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RACHNA SHARIR VĪJNĀNA

Author :
Dr. Mahendra Singh
B.A.M.S., M.D. (Sharir Rachna)

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भाग-क

SYLLABUS B.A.M.S. [1st Prof.]

पाठ्यक्रम-प्रथम व्यावसायिक परीक्षा

भाग-क—५० अंक

Rachna Sharir– B

(१) शरीरोपक्रम–

* कोष्ठ एवं आशय शब्दों की व्याख्या, कोष्ठांगों के नाम एवं संख्या, आशयों के नाम एवं संख्या।
* उर: प्रदेश एवं उदर प्रदेश के कोष्ठांगों का विस्तृत वर्णन।
* मुख से गुद पर्यन्त पाचन अवयवों का रचनात्मक वर्णन।
* श्वास-प्रश्वास के अवयवों का रचनात्मक वर्णन।
* मूत्रवह संस्थान के अवयवों का वर्णन।
* स्त्री एवं पुरुष जननांगों का रचनात्मक वर्णन।
* रक्तवह संस्थान (हृदय) का रचनात्मक वर्णन।

(२) ग्रन्थि शारीर–

* स्रोतस् एवं नि:स्रोतस ग्रन्थियों की रचना का वर्णन।

(३) कला शारीर–

* कला की परिभाषा, सप्तकलाओं का स्वरूप, भेद और प्रयोजन।
* फुफ्फुसावरण कला (Pleura)
* हृदयावरण कला (Pericardium)
* उदरगुहा कला (Peritoneum)
* मस्तिष्कावरण कला (Meninges)

  आदि विशिष्ट कलाओं का विस्तृत वर्णन ।

(४) त्वक् शारीर–

* त्वचा की परिभाषा, स्वरूप, भेद और प्रयोजन।

भाग-ख—५० अंक

(५) उत्तमांगीय एवं नाड़ी संस्थान शारीर–

* शिर की परिभाषा एवं महत्ता।

* ग्रीवा का सामान्य रचनात्मक वर्णन।
* वृहद मस्तिष्क (Cerebrum)
* लघु मस्तिष्क (Cerebellum)
* मध्य मस्तिष्क (Mid-brain)
* उष्णीषक (Pons)
* सुषुम्ना शीर्ष (Medulla oblongata)
* सुषुम्ना (Spinal cord)
* सुषुम्ना से सम्बन्धित नाड़ियाँ– Spinal nerves
* शीर्षस्थ नाड़ियों का वर्णन– Cranial nerves
* शरीर की समस्त परिसर नाड़ियाँ– Peripheral nerves
* स्वतन्त्र नाड़ी संस्थान– Autonomic nervous system
* अनुकम्पी एवं परानुकम्पी नाड़ियाँ– Sympathetic and parasympathetic nerves.

(६) तन्त्र शारीर–

* इड़ा, पिंगला, सुषुम्ना आदि प्राचीन नाड़ियाँ।
* षड्चक्र का वर्णन।
* उत्तमांगीय मस्तुलुंग का वर्णन।
* ब्रह्मरन्ध्र, त्रिवेणी, कुण्डलिनी परिचय।

(७) मर्म शारीर–

* मर्म शब्द की व्याख्या, संख्या, स्थान आदि विविध भेदों का वर्णन।
* मर्म का शल्य तन्त्रीय महत्व, त्रिमर्मों की प्रमुखता का वर्णन।

(८) अंगरेखा शारीर–

* अंगरेखाओं एवं शरीर की विकीर्ण रचना का वर्णन।

(९) इन्द्रिय विज्ञान शारीर–

* इन्द्रिय शब्द की निरूक्ति एवं संख्या।
* इन्द्रिय पंचपंचक का वर्णन।
* ज्ञानेन्द्रियों की संरचना का विस्तृत वर्णन।

त्वकेन्द्रिय (Skin), श्रोत्रेन्द्रिय (Ear), दर्शनेन्द्रिय (Eye), घ्राणेन्द्रिय (Nose) एवं रसनेन्द्रिय (Tongue)।

अध्याय- १

कोष्ठ एवं आशय शारीर

(A) कोष्ठ शब्द की व्याख्या

१. कोष्ठ शब्द का अर्थ सन्दूक या पेटी (Box) होता है।

जिसमें कोई वस्तु या पदार्थ सुरक्षित रखे जाते हैं। इस अर्थ को आधार मानकर ही शरीर के मध्य भाग (Trunk) को कोष्ठ कहा गया है। और उसके कार्य या महत्व के अनुसार शरीर के इस मध्य भाग या कोष्ठ में कुछ महत्व के प्रत्यंग (Organs) जैसे– आमाशय, आन्त्र, यकृत, वृक्क आदि सुरक्षित रहते हैं।

२. शरीर के अवकाश (रिक्त) स्थानों को कोष्ठ (Body cavity) कहते हैं।

३. "अन्तराधिः शरीरमध्य भाग इति।"

आचार्य सुश्रुत ने कोष्ठ का पर्याय अन्तराधि (शरीर मध्य) (Thoraco-abdominal cavity) इसी दृष्टि से रखा है।

४. आचार्य चरक ने महास्रोतस् (Alimentary canal) और शरीर का मध्य भाग आदि कोष्ठ के पर्याय माने हैं।

५. आचार्य दामोदर शर्मा गौड़ के अनुसार– कोष्ठ पद से उदर एवं उरो गुहा और अन्न के वहन करने वाले महास्रोतस् का ग्रहण किया गया है।

६. पारिषद्यं शब्दार्थ शारीरम् के अनुसार– जिस कोष्ठ में शरीरावयव पाये जाते हैं, उसे आचार्य चरक, सुश्रुत, डल्हण आदि के मत से अन्तराधि शरीरमध्य भाग कहा गया है।

७. **स्थानान्यामाग्नि पक्वानां मूत्रस्य रूधिरस्य च ।**
हृदुण्डुकः फुफ्फुसश्च कोष्ठ इत्यभिधीयते ।। (सु.चि. २/१२)

आमाशय, अग्न्याशय, पक्वाशय, मूत्राशय, रक्ताशय, हृदय, उण्डुक और फुफ्फुस ये सभी अवयव जिस स्थान पर सुरक्षित रहते हैं, वह कोष्ठ कहलाता है।

८. आधुनिक दृष्टि से इसे Trunk कह सकते हैं। क्योंकि इसमें चरक द्वारा वर्णित महास्रोतस् (Alimentary canal) और सुश्रुत द्वारा वर्णित अन्तराधि (Thoraco-abdominal cavity) इन दोनों का बोध (ज्ञान) होता है।

(B) कोष्ठांग परिभाषा

- कोष्ठ में स्थित अवयवों को कोष्ठांग कहते हैं।
- वक्षगुहा (Thoracic cavity), उदर गुहा (Abdominal cavity) और श्रोणिगुहा (Pelvic cavity) में स्थित रहने वाले अंगों को कोष्ठांग कहते हैं।

(C) कोष्ठांगों की संख्या

आचार्य चरक के अनुसार– १५

आचार्य सुश्रुत के अनुसार– ८

(D) कोष्ठांगों के नाम

आचार्य चरक के अनुसार– "पञ्चदश कोष्ठांगानि तद्यथा–

नाभिश्च, हृदयं च, क्लोम च, यकृत च, प्लीहा च, वृक्कौ च, बस्ति च, पुरीषाधारश्च, आमाशयश्च, पक्वाशयश्च, उत्तरगुदं च, अधरगुदं च, क्षुद्रान्त्रं च, स्थूलान्त्रं च, वपावहनं चेति।" (च.शा. ७/१०)

१. नाभि–	Umbilicus	९. आमाशय–	Stomach
२. हृदय–	Heart	१०. पक्वाशय–	Intestine
३. क्लोम–	Pancreas	११. उत्तरगुद–	Rectum
४. यकृत–	Liver	१२. अधरगुद–	Anus
५. प्लीहा–	Spleen	१३. क्षुद्रान्त्र–	Small intestine
६. वृक्कौ–	Kidneys	१४. स्थूलान्त्र–	Large intestine
७. वस्ति–	Urinary bladder	१५. वपावहन–	Omentum
८. पुरीषाधार–	Caecum		

आचार्य सुश्रुत के अनुसार

स्थानान्यामाग्नि पक्वानां मूत्रस्य रुधिरस्य च ।
हृदुण्डुकः फुप्फुसश्च कोष्ठ इत्यभिधीयते ।। (सु.चि. २/१२)

१. आमाशय–	Stomach	५. रक्ताशय–	Liver and spleen
२. अग्न्याशय–	Pancreas	६. हृदय–	Heart
३. पक्वाशय–	Intestine	७. उण्डुक–	Caecum
४. मूत्राशय–	Urinary bladder	८. फुप्फुस–	Lungs

(A) आशय शब्द की व्याख्या

१. आशय का अर्थ है– अधिष्ठान।

२. जिसमें कोई द्रव्य विशेष या वस्तु आश्रय लेकर रहता हो, उसे आशय कहते हैं।

३. जो अवकाश युक्त अवयव हों, उन्हें आशय कहा जाता है।

४. शरीर के वे स्थान जो दोष, धातु एवं मलमूत्रादि का आधार हों, उन्हें आशय कहा जाता है।

(B) आशयों की संख्या

- आचार्य सुश्रुत के अनुसार = ७
  स्त्रियों में = ७+१ = ८
- आचार्य वाग्भट के अनुसार = ७
  स्त्रियों में = ७+१ = ८
- आचार्य शार्ङ्गधर के अनुसार = ७
  स्त्रियों में = ७+१+२ = १०
- आचार्य काश्यप के अनुसार = ७
  स्त्रियों में = ७+१ = ८

(C) आशयों के नाम

आचार्य सुश्रुत के अनुसार

''आशयास्तु– **वाताशयः, पित्ताशयः, श्लेष्माशयो, रक्ताशय, आमाशयः, पक्वाशयो, मूत्राशयः, स्त्रीणां गर्भाशयोऽष्टम इति ।।''** (सु.शा. ५/८)

१. वात्ताशय– Lungs
२. पित्ताशय– Pancreas/gall bladder
३. श्लेष्माशय– Pleura/pericardium
४. रक्ताशय– Liver and spleen
५. आमाशय– Stomach
६. पक्वाशय– Intestine
७. मूत्राशय– Urinary bladder
८. गर्भाशय– Uterus (In female)

आचार्य शार्ङ्गधर ने दो आशय स्त्रियों में ओर अधिक माने हैं– स्तन्याशय– Mammary glands. (७+१+२=१०)

आचार्य गणनाथ सेन के अनुसार

१. सगर्भाशय– जिसके अन्दर शून्य स्थान हो।

२. अगर्भाशय– जिसके अन्दर शून्य स्थान न हो।

१. सगर्भाशय — महागर्भाशय– जिसमें शून्य स्थान अधिक हो। जैसे– आमाशय, मूत्राशय आदि

अल्प गर्भाशय–जिसमें शून्य स्थान अल्प हो। जैसे– वृक्क, मस्तिष्क आदि।

२. अगर्भाशय– जिसमें शून्य स्थान न हो। जैसे– यकृत, प्लीहा आदि ठोस अवयव।

१. उरः प्रदेश या उरः गुहा या वक्षगुहा के कोष्ठांगों का वर्णन (Thoracic cavity)

१. हृदय– Heart २. फुफ्फुस– Lungs

१. हृदय

(१)
- हृ– हरति– पूरे शरीर से रक्त लेता है ।
- द– ददाति– रक्त को वापस देता है।
- य– यच्छति–रक्त में गति होती है।

(२) उत्पत्ति–

''शोणित कफप्रसादजं हृदयं, यदाश्रया हि धमन्यः प्राणवहाः, तस्याधो वामतः प्लीहा फुफ्फुसश्च, दक्षिणतो यकृत् क्लोम च; तद्विशेषेण चेतनास्थानम् ।

अतस्तस्मिस्तमसाऽऽवृते सर्वप्राणिनः स्वपन्ति ।।'' (सु.शा. ४/३०)

रक्त और कफ के प्रसाद रूप भागों से हृदय की निर्मिति होती है। जिसके आधार से प्राणवहा धमनियाँ रहती हैं। उसके नीचे बाँई ओर प्लीहा (Spleen) और फुफ्फुस (Lungs) हैं। दक्षिण ओर यकृत् (Liver) और क्लोम (Gall-bladder) हैं।

हृदय यह विशेष करके चेतना का स्थान है। इसलिए तम से जब हृदय आच्छादित होता है, तो सब प्राणी सो जाते हैं।

(३) हृदय का स्वरूप–

पुण्डरीकेण सदृशं हृदय स्यादधोमुखम् ।
जाग्रतस्त द्विकसति स्वपतश्च निमीलति ।। (सु.शा. ४/३१)

अधोमुख कमल के समान हृदय होता है, जागरूक मनुष्य का हृदय विकसित रहता है। तथा निद्रित मनुष्य का हृदय संकुचित हो जाता है।

महाधमनी से लगा हुआ हृदय देखने में ऐसा ही लगता है। उस Conica/organ का Apex नीचे है और Base ऊपर है।

(४) "**हृदयं चेतनास्थानम् ।**" (सु.शा. ४/३०)

प्राणिमात्र में हृदय ही उनके शरीर में स्थित चेतना का स्थान है।

(५) "**सत्वादिधाम हृदयं स्तनोरः कोष्ठमध्यगम् ।**" (अ.हृ.शा. ४/१३)

सत्व आदि गुणों का आश्रय जो हृदय है, वह उरः गुहा में दोनों स्तनों के मध्य में रहता है।

(६) "**हृदि प्राणेः ।**"

हृदय में प्राण वायु का स्थान है।

२. फुफ्फुस

"**शोणित फेन प्रभवः फुफ्फुस ।**" (सु.शा. ४/२५)

रक्त के फेन से फुफ्फुस की उत्पत्ति हुई है।

२. उदर प्रदेश या उदर गुहा के कोष्ठांगों का वर्णन (Abdominal cavity)

१. नाभि– Umbilicus
२. क्लोम– Pancreas
३. यकृत– Liver
४. प्लीहा– Spleen
५. वृक्कौ– Kidneys
६. वस्ति– Urinary bladder
७. पुरीषाधार– Caecum
८. आमाशय– Stomach
९. पक्वाशय– Intestine
१०. उत्तरगुद– Rectum
११. अधरगुद– Anal canal and anus
१२. क्षुद्रान्त्र– Small intestine
१३. स्थूलान्त्र– Large instestine
१४. वपावहन– Omentum

३. रक्तवह संस्थान (हृदय-Heart) का रचनात्मक वर्णन

४. मुख से गुद (Mouth to anus) पर्यन्त पाचन अवयवों का रचनात्मक वर्णन (Digestive system or alimentary canal)

(१) मुखगुहा Mouth cavity or oral cavity
(२) ग्रसनी– Pharynx
(३) ग्रासनली– Oesophagus
(४) आमाशय– Stomach
(५) क्षुद्रान्त्र– Small intestine
   १. ग्रहणी– Duodenum
   २. मध्यान्त्र– Jejunum
   ३. शेषान्त्र– Ileum

(६) वृहदांत्र– Large intestine

१. उण्डुक (पुरीषाधार)– Caecum

२. उण्डुक पुच्छ या आंत्र पुच्छ– Vermiform appendix

३. आंत्र– Colon
- १. आरोही वृहदांत्र– Ascending colon
- २. अनुप्रस्थ वृहदांत्र– Transverse colon
- ३. अवरोही वृहदांत्र– Descending colon
- ४. श्रोणी वृहदांत्र या अवग्रह वृहदांत्र– Sigmoid colon or pelvic colon

(७) मलाशय– Rectum

(८) गुद नाल– Anal canal

(९) गुद– Anus

१. यकृत– Liver

२. यकृत के उपसर्गी उपकरण– Excretory apparatus or extra-hepatic biliary apparatus

१. दक्षिण एवं वाम यकृत वाहिनी– Rt. and lt. hepatic ducts

२. सामान्य यकृत वाहिनी– Common hepatic duct

३. पित्ताशय– Gall bladder

४. पिताशय वाहिनी– Cystic duct

५. पित वाहिनी– Bile duct

३. अग्न्याशय– Pancreas

४. प्लीहा– Spleen

*** आमाशय (Stomach)–**

१. *"आमानाम् अन्नानाम् आशयः इति आमाशयः ।"*

जो आम अन्न अर्थात् अधपके अन्न (Semidigested food) का आधार है, वह आमाशय कहलाता है।

२. *"नाभिस्तनांतरे आमाशयः ।"*

नाभि और स्तनों के बीच आमाशय का स्थान है। अर्थात् नाभि और हृदय के बीच आमाशय का स्थान है।

३. क्लेदक कफ का स्थान है।

* **आन्त्र (Intestine)–**

१. संहिता ग्रन्थों में पुरूष शरीर में ३½ व्याम तथा स्त्री शरीर में ३ व्याम क्षुद्रान्त्र की लम्बाई बताई है।

२. उदर गुहा में लघ्वांत्र मध्य में नाभिप्रदेश में कुंडलियों के रुप में रहता है। तथा वृहदान्त्र के भाग, इसके चारों ओर रहते हैं।

३. आमाशय से जो अपाचित आहार लघ्वांत्र में लाया जाता है। उस अन्न का इसकी अधिक लम्बाई के कारण पाचन आराम से होता है।

४. मनुष्य की लम्बाई के अनुसार इसकी लम्बाई कम या अधिक रहती है।

५. मृत्यु के पश्चात् इसकी मांसपेशियों का प्रसारण हो जाने से इसकी लम्बाई अधिक हो जाती है।

* **ग्रहणी (Duodenum)**

''अग्नि अधिष्ठानम् अन्नस्य ग्रहणात् ग्रहणी मता ।'' (च.चि.)

अग्नि का स्थान होने से ग्रहणी अन्न को ग्रहण करती है, उसका पाचन करती है। इसी से इसे ग्रहणी कहा जाता है।

भगवान धन्वन्तरि ने इसे पित्तधरा कला कहा है।

* **यकृत (Liver)–**

१. ''गर्भस्य यकृत प्लीहानौ शोणितजौ ।'' (सु.शा. ४/२५)

गर्भ के यकृत और प्लीहा रक्त से निर्मित होते हैं।

२. यकृत हृदय के दक्षिण की ओर अधः प्रदेश में स्थित है।

३. यकृत को रक्ताशय कहते हैं।

४. यकृत को रक्तवह स्रोतस् का मूल स्थान माना गया है।

* **प्लीहा Spleen–**

१. ''गर्भस्य यकृत प्लीहानौ शोणितजौ ।'' (सु.शा. ४/२५)

गर्भ के यकृत और प्लीहा रक्त से निर्मित होते हैं।

२. प्लीहा हृदय के वाम भाग की ओर अधः प्रदेश में स्थित है।

३. प्लीहा को रक्ताशय कहते हैं।

४. प्लीहा को रक्तवह स्रोतस् का मूल स्थान माना गया है।

५. श्वसन संस्थान (श्वास-प्रश्वास) के अवयवों का रचनात्मक वर्णन (Respiratory system)

१. नासागुहा– Nasal cavity
२. ग्रसनी– Pharynx
३. स्वरयन्त्र– Larynx
४. श्वास प्रणाली– Trachea
५. दक्षिण एवं वाम मुख्य श्वसनी– Rt. and lt. principal bronchus
६. श्वसनिका– Bronchioles
७. फुफ्फुस– Lungs

६. मूत्रवह संस्थान के अवयवों का वर्णन (Urinary system)

१. वृक्कौ– Kidneys
२. गवीनियाँ– Ureters
३. मूत्राशय या वस्ति– Urinary bladder
४. पुरूष मूत्र मार्ग– Male urethra
५. स्त्री मूत्र मार्ग– Female urethra

* **वृक्कौ (Kidneys)–**

"**रक्तमेदः प्रसादाद् वृक्कौ ।**" (सु.शा. ४/३०)

रक्त और मेद के प्रसाद से दोनों वृक्क बनते हैं।

* **मूत्राशय (Urinary bladder)–**

१. मूत्राशय धनुष की तरह वक्र, मध्य में अधः ओर एक मुख वाला और अल्प रक्त एवं मांस से बना अंग है।
२. यह श्रोणि गुहा में स्थित है।
३. यह सद्यः प्राणहर मर्म है।
४. वस्ति– यह प्राणायतन है।

७. पुरूष जननांगों का रचनात्मक वर्णन

(Male reproductive system or male genital organs)

(1) Penis– शेफ या मेढ्र या लिङ्ग या शिश्न
(2) Scrotum– वृषण
(3) Testis– वृषण ग्रन्थि
(4) Epididymis–अधिवृषण

(5) Ductus deferens or vas deferens– शुक्रवाहिनी या शुक्रनलिका

(6) Seminal vesicle– शुक्राशय

(7) Ejaculatory duct– शुक्र प्रसेक वाहिनी

(8) Male urethra– पुरूष मूत्र मार्ग

(9) Spermatic cord– वृषण रज्जु

(10) Prostate gland– पौरूष ग्रन्थि या अष्ठीला

(11) Bulbourethral glands or cowper's glands– शिश्नमूल ग्रन्थियाँ या कूपर ग्रन्थियाँ

८. स्त्री जननांगों का रचनात्मक वर्णन (Female reproductive system or female genital organs)

(1) Vagina– योनि

(2) Female urethra– स्त्री मूत्र मार्ग

(3) Para urethral glands– योनिमूल ग्रन्थियाँ

(4) Greater vestibular glands or bartholin's glands– महाप्रघाण ग्रन्थियाँ या बार्थोलिन ग्रन्थियाँ

(5) **Vulva– स्त्रियों के बाह्य जननांग–**

I. Mons pubis– भग शैल
II. Labia majora– बृहत् भगोष्ठ
III. Labia minora– लघु भगोष्ठ
IV. Clitoris– भग शिश्निका
V. Vestibule– योनि प्रघाण
VI. Vaginal orifice– योनि द्वार

(6) Ovary– डिम्ब ग्रन्थि या बीज ग्रन्थि

(7) Uterine tube or fallopian tube– डिम्ब वाहिनी

(8) Uterus– गर्भाशय

*** गर्भाशय (Uterus)–**

(१) **यथा रोहित मत्स्यस्य मुखं भवति रूपतः ।**
तत्संस्थानां तथारूपां गर्भशय्यां विदुर्बुधः ।। (सु.शा. ५/५६)

आयुर्वेद में गर्भाशय को ही गर्भशय्या यह संज्ञा दी है, क्योंकि गर्भ उत्पत्ति के बाद प्रसव होने तक गर्भाशय में ही रहता है।

रोहित मत्स्य का मुख जैसा होता है, वैसा, अल्प मुख और अन्ततः विस्तृत रिक्त स्थान, ऐसा ही गर्भाशय होता है।

(२) आशयों के वर्णन में आठवां आशय स्त्रियों में गर्भाशय बताया है।

(३) आचार्य सुश्रुत ने इसे 'गर्भशय्या' कहा है।

(४) आचार्य शार्ङ्गधर ने इसे 'धरा' कहा है।

(A) Cardiovascular system (रक्तवह संस्थान)

Heart (हृदय)

(1) Introduction–

- Greek name - Cardia - Cardiac.
- Latin name - Cor - Coronary.
- The heart is a conical hollow muscular organ.
- It is situated in the middle mediastinum.
- It is enclosed within the pericardium.
- It pumps blood to various parts of the body to meet their nutritive requirements.
- The heart is placed obliquely behind the body of the sternum and adjoining parts of the costal cartilage.
- It lies 1/3 to the right and 2/3 to the left of the median plane.
- The direction of blood flow, from atria to the ventricles is downwards, forwards and to the left.
- Measurement– Length– 12 cm.
  Width– 9 cm.
  Thickness– 6 cm.
  Weight–In female– 230-280 gm. average weight= 250 gm.
  In male– 280-340 gm. average weight= 300 gm.

(2) External features– External features are followings–

(1) Chambers– 1. Right atrium 3. Right ventricle
2. Left atrium 4. Left ventricle

(2) Surfaces–
1. Sternocostal surface or anterior surface
2. Diaphragmatic surface or inferior surface
3. Pulmonary surface– Right surface, Left surface

(3) Borders–
1. Upper border
2. Inferior border
3. Right border
4. Left border

(4) Grooves or sulci–
1. Atrioventricular groove or coronary sulcus
2. Interatrial groove
3. Interventricular groove – Anterior interventricular groove (Left margin), Posterior interventricular groove (Right margin)

(5) Base– Posterior surface and backward.

(6) Apex– Downward, forward and to the left.

* **Surfaces–**

1. Sternocostal surface–
- It is formed mainly by the right atrium and right ventricle and partly by the left ventricle and left auricle.
- Most of the sternocostal surface is covered by the lungs but a part of it that lies behind the cardiac notch of the left lung is uncovered.
- The uncovered area is dull percussion.

2. Diaphragmatic surface–
- It is formed mainly by the right ventricle 1/3 and left ventricle 2/3.
- Rests on the central tendon of the diaphragm.

3. Pulmonary surface–

Left surface– It is formed mainly by the left ventricle and upper end by the left auricle.

Right surface– It is formed by the right atrial wall.

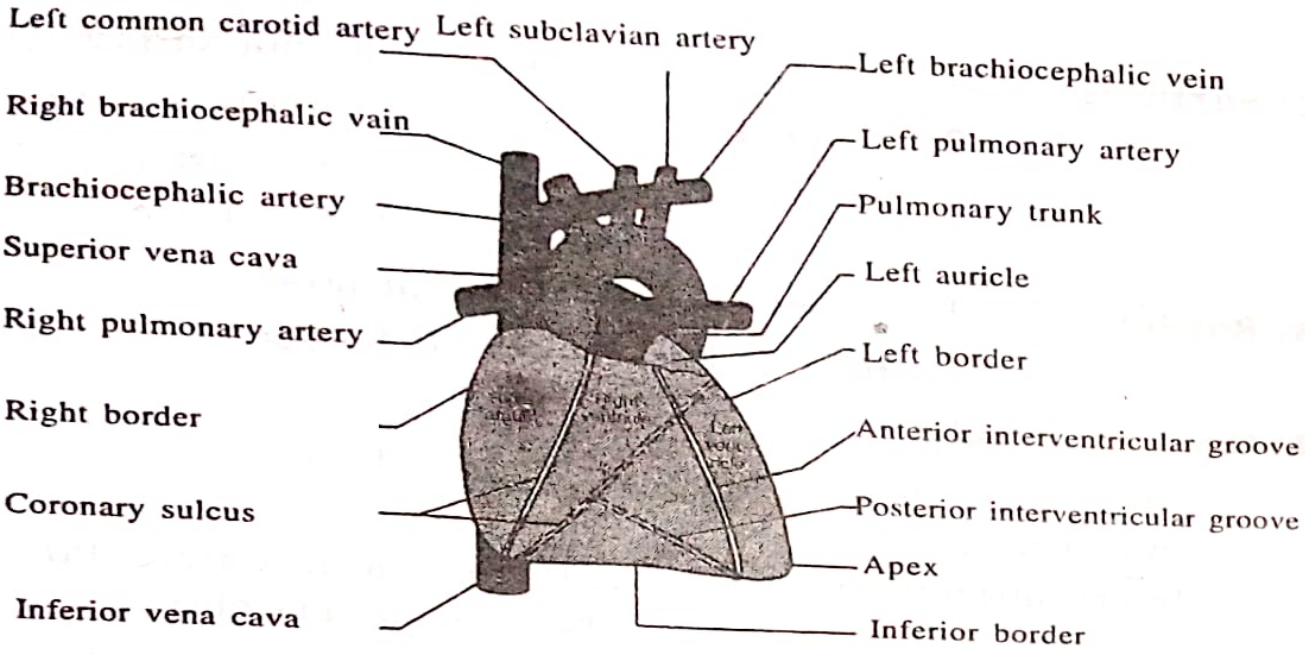

Fig. 1.1 Heart-Anterior view

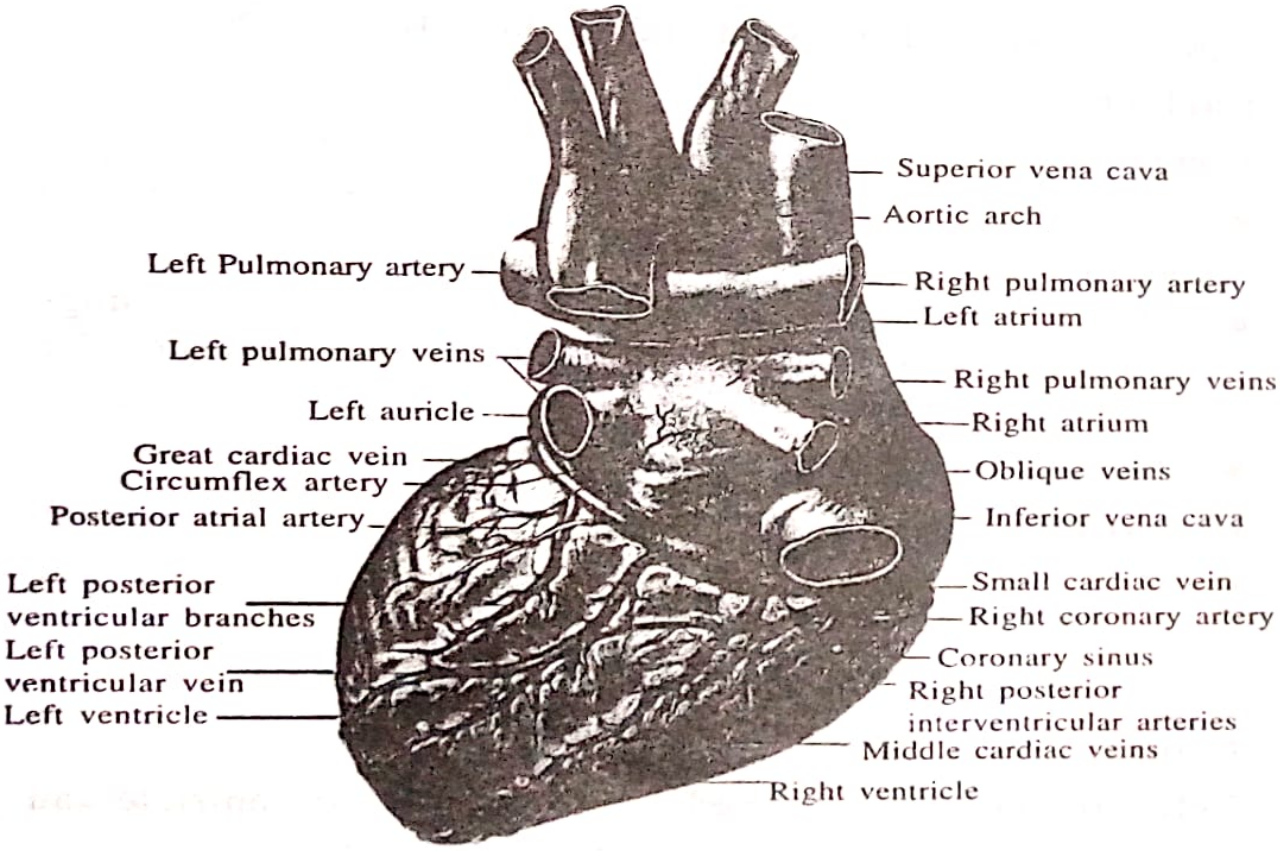

Fig. 1.2 Heart-Posterior view

* **Borders–**

1. **Upper border–** is slightly oblique and is formed by two atria. Chiefly the left atrium.
2. **Inferior border–** is nearly horizontal and is formed mainly by the right ventricle and small part near the apex is formed by the left ventricle.
3. **Right border–** is vertical and is formed by the right atrium.
4. **Left border–** is oblique, curved and is formed mainly by the left ventricle and partly by the left auricle. It separates the anterior and left surface of heart.

* **Grooves or sulci–**

1. **Atrioventricular groove–** is seprate the atria from ventricles.
2. **Interatrial groove–** is separate right and left atrium.
3. **Interventricular groove–**
   - **Anterior interventricular groove–** is nearer to the left margin of the heart. The lower end of the groove separate the apex from inferior border of heart.
   - **Posterior interventricular groove–** is situated on the diaphragmatic surface of the heart. It is nearer to right margin of this surface.

- The two interventricular groove meet at the inferior border near the apex.

* **Base or posterior surface–**
   - It is formed mainly by the left atrium and by a small part of the right atrium.
   - It is related to the middle four thoracic vertebrae (T_5-T_8) in lying posture.
   - And descends by one vertebrae (T_6-T_9) in the erect posture.

* **Apex of the heart–** This is formed by the left ventricle. It is directed downwards, forwards and to the left. It is situated in the left fifth intercostal space just medial to the midclavicular line.
   - 9 cm. lateral to the mid sternal line.
   - The living subject pulsation may be seen and felt over this portion.

(3) Circulation of blood–

- Right atrium receive deoxygenated blood from the whole body through the superior and inferior venacava and the coronary sinus.
- It contracts and sends the blood through right atrioventricular orifice to the right ventricle.
- Right ventricle– pulmonary trunk (pulmonary arteries)– lungs where the blood is oxygenated.
- O_2 blood return to the heart through the four pulmonary veins and enters the left atrium.
- Lt atrium– lt. atrioventricular orifice into the lt. ventricle.
- Lt. ventricle– ascending aorta and its branches.

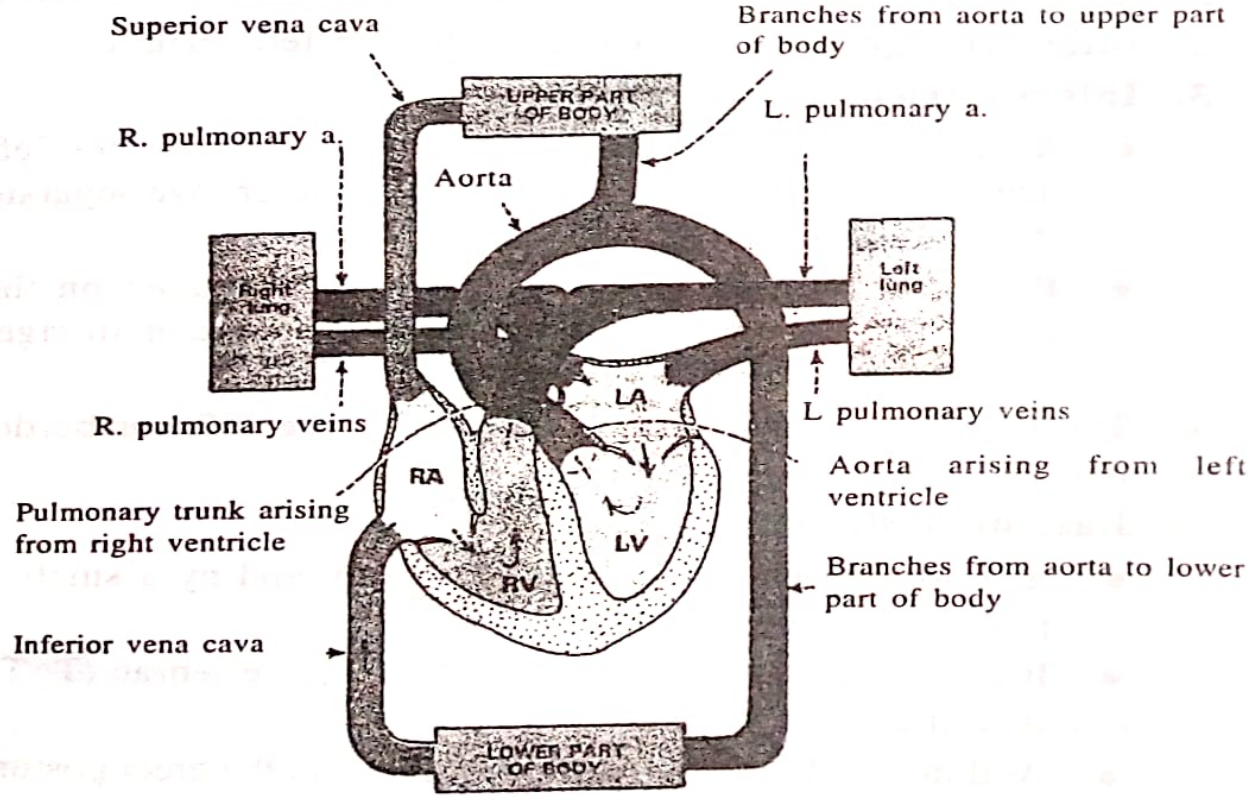

Fig. 1.3 Heart-Circulation of blood

(4) Chambers of the heart–

- The heart is divided by vertical septa. The right and left atria, and right and left ventricles.
- The right atrium lies anterior to left atrium.

- The right ventricle lies anterior to left ventricle.
- The wall of the heart are composed of cardiac muscle, the **myocardium.**
- Covered externally with serous pericardium called, the **epicardium.**
- And lined internally with a layer of endothelium, the **endo cardium.**

(A) Right atrium–

(I) It is the right upper chamber of the heart. It receives venous blood from the whole body and pumps it to the right ventricle through the right atrioventricular opening.

(II) It forms the right border and parts of the upper border, the sterno- costal surface and the base of the heart.

(III) External features–

- The chamber is elongated vertically, receiving the superior venacava at the upper end and the inferior venacava at the lower end.
- The upper end is prolonged to the left to form the right auricle.
- Along the right border of the atrium, there is a shallow vertical groove which passes from the superior venacava to the inferior venacava. This groove is called the sulcus terminalis. It is produced by an internal muscular ridge called the crista terminalis. The upper part of the sulcus contains the sinuatrial (S.A.) node. Which act as the pace-maker of the heart.

(IV) Tributaries of the right atrium–

- Superior venacava
- Inferior venacava
- Coronary sinus
- Anterior cardiac veins.
- Venae cordis minimi (Thebasian vein)
- Sometimes right marginal veins.

(V) Internal features– There is three parts.

a. The smooth posterior part (Sinus venarum)– Developmentally it is derived from the right horn of the sinus venosus.

- Most of the tributaries open into it. (except the anterior cardiac vein).
- Superior venacava opens at the upper end. Inferior venacava opens at the lower end. The opening is guarded by a rudimentary valve of the inferior venacava (Eustachian valve).
- Coronary sinus opens B/w the opening of the inferior venacava and the right atrioventricular orifice. The opening is guarded by valve of coronary sinus.

b. Rough anterior part (Pectinate part, including the auricle)–

- Developmentally it is derived from the primitive atrial chamber.
- It presents a series of transverse muscular ridge, called musculi pectinati. They arise from the crista terminalis and run forwards and downwards towards the atrioventricular orifice, giving the appearance of the teeth of a comb.

c. Interatrial septum (septal wall)–

- Developmentally it is derived from the septum primum and septum secondum.
- Presents the fossa ovalis, a shallow saucer shaped depression in lower part.
- Annulus ovalis (Limbs fossa ovalis) is promient margin of fossa ovalis.
- The remains of the foramen ovale are occasionally present.

(B) Right ventricle–

- The right ventricle is a triangular chamber which receives blood from the right atrium and pumps it to the lungs through the pulmonary trunk and pulmonary arteries.
- It forms the inferior border, a large part of the sternocostal surface and a small part of the diaphragmatic surface of the heart.

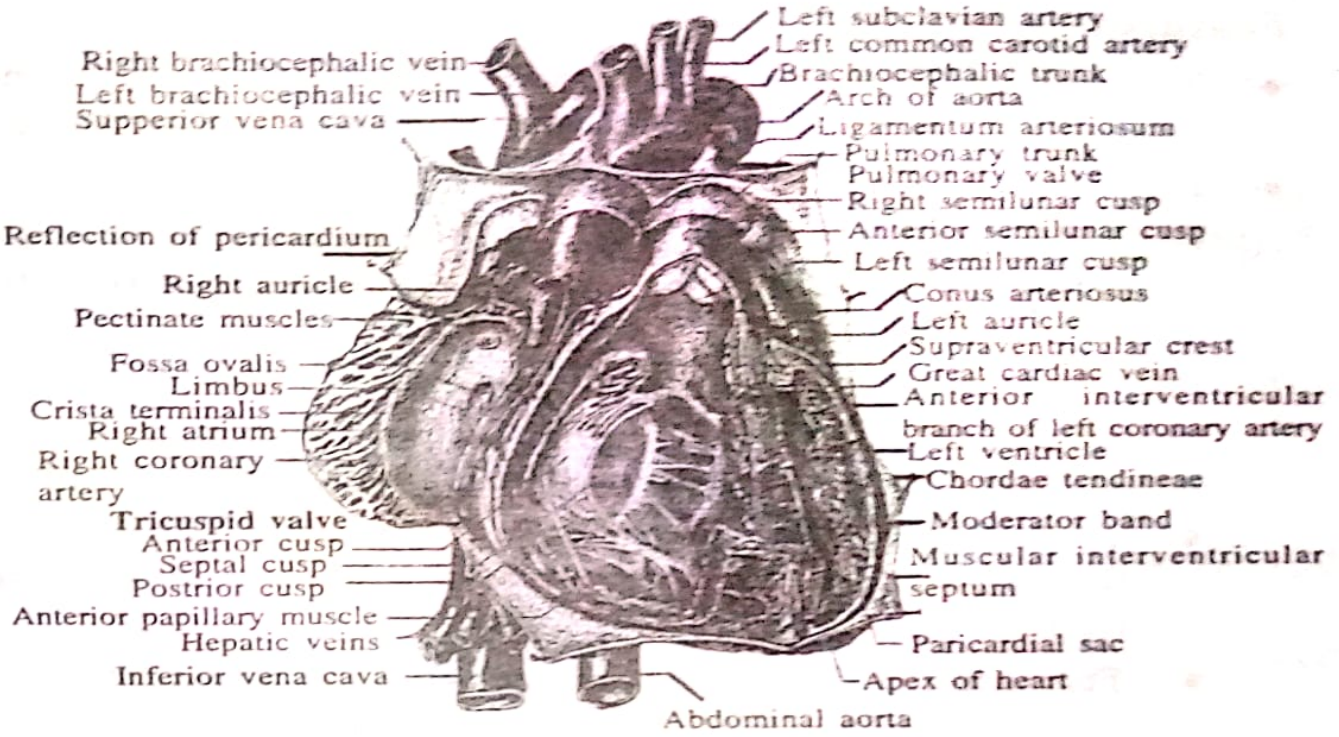

Fig. 1.4 Heart- Right interior view

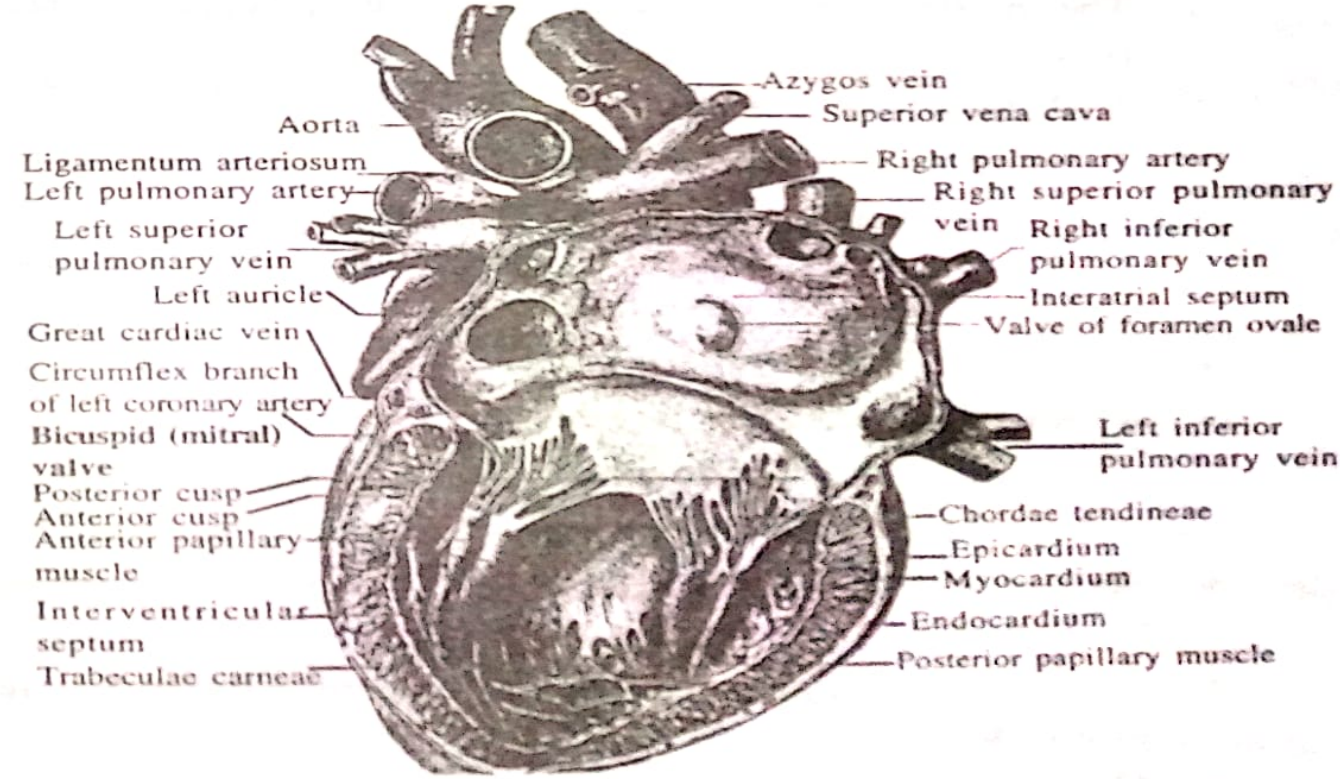

Fig. 1.5 Heart- Left interior view

Features–

- **Externally–** Right ventricle has two surfaces– anterior (sterno-costal) and inferior (Diaphragmatic) surfaces.
- **Interior–** It has two parts.

(i) **Inflowing part–** It is rough due to the presence of muscular ridges called trabeculae carneae. It develops from the primitive ventricle of the heart tube.

(ii) **Out flowing part or infundibulum–** It is smooth and forms the upper conical part of the right ventricle which gives rise to the pulmonary trunk. It develops from the bulbus cordis.

- The two parts are separated by a muscular ridge called the supraventricular crest situated B/w the tricuspid and pulmonary valve.
- The interior shows two orifices–1. Right atrioventricular orifice.
  2. Pulmonary orifice.
- The interior of the inflowing part shows trabeculae carneae (muscular ridges) of three types–
  1. Ridges– Fixed elevations.
  2. Bridges– Having two fixed ends but with a free centre.
  3. Pillars (papillary muscles)– With one end attached to the ventricular wall and the other end connected to the cusps of the tricuspid valve by chordae tendinae.
- There are three papillary muscles in the right ventricle–
  - Anterior muscle is largest.
  - Posterior or inferior muscle is small and irregular.
  - Septal muscle is divided into a number of little nipples.
- Each papillary muscles is attached by chordae tendinae to the contiguous sides of two cusps.
- The wall of the right ventricle is thinner than left ventricle in a ratio of 1:3
- The cavity of right ventricle is cresentic in section.

(C) Left atrium–

- It is a quadrangular chamber, situated posteriorly. Its appendage, the left auricle projects anteriorly to overlap the infundibulum of the right ventricle.
- The left atrium forms the left 2/3 of the base of the heart. The greater part of the upper border. Part of the sterno costal and left surface and left border.
- It receives O_2 blood from the lungs through four pulmonary veins and pumps it to the left ventricle through the left atrioventricular (A.V.) orifice.

