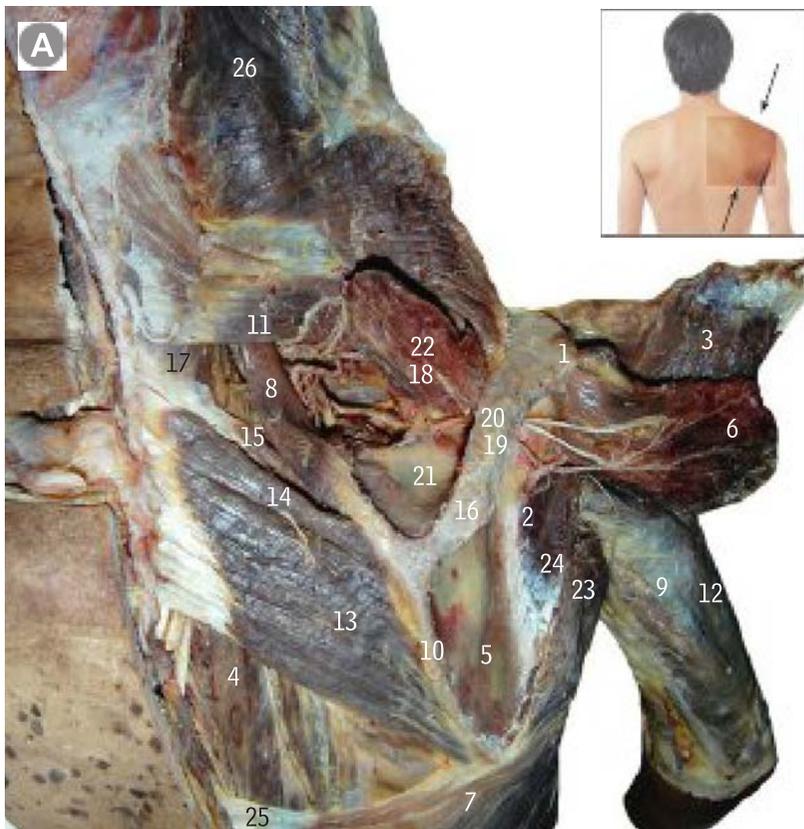
Right shoulder
from behind,
trapezius reflected

- 1 Acromion
- 2 Branches of circumflex scapular artery
- 3 Deep branch of transverse cervical artery
- 4 Deltoid muscle
- 5 Erector spinae muscle
- 6 Infraspinatus muscle
- 7 Latissimus dorsi muscle
- 8 Levator scapulae muscle
- 9 Medial border of scapula
- 10 Rhomboid major muscle
- 11 Rhomboid minor muscle
- 12 Spinal accessory nerve
- 13 Spine of scapula
- 14 Splenius capitis muscle
- 15 Supraspinatus muscle
- 16 Teres major muscle
- 17 Teres minor muscle
- 18 Thoracic part of thoracolumbar fascia
- 19 Trapezius muscle (cut and reflected)



Shoulder joint
injection

Right shoulder *from above and behind*



- 1 Acromion
- 2 Branches of circumflex scapular artery anastomosing with suprascapular artery
- 3 Deltoid muscle (cut and reflected)
- 4 Erector spinae muscle
- 5 Infraspinous fossa
- 6 Infraspinatus muscle (cut and reflected)
- 7 Latissimus dorsi muscle
- 8 Levator scapulae muscle
- 9 Long head of triceps brachii muscle
- 10 Medial border of scapula
- 11 Omohyoid muscle
- 12 Posterior cutaneous nerve to the arm
- 13 Rhomboid major muscle
- 14 Rhomboid minor muscle
- 15 Serratus posterior superior muscle
- 16 Spine of the scapula
- 17 Splenius capitis muscle
- 18 Superior transverse scapular ligament
- 19 Suprascapular artery
- 20 Suprascapular nerve
- 21 Supraspinous fossa
- 22 Supraspinatus muscle (cut and reflected)
- 23 Teres major muscle
- 24 Teres minor muscle
- 25 Thoracic part of thoracolumbar fascia
- 26 Trapezius muscle (cut and reflected)

Right shoulder and upper arm *from the right*

Deltoid (7) extends over the tip of the shoulder to its attachment halfway down the lateral side of the shaft of the humerus. Biceps brachii (3) is on the front of the arm below pectoralis major (8) and triceps (11 and 12) is at the back.

- | | |
|--------------------|--|
| 1 Acromion | 9 Radial nerve |
| 2 Anconeus | 10 Radial nerve, posterior cutaneous branch to the forearm |
| 3 Biceps brachii | 11 Triceps, lateral head |
| 4 Brachialis | 12 Triceps, long head |
| 5 Brachioradialis | 13 Triceps, tendon |
| 6 Cephalic vein | |
| 7 Deltoid | |
| 8 Pectoralis major | |



Posterior dislocation of the shoulder

Right shoulder *deep dissection of scapular region*



- | | |
|---|--|
| 1 Acromion | 11 Rhomboid major muscle |
| 2 Branches of circumflex scapular artery | 12 Rhomboid minor muscle |
| 3 Deltoid muscle (cut and reflected) | 13 Suprascapular artery |
| 4 Erector spinae muscle | 14 Suprascapular nerve |
| 5 Infraspinatus muscle (cut and reflected) | 15 Supraspinatus muscle (cut and reflected) |
| 6 Latissimus dorsi muscle | 16 Teres major muscle |
| 7 Levator scapulae muscle | 17 Teres minor muscle |
| 8 Long head of triceps brachii muscle | 18 Thoracic part of thoracolumbar fascia |
| 9 Medial border of scapula | 19 Trapezius muscle (cut and reflected) |
| 10 Posterior cutaneous nerve to the arm | |

Right shoulder deep dissection of scapular region as seen from above and behind



- | | |
|--|--|
| 1 Acromion | 12 Rhomboid minor muscle |
| 2 Branches of circumflex scapular artery anastomosing with suprascapular artery | 13 Serratus posterior superior muscle |
| 3 Deltoid muscle (cut and reflected) | 14 Spine of the scapula |
| 4 Erector spinae muscle | 15 Splenius capitis muscle |
| 5 Infraspinous fossa | 16 Superior transverse scapular ligament |
| 6 Infraspinatus muscle (cut and reflected) | 17 Suprascapular artery |
| 7 Latissimus dorsi muscle | 18 Suprascapular nerve |
| 8 Levator scapulae muscle | 19 Suprascapular fossa |
| 9 Medial border of scapula | 20 Supraspinatus muscle (cut and reflected) |
| 10 Omohyoid muscle | 21 Teres major muscle |
| 11 Rhomboid major muscle | 22 Teres minor muscle |
| | 23 Trapezius muscle (cut and reflected) |

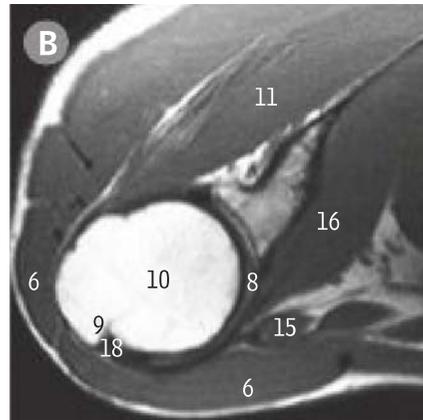
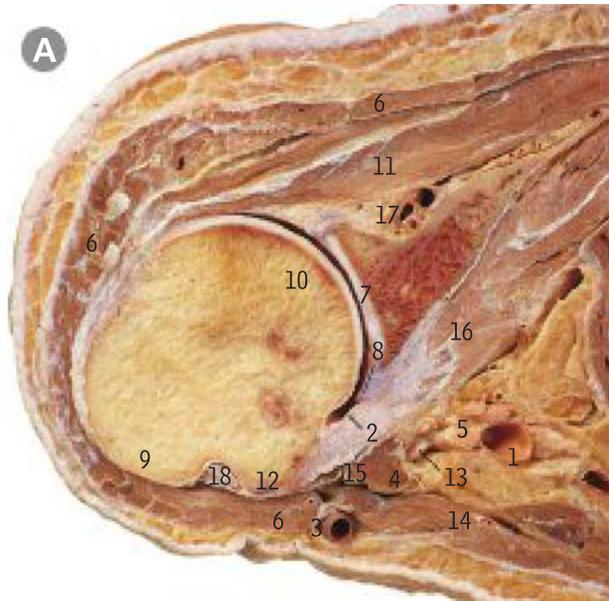


Scapular
arterial
anastomoses

Right shoulder joint

cross section

axial MR image



Viewed from below, this cadaveric section shows the articulation of the head of the humerus (10) with the glenoid cavity of the scapula (7). The tendon of the long head of biceps (18) lies in the groove between the greater and lesser tubercles of the humerus (9 and 12). Subscapularis tendon (16) passes immediately in front of the joint, and infraspinatus tendon (11) behind it. Compare the MR image in B with features in A.

Right shoulder joint from the front



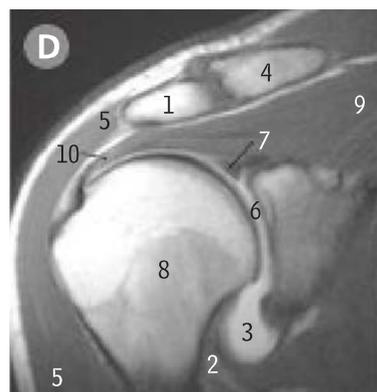
- | | |
|----------------------------|--|
| 1 Axillary artery | 12 Lesser tubercle |
| 2 Capsule | 13 Musculocutaneous nerve |
| 3 Cephalic vein | 14 Pectoralis major |
| 4 Coracobrachialis | 15 Short head of biceps |
| 5 Cords of brachial plexus | 16 Subscapularis |
| 6 Deltoid | 17 Suprascapular nerve and vessels |
| 7 Glenoid cavity | 18 Tendon of long head of biceps in intertubercular groove |
| 8 Glenoid labrum | |
| 9 Greater tubercle | |
| 10 Head of humerus | |
| 11 Infraspinatus | |



Shoulder coronal oblique MR arthrogram

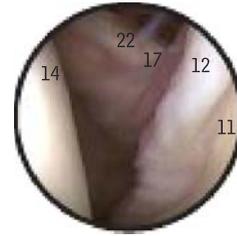
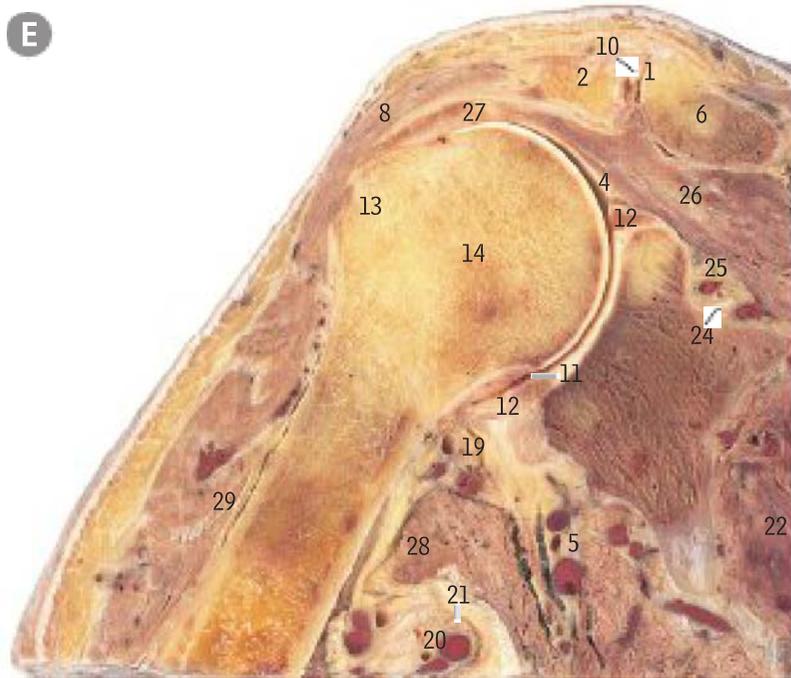
The synovial joint cavity inside the capsule (2) and the subacromial bursa (5) have been injected separately with green resin.

- 1 Acromioclavicular joint
- 2 Capsule of shoulder joint
- 3 Conoid ligament
- 4 Coracoacromial ligament
- 5 Subacromial bursa
- 6 Subscapularis bursa
- 7 Superior transverse scapular (suprascapular) ligament
- 8 Tendon of long head of biceps
- 9 Trapezoid ligament



- 1 Acromion
- 2 Axillary nerve and circumflex humeral vessels
- 3 Axillary recess of shoulder joint
- 4 Clavicle
- 5 Deltoid
- 6 Glenoid cavity
- 7 Glenoid labrum
- 8 Humerus
- 9 Supraspinatus muscle
- 10 Supraspinatus tendon

Shoulder dissection, coronal section



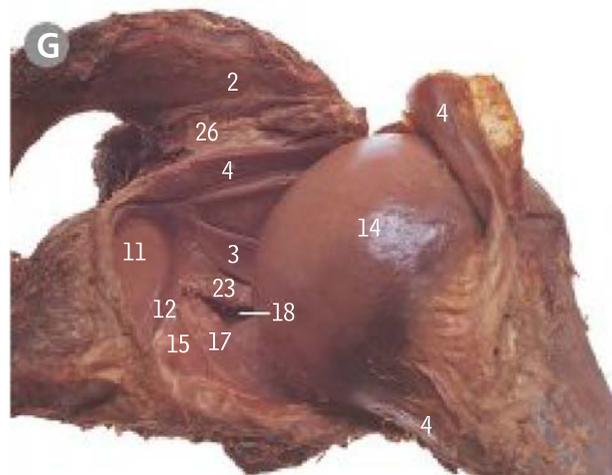
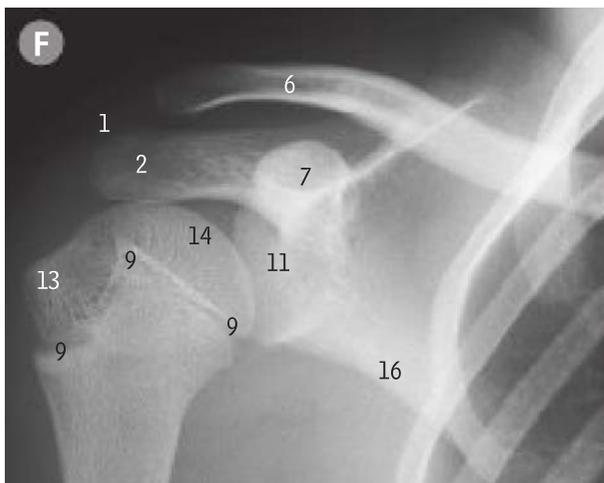
This is the first view of the shoulder on entering the joint from the posterior aspect with an arthroscope. The humeral head is on the left, the subscapularis tendon is in the middle and the glenoid and the surrounding labrum is on the right. The joint is slightly distracted with the aid of traction and also the fluid in the joint used in the arthroscopy.

Right shoulder joint opened from behind

In this view, after removing all the posterior part of the capsule, the inner surface of the front of the capsule (4) is seen, with its reinforcing glenohumeral ligaments (15, 17 and 23).

Shoulder radiograph

anteroposterior projection in a 9-year-old child



The joint cavity communicates with the subscapularis bursa through an opening between the superior and middle glenohumeral ligaments.

The tendon of the long head of biceps is continuous with the glenoid labrum.

- | | | | |
|-------------------------------|-----------------------------------|---|--------------------------|
| 1 Acromioclavicular joint | 10 Fibrocartilaginous disc | 18 Opening into subscapularis bursa | 24 Suprascapular nerve |
| 2 Acromion | 11 Glenoid cavity | 19 Posterior circumflex humeral vessels | 25 Suprascapular vessels |
| 3 Biceps, long head | 12 Glenoid labrum | 20 Profunda brachii vessels | 26 Supraspinatus |
| 4 Capsule | 13 Greater tubercle | 21 Radial nerve | 27 Supraspinatus tendon |
| 5 Circumflex scapular vessels | 14 Head of humerus | 22 Subscapularis | 28 Teres major |
| 6 Clavicle | 15 Inferior glenohumeral ligament | 23 Superior glenohumeral ligament | 29 Triceps, lateral head |
| 7 Coracoid process | 16 Lateral border of scapula | | |
| 8 Deltoid | 17 Middle glenohumeral ligament | | |
| 9 Epiphysial line (physis) | | | |



Bicipital tendinitis and rupture

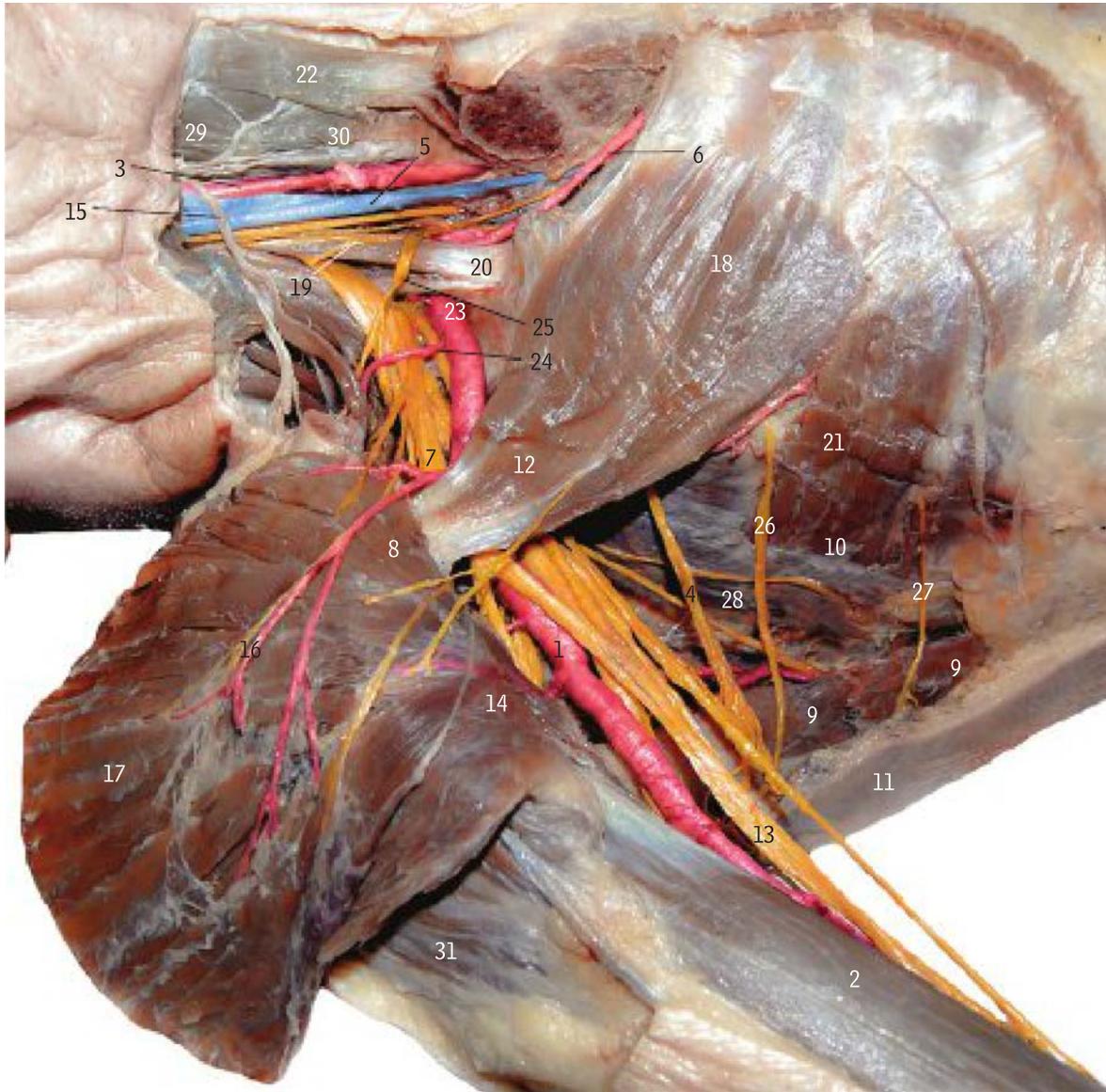


Calcific tendinitis

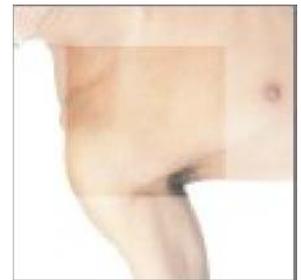


Painful arc syndrome/rotator cuff tear

Right axilla anterior chest wall



- | | |
|---|--|
| 1 Axillary artery | 17 Pectoralis major muscle (reflected) |
| 2 Biceps brachii muscle | 18 Pectoralis minor muscle |
| 3 Common carotid artery | 19 Phrenic nerve |
| 4 Intercostobrachial nerve | 20 Scalenus anterior muscle |
| 5 Internal jugular vein | 21 Serratus anterior muscle |
| 6 Internal thoracic artery | 22 Sternohyoid muscle |
| 7 Lateral cord of brachial plexus | 23 Subclavian artery |
| 8 Lateral pectoral artery | 24 Suprascapular artery |
| 9 Latissimus dorsi muscle | 25 Suprascapular nerve |
| 10 Long thoracic nerve | 26 T3 spinal nerve |
| 11 Medial cutaneous nerve to the forearm | 27 T4 spinal nerve |
| 12 Medial pectoral nerve | 28 Thoracodorsal nerve |
| 13 Median nerve | 29 Thyrohyoid muscle |
| 14 Musculocutaneous nerve | 30 Thyroid gland |
| 15 Omohyoid tendon | 31 Triceps brachii muscle |
| 16 Pectoral branch of thoracoacromial trunk | |



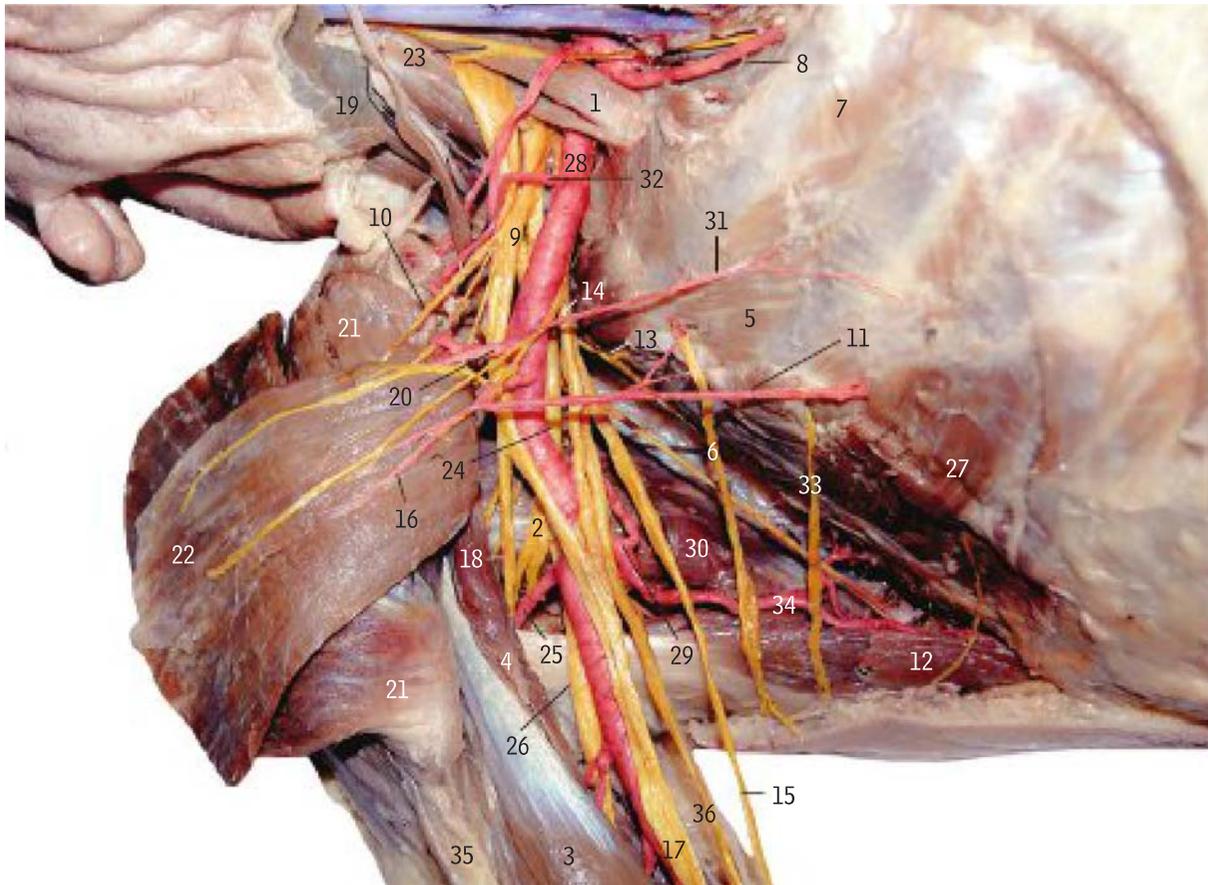
Axillary-subclavian vein thrombosis



Cervical rib



Right axilla and brachial plexus *from the front*



- | | |
|---|--|
| 1 Anterior scalene muscle | 19 Omohyoid muscle |
| 2 Axillary nerve | 20 Pectoral branch of thoracoacromial trunk |
| 3 Biceps brachii muscle | 21 Pectoralis major muscle (reflected) |
| 4 Coracobrachialis | 22 Pectoralis minor muscle (reflected) |
| 5 External intercostal muscle | 23 Phrenic nerve |
| 6 Intercostobrachial nerve | 24 Posterior cord of brachial plexus |
| 7 Internal intercostal muscle | 25 Posterior circumflex humeral artery |
| 8 Internal thoracic artery | 26 Radial nerve |
| 9 Lateral cord of brachial plexus | 27 Serratus anterior muscle |
| 10 Lateral pectoral nerve | 28 Subclavian artery |
| 11 Lateral thoracic artery | 29 Subscapular trunk |
| 12 Latissimus dorsi muscle | 30 Subscapularis muscle |
| 13 Long thoracic nerve | 31 Superior thoracic artery |
| 14 Medial cord of brachial plexus | 32 Suprascapular artery |
| 15 Medial cutaneous nerve of the forearm | 33 T3 spinal nerve |
| 16 Medial pectoral artery | 34 Thoracodorsal artery |
| 17 Median nerve | 35 Triceps brachii muscle |
| 18 Musculocutaneous nerve | 36 Ulnar nerve |

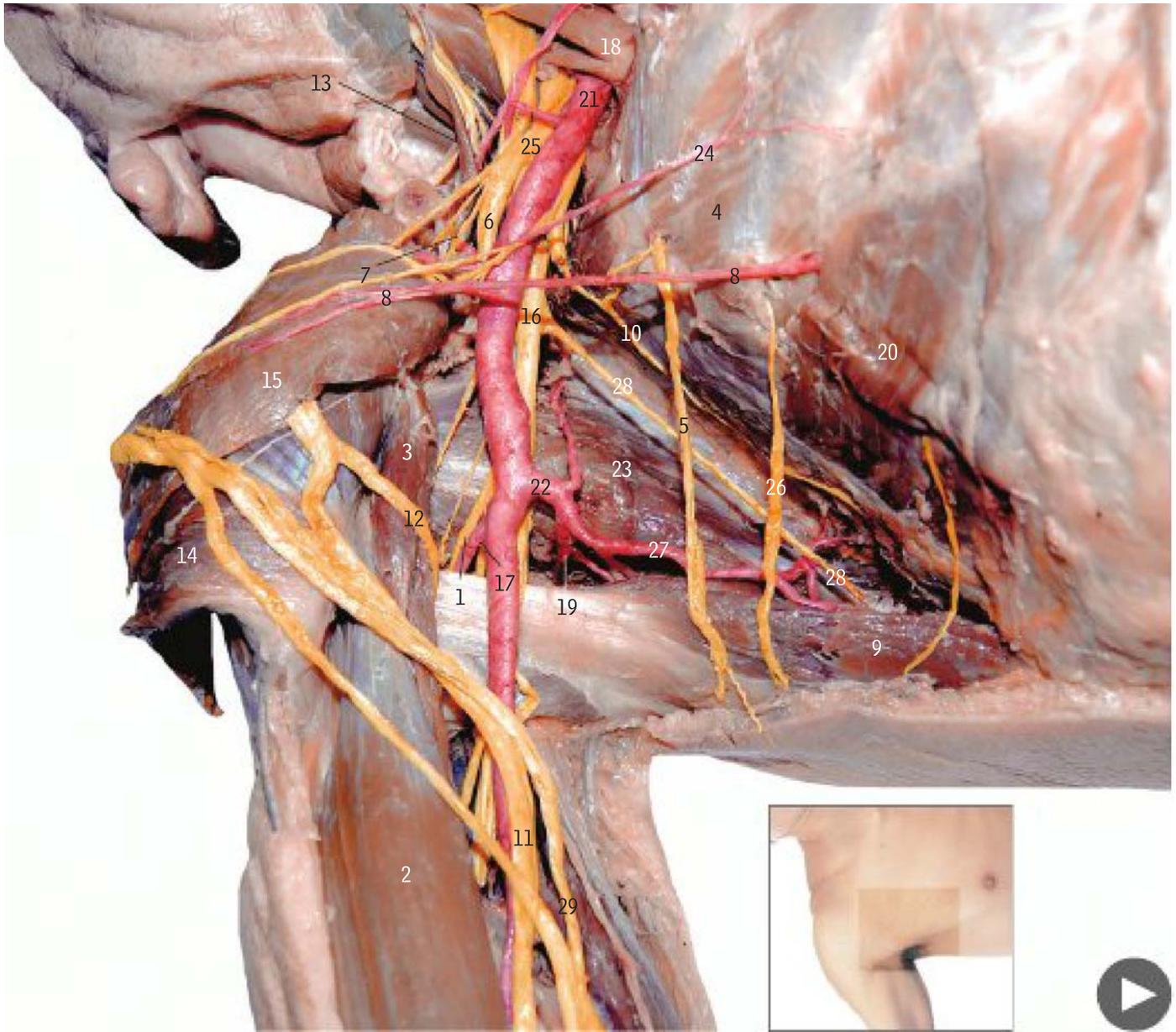


Erb's palsy



Winging of the scapula

Right brachial plexus removed to reveal arterial branches



- | | | | |
|--|---|---|--------------------------------|
| 1 Axillary nerve | 11 Median nerve | 17 Posterior circumflex humeral artery | 26 T3 spinal nerve |
| 2 Biceps brachii muscle | 12 Musculocutaneous nerve | 18 Scalenus anterior muscle | 27 Thoracodorsal artery |
| 3 Coracobrachialis muscle | 13 Omohyoid muscle (inferior belly) | 19 Scapular circumflex artery | 28 Thoracodorsal nerve |
| 4 External intercostal muscle | 14 Pectoralis major muscle (reflected) | 20 Serratus anterior muscle | 29 Ulnar nerve |
| 5 Intercostobrachial nerve | 15 Pectoralis minor muscle (reflected) | 21 Subclavian artery | |
| 6 Lateral cord of brachial plexus | 16 Posterior cord of brachial plexus | 22 Subscapular trunk | |
| 7 Lateral pectoral nerve | | 23 Subscapularis muscle | |
| 8 Lateral thoracic artery | | 24 Superior thoracic artery | |
| 9 Latissimus dorsi muscle | | 25 Suprascapular artery | |
| 10 Long thoracic nerve | | | |



Axillary artery aneurysm



Vascular abnormalities

Right brachial plexus and axilla



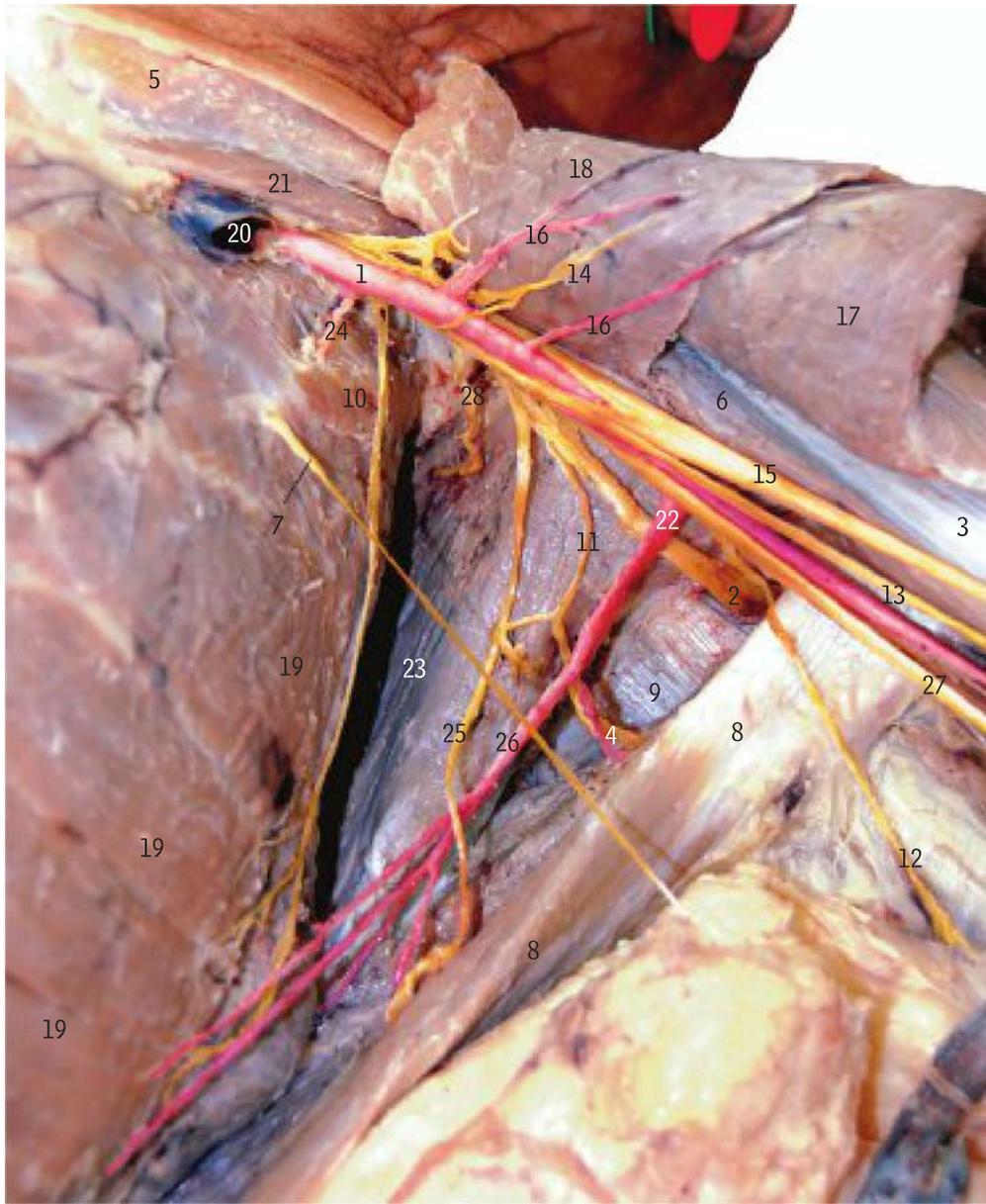
- | | | |
|---|---|--|
| 1 1 st part of axillary artery | 15 Latissimus dorsi | 29 Sternocleidomastoid muscle (reflected) |
| 2 3 rd part of the axillary artery | 16 Long thoracic nerve | 30 Sternohyoid |
| 3 Ansa cervicalis | 17 Lower subscapular nerve | 31 Sternothyroid |
| 4 Anterior circumflex humeral artery | 18 Medial cutaneous nerve of the forearm | 32 Subclavius muscle (reflected) |
| 5 Axillary nerve | 19 Muscular pectoral nerves | 33 Subscapular artery |
| 6 Biceps brachii (short head) | 20 Median nerve (retracted medially) | 34 Subscapularis muscle |
| 7 Circumflex scapular artery | 21 Middle trunk of brachial plexus | 35 Superior belly of omohyoid |
| 8 Coracobrachialis muscle | 22 Muscular arterial branch to serratus anterior | 36 Superior trunk of brachial plexus |
| 9 Cut edge of the clavicle | 23 Musculocutaneous nerve | 37 Suprascapular artery (variation) |
| 10 Deltoid muscle | 24 Pectoralis minor | 38 Thoracodorsal artery |
| 11 Inferior trunk of brachial plexus (Erb's point) | 25 Posterior circumflex humeral artery | 39 Thoracodorsal nerve |
| 12 Internal jugular node | 26 Radial nerve | 40 Thyrocervical trunk |
| 13 Internal jugular vein | 27 Serratus anterior | 41 Transverse cervical artery |
| 14 Lateral thoracic artery | 28 Spinal accessory nerve | 42 Ulnar nerve |
| | | 43 Upper subscapular nerve |

Right brachial plexus and axillary vessels *pectoralis muscles retracted*



- | | | |
|---|---|--|
| 1 1 st part of axillary artery | 17 Internal jugular vein | 33 Spinal accessory nerve |
| 2 2 nd part of axillary artery | 18 Jugulodigastric lymph node | 34 Sternocleidomastoid muscle (reflected) |
| 3 3 rd part of the axillary artery | 19 Lateral thoracic artery | 35 Sternohyoid muscle |
| 4 Acromial branch of thoracoacromial artery | 20 Latissimus dorsi | 36 Sternothyroid muscle |
| 5 Ansa cervicalis | 21 Long thoracic nerve | 37 Subscapular artery |
| 6 Anterior circumflex humeral artery | 22 Lower subscapular nerve | 38 Subscapularis |
| 7 Axillary nerve | 23 Medial cutaneous nerve of the forearm | 39 Superior belly of omohyoid |
| 8 Biceps brachii (short head) | 24 Medial pectoral nerves (detached) | 40 Superior trunk of brachial plexus |
| 9 Circumflex scapular artery | 25 Median nerve (reflected medially) | 41 Suprascapular artery (variation) |
| 10 Common carotid artery | 26 Middle trunk of brachial plexus | 42 Thoracodorsal artery |
| 11 Coracobrachialis muscle | 27 Muscular arterial branch to serratus anterior | 43 Thoracodorsal nerve |
| 12 Cut edge of the clavicle | 28 Musculocutaneous nerve | 44 Thyrocervical trunk |
| 13 Deltoid muscle | 29 Pectoralis minor (reflected) | 45 Transverse cervical artery |
| 14 First rib | 30 Posterior circumflex humeral artery | 46 Ulnar nerve |
| 15 Inferior trunk of brachial plexus (Erb's point) | 31 Radial nerve | 47 Upper subscapular nerve |
| 16 Internal jugular lymph node | 32 Serratus anterior | |

Left brachial plexus and branches *anteroinferior aspect*



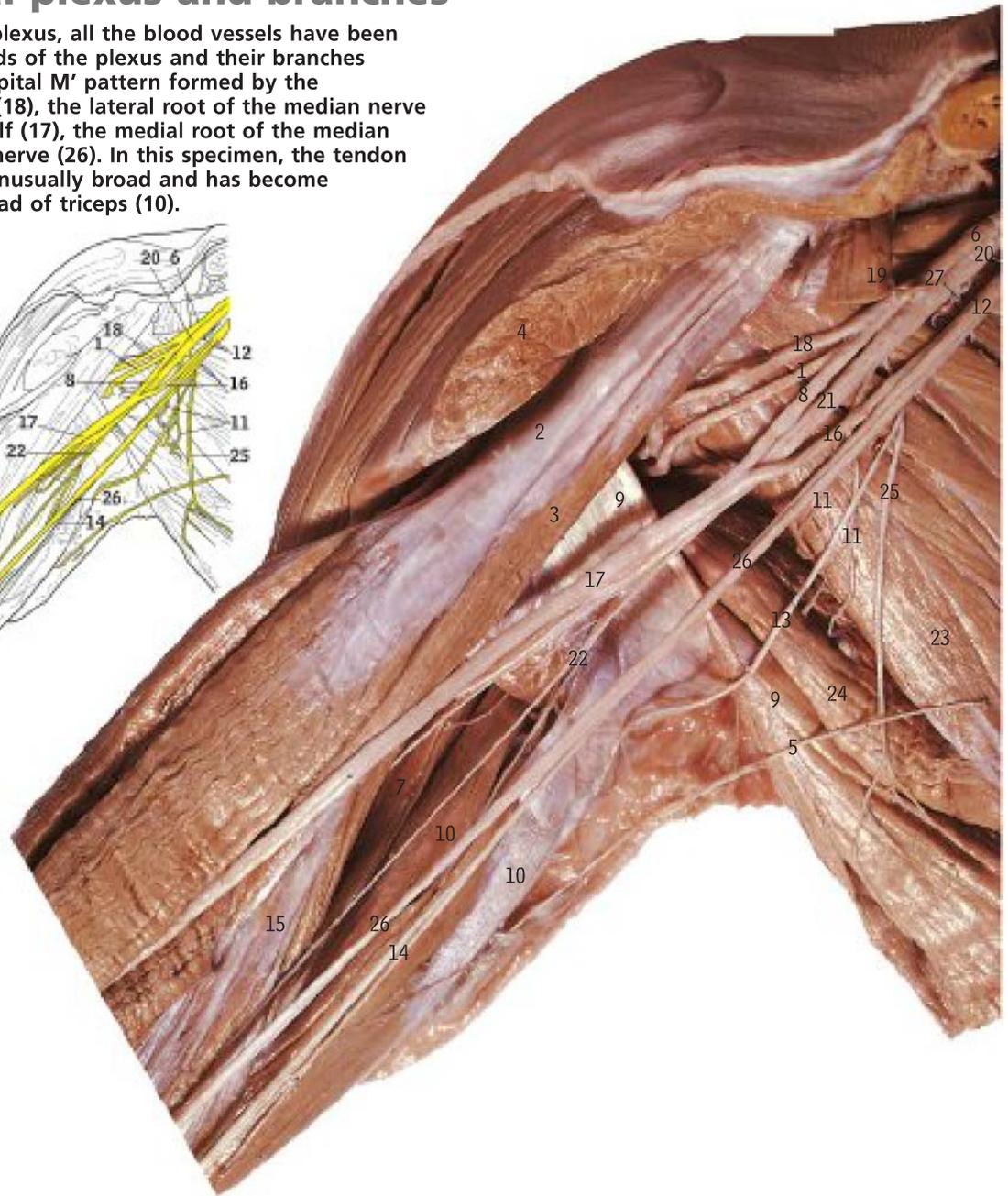
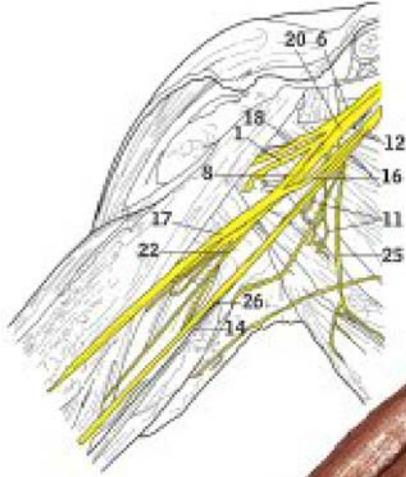
- | | |
|--|--|
| 1 Axillary artery | 15 Median nerve |
| 2 Axillary nerve (passing through the quadrangular space) | 16 Pectoral arteries |
| 3 Biceps brachii muscle | 17 Pectoralis major muscle (reflected) |
| 4 Circumflex scapular artery | 18 Pectoralis minor muscle (reflected) |
| 5 Clavicle | 19 Serratus anterior muscle |
| 6 Coracobrachialis muscle | 20 Subclavian vein (cut) |
| 7 Intercostobrachial nerve | 21 Subclavius muscle |
| 8 Latissimus dorsi muscle | 22 Subscapular trunk |
| 9 Long head of triceps brachii muscle | 23 Subscapularis muscle |
| 10 Long thoracic nerve | 24 Superior thoracic artery |
| 11 Lower subscapular nerve | 25 Thoracodorsal (middle subscapular) nerve |
| 12 Medial cutaneous nerve of the arm | 26 Thoracodorsal artery |
| 13 Medial cutaneous nerve of the forearm | 27 Ulnar nerve |
| 14 Medial pectoral nerve | 28 Upper subscapular nerve |



Brachial plexus block

Right brachial plexus and branches

In this front view of the plexus, all the blood vessels have been removed to show the cords of the plexus and their branches more clearly. Note the 'capital M' pattern formed by the musculocutaneous nerve (18), the lateral root of the median nerve (8), the median nerve itself (17), the medial root of the median nerve (16) and the ulnar nerve (26). In this specimen, the tendon of latissimus dorsi (9) is unusually broad and has become blended with the long head of triceps (10).



Posterior dislocation of the shoulder

- | | |
|---|---|
| 1 Axillary nerve | 15 Medial head of triceps |
| 2 Biceps | 16 Medial root of median nerve |
| 3 Coracobrachialis | 17 Median nerve |
| 4 Deltoid | 18 Musculocutaneous nerve |
| 5 Intercostobrachial nerve | 19 Pectoralis minor and lateral pectoral nerve |
| 6 Lateral cord | 20 Posterior cord |
| 7 Lateral head of triceps | 21 Radial nerve |
| 8 Lateral root of median nerve | 22 Radial nerve branches to triceps |
| 9 Latissimus dorsi | 23 Subscapularis |
| 10 Long head of triceps | 24 Teres major |
| 11 Lower subscapular nerves | 25 Thoracodorsal nerve |
| 12 Medial cord | 26 Ulnar nerve |
| 13 Medial cutaneous nerve of arm | 27 Upper subscapular nerves |
| 14 Medial cutaneous nerve of forearm | |

Right arm vessels and nerves, from the front

Biceps (16 and 8) has been turned laterally to show the musculocutaneous nerve (12) emerging from coracobrachialis (6), giving branches to biceps and brachialis (14 and 13) and becoming the lateral cutaneous nerve of the forearm (7) on the lateral side of the biceps tendon (17).

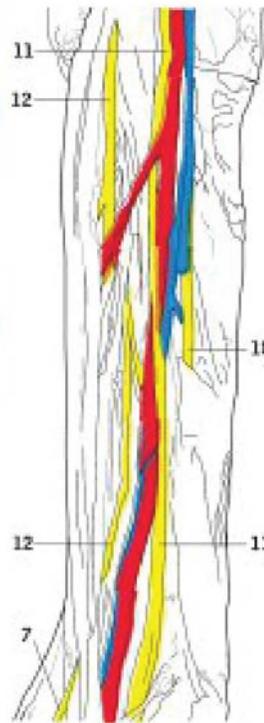
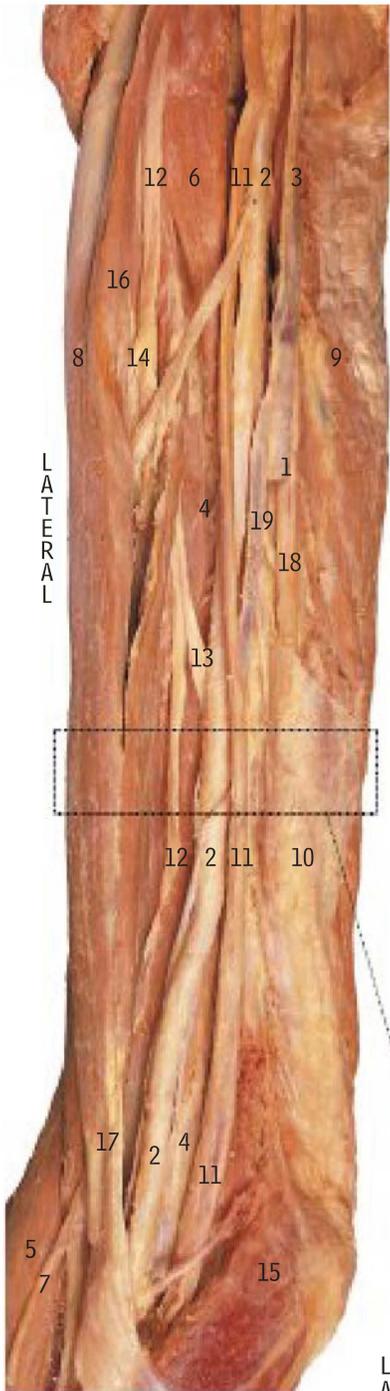
The median nerve (11) gradually crosses over in front of the brachial artery (2) from the lateral to the medial side. The ulnar nerve (18) passes behind the medial intermuscular septum (10), and the end of the basilic vein (1) is seen joining a vena comitans (19) of the brachial artery to form the brachial vein (3).

- | | | | |
|----|------------------------------------|----|----------------------------------|
| 1 | Basilic vein (cut end) | 11 | Median nerve |
| 2 | Brachial artery | 12 | Musculocutaneous nerve |
| 3 | Brachial vein | 13 | Nerve to brachialis |
| 4 | Brachialis | 14 | Nerve to short head of biceps |
| 5 | Brachioradialis | 15 | Pronator teres |
| 6 | Coracobrachialis | 16 | Short head of biceps |
| 7 | Lateral cutaneous nerve of forearm | 17 | Tendon of biceps |
| 8 | Long head of biceps | 18 | Ulnar nerve |
| 9 | Long head of triceps | 19 | Vena comitans of brachial artery |
| 10 | Medial intermuscular septum | | |

The musculocutaneous nerve (A12) supplies coracobrachialis (A6), biceps (A16 and 8) and brachialis (A4), and at the level where the muscle fibres of biceps become tendinous (A17) it pierces the deep fascia to become the lateral cutaneous nerve of the forearm (A7).

The median nerve does not give off any muscular branches in the arm.

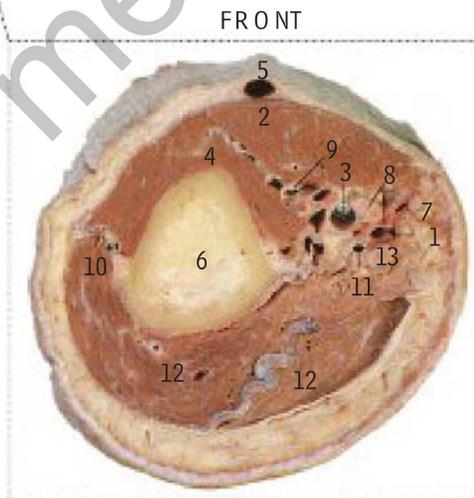
The ulnar nerve (A18) leaves the anterior compartment of the arm by piercing the medial intermuscular septum (A10), and does not give off any muscular branches in the arm.



Right arm cross-section, from below

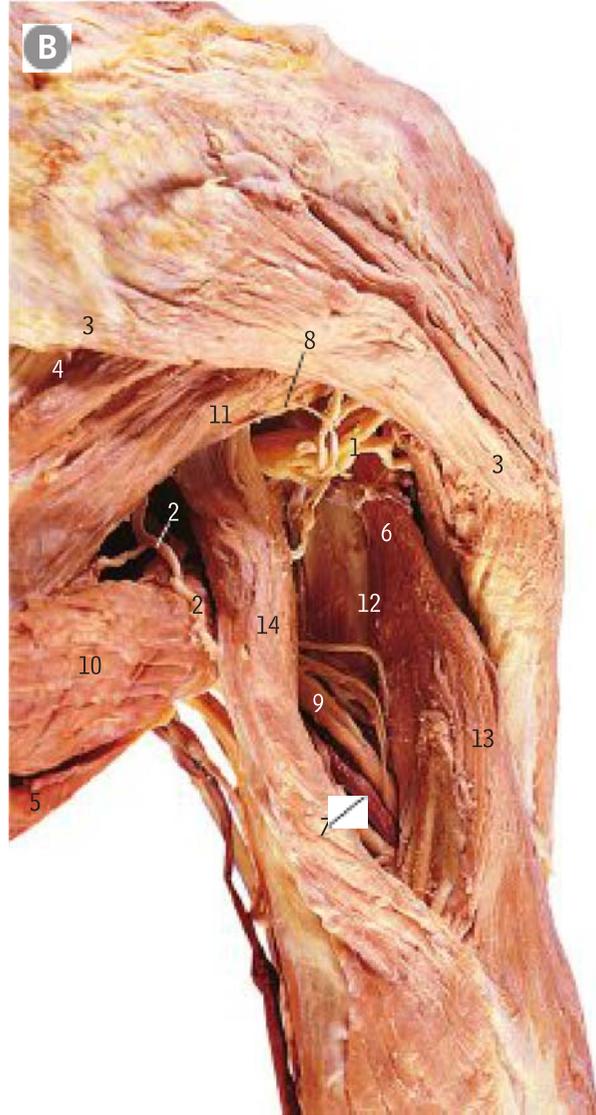
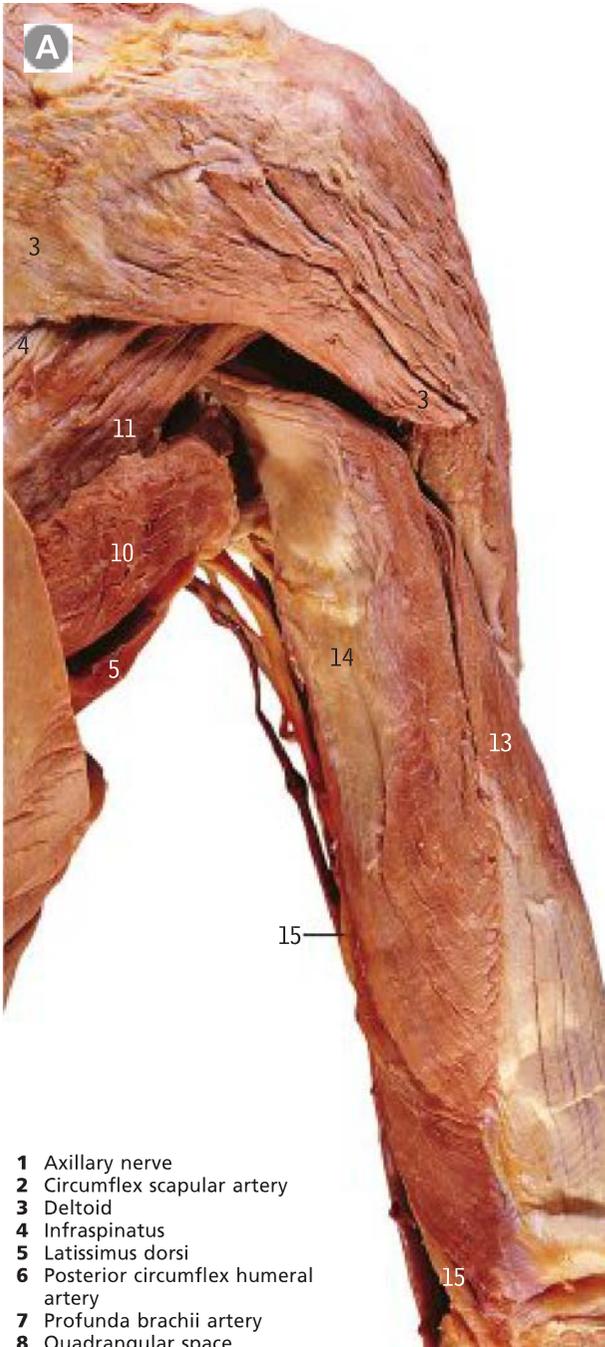
Looking from the elbow towards the shoulder, the section is taken through the middle of the arm. The musculocutaneous nerve (9) lies between brachialis (4) and biceps (2), and the median nerve (8) is on the medial side of the brachial artery (3) which has several venae comitantes adjacent (unlabelled). The ulnar nerve (13), with the superior ulnar collateral artery (11) beside it, is behind the median nerve (8) and the basilic vein (1). The radial nerve and the profunda brachii vessels (10) are in the posterior compartment at the lateral side of the humerus (6).

- | | |
|----|---|
| 1 | Basilic vein |
| 2 | Biceps |
| 3 | Brachial artery |
| 4 | Brachialis |
| 5 | Cephalic vein |
| 6 | Humerus |
| 7 | Medial cutaneous nerve of forearm |
| 8 | Median nerve |
| 9 | Musculocutaneous nerve |
| 10 | Radial nerve and profunda brachii vessels |
| 11 | Superior ulnar collateral artery |
| 12 | Triceps |
| 13 | Ulnar nerve |



Volkmann's ischaemic contracture

Right arm posterior view



- 1 Axillary nerve
- 2 Circumflex scapular artery
- 3 Deltoid
- 4 Infraspinatus
- 5 Latissimus dorsi
- 6 Posterior circumflex humeral artery
- 7 Profunda brachii artery
- 8 Quadrangular space
- 9 Radial nerve in spiral groove
- 10 Teres major
- 11 Teres minor
- 12 Triangular space (lateral)
- 13 Triceps, lateral head
- 14 Triceps, long head
- 15 Ulnar nerve

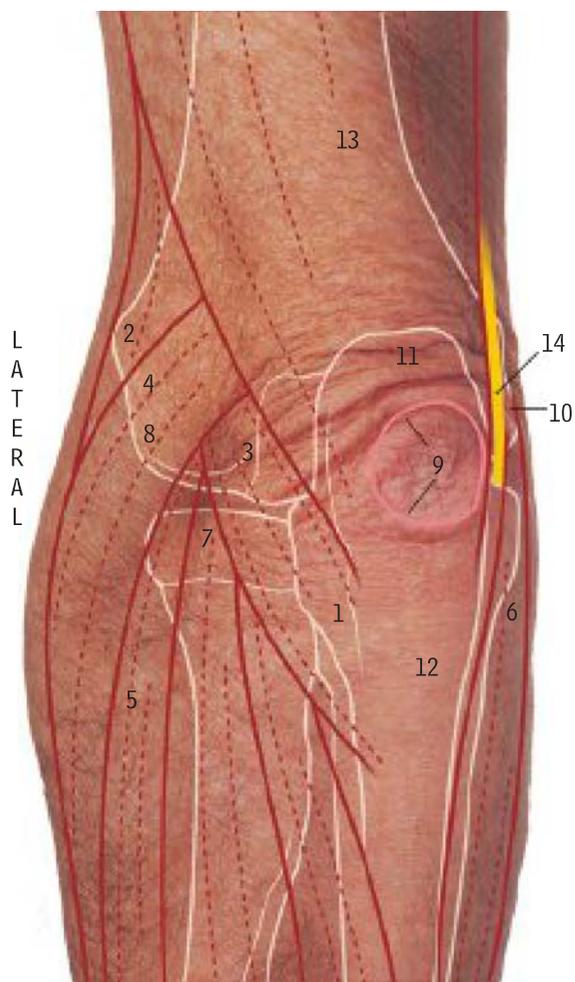
after removal of skin and subcutaneous fat

after muscle separation to demonstrate spaces and neurovascular bundle



Radial nerve palsy

Left elbow surface markings, from behind

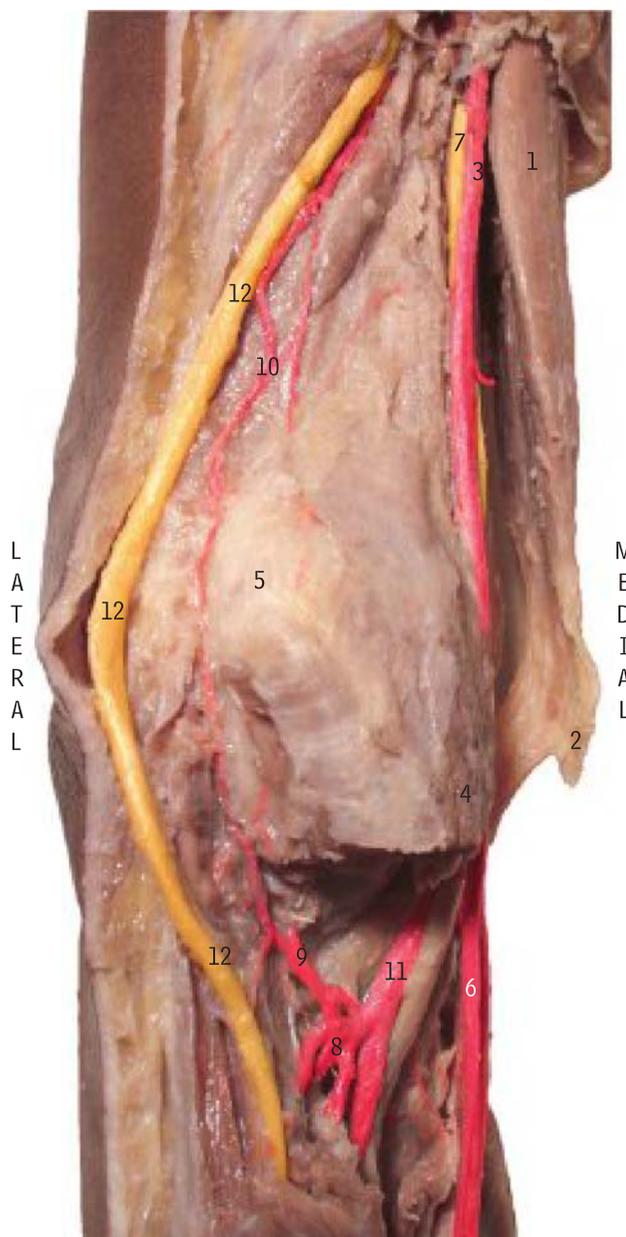


With the elbow fully extended, the extensor muscles (5, 4) form a bulge on the lateral side. In the adjacent hollow can be felt the head of the radius (7) and the capitulum of the humerus (3) which indicate the line of the humeroradial part of the elbow joint. The lateral and medial epicondyles of the humerus (8 and 10) are palpable on each side. Wrinkled skin lies at the back of the prominent olecranon of the ulna (11), and in this arm the margin of the olecranon bursa (9) is outlined. The most important structure in this region is the ulnar nerve (14) which is palpable as it lies in contact with the humerus behind the medial epicondyle (10). The posterior border of the ulna (12) is subcutaneous throughout its whole length.

- | | |
|----------------------------------|---------------------------------|
| 1 Anconeus | 9 Margin of olecranon bursa |
| 2 Brachioradialis | 10 Medial epicondyle of humerus |
| 3 Capitulum of humerus | 11 Olecranon of ulna |
| 4 Extensor carpi radialis longus | 12 Posterior border of ulna |
| 5 Extensor muscles | 13 Triceps |
| 6 Flexor carpi ulnaris | 14 Ulnar nerve |
| 7 Head of radius | |
| 8 Lateral epicondyle of humerus | |



Right elbow medial view from behind



- | |
|--|
| 1 Biceps muscle |
| 2 Bicipital aponeurosis |
| 3 Brachial artery |
| 4 Common flexor origin |
| 5 Medial epicondyle |
| 6 Median artery |
| 7 Median nerve |
| 8 Muscular arterial branches to flexors of forearm |
| 9 Posterior ulnar recurrent artery |
| 10 Superior ulnar collateral artery |
| 11 Ulnar artery |
| 12 Ulnar nerve |



Note: high division and persistent median artery.



Olecranon bursitis



Triceps tendon reflex

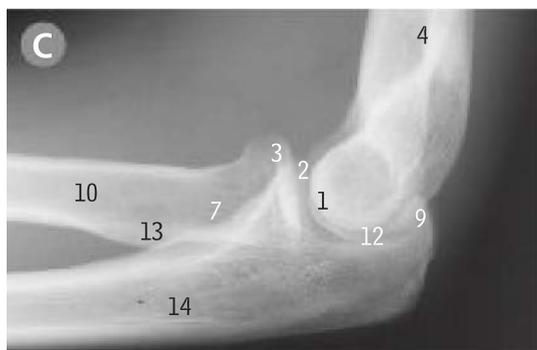
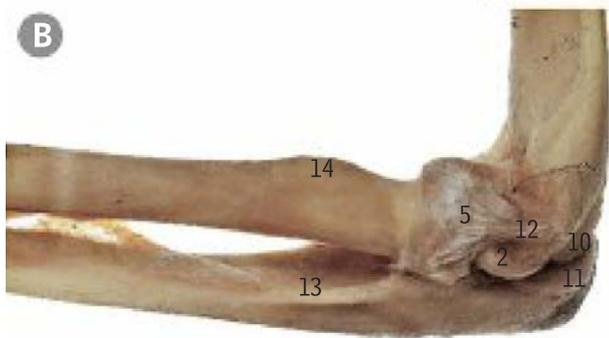


Ulnar nerve palsy

Left elbow and radioulnar joint

from the medial side

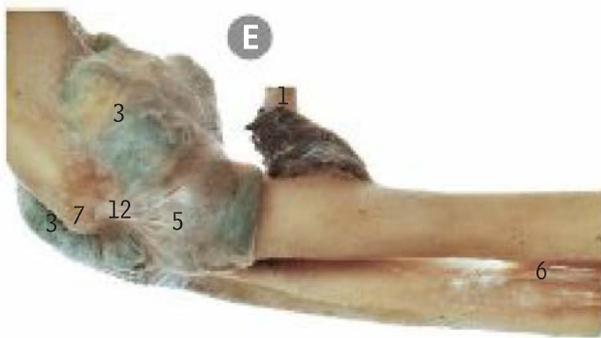
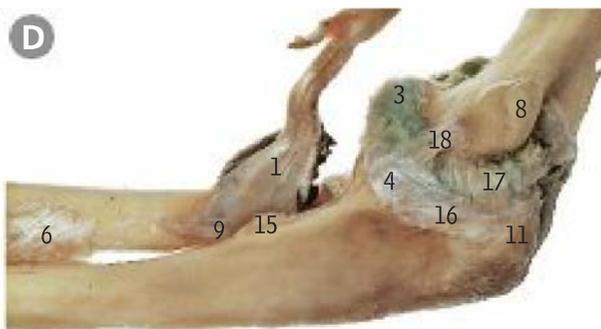
from the lateral side



Right elbow and radioulnar joint

from the medial side

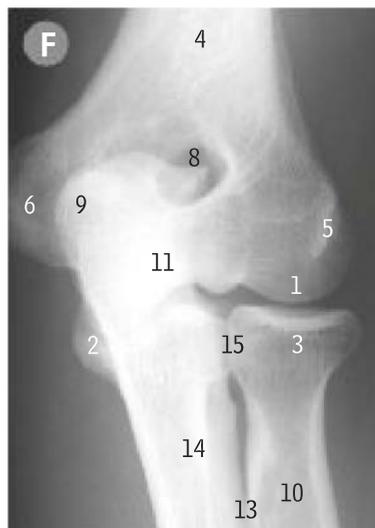
from the lateral side



Elbow radiographs

lateral projection

AP projection



In A and B the forearm is flexed to a right angle. In D and E the forearm is partially flexed, and the synovial cavity within the capsule (3) and the bursa beneath the biceps tendon (1) have been injected with green resin.

- | | |
|--------------------------------------|--|
| 1 Biceps tendon and underlying bursa | 11 Olecranon process of ulna |
| 2 Capitulum | 12 Radial collateral ligament |
| 3 Capsule (distended) | 13 Supinator crest of ulna |
| 4 Coronoid process of ulna | 14 Tuberosity of radius |
| 5 Head and neck of radius | 15 Tuberosity of ulna |
| 6 Interosseous membrane | 16 Ulnar collateral ligament: oblique band |
| 7 Lateral epicondyle | 17 Ulnar collateral ligament: posterior band |
| 8 Medial epicondyle | 18 Ulnar collateral ligament: upper band |
| 9 Oblique cord | |
| 10 Olecranon fossa | |

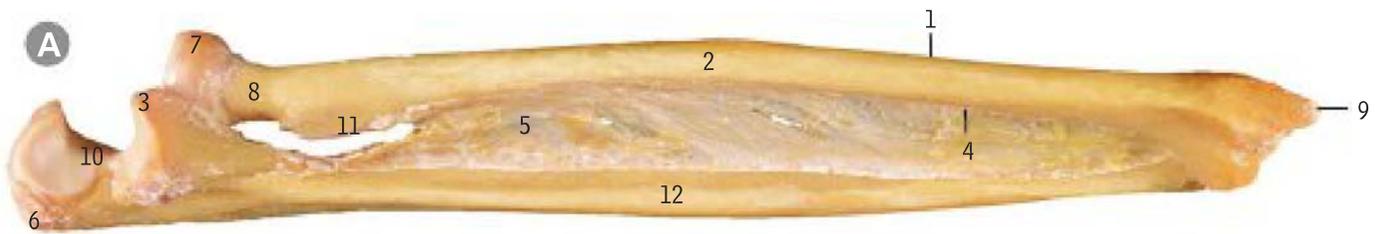
- | |
|---------------------------------|
| 1 Capitulum of humerus |
| 2 Coronoid process of ulna |
| 3 Head of radius |
| 4 Humerus |
| 5 Lateral epicondyle of humerus |
| 6 Medial epicondyle of humerus |
| 7 Neck of radius |
| 8 Olecranon fossa of humerus |
| 9 Olecranon process of ulna |
| 10 Radius |
| 11 Trochlea of humerus |
| 12 Trochlear notch of ulna |
| 13 Tuberosity of radius |
| 14 Ulna |
| 15 Radioulnar joint |



Dislocation of the radial head

Upper limb – interosseous membrane

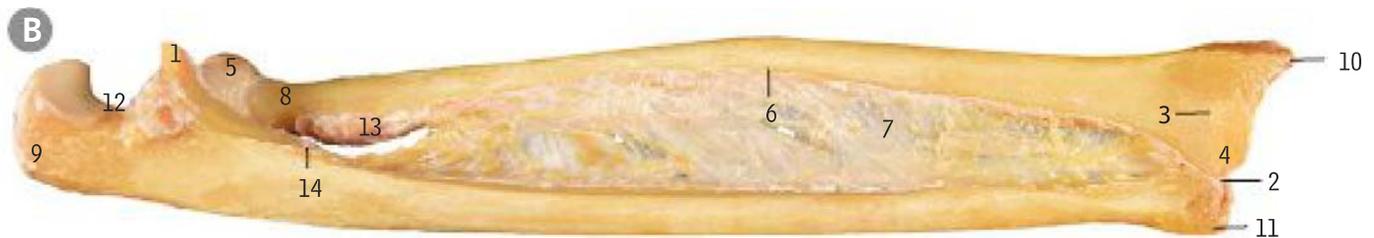
Anterior pronation view



- 1 Anterior border of radius
- 2 Anterior surface of radius
- 3 Coronoid process
- 4 Interosseous border
- 5 Interosseous membrane
- 6 Olecranon

- 7 Radial head
- 8 Radial neck
- 9 Styloid process of radius
- 10 Trochlear notch
- 11 Tuberosity of radius
- 12 Ulna

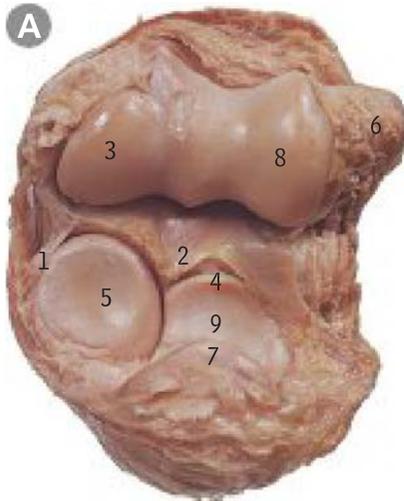
Anterior supinated view



- 1 Coronoid process of ulna
- 2 Distal radio-ulnar joint
- 3 Dorsal (Lister's) tubercle
- 4 Groove for extensor digitorum and extensor indicis muscles
- 5 Head of radius
- 6 Interosseous border
- 7 Interosseous membrane

- 8 Neck of radius
- 9 Olecranon of ulna
- 10 Styloid process of radius
- 11 Styloid process of ulna
- 12 Trochlear notch of ulna
- 13 Tuberosity of radius
- 14 Tuberosity of ulna

Left elbow joint

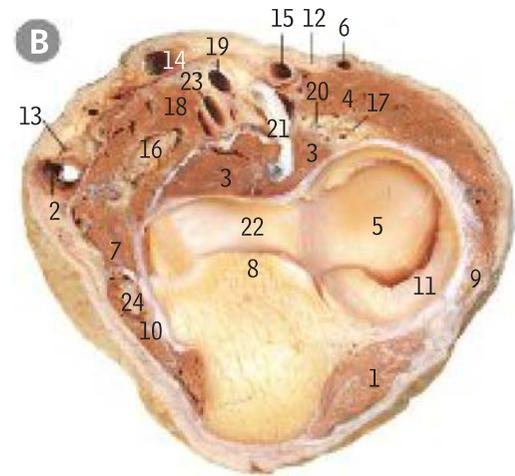


opened from behind

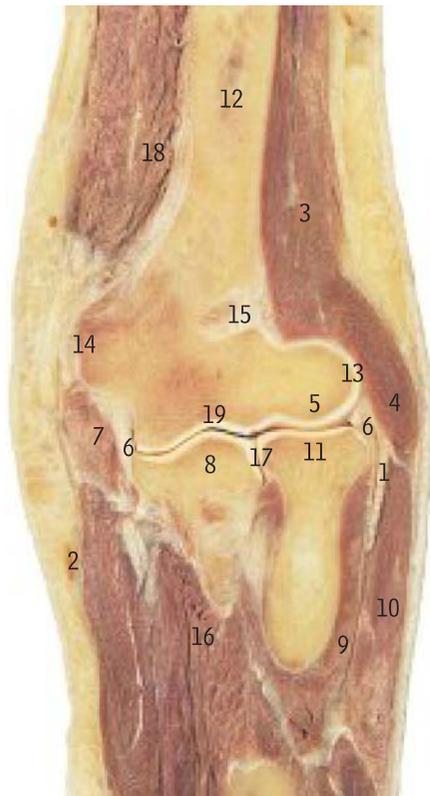
The joint has been 'forced open' from behind: the capitulum (3) and trochlea (8) of the lower end of the humerus are seen from below with the forearm in forced flexion to show the upper ends of the radius and ulna (5 and 9) from above.

- 1 Annular ligament
- 2 Anterior part of capsule
- 3 Capitulum of humerus
- 4 Coronoid process of ulna
- 5 Head of radius
- 6 Medial epicondyle of humerus
- 7 Olecranon process of ulna
- 8 Trochlea of humerus
- 9 Trochlear notch of ulna

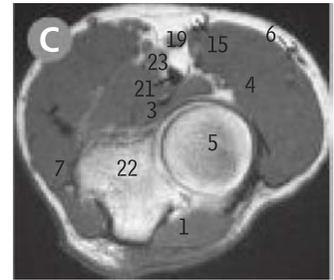
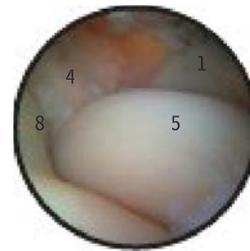
Left elbow



Elbow coronal section



- 1 Annular ligament
- 2 Basilic vein
- 3 Brachialis
- 4 Brachioradialis
- 5 Capitulum of humerus
- 6 Capsule
- 7 Common flexor origin
- 8 Coronoid process of ulna
- 9 Extensor carpi radialis brevis
- 10 Extensor carpi radialis longus
- 11 Head of radius
- 12 Humerus
- 13 Lateral epicondyle
- 14 Medial epicondyle
- 15 Olecranon fossa
- 16 Pronator teres
- 17 Radio-ulnar joint, proximal
- 18 Triceps, medial head
- 19 Trochlea of humerus



This is the arthroscopic view of an elbow joint. The view is from the superior aspect showing the orientation and the articulation of the radio-capitular joint. Just distal to the radial head is the proximal edge of the annular ligament. The radial head is seen articulating with the coronoid process of the ulna.

cross-section

axial MR image

The section is viewed from below, looking towards the shoulder, and is just below the point where the brachial artery has divided into radial and ulnar arteries (19 and 23). The cut has passed immediately below the trochlea (22) and capitulum (5) of the humerus, and has gone through the coronoid process of the ulna (8). The radial nerve (20) and its posterior interosseous branch (17) lie between brachioradialis (4) and brachialis (3). The median nerve (16) is under the main part of pronator teres (18), and the ulnar nerve (24) is passing under flexor carpi ulnaris (10).

- 1 Anconeus
- 2 Basilic vein
- 3 Brachialis
- 4 Brachioradialis
- 5 Capitulum of humerus
- 6 Cephalic vein
- 7 Common flexor origin
- 8 Coronoid process of ulna
- 9 Extensor carpi radialis longus and brevis
- 10 Flexor carpi ulnaris
- 11 Fringe of synovial membrane
- 12 Lateral cutaneous nerve of forearm
- 13 Medial cutaneous nerve of forearm
- 14 Median basilic vein
- 15 Median cephalic vein
- 16 Median nerve
- 17 Posterior interosseous nerve
- 18 Pronator teres
- 19 Radial artery
- 20 Radial nerve
- 21 Tendon of biceps brachii
- 22 Trochlea of humerus
- 23 Ulnar artery
- 24 Ulnar nerve

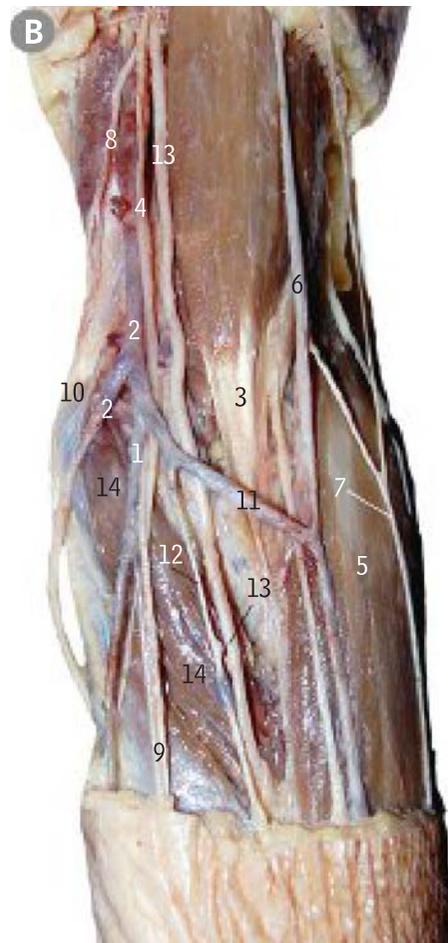
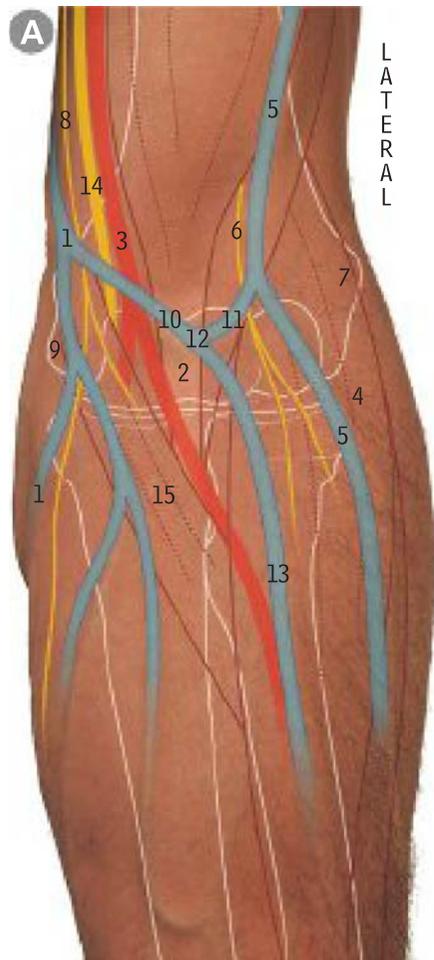


Elbow arthroscopy

Left cubital fossa

surface markings

superficial veins



The superficial veins on the front of the elbow such as the cephalic (5) and basilic (1) and their intercommunicating tributaries are those most commonly used for intravenous injections and obtaining specimens of venous blood. The pattern of veins is typically M-shaped (as in A) or H-shaped (as in B), but there is much variation and it is not always possible or necessary to name every vessel.

The order of the structures in the cubital fossa from lateral to medial is: biceps tendon (2), brachial artery (3) and median nerve (14).



Upper limb venogram

- 1 Basilic vein
- 2 Biceps tendon
- 3 Brachial artery
- 4 Brachioradialis
- 5 Cephalic vein
- 6 Lateral cutaneous nerve of forearm
- 7 Lateral epicondyle
- 8 Medial cutaneous nerve of forearm
- 9 Medial epicondyle
- 10 Median basilic vein
- 11 Median cephalic vein
- 12 Median cubital vein
- 13 Median forearm vein
- 14 Median nerve
- 15 Pronator teres

and

- 1 Accessory basilic vein
- 2 Basilic vein
- 3 Biceps brachii tendon
- 4 Brachial artery
- 5 Brachioradialis muscle
- 6 Cephalic vein
- 7 Lateral cutaneous nerve of forearm
- 8 Medial cutaneous nerve of arm
- 9 Medial cutaneous nerve of forearm
- 10 Medial epicondyle
- 11 Median cubital vein
- 12 Median forearm vein
- 13 Median nerve
- 14 Pronator teres muscle

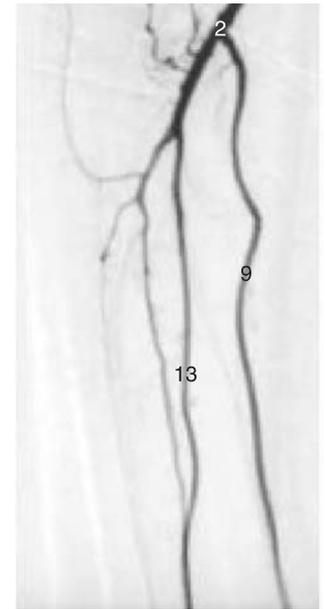
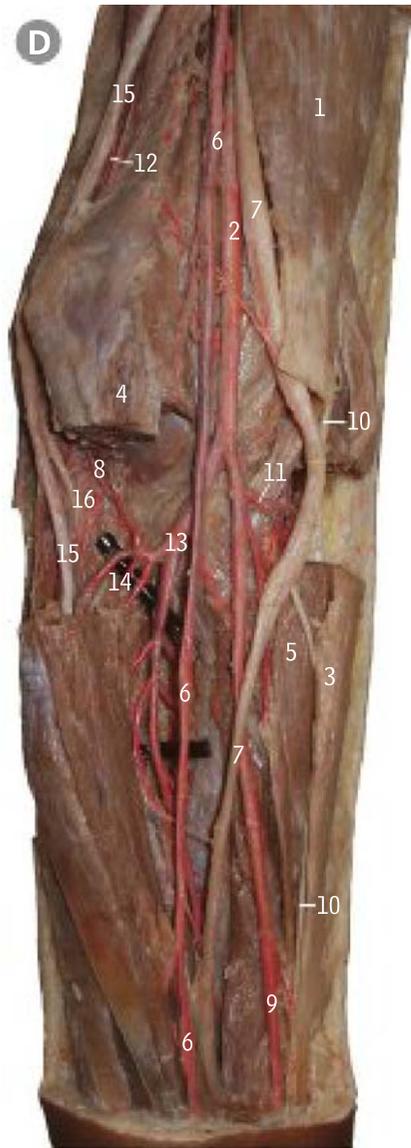
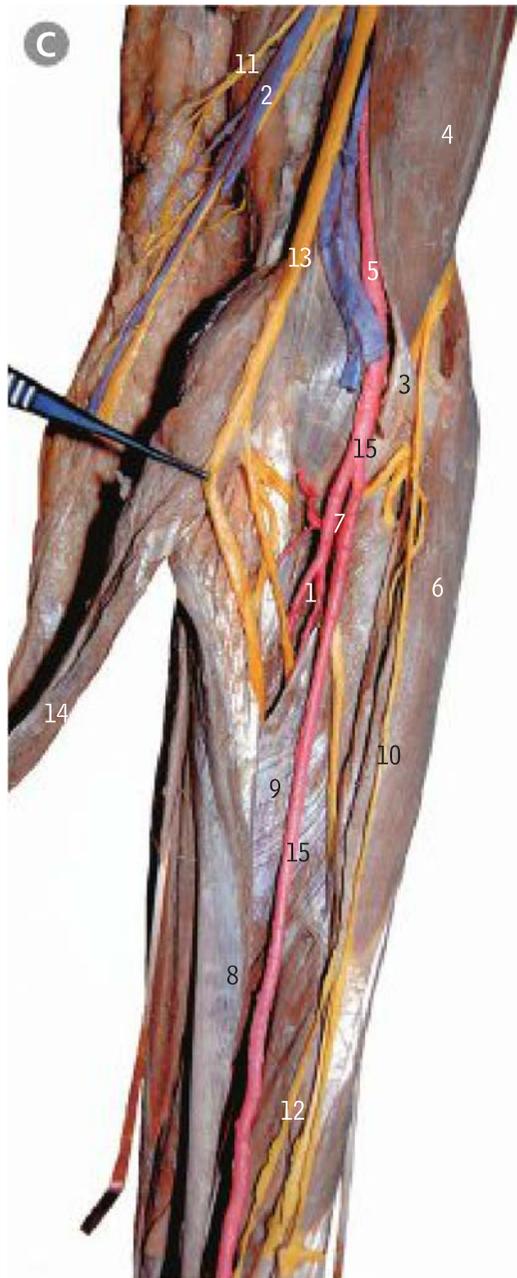
Auscultation
of the brachial
pulseBiceps tendon
reflexGolfer's elbow –
injection

Tennis elbow

Left elbow and upper forearm

deeper dissection

deeper dissection of nerves and arteries



Brachial arteriogram

- 1 Anterior interosseous artery
- 2 Basilic vein
- 3 Biceps brachii aponeurosis, reflected
- 4 Biceps brachii muscle
- 5 Brachial artery
- 6 Brachioradialis muscle
- 7 Common interosseous artery
- 8 Flexor carpi ulnaris muscle
- 9 Flexor digitorum profundus muscle

- 10 Lateral cutaneous nerve of forearm
- 11 Medial cutaneous nerve of arm
- 12 Median nerve
- 13 Median nerve, reflected medially
- 14 Pronator teres muscle, reflected
- 15 Ulnar artery

- 1 Biceps
- 2 Brachial artery
- 3 Brachioradialis
- 4 Common flexor origin
- 5 Extensor carpi radialis longus
- 6 Median artery
- 7 Median nerve, pulled laterally
- 8 Posterior ulnar recurrent artery
- 9 Radial artery
- 10 Radial nerve, superficial branch

- 11 Radial recurrent artery
- 12 Superior ulnar collateral artery
- 13 Ulnar artery
- 14 Ulnar artery, branches to forearm flexors
- 15 Ulnar nerve
- 16 Ulnar nerve, branch to flexor carpi ulnaris

Note: high division and persistent median artery



Anterior interosseous nerve entrapment



Arterial puncture at the elbow

Left forearm

superficial muscles, from the front

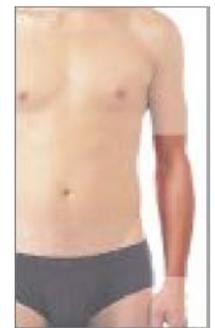
Skin and fascia have been removed, but the larger superficial veins (1, 6 and 13) have been preserved. On the lateral side, the radial artery (21) is largely covered by brachioradialis (5). At the wrist the tendon of flexor carpi radialis (8) has the radial artery (21) on its lateral side; on its medial side is the median nerve (15), slightly overlapped from the medial side by the tendon of palmaris longus (18) (if present; it is absent in 13% of forearms).

- | | |
|-----------------------------------|----------------------------------|
| 1 Basilic vein | 13 Median cubital vein |
| 2 Biceps tendon | 14 Median forearm vein |
| 3 Bicipital aponeurosis | 15 Median nerve |
| 4 Brachial artery | 16 Palmar branch of median nerve |
| 5 Brachioradialis | 17 Palmar branch of ulnar nerve |
| 6 Cephalic vein | 18 Palmaris longus |
| 7 Common flexor origin | 19 Pronator quadratus |
| 8 Flexor carpi radialis | 20 Pronator teres |
| 9 Flexor carpi ulnaris | 21 Radial artery |
| 10 Flexor digitorum superficialis | 22 Ulnar artery |
| 11 Flexor pollicis longus | 23 Ulnar nerve |
| 12 Medial epicondyle | |

Left forearm deep muscles, from the front

All vessels and nerves have been removed, together with the superficial muscles, to show the deep flexor group – flexor digitorum profundus (10), flexor pollicis longus (11) and pronator quadratus (13).

- | |
|----------------------------------|
| 1 Abductor pollicis longus |
| 2 Biceps |
| 3 Brachialis |
| 4 Brachioradialis |
| 5 Common flexor origin |
| 6 Extensor carpi radialis brevis |
| 7 Extensor carpi radialis longus |
| 8 Flexor carpi radialis |
| 9 Flexor carpi ulnaris |
| 10 Flexor digitorum profundus |
| 11 Flexor pollicis longus |
| 12 Flexor retinaculum |
| 13 Pronator quadratus |
| 14 Pronator teres |
| 15 Supinator |



Venous cutdown

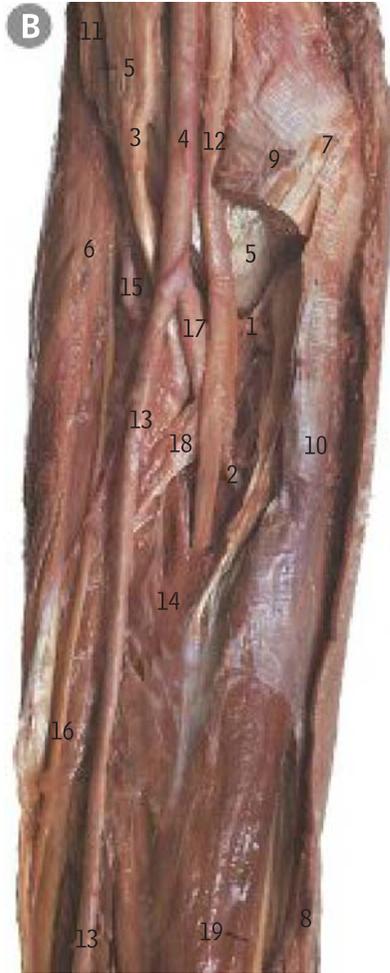
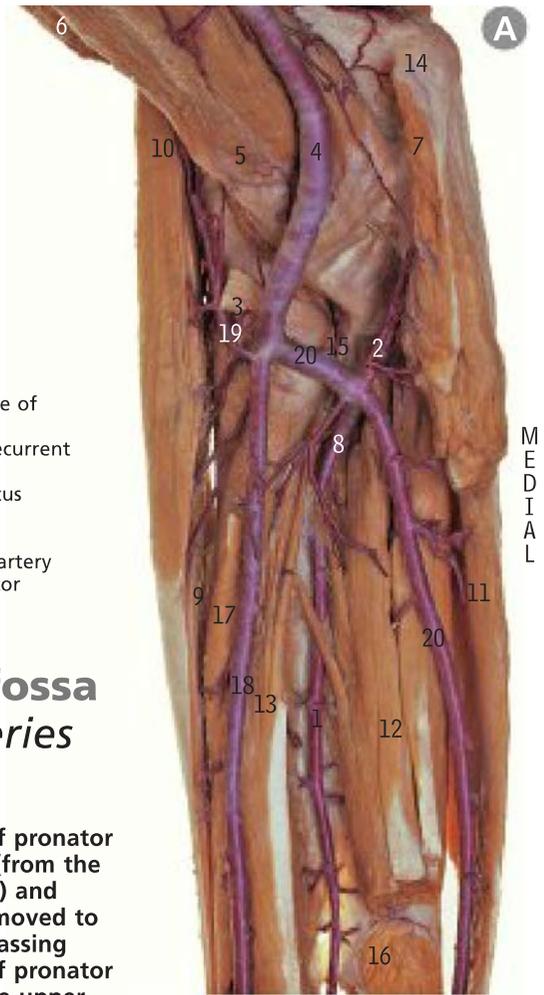


Venipuncture of the upper limb

Right cubital fossa and forearm arteries

The arteries have been injected, and after removal of most of the superficial muscles, the brachial artery (4) is seen dividing into the radial artery (18) and the ulnar artery (20). The radial artery gives off the radial recurrent (19) which runs upwards in front of supinator, giving branches to the carpal extensor muscles (10 and 9). The ulnar artery gives off the anterior and posterior ulnar recurrent vessels (2 and 15), and its common interosseous branch (8) is seen giving off the anterior interosseous (1) which passes down in front of the interosseous membrane between flexor pollicis longus (13) and flexor digitorum profundus (12).

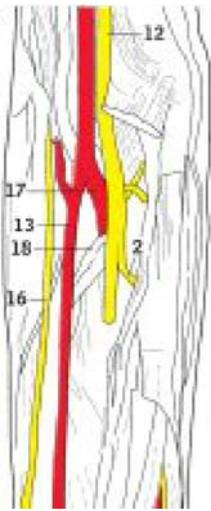
- | | | |
|--|-----------------------------------|--|
| 1 Anterior interosseous artery overlying interosseous membrane | 8 Common interosseous artery | 14 Medial epicondyle of humerus |
| 2 Anterior ulnar recurrent artery | 9 Extensor carpi radialis brevis | 15 Posterior ulnar recurrent artery |
| 3 Biceps tendon | 10 Extensor carpi radialis longus | 16 Pronator quadratus |
| 4 Brachial artery | 11 Flexor carpi ulnaris | 17 Pronator teres |
| 5 Brachialis | 12 Flexor digitorum profundus | 18 Radial artery |
| 6 Brachioradialis | 13 Flexor pollicis longus | 19 Radial recurrent artery overlying supinator |
| 7 Common flexor origin | | 20 Ulnar artery |



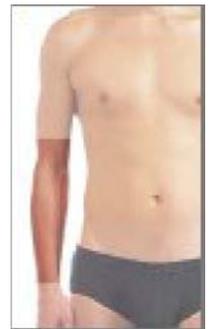
Right cubital fossa and forearm arteries and nerves

Most of the humeral origins of pronator teres and flexor carpi radialis (from the common flexor origin, 9 and 7) and palmaris longus have been removed to show the median nerve (12) passing superficially to the deep head of pronator teres (18) and then deep to the upper border of the radial head of flexor digitorum superficialis (14).

MEDIAL



- | |
|---|
| 1 A muscular branch of median nerve |
| 2 Anterior interosseous nerve |
| 3 Biceps |
| 4 Brachial artery |
| 5 Brachialis |
| 6 Brachioradialis (displaced laterally) |
| 7 Common flexor origin |
| 8 Flexor carpi ulnaris (displaced medially) |
| 9 Humeral head of pronator teres |
| 10 Humero-ulnar head of flexor digitorum superficialis |
| 11 Lateral cutaneous nerve of forearm |
| 12 Median nerve |
| 13 Radial artery |
| 14 Radial head of flexor digitorum superficialis |
| 15 Radial recurrent artery |
| 16 Superficial terminal branch of radial nerve overlying extensor carpi radialis longus |
| 17 Ulnar artery |
| 18 Ulnar head of pronator teres |
| 19 Ulnar nerve and artery |



Anterior interosseous nerve entrapment

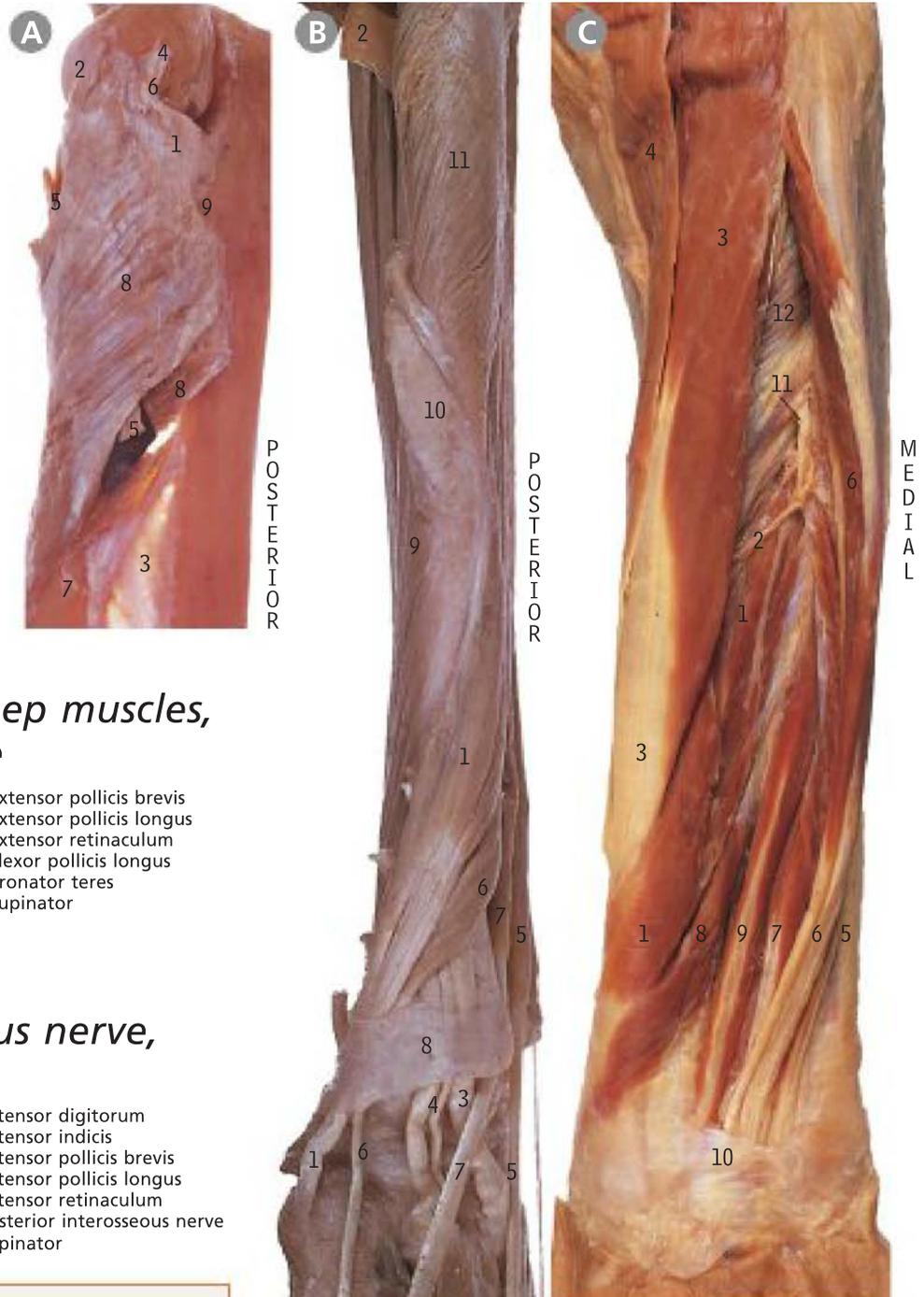


Volkmann's ischaemic contracture

Left elbow from the lateral side

With the forearm in mid-pronation and seen from the lateral side so that the radius (7) lies in front of the ulna, all muscles have been removed except supinator (8) to show its humeral and ulnar origins (see notes).

- 1 Annular ligament
- 2 Capitulum of humerus
- 3 Interosseous membrane
- 4 Lateral epicondyle
- 5 Posterior interosseous nerve
- 6 Radial collateral ligament
- 7 Radius
- 8 Supinator
- 9 Supinator crest of ulna



Left forearm deep muscles, from the lateral side

- | | |
|---|----------------------------|
| 1 Abductor pollicis longus | 6 Extensor pollicis brevis |
| 2 Biceps brachii | 7 Extensor pollicis longus |
| 3 Extensor carpi radialis brevis | 8 Extensor retinaculum |
| 4 Extensor carpi radialis longus (double) | 9 Flexor pollicis longus |
| 5 Extensor indicis | 10 Pronator teres |
| | 11 Supinator |

Left forearm posterior interosseous nerve, from behind

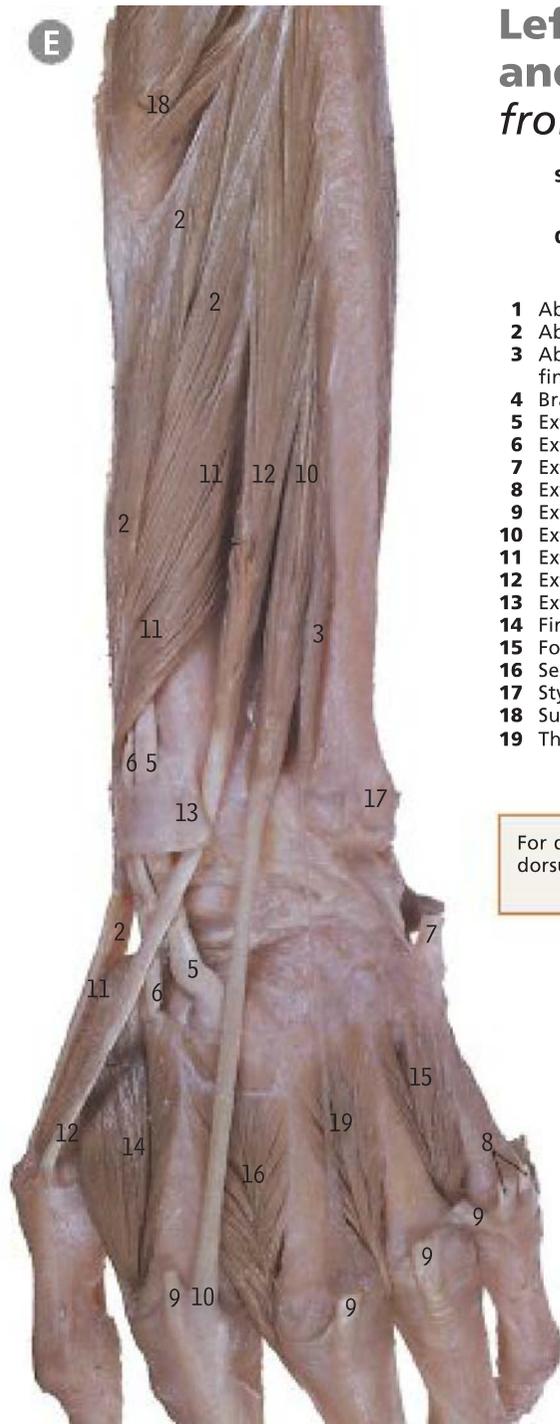
- | | |
|---|---------------------------------|
| 1 Abductor pollicis longus | 6 Extensor digitorum |
| 2 Branch of posterior interosseous artery | 7 Extensor indicis |
| 3 Extensor carpi radialis brevis | 8 Extensor pollicis brevis |
| 4 Extensor carpi radialis longus | 9 Extensor pollicis longus |
| 5 Extensor carpi ulnaris | 10 Extensor retinaculum |
| | 11 Posterior interosseous nerve |
| | 12 Supinator |

The fibres of the interosseous membrane (A3) pass obliquely downwards from the radius (A7) to the ulna, so transmitting weight from the hand and radius to the ulna.

The supinator muscle (A8) arises from the lateral epicondyle of the humerus (A4), radial collateral ligament (A6), annular ligament (A1), supinator crest of the ulna (A9) and bone in front of the crest (page 125, D10), and an aponeurosis overlying the muscle. From these origins, the fibres wrap themselves round the upper end of the radius above the pronator teres attachment, to be attached to the lateral surface of the radius and extending anteriorly and posteriorly as far as the tuberosity of the radius.



Posterior interosseous nerve entrapment



Left forearm and hand from behind

superficial muscles

deep muscles

- 1 Abductor digiti minimi
- 2 Abductor pollicis longus
- 3 Abnormal slip of 10 to middle finger
- 4 Brachioradialis
- 5 Extensor carpi radialis brevis
- 6 Extensor carpi radialis longus
- 7 Extensor carpi ulnaris
- 8 Extensor digiti minimi
- 9 Extensor digitorum
- 10 Extensor indicis
- 11 Extensor pollicis brevis
- 12 Extensor pollicis longus
- 13 Extensor retinaculum
- 14 First dorsal interosseous
- 15 Fourth dorsal interosseous
- 16 Second dorsal interosseous
- 17 Styloid process of ulna
- 18 Supinator
- 19 Third dorsal interosseous

For details of tendons on the dorsum of the hand, see [page 175](#).



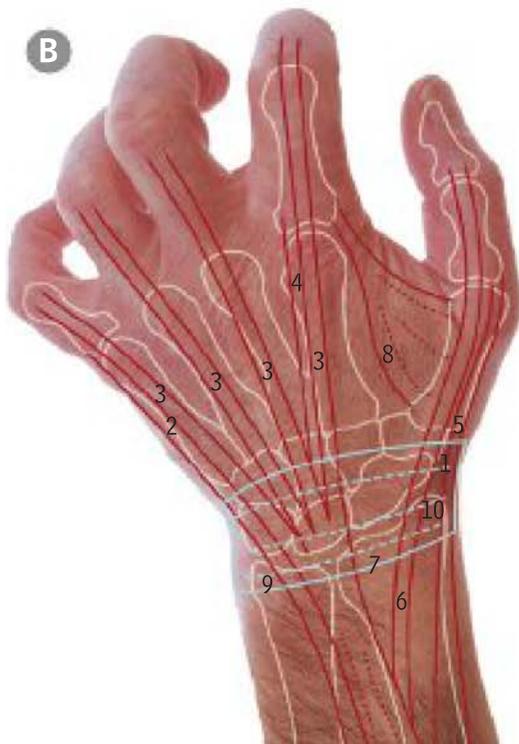
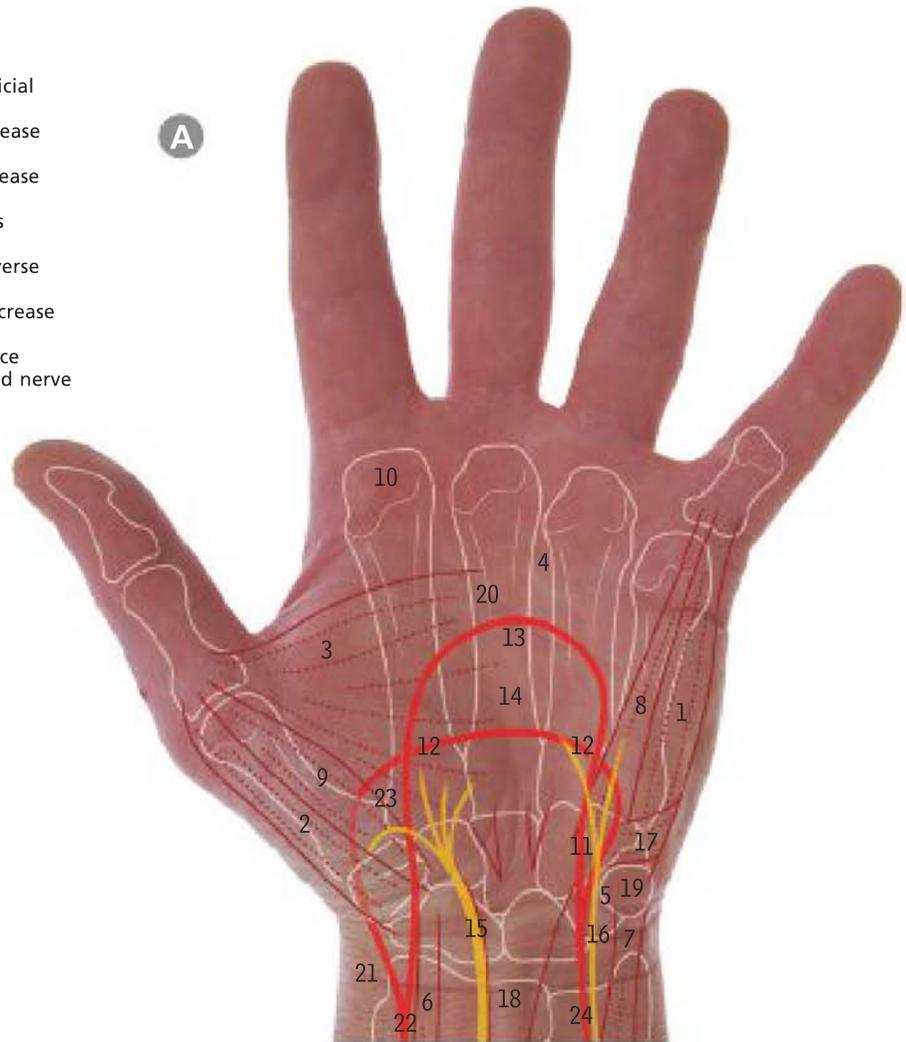
de Quervain's disease



Wrist drop

Palm of left hand

- | | |
|-------------------------------|-------------------------------------|
| 1 Abductor digiti minimi | 13 Level of superficial palmar arch |
| 2 Abductor pollicis brevis | 14 Longitudinal crease |
| 3 Adductor pollicis | 15 Median nerve |
| 4 Distal transverse crease | 16 Middle wrist crease |
| 5 Distal wrist crease | 17 Palmaris brevis |
| 6 Flexor carpi radialis | 18 Palmaris longus |
| 7 Flexor carpi ulnaris | 19 Pisiform |
| 8 Flexor digiti minimi brevis | 20 Proximal transverse crease |
| 9 Flexor pollicis brevis | 21 Proximal wrist crease |
| 10 Head of metacarpal | 22 Radial artery |
| 11 Hook of hamate | 23 Thenar eminence |
| 12 Level of deep palmar arch | 24 Ulnar artery and nerve |



Dorsum of left hand

The fingers are extended at the metacarpophalangeal joints, causing the extensor tendons of the fingers (2, 3 and 4) to stand out, and partially flexed at the interphalangeal joints. The thumb is extended at the carpometacarpal joint and partially flexed at the metacarpophalangeal and interphalangeal joints. The lines proximal to the bases of the fingers indicate the ends of the heads of the metacarpals and the level of the metacarpophalangeal joints. The anatomical snuffbox (1) is the hollow between the tendons of abductor pollicis longus and extensor pollicis brevis (5) laterally and extensor pollicis longus (6) medially.

- | | | |
|--------------------------|---|------------------------------|
| 1 Anatomical snuffbox | 5 Extensor pollicis brevis and abductor pollicis longus | 8 First dorsal interosseous |
| 2 Extensor digiti minimi | 6 Extensor pollicis longus | 9 Head of ulna |
| 3 Extensor digitorum | 7 Extensor retinaculum | 10 Styloid process of radius |
| 4 Extensor indicis | | |

Fingers movements

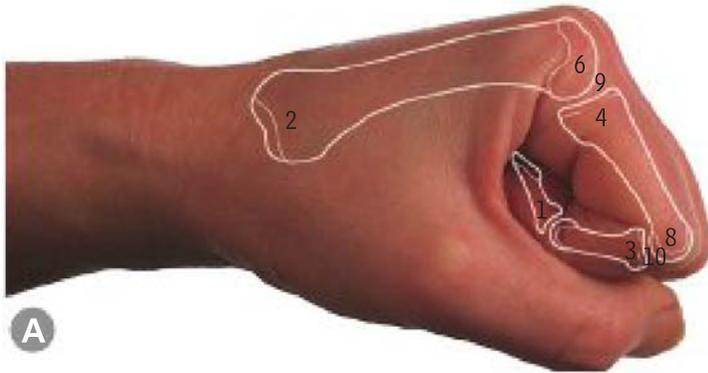
flexion of the metacarpophalangeal joints and flexion of the interphalangeal joints

extension of the metacarpophalangeal joints and flexion of the interphalangeal joints

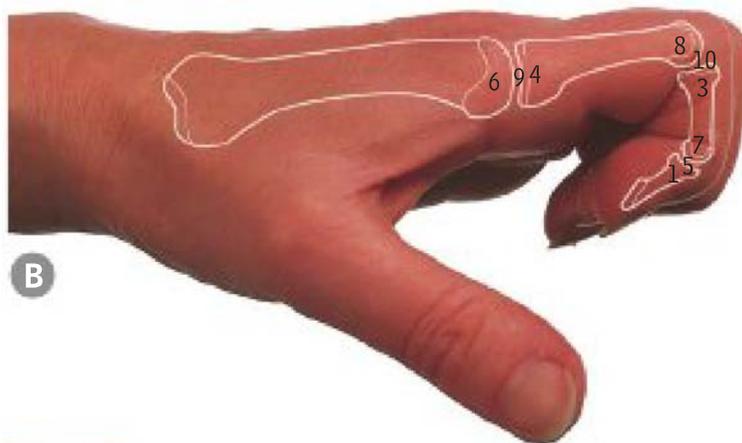
extension of the metacarpophalangeal and interphalangeal joints

When 'making a fist' with all finger joints flexed (A), the heads of the metacarpals (6) form the knuckles. To extend the metacarpophalangeal joints (B9) requires the activity of the long extensor tendons of the fingers, but to extend the interphalangeal joints (C10 and 5) as well requires the activity of the interossei and lumbricals, pulling on the dorsal extensor expansions (page 176B). Only if the metacarpophalangeal joints remain flexed can the long extensors extend the interphalangeal joints.

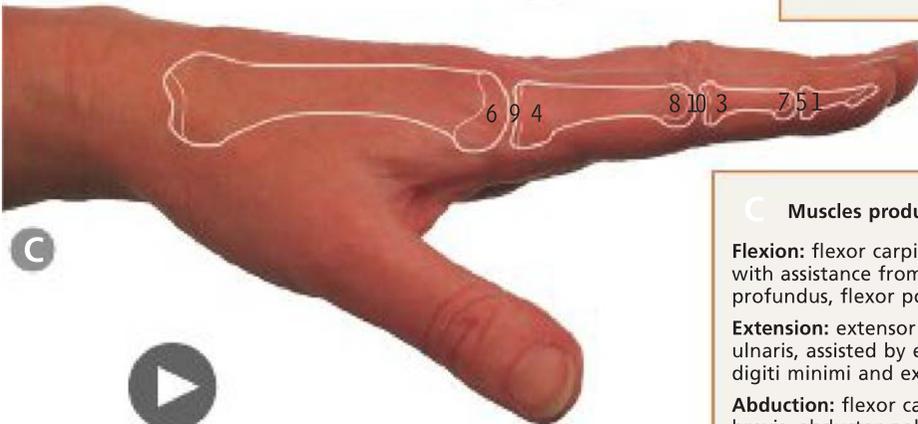
- | | |
|--------------------------------|-----------------------------------|
| 1 Base of distal phalanx | 6 Head of metacarpal |
| 2 Base of metacarpal | 7 Head of middle phalanx |
| 3 Base of middle phalanx | 8 Head of proximal phalanx |
| 4 Base of proximal phalanx | 9 Metacarpophalangeal joint |
| 5 Distal interphalangeal joint | 10 Proximal interphalangeal joint |



A



B



C



A Muscles producing movements at the metacarpophalangeal joints

Flexion: flexor digitorum profundus, flexor digitorum superficialis, lumbricals, interossei, with flexor digiti minimi brevis for the little finger and flexor pollicis longus, flexor pollicis brevis and the first palmar interosseous for the thumb.

Extension: extensor digitorum, extensor indicis (index finger) and extensor digiti minimi (little finger), with extensor pollicis longus and extensor pollicis brevis for the thumb.

Adduction: palmar interossei; when flexed, the long flexors assist.

Abduction: dorsal interossei and the long extensors, with abductor digiti minimi for the little finger.

B Muscles producing movements at the interphalangeal joints

Flexion: at the proximal joints, flexor digitorum superficialis and flexor digitorum profundus; at the distal joints, flexor digitorum profundus. For the thumb, flexor pollicis longus.

Extension: with the metacarpophalangeal joints flexed, extensor digitorum, extensor indicis and extensor digiti minimi; with the metacarpophalangeal joints extended, interossei and lumbricals. For the thumb, extensor pollicis longus.

C Muscles producing movements at the wrist joint

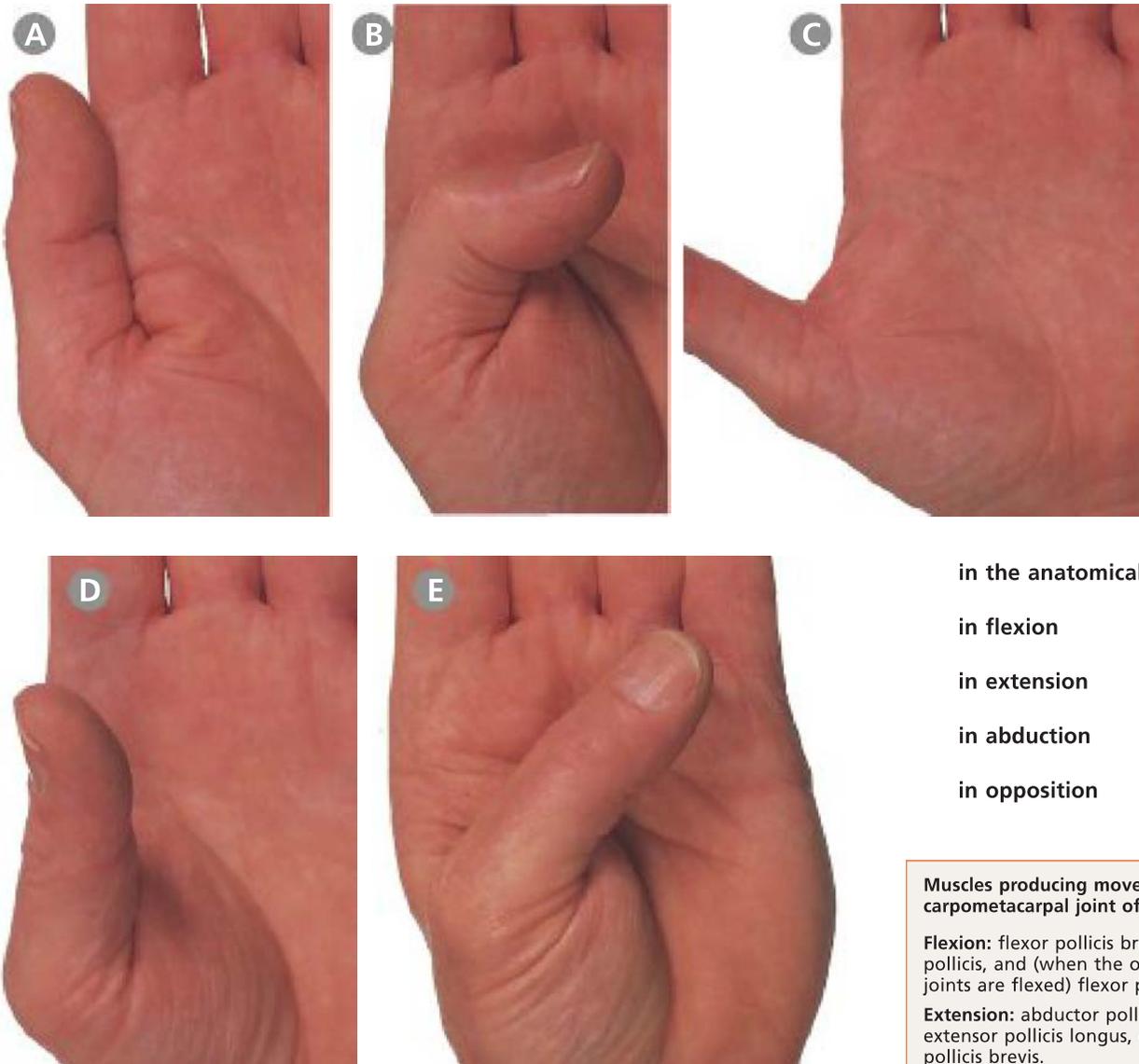
Flexion: flexor carpi radialis, flexor carpi ulnaris, palmaris longus, with assistance from flexor digitorum superficialis, flexor digitorum profundus, flexor pollicis longus and abductor pollicis longus.

Extension: extensor carpi radialis longus and brevis, extensor carpi ulnaris, assisted by extensor digitorum, extensor indicis, extensor digiti minimi and extensor pollicis longus.

Abduction: flexor carpi radialis, extensor carpi radialis longus and brevis, abductor pollicis longus and extensor pollicis brevis.

Adduction: flexor carpi ulnaris, extensor carpi ulnaris.

Thumb movements



in the anatomical position

in flexion

in extension

in abduction

in opposition

Muscles producing movements at the carpometacarpal joint of the thumb

Flexion: flexor pollicis brevis, opponens pollicis, and (when the other thumb joints are flexed) flexor pollicis longus.

Extension: abductor pollicis longus, extensor pollicis longus, extensor pollicis brevis.

Abduction: abductor pollicis brevis, abductor pollicis longus.

Adduction: adductor pollicis.

Opposition: opponens pollicis, flexor pollicis brevis, reinforced by adductor pollicis and flexor pollicis longus.

With the thumb in the anatomical position (A), the thumb nail is at right angles to the fingers because the first metacarpal is at right angles to the others (pages 129–130). This is a rather artificial position; in the normal position of rest, the thumb makes an angle of about 60° with the plane of the palm (i.e. it is partially abducted). Flexion (B) means bending the thumb across the palm, keeping the phalanges at right angles to the palm. Extension (C) is the opposite movement, away from the palm. In abduction (D) the thumb is lifted forwards from the plane of the palm, and continuation of this movement inevitably leads to opposition (E), with rotation of the first metacarpal, twisting the whole digit so that the pulp of the thumb can be brought towards the palm at the base of the little finger (or more commonly in everyday use, to contact or overlap any of the flexed fingers). Opposition is a combination of abduction with flexion and medial rotation at the carpometacarpal joint; it is not necessarily accompanied by flexion at the other thumb joints.



Wrist drop

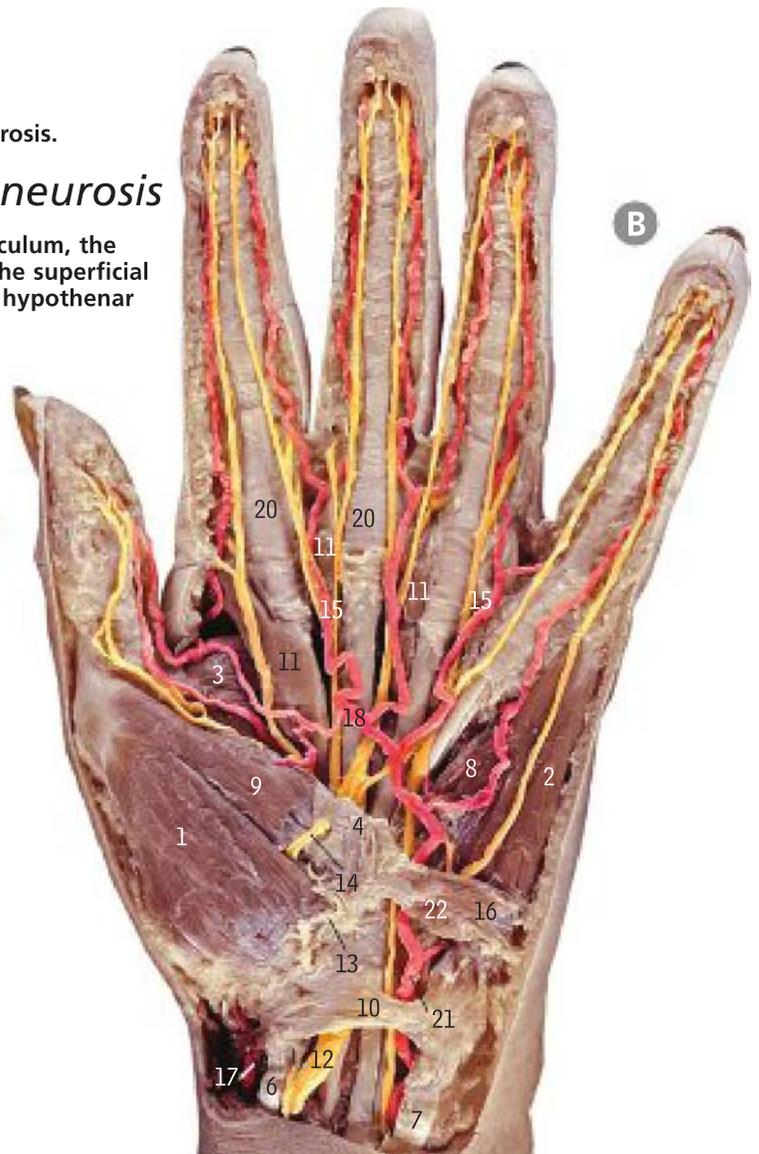
Palm of left hand

palmar aponeurosis

Removal of the palmar skin reveals the palmar aponeurosis.

after removal of palmar aponeurosis

Deeper dissection of the palm reveals the flexor retinaculum, the palmar branches of the median and ulnar nerves and the superficial palmar arch, flanked by the muscles of the thenar and hypothenar eminences.



- | | |
|--|---|
| <ul style="list-style-type: none"> 1 Abductor pollicis brevis 2 Abductor digiti minimi 3 Adductor pollicis 4 Aponeurosis, central part 5 Aponeurosis, digital slips 6 Flexor carpi radialis 7 Flexor carpi ulnaris 8 Flexor digiti minimi brevis 9 Flexor pollicis brevis 10 Flexor retinaculum 11 Lumbrical 12 Median nerve | <ul style="list-style-type: none"> 13 Median nerve, palmar branch 14 Median nerve, recurrent branch 15 Palmar digital vessels and nerves 16 Palmaris brevis 17 Radial artery 18 Superficial palmar arch 19 Superficial transverse metacarpal ligaments 20 Synovial sheaths of flexor tendons 21 Ulnar artery 22 Ulnar nerve |
|--|---|

CT 3D reconstruction to show flexor digitorum profundus tendons



Arteriovenous fistula



Dupuytren's contracture

Palm of right hand with synovial sheaths

The synovial sheaths of the wrist and fingers have been emphasised by blue tissue. On the middle finger, the fibrous flexor sheath has been removed (but retained on the other fingers, as at 3) to show the whole length of the synovial sheath (22). On the index and ring fingers, the synovial sheath projects slightly proximal to the fibrous sheath. The synovial sheath of the little finger is continuous with the sheath surrounding the finger flexor tendons under the flexor retinaculum (the ulnar bursa, 24), and the sheath of flexor pollicis longus is the radial bursa (20), which also continues under the retinaculum (9).

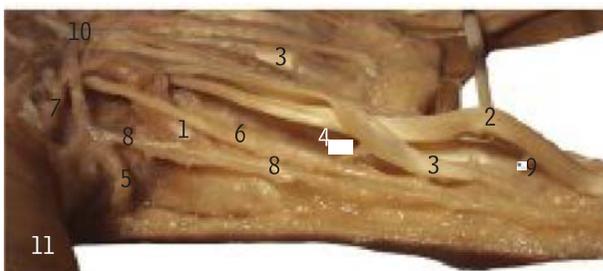
- | | |
|--|--|
| 1 Abductor digiti minimi | 14 Palmar digital artery |
| 2 Abductor pollicis brevis | 15 Palmar digital nerve |
| 3 Fibrous flexor sheath | 16 Palmaris brevis |
| 4 Flexor carpi radialis | 17 Palmaris longus |
| 5 Flexor carpi ulnaris | 18 Pisiform bone |
| 6 Flexor digiti minimi brevis | 19 Radial artery |
| 7 Flexor digitorum superficialis | 20 Radial bursa and flexor pollicis longus |
| 8 Flexor pollicis brevis | 21 Superficial palmar arch |
| 9 Flexor retinaculum | 22 Synovial sheath |
| 10 Median nerve | 23 Ulnar artery |
| 11 Muscular (recurrent) branch of median nerve | 24 Ulnar bursa |
| 12 Palmar branch of median nerve | 25 Ulnar nerve |
| 13 Palmar branch of ulnar nerve | |

In the carpal tunnel (beneath the flexor retinaculum), one synovial sheath envelops the eight tendons of flexor digitorum superficialis and profundus (A24), another envelops the flexor pollicis longus tendon (A20), and flexor carpi radialis (in its own compartment of the flexor retinaculum) has its own sheath also (A4). The synovial sheaths for flexor carpi radialis and flexor pollicis longus extend as far as the tendon insertions.

The sheath of the long finger flexors is continuous with the digital synovial sheath of the little finger, but is *not* continuous with the digital synovial sheaths of the ring, middle or index fingers; these fingers have their own synovial sheaths whose proximal ends project slightly beyond the *fibrous* sheaths within which the digital *synovial* sheaths lie.

The muscular (recurrent) branch (A11) of the median nerve usually supplies abductor pollicis brevis, flexor pollicis brevis and opponens pollicis, but of all the muscles in the body flexor pollicis brevis (A8) is the one most likely to have an anomalous supply: in about one-third of hands by the median nerve, in another third by the ulnar nerve, and in the rest by both the median and ulnar nerves.

Right index finger long tendons, vincula and relations



- | |
|---|
| 1 First lumbrical muscle |
| 2 Flexor digitorum profundus |
| 3 Flexor digitorum superficialis |
| 4 Long vinculum of superficialis tendon |
| 5 Metacarpal arterial branch |
| 6 Palmar digital nerve |
| 7 Princeps pollicis artery |
| 8 Radialis indicis artery |
| 9 Short vinculum of profundus tendon |
| 10 Superficial palmar arterial arch |
| 11 Thumb |



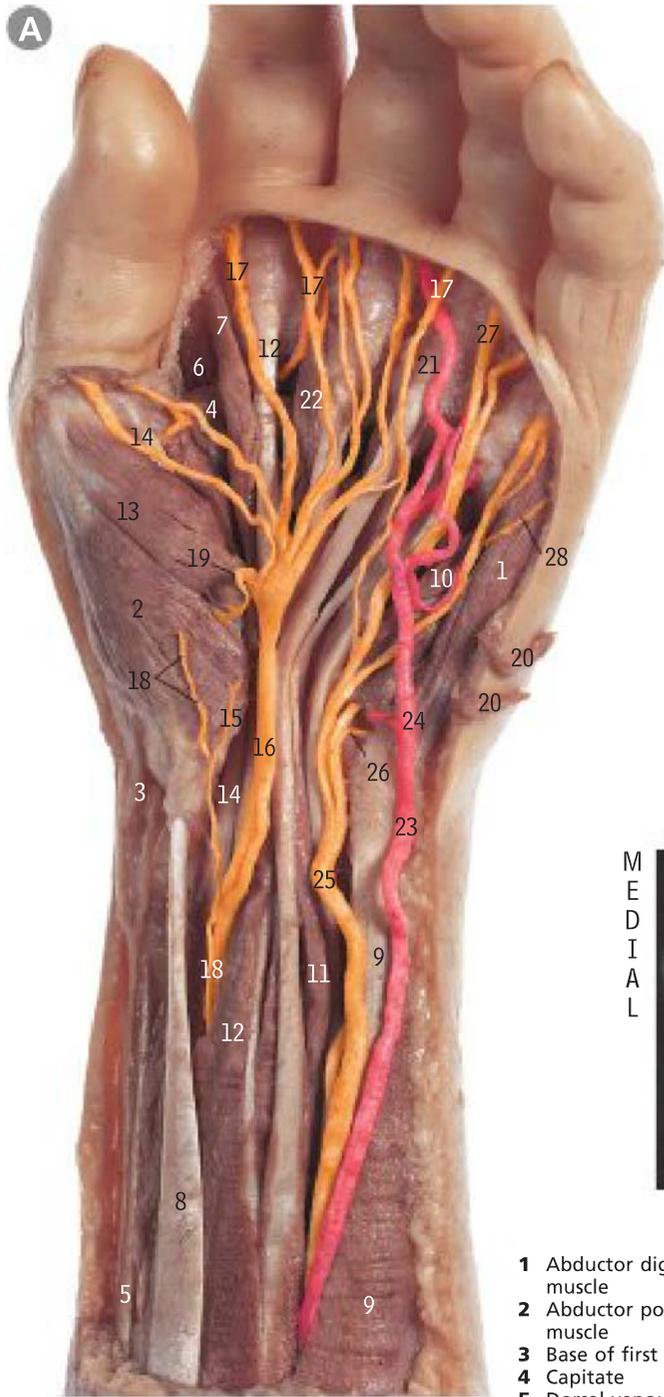
Digital nerve block



Mallet finger

Left wrist and hand

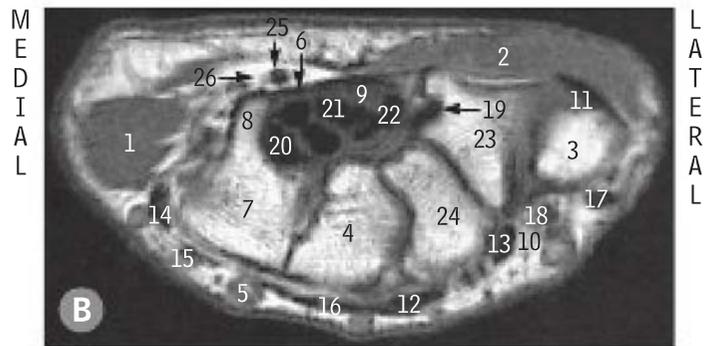
palmar surface *axial MR image*



Parts of the fibrous flexor sheaths of the fingers (A21) have also been excised to show the contained tendons of flexor digitorum superficialis (A12) and flexor digitorum profundus (A11). In the palm, the lumbrical muscles (A7 and 22) arise from the profundus tendons. Compare features in the MR image with the dissection.

- | | |
|-----------------------------------|---|
| 1 Abductor digiti minimi | 17 Median nerve, digital branch |
| 2 Abductor pollicis brevis | 18 Median nerve, palmar cutaneous branch |
| 3 Abductor pollicis longus | 19 Median nerve, recurrent branch |
| 4 Adductor pollicis | 20 Palmaris brevis |
| 5 Brachioradialis | 21 Remaining parts of fibrous flexor sheath |
| 6 First dorsal interosseous | 22 Second lumbrical |
| 7 First lumbrical | 23 Ulnar artery |
| 8 Flexor carpi radialis | 24 Ulnar artery, deep branch |
| 9 Flexor carpi ulnaris | 25 Ulnar nerve |
| 10 Flexor digiti minimi brevis | 26 Ulnar nerve, deep branch |
| 11 Flexor digitorum profundus | 27 Ulnar nerve, digital branch |
| 12 Flexor digitorum superficialis | 28 Ulnar nerve, muscular branch |
| 13 Flexor pollicis brevis | |
| 14 Flexor pollicis longus | |
| 15 Flexor retinaculum cut edge | |
| 16 Median nerve | |

The lumbrical muscles have no bony attachments. They arise from the tendons of flexor digitorum profundus (A11) – the first and second (A7 and A22) from the tendons of the index and middle fingers respectively, and the third and fourth from adjacent sides of the middle and ring, and ring and little fingers respectively. Each is attached distally to the radial side of the dorsal digital expansion of each finger (page 176).



- | | | |
|--|--|--|
| 1 Abductor digiti minimi muscle | 13 Tendon of extensor carpi radialis longus muscle | 20 Tendon of flexor digitorum profundus muscle |
| 2 Abductor pollicis brevis muscle | 14 Tendon of extensor carpi ulnaris muscle | 21 Tendon of flexor digitorum superficialis muscle |
| 3 Base of first metacarpal | 15 Tendon of extensor digiti minimi muscle | 22 Tendon of flexor pollicis longus muscle |
| 4 Capitate | 16 Tendon of extensor digitorum muscle | 23 Trapezium |
| 5 Dorsal venous arch | 17 Tendon of extensor pollicis brevis muscle | 24 Trapezoid |
| 6 Flexor retinaculum | 18 Tendon of extensor pollicis longus muscle | 25 Ulnar artery |
| 7 Hamate | 19 Tendon of flexor carpi radialis muscle | 26 Ulnar nerve |
| 8 Hook of hamate | | |
| 9 Median nerve | | |
| 10 Radial artery | | |
| 11 Tendon of abductor pollicis longus muscle | | |
| 12 Tendon of extensor carpi radialis brevis muscle | | |



Carpal tunnel syndrome



Median nerve palsy

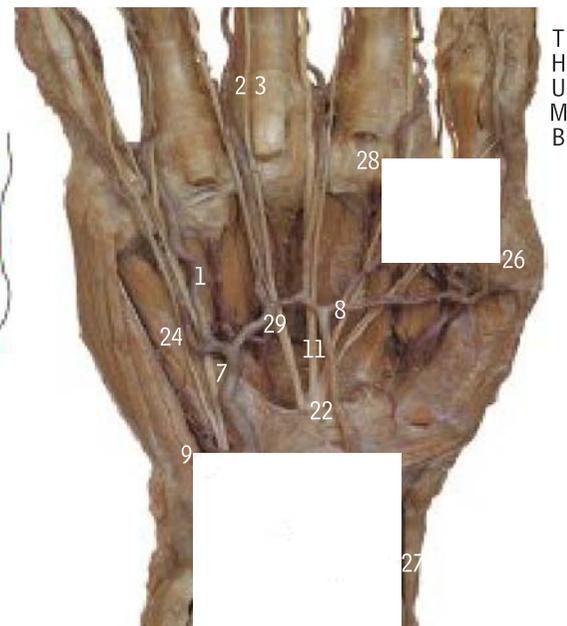
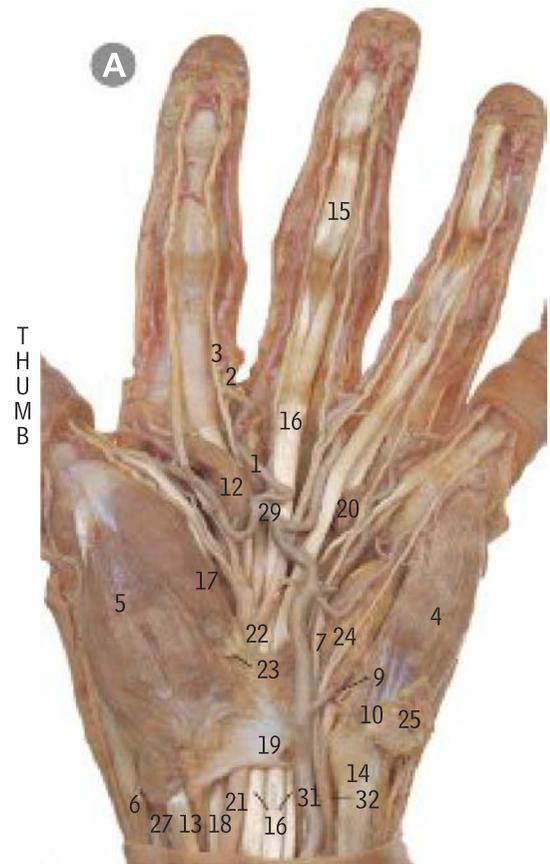
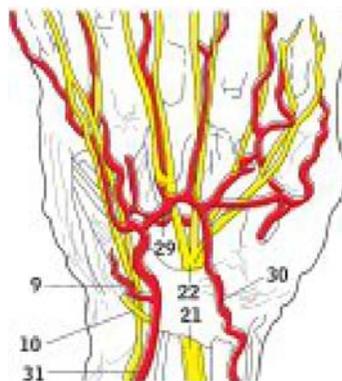
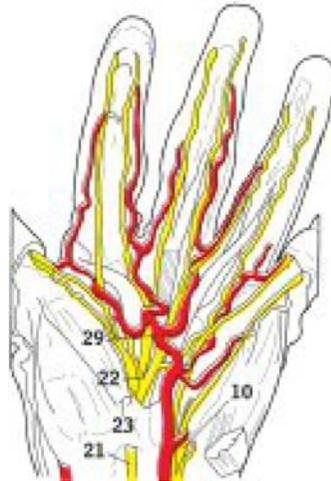
Superficial palmar arch

incomplete in the left hand
complete in the right hand

In two-thirds of hands, the superficial palmar arch is not complete (as in A29). In the other third, it is usually completed by the superficial palmar branch of the radial artery (B30).

In the palm the superficial arterial arch (29) and its branches (as at 1) lie superficial to the common palmar digital nerves (22 and 7), but on the fingers the palmar digital nerves (as at 3) lie superficial (anterior) to the palmar digital arteries (as at 2).

- 1 A common palmar digital artery
- 2 A palmar digital artery
- 3 A palmar digital nerve
- 4 Abductor digiti minimi
- 5 Abductor pollicis brevis
- 6 Abductor pollicis longus
- 7 Common palmar digital branch of ulnar nerve
- 8 Common origin of 28 and 26
- 9 Deep branch of ulnar artery
- 10 Deep branch of ulnar nerve
- 11 Deep palmar arch
- 12 First lumbrical
- 13 Flexor carpi radialis
- 14 Flexor carpi ulnaris and pisiform
- 15 Flexor digitorum profundus
- 16 Flexor digitorum superficialis
- 17 Flexor pollicis brevis
- 18 Flexor pollicis longus
- 19 Flexor retinaculum
- 20 Fourth lumbrical
- 21 Median nerve
- 22 Median nerve dividing into common palmar digital branches
- 23 Muscular (recurrent) branch of median nerve
- 24 Opponens digiti minimi
- 25 Palmaris brevis
- 26 Princeps pollicis artery
- 27 Radial artery
- 28 Radialis indicis artery
- 29 Superficial palmar arch
- 30 Superficial palmar branch of radial artery
- 31 Ulnar artery
- 32 Ulnar nerve



Arterial puncture at the wrist

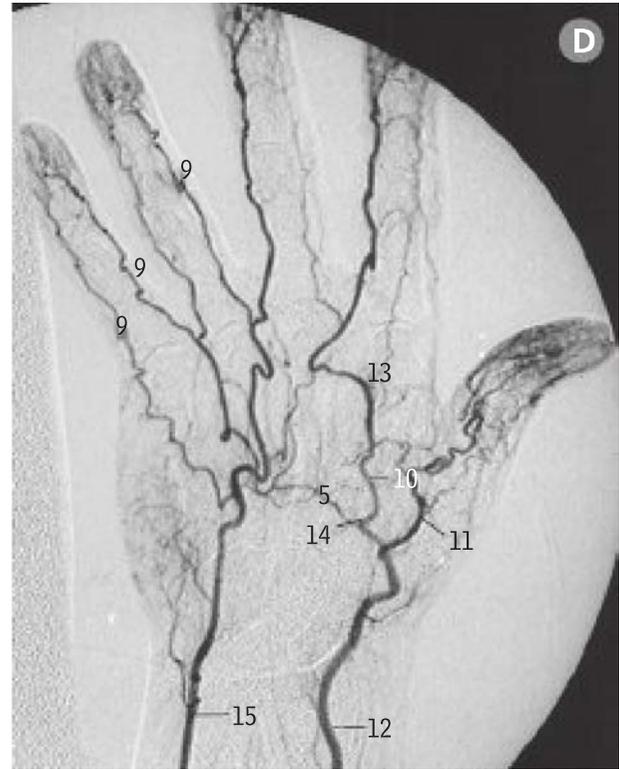
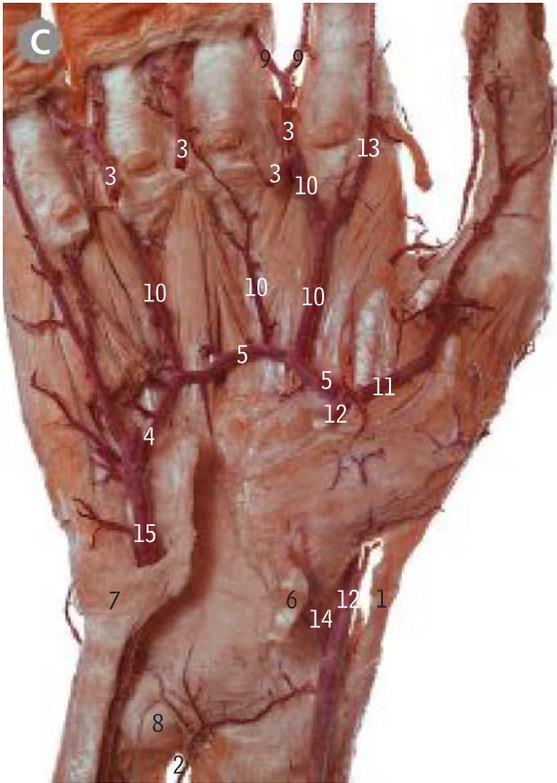


Guyon's canal syndrome

Palm of right hand

deep palmar arch

arteriogram of palmar arteries

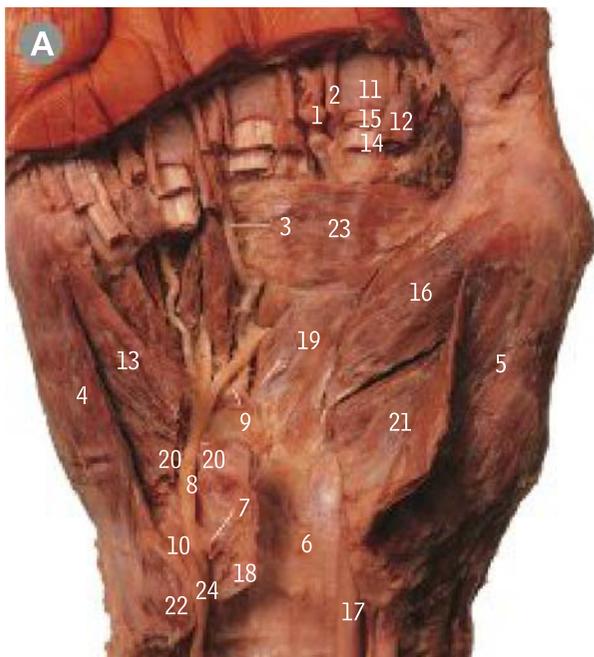


Most muscles and tendons have been removed and the arteries have been distended by injection. The deep palmar arch (5) is seen giving off the palmar metacarpal arteries (10) which join the common palmar digital arteries (3) from the superficial arch. Compare C with the vessels in the arteriogram.

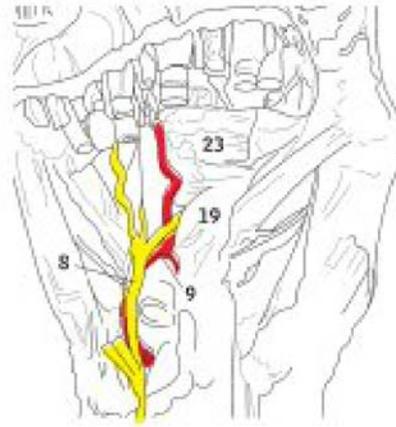
- | | |
|--|---|
| 1 Abductor pollicis longus | 8 Head of ulna |
| 2 Branch of anterior interosseous artery to anterior carpal arch | 9 Digital arteries |
| 3 Common palmar digital arteries (from superficial arch) | 10 Palmar metacarpal arteries |
| 4 Deep branch of ulnar artery | 11 Princeps pollicis artery |
| 5 Deep palmar arch | 12 Radial artery |
| 6 Flexor carpi radialis | 13 Radialis indicis artery (anomalous origin) |
| 7 Flexor carpi ulnaris and pisiform | 14 Superficial palmar branch of radial artery |
| | 15 Ulnar artery |



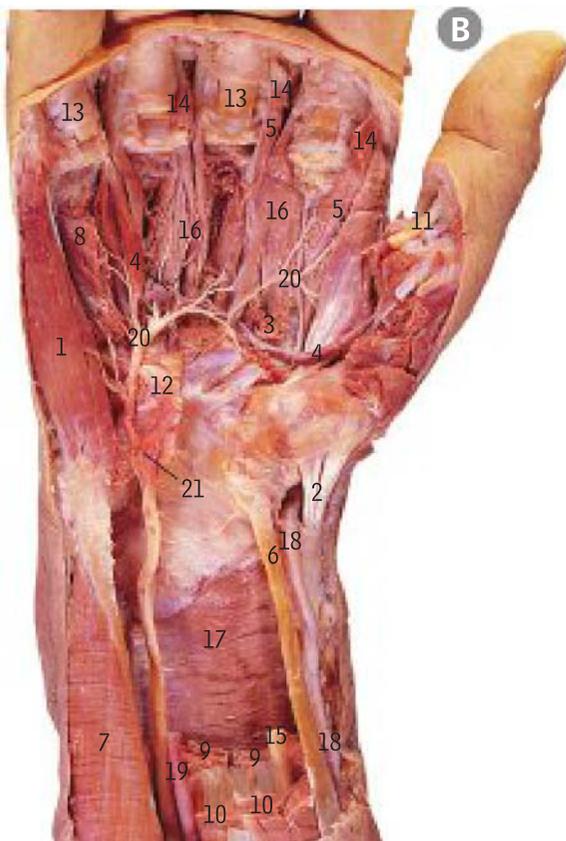
Trigger finger



Palm of right hand deep branch of the ulnar nerve



The long flexor tendons (15 and 14) and lumbricals (12) have been cut off near the heads of the metacarpals, and parts of the hypothenar muscles removed to show the deep branches of the ulnar nerve and artery (8 and 7) running into the palm and curling laterally to pass between the transverse and oblique heads of adductor pollicis (23 and 19).



- | | | | |
|----|---------------------------------|----|--------------------------------------|
| 1 | A common palmar digital artery | 13 | Flexor digiti minimi brevis |
| 2 | A palmar digital nerve | 14 | Flexor digitorum profundus |
| 3 | A palmar metacarpal artery | 15 | Flexor digitorum superficialis |
| 4 | Abductor digiti minimi | 16 | Flexor pollicis brevis |
| 5 | Abductor pollicis brevis | 17 | Flexor pollicis longus |
| 6 | Carpal tunnel | 18 | Flexor retinaculum (cut edge) |
| 7 | Deep branch of ulnar artery | 19 | Oblique head of adductor pollicis |
| 8 | Deep branch of ulnar nerve | 20 | Opponens digiti minimi |
| 9 | Deep palmar arch | 21 | Opponens pollicis |
| 10 | Digital branches of ulnar nerve | 22 | Pisiform |
| 11 | Fibrous flexor sheath | 23 | Transverse head of adductor pollicis |
| 12 | First lumbrical | 24 | Ulnar nerve |

Palm of right hand deep dissection

Deep to the adductor pollicis and the flexor tendons lie the pronator quadratus proximally and the extensive deep palmar branches of the ulnar nerve and deep palmar arch distally.

- | | | | |
|----|--------------------------------------|----|--|
| 1 | Abductor digiti minimi | 12 | Flexor retinaculum – cut |
| 2 | Abductor pollicis longus | 13 | Flexor tendon sheaths |
| 3 | Adductor pollicis – cut | 14 | Lumbrical – cut |
| 4 | Deep palmar arch | 15 | Median nerve – cut |
| 5 | Dorsal interossei | 16 | Palmar interossei |
| 6 | Flexor carpi radialis | 17 | Pronator quadratus |
| 7 | Flexor carpi ulnaris | 18 | Radial artery |
| 8 | Flexor digiti minimi – cut | 19 | Ulnar artery – cut |
| 9 | Flexor digitorum profundus – cut | 20 | Ulnar nerve, deep branches to intrinsic hand muscles |
| 10 | Flexor digitorum superficialis – cut | 21 | Ulnar nerve, superficial branch (cut at wrist) |
| 11 | Flexor pollicis longus | | |



DIPJ distal interphalangeal joint
PIPJ proximal interphalangeal joint
MCPJ metacarpophalangeal joint

1 Base of proximal phalanx
2 Collateral ligament
3 Fibrous flexor sheath
4 Head of second metacarpal



Gamekeeper's
thumb

Palm of right hand ligaments and joints

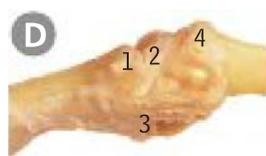
The capsule of the carpometacarpal joint of the thumb (between the base of the first metacarpal and the trapezium) has been removed, to show the saddle-shaped joint surfaces, which allow the unique movement of opposition of the thumb to occur. The palmar and lateral ligaments (11 and 8) of the joint remain intact. The capsule of the distal radio-ulnar joint has also been removed to show the articular disc, but the wrist joint, the ulnar part of which lies distal to the disc, has not been opened.

- 1** Articular disc of distal radio-ulnar joint
- 2** Base of first metacarpal
- 3** Collateral ligament of interphalangeal joint
- 4** Deep transverse metacarpal ligament
- 5** Head of capitate
- 6** Hook of hamate
- 7** Interosseous metacarpal ligament
- 8** Lateral ligament of carpometacarpal joint of thumb
- 9** Lunate
- 10** Marker in groove on trapezium for flexor carpi radialis tendon
- 11** Palmar ligament of carpometacarpal joint of thumb
- 12** Palmar ligament of metacarpophalangeal joint with groove for flexor tendon
- 13** Palmar radiocarpal ligament
- 14** Palmar ulnocarpal ligament
- 15** Pisiform
- 16** Pisohamate ligament
- 17** Pisometacarpal ligament
- 18** Sacciform recess of capsule of distal radio-ulnar joint
- 19** Sesamoid bones of flexor pollicis brevis tendons (with adductor pollicis on ulnar side)
- 20** Trapezium
- 21** Tubercle of scaphoid
- 22** Tubercle of trapezium
- 23** Ulnar collateral ligament of wrist joint

The collateral ligaments of the metacarpophalangeal and interphalangeal joints (D2, C3) pass obliquely forwards from the posterior part of the side of the head of the proximal bone to the anterior part of the side of the base of the distal bone.

Opposition of the thumb is a combination of flexion and abduction with medial rotation of the first metacarpal (page 165). The saddle-shape of the joint between the base of the first metacarpal and the trapezium, together with the way that the capsule and its reinforcing ligaments are attached to the bones, ensures that when flexor pollicis brevis and opponens pollicis contract they produce the necessary metacarpal rotation.

The articular disc (1) holds the lower ends of the radius and ulna together, and separates the distal radio-ulnar joint from the wrist joint, so that the cavities of these joints are not continuous (unlike those of the elbow and proximal radio-ulnar joints, which have one continuous cavity – page 154).



Right index finger metacarpophalangeal (MP) joint, from the radial side

Part of the capsule has been removed to define the collateral ligament (2).



Dorsum of right hand ligaments and joints

Most joint capsules have been removed, including the radial parts of the wrist joint capsule, thus showing the articulation between the scaphoid (6) and the lower end of the radius (7).

- 1 Dorsal radiocarpal ligament
- 2 Fifth metacarpal
- 3 First metacarpal
- 4 Hamate
- 5 Radial collateral ligament of wrist joint
- 6 Scaphoid
- 7 Styloid process of radius
- 8 Styloid process of ulna
- 9 Triquetral

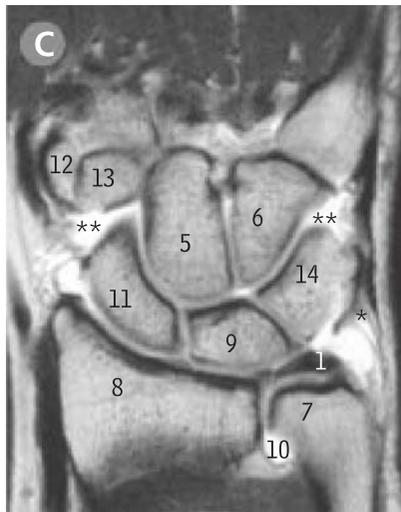
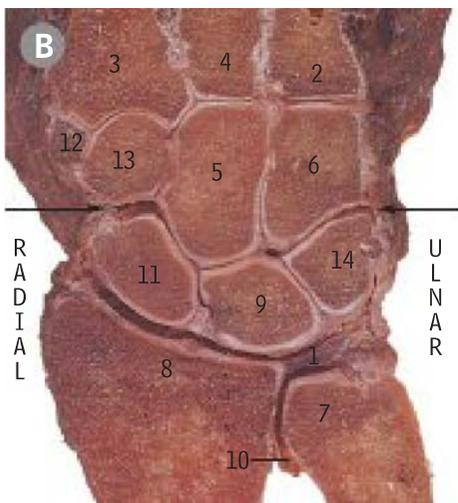


Right wrist coronal section

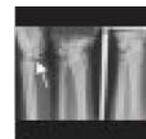
dissection

coronal MR arthrogram

- 1 Articular disc (triangular fibrocartilage)
 - 2 Base of fourth metacarpal
 - 3 Base of second metacarpal
 - 4 Base of third metacarpal
 - 5 Capitate
 - 6 Hamate
 - 7 Head of ulna
 - 8 Lower end of radius
 - 9 Lunate
 - 10 Sacciform recess of distal radio-ulnar joint
 - 11 Scaphoid
 - 12 Trapezium
 - 13 Trapezoid
 - 14 Triquetral
- * Normal vascular penetration of triangular fibrocartilage peripherally
- ** Contrast in midcarpal joint indicates abnormal communication between radiocarpal and midcarpal joints



Viewed from the dorsal surface, the section has passed through the wrist near this surface, and the first and fifth metacarpals have not been included in the cut. The arrows between the two rows of carpal bones indicate the line of the midcarpal joint. Compare the MR image with the section.



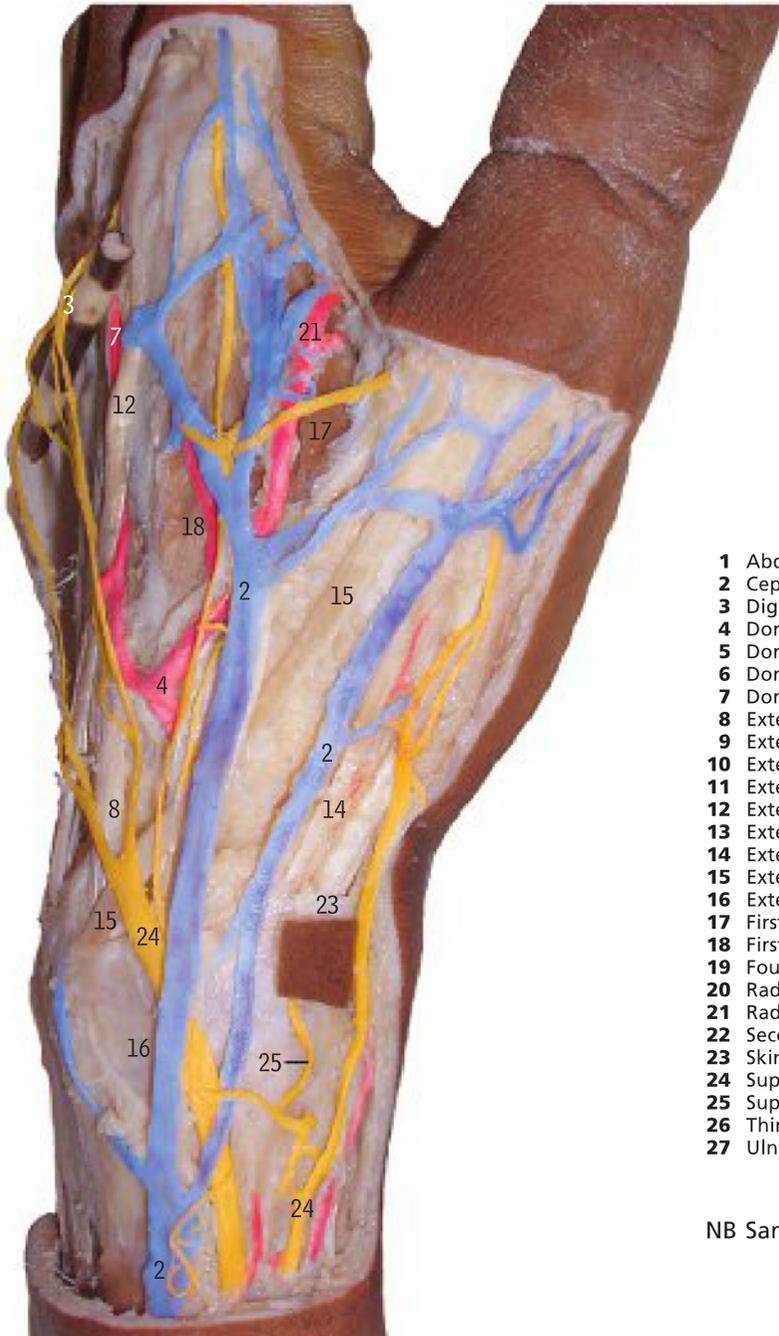
Dislocation of the lunate



Avascular necrosis of the scaphoid

Dorsum of left hand

Radial side view of 'Anatomical snuff box'



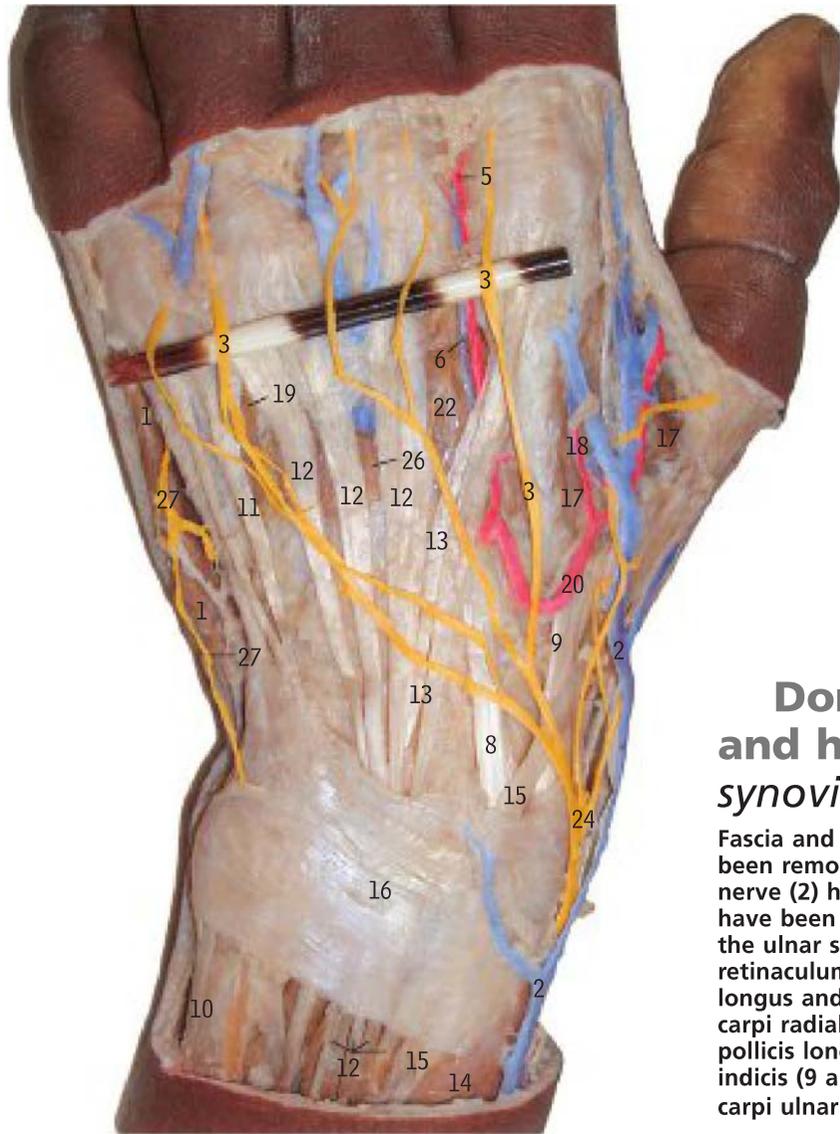
- 1 Abductor digiti minimi
- 2 Cephalic vein
- 3 Digital branches of superficial radial nerve over porcupine quill
- 4 Dorsal carpal arch
- 5 Dorsal digital artery
- 6 Dorsal digital vein
- 7 Dorsal metacarpal artery
- 8 Extensor carpi radialis brevis
- 9 Extensor carpi radialis longus
- 10 Extensor carpi ulnaris
- 11 Extensor digiti minimi
- 12 Extensor digitorum
- 13 Extensor indicis
- 14 Extensor pollicis brevis
- 15 Extensor pollicis longus
- 16 Extensor retinaculum
- 17 First dorsal interosseous
- 18 First dorsal interosseous artery
- 19 Fourth dorsal interosseous
- 20 Radial artery, dorsal branch
- 21 Radialis indicis artery
- 22 Second dorsal interosseous
- 23 Skin overlying abductor pollicis longus
- 24 Superficial radial nerve
- 25 Superficial radial nerve, cutaneous branch
- 26 Third dorsal interosseous
- 27 Ulnar nerve, dorsal cutaneous branch

NB Same label box for 174A and 175B



Mallet finger

Dorsum of left hand



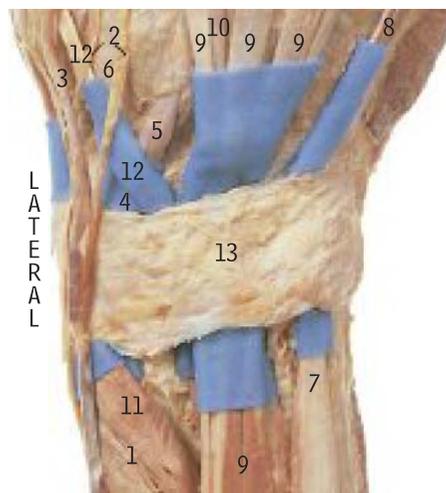
NB Labels for B are on page 174



Dorsum of right wrist and hand *synovial sheaths*

Fascia and cutaneous branches of the ulnar nerve have been removed; the extensor retinaculum (13) and the radial nerve (2) have been preserved and the synovial sheaths have been emphasised by blue tissue. From the radial to the ulnar side, the six compartments of the extensor retinaculum contain the tendons of: (a) abductor pollicis longus and extensor pollicis brevis (1 and 11); (b) extensor carpi radialis longus and brevis (6 and 5); (c) extensor pollicis longus (12); (d) extensor digitorum and extensor indicis (9 and 10); (e) extensor digiti minimi (8); (f) extensor carpi ulnaris (7).

- 1 Abductor pollicis longus
- 2 Branches of radial nerve
- 3 Cephalic vein
- 4 Common sheath for 5 and 6
- 5 Extensor carpi radialis brevis
- 6 Extensor carpi radialis longus
- 7 Extensor carpi ulnaris
- 8 Extensor digiti minimi
- 9 Extensor digitorum
- 10 Extensor indicis
- 11 Extensor pollicis brevis
- 12 Extensor pollicis longus
- 13 Extensor retinaculum

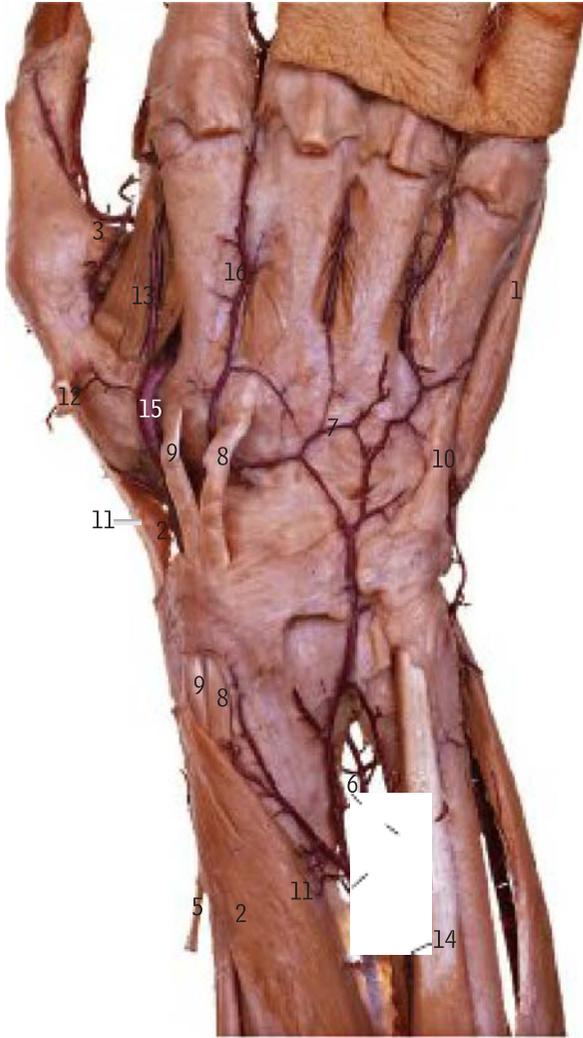


Nail abnormalities



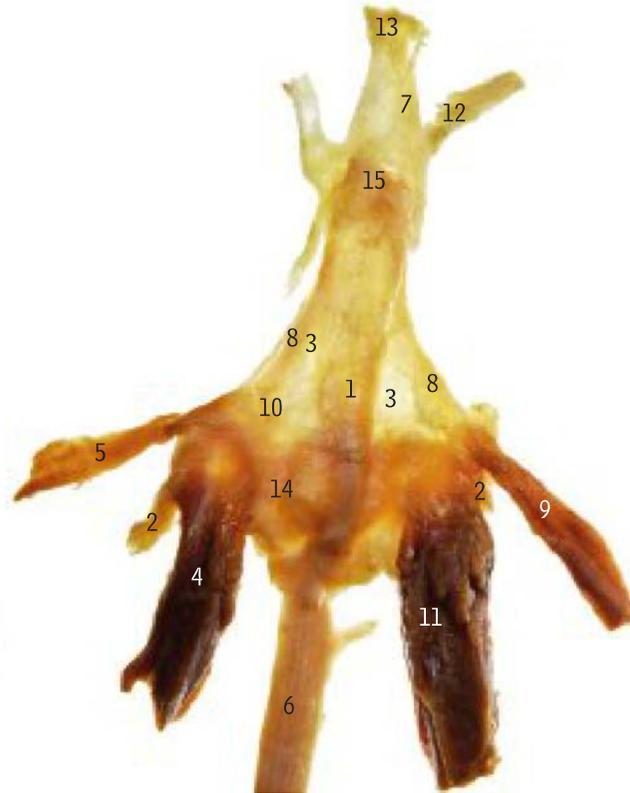
Wrist ganglion

Dorsum of right hand *arteries*



The arteries have been injected and the long finger tendons removed to display the dorsal carpal arch (7) and dorsal metacarpal arteries (as at 13 and 16). Above the wrist pronator quadratus has been removed to show the branch (6) of the anterior interosseous artery (4), which continues towards the palm; the anterior interosseous itself passes to the dorsal surface to join the posterior interosseous artery (14).

Left ring finger extensor expansion (dorsal digital expansion)



- | | | | |
|--|---|---|--|
| 1 Abductor digiti minimi | 9 Extensor carpi radialis longus | 1 Common extensor tendon | 8 Lateral tendon "wing tendon" |
| 2 Abductor pollicis longus | 10 Extensor carpi ulnaris | 2 Deep transverse metacarpal ligament | 9 Lumbrical muscle |
| 3 Adductor pollicis and branch of princeps pollicis artery | 11 Extensor pollicis brevis | 3 Dorsal digital expansion | 10 Oblique interosseous fibres |
| 4 Anterior interosseous artery | 12 Extensor pollicis longus | 4 Dorsal interosseous muscle | 11 Palmar interosseous muscle |
| 5 Brachioradialis | 13 First dorsal interosseous and first dorsal metacarpal artery | 5 Dorsal interosseous muscle, phalangeal attachment | 12 Retinacular ligament, transverse band |
| 6 Branch of anterior interosseous artery to anterior carpal arch | 14 Posterior interosseous artery | 6 Extensor digitorum tendon | 13 Terminal conjoint extensor tendon |
| 7 Dorsal carpal arch | 15 Radial artery | 7 Lateral conjoined extensor tendon | 14 Transverse ligament |
| 8 Extensor carpi radialis brevis | 16 Second dorsal interosseous and second dorsal metacarpal artery | | 15 Triangular ligament |

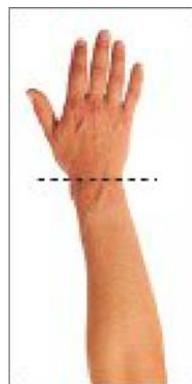
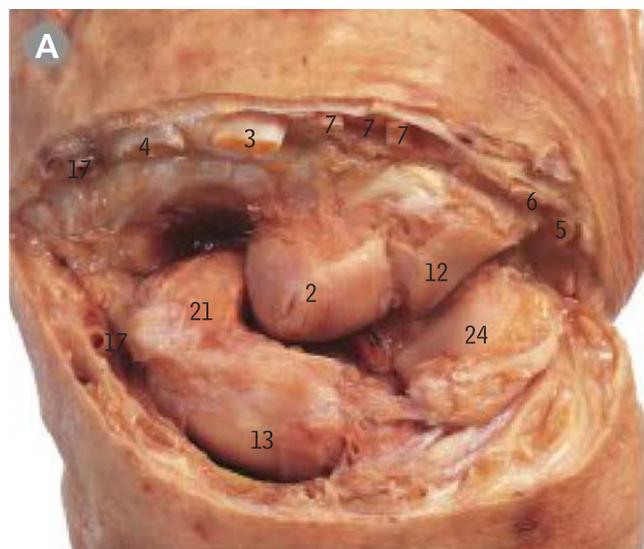
Three tendons pass to different levels of the thumb: abductor pollicis longus (A2) to the base of the first metacarpal, extensor pollicis brevis (A11) to the base of the proximal phalanx, and extensor pollicis longus (A12) to the base of the distal phalanx.

Right midcarpal and wrist joints

midcarpal joint, opened up in forced flexion

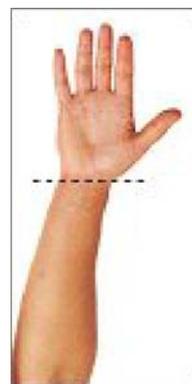
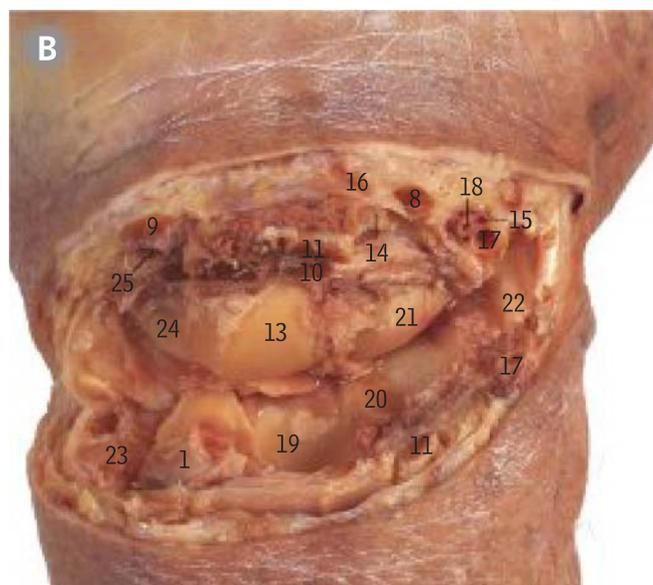
wrist joint, opened up in forced extension

BACK OF RIGHT THUMB EDGE



- 1 Articular disc
- 2 Capitate
- 3 Extensor carpi radialis brevis
- 4 Extensor carpi radialis longus
- 5 Extensor carpi ulnaris
- 6 Extensor digiti minimi
- 7 Extensor digitorum
- 8 Flexor carpi radialis tendon
- 9 Flexor carpi ulnaris tendon
- 10 Flexor digitorum profundus tendon
- 11 Flexor digitorum superficialis tendon
- 12 Hamate
- 13 Lunate
- 14 Median nerve
- 15 Palmar arch vein
- 16 Palmaris longus tendon
- 17 Radial artery
- 18 Radial artery, palmar arch branch
- 19 Radial surface for lunate
- 20 Radial surface for scaphoid
- 21 Scaphoid
- 22 Styloid process of radius
- 23 Styloid process of ulna
- 24 Triquetrum
- 25 Ulnar artery

FRONT OF RIGHT THUMB EDGE



Both joints have been opened up (far beyond the normal range of movement) in order to demonstrate the bones of the joint surfaces. The wrist joint in B has been forced open in extension. A has been forced open in flexion. The proximal (wrist joint) surfaces of the scaphoid (21), lunate (13) and triquetrum (24) are seen in B, and their distal (midcarpal joint) surfaces in A.

Wrist and hand radiographs



dorsopalmar projection

of a 4-year-old child

oblique projection

posteroanterior projection

lateral projection

The epiphysis at the lower end of the radius appears on a radiograph at 2 years and in the ulna at 6 years. The first carpal bone to appear is the capitate at 1 year.

Compare the epiphyses of the metacarpals and phalanges seen in B with the bony specimens in I and J on [page 131](#).

- | | |
|------------------------------------|---|
| 1 Base of first metacarpal | 16 Position of articular disc (triangular fibrocartilage) |
| 2 Base of phalanx | 17 Proximal phalanx of middle finger |
| 3 Base of third metacarpal | 18 Proximal phalanx of thumb |
| 4 Capitate | 19 Scaphoid |
| 5 Distal phalanx of middle finger | 20 Sesamoid bone in flexor pollicis brevis |
| 6 Distal phalanx of thumb | 21 Shaft of phalanx |
| 7 Hamate | 22 Styloid process at lower end of radius |
| 8 Head of first metacarpal | 23 Styloid process of ulna |
| 9 Head of phalanx | 24 Trapezium |
| 10 Head of third metacarpal | 25 Trapezoid |
| 11 Head of ulna | 26 Triquetral |
| 12 Hook of hamate | |
| 13 Lunate | |
| 14 Middle phalanx of middle finger | |
| 15 Pisiform | |

Thorax



Thorax *surface anatomy, from the front*

axial skeleton, from behind

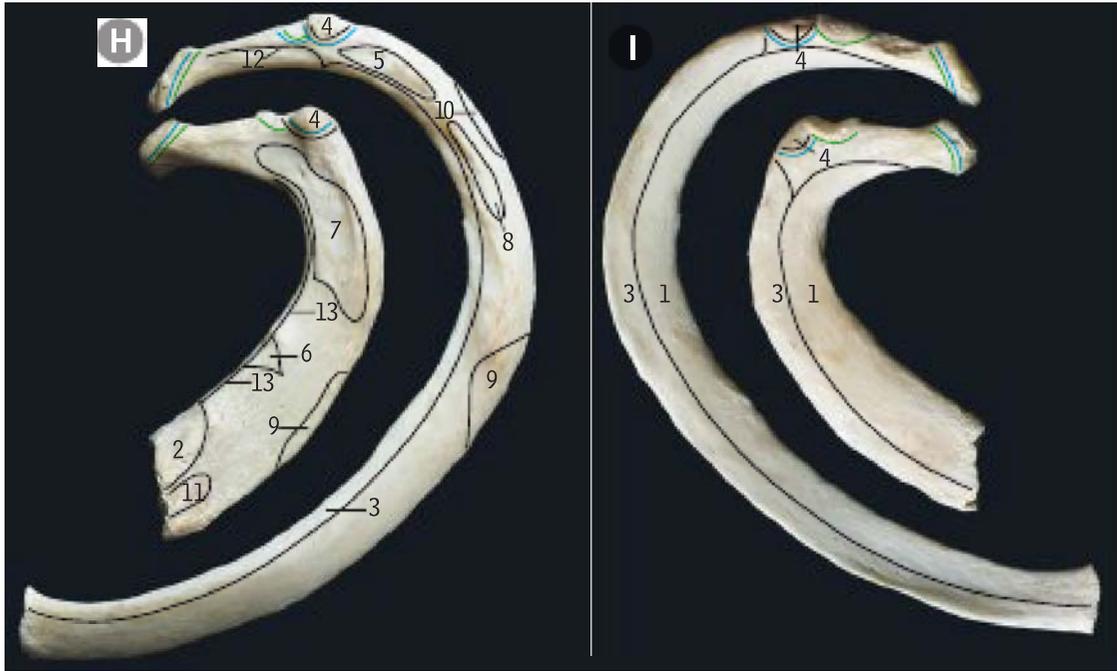
axial skeleton, from the front (vertebral column and thoracic cage)



- 1 Acromion
- 2 Clavicle
- 3 Costal margin
- 4 Deltopectoral groove
- 5 Manubrium
- 6 Rib
- 7 Second rib
- 8 Sternal body
- 9 Suprasternal jugular notch
- 10 Thoracic vertebra, body
- 11 Thoracic vertebra, spinous process
- 12 Twelfth rib
- 13 Trapezius
- 14 Xiphoid process







Left first rib (inner) and second rib (outer)

from above

from below

- 1 Angle of rib
- 2 Costal groove
- 3 Groove for subclavian artery and first thoracic ventral ramus
- 4 Groove for subclavian vein
- 5 Head
- 6 Neck
- 7 Scalene tubercle
- 8 Serratus anterior tuberosity
- 9 Shaft
- 10 Tubercle



Ribs and relationships

a typical rib and vertebra articulated, from above

the left fifth rib from behind (a typical upper rib)

the left seventh rib from behind (a typical lower rib)

the left twelfth rib from the front, with attachments

the left twelfth rib from behind, with attachments

- | | | |
|---|-----------------------------------|---|
| 1 Angle of rib | 10 External intercostal | 19 Quadratus lumborum |
| 2 Area covered by pleura | 11 External oblique | 20 Shaft of rib |
| 3 Articular facet of head | 12 Head | 21 Serratus posterior inferior |
| 4 Articular facet of transverse process | 13 Internal intercostal | 22 Tubercle |
| 5 Articular part of tubercle | 14 Latissimus dorsi | 23 Upper costal facet of head of rib |
| 6 Costal groove | 15 Levator costae | 24 Upper costal facet of vertebral body |
| 7 Costotransverse ligament | 16 Line of pleural reflexion | |
| 8 Diaphragm | 17 Neck of rib | |
| 9 Erector spinae | 18 Non-articular part of tubercle | |

The atypical ribs are the first, second, tenth, eleventh and twelfth.

The **first rib** has a head with one facet (A5), a prominent tubercle (A10), no angle and no costal groove. The shaft has superior and inferior surfaces.

The **second rib** has a head with two facets (B5), an angle (B1) near the tubercle (B10), a broad costal groove (B2) posteriorly, and an external surface facing upwards and outwards with the inner surface facing correspondingly downwards and inwards.

The **twelfth rib** has a head with one facet (F12) but there is no tubercle, no angle and no costal groove. The shaft tapers at its end (the ends of all other ribs widen slightly).

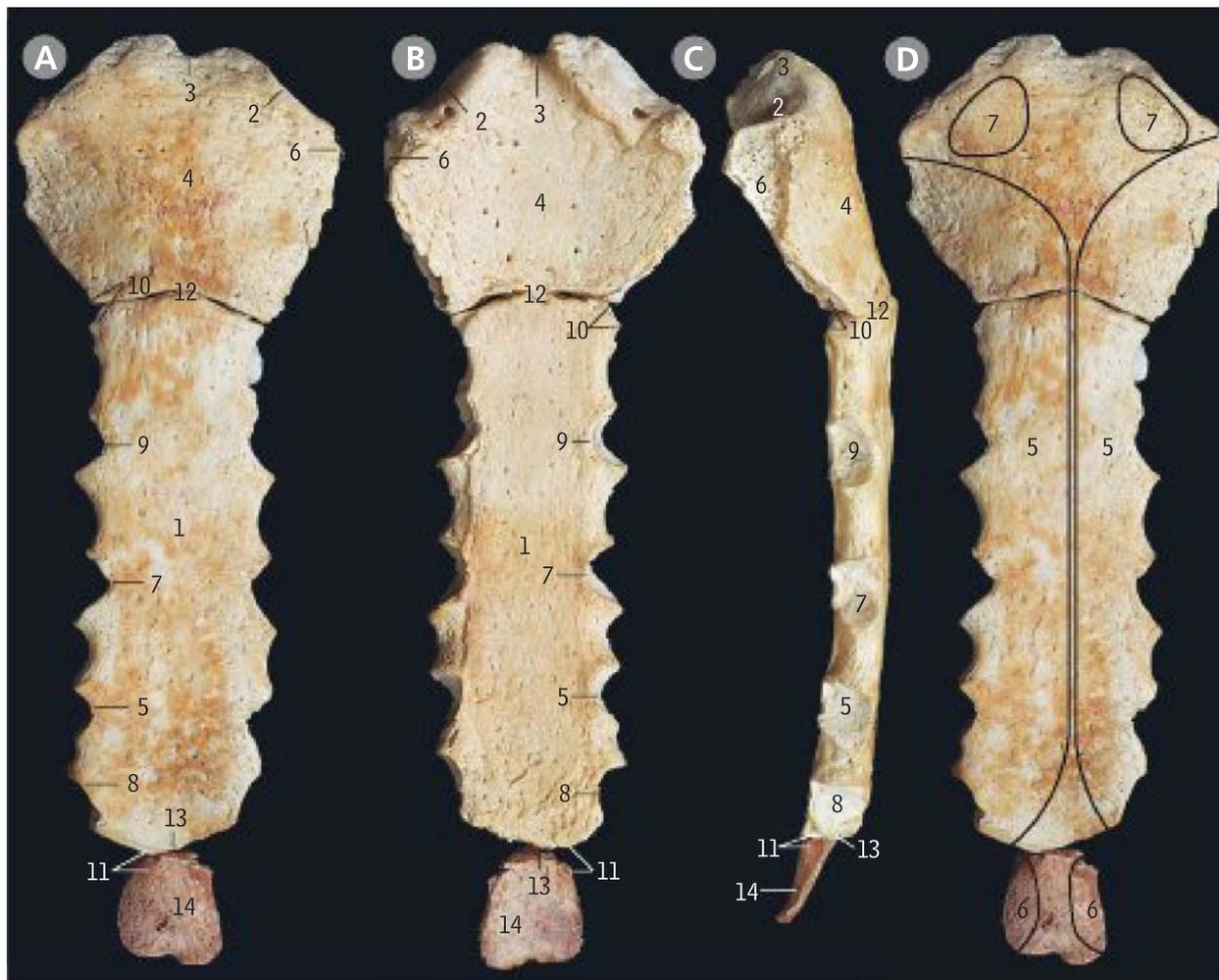
Left first rib (inner) and second rib (outer), attachments

from above

from below

Blue lines, epiphysial lines; green lines, capsule attachments of costovertebral joints

- | | |
|-------------------------------------|--------------------------------------|
| 1 Area covered by pleura | 7 Scalenus medius |
| 2 Costoclavicular ligament | 8 Scalenus posterior |
| 3 Intercostal muscles and membranes | 9 Serratus anterior |
| 4 Lateral costotransverse ligament | 10 Serratus posterior superior |
| 5 Levator costae | 11 Subclavius |
| 6 Scalenus anterior | 12 Superior costotransverse ligament |
| | 13 Suprapleural membrane |



The sternum

from the front

from behind

from the right

- 1 Body
- 2 Clavicular notch
- 3 Jugular notch
- 4 Manubrium
- 5 Notch for fifth costal cartilage
- 6 Notch for first costal cartilage
- 7 Notch for fourth costal cartilage
- 8 Notch for sixth costal cartilage
- 9 Notch for third costal cartilage
- 10 Notches for second costal cartilage
- 11 Notches for seventh costal cartilage
- 12 Sternal angle and manubriosternal joint
- 13 Xiphisternal joint
- 14 Xiphoid process

The sternum consists of the manubrium (4), body (1) and xiphoid process (14).

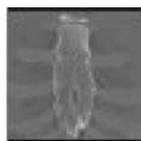
The body of the sternum (1) is formed by the fusion of four sternabrae, the sites of the fusion sometimes being indicated by three slight transverse ridges.

The manubrium (4) and body (1) are bony. The xiphoid process (14) is a cartilaginous structure which frequently shows some degree of ossification. It varies considerably in size and shape.

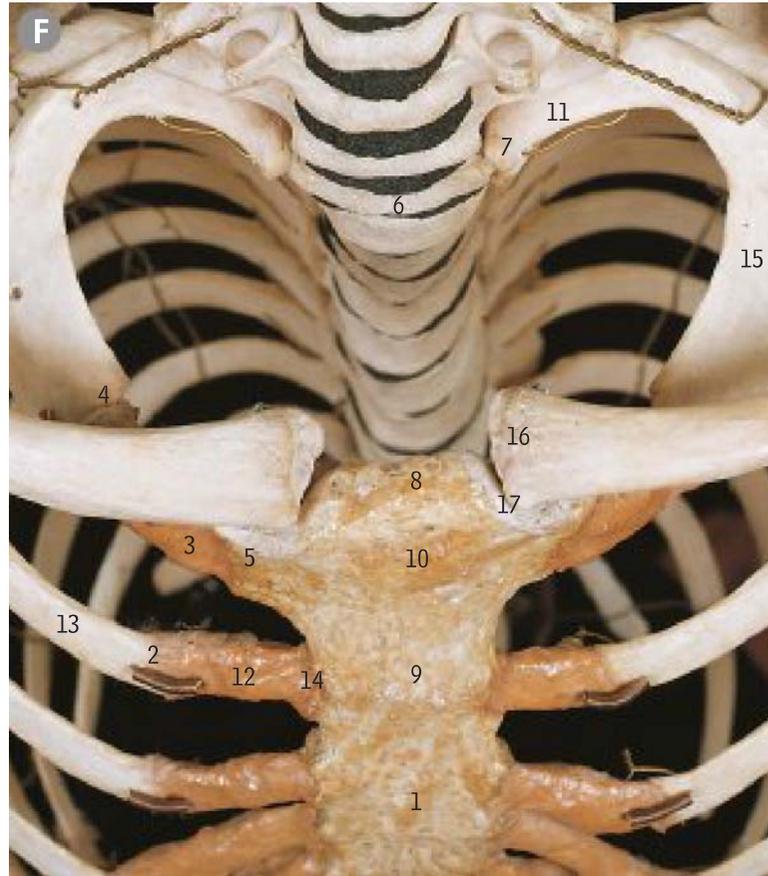
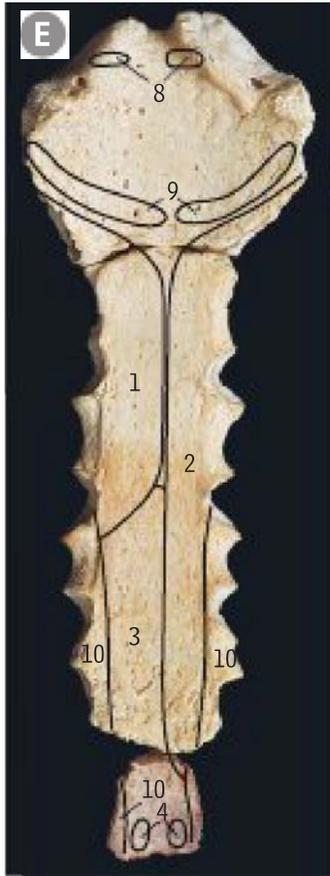
The manubriosternal and xiphisternal joints (12 and 13) are both symphyses, the surfaces being covered by hyaline cartilage and united by a fibrocartilaginous disc.



Median sternotomy



Sternal variants



The sternum attachments

from the front

from behind

- 1 Area covered by left pleura
- 2 Area covered by right pleura
- 3 Area in contact with pericardium
- 4 Diaphragm
- 5 Pectoralis major
- 6 Rectus abdominis
- 7 Sternocleidomastoid
- 8 Sternohyoid
- 9 Sternothyroid
- 10 Transversus thoracis

The two pleural sacs are in contact from the levels of the second to fourth costal cartilages (E2 and 1).

Thoracic inlet in an articulated skeleton, from above and in front

The thoracic inlet or outlet (upper aperture of the thorax) is approximately the same size and shape as the outline of the kidney, and is bounded by the first thoracic vertebra (6), first ribs (15), and costal cartilages (3) and the upper border of the manubrium of the sternum (jugular notch, 8). It does not lie in a horizontal plane but slopes downwards and forwards.

The second costal cartilage (12) joins the manubrium and body of the sternum (10 and 1) at the level of the manubriosternal joint (9). This is an important landmark, since the joint line is palpable as a ridge at the slight angle between the manubrium and body, and the second costal cartilage and rib can be identified lateral to it. Other ribs can be identified by counting down from the second.

- 1 Body of sternum
- 2 Costochondral joint (2nd)
- 3 First costal cartilage
- 4 First costochondral joint
- 5 First sternocostal joint
- 6 First thoracic vertebra
- 7 Head of first rib
- 8 Jugular notch
- 9 Manubriosternal joint (angle of Louis)
- 10 Manubrium of sternum
- 11 Neck of first rib
- 12 Second costal cartilage
- 13 Second rib
- 14 Second sternocostal joint
- 15 Shaft of first rib
- 16 Sternal end of clavicle
- 17 Sternoclavicular joint

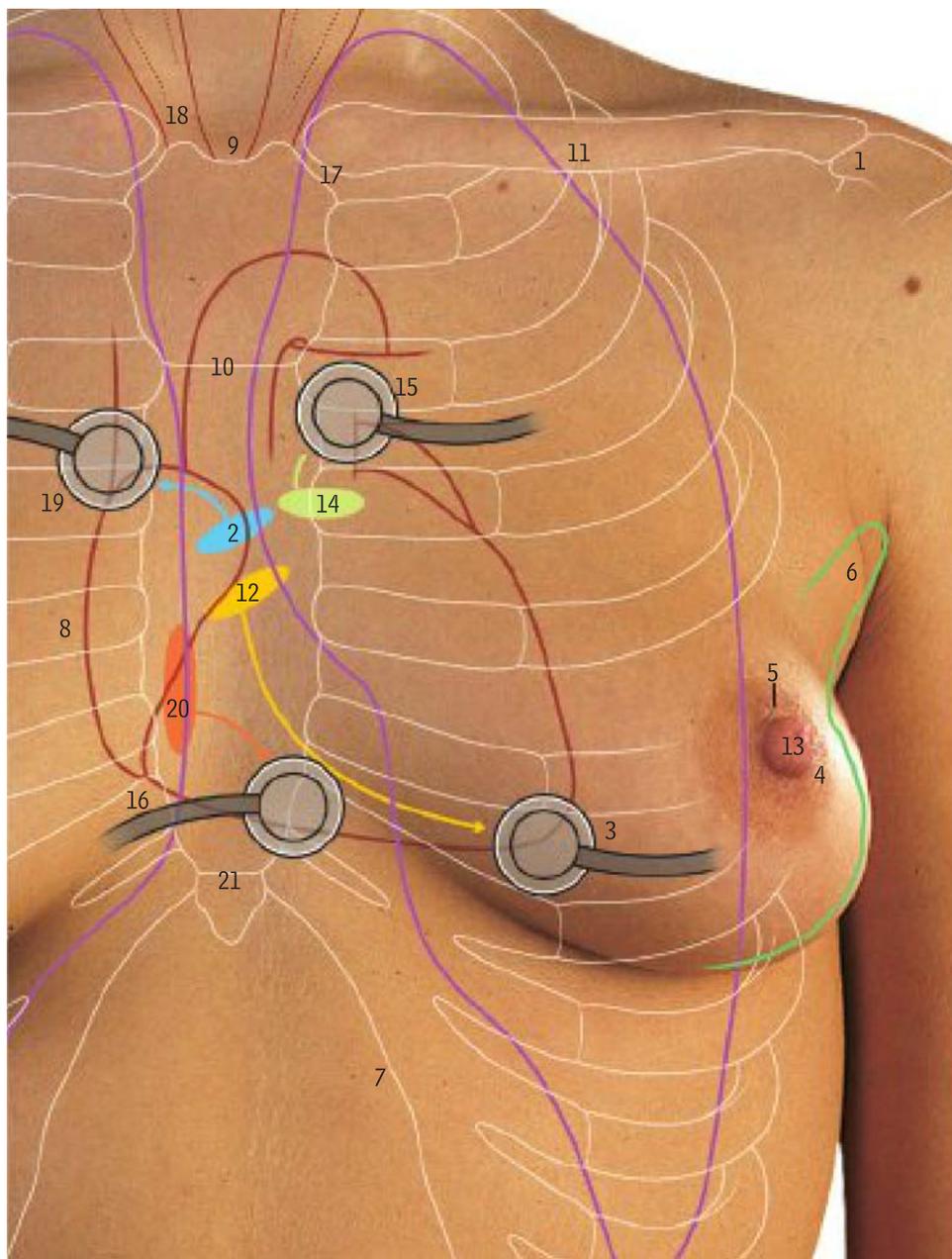


Costochondral pathology



Flail chest

Heart, left parietal pleura and lung surface markings, in the female



Brown line, heart; purple line, pleura; green line, axillary tail of breast

The positions of the four heart valves are indicated by coloured ellipses, and the sites where the sounds of the corresponding valves are best heard with the stethoscope are shown.

The manubriosternal joint (10) is palpable and a guide to identifying the second costal cartilage (15) which joins the sternum at this level (see [page 183](#), F9, 14 and 12).

The pleura and lung extend into the neck for 2.5 cm above the medial third of the clavicle.

In the midclavicular line the lower limit of the *pleura* reaches the eighth costal cartilage, in the midaxillary line it reaches the tenth rib, and at the lateral border of the erector spinae muscle it crosses the twelfth rib. The lower border of the *lung* is about two ribs higher than the pleural reflection.

Behind the sternum, the pleural sacs are adjacent to one another in the midline from the level of the second to fourth costal cartilages, but then diverge owing to the mass of the heart on the left.

- 1 Acromioclavicular joint
- 2 Aortic valve
- 3 Apex of heart
- 4 Areola of breast
- 5 Areolar glands of breast
- 6 Axillary tail of breast (of Spence)

- 7 Costal margin (at eighth costal cartilage)
- 8 Fourth costal cartilage
- 9 Jugular notch
- 10 Manubriosternal joint
- 11 Midpoint of clavicle

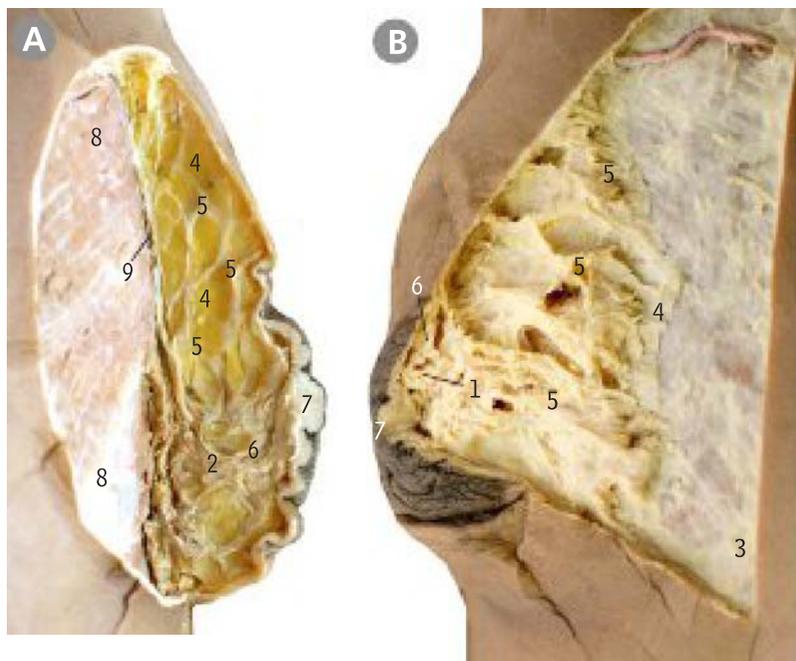
- 12 Mitral valve
- 13 Nipple of breast
- 14 Pulmonary valve
- 15 Second costal cartilage
- 16 Sixth costal cartilage
- 17 Sternoclavicular joint

- 18 Sternocleidomastoid
- 19 Third costal cartilage
- 20 Tricuspid valve
- 21 Xiphisternal joint



Auscultation of heart sounds

Female breast *mammary gland*

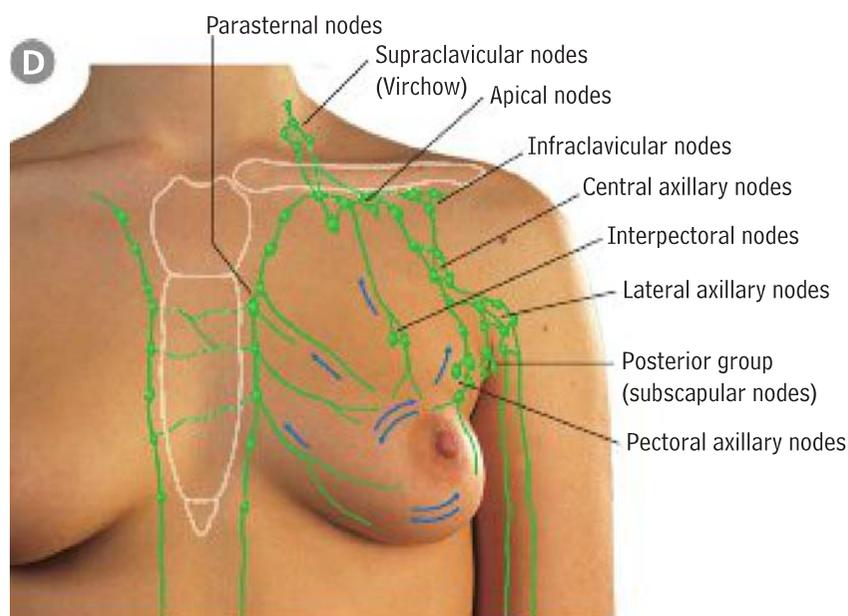


median parasagittal section

dissection of areola, nipple and breast tissue

MRI

- 1 Ampulla of lactiferous duct
- 2 Condensed glandular tissue
- 3 Fascia over pectoralis major muscle
- 4 Fat
- 5 Fibrous septum
- 6 Lactiferous duct
- 7 Nipple
- 8 Pectoralis major muscle
- 9 Retromammary space



Breast lymph drainage

There is a diffuse network of anastomosing lymphatic channels within the breast, including the overlying skin, and *lymph in any part may travel to any other part*. Larger channels drain most of the lymph to axillary nodes, but some from the medial part pass through the thoracic wall near the sternum to parasternal nodes adjacent to the internal thoracic vessels. These are the commonest and initial sites for cancerous spread, but other nodes may be involved (especially in the later spread of disease); these include infraclavicular and supraclavicular (deep cervical) nodes, nodes in the mediastinum, and nodes in the abdomen (via the diaphragm and rectus sheath). Spread to the opposite breast may also occur.



Breast abnormalities



Breast examination



Carcinoma of the breast



Mastectomy



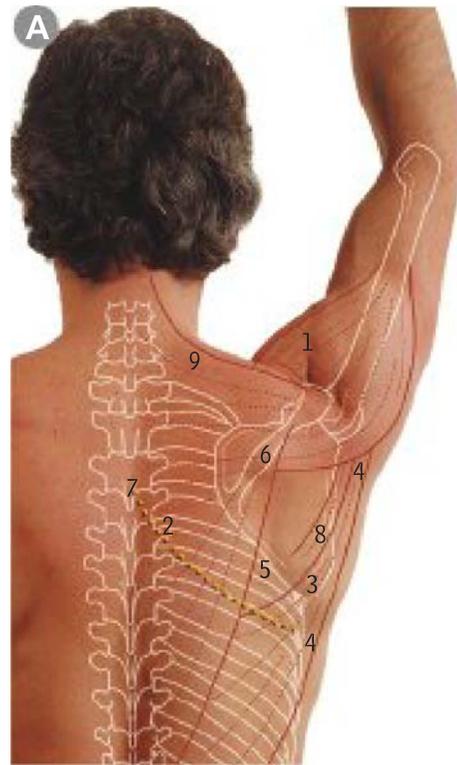
Orange peel texture of the skin and retraction of the nipple

Right side of the thorax from behind with the arm abducted and rotated

With the arm fully abducted and rotated, the medial (vertebral) border of the scapula (5) comes to lie at an angle of about 60° to the vertical, and indicates approximately the line of the oblique fissure of the lung (interrupted line). Red line indicates muscle fiber orientation of trapezius, deltoid and latissimus dorsi muscles.

- 1 Deltoid
- 2 Fifth intercostal space
- 3 Inferior angle of scapula
- 4 Latissimus dorsi
- 5 Medial border of scapula
- 6 Spine of scapula
- 7 Spinous process of third thoracic vertebra
- 8 Teres major
- 9 Trapezius

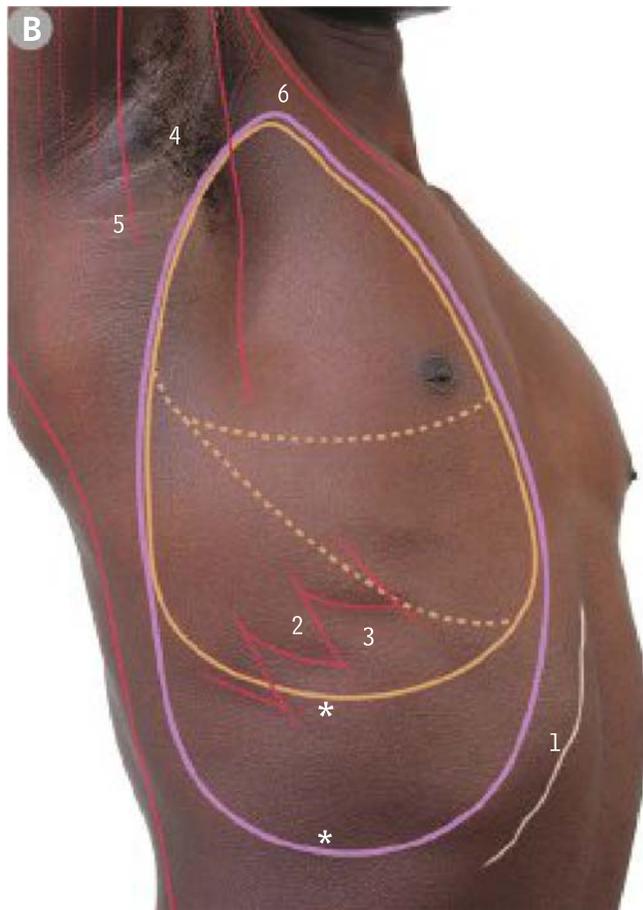
The line of the oblique fissure of the lung runs from the level of the spine of the third thoracic vertebra (7) to the sixth costal cartilage at the lateral border of the sternum (see B). With the arm fully abducted and rotated, the vertebral border of the scapula (5) is a good guide to the direction of this fissure.



Right side of the thorax surface markings, from the right, with the arm abducted and rotated

The purple line indicates the extent of the pleura, and the solid orange line the lower limit of the lung; note the gap between the two at the lower part of the thorax, indicating the costodiaphragmatic recess of pleura, the lung expands into this space during inspiration. The transverse and oblique fissures of the lung are represented by the interrupted orange lines.

- 1 Costal margin
- 2 Digitations of serratus anterior
- 3 External oblique
- 4 Floor of axilla
- 5 Latissimus dorsi
- 6 Pectoralis major



The transverse fissure of the right lung is represented by a line drawn horizontally backwards from the fourth costal cartilage until it meets the line of the oblique fissure (described in A) running forwards to the sixth costal cartilage. The triangle so outlined indicates the middle lobe of the lung, with the superior lobe above it and the inferior lobe below and behind it. It is the area covered by the right breast.

On the left side, where the lung has only two lobes, superior and inferior, there is no transverse fissure; the surface marking for the oblique fissure is similar to that on the right.

* The asterisks represent the places where the lower edges of the lung and pleura cross the eighth and tenth ribs, respectively, in the mid-axillary line.

Anterior chest wall muscles of the thorax *intercostal and from the front*

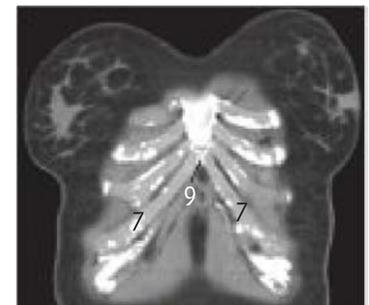


- | | |
|---------------------------------|---------------------------|
| 1 External intercostal muscle | 5 Second costal cartilage |
| 2 External intercostal membrane | 6 Second rib |
| 3 Internal intercostal muscle | 7 Sixth costal cartilage |
| 4 Pectoralis minor muscle | 8 Sternal angle (Louis) |
| | 9 Xiphoid process |

The fibres of the **external intercostal muscles** (1) run downwards and medially, and near the costochondral junctions (as between 5 and 6) give place to the anterior intercostal membrane (here removed); these are thin sheets of connective tissue through which the underlying internal intercostal muscles (3) can be seen.

The fibres of the **internal intercostal muscles** (3) run downwards and laterally. At the front, they are covered by the anterior intercostal membranes, and at the back of the thorax they give place to the posterior intercostal membranes. The different directions of the muscle fibres enable the two muscle groups to be distinguished – down and medially for the externals (1), down and laterally for the internals (3).

The seventh costal cartilage is the lowest to join the sternum and together with the eighth, ninth and tenth cartilages forms the costal margin.



Flail chest

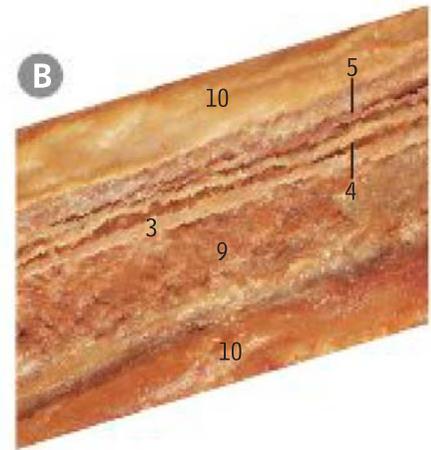
Muscles of the thorax *right* intercostal muscles

from the outside

from the inside

- 1 Eighth rib
- 2 External intercostal
- 3 Fifth intercostal nerve
- 4 Fifth posterior intercostal artery
- 5 Fifth posterior intercostal vein
- 6 Fifth rib
- 7 Fourth rib
- 8 Innermost intercostal
- 9 Internal intercostal
- 10 Pleura
- 11 Seventh rib
- 12 Sixth intercostal nerve
- 13 Sixth rib

The **internal intercostal muscles** are continuous posteriorly with the posterior intercostal membranes which are covered by the medial ends of the external intercostals (as at 2).



In A, each intercostal space has been dissected to a different depth, showing from above downwards an external intercostal muscle (2), internal intercostal (9), innermost intercostal (8) and pleura (10). The main intercostal vessels and nerve lie between the internal and innermost muscles; the nerve (12) is seen in the sixth interspace immediately below the sixth rib (13) and lying on the outer surface of the innermost intercostal (8), but the artery and vein are under cover of the costal groove. The vessels as well as the nerve are seen in the fifth intercostal space when this is dissected from the inside of the thorax, as in B; here the pleura and innermost intercostal muscle have been removed, and the vessels (5 and 4) and fifth intercostal nerve (3) lie against the inner surface of the internal intercostal (9).

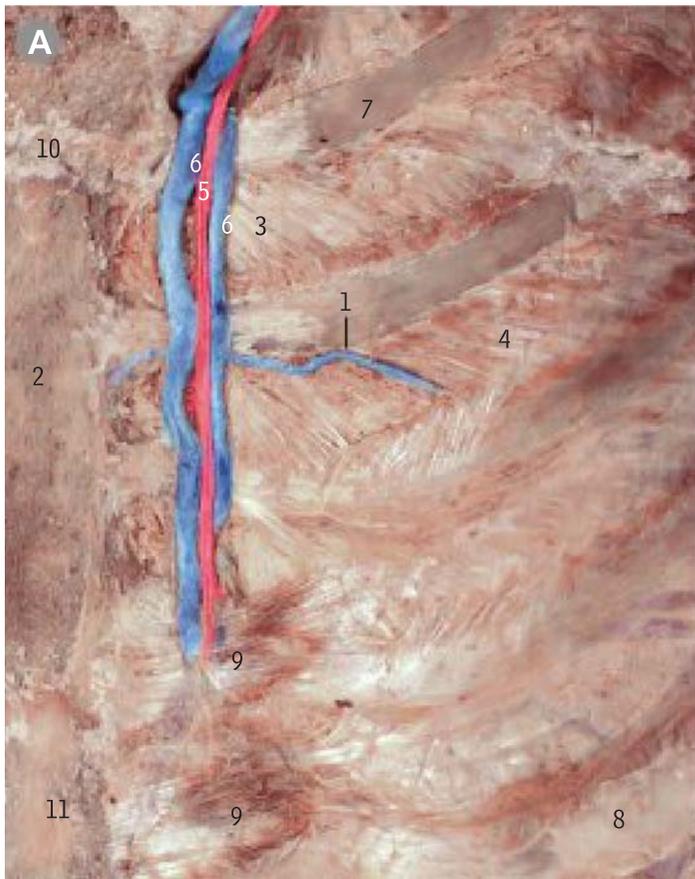


Intercostal
nerve block

Muscles of the thorax

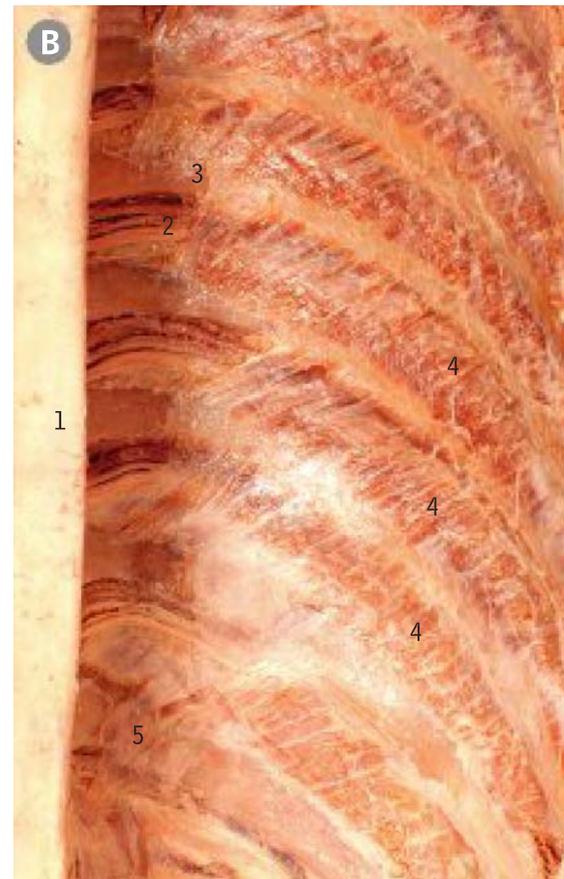
anterior thorax internal view

left lower intercostal muscles



This view of the internal surface of the thoracic wall shows the posterior surface of the right half of the sternum and adjacent wall, with the pleura removed. The internal thoracic artery (5) is seen passing deep to the slips of transversus thoracis (9, previously called sternocostalis).

- | | |
|----------------------------------|--|
| 1 Anterior intercostal vein | 7 Second rib |
| 2 Body of sternum | 8 Sixth rib |
| 3 Innermost intercostal membrane | 9 Slips of transversus thoracis muscle |
| 4 Internal intercostal muscle | 10 Sternal angle (Louis) |
| 5 Internal thoracic artery | 11 Xiphoid process |
| 6 Internal thoracic veins | |



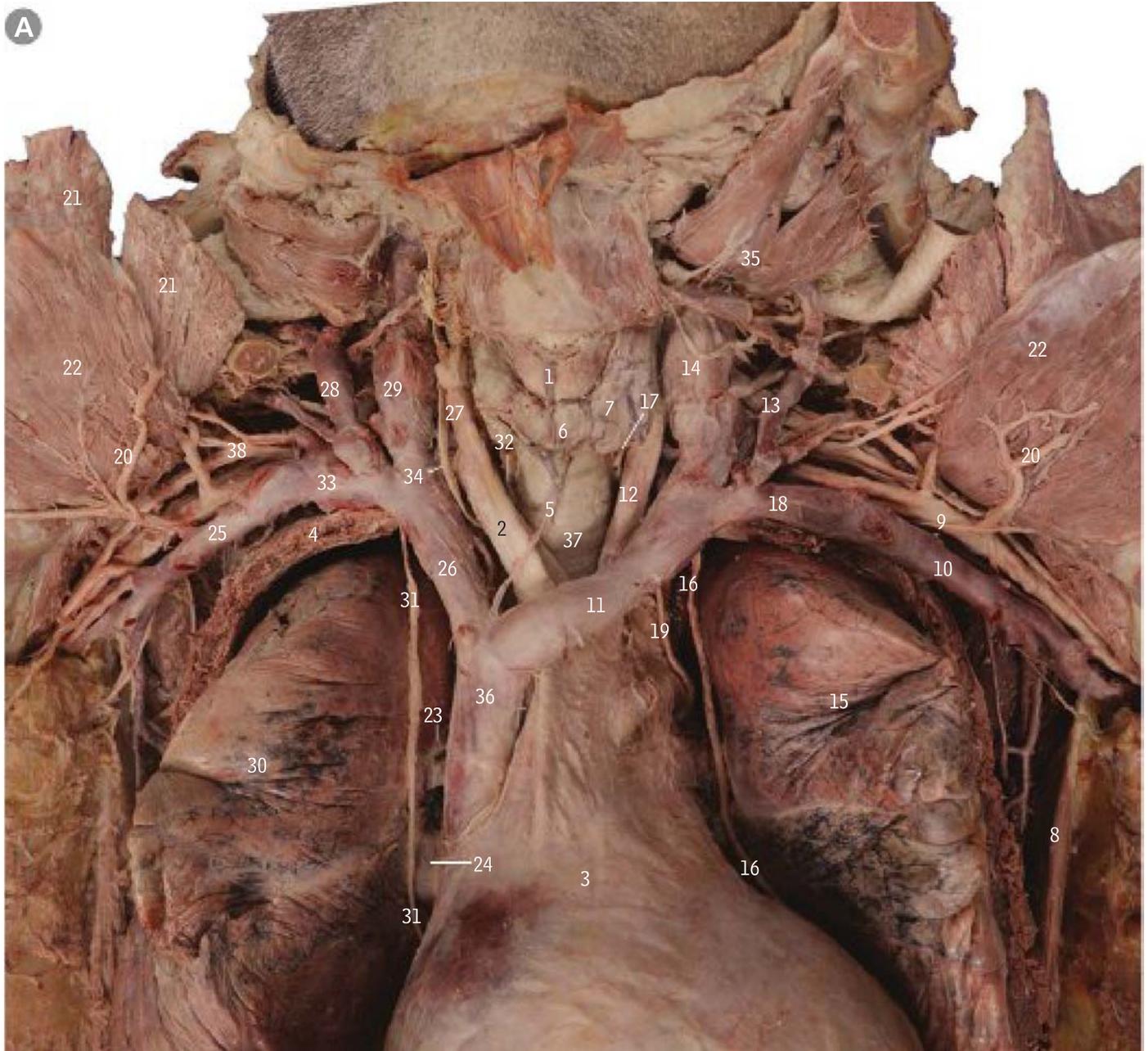
This view of the lower left hemithorax is seen from the right and in front, with the pleura, vessels and nerves removed, and shows part of the innermost layer of thoracic wall muscles (3 and 4).

- | |
|---|
| 1 Descending thoracic aorta |
| 2 Eighth intercostal neurovascular bundle |
| 3 Eighth rib |
| 4 Innermost intercostal muscle |
| 5 Twelfth rib |



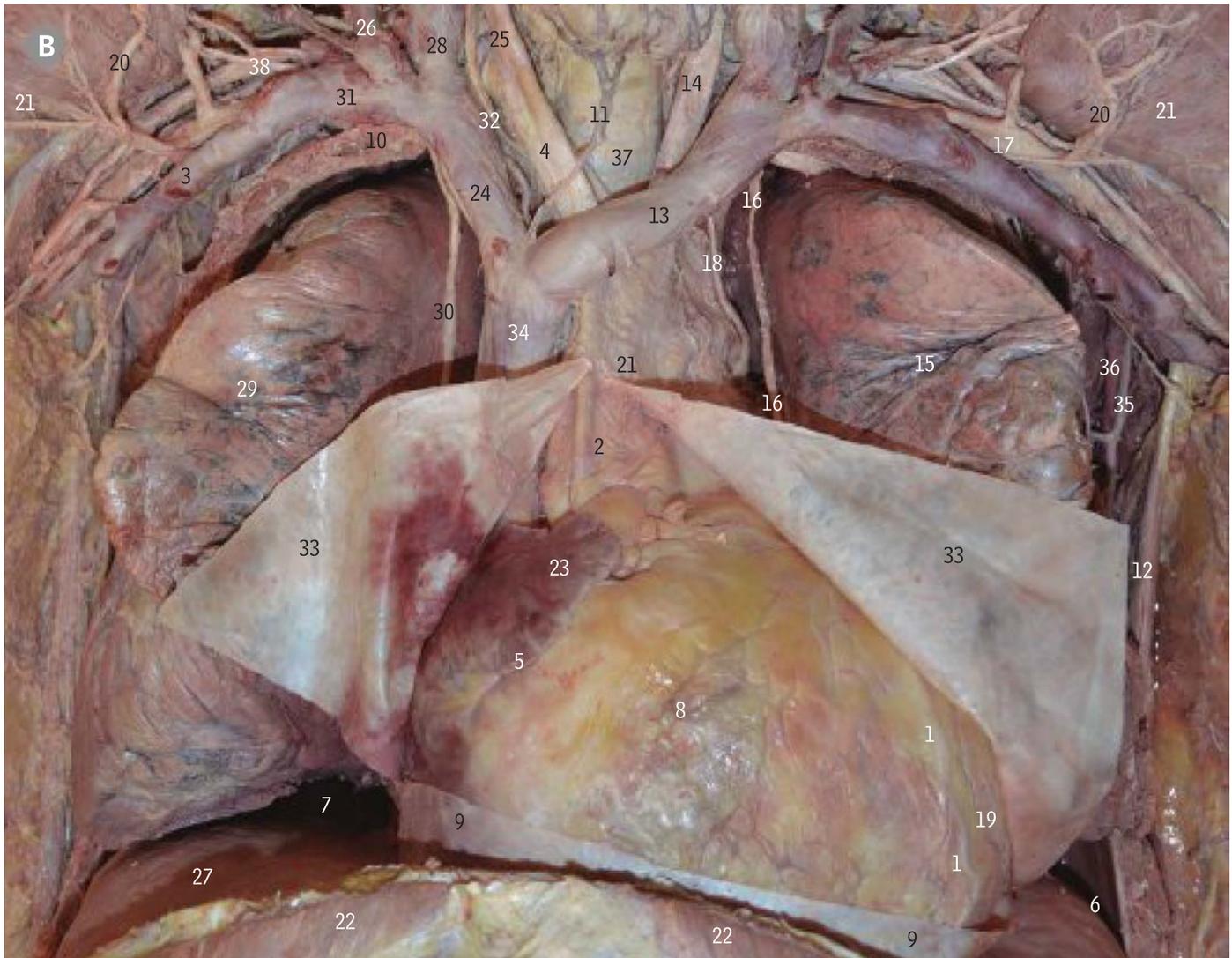
Costochondral pathology

Root of neck and thoracic viscera



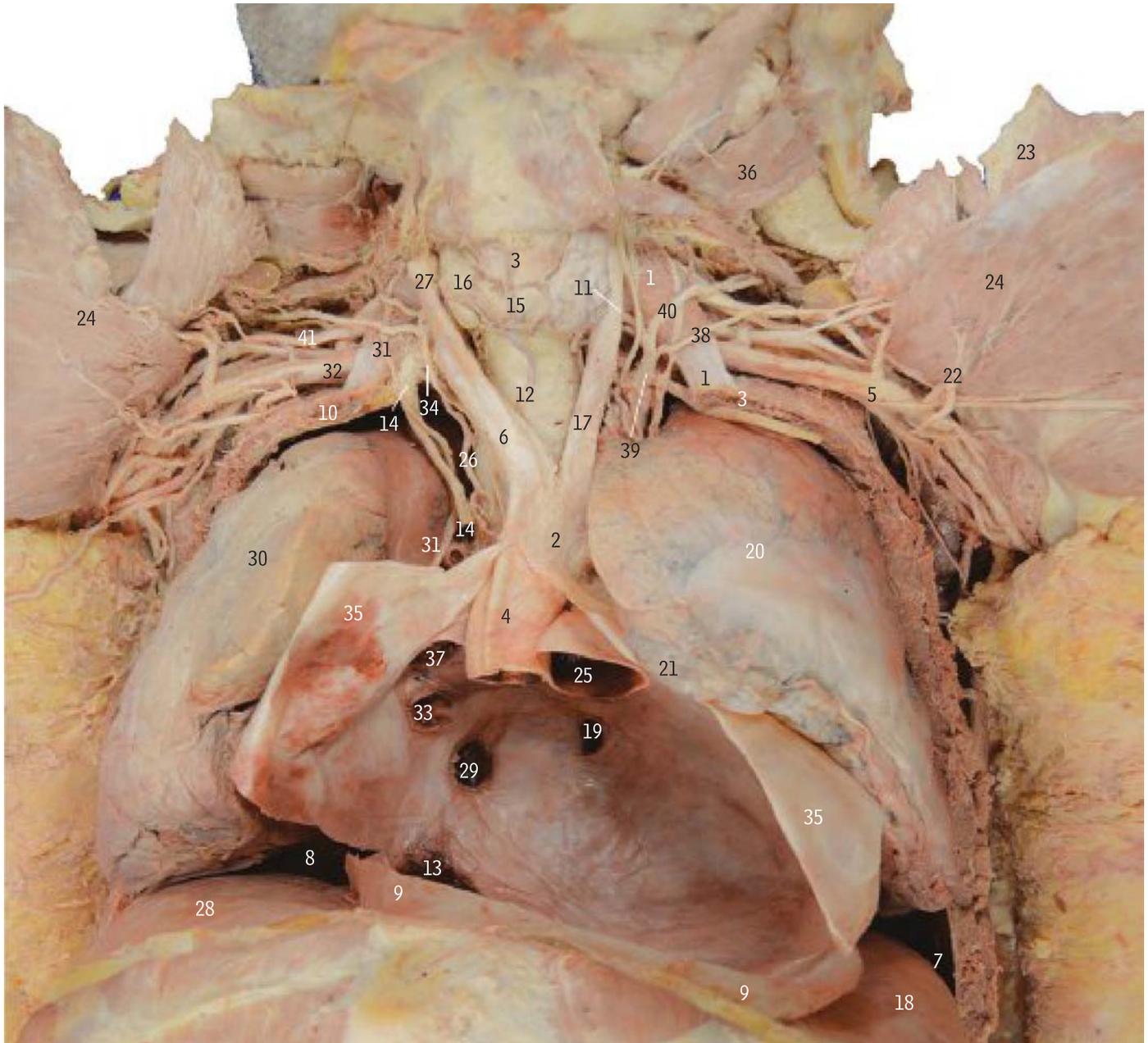
- | | |
|-----------------------------------|--|
| 1 Arch of cricoid cartilage | 20 Pectoral branch of thoracoacromial artery |
| 2 Brachiocephalic trunk | 21 Pectoralis major |
| 3 Fibrous pericardium | 22 Pectoralis minor |
| 4 First rib (cut edge) | 23 Pulmonary artery (right) |
| 5 Inferior thyroid veins | 24 Pulmonary vein |
| 6 Isthmus of thyroid gland | 25 Right axillary vein |
| 7 Lateral lobe of thyroid gland | 26 Right brachiocephalic vein |
| 8 Latissimus dorsi muscle | 27 Right common carotid artery |
| 9 Left axillary artery | 28 Right external jugular vein |
| 10 Left axillary vein | 29 Right internal jugular vein |
| 11 Left brachiocephalic vein | 30 Right lung |
| 12 Left common carotid artery | 31 Right phrenic nerve |
| 13 Left external jugular vein | 32 Right recurrent laryngeal nerve |
| 14 Left internal jugular vein | 33 Right subclavian vein |
| 15 Left lung | 34 Right vagus nerve (CN X) |
| 16 Left phrenic nerve | 35 Strap muscles (Infrahyoid) (reflected) |
| 17 Left recurrent laryngeal nerve | 36 Superior vena cava |
| 18 Left subclavian vein | 37 Trachea |
| 19 Left vagus nerve (CN X) | 38 Upper trunk of right brachial plexus |

Thoracic viscera with heart in situ



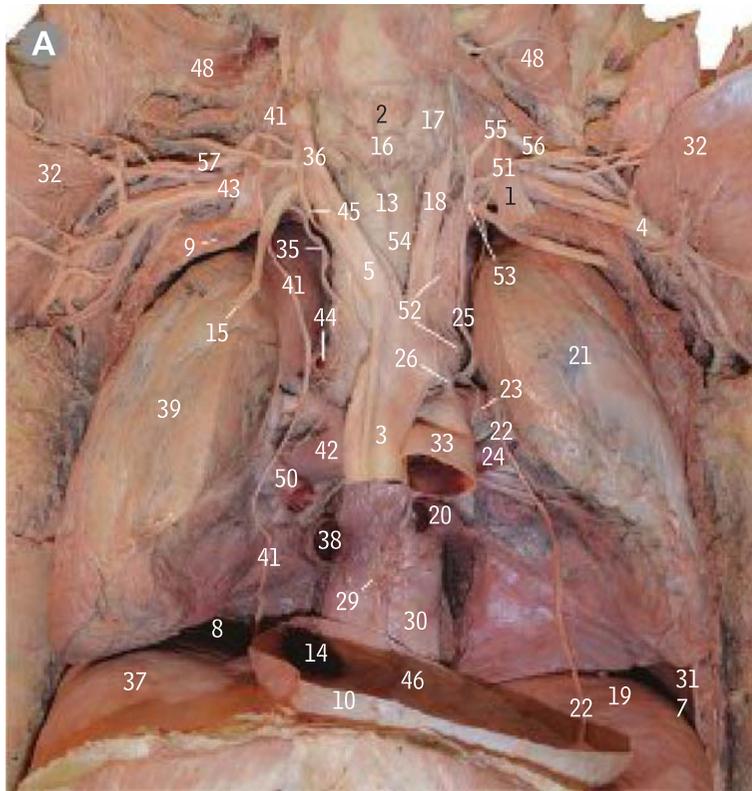
- | | |
|--|---|
| 1 Anterior interventric artery (LAD) | 20 Pectoral branch of thoracoacromial artery |
| 2 Ascending aorta | 21 Pectoralis minor muscle (reflected) |
| 3 Axillary vein | 22 Rectus abdominis muscle |
| 4 Brachiocephalic trunk | 23 Right auricle (appendage) |
| 5 Coronary/atrioventricular sulcus | 24 Right brachiocephalic vein |
| 6 Costodiaphragmatic recess | 25 Right common carotid artery |
| 7 Costomediastinal recess | 26 Right external jugular vein |
| 8 Epicardium (visceral pericardial layer) | 27 Right hemidiaphragm |
| 9 Fibrous pericardium | 28 Right internal jugular vein |
| 10 First rib (cut edge) | 29 Right lung |
| 11 Inferior thyroid vein | 30 Right phrenic nerve |
| 12 Latissimus dorsi muscle | 31 Right subclavian vein |
| 13 Left brachiocephalic vein | 32 Right vagus nerve (CN X) |
| 14 Left common carotid artery | 33 Serous pericardium (parietal layer) |
| 15 Left lung | 34 Superior vena cava |
| 16 Left phrenic nerve | 35 Thoracodorsal artery |
| 17 Left axillary artery | 36 Thoracodorsal vein |
| 18 Left vagus nerve (CN X) | 37 Trachea |
| 19 Left ventricle | 38 Upper trunk of left brachial plexus |

Thoracic viscera with heart removed



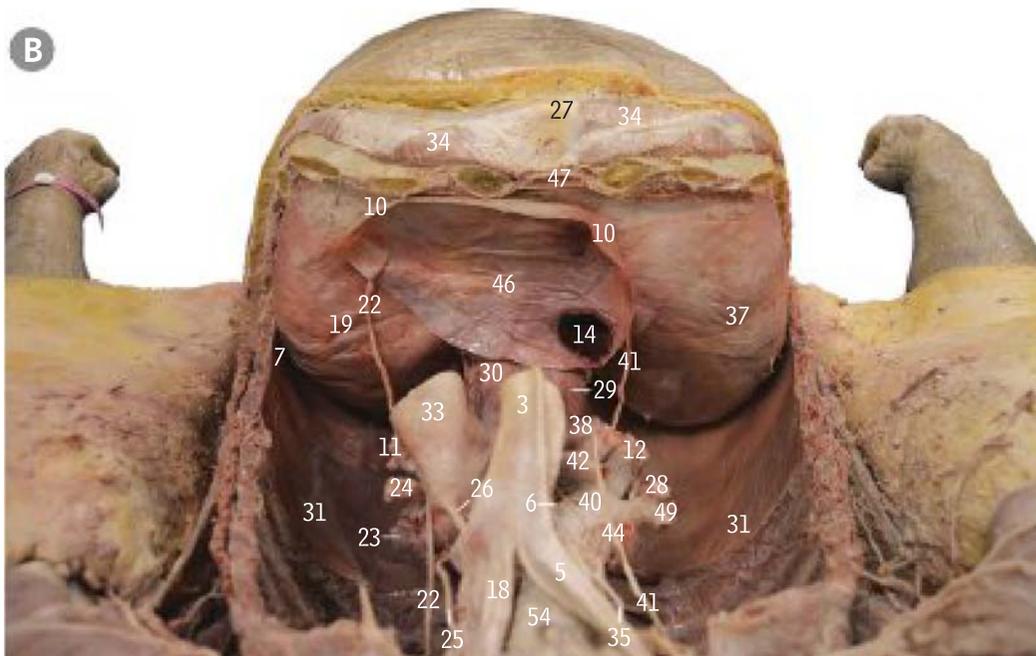
- | | |
|--|--|
| 1 Anterior scalene muscle and tendon | 22 Pectoral branch of thoracoacromial artery |
| 2 Arch of aorta | 23 Pectoralis major (reflected) |
| 3 Arch of cricoid cartilage | 24 Pectoralis minor (reflected) |
| 4 Ascending aorta | 25 Pulmonary trunk |
| 5 Axillary artery (2 nd part) | 26 Right bronchial artery |
| 6 Brachiocephalic trunk | 27 Right common carotid artery |
| 7 Costodiaphragmatic recess | 28 Right hemidiaphragm |
| 8 Costomediastinal recess | 29 Right inferior pulmonary vein |
| 9 Fibrous pericardium | 30 Right lung |
| 10 First rib (cut edge) | 31 Right phrenic nerve |
| 11 Inferior thyroid artery | 32 Right subclavian artery |
| 12 Inferior thyroid veins | 33 Right superior pulmonary vein |
| 13 Inferior vena cava | 34 Right vagus nerve (CN X) |
| 14 Internal thoracic artery | 35 Serous pericardium (parietal layer) |
| 15 Isthmus of thyroid gland | 36 Strap muscles (Infrahyoid) (reflected) |
| 16 Lateral lobe of thyroid gland | 37 Superior vena cava |
| 17 Left common carotid artery | 38 Suprascapular artery |
| 18 Left hemidiaphragm | 39 Thyrocervical trunk |
| 19 Left inferior pulmonary vein | 40 Transverse cervical artery |
| 20 Left lung | 41 Upper trunk of brachial plexus |
| 21 Lingula | |

Thoracic contents with heart removed



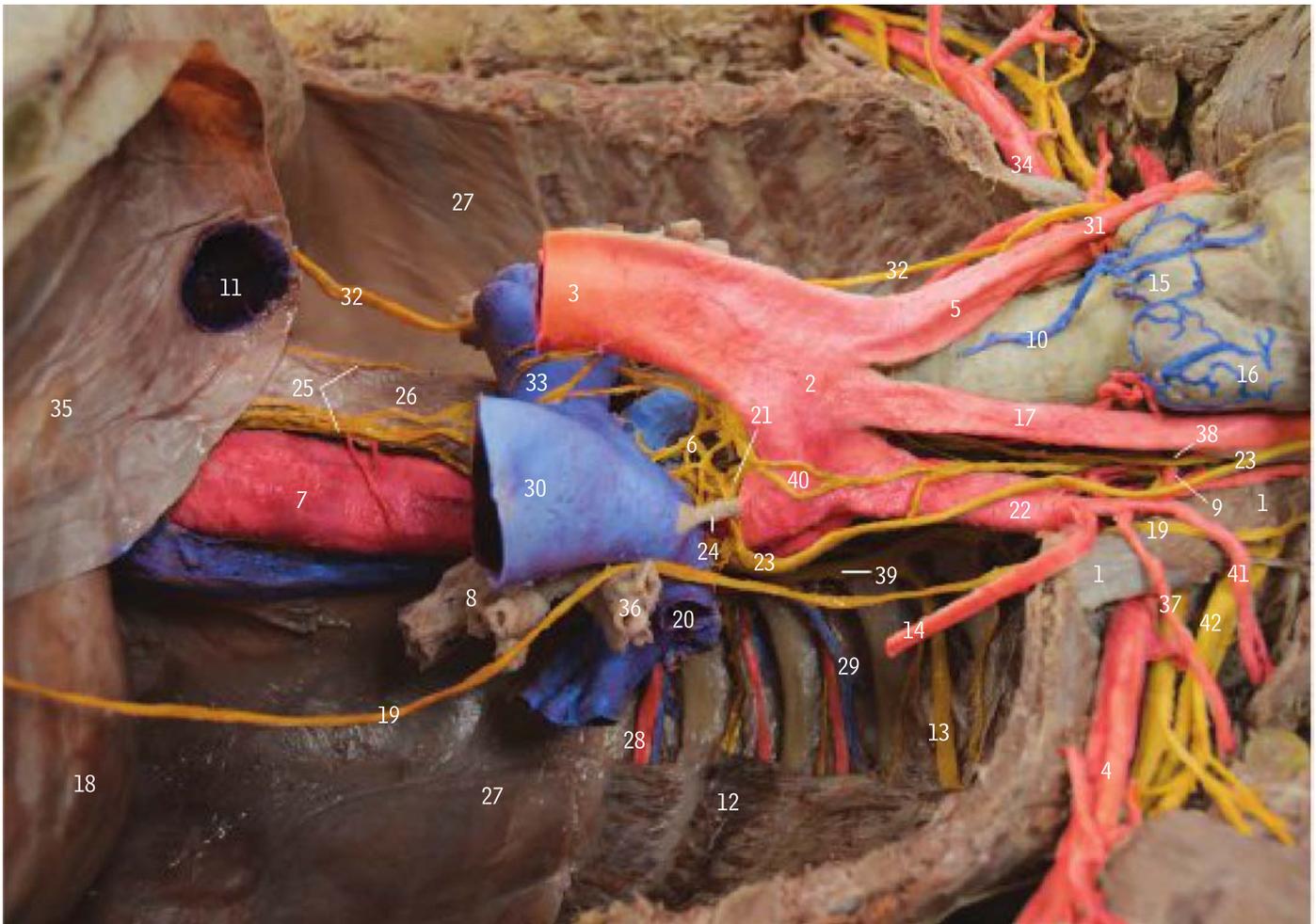
- 1 Anterior scalene muscle
- 2 Arch of cricoid cartilage
- 3 Ascending aorta
- 4 Axillary artery (second part)
- 5 Brachiocephalic trunk
- 6 Carina (internally)
- 7 Costodiaphragmatic recess
- 8 Costomediastinal recess
- 9 Cut edge 1st rib
- 10 Fibrous pericardium
- 11 Inferior lobar bronchus (left)
- 12 Inferior lobar bronchus (right)
- 13 Inferior thyroid veins
- 14 Inferior vena cava
- 15 Internal thoracic artery (reflected laterally)
- 16 Isthmus of thyroid gland
- 17 Lateral lobe of thyroid gland
- 18 Left common carotid
- 19 Left hemidiaphragm
- 20 Left inferior pulmonary vein
- 21 Left lung
- 22 Left phrenic nerve
- 23 Left pulmonary artery
- 24 Left superior pulmonary vein
- 25 Left vagus nerve
- 26 Ligamentum arteriosum
- 27 Linea alba
- 28 Middle lobar bronchus
- 29 Oesophageal plexus
- 30 Oesophagus
- 31 Parietal pleura
- 32 Pectoralis minor muscle (reflected)
- 33 Pulmonary trunk
- 34 Rectus abdominis
- 35 Right bronchial artery (arises from internal thoracic artery, variation)
- 36 Right common carotid
- 37 Right hemidiaphragm
- 38 Right inferior pulmonary vein
- 39 Right lung
- 40 Right main bronchus
- 41 Right phrenic nerve
- 42 Right pulmonary artery
- 43 Right subclavian artery
- 44 Right superior epartial bronchus
- 45 Right vagus nerve
- 46 Serous pericardium (parietal layer)
- 47 Sternum
- 48 Strap muscles (reflected)
- 49 Superior lobar bronchus
- 50 Superior right pulmonary vein
- 51 Suprascapular artery
- 52 Thoracic cardiac nerves
- 53 Thyrocervical trunk
- 54 Trachea
- 55 Transverse cervical artery
- 56 Upper trunk of left brachial plexus
- 57 Upper trunk of right brachial plexus

Superoinferior view of thoracic cavity from head to diaphragm with pericardium and lungs removed



- 7
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- 57

Superior and posterior mediastinum and cardiac plexus view from left



- | | |
|---|---|
| 1 Anterior scalene muscle and tendon | 22 Left subclavian artery |
| 2 Aortic arch | 23 Left vagus nerve (CN X) |
| 3 Ascending aorta | 24 Ligamentum arteriosum |
| 4 Axillary artery | 25 Oesophageal plexus |
| 5 Brachiocephalic trunk | 26 Oesophagus |
| 6 Cardiac plexus (superficial) | 27 Parietal pleura |
| 7 Descending aorta | 28 Posterior intercostal artery |
| 8 Inferior lobar bronchus | 29 Posterior intercostal vein |
| 9 Inferior thyroid artery | 30 Pulmonary trunk |
| 10 Inferior thyroid vein | 31 Right common carotid artery |
| 11 Inferior vena cava | 32 Right phrenic nerve |
| 12 Innermost intercostal muscle | 33 Right pulmonary artery |
| 13 Intercostal nerve | 34 Right subclavian artery |
| 14 Internal thoracic artery | 35 Serous pericardium (parietal layer) |
| 15 Isthmus of thyroid gland | 36 Superior lobar bronchus |
| 16 Lateral lobe of thyroid gland | 37 Suprascapular artery |
| 17 Left common carotid artery | 38 Sympathetic trunk (cervical) |
| 18 Left hemidiaphragm | 39 Sympathetic trunk (thoracic) |
| 19 Left phrenic nerve | 40 Thoracic cardiac nerves (sympathetic) |
| 20 Left pulmonary artery | 41 Transverse cervical artery |
| 21 Left recurrent laryngeal nerve | 42 Upper trunk of brachial plexus |

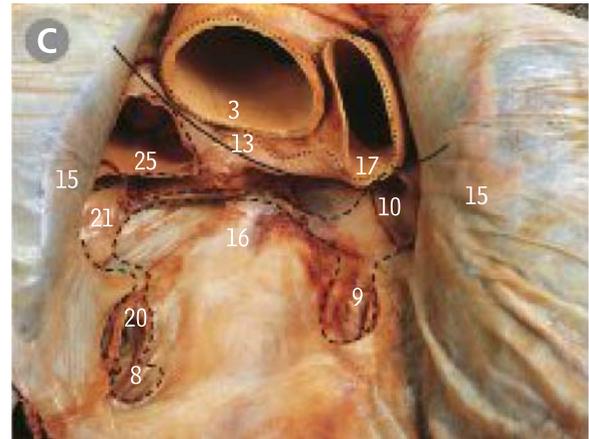
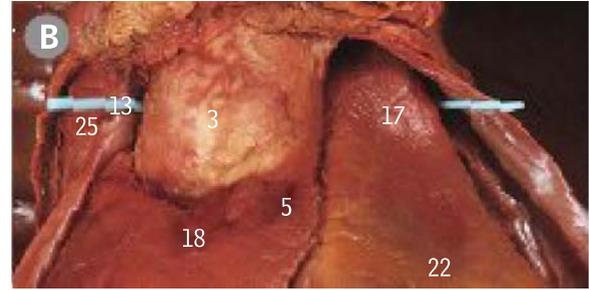
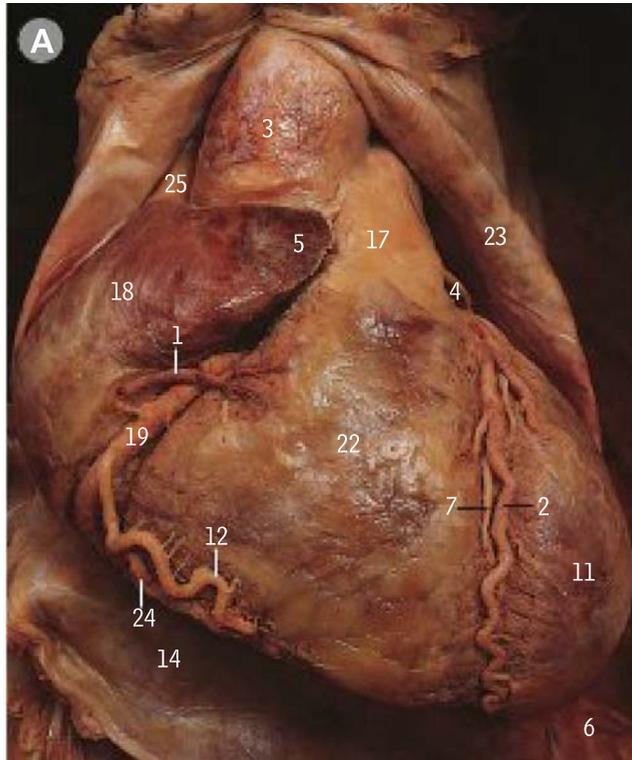
Superior and posterior mediastinum view from the right



- | | |
|--|--|
| 1 Anterior scalene muscle | 23 Pulmonary trunk |
| 2 Ascending aorta | 24 Right bronchial artery |
| 3 Ascending cervical artery | 25 Right common carotid artery |
| 4 Axillary artery | 26 Right lobe of thyroid gland |
| 5 Brachiocephalic trunk | 27 Right main bronchus |
| 6 Cardiac plexus | 28 Right phrenic nerve |
| 7 Carina (internal feature) | 29 Right pulmonary artery |
| 8 Inferior belly of omohyoid muscle | 30 Right recurrent laryngeal nerve |
| 9 Inferior lobar bronchus | 31 Right sternocleidomastoid muscle (reflected) |
| 10 Inferior thyroid artery | 32 Right subclavian artery |
| 11 Innermost intercostal muscle | 33 Right superior eapartial bronchus |
| 12 Internal thoracic artery | 34 Right vagus nerve (CN X) |
| 13 Isthmus of thyroid gland | 35 Strap muscles (reflected) |
| 14 Left main bronchus | 36 Superior lobar bronchus |
| 15 Left phrenic nerve | 37 Suprascapular artery |
| 16 Middle lobar bronchus | 38 Sympathetic trunk |
| 17 Oesophageal plexus | 39 Sympathetic trunk ganglion |
| 18 Oesophagus | 40 Thoracic cardiac nerves |
| 19 Parietal pleura | 41 Thyrocervical trunk |
| 20 Posterior intercostal artery | 42 Trachea |
| 21 Posterior intercostal nerve | 43 Transverse cervical artery |
| 22 Posterior intercostal vein | |



Heart and pericardium



from the front

with marker in the transverse sinus

oblique sinus after removal of the heart



- | | |
|--|--|
| 1 Anterior cardiac vein | 15 Pericardium turned laterally over lung |
| 2 Anterior interventricular branch of left coronary artery | 16 Posterior wall of pericardial cavity and oblique sinus |
| 3 Ascending aorta | 17 Pulmonary trunk |
| 4 Auricle of left atrium | 18 Right atrium |
| 5 Auricle of right atrium | 19 Right coronary artery |
| 6 Diaphragm | 20 Right inferior pulmonary vein |
| 7 Great cardiac vein | 21 Right superior pulmonary vein |
| 8 Inferior vena cava | 22 Right ventricle |
| 9 Left inferior pulmonary vein | 23 Serous pericardium overlying fibrous pericardium (turned laterally) |
| 10 Left superior pulmonary vein | 24 Small cardiac vein |
| 11 Left ventricle | 25 Superior vena cava |
| 12 Marginal branch of right coronary artery | |
| 13 Marker (B) black line (C) in transverse sinus | |
| 14 Pericardium fused with central tendon of diaphragm | |

The **right border of the heart** is formed by the right atrium (A18).

The **left border** is formed mostly by the left ventricle (A11) with at the top the uppermost part (infundibulum) of the right ventricle (A22) and the tip of the left auricle (A4).

The **inferior border** is formed by the right ventricle (A22) with a small part of the left ventricle (A11) at the apex.

In A, the pericardium has been incised and turned back (23) to display the anterior surface of the heart. The pulmonary trunk (17) leaves the right ventricle (22) in front and to the left of the ascending aorta (3), which is overlapped by the auricle (5) of the right atrium (18). The superior vena cava (25) is to the right of the aorta and still largely covered by pericardium. The anterior interventricular branch (2) of the left coronary artery and the great cardiac vein (7) lie in the interventricular groove between the right and left ventricles (22 and 11), and the right coronary artery (19) is in the atrioventricular groove between the right ventricle (22) and right atrium (18). In B, only the upper part of another heart is shown, with a marker in the transverse sinus, the space behind the aorta (3) and pulmonary trunk (17). In C, the heart has been removed from the pericardium, leaving the orifices of the great vessels. The dotted line indicates the attachment of the single sleeve of serous pericardium surrounding the aorta (3) and pulmonary trunk (17). The interrupted line indicates the attachment of another more complicated but still single sleeve of serous pericardium surrounding all the other six great vessels (the four pulmonary veins, 10, 9, 20 and 21, and the superior and inferior venae cavae, 25 and 8). The narrow interval between the two sleeves is the transverse sinus; the solid line in C indicates the path of the marker in B. The area of the pericardium (16) between the pulmonary veins and limited above by the reflection of the serous pericardium on to the back of the heart is the oblique sinus.

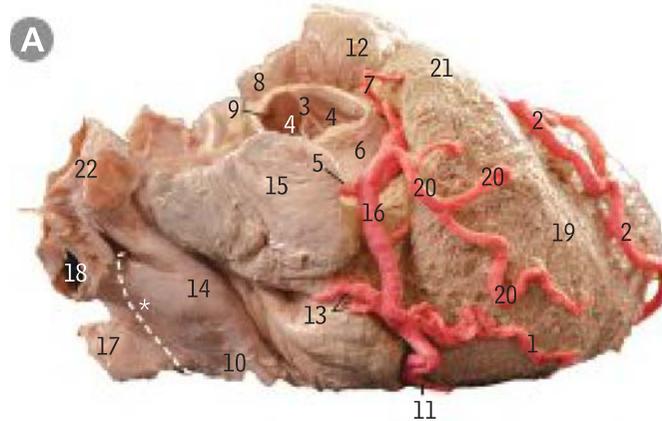


Cardiac tamponade



Pericardial effusion

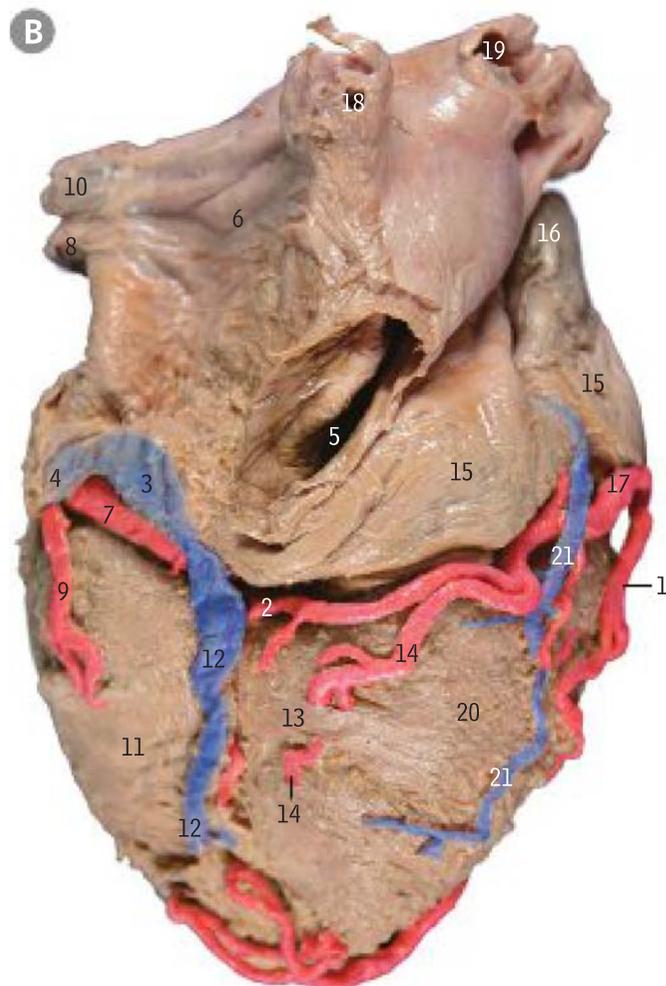
Heart with blood vessels anterolateral from the back



- | | |
|---|---|
| <ol style="list-style-type: none"> 1 Acute marginal artery 2 Anterior interventricular artery (LAD)** 3 Aortic leaflets 4 Aortic sinus (of Valsalva) 5 Artery to the SA node 6 Ascending aorta 7 Conus branch of RCA 8 Left auricle (appendage) 9 Left coronary arterial orifice 10 Opening of the inferior vena cava 11 Posterior (inferior) interventricular branch of RCA | <ol style="list-style-type: none"> 12 Pulmonary trunk 13 Right atrial branches of RCA 14 Right atrium 15 Right auricle 16 Right coronary artery (RCA) 17 Right inferior pulmonary vein 18 Right superior pulmonary vein 19 Right ventricle 20 Right ventricular branches of RCA 21 Subpulmonary infundibulum 22 Superior vena cava |
|---|---|

*Imaginary line demarcating the division between right and left atria

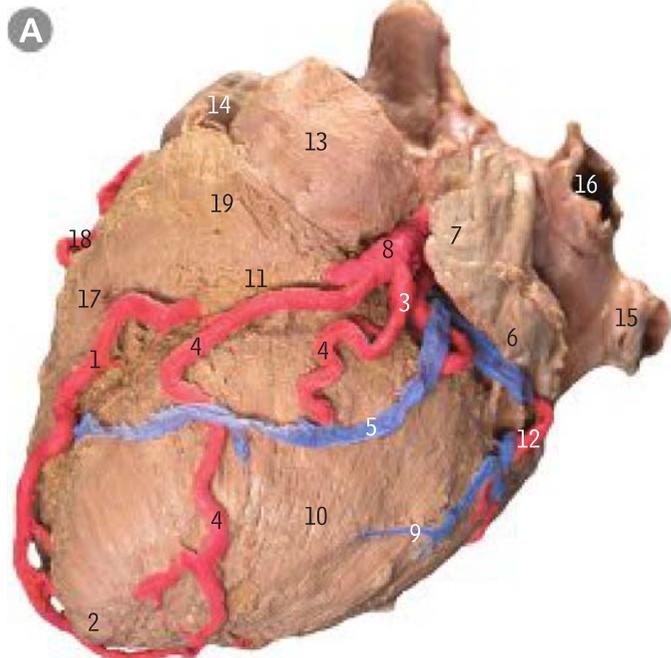
**Also known as left anterior descending artery.