Features–

- The posterior surface of the atrium forms the anterior wall of the oblique sinus of pericardium.
- The anterior wall of the atrium is formed by the interatrial septum.
- Two pulmonary veins open in to the atrium on each side of the posterior wall.
- The greater part of the interior of the atrium is smooth walled.
- The septal wall shows the fossa lunata corresponding to the fossa ovalis of the right atrium.

(D) Left ventricle–

- The left ventricle receives O_2 blood from the left atrium and pumps it into the aorta.
- It forms the apex of the heart. A part of sternocostal surface. Most of the left border and left surface and left 2/3 of the diaphragmatic surface.

Features

External–

The left ventricle has three surface– anterior (sternocostal), inferior (Diaphragmatic) and left surfaces.

Interior– The interior is divisible into two parts–

1. The lower rough part with develops from the primitive ventricle of the heart tube.

2. Upper smooth part gives origin to the ascending aorta it develops from the bulbus cordis.

- The interior of the ventricle shows two orifices. Bicuspid orifice and aortic orifice.
- There are two papillary muscles– Anterior and posterior chordae tendinae from both muscles are attached to both the cusps of mitral valve.
- Cavity of the left ventricle is circular in cross section.

(5) Valves of the heart–

- The valves of the heart maintain unidirectional flow of the blood and prevent its regurgitation in the opposite direction.
- There are two pairs of valves in the heart.
- A pair of atrioventricular valves and a pair of semilunar valves.
- The right A.V. valves known as the tricuspid valve because it has three cusps.
- The left A.V. valve is known as the bicuspid valve because it has two cusps. It is also called the mitral valve.
- The semilunar valves include the aortic and pulmonary valves, each having three semilunar cusps. The cusps are fold of endocardium.

* **Atrioventricular (A.V.) valves–**

- Both valves are made up of the following components–

1. **A fibrous ring–** to which the cusps are attached.
2. **The cusps–** are flat and project into the ventricular cavity. Each cusp has an attached and a free margin and an atrial and a ventricular surface.

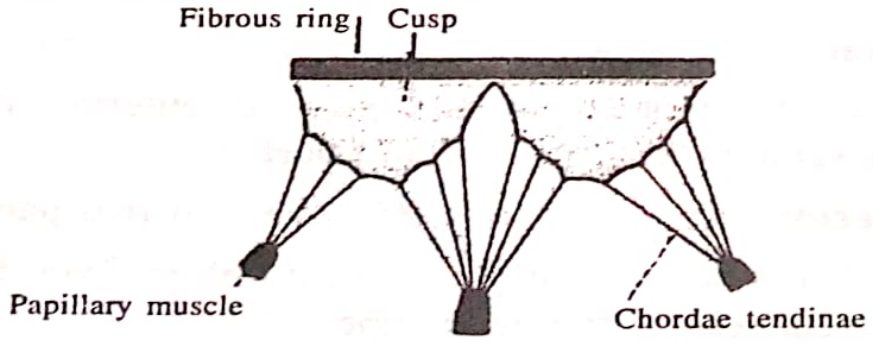

Fig. 1.6 Heart-Atrioventricular Valve

- The atrial surface– is smooth.
- The ventricular surface and free margin– are rough and irregular due to the attachment of chordae tendinae.

3. **The chordae tendinae–** Connect the free margins and ventricular surface of the cusps to the apices of the papillary muscles.
   - Tricuspid valve has three cusps-anterior, posterior (inferior), septal and can admit the tips of three finger.
   - The bicuspid valve has two cusps-anterior (aortic), posterior. It admit the tip of two finger.

Semilunar valves–

- The aortic and pulmonary valves are called semilunar valves because their cusps are semilunar in shape.
- Each valve has three cusps which are attached directly to the vessel wall there being no fibrous ring.
- The free margin of each cusp contains a central fibrous nodule from each side of which a thin smooth margin (Lunule) extends up to the base of the cusp.

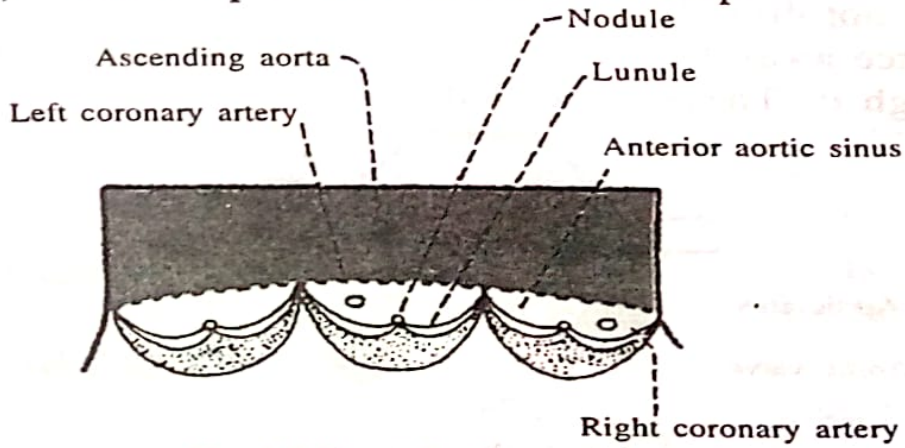

Fig. 1.7 Heart-Semilunar Valve

(6) Arterial supply of the heart–

- Right coronary artery
- Left coronary artery

(7) Venous drainage -

(A) * Coronary sinus– Largest vein of the heart.
   - It receives the following tributaries–

1. Great cardiac vein
2. Middle cardiac vein
3. Small cardiac vein
4. Posterior vein of the left ventricle
5. Oblique vein of the left atrium
6. Right marginal vein

(B) Anterior cardiac veins and venae cordis minimi direct open in to the heart cavity.

(8) Lymphatic drainage of the heart–

- Brachiocephalic nodes.
- Tracheobronchial nodes.

(9) Nerve supply of the heart–

- Sympathetic nerves– T3–T5
- Parasympathetic nerves– Vagus

(10) Surface marking of the cardiac valves and auscultatory areas–

- Sound produced by closure of the valves of the heart can be heart using a stethoscope.
- The sound arising in relation to a particular valve are best heard not directly over the valve, but at areas situated some distance away from the valve in the direction of blood flow through it. These are called auscultatory areas.

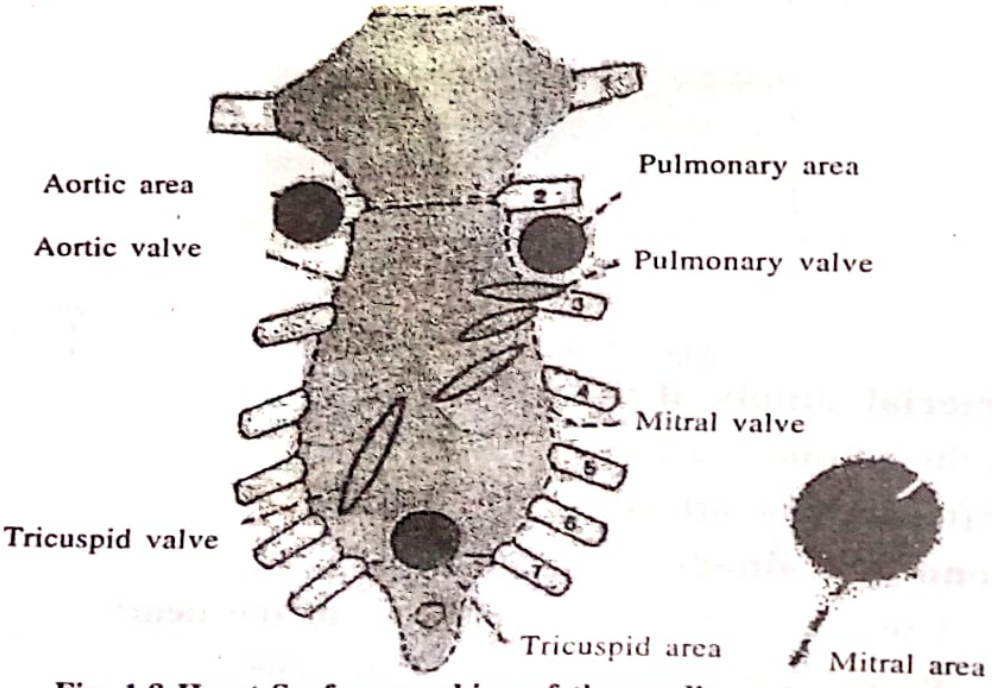

Fig. 1.8 Heart-Surface marking of the cardiac valve

Valve	Diameter of orifice	Surface marking	Ausculta-tory area
1. Pulm-onary	2.5 cm.	A horizontal line, 2.5 cm. long. Behind the upper border of the third left costal cartilage and adjo-ining part of sternum.	Second left inter space near the sternum.
2. Aortic	2.5 cm.	A slightly oblique line, 2.5 cm. long. Behind left half of sternum at the level of lower border of the third costal cartilage.	Second right cost-al car-tilage near sternum.
3. Mitral	3 cm.	An oblique line,3 cm.long.Be-hind left half of sternum oppo-site the fourth costal cartilage.	Cardiac apex
4. Tric-uspid	4 cm.	Most oblique of all valve, be-ing nearly vertical, 4 cm. long behind right half of sternum opp-osite the fourth and fifth space.	Lower end of the sternum.

(11) Surface marking of the heart–

1. **Apex–** Formed by the left ventricle correspond to apex beat and is found in the fifth left intercostal space just medial to midclavicular line, or 9 cm. from lateral to midsternal line.
2. **Superior border–** Formed by the root of great vessels. Extends from a point on the lower border of the second left costal cartilage about half inch from the sternal margin.
   - A point of the upper border of third right costal cartilage, half inch from the sternal margin.
3. **Inferior border–** Formed by right ventricle.
   - A point at the lower border of 6th right costal cartilage. 2 cm. from the sternal margin.
   - A point at the apex of the heart in the 5th intercostal space 9 cm. from the midsternal line.
4. **Right border–** Formed by the right atrium.

- The right border is marked by a line, slightly convex to the right, joining the right ends of the upper and lower borders.

  The maximum convexity is about 3.75 cm. from the median place in the 4th space.

5. Left border– Formed by left ventricle.

- The left border is marked by a line. Fairly convex to the left, joining the left ends of the upper and lower borders.
- The area of the chest wall overlying the heart is called the precordium.

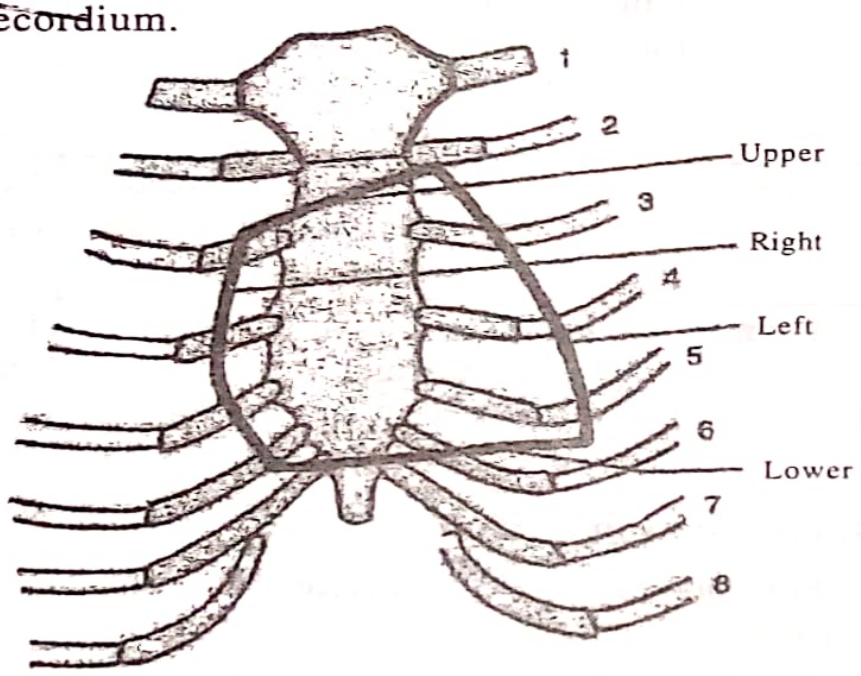

Fig. 1.9 Heart-Surface Marking of the Heart

(12) Conducting system of the heart–

1. S.A. node (Sinuatrial node)
2. A.V. node (Atrioventricular node)
3. Bundle of his or AV bundle (Atrioventricular bundle)
4. The right branch
5. The left branch
6. Purkinje fibres

– Damage or defects to this system results in– Cardiac arrhythmias. (Irregular heart rate)

– The whole of the conducting system supplied by– Right coronary artery.

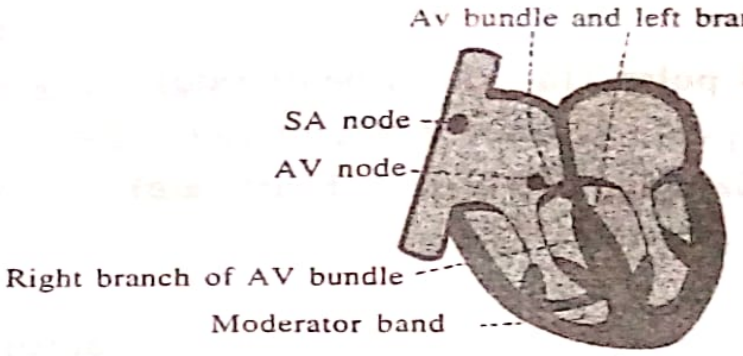

Fig. 1.10 Heart-Cardiac Conduction

(13) Applied aspect–

(A) Applied aspect of the valves–

1. The first heart sound is produced by closure of A.V. valves– **LUB**. The second heart sound is produced by closure of semilunar valves– **DUP**.
2. **Stenosis–** Narrowing of valve orifice due to fusion of the valve cusps is known stenosis.– Mitral stenosis, aortic stenosis etc.
3. **Regurgitation or incompetence–** Dilation of the valve orifice or stiffening of the cusps causes imperfect closure of the valve leading to back flow of blood. This is known as regurgitation.

– Mitral regurgitation, aortic regurgitation.

* Stenosis– Narrowing of valve
* Regurgitation– Dilation of valve

(B) Applied aspect of artery–

1. Thrombosis of coronary artery– is a common cause of sudden death. This is due to myocardial infarction. **(M.I.)**
2. Spasm of coronary artery– Incomplete obstruction causes angina pectoris.

   Which is associated with agonising pain in the precordial region and down the medial side of the left arm and forearm.

* Thrombosis of coronary artery– Sudden death
* Spasm of coronary artery– Incomplete obstruction

1. Nasal cavity– नासागुहा
2. Naso pharynx– नासा ग्रसनी
3. Oropharynx– मुख ग्रसनी
4. Larynx– लैरिंग्स (स्वरयन्त्र)
5. Trachea– श्वास प्रणाली
6. Right and left principal bronchi– दक्षिण और वाम मुख्य श्वसनी
7. Bronchioles– श्वसनिकाएँ
8. Lungs– फुफ्फुस

Larynx or voice box (स्वरयन्त्र)

(1) Introduction– The larynx is the organ for production of voice. It is also an air passage and acts as a sphincter at the inlet of the lower respiratory passage.

* The upper respiratory passage include the nose, the nasopharynx and the oropharynx.

(2) Situation–

- The larynx lies in the anterior midline of the neck.
- The larynx is a short passageway that connects the laryngo-pharynx (Root of the tongue) to the trachea.
- It lies infront of the C_3–C_6 vertebrae.

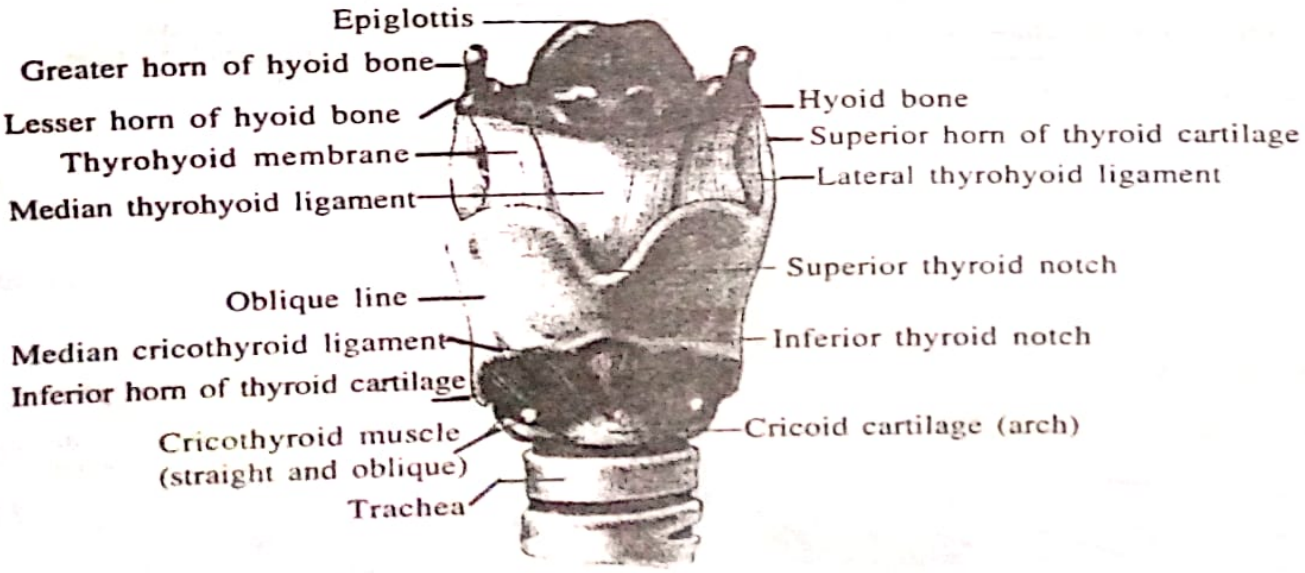

Fig. 1.12 Larynx-Anterior view

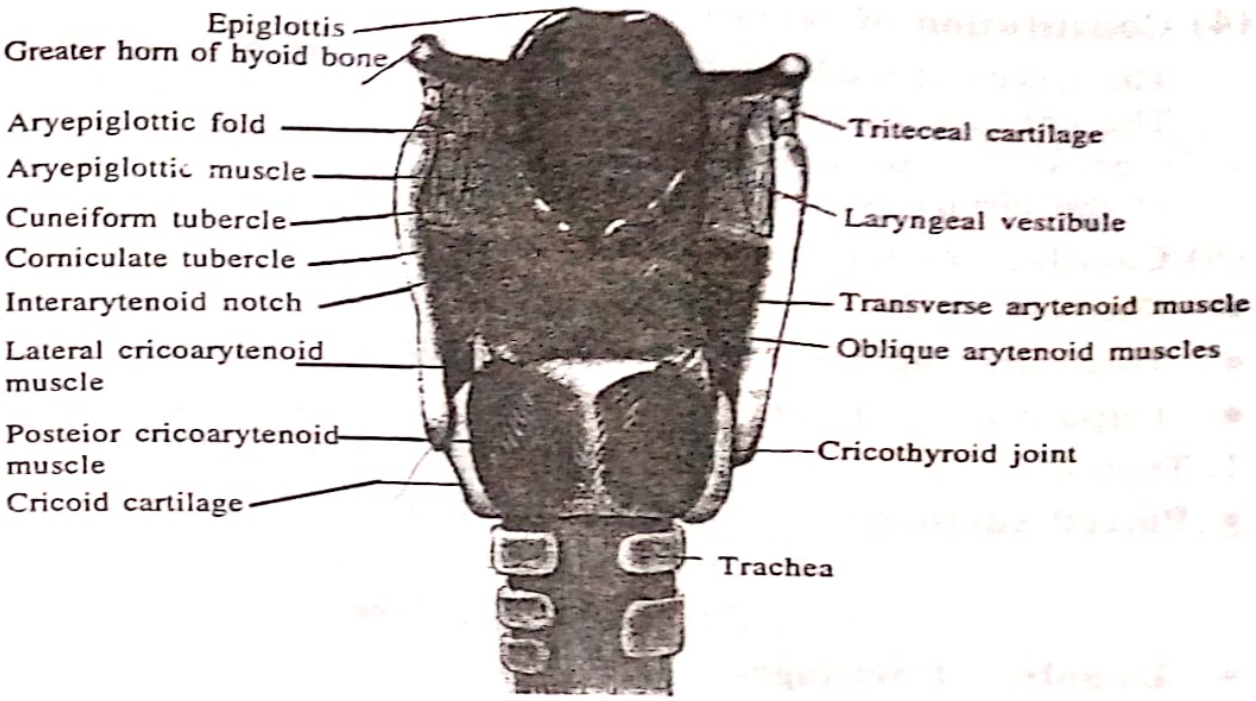

Fig. 1.13 Larynx-Posterior view

(3) Measurement– Length– 44 m.m. in male.
– 36 m.m. in female.

- At puberty male larynx grows rapidly and become larger than the female larynx.
- The pubertal growth of the female larynx is negligible.

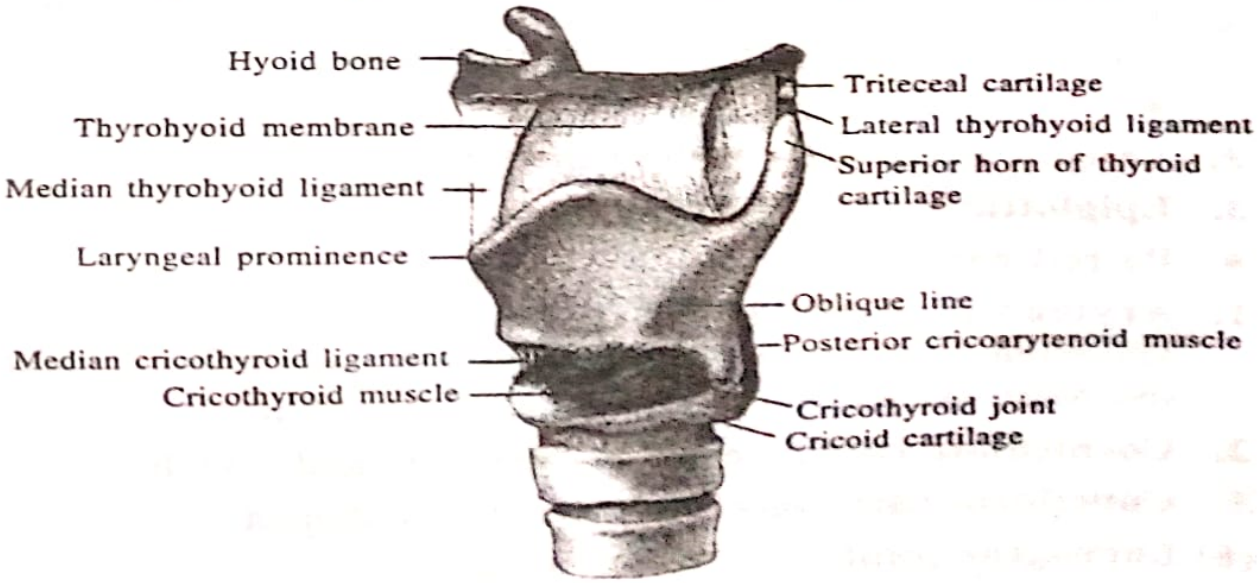

Fig. 1.14 Larynx-Lateral view

(4) Constitution of larynx–

The larynx is made up of a skeletal framework of cartilages. The cartilages are connected by joints, ligaments and membranes. And are moved by a number of muscles. The cavity of the larynx is lined by muscous membrane.

(5) Cartilage of larynx or skeleton of larynx–

- The wall of the larynx is composed of 9 pieces of cartilages.
- Three are unpaired and three are paired.
- **Unpaired cartilage–**

1. Thyroid cartilage 2. Cricoid cartilage 3. Epiglottic cartilage

- **Paired cartilage–** 1. Arytenoid cartilage
  2. Corniculate cartilage
  3. Cuneiform cartilage

* **Unpaired Cartilage–**

1. Thyroid cartilage or adam's apple–

- The thyroid cartilage consists of two fused plates of hyaline cartilage that form the anterior wall of the larynx and give it.
- Triangular in shape.
- It is usually larger in males than females.
- Due to the influence of male sex hormones during puberty.
- The ligament that connects the thyroid cartilage to the hyoid bone is called the thyrohyoid membrane.
- 'V' shaped in cross section.

2. Cricoid cartilage– Ring shape.

3. Epiglottic cartilage– Leaf shape.

* **Paired cartilage–**

1. Arytenoid cartilage– Two small pyramid shaped. The arytenoid cartilage are most important since they influence the positions and tensions of the vocal cord.

2. Corniculate cartilage– Two small conical nodules.

3. Cuneiform cartilage– Two small rod shaped.

(6) Laryngeal joints– 1. Cricothyroid joint
2. Cricoarytenoid joint

(7) Intrinsic muscles of larynx–

Muscles	Nerve supply
1. Posterior cricoarytenoid–	Recurrent laryngeal nerve.
2. Lateral cricoarytenoid–	" " "
3. Transverse arytenoid–	" " "
4. Oblique arytenoid–	" " "
5. Thyroarytenoid–	" " "
6. Thyroepiglotticus–	" " "
7. Aryepiglotticus–	" " "
8. Vocalis–	" " "

9. Cricothyroid– Lying on external aspect of larynx– External laryngeal nerve.

(8) Arterial supply– Superior and inferior laryngeal artery.

(9) Venous drainage– Superior and inferior laryngeal vein.

(10) Lymphatic drainage–
- Deep cervical nodes.
- Prelaryngeal nodes.

(11) Nerve supply–
- Recurrent laryngeal nerve.

(12) Applied aspect–

1. **Laryngitis–**
   - Infection or inflammation of the larynx is called laryngitis.
   - It is characterized by hoarseness of voice.
2. Laryngeal oedema– Obstruction to breathing.
3. The larynx (glottis) is the narrowest part of the respiratory passage, foreign bodies are usually lodged here.
4. Laryngoscopy– Examination of larynx.

Trachea (श्वास प्रणाली)

(1) Introduction–

- The trachea is a mobile cartilaginous and membranous tube. Formed by 'C' shaped rings.
- The rings are about 16-20 in number and make the tube convex anterolaterally.
- The trachea is a wide tube lying in the midline.

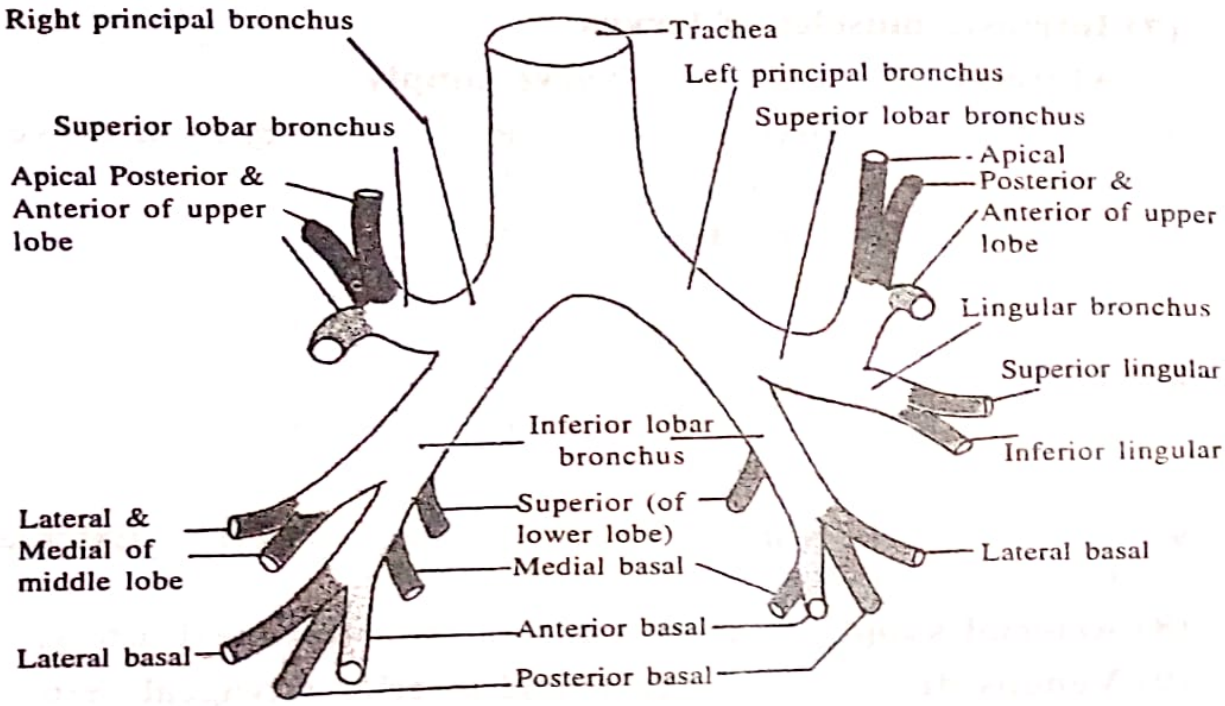

Fig. 1.15 Trachea-Anterior view

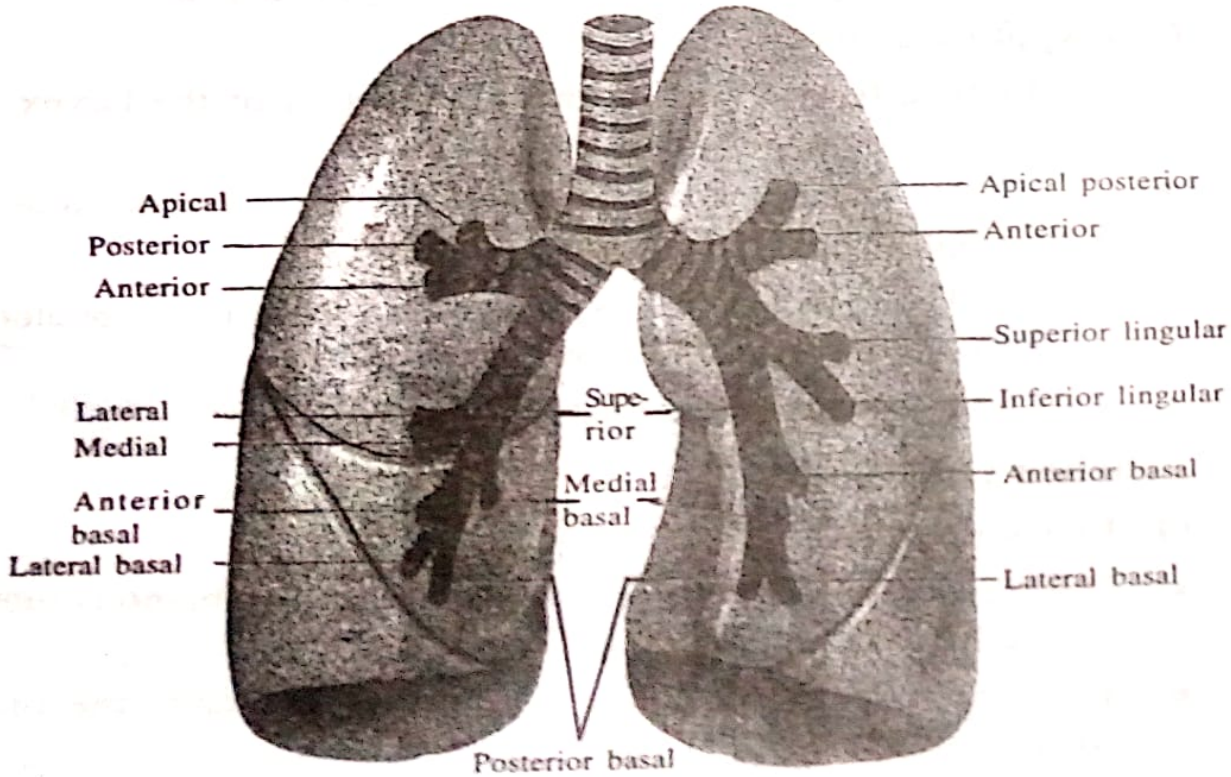

Fig. 1.16 Bronchial branches

- The upper end of the trachea lies at the lower border of the cricoid cartilage (opposite 6th cervical vertebrae) of the larynx. And extends downwards in the midline of the neck.
- In the thorax, it ends by dividing into two main bronchi at the level of lower border of 4th thoracic vertebrae.

* Vertebral level– C_6–T_4– In cadaver

* Vertebral level– C_6–T_6– In living erect posture.

(2) Measurement–

* Length– 4-6 inches (10-15 cm.)
* External diameter– 2 cm. in males, 1.5 cm. in females.
* Lumen is smaller in the living than in the cadaver.

3 mm.– At 1 year.

12 mm.– In adult.

(3) Relations–

* Cervical part	* Thoracic part
1. Anterioriy–	**1. Anterioly–**
• Skin, fascia, isthmus of the thyroid gland. • Sternohyoid and sternothyroid muscles. • Left brachiocephalic vein and inferior thyroid vein.	• Manubrium sterni, sternothyroid muscle, left brachiocephalic vein and inferior thyroid vein, left common carotid artery.
2. Posteriorly– Esophagus, vertebral column.	**2. Posteriorly–** Esophagus, vertebral column.
3. Laterally (Side to side)– Lobe of thyroid gland.	**3. Right side–** Right lung and pleura, azygos vein, right vagus nerve. **Left side–** Arch of aorta, left common carotid artery, left subclavian artery.

(4) Arterial supply– Inferior thyroid artery.

(5) Venous drainage–

- Inferior thyroid vein.
- Left brachiocephalic vein.

(6) Lymphatic drainage–
- Pretracheal nodes.
- Paratracheal nodes.

(7) Nerve supply–
- Sympathetic– Fibres from the middle cervical ganglion.
- Parasympathetic– Vagus– through recurrent laryngeal nerve.

(8) Applied aspect–

1. Clinically the trachea is palpated in the suprasternal notch.
2. Tracheal tug.
3. The trachea may get compressed by pathological enlargements of the thyroid, thymus, lymph nodes and the aortic arch. This causes dyspnoea, irritable cough and often a husky voice.
4. Tracheostomy– Surgical creation of an opening into the trachea.
5. Tracheotomy– An incision of the trachea.

Lungs (फुफ्फुस)

(1) Situation–
- The lungs are a pair of respiratory organs situated in the thoracic cavity.
- Each lung invaginates the corresponding pleural cavity.
- The right and left lungs are separated by the mediastinum.
- The lungs are spongy in texture.

(2) Colour–
- In the child– Pink colour.
- In the young– Brown or grey in colour.
- Gradually they become mottled black because of the deposition of inhaled carbon particles.

(3) Weight– Right lung– 625 gm.
Left lung– 575 gm.

(4) External feature– Each lung is conical in shape. It has–

1. Apex
2. Base

3. Borders
   - Anterior border
   - Posterior border
   - Inferior border
4. Surfaces
   - Costal surface
   - Medial surface
     - Vertebral part
     - Mediastinal part

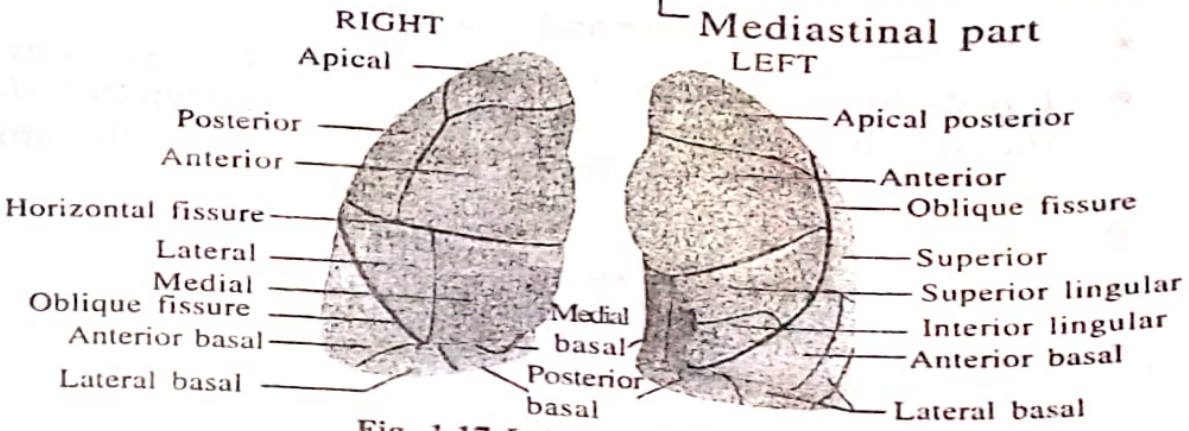

Fig. 1.17 Lungs-Anterior view

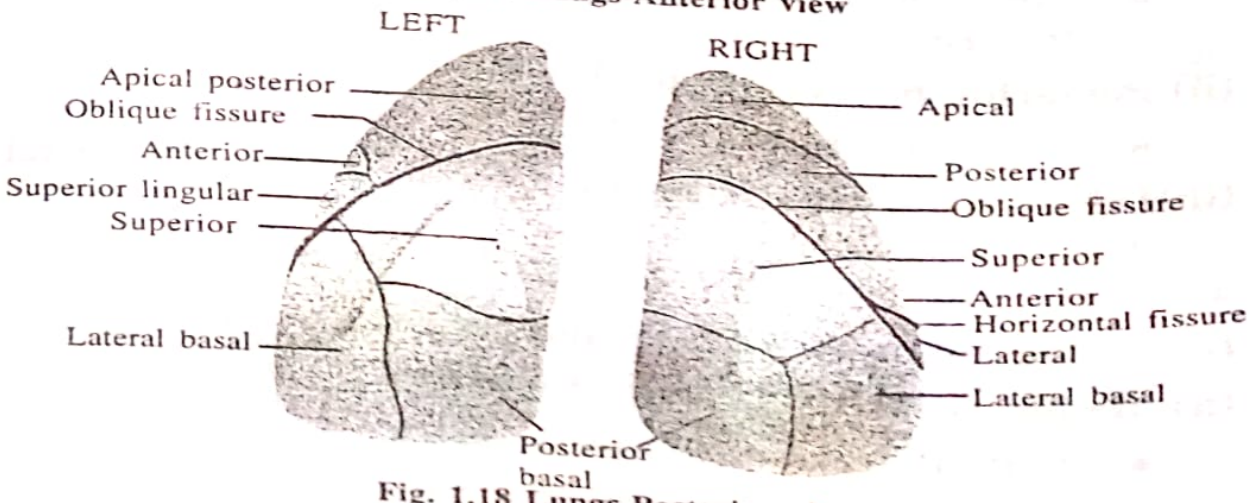

Fig. 1.18 Lungs-Posterior view

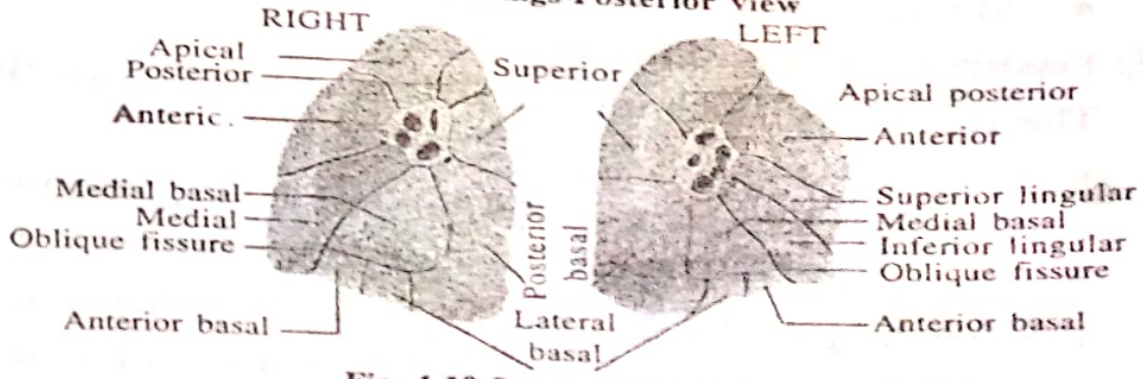

Fig. 1.19 Lungs-Medial view

1. **Apex (Cupola)–** The apex is blunt and lies above the level of the anterior end of the first rib. It reaches nearly an one inch above the medial 1/3 of the clavicle. Just medial to the supraclavicular fossa.
2. **Base–**
   - The base is semilunar and concave.
   - It rests on the diaphragm which separates the right lung from the right lobe of the liver and the left lung from the left lobe of the liver, the fundus of the stomach and the spleen.
3. **Borders–**

(i) **Anterior border–** is very thin.
   - Anterior border of the left lung shows a wide cardiac notch below the level of 4th costal cartilage.
   - The heart and pericardium are uncovered by the lung in the region of this notch.

(ii) **Posterior border–** is thick and ill defined.
   - It extends from the C_7-T_{10} spine.

(iii) **Inferior border–** It separate the base from the costal and medial surfaces.

4. **Surfaces–**

(i) **Costal surface–** is large and convex.

(ii) **Medial surface–** is divided into two parts.
   - Vertebral part or posterior part.
   - Mediastinal part or anterior part.

(5) **Fissures and lobes of the lungs–**

* The right lung is divided into three lobes by two fissures.
   - **Lobes–**

   1. Superior lobe 2. Middle lobe 3. Inferior lobe
   - **Fissures–** 1. Oblique fissure 2. Horizontal fissure

* The left lung is divided into two lobes by one fissure.
   - **Lobes–** 1. Superior lobe 2. Inferior lobe
   - **Fissure** 1. Oblique fissure.

Lingula– The tongue shaped projection of the left lung below the cardiac notch is called the lingula. It corresponds to the middle lobe of the right lung.

(6) Root of the lungs–

- It is short, broad pedicle which connects medial surface of the lung to mediastinum.
- The roots of the lungs lie opposite the bodies of 5-6-7th thoracic vertebrae.

Contents–

1. Principal bronchus on the left side and eparterial and hyparterial bronchi on right side.
2. One pulmonary artery.
3. Two pulmonary vein– Superior and inferior.
4. Bronchial arteries– One on right side and two on left side.
5. Bronchial veins.
6. Anterior and posterior pulmonary plexuses of nerves.
7. Bronchiopulmonary lymph nodes and lymphatics of lungs.
8. Areolar tissue.

(7) Surface marking of the lungs–

1. **Apex–** • One inch above the medial 1/3 of the clavicle.
   • Above the level of anterior end of first rib.

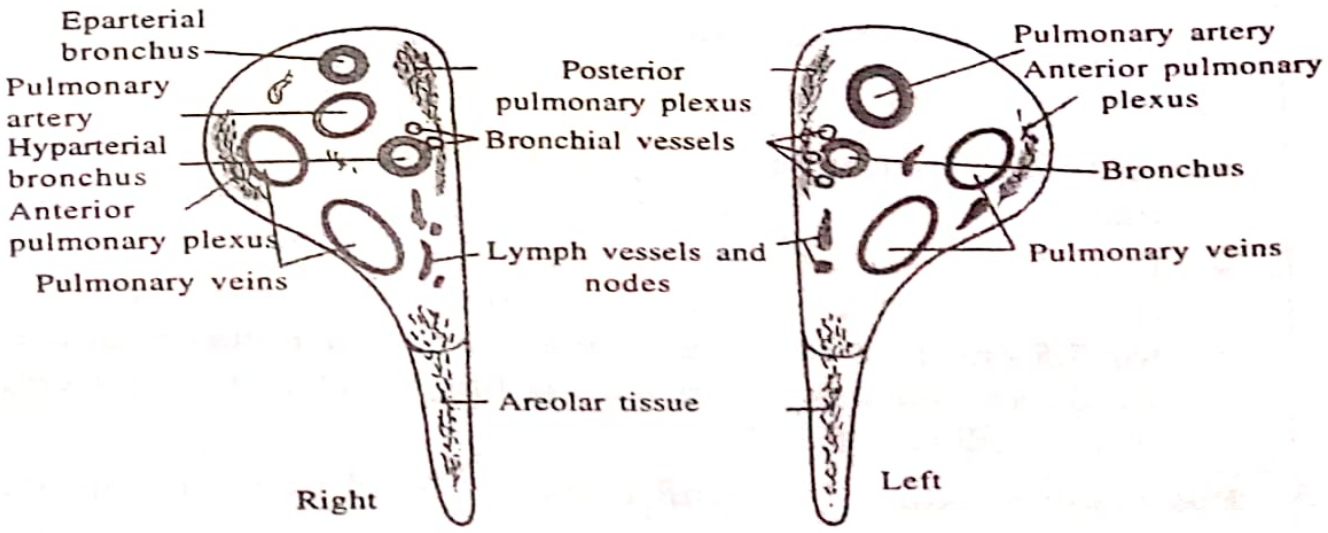

Fig. 1.20 Roots of the lungs

2. * **Anterior border of right lung–**

Corresponds very closely to the anterior margin of the pleura and is obtained by joining–

- A point at the– Sternoclavicular joint.
- Another point in the– Median plane at the sternal angle.
- A third point in the– Median plane just above the xiphisternal joint.

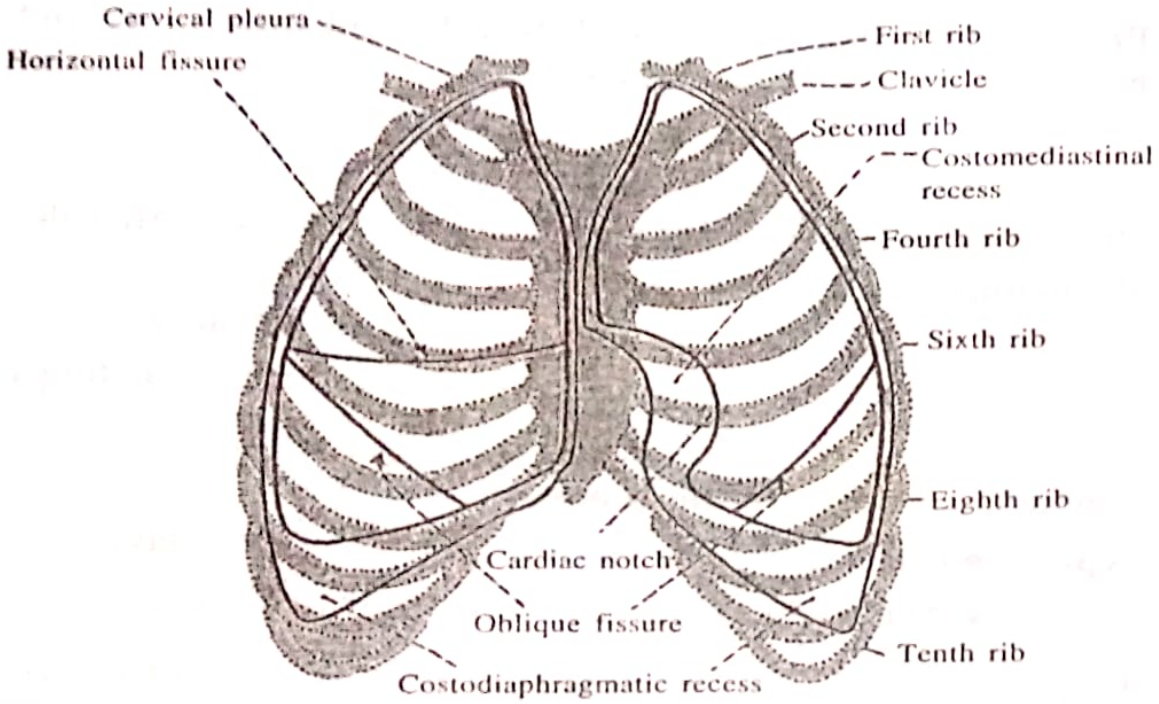

Fig. 1.21 Surface marking of the lungs and pleura

* **Anterior border of left lung–** Corresponds to the anterior margin of the pleura up to the level of 4th costal cartilage.
* **Cardiac notch–** Below the level of 4th costal cartilage, from the level of 4th costal cartilage. It passage laterally for 3.5 cm. from the sternal margin and then curves downwards and medially to reach the 6th costal cartilage 4 cm. from median plane.