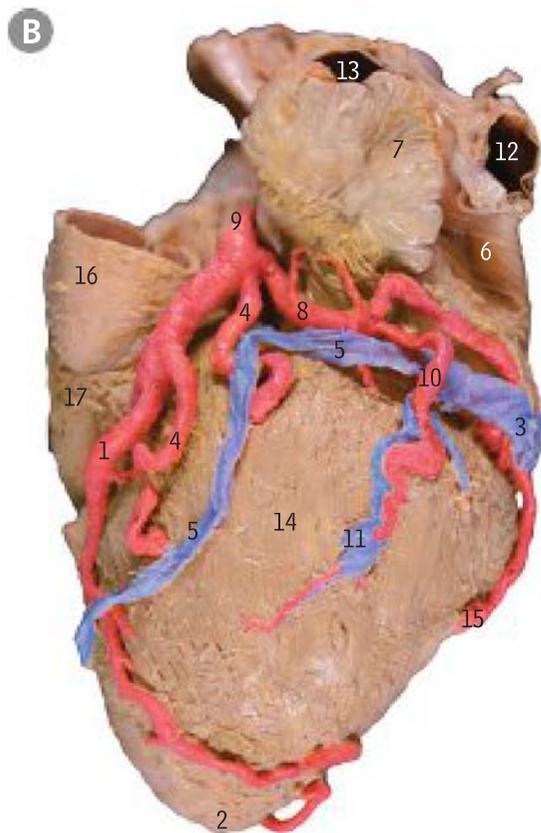
- | |
|--|
| <ol style="list-style-type: none"> 1 Acute marginal artery 2 Atrioventricular nodal branch of RCA 3 Coronary sinus 4 Great cardiac vein 5 Inferior vena cava 6 Left atrium 7 Left circumflex branch, left coronary artery 8 Left inferior pulmonary vein 9 Left marginal artery 10 Left superior pulmonary vein 11 Left ventricle (inferior surface) 12 Middle cardiac vein 13 Myocardial bridge 14 Posterior (inferior) interventricular branch of RCA 15 Right atrium 16 Right auricle (appendage) 17 Right coronary artery (RCA) 18 Right inferior pulmonary vein 19 Right superior pulmonary vein 20 Right ventricle (inferior surface) 21 Small cardiac vein |
|--|

The interventricular branches are often called by clinicians the descending branches (anterior interventricular, left anterior descending; posterior interventricular, posterior descending).

Heart with blood vessels *from the left* *from the left and to the back*



- 1 Anterior interventricular artery (LAD)
- 2 Apex
- 3 Circumflex branch, left coronary artery
- 4 Diagonal artery
- 5 Great cardiac vein
- 6 Left atrium
- 7 Left auricle (appendage)
- 8 Left coronary artery
- 9 Left marginal vein
- 10 Left ventricle
- 11 Myocardial bridge
- 12 Obtuse marginal artery
- 13 Pulmonary trunk
- 14 Right auricle
- 15 Right inferior pulmonary vein
- 16 Right superior pulmonary vein
- 17 Right ventricle
- 18 Right ventricular branches of RCA
- 19 Subpulmonary infundibulum



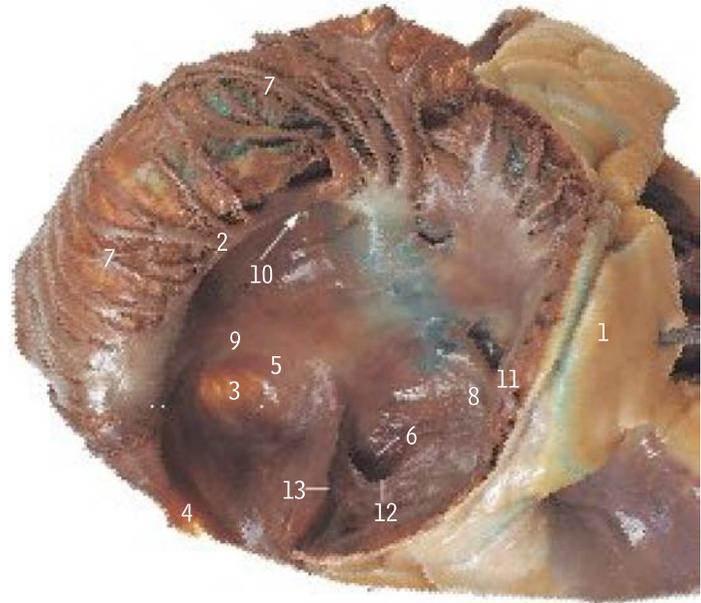
- 1 Anterior interventricular artery (LAD)
- 2 Apex
- 3 Coronary sinus
- 4 Diagonal artery
- 5 Great cardiac vein
- 6 Left atrium
- 7 Left auricle (reflected)
- 8 Left circumflex branch, left coronary artery
- 9 Left coronary artery
- 10 Left marginal artery
- 11 Left marginal vein
- 12 Left inferior pulmonary vein
- 13 Left superior pulmonary vein
- 14 Left ventricle
- 15 Obtuse marginal artery
- 16 Pulmonary trunk
- 17 Subpulmonary infundibulum



Right atrium *from the front and right*

The anterior wall has been incised near its left margin and reflected to the right, showing on its internal surface the vertical crista terminalis (2) and horizontal pectinate muscles (7). The fossa ovalis (3) is on the interatrial septum, and the opening of the coronary sinus (6) is to the left of the inferior vena caval opening (4).

- | | |
|-------------------------------------|---|
| 1 Auricle | 9 Position of intervenous tubercle (lower) |
| 2 Crista terminalis | 10 Superior vena cava |
| 3 Fossa ovalis | 11 Tricuspid valve |
| 4 Inferior vena cava | 12 Valve of coronary sinus (Thebesian valve) |
| 5 Limbus | 13 Valve of inferior vena cava (Eustachian valve) |
| 6 Opening of coronary sinus | |
| 7 Pectinate muscles | |
| 8 Position of atrioventricular node | |



The fossa ovalis (3) forms part of the interatrial septum, and is part of the embryonic primary septum.

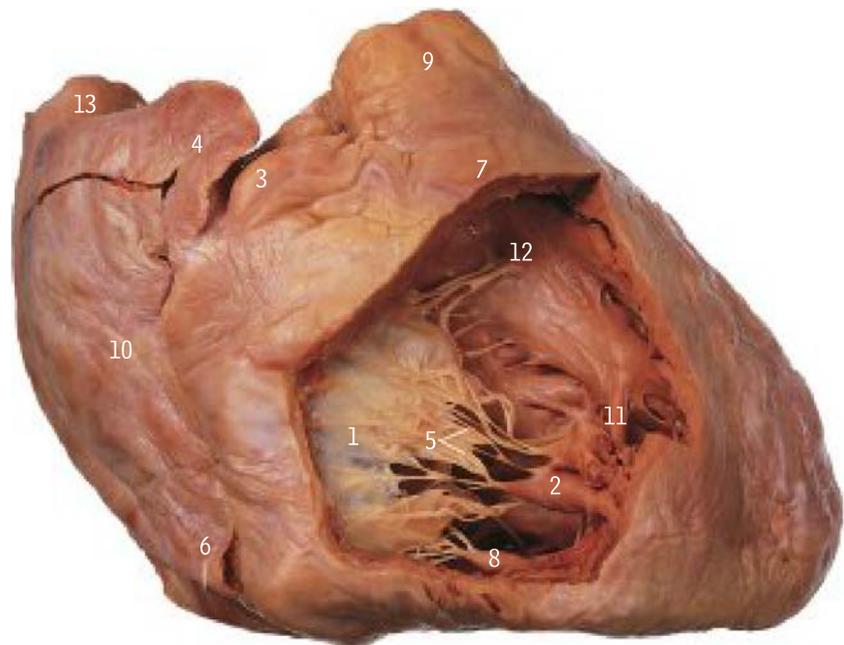
The limbus (5), which forms the margin of the fossa ovalis (3), represents the lower margin of the embryonic secondary septum. Before the primary and secondary septa fuse (at birth), the gap between them forms the foramen ovale.

The sinoatrial node (SA node, not illustrated) is embedded in the anterior wall of the atrium at the upper end of the crista terminalis, just below the opening of the superior vena cava.

The atrioventricular node (AV node, 8) is embedded in the interatrial septum, just above and to the left of the opening of the coronary sinus (6).

Right ventricle *from the front*

- | |
|--|
| 1 Anterior leaflet of tricuspid valve |
| 2 Anterior papillary muscle |
| 3 Ascending aorta |
| 4 Auricle of right atrium |
| 5 Chordae tendineae |
| 6 Inferior vena cava |
| 7 Infundibulum of right ventricle (conus arteriosus) |
| 8 Posterior papillary muscle |
| 9 Pulmonary trunk |
| 10 Right atrium |
| 11 Septomarginal trabeculation (moderator band) |
| 12 Septal papillary muscle (of conus) |
| 13 Superior vena cava |



The septomarginal trabeculation (11), which conducts part of the right limb of the atrioventricular bundle from the interventricular septum to the anterior papillary muscle (2), was formerly known as the moderator band.

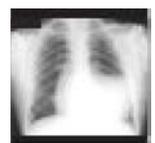
The chordae tendineae (5) connect the leaflets of the tricuspid valve to the papillary muscles.



Artificial cardiac pacemaker

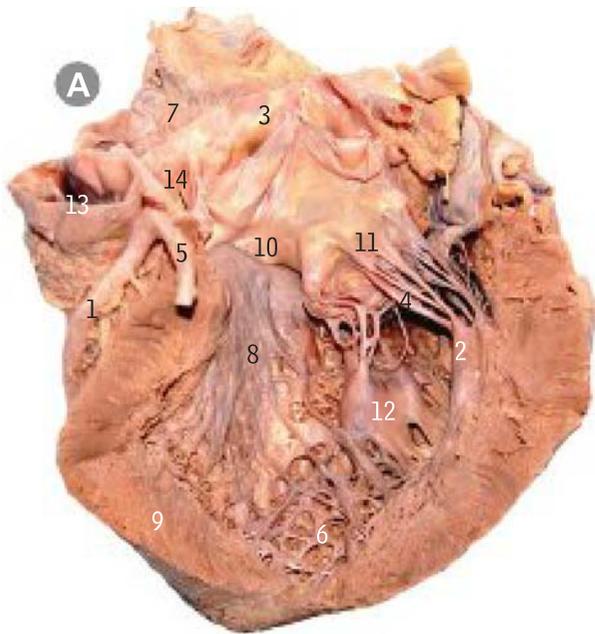


Cardiac pacemaker



Left ventricular enlargement

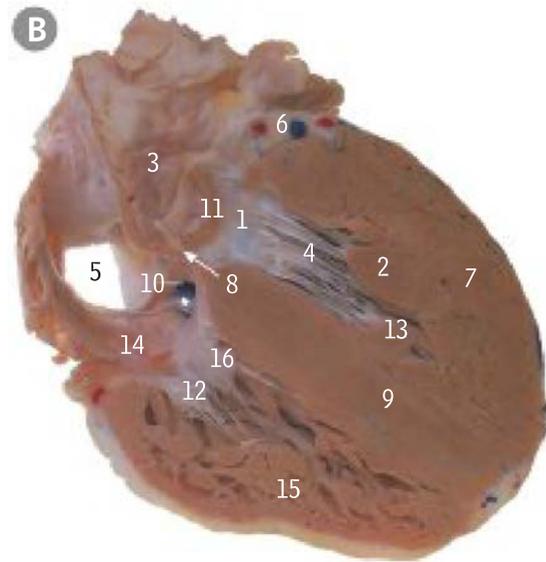
Left ventricle from the left and below



The ventricle has been opened by removing much of the left, anterior and posterior walls, and is viewed from below, looking upwards to the under-surface of the leaflets of the mitral valve (1 and 7) which are anchored to the anterior and posterior papillary muscles (3 and 8) by chordae tendineae (6). The posterior leaflet (7) is largely hidden by the anterior leaflet (1) in this view.

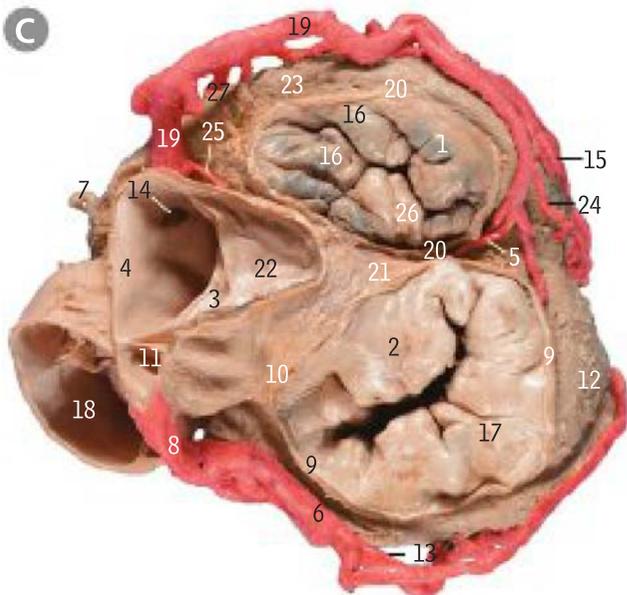
- | | |
|------------------------------------|-----------------------------------|
| 1 Anterior interventricular artery | 8 Left bundle branch |
| 2 Anterolateral papillary muscle | 9 Left ventricle open |
| 3 Aorta (ascending) | 10 Membranous septum |
| 4 Chordae tendineae | 11 Mitral valve |
| 5 Circumflex coronary artery | 12 Posteromedial papillary muscle |
| 6 Coarse trabeculations | 13 Pulmonary valve |
| 7 Left atrium | 14 Right coronary orifice |

Heart coronal section of the ventricles



The heart has been cut in two in the coronal plane, and this is the posterior section seen from the front, looking towards the back of both ventricles. The section has passed immediately in front of the anterior leaflet of the mitral valve (1) and the posterior leaflet of the aortic valve (11).

- | | |
|--|--|
| 1 Anterior leaflet of mitral valve | 9 Muscular part of interventricular septum |
| 2 Anterolateral papillary muscle | 10 Opening of coronary sinus |
| 3 Ascending aorta | 11 Posterior leaflet of aortic valve |
| 4 Chordae tendineae | 12 Posterior leaflet of tricuspid valve |
| 5 Inferior vena cava | 13 Posterior papillary muscle |
| 6 Left coronary artery branches and great cardiac vein | 14 Right atrium |
| 7 Left ventricular wall | 15 Right ventricular wall |
| 8 Membranous part of interventricular septum | 16 Septal leaflet of tricuspid valve |

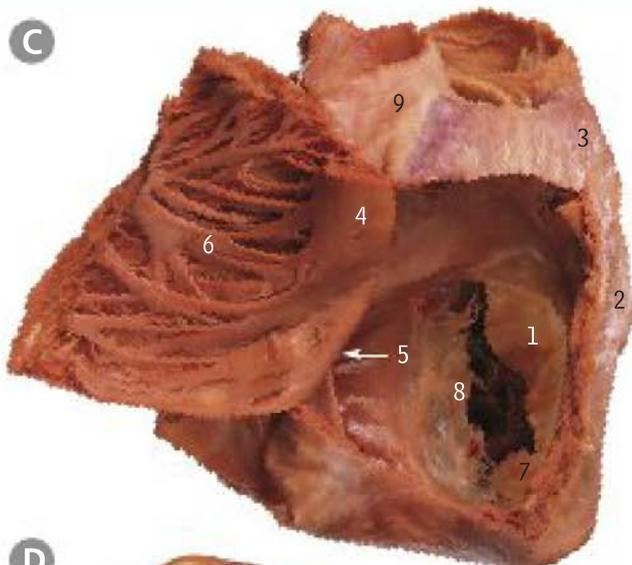


Heart with atria removed to show fibrous skeleton

- | | |
|---|---|
| 1 Anterior (anterosuperior) leaflet of tricuspid valve | 16 Posterior (inferior) leaflet of tricuspid valve |
| 2 Anterior (aortic) leaflet of mitral valve | 17 Posterior (mural) leaflet of mitral valve |
| 3 Anterior (right coronary) leaflet of aortic valve | 18 Pulmonary artery |
| 4 Ascending aorta | 19 Right coronary artery |
| 5 AV nodal artery | 20 Right fibrous ring of tricuspid valve |
| 6 Circumflex branch, left coronary artery | 21 Right fibrous trigone |
| 7 Conus branch of RCA | 22 Right posterior (non-adjacent or non-coronary) leaflet of aortic valve |
| 8 Left coronary artery | 23 Right ventricle |
| 9 Left fibrous ring of mitral valve | 24 Right ventricular branches of RCA |
| 10 Left fibrous trigone | 25 SA nodal artery |
| 11 Left posterior (left coronary) leaflet of aortic valve | 26 Septal leaflet of tricuspid valve |
| 12 Left ventricle | 27 Ventricular branches |
| 13 Obtuse marginal artery | |
| 14 Opening of right coronary artery | |
| 15 Posterior (inferior) interventricular branch of RCA | |



Mitral valve disease

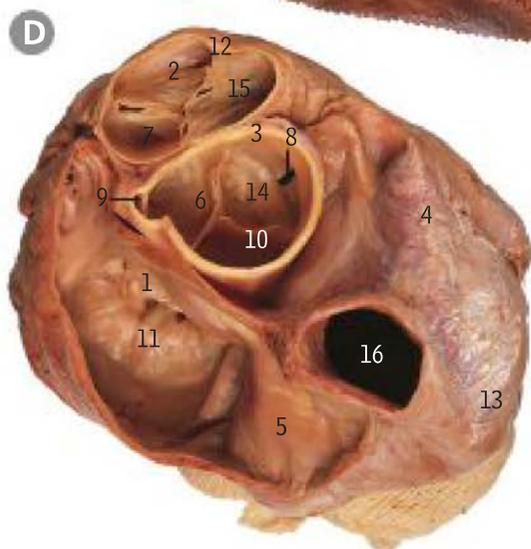


Tricuspid valve from the right atrium

The atrium has been opened by incising the anterior wall (2) and turning the flap outwards so that the atrial surface of the atrioventricular orifice is seen, guarded by the three leaflets of the tricuspid valve – anterior (1), posterior (7) and septal (8).

- | | |
|---------------------------------------|--|
| 1 Anterior leaflet of tricuspid valve | 6 Pectinate muscles |
| 2 Anterior wall of right atrium | 7 Posterior leaflet of tricuspid valve |
| 3 Auricle of right atrium | 8 Septal leaflet of tricuspid valve |
| 4 Crista terminalis | 9 Superior vena cava |
| 5 Interatrial septum | |

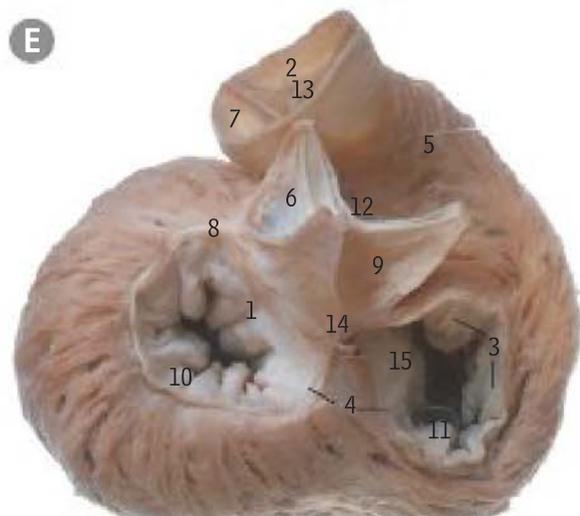
The posterior leaflet (7) of the tricuspid valve is the smallest.



Pulmonary, aortic and mitral valves from above

The pulmonary trunk (12) and ascending aorta (3) have been cut off immediately above the three leaflets of the pulmonary and aortic valves (7, 2 and 15, and 14, 10 and 6). The upper part of the left atrium (5) has been removed to show the upper surface of the mitral valve leaflets (11 and 1).

- | | |
|---|--------------------------------------|
| 1 Anterior leaflet of mitral valve | 9 Ostium of left coronary artery |
| 2 Anterior leaflet of pulmonary valve | 10 Posterior leaflet of aortic valve |
| 3 Ascending aorta | 11 Posterior leaflet of mitral valve |
| 4 Auricle of right atrium | 12 Pulmonary trunk |
| 5 Left atrium | 13 Right atrium |
| 6 Left leaflet of aortic valve | 14 Right leaflet of aortic valve |
| 7 Left leaflet of pulmonary valve | 15 Right leaflet of pulmonary valve |
| 8 Marker in ostium of right coronary artery | 16 Superior vena cava |



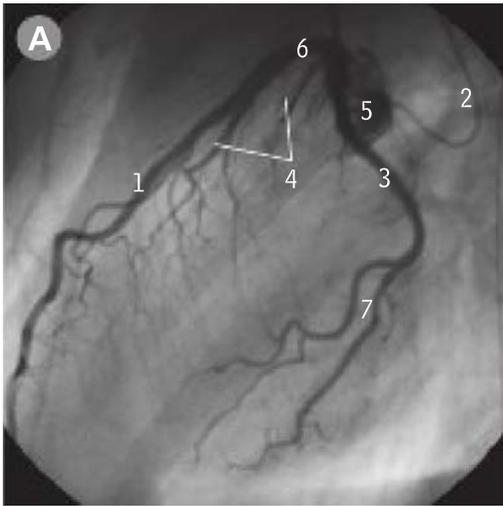
Heart fibrous skeleton

The heart is seen from the right and behind after removing both atria, looking down on to the fibrous rings (4) that surround the mitral and tricuspid orifices and form the attachments for the bases of the valve leaflets. The leaflets of the pulmonary valve (7, 2 and 13) are seen at the top of the infundibulum of the right ventricle (5), and the aortic valve leaflets (12, 9 and 6) have been dissected out from the beginning of the ascending aorta.

- | | |
|---------------------------------------|---|
| 1 Anterior leaflet of mitral valve | 9 Posterior leaflet of aortic valve |
| 2 Anterior leaflet of pulmonary valve | 10 Posterior leaflet of mitral valve |
| 3 Anterior leaflet of tricuspid valve | 11 Posterior leaflet of tricuspid valve |
| 4 Fibrous ring | 12 Right leaflet of aortic valve |
| 5 Infundibulum of right ventricle | 13 Right leaflet of pulmonary valve |
| 6 Left leaflet of aortic valve | 14 Right fibrous trigone |
| 7 Left leaflet of pulmonary valve | 15 Septal leaflet of tricuspid valve |
| 8 Left fibrous trigone | |

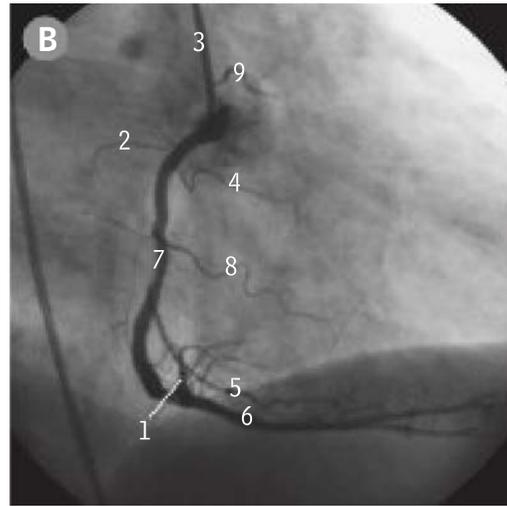
Coronary arteries

*left coronary arteriogram,
lateral projection*



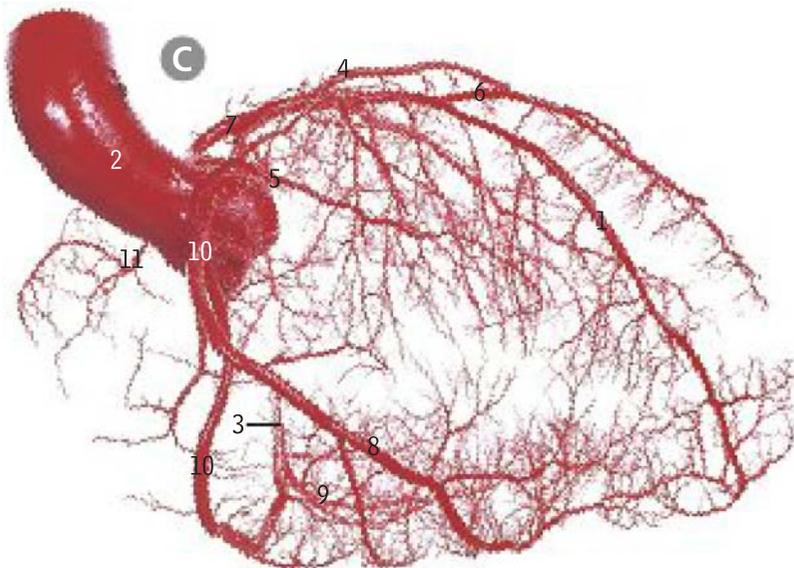
- 1 Anterior interventricular artery
- 2 Catheter in ascending aorta
- 3 Circumflex artery
- 4 Diagonal branches
- 5 Left coronary sinus (Valsalva)
- 6 Left main coronary artery
- 7 Marginal artery

*right coronary arteriogram,
left anterior oblique projection*



- 1 Atrioventricular nodal artery
- 2 Atrial branch
- 3 Catheter at aortic root
- 4 Conus branch of RCA
- 5 Marginal branch right coronary artery
- 6 Posterior interventricular artery
- 7 Right coronary artery
- 8 Right ventricular branch
- 9 Sinatrial nodal artery

*cast of the coronary arteries,
from the front*



- 1 Anterior interventricular artery
- 2 Ascending aorta
- 3 Atrioventricular nodal artery
- 4 Circumflex artery
- 5 Conal artery
- 6 Diagonal artery
- 7 Left main stem
- 8 Marginal branch of right coronary artery
- 9 Posterior interventricular branch of right coronary artery
- 10 Right coronary artery
- 11 Sinatrial nodal branch

The interventricular branches are often called by clinicians the descending branches (anterior interventricular, left anterior descending; posterior interventricular, posterior descending).

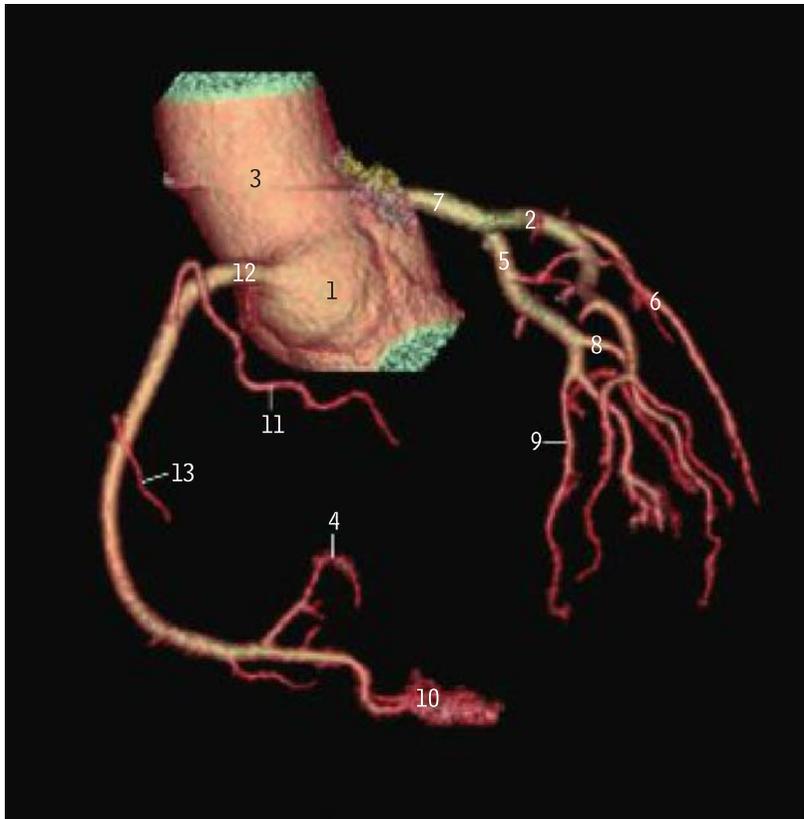


Angina pectoris



Coronary angiography

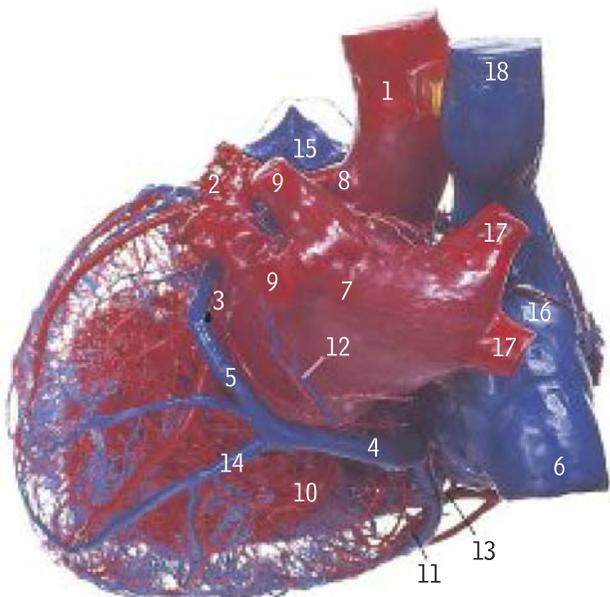
Coronary arteries 3D CT reconstruction



- 1 Anterior aortic sinus
- 2 Anterior interventricular, left anterior descending branch, left coronary artery (LAD)
- 3 Aorta, ascending
- 4 Atrioventricular nodal artery
- 5 Circumflex branch, left coronary artery
- 6 Diagonal artery
- 7 Left coronary main stem
- 8 Marginal artery, left coronary artery
- 9 Obtuse marginal branch, left coronary artery
- 10 Posterior interventricular branch, right coronary artery
- 11 Right conal artery
- 12 Right coronary artery
- 13 Right ventricular branch, right coronary artery



Cast of the heart and great vessels from below and behind



This cast shows the coronary sinus (4) in the atrioventricular groove, and various tributaries (see notes).

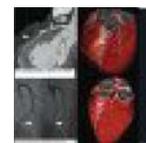
- | | |
|---|---|
| 1 Ascending aorta | 10 Left ventricle |
| 2 Auricle of left atrium | 11 Middle cardiac vein |
| 3 Circumflex branch of left coronary artery | 12 Oblique vein of left atrium |
| 4 Coronary sinus | 13 Posterior interventricular branch of right coronary artery |
| 5 Great cardiac vein | 14 Posterior vein of left ventricle |
| 6 Inferior vena cava | 15 Pulmonary trunk |
| 7 Left atrium | 16 Right atrium |
| 8 Left coronary artery | 17 Right pulmonary veins |
| 9 Left pulmonary veins | 18 Superior vena cava |

The base of the heart is its posterior surface, formed largely by the left atrium (E7). Note that the base is not the part of the heart which joins the superior vena cava, aorta and pulmonary trunk; this part has no special name.

The very small oblique vein of the left atrium (E12) marks the point where the great cardiac vein (E5) becomes the coronary sinus (E4), but in E, the junction is unusually far to the right so that the posterior vein of the left ventricle (E14) joins the great cardiac vein (E5) instead of the coronary sinus itself.

The coronary sinus (E4), which receives most of the venous blood from the heart, lies in the posterior part of the atrioventricular groove between the left atrium and left ventricle and opens into the right atrium.

The coronary sinus normally receives as tributaries the great cardiac vein (E5), middle cardiac vein (E11), and the small cardiac vein, the posterior vein of the left ventricle (E14) and the oblique vein of the left atrium (E12).

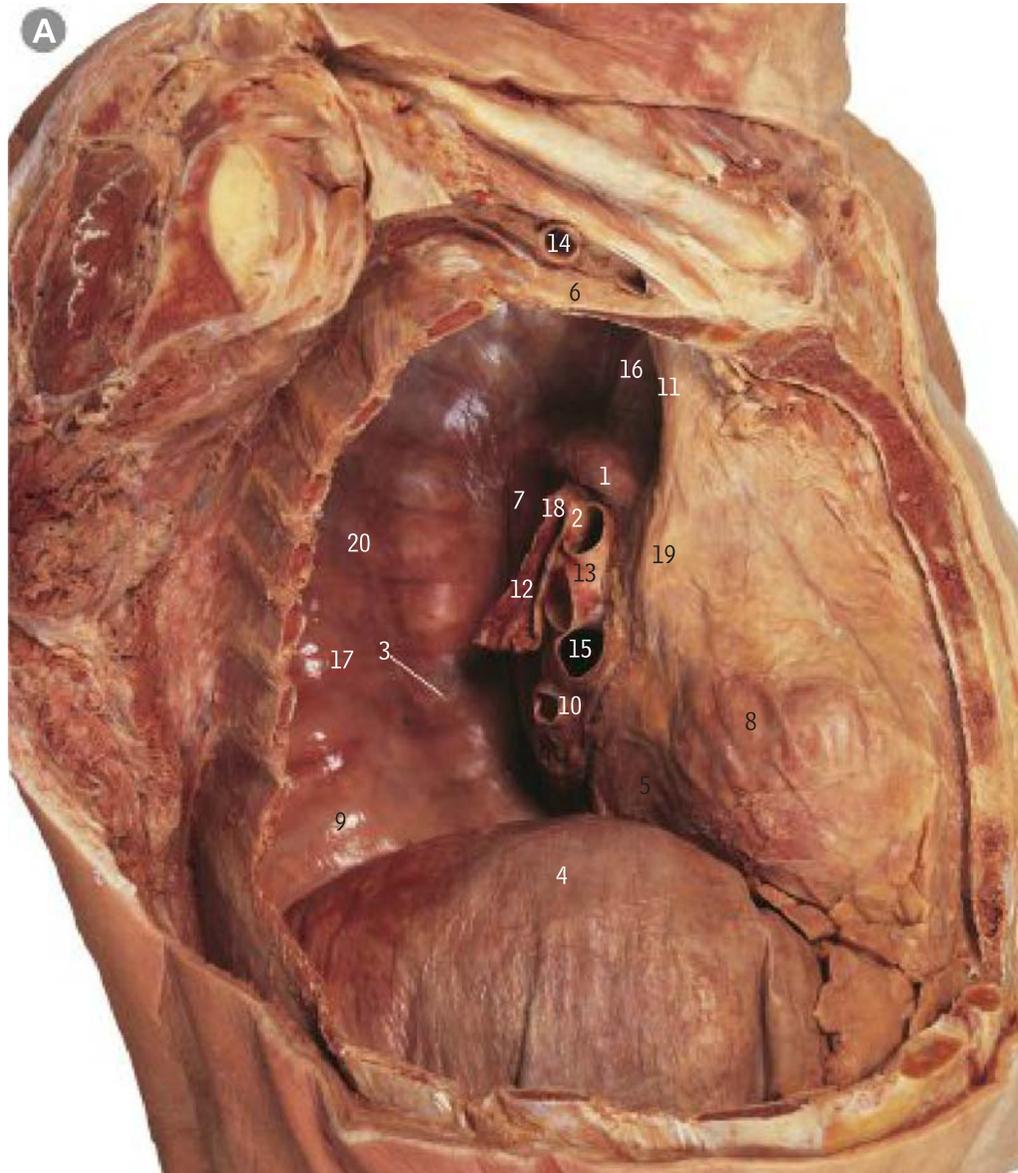


Coronary artery abnormalities



Dextrocardia

Right lung root and mediastinal pleura



This is the view of the right side of the mediastinum after removing the lung but with the parietal pleura still intact.

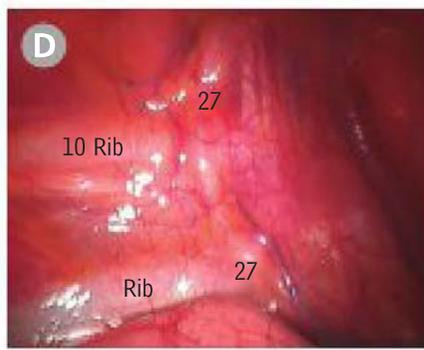
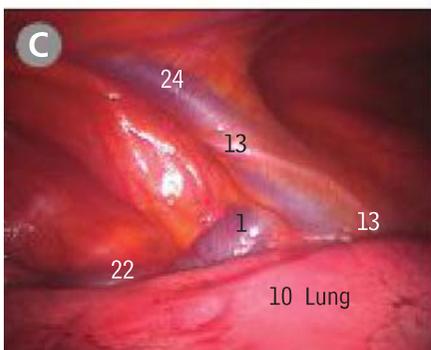
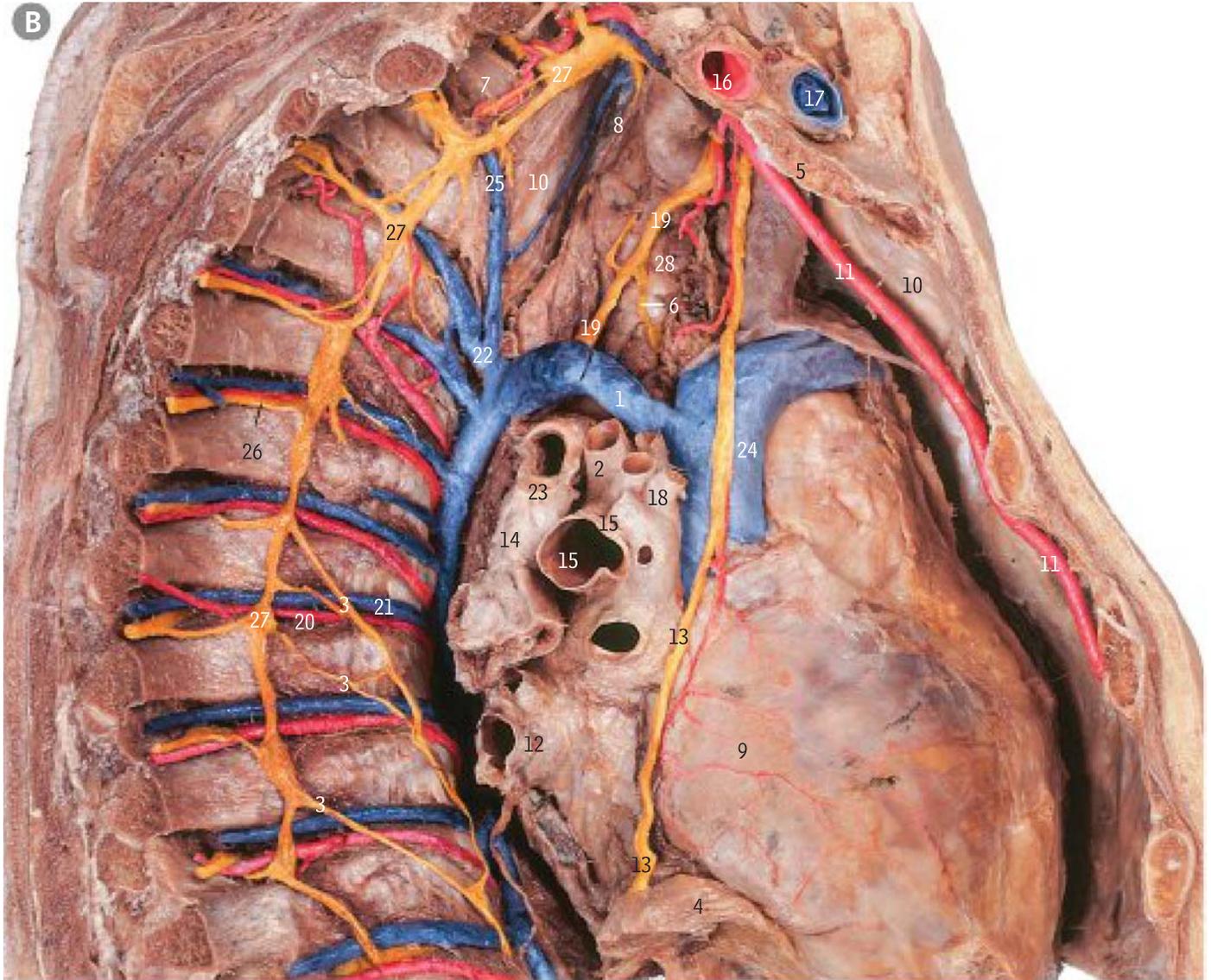
- 1 Azygos vein
- 2 Branch of right pulmonary artery to superior lobe
- 3 Branches of sympathetic trunk to greater splanchnic nerve
- 4 Diaphragm
- 5 Inferior vena cava
- 6 Shaft of the first rib
- 7 Oesophagus
- 8 Pericardium over right atrium
- 9 Pleura, costal
- 10 Right inferior pulmonary vein
- 11 Right phrenic nerve
- 12 Right primary bronchus
- 13 Right pulmonary artery
- 14 Right subclavian artery
- 15 Right superior pulmonary vein
- 16 Right vagus nerve
- 17 Sixth right posterior intercostal vessels under parietal pleura
- 18 Superior lobe bronchus
- 19 Superior vena cava
- 20 Sympathetic trunk and ganglion

Right lung root and mediastinum

In a similar specimen to A, most of the pleura has been removed to display the underlying structures. The azygos vein (1) arches over the structures forming the lung root to enter the superior vena cava (24). The highest structures in the lung root are the artery (2) and bronchus (14) to the superior lobe of the lung. The right superior pulmonary vein (18) is in front of the right pulmonary artery, with the right inferior pulmonary vein (12) the lowest structure in the root. Above the arch of the azygos vein the trachea (28), with the right vagus nerve (19) in contact with it, lies in front of the oesophagus (8). Part of the first rib has been cut away to show the structures lying in front of its neck (5), the sympathetic trunk (27), superior intercostal vein (22), superior intercostal artery (20) and the ventral ramus of the first thoracic nerve. The right recurrent laryngeal nerve hooks underneath the right subclavian artery (16). The right phrenic nerve (13) runs down over the superior vena cava (24) and the pericardium overlying the right atrium (9), and pierces the diaphragm (4) beside the inferior vena cava. Contributions from the sympathetic trunk (3) pass over the sides of vertebral bodies superficial to posterior intercostal arteries and veins (as at 20 and 21) to form the greater splanchnic nerve. The lower part of the oesophagus (8) behind the lung root and heart has the azygos vein (1) on its right side.



Surgical emphysema



D Thoracoscopies

- | | | | |
|---|---|--|--|
| <ul style="list-style-type: none"> 1 Azygos vein (arch) 2 Branch of right pulmonary artery to superior lobe 3 Branches of sympathetic trunk to greater splanchnic nerve 4 Diaphragm 5 First rib (sectioned) 6 Inferior cardiac branches of vagus nerve 7 Neck of first rib 8 Oesophagus | <ul style="list-style-type: none"> 9 Pericardium over right atrium 10 Pleura 11 Right internal thoracic artery 12 Right inferior pulmonary vein 13 Right phrenic nerve 14 Right primary bronchus 15 Right pulmonary artery 16 Right subclavian artery 17 Right subclavian vein (NB thrombus) 18 Right superior pulmonary vein | <ul style="list-style-type: none"> 19 Right vagus nerve 20 Sixth right posterior intercostal artery 21 Sixth right posterior intercostal vein 22 Superior intercostal vein 23 Superior lobar bronchus | <ul style="list-style-type: none"> 24 Superior vena cava 25 Supreme intercostal vein 26 Sympathetic rami communicantes 27 Sympathetic trunk and ganglion 28 Trachea |
|---|---|--|--|



Pleural effusion

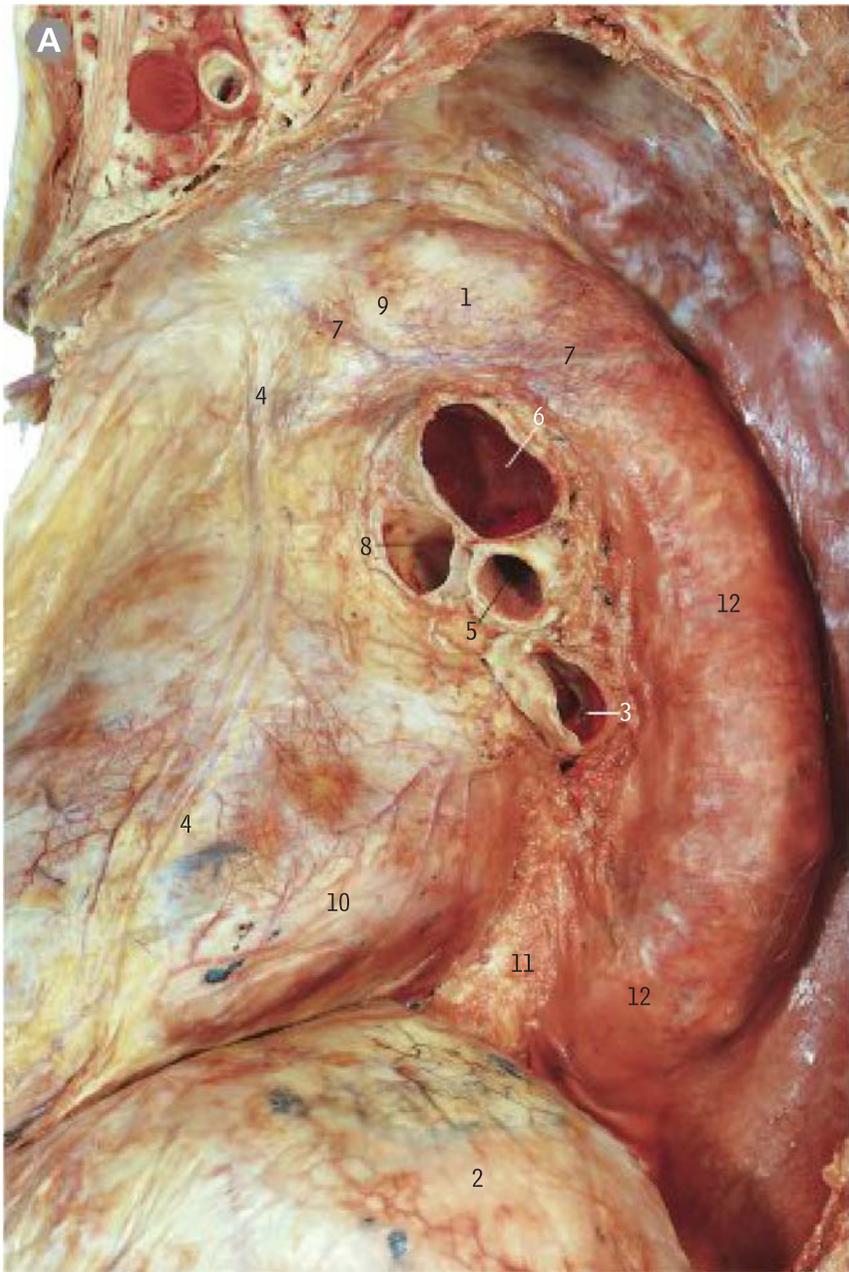


Thoracoscopy

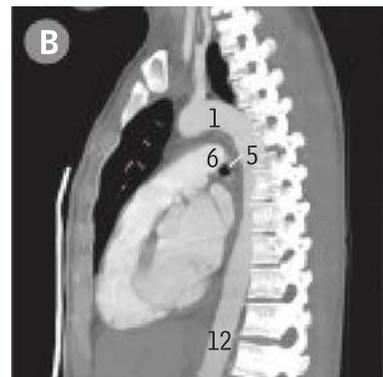


Transthoracic sympathectomy

Left lung root and mediastinal pleura



- 1 Arch of aorta
- 2 Diaphragm
- 3 Left inferior pulmonary vein
- 4 Left phrenic nerve and pericardiophrenic vessels
- 5 Left primary bronchus
- 6 Left pulmonary artery
- 7 Left superior intercostal vein
- 8 Left superior pulmonary vein
- 9 Left vagus nerve
- 10 Mediastinal pleura and pericardium overlying left ventricle
- 11 Oesophagus
- 12 Thoracic aorta, descending



On the left side above the diaphragm, the lower end of the oesophagus lies in a triangle bounded by the diaphragm below (2), the heart in front (10) and the descending aorta behind (12).

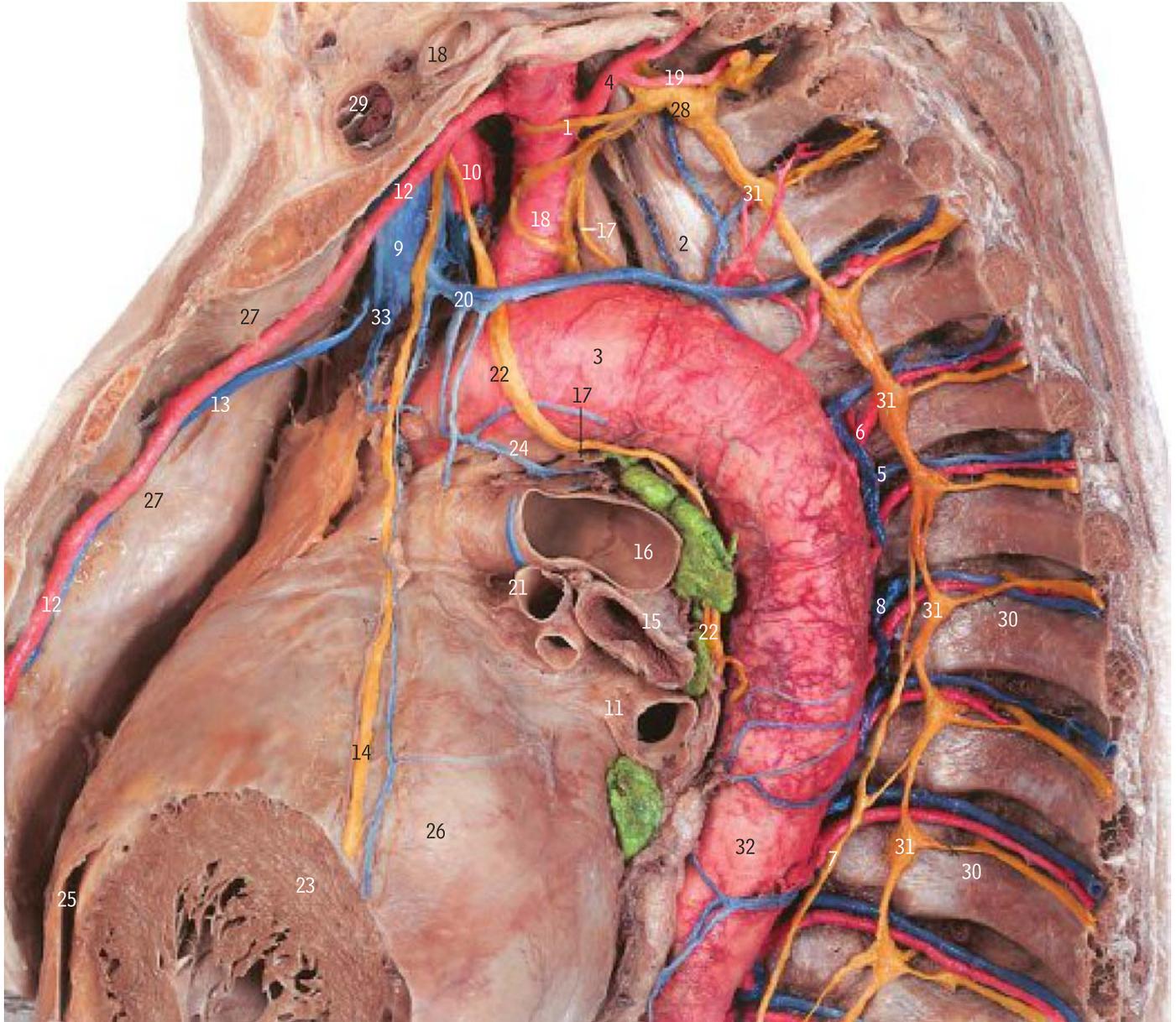
This is the view of the left side of the mediastinum after removing the lung but with the parietal pleura still intact. Compare the features seen here with those in the dissection opposite (a different specimen), from which the pleura has been removed.



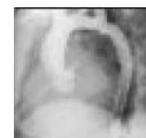
Pneumothorax



Thoracic aortic aneurysm



- | | | | |
|---|---|--|---|
| <ul style="list-style-type: none"> 1 Ansa subclavia 2 Longus colli muscle 3 Arch of aorta 4 Costocervical trunk 5 Fifth left posterior intercostal vein 6 Fourth left posterior intercostal artery 7 Greater splanchnic nerve 8 Hemi-azygos vein 9 Left brachiocephalic vein | <ul style="list-style-type: none"> 10 Left common carotid artery 11 Left inferior pulmonary vein 12 Left internal thoracic artery 13 Left internal thoracic vein 14 Left phrenic nerve and pericardiophrenic vessels 15 Left primary bronchus 16 Left pulmonary artery 17 Left recurrent laryngeal nerve 18 Left subclavian artery | <ul style="list-style-type: none"> 19 Left superior intercostal artery 20 Left superior intercostal vein 21 Left superior pulmonary vein 22 Left vagus nerve 23 Left ventricle (NB thick-walled cavity) 24 Ligamentum arteriosum 25 Pericardial cavity (space) 26 Pericardium overlying left ventricle | <ul style="list-style-type: none"> 27 Pleura (cut edge) 28 Stellate ganglion 29 Subclavian vein 30 Sympathetic rami communicantes 31 Sympathetic trunk and ganglion 32 Thoracic aorta 33 Thymic veins (page 366) |
|---|---|--|---|

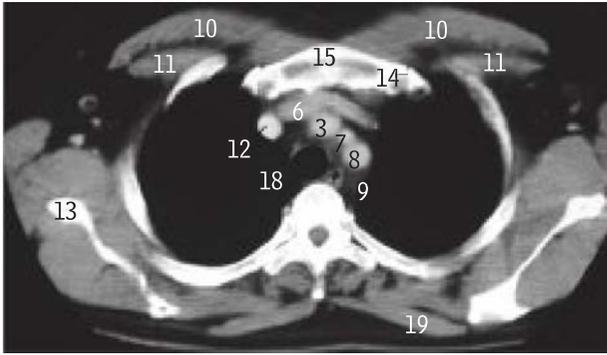


Coarctation of the aorta



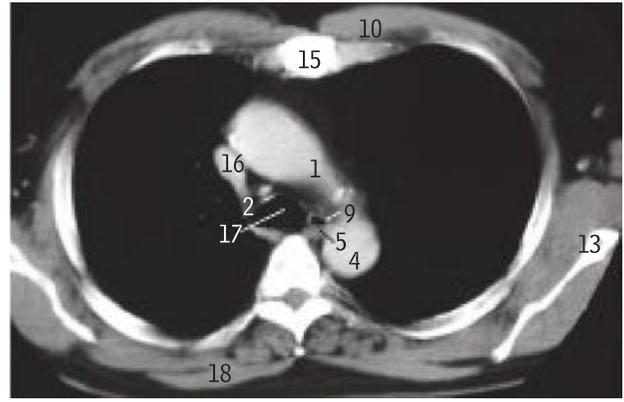
Subclavian arterial stent

Axial CT images *with contrast*



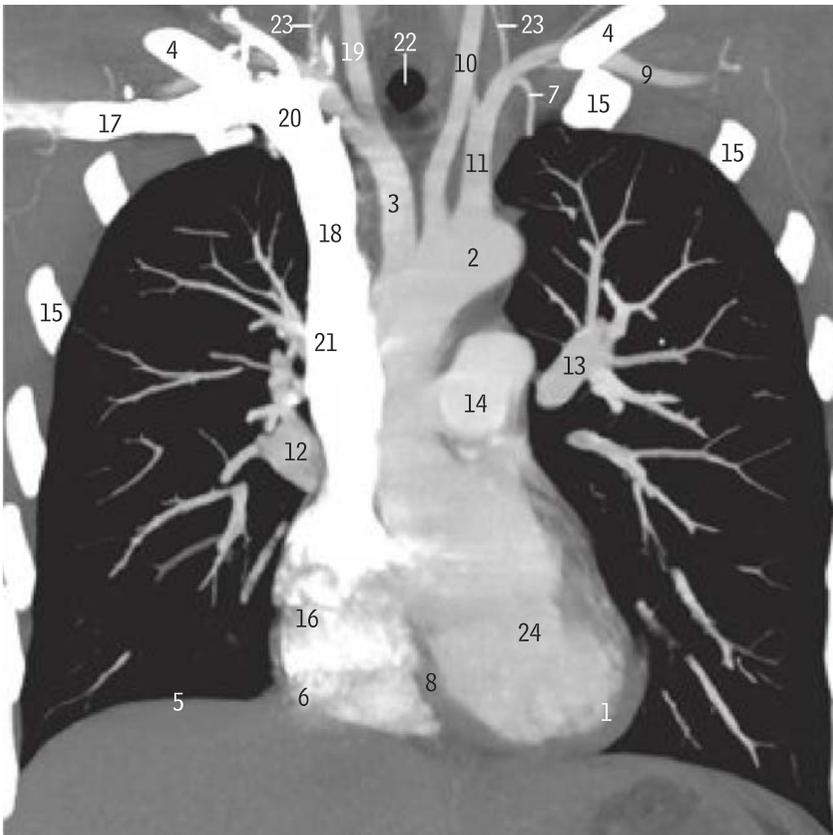
Level of T2

- | | |
|----------------------------------|------------------------------|
| 1 Arch aorta | 6 Left brachiocephalic vein |
| 2 Azygos vein | 7 Left common carotid artery |
| 3 Brachiocephalic trunk (artery) | 8 Left subclavian artery |
| 4 Descending aorta | 9 Oesophagus |
| 5 Hemi-azygos vein | 10 Pectoralis major |



Level of T4

- | | |
|-------------------------------|-----------------------|
| 11 Pectoralis minor | 16 Superior vena cava |
| 12 Right brachiocephalic vein | 17 Trachea |
| 13 Scapula | 18 Trapezius |
| 14 Sternoclavicular joint | |
| 15 Sternum | |



Thorax coronal 64 slice CT reconstruction – venous phase of the cardiac cycle

- 1 Apex of heart
- 2 Arch of aorta
- 3 Brachiocephalic trunk
- 4 Clavicle
- 5 Dome of diaphragm, right
- 6 Inferior vena cava
- 7 Internal thoracic artery
- 8 Interventricular septum
- 9 Left axillary artery
- 10 Left common carotid artery
- 11 Left subclavian artery
- 12 Pulmonary artery, right
- 13 Pulmonary artery, upper lobe branch
- 14 Pulmonary trunk
- 15 Ribs
- 16 Right atrium
- 17 Right axillary vein
- 18 Right brachiocephalic vein
- 19 Right common carotid artery
- 20 Right subclavian vein
- 21 Superior vena cava
- 22 Trachea
- 23 Vertebral artery
- 24 Ventricle, left

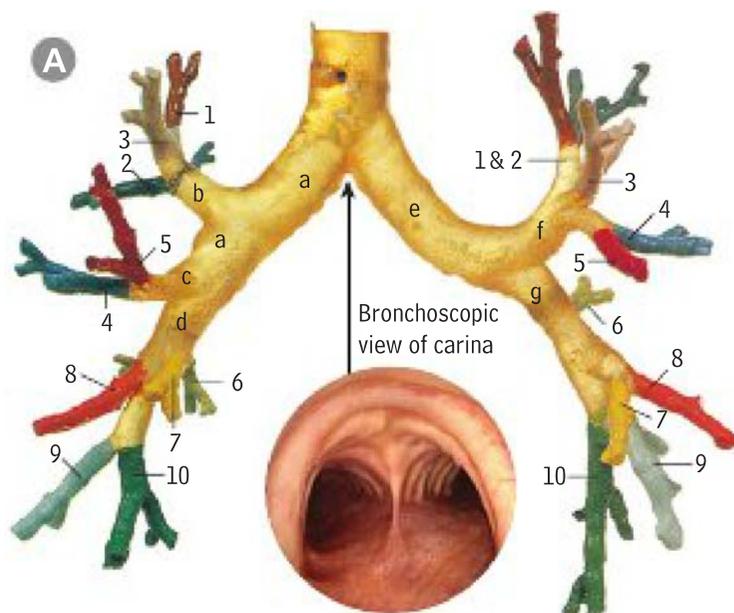


Phrenic nerve
palsy

Cast of the lower trachea and bronchi

vertical from the front

oblique from the left



The principal and lobar bronchi are labelled with letters; the segmental bronchi are labelled with their conventional numbers. In the side view in B, the cast has been tilted to avoid overlap, and the right side is more anterior than the left.

Right lung
Lobar bronchi
 a Principal
 b Superior lobe
 c Middle lobe
 d Inferior lobe

Segmental bronchi
Superior lobe
 1 Apical
 2 Posterior
 3 Anterior

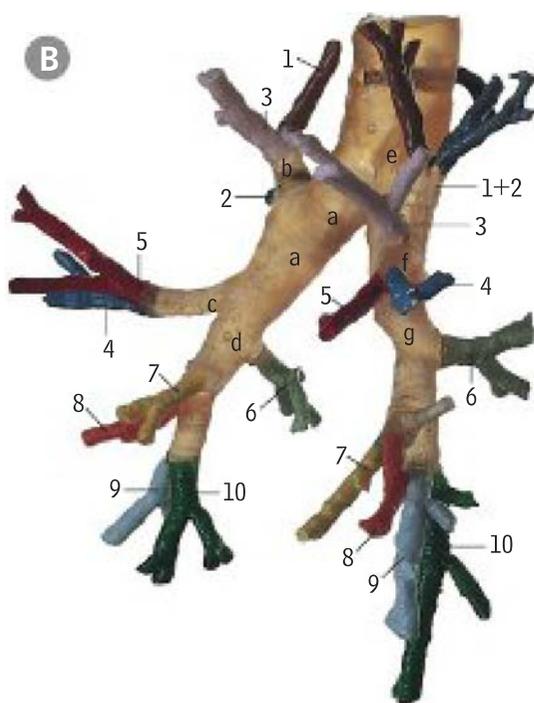
Middle lobe
 4 Lateral
 5 Medial

Inferior lobe
 6 Apical (superior)
 7 Medial basal
 8 Anterior basal
 9 Lateral basal
 10 Posterior basal

Left lung
 e Principal
 f Superior lobe
 g Inferior lobe

Superior lobe
 1 & 2 Apicoposterior
 3 Anterior
 4 Superior lingular
 5 Inferior lingular

Inferior lobe
 6 Apical (superior)
 7 Medial basal
 8 Anterior basal
 9 Lateral basal
 10 Posterior basal



The trachea divides into right and left principal bronchi (a and e).

The right primary bronchus (a) is shorter, wider and more vertical than the left (e).

The left primary bronchus (e) is longer and narrower and lies more transversely than the right. Foreign bodies are therefore more likely to enter the right primary bronchus than the left.

The right primary bronchus (a) gives off a superior lobe bronchus (b) and then enters the hilum of the right lung before dividing into middle and inferior lobe bronchi (c and d).

The left primary bronchus (e) enters the hilum of the lung before dividing into superior and inferior lobe bronchi (f and g).

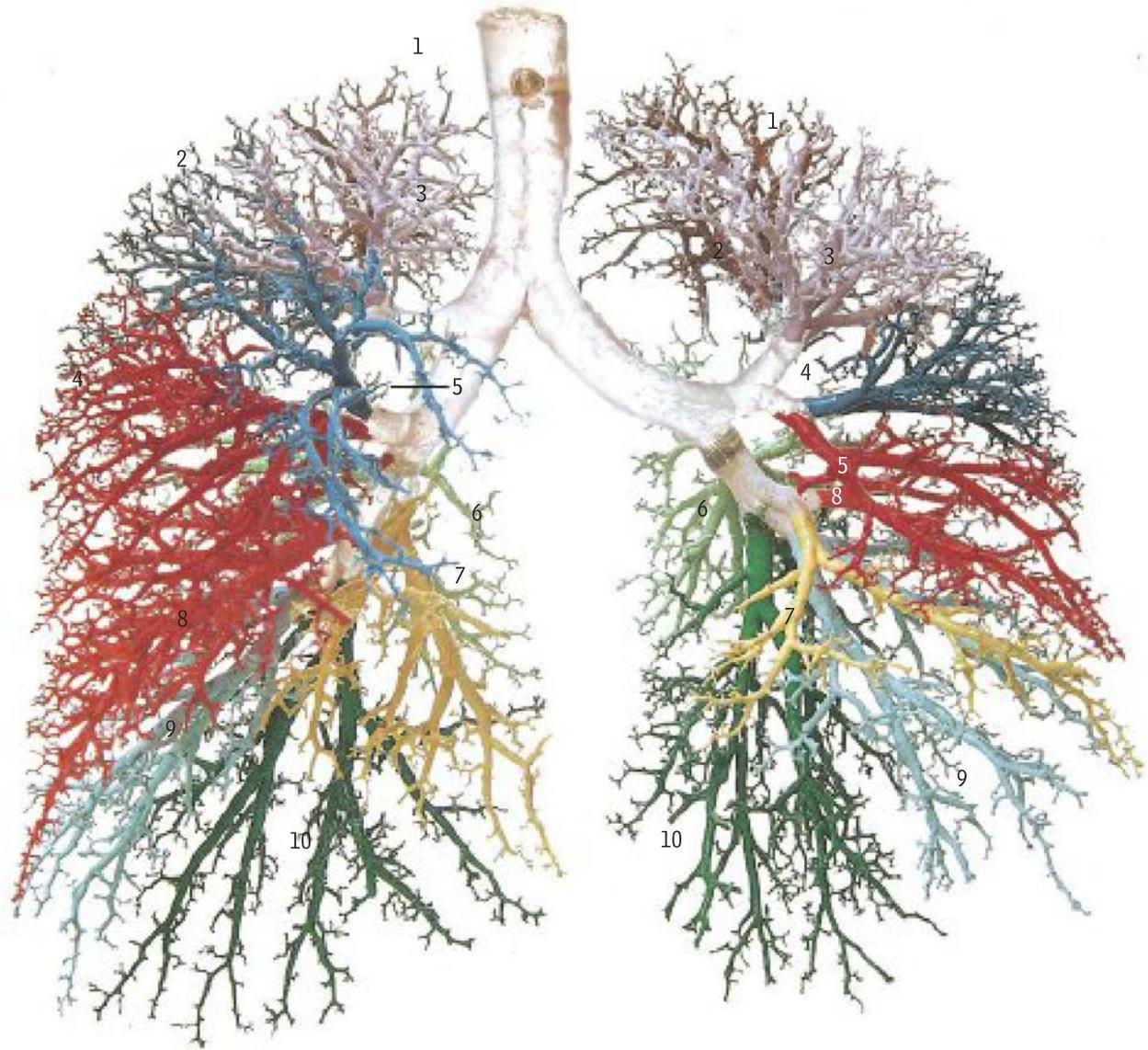
The branches of the lobar bronchi are called segmental bronchi and each supplies a segment of lung tissue – bronchopulmonary segment. The segmental bronchi and the bronchopulmonary segments have similar names, and the ten segments of each lung are officially numbered (as here and [page 210](#)) as well as being named.

The segmental bronchi of the left and right lungs are essentially similar except that the apical and posterior bronchi of the superior lobe of the left lung arise from a common stem, thus called the apicoposterior bronchus and labelled here as 1 and 2; also there is no middle lobe of the left lung, and so the corresponding segments bear similar numbers; and the medial basal bronchus (7) of the left lung usually arises in common with the anterior basal (8).

The apical (superior) bronchus of the inferior lobe (6) of both lungs is the first or highest bronchus to arise from the posterior surface of the bronchial tree, as illustrated in B. When lying on the back fluid may therefore gravitate into this bronchus.

Cast of the bronchial tree

The bronchi and bronchopulmonary segments have been coloured and labelled with their conventional numbers.



Right lung

Superior lobe

- 1 Apical
- 2 Posterior
- 3 Anterior

Middle lobe

- 4 Lateral
- 5 Medial

Inferior lobe

- 6 Apical (superior)
- 7 Medial basal
- 8 Anterior basal
- 9 Lateral basal
- 10 Posterior basal

Left lung

Superior lobe

- 1 Apical
- 2 Posterior
- 3 Anterior
- 4 Superior lingular
- 5 Inferior lingular

Inferior lobe

- 6 Apical (superior)
- 7 Medial basal (cardiac)
- 8 Anterior basal
- 9 Lateral basal
- 10 Posterior basal

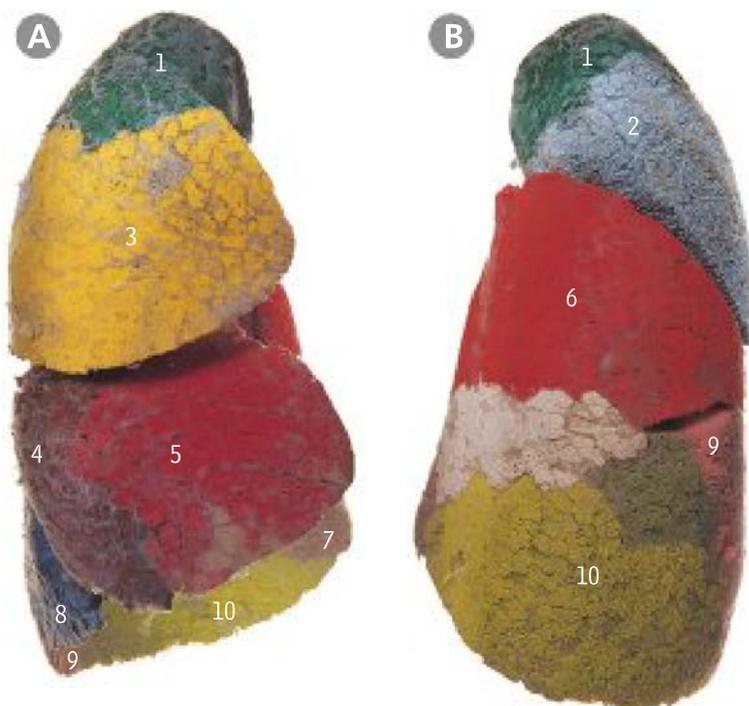


Bronchoscopy



Empyema

Bronchopulmonary segments of the right lung



from the front

from behind

Superior lobe

- 1 Apical
- 2 Posterior
- 3 Anterior

Middle lobe

- 4 Lateral
- 5 Medial

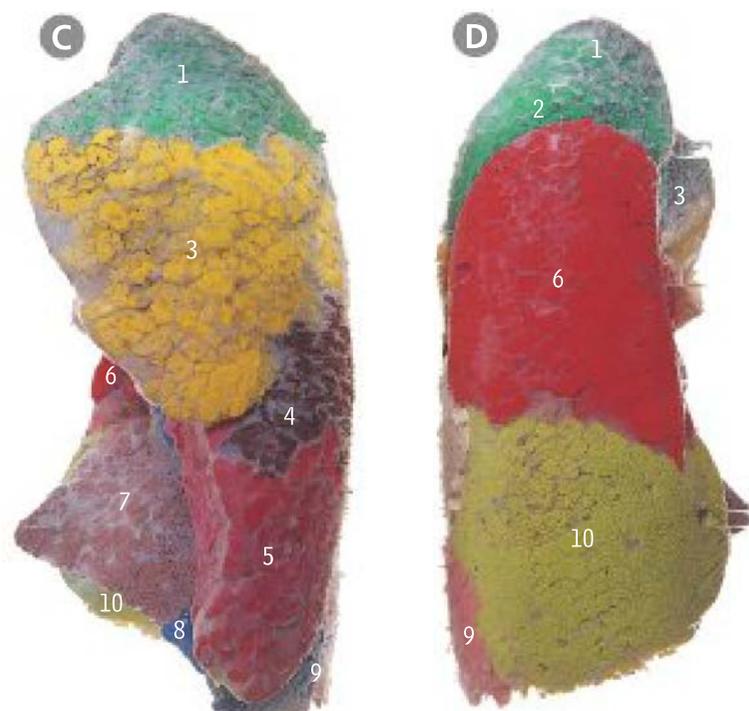
Inferior lobe

- 6 Apical (superior)
- 7 Medial basal
- 8 Anterior basal
- 9 Lateral basal
- 10 Posterior basal

A subapical (subsuperior) segmental bronchus and bronchopulmonary segment are present in over 50% of lungs; in this specimen, this additional segment is shown in white.

The posterior basal segment (10) is coloured with two different shades of yellow ochre.

Bronchopulmonary segments of the left lung



from the front

from behind

Superior lobe

- 1 Apical
- 2 Posterior
- 3 Anterior
- 4 Superior lingular
- 5 Inferior lingular

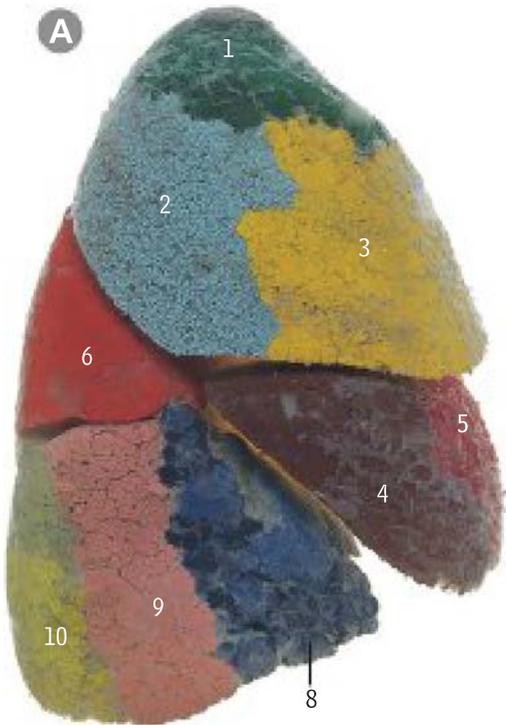
Inferior lobe

- 6 Apical (superior)
- 7 Medial basal (cardiac)
- 8 Anterior basal
- 9 Lateral basal
- 10 Posterior basal

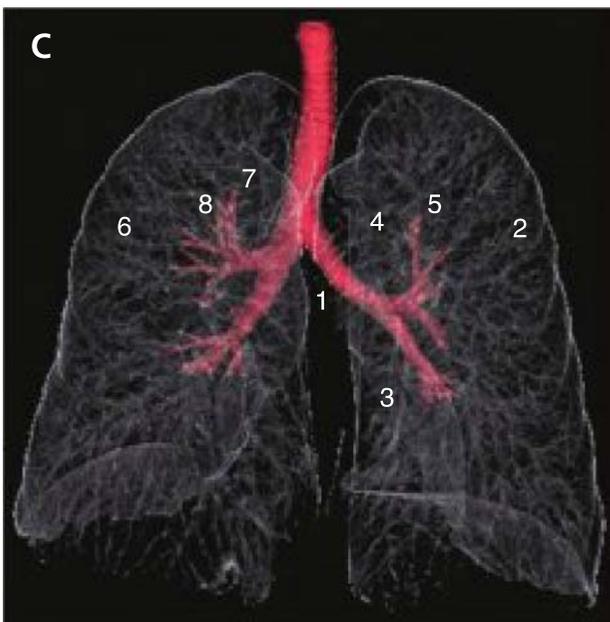
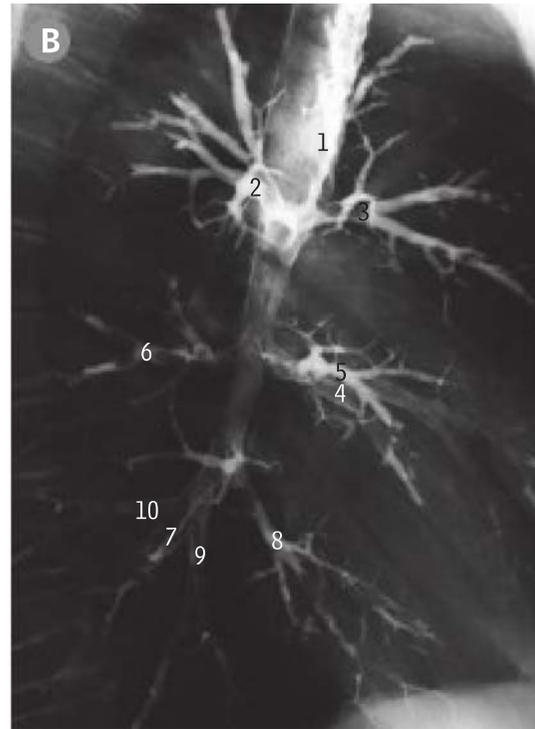
The apical and posterior segments (1 and 2) are both coloured green, having been filled from the common apicoposterior bronchus (see [page 209](#)).



Bronchopulmonary segments of the right lung from the lateral sides



Right bronchogram



Superior lobe

- 1 Apical
- 2 Posterior
- 3 Anterior

Middle lobe

- 4 Lateral
- 5 Medial

Inferior lobe

- 6 Apical (superior)
- 7 Medial basal
- 8 Anterior basal
- 9 Lateral basal
- 10 Posterior basal

The medial basal segment (7) is not seen in the view in A.

The posterior basal segment in A (10) is coloured with two different shades of green.

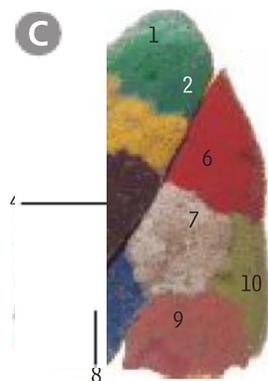
3D CT lungs and airways mid coronal

- 1 Carina
- 2 Left lung
- 3 Left lower lobe bronchus
- 4 Left main bronchus
- 5 Left upper lobe bronchus
- 6 Right lung
- 7 Right main bronchus
- 8 Right upper lobe bronchus



Empyema

Bronchopulmonary segments of the left lung from a lateral view



Superior lobe

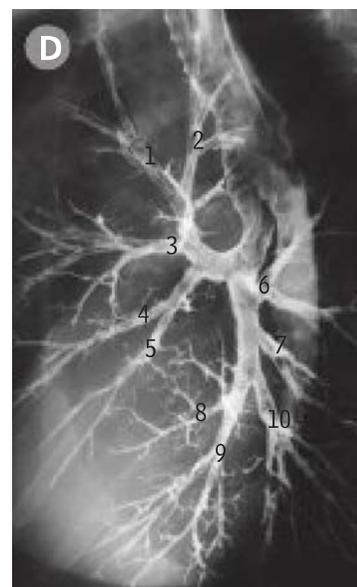
- 1 Apical
- 2 Posterior
- 3 Anterior
- 4 Superior lingular
- 5 Inferior lingular

Inferior lobe

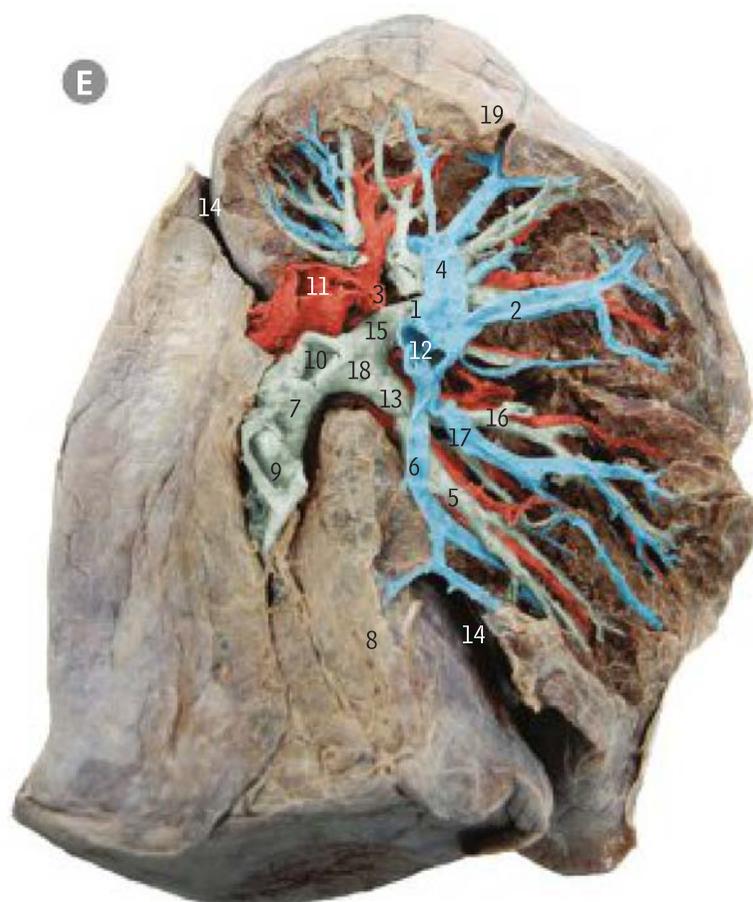
- 6 Apical (superior)
- 7 Medial basal (cardiac)
- 8 Anterior basal
- 9 Lateral basal
- 10 Posterior basal

The apical and posterior segments (1 and 2) are both coloured green, having been filled from the common apicoposterior bronchus (see [page 211](#)).

Left bronchogram



Lungs, detailed dissections to show bronchopulmonary segments of left lung

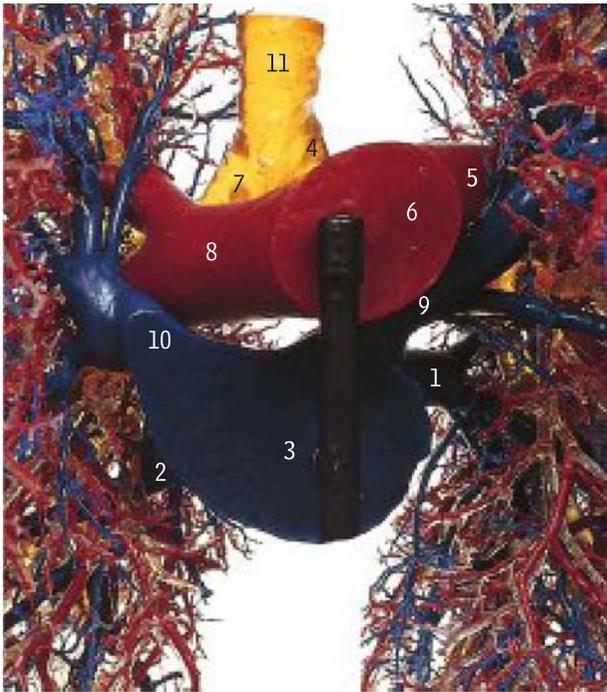


- 1 Anterior segmental bronchi
- 2 Anterior segmental vein
- 3 Apicoposterior segmental bronchi
- 4 Apicoposterior segmental vein
- 5 Inferior lingular segmental bronchus
- 6 Inferior lingular segmental vein
- 7 Inferior lobar bronchus
- 8 Inferior lobe
- 9 Left inferior pulmonary vein
- 10 Left main bronchus
- 11 Left pulmonary artery
- 12 Left superior pulmonary vein
- 13 Lingular bronchus
- 14 Oblique fissure
- 15 Superior division bronchus
- 16 Superior lingular segmental bronchus
- 17 Superior lingular segmental vein
- 18 Superior lobar bronchus
- 19 Superior lobe



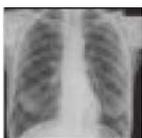
Haemothorax

Cast of the bronchial tree and pulmonary vessels from the front



The pulmonary trunk (6) divides into the left and right pulmonary arteries (5 and 8), and these vessels have been injected with red resin. The four pulmonary veins (9, 1, 2 and 10) which drain into the left atrium (3) have been filled with blue resin. Note that in the living body the pulmonary veins are filled with oxygenated blood from the lungs and would normally be represented by a red colour; similarly the pulmonary arteries contain deoxygenated blood and should be represented by a blue colour.

- | | |
|---------------------------------|----------------------------------|
| 1 Inferior left pulmonary vein | 7 Right primary bronchus |
| 2 Inferior right pulmonary vein | 8 Right pulmonary artery |
| 3 Left atrium | 9 Superior left pulmonary vein |
| 4 Left primary bronchus | 10 Superior right pulmonary vein |
| 5 Left pulmonary artery | 11 Trachea |
| 6 Pulmonary trunk | |



Carcinoma of the oesophagus



Pulmonary embolism

Lung roots and bronchial arteries right side from above

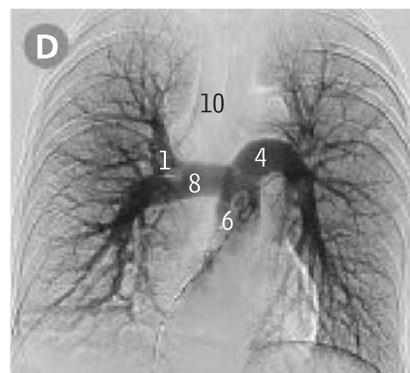
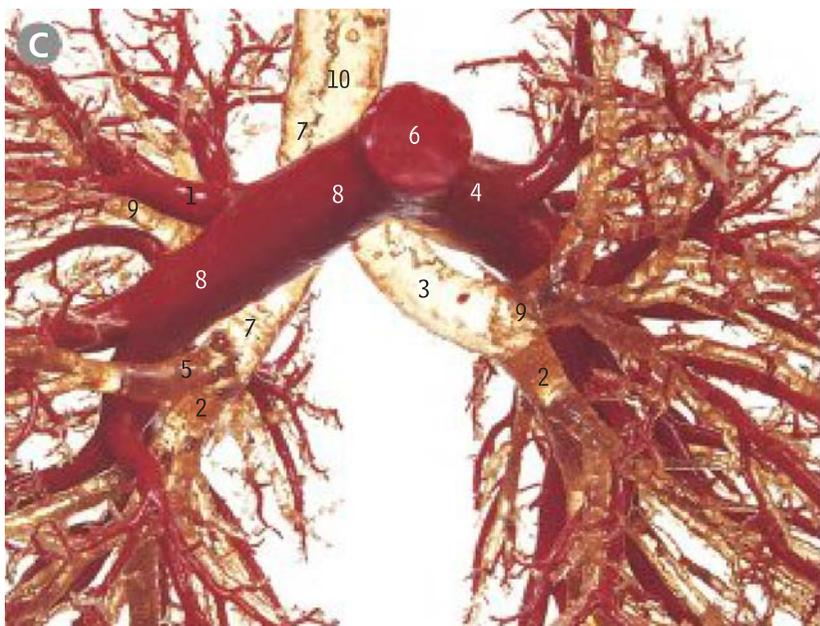


The thorax has been sectioned transversely at the level of the third thoracic vertebra (17), just above the arch of the aorta (1) whose three larger branches have been removed (8, 6 and 3), and lung tissue at the hilum has been dissected away from above. The oesophagus (10) and trachea (19) have been tilted forwards to show one of the bronchial arteries (11).

- | | |
|--|---|
| 1 Arch of aorta | 11 Right bronchial artery |
| 2 Azygos vein | 12 Right primary bronchus |
| 3 Brachiocephalic trunk | 13 Right pulmonary artery |
| 4 Inferior lobe artery | 14 Right vagus nerve |
| 5 Inferior lobe bronchus | 15 Superior lobe bronchus |
| 6 Left common carotid artery | 16 Superior vena cava |
| 7 Left recurrent laryngeal nerve (cut) | 17 Third thoracic vertebra |
| 8 Left subclavian artery | 18 Thoracic duct |
| 9 Middle lobe bronchus | 19 Trachea |
| 10 Oesophagus | 20 Tributary of inferior pulmonary vein |

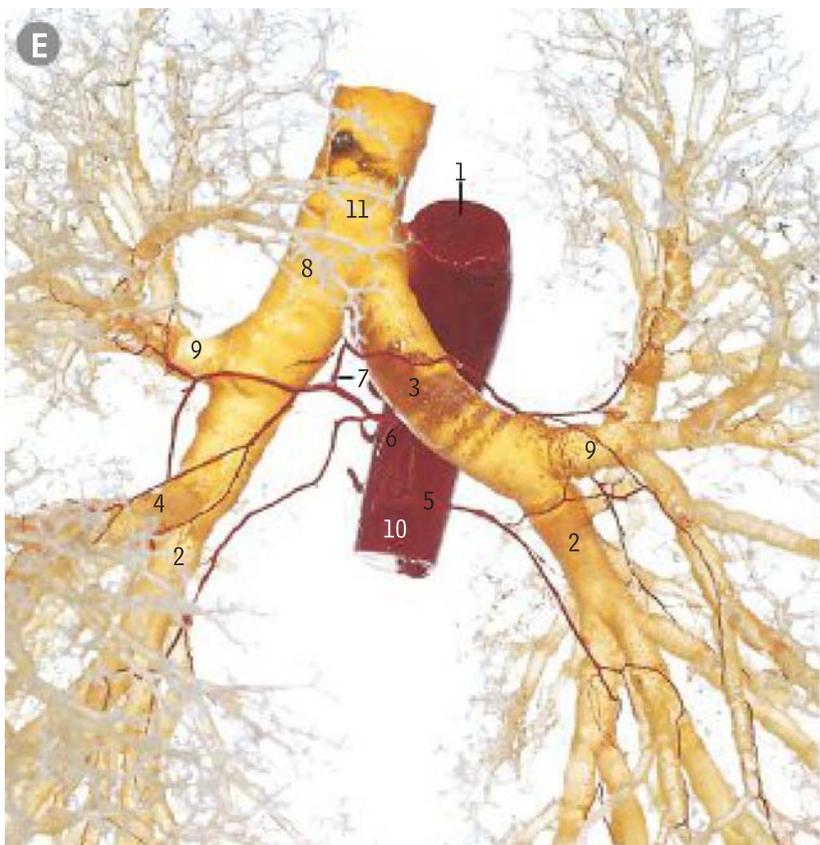
Cast of the pulmonary arteries and bronchi *from the front*

Pulmonary arteriogram



The upper part of the pulmonary trunk (6) is seen end-on after cutting off the lower part, and the bifurcation of the trunk into the left (4) and right (8) pulmonary arteries is in front of the beginning of the left main bronchus (3). In the living body, these pulmonary vessels contain deoxygenated blood and would normally be represented by a blue colour, but here they have been filled with red resin. Compare the vessels in the cast with those in the arteriogram D.

- 1 Branch of right pulmonary artery to superior lobe
- 2 Inferior lobe bronchus
- 3 Left primary bronchus
- 4 Left pulmonary artery
- 5 Middle lobe bronchus
- 6 Pulmonary trunk
- 7 Right primary bronchus
- 8 Right pulmonary artery
- 9 Superior lobe bronchus
- 10 Trachea

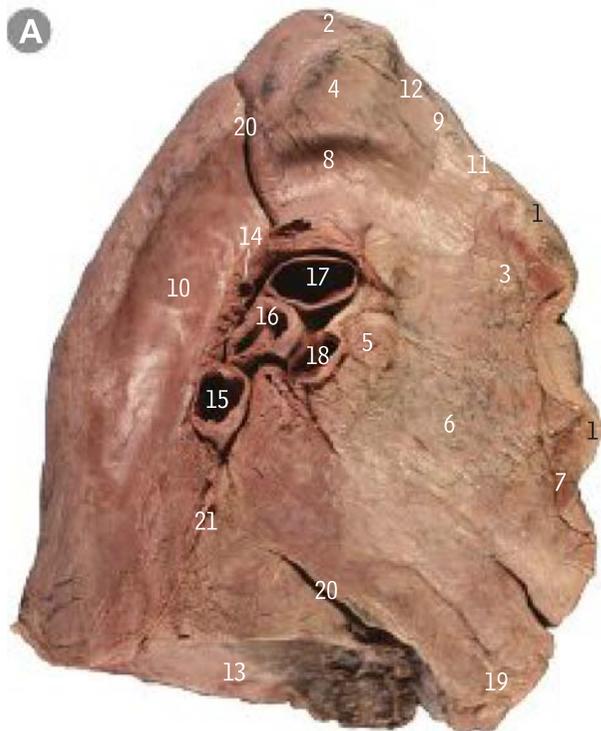


Cast of the bronchi and bronchial arteries *from the front*

Part of the aorta (1 and 10) has been injected with red resin to fill the bronchial arteries. These vessels normally run behind the bronchi and their branches but in this specimen, they are in front.

- 1 Arch of aorta
- 2 Inferior lobe bronchus
- 3 Left primary bronchus
- 4 Middle lobe bronchus
- 5 Origin of lower left bronchial artery
- 6 Origin of right bronchial artery
- 7 Origin of upper left bronchial artery
- 8 Right primary bronchus
- 9 Superior lobe bronchus
- 10 Thoracic aorta
- 11 Trachea

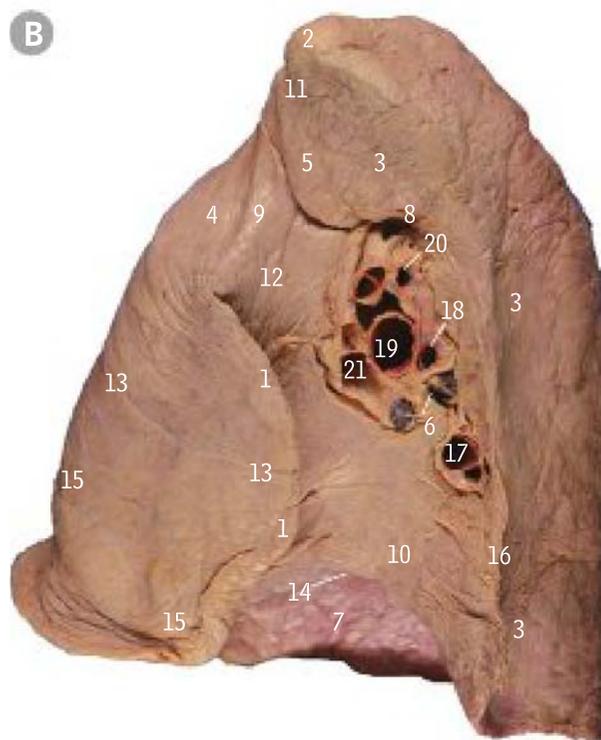
Left lung *medial surface*



Left lung (medial surface)

- 1 Anterior border
- 2 Apex
- 3 Area for thymus & fatty tissue of anterior mediastinum
- 4 Area for trachea & oesophagus
- 5 Bronchopulmonary lymph node
- 6 Cardiac impression
- 7 Cardiac notch
- 8 Groove for arch of aorta
- 9 Groove for brachiocephalic vein
- 10 Groove for descending aorta
- 11 Groove for first rib
- 12 Groove for left subclavian artery
- 13 Inferior border, diaphragmatic surface
- 14 Left bronchial artery
- 15 Left inferior pulmonary vein
- 16 Left main bronchus
- 17 Left pulmonary artery
- 18 Left superior pulmonary vein
- 19 Lingula
- 20 Oblique fissure
- 21 Pulmonary ligament

Right lung *medial surface*



Right lung (medial surface)

- 1 Anterior border (displaced medially)
- 2 Apex
- 3 Area and groove for oesophagus
- 4 Area for thymus and fatty tissue of anterior mediastinum
- 5 Area for trachea
- 6 Bronchopulmonary (hilar) lymph nodes
- 7 Diaphragmatic surface
- 8 Groove for azygos vein
- 9 Groove for brachiocephalic vein
- 10 Groove for inferior vena cava
- 11 Groove for right subclavian artery
- 12 Groove for superior vena cava
- 13 Horizontal fissure
- 14 Inferior border
- 15 Oblique fissure
- 16 Pulmonary ligament
- 17 Right inferior pulmonary vein
- 18 Right intermediate bronchus
- 19 Right pulmonary artery
- 20 Right superior lobar (eparterial) bronchus
- 21 Right superior pulmonary vein



Carcinoma of the lung

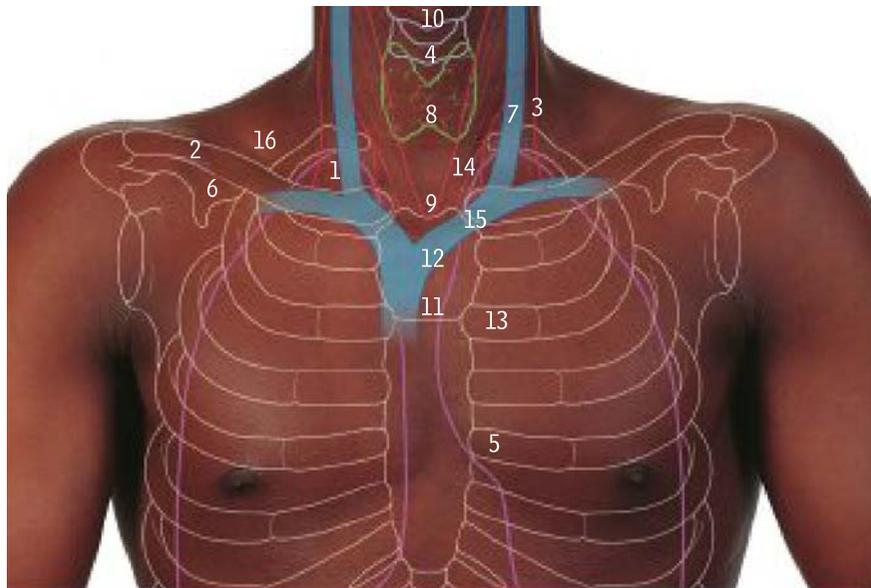


Mesothelioma

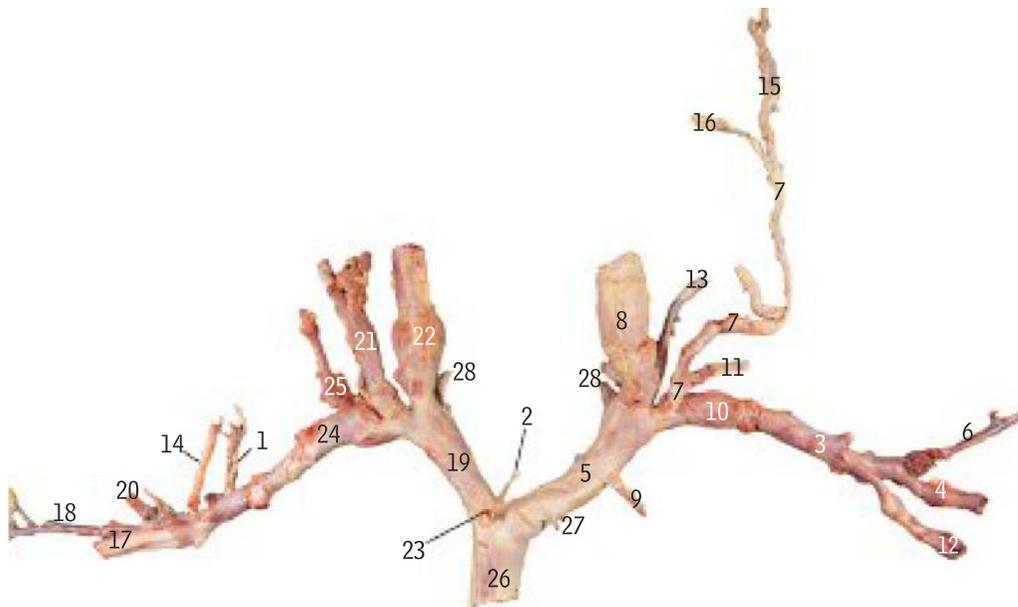


Tuberculosis

Lower neck and upper thorax *surface markings*



- 1 Apex of pleura and lung
- 2 Clavicle
- 3 Clavicular head of sternocleidomastoid
- 4 Cricoid cartilage
- 5 Fourth costal cartilage
- 6 Infraclavicular fossa
- 7 Internal jugular vein
- 8 Isthmus of thyroid gland overlying trachea
- 9 Jugular notch (suprasternal)
- 10 Laryngeal prominence of the thyroid cartilage
- 11 Manubriosternal joint
- 12 Midpoint of manubrium of sternum
- 13 Second costal cartilage
- 14 Sternal head of sternocleidomastoid
- 15 Sternoclavicular joint
- 16 Supraclavicular fossa



Veins of the root of the neck

- | | |
|--|---|
| <ol style="list-style-type: none"> 1 Acromial tributary of thoracoacromial vein 2 Inferior thyroid vein 3 Left axillary vein 4 Left basilic vein 5 Left brachiocephalic vein 6 Left cephalic vein 7 Left external jugular vein 8 Left internal jugular vein 9 Left internal thoracic vein 10 Left subclavian vein 11 Left suprascapular vein 12 Left thoracodorsal vein 13 Left transverse cervical vein (joining IJV) 14 Pectoral tributary of thoracoacromial vein | <ol style="list-style-type: none"> 15 Posterior auricular vein 16 Retromandibular vein 17 Right basilic vein 18 Right brachial vein 19 Right brachiocephalic vein 20 Right cephalic vein 21 Right external jugular vein 22 Right internal jugular vein 23 Right internal thoracic vein 24 Right subclavian vein 25 Right suprascapular vein 26 Superior vena cava 27 Thymic veins 28 Vertebral vein |
|--|---|



Superior vena cava obstruction



Variation in great veins

Thoracic inlet and mediastinum *from the front*



The anterior thoracic wall and the medial ends of the clavicles have been removed, but part of the parietal pleura (16) remains over the medial part of each lung. The right internal jugular vein has also been removed, displaying the thyrocervical trunk (32) and the origin of the internal thoracic artery (9). Inferior thyroid veins (7) run down over the trachea (33) to enter the left brachiocephalic vein (13). The thymus (31) has been dissected out from mediastinal fat; thymic veins (30) enter the left brachiocephalic vein, and an unusual thymic artery (1) arises from the brachiocephalic trunk (4).



- | | | |
|---|--|--|
| 1 A thymic artery | 14 Left common carotid artery | 26 Superior vena cava |
| 2 Arch of cricoid cartilage | 15 Left vagus nerve | 27 Suprascapular artery |
| 3 Ascending cervical artery | 16 Parietal pleura (cut edge) over lung | 28 Sympathetic trunk |
| 4 Brachiocephalic trunk | 17 Phrenic nerve | 29 Thoracic duct |
| 5 First rib cut edge | 18 Right brachiocephalic vein | 30 Thymic veins |
| 6 Inferior thyroid artery | 19 Right common carotid artery | 31 Thymus |
| 7 Inferior thyroid veins | 20 Right recurrent laryngeal nerve | 32 Thyrocervical trunk |
| 8 Internal jugular vein | 21 Right subclavian artery | 33 Trachea |
| 9 Internal thoracic artery | 22 Right vagus nerve | 34 Unusual cervical tributary of 18 |
| 10 Internal thoracic vein | 23 Scalenus anterior | 35 Upper trunk of brachial plexus |
| 11 Isthmus of thyroid gland | 24 Subclavian vein | 36 Vertebral vein |
| 12 Lateral lobe of thyroid gland | 25 Superficial branch of transverse cervical artery | |

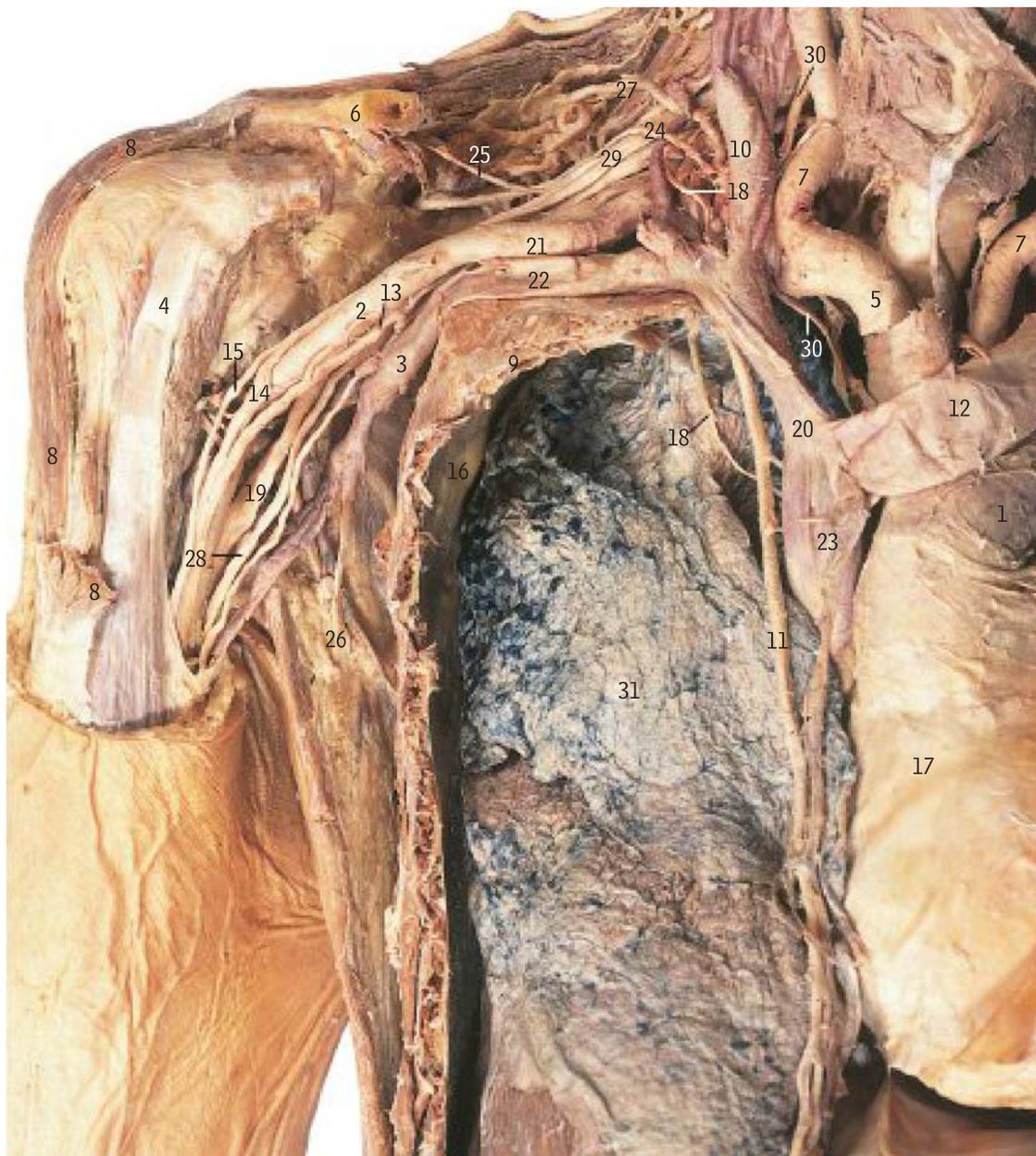


Pancoast tumour



Thoracic outlet syndromes

Thoracic inlet and superior mediastinum axilla and root of neck



- | | | | |
|------------------------------|--|-------------------------------|----------------------------------|
| 1 Aortic arch | 10 Internal jugular vein | 18 Phrenic nerve | 27 Transverse cervical artery |
| 2 Axillary artery | 11 Internal thoracic artery | 19 Radial nerve | 28 Ulnar nerve |
| 3 Axillary vein | 12 Left brachiocephalic vein | 20 Right brachiocephalic vein | 29 Upper trunk, brachial plexus |
| 4 Biceps, short head | 13 Medial cord, brachial plexus | 21 Subclavian artery | 30 Vagus nerve |
| 5 Brachiocephalic trunk | 14 Median nerve | 22 Subclavian vein | 31 Visceral pleura covering lung |
| 6 Clavicle (cut and removed) | 15 Musculocutaneous nerve | 23 Superior vena cava | |
| 7 Common carotid artery | 16 Parietal pleural covering of chest wall | 24 Suprascapular artery | |
| 8 Deltoid | 17 Pericardium, fibrous layer | 25 Suprascapular nerve | |
| 9 First rib | | 26 Thoracodorsal vein | |

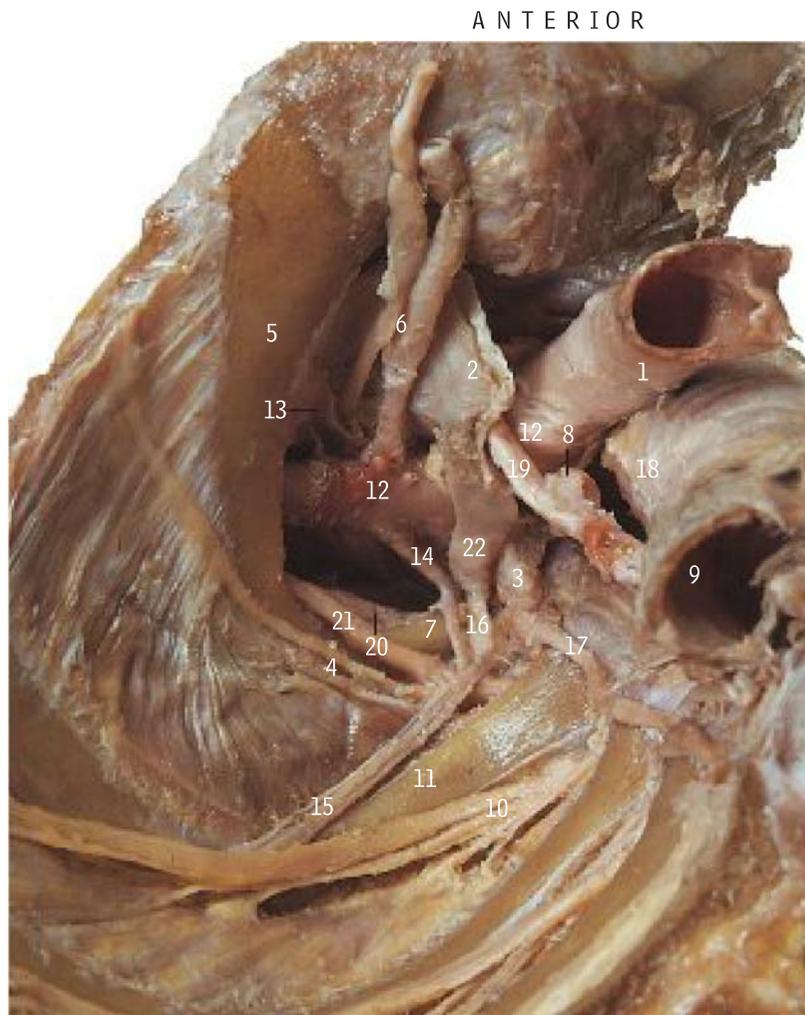


Bronchiectasis



Sarcoidosis

Thoracic inlet *right upper ribs, from below*



- 1 Brachiocephalic trunk
- 2 Brachiocephalic vein
- 3 Cervicothoracic (stellate) ganglion
- 4 First intercostal nerve
- 5 First rib
- 6 Internal thoracic vessels
- 7 Neck of first rib
- 8 Recurrent laryngeal nerve
- 9 Right primary bronchus
- 10 Second intercostal nerve
- 11 Second rib
- 12 Subclavian artery
- 13 Subclavian vein
- 14 Superior intercostal artery
- 15 Superior intercostal vein
- 16 Supreme intercostal vein (unusually large)
- 17 Sympathetic trunk
- 18 Trachea
- 19 Vagus nerve
- 20 Ventral ramus of eighth cervical nerve
- 21 Ventral ramus of first thoracic nerve
- 22 Vertebral vein

The neck of the first rib (7) is crossed in order from medial to lateral by the sympathetic trunk (17), supreme intercostal vein (16), superior intercostal artery (14) and the ventral ramus of the first thoracic nerve (21).



This is the view looking upwards into the right side of the thoracic inlet – the region occupied by the cervical pleura, here removed. The under-surface of most of the first rib (5) is seen from below, with the subclavian artery (12) passing over the top of it after giving off the internal thoracic branch (6) which runs towards the top of the picture (to the anterior thoracic wall), and the costocervical trunk whose superior intercostal branch (14) runs down over the neck of the first rib (7). The vertebral vein (22) has come down from the neck and is labelled on its posterior surface before entering the brachiocephalic vein (2, labelled at its opened cut edge). The vertebral vein receives an unusually large supreme intercostal vein (16). On its medial side is the sympathetic trunk (17) with the cervicothoracic ganglion (3). The neck of the first rib (7) has the ventral ramus of the first thoracic nerve (21) below it.



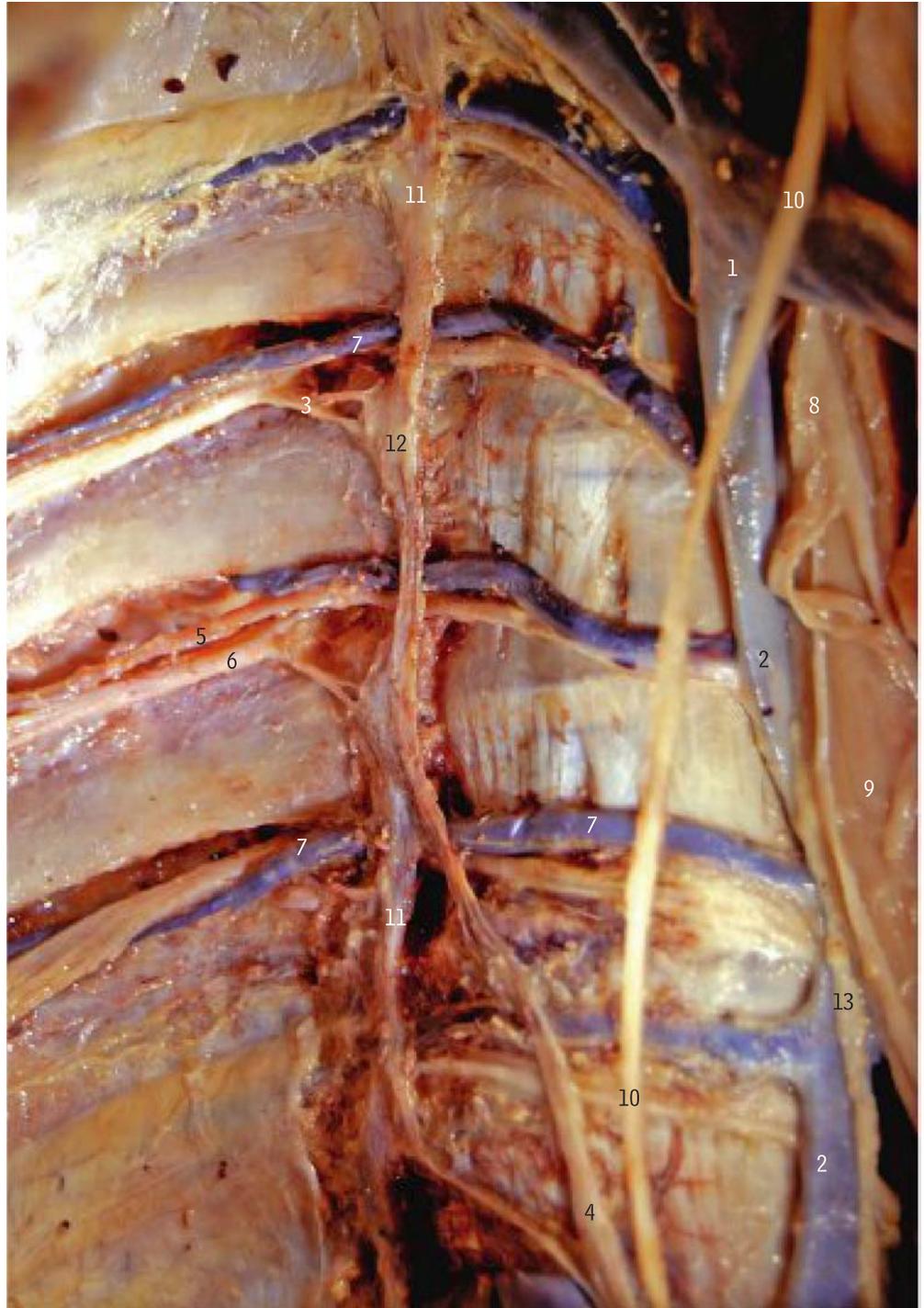
Catheterisation of subclavian vein



Thoracic outlet syndromes

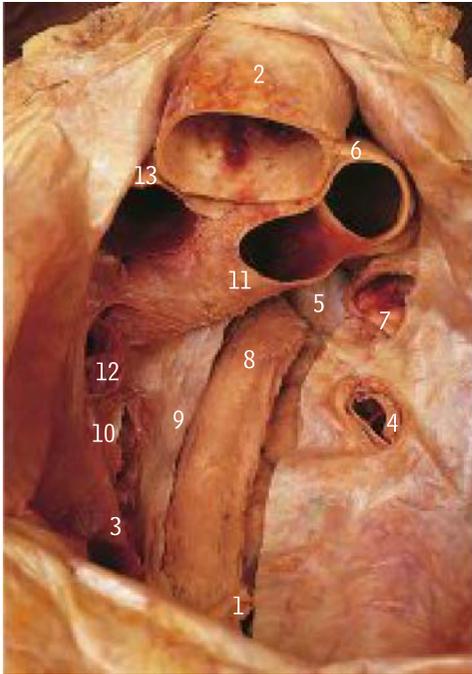
Posterior mediastinum *from the right hand side of the chest*

- 1 Azygos arch
- 2 Azygos vein
- 3 Gray and white communicating rami
- 4 Greater splanchnic nerve
- 5 Intercostal artery
- 6 Intercostal nerve
- 7 Intercostal vein
- 8 Oesophageal plexus
- 9 Oesophagus
- 10 Phrenic nerve
- 11 Sympathetic trunk
- 12 Sympathetic ganglion
- 13 Thoracic duct

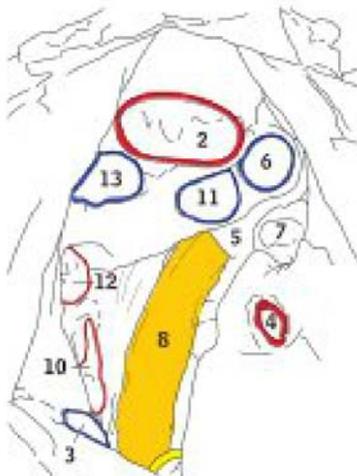


Azygos lobe

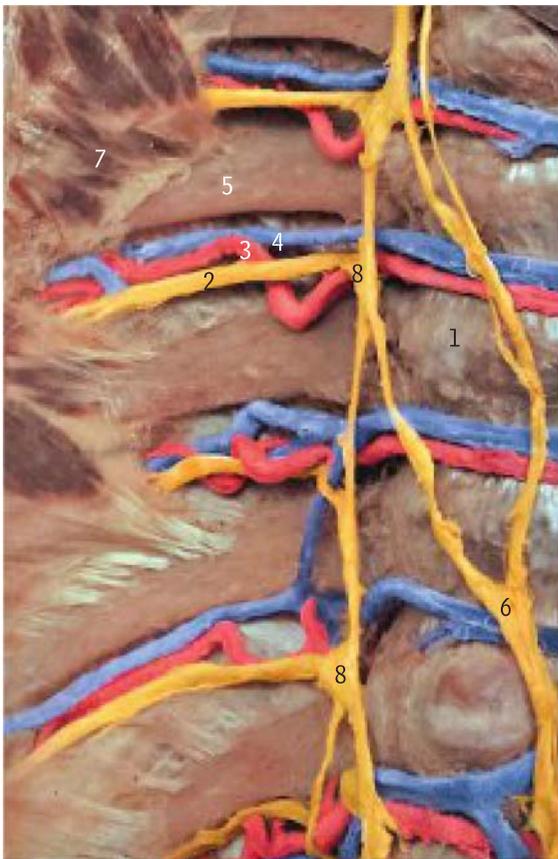
Oesophagus lower thoracic part, from the front



The heart has been removed from the pericardial cavity by transecting the great vessels, the pulmonary trunk being cut at the point where it divides into the two pulmonary arteries (11 and 6). Part of the pericardium (9) at the back has been removed to reveal the oesophagus (8). It is seen below the left primary bronchus (5) and is being crossed by the beginning of the right pulmonary artery (11).



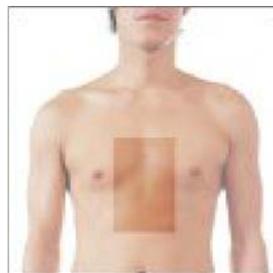
- 1 Anterior oesophageal trunk
- 2 Ascending aorta
- 3 Inferior vena cava
- 4 Left inferior pulmonary vein
- 5 Left primary bronchus
- 6 Left pulmonary artery
- 7 Left superior pulmonary vein
- 8 Oesophagus
- 9 Pericardium (cut edge)
- 10 Right inferior pulmonary vein
- 11 Right pulmonary artery
- 12 Right superior pulmonary vein
- 13 Superior vena cava



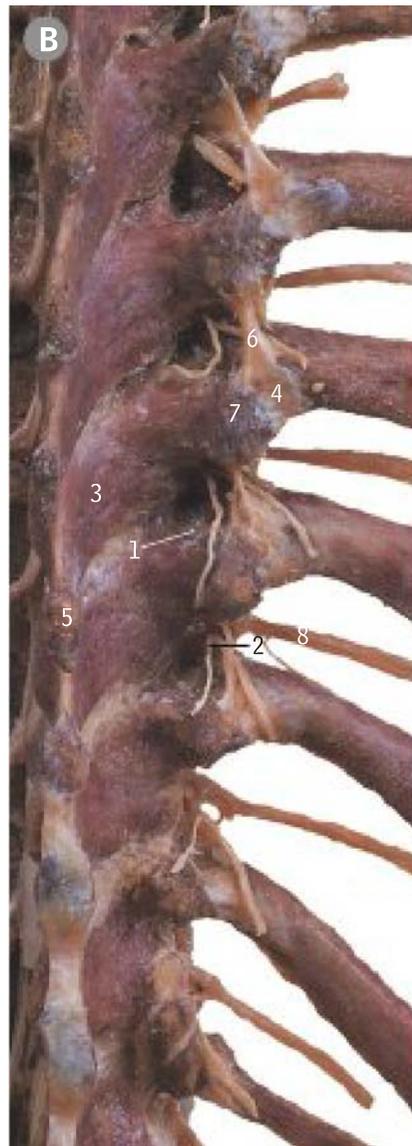
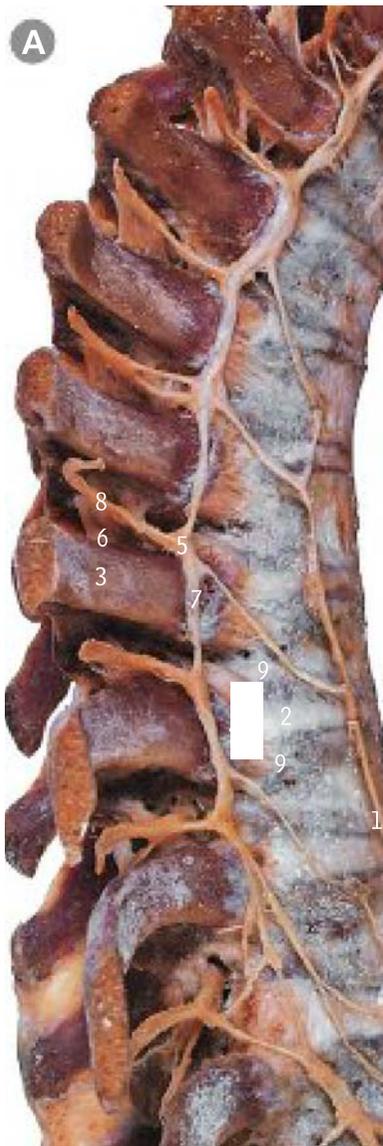
Intercostal spaces posterior internal view

This dissection shows the medial ends of some intercostal spaces of the right side, viewed from the front and slightly from the right. The pleura has been removed, revealing subcostal muscles (7) laterally, the nerves and vessels (4, 3 and 2) in the intercostal spaces, and the sympathetic trunk (8) and greater splanchnic nerve (6) on the sides of the vertebral bodies (as at 1).

- 1 Body of ninth thoracic vertebra
- 2 Eighth intercostal nerve
- 3 Eighth posterior intercostal artery
- 4 Eighth posterior intercostal vein
- 5 Eighth rib
- 6 Greater splanchnic nerve
- 7 Subcostal muscle
- 8 Sympathetic trunk and ganglia



Intercostal drainage



Joints of the heads of the ribs from the right

In this part of the right mid-thoracic region, the ribs have been cut short beyond their tubercles, and the joints that the two facets of the head of a rib make with the facets on the sides of adjacent vertebral bodies and the intervening disc are shown, as at 4, 9 and 2, where the radiate ligament (4) covers the capsule of these small synovial joints.

- 1 Greater splanchnic nerve
- 2 Intervertebral disc
- 3 Neck of rib
- 4 Radiate ligament of head of rib
- 5 Rami communicantes
- 6 Superior costotransverse ligament
- 7 Sympathetic trunk
- 8 Ventral ramus of thoracic nerve
- 9 Vertebral body

Costotransverse joints from behind

In this view of the right half of the thoracic vertebral column from behind, costotransverse joints between the transverse processes of vertebrae and the tubercles of ribs are covered by the lateral costotransverse ligaments (as at 4). The dorsal rami of spinal nerves (2) pass medial to the superior costotransverse ligaments (6); ventral rami (8) run in front of these ligaments.

- 1 Costotransverse ligament
- 2 Dorsal ramus of spinal nerve
- 3 Lamina
- 4 Lateral costotransverse ligament
- 5 Spinous process
- 6 Superior costotransverse ligament
- 7 Transverse process
- 8 Ventral ramus of spinal nerve



Costovertebral joints disarticulated, from the right

In the upper part of the figure, the upper rib has been severed through its neck (5) and the part with the tubercle attached has been turned upwards after cutting through the capsule of the costotransverse joint, to show the articular facet of the tubercle (2) and the transverse process (1). The head of the lower rib has been removed after transecting the radiate ligament (6) and underlying capsule of the joint of the head of the rib (3).

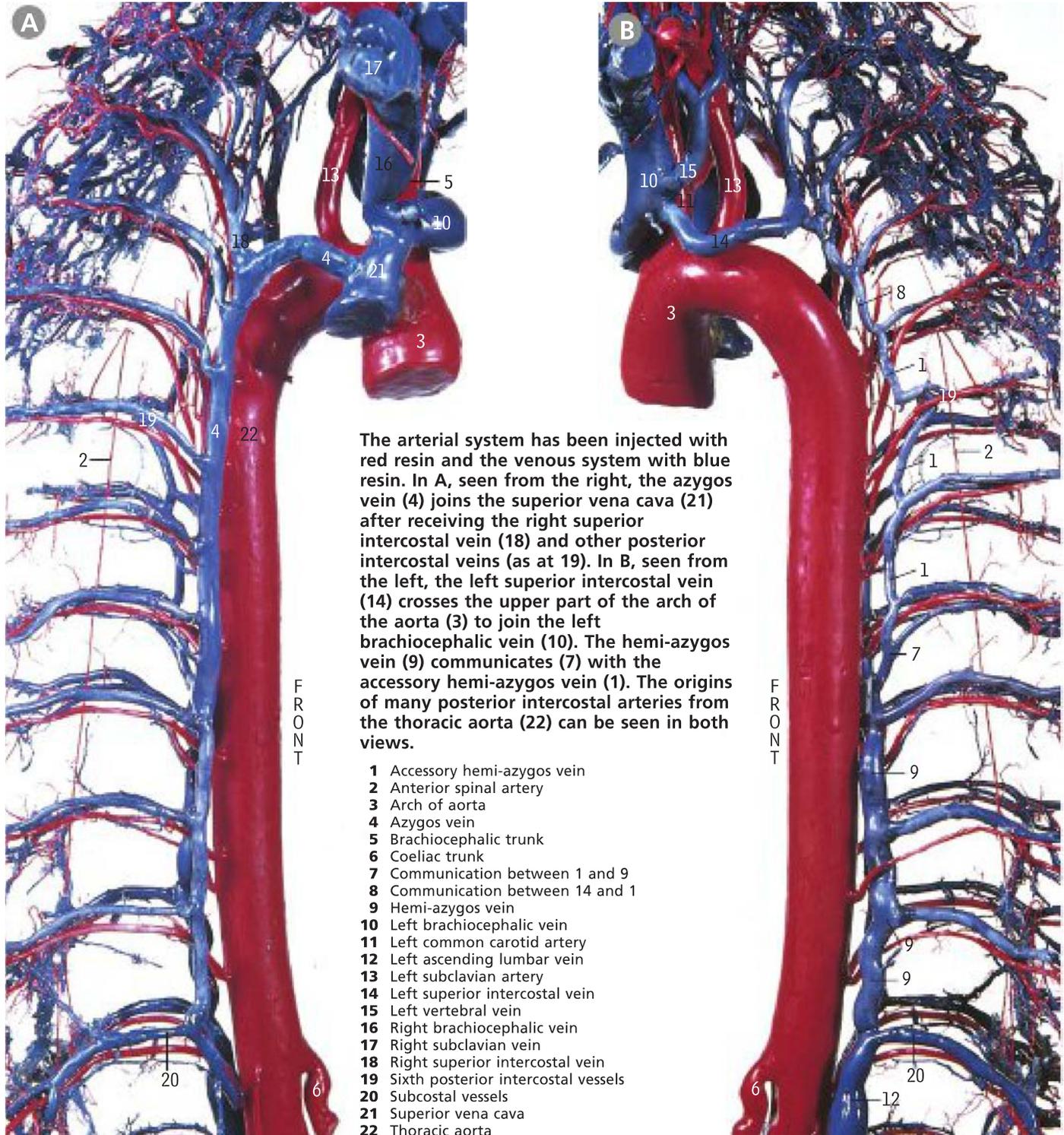
- 1 Articular facet of transverse process
- 2 Articular facet of tubercle of rib
- 3 Cavity of joint of head of rib
- 4 Marker between anterior and posterior parts of superior costotransverse ligament
- 5 Neck of rib
- 6 Radiate ligament
- 7 Superior costotransverse ligament



Varicella-zoster virus infection
– chest wall

Cast of the aorta and associated vessels

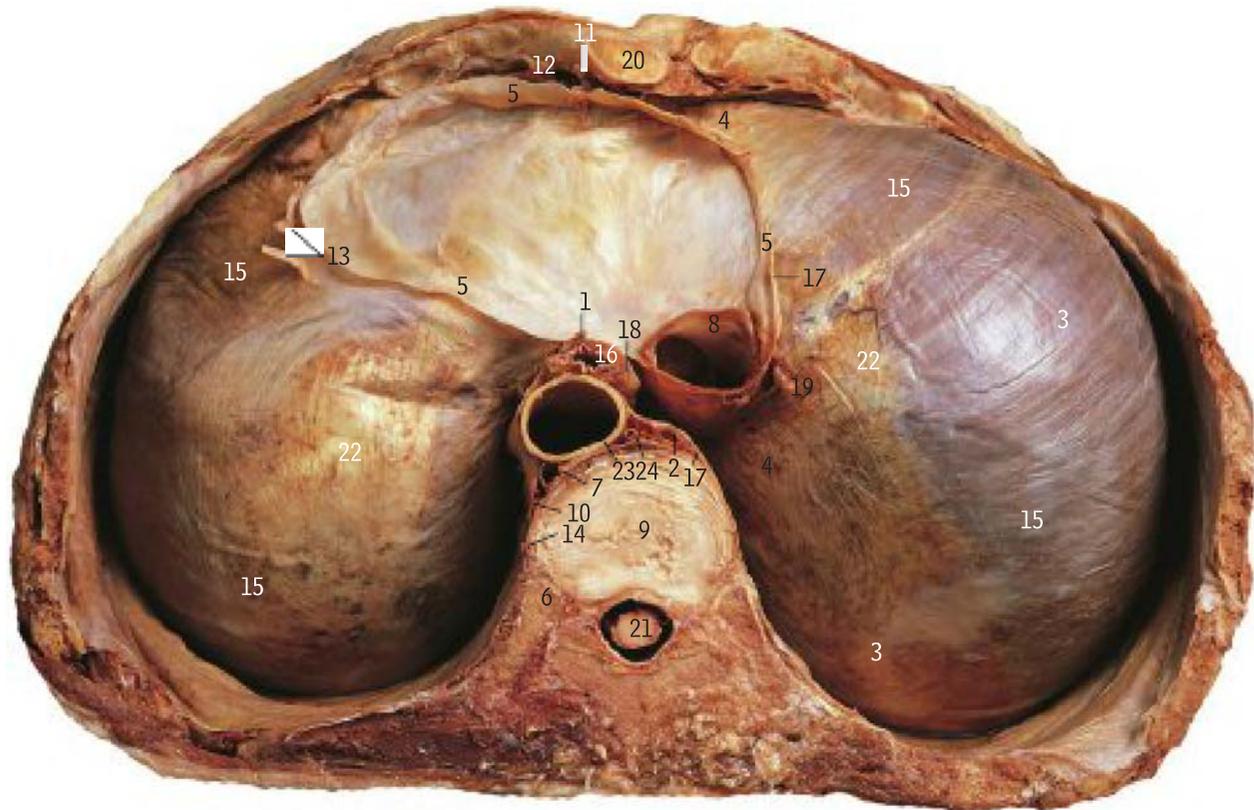
from the right *from the left*



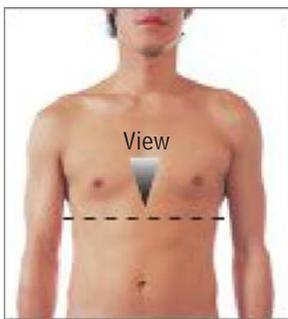
Aortic dissection



Variation in great arteries

Diaphragm *from above*

The thorax has been transected at the level of the intervertebral disk between the ninth and tenth thoracic vertebrae.



- 1 Anterior oesophageal plexus
- 2 Azygos vein
- 3 Costodiaphragmatic recess
- 4 Costomediastinal recess
- 5 Fibrous pericardium (cut edge)
- 6 Head of left ninth rib
- 7 Hemi-azygos vein
- 8 Inferior vena cava
- 9 Intervertebral disc
- 10 Left greater splanchnic nerve
- 11 Left internal thoracic artery
- 12 Left musculophrenic artery
- 13 Left phrenic nerve
- 14 Left sympathetic trunk
- 15 Muscle of diaphragm
- 16 Oesophagus
- 17 Pleura (cut edge)
- 18 Posterior oesophageal plexus
- 19 Right phrenic nerve
- 20 Seventh left costal cartilage
- 21 Spinal cord
- 22 Tendon of diaphragm
- 23 Thoracic aorta
- 24 Thoracic duct

According to the standard textbook description, the foramen for the vena cava is at the level of the disc between the eighth and ninth thoracic vertebrae, the oesophageal opening at the level of the tenth thoracic vertebra and the aortic opening opposite the twelfth thoracic vertebra. However, it is common for the oesophageal hiatus to be nearer the midline, as in this specimen (16), and the caval foramen (8) is lower than usual.

The caval foramen is in the tendinous part of the diaphragm and the oesophageal opening in the muscular part. The aortic hiatus is not *in* the diaphragm but behind it.

The central tendon of the diaphragm has the shape of a trefoil leaf and has no bony attachment.

The right phrenic nerve (19) passes through the caval foramen in the tendinous part, but the left phrenic nerve (13) pierces the muscular part in front of the central tendon just lateral to the overlying pericardium.

The phrenic nerves are the *only motor* nerves to the diaphragm, including the crura. The supply from lower thoracic (intercostal and subcostal) nerves is purely sensory. Damage to one phrenic nerve completely paralyses its own half of the diaphragm.

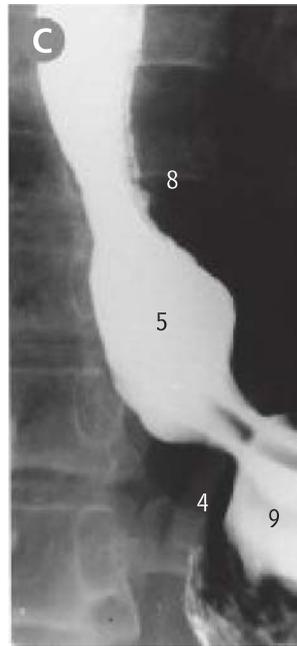
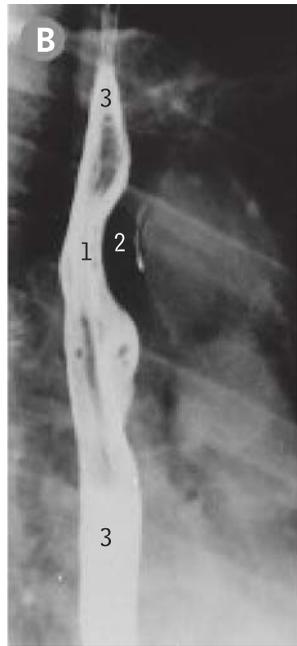


Diaphragmatic hernia



Gastro-oesophageal reflux

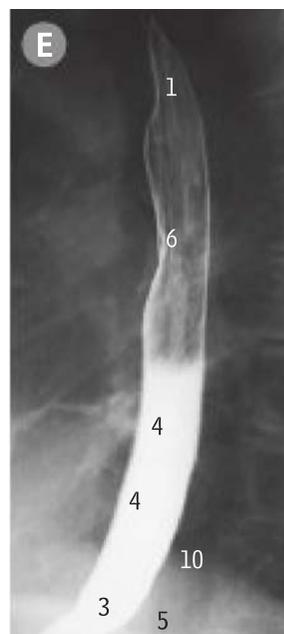
Oesophageal radiographs during a barium swallow



lower pharynx and
upper oesophagus
middle part
lower end

- 1 Aortic impression in oesophagus
- 2 Arch of aorta with plaque of calcification
- 3 Barium in oesophagus
- 4 Diaphragm
- 5 Lower thoracic oesophagus
- 6 Margins of trachea (translucent with contained air)
- 7 Piriform recess in laryngopharynx
- 8 Position of left atrium
- 9 Stomach

In A, viewed from the front, some of the barium paste adheres to the pharyngeal wall, outlining the piriform recesses (7), but most of it has passed into the oesophagus (3). In B, viewed obliquely from the left, the oesophagus is indented by the arch of the aorta (2) which shows some calcification in its wall – a useful aid to its identification. In C, there is some dilatation at the lower end of the thoracic oesophagus (5) and it is constricted where it passes through the diaphragm (4) to join the stomach (9). The left atrium of the heart (8) lies in front of the lower thoracic oesophagus (page 222, A8), but only when enlarged does the atrium cause an indentation in the oesophagus.



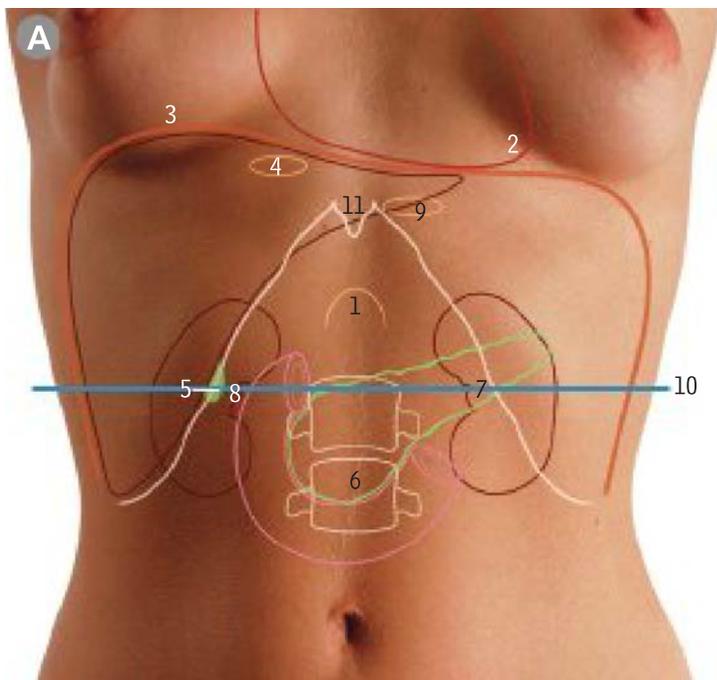
cervical part

thoracic part

- 1 Aortic arch impression
- 2 Root of tongue
- 3 Gastro-oesophageal junction
- 4 Left atrium position
- 5 Left hemidiaphragm
- 6 Left primary bronchus impression
- 7 Oesophagus
- 8 Oropharynx
- 9 Postcricoid venous plexus impression
- 10 Right hemidiaphragm
- 11 Trachea
- 12 Vallecula

Abdomen and pelvis

5



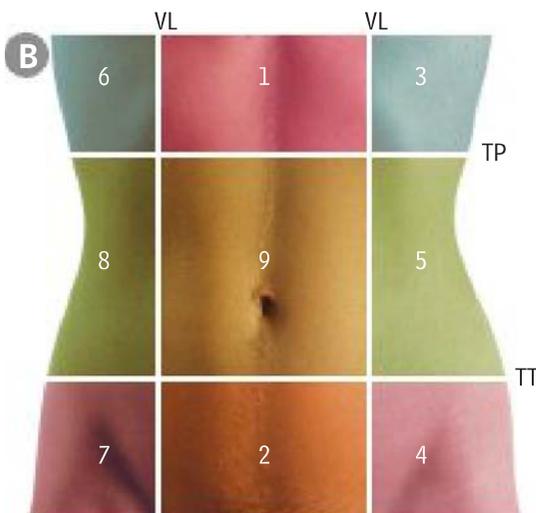
Anterior abdominal wall

surface markings, above the umbilicus

The solid white line indicates the costal margin. The blue line indicates the transpyloric plane. The C-shaped duodenum is outlined in pink, the kidneys and liver in brown and the pancreas in pale green.

- 1 Aortic opening in diaphragm
- 2 Apex of heart in left fifth intercostal space
- 3 Dome of diaphragm and upper margin of liver
- 4 Foramen for inferior vena cava in diaphragm
- 5 Fundus of gall bladder, and junction of ninth costal cartilage and lateral border of rectus sheath
- 6 Head of pancreas and level of second lumbar vertebra
- 7 Hilum of left kidney
- 8 Hilum of right kidney
- 9 Oesophageal opening in diaphragm
- 10 Transpyloric plane
- 11 Xiphoid process

The transpyloric plane (10) lies midway between the jugular notch of the sternum and the upper border of the pubic symphysis, or approximately a hand's breadth below the xiphisternal joint (11), and level with the lower part of the body of the first lumbar vertebra.



Regions of the abdomen

The abdomen may be divided into regions by two vertical and two horizontal lines. The vertical lines (VL) pass through the midinguinal points: the upper horizontal line corresponds to the transpyloric plane (TP, A10), the lower line is drawn between the tubercles of the iliac crests (transtubercular plane, TT).

- | | |
|-------------------------------------|-------------------------------------|
| 1 Epigastric region | 6 Right hypochondrium |
| 2 Hypogastrium or suprapubic region | 7 Right iliac region or iliac fossa |
| 3 Left hypochondrium | 8 Right lumbar region |
| 4 Left iliac region or iliac fossa | 9 Umbilical region |
| 5 Left lumbar region | |



Varicella-zoster virus infection – abdominal wall

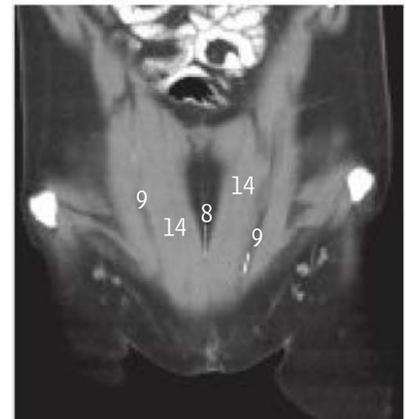
Anterior abdominal wall



- 1 Anterior cutaneous nerve (eighth intercostal)
- 2 Anterior cutaneous nerve (tenth intercostal)
- 3 Anterior layer internal oblique aponeurosis
- 4 External oblique aponeurosis
- 5 External oblique muscle
- 6 Ilioinguinal nerve
- 7 Iliotibial tract
- 8 Linea alba
- 9 Linea semilunaris
- 10 Mons pubis
- 11 Pectoralis major, abdominal part
- 12 Posterior layer internal oblique aponeurosis
- 13 Pyramidalis muscle
- 14 Rectus abdominis
- 15 Rectus sheath, anterior
- 16 Round ligament of uterus
- 17 Serratus anterior muscle
- 18 Superficial inguinal lymph node (horizontal group)
- 19 Superficial inguinal lymph node (vertical group)
- 20 Superficial inguinal ring
- 21 Superficial inguinal veins
- 22 Tendinous intersection of rectus abdominis
- 23 Umbilicus

The rectus sheath (A15) is formed by the internal oblique aponeurosis (A3), which splits at the lateral border of the rectus muscle (A9) into two layers. The posterior layer (A12) passes behind the muscle to blend with the aponeurosis of transversus abdominis (B19) to form the posterior wall of the sheath (B13), and the anterior layer (A3) passes in front of the muscle to blend with the external oblique aponeurosis (A4) as the anterior wall (A15).

The anterior and posterior walls of the sheath unite at the medial border of the rectus muscle to form the midline linea alba (A8, B11).



Coronal CT, anterior abdominal wall



Haematoma of the rectus sheath



Spigelian hernia

Rectus sheath



- 1 Anterior cutaneous nerve (tenth intercostal)
- 2 Anterior layer of internal oblique aponeurosis
- 3 Anterior wall of rectus sheath
- 4 Eighth rib
- 5 External oblique aponeurosis
- 6 External oblique muscle
- 7 Ilioinguinal nerve
- 8 Inferior epigastric vessels
- 9 Internal oblique aponeurosis
- 10 Internal oblique muscle
- 11 Linea alba
- 12 Mons pubis
- 13 Posterior wall of rectus sheath
- 14 Rectus abdominis
- 15 Rectus abdominis, reflected
- 16 Round ligament of uterus
- 17 Superficial inguinal lymph nodes
- 18 Tendinous intersection
- 19 Transversus abdominis
- 20 Umbilicus

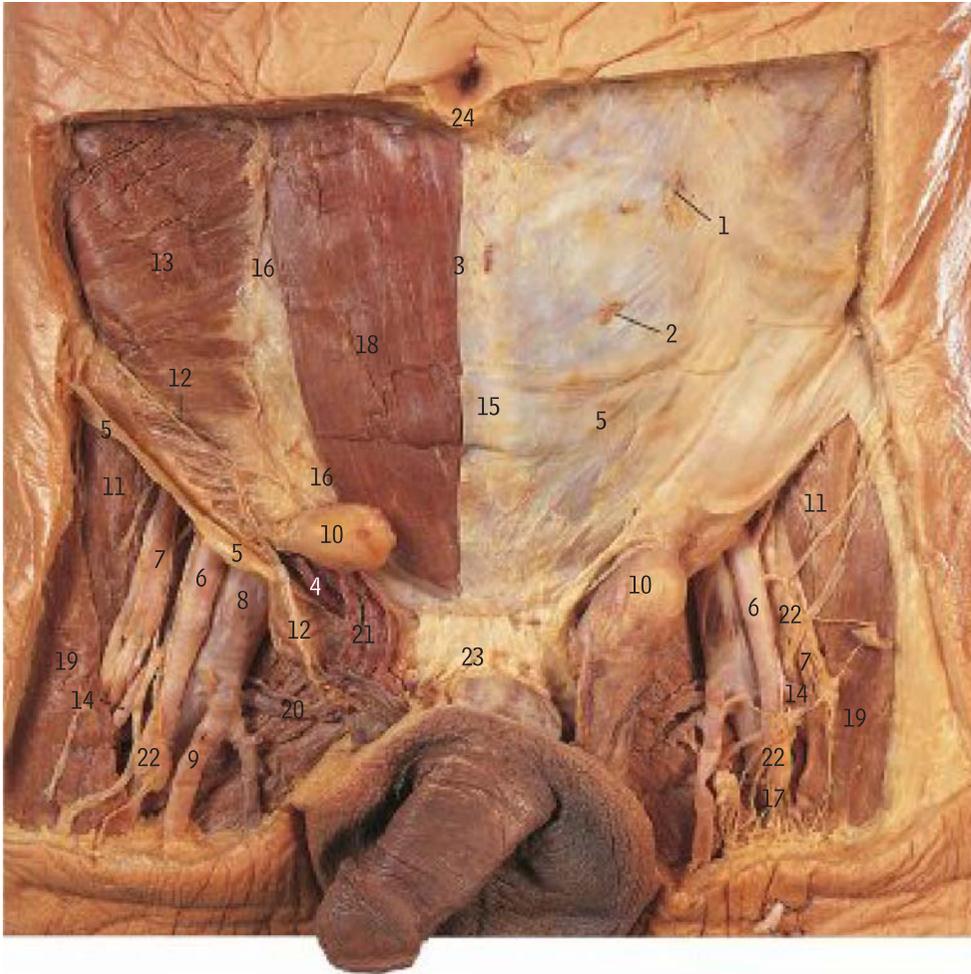
There is no posterior rectus sheath in the lower third of rectus abdominis, below the arcuate line (page 232, A1).

Coronal CT



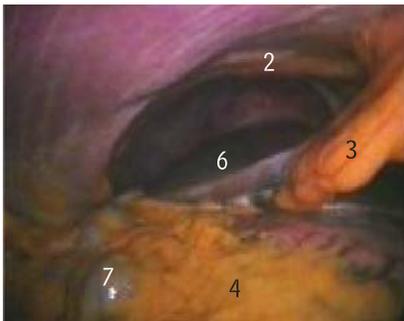
Cushing's striae

Groin in the male

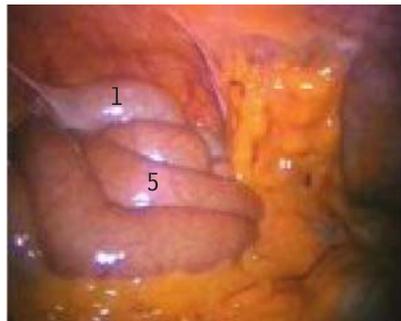


- 1 Anterior cutaneous nerve (eleventh intercostal)
- 2 Anterior cutaneous nerve (twelfth intercostal)
- 3 Anterior rectus sheath (cut edge)
- 4 Ductus (vas) deferens
- 5 External oblique aponeurosis
- 6 Femoral artery
- 7 Femoral nerve
- 8 Femoral vein
- 9 Great saphenous vein
- 10 Hernial sac (indirect)
- 11 Iliacus muscle
- 12 Ilioinguinal nerve
- 13 Internal oblique muscle
- 14 Lateral circumflex femoral artery
- 15 Linea alba
- 16 Linea semilunaris
- 17 Lymphatic vessels
- 18 Rectus abdominis muscle
- 19 Sartorius muscle
- 20 Scrotal venous connections
- 21 Spermatic cord
- 22 Superficial inguinal lymph node
- 23 Suspensory ligament of penis
- 24 Umbilicus

The hernial sacs (10), shown here, are not present in normal subjects.



Laparoscopic view of upper abdominal cavity



Laparoscopic view of lower abdominal cavity

- 1 Caecum
- 2 Diaphragm
- 3 Falciform ligament
- 4 Greater omentum
- 5 Ileum
- 6 Right lobe, liver
- 7 Transverse colon

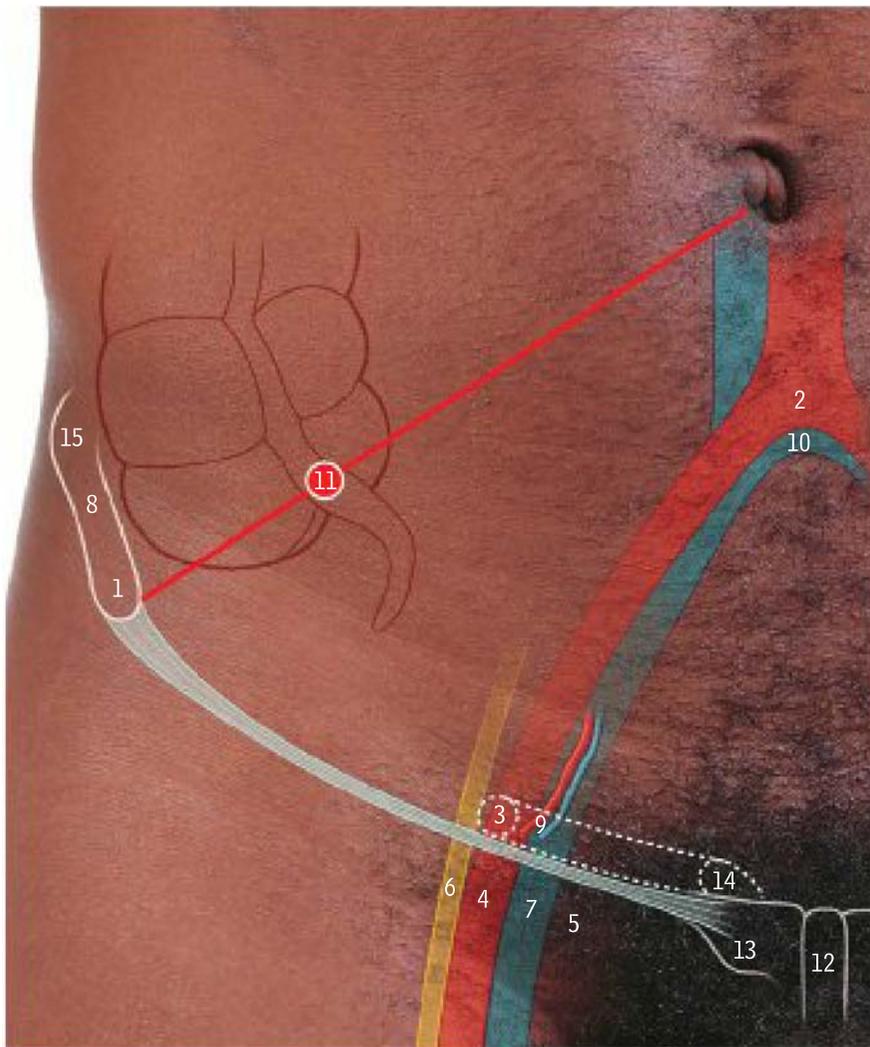


Inguinal hernia repair



Varicella-zoster virus infection – abdominal wall

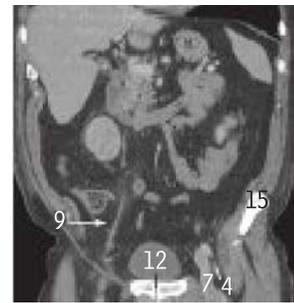
Adult anterior abdominal wall in the male *surface markings, right iliac fossa*



- 1 Anterior superior iliac spine
- 2 Bifurcation of aorta (fourth lumbar vertebra)
- 3 Deep inguinal ring
- 4 Femoral artery
- 5 Femoral canal
- 6 Femoral nerve
- 7 Femoral vein
- 8 Iliac crest
- 9 Inferior epigastric vessels
- 10 Lower end of inferior vena cava (fifth lumbar vertebra)
- 11 McBurney's point
- 12 Pubic symphysis
- 13 Pubic tubercle
- 14 Superficial inguinal ring
- 15 Tubercle of iliac crest

The femoral artery (4, whose pulsation should normally be palpable) enters the thigh midway between the pubic symphysis (12) and the anterior superior iliac spine (1). This is often referred to as the midinguinal point.

Coronal CT, abdomen



Sagittal CT, abdomen



Arrows point to inferior epigastric artery

The caecum with the appendix opening into it from the left and the ascending colon continuing upwards from it are indicated by the brown line. The inguinal ligament, between the anterior superior iliac spine (1) and the pubic tubercle (13), is indicated by the light blue line. The femoral artery (4) has the femoral vein (7) on its medial side and the femoral nerve (6) on its lateral side. The femoral canal (5) is on the medial side of the vein. The deep inguinal ring (3) and inferior epigastric vessels (9) are above the femoral artery, while the superficial inguinal ring (14) is above and lateral to the pubic tubercle (13). McBurney's point (11) is a site on the surface of the anterior abdominal wall indicating the usual location of the base of the appendix internally. It lies one-third of the way along a line from the right anterior superior iliac spine to the umbilicus (red line).



Femoral hernia



McBurney's point

Adult anterior abdominal wall *umbilical folds, from behind*

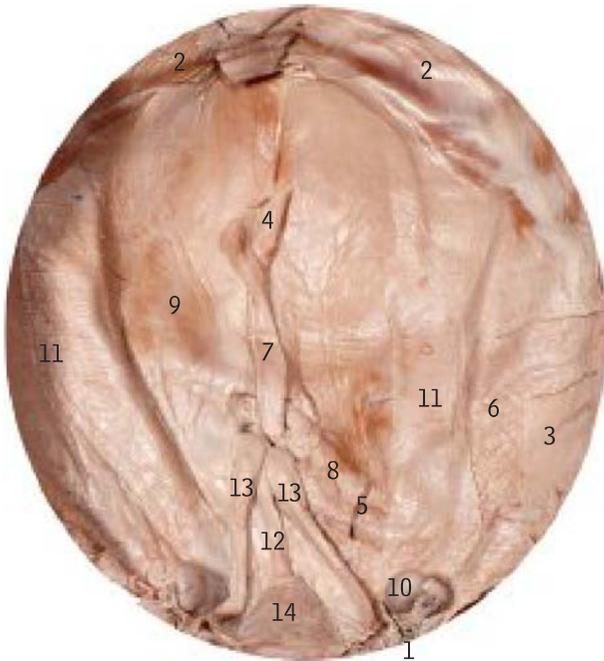


This view of the peritoneal surface of the central region of the anterior abdominal wall shows the peritoneal folds raised by underlying structures. There is one fold above the umbilicus – the falciform ligament – and there are five below it: the median umbilical fold (7) in the midline, and a pair of medial and lateral umbilical folds on each side (6 and 4).

- 1 Arcuate line
- 2 Falciform ligament
- 3 Inguinal triangle (Hesselbach)
- 4 Lateral umbilical fold which contains the inferior epigastric vessels
- 5 Linea semilunaris
- 6 Medial umbilical fold
- 7 Median umbilical fold
- 8 Umbilicus

The inguinal triangle of Hesselbach is a naturally weak region between rectus abdominis and the inferior epigastric vessels. Direct inguinal hernias appear through this region.

Foetal anterior abdominal wall *from behind*



In this at term foetus, the peritoneum and extraperitoneal tissues have been removed from the anterior abdominal wall to show the umbilical arteries (9) and left umbilical vein (6) converging at the back of the (unlabelled) umbilicus.

- 1 Deep inguinal ring
- 2 Diaphragm
- 3 External oblique muscle
- 4 Falciform ligament
- 5 Inferior epigastric vessels
- 6 Internal oblique muscle
- 7 Left umbilical vein
- 8 Rectus abdominis muscle
- 9 Rectus sheath (posterior layer)
- 10 Testis (undescended)
- 11 Transversus abdominis muscle
- 12 Urachus
- 13 Umbilical arteries
- 14 Urinary bladder



Caput medusae



Omphalocele

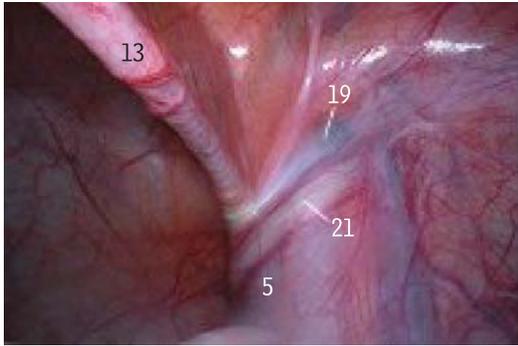


Postnatal umbilical vein catheter



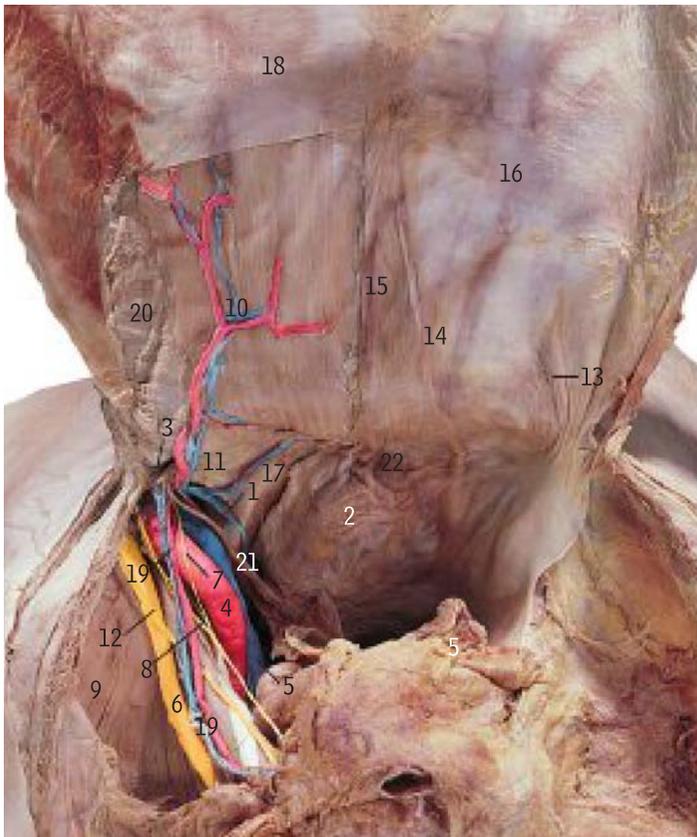
Umbilical and paraumbilical hernia

Right deep inguinal ring in adult male *laparoscopic view*



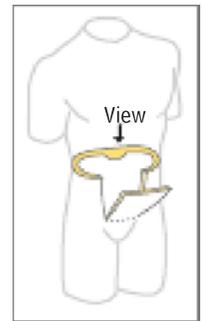
Axial CT, pelvis

Anterior abdominal wall *abdominal view*



Abdominal viscera have been removed and the anterior abdominal wall detached laterally and reflected anteriorly and inferiorly to reveal the internal surface of the abdominal wall. The parietal peritoneum has been removed from the left side to show deeper structures in the pelvic and abdominal walls.

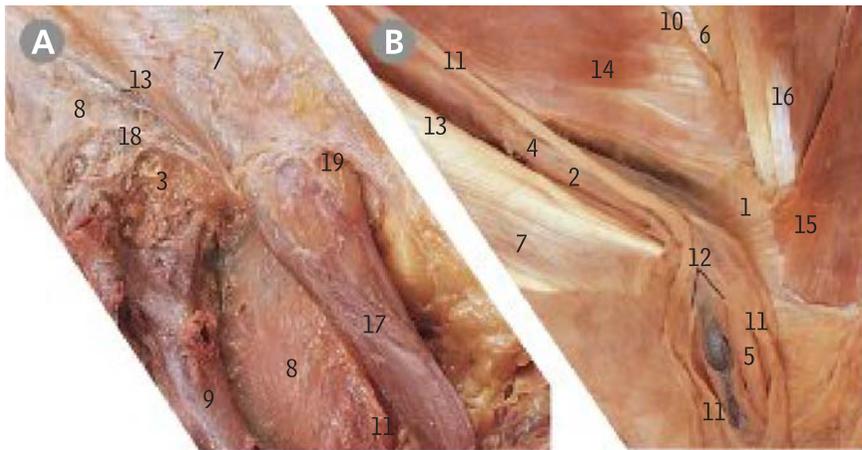
- 1 Accessory obturator artery
- 2 Bladder
- 3 Deep inguinal ring
- 4 External iliac artery
- 5 External iliac vein
- 6 Femoral nerve
- 7 Genitofemoral nerve, femoral branch
- 8 Genitofemoral nerve, genital branch
- 9 Iliacus
- 10 Inferior epigastric vessels
- 11 Inguinal triangle (Hesselbach)
- 12 Lateral cutaneous nerve of the thigh
- 13 Lateral umbilical fold (inferior epigastric vessels)
- 14 Medial umbilical fold (umbilical artery)
- 15 Median umbilical fold (urachus)
- 16 Parietal peritoneum
- 17 Pelvic brim
- 18 Posterior surface, rectus sheath
- 19 Testicular vessels
- 20 Transversus abdominis
- 21 Vas/ductus deferens
- 22 Visceral peritoneum, over bladder



Inguinal hernia



Indirect inguinal hernia



Right inguinal region *in the male*

superficial dissection

with the external oblique aponeurosis and spermatic cord incised

In A, the spermatic cord (17) is seen emerging from the superficial inguinal ring (19) and covered by the external spermatic fascia. In B, with the external oblique aponeurosis reflected and the anterior wall of the rectus sheath removed, the cord is emerging from the deep inguinal ring (4) with the cremasteric fascia (2) now the most superficial covering. All three coverings of the cord have been incised (12) to show the ductus/vas deferens (5).

- | | |
|--|--|
| <ol style="list-style-type: none"> 1 Conjoint tendon 2 Cremasteric fascia and cremaster muscle over spermatic cord 3 Cribriform fascia 4 Deep inguinal ring 5 Ductus/vas deferens 6 Edge of rectus sheath 7 External oblique aponeurosis 8 Fascia lata 9 Great saphenous vein 10 Iliohypogastric nerve | <ol style="list-style-type: none"> 11 Ilioinguinal nerve 12 Incised margin of coverings of cord 13 Inguinal ligament 14 Internal oblique 15 Pyramidalis 16 Rectus abdominis 17 Spermatic cord 18 Upper margin of saphenous opening 19 Upper margin of superficial inguinal ring |
|--|--|



Right inguinal region *in the female*



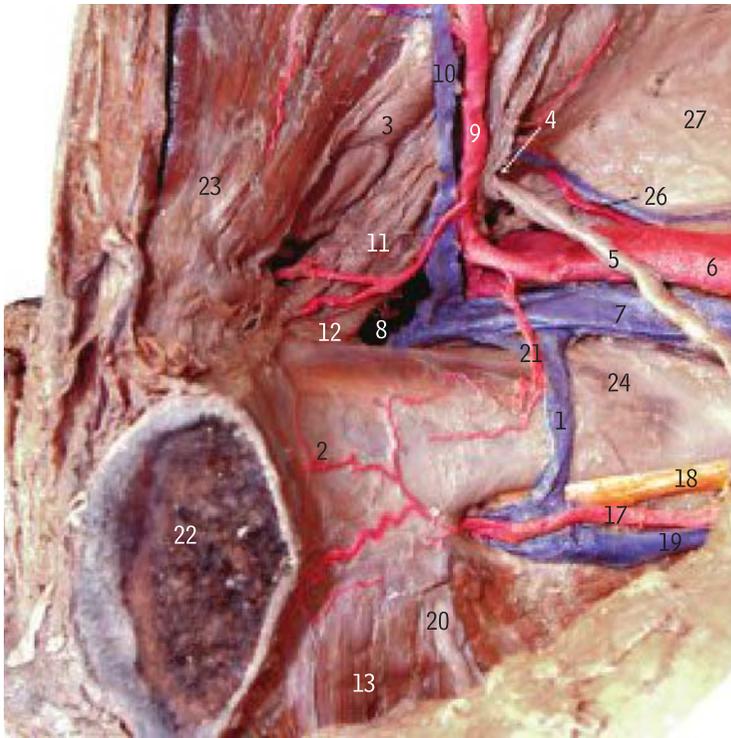
The external oblique aponeurosis (2) has been incised and reflected to show the position of the deep inguinal ring (7) which marks the lateral end of the inguinal canal. The round ligament of the uterus (9) emerges from the superficial inguinal ring (8), which marks the medial end of the canal, and becomes lost in the fat of the labium majus (3). The ilioinguinal nerve (5) also passes through the canal and out of the superficial ring.

- | |
|--|
| <ol style="list-style-type: none"> 1 Conjoint tendon 2 External oblique aponeurosis 3 Fat of labium majus 4 Great saphenous vein 5 Ilioinguinal nerve 6 Internal oblique 7 Position of deep inguinal ring 8 Position of superficial inguinal ring 9 Round ligament of uterus 10 Upper surface of inguinal ligament |
|--|

In the female, the inguinal canal contains the round ligament of the uterus and the ilioinguinal nerve.

The processus vaginalis is normally obliterated, but if it remains patent within the female inguinal canal, it is sometimes known as the canal of Nuck.

Right deep inguinal ring and inguinal triangle *internal view*

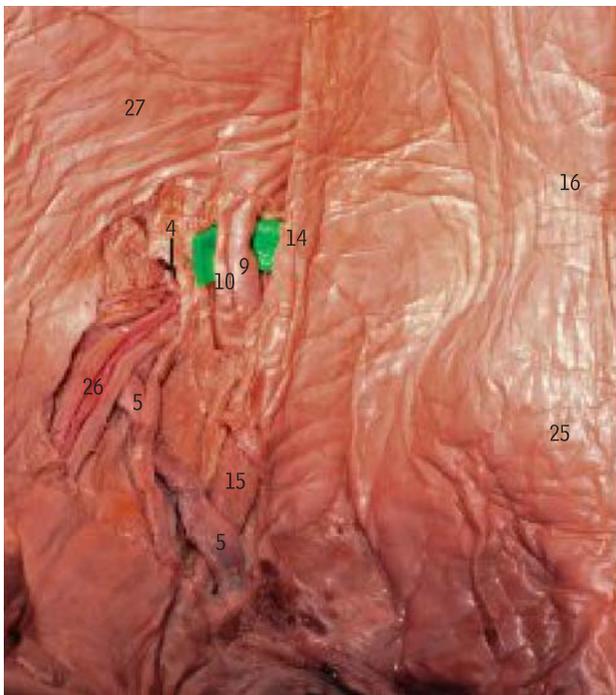


This is the view looking into the right half of the pelvis from the left, showing the posterior surface of the lower part of the anterior abdominal wall, above the pubic symphysis. The femoral ring (8), the entrance to the femoral canal, is below the medial end of the inguinal ligament (11). The inferior epigastric vessels (9, 10) lie medial to the deep inguinal ring (4).

The inguinal triangle (Hesselbach's triangle) is the area bounded laterally by the inferior epigastric vessels, medially by the lateral border of rectus abdominis and below by the inguinal ligament. A direct inguinal hernia passes forwards through this triangle, medial to the inferior epigastric vessels.

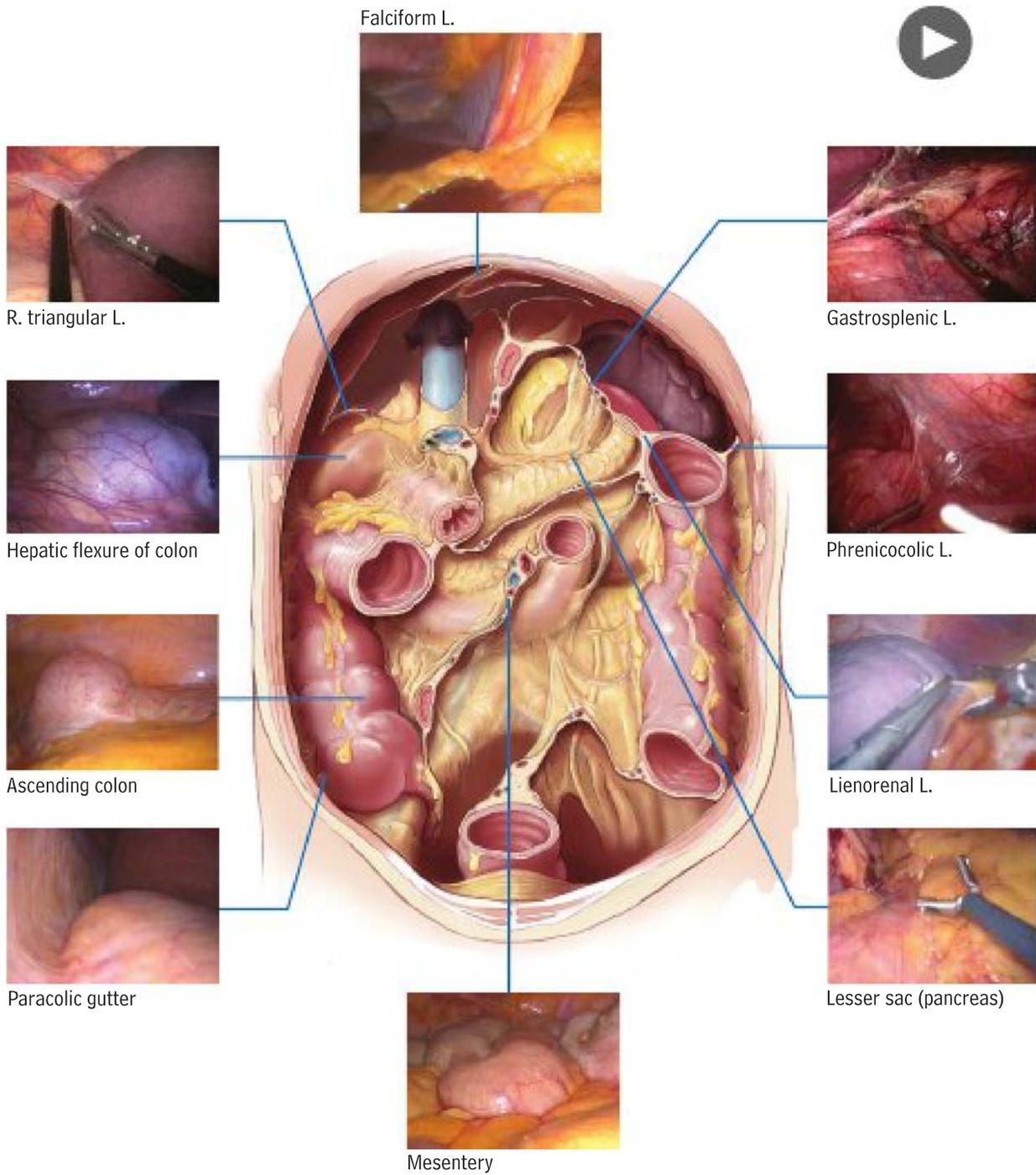
An indirect inguinal hernia passes through the deep inguinal ring lateral to the inferior epigastric vessels.

Left deep inguinal ring in the male *internal peritoneal (view as seen at laparoscopy)*



- 1 Abberant obturator vein
- 2 Body of pubis
- 3 Conjoint tendon
- 4 Deep inguinal ring
- 5 Ductus/vas deferens
- 6 External iliac artery
- 7 External iliac vein
- 8 Femoral ring
- 9 Inferior epigastric artery
- 10 Inferior epigastric vein
- 11 Inguinal ligament
- 12 Lacunar ligament
- 13 Levator ani muscle
- 14 Medial umbilical fold
- 15 Medial umbilical ligament
- 16 Median umbilical ligament
- 17 Obturator artery
- 18 Obturator nerve
- 19 Obturator vein
- 20 Origin of levator ani from fascia overlying obturator internus muscle
- 21 Pubic branches of the inferior epigastric vessels
- 22 Pubic ramus (transected)
- 23 Rectus abdominis muscle
- 24 Superior pubic ramus
- 25 Superior surface of bladder
- 26 Testicular vessels
- 27 Transversalis fascia overlying transversus abdominis muscle

Abdominal peritoneal folds after removal of intra-abdominal organs, to show relations of ligaments and mesenteries



Drainage of subphrenic abscesses



Peritoneal lavage



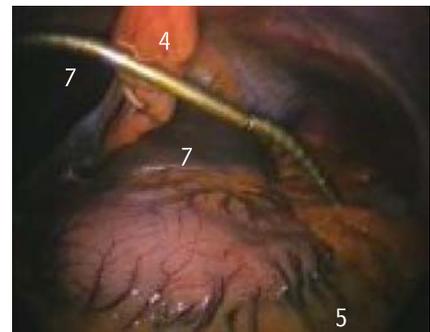
Peritonitis

Abdominal viscera from the front



- | | |
|---|--|
| 1 Appendices epiploicae | 8 Parietal peritoneum on anterior abdominal wall |
| 2 Ascending colon | 9 Rectus abdominis muscle, reflected laterally |
| 3 Descending colon | 10 Small intestine |
| 4 Falciform ligament | 11 Transverse colon |
| 5 Greater omentum | |
| 6 Ligamentum teres hepatis (round ligament) | |
| 7 Liver | |

For an explanation of peritoneal structures, see the diagrams on pages 236, 243.



Laparoscopic view of upper abdominal viscera



Liver biopsy



Situs inversus totalis

Abdominal viscera *from the front*

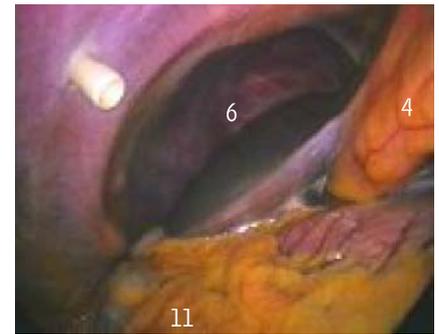


- 1 Appendices epiploicae
- 2 Ascending colon
- 3 Descending colon
- 4 Falciform ligament
- 5 Ligamentum teres hepatis
- 6 Liver, right lobe
- 7 Posterior surface of greater omentum
- 8 Rectus abdominis muscle, reflected laterally
- 9 Small intestine (ileum)
- 10 Small intestine (jejunum)
- 11 Transverse colon

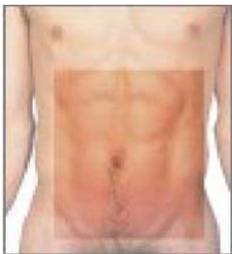


Cholecystectomy

Abdominal viscera *from the front*



Laparoscopic view of abdominal viscera



- 1 Appendices epiploicae
- 2 Ascending colon
- 3 Descending colon
- 4 Greater omentum
- 5 Ligamentum teres hepatis in falciform ligament
- 6 Liver, left lobe
- 7 Rectus abdominis muscle, reflected laterally
- 8 Small intestine
- 9 Stomach
- 10 Stomach, greater curvature
- 11 Transverse colon

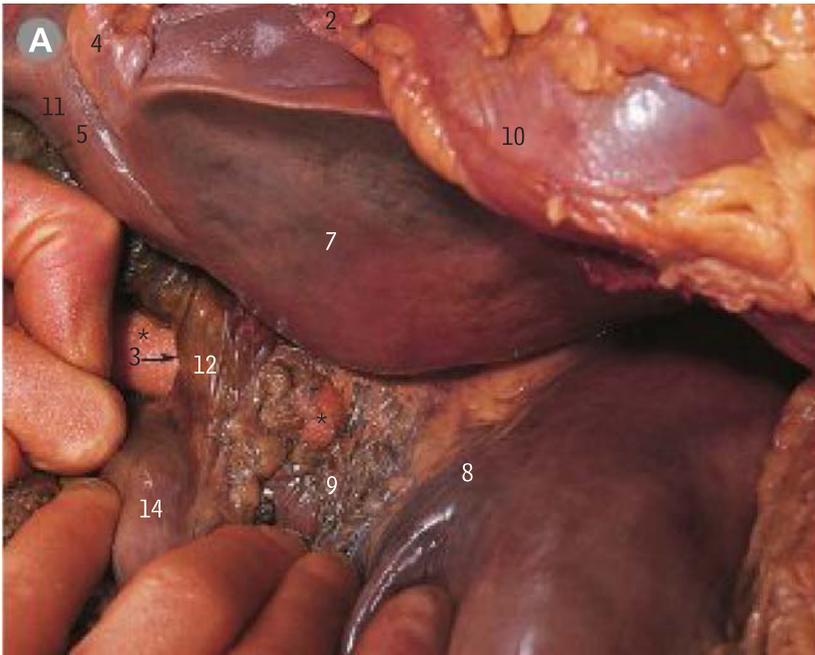
The appendices epiploicae (1) are fat-filled appendages of peritoneum on the various parts of the colon (ascending, transverse, descending and sigmoid). They are not present on the small intestine or the rectum, and may be rudimentary on the caecum and appendix. In abdominal operations, they are one feature that helps to distinguish colon from other parts of the intestine.



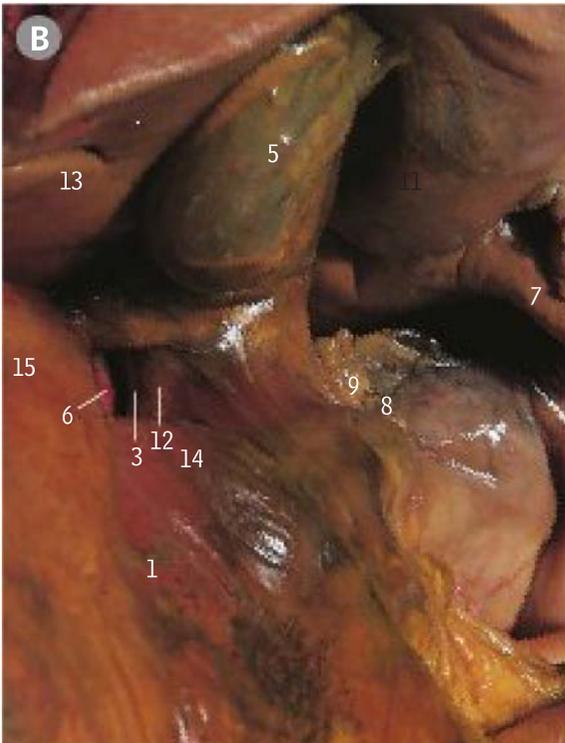
Omental cake

Lesser omentum and epiploic foramen

from the front *from the front and the right*

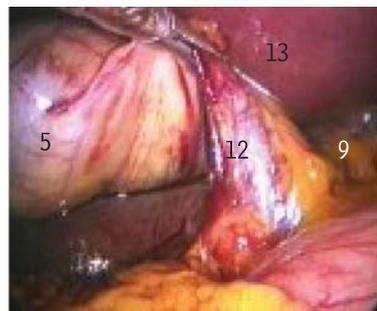


- 1 Descending (second) part of duodenum
- 2 Diaphragm
- 3 Epiploic foramen* (Winslow)
- 4 Falciform ligament
- 5 Gall bladder
- 6 Inferior vena cava
- 7 Left lobe of liver
- 8 Lesser curvature of stomach
- 9 Lesser omentum
- 10 Pericardium
- 11 Quadrate lobe of liver
- 12 Right free margin of lesser omentum
- 13 Right lobe of liver
- 14 Superior (first) part of duodenum
- 15 Upper pole of right kidney



In A, a finger* has been placed in the epiploic foramen (3) behind the right free margin of the lesser omentum (12), and the tip can be seen in the lesser sac, through the transparent lesser omentum (9) which stretches between the liver (7) and the lesser curvature of the stomach (8). In the more lateral view in B, looking into the foramen from the right, the foramen (3) is identified between the right free margin of the lesser omentum (12) in front and the inferior vena cava (6) behind, above the first part of the duodenum (14).

The epiploic foramen (of Winslow, A3 and B3) is the communication between the general peritoneal cavity (sometimes called the greater sac) and the lesser sac (omental bursa), a space lined by peritoneum behind the stomach (A8 and B8) and lesser omentum (A9 and A12) and in front of parts of the pancreas and left kidney.



Laparoscopic view of lesser omentum (free margin)

Upper abdominal viscera *from the front*

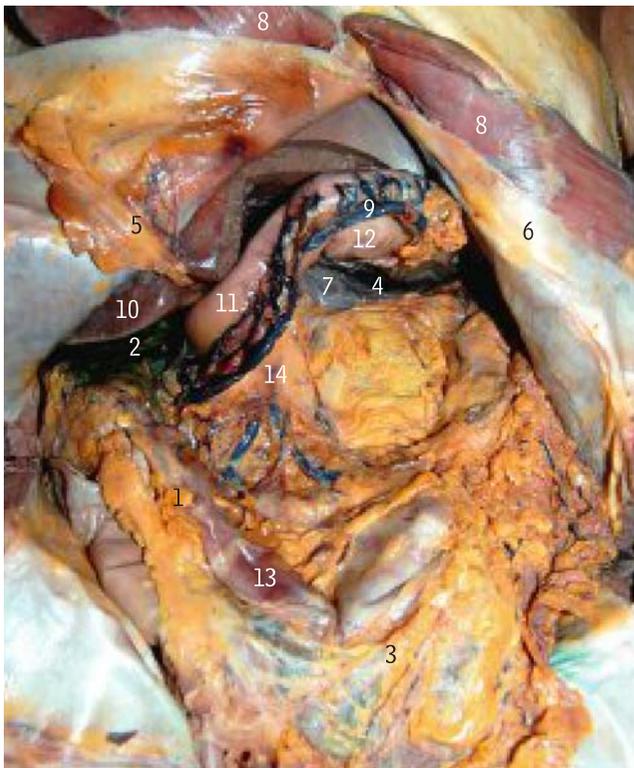


In this view the stomach, transverse colon (9) and greater omentum (5) have been lifted up to show the region of the duodenojejunal flexure (3).

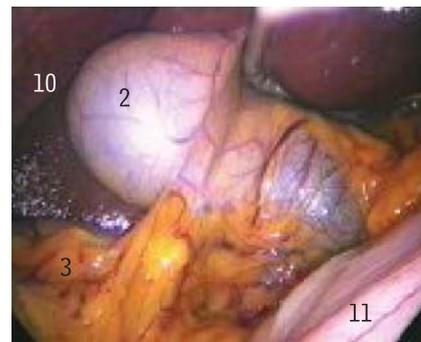
- 1 Ascending colon
- 2 Coils of the small intestine
- 3 Duodenojejunal flexure
- 4 Duodenum, first part
- 5 Greater omentum
- 6 Jejunum
- 7 Mesentery
- 8 Parietal peritoneum on anterior abdominal wall, reflected superiorly
- 9 Transverse colon, reflected superiorly
- 10 Transverse mesocolon



Lesser sac in upper abdomen



- 1 Appendices epiploicae
- 2 Gall bladder
- 3 Greater omentum, reflected inferiorly
- 4 Lesser sac (omental bursa)
- 5 Ligamentum teres hepatis in falciform ligament
- 6 Parietal peritoneum on anterior abdominal wall
- 7 Peritoneum of lesser sac overlying pancreas
- 8 Rectus abdominis muscle, reflected
- 9 Right and left gastro-epiploic veins
- 10 Right lobe of the liver
- 11 Stomach, greater curvature
- 12 Stomach, posterior surface
- 13 Transverse colon, reflected inferiorly
- 14 Transverse mesocolon



Laparoscopic view of gall bladder



Ascites



Laparoscopy

Mesentery and colon *from the front*



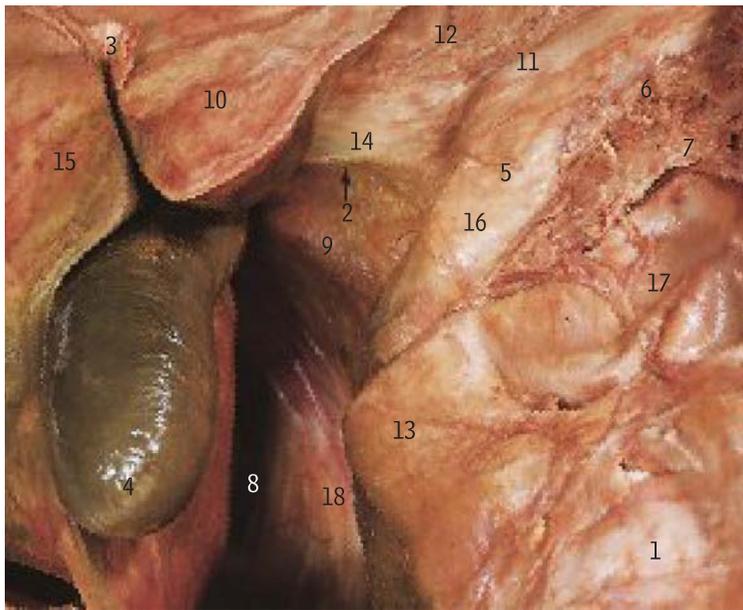
- 1** Appendices epiploicae
- 2** Appendix
- 3** Ascending colon
- 4** Caecum
- 5** Coils of small intestine
- 6** Distal ileum
- 7** Duodenojejunal junction
- 8** Greater omentum
- 9** Ileocaecal junction
- 10** Liver
- 11** Mesentery of small intestine
- 12** Mesoappendix
- 13** Parietal peritoneum on anterior abdominal wall
- 14** Proximal jejunum
- 15** Rectus abdominis muscle, reflected
- 16** Transverse colon



Diverticular disease



Volvulus



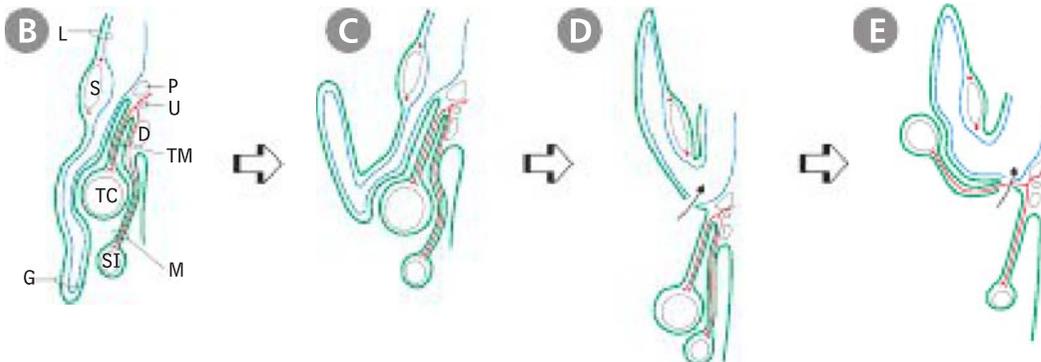
Hepatorenal pouch of peritoneum from the right and below

With the body lying on its back and seen from the right, the liver (15) has been turned upwards (towards the left) to open up the gap between the liver and upper pole of the right kidney (18) – the hepatorenal pouch of peritoneum (8, Morison's pouch or the right subhepatic compartment of the peritoneal cavity).



- | | | |
|--------------------------------|--------------------------------------|--|
| 1 Ascending colon | 7 Greater omentum | 13 Right colic (hepatic) flexure |
| 2 Epiploic foramen (Winslow) | 8 Hepatorenal (Morison's) pouch | 14 Right free margin of lesser omentum |
| 3 Falciform ligament | 9 Inferior vena cava | 15 Right lobe of liver |
| 4 Gall bladder | 10 Left lobe of liver | 16 Superior (first) part of duodenum |
| 5 Gastroduodenal junction | 11 Lesser curvature of stomach | 17 Transverse colon |
| 6 Greater curvature of stomach | 12 Lesser omentum overlying pancreas | 18 Upper pole of right kidney |

Diagrams of peritoneum (see pages 237–242)



normal position

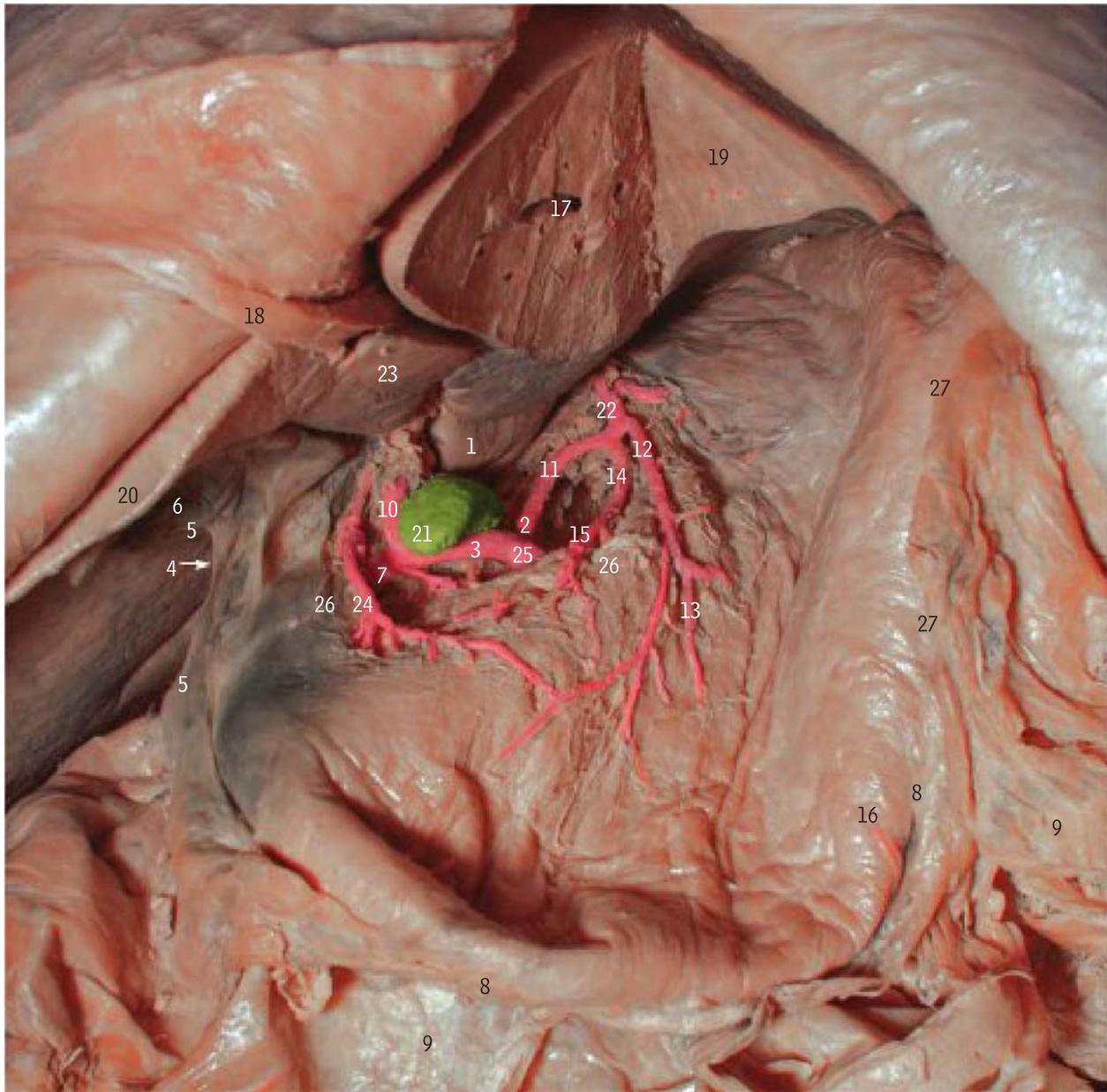
with the lower part of the greater omentum lifted up

with the greater omentum lifted up and separated from the transverse mesocolon and colon, with an opening into the lesser sac

with the greater omentum and transverse mesocolon and colon lifted up, with an opening into the lesser sac through the mesocolon

These drawings of a sagittal section through the middle of the abdomen, viewed from the left, illustrate theoretically how the peritoneum forms the lesser omentum (L, passing down to the stomach, S), greater omentum (G), transverse mesocolon (TM) passing to the transverse colon (TC), and the mesentery (M) of the small intestine (SI). The layer in blue represents the peritoneum of the lesser sac. The superior mesenteric artery passes between the head and uncinate process of the pancreas (P and U), and continues across the duodenum (D) into the mesentery (M) to the small intestine (SI), giving off the middle colic artery which runs in the transverse mesocolon (TM) to the transverse colon (TC). The greater omentum (G) is formed by four layers fused together and also fused with the front of the transverse mesocolon (TM, two layers) and transverse colon. On dissection, no separation between any layers is possible except between the greater omentum and the transverse mesocolon. The six layers between the stomach and transverse colon are sometimes collectively known as the gastrocolic omentum. B corresponds to the dissections on pages 237 and 238, C to page 239, D to page 241A, and E to page 241B. The small arrows in D and E indicate the layers cut to make artificial openings into the lesser sac.

Coeliac trunk



- | | |
|--|--|
| <p>1 Caudate lobe of liver
 2 Coeliac trunk
 3 Common hepatic artery
 4 Epiploic foramen – arrow
 5 Free edge, lesser omentum
 6 Gall bladder
 7 Gastroduodenal artery
 8 Greater curvature of stomach
 9 Greater omentum
 10 Hepatic artery, proper
 11 Left gastric artery
 12 Left gastric, anterior branch
 13 Left gastric, anterior branch to body of stomach
 14 Left gastric, posterior branch</p> | <p>15 Left gastric, posterior branch to lesser curvature of stomach
 16 Left gastroepiploic vessels
 17 Left portal vein
 18 Ligamentum teres hepatis within falciform ligament
 19 Liver, left lobe
 20 Liver, right lobe
 21 Lymph node, enlarged coeliac node
 22 Oesophageal branch of left gastric artery
 23 Quadrate lobe of liver
 24 Right gastric artery, antral branch
 25 Splenic artery
 26 Stomach, lesser curvature
 27 Visceral peritoneum, cut edge</p> |
|--|--|



Abdominal
vasculature
variations



Carcinoma of
the stomach



Superior mesenteric vessels, origins

duodenum and pancreas in situ

duodenum reflected to reveal posterior relations of vessels



- 1 Aorta
- 2 Duodenum reflected and pinned
- 3 Duodenum, ascending (fourth) part
- 4 Duodenum, descending (second) part
- 5 Duodenum, horizontal (third) part
- 6 Falciform ligament
- 7 Gall bladder, fundus
- 8 Inferior mesenteric artery
- 9 Inferior mesenteric vein
- 10 Inferior vena cava
- 11 Jejunum, origin
- 12 Left gonadal vein
- 13 Left renal artery
- 14 Left renal vein
- 15 Liver, left lobe
- 16 Liver, Riedel's lobe
- 17 Liver, right lobe
- 18 Lymph nodes, moderately enlarged pre- and para-aortic
- 19 Pancreas, body
- 20 Pancreas, head
- 21 Pancreas, tail
- 22 Pancreas, uncinate process
- 23 Renal cyst, benign
- 24 Right gonadal vein
- 25 Spleen
- 26 Splenic artery
- 27 Splenic vein
- 28 Subcostal nerve
- 29 Superior mesenteric artery
- 30 Superior mesenteric vein
- 31 Ureter



Inferior vena cava (IVC) obstruction



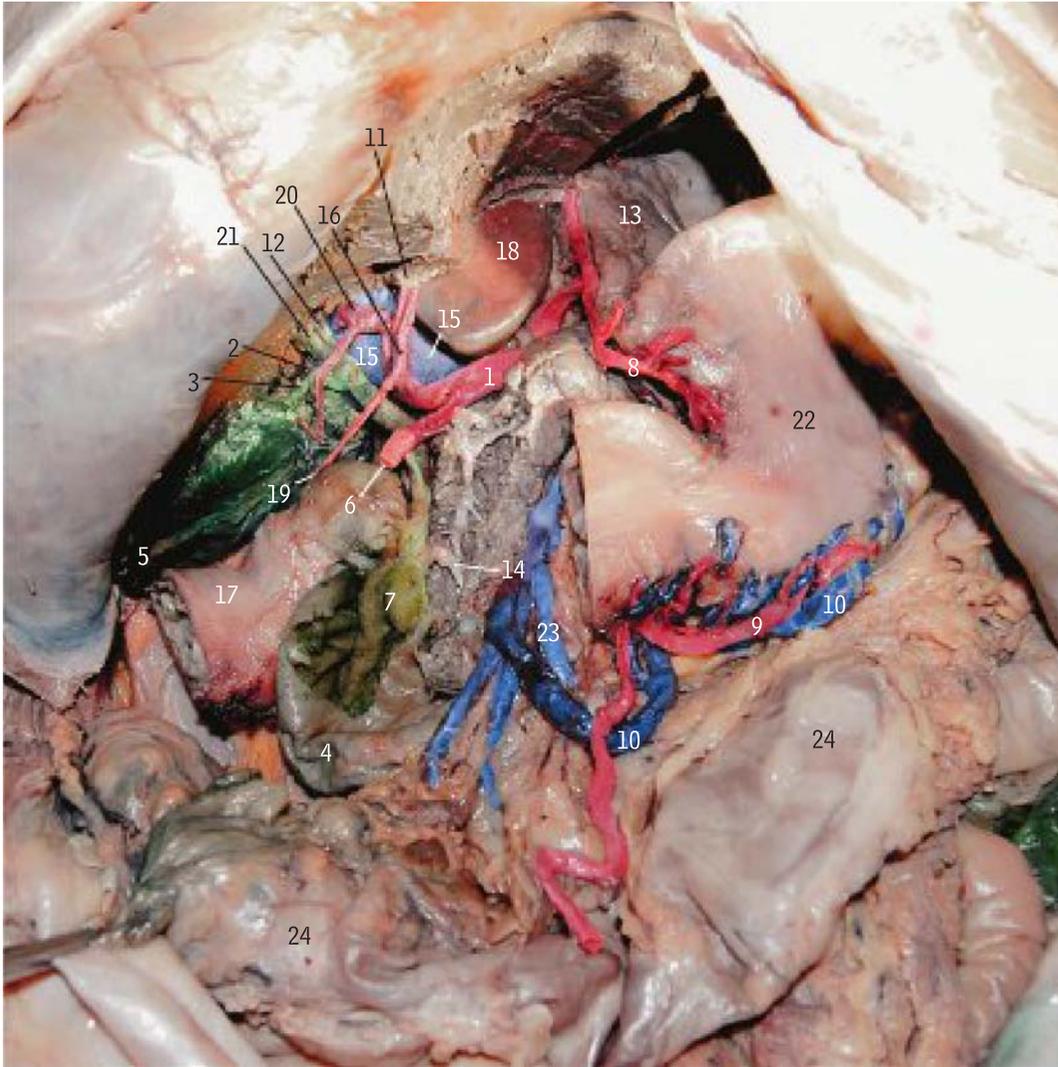
Pancreatic pathology



Pancreatitis

Coeliac trunk, upper abdomen *detailed dissection*

The stomach has been sectioned to expose the dissected liver, biliary tree, pancreas, duodenum, and superior mesenteric vessels lying posterior to the stomach bed.



- | | |
|-------------------------------------|------------------------------------|
| 1 Common hepatic artery | 13 Oesophagus |
| 2 Cystic artery | 14 Pancreatic duct |
| 3 Cystic duct | 15 Portal vein |
| 4 Duodenum | 16 Proper hepatic artery |
| 5 Gall bladder | 17 Pylorus |
| 6 Gastroduodenal artery | 18 Caudate lobe (liver) |
| 7 Hepatopancreatic ampulla | 19 Right gastric artery |
| 8 Left gastric artery | 20 Right hepatic artery |
| 9 Left gastroepiploic artery | 21 Right hepatic duct |
| 10 Left gastroepiploic vein | 22 Stomach |
| 11 Left hepatic artery | 23 Superior mesenteric vein |
| 12 Left hepatic duct | 24 Transverse colon |



Pyloric stenosis
(adult)

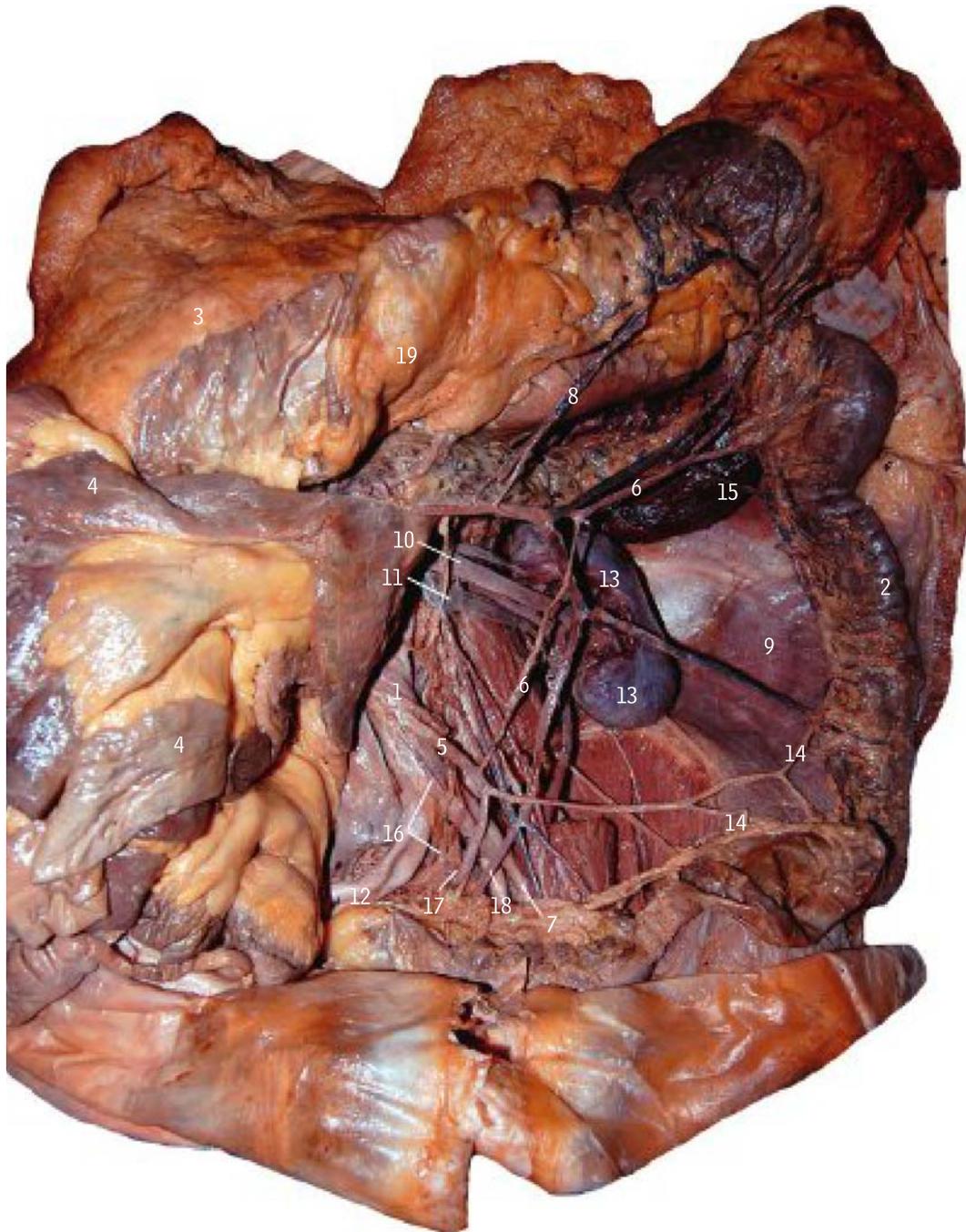
Coeliac trunk, upper abdomen *detailed dissection*



- | | |
|--|--|
| 1 (Common) bile duct | 11 Left gastric artery |
| 2 Caudate lobe of liver | 12 Lesser curvature of stomach |
| 3 Cut edge of the liver | 13 Pancreas |
| 4 Cystic duct | 14 Parietal peritoneum on anterior abdominal wall,
reflected laterally |
| 5 Fundus of gallbladder | 15 Proper hepatic artery |
| 6 Gastroduodenal artery | 16 Gastroepiploic artery |
| 7 Greater curvature of stomach | 17 Gastroepiploic vein |
| 8 Greater omentum | 18 Transverse colon |
| 9 Left and right hepatic artery | |
| 10 Left and right hepatic duct | |



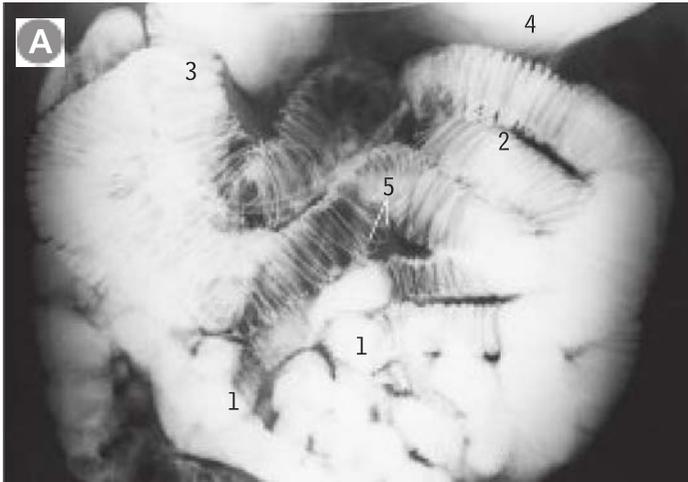
Inferior mesenteric vessels *from the front*



- | | | | |
|-------------------------------------|-----------------------------------|-------------------------------------|---------------------------------------|
| 1 Abdominal aorta | 6 Left colic artery | 11 Renal vein | 16 Superior hypogastric plexus |
| 2 Descending colon | 7 Left common iliac artery | 12 Right common iliac artery | 17 Superior rectal artery |
| 3 Greater omentum | 8 Marginal artery | 13 Left kidney | 18 Superior rectal vein |
| 4 Ileum and jejunum | 9 Transverse abdominis | 14 Sigmoid arteries | 19 Transverse colon |
| 5 Inferior mesenteric artery | 10 Renal artery | 15 Spleen | |



Bowel
ischaemia

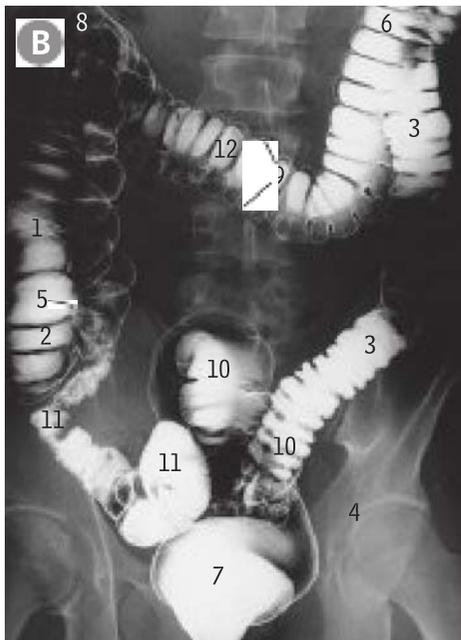


Small bowel radiograph *enema via a tube in the proximal jejunum Enteroclysis*

- 1 Loops of ileum
- 2 Loops of jejunum
- 3 Descending (second) part of duodenum
- 4 Stomach
- 5 Plicae circulares

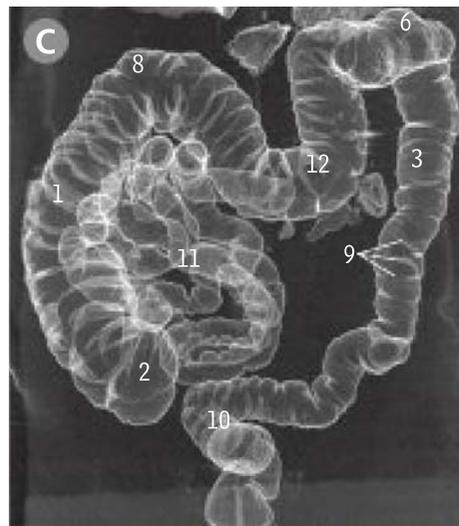
Double-contrast *Barium enema*

In this double-contrast barium enema (barium and air), the sacculations (haustrations, 9) of the various parts of the colon allow it to be distinguished from the narrower terminal ileum (11), which has become partly filled by barium flowing into it through this incompetent ileocaecal junction (5).



- 1 Ascending colon
- 2 Caecum
- 3 Descending colon
- 4 Hip joint
- 5 Ileocaecal junction
- 6 Left colic (splenic) flexure
- 7 Rectum
- 8 Right colic (hepatic) flexure
- 9 Sacculations
- 10 Sigmoid colon
- 11 Terminal ileum
- 12 Transverse colon

3D scout scan from CT cologram



Colonic stents



Colostomy



Crohn's



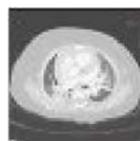
Rectosigmoid foreign bodies

Stomach with vessels and vagus nerves, from the front



The anterior thoracic and abdominal walls and the left lobe of the liver have been removed, with part of the lesser omentum (12), to show the stomach (6, 2, 18 and 19) in its undisturbed position.

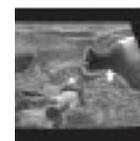
- | | |
|--|---|
| 1 Anterior (left) vagal trunk | 13 Inferior pole of spleen |
| 2 Body of stomach | 14 Oesophageal branches of left gastric vessels |
| 3 Branches of left gastro-epiploic vessels | 15 Oesophageal hiatus in diaphragm |
| 4 Caudate lobe of liver | 16 Oesophagus |
| 5 Fissure for ligamentum venosum | 17 Posterior (right) vagal trunk |
| 6 Fundus of stomach | 18 Pyloric antrum |
| 7 Greater curvature of stomach | 19 Pyloric canal |
| 8 Greater omentum | 20 Right gastric artery |
| 9 Left gastric artery | 21 Right gastro-epiploic vessels and branches |
| 10 Left gastric vein | 22 Right lobe of liver |
| 11 Lesser curvature of stomach | 23 Superior (first) part of duodenum |
| 12 Lesser omentum (cut edge) | |



Gastro-oesophageal reflux in infants



Oesophageal varices



Pyloric stenosis in infants



Vagotomy

Upper abdomen

stomach – barium meal



- 1 Body of stomach
- 2 Greater curvature of stomach
- 3 Lesser curvature of stomach
- 4 Pyloric antrum
- 5 Pyloric canal
- 6 Duodenal cap

SUPERIOR



*posterior wall
– coeliac ganglion
and relations.
abdominal aorta
removed*

- 1 Aorto-renal ganglion
- 2 Coeliac arterial trunk (reflected anteriorly)
- 3 Coeliac ganglion
- 4 Diaphragm
- 5 Inferior phrenic artery
- 6 Inferior suprarenal artery
- 7 Inferior vena cava (reflected inferiorly)
- 8 Kidney, right, upper pole
- 9 Renal artery, right
- 10 Renal vein (reflected)
- 11 Right crus, diaphragm
- 12 Superior mesenteric artery
- 13 Superior mesenteric ganglion
- 14 Superior suprarenal artery
- 15 Suprarenal gland

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INFERIOR



Coeliac plexus block



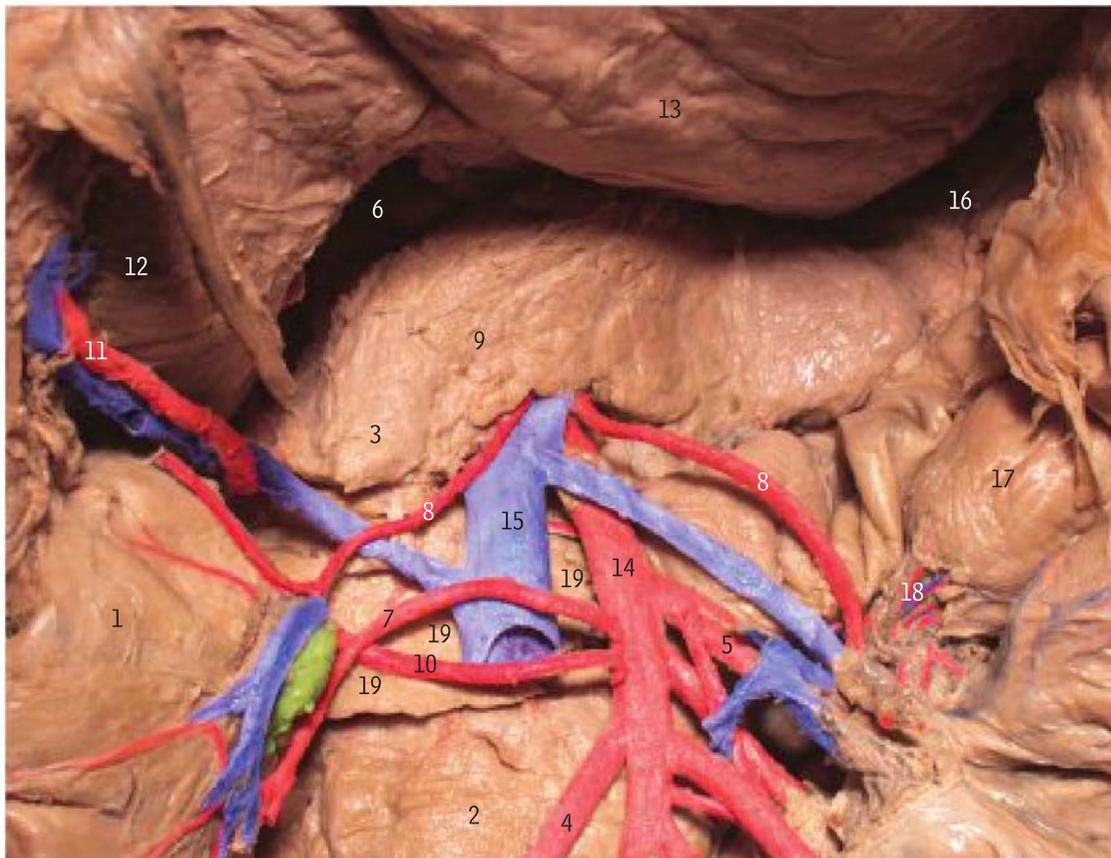
Gastric pacemaker



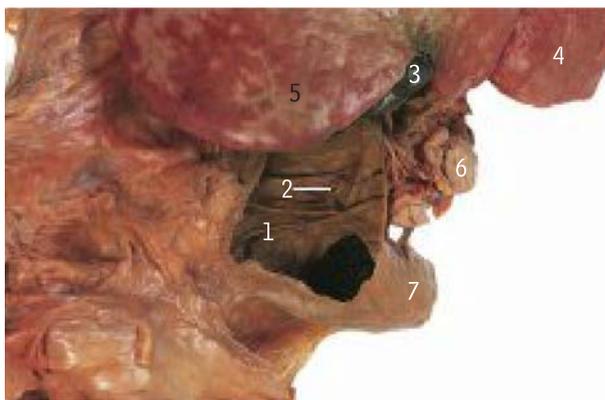
Hiatus hernia

Pancreas, duodenum and superior mesenteric vessels

The stomach with its attached greater omentum has been lifted up.



Duodenal papilla



The anterior wall of the descending (second) part of the duodenum has been removed.

- | | |
|-------------------------------------|--------------------------|
| 1 Circular folds of mucous membrane | 4 Liver, left lobe |
| 2 Duodenal papilla | 5 Liver, right lobe |
| 3 Gall bladder | 6 Pancreas |
| | 7 Third part of duodenum |

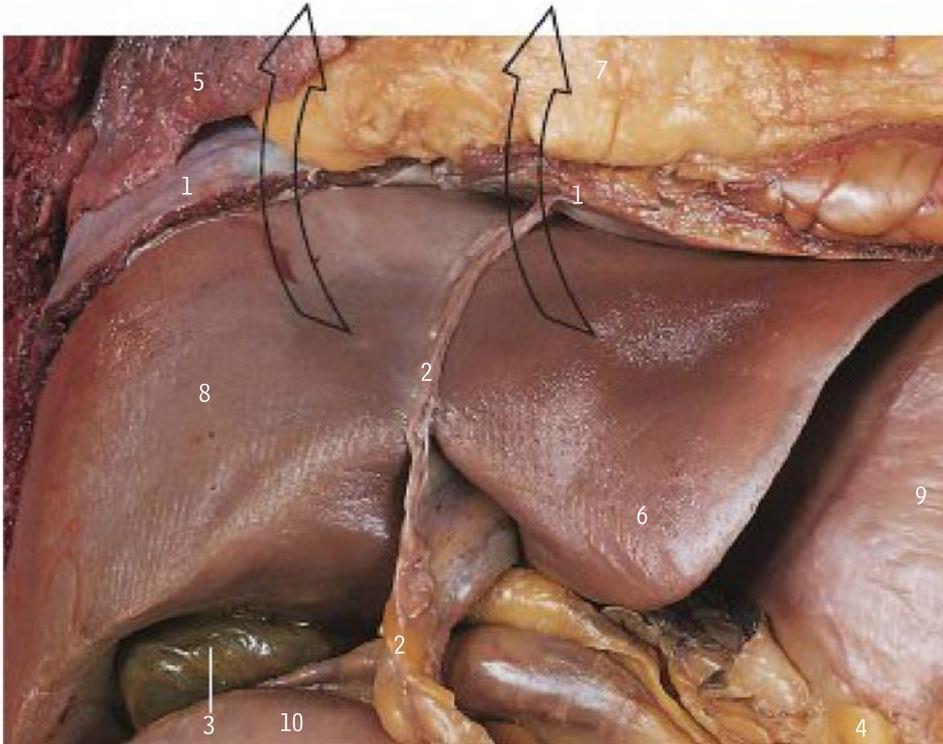
The stomach has been retracted superiorly to reveal the 'stomach bed.'

- | | |
|--|---|
| 1 Ascending colon | 11 Right gastroepiploic vessels |
| 2 Duodenum, third part | 12 Stomach, antrum (reflected anteriorly) |
| 3 Head of pancreas | 13 Stomach, body |
| 4 Ileocolic artery | 14 Superior mesenteric artery |
| 5 Jejunal branch of superior mesenteric artery | 15 Superior mesenteric vein |
| 6 Lesser sac | 16 Tail of pancreas |
| 7 Middle colic artery | 17 Transverse colon |
| 8 Middle colic artery, aberrant variation | 18 Transverse colon, artery and vein |
| 9 Neck of pancreas | 19 Uncinate process of pancreas |
| 10 Right colic artery | |



Pancreatitis

Liver from the front



- 1 Diaphragm
- 2 Falciform ligament
- 3 Gall bladder, fundus
- 4 Greater omentum
- 5 Lower lobe of right lung
- 6 Left lobe of liver
- 7 Pericardial fat
- 8 Right lobe of liver
- 9 Stomach
- 10 Transverse colon

For an explanation of peritoneal structures, see the diagrams on pages 236, 240.

The thoracic and abdominal walls and the anterior part of the diaphragm have been removed to show the undisturbed viscera. The liver (6 and 8) and stomach (9) are immediately below the diaphragm (1). The greater omentum (4) hangs down from the greater curvature (lower margin) of the stomach (9), overlying much of the small and large intestine but leaving some of the transverse colon (10) uncovered. The fundus (tip) of the gall bladder (3) is seen between the right lobe of the liver (8) and transverse colon (10). Arrows indicate the direction of liver reflection for the view on following page (page 255).



Coronal CT, upper abdomen



Laparoscopic view of upper abdominal viscera

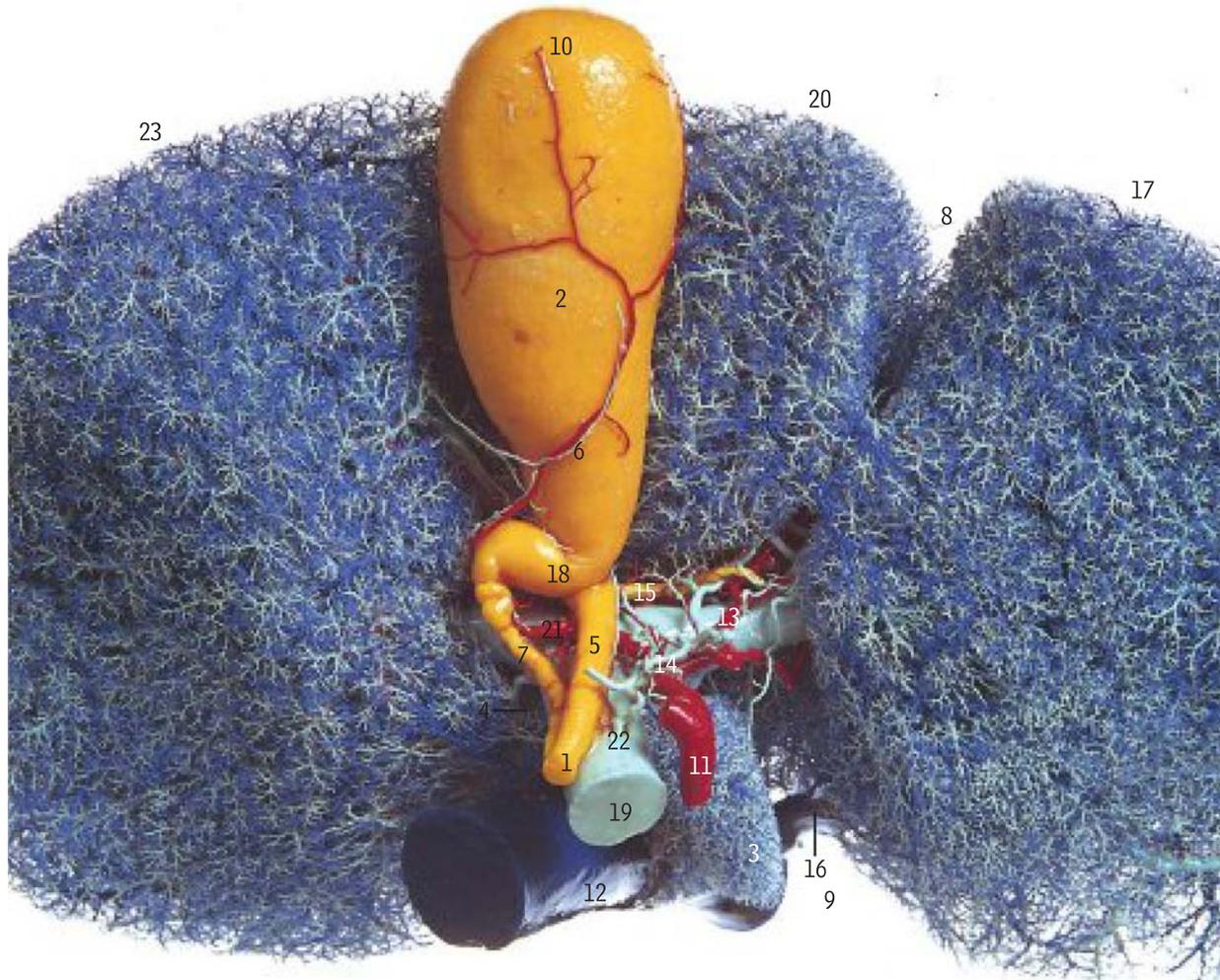


Cirrhosis of liver



Liver trauma

Cast of the liver, extrahepatic biliary tract and associated vessels



Yellow, gall bladder and biliary tract
 Red, hepatic artery and branches
 Light blue, portal vein and tributaries
 Dark blue, inferior vena cava, hepatic
 veins and tributaries

- | | |
|---|---|
| 1 Bile duct | 14 Left gastric vein |
| 2 Body of gall bladder | 15 Left hepatic duct |
| 3 Caudate lobe | 16 Left hepatic vein |
| 4 Caudate process | 17 Left lobe |
| 5 Common hepatic duct | 18 Neck of gall bladder |
| 6 Cystic artery and veins | 19 Portal vein |
| 7 Cystic duct | 20 Quadrate lobe |
| 8 Fissure for ligamentum teres | 21 Right branch of hepatic artery overlying
right branch of portal vein |
| 9 Fissure for ligamentum venosum | 22 Right gastric vein |
| 10 Fundus of gall bladder | 23 Right lobe |
| 11 Hepatic artery | |
| 12 Inferior vena cava | |
| 13 Left branch of hepatic artery overlying
left branch of portal vein | |

Endoscopic retrograde cholangiopancreatogram *ERCP*



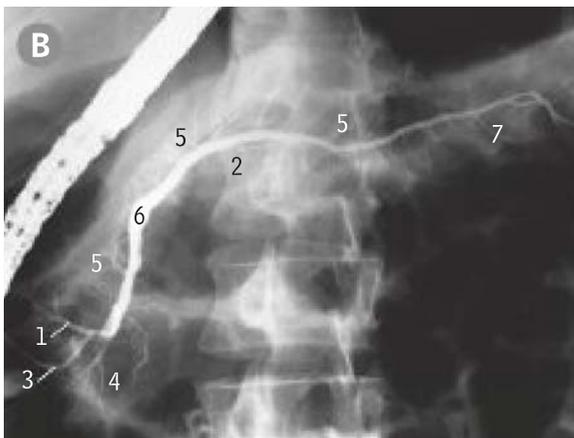
During an ERCP, an endoscope is passed through the mouth, pharynx, oesophagus and stomach into the duodenum, and through it, a cannula is introduced into the major duodenal papilla (page 253B) and bile duct so that contrast medium can be injected up the biliary tract. (The pancreatic duct can also be cannulated in this way.)

- 1 Common bile duct
- 2 Common hepatic duct
- 3 Cystic duct
- 4 Gall bladder
- 5 Left hepatic duct
- 6 Liver shadow and tributaries of hepatic ducts
- 7 Right hepatic duct
- 8 Pancreatic duct

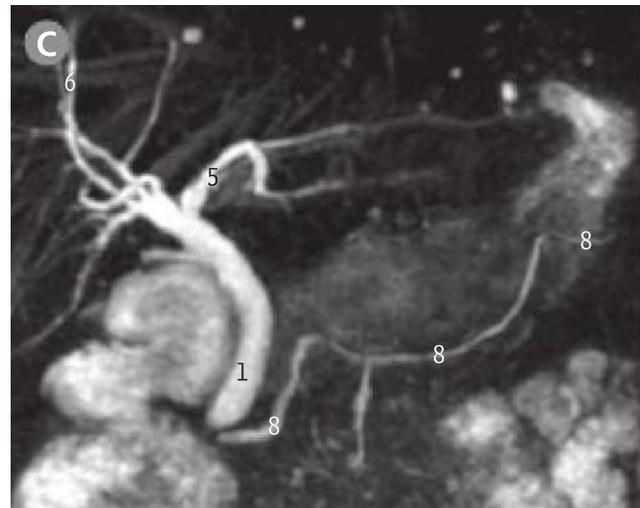


Magnetic resonance cholangiopancreatogram *MRCP*

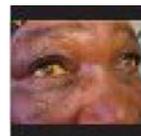
Pancreatic duct *ERCP*



- 1 Accessory pancreatic duct (Santorini)
- 2 Body of pancreas
- 3 Cannula in ampulla (Vater)
- 4 Head of pancreas
- 5 Intralobular ducts of the pancreas
- 6 Pancreatic duct (Wirsung)
- 7 Tail of pancreas



See label list for A



Carcinoma of the pancreas

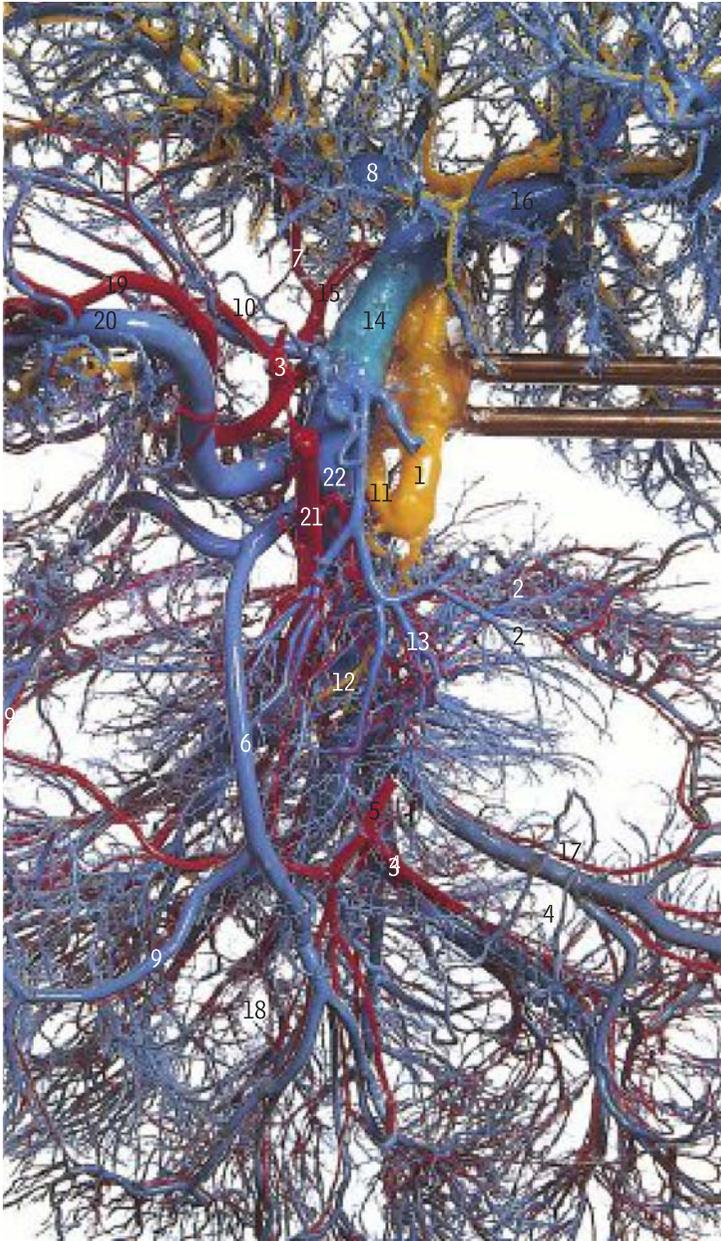


Cholecystectomy



Gallstones

Cast of the portal vein and tributaries, and the mesenteric vessels *from behind*



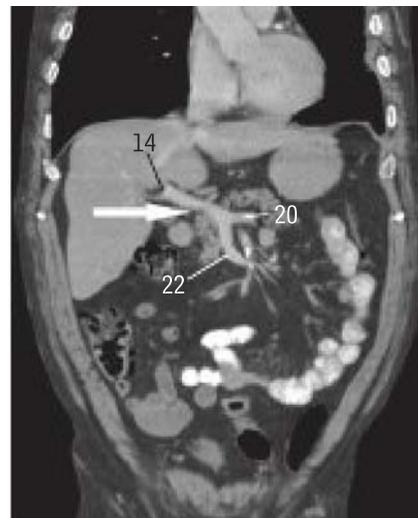
Yellow, biliary tract and pancreatic ducts; red, arteries; blue, portal venous system

In this posterior view (chosen in preference to the anterior view, where the many very small vessels to the intestines would have obscured the larger branches), the superior mesenteric vein (22) is seen continuing upwards to become the portal vein (14) after it has been joined by the splenic vein (20). In the porta hepatis, the portal vein divides into the left and right branches (8 and 16). Owing to removal of the aorta, the upper part of the inferior mesenteric artery (5) has become displaced slightly to the right and appears to have given origin to the ileocolic artery (4), but this is simply an overlap of the vessels; the origin of the ileocolic from the superior mesenteric is not seen in this view.

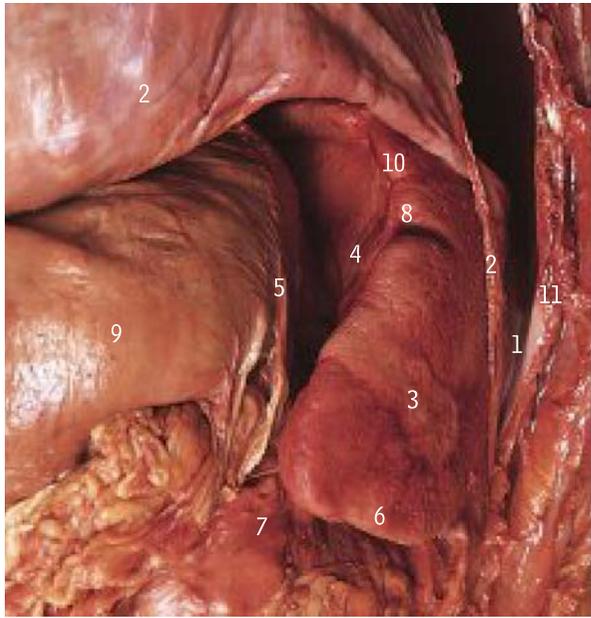
- 1 Bile duct
- 2 Branches of middle colic vessels
- 3 Coeliac trunk
- 4 Ileocolic vessels
- 5 Inferior mesenteric artery
- 6 Inferior mesenteric vein
- 7 Left branch of hepatic artery
- 8 Left branch of portal vein
- 9 Left colic vessels
- 10 Left gastric artery and vein
- 11 Pancreatic duct
- 12 Pancreatic ducts in head of pancreas
- 13 Pancreaticoduodenal vessels
- 14 Portal vein
- 15 Right branch of hepatic artery
- 16 Right branch of portal vein
- 17 Right colic vessels
- 18 Sigmoid vessels
- 19 Splenic artery
- 20 Splenic vein
- 21 Superior mesenteric artery
- 22 Superior mesenteric vein



Coronal CT, abdomen



Spleen from the front

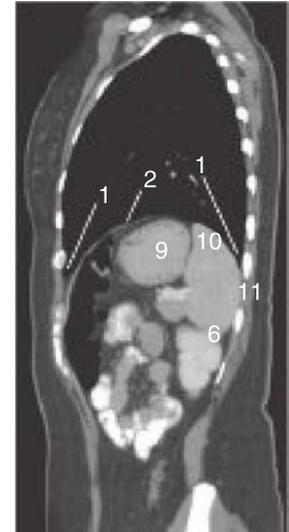


The left upper anterior abdominal and lower anterior thoracic walls have been removed and part of the diaphragm (2) turned upwards to show the spleen in its normal position, lying adjacent to the stomach (9) and colon (7), with the lower part against the kidney (D16 and 9, opposite).

The gastrosplenic ligament contains the short gastric and left gastro-epiploic branches of the splenic vessels.

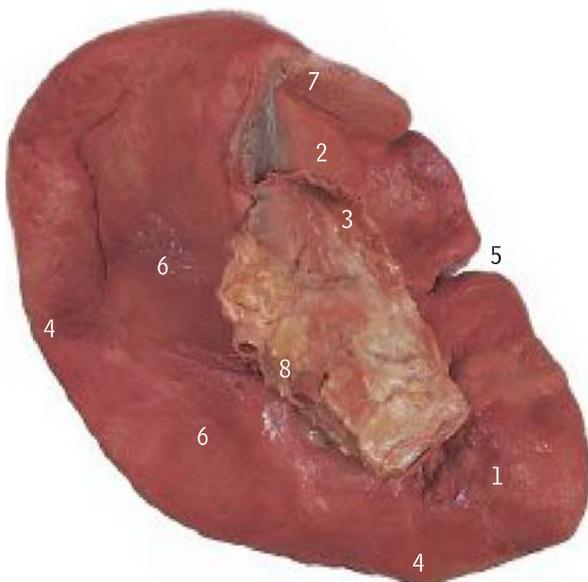
The lienorenal ligament contains the tail of the pancreas and the splenic vessels.

Sagittal CT upper abdomen and chest

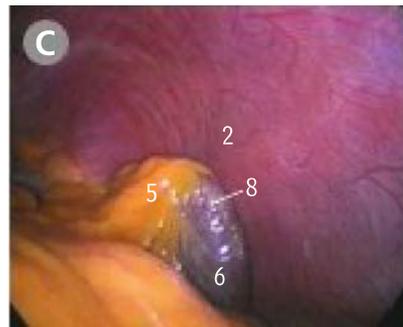


- 1 Costodiaphragmatic recess
- 2 Diaphragm
- 3 Diaphragmatic surface
- 4 Gastric impression
- 5 Gastrosplenic ligament
- 6 Inferior border of spleen
- 7 Left colic flexure
- 8 Splenic notch
- 9 Stomach
- 10 Superior border of spleen
- 11 Thoracic wall

Spleen visceral surface



In B, the spleen has been removed and its visceral or medial surface is shown, with a small part of the gastrosplenic (3) and lienorenal (8) ligaments remaining attached.



Laparoscopic view of spleen

Labels refer to key in A.

- 1 Colic impression
- 2 Gastric impression
- 3 Gastrosplenic ligament containing short gastric and left gastro-epiploic vessels
- 4 Inferior border
- 5 Splenic notch
- 6 Renal impression
- 7 Superior border
- 8 Tail of pancreas and splenic vessels in lienorenal ligament



Ruptured spleen



Splenectomy



Splenic cysts



Splenic infarct

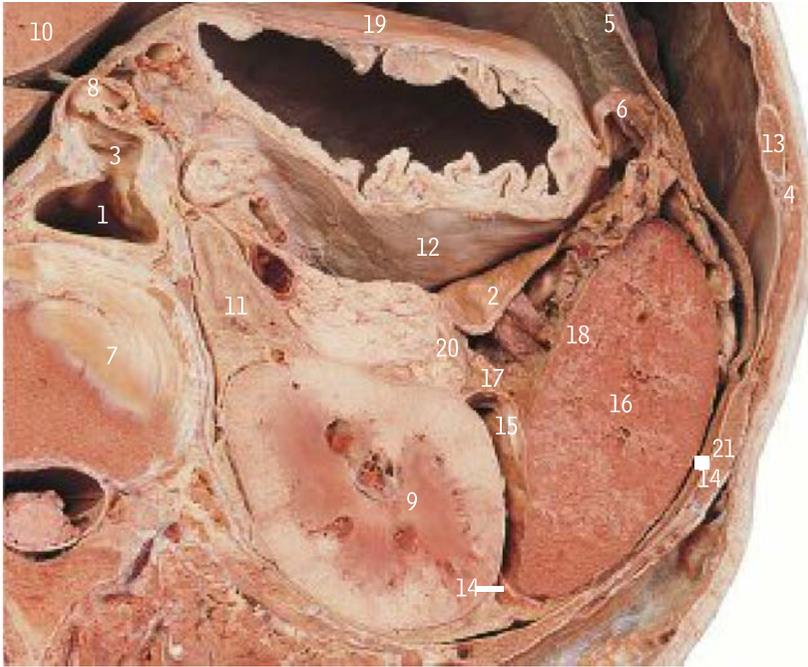


Splenomegaly



Splenunculi

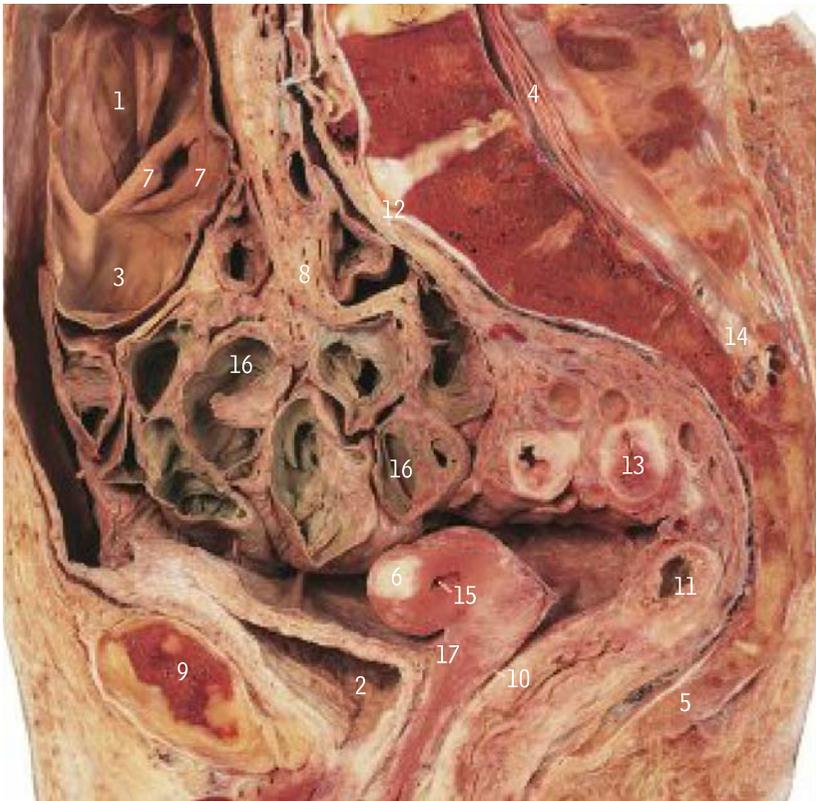
Spleen in a transverse section of the left upper abdomen



The section is at the level of the disc (7) between the twelfth thoracic and first lumbar vertebrae, and is viewed from below looking towards the thorax.

- 1 Abdominal aorta
- 2 Anterior layer of lienorenal ligament
- 3 Coeliac trunk
- 4 Costodiaphragmatic recess of pleura
- 5 Diaphragm
- 6 Gastrosplenic ligament
- 7 Intervertebral disc
- 8 Left gastric artery
- 9 Left kidney
- 10 Left lobe of liver
- 11 Left suprarenal gland
- 12 Lesser sac
- 13 Ninth rib
- 14 Peritoneum of greater sac
- 15 Posterior layer of lienorenal ligament
- 16 Spleen
- 17 Splenic artery
- 18 Splenic vein
- 19 Stomach
- 20 Tail of pancreas
- 21 Tenth rib

Caecum in sagittal section, interior view

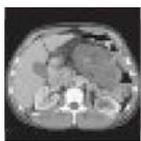


This is a median section of the female pelvis, right side viewed from the left. The caecal anterior wall has been cut open and reflected to show the lips of the ileocaecal valve (7).

- 1 Ascending colon
- 2 Bladder
- 3 Caecum
- 4 Cauda equina
- 5 Coccyx
- 6 Fibroid in uterine fundus
- 7 Lips of ileocaecal valve
- 8 Mesentery of small intestine
- 9 Pubic symphysis
- 10 Recto-uterine pouch (of Douglas)
- 11 Rectum
- 12 Sacral promontory
- 13 Sigmoid colon
- 14 Thecal sac termination
- 15 Uterine cavity
- 16 Valvulae conniventes
- 17 Vesico-uterine pouch



Carcinoma of the bladder



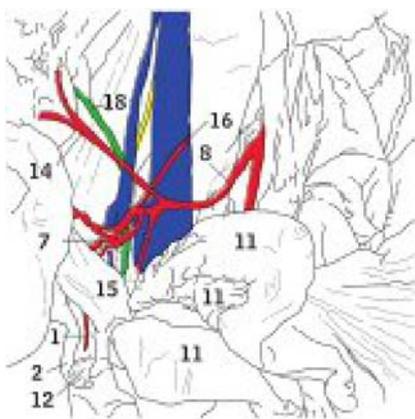
Intussusception

Appendix, ileocolic artery and related structures from the front

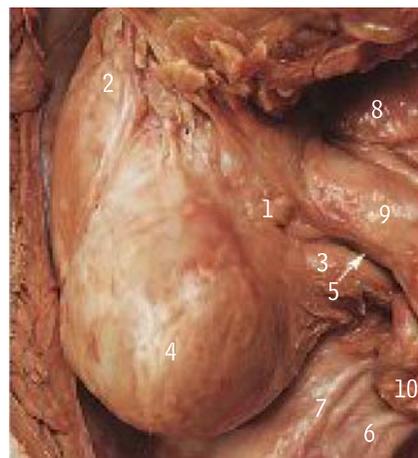


Most of the peritoneum of the mesentery and posterior abdominal wall has been removed, and coils of small intestine (11) have been displaced to the right of the picture, to show the ileocolic artery (8), terminal ileum (15) and appendix (2) with its appendicular artery (1).

- 1 Appendicular artery in mesoappendix
- 2 Appendix
- 3 Ascending colon
- 4 Caecum
- 5 Descending (second) part of duodenum
- 6 Genitofemoral nerve
- 7 Ileal and caecal vessels
- 8 Ileocolic artery
- 9 Inferior vena cava
- 10 Lower pole of kidney
- 11 Mesentery and coils of jejunum and ileum
- 12 Mesoappendix
- 13 Psoas major
- 14 Right colic artery
- 15 Terminal part of ileum
- 16 Testicular artery
- 17 Testicular vein
- 18 Ureter



Caecum and appendix *from the front*



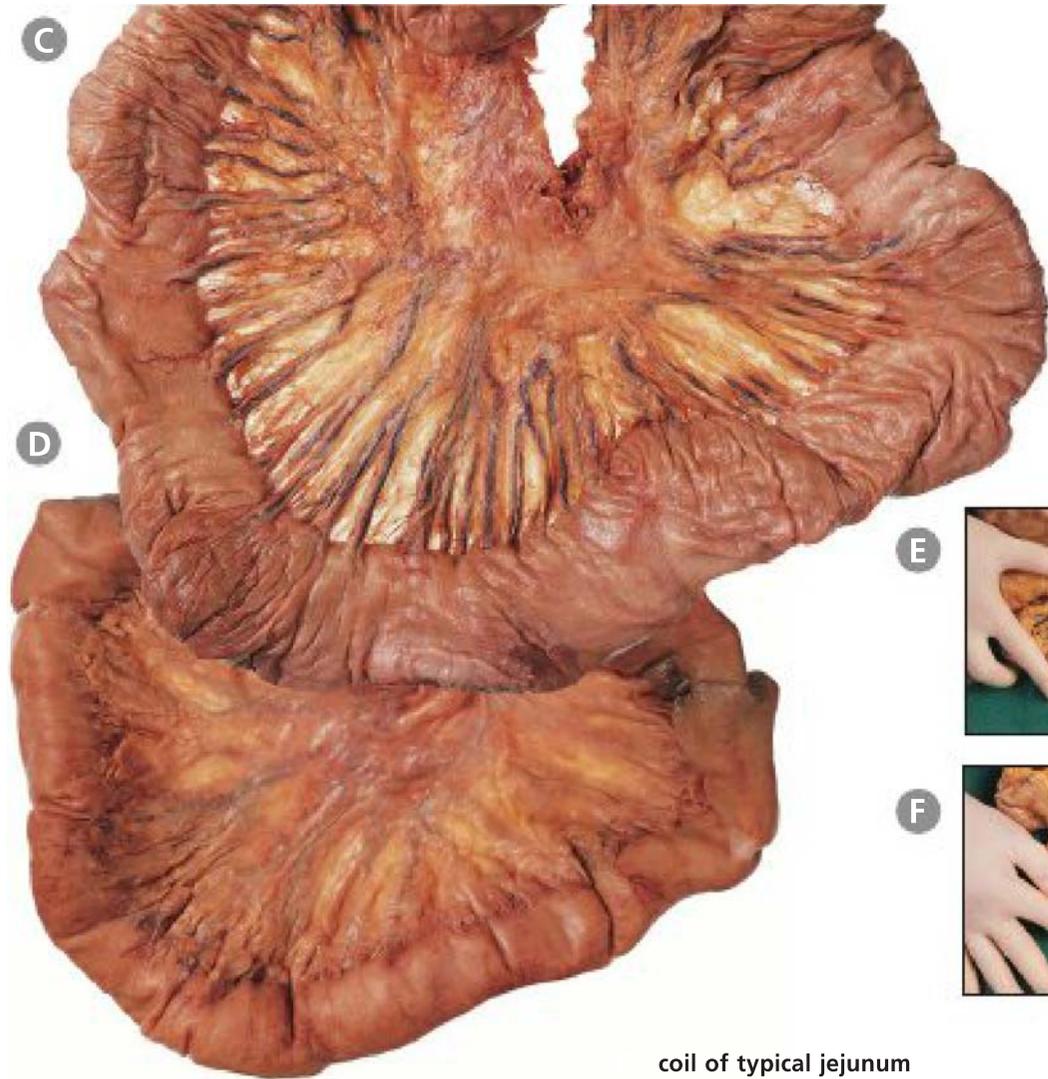
The terminal ileum (9) is seen joining the large intestine at the junction of the caecum (4) and ascending colon (2), and the appendix (3) joins the caecum just below the ileocaecal junction.

- 1 Anterior taenia coli
- 2 Ascending colon
- 3 Base of appendix
- 4 Caecum
- 5 Inferior ileocaecal recess
- 6 Peritoneum overlying external iliac vessels
- 7 Retrocaecal recess
- 8 Superior ileocaecal recess
- 9 Terminal ileum
- 10 Tip of appendix



Appendicitis

Small intestine



coil of typical jejunum

dissected jejunal vessels

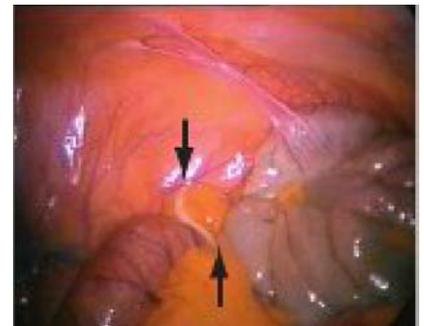
coil of typical ileum

dissected ileal vessels

In the part of the mesentery supporting the jejunum in C, the vessels anastomose to form one or perhaps two vascular arcades (E) which give off long straight branches that run to the intestinal wall. The fat in the mesentery tends to be concentrated near the root, leaving areas or 'windows' near the gut wall that are devoid of fat. In the mesentery supporting the ileum in D, the vessels form several arcades with shorter branches (F), and there are no fat-free areas. The jejunal wall (C) is thicker than that of the ileum (D) and has a larger lumen. The jejunum also feels thicker, because the folds of its mucous membrane are more numerous than in the ileum.