3. **Posterior border–** It extend from the level of C_7-T_{10} spine.
4. **Inferior border–** Lower border of each lung lie two ribs higher than the pleural reflection.

Lungs	Surface marking of pleura
• Midclavicular line– up to 6th rib	8th rib
• Midaxillary line– up to 8th rib	10th rib
• Lateral border of the erector spinae. – up to 10th rib	12th rib

5. Oblique fissure–

- A point 2 cm. lateral to the– 3rd thoracic spine.
- Another point on the– 5th rib in the midaxillary line.
- A third point on the– 6th costal cartilage, 7.5 cm. from median line.

6. Horizontal fissure–

- A point on the anterior border of right lung at the level of 4th costal cartilage.
- A second point on the 5th rib in the midaxillary line.

(8) Structures related to the mediastinal surface of right and left lung–

Right lung	Left lung
1. Rt. atrium and aurjcle	1. Left auricle
2. A small part of right ventricle	2. Left ventricle
3. Lower part of right brachio-cephalic vein	3. Left brachio cephalic vein
4. Oesophagus	4. Oesophagus
5. Right vagus nerve	5. Left vagus nerve
6. Right phrenic nerve	6. Left phrenic nerve
7. Superior venacava	7. Pulmonary trunk
8. Azygos vein	8. Arch of aorta
9. Inferior venacava	9. Descending thoracic aorta
10.Trachea	10. Thoracic duct

(9) Difference B/w the lungs–

Right lung	Left lung
1. It has two fissures and three lobes.	1. It has only one fissure and two lobes.

Right lung	Left lung
	* Third lobe– Lingula– Accomadation of heart.
2. Anterior border is straight.	2. Anterior border is interrupted by the cardiac notch.
3. Larger and heavier, weight about 625 gm.	3. Smaller and lighter, weight about 575 gm.
4. Shorter and wider.	4. Longer and narrower.
5. Right lung lies slightly above than left due to liver.	5. Left lung lies slighlty below than right due to small spleen.

(10) Bronchial tree–

- The trachea divides at the level of lower border of the 4th thoracic vertebrae into two primary bronchi.
- One for each lungs. The right principal bronchus is shorter (1 inch) wider and vertical than the left principal bronchus.
- Inhaled particles, therefore, tend to pass more frequently to the right lung. With the result than infection are more common on the right side than on the left.
- The left principal bronchus is longer (2 inches), narrower and more oblique than the right bronchus.
- Each principal bronchus enters the lung through the hilum and divides into secondary (lobar) bronchi one for each lobe of the lungs. (3 on the right and 2 on the left side)
- Each lobar bronchus divides into tertiary (segmental) bronchi.

One for each bronchopulmonary segment (10 on the right side and 8 on the left side). The segmental bronchi divide repeatedly to form very small branches called terminal bronchioles. Still smaller branches are called respiratory bronchioles.

- Each respiratory bronchiole aereates a small part of the lung known as a pulmonary unit.
- The respiratory bronchiole ends in microscopic passages which are termed–
  - Alveolar ducts
  - Atria

- Air saccules
- Pulmonary alveoli

* Gaseous exchanges take place in the alveoli

Trachea
↓
Rt. and left principal bronchi (primary)
↓
Secondary bronchi (Lobar)
↓
Tertiary bronchi (Segmental)
↓→ Divides repeately
Terminal bronchioles
↓→ Still smaller
Respiratory bronchioles
↓→ ends in microscopic passage
- Alveolar ducts
↓
- Atria
↓
- Air saccules
↓
- Pulmonary alveoli

[Gaseous exchanges take place in the alveoli]

* **Pulmonary unit–** Each respiratory bronchioles aereates a small part of lung known as pulmonary unit

(11) Bronchiopulmonary segments–

Definition– There are well defined sectors of the lung.

Right lung		Left lung	
Lobes	**Segments**	**Lobes**	**Segments**
1. Upper lobe–	1. Apical	1. Upper lobe–	
	2. Anterior	* Upper division–	
	3. Posterior	1. Apical	1. Apicopost.
		2. Posterior	
		3. Anterior→	2 Anteior

Right lung		Left lung	
Lobes	**Segments**	**Lobes**	**Segments**
2. Middle lobe–	1. Medial 2. Lateral	* Lower division–	1. Supesrior lingular 2. Inferior lingular
3. Lower lobe–	1. Superior or apical 2. Anterior basal 3. Posterior basal 4. Lateral basal 5. Medial basal	2. Lower lobe–	1. Superior 2. Anterior basal 3. Medial basal 4. Posterior basal 5. Lateral basal
3+2+5= 10 segments		2+2+4= 8 segments or 3+2+5= 10 segments	

(12) Arterial supply–

* Bronchial arteries – Right side one bronchial artery.
  Left side two bronchial artery.
* Pulmonary artery– Do_2 blood.

(13) Venous drainage–

* Bronchial veins – Right bronchial vein drains into–Azygos vein.
  Left bronchial vein drains into–Hemiazygos vein.

(14) Lymphatic drainage–

* Bronchiopulmonary nodes.

(15) Nerve supply–

- Sympathetic nerve– T_2-T_5
- Parasympathetic nerve– Vagus.

(16) Applied aspect–

1. **C.O.P.D.**– Chronic obstructive pulmonary disease. Disease such as asthma, bronchitis, emphysema have in common degree of obstruction of the air ways.

   Air flow obstruction– Coughing, wheezing, dyspnea.

2. **Pneumonia**– Acute infection or inflammation of the alveoli.
3. **Bronchogenic carcinoma**– A common lung cancer. Start in the wall of the bronchi.
4. **Tuberculosis (T.B.)**– Mainly occur in apices of lungs.
5. **Haemoptysis**–The spitting of blood from the respiratory tract.
6. **Pulmonary embolism**
7. **Pulmonary oedema**

   } is a blood clot or other foreign body substance in a pulmonary blood vessels that obstructs circulation to lung tissue. (Heart diseases)

8. **Haematemesis**– Vomiting of blood.
9. **Epistaxix**– Bleeding from the nose.
10. **Pneumothorax**– Presence of air in pleural cavity.
11. **Haemothorax**– " " blood " " .
12. **Empyema**– " " pus " " .
13. **Hydropneumothorax**– " both-fluid and air " .
14. **Pleurisy**– Inflammation of pleura. It may be dry.
15. **Pleural effusion**– Collection of fluid in the pleural cavity.
16. **Parencentesis**– Aspiration of fluid.
17. **Bronchioscopy**– Examination of bronchi.
18. **Bronchiography** or bronchiogram or chest X-ray– Picture of bronchial tree.
19. **Pneumonectomy**– Surgical removal of a lung.
20. **Segmental resection**– Surgical removal of a segment.
21. Tracheostomy
22. Intubation
23. Nebulization

(17) Ayurvedic aspect of lungs–

"शोणित फेन प्रभवः फुप्फुसः ।" (सु.शा. ४/२५)

रक्त के फेन से फुप्फुस की उत्पत्ति होती है।

(C) Digestive system (पाचन संस्थान)

The digestive systems are following organs.

1. Mouth cavity or oral cavity– मुखगुहा
2. Pharynx– ग्रसनी
3. Oesophgus– ग्रासनली
4. Nine part of the abdomen– उदर के नौ भाग
5. Stomach– आमाशय
6. Duodenum– ग्रहणी
7. Jejunum– मध्यान्त्र
8. Ileum– शेषान्त्र
9. Caecum– उण्डुक (पुरीषाधार)
10. Vermiform appendix– उण्डुक पुच्छ या आन्त्र पुच्छ
11. Colon– आंत्र
12. Rectum– मलाशय
13. Anal canal and anus– गुदनाल और गुद
14. Extrahepatic biliary apparatus– यकृत के उपसर्गी उपकरण
15. Liver– यकृत
16. Pancreas– अग्न्याशय
17. Spleen– प्लीहा

(1) Mouth cavity or oral cavity (मुखगुहा)

* The oral cavity or mouth cavity is divided two parts–
  1. Outer (Smaller portion)– The vestibule.
  2. Inner (Larger part)– The oral cavity proper.

(1) Vestibule (entrance to a canal)–

The vestibule of the mouth is a narrow space bounded externally by the lips and cheeks and internally by the teeth and gums.

* **Externally–**

(I) Lips– are fleshy folds lined externally by skin and internally by mucous membrane.

- Each lip is composed of–
  1. Skin
  2. Superficial fascia
  3. Orbicularis oris muscle
  4. Submucosa
  5. Mucous membrane

(II) Cheeks or buccae–

- The cheeks are fleshy flaps, forming a large part of each side of the face.
- Each cheek is composed of–

1. Skin
2. Superficial fascia
3. Buccinator muscle
4. Submucosa
5. Mucous membrane

(2) Oral cavity proper– It is bounded–

1. Anterolaterally– Teeth, gums, alveolar arches of jaws.
2. Roofs– Hard and soft palate.
3. Floor– Tongue
4. Posteriorly– The cavity communicates with the pharynx.

(I) Gums (Gingivae)–

- The gums are the soft tissue which envelop the alveolar process of the upper and lower jaw and surround the neck of the teeth.
- Each gum has two parts–

(i) Free part– surrounds the neck of the tooth like a collar.

(ii) Attached part– is firmly fixed to the alveolar arch of the jaw.

(II) Teeth–

- The teeth form a part of the masticatory apparatus and are fixed to the jaws.

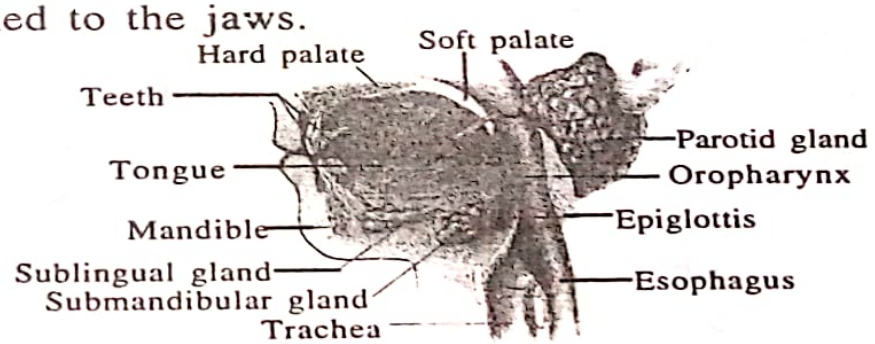

Fig. 1.22 Oral cavity- lateral view

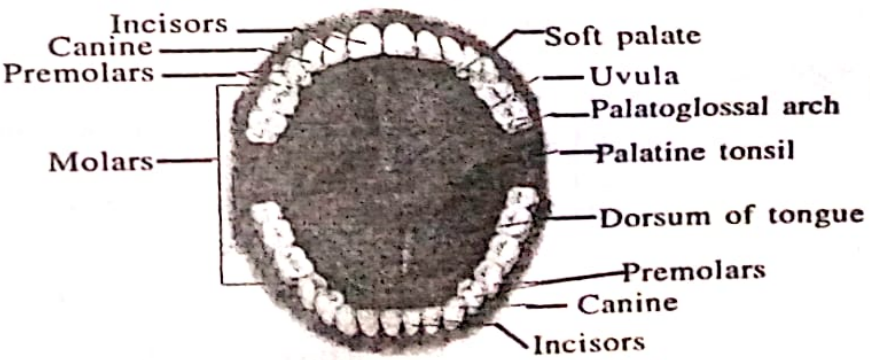

Fig. 1.23 Oral cavity- Anterior view

(A) Deciduous teeth–First set, milk teeth– 20 in number.

In each half of each jaw– $\frac{\text{I-C-M}}{\text{2-1-2}} = 5 \times 4 = 20$

(B) Permanent teeth–Second set– 32 in numbers.

In each half of each jaw–

$$\frac{\text{I-C-P-M}}{\text{2-1-2-3}} = 8 \times 4 = 32$$

I–	Incisor
C–	Cannine
P–	Premolar (Bicuspid)
M–	Molar

* **Part of a tooth–** It has three parts.

I– Crown– Projecting above the gum.

II– Root– Embedded in the jaw beneath the gum.

III– Neck– B/w the crown and root and surrounded by the gum.

* **Structure of a tooth–** Each tooth is composed of–

1. Pulp– In the centre.
2. Dentine– Surrounding the pulp.
3. Enamel– Covering the projecting part of dentine or crown.
4. Cementum– Surrounding the embedded part of the dentine.
5. Periodontal membrane– Hold the root in its socket.

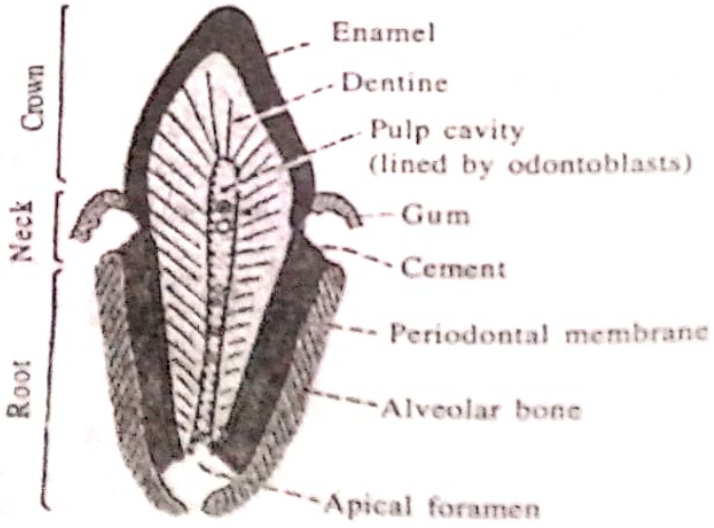

Fig. 1.24 Structure of tooth

* **Function of a tooth–**

1. Incisor– Cutting teeth.
2. Cannine– Holding and tearing teeth.
3. Premolar (Bicuspid)
4. Molar– Grinding

* **Eruption of teeth–**

(A) Deciduous or milky teeth–
- Begins to erupt at about–6 month
- End of – 2 year

I-C-M
2-1-2

= 5x4= 20

1. Lower central incisors– 6 month
2. Upper central incisors– 7 month
3. Lateral incisors– 8-9 month
4. First molar– 1 year
5. Canines– 1½ year (18 month)
6. Second molar– 2 years

(B) Permanent teeth–

I-C-P-M
2-1-2-3

= 8x4= 32

1. First molar– 6 years
2. Medial incisors– 7 years
3. Lateral incisors– 8 years
4. First premolar– 9 years
5. Second premolar– 10 years
6. Canines– 11 years
7. Second molar– 12 years
8. Third molar– 17-25 years
   or or
   Wisdom tooth Even later

Hard palate–

- It is a partition B/w nasal and oral cavities.

- Its anterior 2/3 are formed by the palatine processes of the maxilla.
- And its posterior 1/3 by the horizontal plates of the palatine bones.
- The anterolateral margin of the palate are continuous with alveolar arch and gums.
- Posterior margin gives attachment to the soft palate.
- Superior surface forms the floor of the nose.
- Inferior surface forms the roof of the oral cavity.

Soft palate–

- It is a movable, muscular fold, suspended from the posterior border of the hard palate.
- It separates the nasopharynx from the oropharynx and is often looked upon as a traffic controller at the cross roads B/w the food and air passages.
- The soft palate has **two surfaces–** 1. Anterior surface (oral)
  2. Posterior surface

  Two borders 1. Superior border
  2. Inferior border (Uvula)
- Muscles of the soft palate–

1. Tensor palati (Tensor veli palatini)
2. Levator palati (Levator veli palatini)
3. Musculus uvulae– *Uvula– (conical muscular process).
4. Palatoglossus
5. Palatopharyngeus

* **Blood supply–**
  - Greater palatine branch of maxillary artery.
  - Ascending palatine branch of facial artery.
  - Palatine branch of ascending pharyngeal artery.
* **Venous drainage–** Pterygoid and tonsillar plexuses of veins.
* **Lymphatic drainage–** • Upper deep cervical nodes.
  • Retro pharyngeal nodes.

* **Nerve supply–** • Palatine nerve. • Alveolar nerve.

* **Applied aspect–**

1. Paralysis of the soft palate in lession of the vagus nerve.
2. Nasal regurgitation of liquids.
3. Nasal twang in voice.
4. Scurvy– Deficency of vit. c.
5. Gingivitis.
6. Pyorrhoea alveolaris.
7. Cleft palate is a congenital defect.

(2) The Pharynx (ग्रसनी)

(1) Introduction–

- The pharynx or throat is a wide muscular tube.
- That starts at the internal nares (Nose) and extends to the level of cricoid cartilage of larynx. The most inferior cartilage of the larynx at the level of 6th cervical vertebrae (C_6).
- It lies just posterior to the nasal cavity and oral cavity.
  Superior to the larynx.
  Anterior to the cervical vertebrae.
- Its wall is composed of skeletal muscles and lined with mucous membrane.
- The pharynx functions as a passageway for air and food, provides a resonating chamber for speech, sound and houses the tonsils, which help to expel foregin invaders through immunological reactions.
- Clinically it is a part of the upper respiratory passage where infection are common.
- Upper part of pharynx transmits– Only air.
  The lower part– Only food.
  But the middle part is a common passage for both– Air and food (but only one at a time)

(2) Dimensions–

Length– About 12 cm.

Width– (1) Upper part is widest and non collapsible.– 3.5 cm.

(2) Middle part is narrow.

(3) Lower end is a narrowest part of the gastrointestinal tract except the appendix.

(3) Part of the pharynx–

1. Nasopharynx– Nasal part of pharynx– Superior portion of pharynx.
2. Oropharynx– Oral part of pharynx– Intermediate portion of pharynx.
3. Laryngopharynx– Laryngeal part of pharynx– Inferior portion of pharynx.

1. Nasopharynx–

- It lies posterior to the nasal cavity and extends to the plane of the soft palate.
- There are five openings in its wall– Two internal nares, two openings that lead into the auditory tubes and the opening into the oropharynx.

2. Oropharynx–

- It lies posterior to the oral cavity and extends from the soft palate. Inferiorly to the level of the hyoid bone.
- It has only one opening, the fauces (The cavity B/w mouth and throat), the opening from the mouth.
- This portion of the pharynx is both respiratory and digestive in function, because it is a common passageway for air, food and drink.
- Two pairs of tonsils, the palatine and lingual tonsil are found in the oropharynx.

3. Laryngopharynx–

- It begins at the level of the hyoid bone and connects the esophagus with the larynx.

(4) Palatine tonsil– The tonsil occupies the tonsillar sinus B/w the palatoglossal and palatopharyngeal arches. It can be seen through the mouth. The tonsil is almond shaped.

(5) Blood supply–
- Tonsillar branch of facial artery.
- Dorsal lingual branch of lingual artery.

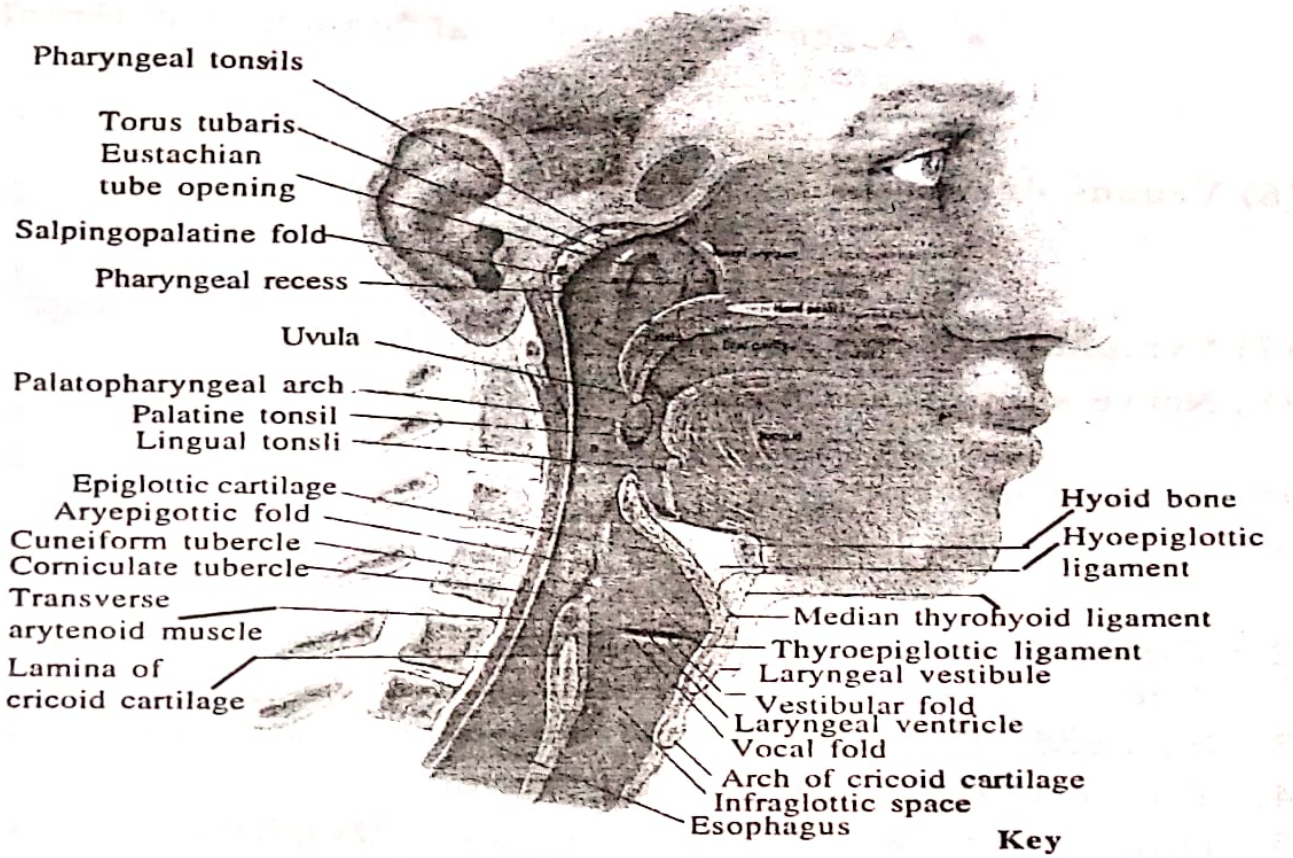

Fig. 1.25 Pharynx-Sagittal section

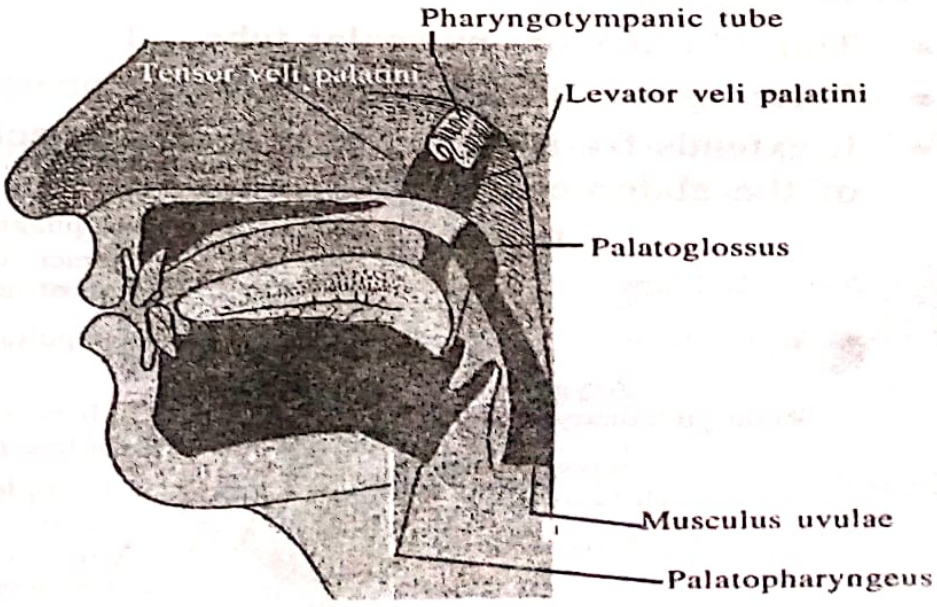

Fig. 1.26 Subdivision of the pharynx

- Ascending pharyngeal branch of external carotid artery.
- Greater palatine branch of maxillary artery.

(6) Venous drainage–
- Facial vein
- Palatine vein
- Pharyngeal vein

(7) Lymphatic drainage– Deep cervical nodes.

(8) Nerve supply–
- Glossopharyngeal nerve.
- Lesser palatine nerve.

(9) Applied aspect–

1. The tonsil are large in children.
   They retrogress after puberty.
2. The tonsil are frequently sites of infection, specially in children.
3. Enlarged and infected tonsils often require surgical removal.
4. The operation is called– Tonsillectomy.
5. Difficulty in swallowing is known as– Dysphagia.

(3) The Oesophagus (ग्रासनली)

(1) Introduction–

- This is a narrow muscular tube.
- Forming the food passage B/w the pharynx and stomach.
- It extends from the lower part of the neck to the upper part of the abdomen.

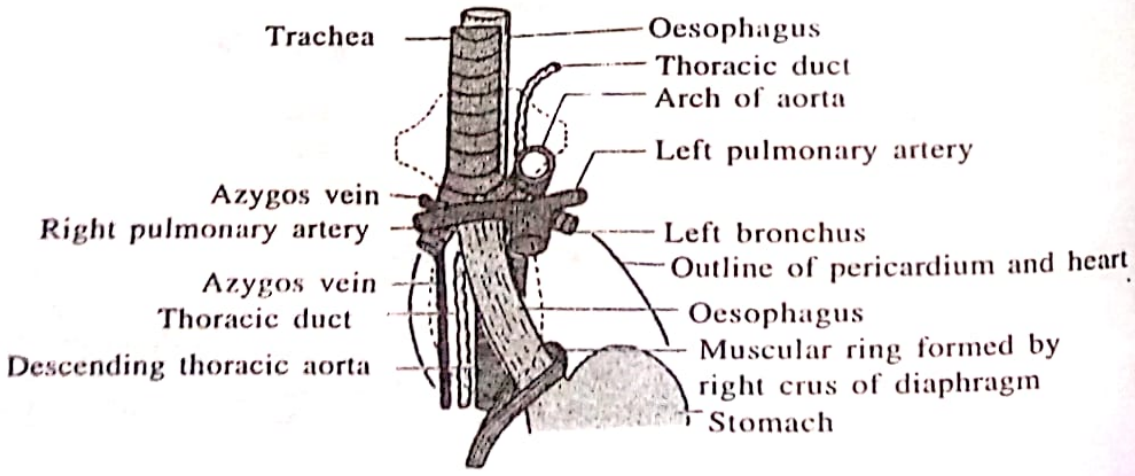

Fig. 1.27 Oesophagus

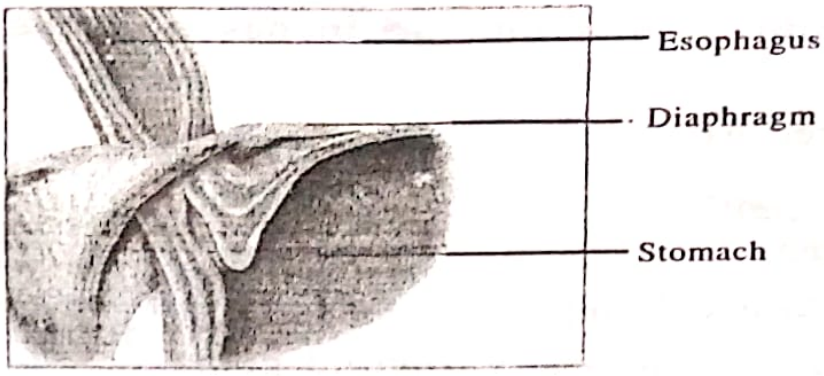

Fig. 1.28 Oesophagogastric junction

- Length– 25 cm.
- The tube is flattened anteroposteriorly and the lumen is kept collapsed, it dilates only during the passage of the food bolus.
- The pharyngooesophageal junction is the narrowest part of the alimentary canal except for the vermiform appendix.
- The esophagus begins in the neck at the lower border of the cricoid cartilage, where it is continuous with the lower end of the pharynx.
- It descends in front of the vertebral column through the superior and posterior parts of the mediastinum and pierces the diaphragm at the level of vertebrae T_{10}.
- It ends by opening into the stomach (cardiac end) at the level of vertebrae T_{11}.

(2) **Curvatures–**

- In general the esophagus is vertical but shows slight curvatures in the following directions. There are two side to side curvatures, both towards the left.
- One is at the root of the neck and the other near the lower end.

(3) **Constrictions–** Normally the esophagus shows four constrictions.

1. At its beginning– 6 inches from the incisor teeth.
2. Where it is crossed by the aortic arch– 9 inches from the incisor teeth.
3. Where it is crossed by the left bronchus– 11 inches from the incisor teeth.

4. Where it pierces by the diaphragm– 15 inches from the incisor teeth.

(4) Relations– It has three parts–

(I) Cervical part–

- Anteriorly– Trachea.
- Posteriorly– Vertebral column.
- Laterally– Common carotid artery, thyroid gland.

(II)Thoracic part–

Anteriorly– Trachea

Posteriorly– Vertebral column.

Right– Right lung and pleura, azygos vein.

Left– Aortic arch, left subclavian artery, thoracic duct, left lung and pleura.

(III) Abdominal part–

Anteriorly– peritoneum

Posteriorly– Diaphragm

(5) Blood supply–

- Cervical part– Inferior thyroid artery.
- Thoracic part– Esophageal branches of aorta.
- Abdominal part– Esophageal branches of left gastric artery.

(6) Venous drainage–

- Brachiocephalic vein.
- Azygos vein.
- Left gastric vein.

(7) Lymphatic drainage–

- Deep cervical node.
- Posterior mediastinal node.
- Left gastric node.

(8) Nerve supply–

- Recurrent laryngeal nerve.
- Vagus nerve.
- Esophageal plexus.

(9) Applied aspect–

- Haematemesis– Vomitting of blood.

(3) Nine parts of the abdomen or nine regions of abdomen (उदर के नौ विभाग)

* **Three vertical zones.**

  1. Median zone 2. Right zone 3. Left zone

* Each zone has three regions (3x3= 9 regions)

	Right zone	Median zone	Left zone
1.	Rt. Hypochondrium [RH]	1. Epigastrium [EPG]	1. Lt. Hypochondrium [LH]
2.	Rt. Lumbar [RL]	2. Umbilical [UMB]	2. Lt. Lumbar [LL]
3.	Rt. Inguinal or Iliac [RI]	3. Hypogastrium or Pubic [HYG]	3. Lt. Inguinal or Iliac [LI]

* **Two transeverse planes–** 1. Transpyloric plane.
  2. Transtubercular or intertubercular plane

* **Two vertical planes–** 1. Right lateral plane.
  2. Left lateral plane.

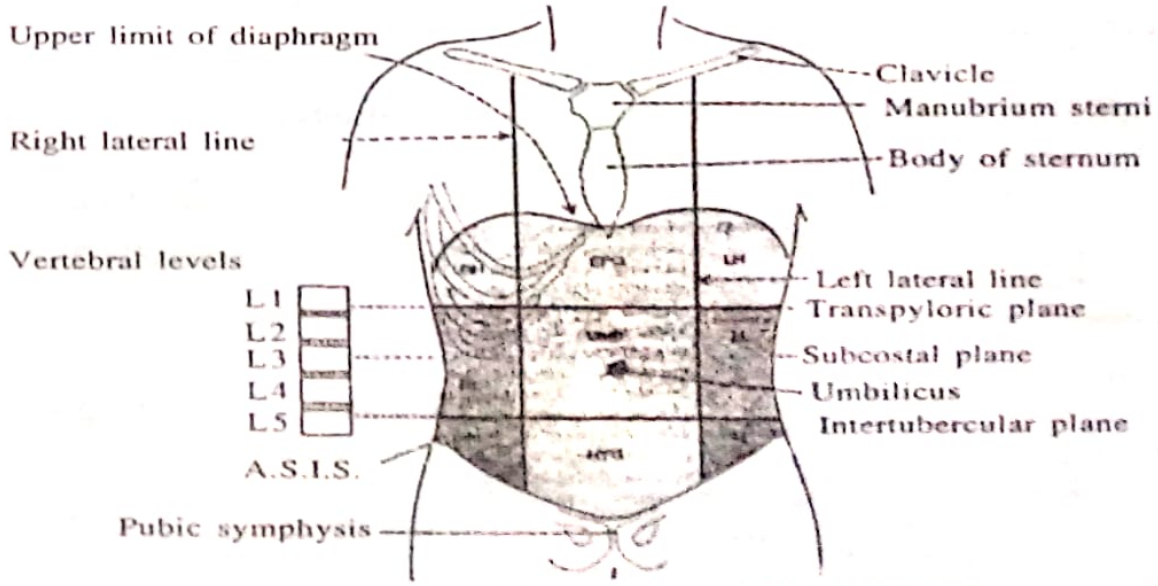

Fig. 1.29 Nine regions of the abdomen

* **Transverse planes–**

1. Transpyloric plane–

- Lower part of body of L1 vertebrae.
- B/w lower end of the body of sternum and umbilicus.
- B/w upper border of the manubrium sterni and upper border of the pubic symphysis.

2. Intertubercular plane– Upper part of L_5 vertebrae.

* **Vertical plane–**

Right and left lateral plane–

- **Upper–** Midclavicular line.
- **Lower–** B/w ant. sup. iliac spine and pubic symphysis.

(4) The Stomach (आमाशय)

(1) Introduction–

- Stomach is also called gaster.
- The stomach is a muscular bag forming the widest and most distensible part of the digestive tube.
- It is connected above to the lower end of the oesophagus and below to the duodenum.
- It acts as a **reservoir of food** and helps in digestion of proteins and fats.

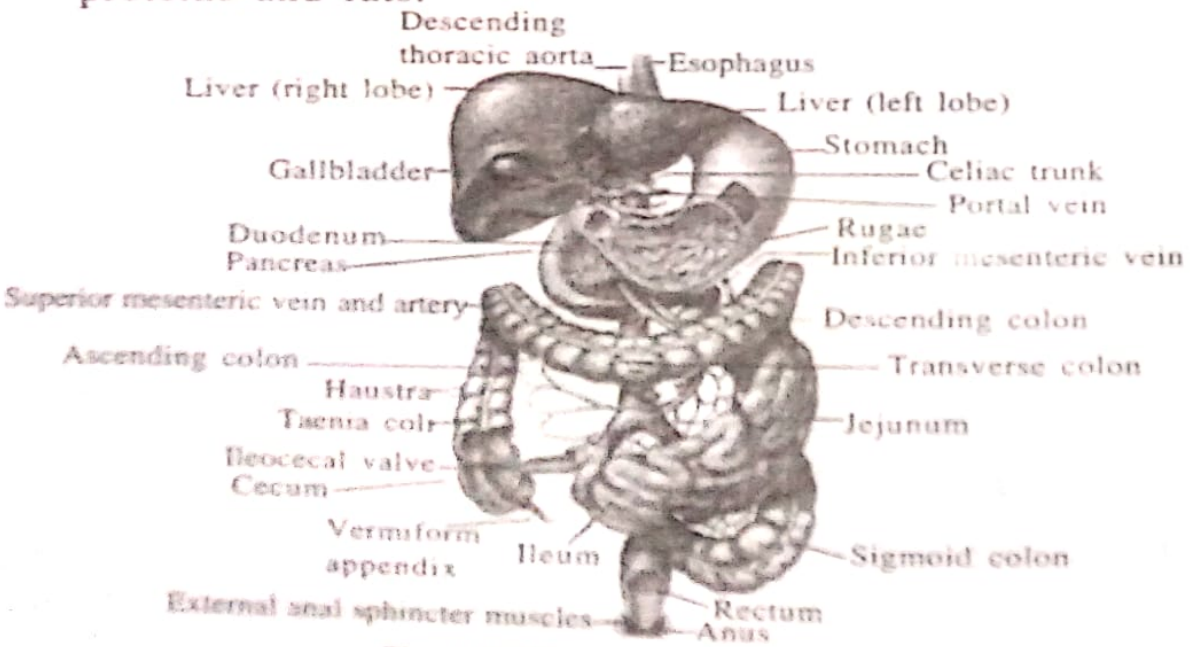

Fig. 1.30 Gastrointestinal system

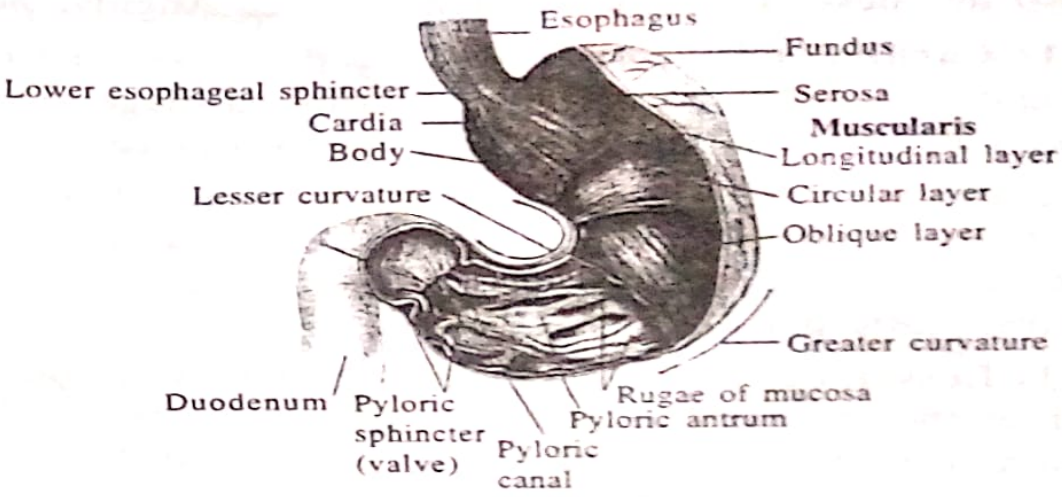

Fig. 1.31 Stomach-Anterior view

(2) Location–

- The stomach lies obliquely in the upper and left part of the abdomen.
- Occupying the epigastrium, umbilical and left hypochondrium regions.

E. P. G.
U. M. B.
L.H.

- Most of it lies under cover of the left costal margin and the ribs.

(3) Shape–
- Empty stomach– **J shaped (vertical)**
- When partially distended it becomes **piriform** in shape.
- In obese persons it is more– **Horizontal– steerhorn** stomach.

(4) Size– Length– 10 inch or 25 cm.

(5) Capacity–
- At birth– 30 ml.
- At puberty– 1 lt.
- Adult– 1.5- 2 lt. or more.

(6) External features–

* Two orifices or openings– 1. Cardiac orifice 2. Pyloric orifice
* Two curvatures or borders–1. Lesser curvature
  2. Greater curvature
* Two surfaces–1. Anterior surface or antero superiorsurface.
  2. Posterior surface or posteroinferior surface.

* Two notches– 1. Cardiac notch 2. Angular notch

(1) Cardiac orifice– is joined by the lower end of the esophagus. It lies behind the left 7th costal cartilage, one inch from its junction with the sternum, at the level of vertebrae T_{11}.

(2) Pyloric orifice– Opens into the duodenum. In on empty stomach and in supine position, it lies 1/2 inch to the right of the median plane, at the level of the lower border of vertebrae L_1 (Transpyloric plane).

(3) Lesser curvature– is concave and forms the right border of the stomach. It provides attachment to the lesser omentum. The most dependent part of the curvature is marked by the angular notch or incisura angularis.

(4) Greater curvature– is convex and forms the left border of the stomach. It provides attachment to the greater omentum, the gastrosplenic ligament and the gastrophrenic ligament. At its upper end the greater curvature presents the cardiac notch which separates it from the oesophagus.

(5) Anterior surface– Faces forwards and upwards.

(6) Posterior surface– Faces backwards and downwards.

(7) Cardiac notch

(8) Angular notch

(7) Subdivisions of the stomach–

- The stomach is divided into two parts–

  1. Cardiac part 2. Pyloric part

  By a line draw downwards and to the left from the angular notch.

- The large cardiac part is subdivided into the–

  1. Funds 2. Body

- The smaller pyloric part is sub divided into the–

  1. Pyloric antrum 2. Pyloric canal

1. **Funds–** The funds of the stomach is the upper convex dome shaped part situated above a horizontal line drawn at the level of cardiac orifice.

2. Body– The body of the stomach lies B/w the funds and the pyloric antrum. It can be distended excessive along the greater curvature.
3. Pyloric antrum– 7.5 cm. long. Extends from the angular notch. The pylorus is the tubular part of the stomach. It has a thick muscular wall called the pyloric sphincter.
4. Pyloric canal– 2.5 cm. long. The cavity of stomach is called pyloric canal. It is narrow and tubular. At its right end it terminates at the pylorus.

(8) Relations of stomach–

(A) Peritoneal relations– The stomach is lined by peritoneum on both its surface. At the lesser curvature it is in form of lesser omentum. At the greater curvature it is in form of greater omentum. Near the funds the two layers meet to form the gastro splenic ligament near the cardiac end on posterior surface. The peritoneum form the gastrophrenic ligament.

(B) Visceral relations–

I. Anterior surface–

is related to liver, diaphragm, anterior abdominal wall.

The diaphragm separates the stomach from 6-9th ribs.

II. Posterior surface–of the stomach is related to structures forming the stomach bed.

- **Stomach bed–** These structure are–
  - Diaphragm
  - Left kidney
  - Left suprarenal gland
  - Pancreas
  - Transverse mesocolon
  - Splenic flexure of the colon
  - Splenic artery

* Sometime the spleen is also included in the stomach bed.

(9) Interior of stomach–

The stomach wall composed four layers.

1. Mucosa
2. Submucosa
3. Muscularis
4. Serosa

* **Mucosa–** Innermost layer of the stomach.

(10) Arterial supply of stomach–

The arteries are derived from the branches of the coeliac trunk.

1. Left gastric artery–	Branch of coeliac trunk	
2. Right gastric artery–	"	" hepatic artery
3. 5-7 short gastric arteries–	"	" splenic artery
4. Left gastroepiploic artery–	"	splenic artery
5. Right gastroepiploic artery–	"	gastroduodenal branch of hepatic artery.

(11) Venous drainage– Portal vein

(12) Lymphatic drainage–

- Right gastric nodes
- Left gastric nodes
- Short gastric nodes
- Right gastro epiploic nodes

(13) Nerve supply–

- Sympathetic nerve– T_6-T_{10}
- Parasympathetic nerve– Vagus

(14) Applied aspect–

1. Trauma to the stomach.
2. Gastric ulcer– Common body of the stomach.
3. Gastric pain– is felt in the EPG.
4. Cancer of the stomach.
5. Gastroscopy.

(15) Ayurvedic aspect of stomach–

(१) **"आमानाम् अन्नानाम् आशयः इति आमाशयः ।"**

जो आम अन्न अर्थात् अधपके अन्न (Semidigested food) का आधार है, वह आमाशय कहलाता है।

(२) **"नाभिस्तनांतरे आमाशयः ।"**

नाभि और स्तनों के बीच आमाशय का स्थान है। अर्थात् नाभि और हृदय के बीच आमाशय का स्थान है।

(३) क्लेदक कफ का स्थान आमाशय है।

Small Intesting (क्षुद्रान्त्र)

(1) Introduction–

- The small intestine is the longest part of the alimentary canal.
- It extends from the pylorus of the stomach to the ileocaecal junction.
- The greater part of digestion and food absorption takes place in the small intestine.

(2) Size–

- It is about 6 meter long.
- The length is greater in males than in females.
- Greater in cadavers (due to loss of tone) than in the living.

(3) Division– It is divided into–

(A) An upper part– Fixed part, called the duodenum, which measures about 25 cm. in length.

(B) A lower part– Mobile part, forming a very long convoluted tube.

- The upper 2/5 of the mobile intestine are known as the jejunum and
- The lower 3/5 are known as the ileum.

- Upper part– Fixed part– (1) Duodenum– 25 cm.
- Lower part– Mobile part– (2) Jejunum–Upper 2/5=230 cm.
  (3) Ileum– Lower 3/5= 345 cm.

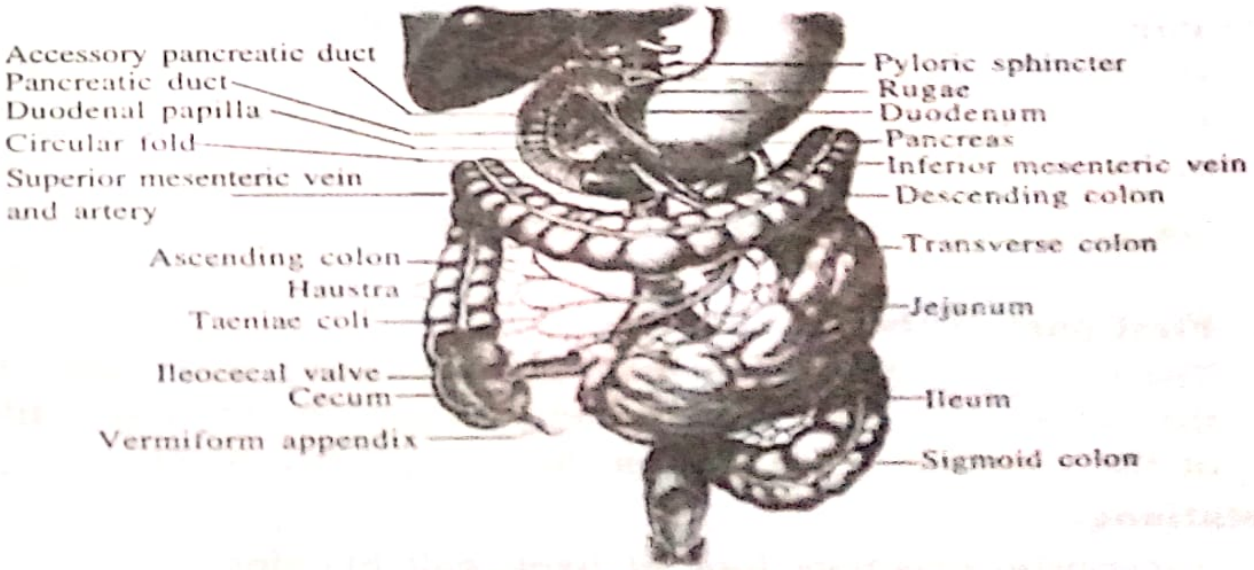

Fig. 1.32 Small intestine

(5) Duodenum (ग्रहणी)

(1) Introduction–

- The duodenum is a ⊆ shaped tube, about 10 inches long, that joins the stomach to the jejunum.
- The duodenum curves around the head of the pancreas.
- It receives the openings of the bile and pancreatic ducts.
- It is mostly retroperitoneal.

(2) Location–

- The duodenum lies above the level of the umbilicus opposite to vertebrae L_1-L_2-L_3. L_1-L_2-L_3
- Duodenum is situated in the epigastrium and umbilical region.