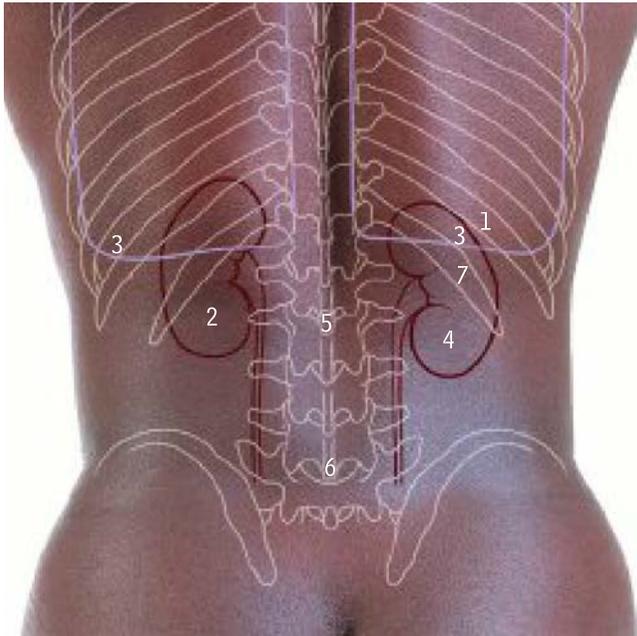
Laparoscopic view of coils of small intestine



Laparoscopic view of appendix



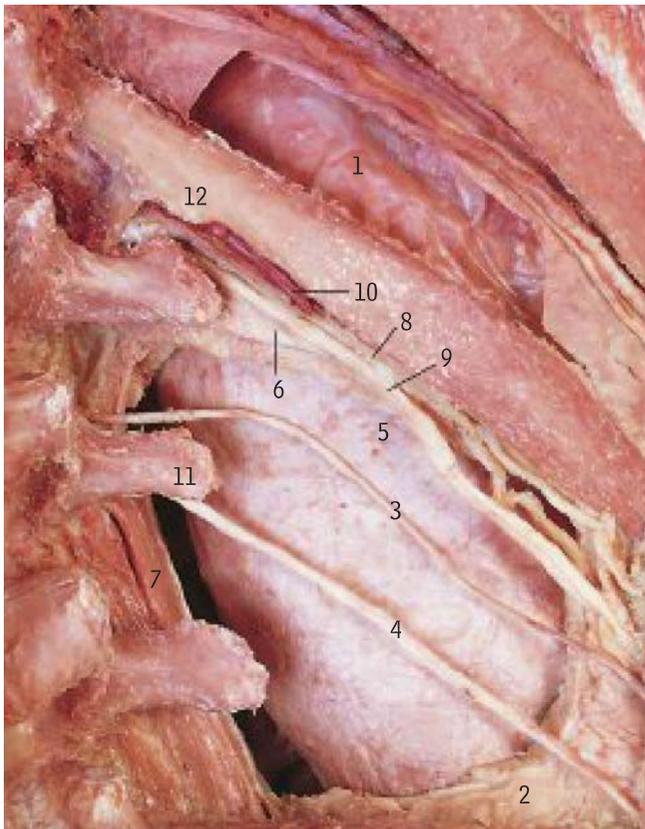
Intussusception in children



Kidneys and ureters *surface markings, from behind*

The upper pole of the left kidney rises to the level of the eleventh rib, but the right kidney is slightly lower (due to the bulk of the liver on the right). The hilum of each kidney is 5 cm (2 in) from the midline. The lower edge of the costodiaphragmatic recess of the pleura crosses the twelfth rib; compare with the dissection below (B6).

- 1 Eleventh rib
- 2 Left kidney
- 3 Lower edge of pleura
- 4 Right kidney
- 5 Spinous process of first lumbar vertebra
- 6 Spinous process of fourth lumbar vertebra
- 7 Twelfth rib



Right kidney *from behind*

Most thoracic and abdominal muscles have been removed to show the three nerves (9, 3 and 4) that lie behind the kidney (5). Much more important is the relationship of the upper part of the kidney to the pleura. A window has been cut in the parietal pleura above the twelfth rib (12) to open into the costodiaphragmatic recess (1), whose lower limit (6) runs transversely behind the kidney and in front of the obliquely placed twelfth rib.

- 1 Costodiaphragmatic recess of pleura
- 2 Extraperitoneal tissue
- 3 Iliohypogastric nerve
- 4 Ilioinguinal nerve
- 5 Kidney
- 6 Lower edge of pleura
- 7 Psoas major
- 8 Subcostal artery
- 9 Subcostal nerve
- 10 Subcostal vein
- 11 Transverse process of second lumbar vertebra
- 12 Twelfth rib

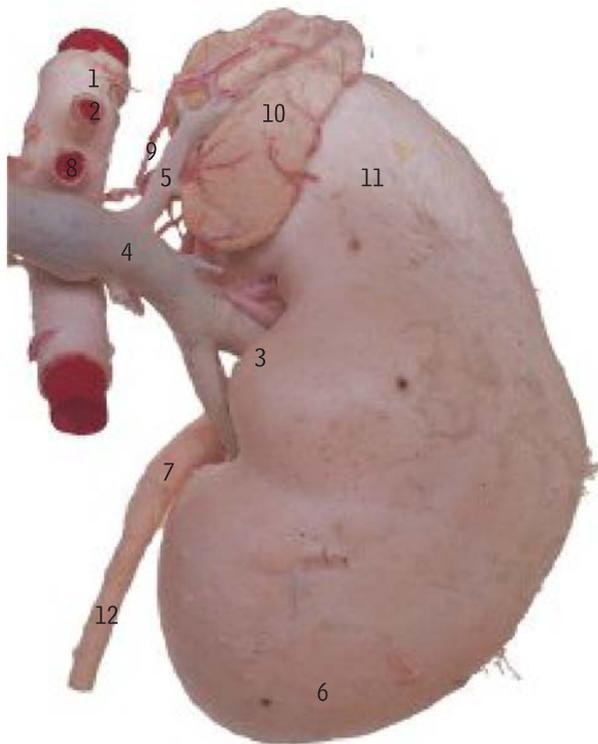


Lumbar hernia

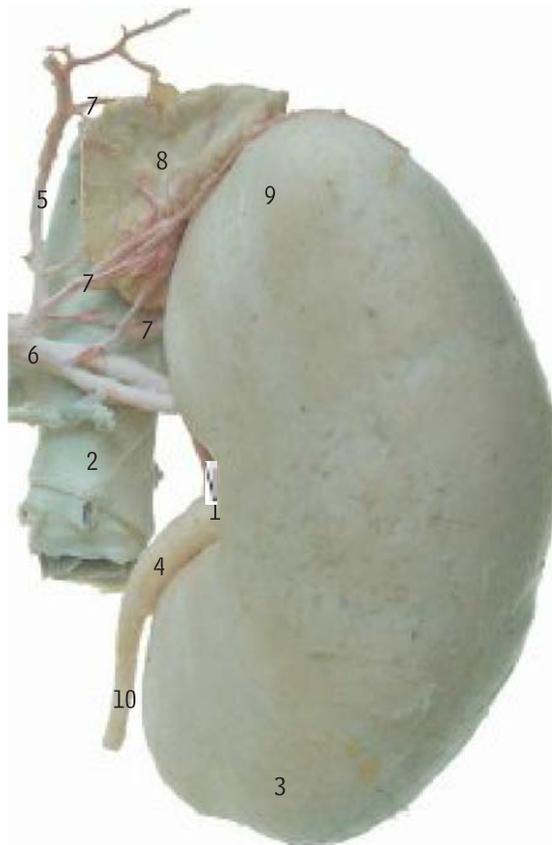


Renal biopsy

Left kidney, suprarenal gland and related vessels from the front



Right kidney, suprarenal gland and related vessels from behind



The vessels have been distended by injection of resin, and all fascia has been removed, but the suprarenal gland (10) has been retained in its normal position, lying against the medial side of the upper pole of the kidney (11).

Similar to B, but note that this is the right kidney from behind, not the left; the hilum of each kidney faces medially.

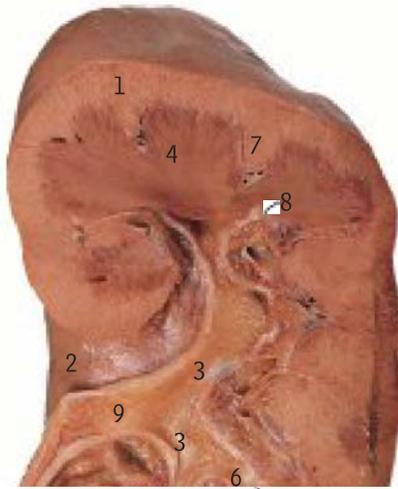
- | | |
|--|------------------------------|
| 1 Abdominal aorta | 7 Pelvis of kidney |
| 2 Coeliac trunk | 8 Superior mesenteric artery |
| 3 Hilum of kidney | 9 Suprarenal arteries |
| 4 Left renal vein overlying renal artery | 10 Suprarenal gland |
| 5 Left suprarenal vein | 11 Upper pole of kidney |
| 6 Lower pole of kidney | 12 Ureter |

- | | |
|---------------------------------|------------------------|
| 1 Hilum of kidney | 6 Right renal artery |
| 2 Inferior vena cava | 7 Suprarenal arteries |
| 3 Lower pole of kidney | 8 Suprarenal gland |
| 4 Renal Pelvis | 9 Upper pole of kidney |
| 5 Right inferior phrenic artery | 10 Ureter |



Adrenal gland pathology

Kidney *internal structure in longitudinal section*



The section is through the centre of the kidney and has included the renal pelvis (9) and beginning of the ureter (10). The major vessels in the hilum (2) have been removed.

- | | |
|---------------------|-----------------|
| 1 Cortex | 6 Minor calyx |
| 2 Hilum | 7 Renal column |
| 3 Major calyx | 8 Renal papilla |
| 4 Medulla | 9 Renal pelvis |
| 5 Medullary pyramid | 10 Ureter |

The two or three major calyces (3) unite to form the renal pelvis (9) which passes out through the hilum (2) to become the ureter (10), often with a slight narrowing at the junction. This is known as the pelvi-ureteric junction (PUJ) and is a site of renal stone obstruction.

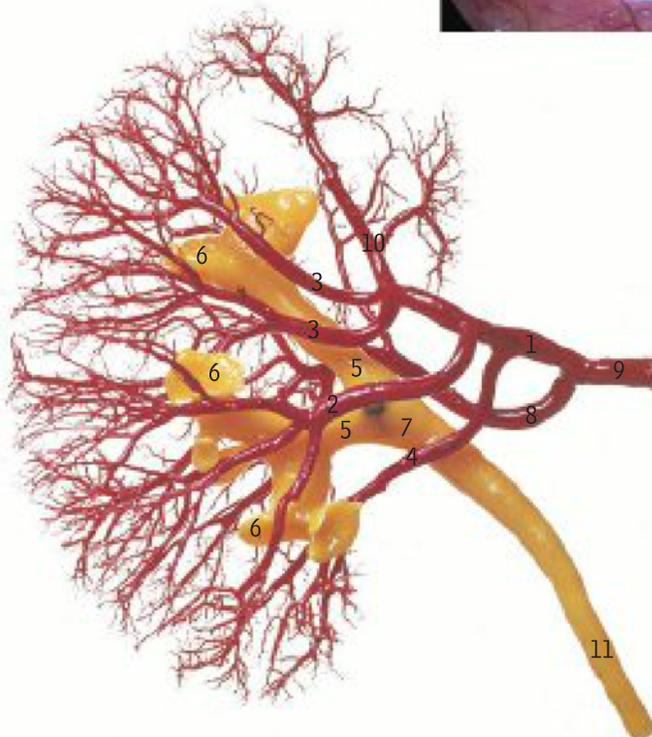
Laparoscopic view of right kidney (NB peritoneal covering)



Cast of the right kidney *from the front*

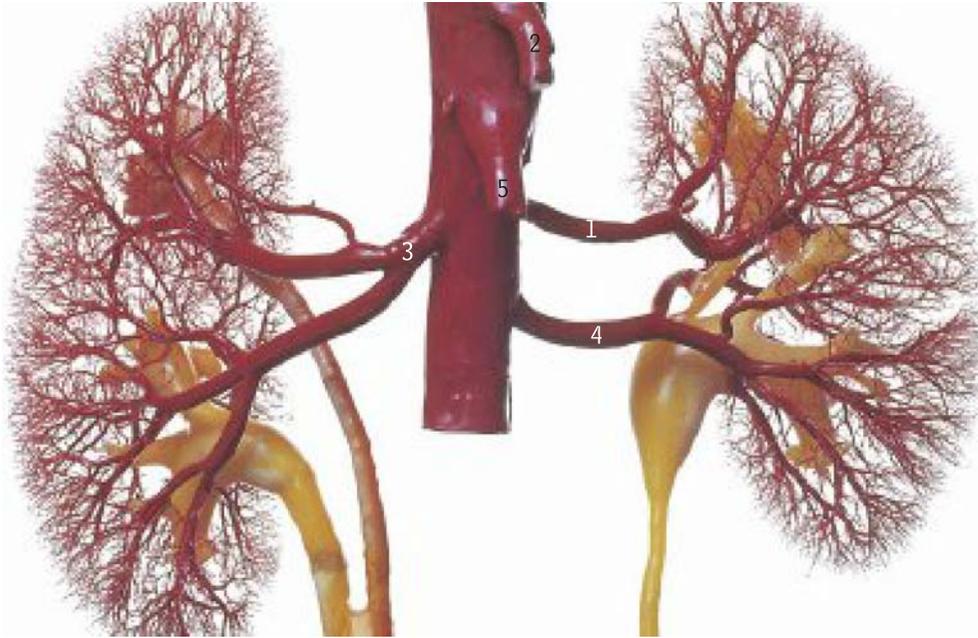
Red, renal artery
Yellow, urinary tract

The posterior division (8) of the renal artery (9) here passes behind the pelvis (7) and upper calyx (upper 5), but all other vessels are in front of the urinary tract; hence this is a right kidney seen from the front (vein, artery, ureter from front to back, and the hilum on the medial side – see page 264), not a left kidney from behind.



- | |
|---|
| 1 Anterior division of the renal artery |
| 2 Anterior inferior segment artery |
| 3 Anterior superior segment artery (double) |
| 4 Inferior segment artery |
| 5 Major calyx |
| 6 Minor calyx |
| 7 Pelvis of kidney |
| 8 Posterior division (forming posterior segment artery) |
| 9 Renal artery |
| 10 Superior segment artery |
| 11 Ureter |

Cast of the aorta and kidneys *from the front*



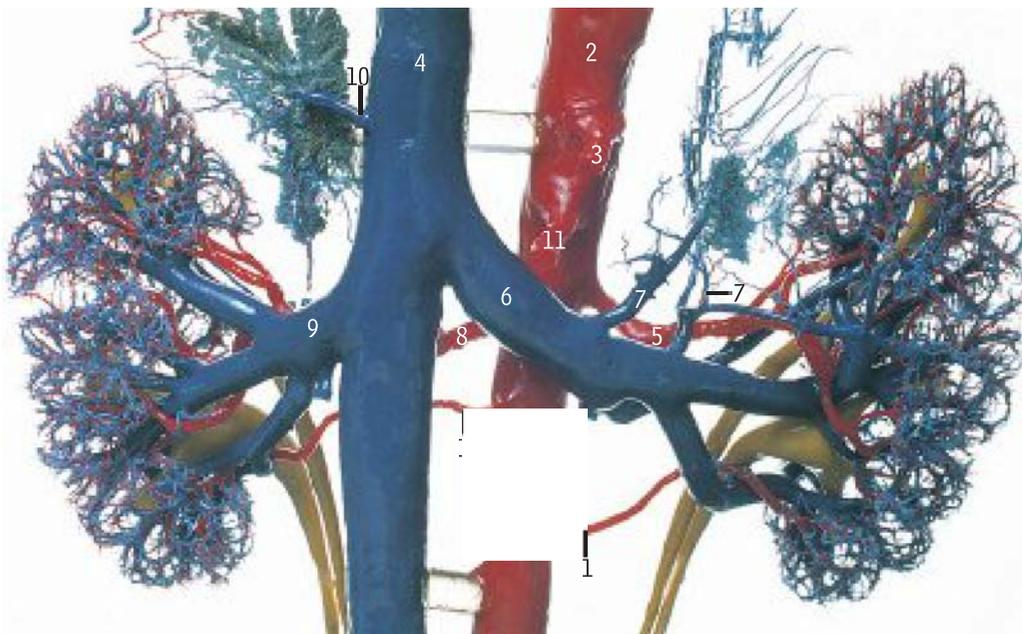
Red, arteries
Yellow, urinary tracts

- 1 Accessory left renal artery
- 2 Coeliac trunk
- 3 Early branching of right renal artery
- 4 Left renal artery
- 5 Superior mesenteric artery

Accessory renal arteries represent segmental vessels that arise directly from the aorta. In this specimen, the left accessory vessel (C1) supplies the superior and anterior superior segments, leaving the 'normal' vessel to supply the posterior, anterior inferior and inferior segments.

On the right side, the ureters (unlabelled) are duplex, each arising from a separate set of calyces. On the left, the arteries are double (1 and 4).

Cast of the kidneys and great vessels *from the front*



Red, arteries
Blue, veins
Yellow, urinary tracts

- 1 Accessory renal arteries
- 2 Aorta
- 3 Coeliac trunk
- 4 Inferior vena cava
- 5 Left renal artery
- 6 Left renal vein
- 7 Left suprarenal veins
- 8 Right renal artery
- 9 Right renal vein
- 10 Right suprarenal vein
- 11 Superior mesenteric artery

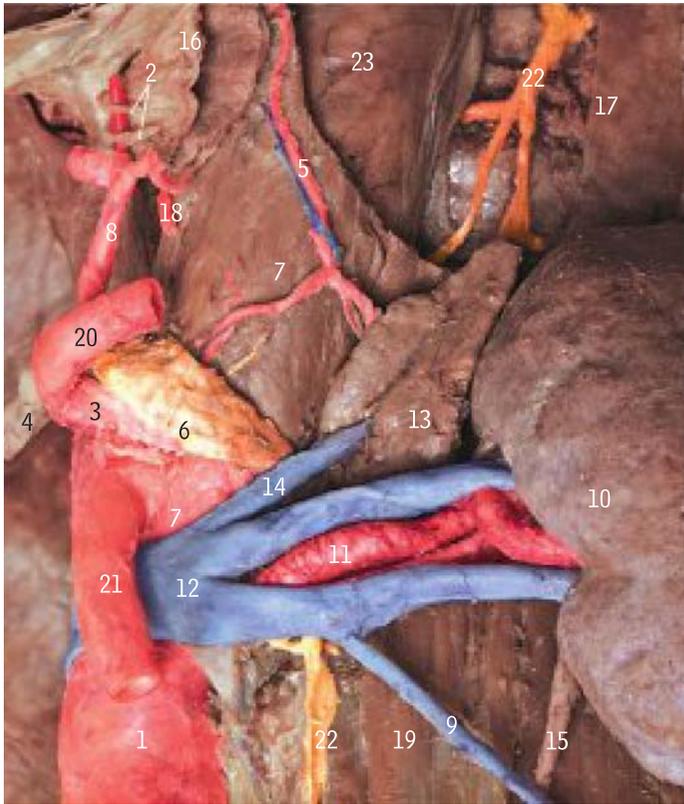


Here both kidneys show double ureters (unlabelled), and there are accessory renal arteries (1) to the lower poles of both kidneys. The suprarenal glands (also unlabelled) are outlined by their venous patterns, and the short right suprarenal vein (10) is shown draining directly to the inferior vena cava (4). On the left, there are two suprarenal veins (7), both draining to the left renal vein (6). See also page 267, A14, A9, A12.



Congenital kidney variants

Left kidney and suprarenal gland *from the front*

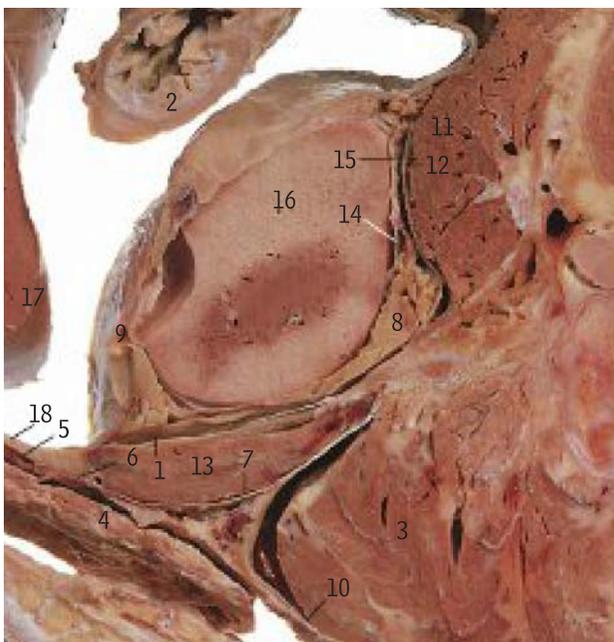


The left kidney (10) and suprarenal gland (13) are seen on the posterior abdominal wall. Much of the diaphragm has been removed but the oesophageal opening remains, with the end of the oesophagus (16) opening out into the cardiac part of the stomach and a (double) anterior vagal trunk (2) overlying the red marker. The posterior vagal trunk (18) is behind and to the right of the oesophagus. Part of the pleura has been cut away (17) to show the sympathetic trunk (22) on the side of the lower thoracic vertebrae. The left coeliac ganglion and the coeliac plexus (6) are at the root of the coeliac trunk (3).

- 1 Abdominal aorta
- 2 Anterior vagal trunk (double, over marker)
- 3 Coeliac trunk
- 4 Common hepatic artery
- 5 Inferior phrenic vessels
- 6 Left coeliac ganglion and coeliac plexus
- 7 Left crus of diaphragm
- 8 Left gastric artery
- 9 Left gonadal vein
- 10 Left kidney
- 11 Left renal artery
- 12 Left renal vein
- 13 Left suprarenal gland
- 14 Left suprarenal vein
- 15 Left ureter
- 16 Lower end of oesophagus
- 17 Pleura (cut edge)
- 18 Posterior vagal trunk
- 19 Psoas major
- 20 Splenic artery
- 21 Superior mesenteric artery
- 22 Sympathetic trunk
- 23 Thoracic aorta



Right kidney and renal fascia *in transverse section from below*



In the transverse section of the lower part of the right kidney (16), seen from below looking towards the thorax, the renal fascia (15) has been dissected out from the perirenal fat (8) and the kidney's own capsule (14). (There was a small cyst on the surface of this kidney.) The section also displays the three layers (10, 7 and 1) of the lumbar fascia (6).

- | | |
|-----------------------------------|-------------------------------------|
| 1 Anterior layer of lumbar fascia | 10 Posterior layer of lumbar fascia |
| 2 Coil of small intestine | 11 Psoas major |
| 3 Erector spinae | 12 Psoas sheath |
| 4 External oblique | 13 Quadratus lumborum |
| 5 Internal oblique | 14 Renal capsule |
| 6 Lumbar fascia | 15 Renal fascia |
| 7 Middle layer of lumbar fascia | 16 Right kidney |
| 8 Perirenal fat | 17 Right lobe of liver |
| 9 Peritoneum | 18 Transversus abdominis |

Outside the kidney's own capsule (renal capsule, 14), there is a variable amount of fat (perirenal fat, 8) and outside this is a condensation of connective tissue forming the renal fascia (15).



Haemoperitoneum



Nephrectomy



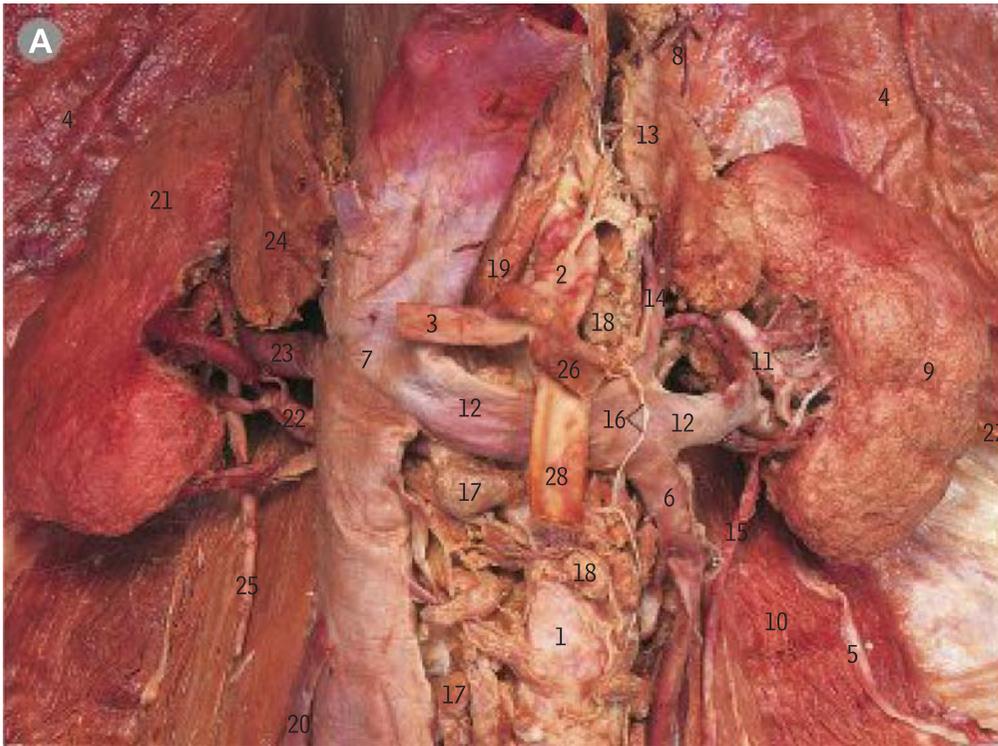
Pneumoretroperitoneum



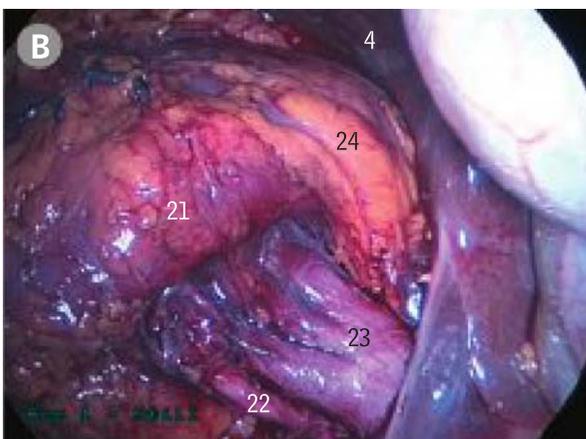
Superior mesenteric artery syndrome

Kidneys and suprarenal glands

dissection right kidney and suprarenal gland, laparoscopic view



The kidneys (9 and 21) and suprarenal glands (13 and 24) are displayed on the posterior abdominal wall after the removal of all other viscera. The left renal vein (12) receives the left suprarenal (14) and gonadal (6) veins and then passes over the aorta (1) and deep to the superior mesenteric artery (28) to reach the inferior vena cava (7). In the hilum of the right kidney (21) a large branch of the renal artery (22) passes in front of the renal vein (23). The origins of the renal arteries from the aorta are not seen because they underlie the left renal vein (12) and inferior vena cava (7).



- | | |
|-------------------------------------|-------------------------------|
| 1 Abdominal aorta and aortic plexus | 15 Left ureter |
| 2 Coeliac trunk | 16 Lymphatic vessels |
| 3 Common hepatic artery | 17 Para-aortic lymph nodes |
| 4 Diaphragm | 18 Pre-aortic lymph nodes |
| 5 First lumbar spinal nerve | 19 Right crus of diaphragm |
| 6 Gonadal vein, left | 20 Right gonadal vein |
| 7 Inferior vena cava | 21 Right kidney |
| 8 Left inferior phrenic vessels | 22 Right renal artery |
| 9 Left kidney | 23 Right renal vein |
| 10 Left psoas major | 24 Right suprarenal gland |
| 11 Left renal artery | 25 Right ureter |
| 12 Left renal vein | 26 Splenic artery |
| 13 Left suprarenal gland | 27 Subcostal nerve, left |
| 14 Left suprarenal vein | 28 Superior mesenteric artery |



Aortic bruits



IVC duplication

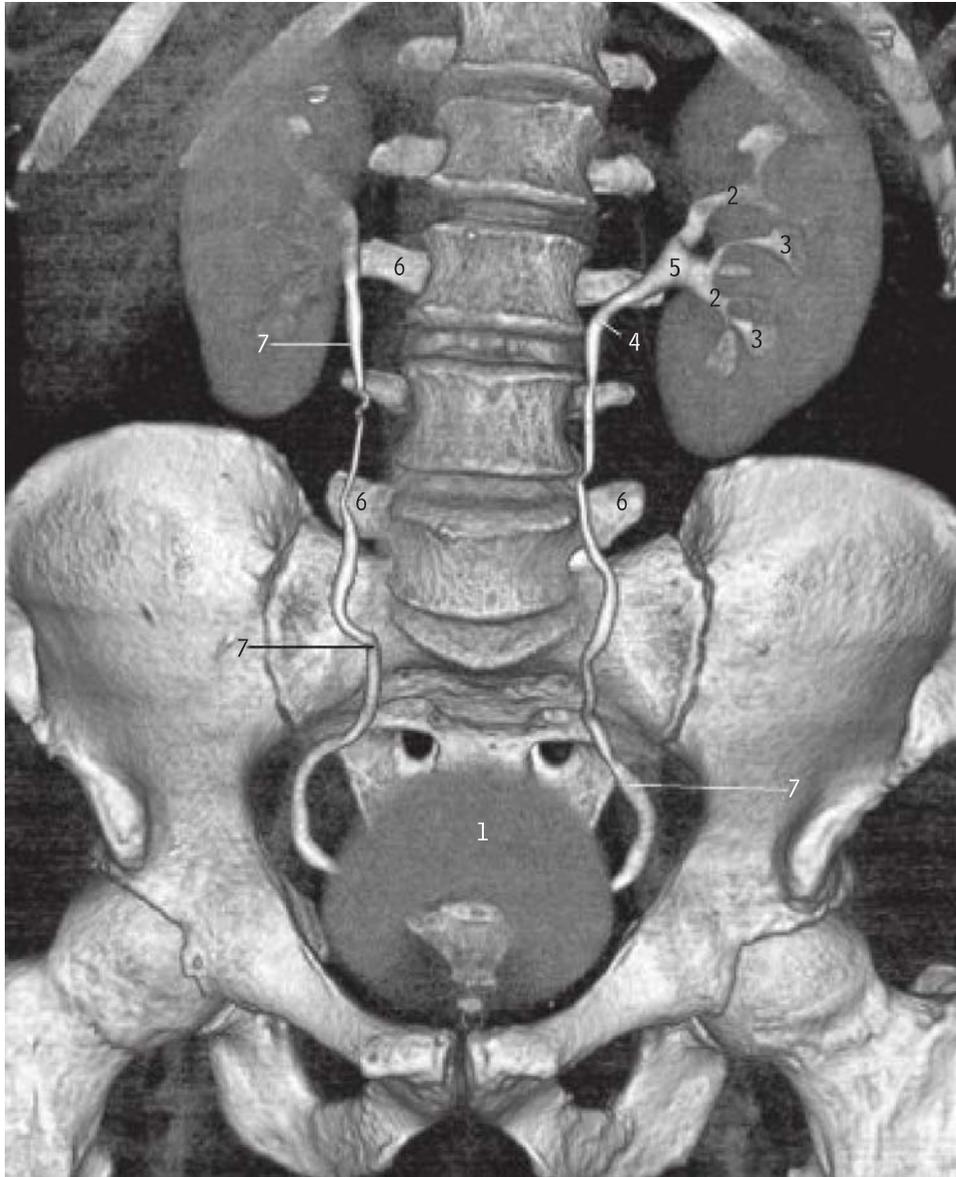


Renal carcinoma



Retroperitoneal fibrosis

Intravenous urogram *IVU* – 3D CT



Contrast medium injected intravenously is excreted by the kidneys to outline the calyces (3 and 2), renal pelvis (5) and the ureters (7) which enter the bladder (1) in the pelvis.

- 1 Bladder
- 2 Major calyx
- 3 Minor calyx
- 4 Pelvi-ureteric junction
- 5 Renal pelvis
- 6 Transverse processes of lumbar vertebrae
- 7 Ureter

The ureters normally lie near the tips of the transverse processes of the lumbar vertebrae and may kink over the psoas when the muscle is hypertrophied (e.g., in rowers and professional cyclists).



Cytoscopic view of the ureteric orifice



Abdominal aortic aneurysm



Renal trauma

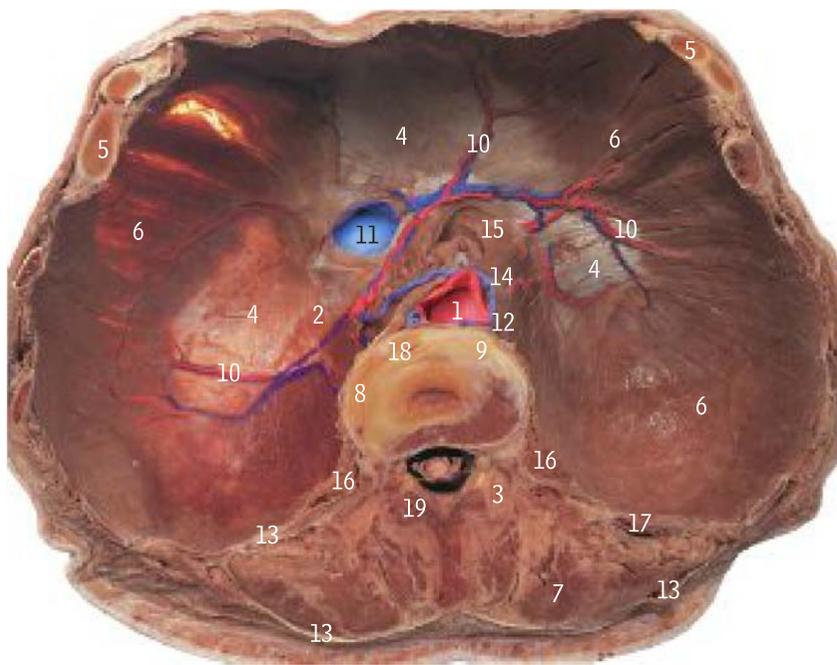


Ureterocele



Urinary tract calculi

Diaphragm from below

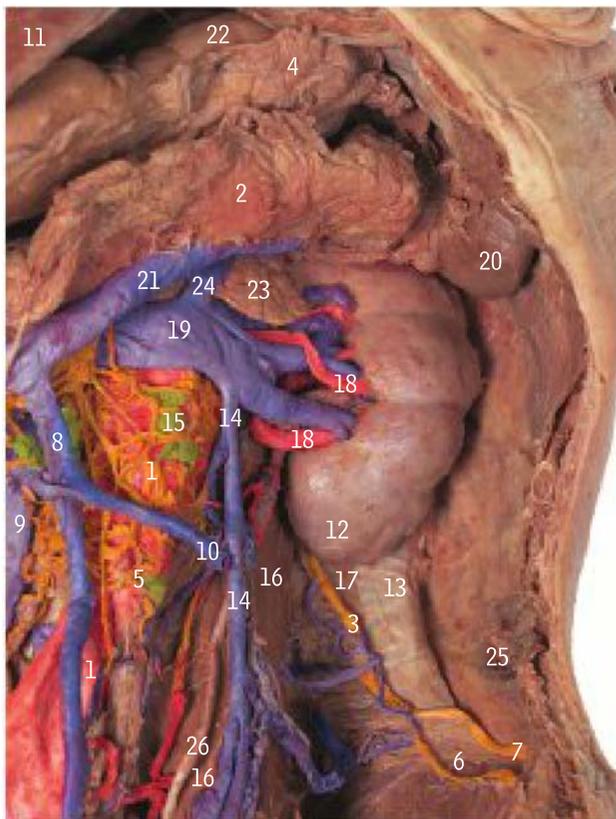


- 1 Aorta
- 2 Azygos vein
- 3 Cauda equina
- 4 Central tendon of diaphragm
- 5 Costal margin
- 6 Diaphragm
- 7 Erector spinae muscles
- 8 First lumbar intervertebral disc
- 9 Hemi-azygos vein
- 10 Inferior phrenic vessels
- 11 Inferior vena caval opening
- 12 Left crus
- 13 Lumbar fascia
- 14 Median arcuate ligament
- 15 Oesophageal opening (hiatus)
- 16 Psoas major
- 17 Quadratus lumborum
- 18 Right crus
- 19 Spinal cord

Fibres of the right crus (A18) form the right and left boundaries of the oesophageal opening or hiatus (A15).

Posterior abdominal wall left side

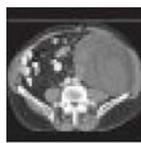
The structures on the posterior abdominal wall are here viewed from the front. The body of the pancreas (2) has been turned upwards to expose the splenic vein (21). The suprarenal gland (23) appears detached from the superior pole of the kidney (compared with A13 and 10, page 267).



- 1 Aorta and aortic plexus
- 2 Body of pancreas
- 3 First lumbar spinal nerve
- 4 Greater omentum
- 5 Hypogastric plexus
- 6 Ilioinguinal nerve
- 7 Iliohypogastric nerve
- 8 Inferior mesenteric vein
- 9 Inferior vena cava
- 10 Left colic vein
- 11 Liver
- 12 Lower pole of kidney
- 13 Lumbar part of thoracolumbar fascia
- 14 Ovarian vein
- 15 Para-aortic lymph node
- 16 Psoas major
- 17 Quadratus lumborum
- 18 Renal artery
- 19 Renal vein
- 20 Spleen
- 21 Splenic vein
- 22 Stomach
- 23 Suprarenal gland
- 24 Suprarenal vein
- 25 Transversus abdominis
- 26 Ureter



Medullary sponge kidney



Retroperitoneal bleed

Posterior abdominal and pelvic walls



All peritoneum and viscera (except for the bladder, 2, ureter, 40, and ductus deferens or vas deferens, 6) have been removed, to display vessels and nerves.



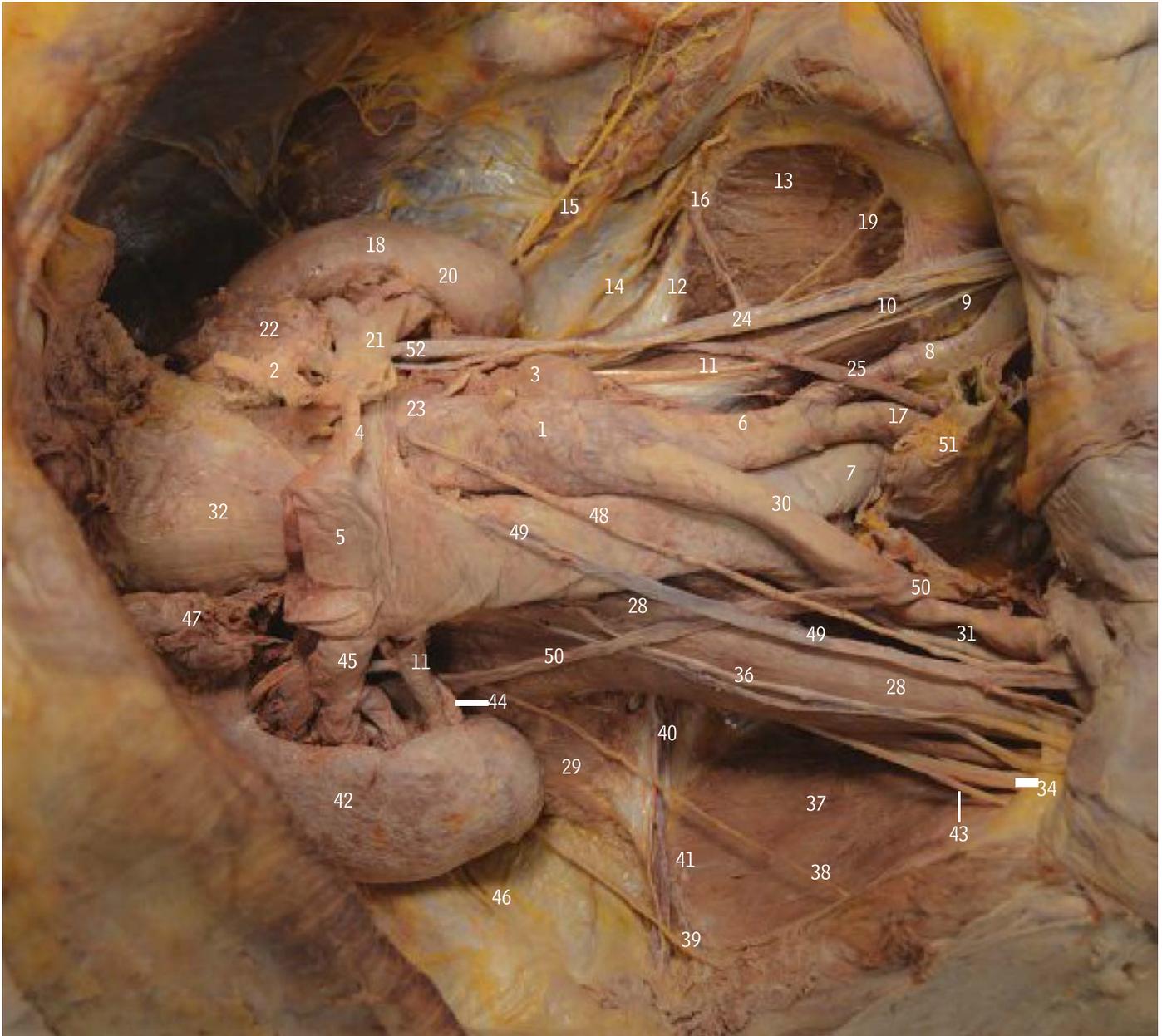
- 1 Aorta and aortic plexus
- 2 Bladder
- 3 Common iliac artery
- 4 Common iliac vein
- 5 Deep circumflex iliac artery
- 6 Ductus deferens
- 7 External iliac artery
- 8 External iliac vein
- 9 Femoral artery
- 10 Femoral branch of genitofemoral nerve
- 11 Femoral nerve
- 12 Femoral vein
- 13 Fourth lumbar artery
- 14 Genital branch of genitofemoral nerve
- 15 Genitofemoral nerve

- 16 Hypogastric nerve
- 17 Iliacus and branches from femoral nerve and iliolumbar artery
- 18 Iliohypogastric nerve
- 19 Ilioinguinal nerve
- 20 Iliolumbar ligament
- 21 Inferior hypogastric (pelvic) plexus and pelvic splanchnic nerves
- 22 Inferior mesenteric artery and plexus
- 23 Inferior vena cava
- 24 Inguinal ligament
- 25 Internal iliac artery
- 26 Lacunar ligament
- 27 Lateral femoral cutaneous nerve arising from femoral nerve

- 28 Lumbar part of thoracolumbar fascia
- 29 Obturator nerve and vessels
- 30 Pectineal ligament
- 31 Position of femoral canal
- 32 Psoas major
- 33 Quadratus lumborum
- 34 Rectum (cut edge)
- 35 Rectus abdominis
- 36 Spermatic cord
- 37 Superior hypogastric plexus
- 38 Sympathetic trunk and ganglia
- 39 Testicular vessels
- 40 Ureter



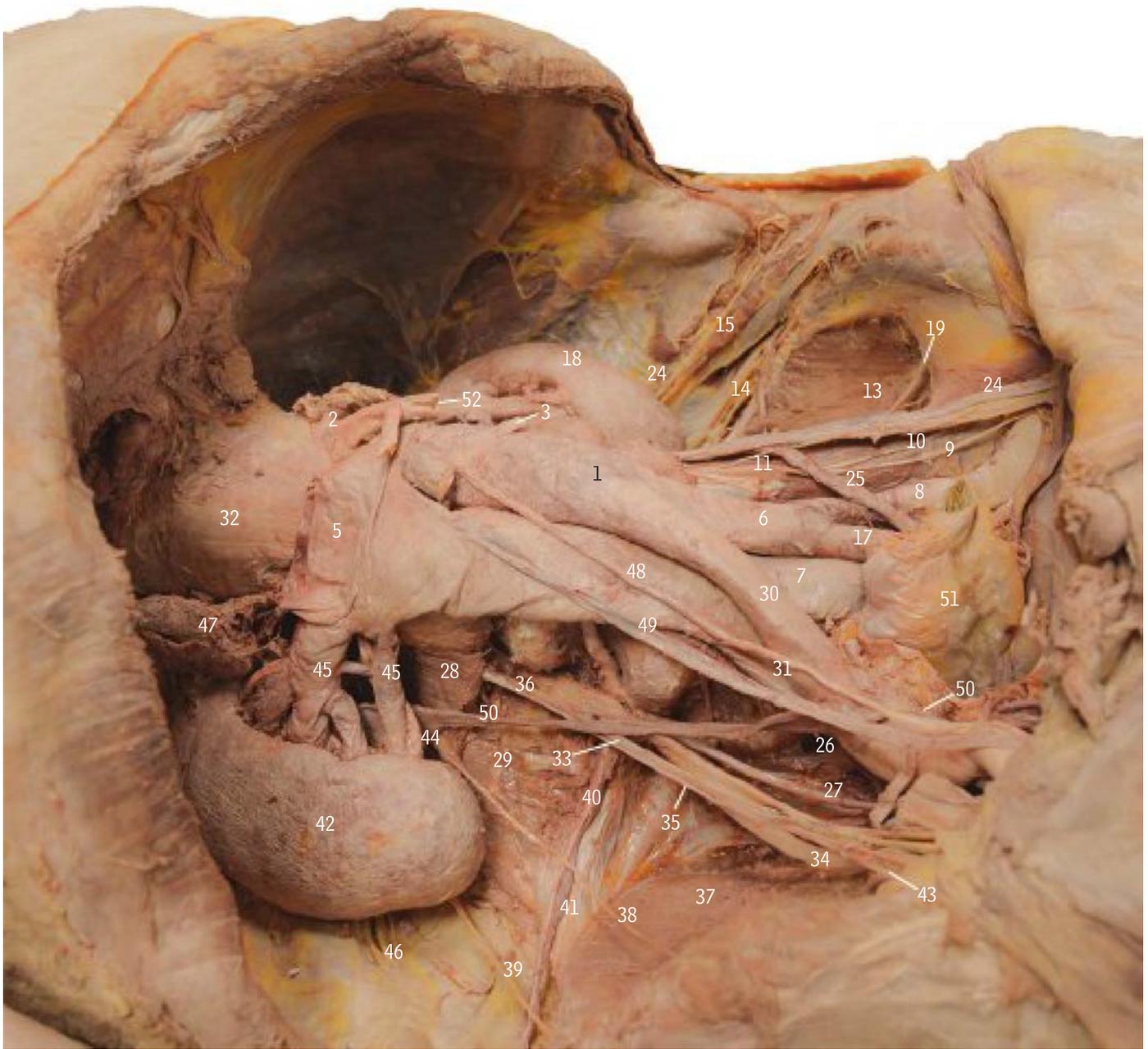
Psoas abscess



- 1 Abdominal aorta
- 2 Coeliac trunk
- 3 Inferior mesenteric artery
- 4 Inferior pancreaticoduodenal artery
- 5 Inferior vena cava
- 6 Left common iliac artery
- 7 Left common iliac vein
- 8 Left external iliac artery
- 9 Left femoral branch of genitofemoral nerve

- 10 Left genital branch of genitofemoral nerve
- 11 Left genitofemoral nerve
- 12 Left iliac crest
- 13 Left iliacus muscle
- 14 Left ilioinguinal nerve
- 15 Left iliohypogastric nerve
- 16 Left iliolumbar artery
- 17 Left internal iliac artery
- 18 Left kidney

- 19 Left lateral femoral cutaneous nerve
- 20 Left renal artery
- 21 Left renal vein
- 22 Left suprarenal gland
- 23 Left testicular artery
- 24 Left testicular vein
- 25 Left ureter

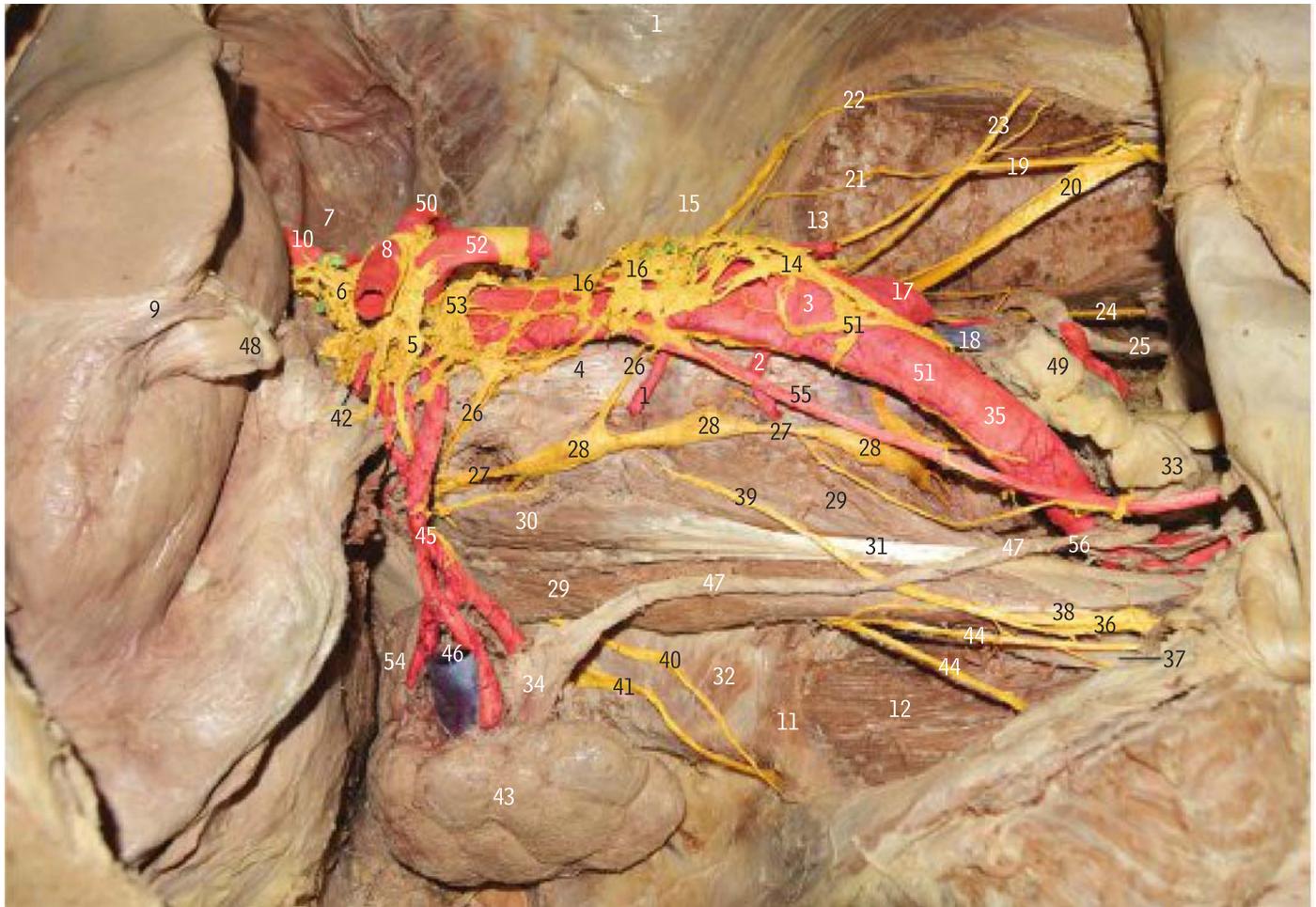


- 26 Lumbosacral trunk
- 27 Obturator nerve
- 28 Psoas major muscle
- 29 Quadratus lumborum
- 30 Right common iliac artery
- 31 Right common iliac vein
- 32 Right crus of diaphragm
- 33 Right femoral branch of genitofemoral nerve
- 34 Right femoral nerve

- 35 Right genital branch of genitofemoral nerve
- 36 Right genitofemoral nerve
- 37 Right iliacus muscle
- 38 Right ilioinguinal nerve
- 39 Right iliohypogastric nerve
- 40 Right iliolumbar artery
- 41 Right iliolumbar vein
- 42 Right kidney
- 43 Right lateral femoral cutaneous nerve

- 44 Right renal artery
- 45 Right renal vein
- 46 Right subcostal nerve
- 47 Right suprarenal gland
- 48 Right testicular artery
- 49 Right testicular vein
- 50 Right ureter
- 51 Sigmoid colon
- 52 Superior mesenteric artery

Autonomics of the abdomen



- | | | |
|--|--|---|
| 1 3 rd lumbar artery | 21 Left genital branch of genitofemoral nerve | 39 Right genitofemoral nerve |
| 2 4 th lumbar artery | 22 Left ilioinguinal nerve | 40 Right ilioinguinal nerve |
| 3 Abdominal aorta | 23 Left lateral femoral cutaneous nerve (early split into two branches) | 41 Right iliohypogastric nerve |
| 4 Anterior longitudinal ligament | 24 Left obturator nerve | 42 Right inferior phrenic artery |
| 5 Aorticorenal ganglion | 25 Left ureter | 43 Right kidney |
| 6 Coeliac ganglion | 26 Lumbar splanchnic nerves | 44 Right lateral femoral cutaneous nerve (early split into two branches) |
| 7 Coeliac lymph nodes (pre-aortic) | 27 Lumbar sympathetic chain | 45 Right renal artery |
| 8 Coeliac trunk | 28 Lumbar sympathetic ganglia | 46 Right renal vein |
| 9 Falciform ligament of the liver | 29 Psoas major muscle | 47 Right ureter |
| 10 Hepatic artery proper (variation) | 30 Psoas minor muscle | 48 Round ligament of the liver |
| 11 Iliac crest | 31 Psoas minor tendon | 49 Sigmoid colon |
| 12 Iliacus muscle | 32 Quadratus lumborum muscle | 50 Splenic artery |
| 13 Inferior mesenteric artery | 33 Rectum | 51 Superior hypogastric plexus |
| 14 Inferior mesenteric ganglion | 34 Renal pelvis | 52 Superior mesenteric artery |
| 15 Inferior mesenteric lymph nodes (pre-aortic) | 35 Right common iliac artery | 53 Superior mesenteric ganglion |
| 16 Intermesenteric (aortic) plexus | 36 Right femoral branch of the genitofemoral nerve | 54 Suprarenal gland |
| 17 Left common iliac artery | 37 Right femoral nerve | 55 Testicular artery |
| 18 Left common iliac vein | 38 Right genital branch of genitofemoral nerve | 56 Testicular plexus |
| 19 Left femoral branch of genitofemoral nerve | | |
| 20 Left femoral nerve | | |

Left lumbar plexus from the front



The psoas major has been removed to show the constituent nerves of the lumbar plexus which are embedded within the muscle. Because of the removal of most of the anterolateral abdominal wall (except for the lowest parts of the external oblique, 1, internal oblique, 9, and transversus, 18), the iliohypogastric (6) and ilioinguinal (7) nerves have fallen too far medially; they do not overlie iliacus (5).

- 1 External oblique
- 2 External oblique aponeurosis
- 3 Femoral nerve
- 4 Genitofemoral nerve
- 5 Iliacus
- 6 Iliohypogastric nerve
- 7 Ilioinguinal nerve
- 8 Iliolumbar ligament
- 9 Internal oblique
- 10 Lateral femoral cutaneous nerve
- 11 Lumbar sacral trunk
- 12 Obturator nerve
- 13 Quadratus lumborum
- 14 Rami communicantes
- 15 Superficial inguinal ring
- 16 Sympathetic trunk and ganglia
- 17 Third lumbar vertebra and anterior longitudinal ligament
- 18 Transversus abdominis
- 19 Upper surface of inguinal ligament
- 20 Ventral ramus of fifth lumbar nerve
- 21 Ventral ramus of first sacral nerve
- 22 Ventral ramus of fourth lumbar nerve



Lumbar
sympathectomy

Muscles of the left pelvis and proximal thigh *slightly oblique anterior view*



- 1 Adductor brevis
- 2 Adductor longus
- 3 Anterior superior iliac spine
- 4 Coccygeus
- 5 Disc, fifth lumbar
- 6 External iliac artery
- 7 Femoral artery
- 8 Femoral nerve
- 9 Femoral vein
- 10 Gracilis
- 11 Iliacus
- 12 Inferior epigastric artery, origin
- 13 Inguinal ligament
- 14 Lumbosacral trunk
- 15 Obturator internus
- 16 Obturator nerve
- 17 Pectineus
- 18 Piriformis
- 19 Psoas major
- 20 Rectus femoris
- 21 Sacral plexus
- 22 Sartorius
- 23 Tendinous arch of levator ani
- 24 Tensor fasciae latae
- 25 Vastus lateralis



The anterior superior iliac spine (3) and the pubic tubercle, which give attachment to the ends of the inguinal ligament (13), are important palpable landmarks in the inguinal region (see page 234).

The part of obturator internus (15) *above* the attachment of levator ani is part of the lateral wall of the pelvic cavity, while the part *below* the attachment is in the perineum and forms part of the lateral wall of the ischio-anal (ischio-rectal) fossa (pages 290 and 292).

Piriformis (18) passes out of the pelvis into the gluteal region through the *greater* sciatic foramen *above* the ischial spine, while obturator internus (15) passes out through the *lesser* sciatic foramen *below* the ischial spine.

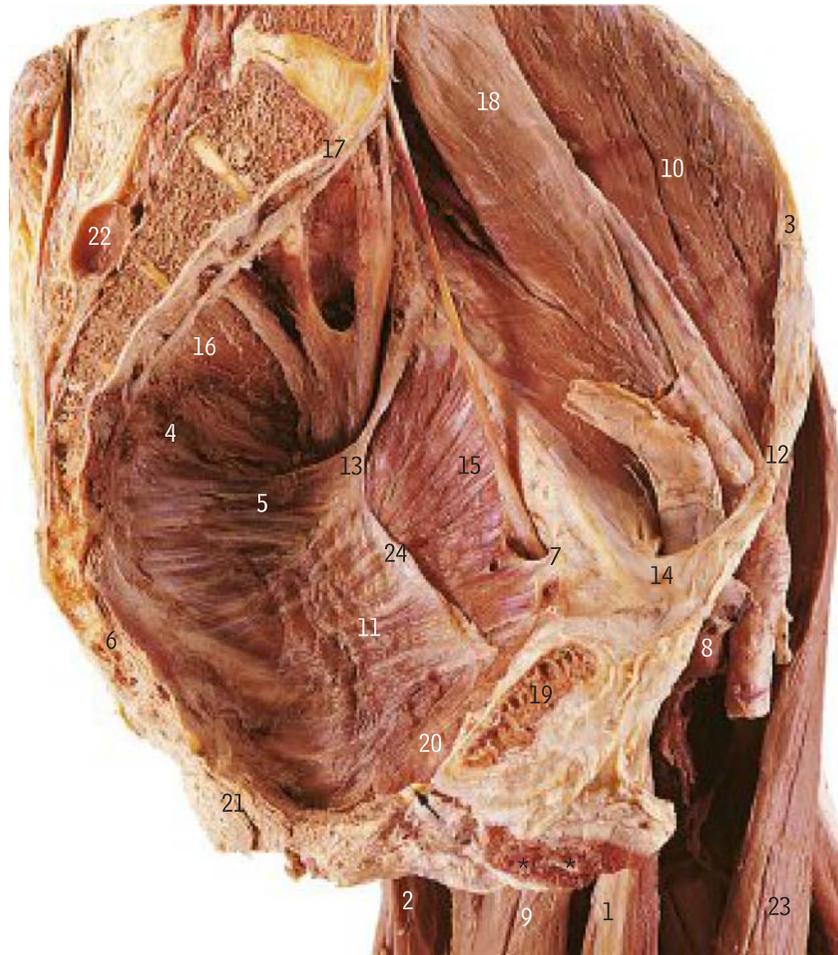
The anterior abdominal wall, most viscera and fasciae have been removed. Segments of the external iliac/femoral vessels and the inferior margin of the external oblique aponeurosis (inguinal ligament) have been retained to assist orientation.

Muscles of the left half of the pelvis

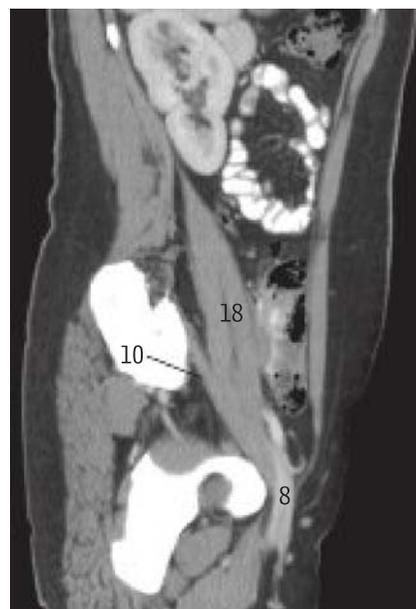
Male pelvis

The fascia overlying the obturator internus (15) has been removed down to the tendinous origin of the levator ani (11 and 20), a urethral catheter (arrow) indicates the position of the sphincter urethrae, and the plane of section passes through the bulbocavernosus (asterisks).

- 1 Adductor longus
 - 2 Adductor magnus
 - 3 Anterior superior iliac spine
 - 4 Branch of fourth sacral nerve
 - 5 Coccygeus
 - 6 Coccyx
 - 7 Fascia over obturator internus
 - 8 Femoral vein
 - 9 Gracilis
 - 10 Iliacus
 - 11 Iliococcygeus part of levator ani
 - 12 Inguinal ligament
 - 13 Ischial spine
 - 14 Lacunar ligament
 - 15 Obturator internus, pierced by obturator nerve
 - 16 Piriformis
 - 17 Promontory of sacrum
 - 18 Psoas major
 - 19 Pubic symphysis
 - 20 Pubococcygeus part of levator ani
 - 21 Rectum
 - 22 Sacral canal with cyst
 - 23 Sartorius
 - 24 Tendinous arch of levator ani
- Left parasagittal CT of abdomen and pelvis**



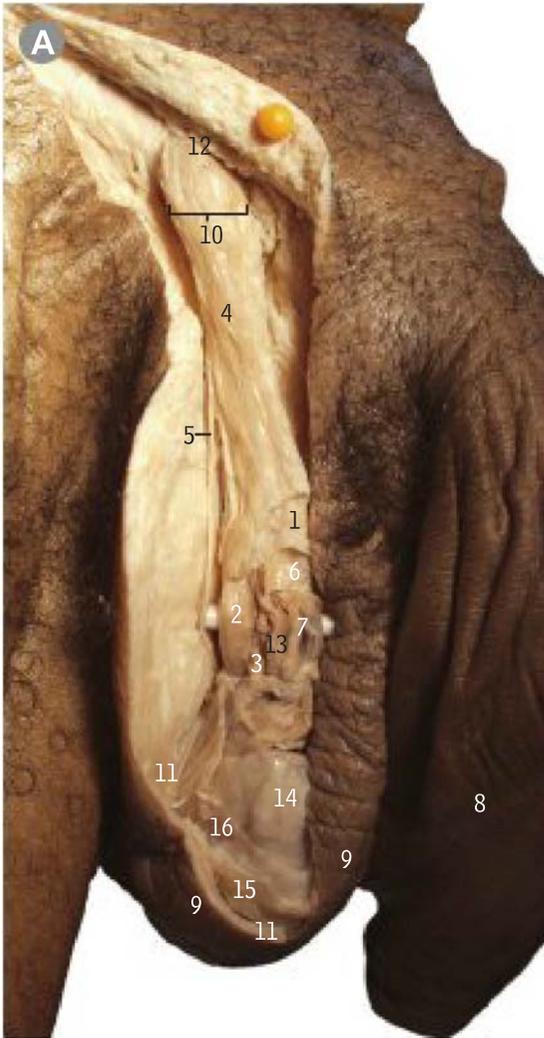
Right



Inguinal lymphadenopathy

spermatic cord and testis

Right testis, epididymis and penis from the right



- 1 Cremasteric fascia
- 2 Ductus deferens
- 3 Ductus deferens, artery
- 4 External spermatic fascia
- 5 Ilioinguinal nerve
- 6 Internal spermatic fascia
- 7 Pampiniform venous plexus
- 8 Penis
- 9 Scrotal sac
- 10 Spermatic cord
- 11 Superficial fascia with dartos muscle fibres
- 12 Superficial inguinal ring
- 13 Testicular artery
- 14 Tunica albuginea
- 15 Tunica vaginalis, parietal layer
- 16 Tunica vaginalis, visceral layer

- 1 Appendix epididymis
- 2 Body of epididymis
- 3 Corona of glans
- 4 Head of penis
- 5 Ductus deferens
- 6 External urethral orifice
- 7 Foreskin
- 8 Glans penis
- 9 Head of epididymis
- 10 Lateral superficial vein
- 11 Pampiniform venous plexus
- 12 Sac of tunica vaginalis

- 13 Scrotal sac
- 14 Spermatic cord
- 15 Superficial dorsal artery
- 16 Superficial dorsal nerve
- 17 Superficial dorsal vein
- 18 Superficial scrotal (dartos) fascia
- 19 Tail of epididymis
- 20 Testis
- 21 Tunica vaginalis, parietal
- 22 Tunica vaginalis, visceral, overlying tunica albuginea



Circumcision



Fournier's gangrene



Hydrocele



Phimosis and paraphimosis



Scrotal swellings

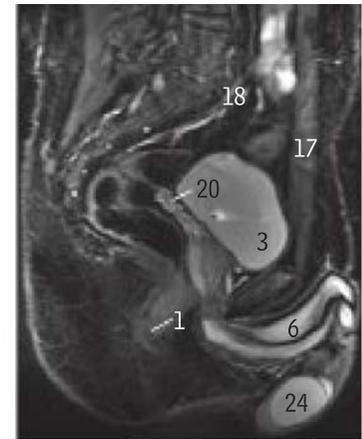


Varicocele



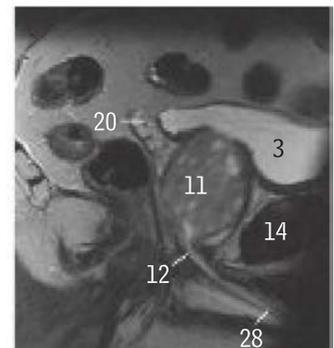
Vasectomy

Male pelvis left half of a midline sagittal section

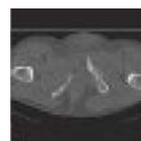


Parasagittal MRI, pelvis

- | | | |
|-----------------------------|--|--|
| 1 Anal canal | 12 Prostatic urethra | 22 Small intestine, multiple coils |
| 2 Annulus fibrosus | 13 Prostatic venous plexus | 23 Superior mesenteric vessels, jejunal and ileal branches |
| 3 Bladder | 14 Pubic symphysis | 24 Testis |
| 4 Coccyx | 15 Rectosigmoid junction | 25 Tunica albuginea |
| 5 Common iliac artery | 16 Rectovesical pouch of pelvic peritoneum | 26 Tunica vaginalis, parietal layer |
| 6 Corpus cavernosum | 17 Rectus abdominis | 27 Tunica vaginalis, visceral layer |
| 7 Deep dorsal vein of penis | 18 Sacral promontory | 28 Urethra, spongy/penile |
| 8 Ductus deferens | 19 Seminal colliculus | |
| 9 Inferior vena cava | 20 Seminal vesicle | |
| 10 Parietal peritoneum | 21 Sigmoid colon | |



Sagittal MR imaging, pelvis



Extravasation of urine

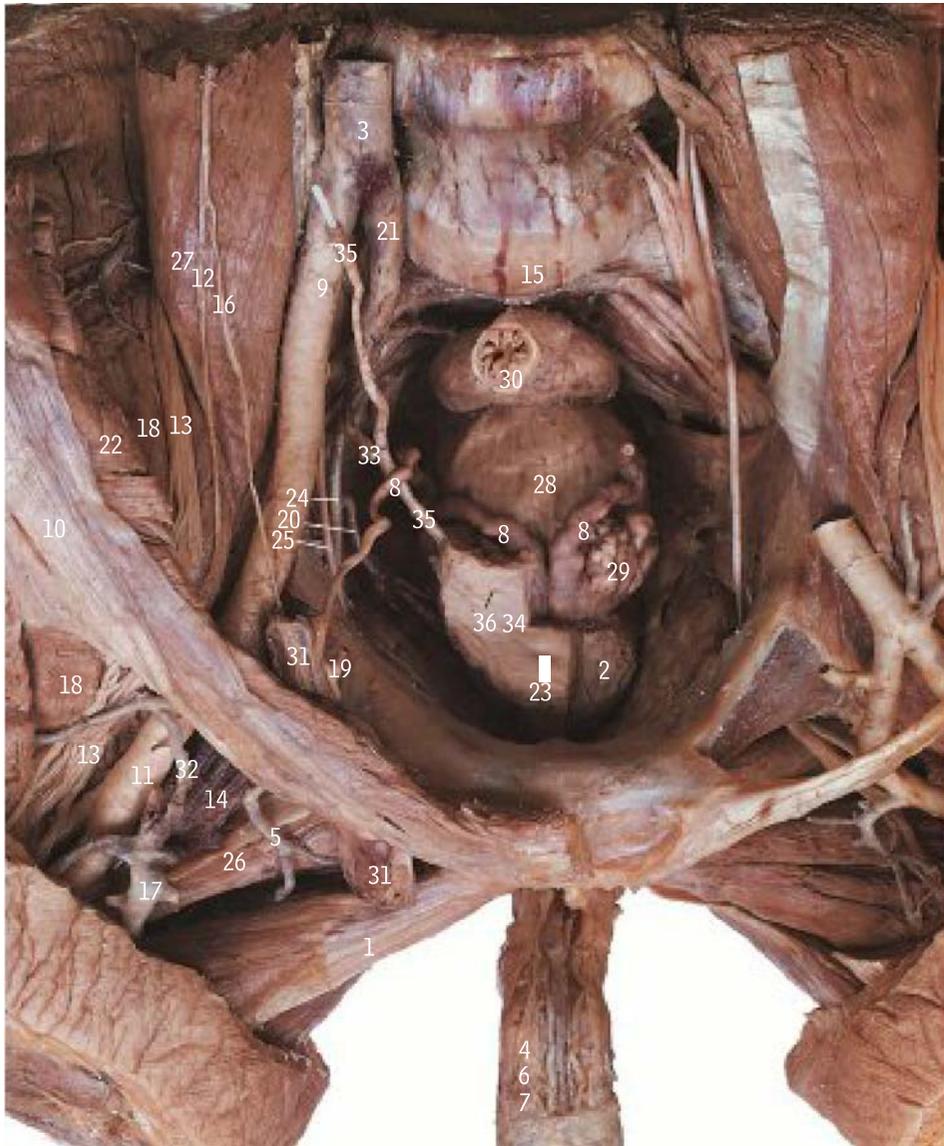


Proctoscopy and sigmoidoscopy



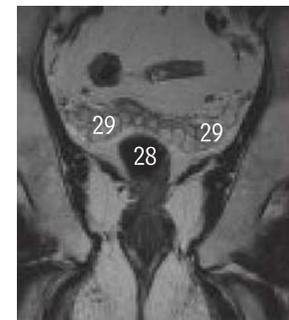
Testicular torsion

Pelvis, right inguinal region and penis from above



In the pelvis, most of the bladder (34) has been removed to show part of the basal surface of the prostate (2), and the left seminal vesicle (29) lying lateral to the ductus deferens (8). The ductus in the pelvis crosses superficial to the ureter (35). The external iliac artery (9) passes under the inguinal ligament (10) to become the femoral artery (11). On the dorsum of the penis, the fascia has been removed, showing the single midline deep dorsal vein (4) with a dorsal artery (6) and dorsal nerve (7) on each side.

The trigone of the bladder (34), at the lower part of the base or posterior surface, is the relatively fixed area with smooth mucous membrane between the internal urethral orifice (23) and the two ureteral openings (36 on the right side).



Coronal MR imaging, pelvis



- | | | |
|---|---|--|
| <ul style="list-style-type: none"> 1 Adductor longus 2 Base of prostate 3 Common iliac artery 4 Deep dorsal vein of penis 5 Deep external pudendal artery 6 Dorsal artery of penis 7 Dorsal nerve of penis 8 Ductus deferens 9 External iliac artery 10 External oblique aponeurosis and inguinal ligament 11 Femoral artery | <ul style="list-style-type: none"> 12 Femoral branch of genitofemoral nerve 13 Femoral nerve 14 Femoral vein 15 Fifth lumbar intervertebral disc 16 Genital branch of genitofemoral nerve 17 Great saphenous vein 18 Iliacus 19 Inferior epigastric artery 20 Inferior vesical artery 21 Internal iliac artery 22 Internal oblique 23 Internal urethral orifice | <ul style="list-style-type: none"> 24 Obturator artery 25 Obturator nerve 26 Pectineus 27 Psoas major 28 Rectum 29 Seminal vesicle 30 Sigmoid colon (cut lower end) 31 Spermatic cord 32 Superficial circumflex iliac vein 33 Superior vesical artery 34 Trigone of bladder 35 Ureter 36 Ureteral orifice |
|---|---|--|



Carcinoma of the large bowel



Cystitis



Cystoscopy



Ureteric variants

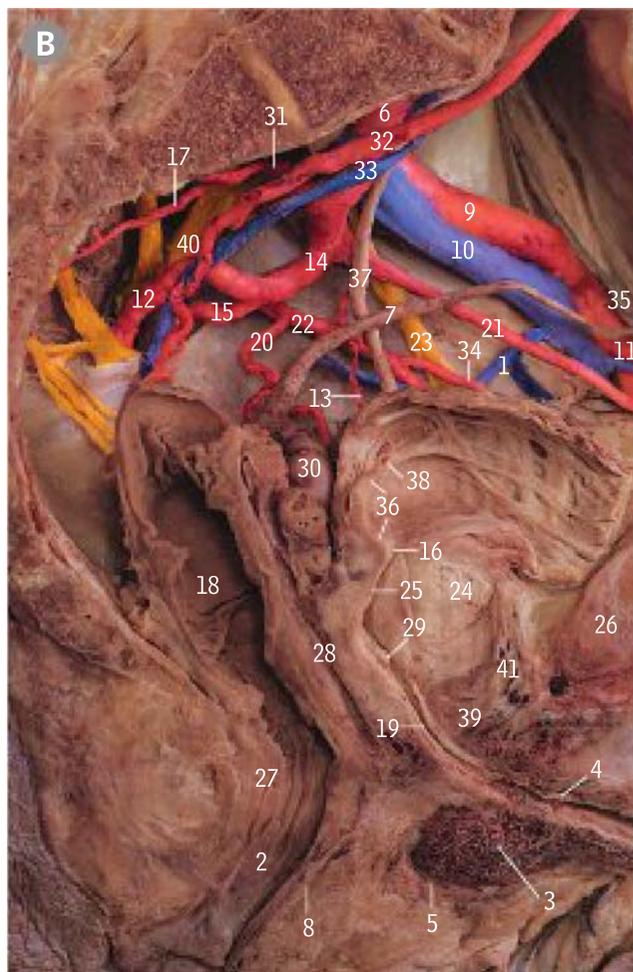
Bladder and prostate from behind

- 1 Base of bladder
- 2 Ductus deferens
- 3 Left ejaculatory duct
- 4 Posterior surface of prostate
- 5 Seminal vesicle
- 6 Ureter

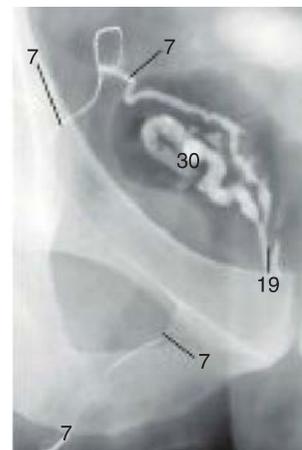


Left side of the male pelvis from the right

In this midline sagittal section, the prostate (24) is enlarged, lengthening the prostatic urethra (25) and accentuating the trabeculae of the bladder. The mucous membrane of the bladder (whose trigone is labelled at 36) has been removed to show muscular trabeculae in the wall. Variations in the branches of the internal iliac artery (14) are common, and here the obturator artery (22) gives origin to the superior vesical (34) and inferior vesical (13) as well as the middle rectal (20) arteries.



Seminal vesiculogram Vasogram - contrast



- 1 Accessory obturator vein
- 2 Anal canal
- 3 Bulb of penis
- 4 Bulbar part of spongy urethra
- 5 Bulbospongiosus
- 6 Common iliac artery
- 7 Ductus deferens
- 8 External anal sphincter
- 9 External iliac artery
- 10 External iliac vein
- 11 Inferior epigastric vessels
- 12 Inferior gluteal artery
- 13 Inferior vesical artery
- 14 Internal iliac artery
- 15 Internal pudendal artery
- 16 Internal urethral orifice
- 17 Lateral sacral artery
- 18 Lower end of rectum
- 19 Membranous part of urethra
- 20 Middle rectal artery
- 21 Obliterated umbilical artery
- 22 Obturator artery

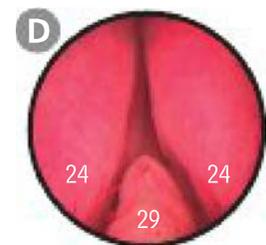


Benign prostatic hyperplasia



Carcinoma of the prostate

Cystoscopy of prostate (TURP)



- 23 Obturator nerve
- 24 Prostate (enlarged)
- 25 Prostatic part of urethra
- 26 Pubic symphysis
- 27 Puborectalis part of levator ani
- 28 Rectovesical fascia
- 29 Seminal colliculus
- 30 Seminal vesicle
- 31 Superior gluteal artery
- 32 Superior rectal artery
- 33 Superior rectal vein
- 34 Superior vesical artery
- 35 Testicular vessels and deep inguinal ring
- 36 Trigone of bladder
- 37 Ureter
- 38 Ureteral orifice
- 39 Urogenital diaphragm
- 40 Ventral ramus of first sacral nerve
- 41 Vesicoprostatic venous plexus

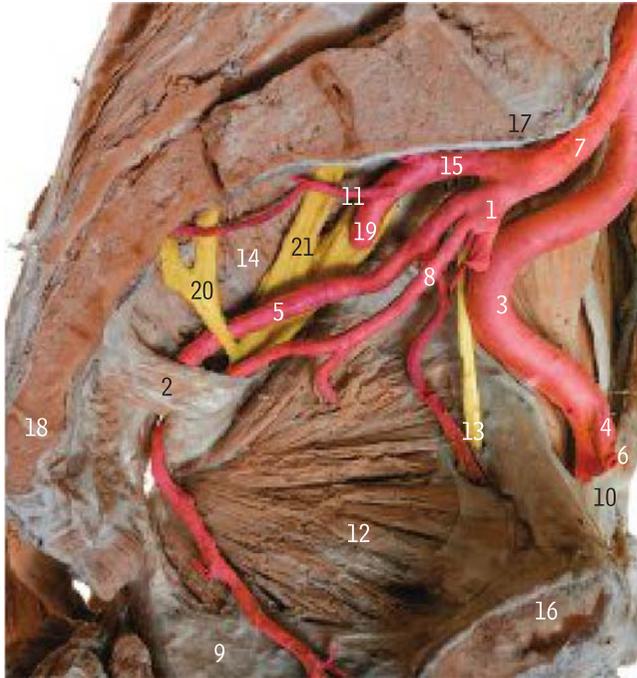


Transurethral resection of the prostate (TURP)



Urethral stricture

Arteries and nerves of the pelvis *from the right*

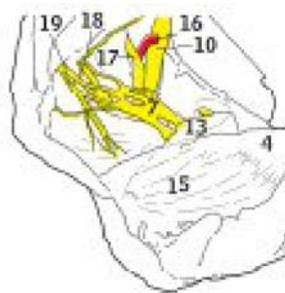
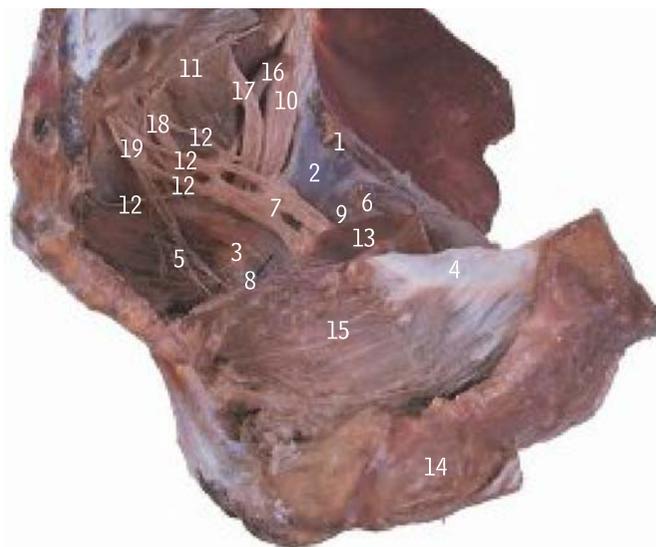


- | | |
|---|--|
| 1 Anterior trunk of internal iliac artery | 13 Obturator nerve and artery |
| 2 Coccygeus and sacrospinous ligament | 14 Piriformis |
| 3 External iliac artery | 15 Posterior trunk of internal iliac artery |
| 4 Inferior epigastric artery | 16 Pubic symphysis |
| 5 Inferior gluteal artery | 17 Sacral promontory |
| 6 Inguinal ligament | 18 Sacrococcygeal joint |
| 7 Internal iliac artery | 19 Superior gluteal artery piercing lumbosacral trunk |
| 8 Internal pudendal artery | 20 Union of ventral rami of second and third sacral nerves |
| 9 Ischial tuberosity | 21 Ventral ramus of first sacral nerve |
| 10 Lacunar ligament | |
| 11 Lateral sacral artery | |
| 12 Obturator internus | |

In this left half section of the pelvis, all peritoneum, fascia, veins and visceral arteries have been removed together with the left levator ani, so displaying the whole of the internal surface of obturator internus (12). On the posterior pelvic wall, the vessels in general lie superficial to the nerves.

In this specimen, the external iliac artery (3) is unusually tortuous, and the anterior trunk of the internal iliac artery (1) has divided unusually high up into its terminal branches, the internal pudendal (8) and the inferior gluteal (5). The superior gluteal artery (19) has perforated the lumbosacral trunk.

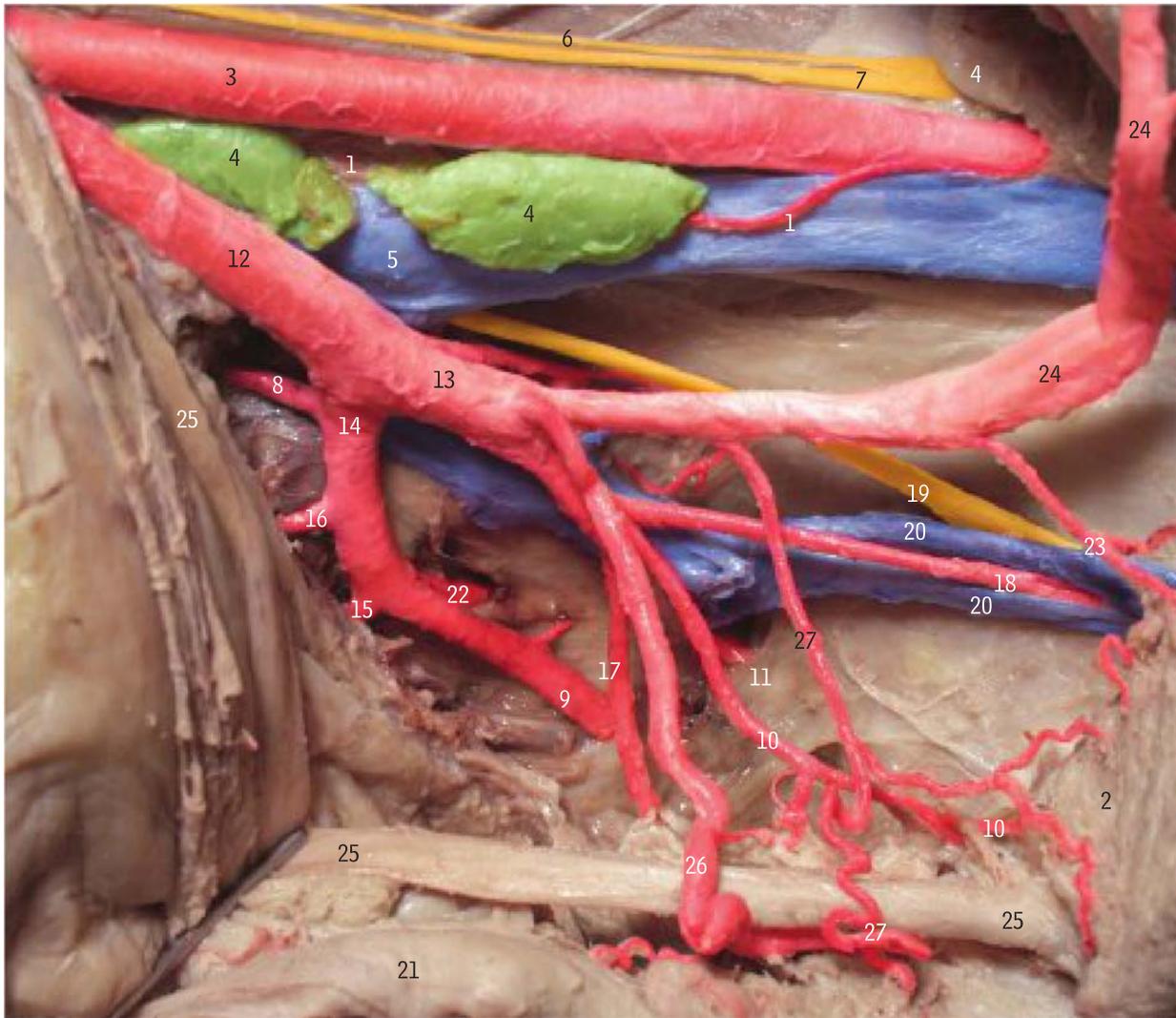
Left inferior hypogastric plexus *from the right*



In this view of the left side of the pelvis from the right, the right pelvic wall has been removed but the right levator ani (15) forming part of the pelvic floor (pelvic diaphragm) has been preserved and is seen from its right (perineal) side. Pelvic splanchnic nerves (12) arise from the ventral rami of the second and third sacral nerves (18 and 19) and contribute to the inferior hypogastric plexus (7).

- | | |
|--|---|
| 1 Arcuate line of ilium | 16 Superior gluteal artery |
| 2 Fascia overlying obturator internus | 17 Ventral ramus of first sacral nerve |
| 3 Ischial spine | 18 Ventral ramus of second sacral nerve |
| 4 Lateral surface of fascia overlying right obturator internus | 19 Ventral ramus of third sacral nerve |
| 5 Left coccygeus and nerves to levator ani | |
| 6 Left ductus deferens | |
| 7 Left inferior hypogastric plexus | |
| 8 Left levator ani | |
| 9 Left seminal vesicle | |
| 10 Lumbosacral trunk | |
| 11 Part of left sympathetic trunk | |
| 12 Pelvic splanchnic nerves (nervi erigentes) | |
| 13 Rectum | |
| 14 Right ischiopubic ramus | |
| 15 Right levator ani and ischio-anal (ischio-rectal) fossa | |

Internal iliac artery *branches and relationships, left side female pelvis*

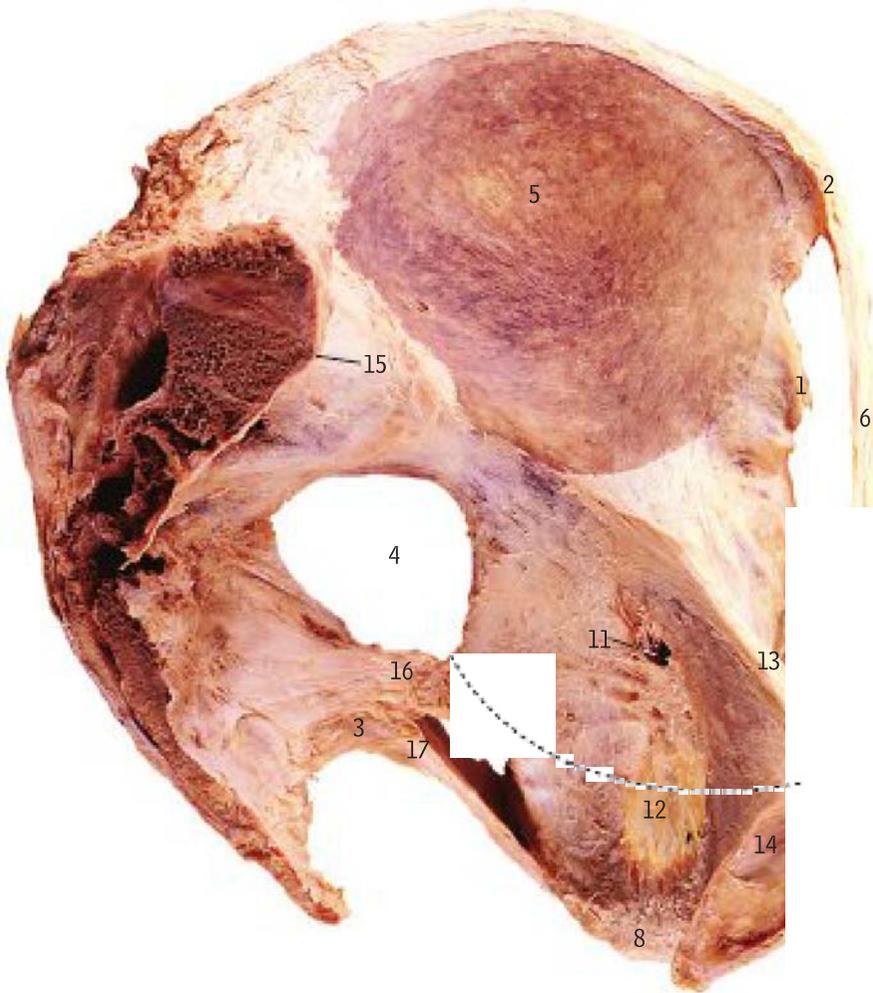


- | | | |
|--|---|--|
| 1 Artery to iliac nodes | 10 Inferior vesical artery | 19 Obturator nerve |
| 2 Bladder | 11 Internal pudendal artery | 20 Obturator veins |
| 3 External iliac artery | 12 Internal iliac artery | 21 Round ligament of the uterus (reflected) |
| 4 External iliac lymph nodes (enlarged) | 13 Internal iliac artery, anterior division | 22 Superior gluteal artery |
| 5 External iliac vein | 14 Internal iliac artery, posterior division | 23 Superior vesical artery |
| 6 Genitofemoral nerve, femoral branch | 15 Lateral sacral artery, inferior | 24 Umbilical artery remnant |
| 7 Genitofemoral nerve, genital branch | 16 Lateral sacral artery, superior | 25 Ureter (retracted) |
| 8 Iliolumbar artery | 17 Middle rectal artery | 26 Uterine artery |
| 9 Inferior gluteal artery | 18 Obturator artery | 27 Vaginal artery |



Internal iliac embolisation

Pelvic skeleton and ligaments *left side*



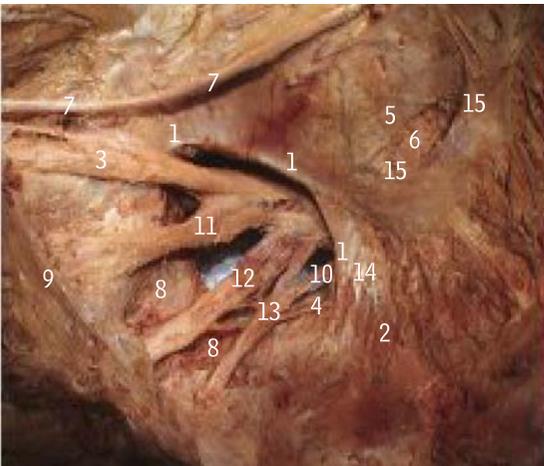
- 1 Anterior inferior iliac spine and origin of straight head of rectus femoris
- 2 Anterior superior iliac spine
- 3 Falciform process of sacrotuberous ligament
- 4 Greater sciatic foramen
- 5 Iliac fossa
- 6 Inguinal ligament
- 7 Ischial spine
- 8 Ischial tuberosity
- 9 Lacunar ligament
- 10 Lesser sciatic foramen
- 11 Obturator foramen with obturator nerve and vessels
- 12 Obturator membrane
- 13 Pectineal ligament
- 14 Pubic symphysis
- 15 Sacral promontory
- 16 Sacrospinous ligament
- 17 Sacrotuberous ligament



The ligaments classified as 'the ligaments of the pelvis' (vertebropelvic ligaments) are the sacrotuberous (17), sacrospinous (16) and iliolumbar (seen in the posterior view on page 334, C7).

The lacunar ligament (9) passes backwards from the medial end of the inguinal ligament (6) to the medial end of the pectineal line of the pubis, to which the pectineal ligament (13) is attached.

In this mid-sagittal section, viewed from slightly above the midline, most soft tissues except ligaments have been removed.



Greater sciatic foramen, sacral plexus and levator ani *left side*

- | | |
|--|---|
| <ol style="list-style-type: none"> 1 Greater sciatic foramen 2 Levator ani 3 Lumbosacral trunk (with S1) 4 Nerve to levator ani 5 Obturator internus fascia 6 Obturator internus muscle 7 Obturator nerve 8 Piriformis muscle fibres (muscle bulk removed) | <ol style="list-style-type: none"> 9 Anterior longitudinal ligament, overlying sacrum 10 Pudendal nerve 11 Sacral nerve, S2 12 Sacral nerve, S3 and S4 13 Sacral nerve, S5 14 Sacrospinous ligament 15 Tendinous arch of levator ani, an origin of levator ani |
|--|---|



Bone marrow aspiration

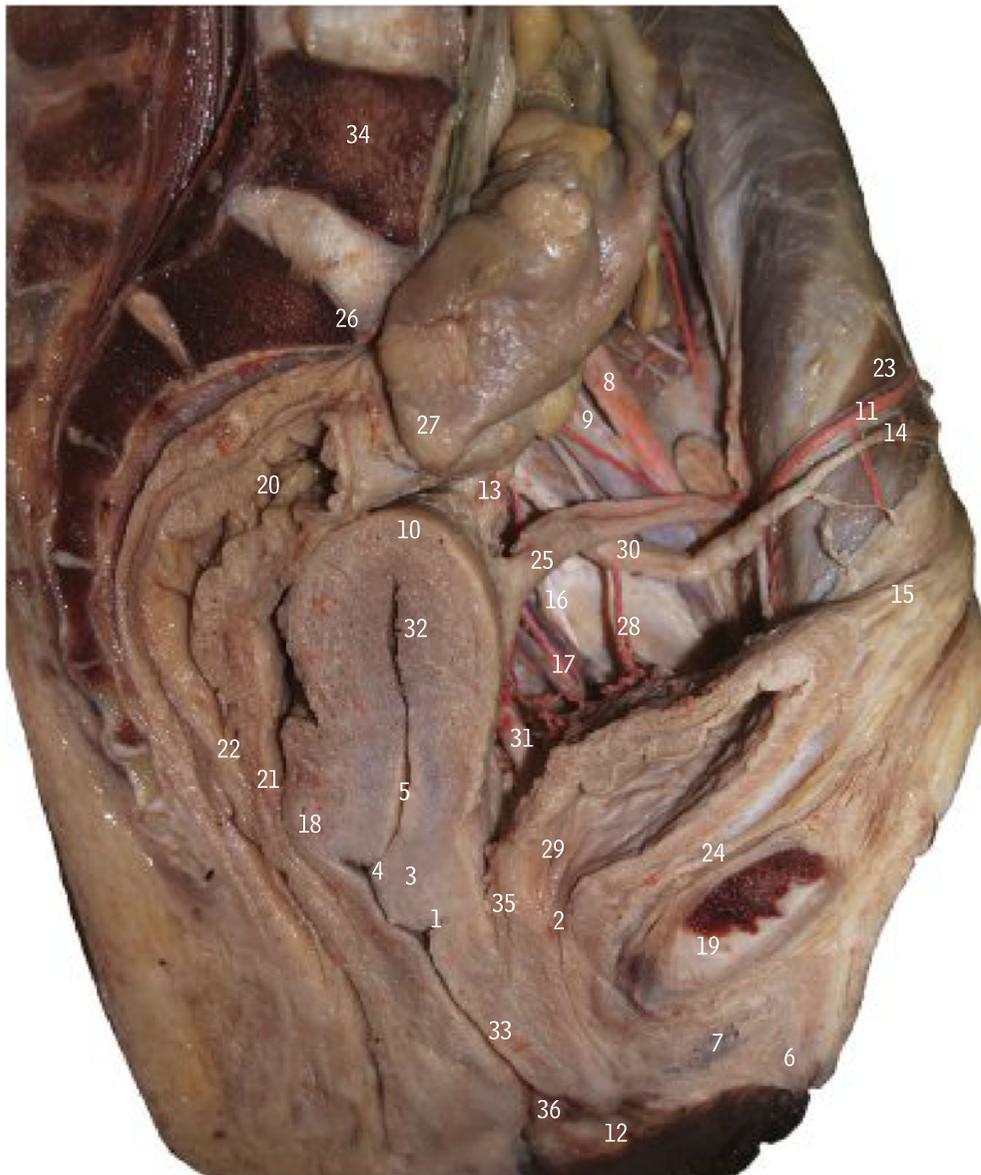


Obturator hernia



Sacral nerve stimulation

Female pelvis left half with arterial injection, viewed from right



- | | | |
|--------------------------------|--|-----------------------------------|
| 1 Anterior vaginal fornix | 15 Median umbilical ligament (urachus) | 28 Superior vesical artery |
| 2 Bladder neck | 16 Obturator nerve | 29 Trigone of bladder |
| 3 Cervix | 17 Obturator vessels | 30 Umbilical artery (remnant) |
| 4 Cervix, external os | 18 Posterior vaginal fornix | 31 Ureter |
| 5 Cervix, internal os | 19 Pubic symphysis | 32 Uterine cavity |
| 6 Clitoris | 20 Rectosigmoid junction | 33 Vagina |
| 7 Crus of clitoris | 21 Rectouterine peritoneal space | 34 Vertebral body, L5 |
| 8 External iliac artery | 22 Rectum | 35 Vesicouterine peritoneal pouch |
| 9 External iliac vein | 23 Rectus abdominis | 36 Vestibule of vagina |
| 10 Fundus of uterus | 24 Retropubic space | |
| 11 Inferior epigastric vessels | 25 Round ligament of uterus | |
| 12 Labium minus | 26 Sacral promontory | |
| 13 Ligament of ovary | 27 Sigmoid colon | |
| 14 Medial umbilical ligament | | |

NB: retroverted uterus – a common normal variant.



Faecal continence



Haemorrhoids



Ligation-uterine tubes



Rectal (PR) examination



Rectal prolapse



Uterine fibroids

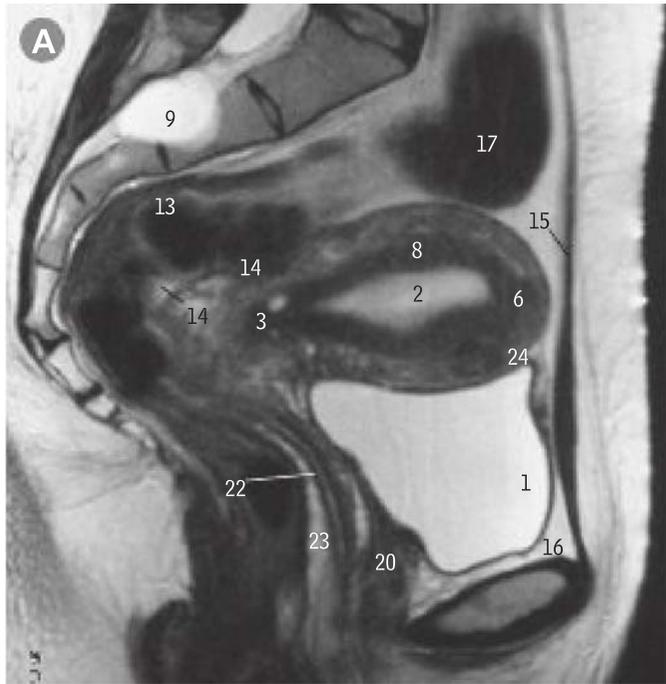


Uterine variants

Female pelvis

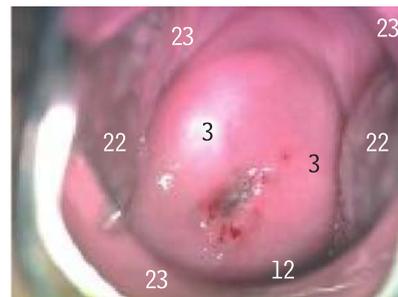
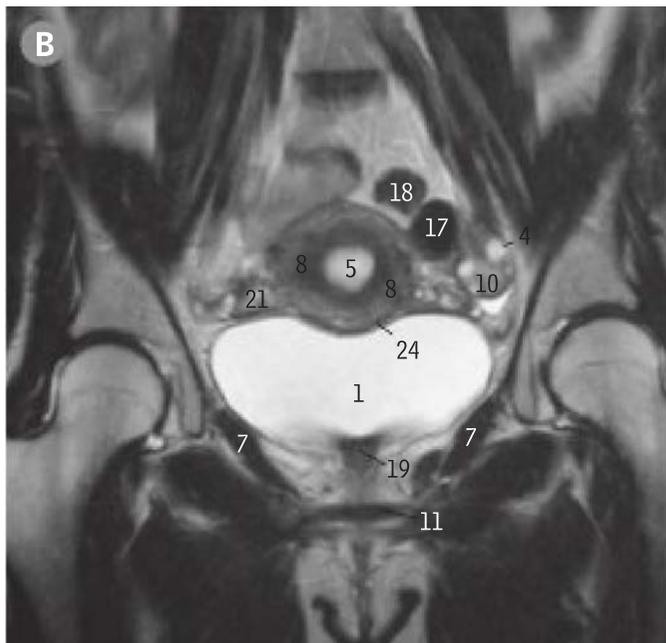
sagittal MR image during menstruation

coronal MR image



- 1 Bladder
- 2 Blood clot in endometrial cavity
- 3 Cervix of uterus
- 4 Corpus luteum
- 5 Endometrial cavity
- 6 Fundus of uterus
- 7 Levator ani
- 8 Myometrium
- 9 Nerve root cyst (Tarlov)
- 10 Ovary
- 11 Perineal muscles
- 12 Posterior fornix of vagina
- 13 Rectosigmoid junction
- 14 Recto-uterine pouch (Douglas)
- 15 Rectus abdominis muscle
- 16 Retropubic space (Retzius)
- 17 Sigmoid colon
- 18 Small intestine
- 19 Trigone
- 20 Urethra
- 21 Uterine (Fallopian) tube
- 22 Vaginal cavity
- 23 Vaginal wall
- 24 Vesico-uterine pouch

Looking down into the pelvis from the front, the fundus of the uterus (6) overlies the bladder (1) with the peritoneum of the vesico-uterine pouch (24) intervening. These relationships are seen in this MR image B.



Speculum examination of cervix



Cervical smear



Cystitis



Ovarian dermoid

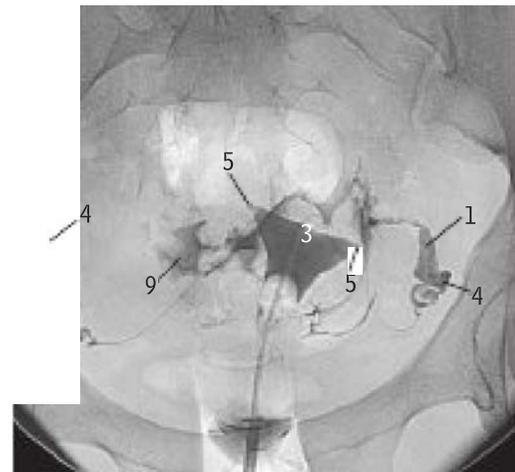
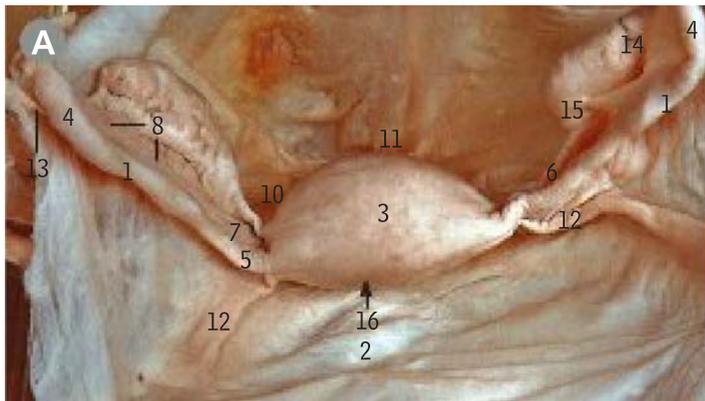


Vaginal examination

Female pelvis

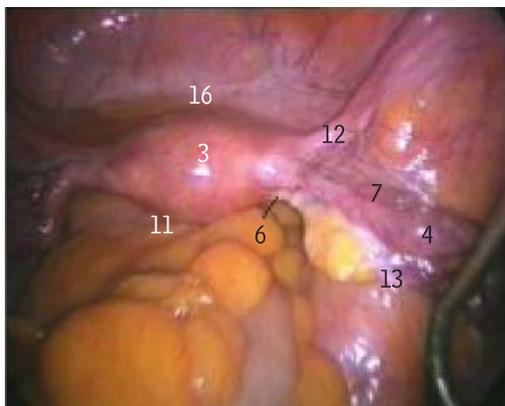
uterus and ovaries, from above and in front

hysterosalpingogram



- | | |
|--|--|
| 1 Ampulla of uterine tube | 10 Posterior surface of broad ligament |
| 2 Bladder | 11 Recto-uterine space |
| 3 Fundus of uterus | 12 Round ligament of uterus |
| 4 Infundibulum of uterine tube | 13 Suspensory ligament of ovary with ovarian vessels |
| 5 Isthmus of uterine tube | 14 Tubal extremity of ovary |
| 6 Ligament of ovary | 15 Uterine extremity of ovary |
| 7 Mesosalpinx | 16 Vesico-uterine pouch |
| 8 Mesovarium | |
| 9 Overspill of contrast into the peritoneal cavity | |

Looking down into the pelvis from the front in A, the fundus of the uterus (3) overlies the bladder (2) with the peritoneum of the vesico-uterine pouch (16) intervening. In B, contrast medium has filled the uterus and tubes (3, 5, 1 and 4) and spilled out into the peritoneal cavity (9).



Laparoscopic view of female pelvis



Hysteroscopic view of uterine cavity and uterine tubes



Acute salpingitis



Carcinoma of the ovary



Ectopic pregnancy rupture

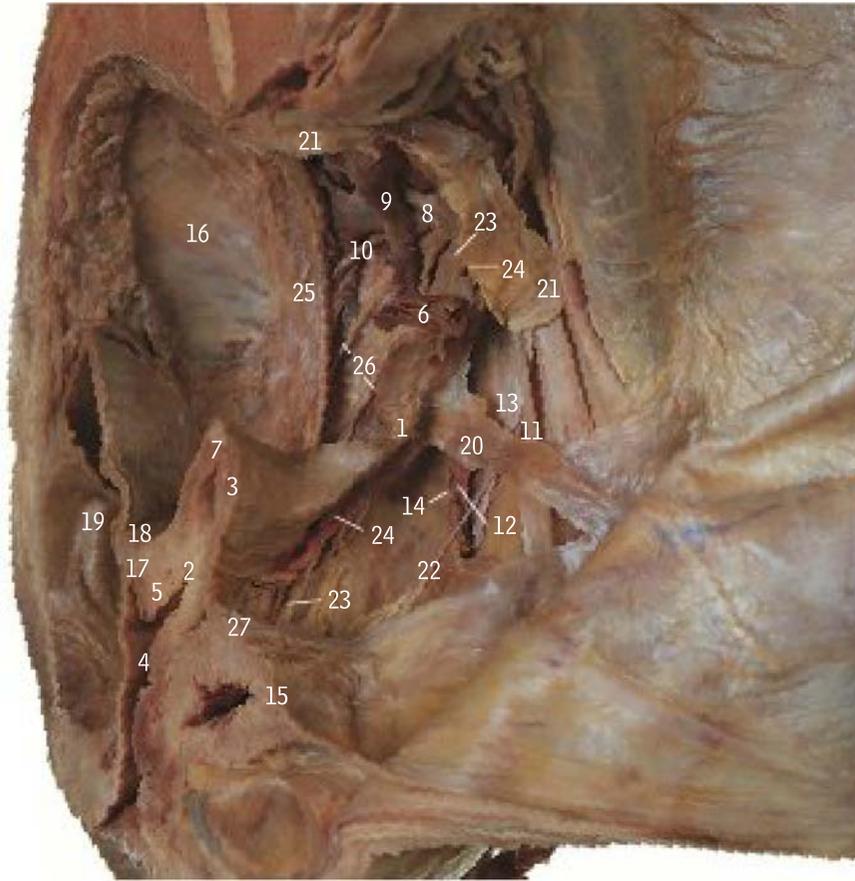


Intrauterine contraceptive devices (IUCDs)

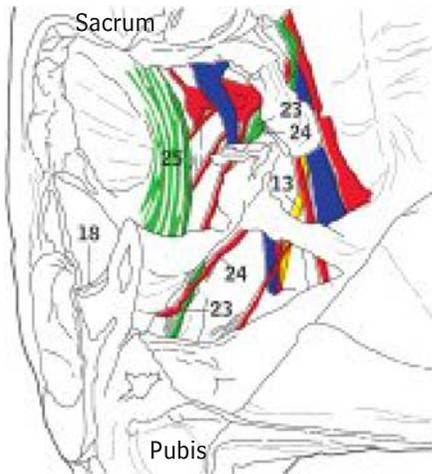


Ligation-uterine tubes

Female pelvis *left half, obliquely from the front*



- 1 Ampulla of uterine tube
- 2 Anterior fornix of vagina
- 3 Body of uterus
- 4 Cavity of vagina
- 5 Cervix of uterus
- 6 Fimbriated end of uterine tube
- 7 Fundus of uterus
- 8 Internal iliac artery
- 9 Internal iliac vein
- 10 Middle rectal artery
- 11 Obliterated umbilical artery
- 12 Obturator artery
- 13 Obturator nerve
- 14 Obturator vein
- 15 Peritoneum overlying bladder
- 16 Peritoneum overlying piriformis
- 17 Posterior fornix of vagina
- 18 Recto-uterine pouch
- 19 Rectum
- 20 Round ligament of uterus
- 21 Sigmoid mesocolon
- 22 Superior vesical artery
- 23 Ureter
- 24 Uterine artery
- 25 Uterosacral ligament
- 26 Vaginal artery (double)
- 27 Vesico-uterine pouch



Looking obliquely into the left half of the pelvis from the front, with the anterior abdominal wall turned forwards, the peritoneum of the vesico-uterine pouch (27) has been incised and the uterus (3) displaced backwards. This shows the ureter (23) running towards the bladder and being crossed by the uterine artery (24). The uterosacral ligament (25) passes backwards at the side of the rectum (19) towards the pelvic surface of the sacrum. The root of the sigmoid mesocolon (21) has been left in place to emphasise that the left ureter (23) passes from the abdomen into the pelvis beneath it.



Anorectal abscesses



Carcinoma of the uterus



Hysterectomy

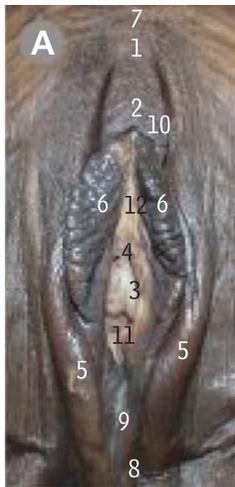


Support of the pelvic viscera



Unsafe abortion

Female perineum *surface features*



- | | |
|---|---|
| 1 Anterior commissure of labia majora | 7 Mons pubis |
| 2 Clitoris | 8 Perineal body |
| 3 Cystocele (prolapse of bladder) | 9 Posterior commissure of labia majora |
| 4 External urethral orifice (urinary meatus) | 10 Prepuce of clitoris |
| 5 Labium majus | 11 Vaginal orifice (introitus) |
| 6 Labium minus | 12 Vestibule |

ischio-anal fossae from behind

- | | | |
|------------------------------------|--|--|
| 1 Anal margin | 12 Ischial tuberosity | 22 Quadratus femoris |
| 2 Anococcygeal body | 13 Ischio-anal fossa, fat removed | 23 Sacrotuberous ligament |
| 3 Biceps femoris, long head | 14 Levator ani | 24 Sacrum |
| 4 Coccyx | 15 Obturator internus and fascia | 25 Sciatic nerve |
| 5 External anal sphincter | 16 Obturator internus tendon | 26 Semimembranosus and semitendinosus |
| 6 Gluteal maximus | 17 Piriformis | 27 Superficial transverse perineal muscle |
| 7 Gluteus medius | 18 Posterior femoral cutaneous nerve, perineal branch | 28 Superior gluteal artery |
| 8 Gracilis | 19 Posterior labial nerve | |
| 9 Inferior gemellus | 20 Pudendal artery (internal) | |
| 10 Inferior gluteal artery | 21 Pudendal nerve | |
| 11 Inferior rectal nerve | | |



The ischiorectal fossa is now properly and more correctly called the ischio-anal fossa; the anal canal, not the rectum, is its lower medial boundary. The walls and contents are similar in both sexes.



Bartholin's abscess



Episiotomy

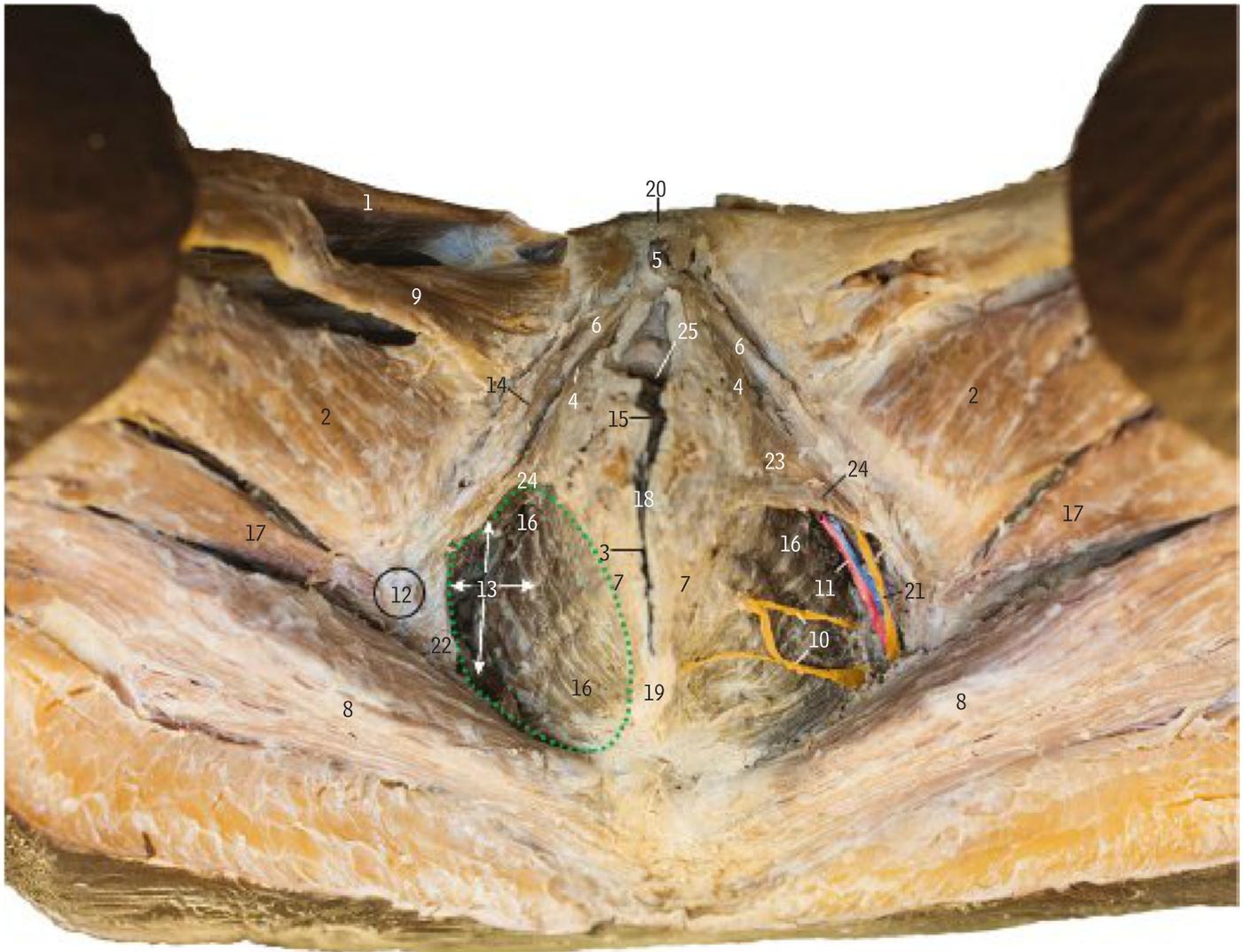


Female genital circumcision (FGM)



Pudendal block

Female perineum and ischio-anal fossae *from below* (*lithotomy position*)



- 1 Adductor longus muscle
- 2 Adductor magnus muscle
- 3 Anal opening
- 4 Bulbospongiosus muscle
- 5 Clitoris (transected)
- 6 Crus of the clitoris
- 7 External anal sphincter
- 8 Gluteus maximus
- 9 Gracilis

- 10 Inferior rectal nerve branches
- 11 Internal pudendal artery and vein
- 12 Ischial tuberosity
- 13 Ischio-anal fossa (dotted)
- 14 Ischiocavernosus muscle
- 15 Labium minus
- 16 Levator ani muscle
- 17 Long head of biceps femoris and semitendinosus muscles

- 18 Perineal body
- 19 Perineal raphe
- 20 Pubic symphysis
- 21 Pudendal nerve
- 22 Sacrotuberous ligament
- 23 Site of perineal membrane (removed)
- 24 Superficial transverse perineal muscle
- 25 Vestibule of vagina (space between labia minora)



Gartner's duct cyst in vaginal wall

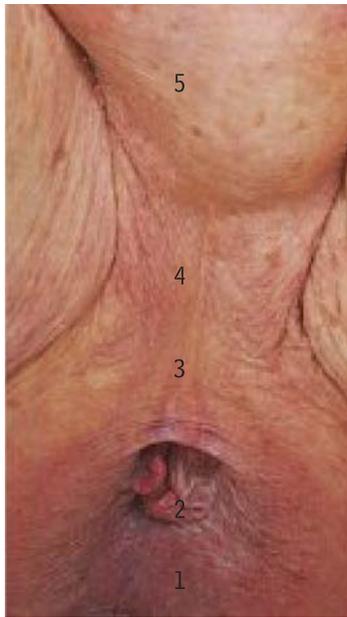


Genital ambiguous development



Ischioanal fossa abscess

Male perineum



The central area is shown, with the scrotum (5) pulled upwards and forwards.

- 1 Anococcygeal body
- 2 Margin of anus, with skin tags
- 3 Perineal body
- 4 Raphe overlying bulb of penis
- 5 Scrotum overlying right testis

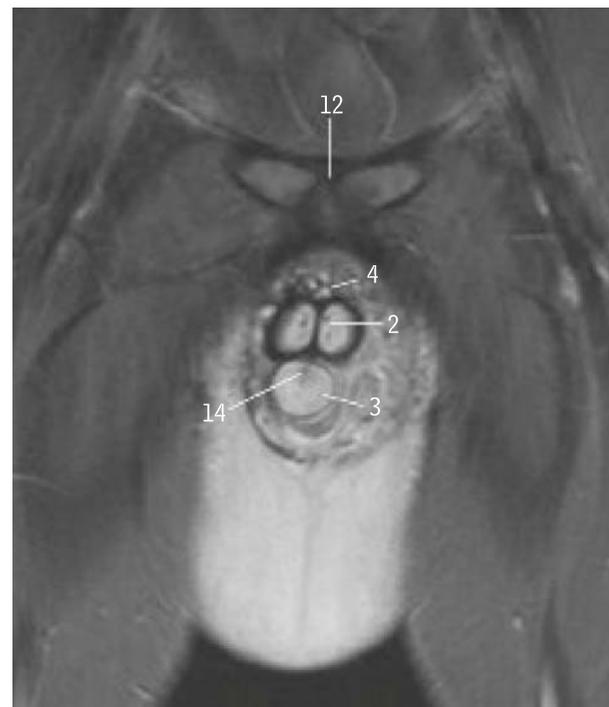
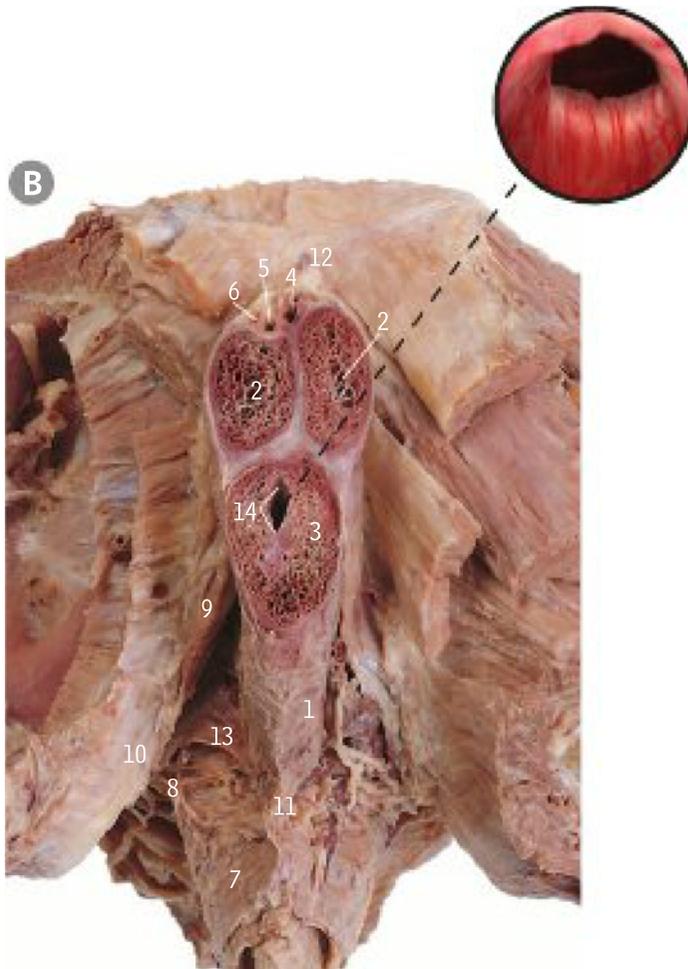
Skin tags are often the remnants of previous haemorrhoids.

Root of the penis from below and in front

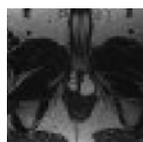
The front part of the penis has been removed to show the root, formed by the two corpora cavernosa dorsally (2) and the single corpus spongiosum ventrally (3) containing the urethra (14).

- 1 Bulbospongiosus
- 2 Corpus cavernosum
- 3 Corpus spongiosum
- 4 Deep dorsal vein of penis
- 5 Dorsal artery of penis
- 6 Dorsal nerve of penis
- 7 External anal sphincter
- 8 Inferior rectal vessels and nerve crossing ischio-anal fossa
- 9 Ischiocavernosus
- 10 Ischiopubic ramus
- 11 Perineal body
- 12 Pubic symphysis
- 13 Superficial transverse perineal muscle overlying perineal membrane
- 14 Urethra

Cytoscopic view of urethra



MR, penis



Bulbourethral glands



Carcinoma of the anus



Hydrocele

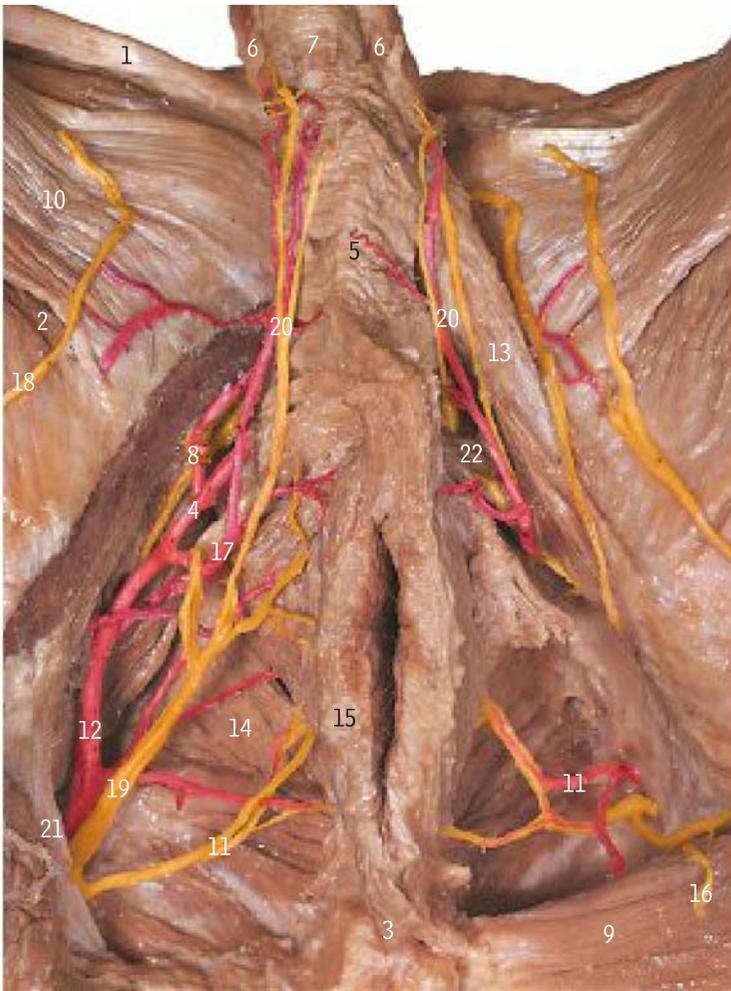


Hypospadias



Imperforate anus

Male perineum and ischio-anal (ischio-rectal) fossae from below

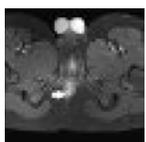
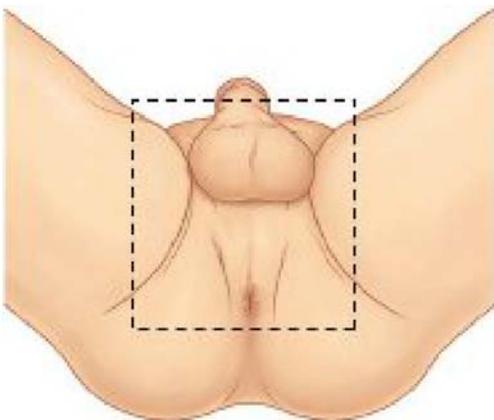


All the fat has been removed from the ischio-anal fossae so that a clear view is obtained of the perineal surface of levator ani (14) and of the vessels and nerves within the fossae. On the left side (right of the picture) the perineal membrane (22) is intact but on the right side it, and the underlying muscle (urogenital diaphragm), have been removed.

- 1 Adductor longus
- 2 Adductor magnus
- 3 Anococcygeal body
- 4 Artery to bulb
- 5 Bulbospongiosus overlying bulb of penis
- 6 Corpus cavernosum of penis
- 7 Corpus spongiosum of penis
- 8 Dorsal nerve and artery of penis
- 9 Gluteus maximus
- 10 Gracilis
- 11 Inferior rectal vessels and nerve in ischio-anal fossa
- 12 Internal pudendal artery
- 13 Ischiocavernosus overlying crus of penis
- 14 Levator ani
- 15 Margin of anus
- 16 Perforating cutaneous nerve
- 17 Perineal artery
- 18 Perineal branch of posterior femoral cutaneous nerve
- 19 Perineal nerve
- 20 Posterior scrotal vessels and nerves
- 21 Sacrotuberous ligament
- 22 Superficial transverse perineal muscle overlying posterior border of perineal membrane

In both sexes, the ischio-anal (ischio-rectal) fossa has the pudendal canal in its lateral wall. The canal has been opened up to display its contents: the internal pudendal artery (12) and the terminal branches of the pudendal nerve – the perineal nerve (19) and the dorsal nerve of the penis (8) or clitoris.

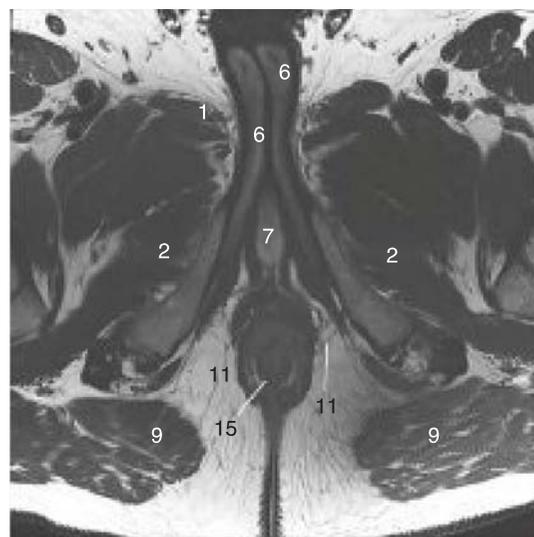
Lithotomy position



Perianal fistula



Priapism



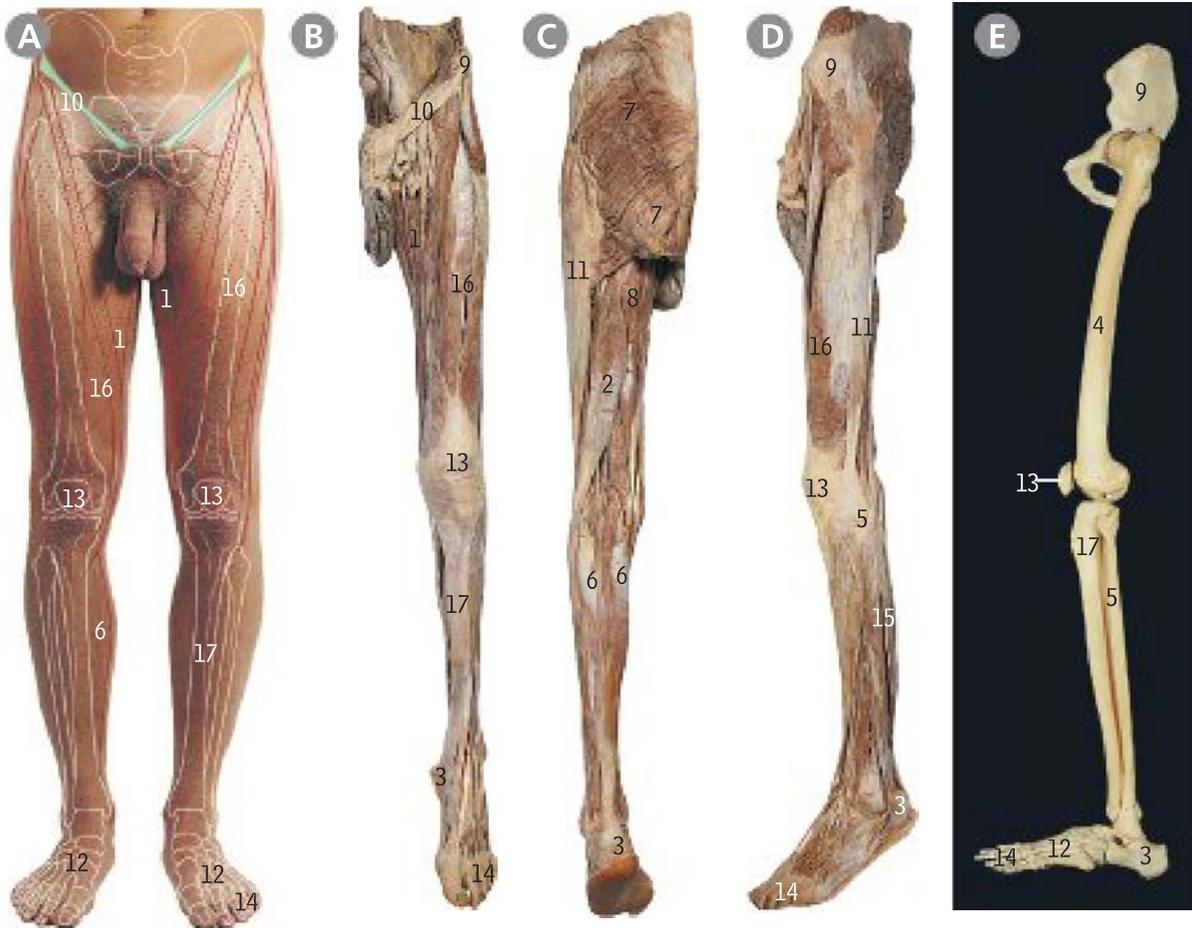
Axial MRI, urogenital triangle

Lower limb

6

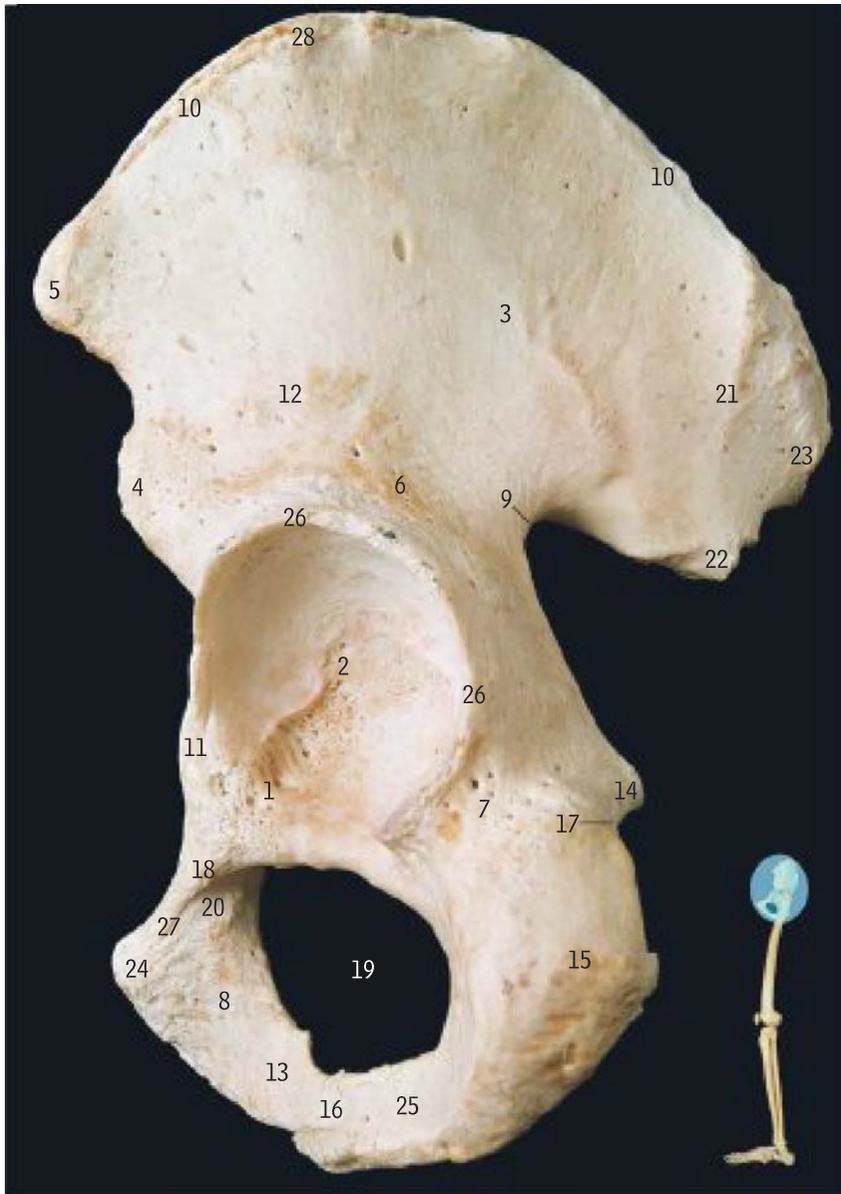


Lower limb *surface anatomy, from the front*
dissection, from the front *dissection, from behind*
dissection, from the lateral side *skeleton, from the lateral side*



- | | | | | |
|-------------------------|--------------------------|-----------------------------|-----------------------------|--------------------------------|
| 1 Adductors | 5 Fibula | 9 Hip bone | 12 Metatarsal bones | 15 Peroneus (fibularis) |
| 2 Biceps femoris | 6 Gastrocnemius | 10 Inguinal ligament | 13 Patella | 16 Quadriceps |
| 3 Calcaneus | 7 Gluteus maximus | 11 Iliotibial tract | 14 Phalanges of toes | 17 Tibia |
| 4 Femur | 8 Hamstrings | | | |

Left hip bone *lateral surface*



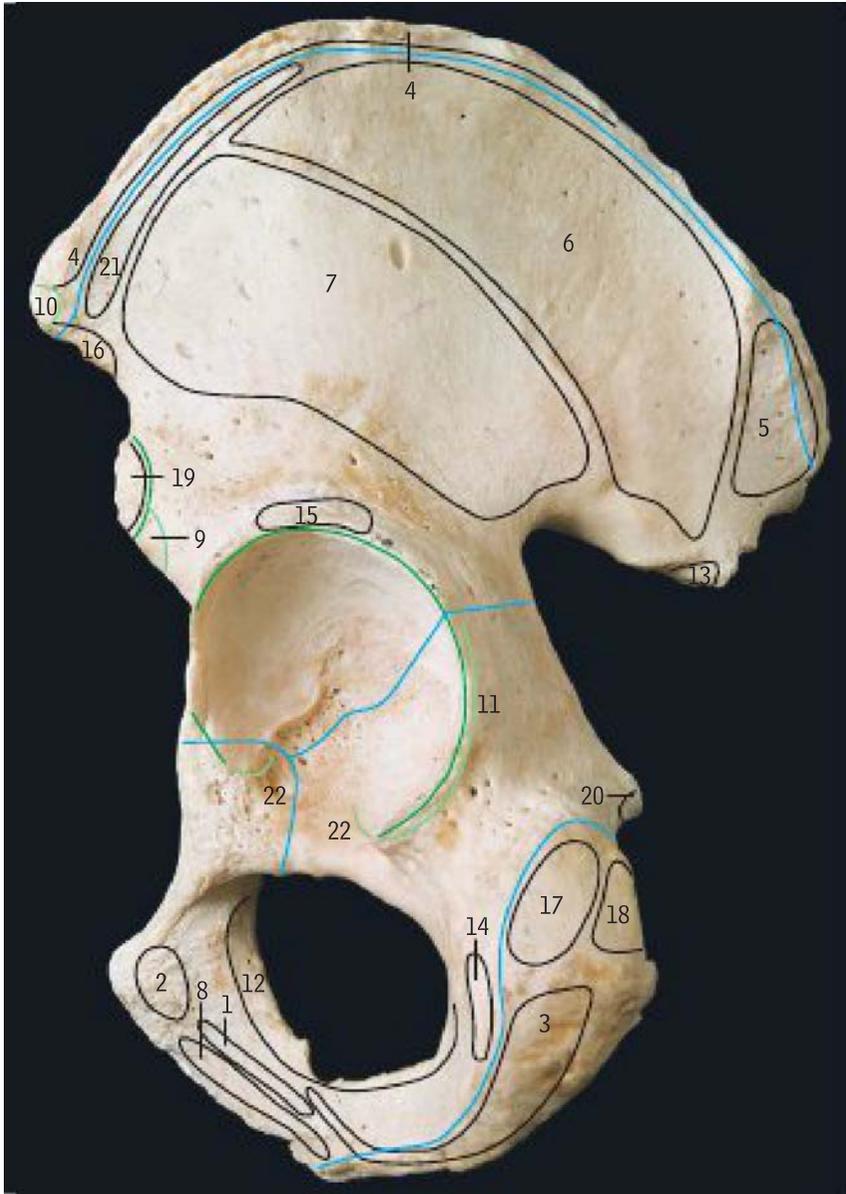
- 1 Acetabular notch
- 2 Acetabulum
- 3 Anterior gluteal line
- 4 Anterior inferior iliac spine
- 5 Anterior superior iliac spine
- 6 Body of ilium
- 7 Body of ischium
- 8 Body of pubis
- 9 Greater sciatic notch
- 10 Iliac crest
- 11 Iliopubic eminence
- 12 Inferior gluteal line
- 13 Inferior ramus of pubis
- 14 Ischial spine
- 15 Ischial tuberosity
- 16 Joint between 25 and 13
- 17 Lesser sciatic notch
- 18 Obturator crest
- 19 Obturator foramen
- 20 Obturator groove
- 21 Posterior gluteal line
- 22 Posterior inferior iliac spine
- 23 Posterior superior iliac spine
- 24 Pubic tubercle
- 25 Ramus of ischium
- 26 Rim of acetabulum
- 27 Superior ramus of pubis
- 28 Tubercle of iliac crest

The hip (innominate) bone is formed by the union of the ilium (6), ischium (7) and pubis (8).

The two hip bones articulate in the midline anteriorly at the pubic symphysis; posteriorly they are separated by the sacrum, forming the sacro-iliac joints. The two hip bones with the sacrum and coccyx constitute the pelvis (see [page 96](#)).



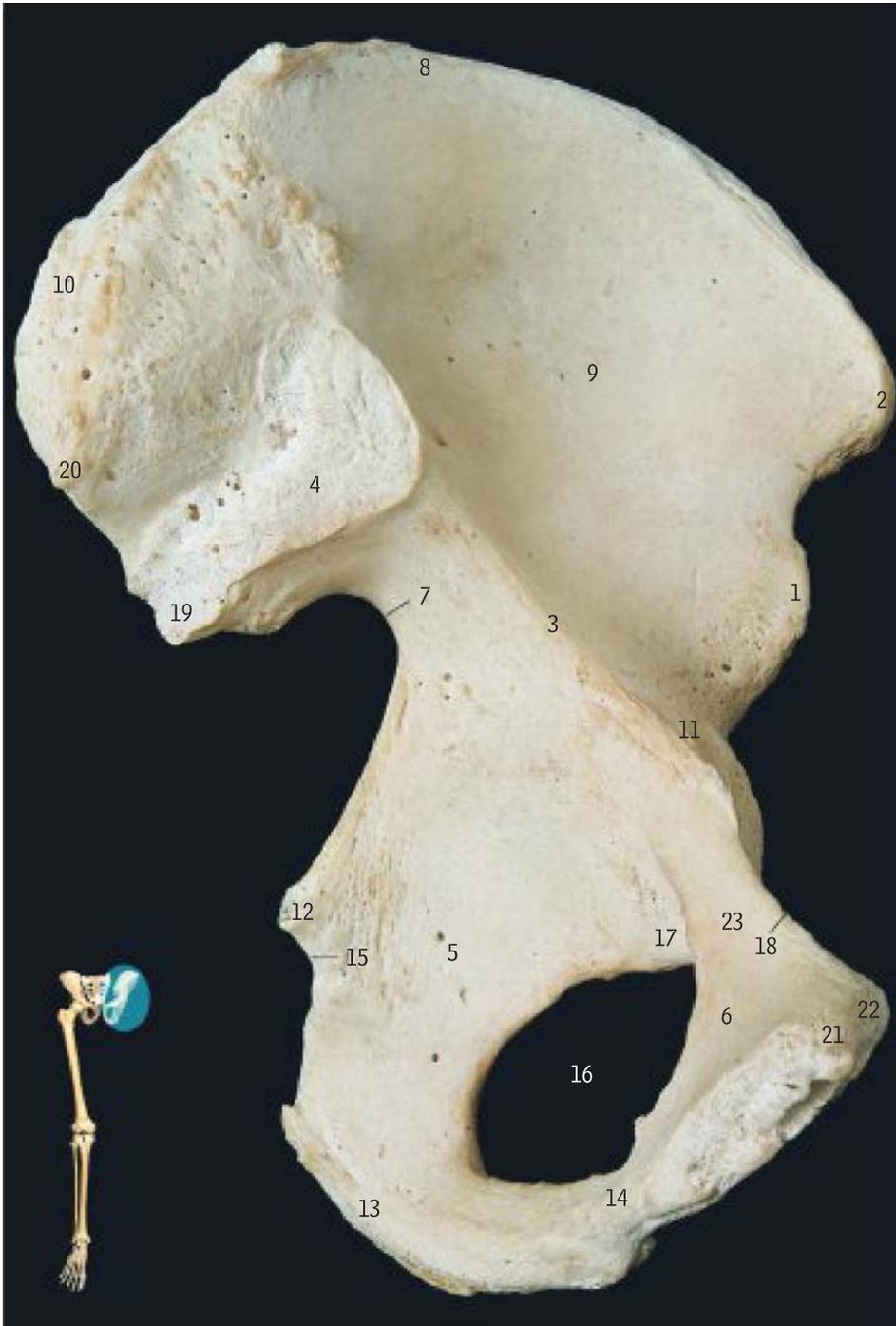
Left hip bone *attachments, lateral surface*



Blue lines, epiphysial lines
 Green lines, capsular attachment
 of hip joint
 Pale green lines, ligament attachments

- 1 Adductor brevis
- 2 Adductor longus
- 3 Adductor magnus
- 4 External oblique
- 5 Gluteus maximus
- 6 Gluteus medius
- 7 Gluteus minimus
- 8 Gracilis
- 9 Iliofemoral ligament
- 10 Inguinal ligament
- 11 Ischiofemoral ligament
- 12 Obturator externus
- 13 Piriformis
- 14 Quadratus femoris
- 15 Reflected head of rectus femoris
- 16 Sartorius
- 17 Semimembranosus
- 18 Semitendinosus and long head of biceps femoris
- 19 Straight head of rectus femoris
- 20 Superior gemellus
- 21 Tensor fasciae latae
- 22 Transverse ligament

Left hip bone *medial surface*



- 1 Anterior inferior iliac spine
- 2 Anterior superior iliac spine
- 3 Arcuate line
- 4 Auricular surface
- 5 Body of ischium
- 6 Body of pubis
- 7 Greater sciatic notch
- 8 Iliac crest
- 9 Iliac fossa
- 10 Iliac tuberosity
- 11 Iliopubic eminence
- 12 Ischial spine
- 13 Ischial tuberosity
- 14 Ischiopubic ramus
- 15 Lesser sciatic notch
- 16 Obturator foramen
- 17 Obturator groove
- 18 Pecten of pubis (pectineal line)
- 19 Posterior inferior iliac spine
- 20 Posterior superior iliac spine
- 21 Pubic crest
- 22 Pubic tubercle
- 23 Superior ramus of pubis

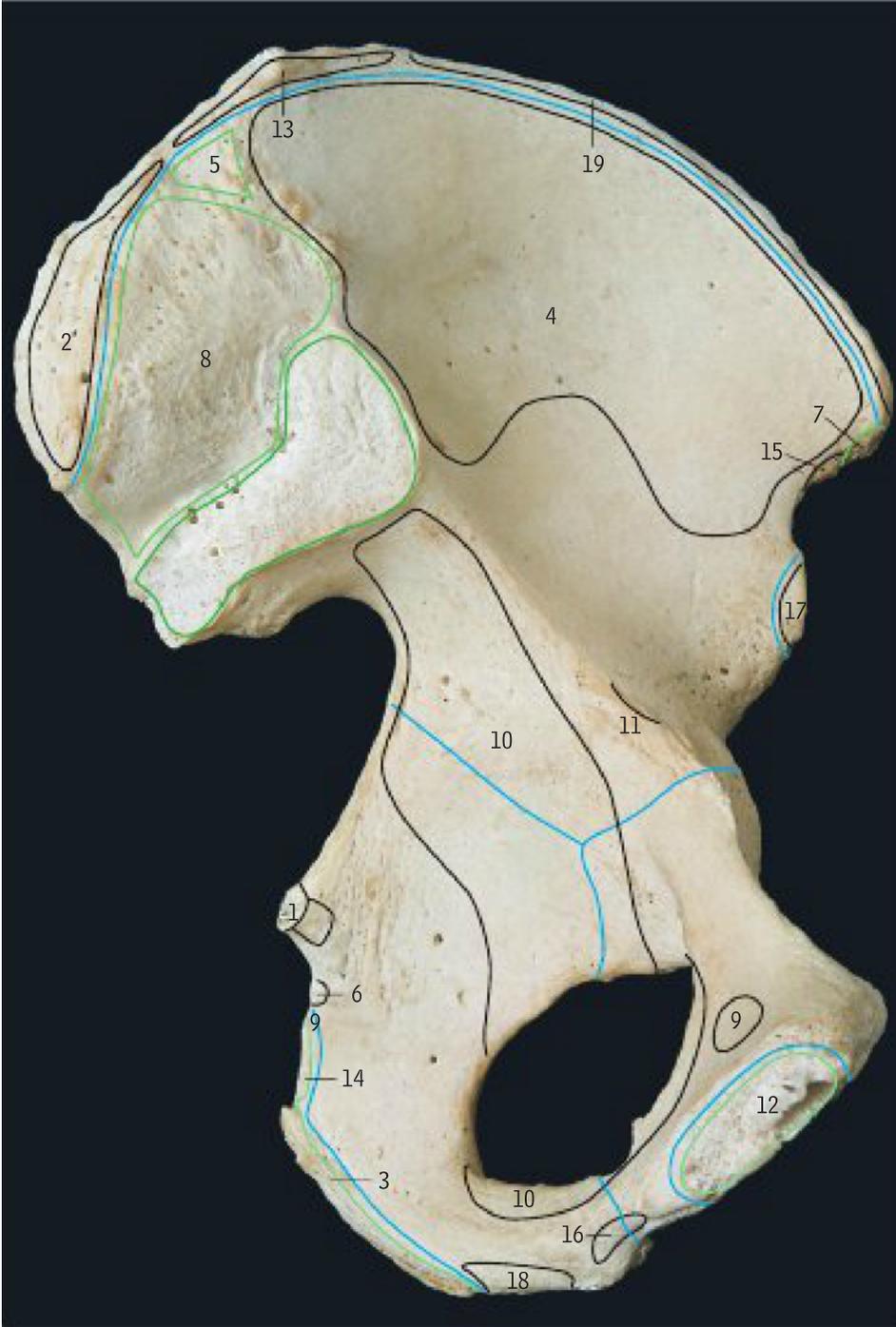
The auricular surface of the ilium (4) is the articular surface for the sacro-iliac joint.

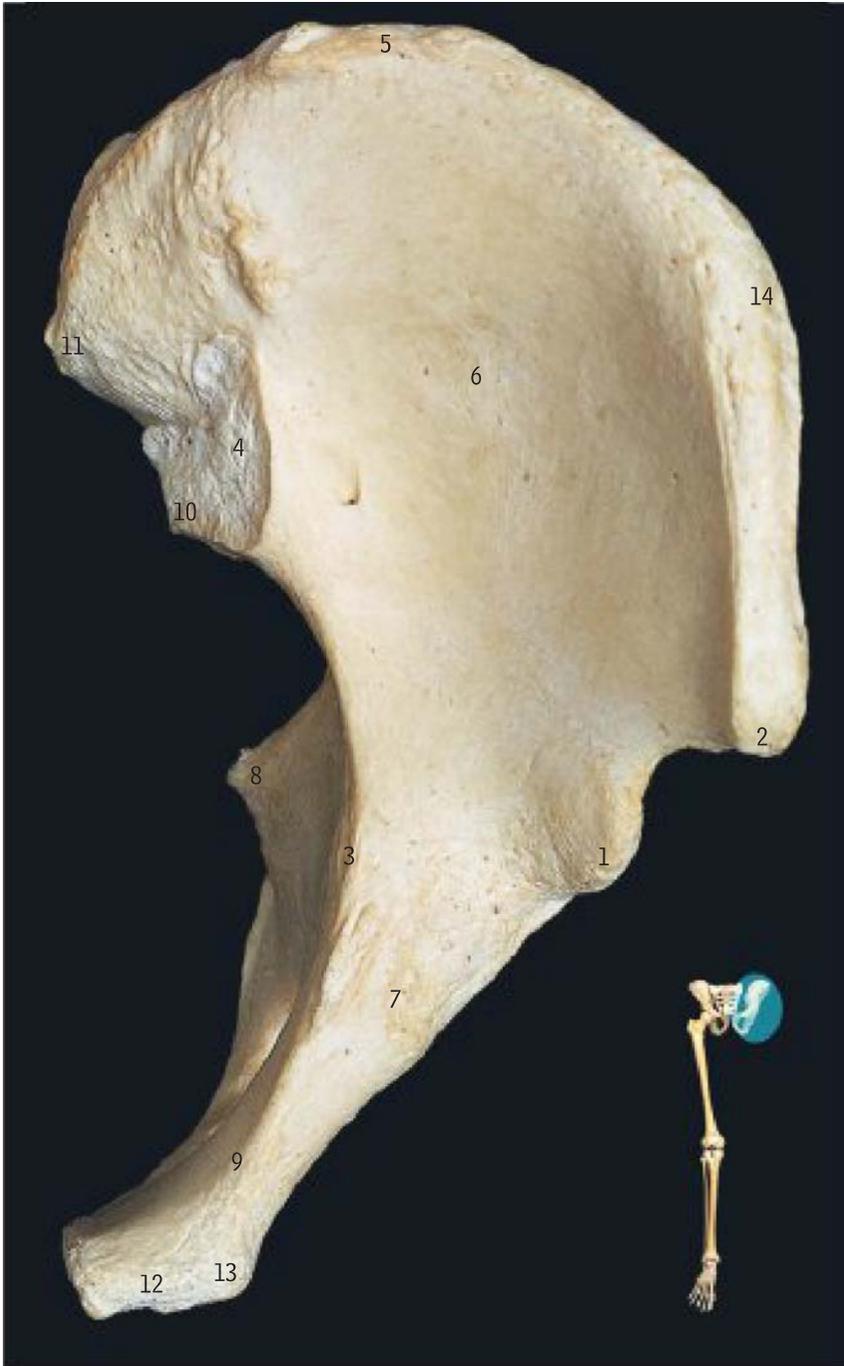
The greater sciatic notch (7) is more hooked (J-shaped) in the male, whereas the female notch is more right-angled (L-shaped).

Left hip bone *attachments, medial surface*

Blue lines, epiphysial lines
 Green line, capsular attachment
 of sacro-iliac joint
 Pale green lines, ligament
 attachments

- 1** Coccygeus and sacrospinous ligament
- 2** Erector spinae
- 3** Falciform process of sacrotuberous ligament
- 4** Iliacus
- 5** Iliolumbar ligament
- 6** Inferior gemellus
- 7** Inguinal ligament
- 8** Interosseous sacro-iliac ligament
- 9** Levator ani
- 10** Obturator internus
- 11** Psoas minor
- 12** Pubic symphysis
- 13** Quadratus lumborum
- 14** Sacrotuberous ligament
- 15** Sartorius
- 16** Sphincter urethrae
- 17** Straight head of rectus femoris
- 18** Superficial transverse perineal and ischiocavernosus
- 19** Transversus abdominis



Left hip bone *from above*

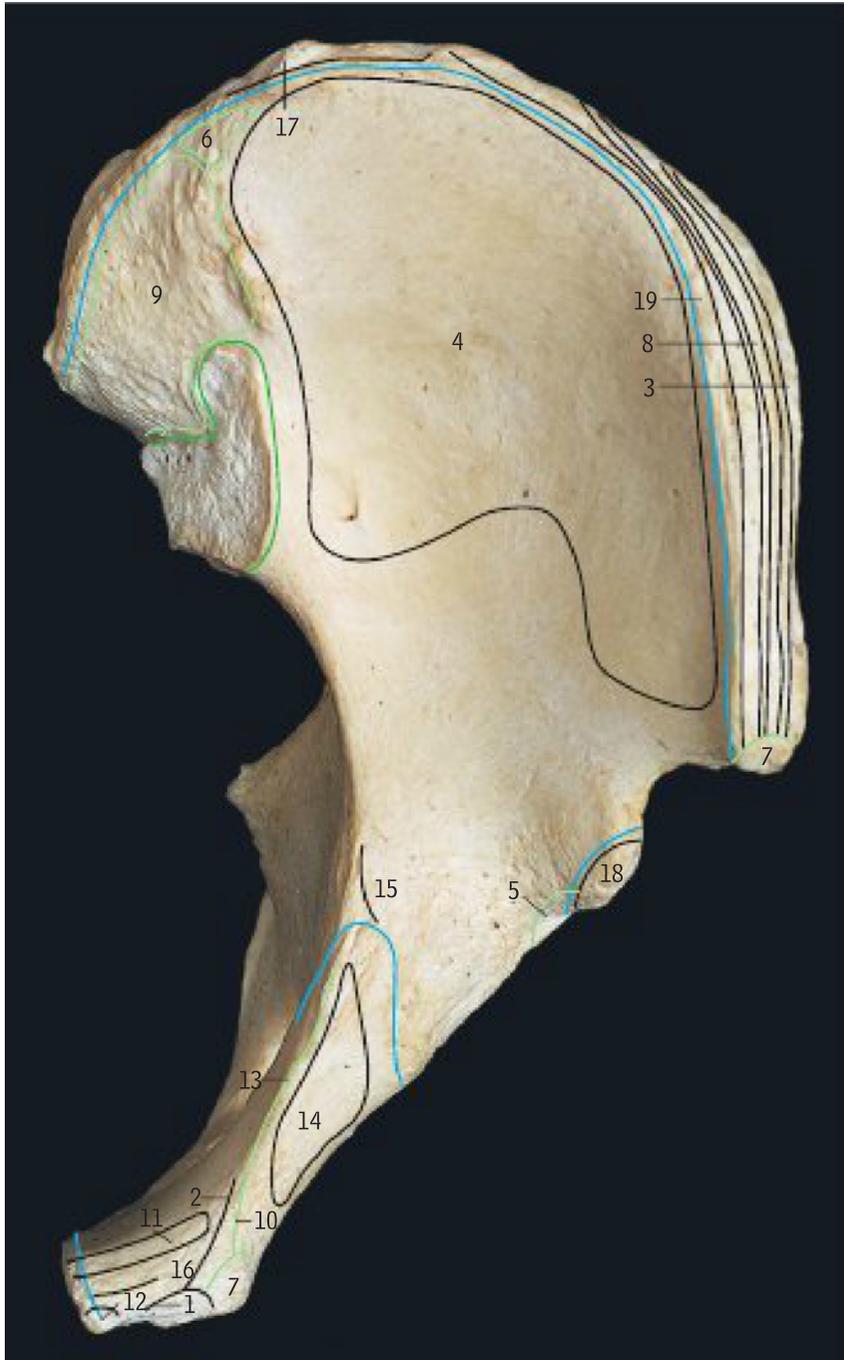
- 1 Anterior inferior iliac spine
- 2 Anterior superior iliac spine
- 3 Arcuate line
- 4 Auricular surface
- 5 Iliac crest
- 6 Iliac fossa
- 7 Iliopubic eminence
- 8 Ischial spine
- 9 Pecten of pubis (pectineal line)
- 10 Posterior inferior iliac spine
- 11 Posterior superior iliac spine
- 12 Pubic crest
- 13 Pubic tubercle
- 14 Tubercle of iliac crest

The arcuate line on the ilium (3) and the pecten and crest of the pubis (9 and 12) form part of the brim of the pelvis (the rest of the brim being formed by the promontory and upper surface of the lateral part of the sacrum – see [pages 94 and 96](#)).

The pecten of the pubis (9) is more commonly called the pectineal line.



Left hip bone attachments, from above



Blue lines, epiphysial lines
 Green line, capsular attachment of sacro-iliac joint
 Pale green lines, ligament attachments

- 1 Anterior wall of rectus sheath
- 2 Conjoint tendon
- 3 External oblique
- 4 Iliacus
- 5 Iliofemoral ligament
- 6 Iliolumbar ligament
- 7 Inguinal ligament
- 8 Internal oblique
- 9 Interosseous sacro-iliac ligament
- 10 Lacunar ligament
- 11 Lateral head of rectus abdominis
- 12 Medial head of rectus abdominis
- 13 Pectineal ligament
- 14 Pectineus
- 15 Psoas minor
- 16 Pyramidalis
- 17 Quadratus lumborum
- 18 Straight head of rectus femoris
- 19 Transversus abdominis

The inguinal ligament (7) is formed by the lower border of the aponeurosis of the external oblique muscle, and extends from the anterior superior iliac spine to the pubic tubercle.

The lacunar ligament (10, sometimes called the pectineal part of the inguinal ligament) is the part of the inguinal ligament that extends backwards from the medial end of the inguinal ligament to the pecten of the pubis.

The pectineal ligament (13) is the lateral extension of the lacunar ligament along the pecten. It is not classified as a part of the inguinal ligament, and must not be confused with the alternative name for the lacunar ligament, i.e. with the pectineal part of the inguinal ligament.

The conjoint tendon (2) is formed by the aponeuroses of the internal oblique and transversus muscles, and is attached to the pubic crest and the adjoining part of the pecten, blending medially with the anterior wall of the rectus sheath.



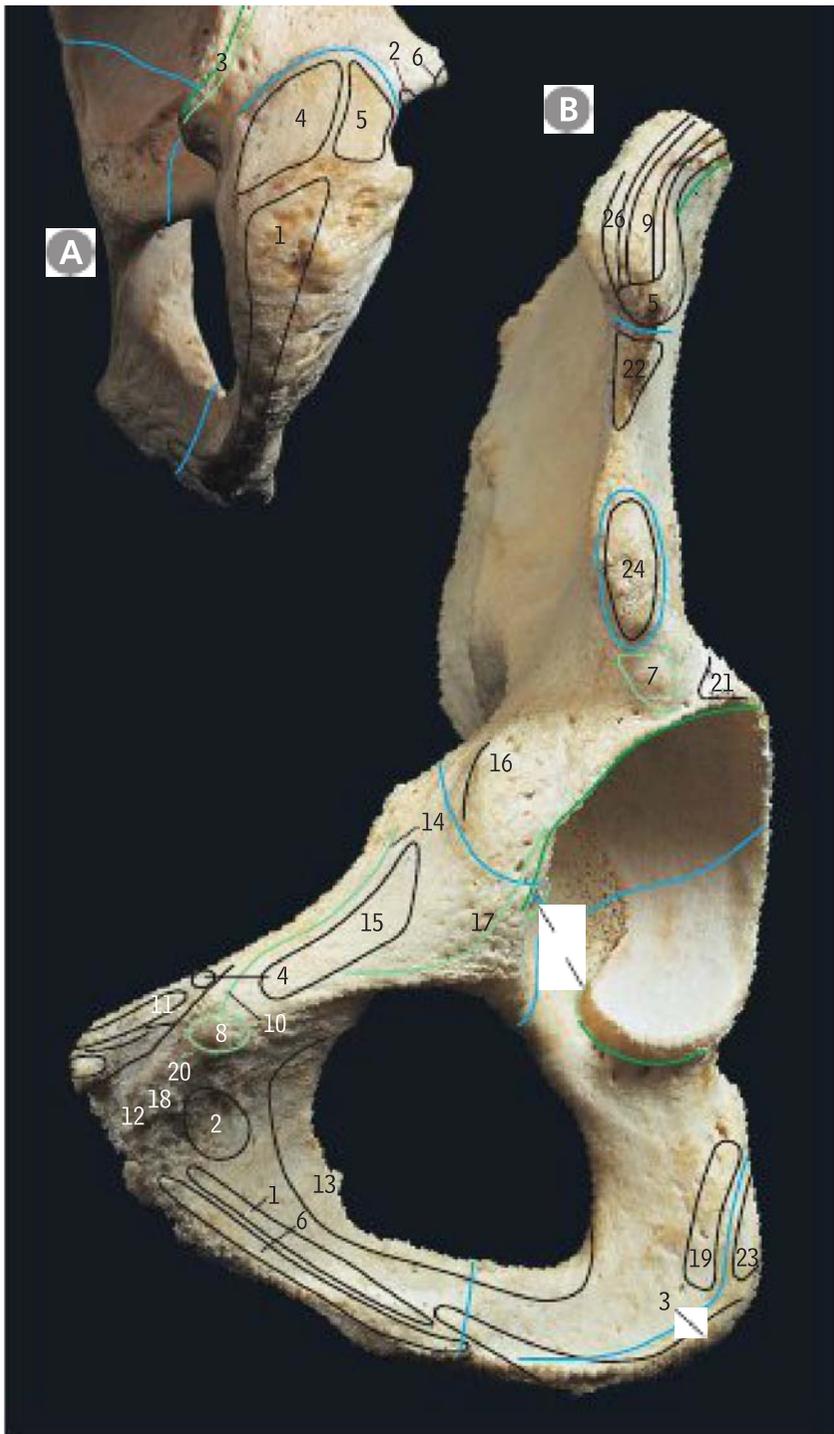
Left hip bone
ischial tuberosity, from behind and below

- 1 Acetabular notch
- 2 Acetabulum
- 3 Ischial spine
- 4 Ischiopubic ramus
- 5 Lesser sciatic notch
- 6 Longitudinal ridge
- 7 Lower part of tuberosity
- 8 Obturator groove
- 9 Rim of acetabulum
- 10 Transverse ridge
- 11 Upper part of tuberosity

Left hip bone
from the front

- 1 Acetabular notch
- 2 Anterior inferior iliac spine
- 3 Anterior superior iliac spine
- 4 Body of pubis
- 5 Iliac fossa
- 6 Iliopubic eminence
- 7 Ischial tuberosity
- 8 Ischiopubic ramus
- 9 Obturator crest
- 10 Obturator foramen
- 11 Obturator groove
- 12 Pecten of pubis (pectineal line)
- 13 Pubic crest
- 14 Pubic tubercle
- 15 Rim of acetabulum
- 16 Tubercle of iliac crest





Left hip bone attachments, ischial tuberosity, from behind and below

Blue lines, epiphysial lines
Green line, capsular attachment of hip
joint
Pale green lines, ligament attachments

- 1 Adductor magnus
- 2 Inferior gemellus
- 3 Ischiofemoral ligament
- 4 Semimembranosus
- 5 Semitendinosus and long head of biceps femoris
- 6 Superior gemellus

The area on the ischial tuberosity medial to the adductor magnus attachment (1) is covered by fibrofatty tissue and the ischial bursa underlying gluteus maximus.

Left hip bone attachments, from the front

Blue lines, epiphysial lines
Green line, capsular attachment of hip
joint
Pale green lines, ligament attachments

- 1 Adductor brevis
- 2 Adductor longus
- 3 Adductor magnus
- 4 Conjoint tendon
- 5 External oblique and inguinal ligament
- 6 Gracilis
- 7 Iliofemoral ligament
- 8 Inguinal ligament
- 9 Internal oblique
- 10 Lacunar ligament
- 11 Lateral head of rectus abdominis
- 12 Medial head of rectus abdominis
- 13 Obturator externus
- 14 Pectineal ligament
- 15 Pectineus
- 16 Psoas minor
- 17 Pubofemoral ligament
- 18 Pyramidalis
- 19 Quadratus femoris
- 20 Rectus sheath
- 21 Reflected head of rectus femoris
- 22 Sartorius
- 23 Semimembranosus
- 24 Straight head of rectus femoris
- 25 Transverse ligament
- 26 Transversus abdominis

Left femur *upper end*



from the front

from the medial side

- 1 Fovea of head
- 2 Greater trochanter
- 3 Head
- 4 Intertrochanteric line
- 5 Lesser trochanter
- 6 Neck
- 7 Pectineal line
- 8 Quadrate tubercle on intertrochanteric crest
- 9 Shaft
- 10 Spiral line
- 11 Trochanteric fossa

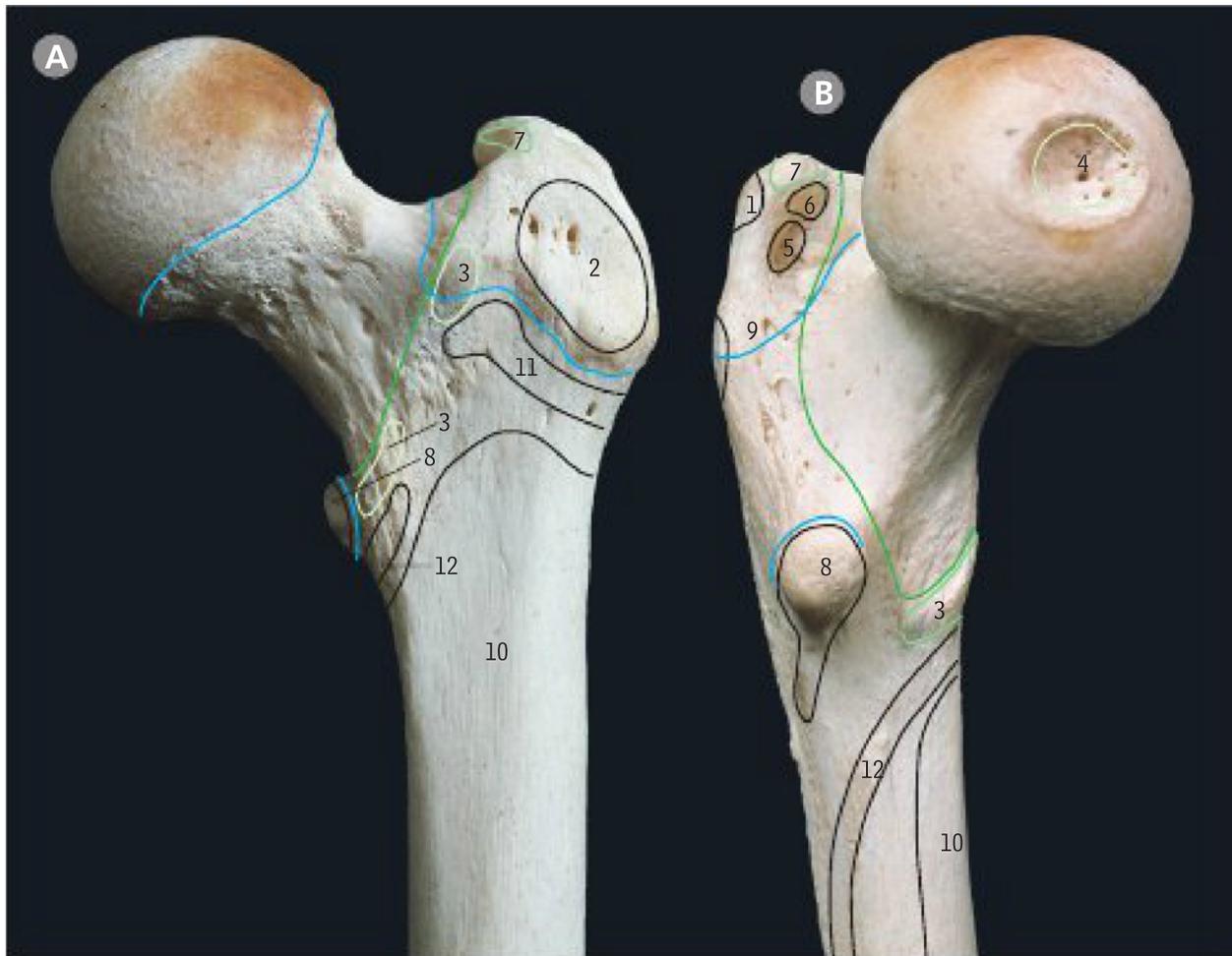
The intertrochanteric *line* (4) is at the junction of the neck (6) and shaft (9) on the anterior surface; the intertrochanteric *crest* is in a similar position on the posterior surface (8, and [page 304, A5](#)).

The neck makes an angle with the shaft of about 125° in an adult.

The pectineal line of the femur (7) must not be confused with the pectineal line (pecten) of the pubis (9, [page 298](#)), nor with the spiral line of the femur (10) which is usually more prominent than the pectineal line.



Avulsion fractures

Left femur *attachments, upper end*

from the front

from the medial side

Blue lines, epiphysial lines
Green line, capsular
attachment of hip joint
Pale green lines, ligament
attachments

- 1 Gluteus medius
- 2 Gluteus minimus
- 3 Iliofemoral ligament
- 4 Ligament of head of femur
- 5 Obturator externus
- 6 Obturator internus and gemelli
- 7 Piriformis
- 8 Psoas major and iliacus
- 9 Quadratus femoris
- 10 Vastus intermedius
- 11 Vastus lateralis
- 12 Vastus medialis

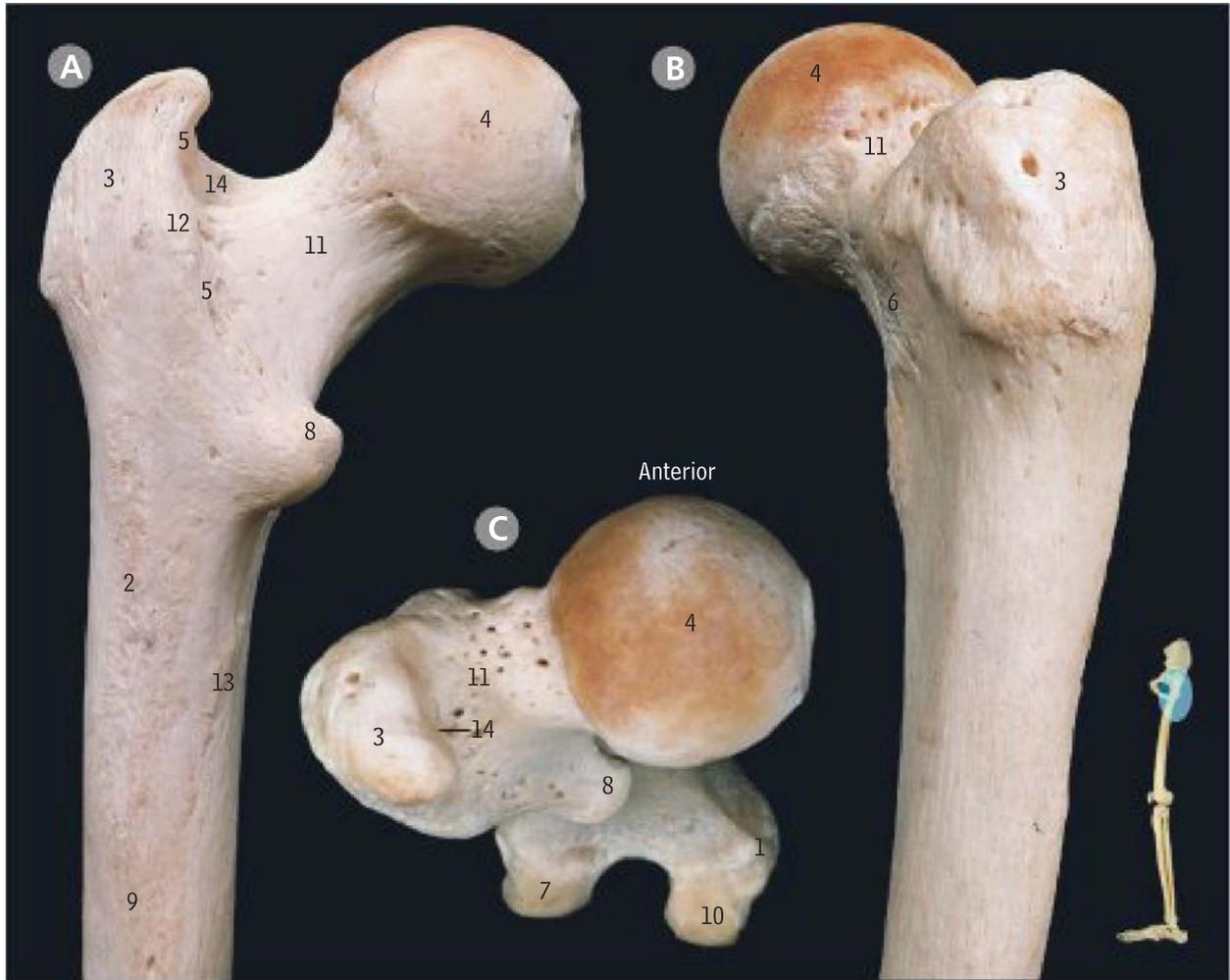
The iliofemoral ligament has the shape of an inverted V, with the stem attached to the anterior inferior iliac spine of the hip bone (page 301, B7), and the lateral and medial bands attached to the upper (lateral) and lower (medial) ends of the intertrochanteric line (page 304, 6), blending with the capsule of the hip joint.

The tendon of psoas major is attached to the lesser trochanter (page 304, 8); many of the muscle fibres of iliacus are inserted into the psoas tendon but some reach the femur below the trochanter.



Intertrochanteric
fracture – femur

Left femur *upper end*



from behind

from the lateral side

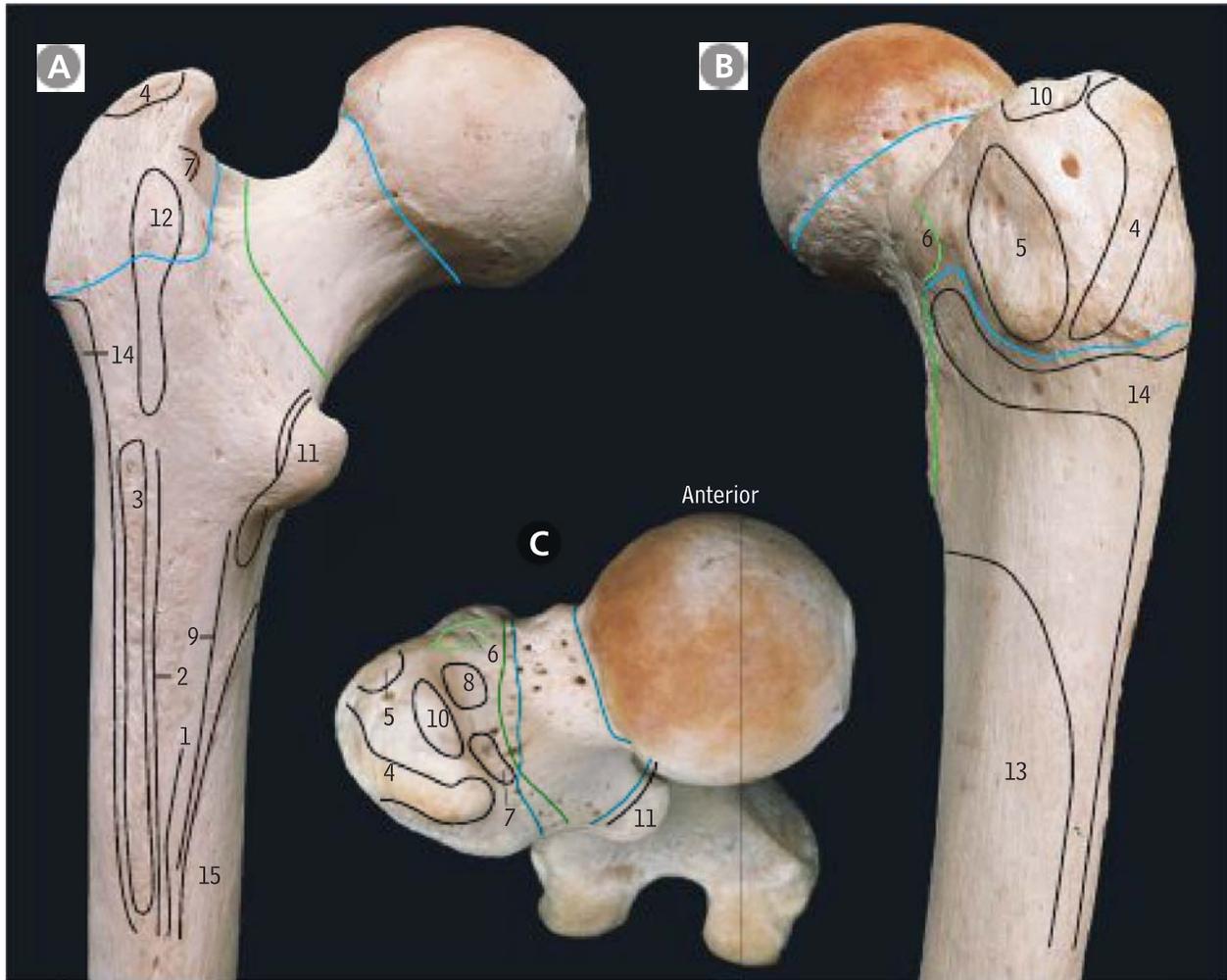
from above

- | | |
|---|---------------------------------------|
| 1 Adductor tubercle at lower end | 8 Lesser trochanter |
| 2 Gluteal tuberosity | 9 Linea aspera |
| 3 Greater trochanter | 10 Medial condyle at lower end |
| 4 Head | 11 Neck |
| 5 Intertrochanteric crest | 12 Quadrate tubercle |
| 6 Intertrochanteric line | 13 Spiral line |
| 7 Lateral condyle at lower end | 14 Trochanteric fossa |

The neck of the femur passes forwards as well as upwards and medially (C11), making an angle of about 15° (in the adult) with the transverse axis of the lower end (the angle of femoral torsion or femoral anteversion).
The lesser trochanter (8) projects backwards and medially.



Fracture – femoral neck



from behind

from the lateral side

from above

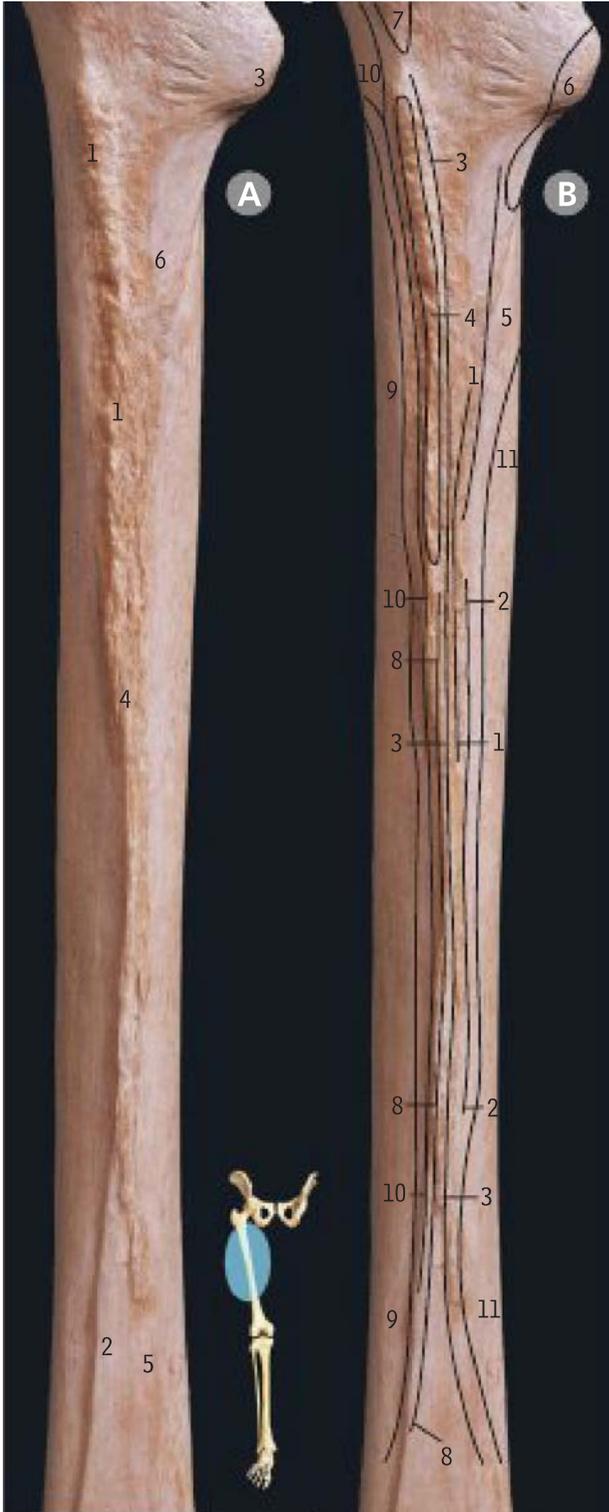
Blue lines, epiphysial lines
Green line, capsular attachment of hip joint
Pale green lines, ligament attachments

- | | |
|---|--|
| <ul style="list-style-type: none"> 1 Adductor brevis 2 Adductor magnus 3 Gluteus maximus 4 Gluteus medius 5 Gluteus minimus 6 Iliofemoral ligament (lateral band) 7 Obturator externus 8 Obturator internus and gemelli | <ul style="list-style-type: none"> 9 Pectineus 10 Piriformis 11 Psoas major and iliacus 12 Quadratus femoris 13 Vastus intermedius 14 Vastus lateralis 15 Vastus medialis |
|---|--|

On the front of the femur (page 303) the capsule of the hip joint is attached to the intertrochanteric line, but at the back the capsule is attached to the neck of the femur and does not extend as far laterally as the intertrochanteric crest (page 304, A5).



Exostoses
femoral spurs



Left femur shaft, from behind

- | | |
|------------------------------|-----------------------------|
| 1 Gluteal tuberosity | 4 Linea aspera |
| 2 Lateral supracondylar line | 5 Medial supracondylar line |
| 3 Lesser trochanter | 6 Pectineal line |

The rough linea aspera (4) often shows distinct medial and lateral lips; the lateral lip continues upwards as the gluteal tuberosity (1).

Left femur attachments, shaft, from behind

- | | |
|---------------------------|--------------------------------|
| 1 Adductor brevis | 7 Quadratus femoris |
| 2 Adductor longus | 8 Short head of biceps femoris |
| 3 Adductor magnus | 9 Vastus intermedius |
| 4 Gluteus maximus | 10 Vastus lateralis |
| 5 Pectineus | 11 Vastus medialis |
| 6 Psoas major and iliacus | |

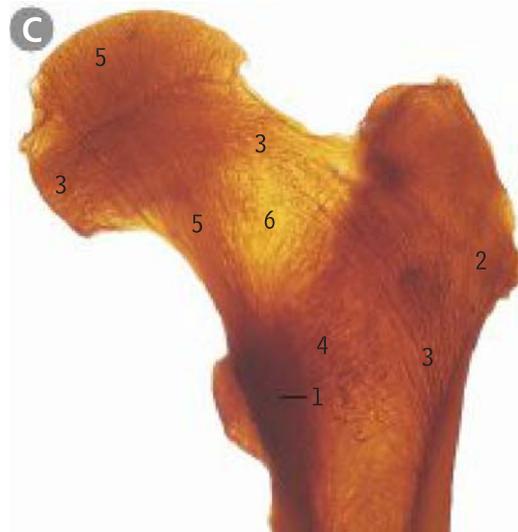
For diagrammatic clarity, the muscle attachments to the linea aspera have been slightly separated.

Left femur upper end, from the front

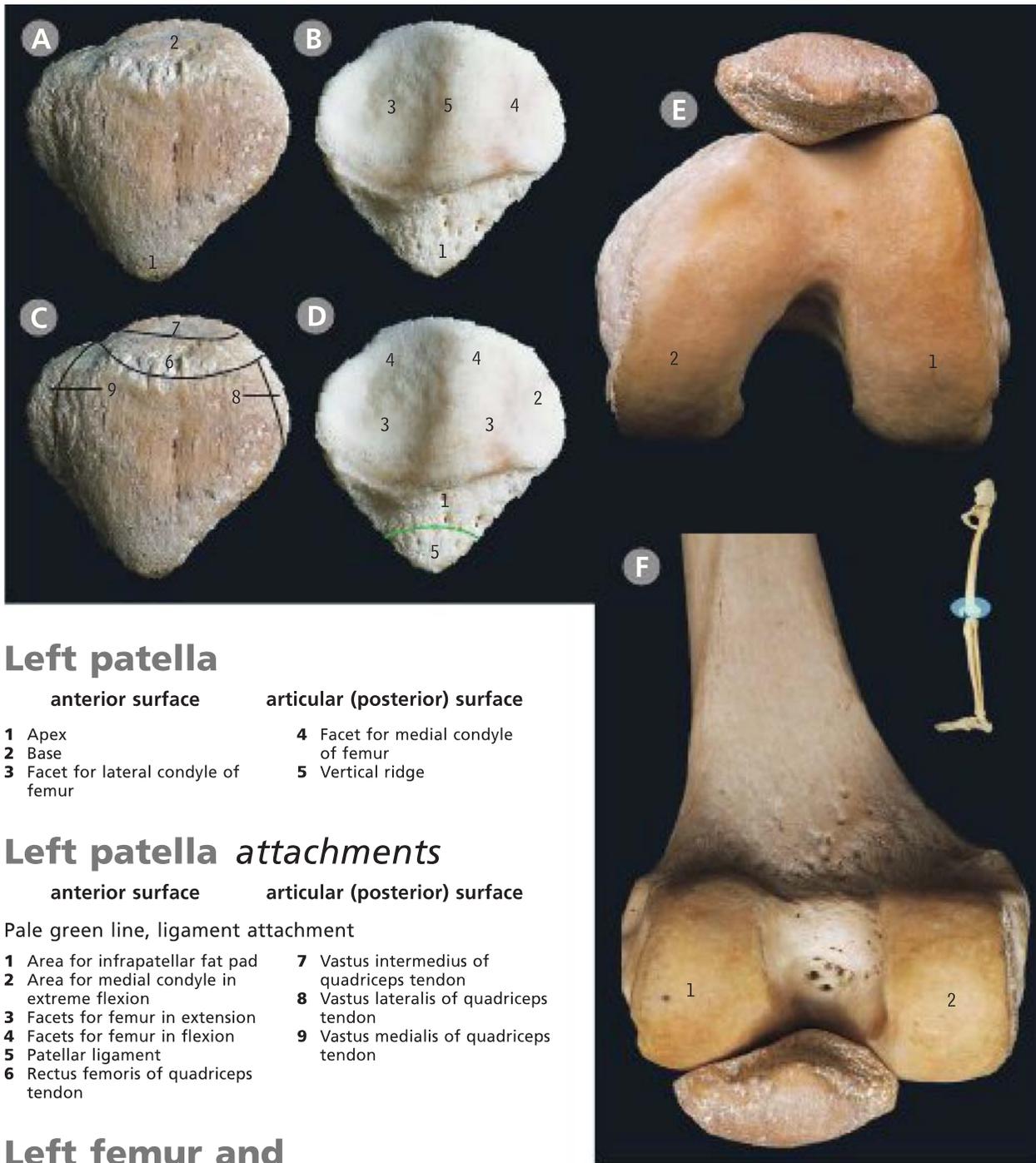
This is the posterior half of a cleared and bisected specimen, to show the major groups of bone trabeculae.

- 1 Calcar femorale
- 2 From lateral surface of shaft to greater trochanter
- 3 From lateral surface of shaft to head
- 4 From medial surface of shaft to greater trochanter
- 5 From medial surface of shaft to head
- 6 Triangular area of few trabeculae

The calcar femorale (1) is a dense concentration of trabeculae passing from the region of the lesser trochanter to the under-surface of the neck.



Fracture – femoral shaft



Left patella

anterior surface

- 1 Apex
- 2 Base
- 3 Facet for lateral condyle of femur

articular (posterior) surface

- 4 Facet for medial condyle of femur
- 5 Vertical ridge

Left patella attachments

anterior surface

Pale green line, ligament attachment

- 1 Area for infrapatellar fat pad
- 2 Area for medial condyle in extreme flexion
- 3 Facets for femur in extension
- 4 Facets for femur in flexion
- 5 Patellar ligament
- 6 Rectus femoris of quadriceps tendon

articular (posterior) surface

- 7 Vastus intermedius of quadriceps tendon
- 8 Vastus lateralis of quadriceps tendon
- 9 Vastus medialis of quadriceps tendon

Left femur and patella articulated

from below with knee extended

from below and behind with knee flexed

In flexion, note the increased area of contact between the medial condyle of the femur (2) and the patella.

- 1 Lateral condyle
- 2 Medial condyle

The most medial facet of the patella (D2) only comes into contact with the medial condyle in extreme flexion as in F.



Bipartite patella

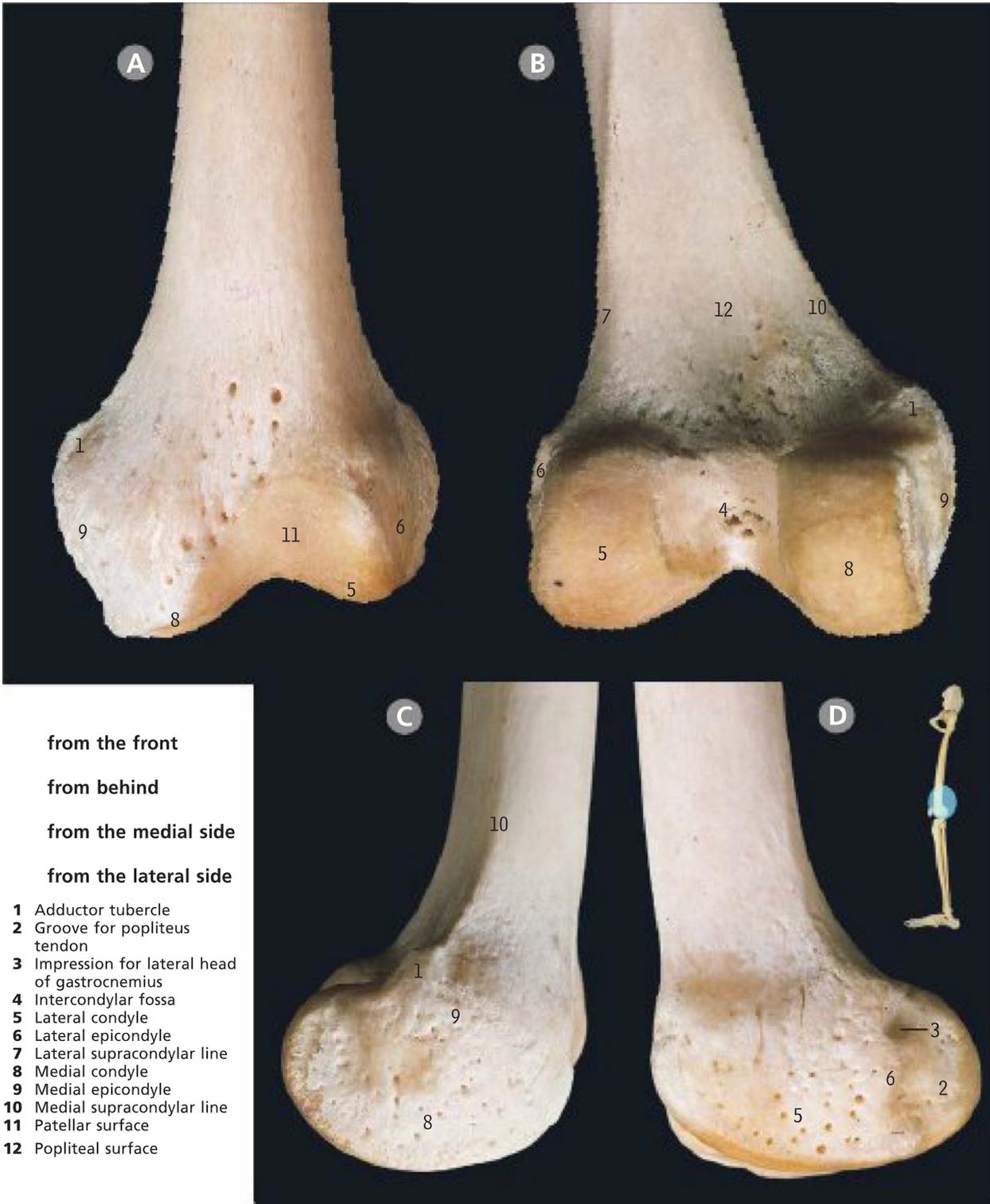


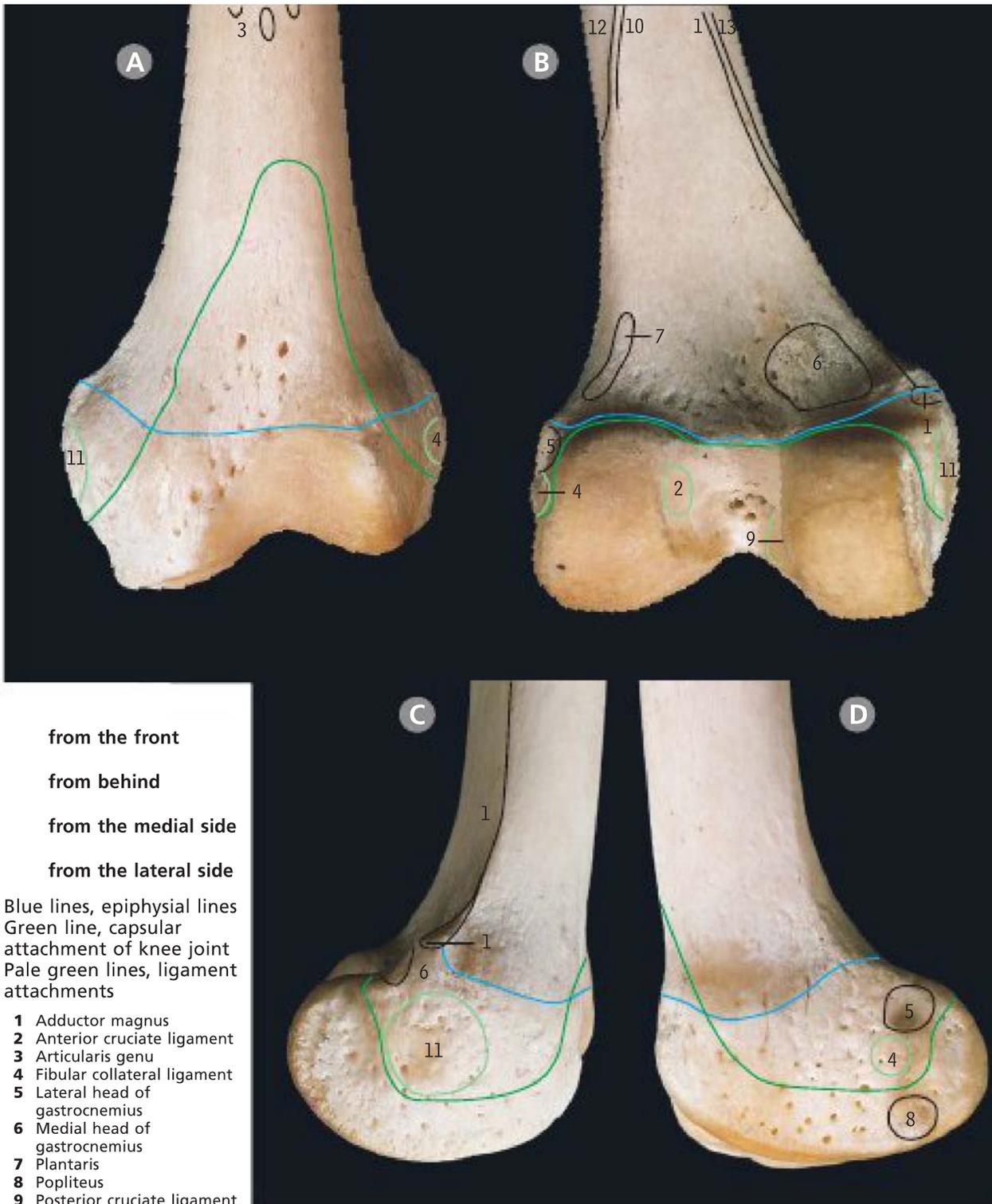
Dislocation of the patella



Patellar fracture

Left femur *lower end*





from the front

from behind

from the medial side

from the lateral side

Blue lines, epiphysial lines
 Green line, capsular attachment of knee joint
 Pale green lines, ligament attachments

- 1 Adductor magnus
- 2 Anterior cruciate ligament
- 3 Articularis genu
- 4 Fibular collateral ligament
- 5 Lateral head of gastrocnemius
- 6 Medial head of gastrocnemius
- 7 Plantaris
- 8 Popliteus
- 9 Posterior cruciate ligament
- 10 Short head of biceps femoris
- 11 Tibial (medial) collateral ligament
- 12 Vastus intermedius
- 13 Vastus medialis

Left tibia *upper end*

from the front

from behind

- 1 Anterior border
- 2 Articular facet for fibula
- 3 Groove for semimembranosus
- 4 Impression for iliotibial tract
- 5 Interosseous border
- 6 Lateral condyle
- 7 Lateral surface
- 8 Medial border
- 9 Medial condyle
- 10 Medial surface
- 11 Posterior surface
- 12 Soleal line
- 13 Tubercles of intercondylar eminence
- 14 Tuberosity
- 15 Vertical line

The shaft of the tibia has three borders: anterior (1), medial (8) and interosseous (5) – and three surfaces: medial (10), lateral (7) and posterior (11).

Much of the anterior border (1) forms a slightly curved crest commonly known as the shin. Most of the smooth medial surface (10) is subcutaneous. The posterior surface contains the soleal and vertical lines (12 and 15).

The tuberosity (14) is at the upper end of the anterior border.



Left tibia attachments, upper end

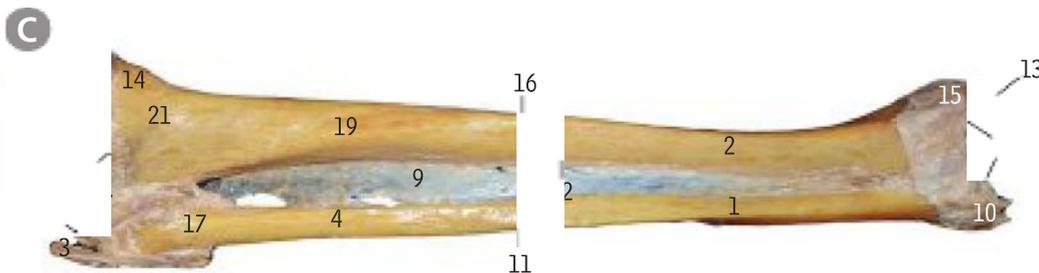


from the front

from behind

Blue lines, epiphysial lines
Green line, capsular attachment of knee joint
Pale green lines, ligament attachments

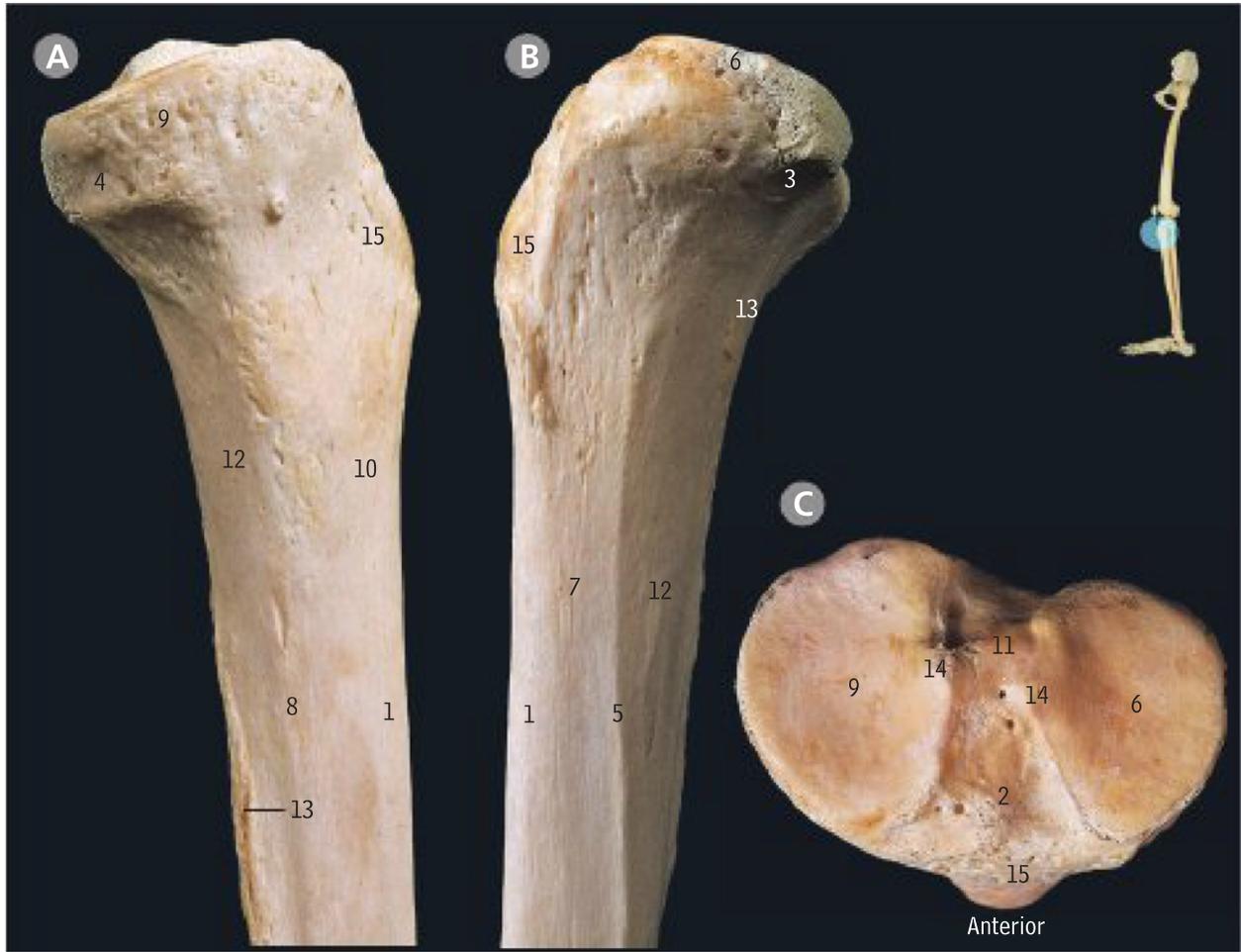
- | | |
|--------------------------------------|---|
| 1 Flexor digitorum longus | 9 Semitendinosus |
| 2 Gracilis | 10 Soleus |
| 3 Iliotibial tract | 11 Tibial (medial) collateral ligament |
| 4 Patellar ligament | 12 Tibialis anterior |
| 5 Popliteus | 13 Tibialis posterior |
| 6 Posterior cruciate ligament | 14 Vastus medialis |
| 7 Sartorius | |
| 8 Semimembranosus | |



INTEROSSEOUS MEMBRANE – TIBIA – FIBULA

- | | |
|--|---|
| 1 Anterior border of fibula | 12 Lateral surface of tibia |
| 2 Anterior border of tibia | 13 Medial (deltoid) ligament of ankle |
| 3 Biceps femoris tendon | 14 Medial condyle |
| 4 Fibula | 15 Medial malleolus |
| 5 Fibular (lateral) collateral ligament | 16 Medial surface of tibia |
| 6 Gerdy's tubercle | 17 Neck of fibula |
| 7 Iliotibial tract | 18 Patellar ligament |
| 8 Inferior articular surface | 19 Tibia |
| 9 Interosseous membrane | 20 Tibial (medial) collateral ligament |
| 10 Lateral malleolus | 21 Tibial tuberosity |
| 11 Lateral surface of fibula | |

Left tibia upper end



from the medial side

from the lateral side

from above

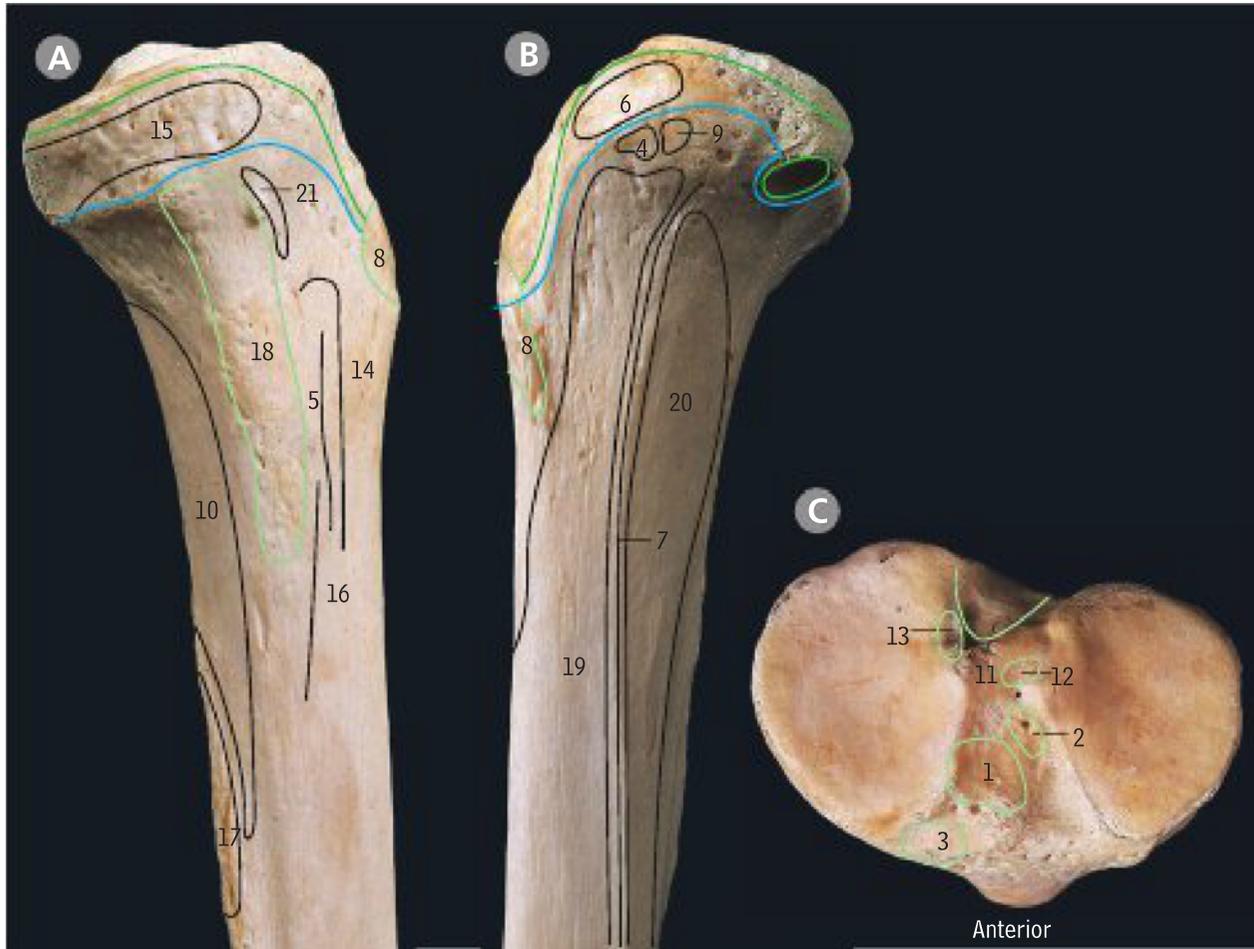
- 1 Anterior border
- 2 Anterior intercondylar area
- 3 Articular facet for fibula
- 4 Groove for semimembranosus
- 5 Interosseous border
- 6 Lateral condyle
- 7 Lateral surface
- 8 Medial border
- 9 Medial condyle
- 10 Medial surface
- 11 Posterior intercondylar area
- 12 Posterior surface
- 13 Soleal line
- 14 Tubercles of intercondylar eminence
- 15 Tuberosity

The medial condyle (C9) is larger than the lateral condyle (C6).
 The articular facet for the fibula is on the postero-inferior aspect of the lateral condyle (B3).



Osgood-Schlatter's disease

Left tibia attachments, upper end



from the medial side

from the lateral side

from above

Blue lines, epiphysal lines
Green lines, capsular
attachments of knee joint
and superior tibiofibular
joint
Pale green lines, ligament
attachments

- 1 Anterior cruciate ligament
- 2 Anterior horn of lateral meniscus
- 3 Anterior horn of medial meniscus
- 4 Extensor digitorum longus
- 5 Gracilis
- 6 Iliotibial tract
- 7 Interosseous membrane
- 8 Patellar ligament
- 9 Peroneus (fibularis) longus
- 10 Popliteus
- 11 Posterior cruciate ligament

- 12 Posterior horn of lateral meniscus
- 13 Posterior horn of medial meniscus
- 14 Sartorius
- 15 Semimembranosus
- 16 Semitendinosus
- 17 Soleus
- 18 Tibial (medial) collateral ligament
- 19 Tibialis anterior
- 20 Tibialis posterior
- 21 Vastus medialis



Left tibia lower end

from the front

from behind

from the medial side

from the lateral side

- 1 Anterior surface
- 2 Fibular notch
- 3 Groove for flexor hallucis longus
- 4 Groove for tibialis posterior
- 5 Interosseous border
- 6 Medial malleolus
- 7 Medial surface
- 8 Posterior surface

Left tibia attachments, lower end

from the front

from behind

from the medial side

from the lateral side

Blue line, epiphysial line
 Green line, capsular attachment of ankle joint
 Pale green lines, ligament attachment

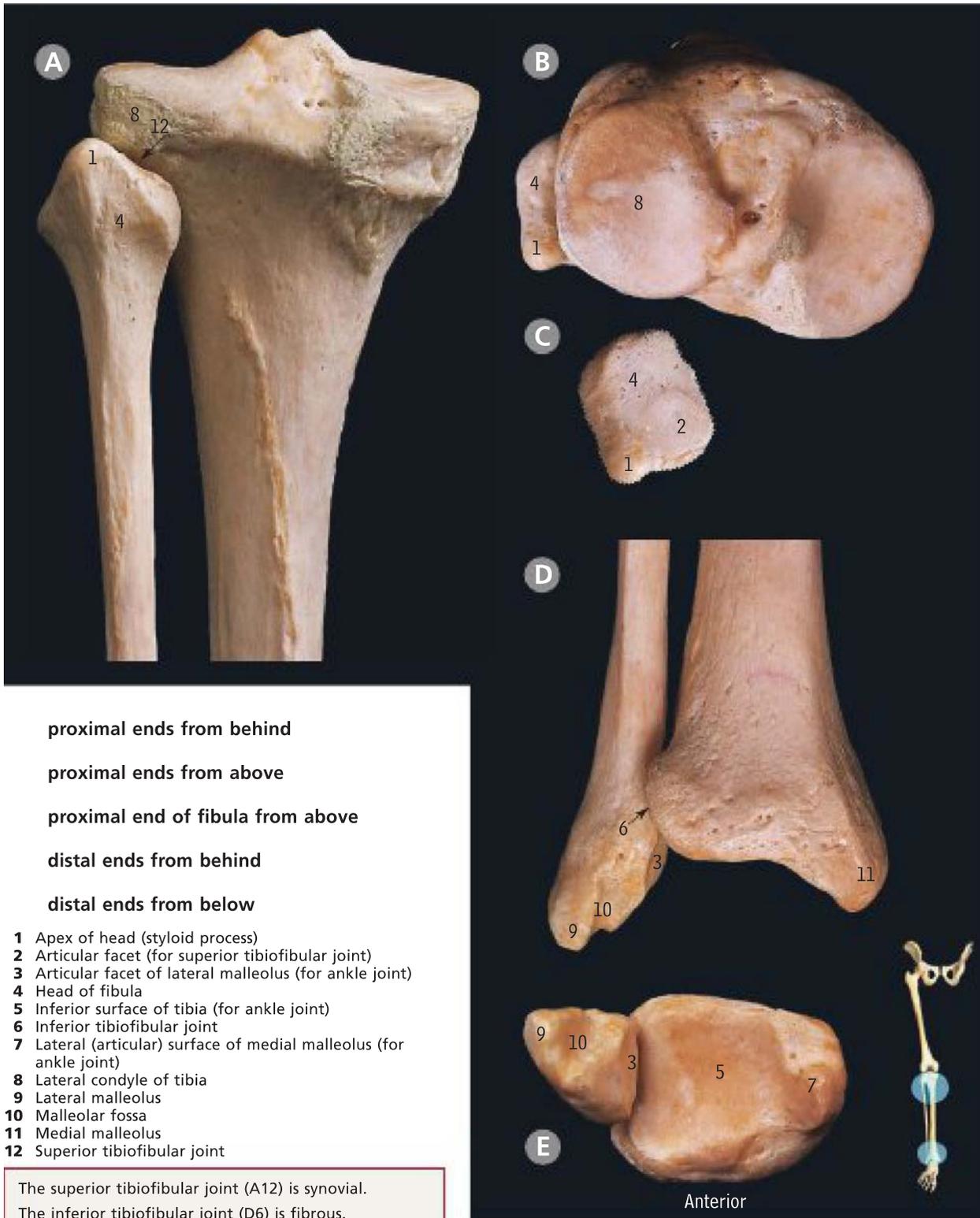
- 1 Inferior transverse ligament
- 2 Interosseous ligament
- 3 Interosseous membrane
- 4 Medial collateral ligament
- 5 Posterior tibiofibular ligament

The medial collateral ligament (G4) is commonly known as the deltoid ligament.



Tibial fractures

Left tibia and fibula articulated



- 1** Apex of head (styloid process)
- 2** Articular facet (for superior tibiofibular joint)
- 3** Articular facet of lateral malleolus (for ankle joint)
- 4** Head of fibula
- 5** Inferior surface of tibia (for ankle joint)
- 6** Inferior tibiofibular joint
- 7** Lateral (articular) surface of medial malleolus (for ankle joint)
- 8** Lateral condyle of tibia
- 9** Lateral malleolus
- 10** Malleolar fossa
- 11** Medial malleolus
- 12** Superior tibiofibular joint

The superior tibiofibular joint (A12) is synovial.
 The inferior tibiofibular joint (D6) is fibrous.
 The lateral malleolus (D9) extends lower than the medial malleolus (D11).



Tarsal dislocations

Left fibula proximal end

from the front

from the medial side

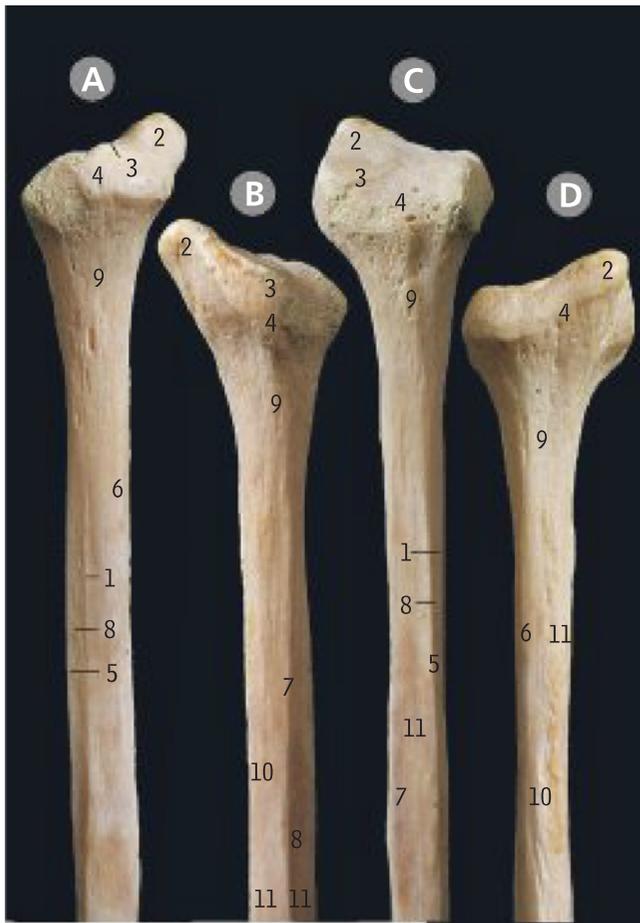
from behind

from the lateral side

- | | |
|------------------------------------|----------------------|
| 1 Anterior border | 7 Medial crest |
| 2 Apex (styloid process) | 8 Medial surface |
| 3 Articular facet on upper surface | 9 Neck |
| 4 Head | 10 Posterior border |
| 5 Interosseous border | 11 Posterior surface |
| 6 Lateral surface | |

The fibula has three borders: anterior (A1), interosseous (A5) and posterior (B10) – and three surfaces: medial (A8), lateral (A6) and posterior (B11).

At first sight, much of the shaft appears to have four borders and four surfaces, but this is because the posterior surface (B11) is divided into two parts (medial and lateral) by the medial crest (B7).



Left fibula distal end

from the front

from behind

from the medial side

from the lateral side

- 1 Anterior border
- 2 Articular surface of lateral malleolus
- 3 Groove for peroneus (fibularis) brevis
- 4 Interosseous border
- 5 Lateral malleolus
- 6 Lateral surface
- 7 Malleolar fossa
- 8 Medial crest
- 9 Medial surface
- 10 Posterior border
- 11 Posterior surface
- 12 Surface for interosseous ligament
- 13 Triangular subcutaneous area





Left fibula attachments, proximal end

from the front

from the medial side

from behind

from the lateral side

Blue line, epiphysial line

Green line, capsular attachment of superior tibiofibular joint

Pale green lines, ligament attachments

- | | |
|--------------------------------------|--------------------------------------|
| 1 Biceps femoris | 6 Interosseous membrane |
| 2 Extensor digitorum longus | 7 Peroneus (fibularis) brevis |
| 3 Extensor hallucis longus | 8 Peroneus (fibularis) longus |
| 4 Fibular collateral ligament | 9 Soleus |
| 5 Flexor hallucis longus | 10 Tibialis posterior |

Left fibula attachments, distal end

from the front

from the medial side

from behind

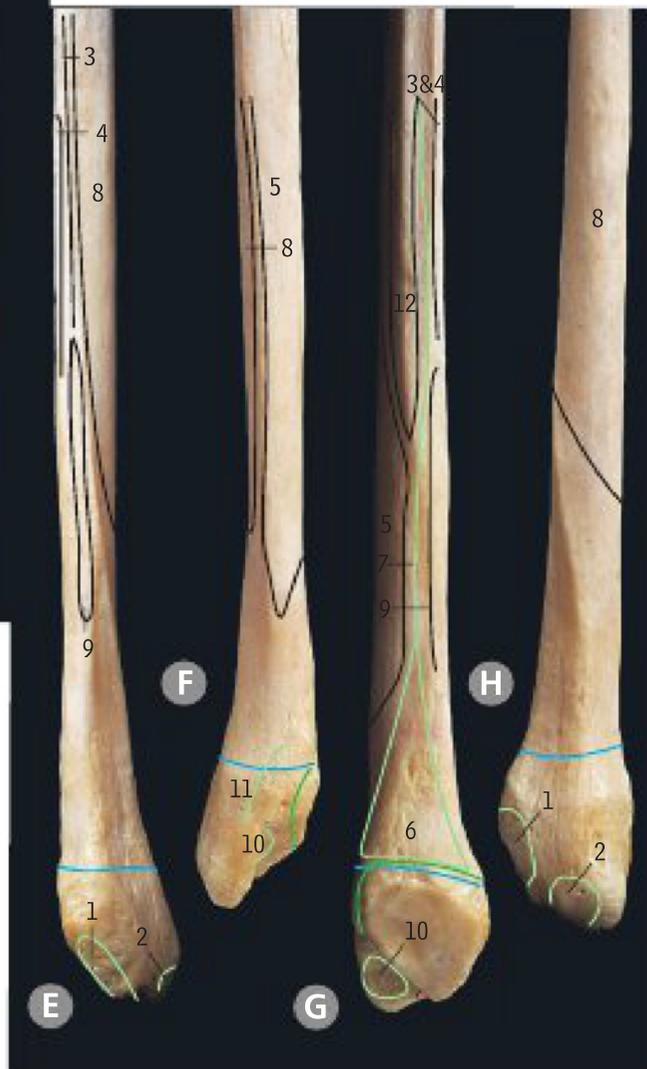
from the lateral side

Blue line, epiphysial line

Green line, capsular attachment of ankle joint

Pale green lines, ligament attachments

- | | |
|--|---|
| 1 Anterior talofibular ligament | 8 Peroneus (fibularis) brevis |
| 2 Calcaneofibular ligament | 9 Peroneus (fibularis) tertius |
| 3 Extensor digitorum longus | 10 Posterior talofibular ligament |
| 4 Extensor hallucis longus | 11 Posterior tibiofibular ligament |
| 5 Flexor hallucis longus | 12 Tibialis posterior |
| 6 Interosseous ligament | |
| 7 Interosseous membrane | |



Bones of the left foot



from above (dorsum)

from below (plantar surface)

- 1 Anterior tubercle of calcaneus
- 2 Base of fifth metatarsal
- 3 Base of first metatarsal
- 4 Calcaneus
- 5 Cuboid
- 6 Distal phalanx of great toe
- 7 Distal phalanx of second toe
- 8 Groove on calcaneus for flexor hallucis longus
- 9 Groove on cuboid for peroneus (fibularis) longus
- 10 Groove on talus for flexor hallucis longus
- 11 Grooves for sesamoid bones in flexor hallucis brevis
- 12 Head of fifth metatarsal
- 13 Head of first metatarsal
- 14 Head of talus
- 15 Intermediate cuneiform
- 16 Lateral cuneiform
- 17 Lateral process of calcaneus
- 18 Lateral tubercle of talus
- 19 Medial cuneiform
- 20 Medial process of calcaneus
- 21 Medial tubercle of talus
- 22 Middle phalanx of second toe
- 23 Navicular
- 24 Neck of talus
- 25 Proximal phalanx of great toe
- 26 Proximal phalanx of second toe
- 27 Shaft of fifth metatarsal
- 28 Shaft of first metatarsal
- 29 Sustentaculum tali of calcaneus
- 30 Trochlear surface of body of talus
- 31 Tuberosity of base of fifth metatarsal
- 32 Tuberosity of cuboid
- 33 Tuberosity of navicular

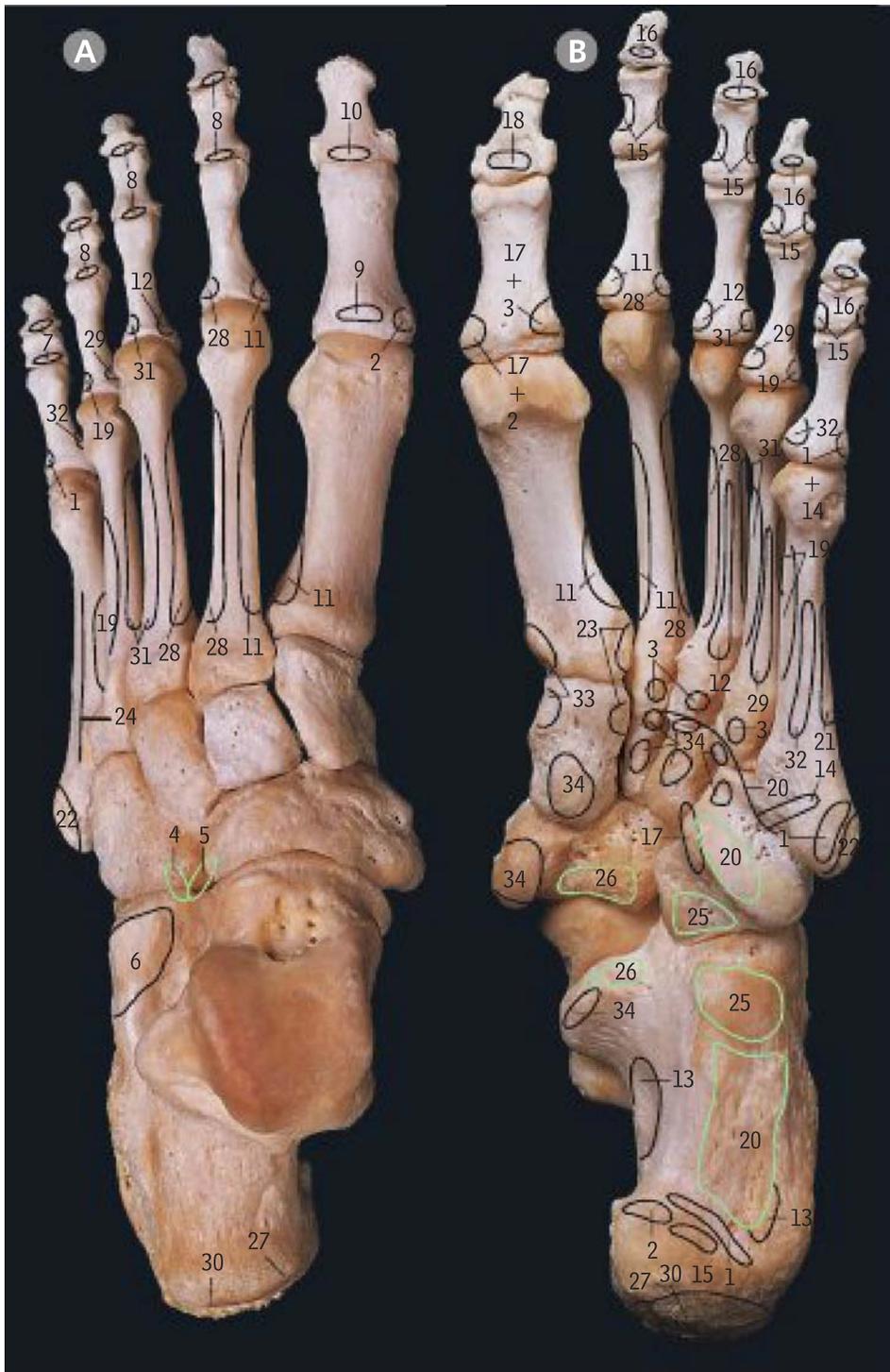


Dislocation of the toe



Hallux valgus

Bones of the left foot *attachments*



from above

from below

Joint capsules and minor ligaments have been omitted.

Pale green lines, ligament attachments

- 1 Abductor digiti minimi
- 2 Abductor hallucis
- 3 Adductor hallucis
- 4 Calcaneocuboid part of bifurcate ligament
- 5 Calcaneonavicular part of bifurcate ligament
- 6 Extensor digitorum brevis
- 7 Extensor digitorum longus
- 8 Extensor digitorum longus and brevis
- 9 Extensor hallucis brevis
- 10 Extensor hallucis longus
- 11 First dorsal interosseous
- 12 First plantar interosseous
- 13 Flexor accessorius (quadratus plantae)
- 14 Flexor digiti minimi brevis
- 15 Flexor digitorum brevis
- 16 Flexor digitorum longus
- 17 Flexor hallucis brevis
- 18 Flexor hallucis longus
- 19 Fourth dorsal interosseous
- 20 Long plantar ligament
- 21 Opponens digiti minimi (part of 14)
- 22 Peroneus (fibularis) brevis
- 23 Peroneus (fibularis) longus
- 24 Peroneus (fibularis) tertius
- 25 Plantar calcaneocuboid (short plantar) ligament
- 26 Plantar calcaneonavicular (spring) ligament
- 27 Plantaris
- 28 Second dorsal interosseous
- 29 Second plantar interosseous
- 30 Tendo calcaneus (Achilles tendon)
- 31 Third dorsal interosseous
- 32 Third plantar interosseous
- 33 Tibialis anterior
- 34 Tibialis posterior



Hallux
sesamoid
fracture



Metatarsal
fractures

Bones of the left foot



from the medial side

from the lateral side

- | | | |
|--|---|---|
| <ul style="list-style-type: none"> 1 Anterior tubercle of calcaneus 2 Cuboid 3 First metatarsal 4 Head of talus 5 Intermediate cuneiform 6 Lateral cuneiform 7 Lateral malleolar surface of talus 8 Lateral process of calcaneus | <ul style="list-style-type: none"> 9 Lateral tubercle of talus 10 Medial cuneiform 11 Medial malleolar surface of talus 12 Medial process of calcaneus 13 Medial surface of calcaneus 14 Medial tubercle of talus 15 Navicular 16 Neck of talus | <ul style="list-style-type: none"> 17 Peroneal (fibular) trochlea of calcaneus 18 Sustentaculum tali of calcaneus 19 Tarsal sinus 20 Tuberosity of base of fifth metatarsal 21 Tuberosity of navicular |
|--|---|---|



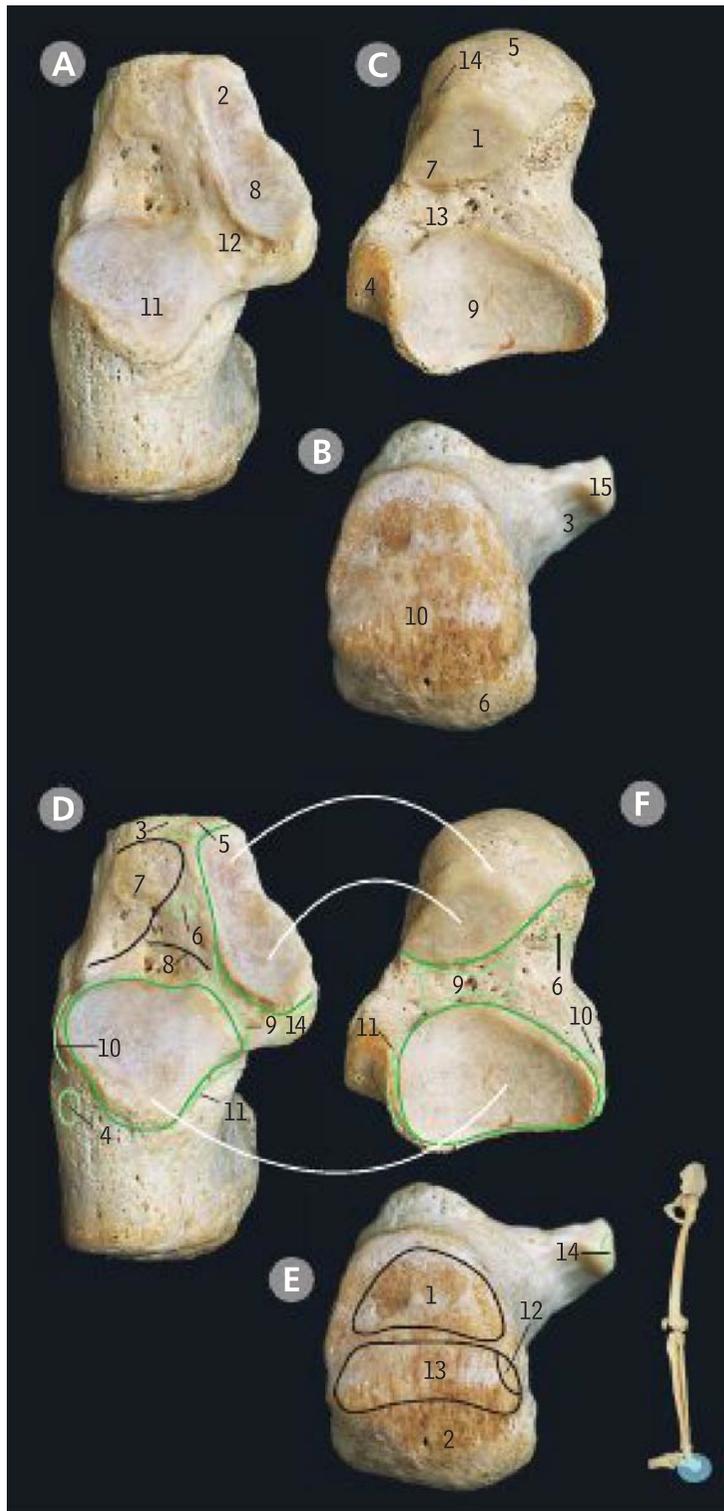
Calcaneal fracture



Hammer toe



Os trigonum



Bones of the left foot

Left calcaneus

from above

from behind

Left talus

from below

- 1 Anterior calcanean articular surface of talus
- 2 Anterior talar articular surface of calcaneus
- 3 Groove of calcaneus for flexor hallucis longus
- 4 Groove of talus for flexor hallucis longus
- 5 Head of talus
- 6 Medial process of calcaneus
- 7 Middle calcanean articular surface of talus
- 8 Middle talar articular surface of calcaneus
- 9 Posterior calcanean articular surface of talus
- 10 Posterior surface of calcaneus
- 11 Posterior talar articular surface of calcaneus
- 12 Sulcus of calcaneus
- 13 Sulcus of talus
- 14 Surface of talus for plantar calcaneonavicular (spring) ligament
- 15 Sustentaculum tali of calcaneus

Left calcaneus, attachments

from above

from behind

Left talus, attachments

from below

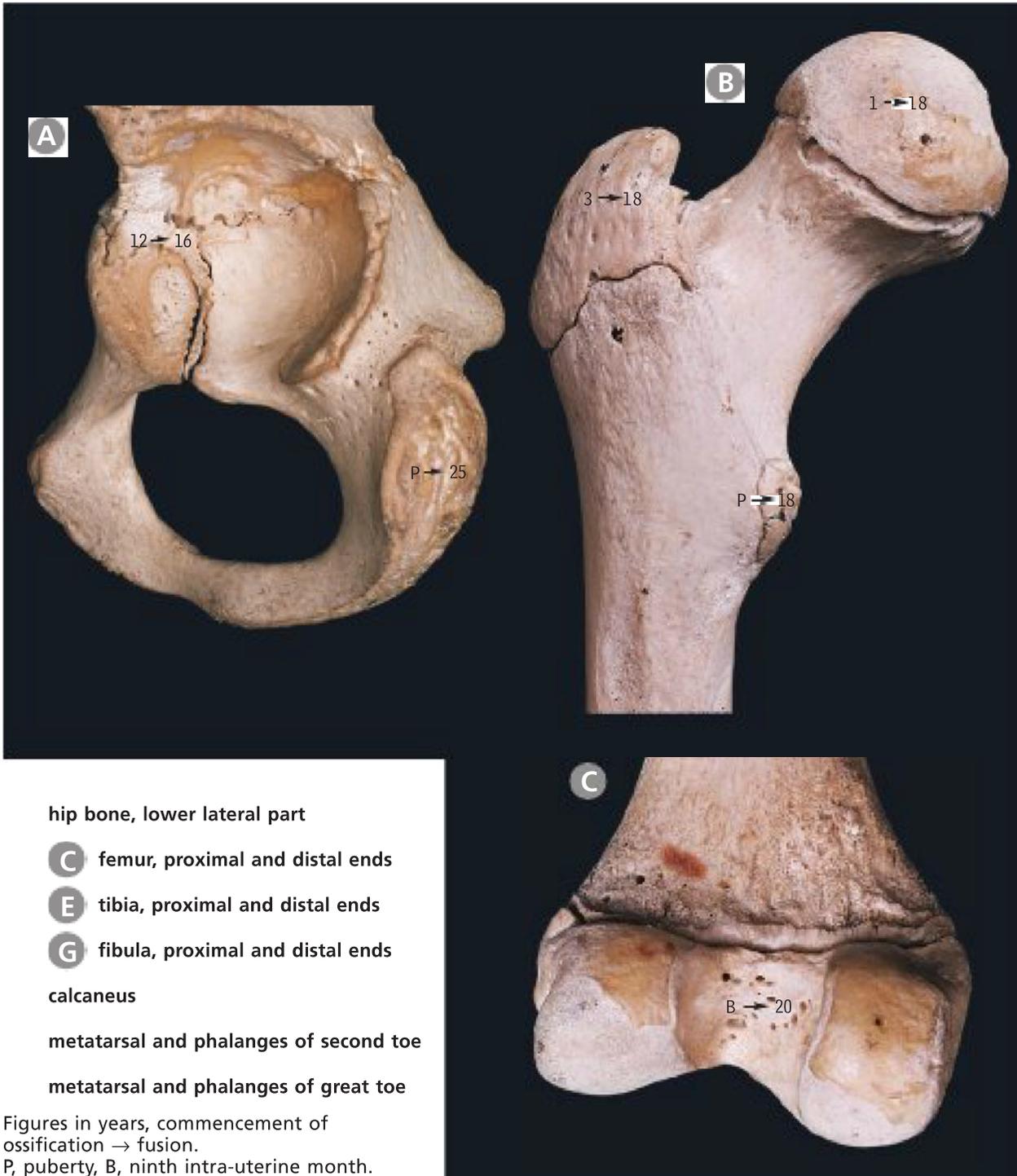
Curved lines indicate corresponding articular surfaces: green, capsular attachment of talocalcanean (subtalar) and talocalcaneonavicular joints; pale green lines, ligament attachments

- 1 Area for bursa
- 2 Area for fibrofatty tissue
- 3 Calcaneocuboid part of bifurcate ligament
- 4 Calcaneofibular ligament
- 5 Calcaneonavicular part of bifurcate ligament
- 6 Cervical ligament
- 7 Extensor digitorum brevis
- 8 Inferior extensor retinaculum
- 9 Interosseous talocalcanean (cervical) ligament
- 10 Lateral talocalcanean ligament
- 11 Medial talocalcanean ligament
- 12 Plantaris
- 13 Tendocalcaneus (Achilles tendon)
- 14 Tibiocalcanean part of deltoid ligament

The interosseous talocalcanean (cervical) ligament (9) is formed by thickening of the adjacent capsules of the talocalcanean and talocalcaneonavicular joints.

For different interpretations of the term 'subtalar joint' see the notes on [page 358](#).

Left lower limb bones *secondary centres of ossification*



hip bone, lower lateral part

C femur, proximal and distal ends

E tibia, proximal and distal ends

G fibula, proximal and distal ends

calcaneus

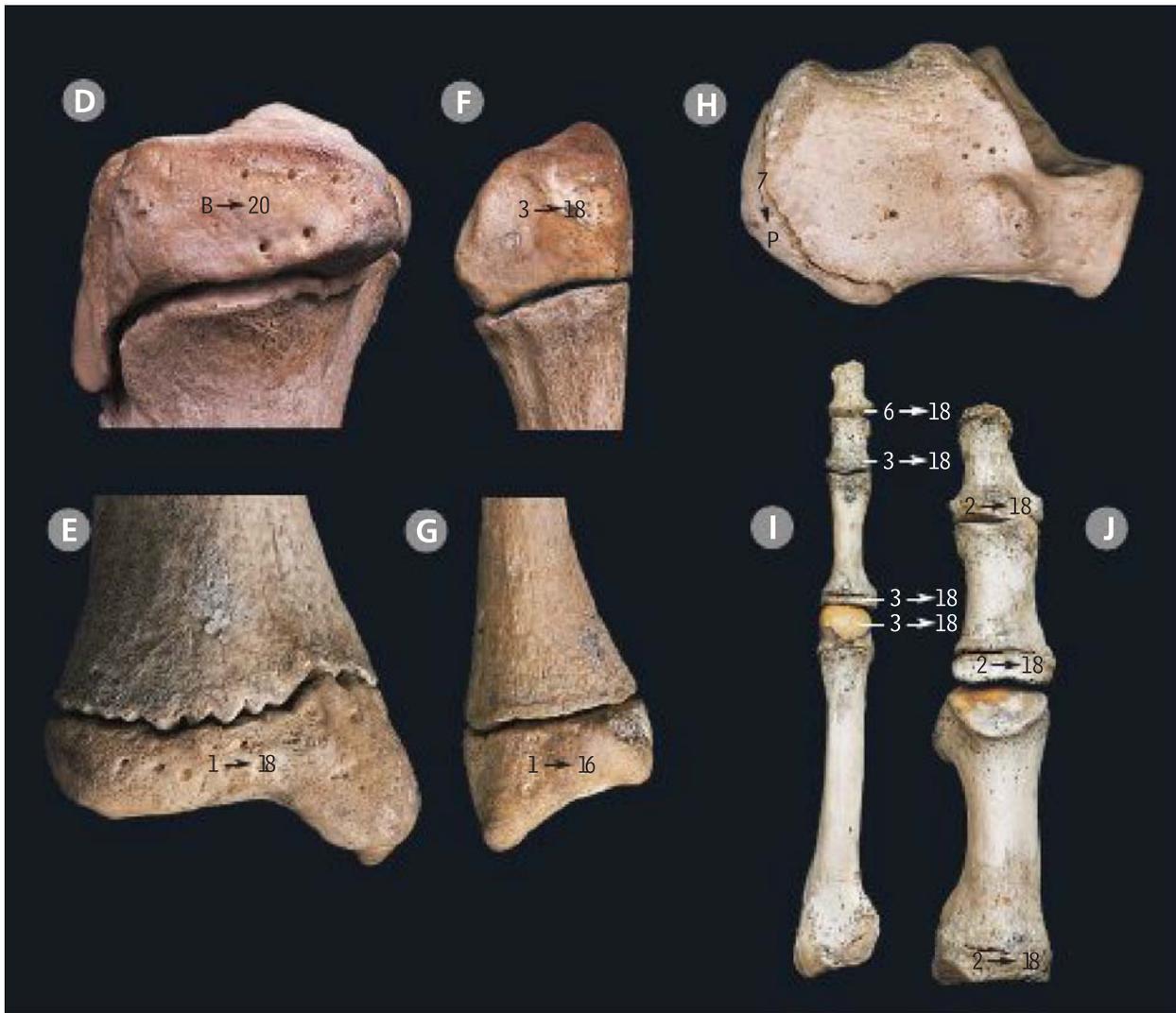
metatarsal and phalanges of second toe

metatarsal and phalanges of great toe

Figures in years, commencement of ossification → fusion.
 P, puberty, B, ninth intra-uterine month.
 See introduction on [page 131](#).



Slipped upper femoral epiphysis



Note knee and ankle epiphyses as seen on plain x-rays

In the hip bone (A) one or more secondary centres appear in the Y-shaped cartilage between ilium, ischium and pubis. Other centres (not illustrated) are usually present for the iliac crest, anterior inferior iliac spine, and (possibly) the pubic tubercle and pubic crest (all P → 25).

The patella (not illustrated) begins to ossify from one or more centres between the third and sixth year.

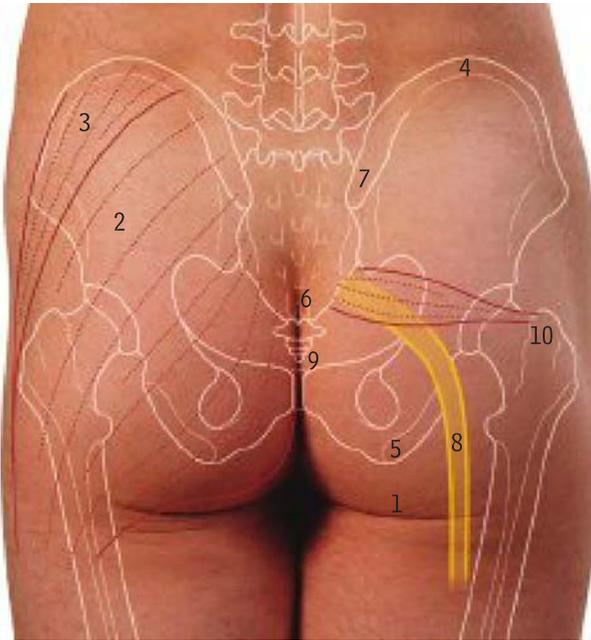
All the phalanges, and the first metatarsal, have a secondary centre at their proximal ends; the other metatarsals have one at their distal ends.

Of the tarsal bones, the largest, the calcaneus, begins to ossify in the third intra-uterine month and the talus about three months later. The cuboid may begin to ossify either just before or just after birth, with the lateral cuneiform in the first year, medial cuneiform at two years and the intermediate cuneiform and navicular at three years.

The calcaneus (H) is the only tarsal bone to have a secondary centre.



Gluteal region *surface features*



The iliac crest (4) with the posterior superior iliac spine (7), the tip of the coccyx (9), the ischial tuberosity (5) and the tip of the greater trochanter of the femur (10) are palpable landmarks. A line drawn from a point midway between the posterior superior iliac spine (7) and the tip of the coccyx (9) to the tip of the greater trochanter (10) marks the lower border of piriformis (illustrated on right buttock), which is a key feature of the gluteal region, where the most important structure is the sciatic nerve (indicated here in yellow, 8; see dissections and notes opposite).

- 1 Fold of buttock
- 2 Gluteus maximus
- 3 Gluteus medius
- 4 Iliac crest
- 5 Ischial tuberosity
- 6 Natal cleft
- 7 Posterior superior iliac spine
- 8 Sciatic nerve
- 9 Tip of coccyx
- 10 Tip of greater trochanter of femur

Right gluteal region *superficial nerves*



Skin and subcutaneous tissue have been removed, preserving cutaneous branches from the first three lumbar (3) and first three sacral (4) nerves, the cutaneous branches of the posterior femoral cutaneous nerve (5) and the perforating cutaneous nerve (11). The curved line near the bottom of the picture indicates the position of the gluteal fold (fold of the buttock). The muscle fibres of gluteus maximus (7) run downwards and laterally, and its lower border does not correspond to the gluteal fold.

- 1 Adductor magnus
- 2 Coccyx
- 3 Cutaneous branches of dorsal rami of first three lumbar nerves
- 4 Gluteal branches of dorsal rami of first three sacral nerves
- 5 Gluteal branches of the posterior femoral cutaneous nerve
- 6 Gluteal fascia overlying gluteus medius
- 7 Gluteus maximus
- 8 Gracilis
- 9 Iliac crest
- 10 Ischio-anal fossa and levator ani
- 11 Perforating cutaneous nerve
- 12 Posterior layer of lumbar fascia overlying erector spinae
- 13 Semitendinosus

The gluteal region or buttock is sometimes used as a site for intramuscular injections. The correct site is in the upper outer quadrant of the buttock, and for delineating this quadrant, it is essential to remember that the upper boundary of the buttock is the uppermost part of the iliac crest. The lower boundary is the fold of the buttock. Dividing the area between these two boundaries by a vertical line midway between the midline and the lateral side of the body indicates that the upper outer quadrant is well above and to the right of the label 7 in B, and this is the safe site for injection – well above and to the right of the sciatic nerve which is displayed in the dissections opposite.

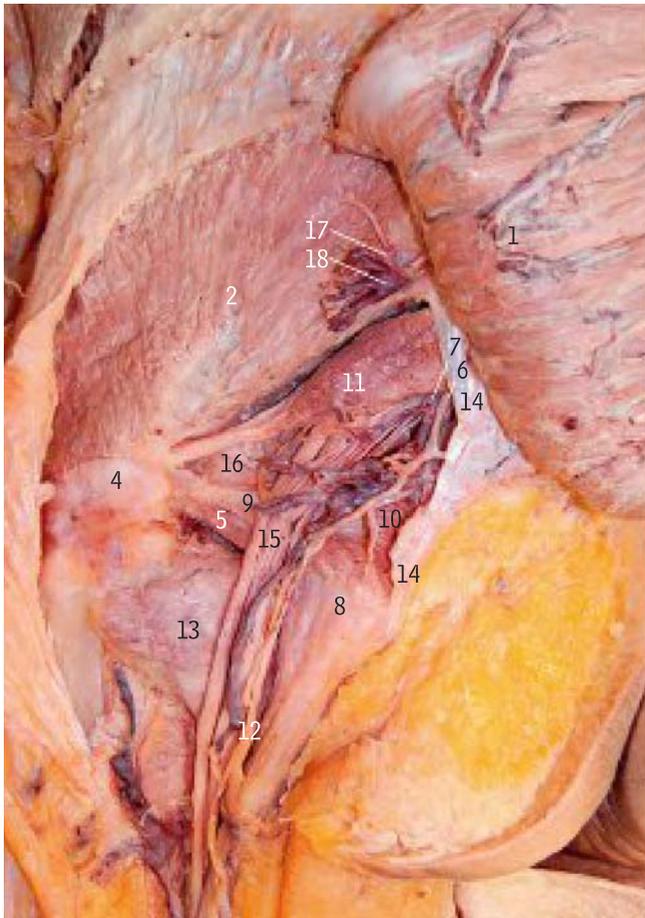


Intramuscular injection – gluteal region



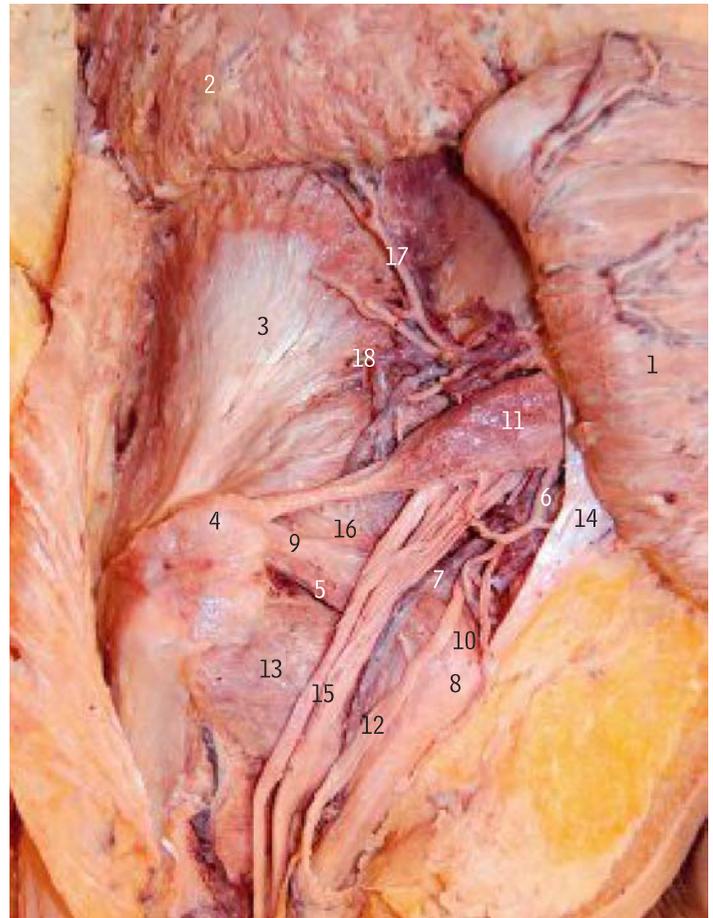
Left gluteal region

superficial dissection

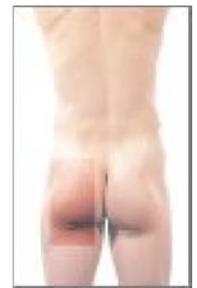


- 1 Gluteus maximus muscle, reflected
- 2 Gluteus medius muscle, reflected
- 3 Gluteus minimus muscle
- 4 Greater trochanter of femur
- 5 Inferior gemellus muscle
- 6 Inferior gluteal artery
- 7 Inferior gluteal vein
- 8 Ischial tuberosity
- 9 Obturator internus tendon

deeper dissection

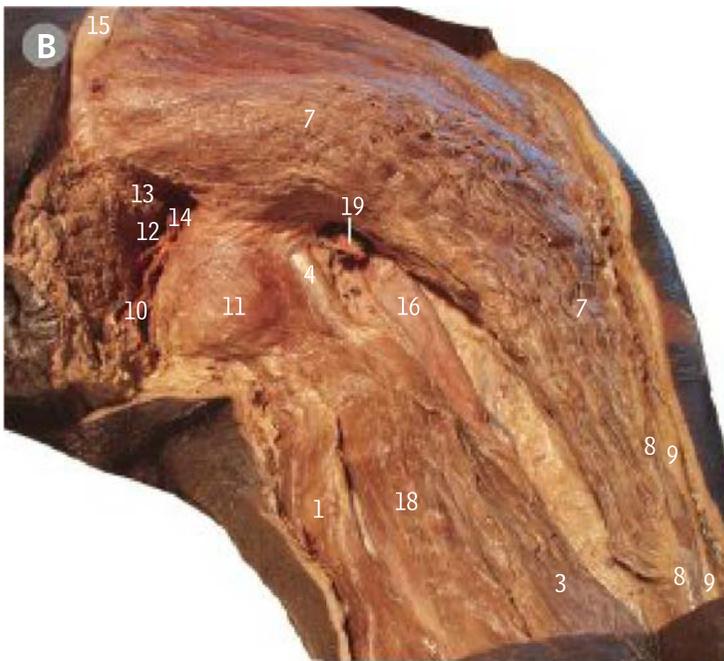


- 10 Obturator internus muscle
- 11 Piriformis
- 12 Posterior cutaneous nerve of thigh
- 13 Quadratus femoris muscle
- 14 Sacrotuberous ligament
- 15 Sciatic nerve
- 16 Superior gemellus muscle
- 17 Superior gluteal artery
- 18 Superior gluteal vein

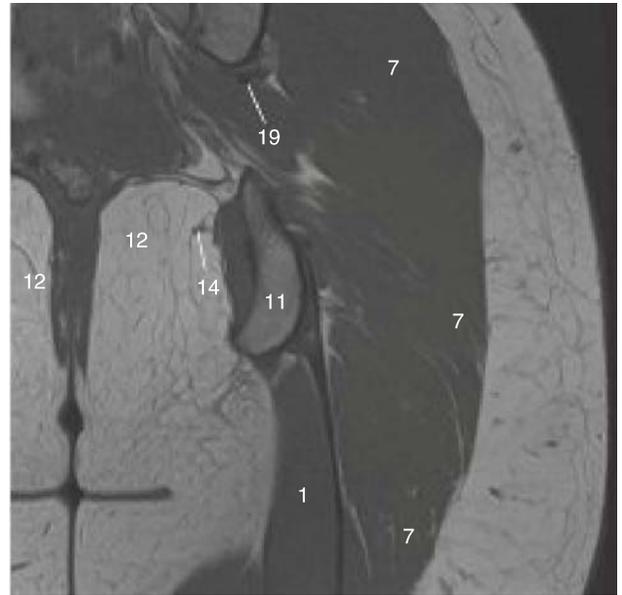


The two parts of the sciatic trunk (common peroneal [fibular] and tibial) usually divide from one another at the top of the popliteal fossa ([page 344](#)) but are sometimes separate as they emerge beneath piriformis, and the common peroneal (fibular) may even perforate piriformis.