E P G
U M B

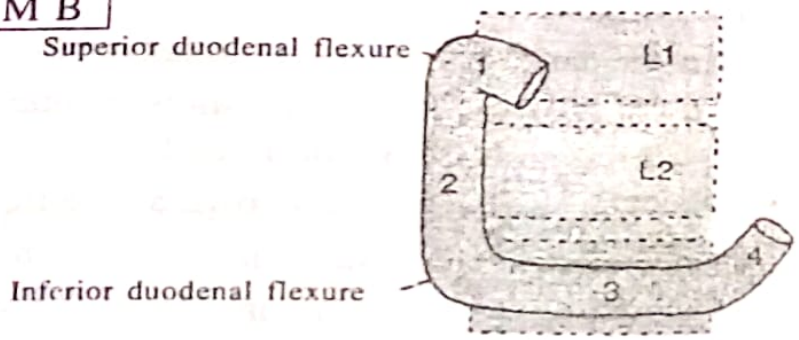

Fig. 1.33 Duodenum

(3) Parts of the duodenum– It have four parts.

1. First part of the duodenum– Superior part–2 inch or 5 cm.
2. Second part of the duodenum– Descending part–3 inch or 7.5 cm.
3. Third part of the duodenum– Horizontal part– 4 inch or 10 cm.
4. Fourth part of the duodenum– Ascending part–1 inch or 2.5 cm.

10 inch or 25 cm.

1. First part of the duodenum–

- The first part of the duodenum is 2 inch long and begins at the pylorus and runs upward and backward on the right side of the vertebrae L_1. It lies on the transpyloric plane.

Relations–

- Anteriorly– Quadrate lobe of liver, gall bladder.

- Posteriorly– Lesser sac, gastroduodenal artery, bile duct, portal vein, inferior venacava.
- Superiorly–Lesser sac.
- Inferiorly– Head and Neck of pancreas.

(2) Second part of the duodenum–

- It is 3 inch long. It begins at the superior duodenal flexure, and runs vertically downward infront of the hilum of the right kidney on the right side of the vertebrae L_2-L_3.
- About halfway down its medial border, the bile duct and the main pancreatic duct pierce the duodenal wall.

Relations–

- Anteriorly– Funds of gall bladder, right lobe of liver, transverse colon, coils of small intestine.
- Posteriorly– Hilum of right kidney, right ureter, inferior venacava.
- Laterally– Ascending colon, right colic flexure.
- Medially– Head of pancreas, bile duct, main pancreatic duct.

(3) Third part of the duodenum–

- It is 4 inch long. It begins at the inferior duodenal flexure on the right side of the lower border of vertebrae L_3.
- It passes almost horizontally and slightly upwards in front of the inferior venacava and ends by joining the 4th part in front of the abdominal aorta.

Relations–

- Anteriorly– Superior mesenteric vessels, root of mesentery.
- Posteriorly– Right ureter, right psoas major muscle, inferior venacava, abdominal aorta, right testicular and ovarian vessels.
- Superiorly– Head of pancreas with uncinate process.
- Inferiorly– Coils of jejunum.

(4) Fourth part of duodenum–

- It is 1 inch long. It runs upward and upto the upper border of the vertebrae L_2. Where it joins with duodenojejunal flexure.

Relations–

1. Anteriorly– Transverse colon, transverse meso colon, stomach.
2. Posteriorly– Left psoas major, left renal vessels, left testicular vessels.
3. Right– Root of mesentery.
4. Left– Left kidney, left ureter.
5. Superiorly– Body of pancreas

(4) Arterial supply of duodenum–

- The upper 1/2 is supplied by the– Superior pancreaticoduodenal artery.
- The lower 1/3 is supplied by the– Inferior pancreaticoduodenal artery.

(5) Venous drainage–

- Splenic vein
- Superior mesenteric vein
- Portal vein

(6) Lymphatic drainage–

- Pancreaticoduodenal nodes
- Hepatic nodes
- Superior mesenteric nodes
- Pyloric nodes
- Coeliac nodes

(7) Nerve supply–

- Sympathetic nerve– T_9-T_{10}
- Parasympathetic nerve– Vagus.

(8) Applied aspect–

1. P.U.D.– Peptic ulcer disease– Most occur in the pylorus or first part of duodenum. Where they are called duodenal ulcers.
2. Duodenal ulcers– First part of duodenum.
3. Duodenal cap.
4. Trauma to the duodenum.
5. Obstruction of the second part of duodenum.

(9) Ayurvedic aspect of duodenum–

१. "अग्नि अधिष्ठानम् अन्नस्य ग्रहणात् ग्रहणी मता ।"

अग्नि का स्थान होने से ग्रहणी अन्न को ग्रहण करती है, उसका पाचन करती है, इसी से इसे ग्रहणी कहा जाता है।

२. भगवान् धन्वन्तरि ने इसे पितधरा कला कहा है।

(6-7) Jejunum and Ileum (मध्यान्त्र और शेषान्त्र)

(1) Introduction–

- The upper 2/5 part of mobile intestine are known as the jejunum.
- And the lower 3/5 part are known as the ileum.
- The total length about 6 meter long.
- The jejunum begins at the duodenojejunal flexure.
- The ileum ends at the ileocaecal junction.
- The coils of jejunum and ilium are freely mobile and are attached to the posterior abdominal wall by a fan shaped fold of peritoneum known as the mesentery of the small intestine. The mesentery extends downwards and to the right from the left side of the vertebrae L_2 to the region of the right sacroiliac joint.

(2) Interior of the intestine– It has four layers.

1. Mucosa
2. Submucosa
3. Muscularis
4. Serosa

* **Large surface area–** For absorption of digested food a very large surface area is required.

(A) The great length of intestine– Absorption

(B) The presence of circular folds of mucous membrane, villi and microvilli.

* **Intestinal glands–** They secrete digestive enzymes and mucus. The duodenal glands (Brunner's glands) lie in the submucosa.

* **Lymphatic follicles–**
- Solitary lymphatic follicles
- Aggregated lymphatic follicles (Peyer's patches)

(3) Differences B/w jejunum and ileum–

Features	Jejunum	Ileum
1. Location	• Around the umbilicus region. • Occupies upper and left parts of the intestinal area.	• Hypogastric and pelvic region. • Occupies lower and right parts of the intestinal area.
2. Wall	• Thicker and more vascular.	• Thinner and less vascular.
3. Lumen	• Wider and often empty	• Narrower and often loaded.
4. Mesentery	• Windows present • Fat less abundant • Arterial arcades, 1 or 2 • Vasa recta longer and fewer.	• No windows • Fat more abundant • Arterial arcades,3 or 6 • Vasa recta shorter and more numerous.
5. Valve of kerkring	• Larger and more closely set.	• Smaller and sparse.
6. Villi	• Large, thick and more abundant.	• Shorter, thinner and less abundant.
7. Solitary lymphatic follicles (S.L.F.)	Fewer	• More numerous
8. Aggregated lymphatic follicles(A.L.F.) or peyer's patches	Absent	• Present

(4) Arterial supply–

- Branches from the superior mesentric artery.

(5) Venous drainage– Superior mesenteric vein.

(6) Lymphatic drainage–
- Superior mesenteric nodes.
- Aortic nodes.

(7) Nerve supply–

- Sympathetic nerve– T9-T11
- Parasympathetic nerve– Vagus nerve.

(8) Applied aspect–

- It may cause intestinal obstructions.
- Acute inflammation.

Difference B/w the small and large intestine

Features	Small intestine	Large intestine
1. Appendices epiploicae	Absent	Present
2. Taeniae coli	Absent	Present
3. Sacculations (Haustrations)	Absent	Present
4. Calibre (Diameter)	Larger	Smaller
5. Fixity	Greater part is freely mobile	Greater part is fixed
6. Villi	Present	Absent
7. Transverse mucosal fold	Permanent	Obliterated when longitudinal muscles coat relaxes.
8. Peyer's patches	Present in ileum	Absent

Large Intestine (बृहदान्त्र)

(1) Introduction–

(1) The large intestine extends from the ileocaecal junction to anus.

(2) It is about 1.5 meter long.

(3) 6.5 cm. (2.5 inch) in diameter.

(4) It is divided in to the–

1. Caecum
2. Appendix
3. **Colon**–Ascending–Transverse–Descending–Sigmoid colon.
4. Rectum
5. Anal canal and anus

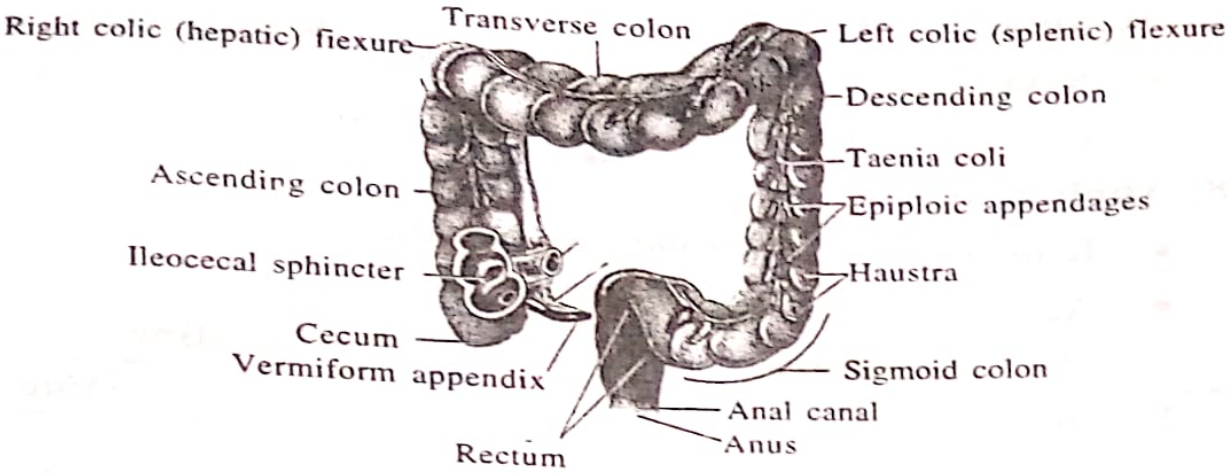

Fig. 1.34 Large intestine

(5) In the angle B/w the caecum and the terminal part of the ileum, there is a narrow diverticulum called the vermiform appendix.

(6) The primary function of the large intestine is the absorption of water and electrolytes and the storage of undigested material until it can be expelled from the body as feces.

(8) Caecum (उण्डुक या पुरीषाधार)

(1) Introduction–

- This is a large blind sac forming the commencement of the large intestine.
- It is situated in the right iliac fossa.
- It communicates superiorly with the ascending colon. Medially at the level of caecocolic junction with the ileum and postero-medially with the appendix.
- It is 2.5 inches (6 cm.) long and 3 inches (7.5) cm. broad.
- It is one of those organs of the body that have greater width than the length (another example is the prostate).

(2) Relations–

- Anteriorly– Coils of small intestine and anterior abdominal wall in the right iliac region.
- Posteriorly– Right psoas and iliacus muscles, femoral and lateral cutaneous nerve of thigh, testicular artery, ovarian artery, right external iliac artery.
- The appendix is commonly found behind the caecum.

- Medially– The appendix arises from the caecum on its medial side.

(3) Types of caecum–

1. Conical type– 13%, where the appendix arises from the apex of the caecum.

2. Intermediate type– 9%, where the right and left caecal pouches are equal in size and the appendix arises from a depression B/w them.

3. Ampullary type– 78%, where the right caecal pouch is much larger than the left and the appendix arises from the medial side.

(4) Arterial supply– Anterior and posterior caecal artery.

(5) Venous drainage– Superior mesentery vein.

(6) Lymphatic drainage– Superior mesentery nodes.

(7) Nerve supply–
- Sympathetic nerve– T_{11}-L_1
- Parasympathetic nerve– Vagus

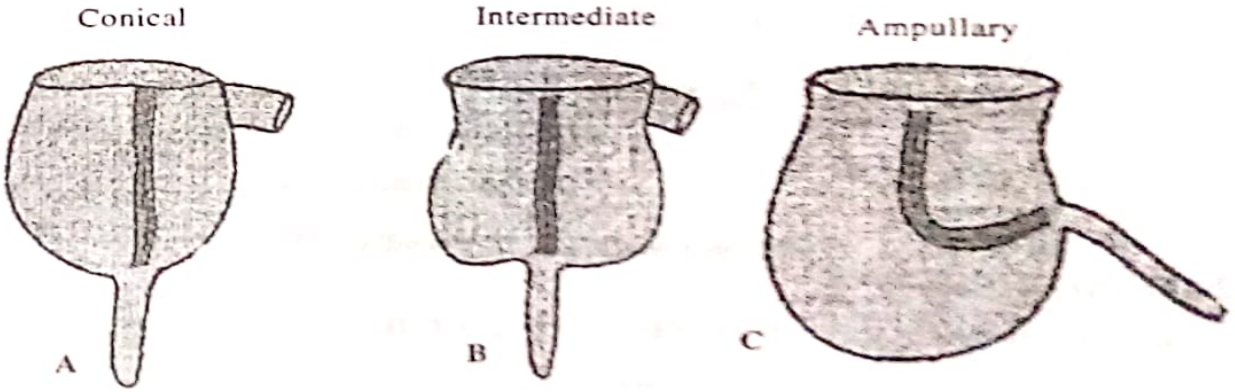

Fig. 1.35 Types of caecum

(8) Ileocaecal valve– A rudimentary structure.
- The lower end of ileum opens on the posteromedial aspect of the caeco-colic junction.
- The ileocaecal opening is guarded by the ileocaecal valve.
- **Structure of ileocecal valve–** The valve has two lips and two frenula.
- The upper lip is horizontal and lies at the ileocolic junction.
- The lower lip is longer and concave and lies at the ileocaecal junction.

- The two frenula are formed by the fusion of the lips at the ends of the aperture. These are the left (anterior) and right (posterior) frenula. The left end of the aperture is rounded and right end narrow and pointed.

(9) Vermiform appendix (उण्डुक पुच्छ या आन्त्रपुच्छ)

(1) Introduction–

- Vermis– worm, Appendix– appendage.– Worm like structures.
- The appendix is a narrow, muscular tube containing a large amount of lymphoid tissue.
- This is a worm like diverticulum arising from the posteromedial wall of the caecum.
- About 2 cm. below the ileocaecal orifice.

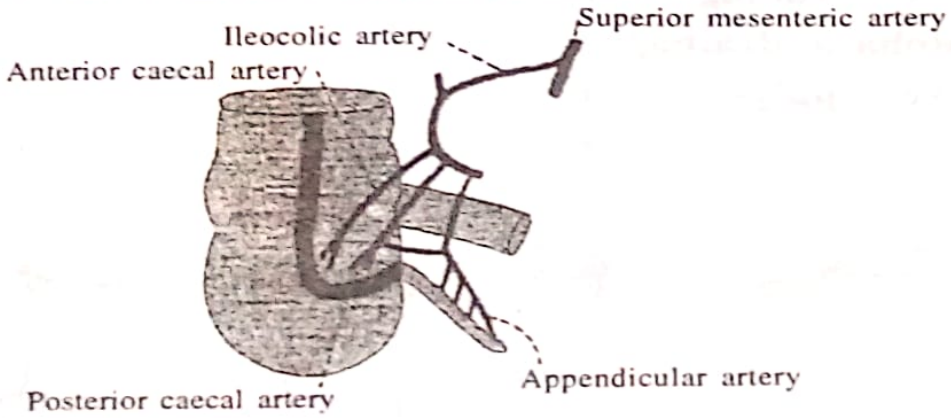

Fig. 1.36 Caecum and appendix

(2) Dimensions–

- The length varies from– 2 to 20 cm.
  Average lengh– 9 cm.
- Diameter is about– 5 mm.
- It is longer in children than in adults.

(3) Position–

- The appendix lies in the right iliac fossa.
- The base of the appendix is fixed. The tip can point in any direction.

1. It may lie behind the caecum (Retrocaecal)– 60%– First common position.
2. It may descend in to the pelvis– 30%– Second common position.
3. Subcaecal– Inferior to the caecum.

4. Preileal– Infront of the terminal ileum.
5. Postileal– Behind the terminal ileum.

(4) Appendicular orifice– Posteromedial aspect of caecum 2 cm. below the ileocaecal orifice.

(5) Surface marking–

- Rt. side draw a line joining the anterior superior iliac spine to the umbilicus. B/w medial 2/3 and lateral 1/3, that is called **MC Burney's point.**
- The base of the appendix is marked by a point 2 cm. below the junction of the transtubercular and right lateral planes.

(6) Peritoneal relations–

- The appendix is suspended by a small, triangular fold of peritoneum, called the mesoappendix or appendicular mesentery.

(7) Arterial supply– Appendicular artery.

(8) Venous drainage– Appendicular vein.

(9) Lymphatic drainage–

- Appendicular nodes
- Ileocolic nodes

] Superior mesenteric nodes.

(10) Nerve supply–
- Sympathetic nerve– T9-T10
- Parasympathetic nerve– Vagus.

(11) Applied aspect–

- **Appendicitis–** Inflammation of the appendix is known as appendicitis. In this condition it is usually necessary to remove the appendix.
- **Appendicectomy–** The operation for removal of the appendix is called appendicectomy.
- **Diagnosis–** Pain – First umbilicus region.
  – Than right iliac fossa.
  – MC burney's point is the site of maximum tenderness and pain in appendicitis.

* The human appendix is often regarded as a vestigeal organ of no functional importance.

(10) Colon (आन्त्र)

- It has four parts.

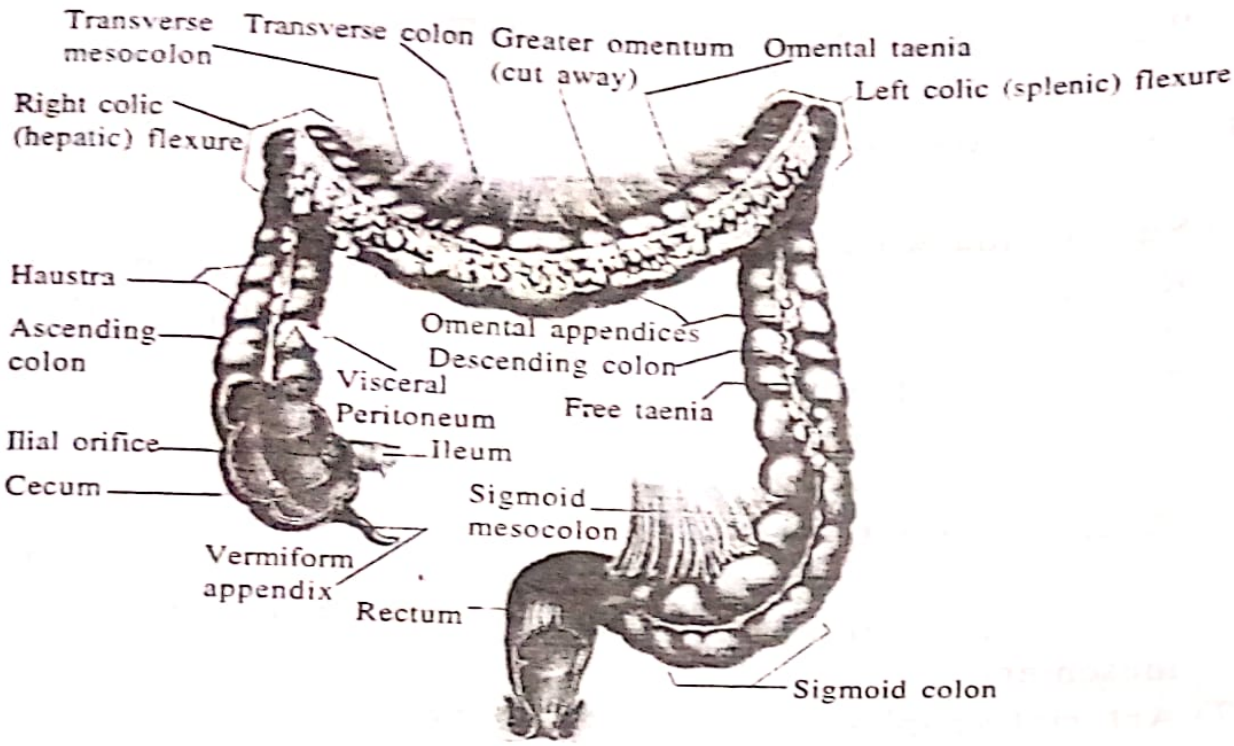

Fig. 1.37 Colon

(1) Ascending colon– आरोही वृहदान्त्र

(2) Transverse colon– अनुप्रस्थ वृहदान्त्र

(3) Descending colon–अवरोही बृहदान्त्र

(4) Sigmoid colon (pelvic)– श्रोणि वृहदान्त्र या अवग्रह बृहदान्त्र

(1) Ascending colon (आरोही वृहदान्त्र)

(A) Introduction–

- It is about 5 inches long.
- It extends from the caecum to the inferior surface of the right lobe of the liver.
- It turns to the left, forming the right colic flexure.

(B) Relations–

- Anteriorly– Coils of small intestine, greater omentum, anterior abdominal wall.
- Posteriorly– Iliacus, quadratus lumborum, transverse abdominis, right kidney.

Right colic flexure (Hepatic flexure)

- This flexure lies at the junctions of the ascending and transverse colon.

(2) Transverse colon (अनुप्रस्थ बृहदान्त्र)

(A) Introduction–

- It is about 20 inches long.
- It extends across the abdomen from the right colic flexure to the left colic flexure.
- Actually it is not transverse but hangs downward, suspended by the transverse mesocolon from the pancreas.

(B) Relations–

- Anteriorly– Greater omentum, anterior abdominal wall.
- Posteriorly– Second part of duodenum, head of pancreas, coils of jejunum and ileum.

Left colic flexure (Splenic flexure)

- This flexure lies at the junction of the transverse and descending colon.

(3) Descending colon (अवरोही बृहदान्त्र)

(A) Introduction–

- It is about 10 inches long.
- It extends from the left colic flexure to the sigmoid colon.
- It becomes continues with the sigmoid colon.

(B) Relations–

- Anteriorly– Coils of small intestine, greater omentum, anterior abdominal wall.
- Posteriorly– Iliacus, quadratus lumborum, transversus abdominis, left kidney.

(4) Sigmoid colon (Pelvic colon) (श्रोणि वृहदान्त्र या अवग्रह वृहदान्त्र)

(A) Introduction–

- It is about 15 inches long.
- It extends from the pelvic brim to the vertebrae S_3. Where it becomes the rectum.

(B) Relations–

- Superiorly– Terminal coils of ileum.
- Inferiorly–
  - Urinary bladder in male.
  - Urinary bladder and uterus in female.

- Posteriorly– Ureter, internal iliac artery, piriformis

* **Arterial supply–**

* **Branches of superior mesenteric artery** – Caecum, ascending colon, right 2/3 of transverse colon.

↓

1. Ileocolic artery– Appendix, caecum, lower 1/3 of ascending colon.
2. Right colic artery– Upper 2/3 of ascending colon.
3. Middle colic artery– Right 2/3 of transverse colon.

* **Branches of inferior mesenteric artery**– Left 1/3 of transverse colon, descending colon, sigmoid colon.

1. Left colic artery– Left 1/3 of transverse colon and descending colon.
2. Sigmoid artery– Sigmoid colon.

* **Venous drainage–**

- Superior and inferior mesentric vein.

* **Lymphatic drainage–**

- Ascending and transverse colon drain– Superior mesentric nodes.
- Descending and sigmoid colon drain– Inferior mesentric nodes.

* **Nerve supply–**
  - Sympathetic nerve– T_{10}–L_2, L_3
  - Parasympathetic nerve– Vagus

* **Applid aspect–**

1. Infection of small intestine– Enteritis.
2. Infection of colon– Colitis.
3. Bacterial infections– T.B. and typhoid fever or enteric fever.
4. Infection by parasites like entamoeba histolytica– Amoebiasis.
5. Trauma to the intestine.
6. Intestinal obstruction.
7. Cancer of colon.

(11) Rectum (मलाशय)

(1) Introduction–

- The rectum is the distal part of the large gut.
- It is placed B/w the sigmoid colon above and the anal canal below.

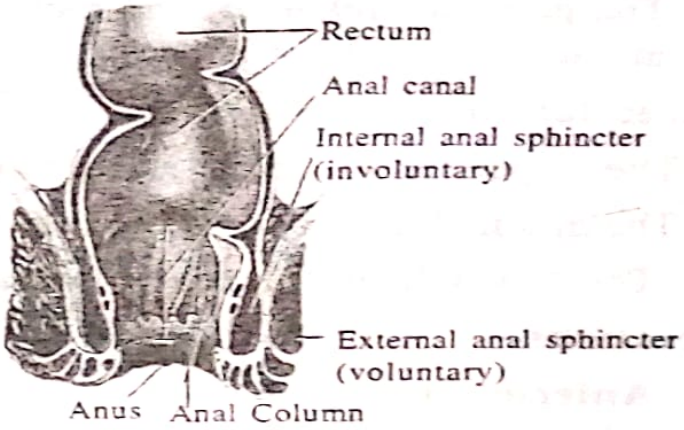

Fig. 1.38 Rectum anal canal and anus

- The rectum is situated in the posterior part of the lesser pelvis. Infront of the lower three pieces of the sacrum and the coccyx.
- It begins as a continuation of the sigmoid colon at the level of vertebrae S_3.
- The rectosigmoid junction is indicated by the lower end of the sigmoid mesocolon. The rectum ends by becoming continuous with the anal canal at the anorectal junction.
- The junction lies 2-3 cm. infront of and a little below the tip of coccyx.
- In male the junction corresponds to the apex of the prostate.
- The three cardinal feature of the large intestine are absent in the rectum (Sacculations, appendices epiploicae, taeniae)

(2) Dimension–

- The rectum is 12 cm. long. In the upper part it has the same diameter (4 cm.) as that of the sigmoid colon, but in the lower part is dilated to form the rectal ampulla.

(3) Course and directions–

- In its course, the rectum runs first downwards and backwards, than downwards and finally downwards and forwards.
- The beginning and the end of the rectum lie in the median plane, but it shows two types of curvatures in its course.

(A) Two anteroposterior curves– I. The sacral flexure of the rectum follow the concavity of the sacrum and coccyx.

II. The perineal flexure of the rectum is the backward bend at the anorectal junction.

(B) Three lateral curves–

I. The upper lateral curve is convex to the right.

II. The middle lateral curve is convex to the left and prominent.

III. The lower lateral curve is convex to the right.

(4) Relations–

(A) • **Anterior in males–** The upper 2/3 of the rectum are related to the rectovesical pouch. (with coils of intestine and sigmoid colon)

The lower 1/3 of the rectum is related to the base of the urinary bladder. The terminal part of the ureters, seminal vesicles, deferent ducts and the prostate.

• **Anterior in female–** Upper 2/3 of the rectum are related to the rectouterine pouch. The pouch separate the rectum from the uterus and from the upper part of vagina.

Lower 1/3 of the rectum is related to the lower part of vagina.

(B) Posterior– The relations are the same in the male and female. Lower three pieces of the sacrum, the coccyx and the anococcygeal ligament, piriformis, coccygeus and levator ani muscles.

• The median sacral, superior rectal, lower lateral sacral vessels.

(5) Arterial supply– • Superior and middle rectal artery.
• Median sacral artery.

(6) Venous drainage– Superior and middle rectal vein.

(7) Lymphatic drainage– • Inferior mesenteric nodes
• Internal iliac nodes.

(8) Nerve supply– • Sympathetic nerve– L_1-L_2
• Parasympathetic nerve– S_2-S_3-S_4

(9) Applied aspect–

• Prolapse of rectum.

• Digital examination (PR)– Per rectum

- Proctoscopy and sigmoidoscopy– Examination of rectum and anal canal.

(12, 13) Anal Canal and Anus (गुदनाल और गुद)

(1) Introduction–

- The anal canal is the lowest part of the alimentary canal.
- Above it is continuous with the lower end of the rectum.
- Below it opens to the exterior at the anus.
- The anal canal is about 4 cm. in length.
- It is distinctly narrower than the rectum.
- There is a sudden change in direction of the alimentary canal at the junction of the rectum with the anal canal.
- While the lower part of the rectum is directed downwards and forwards.
- The anal canal is directed downwards and backwards.
- The anorectal junction lies at the level of the pelvic diaphragm. (formed here by the levator ani muscles)
- The rectum lies above the diaphragm in the true pelvis.
- Where as the anal canal lies below the diaphragm in the perineum. (anterior triangle)

(2) Anus– The anus is the surface opening of the anal canal. Situated about 4 cm. below and infront of the tip of coccyx in the cleft B/w the two buttocks.

(3) Length– 4 cm.

(4) Relations–

- Anteriorly– In both sex– Perineal body.
  In male– Membraneous urethra and bulb of penis.
  In female– Lower end of vagina.
- Posteriorly– Ano coccygeal ligament and tip of coccyx.
- Laterally– Ischiorectal fossa.

(5) Interior of the anal canal–

- Interior of the anal canal may be considered in three parts.

  1. Upper part– About 15 mm. long.

II. Middle part– About 15 mm. long.

III. Lower part– About 10 mm long.

- Each part is lined by a characteristic epithelium and reacts differently to various diseases of this region.

(6) Arterial supply– • Superior rectal and inferior rectal artery.

(7) Venous drainage– • Internal rectal vein.
• External rectal vein.
• Anal vein.

(8) Lymphatic drainage– • Internal iliac nodes.
• Superficial inguinal nodes.

(9) Nerve supply– • Sympathetic nerve– L_1-L_2
• Parasympathetic nerve– S_2-S_3-S_4

(10) Applied aspect–

1. Internal piles
2. External piles
3. Anal fissure– Caused by rupture of one of the anal valves. Usually by the passes of dry hard stool in a constipated person.
4. Fistula in ano– A fistula is an abnormal epithelialized track connecting two cavities or one cavity with the exterior.

(14) Extra Hepatic Biliary Apparatus (यकृत के उपसर्गी उपकरण)

(1) Introduction of biliary apparatus–

- The biliary appartus collects bile from the liver, store it in the gall bladder, and transmits it to the second part of the duodenum.
- The apparatus consists of–

1. Right and left hepatic ducts– दक्षिण और वाम यकृत वाहिनियाँ
2. Common hepatic duct– सामान्य यकृत वाहिनी
3. Gall bladder– पित्ताशय
4. Cystic duct– पित्ताशय वाहिनी
5. Bile duct– पित्त वाहिनी

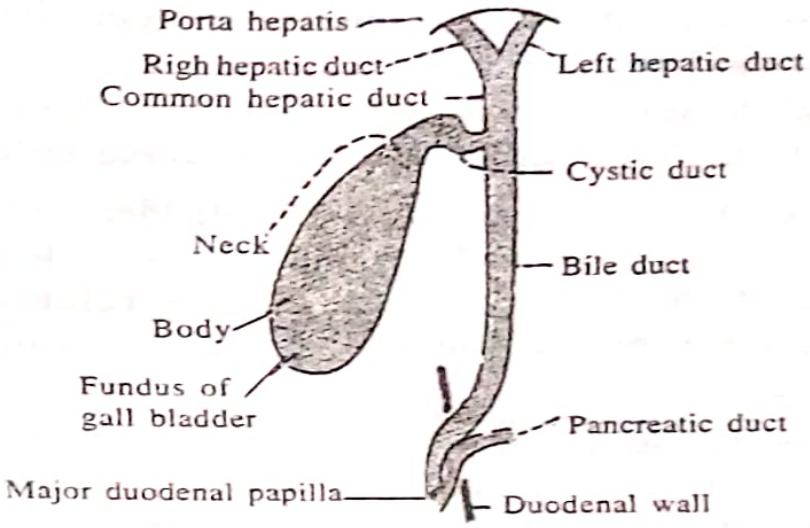

Fig. 1.39 Extrahepatic biliary apparatus

1. Hepatic Ducts (यकृत वाहिनियाँ)

- The right and left hepatic ducts emerge at the porta hepatis from the right and left lobes of the liver.

2. Common Hepatic Duct (सामान्य यकृत वाहिनी)

- It is formed by the union of the right and left hepatic ducts near the right end of the porta hepatis. It runs downwards for about 3 cm. and is joined on its right side (at an acute angle) by the cystic duct to the form the bile duct.

(3) Gall Bladder (पित्ताशय)– Gella-bile

1. **Shape–** pear shape
2. **Situation–** It is situated in a fossa on the inferior surface of the right lobe of the liver.
   - The fossa for the gall bladder extends from the right end of the porta hepatis to the inferior border of the liver.
3. - **Length–** 7-10 cm. (3-4 inch)
   - **Width–** 3 cm. broad at its widest part.
4. **Capacity–** - About 30-50 ml.
   - It is a reservoir of bile.
5. **Parts–** It is divided three parts.
   (A) Fundus (B) Body (C) Neck

(A) Fundus– is rounded and usually projects below the inferior margin of the liver. It is related anteriorly to the anterior abdominal wall at the level of the tip of the 9th costal cartilage. And posteriorly to the beginning of the transverse colon.

(B) Body– lies in the fossa for the gall bladder on the liver. The upper narrow end of the body is continuous with the neck at the right end of the porta hepatis. And is related to the beginning of the transverse colon and to the first and second part of duodenum.

(C) Neck– is the narrow upper end of the gall bladder. It is situated near the right end of the porta hepatis. It first curves anterosuperior and than posteroinferior to become continuous with the cystic duct. Join the right side of common hepatic duct to form bile duct.

- The posteromedial wall of the neck is dilated outwards to form a pouch (Hartmann's pouch). Which is directed downward and backward. Gall stone may lodged in this pouch.

(6) Relations–

- Anteriorly– Anterior abdominal wall and inferior surface of liver.
- Posteriorly– Transverse colon and first and second part of duodenum.

(4) Cystic Duct (पित्ताशय वाहिनी)

- It begins at the neck of the gall bladder, runs downwards, backwards and to the left. And ends by joining the common hepatic duct at an acute angle to form the bile duct. The mucous membrane of the cystic duct forms a series of 5 to 12 crescentic folds, arranged spirally to form the spiral valve (of heister). This is not a true valve.
- Cystic duct– length about 3-4 cm.

(5) Bile Duct (पित्त वाहिनी)

- It is formed by the union of the cystic and common hepatic ducts near the porta hepatis.
- It is 8 cm. long and has a diameter of about 6 mm.
- The bile duct runs downwards and backwards.

- Near the middle of the second part of the duodenum it comes in contact with the pancreatic duct and accompanies it through the wall of the duodenum.
- Within the wall the two ducts usually unite to form the hepato- pancreatic ampulla or ampulla of vater.
- The distal constricted end of the ampulla opens at the major duodenal papilla.

* **Arterial supply of biliary apparatus–**
  - Cystic artery, a branch of right hepatic artery.
* **Venous drainage**– Cystic vein drains directly into the portal vein.
* **Lymphatic drainage–** Cystic lymph nodes.
* **Nerve supply–**
  - Sympathetic nerve– T7-T9
  - Para sympathetic nerve–
    - Vagal fibers from the coeliac plexus.
    - Fibers of right phrenic nerve.
* **Applied aspect–**
  1. Cholecystitis–Inflammation of gall bladder.
  2. Cholelithiasis– Stone in gall bladder or biliary calculus.
  3. Cholecystography– Function can be investigation.
  4. Cholecystectomy– Removal the gall bladder.
  5. Lithotripsy
  6. Inflammation of gall bladder. The patient complains of pain over the **right hypochondrium**– Radiating to inferior angle of scapula or to right shoulder. When a finger is placed just below the costal margin, at the tip of the 9th costal cartilage, the patient feels sharp pain on inspiration. This is referred to as **murphy's sign.**
  7. Severe spasmodic pain, which is called biliary colic.

(15) Liver (यकृत)

(1) Introduction–

- The liver is also called 'Hepar'→ Hepatic.

- The liver is the heaviest or largest gland of the body.
- After the skin the second largest organ of the body.
- It secretes bile and performs various other metabolic function.

(2) Shape– Wedge shaped.

(3) Situation–

- Situated in the right upper quadrant of abdominal cavity.
- Whole of right hypochondrium, greater part of epigastrium, and extend left hypochondrium.

R.H.
E.P.G.
L.H.

- Most of the liver covered by ribs and costal cartilage.

(4) Colour– In living subject the liver is raddish brown.

(5) Weight– About 1600 gm in males.

1300 gm. in females.

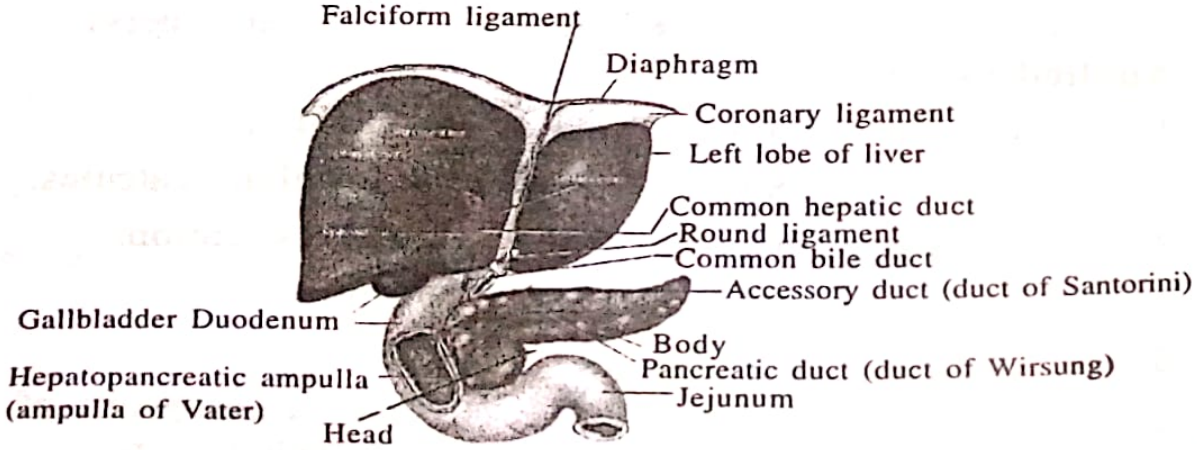

Fig. 1.40 Liver-Anterior view

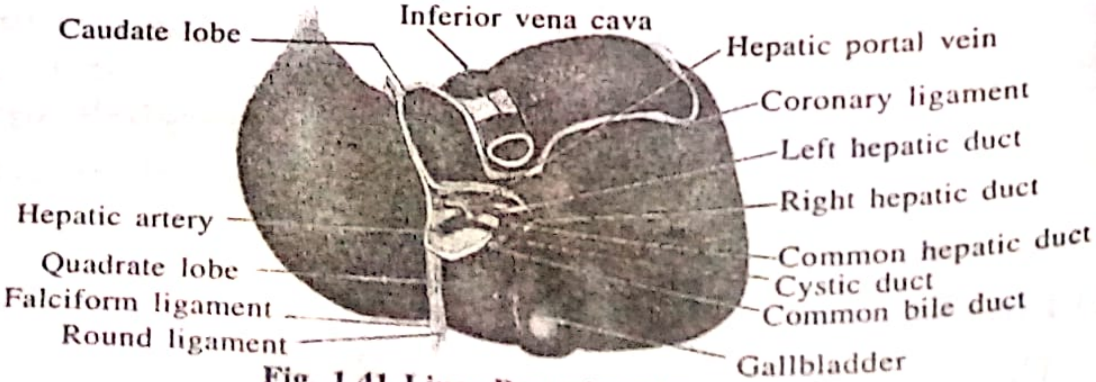

Fig. 1.41 Liver-Posterior view

(6) External features–

- **It has five surfaces–** 1. Anterior surface
  2. Posterior surface → 1. Diaphragmatic surface
  3. Superior surface
  4. Inferior surface → 2. Visceral surface
  5. Right surface
- **Three borders–** 1. Superior border 2. Inferior border 3. Right border
- Out of these the inferior surface is well defined because it is demarcated, anteriorly by a sharp inferior border.
- The sharp anterior part is marked by–
  - An inter lobar notch– For the ligamentum teres.
  - A cystic notch– For the fundus of gall bladder.

(7) Division of liver–

- The liver is divided two lobes.

  1. Right lobe 2. Left lobe

  By the attachment of–
- Anteriorly and posteriorly– Falciform ligament.
- Inferiorly– Fissure for ligamentum teres.
- Posteriorly– Fissure for ligamentum venosum.

1. Right lobe–

- Right lobe is much larger than the left lobe.
- Forms 5/6 part of the liver.
- It contributes to all the five surfaces of the liver.
- It present the caudate and quadrate lobes.

(A) Caudate lobe– is situated on the posterior surface. It is bounded on the–

- Right– by the groove of inferior venacava.
- Left– by fissure for ligamentum venosum.
- Inferior– by the transverse fossa of porta hepatis, just behind porta hepatis, caudate process.

- Above– It is continuous with the superior surface.

(B) Quadrate lobe– is situated on the inferior surface and is rectangular in shape. It is bounded by–

- Anterior– by inferior border.
- Posterior– by porta hepatis.
- On the left– by fissure for ligamentum teres.
- On the right– by fossa for gall bladder.

* **Porta-hepatis–**is a deep, transverse fissure about 2 inch long.
  - Situated on the inferior surface of the right lobe of liver.
  - It lies B/w the caudate lobe above and quadrate lobe below.

Contents– From behind forward–

Portal vein– hepatic artery– right and left hepatic duct– few lymphatics– hepatic plexus of nervs.

V–A–D–L–N

(2) Left lobe– of the liver is smaller than the right lobe. And forms 1/6 of the liver.

(8) Relations–

(A) Peritoneal relations– Most of the liver is covered by peritoneum. The area not covered by peritoneum–

1. A triangular bare area–on the posterior surface of the right lobe.
2. Groove for inferior venacava.
3. Fossa for gall bladder.
4. Porta hepatis.

- A number of peritoneal fold are attached to the liver. These fold are called ligaments.
  1. The falciform ligament– Anterosuperior surface.
  2. Left triangular ligament– Superior surface of left lobe.
  3. Right triangular ligament– Posterior surface of right lobe.
  4. Coronary ligament– Having superior and inferior layer which enclose bare area of liver.

(B) Visceral relations–

1. Anterior surface–

- This surface is triangular and slightly convex.

- It is related to xiphoid process, diaphragm on each side, falciform ligament is attached to this surface.

2. **Posterior surface–** It is triangular.
   - Its middle part deep concavity for vertebral column, bare area, right suprarenal gland, groove for inferior venacava, caudate lobe, ligamentum venosum, esophageal impression.
3. **Superior surface–** It is quadrilateral and shows a concavity in middle. This is cardiac impression, diaphragm.
4. **Inferior surface–** It is quadrilateral and is directed downwards, backwards and to the left.
   - Left lobe– Gastric impression.
   - Inferior border– Ligamentum teres.
   - Quadrate lobe– Pylorus.
   - Right lobe–Fossa of gall bladder, colic impression for the hepatic flexure of colon, renal impression for right kidney
   - Duodenal impression for second part of duodenum.
5. **Right surface–** It is quadrilateral and convex, related to the diaphragm.

(9) Arterial supply–

- Right and left hepatic artery– Branch of coeliac trunk– 30%.
- Portal vein– 70%.

(10) Venous drainage– Hepatic vein drain inferior venacava.

(11) Lymphatic drainage–
- Coeliac lymph nodes.
- Hepatic nodes.

(12) Nerve supply–
- Sympathetic nerve– Hepatic plexus.
- Parasympathetic nerve– Vagus.

(13) Applied aspect–

1. Hepatitis–
   - Inflammation of liver.
   - Viral infection.
2. Cirrhosis of liver–The liver tissue undergoes fibrosis and shrinks (Liver tissue damage).

3. Hepatic coma– Liver failure.

4. Tumour of liver– Hepatoadenoma, Hepatocarcinoma.

5. Percussion. 6. Biopsy. 7. Trauma.

(14) Ayurvedic aspect of liver–

(१) "गर्भस्य यकृत प्लीहानौ शोणितजौ ।" (सु.शा. ४/२५)

गर्भ के यकृत और प्लीहा रक्त से निर्मित होते हैं।

(२) यकृत हृदय के दक्षिण की ओर अधः प्रदेश में स्थित है।

(३) यकृत को रक्ताशय कहते हैं।

(४) यकृत को रक्तवह स्रोतस् का मूल स्थान माना गया है।

(16) Pancreas (अग्न्याशय)

(1) Shape– It is 'J' shaped.

It is soft, lobulated and elongated organ.

(2) Situation–
- It lies in the epigastrium and left upper quadrant.
- Situated transversly on the posterior abdominal wall.
- At the level of vertebrae L_1 and L_2.
- It crosses the transpyloric plane.
- The principal digestive gland situated below and behind the stomach.

(3) Weight– 90 gm. about.

(4) Size–
- Length– 15-20 cm.
- Width– 3 cm.
- Thickness– 2 cm.

(5) Types–

- The pancreas is a gland that is partly exocrine and partly endocrine.
- The Exocrine part secretes the digestive pancreatic juice and the endocrine part secretes hormones like insulin.

(6) Parts– It is divided four part.

1. Head 2. Neck 3. Body 4. Tail

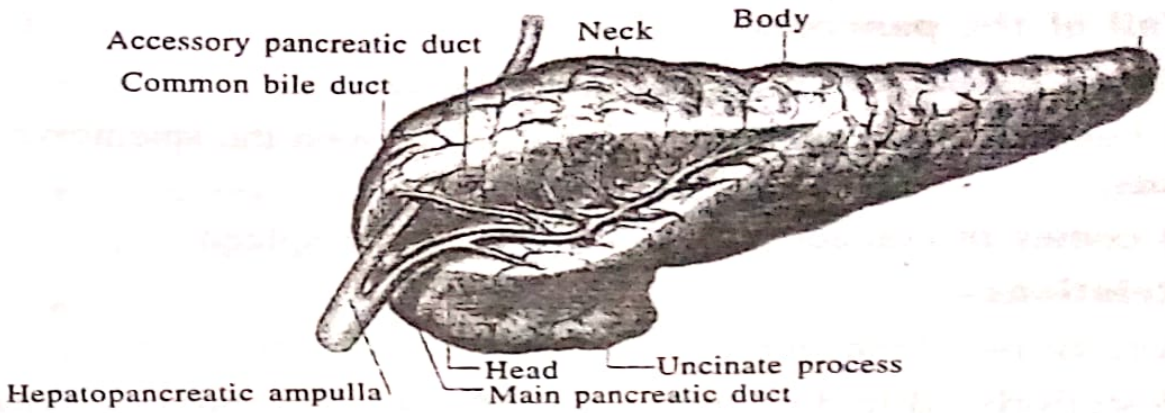

Fig. 1.42 Pancreas

1. Head of the pancreas–

- The head is enlarged and lies within the concavity of the duodenum.
- The head has **three borders–**

  1.Superior border 2.Inferior border 3.Right lateral border

  Two surfaces– 1. Anterior surface 2. Posterior surface

  One process– Uncinate process

2. Neck of the pancreas–

- This is the slightly constricted part of the pancreas B/w its head and body.
- It lies infront of the beginning of the portal vein and the origin of superior mesenteric artery from the aorta.
- It has two surfaces–1.Anterior surface 2. Posterior surface

3. Body of the pancreas–

- The body runs upwards and to the left across the midline.
- It is triangular in cross section.
- It extends from its neck to the tail.
- It has– **Three borders–**

  1. Anterior border 2. Superior border 3. Inferior border

  Three surfaces–

  1. Anterior surface 2. Posterior surface 3. Inferior surface
- Tuber omentale– A projection on the left of neck.

4. Tail of the pancreas–

- This is the narrow left end of the pancreas.
- It lies in the lienorenal ligament together with the splenic vessels.
- It comes in contact with the hilum of the spleen.