Right thigh *posterior view*



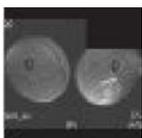
Coronal MRI – hip and upper thigh



Gluteal region and proximal hamstrings

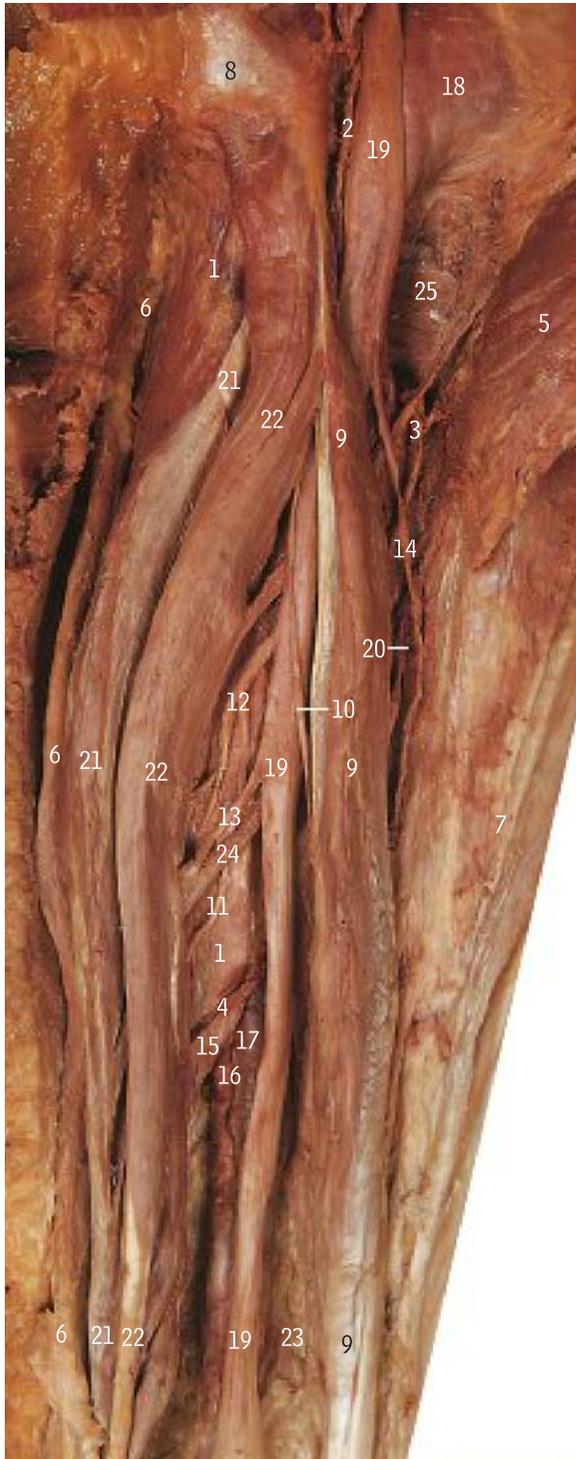
Deeper dissection revealing ischio-anal fossa

- 1 Adductor magnus, hamstring part
- 2 Anus
- 3 Biceps femoris
- 4 Biceps femoris, tendon of long head
- 5 External anal sphincter
- 6 Gluteal fascia
- 7 Gluteus maximus
- 8 Gluteus maximus, attachment to iliotibial tract
- 9 Iliotibial tract (thickened fascia lata)
- 10 Inferior rectal vessels
- 11 Ischial tuberosity
- 12 Ischio-anal fossa
- 13 Levator ani
- 14 Pudendal vessels and nerve
- 15 Sacrum, dorsal fascia
- 16 Sciatic nerve within fascial sheath
- 17 Scrotal skin
- 18 Semitendinosus
- 19 Superior gluteal vessels



Torn hamstrings

Right upper thigh *posterior view*



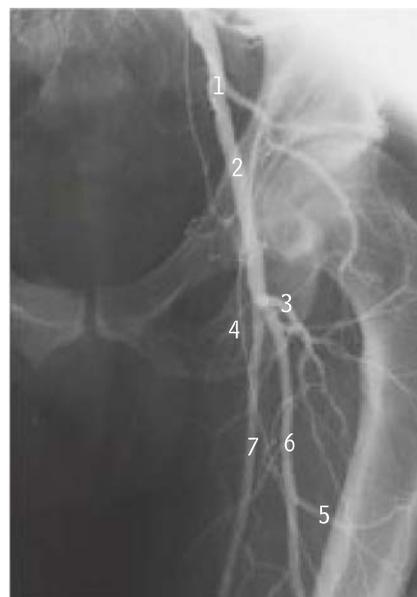
Gluteus maximus (5) has been reflected laterally and the gap between semitendinosus (22) and biceps femoris (9) has been opened up to show the sciatic trunk (19) and its muscular branches.

- | | |
|---|---|
| 1 Adductor magnus | 13 Nerve to semitendinosus |
| 2 Anastomotic branch of inferior gluteal artery | 14 Nerve to short head of biceps femoris |
| 3 First perforating artery | 15 Opening in adductor magnus (hiatus) |
| 4 Fourth perforating artery | 16 Popliteal artery |
| 5 Gluteus maximus | 17 Popliteal vein |
| 6 Gracilis | 18 Quadratus femoris |
| 7 Iliotibial tract overlying vastus lateralis | 19 Sciatic trunk |
| 8 Ischial tuberosity | 20 Second perforating artery |
| 9 Long head of biceps femoris | 21 Semimembranosus |
| 10 Nerve to long head of biceps femoris | 22 Semitendinosus |
| 11 Nerve to semimembranosus | 23 Short head of biceps femoris |
| 12 Nerve to semimembranosus and adductor magnus | 24 Third perforating artery |
| | 25 Upper part of adductor magnus ('adductor minimus') |



The only muscular branch to arise from the lateral side of the sciatic trunk (i.e. from the common peroneal (fibular) part of the nerve (19), uppermost 19, near the top of the picture), is the nerve to the short head of biceps (14). All the other muscular branches – to the long head of biceps femoris (10), semimembranosus (11), semimembranosus and adductor magnus (12) and semitendinosus (13) – arise from the medial side of the sciatic trunk (19, near the centre of the picture) (i.e. from the tibial part of the nerve).

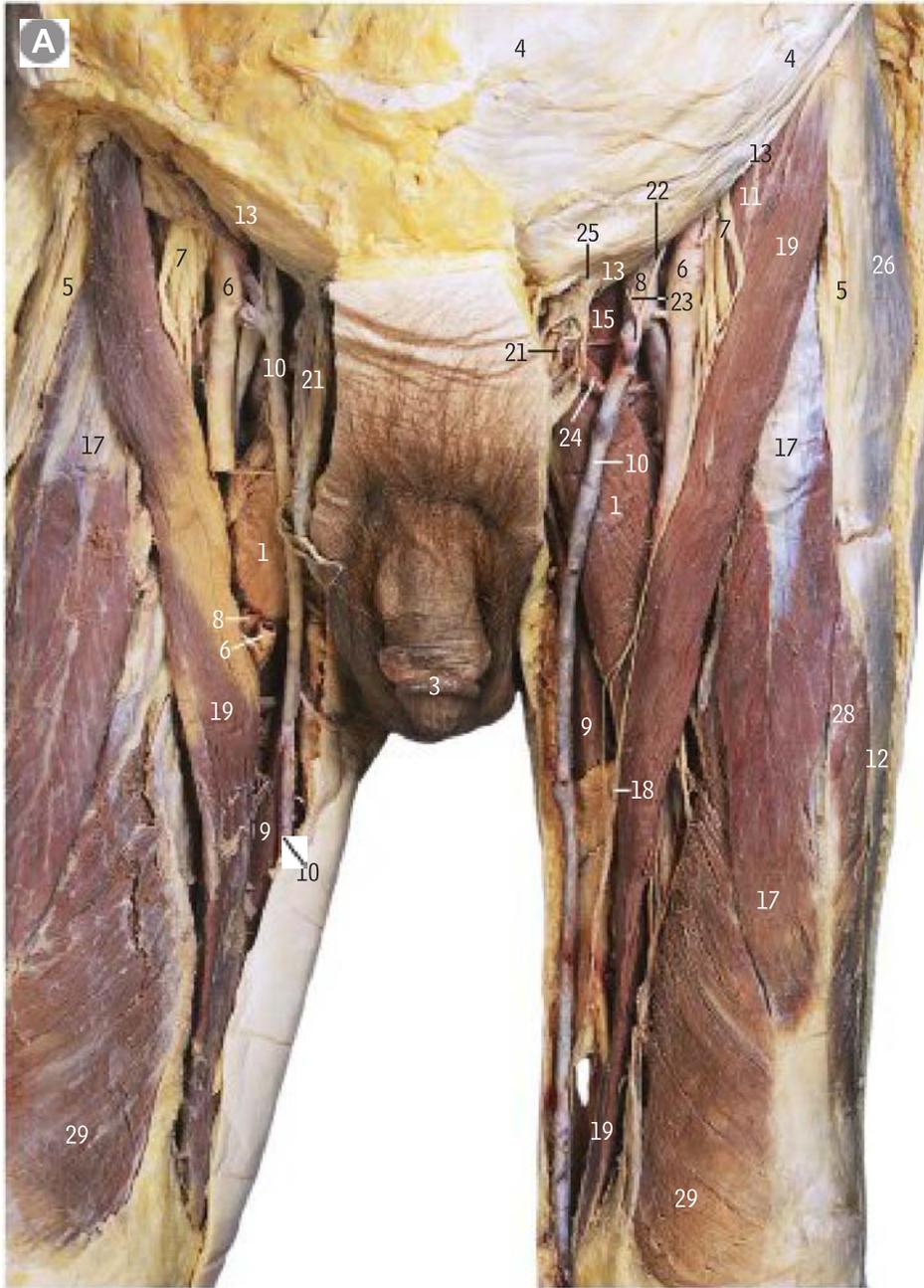
Femoral arteriogram



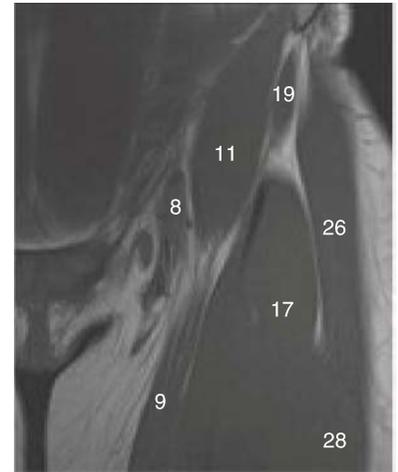
- 1 Catheter introduced into distal abdominal aorta via right common femoral artery
- 2 Common femoral artery
- 3 Lateral circumflex femoral artery
- 4 Medial circumflex femoral artery
- 5 Perforating artery
- 6 Profunda femoris artery (deep femoral)
- 7 Superficial femoral artery



Anterior thigh and lower abdomen



Coronal MR, upper thigh



Lumbar plexus block



Varicella-zoster virus infection - lower limb

Upper anterior thigh *sartorius* retracted medially to show subsartorial canal



The boundaries of the femoral triangle are the inguinal ligament (13), the medial border of sartorius (19) and the medial border of adductor longus (1).

The femoral canal is the medial compartment of the femoral sheath (removed) which contains in its middle compartment the femoral vein (8), and in the lateral compartment the femoral artery (6). The femoral nerve (7) is lateral to the sheath, not within it.

- | | | |
|--------------------------------------|--|---|
| 1 Adductor longus | 12 Iliotibial tract | 22 Superficial circumflex iliac vein |
| 2 Arterial branch to vastus medialis | 13 Inguinal ligament | 23 Superficial epigastric vein |
| 3 Corona of glans penis | 14 Nerve to vastus medialis | 24 Superficial external pudendal vein |
| 4 External oblique aponeurosis | 15 Pectineus | 25 Superficial inguinal ring |
| 5 Fascia lata (cut edge) | 16 Perforating branch of profunda femoris artery | 26 Tensor fasciae latae deep to fascia lata |
| 6 Femoral artery | 17 Rectus femoris | 27 Valvular bulge in vein |
| 7 Femoral nerve | 18 Saphenous nerve | 28 Vastus lateralis |
| 8 Femoral vein | 19 Sartorius | 29 Vastus medialis |
| 9 Gracilis | 20 Subsartorial fascia (thickened aponeurosis) | |
| 10 Great saphenous vein | 21 Spermatic cord | |
| 11 Iliopsoas | | |



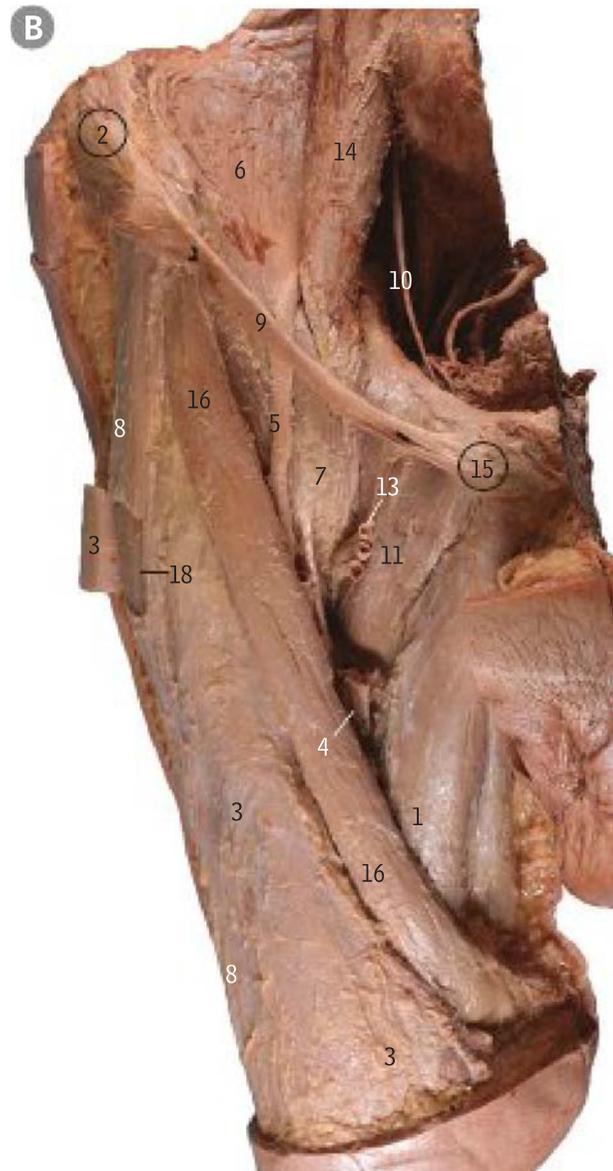
Femoral nerve paralysis



Obturator nerve paralysis

Borders and floor of femoral triangle

from lateral view anterior view



- 1 Adductor longus
- 2 Anterior superior iliac spine
- 3 Fascia lata
- 4 Femoral artery
- 5 Femoral nerve
- 6 Iliacus
- 7 Iliopsoas
- 8 Iliotibial tract (band)
- 9 Inguinal ligament

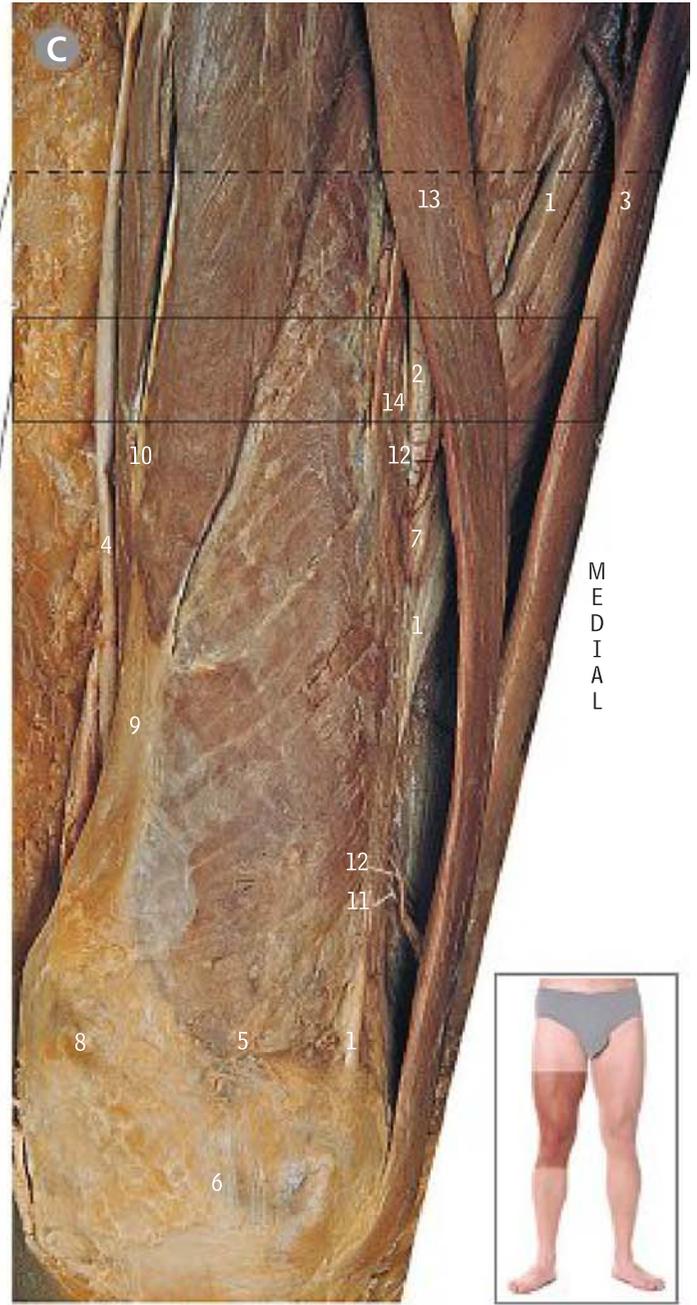
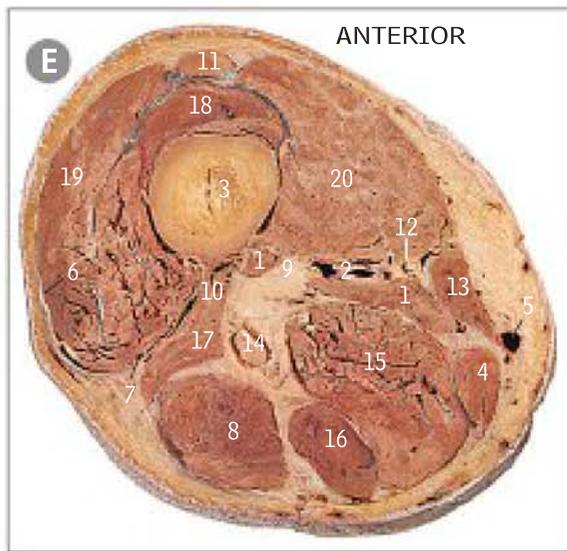
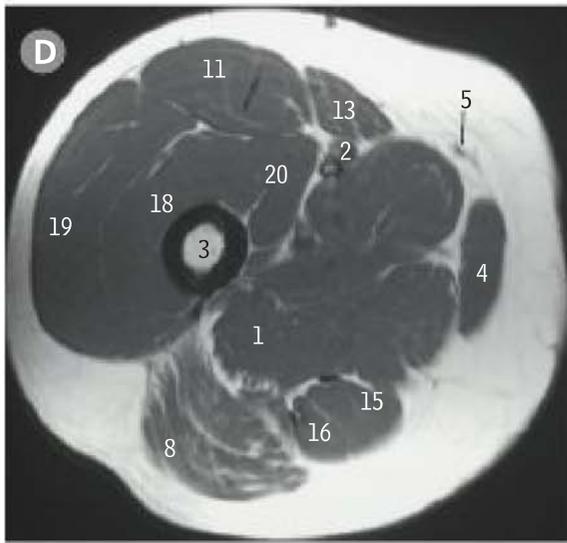
- 10 Obturator nerve
- 11 Pectineus
- 12 Penis
- 13 Perforating arterial branches
- 14 Psoas major
- 15 Pubic tubercle
- 16 Sartorius muscle
- 17 Scrotum
- 18 Tensor fasciae latae muscle

Right lower thigh

from the front and medial side

The lower part of sartorius (13) has been displaced medially to open up the lower part of the adductor canal and expose the femoral artery (2) passing through the opening in adductor magnus (7) to enter the popliteal fossa behind the knee and become the popliteal artery (page 344).

- | | |
|---|--|
| 1 Adductor magnus | 8 Patella |
| 2 Femoral artery | 9 Quadriceps tendon |
| 3 Gracilis | 10 Rectus femoris |
| 4 Iliotibial tract | 11 Saphenous branch of descending genicular artery |
| 5 Lowest (horizontal) fibres of vastus medialis | 12 Saphenous nerve |
| 6 Medial patellar retinaculum | 13 Sartorius |
| 7 Opening in adductor magnus | 14 Vastus medialis and nerve |



Right lower thigh

axial MR image

cross-section

- | | |
|--------------------------------|---------------------------------|
| 1 Adductor magnus | 11 Rectus femoris |
| 2 Femoral vessels | 12 Saphenous nerve |
| 3 Femur | 13 Sartorius |
| 4 Gracilis | 14 Sciatic nerve |
| 5 Great saphenous vein | 15 Semimembranosus |
| 6 Iliotibial tract | 16 Semitendinosus |
| 7 Lateral intermuscular septum | 17 Short head of biceps femoris |
| 8 Long head of biceps femoris | 18 Vastus intermedius |
| 9 Opening in adductor magnus | 19 Vastus lateralis |
| 10 Profunda femoris vessels | 20 Vastus medialis |



Femoropopliteal bypass



Intermittent claudication



Muscular transposition

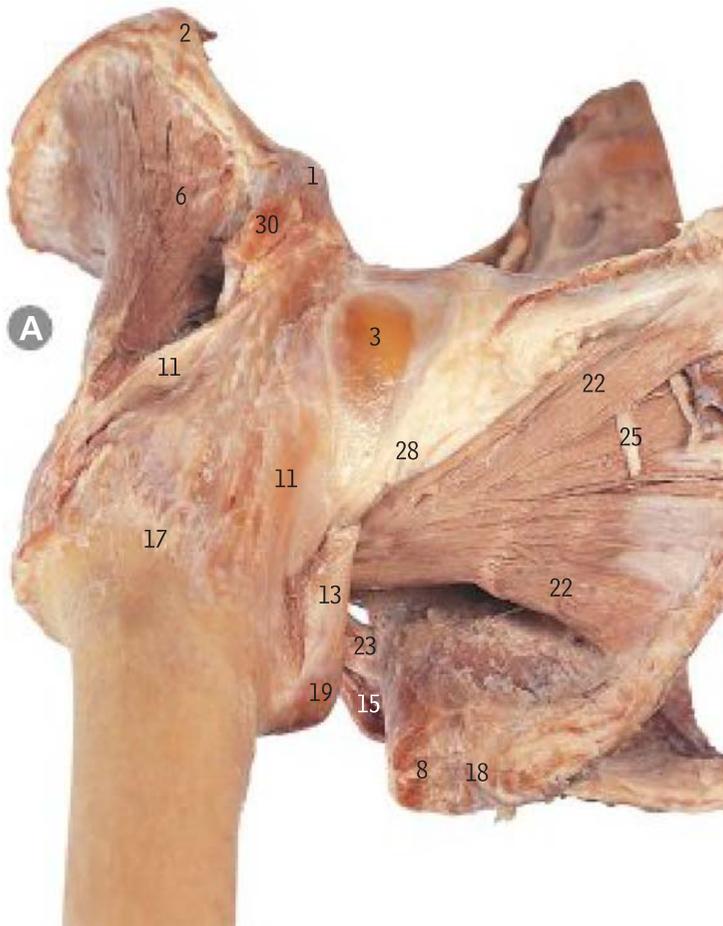


Rupture – quadriceps tendon

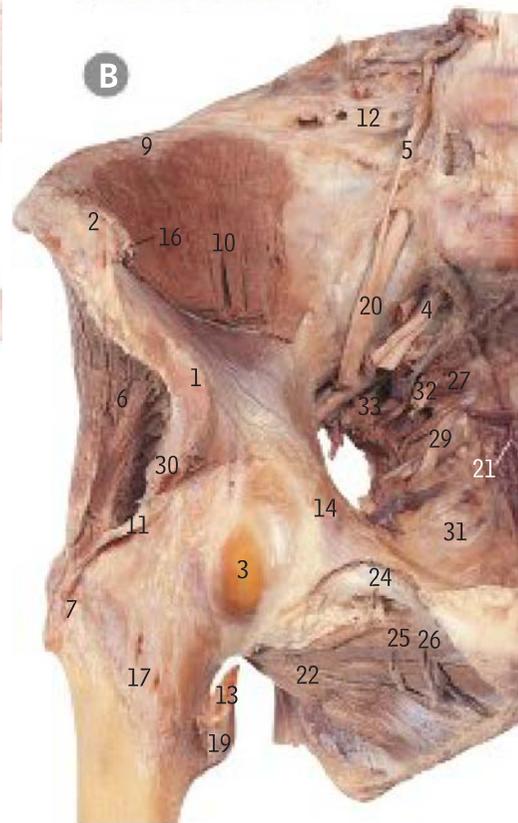
Right hip joint

from the front and below

from the front and above



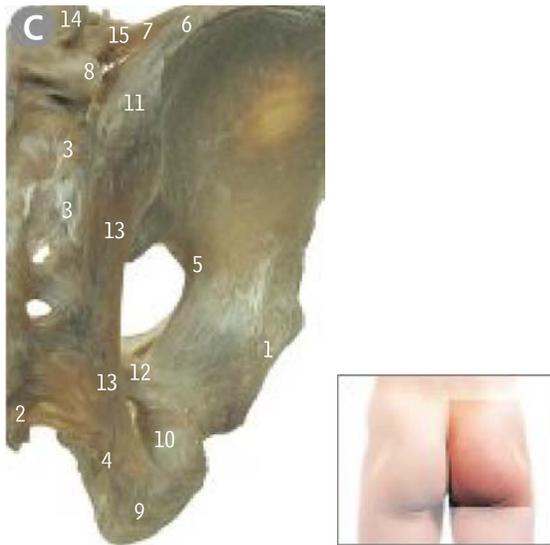
Some of the fibres of the ischiofemoral ligament help to form the zona orbicularis – circular fibres of the capsule that form a collar around the neck of the femur.



- | | |
|--|---|
| <ul style="list-style-type: none"> 1 Anterior inferior iliac spine 2 Anterior superior iliac spine 3 Bursa for psoas tendon 4 First sacral nerve root 5 Fourth lumbar nerve root 6 Gluteus minimus muscle 7 Greater trochanter 8 Hamstring origin 9 Iliac crest 10 Iliacus muscle 11 Iliofemoral ligament 12 Iliolumbar ligament 13 Iliopsoas tendon 14 Iliopubic eminence 15 Inferior gemellus muscle 16 Inguinal ligament (attachment) 17 Intertrochanteric line and capsule attachment | <ul style="list-style-type: none"> 18 Ischial tuberosity 19 Lesser trochanter 20 Lumbosacral trunk 21 Median sacral artery 22 Obturator externus 23 Obturator internus tendon 24 Obturator nerve, anterior branch 25 Obturator nerve, posterior branch 26 Obturator vessels 27 Piriformis muscle 28 Pubofemoral ligament 29 Pudendal nerve 30 Rectus femoris muscle 31 Sacrospinous ligament 32 Second sacral nerve root 33 Superior gluteal artery |
|--|---|



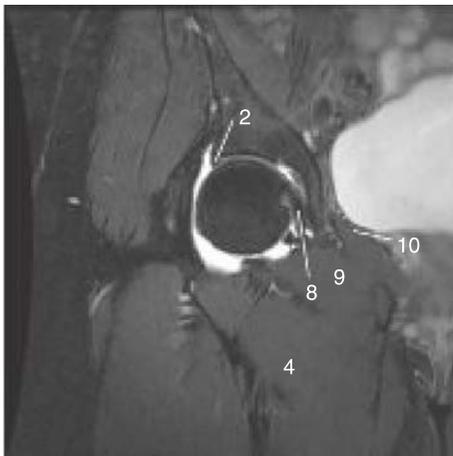
Trendelenburg's sign



Right vertebral pelvis and sacroiliac ligaments from behind

- 1 Acetabular labrum
- 2 Coccyx
- 3 Dorsal sacro-iliac ligaments
- 4 Falciform process of sacrotuberous ligament
- 5 Greater sciatic notch
- 6 Iliac crest
- 7 Iliolumbar ligament
- 8 Inferior articular process of fifth lumbar vertebra
- 9 Ischial tuberosity
- 10 Lesser sciatic notch
- 11 Posterior superior iliac spine
- 12 Sacrospinous ligament and ischial spine
- 13 Sacrotuberous ligament
- 14 Superior articular process of fifth lumbar vertebra
- 15 Transverse process of fifth lumbar vertebra

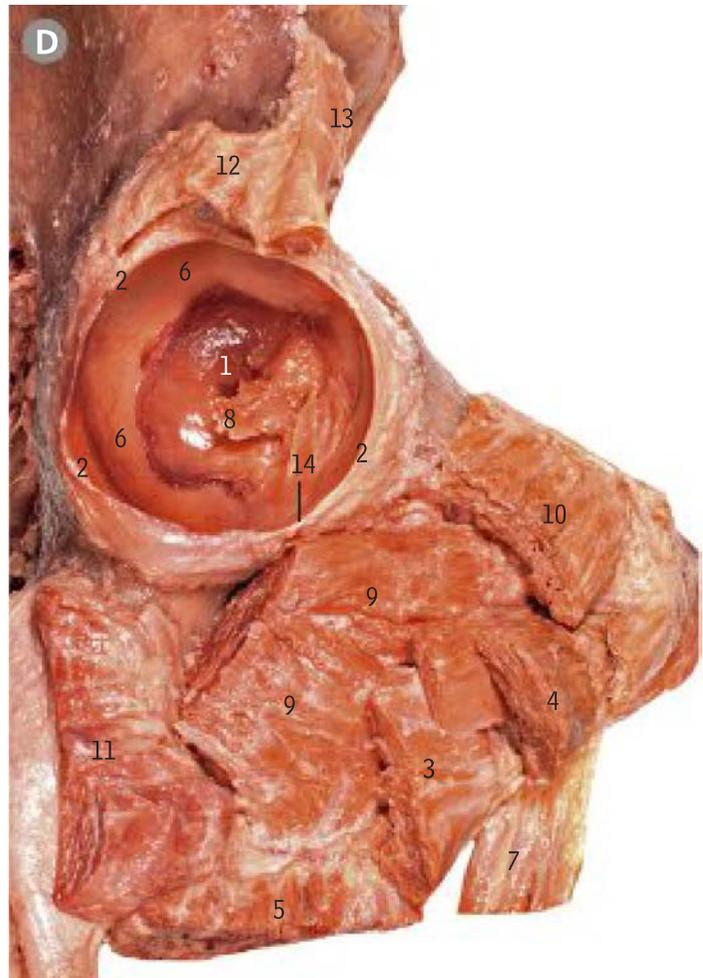
Hip MR arthrogram coronal view



Right hip joint with femur removed from the right

The femur has been disarticulated from the acetabulum and removed, leaving the acetabular labrum, transverse ligament and the ligamentum teres.

- | | |
|----------------------------|--|
| 1 Acetabular fossa | 9 Obturator externus muscle |
| 2 Acetabular labrum | 10 Pectineus muscle |
| 3 Adductor brevis muscle | 11 Quadratus femoris muscle |
| 4 Adductor longus muscle | 12 Reflected head of rectus femoris muscle |
| 5 Adductor magnus muscle | 13 Straight head of rectus femoris muscle |
| 6 Articular surface | 14 Transverse ligament |
| 7 Gracilis muscle | |
| 8 Ligamentum teres femoris | |



Avascular necrosis of the head of the femur

Left hip joint *coronal section, from the front*



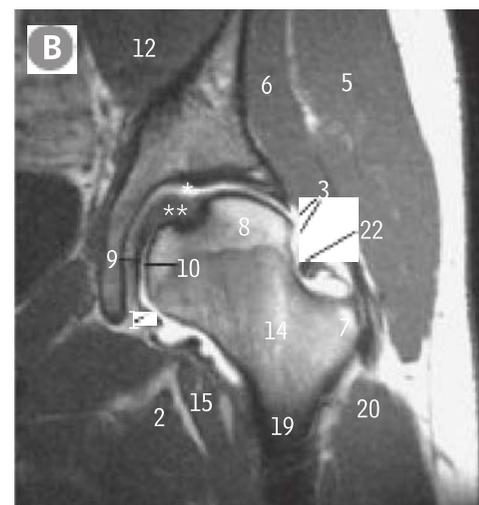
The section has almost passed through the centre of the head (8) of the femur and the centre of the greater trochanter (7). Above the neck of the femur (14), gluteus minimus (6) with gluteus medius (5) above it run down to their attachments to the greater trochanter (7), while below the neck the tendon of psoas major (17) and muscle fibres of iliacus (12) pass backwards the lesser trochanter. The circular fibres of the zona orbicularis (22) constrict the capsule (3) around the intracapsular part of the neck of the femur.

- 1 Acetabular labrum
- 2 Adductor longus
- 3 Capsule of hip joint
- 4 External iliac artery
- 5 Gluteus medius
- 6 Gluteus minimus
- 7 Greater trochanter
- 8 Head of femur
- 9 Hyaline cartilage of acetabulum
- 10 Hyaline cartilage of head
- 11 Iliac crest
- 12 Iliacus
- 13 Medial circumflex femoral vessels
- 14 Neck of femur
- 15 Pectineus
- 16 Profunda femoris vessels
- 17 Psoas major
- 18 Rim of acetabulum
- 19 Shaft of femur
- 20 Vastus lateralis
- 21 Vastus medialis
- 22 Zona orbicularis of capsule

*Contrast outlines the joint cavity

** Ligamentum teres

coronal MR, arthrogram



The convergence of gluteus medius and minimus (5 and 6) on to the greater trochanter is well displayed in this section. These muscles are classified as abductors of the femur at the hip joint, but their more important action is in walking, where they act to prevent adduction – preventing the pelvis from tilting to the opposite side when the opposite limb is off the ground (see Trendelenburg's sign, [page 333](#)).



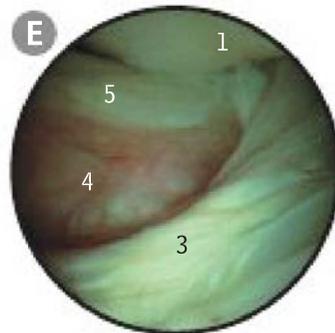
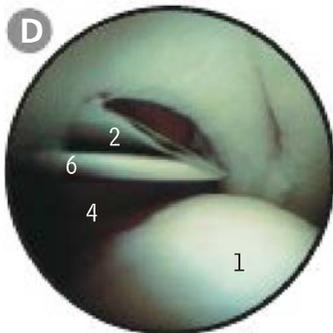
Total hip replacement surgery

Left hip and sacroiliac joint

CT 3D reconstruction



- 1 Anterior superior iliac spine
- 2 First coccygeal vertebra
- 3 Greater trochanter of femur
- 4 Head of femur
- 5 Inferior pubic ramus
- 6 Ischium
- 7 Ischial tuberosity
- 8 Lesser trochanter of femur
- 9 Neck of femur
- 10 Obturator foramen
- 11 Pectineal line
- 12 Promontory of sacrum
- 13 Pubic symphysis
- 14 Pubic tubercle
- 15 Rim of acetabulum
- 16 Sacro-iliac joint
- 17 Sacrum
- 18 Superior pubic ramus
- 19 Transverse process of fifth lumbar vertebra



Hip joint

E arthroscopic views

- 1 Femoral head
- 2 Irrigation needle
- 3 Ligamentum teres
- 4 Synovium
- 5 Transverse ligament
- 6 Zona orbicularis



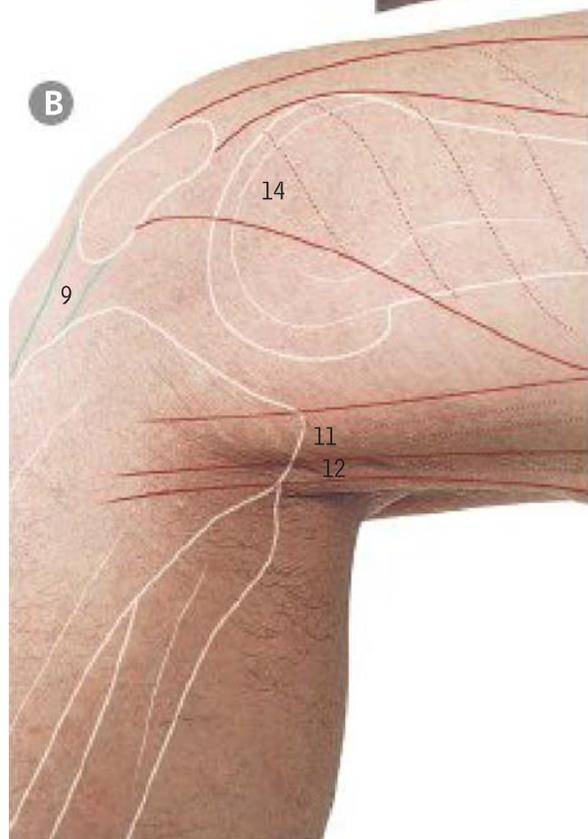
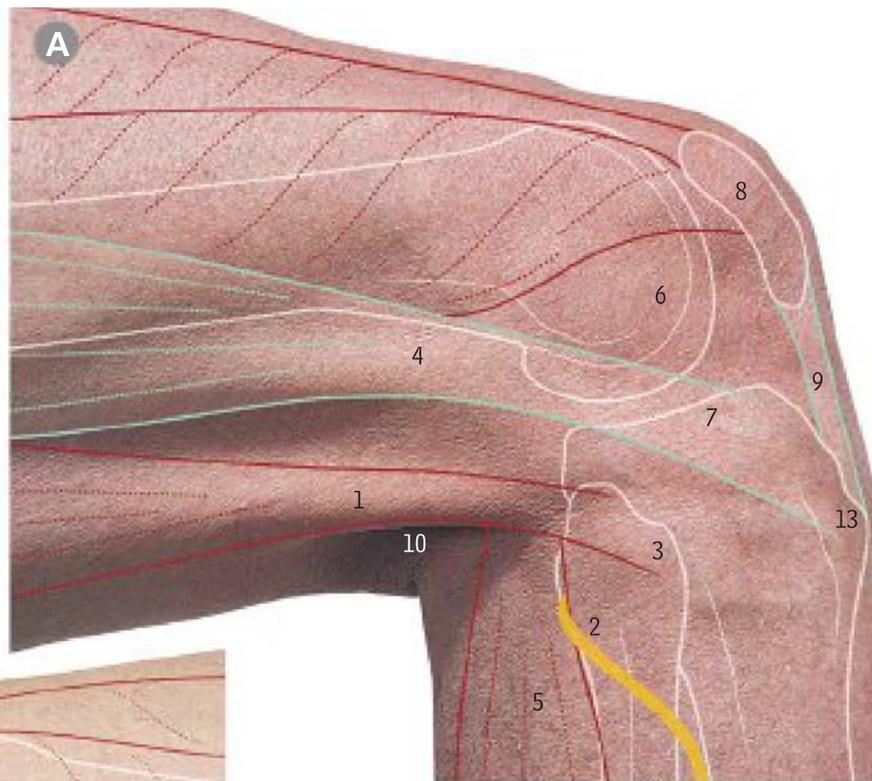
Posterior hip dislocation

Right knee partially flexed

from the lateral side

from the medial side

- 1 Biceps femoris
- 2 Common peroneal (fibular) nerve
- 3 Head of fibula
- 4 Iliotibial tract
- 5 Lateral head of gastrocnemius
- 6 Margin of condyle of femur
- 7 Margin of condyle of tibia
- 8 Patella
- 9 Patellar ligament
- 10 Popliteal fossa
- 11 Semimembranosus
- 12 Semitendinosus
- 13 Tuberosity of tibia
- 14 Vastus medialis



Behind the knee on the lateral side, the rounded tendon of biceps femoris (1) can be felt easily, with the broad strap-like iliotibial tract (4) in front of it, with a furrow between them. On the medial side, two tendons can be felt – the narrow rounded semitendinosus (12) just behind the broader semimembranosus (11). At the front, the patellar ligament (9) keeps the patella (8) at a constant distance from the tibial tuberosity (13), while at the side the adjacent margins of the femoral and tibial condyles (6 and 7) can be palpated.



Genu valgum,
genu varum



Patellar tendon
reflex



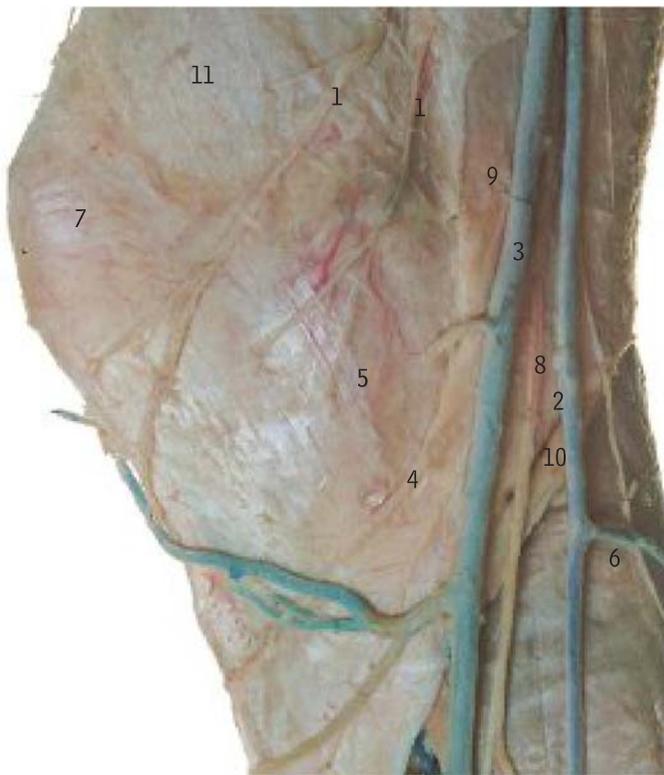
Right knee superficial dissection, from the lateral side

The fascia behind biceps femoris (2) has been removed to show the common peroneal (fibular) nerve (3) passing downwards immediately behind the tendon, and then running between the adjacent borders of soleus (12) and peroneus (fibularis) longus (5), under cover of which it lies against the neck of the fibula. Minor superficial vessels and nerves have been removed.

- 1 Attachment of iliotibial tract to tibia
- 2 Biceps femoris
- 3 Common peroneal (fibular) nerve
- 4 Deep fascia overlying extensor muscles
- 5 Deep fascia overlying peroneus (fibularis) longus
- 6 Fascia lata
- 7 Head of fibula
- 8 Iliotibial tract
- 9 Lateral sural cutaneous nerve of calf
- 10 Lateral head of gastrocnemius
- 11 Patella
- 12 Soleus

The iliotibial tract (8) is the thickened lateral part of the fascia lata (6). At its upper part, the tensor fasciae latae and most of gluteus maximus are inserted into it.

Its subcutaneous position and contact with the neck of the fibula make the common peroneal (fibular) nerve (3) the most commonly injured nerve in the lower limb.



Right knee superficial dissection, from the medial side

The great saphenous vein (3) runs upwards about a hand's breadth behind the medial border of the patella (7). The saphenous nerve (8) becomes superficial between the tendons of sartorius (9) and gracilis (2), and its infrapatellar branch (4) curls forwards a little below the upper margin of the tibial condyle.

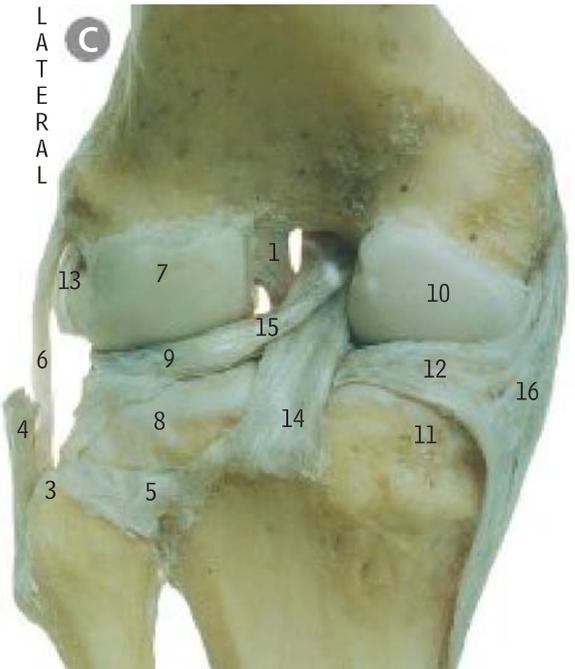
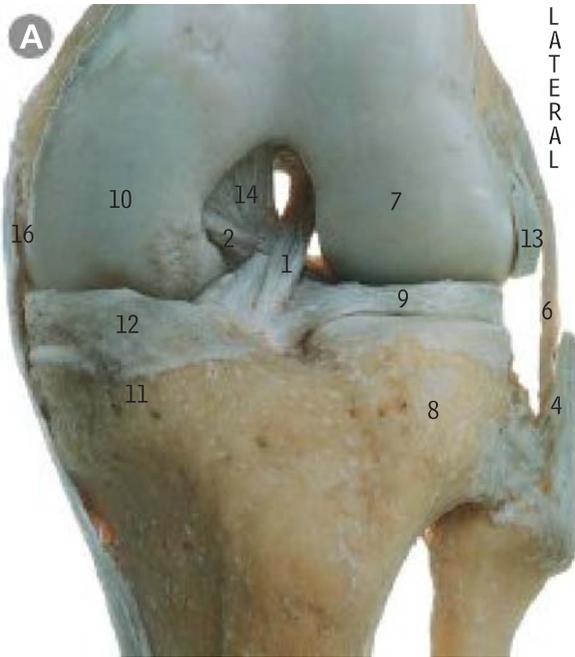
- 1 Branches of medial femoral cutaneous nerve
- 2 Gracilis
- 3 Great saphenous vein
- 4 Infrapatellar branch of saphenous nerve
- 5 Level of margin of medial condyle of tibia
- 6 Medial head of gastrocnemius
- 7 Patella
- 8 Saphenous nerve
- 9 Sartorius
- 10 Semitendinosus
- 11 Vastus medialis



Left knee joint ligaments

coronal MR image

coronal MR image



from the front

from behind

The capsule of the knee joint and all surrounding tissues have been removed, leaving only the ligaments of the joint, which is partially flexed.



— D label key

- | | |
|--|--|
| 1 Anterior cruciate ligament | 9 Lateral meniscus |
| 2 Anterior menisofemoral ligament | 10 Medial condyle of femur |
| 3 Apex of head of fibula | 11 Medial condyle of tibia |
| 4 Biceps femoris tendon | 12 Medial meniscus |
| 5 Capsule of superior tibiofibular joint | 13 Popliteus tendon |
| 6 Fibular (lateral) collateral ligament | 14 Posterior cruciate ligament |
| 7 Lateral condyle of femur | 15 Posterior menisofemoral ligament |
| 8 Lateral condyle of tibia | 16 Tibial (medial) collateral ligament |

The fibular collateral (lateral) ligament (A6) is a rounded cord about 5 cm long, passing from the lateral epicondyle of the femur to the head of the fibula just in front of its apex (C3), largely under cover of the tendon of biceps femoris (C4).

The medial meniscus is attached to the deep part of the tibial (medial) collateral ligament. This helps to anchor the meniscus but makes it liable to become trapped and torn by rotatory movements between the tibia and femur.

The lateral meniscus (A9) is not attached to the fibular (lateral) collateral ligament (A6), but is attached posteriorly to the popliteus muscle.

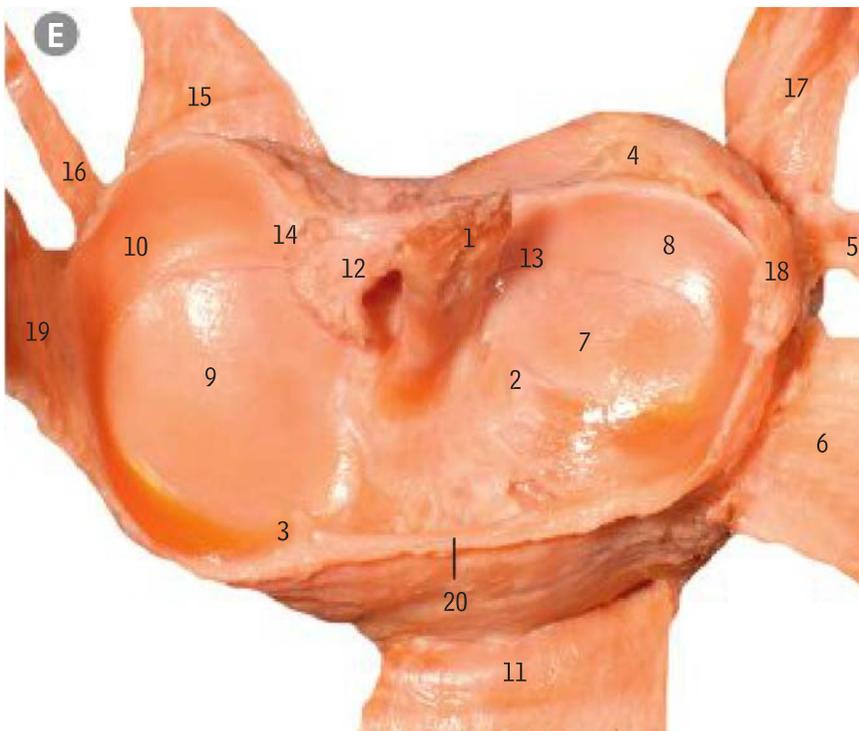
The tibial collateral (medial) ligament is a broad flat band about 12 cm long, passing from the medial epicondyle of the femur to the medial condyle of the tibia and an extensive area of the medial surface of the tibia below the condyle.

The cruciate ligaments are named from their attachments to the tibia.

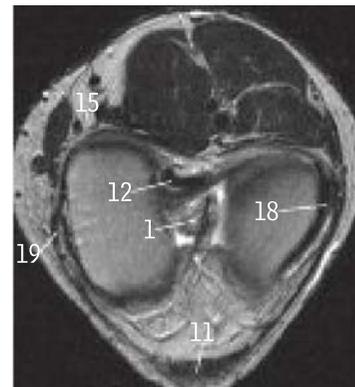
The anterior cruciate ligament (A1) passes upwards, backwards and laterally to be attached to the medial side of the lateral condyle of the femur (C7).

The posterior cruciate ligament (C14) passes upwards, forwards and medially to be attached to the lateral surface of the medial condyle of the femur (A10).

Left knee tibial plateau *from above*



Axial MR, knee



- | | | | |
|--|-------------------------------|---------------------------------------|---|
| 1 Anterior cruciate ligament | 5 Fibular collateral ligament | 12 Posterior cruciate ligament | 17 Tendon of biceps femoris muscle |
| 2 Anterior horn of lateral meniscus | 6 Iliotibial tract | 13 Posterior horn of lateral meniscus | 18 Tendon of popliteus muscle |
| 3 Anterior horn of medial meniscus | 7 Lateral condyle of tibia | 14 Posterior horn of medial meniscus | 19 Tibial collateral ligament attachment to medial meniscus |
| 4 Attachment of lateral meniscus to popliteus muscle | 8 Lateral meniscus | 15 Semimembranosus (tendon) | 20 Transverse ligament |
| | 9 Medial condyle of tibia | 16 Semitendinosus (tendon) | |
| | 10 Medial meniscus | | |
| | 11 Patellar ligament (tendon) | | |



Meniscal tears



Rupture – anterior cruciate ligament



Right knee joint

from the medial side with the medial femoral condyle removed

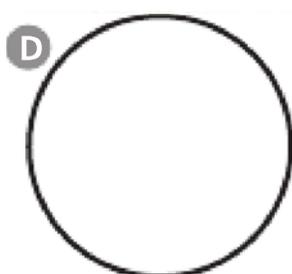
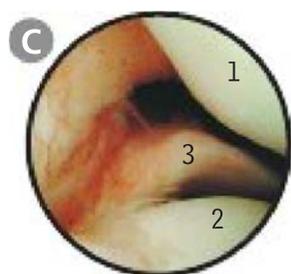
sagittal MR image

Removal of the medial half of the lower end of the femur enables the X-shaped crossover of the cruciate ligaments to be seen; the anterior cruciate (1) is passing backwards and laterally, while the posterior cruciate (13) passes forwards and medially. The MR image in B shows the infrapatellar fat pad (3).



- | | | |
|---|--|--|
| <ul style="list-style-type: none"> 1 Anterior cruciate ligament 2 Femur 3 Infrapatellar fat pad (Hoffa) 4 Intercondylar notch 5 Lateral condyle of femur 6 Lateral head of gastrocnemius muscle 7 Lateral meniscus | <ul style="list-style-type: none"> 8 Patella 9 Patellar apex 10 Patellar ligament (tendon) 11 Popliteus 12 Posterior capsule 13 Posterior cruciate ligament 14 Posterior meniscomfemoral ligament | <ul style="list-style-type: none"> 15 Semimembranosus 16 Soleus 17 Tendon of quadriceps 18 Tibia 19 Tibial (medial) collateral ligament 20 Tibial tubercle 21 Transverse (intermeniscal) ligament |
|---|--|--|

Left knee arthroscopic views



anterolateral approach

posteromedial approach

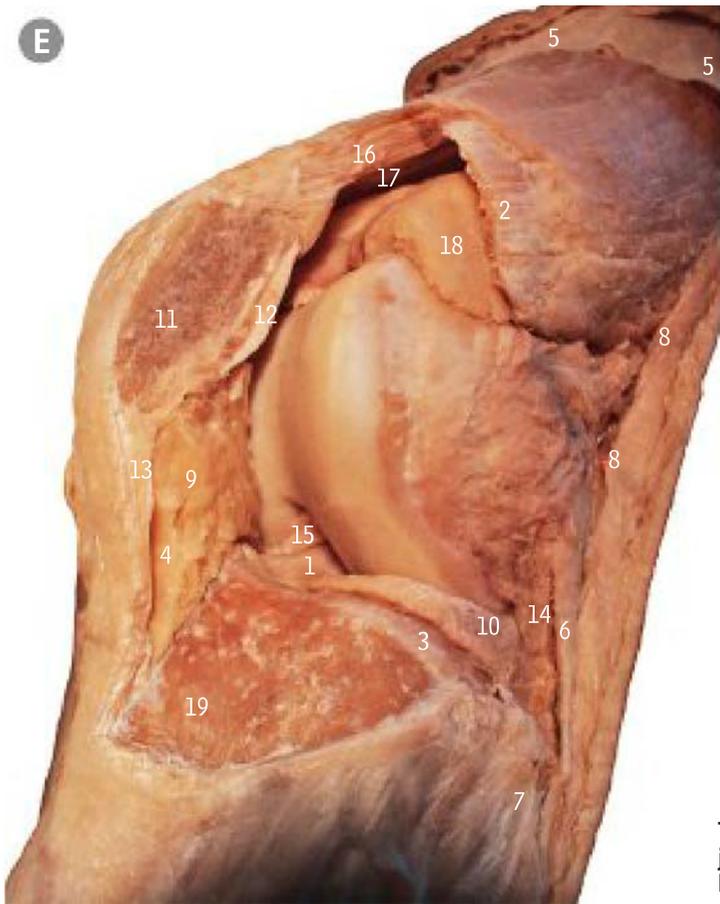
- | | |
|---|---|
| <ul style="list-style-type: none"> 1 Lateral condyle of femur 2 Lateral condyle of tibia 3 Lateral meniscus 4 Medial condyle of femur | <ul style="list-style-type: none"> 5 Medial meniscus 6 Posterior cruciate ligament 7 Posterior part of capsule |
|---|---|



Rupture – posterior cruciate ligament



Suprapatellar bursa



Left knee joint
opened from the lateral side to reveal internal structures

- 1 Anterior cruciate ligament
- 2 Aponeurosis of vastus lateralis (cut edge)
- 3 Articular cartilage, tibial plateau
- 4 Deep infrapatellar bursa
- 5 Fascia lata (deep fascia)
- 6 Fibular collateral ligament
- 7 Head of fibula
- 8 Iliotibial tract (cut edge)
- 9 Infrapatellar fat pad (Hoffa)
- 10 Lateral meniscus
- 11 Patella
- 12 Patellar articular cartilage
- 13 Patellar ligament (tendon)
- 14 Popliteus tendon, attachment to lateral tibial epicondyle
- 15 Posterior cruciate ligament
- 16 Quadriceps tendon
- 17 Suprapatellar bursa
- 18 Suprapatellar fat pad
- 19 Tibial tuberosity

Left knee joint
from the medial side, with synovial and bursal cavities injected

The resin injection has distended the synovial cavity of the joint (3) and extends into the suprapatellar bursa (10), the bursa round the popliteus tendon (2) and the semimembranosus bursa (9).

- | | |
|-----------------------------|--|
| 1 Articularis genu | 7 Quadriceps tendon |
| 2 Bursa of popliteus tendon | 8 Semimembranosus |
| 3 Capsule | 9 Semimembranosus bursa |
| 4 Medial meniscus | 10 Suprapatellar bursa |
| 5 Patella | 11 Tibial (medial) collateral ligament |
| 6 Patellar ligament | |

The suprapatellar bursa (F10) always communicates with the joint cavity. The bursa around the popliteus tendon (F2) usually does so. The semimembranosus bursa (F9) may do so.



Anterior cruciate ligament
anterior arthroscopic view



Knee joint aspiration and injection

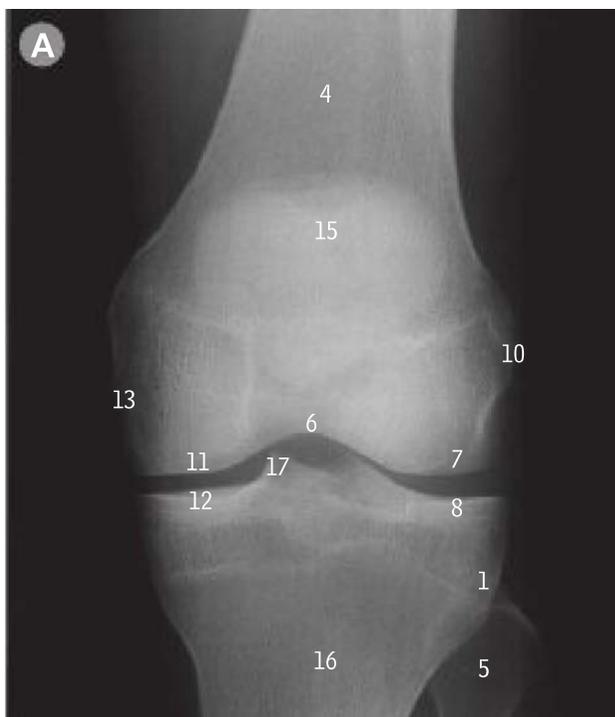


Lower limb bursitis

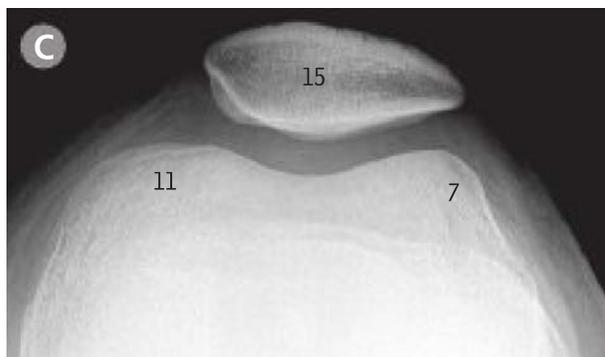


Prepatellar bursitis

Knee radiographs and arthroscopic views

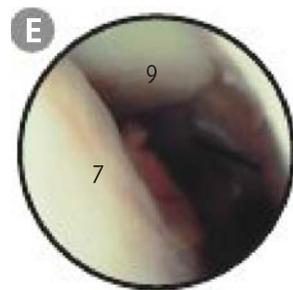
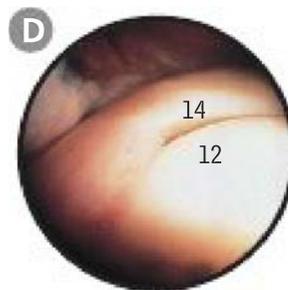


- AP projection
- lateral projection in flexion
- skyline view projection
- anterolateral approach
- lateral view of patella



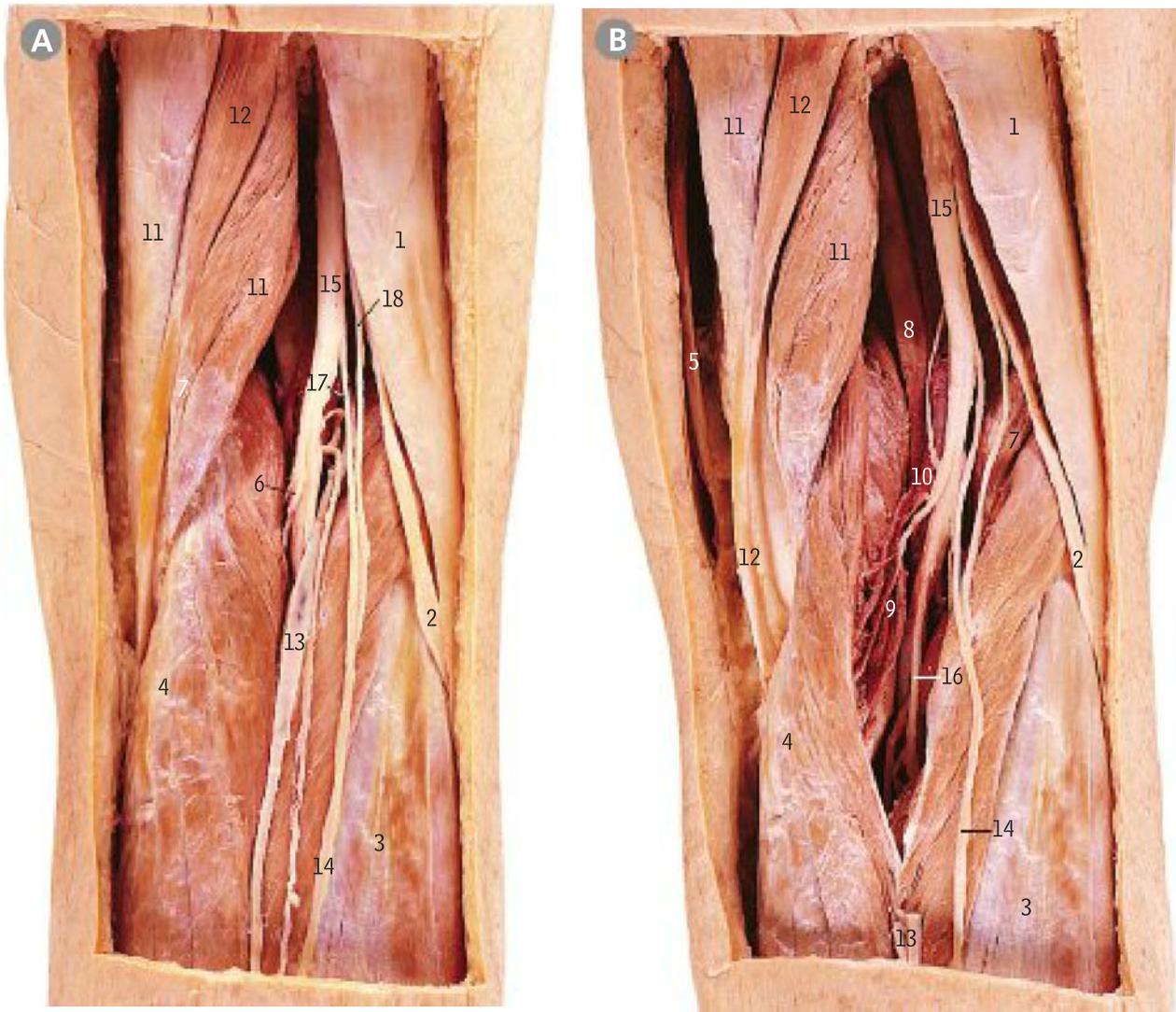
In A, the shadow of the patella (15) is superimposed on that of the femur. The regular space between the condyles of the femur and tibia (7 and 8, 11 and 12) is due to the thickness of the hyaline cartilage on the articulating surface, with the menisci at the periphery. In C, with the knee flexed, the view should be compared with the bones seen on [page 307, E](#), and the lateral edge of the patella (9) is seen in the arthroscopic view in E.

- | | |
|---|--|
| 1 Apex (styloid process) of fibula | 10 Lateral epicondyle of femur |
| 2 Physeal line | 11 Medial condyle of femur |
| 3 Fabella (sesamoid in lateral head of gastrocnemius) | 12 Medial condyle of tibia |
| 4 Femur | 13 Medial epicondyle of femur |
| 5 Head of fibula | 14 Medial meniscus |
| 6 Intercondylar fossa | 15 Patella |
| 7 Lateral condyle of femur | 16 Tibia |
| 8 Lateral condyle of tibia | 17 Tubercles of intercondylar eminence |
| 9 Lateral edge of patella | 18 Tuberosity of tibia |



Knee joint replacement surgeries

Right popliteal fossa *superficial dissections*



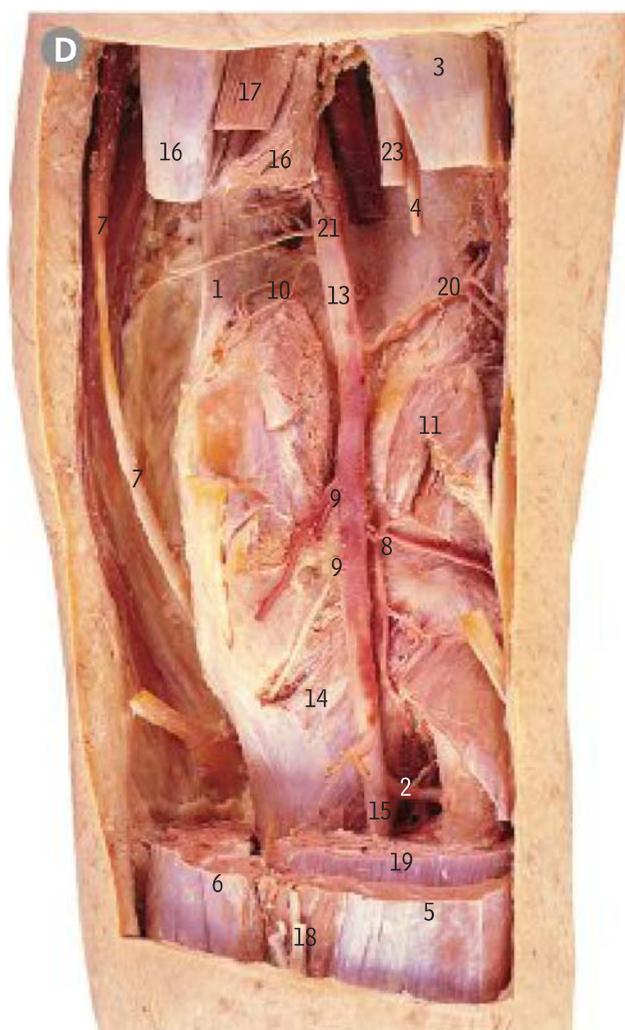
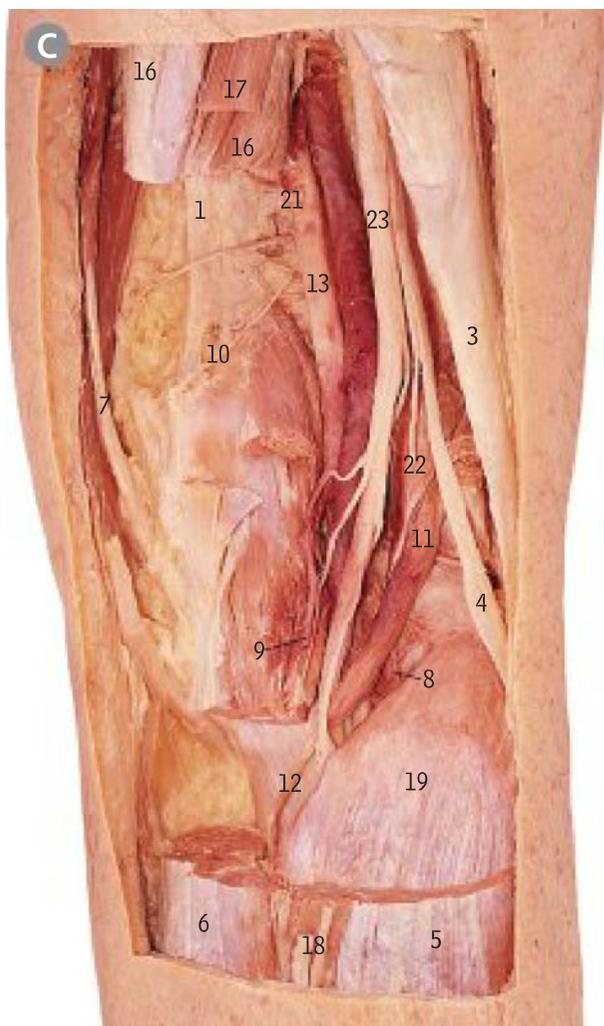
Skin and fascia forming the roof of the diamond-shaped popliteal fossa and the fat within it have been removed but the small saphenous vein which pierces the fascia has been preserved. A high (proximal) union of the lateral and medial sural cutaneous nerves places the sural nerve in this field.

Heads of gastrocnemius have been separated to show deeper structures.



- 1 Biceps femoris
- 2 Common peroneal (fibular) nerve
- 3 Gastrocnemius, lateral head
- 4 Gastrocnemius, medial head
- 5 Gracilis
- 6 Nerve to medial head of gastrocnemius
- 7 Plantaris
- 8 Popliteal artery
- 9 Popliteal vascular branches to gastrocnemius
- 10 Popliteal vein
- 11 Semimembranosus
- 12 Semitendinosus
- 13 Small saphenous vein
- 14 Sural nerve
- 15 Tibial nerve
- 16 Tibial nerve, muscular branches
- 17 Sural nerve, branch from tibial
- 18 Sural nerve, branch from common peroneal (fibular)

Popliteal fossa progressive dissections



Removal of semitendinosus, semimembranosus and most of the origins of the gastrocnemius reveals plantaris and branches of the deeply situated popliteal artery and soleus.

Removal of the muscular boundaries of the popliteal fossa shows the popliteal artery, its genicular anastomoses and its terminal branches, the anterior and posterior tibial arteries.

- | | |
|-------------------------------------|--------------------------------------|
| 1 Adductor magnus | 13 Popliteal artery |
| 2 Anterior tibial artery | 14 Popliteus |
| 3 Biceps femoris | 15 Posterior tibial artery |
| 4 Common peroneal (fibular) nerve | 16 Semimembranosus |
| 5 Gastrocnemius, lateral head | 17 Semitendinosus |
| 6 Gastrocnemius, medial head | 18 Short saphenous vein |
| 7 Gracilis | 19 Soleus |
| 8 Inferior lateral genicular artery | 20 Superior lateral genicular artery |
| 9 Inferior medial genicular artery | 21 Superior medial genicular artery |
| 10 Middle genicular artery | 22 Sural nerve |
| 11 Plantaris muscle | 23 Tibial nerve |
| 12 Plantaris tendon | |



Popliteal (Baker's) cyst



Popliteal artery aneurysm



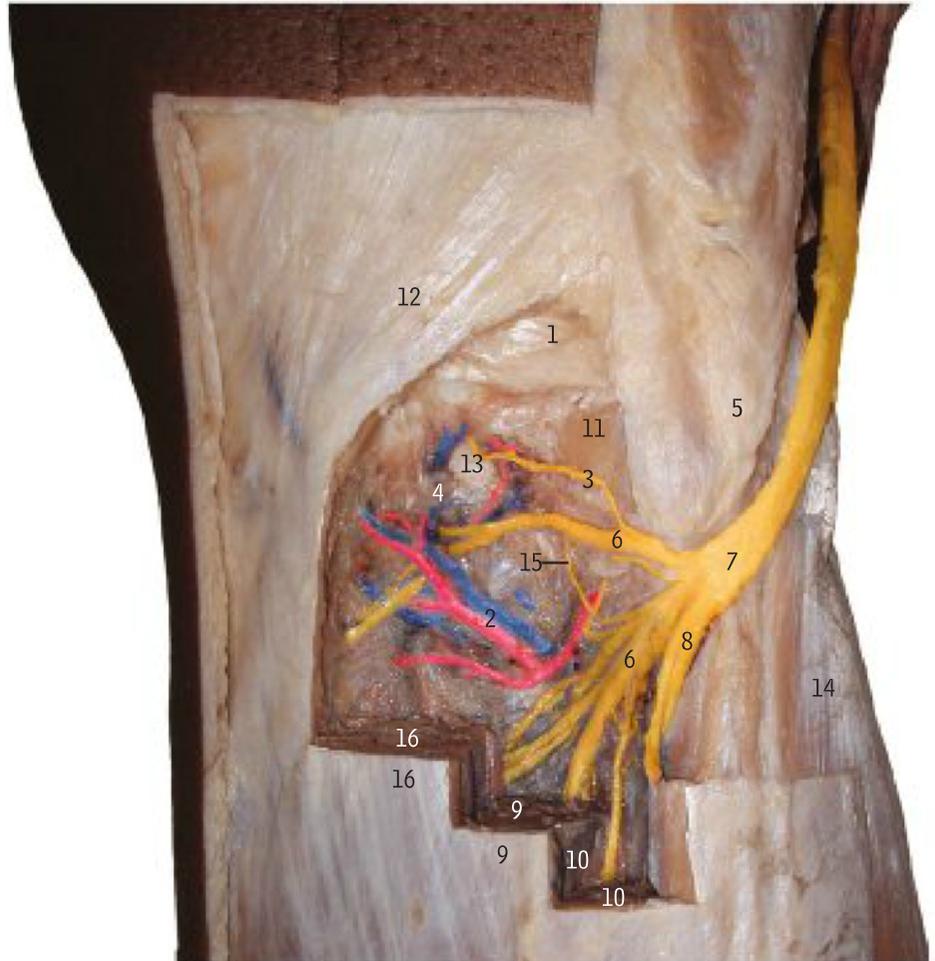
Sural nerve graft

Left leg from the front and lateral side



- 1 Anterior tibial artery overlying interosseous membrane
- 2 Branch of deep peroneal (fibular) nerve to tibialis anterior
- 3 Deep peroneal (fibular) nerve
- 4 Extensor digitorum longus
- 5 Extensor hallucis longus
- 6 Head of fibula
- 7 Lateral branch of superficial peroneal (fibular) nerve
- 8 Medial branch of superficial peroneal (fibular) nerve
- 9 Peroneus (fibularis) longus
- 10 Recurrent branch of common peroneal (fibular) nerve
- 11 Superficial peroneal (fibular) nerve
- 12 Tibialis anterior and overlying fascia
- 13 Tuberosity of tibia and patellar ligament

Left knee from the lateral side to show common peroneal (fibular) nerve and articular branches

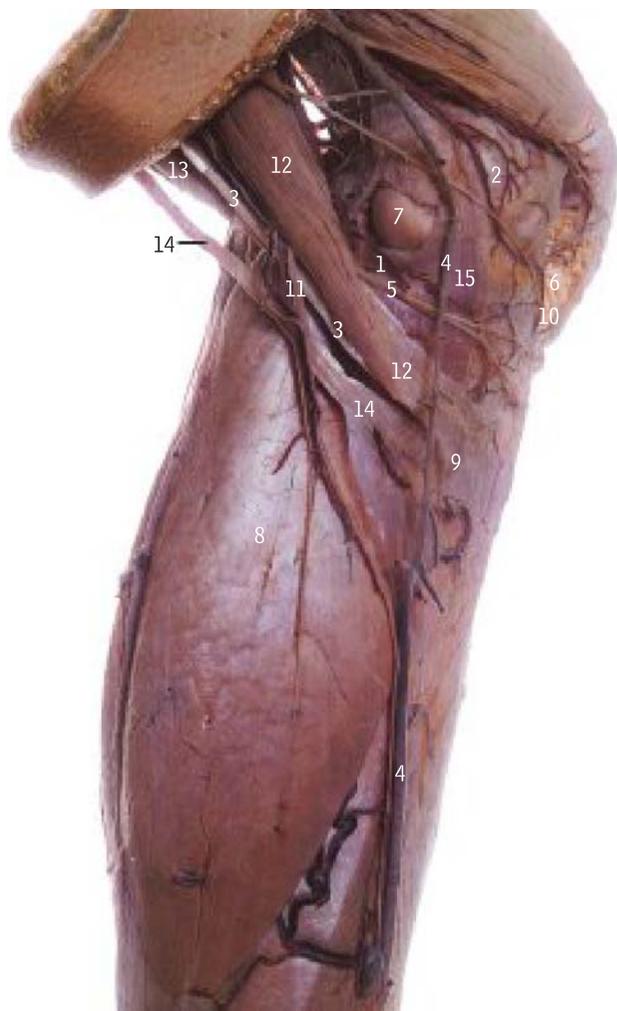


- 1 Anterior ligament of fibular head
- 2 Anterior tibial recurrent artery and vein
- 3 Articular branch from deep common peroneal (fibular) nerve
- 4 Articular vessels
- 5 Biceps femoris tendon
- 6 Common peroneal (fibular) nerve, deep branches
- 7 Common peroneal (fibular) nerve, overlying neck of fibula
- 8 Common peroneal (fibular) nerve, superficial branch
- 9 Extensor digitorum longus
- 10 Peroneus (fibularis) longus
- 11 Head of fibula
- 12 Iliotibial tract
- 13 Interosseous membrane
- 14 Lateral head, gastrocnemius muscle
- 15 Recurrent branch of deep peroneal (fibular) nerve
- 16 Tibialis anterior



Common peroneal (fibular) nerve paralysis

Left knee and leg



Left knee and leg *from the medial side and behind*

A small window has been cut in the capsule of the knee joint to show part of the medial condyle of the femur (7) and the medial meniscus (1).

- 1 Branch of saphenous artery overlying medial meniscus
- 2 Branches of superior medial genicular artery
- 3 Gracilis
- 4 Great saphenous vein
- 5 Infrapatellar branch of saphenous nerve
- 6 Infrapatellar fat pad
- 7 Medial condyle of femur (part of capsule removed)
- 8 Medial head of gastrocnemius
- 9 Medial surface of tibia
- 10 Patellar ligament
- 11 Saphenous nerve and artery
- 12 Sartorius
- 13 Semimembranosus
- 14 Semitendinosus
- 15 Tibial (medial) collateral ligament



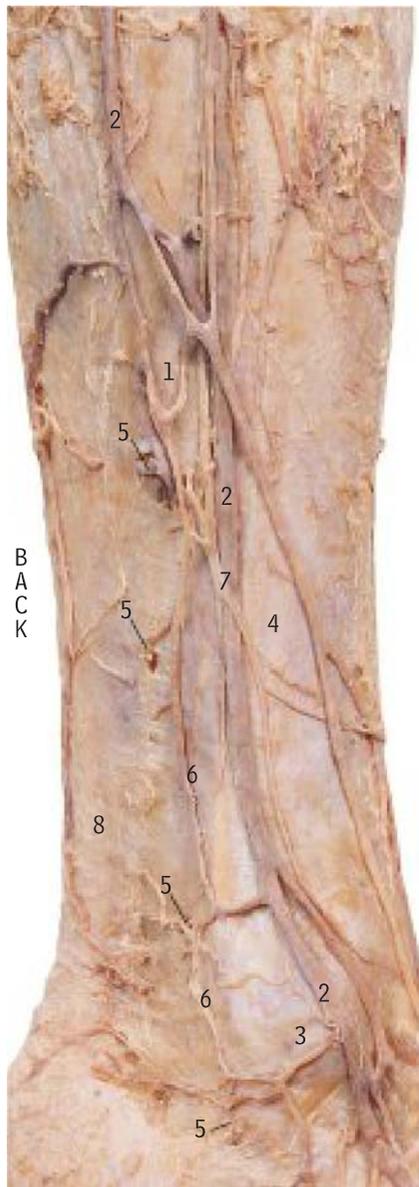
from the lateral side

A small window has been cut in the capsule of the knee joint to show the tendon of popliteus (14) passing deep to the fibular (lateral) collateral ligament (5). The common peroneal (fibular) nerve (2) runs down behind biceps femoris (1) to pass through the gap between peroneus (fibularis) longus (13) and soleus (15). The superficial peroneal (fibular) nerve becomes superficial between peroneus (fibularis) longus (13) and extensor digitorum longus (3).

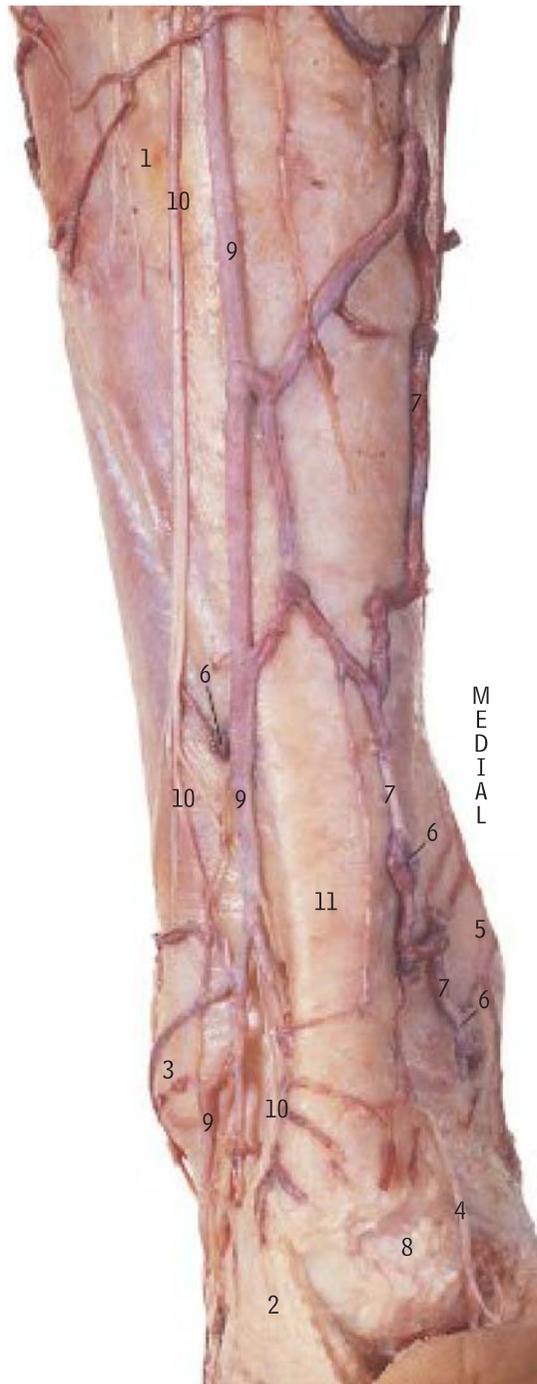
- | | |
|---|---|
| 1 Biceps femoris | 9 Lateral cutaneous nerve of calf |
| 2 Common peroneal (fibular) nerve | 10 Lateral head of gastrocnemius |
| 3 Extensor digitorum longus | 11 Lateral meniscus |
| 4 Fascia overlying tibialis anterior | 12 Patellar ligament |
| 5 Fibular (lateral) collateral ligament | 13 Peroneus (fibularis) longus |
| 6 Head of fibula | 14 Popliteus |
| 7 Iliotibial tract | 15 Soleus |
| 8 Infrapatellar fat pad | 16 Superficial peroneal (fibular) nerve |

Left leg and ankle *superficial veins and nerves*

from the medial side from behind



- 1 Deep fascia over soleus
- 2 Great saphenous vein
- 3 Medial malleolus
- 4 Medial (subcutaneous) surface of tibia
- 5 Perforating veins
- 6 Posterior arch vein
- 7 Saphenous nerve
- 8 Tendocalcaneus (Achilles tendon)



In B (a different specimen from that in A), the posterior arch vein (7) on the medial side is large and becoming varicose.

- 1 Deep fascia
- 2 Fibrofatty tissue of heel
- 3 Lateral malleolus
- 4 Medial calcaneal nerve
- 5 Medial malleolus
- 6 Perforating vein
- 7 Posterior arch vein
- 8 Posterior surface of calcaneus
- 9 Small saphenous vein
- 10 Sural nerve
- 11 Tendocalcaneus (under fascia)

The perforating veins are communications between the superficial veins (outside the deep fascia) and the deep veins (inside the fascia). The commonest sites for them are just behind the tibia, behind the fibula and in the adductor canal. These communicating vessels possess valves which direct the blood flow from superficial to deep; venous return from the limb is then brought about by the pumping action of the deep muscles (which are all below the deep fascia). If the valves become incompetent or the deep veins blocked, pressure in the superficial veins increases and they become varicose (dilated and tortuous).



Ankle ulceration from varicose veins



Deep vein thrombosis (DVT)

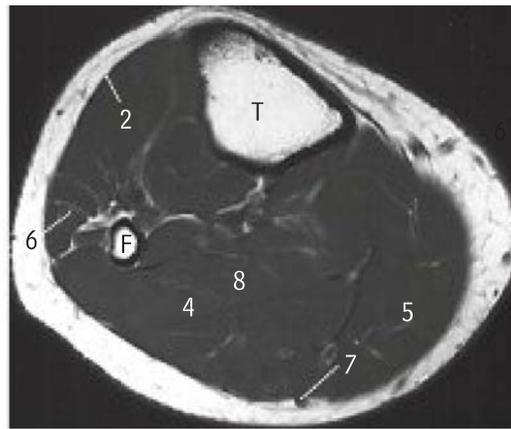
Lower limb venograms

The deep veins of the calf, deep to and within soleus, are sites for potentially dangerous venous thrombosis.

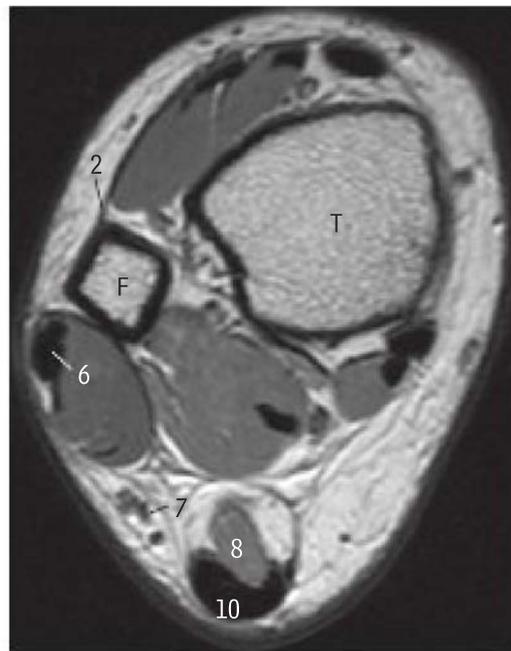


- 1 Anterior tibial vein
- 2 Femoral vein
- 3 Great (long) saphenous vein
- 4 Lateral circumflex calf vein
- 5 Muscular tributary of femoral vein

- 6 Perforating vein
- 7 Popliteal vein
- 8 Posterior tibial veins
- 9 Venous valves
- 10 Venous calf plexus



Axial MR, calf



Axial MR, lower leg

Below knee level, the great saphenous vein (page 348, A2) is accompanied by the saphenous nerve (page 348, A7). In the calf, the small saphenous vein (7) is accompanied by the sural nerve (9).

Left calf

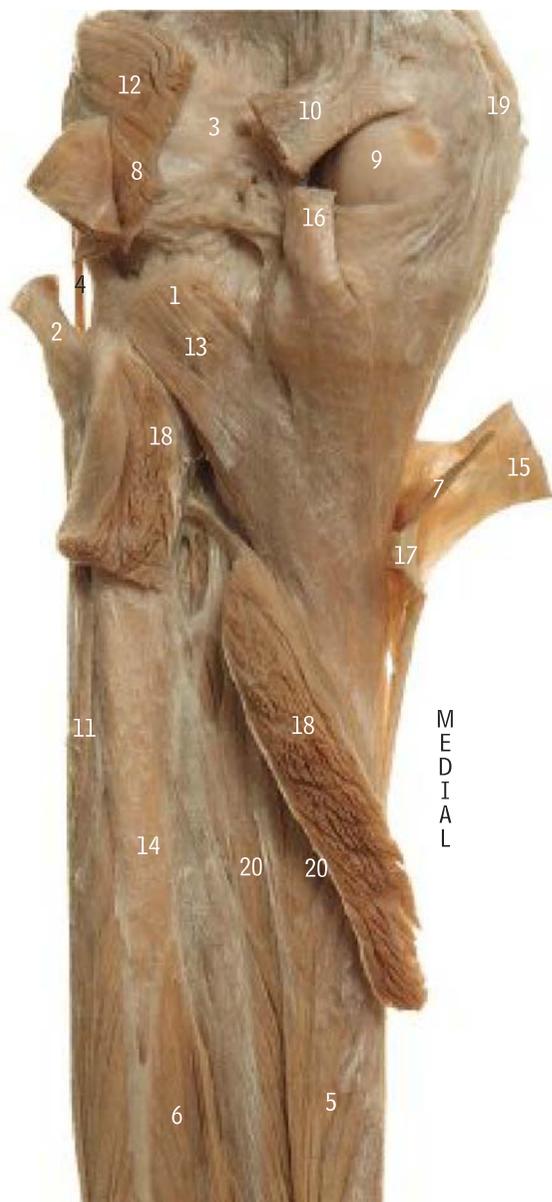
superficial dissection, from behind

- | | |
|-----------------------------------|-------------------------------------|
| 1 Aponeurosis of gastrocnemius | 7 Small saphenous vein |
| 2 Deep fascia | 8 Soleus |
| 3 Lateral cutaneous nerve of calf | 9 Sural nerve |
| 4 Lateral head of gastrocnemius | 10 Tendocalcaneus (Achilles tendon) |
| 5 Medial head of gastrocnemius | |
| 6 Peroneus (fibularis) longus | |



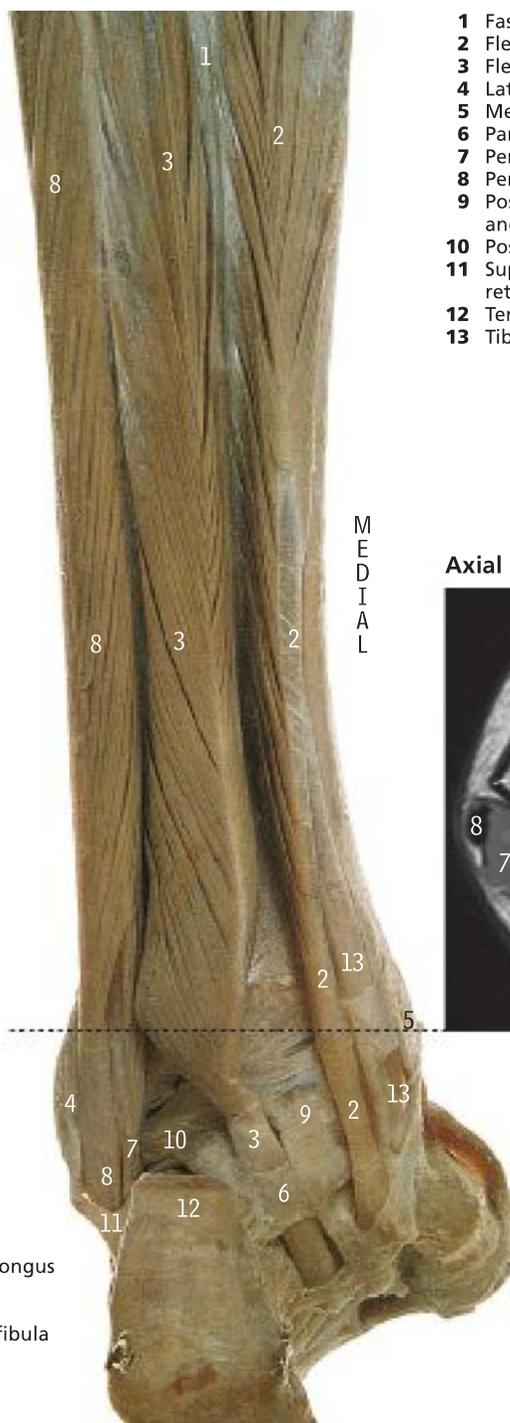
Vein harvest for coronary artery bypass grafting (CABG)

Left popliteal fossa and proximal calf



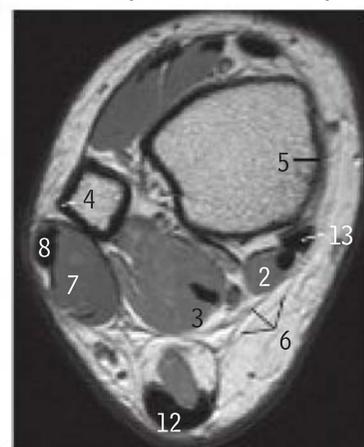
- 1 Attachment of popliteus to lateral meniscus
- 2 Biceps femoris
- 3 Capsule of knee joint
- 4 Fibular (lateral) collateral ligament
- 5 Flexor digitorum longus
- 6 Flexor hallucis longus
- 7 Gracilis
- 8 Lateral head of gastrocnemius
- 9 Medial condyle of femur
- 10 Medial head of gastrocnemius
- 11 Peroneus (fibularis) longus
- 12 Plantaris
- 13 Popliteus
- 14 Posterior surface of fibula (soleus removed)
- 15 Sartorius
- 16 Semimembranosus
- 17 Semitendinosus
- 18 Soleus
- 19 Tibial (medial) collateral ligament
- 20 Tibialis posterior

Left lower calf and ankle



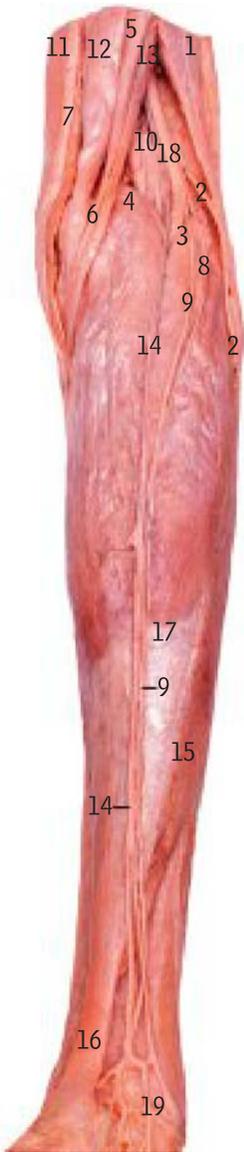
- 1 Fascia overlying tibialis posterior
- 2 Flexor digitorum longus
- 3 Flexor hallucis longus
- 4 Lateral malleolus
- 5 Medial malleolus
- 6 Part of flexor retinaculum
- 7 Peroneus (fibularis) brevis
- 8 Peroneus (fibularis) longus
- 9 Position of posterior tibial vessels and tibial nerve
- 10 Posterior talofibular ligament
- 11 Superior peroneal (fibular) retinaculum
- 12 Tendocalcaneus (Achilles tendon)
- 13 Tibialis posterior

Axial MR, just above ankle joint



Tibialis posterior tendonitis

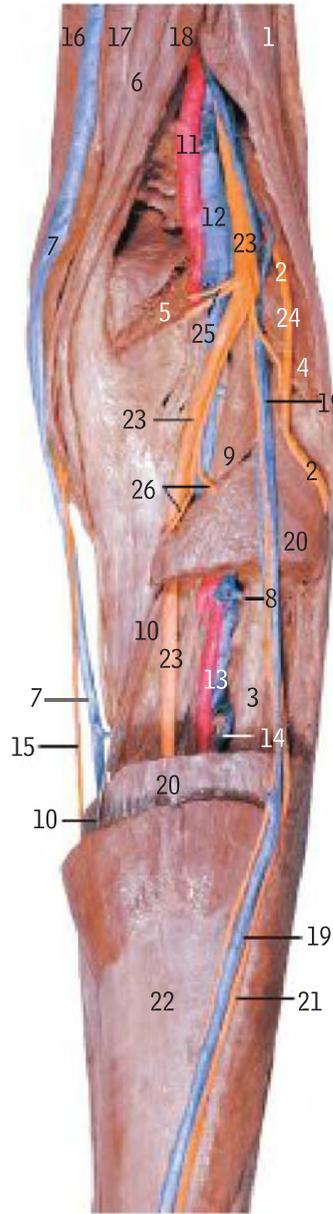
Right leg posterior view, popliteal fossa



- 1 Biceps femoris muscle
- 2 Common peroneal (fibular) nerve
- 3 Gastrocnemius muscle, lateral head
- 4 Gastrocnemius muscle, medial head
- 5 Gracilis muscle
- 6 Gracilis tendon
- 7 Great saphenous vein
- 8 Lateral sural cutaneous nerve
- 9 Medial sural cutaneous nerve

- 10 Popliteal vein
- 11 Sartorius muscle
- 12 Semimembranosus muscle
- 13 Semitendinosus muscle
- 14 Small saphenous vein
- 15 Soleus muscle
- 16 Tendocalcaneus (Achilles)
- 17 Tendocalcaneus (formation)
- 18 Tibial nerve
- 19 Venous network, formation of small saphenous vein

Right calf including muscles, nerves and veins

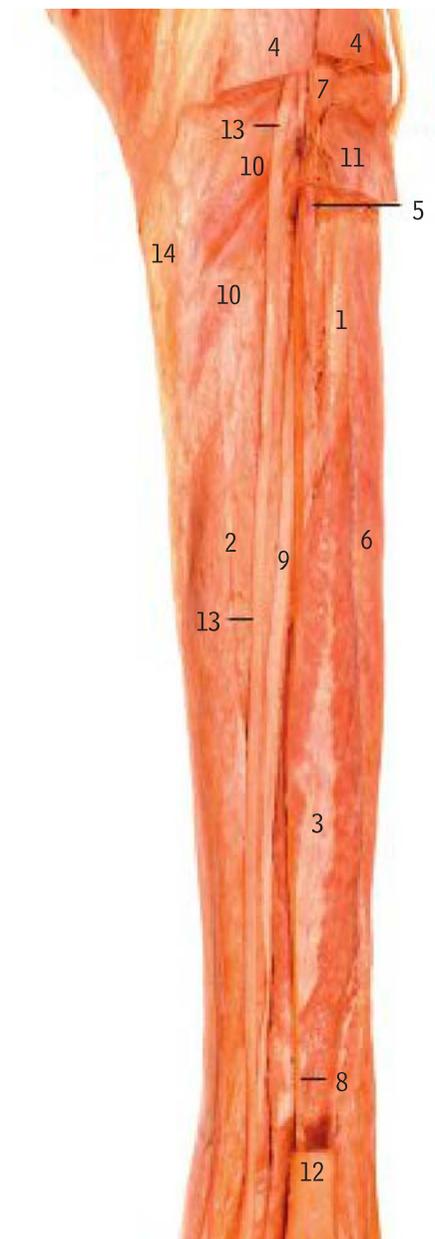


- 1 Biceps femoris muscle
- 2 Common peroneal (fibular) nerve
- 3 Fibula, posterior surface
- 4 Gastrocnemius muscle, lateral head
- 5 Gastrocnemius muscle, medial head
- 6 Gracilis muscle
- 7 Great saphenous vein
- 8 Peroneal (fibular) vein
- 9 Plantaris muscle
- 10 Plantaris tendon
- 11 Popliteal artery
- 12 Popliteal vein
- 13 Posterior tibial artery and vein
- 14 Posterior tibial artery and vein, soleal branches
- 15 Saphenous nerve
- 16 Sartorius muscle
- 17 Semimembranosus muscle
- 18 Semitendinosus muscle
- 19 Small saphenous veins, displaced laterally
- 20 Soleus muscle
- 21 Sural nerve, displaced laterally
- 22 Tendocalcaneus (formation)
- 23 Tibial nerve
- 24 Tibial nerve, muscular branches of lateral head of gastrocnemius
- 25 Tibial nerve, muscular branches of medial head of gastrocnemius
- 26 Tibial nerve, muscular branches of soleus



Compartment syndrome

Right lower leg *deep dissection*



Popliteal angiogram

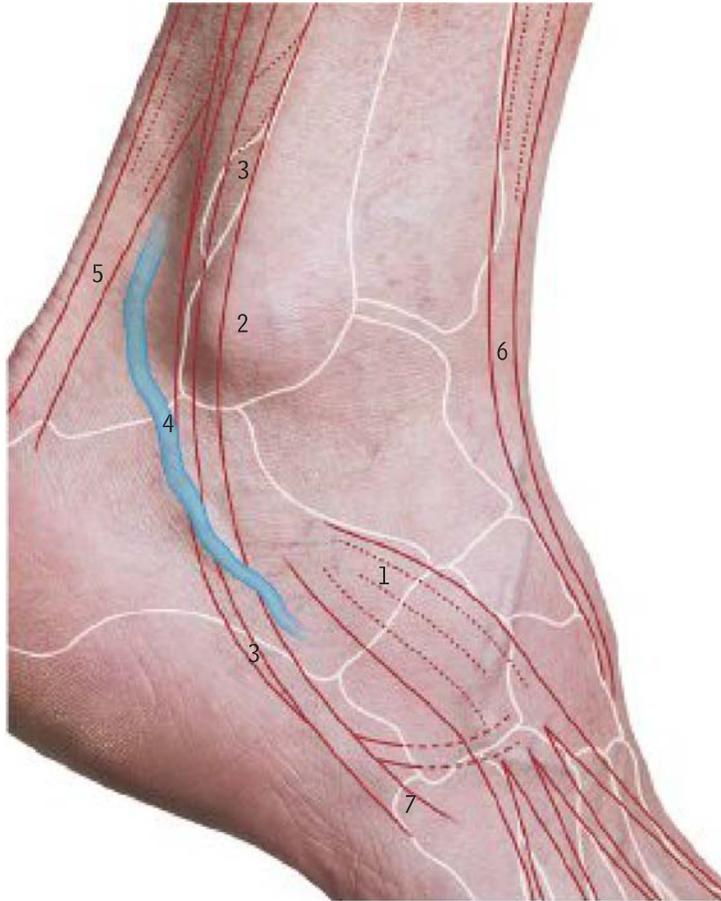


- 1 Anterior tibial artery
- 2 Inferior lateral genicular artery
- 3 Inferior medial genicular artery
- 4 Muscular branches of anterior tibial artery
- 5 Muscular branches of tibioperoneal trunk
- 6 Peroneal (fibular) artery
- 7 Popliteal artery
- 8 Tibioperoneal trunk
- 9 Superior lateral genicular artery
- 10 Superior medial genicular artery
- 11 Posterior tibial artery

- | | |
|----------------------------------|------------------------------|
| 1 Fibula (posterior surface) | 8 Plantaris tendon |
| 2 Flexor digitorum longus muscle | 9 Posterior tibial artery |
| 3 Flexor hallucis longus muscle | 10 Popliteus muscle |
| 4 Gastrocnemius muscle | 11 Soleus muscle |
| 5 Peroneal (fibular) artery | 12 Tendocalcaneus (Achilles) |
| 6 Peroneus (fibularis) longus | 13 Tibial nerve |
| 7 Plantaris muscle | 14 Tibia, posterior surface |



Right ankle and foot from the lateral side



- 1 Extensor digitorum brevis
- 2 Lateral malleolus
- 3 Peroneus (fibularis) longus and brevis
- 4 Small saphenous vein
- 5 Tendocalcaneus (Achilles tendon)
- 6 Tibialis anterior
- 7 Tuberosity of base of fifth metatarsal

The great saphenous vein (B7) runs upwards in front of the medial malleolus (B9).

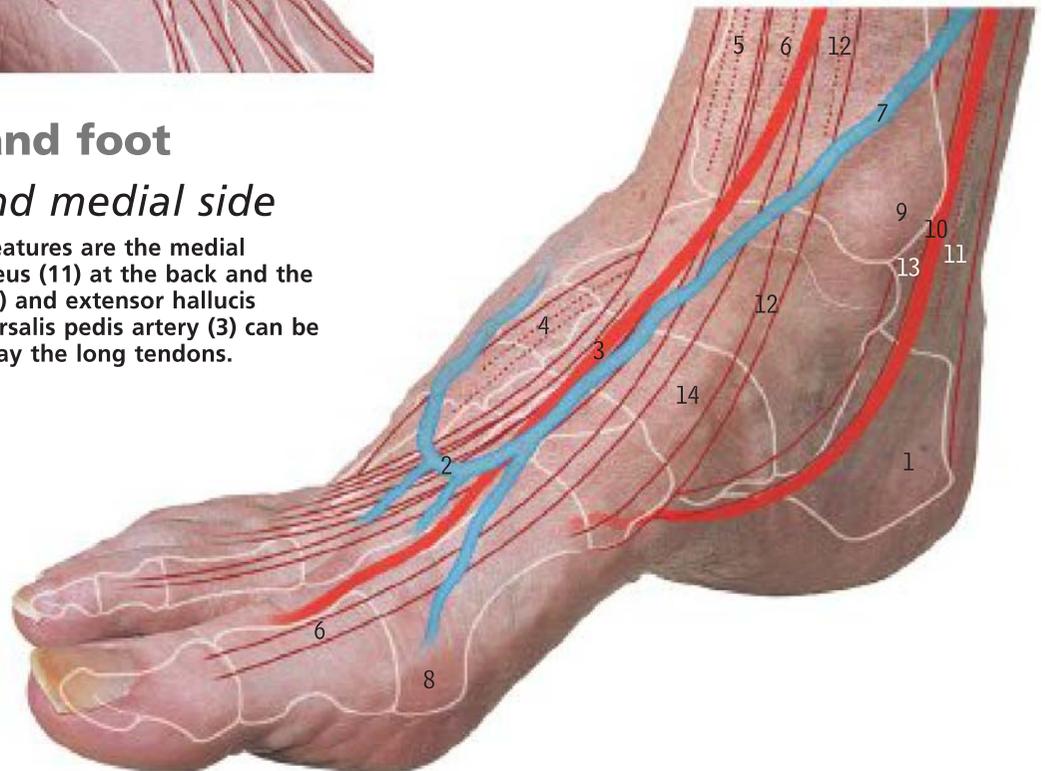
The small saphenous vein (A4) runs upwards behind the lateral malleolus (A2).



Right ankle and foot from the front and medial side

The most prominent surface features are the medial malleolus (9), the tendocalcaneus (11) at the back and the tendons of tibialis anterior (12) and extensor hallucis longus (6) at the front. The dorsalis pedis artery (3) can be palpated where labelled, as may the long tendons.

- 1 Calcaneus
- 2 Dorsal venous arch
- 3 Dorsalis pedis artery
- 4 Extensor digitorum brevis
- 5 Extensor digitorum longus
- 6 Extensor hallucis longus
- 7 Great saphenous vein
- 8 Head of first metatarsal
- 9 Medial malleolus
- 10 Posterior tibial artery
- 11 Tendocalcaneus (Achilles tendon)
- 12 Tibialis anterior
- 13 Tibialis posterior
- 14 Tuberosity of navicular



Achilles tendon
tendocalcaneus
reflex (ankle jerk)



Rupture –
Achilles tendon



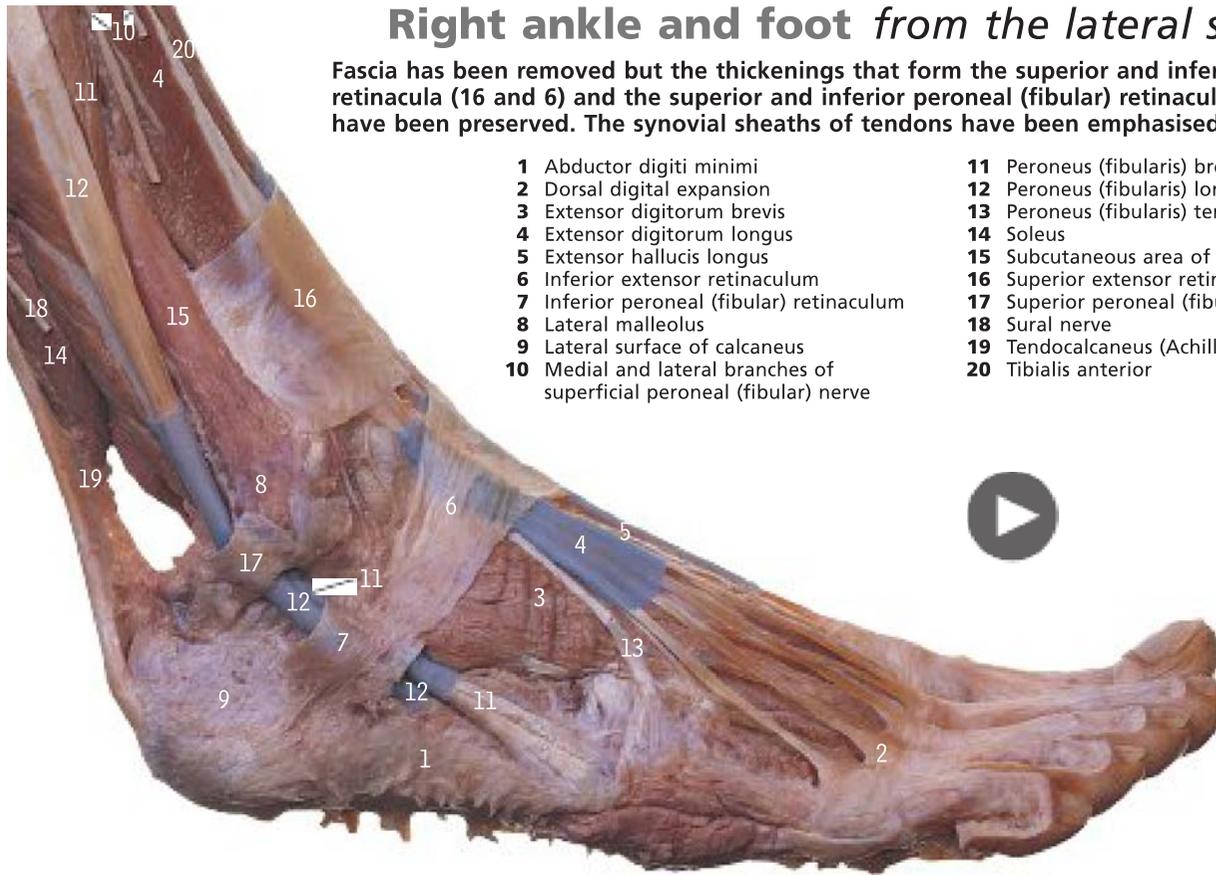
Talipes
equinovarus
(club foot)



Venous cutdown

Right ankle and foot *from the lateral side*

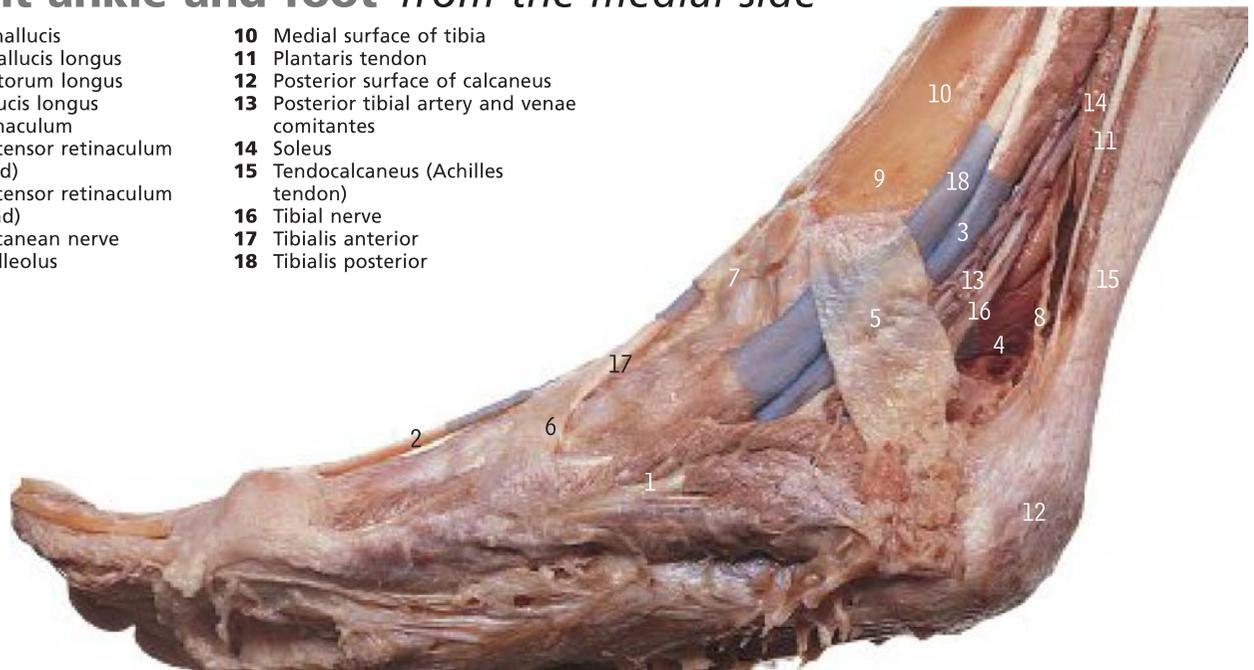
Fascia has been removed but the thickenings that form the superior and inferior extensor retinacula (16 and 6) and the superior and inferior peroneal (fibular) retinacula (17 and 7) have been preserved. The synovial sheaths of tendons have been emphasised by blue tissue.



- | | |
|--|--|
| 1 Abductor digiti minimi | 11 Peroneus (fibularis) brevis |
| 2 Dorsal digital expansion | 12 Peroneus (fibularis) longus |
| 3 Extensor digitorum brevis | 13 Peroneus (fibularis) tertius |
| 4 Extensor digitorum longus | 14 Soleus |
| 5 Extensor hallucis longus | 15 Subcutaneous area of fibula |
| 6 Inferior extensor retinaculum | 16 Superior extensor retinaculum |
| 7 Inferior peroneal (fibular) retinaculum | 17 Superior peroneal (fibular) retinaculum |
| 8 Lateral malleolus | 18 Sural nerve |
| 9 Lateral surface of calcaneus | 19 Tendocalcaneus (Achilles tendon) |
| 10 Medial and lateral branches of superficial peroneal (fibular) nerve | 20 Tibialis anterior |

Right ankle and foot *from the medial side*

- | | |
|--|---|
| 1 Abductor hallucis | 10 Medial surface of tibia |
| 2 Extensor hallucis longus | 11 Plantaris tendon |
| 3 Flexor digitorum longus | 12 Posterior surface of calcaneus |
| 4 Flexor hallucis longus | 13 Posterior tibial artery and venae comitantes |
| 5 Flexor retinaculum | 14 Soleus |
| 6 Inferior extensor retinaculum (lower band) | 15 Tendocalcaneus (Achilles tendon) |
| 7 Inferior extensor retinaculum (upper band) | 16 Tibial nerve |
| 8 Medial calcaneal nerve | 17 Tibialis anterior |
| 9 Medial malleolus | 18 Tibialis posterior |

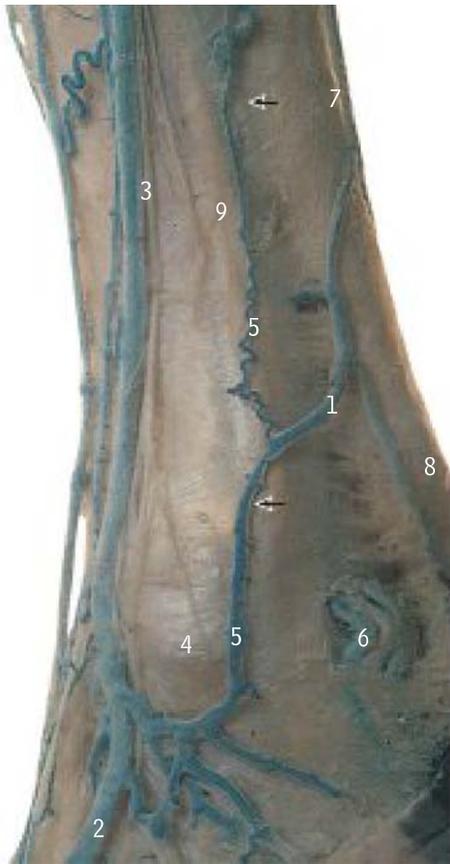


Ankle arthroscopy



Digital abnormalities

Right lower leg and ankle from the medial side and behind



The deep fascia remains intact apart from a small window cut to show the position of the posterior tibial vessels and tibial nerve (6). The great saphenous vein (3) runs upwards in front of the medial malleolus (4) with the posterior arch vein (5) behind it. The arrows indicate common levels for perforating veins (page 348, A5 and B6).

- 1 Communication with small saphenous vein
- 2 Dorsal venous arch
- 3 Great saphenous vein and saphenous nerve
- 4 Medial malleolus
- 5 Posterior arch vein
- 6 Posterior tibial vessels and tibial nerve
- 7 Small saphenous vein
- 8 Tendocalcaneus (Achilles tendon)
- 9 Tibialis posterior and flexor digitorum longus underlying deep fascia

Right ankle from the medial side



- 1 Deep fascia of calf
- 2 Flexor digitorum longus
- 3 Flexor digitorum longus, tendon
- 4 Flexor hallucis longus
- 5 Flexor retinaculum
- 6 Heel
- 7 Medial calcanean nerve
- 8 Medial malleolus, tibia
- 9 Plantaris tendon
- 10 Posterior tibial artery
- 11 Tendocalcaneus (Achilles tendon)
- 12 Tibial nerve
- 13 Tibialis posterior tendon
- 14 Venae comitantes of posterior tibial artery



Ulceration of the leg



Varicose veins



Left ankle and foot

from the front and lateral side

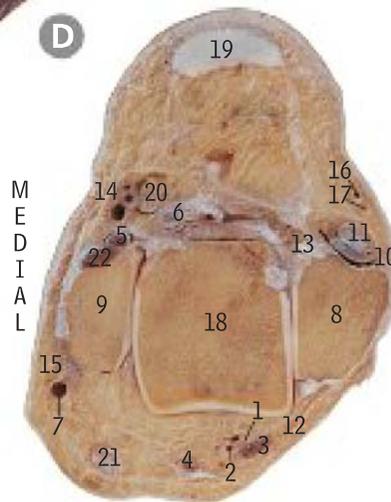
The foot is plantar flexed and part of the capsule of the ankle joint has been removed to show the talus (1). The tendons of peroneus (fibularis) tertius (12) and extensor digitorum longus (5) lie superficial to extensor digitorum brevis (4). The sural nerve and small saphenous vein (13) pass behind the lateral malleolus (8).

- 1 Anterior lateral malleolar artery overlying talus (ankle joint capsule removed)
- 2 Anterior tibial vessels and deep peroneal (fibular) nerve
- 3 Deep fascia forming superior extensor retinaculum
- 4 Extensor digitorum brevis
- 5 Extensor digitorum longus
- 6 Extensor hallucis longus
- 7 Inferior extensor retinaculum (partly removed)
- 8 Lateral malleolus
- 9 Perforating branch of peroneal (fibular) artery
- 10 Peroneus (fibularis) brevis
- 11 Peroneus (fibularis) longus
- 12 Peroneus (fibularis) tertius
- 13 Small saphenous vein and sural nerve
- 14 Superficial peroneal (fibular) nerve
- 15 Tarsal sinus
- 16 Tendocalcaneus (Achilles tendon)
- 17 Tibialis anterior

Left ankle

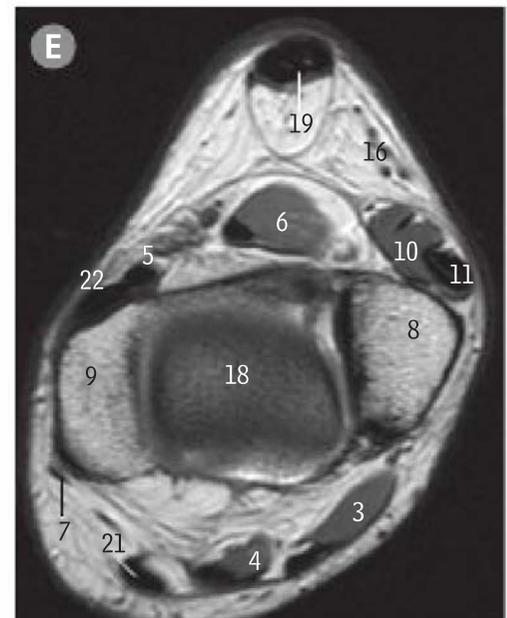
cross-section axial MR image

This section, looking down from above, emphasises the positions of tendons, vessels and nerves in the ankle region. The talus (18) is in the centre, with the medial malleolus (9) on the left of the picture and the lateral malleolus (8) on the right. The great saphenous vein (7) and saphenous nerve (15) are in front of the medial malleolus, with the tendon of tibialis posterior (22) immediately behind it. The small saphenous vein (16) and the sural nerve (17) are behind the lateral malleolus, with the tendons of peroneus (fibularis) longus (11) and peroneus (fibularis) brevis (10) intervening. At the front of the ankle, the dorsalis pedis vessels (2) and deep peroneal (fibular) nerve (1) are between the tendons of extensor hallucis longus (4) and extensor digitorum longus (3). Behind the medial malleolus (9) and tibialis posterior (22), the posterior tibial vessels (14) and tibial nerve (20) are between the tendons of flexor digitorum longus (5) and flexor hallucis longus (6).



- 1 Deep peroneal (fibular) nerve
- 2 Dorsalis pedis artery and venae comitantes
- 3 Extensor digitorum longus
- 4 Extensor hallucis longus
- 5 Flexor digitorum longus
- 6 Flexor hallucis longus
- 7 Great saphenous vein
- 8 Lateral malleolus of fibula
- 9 Medial malleolus of tibia
- 10 Peroneus (fibularis) brevis
- 11 Peroneus (fibularis) longus

Axial MR ankle



- 12 Peroneus (fibularis) tertius
- 13 Posterior talofibular ligament
- 14 Posterior tibial artery and venae comitantes
- 15 Saphenous nerve
- 16 Small saphenous vein
- 17 Sural nerve
- 18 Talus
- 19 Tendocalcaneus (Achilles tendon)
- 20 Tibial nerve
- 21 Tibialis anterior
- 22 Tibialis posterior



Charcot foot

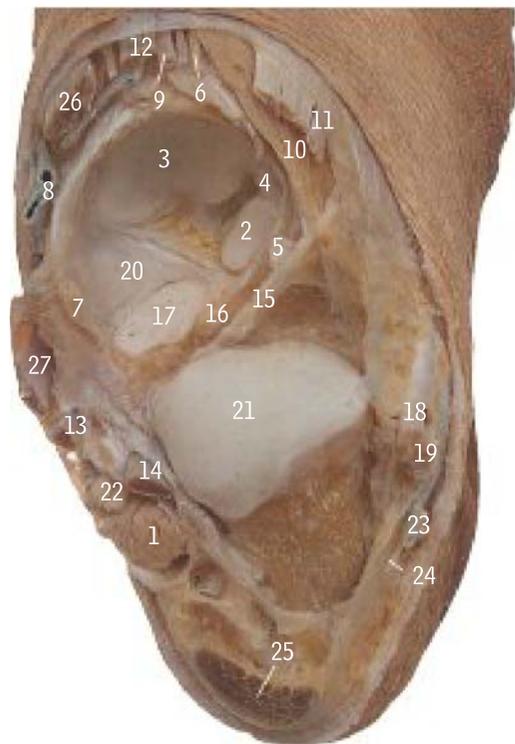
Dorsum of the right foot



- | | |
|---|--|
| 1 Arcuate artery | 11 Fourth dorsal interosseous |
| 2 Digital arteries | 12 Peroneus (fibularis) tertius |
| 3 Dorsalis pedis artery | 13 Second dorsal interosseous |
| 4 Extensor digitorum brevis | 14 Second dorsal metatarsal artery |
| 5 Extensor digitorum longus | 15 Tarsal arteries |
| 6 Extensor hallucis brevis | 16 Third dorsal interosseous |
| 7 Extensor hallucis longus | 17 Tibialis anterior |
| 8 First dorsal interosseous | 18 Tuberosity of base of fifth metatarsal and peroneus (fibularis) brevis |
| 9 First dorsal metatarsal artery | |
| 10 First metatarsophalangeal joint | |

Right talocalcanean and talocalcaneonavicular joints

The talus has been removed to show the articular surfaces of the calcaneus (21, 17 and 2), navicular (3) and plantar calcaneonavicular (spring) ligament (20).



- | | |
|--|--|
| 1 Abductor hallucis | 15 Inferior extensor retinaculum |
| 2 Anterior articular surface on calcaneus for talus | 16 Interosseous talocalcanean ligament |
| 3 Articular surface on navicular for talus | 17 Middle articular surface on calcaneus for talus |
| 4 Calcaneonavicular part of bifurcate ligament | 18 Peroneus (fibularis) brevis |
| 5 Cervical ligament | 19 Peroneus (fibularis) longus |
| 6 Deep peroneal (fibular) nerve | 20 Plantar calcaneonavicular (spring) ligament |
| 7 Deltoid ligament | 21 Posterior articular surface on calcaneus for talus |
| 8 Dorsal venous arch | 22 Posterior tibial vessels and medial and lateral plantar nerves |
| 9 Dorsalis pedis artery and vena comitans | 23 Small saphenous vein |
| 10 Extensor digitorum brevis | 24 Sural nerve |
| 11 Extensor digitorum longus | 25 Tendocalcaneus (Achilles tendon) |
| 12 Extensor hallucis longus | 26 Tibialis anterior |
| 13 Flexor digitorum longus | 27 Tibialis posterior |
| 14 Flexor hallucis longus | |

Clinicians sometimes use the term subtalar joint as a combined name for both the talocalcanean joint and the talocalcanean part of the talocalcaneonavicular joint, because it is at both these joints beneath the talus that most of the movements of inversion and eversion of the foot occur, on the axis of the cervical ligament.



Ankle block

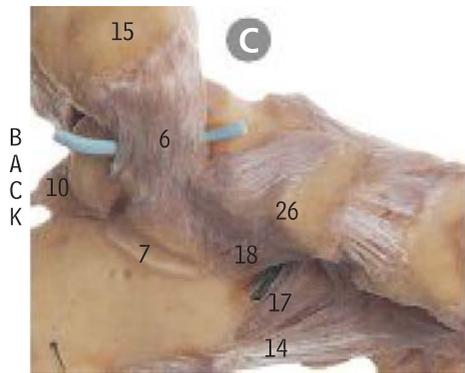


Malignant melanoma



Tarsal tunnel syndrome

Left ankle and foot ligaments



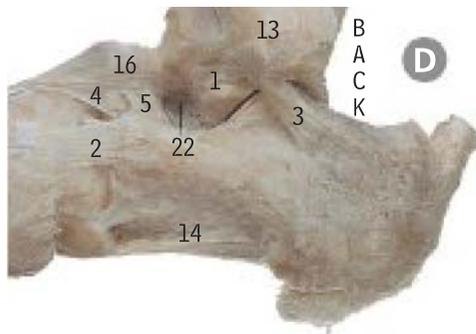
from the medial side

from the lateral side

from behind

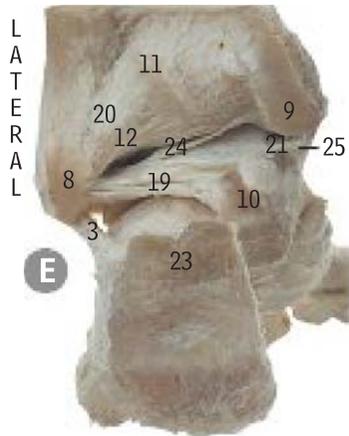
In C, the marker below the medial malleolus (15) passes between the superficial and deep parts of the deltoid ligament (6). The marker below the tuberosity of the navicular (26) passes between the plantar calcaneonavicular (spring) and calcaneocuboid (short plantar) ligaments (18 and 17).

- 1 Anterior talofibular ligament
- 2 Calcaneocuboid part of bifurcate ligament
- 3 Calcaneofibular ligament
- 4 Calcaneonavicular part of bifurcate ligament
- 5 Cervical ligament
- 6 Deltoid ligament
- 7 Groove below sustentaculum tali for flexor hallucis longus
- 8 Groove on lateral malleolus for peroneus (fibularis) brevis
- 9 Groove on medial malleolus for tibialis posterior
- 10 Groove on talus for flexor hallucis longus
- 11 Groove on tibia for flexor hallucis longus
- 12 Inferior transverse ligament
- 13 Lateral malleolus
- 14 Long plantar ligament
- 15 Medial malleolus
- 16 Neck of talus
- 17 Plantar calcaneocuboid (short plantar) ligament
- 18 Plantar calcaneonavicular (spring) ligament
- 19 Posterior talofibular ligament
- 20 Posterior tibiofibular ligament
- 21 Posterior tibiotalar part of deltoid ligament
- 22 Tarsal sinus
- 23 Tendocalcaneus (Achilles tendon)
- 24 Tibial slip of posterior talofibular ligament
- 25 Tibiocalcanean part of deltoid ligament
- 26 Tuberosity of navicular

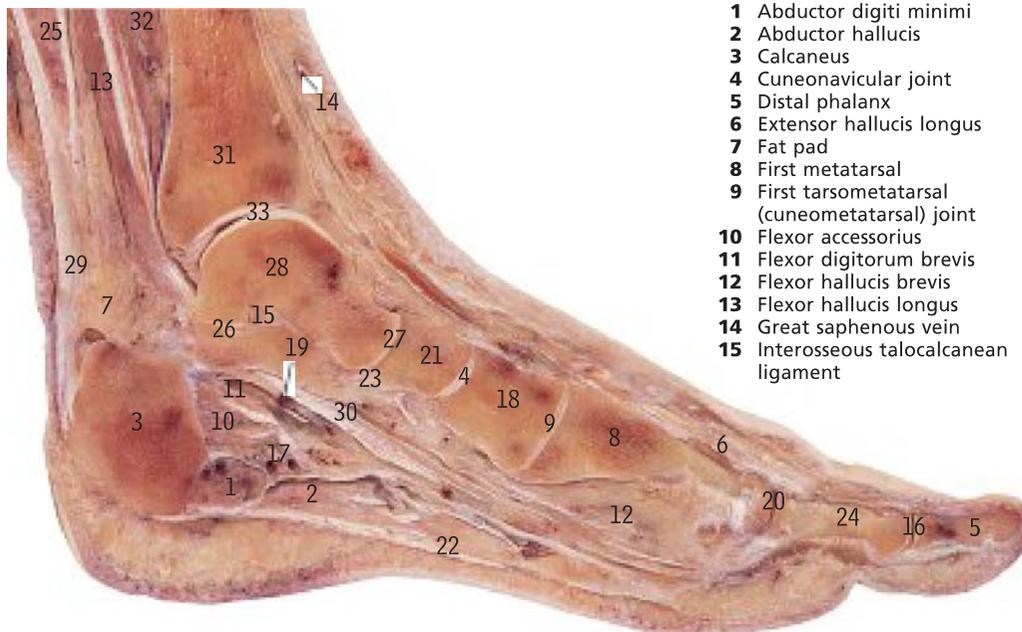


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Left foot sagittal section, from the right



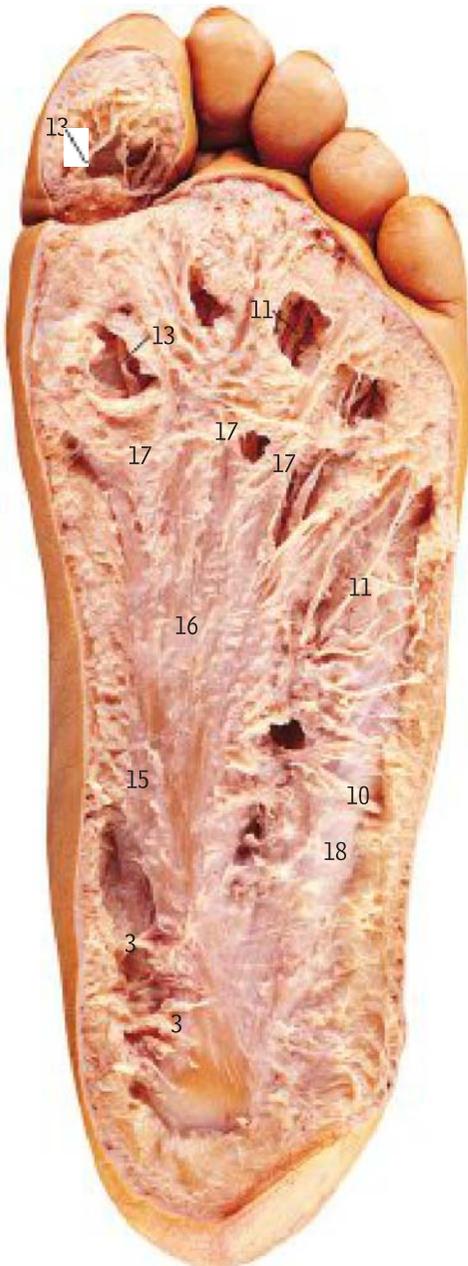
- 1 Abductor digiti minimi
- 2 Abductor hallucis
- 3 Calcaneus
- 4 Cuneonavicular joint
- 5 Distal phalanx
- 6 Extensor hallucis longus
- 7 Fat pad
- 8 First metatarsal
- 9 First tarsometatarsal (cuneometatarsal) joint
- 10 Flexor accessorius
- 11 Flexor digitorum brevis
- 12 Flexor hallucis brevis
- 13 Flexor hallucis longus
- 14 Great saphenous vein
- 15 Interosseous talocalcanean ligament
- 16 Interphalangeal joint
- 17 Lateral plantar nerve and vessels
- 18 Medial cuneiform
- 19 Medial plantar artery
- 20 Metatarsophalangeal joint of great toe
- 21 Navicular
- 22 Plantar aponeurosis
- 23 Plantar calcaneonavicular (spring) ligament
- 24 Proximal phalanx
- 25 Soleus muscle
- 26 Talocalcanean (subtalar) joint
- 27 Talonavicular part of talocalcaneonavicular joint
- 28 Talus
- 29 Tendocalcaneus (Achilles tendon)
- 30 Tendon of flexor hallucis
- 31 Tibia
- 32 Tibialis posterior muscle
- 33 Tibiotalar part of ankle joint



Sprained ankle

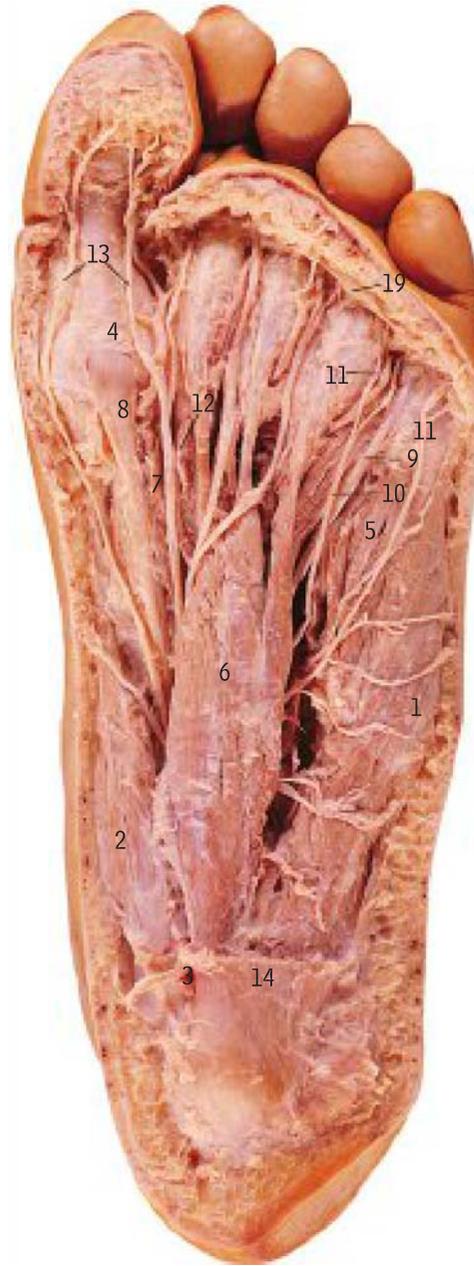
Sole of the left foot

plantar aponeurosis



Removal of the plantar skin reveals the plantar aponeurosis with thick central and digital slips and thin lateral and medial parts.

superficial neuromuscular layer



Deep to the plantar aponeurosis lie the superficial plantar nerves, arteries and muscles.



- 1 Abductor digiti minimi
- 2 Abductor hallucis
- 3 Calcaneal neurovascular bundle
- 4 Fibrous flexor sheath
- 5 Flexor digiti minimi brevis
- 6 Flexor digitorum brevis
- 7 Flexor hallucis brevis
- 8 Flexor hallucis longus
- 9 Lateral plantar artery
- 10 Lateral plantar nerve
- 11 Lateral plantar nerve, digital branches
- 12 Lumbrical
- 13 Medial plantar nerve, digital branches
- 14 Plantar aponeurosis
- 15 Plantar aponeurosis, overlying abductor hallucis
- 16 Plantar aponeurosis, overlying flexor digitorum brevis
- 17 Plantar aponeurosis, digital slips
- 18 Plantar aponeurosis, overlying abductor digiti minimi
- 19 Superficial transverse metatarsal ligament



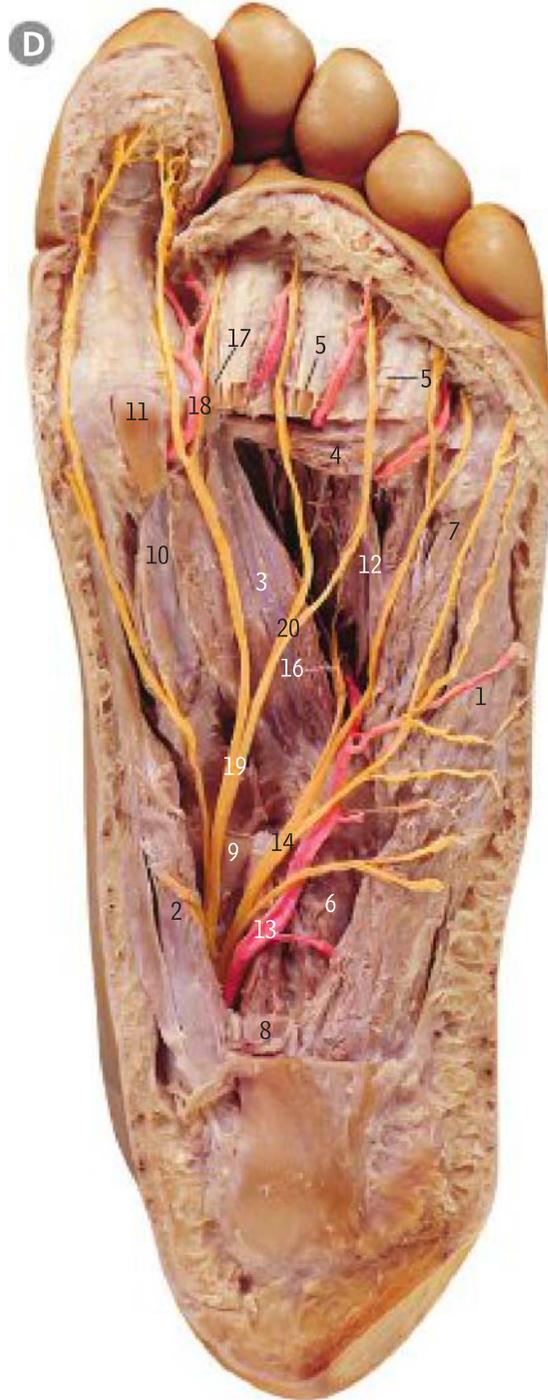
Flat foot (pes planus)



Plantar fasciitis

Sole of the left foot

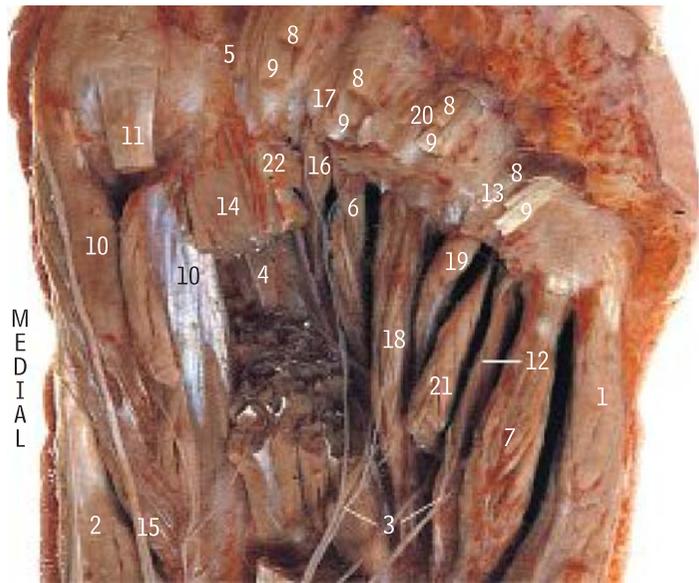
after removal of flexor digitorum brevis
after removal of flexor digitorum longus



- 1 Abductor digiti minimi
- 2 Abductor hallucis
- 3 Adductor hallucis, oblique head
- 4 Adductor hallucis, transverse head
- 5 Fibrous sheath, flexors
- 6 Flexor accessorius (quadratus plantae)
- 7 Flexor digiti minimi brevis
- 8 Flexor digitorum brevis (cut)
- 9 Flexor digitorum longus
- 10 Flexor hallucis brevis
- 11 Flexor hallucis longus
- 12 Interossei
- 13 Lateral plantar artery
- 14 Lateral plantar nerve
- 15 Lateral plantar nerve, common digital branch
- 16 Lateral plantar nerve, deep branch
- 17 Lumbrical
- 18 Medial plantar artery
- 19 Medial plantar nerve, common digital branch
- 20 Medial plantar nerve, common digital branch

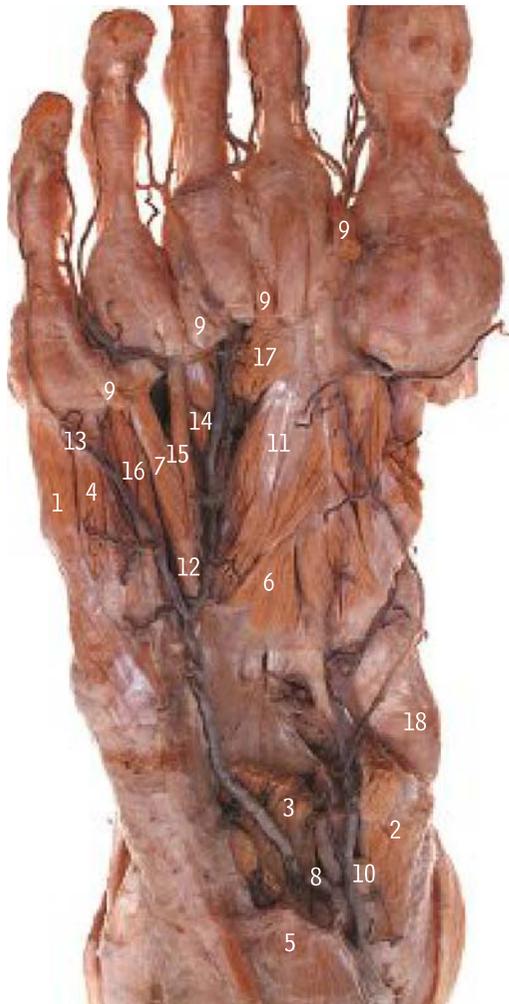


Extensor plantar response – Babinski sign



Sole of the left foot *deep muscles, interossei*

- | | |
|---|--|
| 1 Abductor digiti minimi | 14 Oblique head of adductor hallucis |
| 2 Abductor hallucis | 15 Plantar digital nerve of great toe |
| 3 Branches of deep branch of lateral plantar nerve | 16 Second dorsal interosseous |
| 4 First dorsal interosseous | 17 Second lumbrical |
| 5 First lumbrical | 18 Second plantar interosseous |
| 6 First plantar interosseous | 19 Third dorsal interosseous |
| 7 Flexor digiti minimi brevis | 20 Third lumbrical |
| 8 Flexor digitorum brevis | 21 Third plantar interosseous |
| 9 Flexor digitorum longus | 22 Transverse head of adductor hallucis |
| 10 Flexor hallucis brevis | |
| 11 Flexor hallucis longus | |
| 12 Fourth dorsal interosseous | |
| 13 Fourth lumbrical | |



Sole of the right foot

plantar arch

Most of the flexor muscles and tendons have been removed to show the lateral plantar artery (8) crossing flexor accessorius (quadratus plantae) (3) to become the plantar arch (12) which would lie deep to the flexor tendons.

- | | |
|---|--|
| 1 Abductor digiti minimi | 10 Medial plantar artery and nerve |
| 2 Abductor hallucis | 11 Oblique head of adductor hallucis |
| 3 Flexor accessorius (quadratus plantae) | 12 Plantar arch |
| 4 Flexor digiti minimi brevis | 13 Plantar digital artery |
| 5 Flexor digitorum brevis | 14 Plantar metatarsal artery |
| 6 Flexor hallucis brevis | 15 Second plantar interosseous |
| 7 Fourth dorsal interosseous | 16 Third plantar interosseous |
| 8 Lateral plantar artery | 17 Transverse head of adductor hallucis |
| 9 Lumbrical | 18 Tuberosity of navicular |

Foot, Axial MR

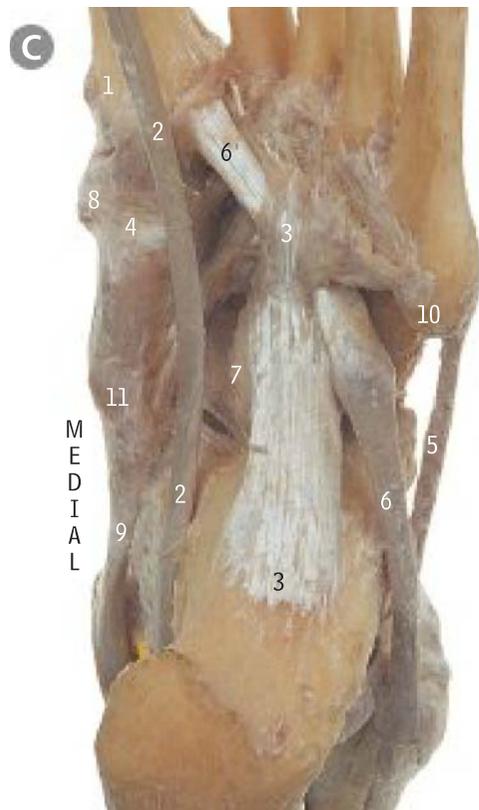


- | |
|---------------------------------|
| 1 Abductor digiti minimi |
| 2 Abductor hallucis |
| 3 Calcaneus |
| 4 Cuboid |
| 5 Flexor hallucis longus |
| 6 Metatarsal base |
| 7 Opponens digiti minimi |
| 8 Peroneus brevis tendon |
| 9 Peroneus longus tendon |

Sole of the left foot

ligaments and tendons

ligaments



The anterior end of the long plantar ligament (3) forms with the groove of the cuboid (D6) a tunnel for the peroneus (fibularis) longus tendon (6) which runs to the medial cuneiform (4) and the base of the first metatarsal (1).

- 1 Base of first metatarsal
- 2 Flexor hallucis longus
- 3 Long plantar ligament
- 4 Medial cuneiform
- 5 Peroneus (fibularis) brevis
- 6 Peroneus (fibularis) longus
- 7 Plantar calcaneocuboid (short plantar) ligament
- 8 Tibialis anterior
- 9 Tibialis posterior
- 10 Tuberosity of base of fifth metatarsal
- 11 Tuberosity of navicular

The plantar calcaneonavicular ligament (D9), commonly called the spring ligament, is one of the most important in the foot. It stretches between the sustentaculum tali (D7) and the tuberosity of the navicular (D16), blending on its medial side with the deltoid ligament of the ankle joint and supporting the upper surface part of the head of the talus.



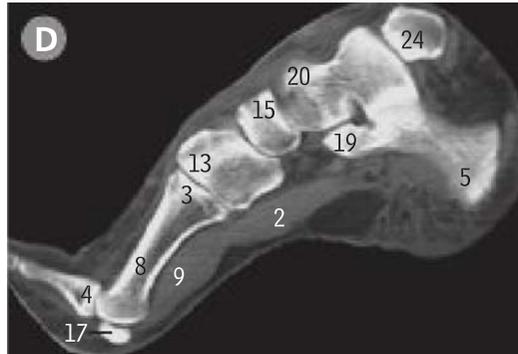
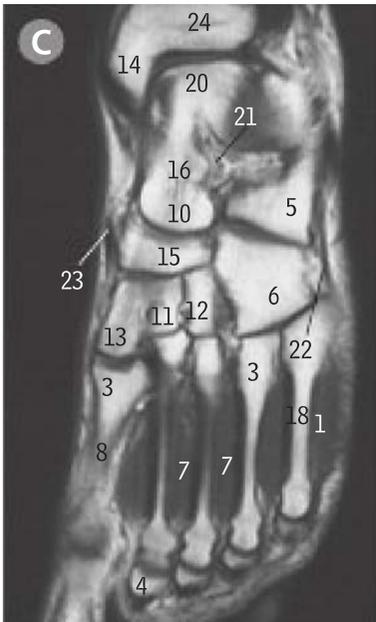
The anterior end of the long plantar ligament (3) has been removed to show the groove for peroneus (fibularis) longus on the cuboid (6).

- 1 Base of proximal phalanx
- 2 Collateral ligament of metatarsophalangeal joint
- 3 Deep fibres of long plantar ligament
- 4 Deltoid ligament
- 5 Fibrous slip from tibialis posterior
- 6 Groove on cuboid for peroneus (fibularis) longus
- 7 Groove on sustentaculum tali for flexor hallucis longus
- 8 Head of second metatarsal
- 9 Plantar calcaneonavicular (spring) ligament
- 10 Plantar cuboideonavicular ligament
- 11 Plantar cuneonavicular ligament
- 12 Plantar metatarsal ligament
- 13 Sesamoid bone
- 14 Tibialis posterior
- 15 Tuberosity of base of fifth metatarsal
- 16 Tuberosity of navicular

Ankle *anteroposterior projection* *lateral projection*

- 1 Calcaneus
- 2 Cuboid
- 3 Fibula
- 4 Head of talus
- 5 Lateral cuneiform
- 6 Lateral malleolus of fibula
- 7 Posterior talar process
- 8 Medial malleolus of tibia
- 9 Medial tubercle of talus
- 10 Navicular
- 11 Region of inferior tibiofibular joint
- 12 Sustentaculum tali of calcaneus
- 13 Talus
- 14 Tibia
- 15 Tuberosity of base of fifth metatarsal

* Small calcaneal spur.



Foot

long axis MR
sagittal CT
through hallux

- 1 Abductor digiti minimi
- 2 Abductor hallucis
- 3 Base of metatarsal
- 4 Base of proximal phalanx
- 5 Calcaneus
- 6 Cuboid
- 7 Dorsal interossei muscle
- 8 First metatarsal
- 9 Flexor digitorum brevis
- 10 Head of talus
- 11 Intermediate cuneiform
- 12 Lateral cuneiform
- 13 Medial cuneiform
- 14 Medial malleolus
- 15 Navicular
- 16 Neck of talus
- 17 Sesamoid bone supporting flexor hallucis brevis
- 18 Shaft of metatarsal
- 19 Sustentaculum tali of calcaneus
- 20 Talus
- 21 Tarsal sinus (talocalcaneal cervical ligament)
- 22 Tendon of peroneus (fibularis) brevis muscle
- 23 Tendon of tibialis anterior
- 24 Tibia



Pott's and other fractures of the ankle



Lymphatics



Lymphatic system



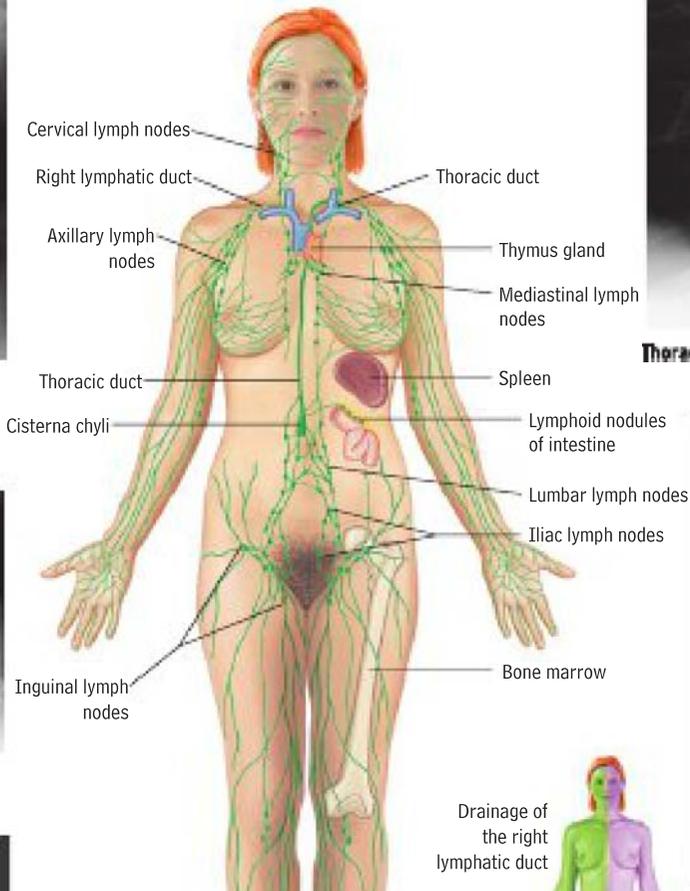
Lumbar spine – AP phase 2



Pelvis – AP phase 2, NB nodes



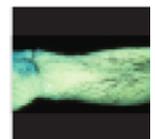
Pelvis – AP phase 1, NB vessels



Thoracic duct termination in neck



Lumbar spine – lateral phase 1, NB vessels



Lymphatic system – methylene blue test

Phase 1 images are taken on day one and best show the vessels whereas phase 2 are taken at about 48 hours and best image the lymph nodes.

Thymus

lying in the superior and anterior mediastinum as seen through a split-sternal approach

SUPERIOR

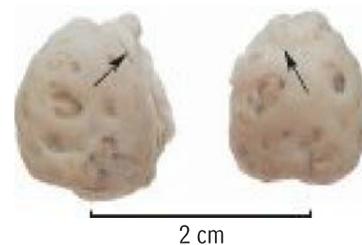


Chest radiograph of a child



Child's thymus can normally be seen under the age of 2 on a plain chest radiograph, appearing as a spinnaker sail (sail sign), as outlined by the interrupted line.

Palatine tonsils



The palatine tonsils (commonly referred to as 'the tonsils') are masses of lymphoid tissue that are frequently enlarged in childhood but become much reduced in size in later life. Together with the lymphoid tissue in the posterior part of the tongue (lingual tonsil) and in the posterior wall of the nasopharynx (pharyngeal tonsil) and the tubal tonsil they form a protective 'ring' of lymphoid tissue (Waldeyer's ring) at the upper end of the respiratory and alimentary tracts.

The pits on the medial surfaces of these operation specimens from a child aged 14 years are the openings of the tonsillar crypts. The arrows indicate the intratonsillar clefts (the remains of the embryonic second pharyngeal pouch). These palatine tonsils are easily seen at the back of the opened mouth in the pharyngeal arches each side of the uvula.

- | | | | |
|----------------------------------|------------------------------|-----------------------------------|---|
| 1 Brachiocephalic trunk (artery) | 5 Left common carotid artery | 10 Pleura (cut edge of left sac) | 15 Thymic vein draining into internal thoracic vein |
| 2 Inferior thyroid vein | 6 Lung, upper lobe right | 11 Pleura (cut edge of right sac) | 16 Thymus gland (bilobed) |
| 3 Internal thoracic vein, right | 7 Pectoralis major | 12 Pleural cavity | 17 Trachea |
| 4 Left brachiocephalic vein | 8 Pericardium, fibrous | 13 Right brachiocephalic vein | |
| | 9 Pleura | 14 Superior vena cava | |



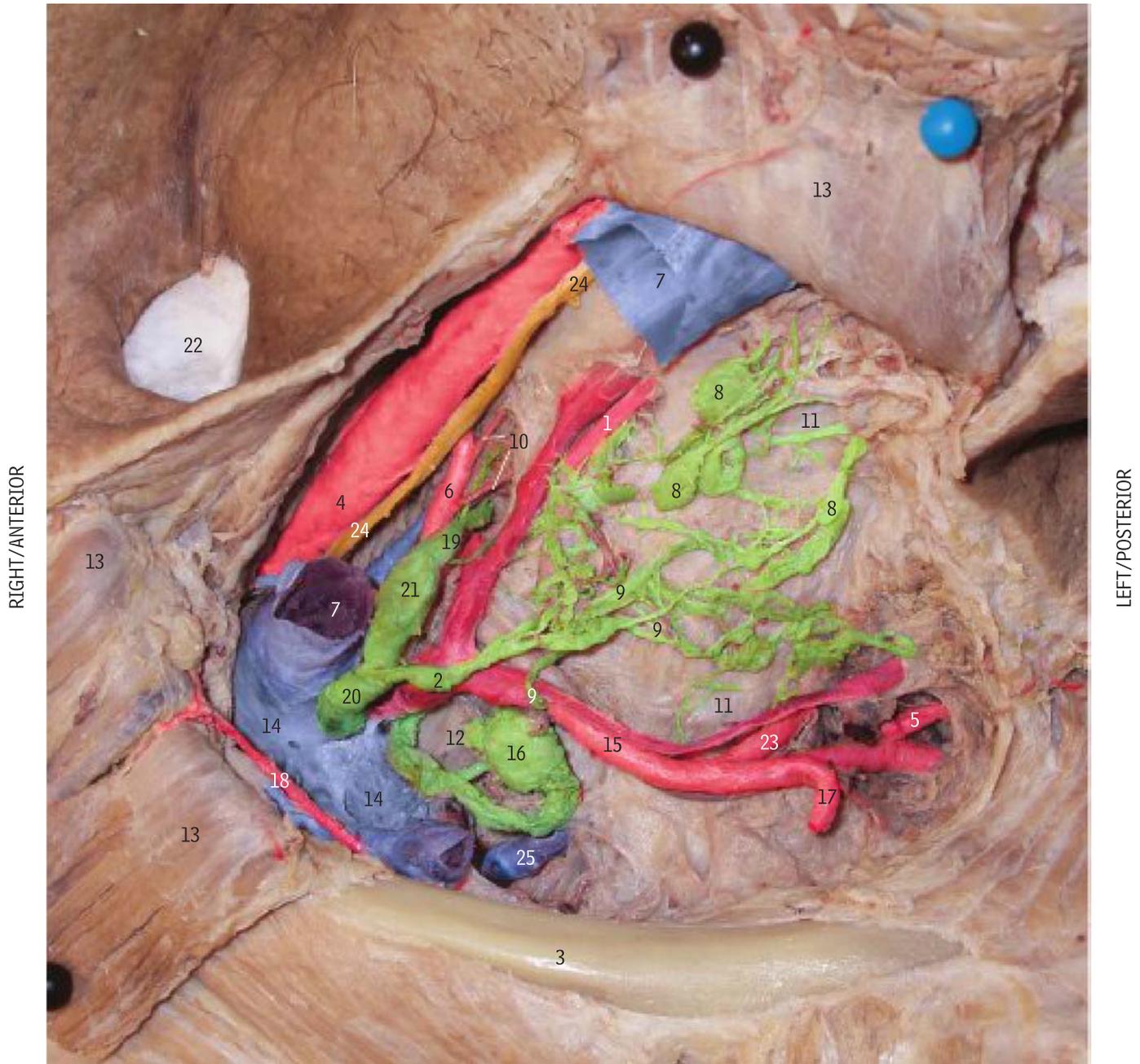
Thymus



Tonsillitis

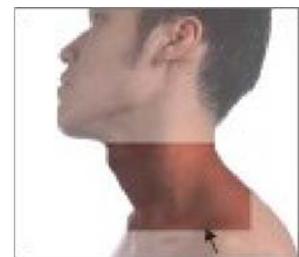
Neck dissection *termination of the thoracic duct into the left subclavian vein in the root of neck – as seen from left side*

SUPERIOR

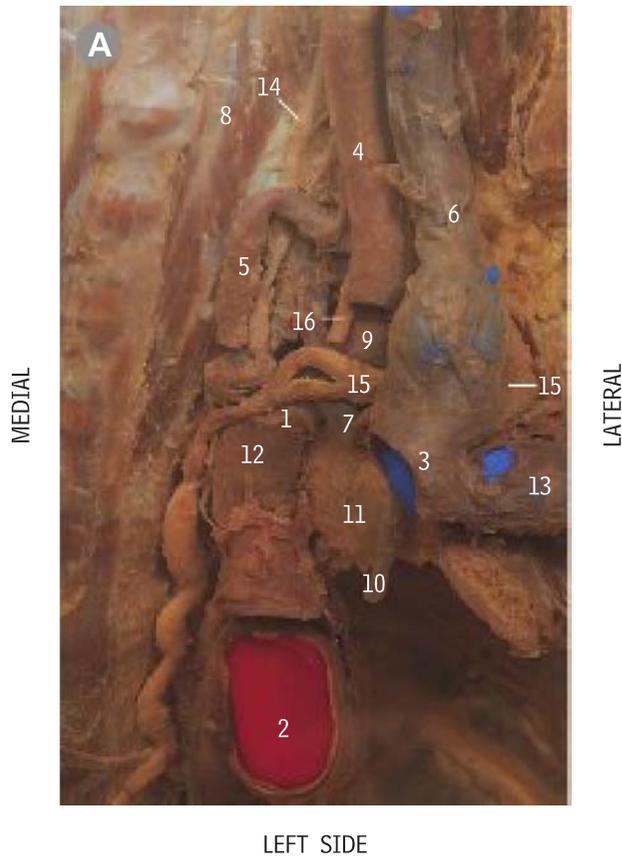


INFERIOR

- | | | |
|--|---|---|
| 1 Ascending cervical artery and vein | 10 Muscular arterial branches to longus colli | 18 Thoraco-acromial artery, clavicular branch |
| 2 Cervical lymphatic trunk | 11 Prevertebral fascia | 19 Thoracic duct |
| 3 Clavicle (left) | 12 Scalenus anterior | 20 Thoracic duct, termination |
| 4 Common carotid artery | 13 Sternocleidomastoid (reflected and pinned) | 21 Thoracic duct, ampulla |
| 5 Dorsal scapular artery | 14 Subclavian vein | 22 Tracheostomy site (midline) |
| 6 Inferior thyroid artery | 15 Superficial cervical artery | 23 Transverse cervical artery |
| 7 Internal jugular vein | 16 Supraclavicular node (Virchow - enlarged) | 24 Vagus nerve |
| 8 Lymph nodes, deep cervical chain | 17 Suprascapular artery | 25 Vertebral vein |
| 9 Lymph vessel from node to cervical trunk | | |



Thoracic duct cervical part



In this deep dissection of the left side of the root of the neck and upper thorax, the internal jugular vein (6) joins the subclavian vein (13) to form the left brachiocephalic vein (3). The thoracic duct (15) is double for a short distance just before passing in front of the vertebral artery (9) and behind the common carotid artery (4), whose lower end has been cut away to show the duct). The duct then runs behind the internal jugular vein (6) before draining into the junction of that vein with the subclavian vein (13).

- 1 Ansa subclavia
- 2 Arch of aorta
- 3 Brachiocephalic vein
- 4 Common carotid artery
- 5 Inferior thyroid artery
- 6 Internal jugular vein
- 7 Internal thoracic artery
- 8 Longus colli
- 9 Origin of vertebral artery
- 10 Phrenic nerve
- 11 Pleura
- 12 Subclavian artery
- 13 Subclavian vein
- 14 Sympathetic trunk
- 15 Thoracic duct
- 16 Vagus nerve

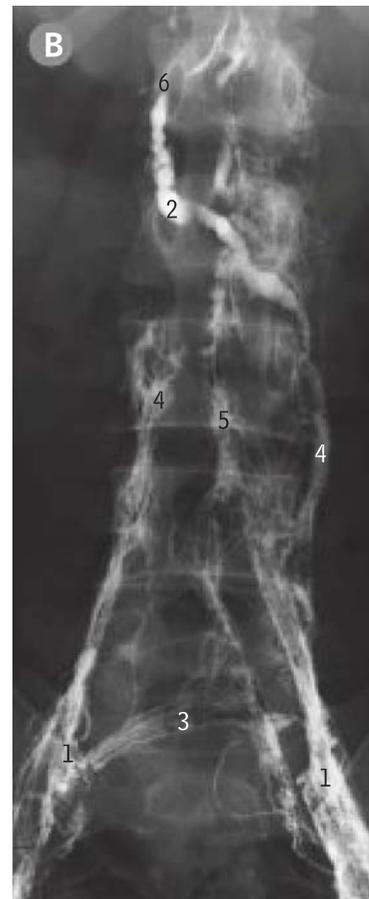


Thoracic duct termination in neck



Virchow's node

Thoracic duct lower thorax and abdomen



- 1 Common iliac vessels
- 2 Cisterna chyli
- 3 Lumbar crossover
- 4 Para-aortic vessels
- 5 Pre-aortic vessels
- 6 Thoracic duct



Lymphangiogram, abdomen – early filling phase

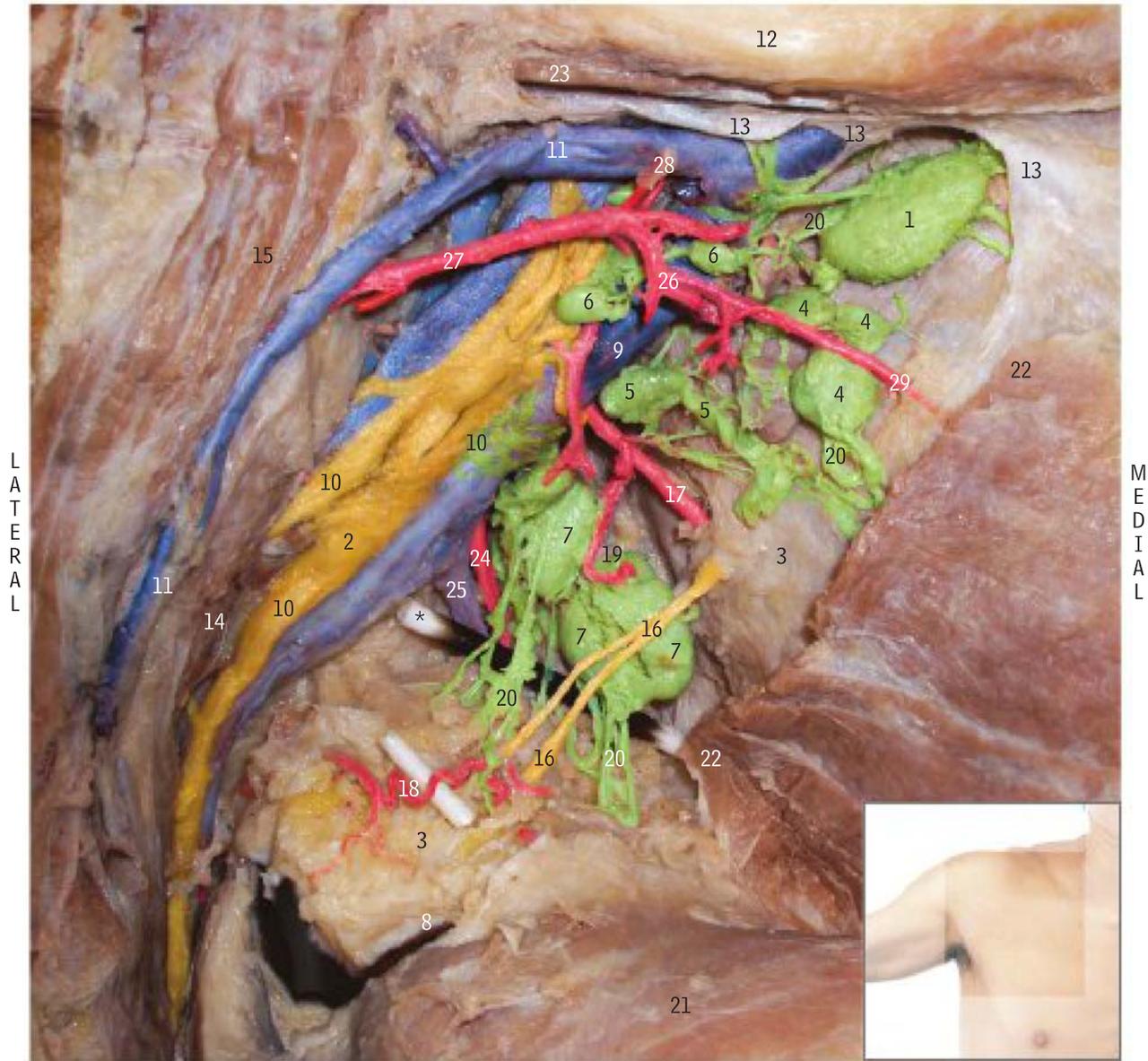
Posterior mediastinum with moderate lymphadenopathy



- | | |
|---|---|
| 1 Anterior portion of oesophageal plexus | 12 Oesophagus |
| 2 Arch of aorta (reflected) | 13 Parietal pleura |
| 3 Azygos vein | 14 Pulmonary trunk |
| 4 Inferior tracheobronchial nodes | 15 Ribs (cut edge) |
| 5 Intercostal space | 16 Right phrenic nerve |
| 6 Left phrenic nerve | 17 Right posterior intercostal vein |
| 7 Left primary (main) bronchus | 18 Right primary (main) bronchus |
| 8 Left pulmonary artery | 19 Right superior tracheobronchial nodes |
| 9 Left recurrent laryngeal nerve | 20 Superior vena cava (reflected) |
| 10 Left tracheobronchial lymph node | 21 Tumour |
| 11 Ligamentum arteriosum | |

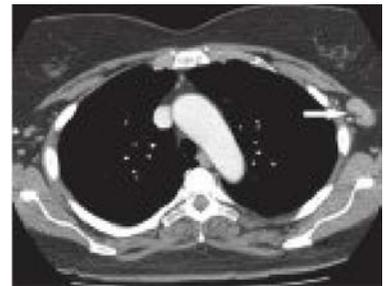
Right axilla with moderate lymphadenopathy

SUPERIOR



- 1 Apical node (infraclavicular – enlarged)
- 2 Axillary fascial sheath
- 3 Axillary fat
- 4 Axillary nodes, anterior or pectoral group
- 5 Axillary nodes, central group
- 6 Axillary nodes, lateral group (normal)
- 7 Axillary nodes, posterior group (enlarged)
- 8 Axillary skin
- 9 Axillary vein
- 10 Brachial plexus within axillary sheath
- 11 Cephalic vein
- 12 Clavicle
- 13 Clavipectoral fascia (cut)
- 14 Coracobrachialis
- 15 Deltoid
- 16 Intercostobrachial nerve
- * Quill placed to lift vessels and nerves
- 17 Lateral thoracic artery
- 18 Lateral thoracic, axillary skin and sweat gland branches
- 19 Lateral thoracic, nodal arterial branch
- 20 Lymphatic vessels
- 21 Pectoralis major (reflected)
- 22 Pectoralis minor
- 23 Subclavius
- 24 Subscapular artery
- 25 Subscapular vein
- 26 Thoraco-acromial artery
- 27 Thoraco-acromial artery, deltoid branch
- 28 Thoraco-acromial artery, clavicular branch
- 29 Thoraco-acromial artery, pectoral branch

Axial CT, axilla*



*Arrow points to enlarged axillary node



Axillary lymph node (sentinel node) dissection for breast cancer

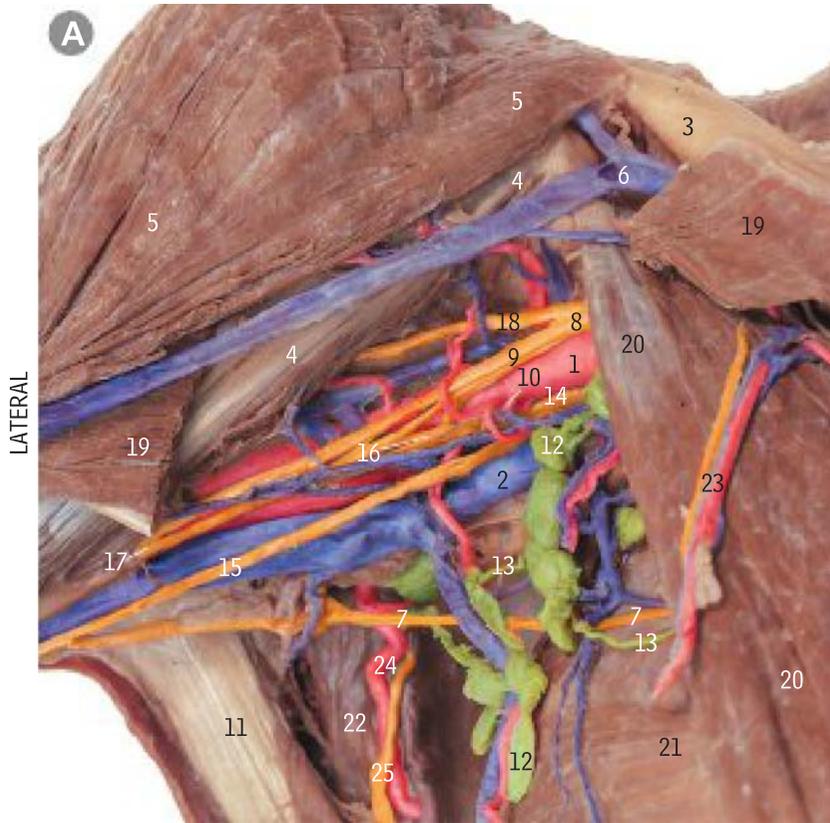


Lymphangitis



Lymphoedema

Right axilla and lymph nodes *from the front*

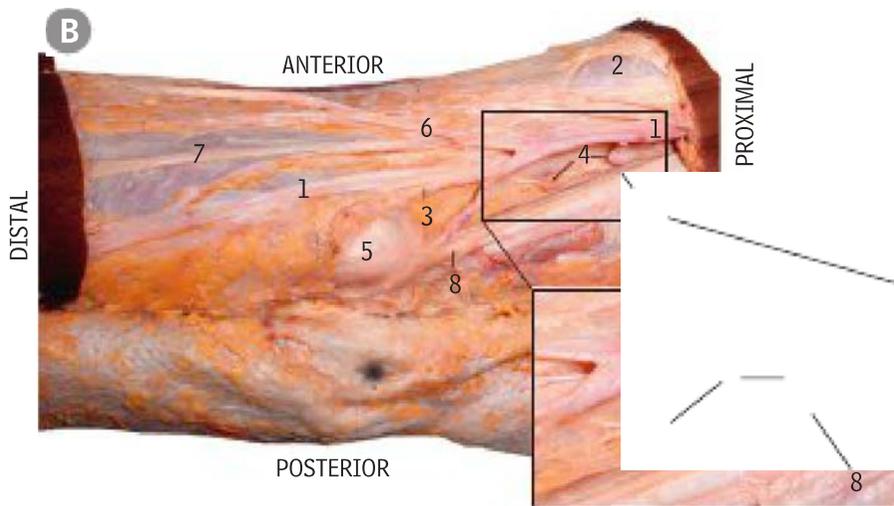


Pectoralis major (19) has been reflected and the clavipectoral fascia removed, together with the axillary sheath which surrounded the axillary artery and brachial plexus.

- 1 Axillary artery
- 2 Axillary vein
- 3 Clavicle
- 4 Coracobrachialis
- 5 Deltoid
- 6 Entry of cephalic vein into deltoid vein
- 7 Intercostobrachial nerve
- 8 Lateral cord of brachial plexus
- 9 Lateral root of median nerve
- 10 Lateral thoracic artery
- 11 Latissimus dorsi
- 12 Lymph nodes
- 13 Lymph vessels
- 14 Medial cord of the brachial plexus
- 15 Ulnar nerve
- 16 Medial root of median nerve
- 17 Median nerve
- 18 Musculocutaneous nerve
- 19 Pectoralis major
- 20 Pectoralis minor
- 21 Serratus anterior
- 22 Subscapularis
- 23 Thoracoacromial vessels and lateral pectoral nerve
- 24 Thoracodorsal artery
- 25 Thoracodorsal nerve

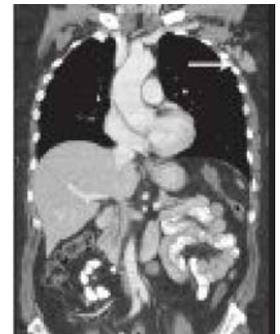


Right cubital fossa *lymph nodes*

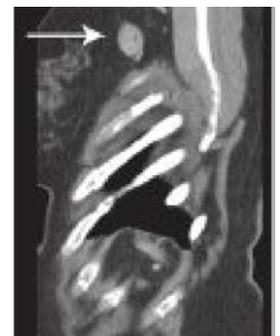


- 1 Basilic vein
- 2 Biceps brachii
- 3 Branches of medial cutaneous nerve of forearm
- 4 Cubital lymph nodes
- 5 Medial epicondyle of humerus
- 6 Median cubital vein
- 7 Median forearm vein
- 8 Ulnar nerve

Coronal CT*



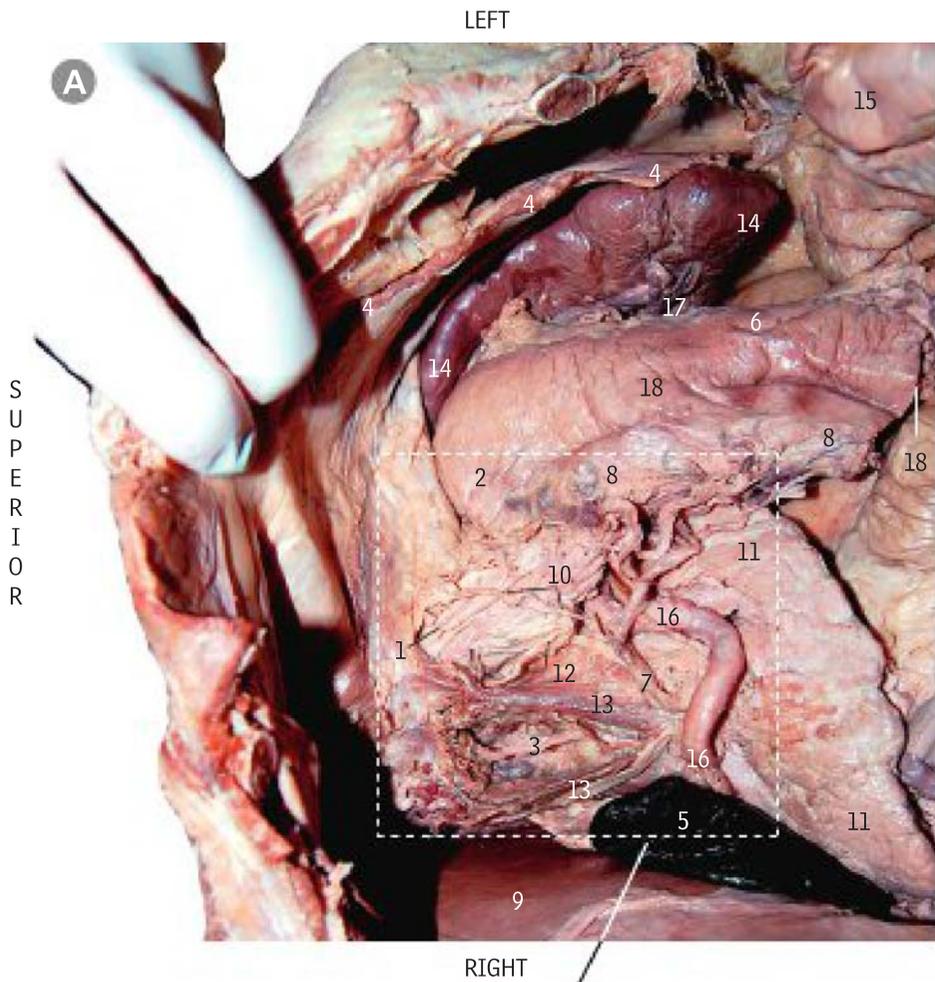
Parasagittal CT*



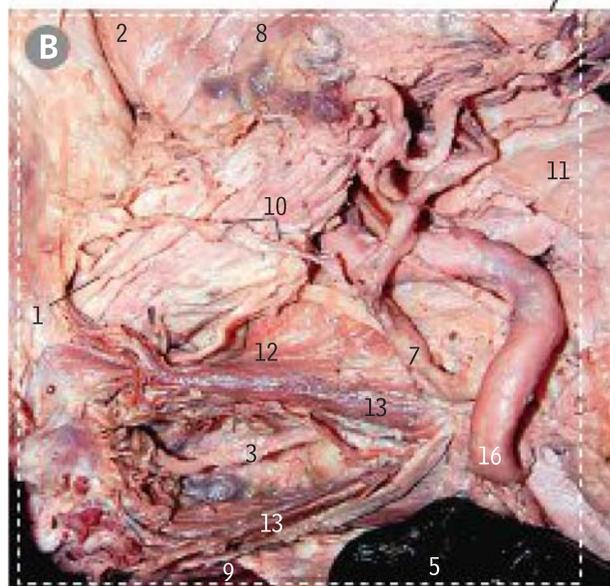
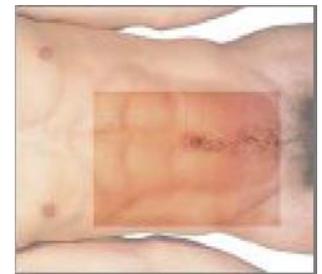
*Arrows indicate axillary lymphadenopathy

Cisterna chyli in posterior upper abdominal wall

Note split right crus

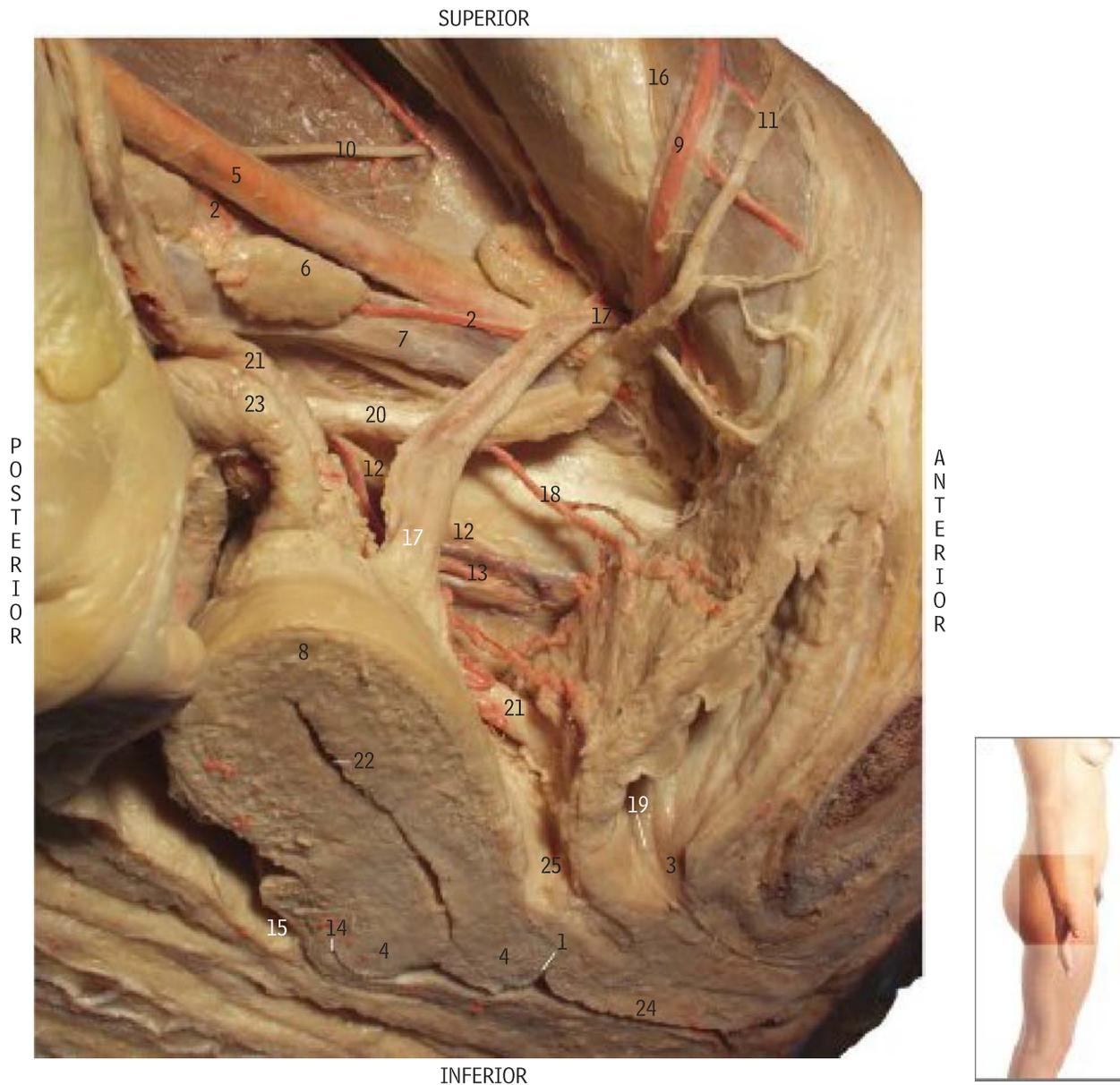


- 1 Anterior vagal trunk
- 2 Cardia of stomach
- 3 Cisterna chyli
- 4 Diaphragm
- 5 Gall bladder
- 6 Greater curvature of stomach
- 7 Left gastric artery
- 8 Lesser curvature of stomach
- 9 Liver
- 10 Oesophageal artery
- 11 Pancreas
- 12 Posterior vagal trunk
- 13 Right crus of the diaphragm (split)
- 14 Spleen
- 15 Splenic flexure
- 16 Splenic artery
- 17 Splenic hilum with splenic artery and vein
- 18 Stomach (cut)



Female pelvis left half of midline sagittal section with lymphadenopathy

Retroverted uterus – a normal variant



- | | | |
|---|--|---|
| <p>1 Anterior vaginal fornix</p> <p>2 Arterial supply to lymph node</p> <p>3 Bladder neck</p> <p>4 Cervix</p> <p>5 External iliac artery</p> <p>6 External iliac lymph node (enlarged)</p> <p>7 External iliac vein</p> <p>8 Fundus of uterus</p> <p>9 Inferior epigastric vessels</p> | <p>10 Lateral cutaneous nerve of thigh</p> <p>11 Medial umbilical ligament</p> <p>12 Obturator nerve</p> <p>13 Obturator vessels</p> <p>14 Posterior vaginal fornix</p> <p>15 Rectouterine peritoneal pouch (Douglas)</p> <p>16 Rectus abdominis</p> <p>17 Round ligament of uterus</p> <p>18 Superior vesical artery</p> | <p>19 Trigone of bladder</p> <p>20 Umbilical artery (remnant)</p> <p>21 Ureter</p> <p>22 Uterine cavity</p> <p>23 Uterine tube (Fallopian)</p> <p>24 Vagina</p> <p>25 Vesicouterine peritoneal pouch</p> |
|---|--|---|

Lymphangiogram pelvis

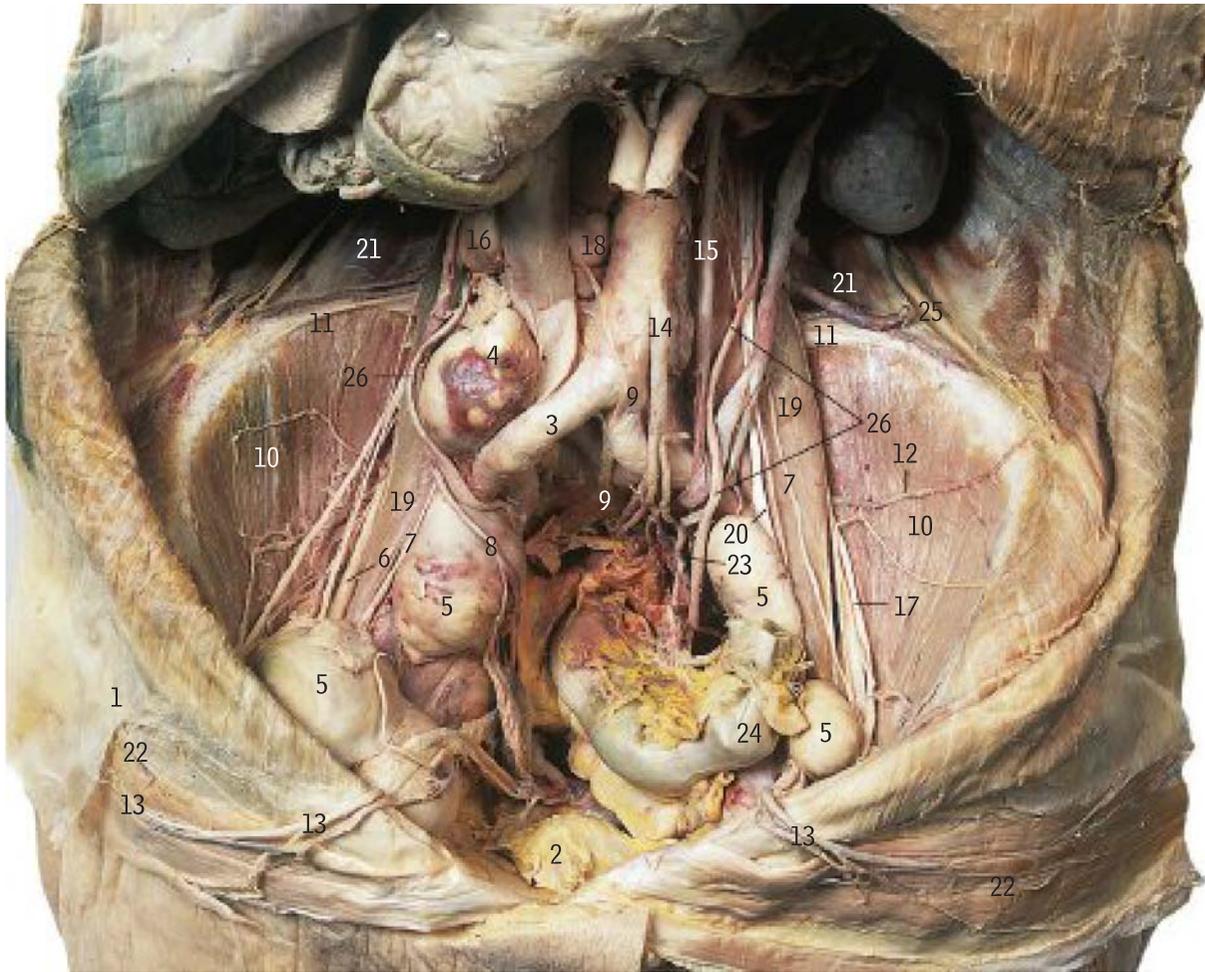
early filling phase *late filling phase*



- 1 Ascending lumbar chains
- 2 Afferent inguinal lymphatics
- 3 Common iliac nodes
- 4 Efferent inguinal lymphatics
- 5 External iliac nodes
- 6 Superficial inguinal nodes
- 7 Lumbar crossover
- 8 Deep inguinal nodes



Gross lymphadenopathy of the pelvis *relationship of nodal groups*



- | | |
|--|--|
| 1 Arcuate line of posterior rectus sheath | 14 Inferior mesenteric artery |
| 2 Bladder | 15 Inferior mesenteric vein |
| 3 Common iliac artery | 16 Lateral aortic (right chain) node (enlarged) |
| 4 Common iliac node (grossly enlarged) | 17 Lateral cutaneous nerve of thigh |
| 5 External iliac node (grossly enlarged) | 18 Pre-aortic (aortocaval) node (enlarged) |
| 6 Femoral nerve | 19 Psoas major |
| 7 Genitofemoral nerve | 20 Psoas minor |
| 8 Gonadal vein | 21 Quadratus lumborum |
| 9 Hypogastric plexus, superior | 22 Rectus abdominis |
| 10 Iliacus | 23 Sigmoid branches of left colic artery |
| 11 Iliolumbar ligament | 24 Sigmoid colon |
| 12 Iliolumbar vein | 25 Subcostal nerve |
| 13 Inferior epigastric vessels | 26 Ureter |



Lymphadenopathy



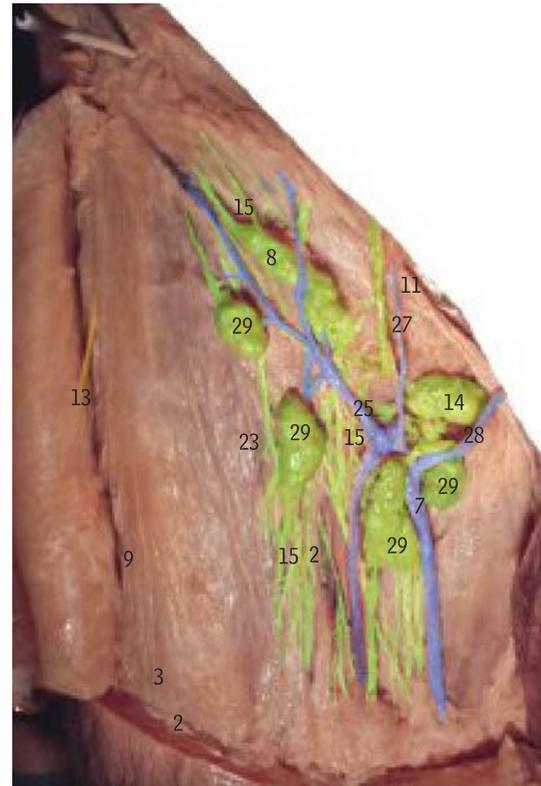
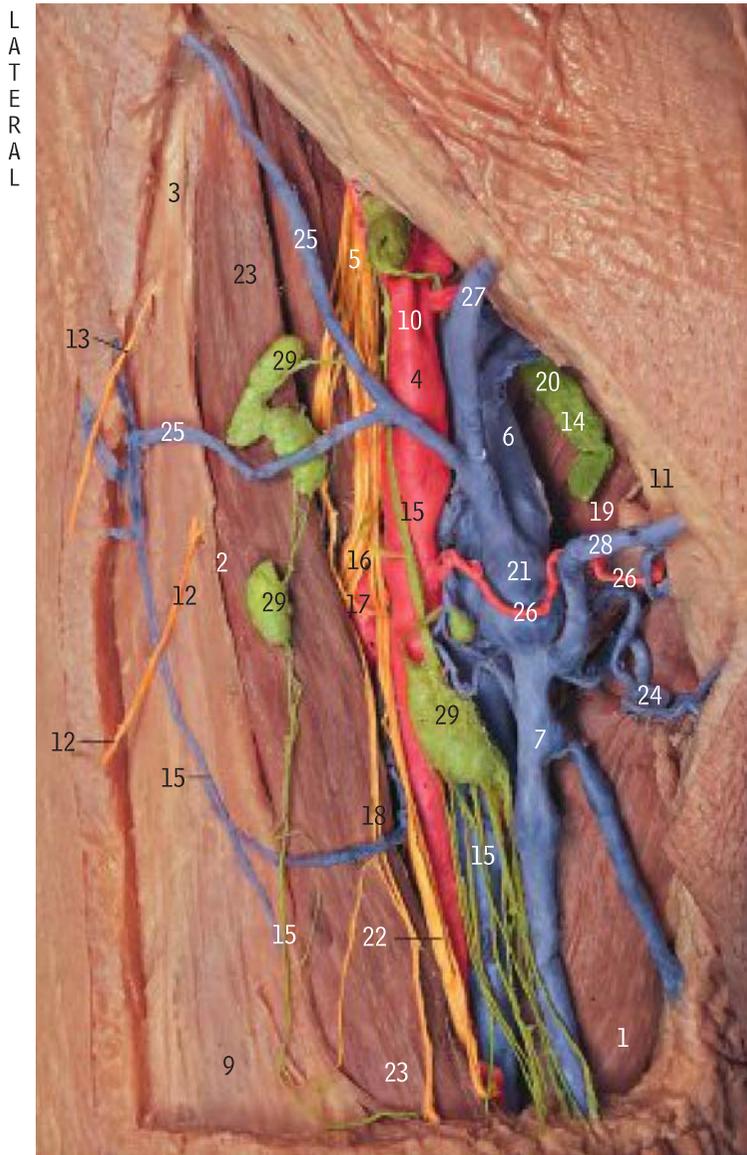
Lymphoma and splenomegaly

Lymphatics of thigh and superficial inguinal lymph nodes

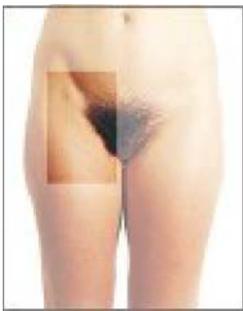
minor lymphadenopathy

moderate lymphadenopathy

* Marker quill is in the right anterior superior iliac spine



- 1 Adductor longus
- 2 Fascia lata, cut edge
- 3 Fascia lata overlying tensor fasciae latae
- 4 Femoral artery
- 5 Femoral nerve
- 6 Femoral vein
- 7 Great saphenous vein
- 8 Horizontal chain of superficial inguinal nodes
- 9 Iliotibial tract overlying vastus lateralis
- 10 Inferior epigastric vessels
- 11 Inguinal ligament
- 12 Intermediate cutaneous nerve of thigh
- 13 Lateral cutaneous nerve of thigh
- 14 Lymph node (Cloquet)
- 15 Lymph vessels
- 16 Muscular branches of femoral nerve overlying lateral circumflex femoral vessels
- 17 Nerve to sartorius
- 18 Nerve to vastus lateralis
- 19 Pectineus
- 20 Position of femoral canal
- 21 Saphena varix
- 22 Saphenous nerve
- 23 Sartorius
- 24 Scrotal veins
- 25 Superficial circumflex iliac vein
- 26 Superficial external pudendal artery
- 27 Superficial epigastric vein
- 28 Superficial external pudendal vein
- 29 Vertical chain of superficial inguinal lymph nodes



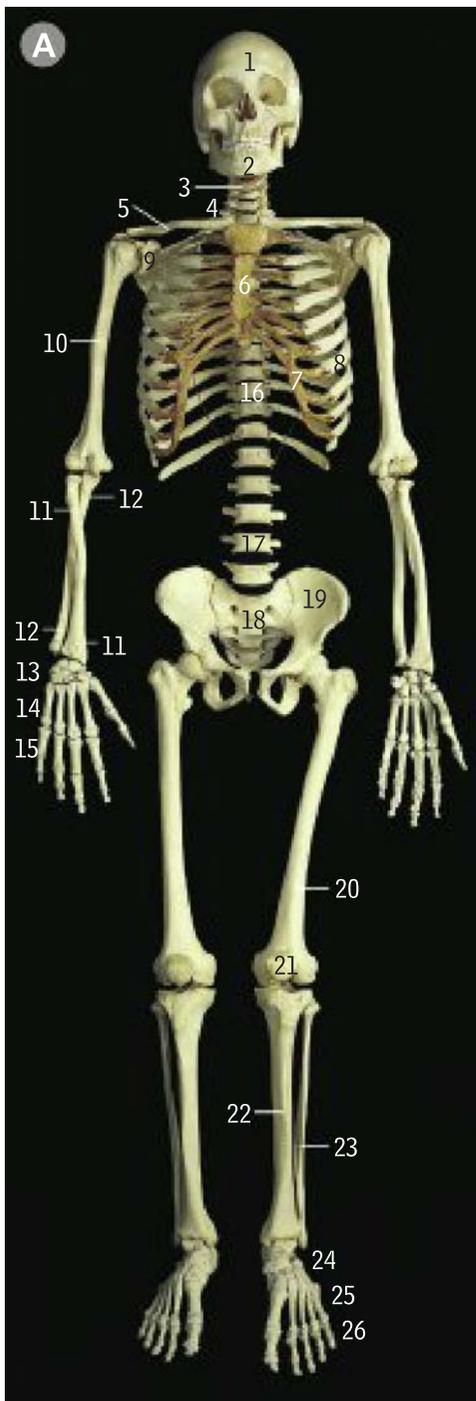
The boundaries of the femoral triangle are the inguinal ligament (11), the medial border of sartorius (23) and the medial border of adductor longus (1).

The femoral canal (20) is the medial compartment of the femoral sheath (removed) which contains in its middle compartment the femoral vein (6) and in the lateral compartment the femoral artery (4). The femoral nerve (5) is lateral to the sheath, not within it.



Milroy's disease Lymphangioma circumscriptum Lymphogranuloma venereum (LGV) Elephantiasis

Systemic review



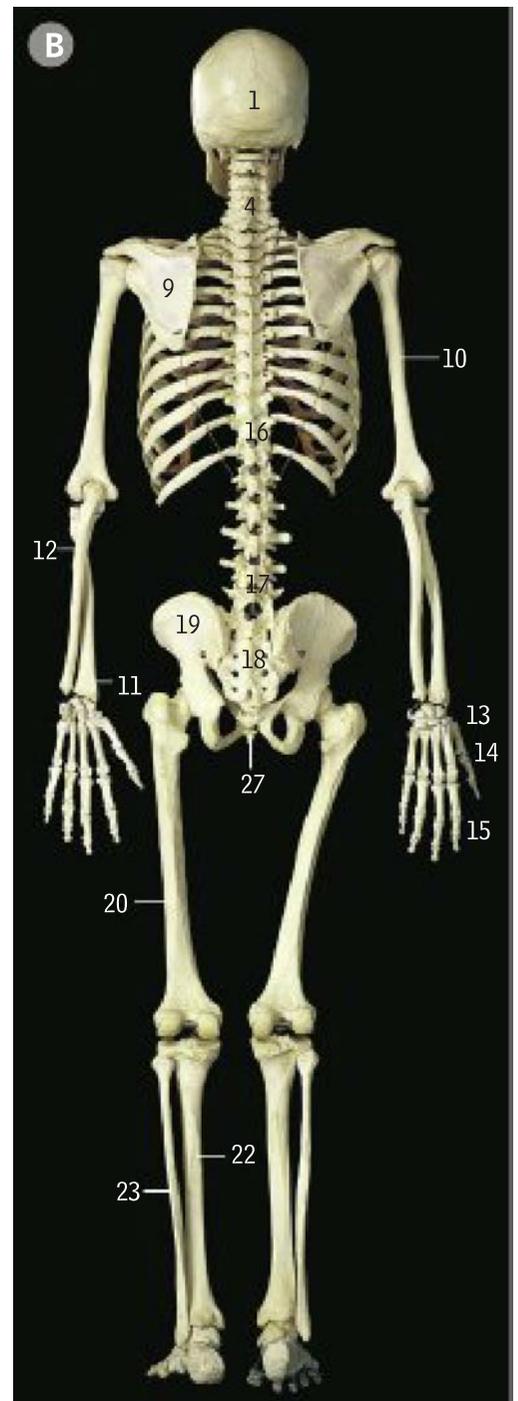
Skeleton

from the front

from behind

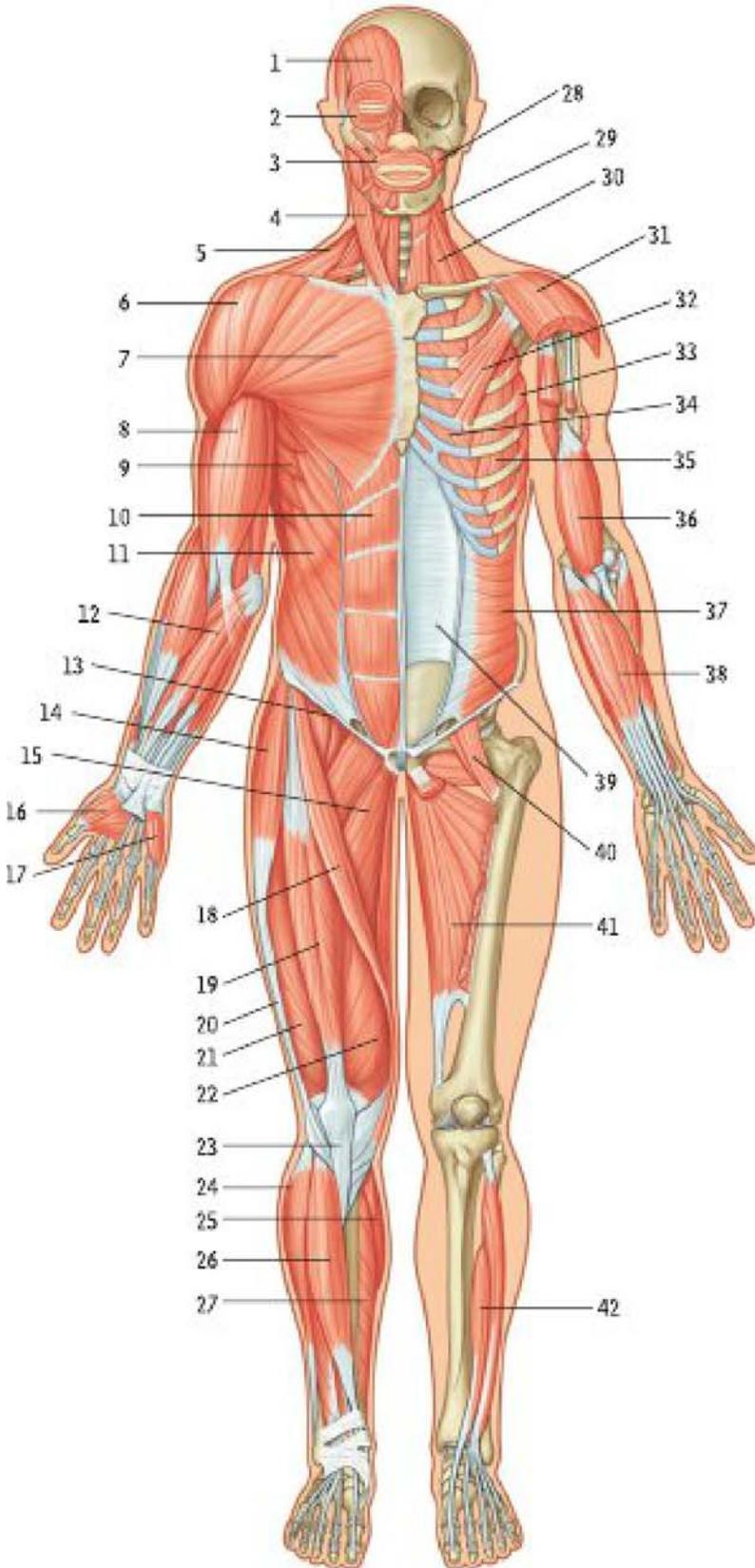
The left forearm is in the position of supination, the right in pronation in A.

- 1 Skull
- 2 Mandible
- 3 Hyoid bone
- 4 Cervical vertebrae
- 5 Clavicle
- 6 Sternum
- 7 Costal arch cartilages
- 8 Ribs
- 9 Scapula
- 10 Humerus
- 11 Radius
- 12 Ulna
- 13 Carpal bones
- 14 Metacarpal bones
- 15 Phalanges of thumb and fingers
- 16 Thoracic vertebrae
- 17 Lumbar vertebrae
- 18 Sacrum
- 19 Hip bone
- 20 Femur
- 21 Patella
- 22 Tibia
- 23 Fibula
- 24 Tarsal bones
- 25 Metatarsal bones
- 26 Phalanges of toes
- 27 Coccyx



Muscles from the front

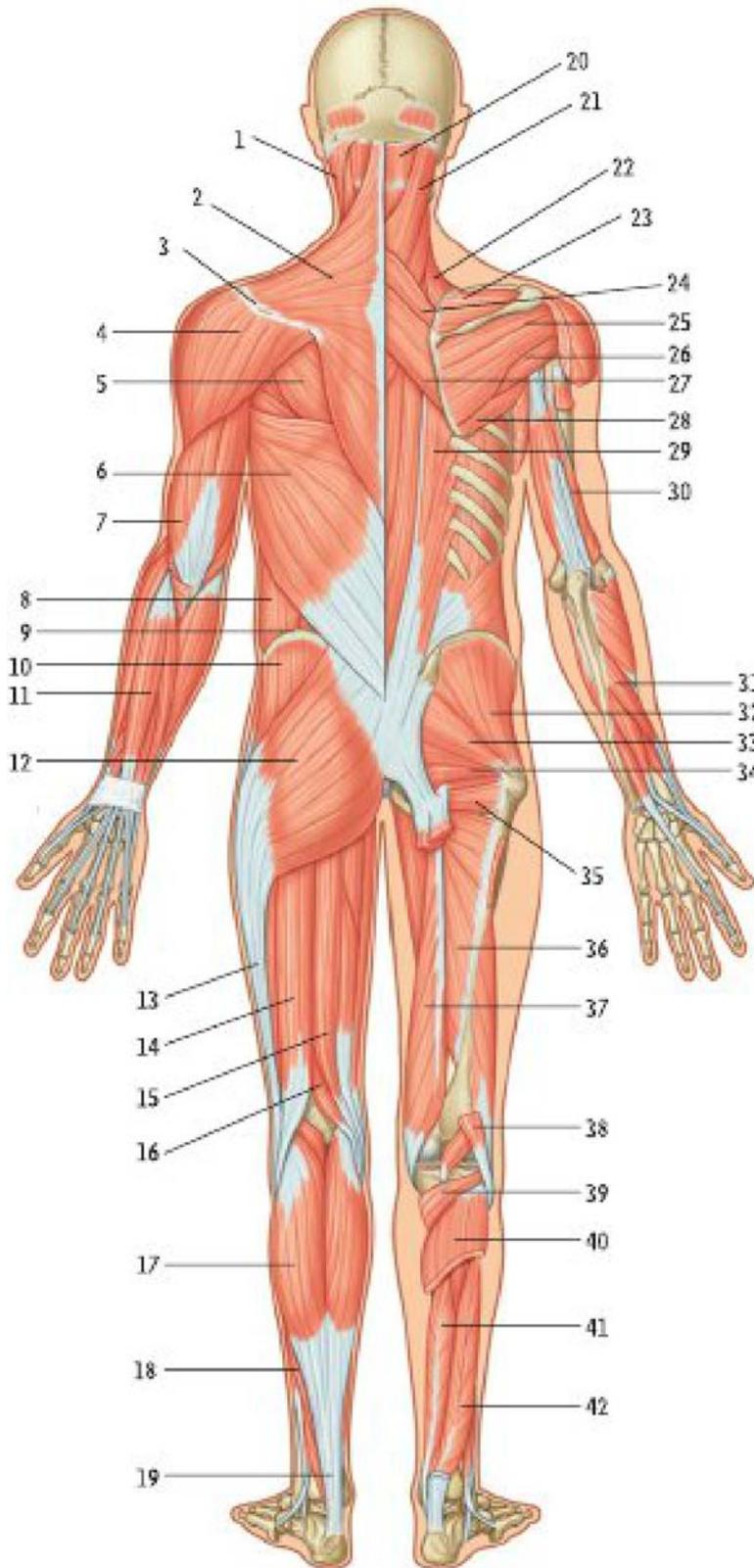
Superficial muscles on the right side the body, deep muscles on the left side.



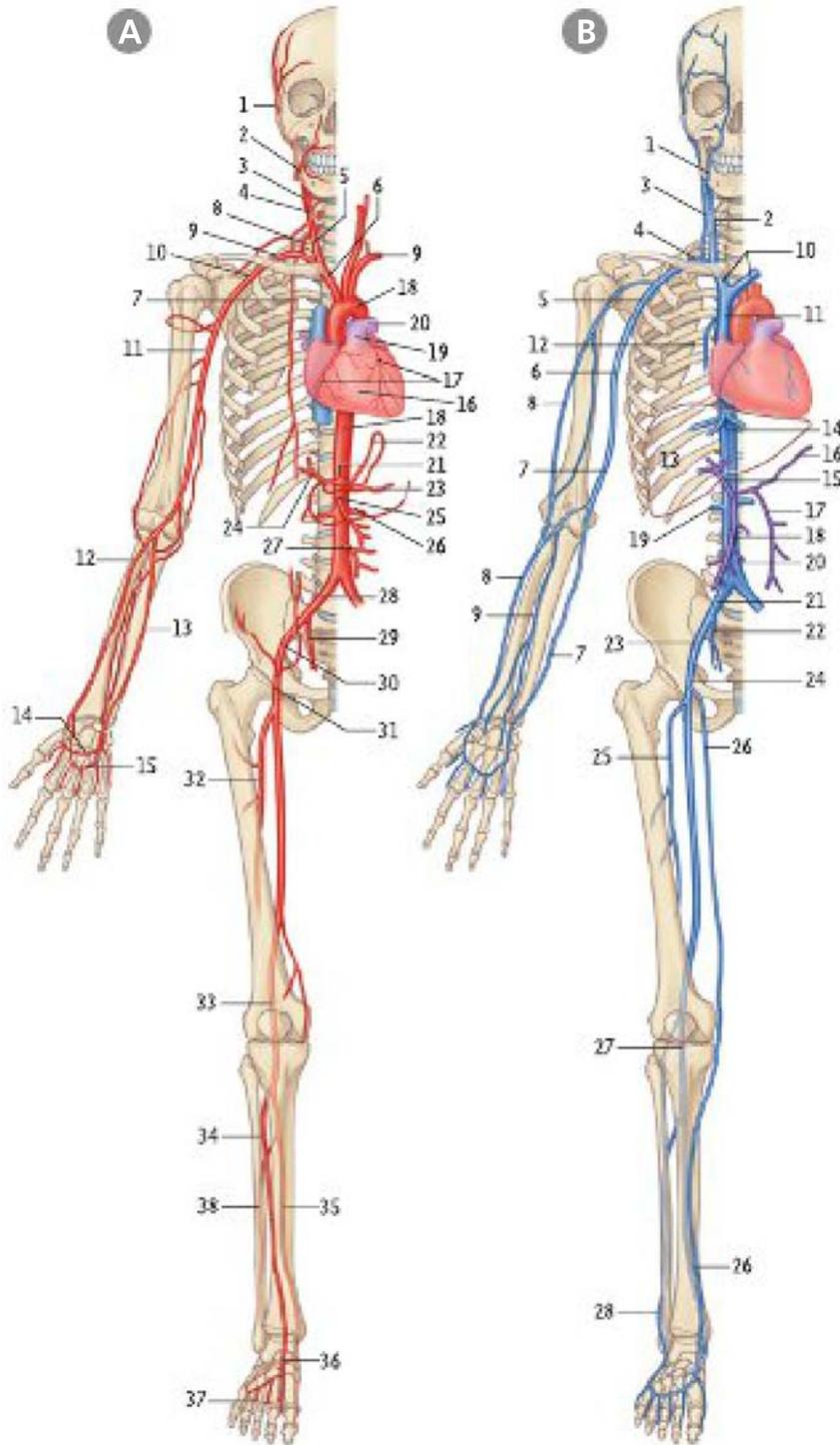
- 1 Frontalis part of occipitofrontalis
- 2 Orbicularis oculi
- 3 Orbicularis oris
- 4 Sternocleidomastoid
- 5 Trapezius
- 6 Deltoid
- 7 Pectoralis major
- 8 Biceps brachii
- 9 Serratus anterior
- 10 Rectus abdominis
- 11 External oblique
- 12 Superficial flexor muscles of forearm
- 13 Inguinal ligament
- 14 Tensor fasciae latae
- 15 Adductor muscles of hip
- 16 Thenar muscles
- 17 Hypothenar muscles
- 18 Sartorius
- 19 Rectus femoris
- 20 Iliotibial tract
- 21 Vastus lateralis
- 22 Vastus medialis
- 23 Patellar ligament
- 24 Peroneal (fibular) muscles
- 25 Gastrocnemius
- 26 Extensor compartment muscles of leg
- 27 Soleus
- 28 Buccinator
- 29 Levator scapulae
- 30 Scalenus anterior
- 31 Deltoid
- 32 Pectoralis minor
- 33 Serratus anterior, rib insertion
- 34 Internal intercostal
- 35 External intercostal
- 36 Brachialis
- 37 Internal oblique
- 38 Deep flexor muscles of forearm
- 39 Rectus sheath (posterior wall)
- 40 Psoas major and iliacus
- 41 Adductor magnus
- 42 Extensor hallucis longus

Muscles from behind

Superficial muscles on the left side of the body, deep muscles on the right side.



- 1 Sternocleidomastoid
- 2 Trapezius
- 3 Spine of scapula
- 4 Deltoid
- 5 Infraspinatus
- 6 Latissimus dorsi
- 7 Triceps
- 8 External oblique
- 9 Iliac crest
- 10 Gluteus medius
- 11 Superficial extensor muscles of forearm
- 12 Gluteus maximus
- 13 Iliotibial tract
- 14 Biceps femoris
- 15 Semimembranosus
- 16 Semitendinosus
- 17 Gastrocnemius
- 18 Soleus
- 19 Tendocalcaneus (Achilles tendon)
- 20 Semispinalis capitis
- 21 Splenius
- 22 Levator scapulae
- 23 Supraspinatus
- 24 Rhomboid minor
- 25 Infraspinatus
- 26 Teres minor
- 27 Rhomboid major
- 28 Teres major
- 29 Erector spinae
- 30 Triceps
- 31 Deep extensor muscles of forearm
- 32 Gluteus medius
- 33 Piriformis
- 34 Obturator internus
- 35 Quadratus femoris
- 36 Adductor magnus
- 37 Semimembranosus
- 38 Biceps femoris
- 39 Popliteus
- 40 Soleus
- 41 Flexor digitorum longus
- 42 Flexor hallucis longus



Arteries

major arteries (a.), from the front

- | | |
|----------------------------|---------------------------|
| 1 Superficial temporal a. | 19 Pulmonary trunk |
| 2 Facial a. | 20 Pulmonary a. |
| 3 Internal carotid a. | 21 Coeliac trunk |
| 4 External carotid a. | 22 Left gastric a. |
| 5 Common carotid a. | 23 Splenic a. |
| 6 Brachiocephalic trunk | 24 Common hepatic a. |
| 7 Internal thoracic a. | 25 Superior mesenteric a. |
| 8 Vertebral a. | 26 Renal a. |
| 9 Subclavian a. | 27 Inferior mesenteric a. |
| 10 Axillary a. | 28 Common iliac a. |
| 11 Brachial a. | 29 Internal iliac a. |
| 12 Radial a. | 30 External iliac a. |
| 13 Ulnar a. | 31 Common femoral a. |
| 14 Deep palmar arch | 32 Profunda femoris a. |
| 15 Superficial palmar arch | 33 Popliteal a. |
| 16 Heart | 34 Anterior tibial a. |
| 17 Coronary aa. | 35 Posterior tibial a. |
| 18 Aorta | 36 Dorsalis pedis a. |
| | 37 Plantar arch |
| | 38 Peroneal (fibular) a. |

Veins

major veins (v.), from the front

(The pulmonary veins enter the left atrium at the back of the heart and are not shown.)

- | | |
|------------------------|---------------------------|
| 1 Facial v. | 16 Splenic v. |
| 2 Internal jugular v. | 17 Inferior mesenteric v. |
| 3 External jugular v. | 18 Superior mesenteric v. |
| 4 Subclavian v. | 19 Renal v. |
| 5 Axillary v. | 20 Inferior vena cava |
| 6 Brachial v. | 21 Common iliac v. |
| 7 Basilic v. | 22 Internal iliac v. |
| 8 Cephalic v. | 23 External iliac v. |
| 9 Median forearm v. | 24 Common femoral v. |
| 10 Brachiocephalic vv. | 25 Profunda femoris v. |
| 11 Superior vena cava | 26 Great saphenous v. |
| 12 Azygos v. | 27 Popliteal v. |
| 13 Liver | 28 Small saphenous v. |
| 14 Hepatic vv. | |
| 15 Portal v. | |

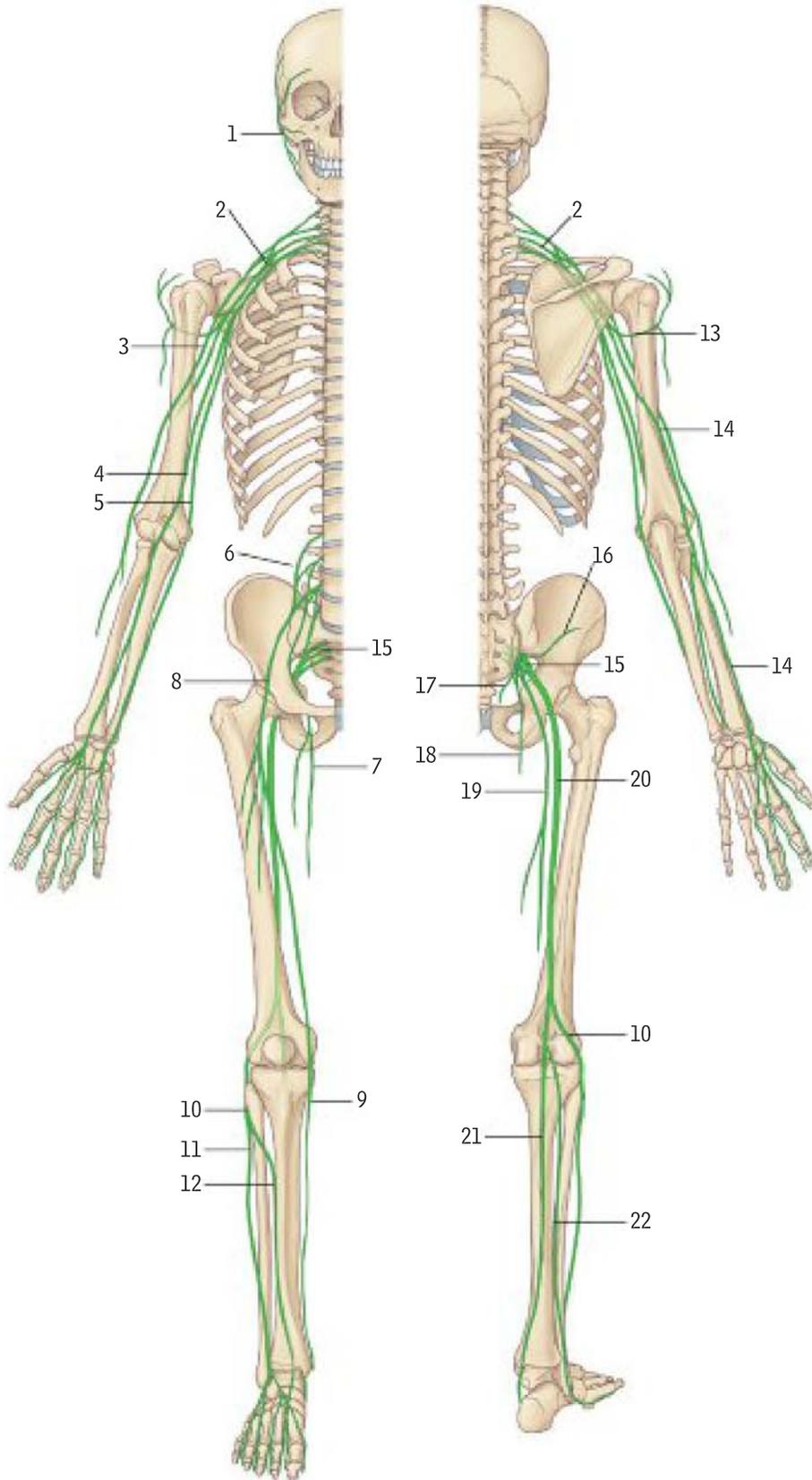
Nerves

main nerves (n.) including the facial nerve and major branches of the brachial, lumbar and sacral plexi

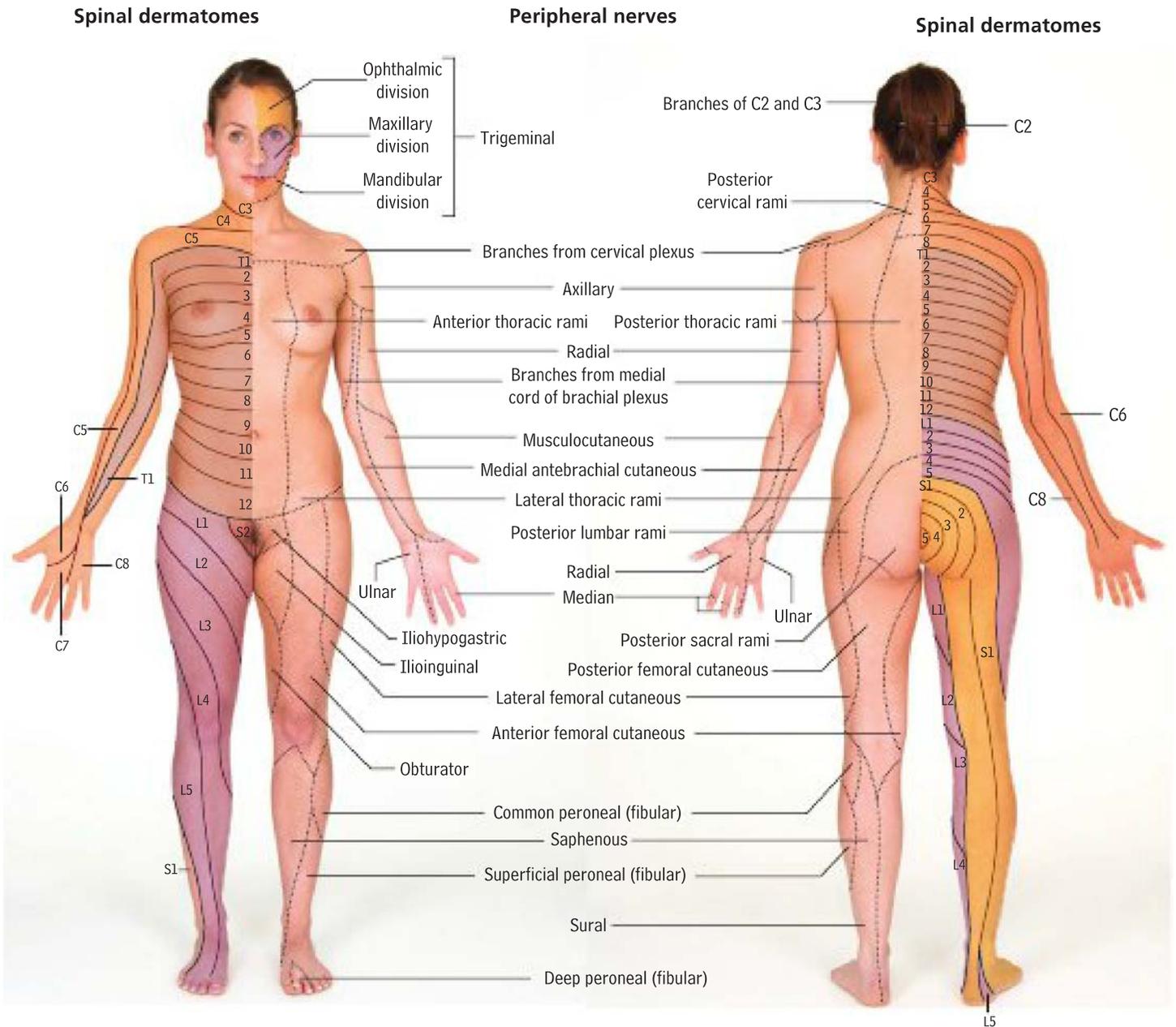
from the front

from the back

- 1 Facial n.
- 2 Brachial plexus (divisions)
- 3 Musculocutaneous n.
- 4 Median n.
- 5 Ulnar n.
- 6 Lumbar plexus
- 7 Obturator n.
- 8 Femoral n.
- 9 Saphenous n.
- 10 Common peroneal (fibular) n.
- 11 Superficial peroneal (fibular) n.
- 12 Deep peroneal (fibular) n.
- 13 Axillary n.
- 14 Radial n.
- 15 Sacral plexus
- 16 Superior gluteal n.
- 17 Inferior gluteal n.
- 18 Pudendal n.
- 19 Posterior femoral cutaneous n.
- 20 Sciatic n.
- 21 Tibial n.
- 22 Sural n.



Dermatomes of cranial, spinal and peripheral nerves



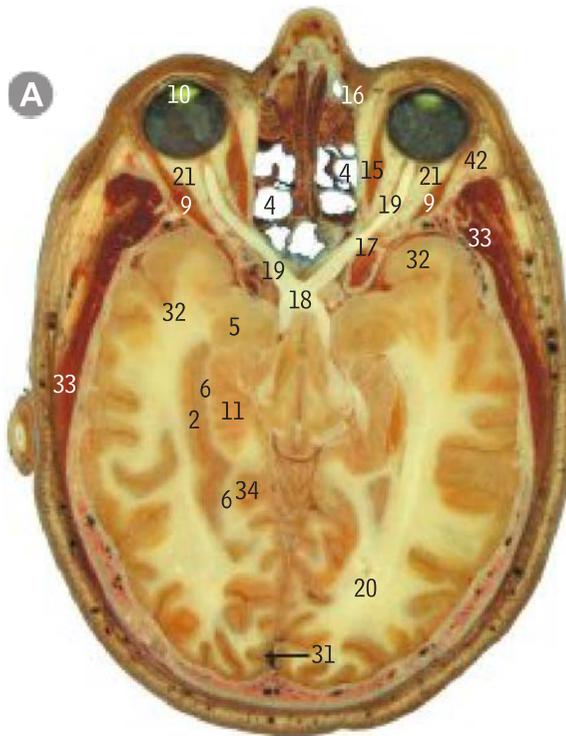
After Keegan et al. 1948 *Anatomical Record* 102; 409–437. There is great personal variation; see Foerster 1933 *Brain* 56; 1–39. Overlap of dermatomes occurs over 2–3 spinal root levels.

Cross-sections of the human body

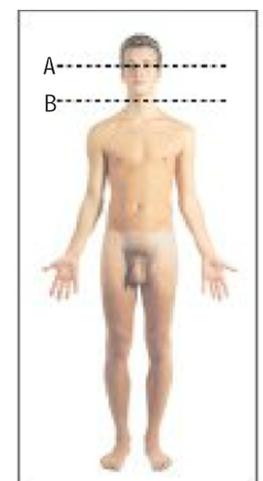
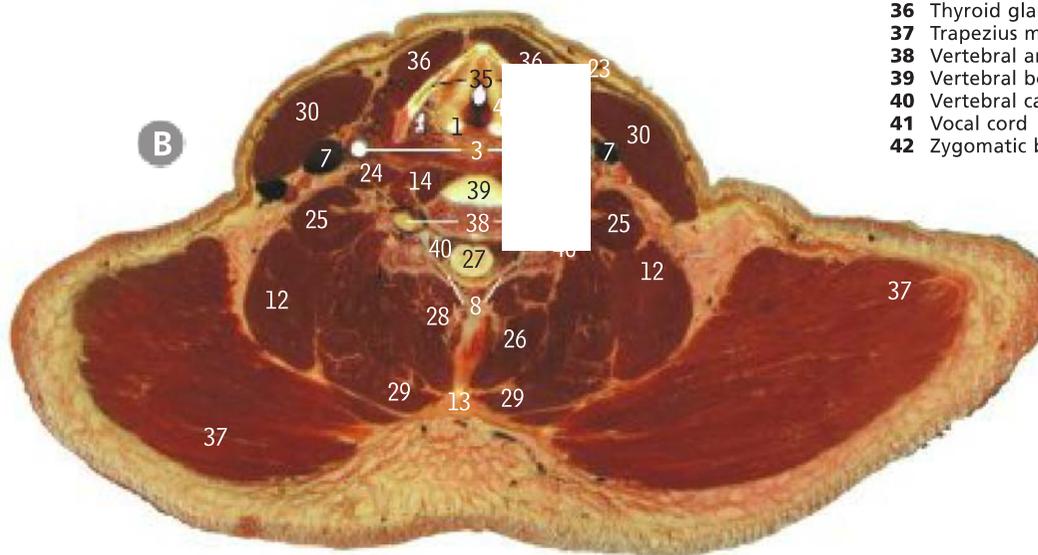
Head and neck *cross-sections*

section at level of optic chiasma

section at level of vocal cords

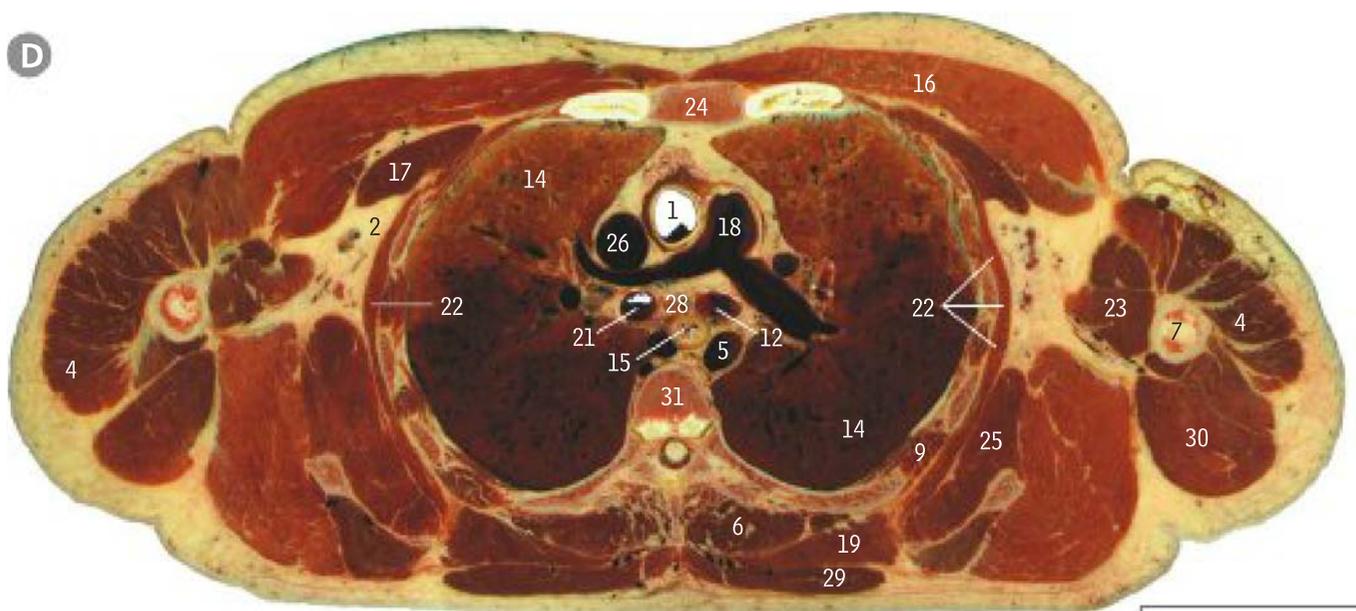
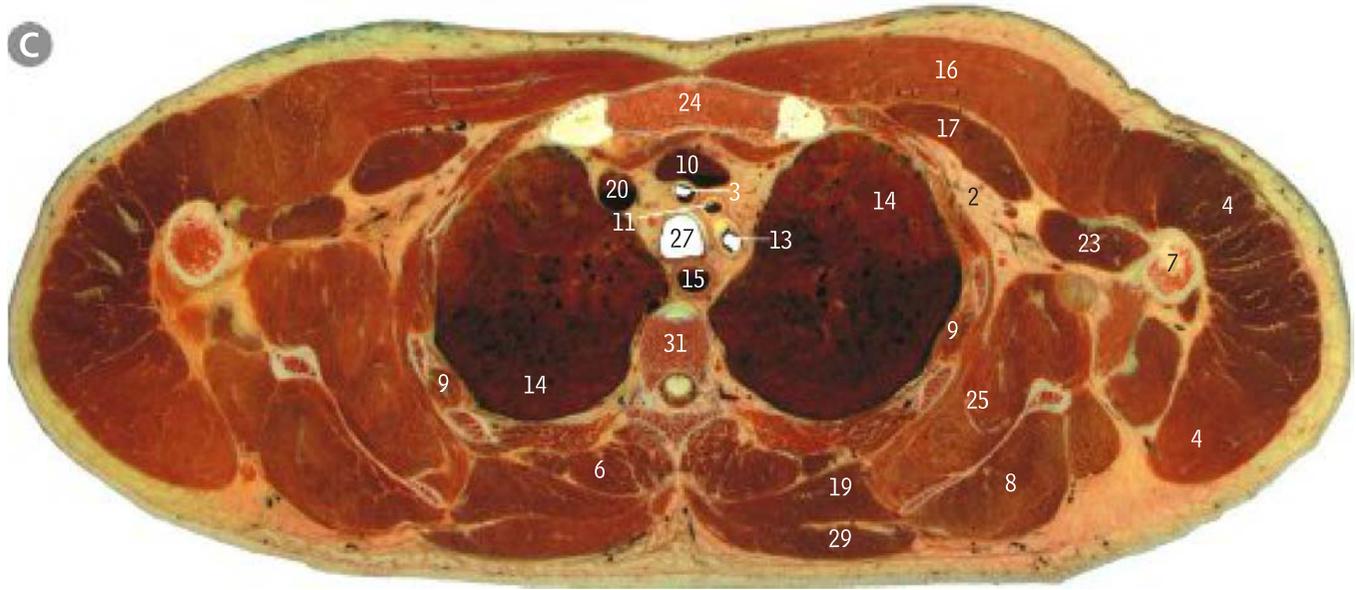


- 1 Arytenoid cartilage
- 2 Clastrum
- 3 Common carotid artery
- 4 Ethmoidal air cells
- 5 Head of caudate nucleus
- 6 Internal capsule of cerebrum
- 7 Internal jugular vein
- 8 Lamina of vertebra
- 9 Lateral rectus muscle
- 10 Lens
- 11 Lentiform nucleus
- 12 Levator scapulae muscle
- 13 Ligamentum nuchae
- 14 Longus colli muscle
- 15 Medial rectus muscle
- 16 Nasal cavity
- 17 Optic canal
- 18 Optic chiasma
- 19 Optic nerve
- 20 Optic radiation
- 21 Orbital fat
- 22 Piriform fossa, pharynx
- 23 Platysma muscle
- 24 Scalenus anterior muscle
- 25 Scalenus medius and scalenus posterior
- 26 Semispinalis capitis muscle
- 27 Spinal cord
- 28 Spinalis muscle
- 29 Splenius capitis muscle
- 30 Sternocleidomastoid muscle
- 31 Superior sagittal sinus
- 32 Temporal lobe, cerebrum
- 33 Temporalis muscle
- 34 Thalamus
- 35 Thyroid cartilage
- 36 Thyroid gland, lateral lobe
- 37 Trapezius muscle
- 38 Vertebral artery in transverse foramen
- 39 Vertebral body
- 40 Vertebral canal
- 41 Vocal cord
- 42 Zygomatic bone



Images on [pages 7–10](#) inclusive are from the National Library of Medicine (USA), Visible Human Data Set.

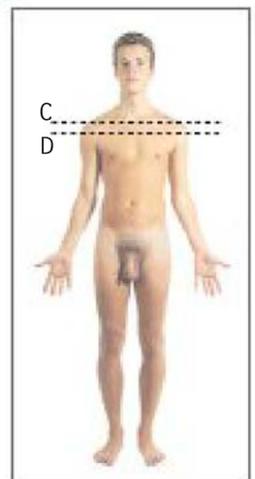
Thorax cross-sections



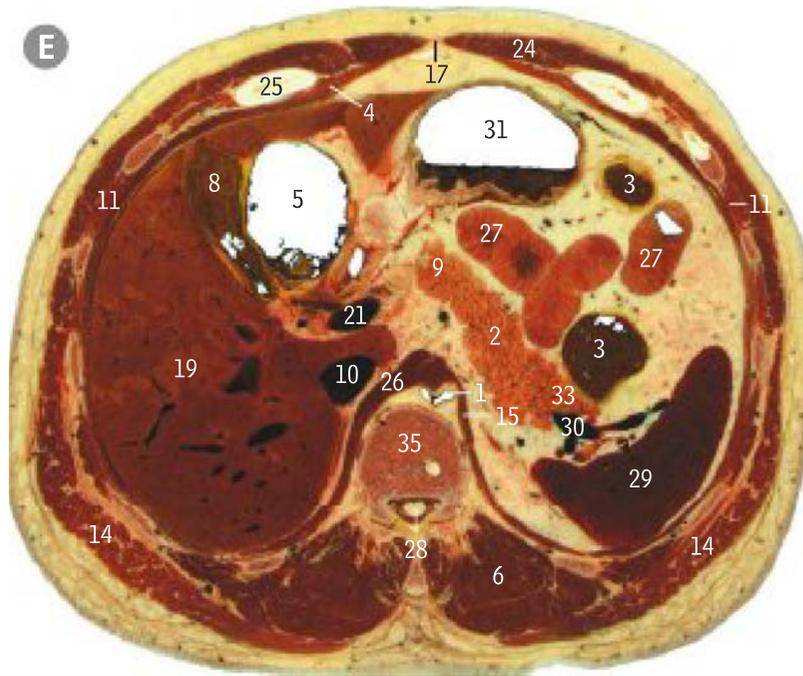
section at T2 vertebral level

section at T4/5 vertebral level

- | | | |
|--|---|---|
| <ul style="list-style-type: none"> 1 Ascending aorta 2 Axillary fat with brachial plexus 3 Brachiocephalic artery 4 Deltoid muscle 5 Descending aorta 6 Erector spinae muscle 7 Humerus | <ul style="list-style-type: none"> 8 Infraspinatus muscle 9 Intercostal muscles 10 Left brachiocephalic vein 11 Left common carotid artery 12 Left main bronchus 13 Left subclavian artery 14 Lung 15 Oesophagus 16 Pectoralis major muscle 17 Pectoralis minor muscle 18 Pulmonary trunk 19 Rhomboid major muscle 20 Right brachiocephalic vein 21 Right main bronchus | <ul style="list-style-type: none"> 22 Serratus anterior muscle 23 Short head of biceps brachii and coracobrachialis muscles 24 Sternal marrow 25 Subscapularis muscle 26 Superior vena cava 27 Trachea 28 Tracheobronchial lymph nodes (subcarinal nodes) 29 Trapezius muscle 30 Triceps muscle 31 Vertebral body |
|--|---|---|



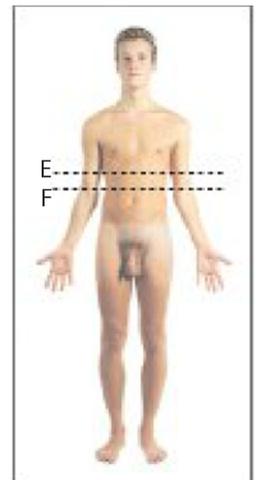
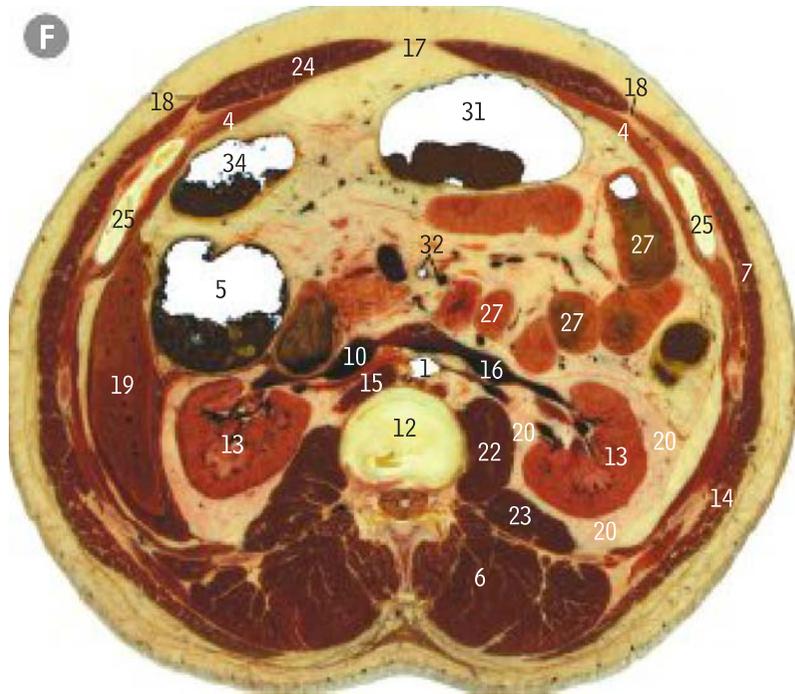
Abdomen cross-sections



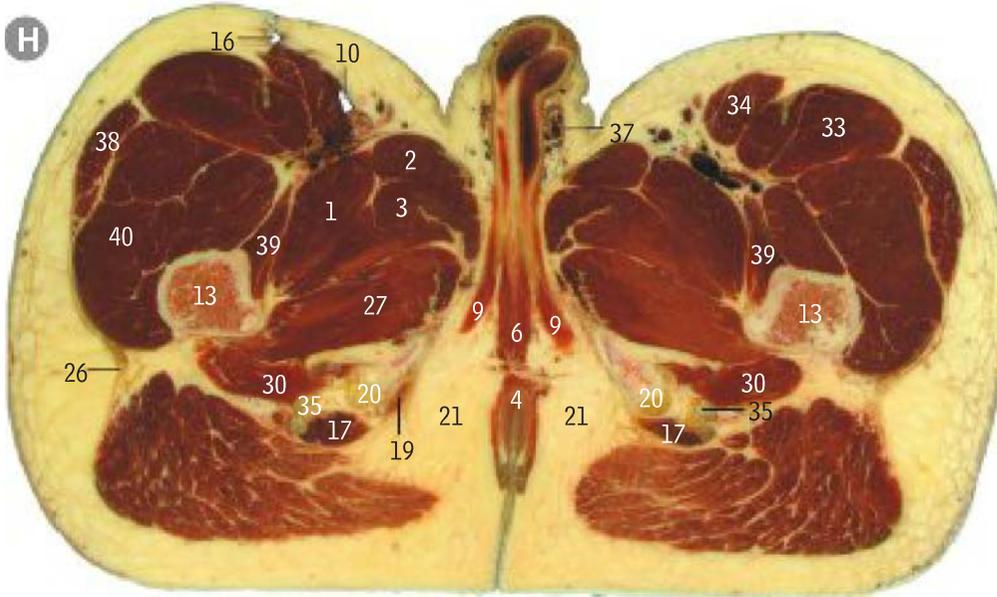
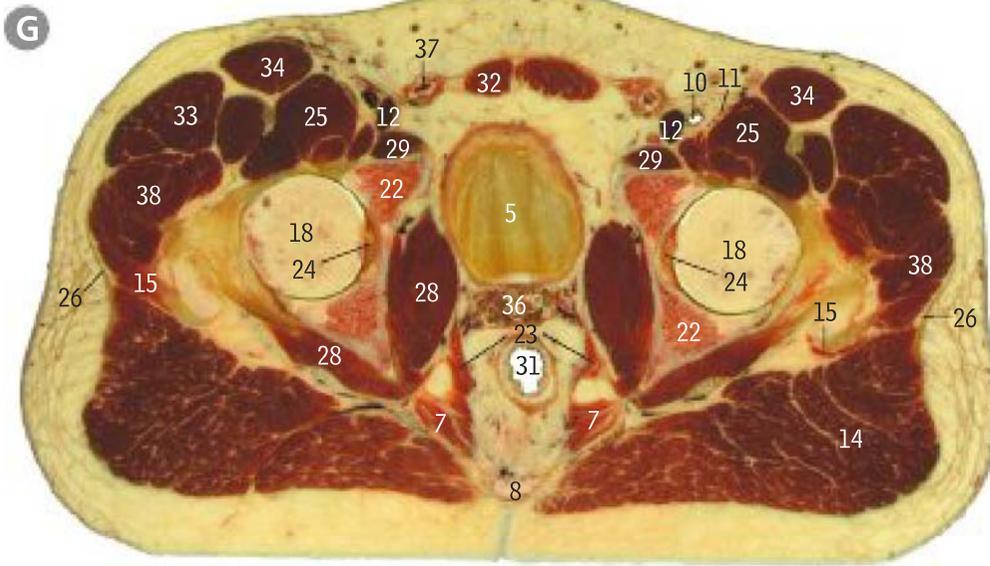
section at L1 vertebral level

section at L2 vertebral level

- 1 Aorta
- 2 Body of pancreas
- 3 Descending colon
- 4 Diaphragm
- 5 Duodenum
- 6 Erector spinae muscle
- 7 External oblique muscle
- 8 Gall bladder
- 9 Head of pancreas
- 10 Inferior vena cava
- 11 Intercostal muscle
- 12 Intervertebral disc
- 13 Kidney
- 14 Latissimus dorsi muscle
- 15 Left crus of diaphragm
- 16 Left renal vein
- 17 Linea alba
- 18 Linea semilunaris
- 19 Liver
- 20 Perirenal fat
- 21 Portal vein
- 22 Psoas major muscle
- 23 Quadratus lumborum muscle
- 24 Rectus abdominis muscle
- 25 Rib
- 26 Right crus of diaphragm
- 27 Small intestine
- 28 Spinal cord
- 29 Spleen
- 30 Splenic artery and vein
- 31 Stomach
- 32 Superior mesenteric vessels
- 33 Tail of pancreas
- 34 Transverse colon
- 35 Vertebral body



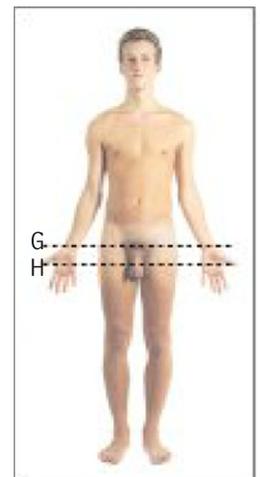
Pelvic region *cross-sections*



section at level of the hip joint in a male pelvis

section at level of the upper thigh in a male pelvis

- | | | |
|--|--|--|
| <ul style="list-style-type: none"> 1 Adductor brevis muscle 2 Adductor longus muscle 3 Adductor magnus muscle 4 Anal canal 5 Bladder 6 Bulb of penis 7 Coccygeus part of levator ani muscle | <ul style="list-style-type: none"> 8 Coccyx 9 Crus of penis 10 Femoral artery 11 Femoral nerve 12 Femoral vein 13 Femur 14 Gluteus maximus muscle 15 Gluteus minimus muscle 16 Great saphenous vein 17 Hamstring origin 18 Head of femur 19 Ischiocavernosus muscle 20 Ischial tuberosity 21 Ischioanal fossa 22 Ischium 23 Levator ani muscle 24 Ligament of head of femur | <ul style="list-style-type: none"> 25 Iliopsoas muscle 26 Iliotibial tract 27 Obturator externus muscle 28 Obturator internus muscle 29 Pectineus muscle 30 Quadratus femoris muscle 31 Rectum 32 Rectus abdominis muscle 33 Rectus femoris muscle 34 Sartorius muscle 35 Sciatic nerve 36 Seminal vesicles 37 Spermatic cord 38 Tensor fasciae latae muscle 39 Vastus intermedius muscle 40 Vastus lateralis muscle |
|--|--|--|



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