(7) Relations–

- Anterior– Transverse colon and mesocolon, stomach.
- Posteriorly– Bile duct, portal and splenic vein, inferior venacava, aorta, superior mesenteric artery, left psoas muscles. left suprarenal gland, left kidney and hilum of spleen.

(8) Duct of pancreas–

- The exocrine pancreas is drained by two ducts–

  1. Main pancreatic duct
  2. Accessory pancreatic duct

1. The main duct of the pancreas begins in the tail and runs the length of the gland, receiving numerous tributaries on the way. It open into the second part of the duodenum at about its middle with the bile duct on the major duodenal papilla. Some time the main duct drains separately into the duodenum.
2. Accessory duct of the pancreas when present, drains the upper part of the head and than opens into the duodenum a short distance above the main duct on the minor duodenal papilla. The accessory duct frequently communicates with the main duct.

(9) Arerial supply–

- Pancreatic branches of the splenic artery.
- Superior pancreatico duodenal artery.
- Inferior pancreaticoduodenal artery.

(10) Venous drainage–

- Splenic vein
- Superior pancreaticoduodenal vein.
- Inferior pancreaticoduodenal vein.

(11) Lymphatic drainage–

- Pancreaticosplenic lymph nodes.
- Coeliac lymph nodes
- Superior mesenteric lymph nodes.

(12) Nerve supply–

- Sympathetic nerve– Splanchnic plexus.
- Parasympathetic nerve– Vagus.

(13) Applied aspect–

1. Deficiency of insulin causes the disease diabetes mellitis.
2. Deficiency of pancreatic enzymes causes digestive disturbance.
3. Carcinoma is common in the head of the pancreas.
4. Pain from the pancreas is commonly referred to the back.
5. Pancreatitis– Inflammation of the pancreas.
6. Pancreatic tumours– Biliary obstruction and jaundice.

(17) Spleen (प्लीहा)

(1) Shape– Wedge shaped.
Sometimes tetrahedral in shaped.

(2) Situation–

- It is mainly lying in the left hypochondrium and partly in the epigastrium.
- B/w stomach and diaphragm and lateral to the liver.
- Largest single mass of lymphatic tissue in the body.
- It covered the 9 to 11th ribs.

(3) Colour– The spleen is dark purple in colour and soft, highly vascular.

(4) Weight–

- 7 ounces averge weight
- 180-300 gm.– (Averge weight– 150 gm.)

(5) Size– Length– 12 cm.= 5 inch
Width– 7 cm. = 3 inch
Thickness– 3 cm. = 1 inch

(A) Ends–

1. **Anterior end–** is expanded and is more like a border. It is directed downwards and forwards, and reaches the mid-axillary line.
2. **Posterior end–** is rounded. It is directed upwards, backwards and rests on the upper pole of left kidney.

(B) Borders–

1. Superior border– is present a notch near the anterior end.
2. Inferior border– is rounded.
3. Intermediate border– is also rounded and is directed to the right.

(C) Surfaces–

1. Diaphragmatic surface– is convex and smooth.
2. Visceral surface– is convex and irregular

(D) Visceral impression– It bears the following impressions–

1. **Gastric impression–** For the fundus of the stomach. It lies B/w the superior and intermediate borders.
   - It is the largest and most concave impression on the spleen.
2. **Renal impression–** • For the left kidney.
   It lies B/w the inferior and intermediate borders.
3. **Colic impression–** For the splenic flexure of the colon. Occupies a triangular area adjoining the anterior end of the spleen. Its lower part is related to the phrenicocolic ligament.
4. **Pancreatic impression–** For the tail of the pancreas.
   Lies B/w the hilum and the colic impression.
5. **Hilum–** Lies on the inferomedial part of the gastric impression, along the long axis of the spleen. It transmits the splenic vessels and nerves, and provides attachments to the gastro-splenic and lienorenal ligaments.

(7) Relations–

(A) Peritoneal relation–

The spleen is surrounded by peritoneum and is suspended by following ligaments.

- It is related to the 9th to 11th ribs.
- Normally the spleen is not palpable

1–3–5–7–9–11

(6) External features

(A) Two ends– 1. Anterior end 2. Posterior end

(B) Three borders– 1. Superior border 2. Inferior border
3. Intermediate border

(C) Two surfaces– 1. Diaphragmatic surface
2. Visceral surface

(D) Visceral impressions–

1. Gastric impression 4. Pancreatic impression
2. Renal impression 5. Hilum
3. Colic impression

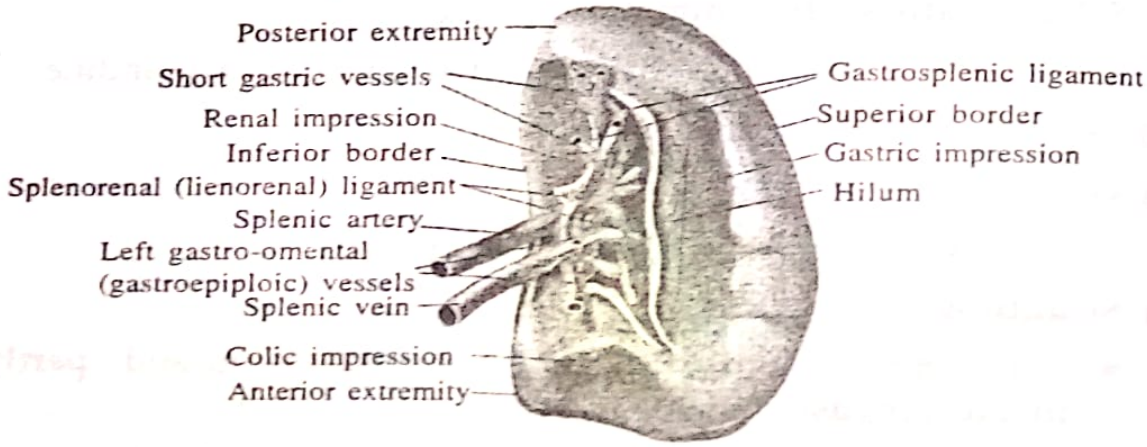

Fig. 1.43 Spleen-Visceral surface

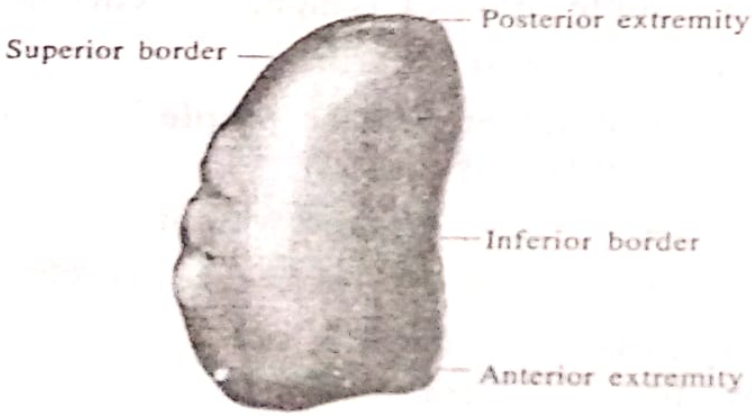

Fig. 1.44 Spleen-Diaphragmatic surface

(A) Ends–

1. **Anterior end–** is expanded and is more like a border. It is directed downwards and forwards, and reaches the mid-axillary line.
2. **Posterior end–** is rounded. It is directed upwards, backwards and rests on the upper pole of left kidney.

(B) Borders–

1. Superior border– is present a notch near the anterior end.
2. Inferior border– is rounded.
3. Intermediate border– is also rounded and is directed to the right.

(C) Surfaces–

1. Diaphragmatic surface– is convex and smooth.
2. Visceral surface– is convex and irregular

(D) Visceral impression– It bears the following impressions–

1. **Gastric impression–** For the fundus of the stomach. It lies B/w the superior and intermediate borders.
   - It is the largest and most concave impression on the spleen.
2. **Renal impression–** • For the left kidney.
   It lies B/w the inferior and intermediate borders.
3. **Colic impression–** For the splenic flexure of the colon. Occupies a triangular area adjoining the anterior end of the spleen. Its lower part is related to the phrenicocolic ligament.
4. **Pancreatic impression–** For the tail of the pancreas.
   Lies B/w the hilum and the colic impression.
5. **Hilum–** Lies on the inferomedial part of the gastric impression, along the long axis of the spleen. It transmits the splenic vessels and nerves, and provides attachments to the gastro-splenic and lienorenal ligaments.

(7) Relations–

(A) Peritoneal relation–

The spleen is surrounded by peritoneum and is suspended by following ligaments.

1. gastrosplenic ligament 2. Lienorenal ligament
3. Phrenicocolic ligament

(B) Visceral relation–

The diaphragmatic surface is related to the diaphragm, which separates the spleen from the pleura, (costo diaphragmatic recess) lung and 9,10,11th ribs of the left side.

The visceral surface is related to the fundus of the stomach, the anterior surface of the left kidney, the splenic flexure of the colon and the tail of pancreas.

(8) Arterial supply– Splenic artery– Branch of coeliac trunk.

(9) Venous drainage– Splenic vein

(10) Lymphatic drainage–Splenic tissue proper has no lymphatics.

A few lymphatics arises from the connective tissue of capsule and trabeculae and drains– Pancreatico splenic lymph nodes.

(11) Nerve supply– Sympathetic fibres are derived from the coeliac plexus.

(12) Function– 1. Phago cytosis 2. Haemopoiesis
3. Storage of RBC

(13) Applied aspect– Splenomegaly– Enlargment of spleen is called splenomagaly.

(14) Ayurvedic aspect of spleen–

(१) "गर्भस्य यकृत प्लीहानौ शोणितजौ ।" (सु.शा. ४/२५)

गर्भ के यकृत और प्लीहा रक्त से निर्मित होते हैं।

(२) प्लीहा हृदय के वाम ओर अधः प्रदेश में स्थित है।

(३) प्लीहा को रक्ताशय कहते हैं।

(४) प्लीहा को रक्तवह स्रोतस् का मूल स्थान माना गया है।

(D) Urinary system (मूत्रवह संस्थान)

- मूत्रवह संस्थान के अवयव निम्नलिखित है–

(1) Kidneys– वृक्कौ (3) Urinary bladder– मूत्राशय या वस्ति

(2) Ureters– गवीनियाँ (4) Urethra– मूत्रमार्ग

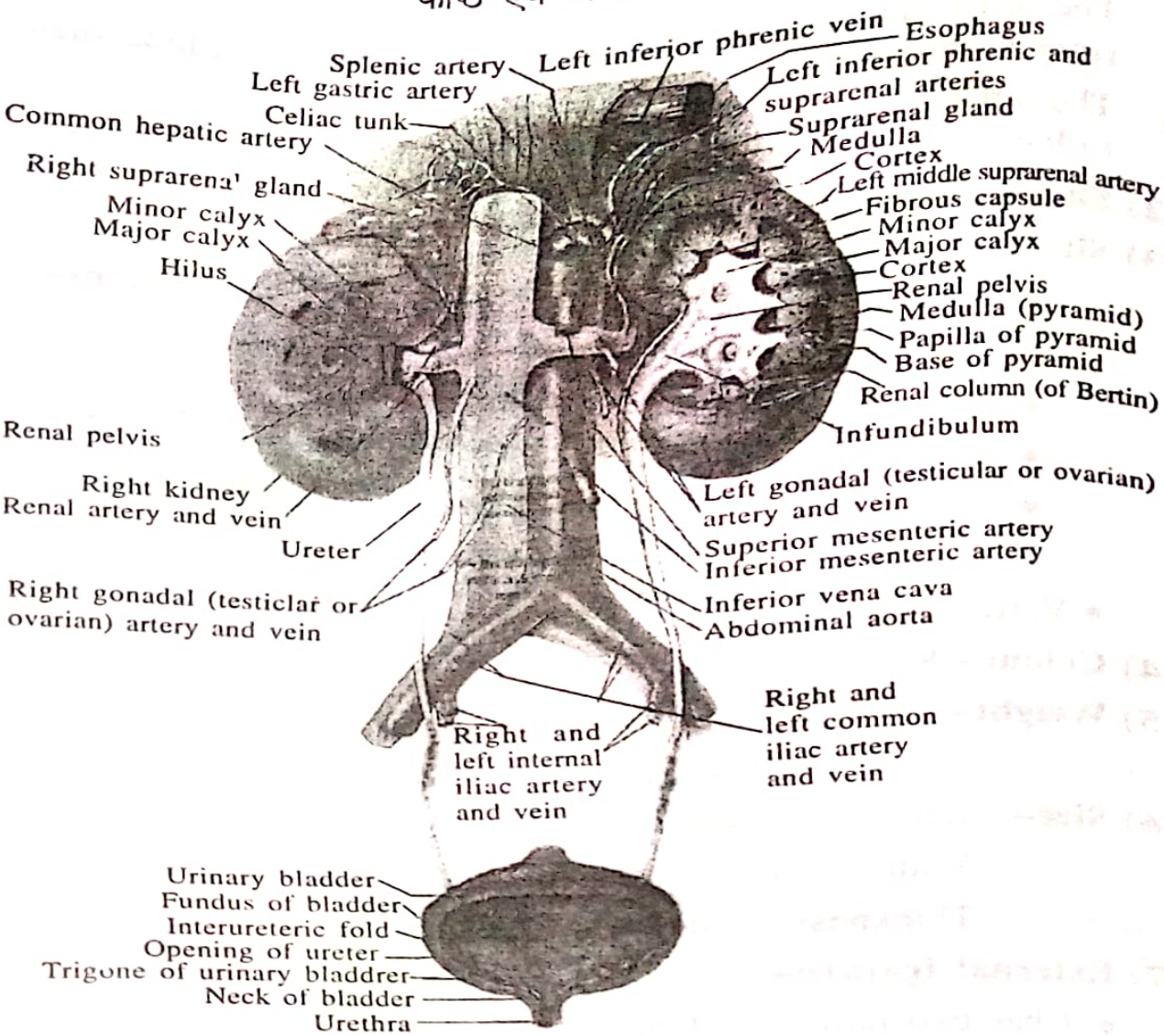

Fig. 1.45 Urinary system

(1) Kidneys (वृक्कौ)

(1) Introduction–

- Renes– Renal
- Nephros– Nephron, Nephritis
- The kidney are a pair of excretory organs situated on the posterior abdominal wall, one on each side of the vertebral column. Behind the peritoneum.
- They remove waste products of metabolism and excess of water and salt from the blood and maintain its Ph.
- The right kidney lies slightly lower than the left kidney because of the large size of the right lobe of the liver.

- The left kidney is a little nearer to the median plane than right kidney.
- The left kidney is a little longer and narrower than the right kidney.

(2) Shape– Bean shaped.

(3) Situation– • The kidneys occupy the following regions–

- Epigastrium– EPG
- Right hypochondric– RH
- Left hypochondric– LH
- Umbilical– UMB
- Right lumbar– RL
- Left lumbar– LL

RH	EPG	LH
RL	UMB	LL

* Vertebral level– T_{11}–L_3

(4) Colour– Raddish brown.

(5) Weight– 150 gm. in male.
135 gm. in female.

(6) Size– Length– 11 cm.
Width– 6 cm.
Thickness– 3 cm.

(7) External feature–

- It has two poles– 1. Upper pole 2. Lower pole
- Two borders– 1. Medial border 2. Lateral border
- Two surfaces– 1. Anterior surface 2. Posterior surface

Poles

1. **Upper pole–** It is broad and is in close contact with the corresponding suprarenal glands. Closer to the median plane.
2. **Lower pole–** It is narrow.

Borders

1. **Medial border–** It is concave. Its middle part shows a depression called the hilum.

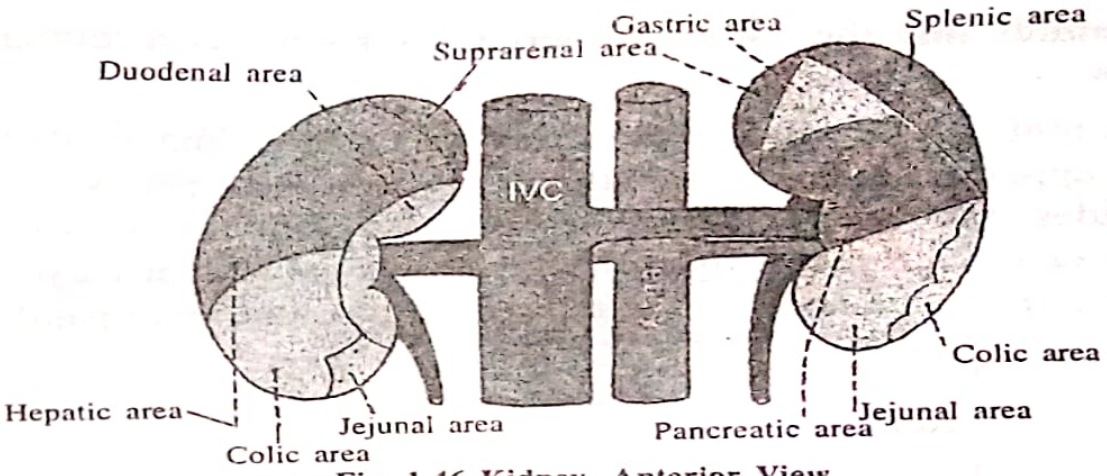

Fig. 1.46 Kidney- Anterior View

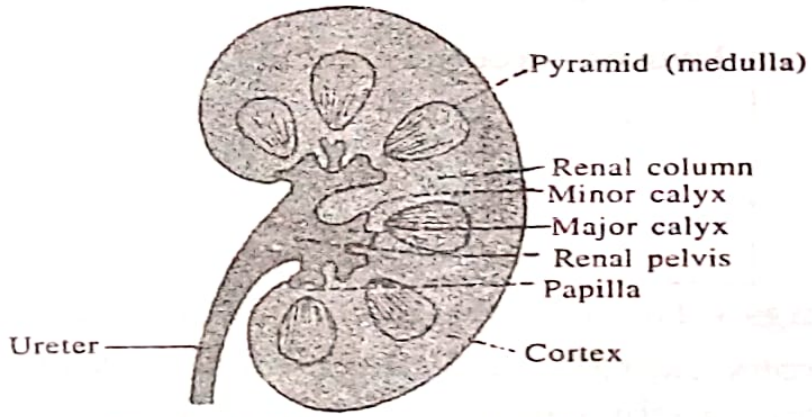

Fig. 1.47 Kidney- coronal section

- The following structure are seen in the hilum from anterior to posterior– **Renal vein– Renal Artery– Renal pelvis** (expanded upper end of ureter)

2. **Lateral Border–** It is convex.

Surfaces–

1. **Anterior surface–** is irregular.
2. **Posterior surface–** is flat.

(8) Renal structure–

- Each kidney has a dark brown outer cortex and a light brown inner medulla. The medulla is composed of about a dozen renal pyramids, each having its base oriented toward the cortex and its apex, the renal papilla, projecting medially. The cortex extends into the medulla B/w adjacent pyramids as the renal columns. Extending from the bases of the renal

pyramids into the cortex are striations known as medullary rays.

- The renal sinus, which is the space within the hilum, contains the upper expanded end of the ureter, the renal pelvis. This divides into two major calyces, each of which divides into two or three minor calyces. Each minor calyces or calyx is indented by the apex of the renal pyramid, the renal papilla.

Ureter
|
Renal pelvis
|
Two major calyx
|
Two or three minor calyx
|
Renal papilla
|
Medullary pyramid
|
Renal Cortex

(9) Coverings– The kidneys have the following coverings.

1. Fibrous capsule– This surrounds the kidney and is closely applied to its outer surface.
2. Perirenal fat– This covers the fibrous capsule.
3. Renal fascia– This is a condensation of connective tissue that lies out side the perirenal fat and enclose the kidneys and suprarenal glands.
4. Pararenal fat– This lies external to the renal fascia and is often in large quantity. It forms part of the retroperitoneal fat.

* The perirenal fat, renal fascia, pararenal fat support the kidneys and hold them in position on the posterior abdominal wall.

(10) Relations–

Right kidney–

1. Anteriorly– The suprarenal gland, the liver, the second part of the duodenum and the right colic flexure.
2. Posteriorly– The diaphragm, the costodiaphragmatic recess of the pleura, the twelth rib. The psoas, quadratus lumborum,

transversus abdominis muscles. The subcostal, iliohypogastric and ilioinguinal nerves run downwards and laterally.

Left kidney–

1. Anteriorly– The suprarenal gland, the spleen, the stomach, the pancreas, the left colic flexure and coils of jejunum.
2. Posteriorly– The diaphragm, the costodiaphragmatic recess of the pleura, the eleventh rib. The psoas, quadratus lumborum, transversus abdominis muscles. The subcostal, iliohypogastric and ilioinguinal nerves run downwards and laterally.

(11) Blood supply– Renal arteries.

(12) Venous drainage– Renal veins.

(13) Lymphatic drainage– Lateral aortic nodes.

(14) Nerve supply– Renal plexus. (T_{10}-L_1)

(15) Applied aspect–

(A) Anomalies of formation–

1. Aplasia– Incomplete development of a tissue.
2. Hypoplasia– The kidney may be under development.
3. Hyperplasia– The kidney may be over development.

(B) Anomalies of shape–

1. Horse shoe shape kidney–The lower poles of kidneys may be fused, horse shoe shape kidney.
2. Pancake kidney– The two kidney may form one mass lying in the midline.

(C) Anomalies of position–

- The kidneys may lie in the sacral region or in the lower lumbar regions because of the failour of normal ascent.

(D) Congenital polycystic kidney–The kidney may be full of cysts.

(E) 1. Pyelocystitis– Inflammation of renal pelvis and bladder.
2. Pyelitis or pyelonephritis– Inflammation and infection of the pelvis of the kidney.
3. Nephritis– Inflammation of kidney.
4. Pyelonephrosis– Any disease of renal pelvis.

5. Pyelogram or pyelography– Radiograph of renal pelvis and bladder.
6. Renal colic– Severe pain in flank.
7. Renal calculi–" " "
8. Kidney tumours
9. Operations for removal of renal calculi–
   - Pyelo lithotomy
   - Nephro lithotomy
   - Partial nephrectomy
   - Nephrectomy
   - Lithotripsy
10. Renal failure and renal transplantation.
11. Haemodialysis– is life saving process but has to be repeated every few days.

16. Ayurvedic aspect of kidneys–

"रक्तमेदः प्रसादाद् वृक्कौ ।" (सु.शा. ४/३०)

रक्त और मेद के प्रसाद भाग से दोनों वृक्क बनते हैं।

(2) Ureters (गवीनियाँ)

(1) Introduction–

- The ureters are a pair of narrow, thick walled long muscular tubes, which convey urine from the lower end of renal pelvis to the urinary bladder.

(2) Situation–

- They lie deep to the peritonuem.
- Posterior abdominal wall in the upper part.
- Lateral pelvic wall in the lower part.

(3) Measurment– Each ureter is about 10 inches or 25 cm. long.

* 5 inches– Upper half lie in abdomen.
* 5 inches– Lower half lie in pelvis.
* Diameter– 3 mm. but it is slightly constricted at three places, called normal constrictions.

Normal constrictions–

1. Pelvi ureteral junction.

2. Brim of lesser (True) pelvic.
3. Passage through the bladder wall.

(4) Course–

The ureter begins within the renal sinus as a funnel-shaped dilation, called the renal pelvis. The pelvis issues from the hilus of the kidney, descends along its medial margin or partly behind it. Gradually it narrows till at the lower end of the kidney. It becomes the ureter proper.

- The ureter passes downwards and slightly medially on the psoas muscles and enters the pelvis by crossing infront of the termination of the common iliac artery.
- In the lesser (True) pelvis the ureter at first runs downwards and slightly backwards and laterally, following the anterior margin of the greater sciatic notch.
- Opposite the ischial spine it turns forwards and medially to reach the base of the urinary bladder.
- The ureter enters the bladder wall obliquely to open into it, at the lateral angle of its trigone.

(5) Relations–

Right ureter–

1. Anteriorly– The duodenum, the terminal part of the ilium, the root of the mesentery of the small intestine, the right colic and ileocolic vessels, the right testicular or ovarian vessels, and right genitofemoral nerve.
2. Posteriorly– The right psoas muscle, the bifurcation of the right common iliac artery.

Left ureter–

1. Anteriorly– The sigmoid colon and sigmoid mesocolon, the left colic vessels, the left testicular or ovarian vessels and left genito- femoral nerve.
2. Posteriorly– The left psoas muscles and bifurcation of the left common iliac artery.

(6) Blood supply–

- Upper part– Renal artery.

- Middle part–Testicular or ovarian artery.(Gonadals artery)
- Lower part– Superior vesical artery.

(7) Venons drainage–

- Upper part– Renal vein.
- Middle part– Testicular or ovarian vein.
- Lower part– Superior vesical vein.

(8) Lymphatic drainage–
- Lateral aortic nodes.
- Iliac nodes.

(9) Nerve supply–
- Sympathetic– T_{10}-L_1
- Parasympathetic– S_2-S_3-S_4

(10) Applied aspect–

1. Renal colic.
2. Ureteric stone.
3. Traumatic injury of ureter.
4. Duplication– Bifid ureter.
5. Pyelogram– X–ray K.U.B.

(3) Urinary bladder (मूत्राशय या बस्ति)

(1) Introduction– The urinary bladder is a hollow distensible muscular **reservior of urine.**

(2) Situation– Situation is variable.

- But mainly it is situated in the pelvic cavity posterior to the pubic symphysis.
- In male– It is directly anterior to the rectum.
- In female– It is anterior to the vagina and inferior to the uterus.

(3) Size, shape and position–

The urinary bladder varies in its size, shape and position according to the amount of urine.

* **Capacity–**
  - 220-320 ml.
  - Desire for passing urine is felt= 300 ml.
* **Maximum capacity–** 500 ml. in painful condition.
* **Shape–**
  - Empty bladder– Tetrahedral shape.
  - Full bladder– Pear shape.

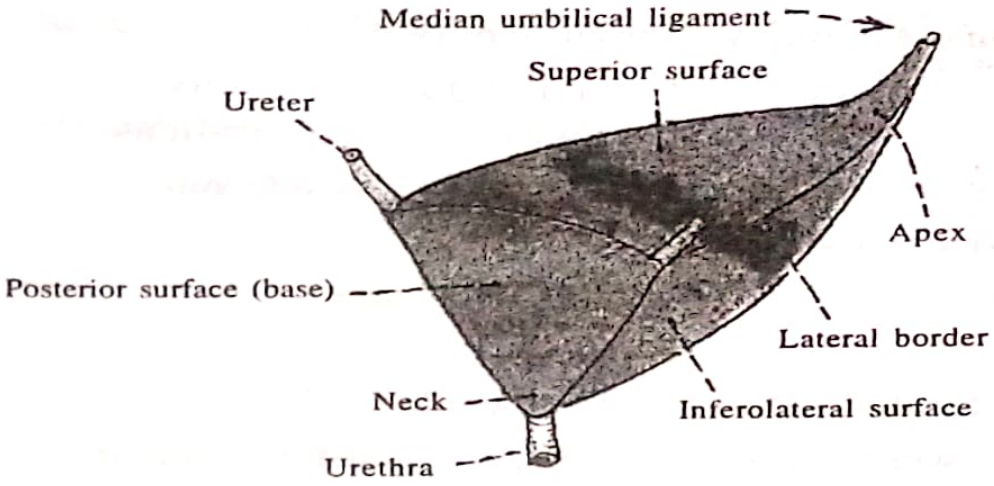

Fig. 1.48 Urinary bladder

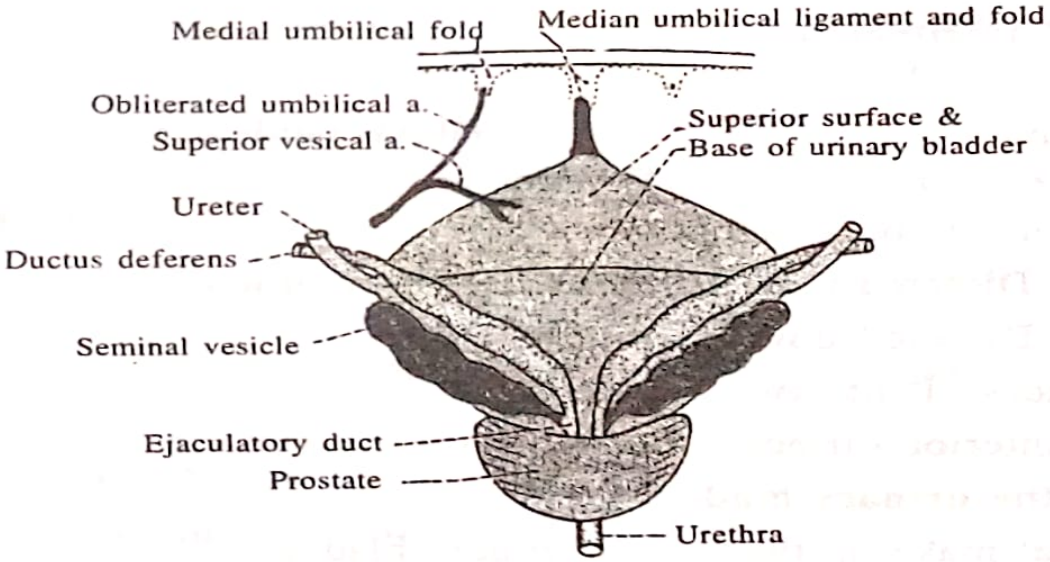

Fig. 1.49 Urinary bladder

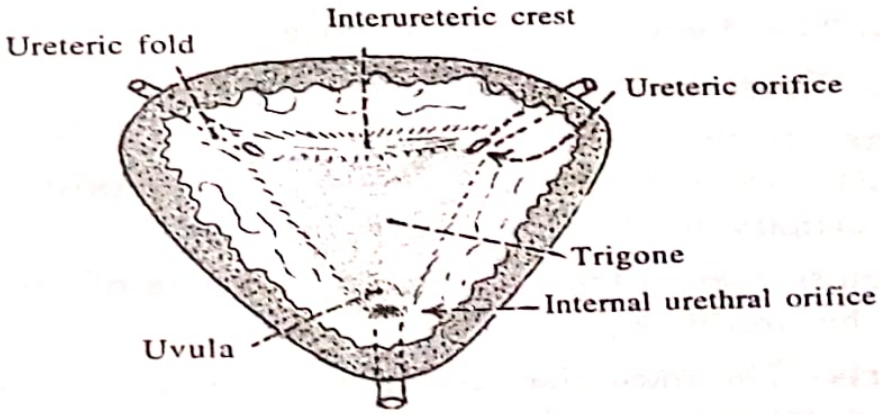

Fig. 1.50 Urinary bladder

III. Serosa– Over the superior surface of the urinary bladder is a layer of visceral peritoneum called the serosa.

(6) Relations–

1. Apex– Umbilicus by the median umbilical ligament.
2. Base–
   - In female– Uterine cervix and vagina.
   - In male– Upper part– Rectovesical pouch and coils of intestine.

     Lower part– Seminal vesicles and ductus deferens.
3. Neck–
   - In male– Base of prostate.
   - In female– Upper part of urethra.
4. **Surfaces– I. Superior surface**

   In male– Covered by peritoneum and contact with sigmoid colon. Coil of terminal ilium.

   In female– Covered by peritoneum except for uterine cervix, isthmus of uterus.

II. Inferolateral surfaces–

- In male– Pubis, puboprostatic ligament, levator ani, obturator internus.
- In female– Pubis, pubovesical ligament, levator ani, obturator internus.

(7) Blood supply– Superior and inferior vesical artery.

(8) Venous drainage– Vesical venous plexus.

(9) Lymphatic drainage– Iliac nodes.

(10) Nerve supply–
- Sympathetic– T_{11}–L_2
- Parasympathetic– S_2–S_3–S_4

(11) Applied aspect–

1. A distended bladder may be reptured by injuries of the lower abdominal wall.
2. Chronic obstruction to the outflow of urine causes hypertrophy of bladder. (enlargment prostate)
3. Urinary retention– Obstruction of urethra.

   Acute urethritis or prostatitis also responsible.

* **Position–** • Empty– Pelvic cavity.
  • Full– Extend abdominal cavity. Hypogastrium to umbilicus.

* It is an abdominal organ rather than a pelvic one.

(4) External feature–

(A) Empty urinary bladder is tetrahedral shape.

1. Apex– Directed forwards.
2. Base or fundus– Directed backwards.
3. Neck– Lowest and most fixed part of urinary bladder.
4. Surfaces– It has three surfaces.

I. Superior surface II. Right inferolateral surface
III. Left inferolateral surface

5. Borders– It has four borders.

I. Right lateral border II. Left lateral border
III. Anterior border IV. Posterior border

(B) Full bladder is pear shaped.

1. Apex– Directed upwards, towards the umbilicus.
2. Neck– Directed downwards.
3. Surfaces– It has two surfaces

I. Anterior surface II. Posterior surface

(5) Wall of the urinary bladder–

1. Three coat make up the wall of urinary bladder.

I. Mucosa II. Muscularis III. Serosa

I. Mucosa– The deepest coat is mucosa.

- **Rugae–** Folds in the mucosa are also present.
- **Trigone–** In the floor of the urinary bladder is a small triangular area called the trigone, or on the posterior wall of the urinary bladder.
- The ureters open at the upper lateral corners of the trigone. While the urethra opens at the lower angle.

II. Muscularis– The muscular coat of the bladder is composed of smooth muscles, and is arranged as three layers of interlacing bundles known as the **detrusor** muscle.

III. Serosa– Over the superior surface of the urinary bladder is a layer of visceral peritoneum called the serosa.

(6) Relations–

1. Apex– Umbilicus by the median umbilical ligament.
2. Base–
   - In female– Uterine cervix and vagina.
   - In male– Upper part– Rectovesical pouch and coils of intestine.

     Lower part– Seminal vesicles and ductus deferens.
3. Neck–
   - In male– Base of prostate.
   - In female– Upper part of urethra.
4. **Surfaces– I. Superior surface**

   In male– Covered by peritoneum and contact with sigmoid colon. Coil of terminal ilium.

   In female– Covered by peritoneum except for uterine cervix, isthmus of uterus.

II. Inferolateral surfaces–

- In male– Pubis, puboprostatic ligament, levator ani, obturator internus.
- In female– Pubis, pubovesical ligament, levator ani, obturator internus.

(7) Blood supply– Superior and inferior vesical artery.

(8) Venous drainage– Vesical venous plexus.

(9) Lymphatic drainage– Iliac nodes.

(10) Nerve supply–
- Sympathetic– T_{11}–L_2
- Parasympathetic– S_2–S_3–S_4

(11) Applied aspect–

1. A distended bladder may be reptured by injuries of the lower abdominal wall.
2. Chronic obstruction to the outflow of urine causes hypertrophy of bladder. (enlargment prostate)
3. Urinary retention– Obstruction of urethra.

   Acute urethritis or prostatitis also responsible.

I. **Prostatic urethra–** It is about 3 cm. long and passes through the prostate from the base to the apex. It is the widest and most dilatable portion of the urethra.

II. **Membranous urethra–** It is about 1 cm. long and lies within the urogenital diaphragm, surrounded by the sphincter urethrae muscle. It is the least dilatable portion of the urethra.

III. **Penile urethra–** It is about 16 cm. long and is enclosed in the bulb and the corpus spongiosum of the penis. The external meatus is the narrowest part of the entire urethra. The part of the urethra that lies within the glans penis is dilated to form the fossa terminalis. The bulbourethral glands open into the penile urethra below the urogenital diaphragm.

(B) Female urethra (स्त्री मूत्रमार्ग)

- The female urethra is about 1.5 inch long. It extends from the neck of the bladder to the external meatus, where it opens into the vestibule about 1 inch below the clitoris. It traverses the sphincter urethrae and lies immediately infront of the vagina. At the side of the external urethral meatus are the small openings of the ducts of the paraurethral glands. The urethra can be dilated relatively easily.

(E) Male reproductive or male genital organs (पुरूष जननांगों का रचनात्मक वर्णन)

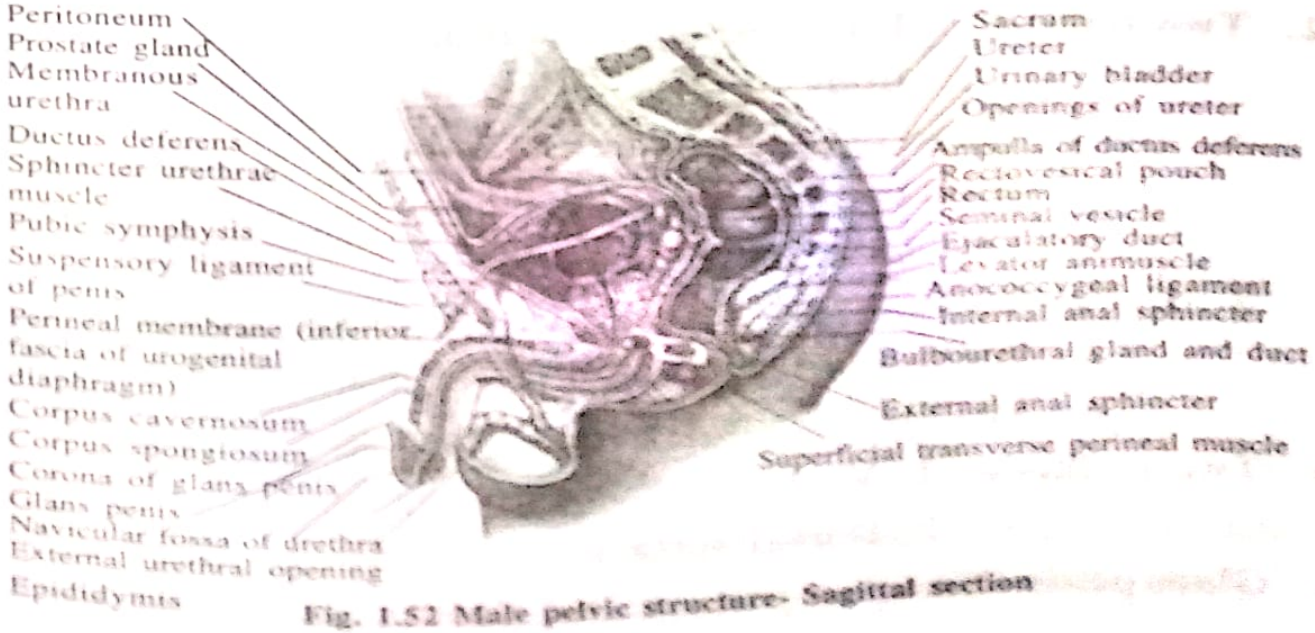

Fig. 1.52 Male pelvic structure- Sagittal section

4. Cystoscopy– The interior of the bladder can be examined in the living by cystoscopy.

(12) Ayurvedic aspect of urinary bladder–

१. मूत्राशय धनुष की तरह वक्र, मध्य में अध: ओर एक मुख वाला और अल्प रक्त एवं मांस से बना अंग है।

२. यह श्रोणि गुहा में स्थित है।

३. यह सद्य: प्राणहर मर्म है।

४. बस्ति-यह प्राणायतन है।

(4) Urethra (मूत्रमार्ग)

(A) Male urethra (पुरूष मूत्रमार्ग)

- The male urethra is about 8 inch. (20 cm.) long and extends from the neck of the bladder to the external meatus on the glans penis.
- It is divided into three parts– I. Prostatic urethra.
  II. Membranous urethra.
  III. Penile (spongy) urethra.

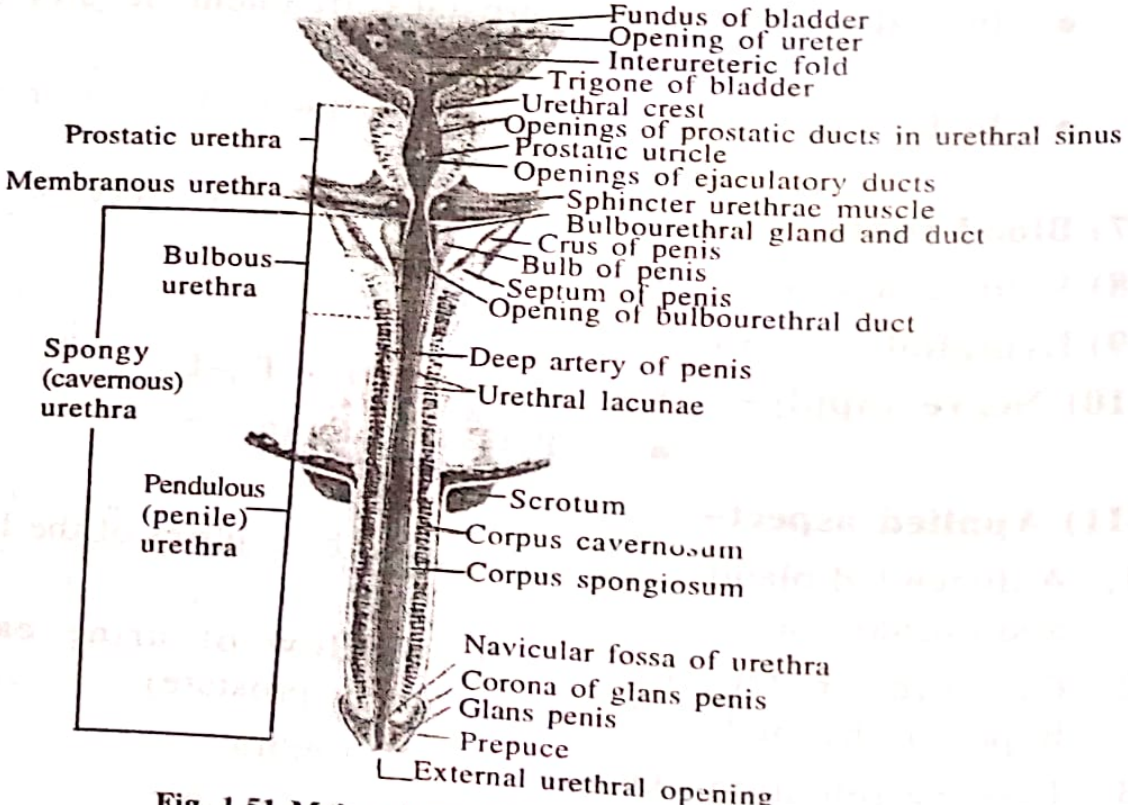

Fig. 1.51 Male urinary bladder and urethra

I. **Prostatic urethra–** It is about 3 cm. long and passes through the prostate from the base to the apex. It is the widest and most dilatable portion of the urethra.

II. **Membranous urethra–** It is about 1 cm. long and lies within the urogenital diaphragm, surrounded by the sphincter urethrae muscle. It is the least dilatable portion of the urethra.

III. **Penile urethra–** It is about 16 cm. long and is enclosed in the bulb and the corpus spongiosum of the penis. The external meatus is the narrowest part of the entire urethra. The part of the urethra that lies within the glans penis is dilated to form the fossa terminalis. The bulbourethral glands open into the penile urethra below the urogenital diaphragm.

(B) Female urethra (स्त्री मूत्रमार्ग)

- The female urethra is about 1.5 inch long. It extends from the neck of the bladder to the external meatus, where it opens into the vestibule about 1 inch below the clitoris. It traverses the sphincter urethrae and lies immediately infront of the vagina. At the side of the external urethral meatus are the small openings of the ducts of the paraurethral glands. The urethra can be dilated relatively easily.

(E) Male reproductive or male genital organs (पुरूष जननांगों का रचनात्मक वर्णन)

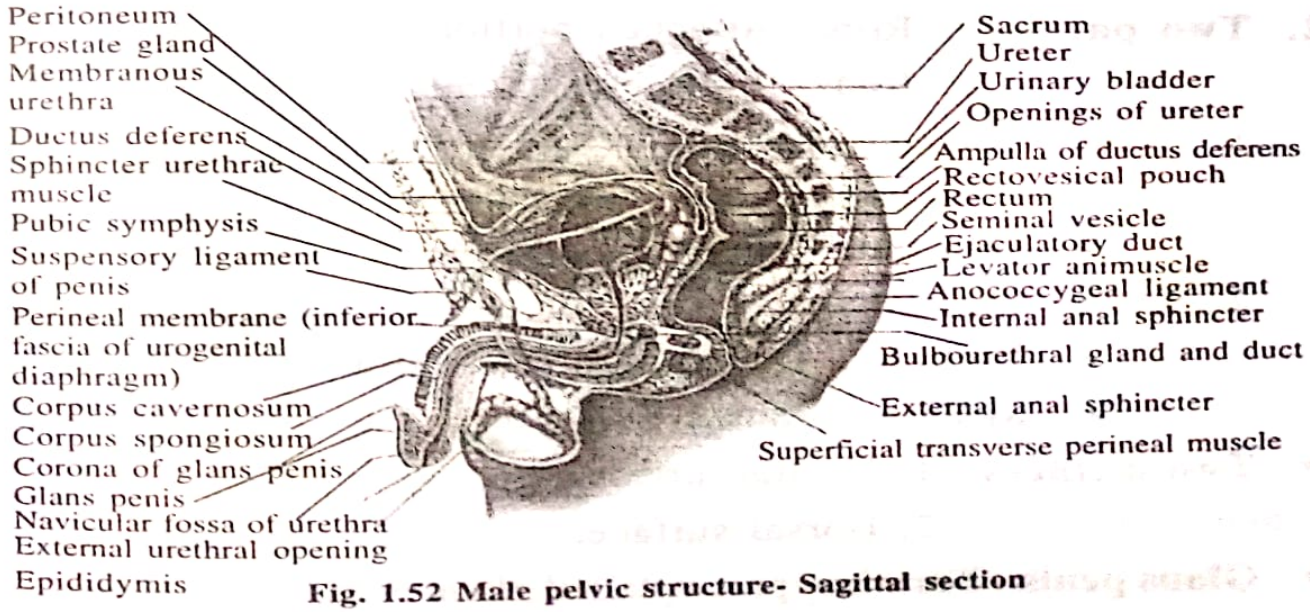

Fig. 1.52 Male pelvic structure- Sagittal section

- The male reproductive organs are followings–

(I) External genital organs (बाह्य जननांग)–

1. Penis– शेफ या मेढ्र या शिश्न या लिङ्ग
2. Scrotum– वृषण

(II) Internal genital organs (अन्त: जननांग)–

1. Testis– वृषण ग्रन्थि
2. Epididymis– अधिवृषण
3. Ductus deferens or vas deferens– शुक्र वाहिनी
4. Seminal vesicle– शुक्राशय
5. Ejaculatory duct– शुक्र प्रसेचक वाहिनी
6. Male urethra– पुरूष मूत्र मार्ग या मूत्रप्रसेक
7. Spermatic cord– वृषण रज्जु
8. Prostate gland– पौरूष ग्रन्थि या अष्ठीला
9. Bulbo urethral glands or cowper's glands– शिश्नमूल ग्रन्थियाँ या कूपर ग्रन्थियाँ

(I) External genital organs (बाह्य जननांग)

(1) Penis (शिश्न)

1. The penis is the male organ of copulation. (sexual intercourse)
2. **Two parts–** 1. Root– Attached portion.
   2. Body– Free portion.

1. Root– Three masses of erectile tissue.
- Two crura– Ischiocavernosus.
- One bulb– Bulbospongiosus.

2. Body– Three masses of erectile tissue.
- Right and left corpora cavernosa.
- Median corpus spongiosum.

★ **Two surfaces–** 1. Ventral surface.
2. Dorsal surface.

★ **Glans penis–** Terminal part is called glans penis.

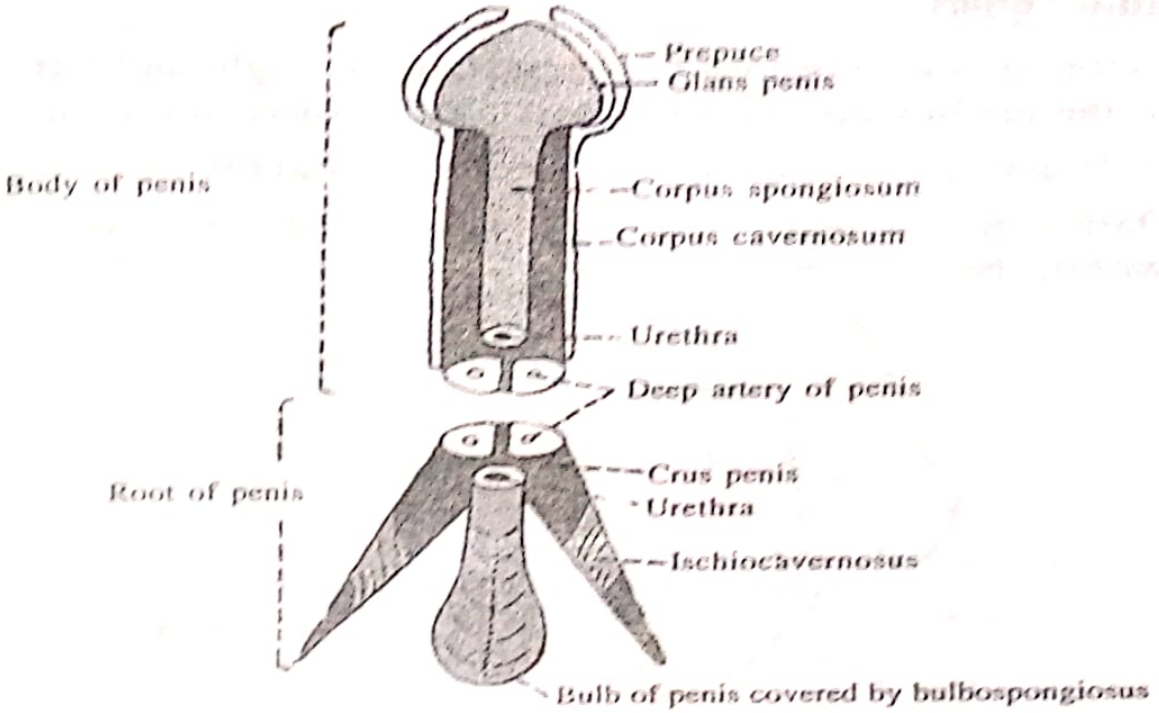

Fig. 1.53 Penis-Anterior View

(3) **Ligaments–**
- Fundiform ligament.
- Suspensory ligament.

(4) **Blood supply–** I. Branches of internal pudendal artery–
- Deep artery of penis.
- Dorsal artery of penis.
- Artery of the bulb of the penis.

II. Branch of femoral artery–
- Superficial external pudendal artery.

(5) **Venous drainage–** Superficial external pudendal vein.

(6) **Nerve supply–**
- Dorsal nerve of penis.
- Pudendal nerve.
- Ilioinguinal nerve.
- Parasympathetic– S_2–S_3–S_4

(7) **Lymphatic drainage–** Inguinal lymph nodes — Deep, Superficial

(8)
- Erection of the penis is a purely vascular phenomenon.
- Erection is controlled by parasympathetic– S_2–S_3–S_4

(2) Scrotum (वृषण)

(1) The scrotum is a cutaneous bag containing the right and left testis, the epididymis and the lower part of spermatic cord.

(2) The subcutaneous muscle of scrotum called **dartos** muscle.

- Dartos muscle helps in regulation of the temperature within the scrotum.

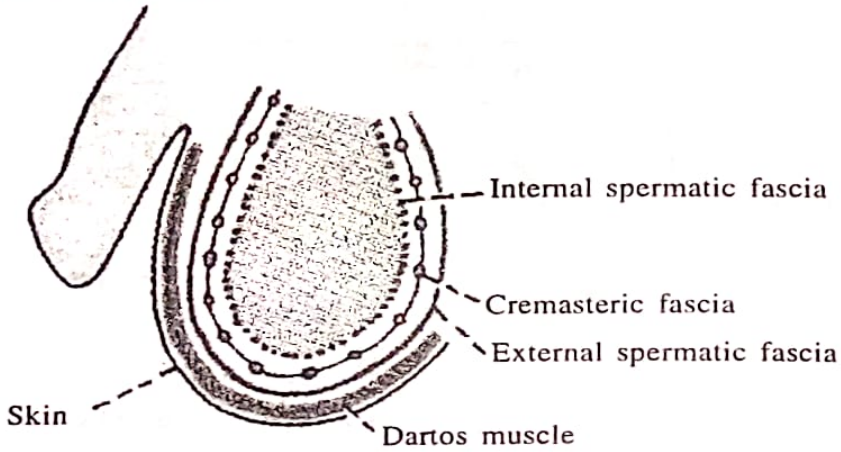

Fig. 1.54 Scrotum

(3) Layers of scrotum–

1. Skin
2. Dartos muscle– Superficial fascia.
3. External spermatic fascia
4. Cremasteric fascia.
5. Internal spermatic fascia.

(4) Blood supply–
- Superficial external pudendal artery.
- Deep external pudendal artery.
- Internal pudendal artery.

(5) Nerve supply–
- Ilioinguinal nerve.
- Genito femoral nerve.
- Pudendal nerve.

(6) Applied aspect–

Common cause of scrotal swelling are complete inguinal hernia and hydrocele.

(II) Internal genital organs (अन्तः जननांग)

(1) Testis (वृषण ग्रन्थि)

(1) Introduction–

- The testis is male gonad.

- It is homologus with the ovary of the female.
- It is suspended in the scrotum by the spermatic cord.
- The left testis is slightly lower than the right testis.
- Oval in shape.
- Measurment–
  - Length– 1.5 inch
  - width– 1 inch
  - Thickness– 3/4 inch
  - Weight– 10-15 gm.

(2) External features– It has following features–

* Two poles or ends– 1. Upper pole– Convex and smooth.
  2. Lower pole– Convex and smooth.
* Two borders– 1. Anterior border– Convex and smooth.
  2. Posterior border– It is straight.
* Two surfaces– 1. Medial surface– Convex and smooth.
  2. Lateral surface– Convex and smooth.

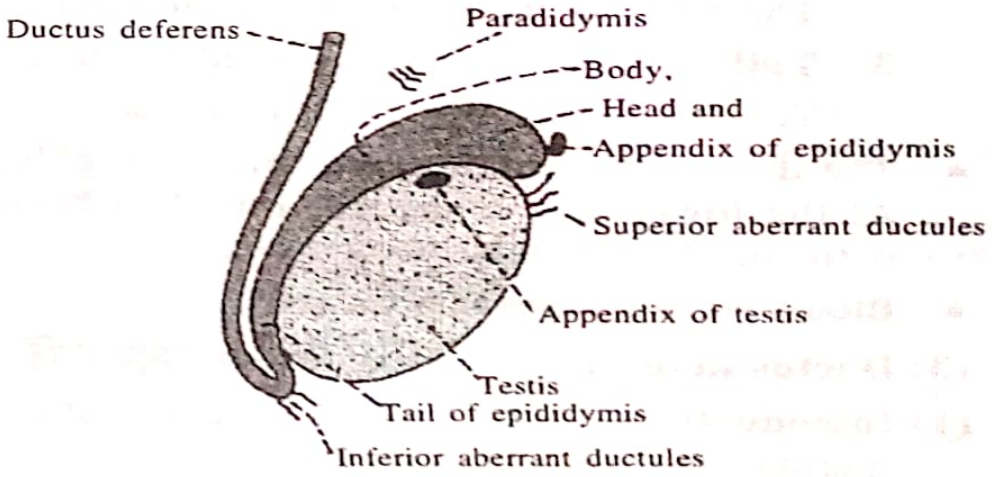

Fig. 1.55 Testis, epididymis and vasa deferens

(3) Covering of the testis– It is covered by three coat out side to inside.

I. Tunica vaginalis II. Tunica albuginea
III. Tunica vasculosa

(4) Blood supply– Testicular artery.

(5) Venous drainage–
- Testicular vein.
- Pampiniform plexus.

(6) Lymphatic drainage– • Prearotic nodes.
• Paraarotic nodes.

(7) Nerve supply– Sympathetic nerve– T10

(8) Applied aspect

- Monorchism– Testis may be absent on one side.
- Anorchism– Testis may be absent on both side.
- Hydrocele– Dropsy of the scrotum.

(2) Epididymis (अधिवृषण)

- The epididymis is a mass made up highly coiled tubes that act as **reservoirs of spermatozoa.**
- It has three parts–

1. **Head–** Its upper end is called the head. The head is enlarged and is connected to the upper pole of the testis.
   The head is made up of highly coiled efferent ductules.
2. **Body–** The middle part is called the body.
   The body is made up the single duct.
3. **Tail–** The lower part is called the tail.
   The tail is made up the single duct.

* The duct of the epididymis which is highly coiled on itself. At the lower end of the tail this duct becomes continuous with the ductus deferens.
* **Blood supply–** Testicular artery.

(3) Ductus deferens or vas deferens (शुक्रवाहिनी)

(1) Introduction– Thick walled, muscular tube, which transmits spermatozoa from the epididymis to the ejaculatory duct. It feels cord like and has a narrow lumen except at the terminal dilated part called the ampulla.

(2) Location–

I. The vas deferens lies within the scrotum along the posterior border of the testis.
II. In the inguinal canal as part of the spermatic cord.
III. In the greater pelvis.
IV. In the lesser pelvis.

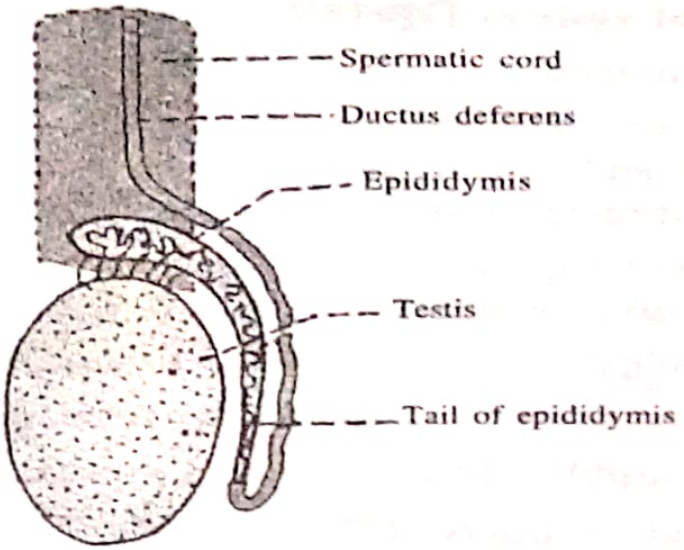

Fig. 1.56 Ductus deferens, testis and spermatic cord

(3) Course and relations–

- It begins as a continuation of the tail of epididymis.
- Along the posterior border of testis, medial to epididymis.
- In the spermatic cord– The ductus deferens lies in the posterior part of the spermatic cord. It runs upwards to the superficial inguinal ring. And than traverse the inguinal canal. It can be felt in the living as a cord like structure within the spermatic cord.
- In greater pelvis– At the deep inguinal ring it leaves the spermatic cord and hooks round the lateral side of inferior epigastric artery.
- In lesser pelvis– The ductus deferens runs downwards and backwards on the lateral pelvic wall, deep to the peritoneum.
- At the base of the prostate, the ductus deferens is joined by the duct of the seminal vesicle to form the ejaculatory duct.
- The part of the ducts lying behind the base of the bladder, is dilated and tortuous and is known as the ampulla.

(4) Blood supply– Superior vesical artery.

(5) Venous drainage– Vesical venous plexus.

(6) Applied aspect– Vasectomy– Cutting vas deferens– Family planning common operation.

(4) Seminal vesicles (शुक्राशय)

(1) Introduction–

- These are two lobulated sacs, situated B/w the urinary bladder and rectum. Each vesicle is about two inches long and is directed upwards and laterally.
- The lower narrow end forms the duct of the seminal vesicle which joins the ductus deferens to form the ejaculatory duct.
- The seminal vesicles do not form a reservoir for spermatozoa.
- Their secretion forms a large part of the seminal fluid.

(2) Blood supply– Inferior vesical artery.

(5) Ejaculatory ducts (शुक्र प्रसेचक वाहिनी)

- The two ejaculatory ducts are each less than one inch long and are formed by the union of the vas deferens and the duct of the seminal vesicles.
- The ejaculatory duct pierce the posterior surface of the prostate and open into the prostatic part of the urethra, close to the margins of the prostatic utricle, their function is to drain the seminal fluid into the prostatic urethra.

(6) Male urethra (पुरूष मूत्र मार्ग)

- The urethra is the shared terminal duct of the reproductive and urinary system. It serve as a passageway for both semen and urine. The urethra passes through the prostate gland, the urogenital diaphragm and the penis.
- It measures about 20 cm. in length.

It subdivided into three parts–

1. Prostatic urethra– about 3 cm.
2. Membranous urethra– about 1 cm.
3. Penile (spongy) urethra– about 16 cm.

* The penile urethra ends at the external urethral orifice.

(7) Spermatic cord (वृषण रज्जु)

(1) Introduction–

- The spermatic cord is a collection of structures that pass through inguinal canal to the testis.

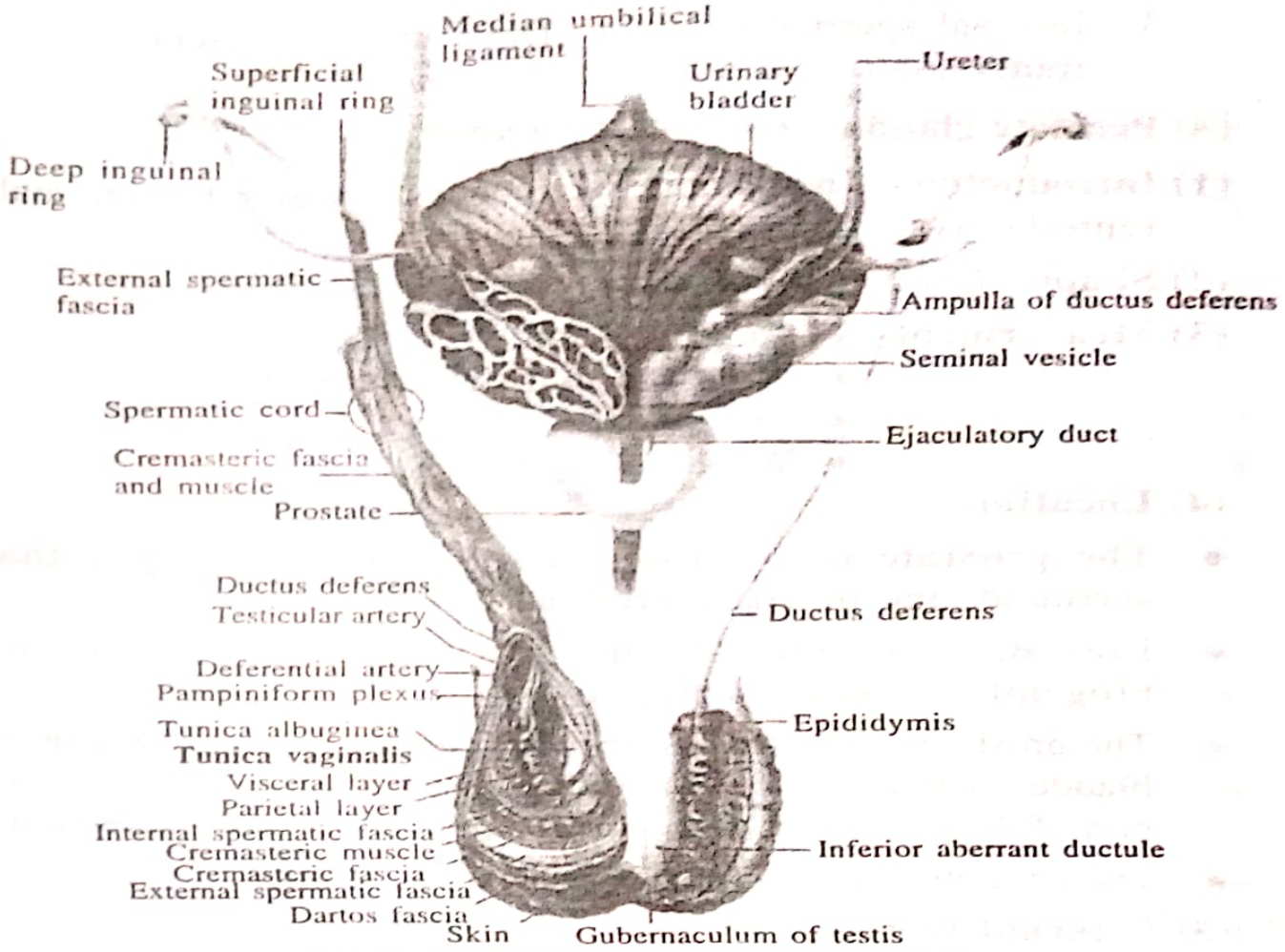

Fig. 1.57 Urinary bladder, testis and prostate

- It is covered with three concentric layers of fascia derived from the layers of the anterior abdominal wall. It begins at the deep inguinal ring lateral to the inferior epigastric artery and ends at the testis.

(2) Structure of spermatic cord–

- Vas deferens, testicular artery, testicular vein (Pampiniform plexus), testicular lymph vessels, autonomic nerve, processus vaginalis (remains of cremastric artery), artery of vas deference, genitofemoral nerve, cremastric artery.

(3) Covering of spermatic cord–

1. External spermatic fascia– Derived from external oblique aponeurosis and attach superficial inguinal ring.
2. Cremasteric fascia– Derived from internal oblique muscle.

3. Internal spermatic fascia– Derived from fascia transversalis and attach deep inguinal ring.

(8) Prostate gland (पौरूष ग्रन्थि या अष्ठीला)

(1) Introduction– The prostate is an accessory gland of the male reproductive system.

(2) Shape– Chest nut shaped.

(3) Measurment–
- Length– 3 cm.
- Width– 4 cm. (Transversely)
- Thickness– 2 cm.
- Weight– 8 gm.

(4) Location–
- The prostate is a fibromuscular glandular organ that surrounds the prostatic urethra.
- Lies B/w the neck of the urinary bladder above and urogenital diaphragm below.
- The prostate lies in the lesser pelvis, below the neck of urinary bladder, behind the lower part of pubis symphysis and the upper part of the pubic arch and infront of the ampulla of the rectum.
- The prostate is surrounded by a fibrous capsules.

(5) External featurs– The prostate has–

I. Apex II. Base

III. surfaces
- Anterior surface
- Posterior surface
- Right inferolateral surface
- Left inferolateral surface

I. Apex– is directed downwards and rest on the upper surface of the urogenital diaphragm.

II. Base– is directed upwards and is continuous with the neck of the bladder.

III.Surfaces–

1. **Anterior surface–** Narrow and convex from side to side.
2. **Posterior surface–** It is triangular in shape. Near its upper border, it is pierced on each side by the ejaculatory duct.

3. **Inferolateral surfaces–** Related to the anterior fibres of levator ani muscles.

(6) Relations–

1. **Superiorly–** The base of the prostate is continuous with neck of urinary bladder. The urethra enter the center of the base of the prostate.
2. **Inferiorly–** The apex of the prostate lies on the upper surface of the urogenital diaphragm.
3. **Anteriorly–** Related to the symphysis pubis.
4. **Posteriorly–** Related to the anterior surface of rectum.
5. **Laterally–** Related to the anterior fibres of levator ani muscles.

(7) Lobes of the prostate– The prostate is incompletely divided into five lobes.

1. **Anterior lobe–** Lies front of the urethra.
2. **Posterior lobe–** It is situated behind the urethra and below the ejaculatory duct.
3. **Middle or median lobe–** It is situated B/w the urethra and ejaculatory duct.

4,5. **Right and left lobe–** Lies on the right and left side of the urethra, and are separeted from one another by a shallow vertical groove on the posterior surface of the prostate.

(8) Function of the prostate– The function of the prostate is the production of a thin milky fluid contaning citric acid and acid phosphatase. It is added to the seminal fluid at the time of ejaculation. The prostate secretion is alkaline and helps neutralize the acidity in the vagina.

(9) Blood supply–
- Inferior vesical artery.
- Middle rectal artery.

(10) Venous drainage– Prostatic venous plexus.

(11) Lymphatic drainage– Internal iliac nodes.

(12) Nerve supply– Inferior hypogastric plexus.

(13) Applied aspect–
- Prostatitis–Inflammation of the prostate.
- Senile enlargement of the prostate.

- Prostate cancer.
- Prostatectomy– Excision of all or part of the prostate.

(9) Bulbo urethral glands or cowper's glands (शिश्नमूल ग्रन्थियाँ या कूपर ग्रन्थियाँ)

1. Paired tiny glands.
2. Lies lateral to membranous urethra in urogenital diaphragm.
3. Their duct pass through diaphragm into bulb of penis and empty their contents into proximal end of penile urethra.
4. The mucus secretion enters urethra during sexual stimulation and may serve as a lubricant.

(F) Female reproductive system or female genital organs (स्त्री जननांगों का रचनात्मक वर्णन)

- The female reproductive organs are followings–

1. Vagina– योनि
2. Female urethra– स्त्री मूत्र मार्ग
3. Para urethral glands– योनिमूल ग्रन्थियाँ
4. Greater vestibular glands or bartholin's glands – महाप्रघाण ग्रन्थियाँ या बार्थोलिन ग्रन्थियाँ

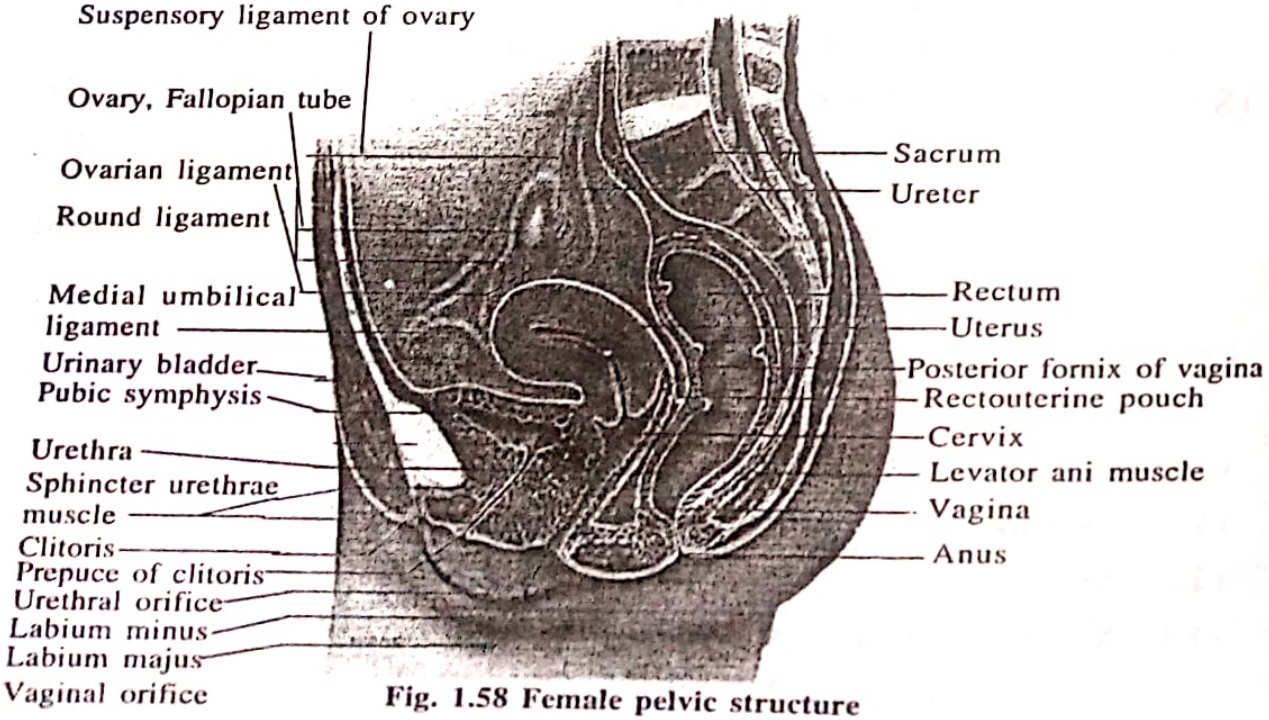

Fig. 1.58 Female pelvic structure

5. Valva (female external genitals) (स्त्रियों के बाह्य जननांग)
   - I – Mons pubis– भग शैल
   - II – Labia majora– बृहत् भगोष्ठ
   - III – Labia minora– लघु भगोष्ठ
   - IV – Clitoris– भग शिश्निका
   - V – Vestibule– योनि प्रघाण
   - VI – Vaginal orifice– योनि द्वार
6. Ovaries– बीज ग्रन्थि या डिम्ब ग्रन्थि
7. Fallopian tubes or uterine tubes– डिम्ब वाहिनी
8. Uterus– गर्भाशय

(1) Vagina (योनि)

- Means sheath.
- The vagina is a fibromuscular canal, forming the female copulatory organs.
- The vagina serve as a passageway for the menstrual flow and child birth.
- It also receives semen from the penis during sexual intercourse.
- It is a tubular, fibromuscular organ lined with mucous membrane and measures about 8-10 cm. in length.
- Situated B/w the urinary bladder and rectum.
- The vagina is directed superiorly and posteriorly, where it attach to the uterus.
- The cervix of the uterus pierces its anterior wall.

(2) Female urethra (स्त्री मूत्रमार्ग)

The female urethra is about 1.5 inches long. It extends from the neck of urinary bladder to the external meatus. Where it opens into the vestibule about one inch below the clitoris. It traverses the sphincter urethra and lies immediately infront of the vagina. At the sides of the external urethral meatus are the small openings of the ducts of the paraurethral glands. The urethra can be dilated relatively easily.

(3) Paraurethral glands (योनिमूल ग्रन्थियाँ)

The paraurethral glands, homologus to the prostate in the male. Open into the vestibule by small ducts on each side of the urethral orifice.

(4) Greater vestibular glands or bartholin's glands (महाप्रघाण या बार्थोलिन ग्रन्थियाँ)

- Bartholin's glands are homologus to the cowper's glands in the male.
- The greater vestibular glands are a pair of small mucus secreting glands that lie under cover of the posterior part of the bulb of the vestibule and the labia majora.
- And each drains its secretion into the vestibule by a small duct. Which opens into the groove B/w the hymen and the posterior part of the labium minus. These glands secrete a lubricating mucus during sexual intercourse.

(5) Vulva (स्त्रियों के बाह्य जननांग)

- Vulva is the term applied to the female external genitalia, and include the– I. Mons pubis– भग शैल
  - II. Labia majora– बृहत् भगोष्ठ
  - III. Labia minora– लघु भगोष्ठ
  - IV. Clitoris– भग शिश्निका
  - V. Vestibule– योनि प्रघाण
  - VI. Vaginal orifice– योनि द्वार

I. Mons pubis (भग शैल)– The mons pubis is the rounded, hair bearing elevation of skin found anterior to the pubis.

II. Labia majora (बृहत् भगोष्ठ)–

- It is homologus to the scrotum in male.
- The labia majora are prominent, hair, bearing folds of skin extending posteriorly from the mons pubis to unite posteriorly in the mid line.

III. Labia minora (लघु भगोष्ठ)– The labia minora are two smallar, hair less fold of soft skin that lie B/w the labia majora.

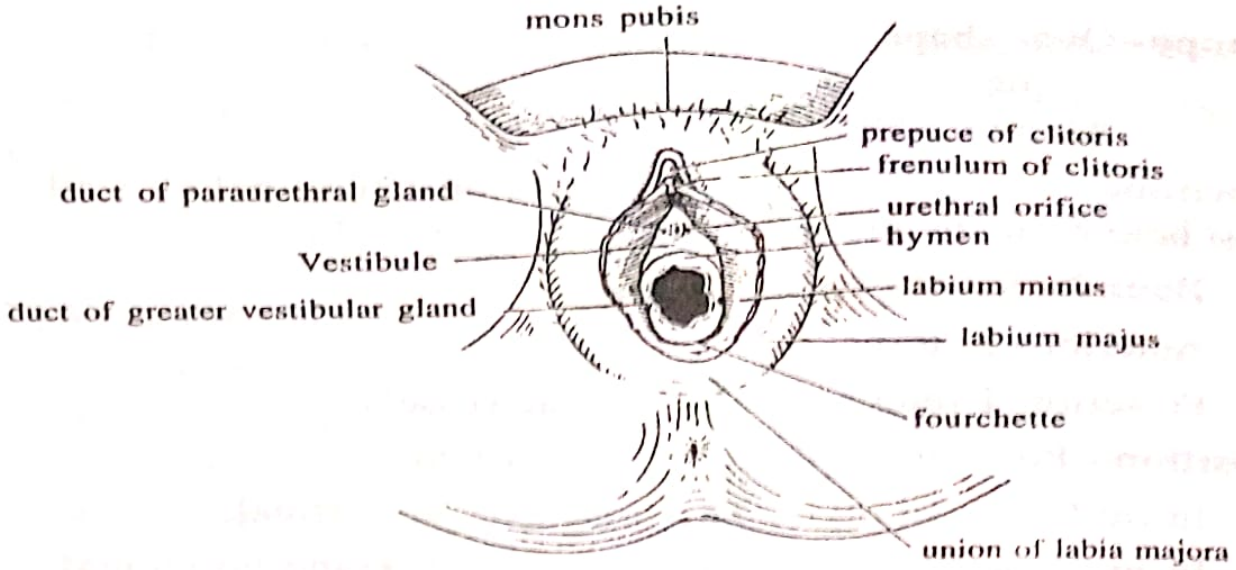

Fig. 1.59 Vulva

- Their posterior ends are united to form a sharp fold, the fourchette.
- Anteriorly, they split to enclose the clitoris, forming an anterior prepuce and a posterior frenulum.

IV. Clitoris (भग शिश्निका)– It is homologus to the penis in male.

- This is situated at the apex of the vestibule anteriorly.
- The glans of the clitoris is partly hidden by the prepuce.

V. Vestibule (योनि प्रघाण)– The vestibule is a smooth triangular area bounded laterally by the labia minora, with the clitoris at its apex and the fourchette at its base.

VI. Vaginal orifice (योनि द्वार)– Vaginal orifice is protected in virgins by a thin mucosal fold called the hymen, which is perforated at its center. At the first coitus, the hymen tears, usually posteriorly or posterolaterally and after childbirth only a few tags of the hymen remain.

(6) Ovaries (डिम्ब ग्रन्थियाँ या बीज ग्रन्थियाँ)

(1) Introduction–

- The ovaries are the female gonad.
- They produce gametes.
- The female gametes produced by the ovary called ova.
- The process is called **Oogenesis.**

(2) Shape– Oval shape.
or
Almond shape.

(3) Location– It lies in the ovarian fossa on lateral pelvic wall. Just below and behind lateral part of uterine tube.

* **Boundaries of ovarian fossa–**

Anterior– External iliac vessels.

Posterior– Ureter and internal iliac vessels.

(4) Position– Position of the ovary is variable.

* In nullipara women– The long axis in vertical.
* In multipara women– The long axis become horizontal.

(5) Measurment– Length– 3 cm.
Width– 1.5 cm.
Thickness– 1 cm.

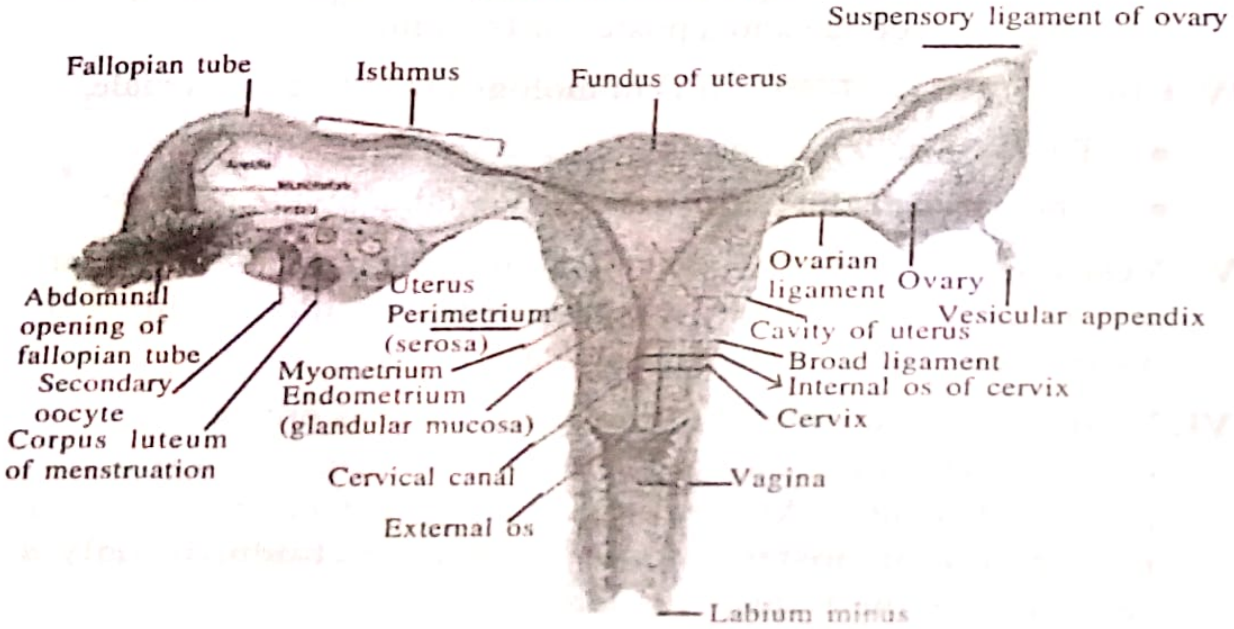

Fig. 1.60 Ovary-Fallopian tubes-uterus-vagina

(6) Colour–

- Before puberty the ovary is smooth and greyish pink colour.
- After puberty the ovary become prograssively pink to grey.

(7) External features– Each ovary has–

- **Two poles or extremities–** 1. Upper pole– Tubal
  2. Lower pole–Uterine

- **Two borders–** 1. Anterior border 2. Posterior border
- **Two surfaces–** 1. Lateral surface 2. Medial surface

(8) Relations–

(A) Peritoneal relation– The ovary is almost entirely covered with peritoneum except along the anterior border.

(B) Visceral relation–

1. Upper pole– Uterine tube and external iliac vein.
2. Lower pole– Pelvic floor.
3. Anterior border– Uterine tube.
4. Posterior border– Uterine tube, ureter.
5. Lateral surface– Ovarian fossa.
6. Medial surface– Uterine tube.

(9) Arterial supply– Ovarian artery.

(10) Venous drainage– Ovarian vein.

(11) Lymphatic drainage–
- Lateral aortic nodes.
- Preaortic nodes.

(12) Nerve supply–
- Ovarian plexus.
- Sympathetic nerve– T_{10}–T_{11}
- Parasympathetic nerve– S_2–S_3–S_4

(13) Applied aspect– Cysts of the ovary.

(7) Fallopian tubes or uterine tubes (डिम्बवाहिनी)

(1) Introduction–

- The uterine tubes are also called fallopian tubes or oviducts.
- They are twisted ducts which convey ova from the ovary to the uterus.
- Fertilization usually takes place in the ampulla of the follopian tube.

(2) Measurement– It is a 10 cm. long.

(3) Subdivision– 1. Infundibulum– 1 cm.
2. Ampulla– 5 cm.
3. Isthmus– 3 cm.
4. Uterine part (Intramural or interstitial)– 1cm.

1. **Infundibulum–**
   - The lateral end of the uterine tube is shaped like a funnel and is therefore, called the infundibulum.
   - It bears a number of finger like processes called fimbriae.
   - One of the fimbriae is longer than the others and is attached to the tubal pole of the ovary. It is known as the ovarian fimbriae.
   - At the lateral end of the uterine tube opens into the peritoneal cavity through its abdominal ostium. This ostium is about 3 mm. in diameter.
2. **Ampulla–** The part of uterine tube medial to the infundibulum is called the ampulla. It form approximatelly the lateral 2/3 of the tube. It arches over the upper pole of the ovary. The ampulla is about 4 mm. in diameter.
3. **Isthmus–** It is narrowest part of the tube and lies lateral to uterus. It form medial 1/3 part of the tube.
4. **Uterine part–** Uterine part of the tube is about 1cm. long and lies within the wall of the uterus. It opens at the superior angle of the uterine cavity by a narrow uterine ostium. This ostium is about 1 mm. in diameter.

(4) Relations–

1. Near lateral pelvic wall– Ampulla is related to anterior and posterior borders, upper pole and medial surface of ovary.
2. One of the fimbria is long and is attached to upper pole of ovary. It is known as ovarian fimbria.

(5) Wall of the uterine tube–

I. Mucosa II. Muscularis III. Serosa

(6) Arterial supply–

- Medial 2/3– Uterine artery.
- Lateral 1/3– Ovarian artery.

(7) Venous drainage– Uterine vein.

(8) Lymphatic drainage–
- Lateral aortic nodes.
- Preaortic nodes.

(9) Nerve supply–
- Sympathetic nerve– T_{11}–L_2
- Parasympathetic nerve– S_2–S_3–S_4

(10) Applied aspect–

- Salpingitis– Inflammation of uterine tube.
- Sterility–
  - In ability to have a child.
  - The condition of infertility.
- Tubectomy–
  - Remove segment of uterine tube.
  - Common family planning operation.

(8) Uterus (गर्भाशय)

(1) Shape– Piriform in shape.

(2) Synonym– Womb and hystera.

(3) Size– Length– 7.5 cm.
Width– 5 cm.
Thickness– 2.5 cm.

(4) Weight– 30-40 gm.

(5) Location– The uterus is a hollow, pear shaped organ with thick muscular walls. Pelvic cavity in the young nullipara adult.

* Lesser pelvic cavity– B/w urinary bladder and rectum.

(6) Parts– It has two parts– 1. Upper part 2. Lower part

[1] Upper part–
- Upper expanded part called the funds and body.
- The upper part forms the upper 2/3 of the organ.
- It has two surfaces–1. Anterior surface or vesical.
  2. Posterior surface or intestinal.
- And two lateral borders.

(A) Funds– The funds is the part of the uterus that lies above the entrance of the uterine tubes.
It is convex like a dome.

(B) Body– The body is the part of the uterus that lies below the entrance of the uterine tubes.
It is narrow below, where it becomes continuous with the cervix.

* **It has two surfaces–**
  1. **Anterior or vesical surface–** It is flat and related to the urinary bladder.
  2. **Posterior or intestinal surface–** It is convex and is related to coils of the terminal ilium and to the sigmoid colon.
* **It has two lateral borders–** Each lateral border is rounded and convex. It provides attachment to the broad ligament of the uterus which connects into the lateral pelvic wall.

  The uterine tube opens into the uterus at the upper end of this border.

[2] Lower part–

The lower cylindrical part called the cervix, and forms the lower 1/3 of the organ.

* **Cervix–** The cervix is the lower, cylindrical part of the uterus. It is about 2.5 cm. long. The lower part of the cervix project into the anterior wall of vagina and divided into the supravaginal and vaginal part of the cervix.
* The cavity of the cervix– The cervical canal communicates with the cavity of the body through the internal O_s and with the vagina through the external O_s (opening)
* **Isthmus–** The junction of these two part is marked by a circular constriction.

(7) Walls of uterus–

I. Endometrium– Mucous membrane.
II. Myometrium– Muscular coat.
III. Perimetrium– Serous coat.

(8) Ligaments– 1. Peritoneal ligaments.
2. Fibromuscular ligaments.

(9) Position of the uterus–

- In most women, the long axis of the uterus is bent forward on the long axis of the vagina.
- This position is referred to as anteversion of the uterus.
- Further more, the long axis of the body of the uterus is bent forward at the level of the internal O_s with the long axis of the cervix. This position is termed anteflexion of the uterus

(10) Age and reproductive changes–

1. In fetal life– Cervix is larger than body.
2. Puberty– Uterus enlarge.
3. During menstruation– Uterus enlarge.
4. During pregnancy– Uterus enlarge.
5. In old age– Uterus smaller.

(11) Arterial supply–
- Uterine artery– Chiefly
- Ovarian artery– Partly

(12) Venous drainage–
- Uterine vein.
- Ovarian vein.
- Vaginal vein.

(13) Lymphatic drainage–
- Aortic nodes.
- Superficial inguinal nodes.
- External iliac nodes.
- Internal iliac nodes.
- Sacral nodes.

(14) Nerve supply–
- Sympathetic nerve– T_{12}–L_1
- Parasympathetic nerve– S_2–S_3–S_4

(15) Applied aspect–
1. Hysterectomy– Surgical removal of the uterus.
2. Prolapse of the uterus
3. Hystero-salpingo graphy

(16) Ayurvedic aspect of uterus–

(१) यथा रोहित मत्स्यस्य मुखं भवति रूपतः ।
तत्संस्थानां तथारूपां गर्भशय्यां विदुर्बुधः ।। (सु.शा. ५/५६)

- आयुर्वेद शास्त्र में गर्भाशय को ही गर्भशय्या यह संज्ञा दी है, क्योंकि गर्भ उत्पत्ति के बाद प्रसव होने तक गर्भाशय मे ही रहता है।
- रोहित मत्स्य का मुख जैसा होता है, वैसा, अल्प मुख और अन्ततः विस्तृत रिक्त स्थान ऐसा ही गर्भाशय होता है।

(२) आशयों के वर्णन में आठवाँ आशय स्त्रियों में गर्भाशय बताया गया है।

(३) आचार्य सुश्रुत ने इसे गर्भशय्या कहा है।

(४) आचार्य शार्ङ्गधर ने इसे 'धरा' कहा है।

अध्याय- २

ग्रन्थि शारीर–
स्रोत एवं नि:स्रोतस ग्रन्थियों की रचना का वर्णन

ग्रन्थियाँ (Glands)

(A) नि:स्रोतस् ग्रन्थियाँ (अन्त: स्रावी ग्रन्थियाँ) [Endocrine Glands (Ductless Glands)]

* The glands that have no ducts, their secretions being observed directly in to the blood.

(1) Pituitary gland or hypophysis cerebri or master gland= पीयूष ग्रन्थि

(2) Pineal gland or pineal body– पिनियल ग्रन्थि

(3) Thymus gland– बालग्रेवैयक ग्रन्थि या बाल्य ग्रन्थि

(4) Thyroid gland– अवटु ग्रन्थि

(5) Parathyroid glands– परावटु ग्रन्थियाँ

(6) Adrenal glands or suprarenal glands– अधिवृक्क ग्रन्थियाँ

(B) स्रोतस् ग्रन्थियाँ (बहि: स्रावी ग्रन्थियाँ) [Ductle glands (Exocrine Glands)]

* The glands from which secretions reach a free surface of the body by ducts.

(1) Salivary glands– लार ग्रन्थियाँ

(2) Stomal glands– जठर ग्रन्थियाँ

(3) Intestinal or solitary glands– आन्त्र ग्रन्थियाँ

(4) Liver– यकृत

(5) Spleen– प्लीहा

(6) Prostate– पौरूष ग्रन्थि या अष्ठीला

* Salivary glands– लार ग्रन्थियाँ

1. Parotid glands– कर्णमूल ग्रन्थियाँ
2. Submandibular glands अधोहनु ग्रन्थियाँ
3. Sublingual glands अवजिह्वा ग्रन्थियाँ

(C) उभयस्रावी ग्रन्थियाँ– (Mixed Glands)

1. Pancreas– अग्न्याशय
2. Gonadal glands– जननांग ग्रन्थियाँ

(A) Testis– नर जनन ग्रन्थि, शुक्र ग्रन्थि, वृषण ग्रन्थि, अण्डग्रन्थि

(B) Ovary– मादा जनन ग्रन्थि, बीज ग्रन्थि, डिम्ब ग्रन्थि

(A) निःस्रोतस् ग्रन्थियाँ (अन्तः स्रावी ग्रन्थियाँ) [Endocrine Glands (Ductless Glands)]

* The glands that have no ducts, their secretions being observed directly in to the blood.

(1) Pituitary gland or hypophysis cerebri or master gland= पीयूष ग्रन्थि

(2) Pineal gland or pineal body– पिनियल ग्रन्थि

(3) Thymus gland– बालग्रेवैयक ग्रन्थि या बाल्य ग्रन्थि

(4) Thyroid gland– अवटु ग्रन्थि

(5) Parathyroid glands– परावटु ग्रन्थियाँ

(6) Adrenal glands or suprarenal glands– अधिवृक्क ग्रन्थियाँ

(1) Pituitary Gland (पीयूष ग्रन्थि)

(1) **Introduction–** The hypophysis cerebri is a small endocrine gland. It is often called the master of the endocrine orchestra because it produces a number of hormons which control the secretions of many other endocrine glands of the body.

(2) **Situation–**

- It lies cranial cavity in the floor of middle cranial fossa.
- The hypophyseal fossa or pituitary fossa or sella turcica of the sphenoid bone.
- It is situated in relation to the base of brain.
- The fossa is roofed by the diaphargma sellae.

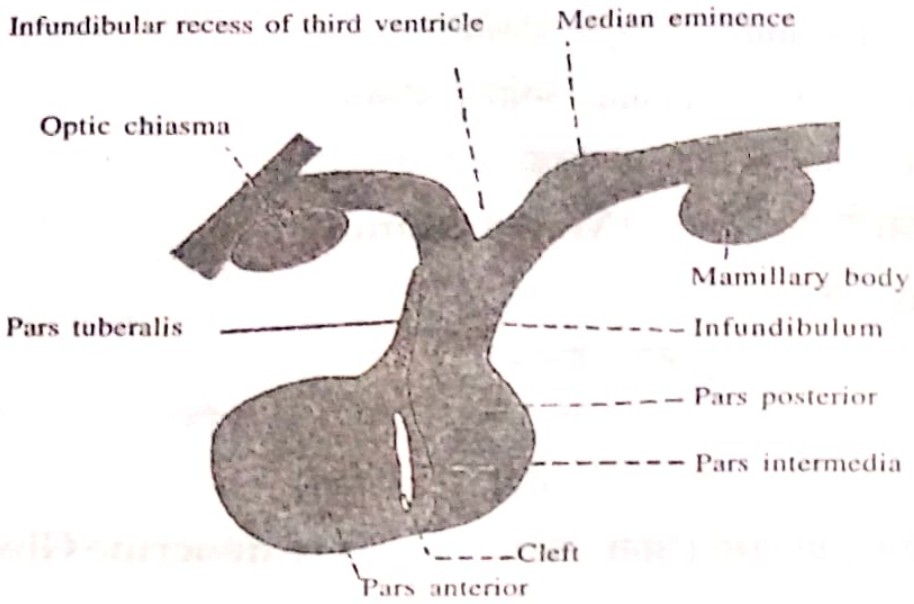

Fig. 2.1 Pituitary gland-Sagittal section

- The stalk of the hypophysis cerebri pierces the diaphragma sella and is attached above to the floor of the IIIrd ventrical of brain.

(3) Shape– Oval shape.

(4) Measurements–

- Anteroposteriorly– 8 mm.
- Transversely– 12 mm.
- Weight– 500 mg.

(5) Sub division– It has two lobes.

1. Ant. lobe (Adenohypophysis)–
   - Pars ant. • Pars intermedia • Pars tuberalis
2. Post. lobe (Neurohypophysis)–
   - Pars post. • Infundibular stem • Median eminence

(6) Relations–

- Superiorly– Diaphragma sellae, optic chiasma.
- Inferiorly– Hypophyseal fossa, sphenoidal air sinuses.
- Anteriorly– Hypophyseal fossa, sphenoidal air sinuses.
- On each side– Cavernosus sinus and its contents. (Laterally)

(7) Blood supply–

- Superior hypophyseal artery.
- Inferior hypophyseal artery.

(8) Applied aspect– Hypophyseal enlargement or pituitary tumours.

(2) Pineal Gland (पिनियल ग्रन्थि)

(1) Introduction–

- The pineal body is a small glandular structure.

(2) Situation– It lies B/w the two superior colliculi. It is attached by a stalk to the region of the post. wall of the third ventricle of brain.

(3) Shape– Pear shape.

(4) Measurments– • Length– 8 mm., • Width– 4 mm.

(5) Applied aspect–

- The pineal commonly calcifies in middle age and thus it can be visualized on radiography.

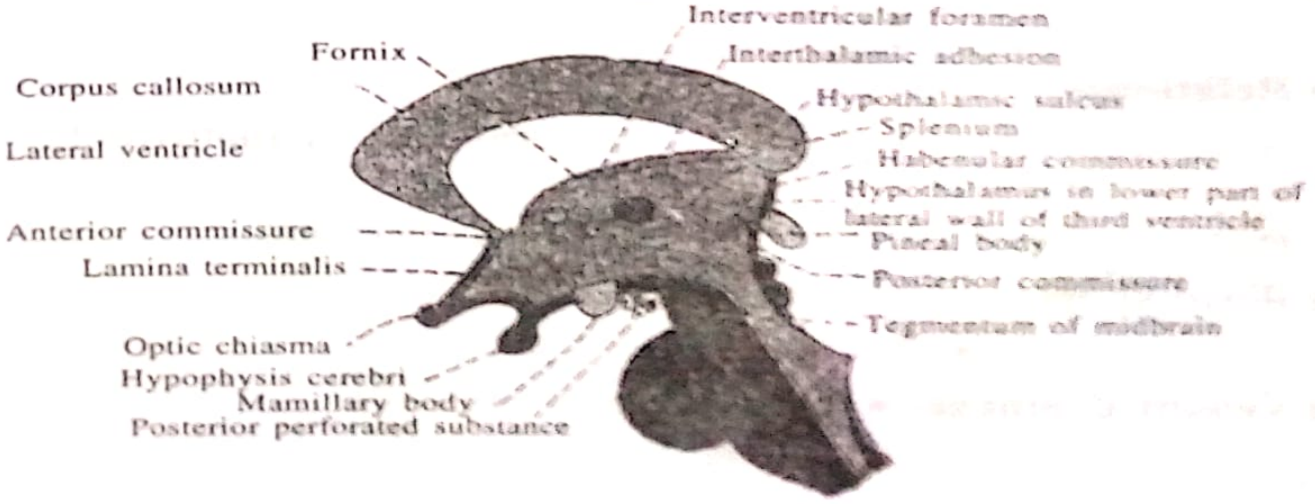

Fig. 2.2 Pineal gland- Sagittal section

(3) Thymus Gland (बालग्रेवैयक ग्रन्थि या बाल्य ग्रन्थि)

(1) Introduction– The thymus is an important lymphoid organ. It is well developed at birth, continues grow up to puberty and thereafter undergoes gradual atrophy and replacement of fat. The thymus is a flattened, bilobed structure.

It has a pink, lobulated appearance and is the site for development of 'T' lymphocytes.

(2) Situation– It is situated in the ant. and post. mediastinum of the thorax extending above into the lower part of neck.

(3) Weight–
- At birth– 10-15 gm.
- At puberty– 30-40 gm.
- After mid adult life– 10 gm.

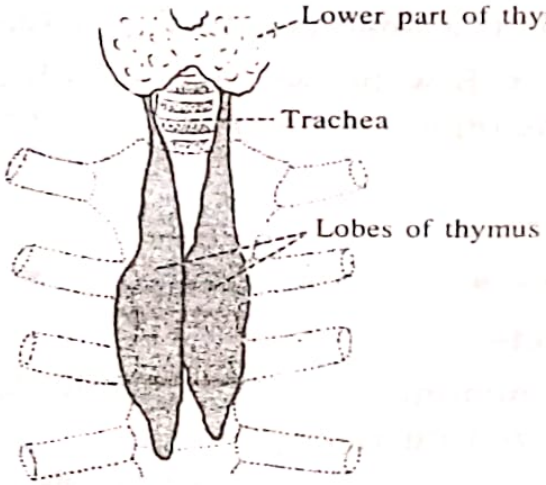

Fig. 2.3 Thymus gland

(4) Relations–

Ant.– Sternum, costal cartilage, sternohyoid, sternothyroid muscles.

Post.– Pericardium, arch of aorta and its branches.

(5) Blood supply–
- Inferior thyroid artery.
- Internal thoracic arteries.

(6) Venous drainage–
- Lt. brachiocephalic vein.
- Internal thoracic vein.
- Inferior thyroid vein.

(7) Nerve supply–
- Phrenic nerve.
- Cervical nerve.

(8) Function– Formation of lymphocytes.

(9) Applied aspect– Thymic tumours.

(4) Thyroid Gland (अवटु ग्रन्थि)

Thyroid→ Shield like structure.

1. **Shape–** Butterfly shaped.
2. **Situation–**
   - Thyroid gland lies infront and sides of lower part of neck.
   - Infront of the lower part of the larynx and the upper part of trachea.
   - The rt. and lt. lateral lobe lies on each side of trachea.
   - The isthmus lies ant. to the trachea.
   - Thyroid gland lies against C_5-C_6-C_7-T_1 vertebrae.

     Vertebral leval– C_5-C_6-C_7-T_1

   - Each lobe extends from the middle of the thyroid cartilage to the fourth or fifth tracheal ring.
   - The isthmus extends from second to the third tracheal ring.

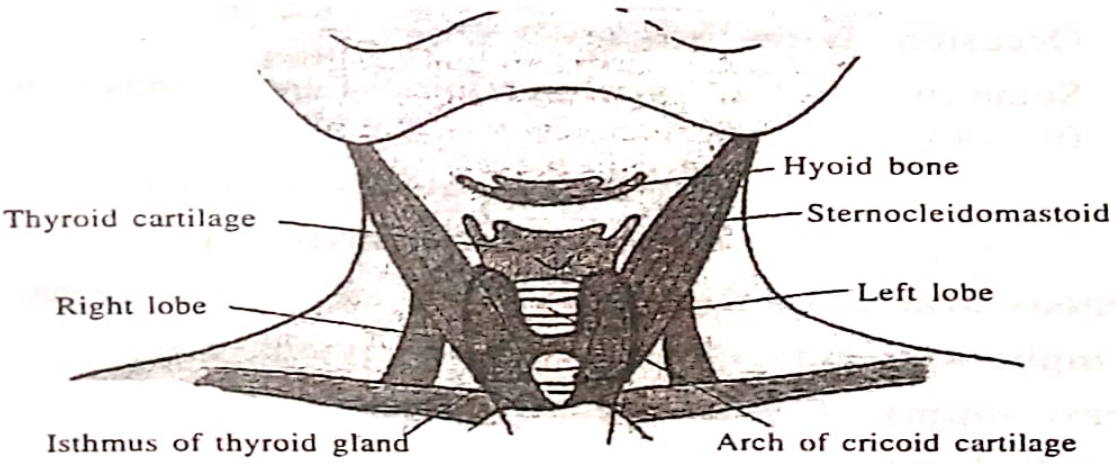

Fig. 2.4 Thyroid gland

(3) Measurment–

- Each lobes measures about– Length– 5 cm.
  Width– 2.5 cm.
  Thick– 2.5 cm.
- Isthmus measures about– Length– 1.2 cm.
  Width– 1.2 cm.

(4) Weight– 25 gm.

It is larger in females than in males and further increases in size during menstruation and pregnancy.

(5) Ext. features– • Lobes– 1 Rt. lobe 2 Lt. lobe
• Isthmus

Lobes– The lobes are conical in shape.

It has– 1. Apex– upwards
2. Base– Downwards
3. Surfaces– It has three surfaces–
(1) Lateral surface. (2) Medial surface.
(3) Posterolateral surface.
4. Borders– It has two borders–
(1) Ant. border. (2) Post. border.

Isthmus– It connects the lower parts of rt. and lt. lobes.

It has– • Two surfaces– 1. Ant. surface. 2. Post. surface.
• Two borders– 1. Sup. border. 2. Inf. border.

- Occasionally the isthmus is absent.
- Some time, a third small pyramidal lobe extends upward from two isthmus.
- Some time accessory thyroid glands are found.

(6) Blood supply– Superior and inferior thyroid artery.

(7) Venous drainage– Sup., middle and inf. thyroid veins.

(8) Lymphatic drainage– Deep cervical lymph node.

(9) Nerve supply– Cervical ganglia.

(10) Applied aspect–

- Goitre–Any enlargement of the thyroid gland.
- Thyroidectomy– Removal of the thyroid gland.

(5) Parathyroid Glands (परावटु ग्रन्थियाँ)

(1) Shape– Oval shape.

(2) Situation– It lies on the post. border of the thyroid gland, within the thyroid capsule.

(3) Numbers– These are two pairs.
Sup. and inf. pairs.

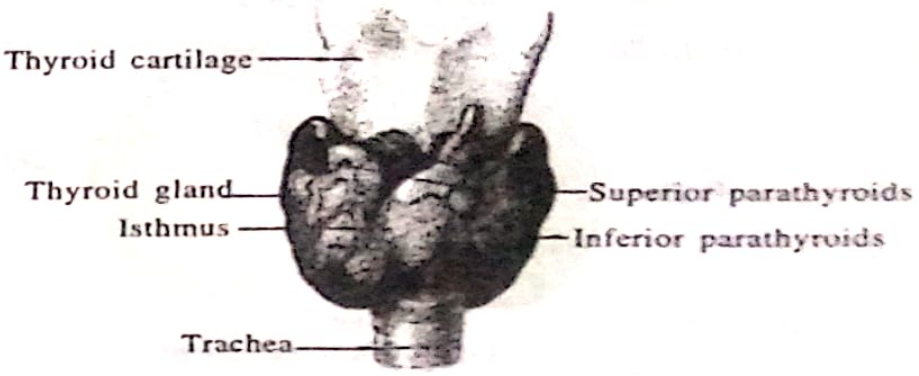

Fig. 2.5 Parathyroid gland

- The sup. parathyroids are also referred to as parathyroid IVth because they develop from the endoderm of the IVth pharyngeal pouch.
- The inf. parathyroids, similarly are also called parathyroid IIIrd because they develop from the IIIrd pharyngeal pouch.

(4) Measurments– Length– 6 mm.
Width– 4 mm.
Thick– 2 mm.

(5) Weight– About 50 mg. each glands.

(6) Blood supply–
- Inf. thyroid artery.
- Sup. thyroid artery.

(7) Venous drainage–
- Sup. thyroid vein.
- Middle thyroid vein.
- Inf. thyroid vein.

(8) Lymphatic drainage– Deep cervical lymph node.

(9) Nerve supply– Cervical ganglia

(10) Applied aspect– Tumours of the parathyroid glands.

(6) Adrenal Glands (Suprarenal Glands) अधिवृक्क ग्रन्थियाँ

(1) Numbers– Two numbers– Rt. and lt. suprarenal glands.

(2) Shape–
- Rt. suprarenal gland– Pyramidal in shape.
- Lt. suprarenal gland– Semilunar in shape.

(3) Situation–
- A pair of adrenal glands situated on the post. abdominal wall over tne upper pole of the kidneys behind the peritoneum.

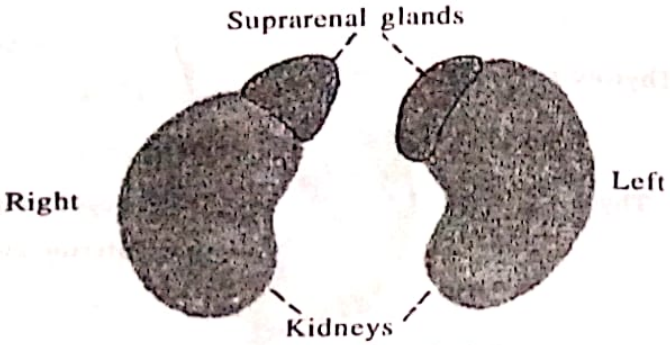

Fig. 2.6 Adrenal gland

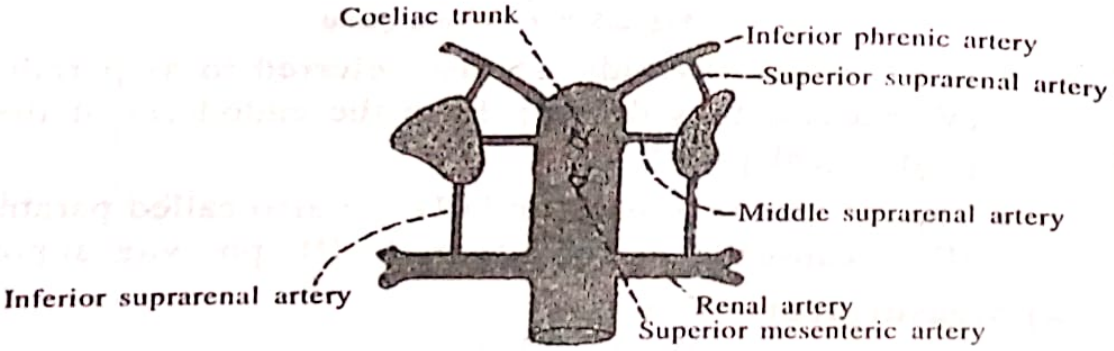

Fig. 2.7 Adrenal gland

- Each glands lies in the epigastrium. At the upper pole of kidneys.
- Infront of the crus of the diaphragm.
- Opposite the vertebral end of the 11th intercostal space and the 12th rib.

(4) Parts– They are made up of two parts–

1. **An outer part–** Cortex– Mesodermal origin. Which secretes a number of steroid hormones.
2. **An inner part–** Medulla– Neural crest origin.

   Which is made up of chromaffin cells and secreted adrenalin and noradrenalin.

(5) Measurement–Height– 5 cm.
Width– 3 cm.
Thick– 1 cm.

(6) Weight– 5 gm.

(7) Rt. suprarenal gland–

- Pyramidal in shape.
- Smaller in size.
- It has– 1. Apex 2. Base

3. Surfaces– 1. Ant., 2. Post.

4. Borders– 1. Ant., 2. Medial 3. Lateral

(8) Lt. suprarenal gland–

- Semilunar in shape.
- Larger in size.
- It has–
- **Two ends–** 1. Upper– Narrow. 2. Lower– Rounded.
- **Two borders–**1. Medial– Convex. 2. Lateral– Concave.
- **Two surfaces–**1. Ant. surface. 2. Post. surface.

(9) Blood supply– • Sup. suprarenal artery.
• Middle " "
• Inf. " "

(10) Venous drainage– Each gland is drain by one vein.

- The rt. suprarenal vein drain in to the– I.V.C.
- The lt. suprarenal vein drain in to the– Lt. renal vein.

(11) Lymphatic drainage– • Lateral aortic lymph nodes.
• Paraaortic " "

(12) Nerve supply– Sympathetic fibres from splanchnic nerves.

(13) Applied aspect– Adrenal tumours.

(B) Ductle Glands (Exocrine Glands) [स्रोतस् ग्रन्थियाँ (बहिः स्रावी ग्रन्थियाँ)]

* A gland from which secretions reach a free surface of the body by ducts.

(1) Salivary glands– लार ग्रन्थियाँ

(2) Stomal glands– जठर ग्रन्थियाँ

(3) Intestinal or solitary glands– आन्त्र ग्रन्थियाँ

(4) Liver– यकृत

(5) Spleen– प्लीहा

(6) Prostate gland– पौरूष ग्रन्थि या अष्ठीला

Salivary Glands (लार ग्रन्थियाँ)

1. Parotid glands (कर्णमूल ग्रन्थियाँ)
2. Submandibular glands (अधोहनु ग्रन्थियाँ)
3. Sublingual glands (अवजिह्वा ग्रन्थियाँ)

(1) Parotid Glands (कर्णमूल ग्रन्थियाँ)

(1) Introduction– This is the largest salivary glands.

(2) Situation– It is situated B/w the ramus of mandible and the sternocleidomastoid muscles, and below the external acoustic meatus.

(3) Weight– About 15 gm.

(4) Parotid duct– It is thick walled and about 5 cm. long. It emerge from the middle of the ant. border of parotid glands.

(5) Blood supply–
- Ext. carotid artery and its branches–
  - Post. auricular artery.
  - Maxillary artery.
  - Superficial temporal artery.

(6) Venous drainage–
- Ext. jugular vein.
- Retromandibular vein.

(7) Lymphatic drainage–
- Parotid node.
- Upper deep cervical node.

(8) Nerve supply–
- Facial nerve.
- Auricular temporal nerve.

(9) Applied aspect– Mumps– Viral infection.
- Parotid swelling are very painful.
- Parotid abscess.
- Parotidectomy– Surgical removal of parotid glands.

Facial nerve is presvered by removing of gland in two parts.

(2) Submandibular Glands (अधोहनु ग्रन्थियाँ)

(1) Shape– 'J' shape or walnut size.

(2) Situation– It is situated in the ant. part of the digastric triangle. diagastric triangle in submandibular region.

Submandibular region–B/w body of mandible and hyoid bone.

(3) **Part–** Post. border of the mylohyoid muscles which divides in to two parts.

1. Superficial part– Large and superficial to mylohyoid.
2. Deep part– Small and deep to mylohyoid.

(4) **Submandibular duct–** It is thin walled and is about 5 cm. long. It emerge at the ant. end of the deep part of the submandi-bular glands.

(5) **Blood supply–** Facial artery.

(6) **Venous drainage–** • Facial vein • Lingual vein

(7) **Lymphatic drainage–** Submandibular node.

(8) **Nerve supply–** • Facial nerve.
• Sub mandibular ganglia.
• Lingual nerve.

(9) **Applied aspect–** Tumours.

(3) Sublingual Glands (अवजिह्वा ग्रन्थियाँ)

(1) **Introduction–** This is the smallest of the salivary glands.

(2) **Shape–** Almond shape.

(3) **Situation–** It lies– Above the mylohyoid muscles.

Below the mucosa of the floor of mouth and lateral to the genioglossus muscles.

(4) **Weight–** About 3–4 gm.

(5) **Duct–** About fifteen ducts emerge from this glands. Most of them open directly into the floor of the mouth on the highest point (summit) of the sublingual fold.

• A few of them join the submandibular duct.

(6) **Blood supply–** • lingual artery.
• Submental artery.

(7) **Nerve supply–** • Facial nerve.
• Submandibular ganglia.

(2) Stomal Glands (जठर ग्रन्थियाँ)

• The glands of the stomach or gastric are divides into the three types, depending upon the situation.

(1) **Fundic glands–** These are situated in the body and funds of stomach.

(2) **Pyloric glands–** These are present in the pyloric part of the stomach.

(3) **Cardiac glands–** These are situated in the cardiac region of the stomach.

(3) Intestinal Glands or Solitary Glands (आंत्र ग्रन्थियाँ)

- Solitary are simple tubular glands distributed over the entire mucous membrane of the jejunum and ileum. They open by small circular aperatures on the surface of mucous membrane B/w the villi. They secrete digestive enzymes.
- These include the duodenal glands. (Brunner glands)

(4) Liver (यकृत)

(1) Introduction–

- The liver is the largest gland in the body and has a wide variety of functions. Three of its basic functions are production and secretion of bile, which is passed into the intestinal tract. Involvement in many metabolic activites related to carbohydrate, fat and protein metabolism and filtration of the blood, removing bacteria and other foreign particles that have gained entrance to the blood from the lumen of the intestine.

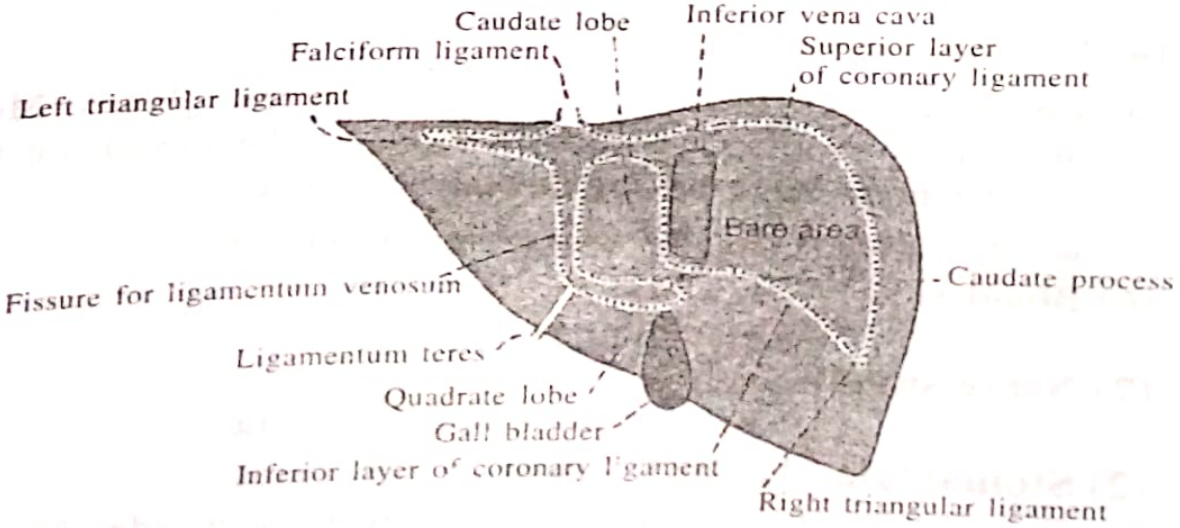

Fig. 2.8 Liver- Posterior view

- The liver synthesizes heparin, an anticoagulant substance, and has an important detoxicating function. It produces bile pigments from the hemoglobin of worn-out red blood corpuscles and secretes bile salts. These together are conveyed to the duodenum by the biliary ducts.
- The liver is soft and occupies the upper part of the abdominal cavity just beneath the diaphragm. The liver occupies the whole of the right hypochondrium, the greater part of the epigastrium and extends into the left hypochondrium reaching up to the left lateral line. The greater part of the liver is situated under cover of the right costal margin and the right hemidiaphragm separates it from the pleura, lungs pericardium and heart. The liver extends to the left to reach the left hemidiaphragm. The convex upper surface of the liver is molded to the undersurface of the domes of the diaphragm. The visceral surface is molded to adjacent viscera and is therefore irregular in shape, it lies in contact with the abdominal part of the oesophagus, the stomach, the duodenum, the right colic flexure, the right kidney and suprarenal gland and the gall-bladder .

(2) Subdivisions–

The liver is divided into a large right lobe and a small left lobe by the attachment of the peritoneum of the falciform ligament. The right lobe is further divided into a quadrate lobe and a caudate lobe by the presence of the gall-bladder, the fissure for the ligamentum teres, the inferior venacava (I.V.C.), and the fissure for the ligamentum venosum. Experiments have shown that, infact, the quadrate and caudate lobes are a functional part of the left lobe of the liver. Thus the right and left branches of the hapatic artery and portal vein and the right and left hepatic ducts are distributes to the right lobe and the left lobe.

(3) Porta hepatis or hilum–

The porta hepatis or hilum of the liver is found on the postero-inferior surface and lies B/w the caudate and quadrate lobes.

Contains–

- The right and left hepatic duct.
- The right and left branches of the hepatic artery.
- The portal vein.
- Sympathetic and parasympathetic nerve fibres.
- Hepatic lymph nodes.

(4) Relations–

Anteriorly–Diaphragm, right and left costal margins, right and left pleura and lower margins of both lungs, xiphoid process and anterior abdominal wall in the subcostal angle.

Posteriorly–Diaphragm, right kidney, duodenum, gall bladder, inferior venacava (I.V.C.). oesophagus, fundus of stomach and the hepatic flexure of the colon.

(5) Ligaments of the liver–

(I) Falciform ligament– The falciform ligament, which is a two layered fold of the peritoneum, ascends from the umbilicus to the liver. It has a sickle-shaped free margin that contains the ligamentum teres, the remains of the umbilical vein. The falciform ligament passes on to the anterior and them the superior surface of the liver and then splits into two layers.

(II) Coronary ligament– The right layer forms the upper layer of the coronary ligament.

(III) Left triangular ligament– The left layer forms the upper layer of the left triangular ligament.

(IV) Right triangular ligament– The right extremity of the coronary ligament is known as the right triangular ligament of the liver.

(V) Bare area of the liver– Portion of liver on posterior aspect of diaphragmatic surface that has no peritoneum is known as the bare area of liver.

(VI) Ligamentum teres of the liver– The ligamentum teres passes into a fissure on the visceral surface of the liver and joins the left branch of the portal vein in the porta hepatis.

(VII) Ligamentum venosum– The ligamentum venosum, a fibrous band that is the remains of the ductus venosus, is attached to the left branch of the portal vein and ascends in a fissure on the visceral surface of the liver to be attached above to the inferior venacava.

In the fetus, O_2 blood is brought to the liver in the umbilical vein (Ligamentum teres). The greater proportion of the blood bypasses the liver in the ductus venosus (ligamentum venosum) and joins the inferior venacava. At birth, the umbilical vein and ductus venosus close and become fibrous cords.

(VIII) Lesser omentum– The lesser omentum arises from the edges of the porta hepatis and the fissure for the ligamentum venosum and passes down to the lesser curvature of the stomach.

(6) Blood supply–

(I) Arteries– Hepatic artery– Right and left.

Provides oxygenated blood to the liver.

(II) Veins– Portal vein– The portal vein divided into right and left terminal branches that enter the porta hepatis behind the arteries.

The hepatic veins emerge from the posterior surface of the liver and drain into the inferior venacava (I.V.C.)

(III) Blood circulation through the liver–

The blood vessels conveying blood to the liver are the hepatic artery (30%) and portal vein (70%). The hepatic artery brings O_2 blood to the liver and the portal vein brings venous blood rich in the products of digestion, which have been absorbed from the gastrointestinal tract. The arterial and venous blood is conducted to the central vein of each liver lobule by the liver sinusoids. The central veins drain into the right and left hepatic veins, and these leave the posterior surface of the liver and open directly into the inferior venacava (I.V.C.)

(7) Lymphatic drainage–
- Coeliac lymph nodes.
- Posterior mediastinal lymph nodes.

(8) Nerve supply–

- Sympathetic fibres–From the coeliac plexus and hepatic plexus.
- Parasympathetic fibres– Via vagus.

(9) Ducts of the liver–

- Bile ducts of the liver– Bile is secreted by the liver cells at a constant rate of about 40 ml. per hour. When digestion is not taking place, the bile is stored and concentrated in the gall bladder; later, it is delivered to the duodenum. The bile ducts of the liver consist of the right and left hepatic ducts, the common hepatic duct, the bile duct, the gall bladder, and the cystic duct.
- The right hepatic duct drains the right lobe of the liver and the left duct drains the left lobe, caudate lobe and quadrate lobe.

(10) Applied aspect–

1. Hepatitis– Inflammation of the liver is called hepatitis. It may be infective hepatitis or amoebic hepatitis.
2. Cirrhosis of the liver– The liver tissue undergoes fibrosis and shrinks.
3. Liver biopsy– Through right 8th intercostal space.

(5) Spleen (प्लीहा)

(1) Introduction–

The spleen is reddish and is the largest single mass of lymphoid tissue in the body. It is oval shaped and has a notched anterior border. It lies just beneath the left half of the diaphragm close to the ninth, tenth and eleventh ribs. The long axis lies along the shaft of the tenth rib, and its lower pole extends forward only as far as the midaxillary line and cannot be palpated on clinical examination.

The spleen is surrounded by peritoneum, which passes from it at the hilum as the gastrosplenic ligament to the greater curvature of the stomach. The peritoneum also passes to the left kidney as the splenicorenal ligament.

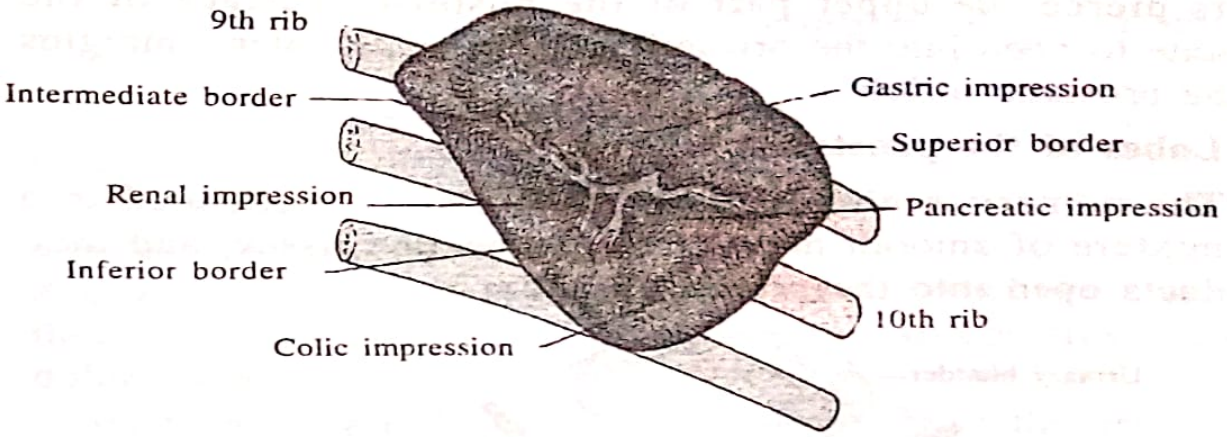

Fig. 2.9 Spleen

(2) Relations–

- Anteiorly– Stomach, tail of the pancreas and left colic flexure. The left kidney lies along its medial border.
- Posteriorly– Diaphragm, left pleura, left lung and 9-10-11th ribs.

(3) Blood supply– Splenic artery.

(4) Venous drainage– Splenic vein.

(5) Lymphatic drainage– Coeliac lymph nodes.

(6) Nerve supply– Coeliac plexus.

(7) Applied aspect–

- Splenomegaly– Enlargement of the spleen is called splenomegaly.
- A normal spleen is not palpable.

(6) Prostate Gland (पौरूष ग्रन्थि या अष्ठीला)

(1) Introduction–

The prostate is a fibromuscular glandular organ that surrounds the prostatic urethra. It is about 3 cm. long and lies B/w the neck of the bladder above and the urogenital diaphragm below.

The prostate is surrounded by a fibrous capsule. Outside the capsule is a fibrous sheath, which is part of the visceral layer of pelvic fascia. The somewhat conical prostate has a base, which superiorly lies against the bladder neck, and an apex, which lies inferiorly against the urogenital diaphragm. The ejaculatory

ducts pierce the upper part of the posterior surface of the prostate to open into the prostatic urethra at the lateral margins of the prostatic utricle.

(2) Lobes of the prostate–

- The numerous glands of the prostate are embedded in a mixture of smooth muscle and connective tissue, and their ducts open into the prostatic urethra.

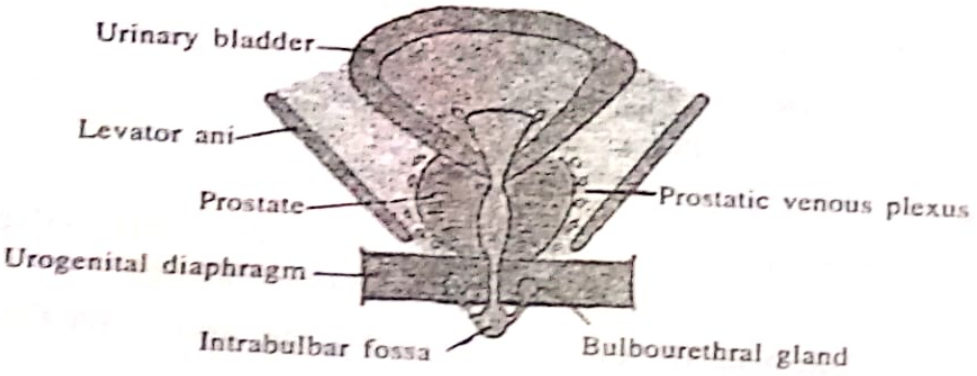

Fig. 2.10 Prostate gland

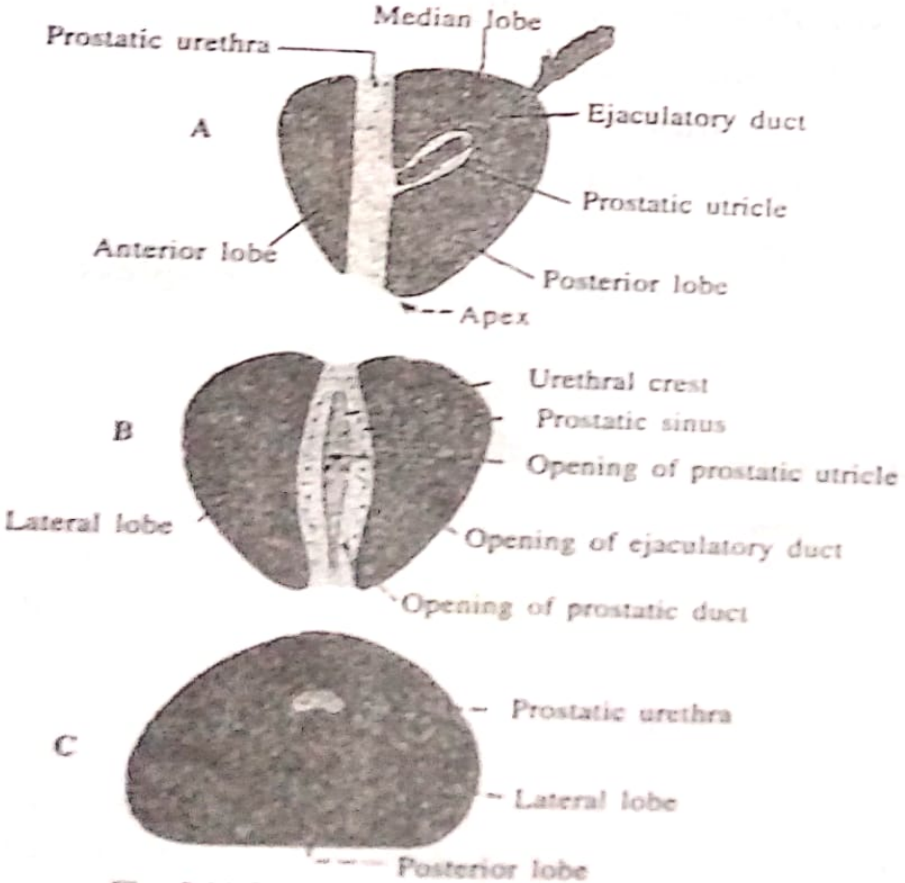

Fig. 2.11 Lobes of the prostate gland

- The prostate is incompletely divided into five lobes.

1. Anterior lobe–The anterior lobe lies infront of the urethra and is devoid of glandular tissue.
2. Median or middle lobe– The middle or median lobe is the wedge of gland situated B/w the urethra and the ejaculatory ducts. Its upper surface is related to the trigone of the bladder. It is rich in glands.
3. Posterior lobe– The posterior lobe is situated behind the urethra and below the ejaculatory ducts and also contains glandular tissue.
4. Right lobe– The right lobe lies on right side of the urethra.
5. Left lobe– The left lobe lies on left side of the urethra.

(3) Relations–

1. Superiorly– The base of the prostate is continuous with the neck of the bladder, the smooth muscle passing without interruption from one organ to the other. The urethra enters the center of the base of the prostate.
2. Inferiorly– The apex of the prostate lies on the upper surface of the urogenital diaphragm. The urethra leaves the prostate just above the apex on the anterior surface.
3. Anteriorly– Symphysis pubis.
4. Posteriorly– Anterioi surface of the rectal ampulla and is separated from it by the rectovesical septum.
5. Laterally– The lateral surface of the prostate are embraced by the anterior fibers of the levator ani as they run posteriorly from the pubis

(4) Function of the prostate–

The function of the prostate is the production of a thin, milky fluid containing citric acid and acid phosphatase. It is added to the seminal fluid at the time of ejaculation. The smooth muscle in the capsule and stroma contract, and the secretion from the many glands is squeezed into the prostatic urethra. The prostatic secretion is alkaline and helps neutralize the acidity in the vagina.

(5) Age changes in the prostate–

1. At birth the prostate is small in size and is made up mainly of stroma in which a simple duct system is embedded.

During the first six weeks after birth the epithelium of the ducts, and of the prostatic utricle undergoes hyperplasia and squamous metaplasia, under the stimulation of maternal oestrogens. There after, up to the age of nine years changes are negligible. B/w nine and fourteen years, the duct system becomes more elaborate by formation of side buds and the gland slowly increases in size.

2. At puberty the male hormones bring about rapid changes in the gland in about one year. It become double, its prepubertal size due to rapid growth of the follicles.The stroma is condensed and its relative proportion is reduced.
3. From twenty to thirty years there occurs marked proliferation of the glandular elements with infolding of the glandular epithelium into the lumen of the follicles, making them irregular.
4. From thirty to fourty-five years the size of the prostate remains constant, and involution starts. The epithelial infoldings gradually disappear and amyloid bodies increase in number.
5. After forty-five to fifty years the prostate is either enlarged called the benign hypertrophy or reduced in size called the senile atrophy.

(6) Blood supply– • Inferior vesical artery.
• Middle rectal artery.

(7) Venous drainage– Prostatic venous plexus

(8) Lymphatic drainage– • Internal iliac lymph nodes.
• Sacral lymph nodes.

(9) Nerve supply– Inferior hypogastric plexus.

(10) Applied aspect–

1. Senile enlargement of prostate.
2. Prostatitis– Inflammation of the prostate.
3. The prostate is a common site of carcinoma.

(C) Mixed Glands (उभयस्रावी ग्रन्थियाँ)

1. Pancreas– अग्न्याशय
2. Gonadal glands– जननांग ग्रन्थियाँ

(A) Testis– नर जनन ग्रन्थि, शुक्र ग्रन्थि, वृषण ग्रन्थि, अण्डग्रन्थि

(B) Ovary– मादा जनन ग्रन्थि, बीज ग्रन्थि, डिम्ब ग्रन्थि

(1) Pancreas (अग्न्याशय)

(1) Introduction–

The pancreas is both an exocrine and an endocrine gland. The exocrine portion of the gland produces a secretion that contains enzymes capable of hydrolyzing proteins, fats and carbohydrates.

The endocrine portion of the gland, the pancreatic islets (islets of langerhans) produces the hormones insulin and glucagon which play a key role in carbohydrate metabolism.

The pancreas is an elongated structure that lies in the epigastrium and the left upper quadrant. It is soft and lobulated and situated on the posterior abdominal wall behind the peritoneum. It crosses the transpyloric plane.

(2) Subdivision– It has four parts.

1. Head
2. Neck
3. Body
4. Tail

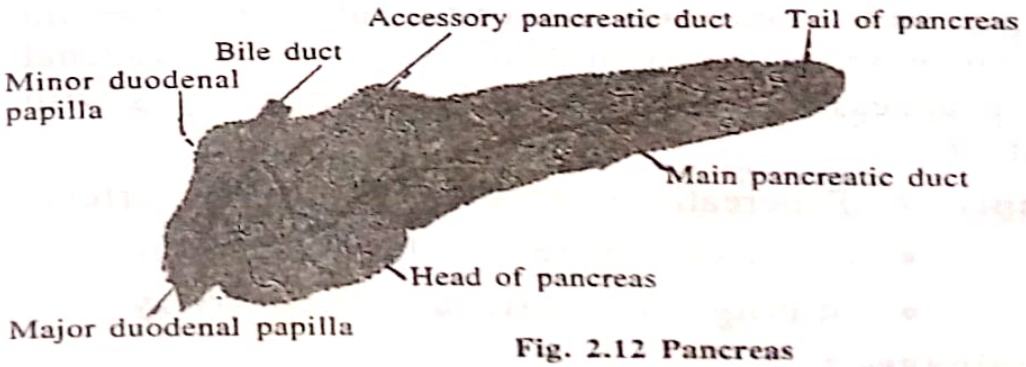

Fig. 2.12 Pancreas

1. Head– The head of the pancreas is disc shaped and lies within the concavity of the duodenum.

   A part of the head extends to the left behind the superior mesenteric vessels and is called the uncinate process.

2. Neck– The neck is the constricted portion of the pancreas and connects the head to the body. It lies infront of the beginning of the portal vein and the origin of the superior mesenteric artery from the aorta.

3. *Body–* The body runs upwards and to the left across the midline. It is somewhat triangular in cross section.

4. *Tail–* The tail passes forward in the splenicorenal ligament and comes in contact with the hilum of the spleen.

(3) Relations–

- Anteriorly– The transverse colon and the transverse mesocolon. The lesser sac and the stomach.
- Posteriorly– The bile duct, the portal and splenic veins. the inferior venacava (I.V.C.), the aorta, the origin of the superior mesenteric artery, the left psoas muscle, the left suprarenal gland, the left kidney and the hilum of the spleen.

(4) Pancreatic ducts– The main duct of the pancreas begins in the tail and runs the length of the gland, receiving numerous tributaries on the way. It opens into the second part of the duodenum at about its middle with the bile duct on the major duodenal papilla. Sometimes the main duct drains separately into the duodenum.

The accessory duct of the pancreas, when present, drains the upper part of the head and then opens into the duodenum a short distance above the main duct on the minor duodenal papilla. The accessory duct frequently communicates with the main duct.

(5) Blood supply–
- Pancreatic branches of the splenic artery.
- Superior pancreaticoduodenal artery.
- Inferior pancreaticoduodenal artery.

(6) Venous drainage–
- Splenic vein.
- Superior mesenteric vein.
- Portal vein.

(7) Lymphatic drainage–
- Pancreaticosplenic nodes.
- Coeliac nodes.
- Superior mesenteric nodes.

(8) Nerve supply–
- Sympathetic– Splanchnic plexus.
- Parasympathetic– Vagus.

(9) Functions–

1. Endocrine– Carbohydrates are the immediate source of energy. Insulin helps in utilization of sugar in the cells. Deficiency of insulin results in hyperglycaemia. The disease is called diabetes mellitus. There appears to be poverty in plenty.
2. Pancreatic juice– It provides appropriate alkaline medium for the activity of the pancreatic enzymes.
3. Digestive– Pancreatic juice contains many digestive enzymes of which the important ones are as follows. Trypsin breaks down proteins to lower peptides. Amylase hydrolyses starch and glycogen to disaccharides. Lipase breaks down fat into fatty acids and glycerol.

(10) Applied aspect–

1. Acute pancreatitis is a 'Graves' disease. It may be a complication of mumps.
2. Pancreatic cyst.
3. Carcinoma is common in the head of the pancreas.
4. Deficiency of pancreatic enzymes causes digestive disturbances.
5. Deficiency of insulin causes the disease diabetes mellitus.
6. Pain from the pancreas is commonly referred to the back. Because the pancrease lies behind the stomach and transverse colon.

(2) Gonadal Glands (जननांग ग्रन्थियाँ)

(A) Testis– नर जनन ग्रन्थि या वृषण ग्रन्थि

(B) Ovary– मादा जनन ग्रन्थि या डिम्ब ग्रन्थि

(A) Testis (वृषण ग्रन्थि)

(1) Introduction–

The testis is a firm, mobile organ lying within the scrotum. The left testis usually lies at a lower level than the right. The upper pole of the gland is tilted slightly forward. Each testis is surrounded by a tough fibrous capsule, the tunica albuginea.

3. Body– The body runs upwards and to the left across the midline. It is somewhat triangular in cross section.
4. Tail– The tail passes forward in the splenicorenal ligament and comes in contact with the hilum of the spleen.

(3) Relations–

- Anteriorly– The transverse colon and the transverse mesocolon. The lesser sac and the stomach.
- Posteriorly– The bile duct, the portal and splenic veins, the inferior venacava (I.V.C.), the aorta, the origin of the superior mesenteric artery, the left psoas muscle, the left suprarenal gland, the left kidney and the hilum of the spleen.

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(2) Gonadal Glands (जननांग ग्रन्थियाँ)

(A) Testis– नर जनन ग्रन्थि या वृषण ग्रन्थि

(B) Ovary– मादा जनन ग्रन्थि या डिम्ब ग्रन्थि

(A) Testis (वृषण ग्रन्थि)

(1) Introduction–

The testis is a firm, mobile organ lying within the scrotum. The left testis usually lies at a lower level than the right. The upper pole of the gland is tilted slightly forward. Each testis is surrounded by a tough fibrous capsule, the tunica albuginea.

Extending from the inner surface of the capsule is a series of fibrous septa that divide the interior of the organ into lobules. Lying within each lobule are one to three called seminiferous tubules. The tubules open into a network of channels called the rete testis. Small efferent ductules connect the rete testis to the upper end of the epididymis.

Normal spermatogenesis can occur only if the testes are at a temperature lower than that of the abdominal cavity. When they are located in the scrotum. Thay are at a temperature about 3°c lower than the abdominal temperature. The control of testicular temperature in the scrotum in not fully understood, but the surface area of the scrotal skin can be changed reflexly by the contraction of the dartos and cremaster muscles. It is now recognized that the testicular veins in the spermatic cord that form the pampiniform plexus together with the branches of the testicular arteries, which lie close to the veins. probably assist in stabilizing the temperature of the testes by a countercurrent heat exchange mechanism. By this means, the hot blood arriving in the artery from the abdomen loses heat to the blood ascending to the abdomen within the veins.

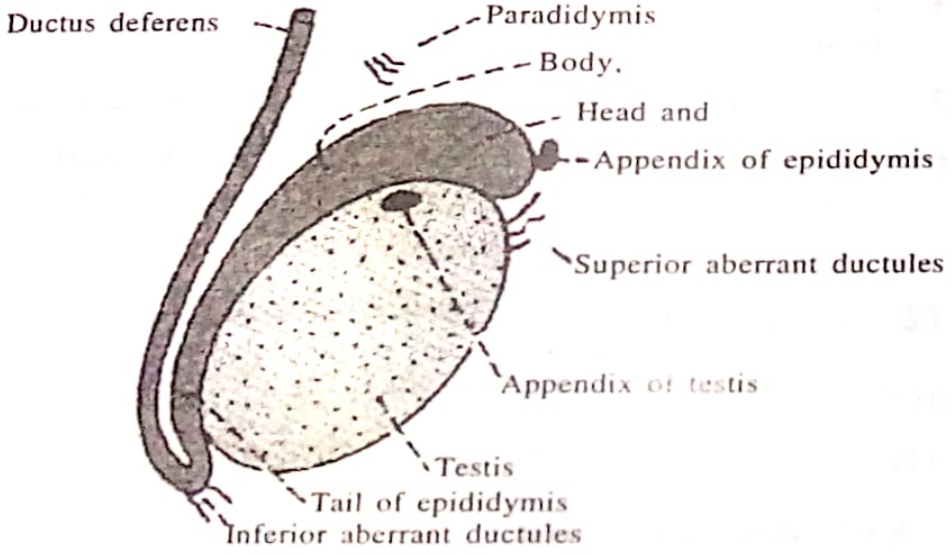

Fig. 2.13 Testis

(2) External features– The testis has–

1. Two poles or ends– 1. Upper pole 2. Lower pole
2. Two borders– 1. Anterior border 2. Posterior border
3. Two surfaces– 1. Medial surface 2. Lateral surface

(3) Coats of the testis–

The testis is covered by three coats.

1. Tunica vaginalis– Outer coat.
2. Tunica albuginea– Middle coat.
3. Tunica vasculosa– Innermost coat.

(4) Blood supply– Testicular artery.

(5) Venous drainage– Pampiniform plexus.

(6) Lymphatic drainage–
- Preaortic nodes.
- Para aortic nodes.

(7) Nerve supply–

Sympathetic nerves arising from segment T_{10} of the spinal cord.

(8) Applied aspect–

1. Monorchism–The testis may be absent on one side called as monorchism.
2. Anorchism– The testis may be absent on both sides known as anorchism.
3. Hydrocoele– Hydrocoele is a condition in which fluid accumulates in the processus vaginales.
4. Varicocoele– Varicocoele is produced by dilation of the pampiniform plexus on veins.
5. The testis may be site of various infections and of tumours.
6. Ectopic testis– The testis may occupy an abnormal position due to deviation from the normal route of descent.
7. Torsion of the testis– Torsion of the testis is a rotation of the testis around the spermatic cord within the scrotum.

(B) Ovary (डिम्ब ग्रन्थि)

(1) Introduction–

The ovaries or female gonads, are paired glands that resemble unshelled almonds in size and shape.

Because they have the same embryonic origin, ovaries are said to be homologous to the testis. The ovaries lie in the superior

portion of the pelvic cavity. One on each side of the uterus. A series of ligaments holds them in position. The broad ligament of the uterus, which is itself part of the parietal peritoneum, attaches to the ovaries by a double-layered fold of peritoneum, called the mesovarium. The ovarian ligament anchors the ovaries to the uterus and the suspensory ligament attached them to the pelvic wall. Each ovary contains a hilus, the point of entrance and exit for blood vessels and nerve and along which the mesovarium is attached.

(2) Parts of the ovary–

Each ovary bears the following parts.

1. Germinal epithelium– The germinal epithelium is a layer of simple epithelium that covers the surface of the ovary and is continuous with the mesothelium that covers the mesovarium.
2. Tunica albuginea– The tunica albuginea is a whiteish capsule of dense germinal epithelium, irregular connective tissue imediately deep to the germinal epithelium.
3. Stroma– The stroma is a region of connective tissue deep to the tunica albuginea and composed of a superficial, dense layer called the cortex and a deep, loose layer known as the medulla.

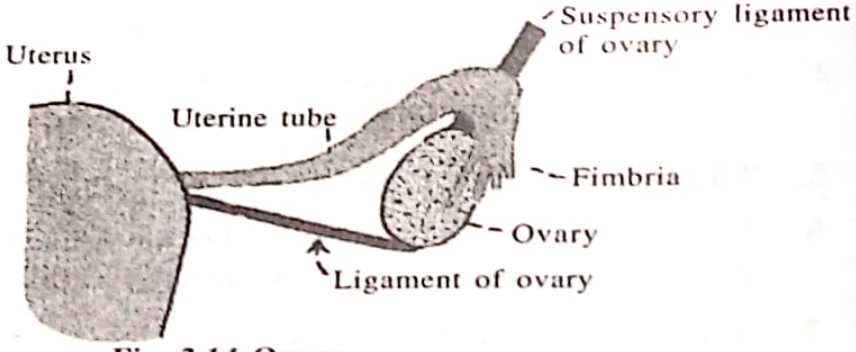

Fig. 2.14 Ovary

4. Ovarian follicles– The ovarian follicles lie in the cortex and consist of oocytes in various stages of development and their surrounding cells. when the surrounding cells form a single layer, they are called follicular cells, later in development when they form several layers, they are referred to as granulosa cells. The surrounding cells nourish the developing oocyte and begin to secrete estrogens as the follicle grows larger.

5. A mature (graafian) follicle– It is a large, fluid filled follicle that soon will rupture and expel a secondary oocyte, a process called ovulation.
6. A corpus luteum– A corpus luteum contains the remnants of an ovulated mature follicle. The corpus luteum produces progesterone, estrogens, relaxin and inhibin until it degenerates and turns into fibrous tissue called a corpus albicans. (white body)

(3) External features– Each ovary has–

- Two poles or extremities– 1. Upper or tubal pole.
  2. Lower or uterine pole.
- Two borders– 1. Anterior or mesovarian border.
  2. Posterior or free border.
- Two surfaces– 1. Lateral surface.
  2. Medial surface.

(4) Visceral relations–

1. Upper pole– It is broader than the lower pole and is related to the uterine tube and the external iliac vein. The ovarian fimbria and the suspensory ligament of the ovary are attached to the upper pole of the ovary.
2. Lower pole– It is narrower than the upper pole and is related to the pelvic floor. It is connected, by the ligament of the ovary, to the lateral angle of the uterus, posteroinferior to the attachment of the uterine tube. The ligament lies B/w the two layers of the broad ligament of the uterus.
3. Anterior border– The anterior border is straight and is related to the uterine tube and the obliterated umbilical artery. It is attached to the back of the broad ligament of the uterus by the mesovarium and forms the hilus of the ovary.
4. Posterior border– The posterior border is convex and is related to the uterine tube and the ureter.
5. Lateral surface– The lateral surface is related to the ovarian fossa which is lined by parietal peritoneum. This peritoneum separates the ovary form the obturator vessels and nerve.

6. Medial surface– The medial surface is largely covered by the uterine tube. The peritoneal recess B/w the mesosalpinx and this surface is known as the ovarian bursa.

(5) Functions–

The ovaries are the organs responsible for the production of the female germ cells, the ova, and the female sex hormones, estrogen and progesterone, in the sexually mature female.

(6) Blood supply– Ovarian artery.

(7) Venous drainage– Ovarian vein

(8) Lymphatic drainage–
- Para-aortic nodes
- Pre-aortic nodes

(9) Nerve supply–
- Sympathetic nerves– T_{10}–T_{11}
- Parasympathetic nerves– S_2–S_3–S_4

(10) Applied aspect–

1. Ovarian cysts.
2. Prolapse of ovaries.
3. Carcinoma of ovary is common.
4. Ovulation can be seen by repeated ultra sonography.

अध्याय- ३

कला शारीर–
(कला की परिभाषा, सप्त कलाओं का स्वरूप, स्थिति, भेद एवं प्रयोजन)

१. कला की परिभाषा

''कलाः खल्वपि सप्त भवन्ति धात्वाशयान्तर मर्यादाः ।'' (सु.शा. ४/५)

- शरीर में कलाएँ सात प्रकार की होती हैं, जो धातु और आशय इनके बीच की मर्यादा है।
- आशय का अर्थ है– रिक्त स्थान।

  उस रिक्त स्थान में जो द्रव्य संचित होते हैं, उन्हीं के अनुसार उस आशय का नाम दिया जाता है। जैसे– मूत्राशय, मलाशय, आमाशय आदि।
- शरीर में सात धातुएँ होती हैं। उनसे ही पूर्वोक्त आशय बनते हैं।
- अतः धातु और आशय इनकी मर्यादा का सही अर्थ होगा– धातु के अन्दर या आशय के अंततः (अन्दर) आच्छादन करने वाली जो पतली रचना है, वही कला है। जिसे हम अन्तस्थाः कला (Inner covering) कहते हैं।
- इस प्रकार Endocardium, endometrium, mucous coat of stomach आदि कला के ही प्रकार हैं।
- धातुओं से जो आशय बने हैं, उन दोनों के बीच में जो क्लेद (Liquid) है, वह अपनी धात्वाग्नि की उष्णता से पक्व होकर कला रूप धारण करता है।
- काष्ठ को काटने से जैसे उसमें से सार भाग निकलता है, वैसे ही यह धातुओं का रस है, इसे ही कला कहते हैं।

२. स्वरूप

यथा हि सारः काष्ठेषु छिद्यमानेषु दृश्यते ।
तथा हि धातुः मांसेषु छिद्यमानेषु दृश्यते ।।
स्नायुभिश्च प्रतिच्छन्नान् सन्ततांश्च जरायुणा ।
श्लेष्मणा वेष्टितांश्चापि कलाभागांस्तु तान् विदुः ।। (सु.शा. ४/६-७)

- जैसे काष्ठ (लकड़ी) को छिलने (काटने) से सारभाग दिखाई देता है, वैसे ही मांस को छिलकर निकालने से धातु दिखाई देती है।
- स्नायुओं (तन्तुओं-Fibrous membrane) से ढके हुए और जरायु (झिल्ली–Serous membrane) से व्याप्त तथा श्लेष्मा (Mucous membrane) से वेष्टित (निर्मित) भागों को कला भाग कहते हैं।
- आचार्य गणनाथ सेन के अनुसार– पतले रेशमी वस्त्र के समान भिन्न-भिन्न प्रकार की रचना वाली और सभी आशयों को अन्दर तथा बाहर से ढकने वाली झिल्ली है, उन्हें कला कहते हैं।

(३) स्थान एवं कार्य के अनुसार इनका नामकरण निम्न प्रकार से किया गया है

१. मांसधरा कला– Deep fascia, intermuscular septa.

२. रक्तधरा कला– Endothelial lining of the blood vessels and sinuses in the liver and spleen.

३. मेदधरा कला– Omentum–Greater to lesser omentum. Mesentary-fold of peritoneum.

४. श्लेष्मधरा कला– Synovial membrane of joints.

५. पुरीषधरा कला– Mucous membrane of the colon and rectum.

६. पित्तधरा कला– Mucous membrane of the small intestine.

७. शुक्रधरा कला– Mucous membrane of the seminal vesicle, vas deference etc. and tunic vaginalis in scrotum.

मा	–	र	–	मे	–	श्र	–	पु	–	पि	–	शु
↓		↓		↓		↓		↓		↓		↓
मांस	–	रक्त	–	मेद	–	श्लेष्म	–	पुरीष	–	पित्त	–	शुक्र

(४) कलाओं के भेद, स्थिति एवं प्रयोजन

१. मांसधरा कला

- **तासां प्रथमा मांसधरा नाम; यस्यां मांसे सिरा स्नायु धमनी स्त्रोतसां प्रताना भवन्ति ।** (सु.शा. ४/८)
- इन सात कलाओं में प्रथमा मांसधरा नामक कला है। जिस मांसधरा के मांस में सिरा, स्नायु, धमनी और स्त्रोतसों की शाखा-प्रशाखाएँ होती हैं।

- **यथा बिस मृणालानि विवर्धन्ते समन्ततः ।**
  भूमौ पङ्कोदकस्थानि तथा मांसे सिराऽऽदयः ।। (सु.शा. ४/९)
- जिस प्रकार पंकयुक्त (कीचड़युक्त- गन्दा) जल में कमलनाल के तन्तु भूमि में चारों ओर फैलते हैं, वैसे ही मांसधरा कला का आश्रय लेकर सिरा-धमनी-स्नायु एवं स्रोतस् फैलते हैं।

२. रक्तधरा कला

द्वितीया रक्तधरा नाम; मांसस्याभ्यन्तरतः,
तस्यां शोणितं विशेषतश्च सिरासु यकृत्प्लीहोश्च भवति ।। (सु.शा. ४/१०)

दूसरी कला का नाम रक्तधरा है, यह मांस के भीतर होती है। उसमें विशेषतया सिराओं में और यकृत तथा प्लीहा में रक्त होता है।

वृक्षाद्यथाऽभिप्रहतात् क्षीरिणः क्षीरमास्रवेत् ।
मांसादेवं क्षतात् क्षिप्रं शोणितं संप्रसिच्यते ।। (सु.शा. ४/११)

जैसे दूध वाले वृक्ष को प्रहार करने से दूध निकलता है, वैसे ही मांस पर क्षत करने से तुरन्त रक्त निकलता है।

३. मेदोधरा कला

''तृतीया मेदोधरा नाम; मेदो हि सर्वभूतानामुदरस्थमण्वस्थिषु च,
महत्सु च मज्जा भवति ।'' (सु.शा. ४/१२)

तीसरी मेदोधरा नामक कला है। मेद सब प्राणियों के उदर में तथा छोटी अस्थियों में होता है। और बड़ी अस्थियों में मज्जा होती है।

स्थूलास्थिषु विशेषेण मज्जा त्वभ्यन्तराश्रितः ।
अथेतरेषु सर्वेषु सरक्तं मेद उच्यते ।।
शुद्धमांसस्य यः स्नेहः सा वसा परिकीर्तिता ।। (सु.शा. ४/१३)

विशेषकर बड़ी अस्थियों के मध्य का आश्रय करके मज्जा होती है। और छोटी सब अस्थियों में जो मेद होता है, वह सरक्त मेद कहलाता है। शुद्ध मांस का जो स्नेहन है, वह वसा कहलाता है।

४. श्लेष्मधरा कला

चतुर्थी श्लेष्मधरा नाम; सर्वसन्धिषु प्राणभूतां भवति । (सु.शा. ४/१४)

चौथी श्लेष्मधरा नामक कला है, जो प्राणियों की सब सन्धियों (Joints) में रहती है।

स्नेहाभ्यक्ते यथा ह्यक्षे चक्रं प्रवर्त्तते ।
सन्धयः साधु वर्तन्ते संश्लिष्टाः श्लेष्मणा तथा ।। (सु.शा. ४/१५)

जैसे अक्ष के ऊपर तैल लगाने से पहिया अच्छी तरह चलता है, वैसे ही श्लेष्मधरा कला से निकले हुए श्लेष्मा से लिप्त सन्धियाँ अच्छी तरह काम करती हैं।

५. पुरीषधरा कला

''पञ्चमी पुरीषधरा नाम, याऽन्तः कोष्ठे मलमभिविभजते पक्वाशयस्था ।'' (सु.शा. ४/१६)

पाँचवी पुरीषधरा (मलधरा) नामक कला है। जो कोष्ठ के अन्दर पक्वाशय में स्थित मल को विभक्त करती है।

यकृत्समन्तात् कोष्ठं च तथाऽन्त्राणि समाश्रिता ।
उण्डुकस्थं विभजते मलं मलधरा कला ।। (सु.शा. ४/१७)

यकृत एवं कोष्ठस्थ अंगों के समीपवर्ती आंत्रों में समाश्रित हुई मलधरा कला उण्डुक स्थित मल को विभक्त करती है।

६. पितधरा कला

''षष्ठी पित्तधरा नाम; या चतुर्विधमन्नपानमाशयात् प्रच्युतं पक्वाशयोपस्थितं धारयति ।'' (सु.शा. ४/१८)

छठी पित्तधरा नामक कला है। जो आमाशय से निकलकर पक्वाशय की ओर जाने के लिए आये हुए उपभुक्त चारों प्रकार के अन्नपान को धारण करती है।

''अशितं खादितं पीतं लीढं कोष्ठगतं नृणाम् ।
तज्जीर्यति यथाकालं शोषितं पित्ततेजसा ।। (सु.शा. ४/१९)

मनुष्य की आंत्रों में पहुँचा हुआ (अशित-पूड़ी, भात, खादित-लड्डू, पीत-दूध, पानक, लीढ़-रबड़ी) चारों प्रकार का उपभुक्त अन्न उचित काल में पित के तेज से जीर्ण हो जाता है, तथा शोषित भी हो जाता है।

७. शुक्रधरा कला

''सप्तमी शुक्रधरा नाम; या सर्वप्राणिनां सर्व शरीर व्यापिनी ।'' (सु.शा. ४/२०)

सातवीं शुक्रधरा नामक कला है। जो सब प्राणियों के सर्व शरीर में व्याप्त रहती है।

यथा पयसि सर्पिस्तु गुडश्चेक्षुरसे यथा ।
शरीरेषु तथा शुक्रं नृणां विद्याद् भिषग्वरः ।। (सु.शा. ४/२१)

जैसे– दूध में घी एवं ईख (गन्ने) में गुड़ व्याप्त होता है। वैसे ही मनुष्य के शरीर में शुक्र व्याप्त रहता है।

द्वयङ्गुले दक्षिणे पार्श्वे बस्तिद्वारस्य चाप्यधः ।
मूत्र स्रोतः यथाच्छुक्रं पुरूषस्य प्रवर्त्तते ।।
कृत्स्नदेहाश्रितं शुक्रं प्रसन्नमनसस्तथा ।
स्त्रीषु व्यायच्छतश्चापि हर्षात्तत् सम्प्रवर्त्तते ।। (सु.शा. ४/२२-२३)

- बस्ति (मूत्राशय) द्वार के नीचे दो अंगुल दक्षिण (और वाम) पार्श्व में (स्थित शुक्रधरा कला में संचित) पुरूष का शुक्र मूत्रमार्ग के रास्ते से बाहर निकलता है।
- प्रसन्न मन होकर स्त्री प्रसंग करने वाले पुरूष के सर्व शरीर में रहने वाला शुक्र हर्ष के कारण प्रवृत होता है।

मुख्य रूप से निम्न कलाओं का वर्णन किया जा रहा है।

१. हृदयावरण कला– Pericardium
२. फुफ्फुसावरण कला– Pleura
३. उदरावरण कला या उदरगुहा कला– Peritoneum
४. मस्तिष्कावरण कला– Meninges

(1) Pericardium (हृदयावरण कला)

(1) Definition–

- The pericardium is a fibroserous sac which encloses the heart and the roots of great vessels.
- Pericardium is a triple layered sac.

(2) Situations– It is situated in the middle mediastinum.

(3) Relations–

Anteriorly– Body of sternum and second to sixth costal cartilage.

Posteriorly– Fifth to eighth thoracic vertebrae.

(4) Types– (A) Fibrous pericardium

(B) Serous pericardium ┌ Parietal layer
└ Visceral layer

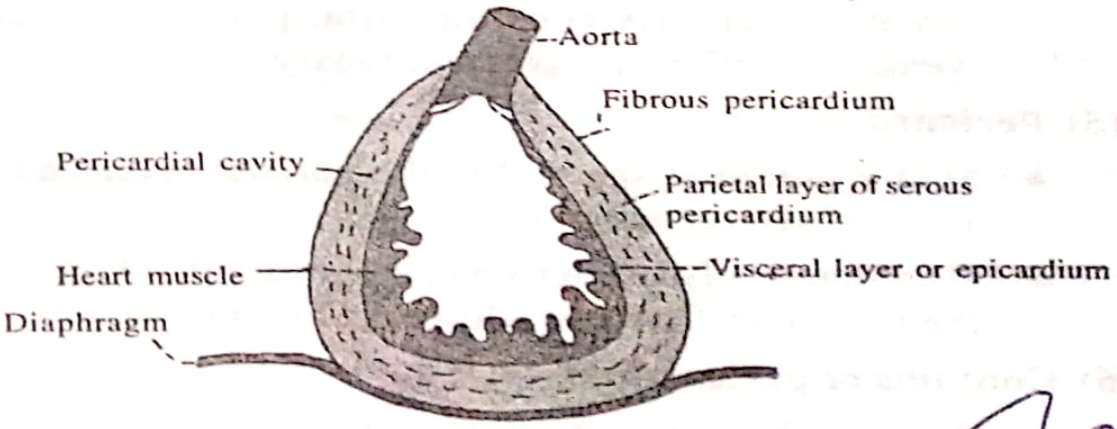

Fig. 3.1 Pericardium

(A) Fibrous pericardium–

- It is a conical sac made up of fibrous tissue.
- The parietal layer of serous pericardium is attached to its deep surface.
- Fibrous pericardium have following features–

1. Apex– Apex is blunt and lies at the level of the sternal angle. It is fused with the root of great vessels.
2. Base– Base is broad and mixed with the central tendon of diaphragm.
3. Anterior– It is connected to the upper and lower end of the body of sternum by weak sup. and inf. sternopericardial ligaments.
4. Posterior– It is related to the principal bronchi, esophagus, descending thoracic aorta.
5. On each side– It is related to the mediastinal pleura.

(B) Serous pericardium–

- It is a thin, double layered serous membrane lined by mesothelium.
- The outer layer (Perietal layer) is fused with the fibrous pericardium.
- The inner layer (visceral layer or epicardium) is fused to the heart. Except along the cardiac groove, where it is separated from the heart by blood vessels.
- The two layer are continuous with each other at the roots of great vessels. (Ascending aorta, pulmonary trunk, sup. venacava, inf. venacava, pulmonary veins)

(5) Pericardial cavity–

- It is a potential space B/w the parietal layer and visceral layer of serous pericardium.
- It contains only a thin film of serous fluid, which lubricates the proper surface and allows the heart to move smoothly.

(6) Contains of pericardium–

- Heart with cardiac vessels and nerves.

- Ascending aorta.
- Pulmonary trunk.
- Lower half of superior venacava.
- Terminal part of inferior venacava.
- Terminal part of pulmonary veins.

(7) Sinuses of pericardium–

1. **Transverse sinus–** It is a horizontal gap B/w the arterial and venous end of the heart tube.
2. **Oblique sinus–** It is a narrow gap behind the heart.

(8) Arterial supply–

(A) The fibrous and perietal pericardium are supplied by branches from–
- Internal thoracic artery.
- Musculophrenic artery.
- Descending thoracic aorta.

(B) The visceral pericardium are supplied by branches from–
- Coronary artery

(9) Nerve supply–

(A) Fibrous and parietal pericardium–
- Phrenic nerve.
- They are sensitive to pain.

(B) Epicardium (Visceral layer)–
- Autonomic nerves of the heart.
- They are not sensitive to pain.

(10) Applied aspect–

- **Pericarditis–**
  - Inflamation of the serous pericardium called pericarditis.
  - Pain of pericarditis originates in the perietal layer alone.
  - Cardiac pain (Angina) originates in the cardiac muscles or in the vessels of the heart.
- **Pericardial effusion–** Collection of fluid in the pericardial cavity.
- **Paracentesis–**
  - The puncture of a cavity with removal of fluid.
  - Aspiration of the fluid from pericardial cavity.

- Pericardial effusion can be drained by puncturing the sixth intercostal space in the midaxillary line.

(2) Pleura (फुफ्फुसावरण कला)

(1) Definition– The pleura is a serous membrane, which is lined by mesothelium.

(2) Situation–

- There are two pleural sac on each side of mediastinum.
- Each pleural sac is invaginated from its medial side by lungs.

(3) Types– (A) Outer layer– parietal pleura.

(B) Inner layer–Visceral pleura or pulmonary pleura.

(4) Pleural cavity– It is a potential space B/w parietal and visceral pleura.

(A) Visceral pleura or pulmonary pleura– It covers the surfaces and fissures of the lungs, except at the hilum, where it is continuous with the perietal pleura.

(B) Parietal pleura– It is thicker than the pulmonary pleura and is subdivided into four parts–

1. Costal part– Costal part line the inner surface of the ribs, the costal cartilages, the intercostal spaces. The side of vertebral bodies and back of sternum.
2. Diaphragmatic part– Covers the thoracic surface of the diaphragm.
3. Mediastinal part– Covers and form the lateral boundary of mediastinum.

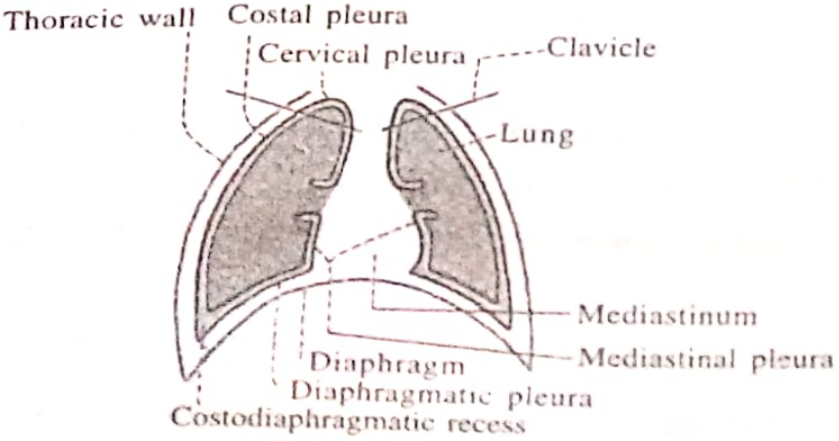

Fig. 3.2 Pleura

4. Cervical part– Extends into the neck.

It is covered by the suprapleural membrane.

(5) **Pulmonary Ligament–** The parietal pleura surrounding the roots of the lung extends downwards beyond the root as a fold called the pulmonary ligament. It provides a dead space into which pulmonary veins can expand during increased venous return.

(6) **Recesses of pleura–** There are two recesses (folds) of parietal pleura. Which act as 'reserve space' for the lung to expand during deep inspiration.

(A) **Costomediastinal recess–** Lies anteriorly, behind the sternum and costal cartilage B/w the costal and mediastinal pleura.

(B) **Costodiaphragmatic recess–**

- Lies inferiorly, B/w the costal and diaphragmatic pleura. Vertically it measures 5 cm. and extends from the 8th to 10th ribs along the midaxillary line.
- This is the first part of the pleural cavity to be filled up by pleural effusion.

(7) **Surface marking–**

1. Cervical pleura– The cervical pleura is represented by a curved line forming a dome over the medial 1/3 of the clavicle with a height of about one inch above the bone.

2. Anterior margin– On the right side it extends from the sternoclavicular joint downwards and medially to the midpoint of the sternal angle. From here it continues vertically downwards to the midpoint of the xiphisternal joint. On the left side, the line follows the same course upto the level of the 4th costal cartilage. It then arches outwards and descends along the sternal margin upto the 6th costal cartilage.

3. Posterior margin– The post. margin of the pleura passes from a point 2 cm. lateral to the 12th thoracic spine to a point 2 cm. lateral to the 7th cervical spine. The costal pleura becomes the mediastinal pleura along this line.

4. Inferior margin– The inf. margin passes laterally from the lower limit of its anterior margin, so, that it crosses.

- The 8th rib in the midclavicular line.
- The 10th rib in the midaxillary line.
- The 12th rib at the lateral border of the sacrospinalis muscle.

(8) Parietal pleura–

(A) Arterial supply–
- Inter costal artery.
- Internal thoracic artery.
- Musculophrenic artery.

(B) Venous drainage–
- Azygos vein.
- Internal thoracic veins.

(C) Lymphatic drainage–
- Intercostal lymph nodes.
- Internal mammary nodes.
- Posterior mediastinal nodes.
- Diaphragmatic nodes.

(D) Nerve supply–
- Intercostal nerves.
- Phrenic nerve.
- They are sensitive to pain.

(9) Visceral pleura–

(A) Arterial supply– Bronchial arteries.

(B) Lymphatic drainage– Bronchiopulmonary nodes.

(C) Nerve supply– Autonomic (sympathetic) nerve of the lungs T_4–T_5.

- They are not sensitive to pain.

(10) Applied aspect–
- Pleurisy or pleuritis– Inflammation of pleura.
- Pneumothorax– Presence of air in pleural cavity.
- Haemothorax– Presence of blood in pleural cavity.
- Hydropneumothorax– Presence of fluid and air in pleural cavity.
- Empyema– Presence of pus in pleural cavity.
- Pleural effusion–Presence of serous fluid in pleural cavity.
- Paracentesis– Aspiration of any fluid from the pleural cavity. It is usually done in 6th intercostal space in the midaxillary line.

(3) Peritoneum (उदरावरण कला या उदरगुहा कला)

Peri = Around

Tonos = Tension

(1) Definition– The peritoneum is the largest serous membrane of the body, lining the abdominal cavity.

(2) Situation– The peritoneum is in the form of a closed sac which is invaginated by a number of viscera.

(3) Types– (A) Parietal layer

(B) Visceral layer

(A) Parietal layer–

- It lines the inner surface of the abdominal and pelvic walls and the lower surface of the diaphragm.
- Its blood supply and nerve supply are same as those of the overlying bodywall. Parietal peritoneum is pain sensitive.

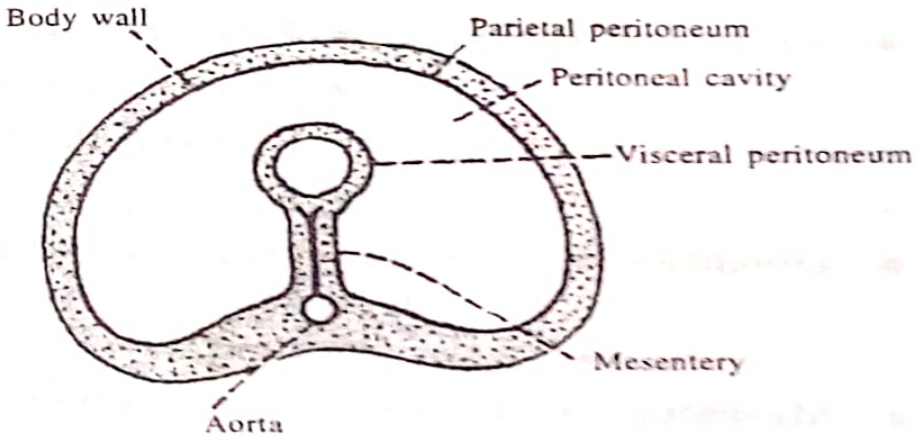

Fig. 3.3 Peritoneum

(B) Visceral layer–

- It lines the outer surface of the viscera.
- Its blood supply and nerve supply are the same as those of the underlying viscera. Visceral peritoneum is pain sensitive.

(4) Peritoneal cavity– The viscera which invaginate the peritoneal cavity completely fill it, so that the cavity is reduced to a potential space B/w these layers. There is a thin film of serous fluid.

This fluid performs a lubricating function and allows free movement.

(5) Parts– Peritoneal cavity is divided two parts–

(A) Greater sac– Greater sac is the main compartment of the peritoneal cavity and extend from the diaphragm to pelvis.

(B) Lesser sac– Lesser sac is smaller and lies behind the stomach.

(6) Retroperitoneal (Behind peritoneum)–

- Some organs lies on the posterior abdominal wall and are covered by peritoneum on their anterior surface only.
- Such organs including the kidney, pancreas, ascending colon and descending colon.

(7) Fold of peritoneum–

- Many organs within the abdomen are suspended by fold of peritoneum.
- **Peritoneal ligament–**
  - Falciform ligament.
  - Coronary ligament.
  - Rt. triangular ligament.
  - Lt. triangular ligament.
- **Omenta–**
  - Greater omentum– Largest peritoneal fold, like apron.
  - Lesser omentum.
- **Mesentery–**
  - Mesentery of small intestine.
  - Transverse mesocolon.
  - Sigmoid mesocolon.

(8) Applied aspect–

- Ascites– Collection of free fluid in the peritoneal cavity. Common causes of ascites are cirrhosis of liver,tubercular peritonitis, congestive heart failure and malignancy.
- Peritonitis– Inflammation of the peritoneum is called peritonitis.
- Laparoscop– Instrument.

- Laparoscopy– Examination method.
- Laparotomy– Opening abdominal cavity by a surgeon.

(3) Meninges (मस्तिष्कावरण कला)

- The brain and spinal cord are surrounded by three membranes or meninges.
  - The dura mater– Outer layer.
  - The arachnoid mater– Middle layer.
  - The pia mater– Inner layer.
- The cerebrospinal fluid (c.s.f.) fills the space B/w the arachnoid and the piamater (Subarachnoid space) and acts as a water cushion.

(A) Meninges of brain–

1. Duramater of the brain–

- It is made up of two layers– An outer endosteal layer and an inner meningeal layer, enclosing the cranial venous sinuses B/w the two layer.

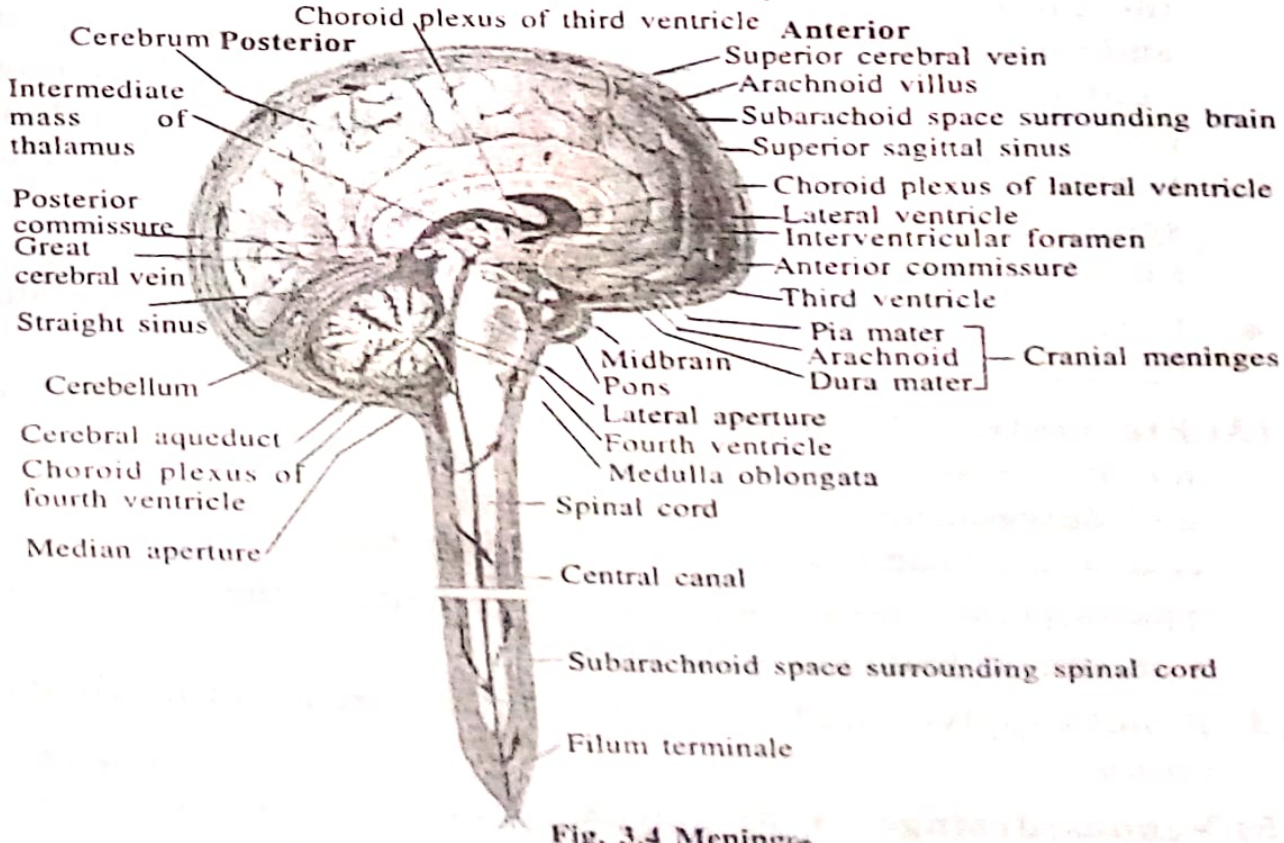

Fig. 3.4 Meninges

- The inner menigeal layer forms four folds (The flax cerebri, the falx cerebelli, the tentorium cerebelli., the diaphragm sellae.)

  Which divide the cranial cavity into intercommunicating compartments for different parts of the brain.

(2) **Arachnoid mater of the brain–** The arachnoid mater is a delicate, impermeable membrane covering the brain and lying B/w the pia mater internally and the dura mater externally.

- It is separated from the dura mater by a potential space, the subdural space. (containing a thin film of serous fluid).
- And from the piamater by the subarachnoid space, which is filled with cerebrospinal fluid.
- The cerebrospinal fluid is produced by the choroid plexuses within the lateral, third and fourth ventricles of the brain.

  It escapes from the ventricular system of the brain through the three foramina (foramen of magendic–median, single and foramen of luschka– lateral, two) in the roof of the fourth ventricle and so inters the subarachnoid space. It now circulates both upwards over the surface of the cerebral hemispheres and downward around the spinal cord. The spinal subarachnoid space extends down as far as the second sacral vertebrae.

- Eventually, the fluid enters the blood stream by passing into the arachnoid villi and diffusing through their walls.

(3) **Pia mater of the brain–** The piamater is a vascular membrane that closely invests the brain, covering the gyri and descending into the deepest sulci. It extends over the cranial nerve and fuses with their epineurium. (Nerve sheath)

The cerebral arteries entering the substance of the brain carry a sheath of piamater with them.

(4) **Blood supply–** Middle meningeal artery, branch of maxillary artery.

(5) **Venous drainge–**
- Meningeal vein.
- Pterygoid venous plexus.

(6) Nerve supply–
- Trigeminal nerve.
- Vagus nerve.
- First three cervical nerve.

(7) Applied aspect–
- Haemorrhage.
- Extradural haemorrhage
- Subdural "
- Subarachnoid "
- Cerebral "

- Lumbar puncture (Spinal tap)–Inter space B/w third and fourth lumbar spine.
- Withdraw a sample of C.S.F. for examination.

(B) Meninges of spinal cord–

- The spinal cord like the brain is surrounded by three meninges.
  1. Dura mater– Outer layer
  2. Arachnoid mater– Middle layer
  3. Pia mater– Inner layer

(1) Dura mater–

- The duramater is the most external membrane, that encloses the spinal cord and cauda equina.
- It is continuous above through the foramen magnum with the meningeal layer of duramater covering the brain.

  Inferior, it ends on the filum terminale at the level of the lower border of the second sacral vertebra.
- The dural sheath lies loosely in vertebral canal and is separated from the wall of the canal by the extradural space. The duramater extends along each nerve root and becomes continuous with connective tissue surrounding each spinal nerve at the intervertebral foramen. The inner surface of the duramater is separated from the arachnoid mater by the potential subdural space. (Containing a thin film of serous fluid)

(2) Arachnoid mater– The arachnoid mater is a delicate impermeable membrane covering the spinal cord and lying B/w the piamater internally and the dura mater externally.

It is separated from the dura mater by the subdural space, that contains a thin film of the tissue fluid.

- The arachnoid separated piamater by a wide space–The sub-arachnoid space, which is filled with cerebrospinal fluid.
- The arachnoid is continuous above through the foramen magnum with the arachnoid covering the brain. Inferior it ends on the filum terminale at the level of the lower border of the second sacral vertebra.

(3) Piamater– The piamater is a vascular membrane that closely covers the spinal cord. It is continuous above through the foramen magnum with the piamater covering the brain. Below, it fuses with the filum terminale.

The piamater is thickened on either side B/w the nerve roots to form the ligamentum denticulatum. Which passes laterally to be attached to the duramater.

अध्याय- ४

त्वक् शारीर

१. परिचय

- सम्पूर्ण शरीर को ढकने वाली एवं स्पर्शनेन्द्रिय का अधिष्ठान है।
- यही स्वेदवह स्रोतस् एवं लोमकूपों का आश्रय स्थान है।
- त्वचा-यह स्पर्श का ज्ञान करने वाला इन्द्रिय (ज्ञानेन्द्रियाँ) है।

२. परिभाषा

सम्पूर्ण शरीर के अंग-प्रत्यंगो को बाहर से आवृत करने वाला एवं शरीर में सर्वप्रथम दिखाई देने वाला अंग त्वचा है।

३. उत्पत्ति

''तस्य खलु एवं प्रवृत्तस्य शुक्र शोणितस्य अभिपच्यमानस्य,
क्षीरस्येव सन्तानिकाः, सप्त त्वचा भवन्ति ।'' (सु.शा. ४/४)

जैसे दूध के उबलने से मलाई बनती है, उसी प्रकार निश्चित रूप से प्रवृत्त हुए शुक्र-शोणित के अभिपाच्य (Activites/processes after conception) से त्वचा बनती हैं। सात त्वचाएँ होती हैं।

४. स्वरूप

- यह त्वचा अनेक वर्ण की, कृष्ण-श्याम-श्वेत-रक्त-पीत ऐसे विभिन्न वर्णों की होती है।
- त्वचा मृदु-कठिन-खुरदरी-अधिक केशयुक्त-अल्प केश युक्त या रोमयुक्त- स्निग्ध-रूक्ष, स्वभावतः शीत या उष्ण, पतली या मोटी होती है।
- आचार्य सुश्रुत के अनुसार त्वचा की मोटाई प्रत्येक स्थान पर एक सी नहीं होती। मांसल स्थानों पर, जैसे– नितम्ब, उदर, मन्या, स्कन्ध आदि स्थानों पर वह अधिक मोटी होती है। कहीं-कहीं पतली होती है। जैसे– हस्त का पृष्ठ भाग आदि।

५. संख्या/प्रकार/भेद (Layers of skin)

आचार्य सुश्रुत के अनुसार त्वचाओं के सात स्तर बनते हैं अर्थात् त्वचा सात प्रकार की होती हैं।

१. अवभासिनी

तासां प्रथमा अवभासिनी नाम, या सर्ववर्णान् अवभासयति, पञ्चविधां च छायां प्रकाशयति, सा ब्रीहेः अष्टादश भाग प्रमाणा, सिध्म-पद्मकण्टक अधिष्ठानाः। (सु.शा. ४/४)

प्रथम अवभासिनी नामक त्वचा होती है, जो सब वर्णों को प्रकट करती है और पाँच प्रकार की छाया को प्रकाशित करती है। वह चावल के **अठारहवें भाग** के समान मोटी होती है। इसी त्वचा में **सिध्म, पद्मकण्टक** आदि रोग होते हैं।

२. लोहिता

द्वितीया लोहिता नाम, ब्रीहि षोडश भाग प्रमाणा, तिलकालक-न्यच्छ-व्यङ्ग अधिष्ठानाः । (सु.शा. ४/४)

दूसरी त्वचा लोहिता नाम की है। वह चावल के **सोलहवें भाग** के बराबर मोटी होती है। इसमें **तिलकालक, न्यच्छ** और **व्यङ्ग** आदि रोग होते हैं।

३. श्वेता

तृतीया श्वेता नाम, ब्रीहि द्वादश भाग प्रमाणा, चर्मदल-अजगल्ली-मशक अधिष्ठाना । (सु.शा. ४/४)

तीसरी त्वचा श्वेता है। वह चावल के **बारहवें भाग** के बराबर मोटी रहती है। उसमें **चर्मदल, अजगल्लिका** और **मशक** का स्थान होता है।

४. ताम्रा

चतुर्थी ताम्रा नाम, ब्रीहेः अष्ट भाग प्रमाणा, विविध किलास-कुष्ठ अधिष्ठाना । (सु.शा. ४/४)

चौथी त्वचा ताम्रा नाम की है। वह चावल के **आठवें** भाग के बराबर मोटी होती है। उसमें अनेक प्रकार के **किलास** और **कुष्ठ** रोग होते हैं ।

५. वेदिनी

पंचमी वेदिनी नाम, ब्रीहि पंच भाग प्रमाणा, कुष्ठ-विसर्प अधिष्ठाना । (सु.शा. ४/४)

पाँचवी वेदिनी नाम की त्वचा है। वह चावल के **पाँचवे भाग** के बराबर मोटी होती है। इसमें **कुष्ठ** और **विसर्प** रोग होते हैं।

६. रोहिणी

षष्ठी रोहिणी नाम, ब्रीहि प्रमाणा, ग्रन्थि-अपची-अर्बुद-श्लीपद-गलगण्ड अधिष्ठाना । (सु.शा. ४/४)

षष्ठी रोहिणी त्वचा है। वह **चावल के बराबर** मोटी रहती है। इसमें **ग्रन्थि, अपची, अर्बुद, श्लीपद** और **गलगण्ड** आदि रोग होते हैं।

७. मांसधरा

सप्तमी मांसधरा नाम, व्रीहि द्वय प्रमाणा, भगन्धर-विद्रधि-अर्शो अधिष्ठाना ।(सु.शा.४/४)

सातवां मांसधरा है। इसकी मोटाई **दो चावल** के बराबर होती है। इसमें **भगन्धर** (Fistula), **विद्रधि** (Abscess) और **अर्श** (Piles) आदि रोग होते हैं।

* आचार्य चरक के अनुसार त्वचाएँ छः प्रकार की होती है।

''शरीरे षट्त्वचः, तद्यथा उदकधरा त्वग्वाह्या, द्वितीया त्वसृग्धरा, तृतीया सिध्मकिलास-संभवाधिष्ठाना, चतुर्थी दद्रुकुष्ठसंभवाधिष्ठाना, पञ्चमी त्वलजीविद्रधिसम्भवाधिष्ठाना, षष्ठी तु यस्यां छिन्नायां ताम्यत्यन्ध इव च तमः प्रविशति या चाप्यधिष्ठायांरूषि जायन्ते, पर्वसु कृष्णरक्तानि स्थूलमूलानि दुश्चिकित्स्यतमानि च; इति षट् त्वचः । एताः षडङ्ग शरीरमवतत्य तिष्ठन्तिः ।'' (च.शा. ७/४)

१. उदक्धरा– जो जल को धारण करती है, त्वचा के बाहरी मार्ग में होती है।

२. असृग्धरा– जो रक्त को धारण करने वाली होती है।

३. सिध्म-किलास– को धारण करने वाली है।

४. दद्रु-कुष्ठ– की उत्पत्ति का स्थान है।

५. अलजी-विद्रधि– की उत्पत्ति का स्थान है।

६. षष्ठी त्वचा–
- वह है, जिसे काटने या कटने से ऐसा अंधेरा छा जाता है, जैसे अन्धे के सामने छाया अन्धेरा।
- इस त्वचा के आश्रयभूत काली, लाल, स्थूलमूल वाली अत्यन्त दुश्चिकित्स्य फुंसियाँ पर्वों पर उत्पन्न होती हैं।

६. प्रयोजन–

- त्वचा पाँच भौतिक है।
- त्वचा में पाँचों महाभूतों के लक्षण या गुण दिखने से हम त्वचा को पाँचभौतिक कहते हैं।
- त्वचा यह स्पर्श का ज्ञान करने वाला इन्द्रिय है। स्पर्शज्ञान वायु से ही होती है। उसमें जो प्रभा-वर्ण आदि हैं, वे अग्नितत्व से बने हैं। त्वचा में जो अनगिनत छिद्र तथा रोमकूप हैं, वे आकाशीय हैं। उसमें रस, रक्त, लसिका, स्वेद आदि रहते हैं, वे सब आप तत्व के बने हैं। तथा चर्म, केश, रोम, श्मश्रु ये पार्थिव हैं।

७. त्वचा की मोटाई (Thickness)

''यदेतत् प्रमाणं निर्दिष्टं तन्मांसलेष्ववकाशेषु न ललाटे सूक्ष्माङ्गुल्यादिषु च,
यतो वक्ष्यत्युदरेषु-व्रीहिमुखेनाङ्गुष्ठोदर प्रमाणमवगाढं विध्येत् ।'' (सु.शा. ४/४)

- उपर्युक्त सातों त्वचाओं के जो प्रमाण या उनकी मोटाई का वर्णन किया गया है। वे केवल मांसल स्थानों की त्वचा के हैं।
- ललाट (Forehead) या छोटी अंगुलियाँ इन पर जो त्वचा आवृत रहती है, उसके नहीं। क्योंकि इन स्थानों की त्वचा पतली होती है।
- ब्रीही का अर्थ यव (चावल) है। अंगुष्ठोदर (अंगुष्ठ के मध्य का भाग) का प्रमाण या मोटाई ६ यव के बराबर होती है।
- प्रत्येक ब्रीही के २० भाग हैं। ऐसी कल्पना करके आचार्य सुश्रुत ने प्रमाण बताये हैं।
- जैसे अष्टादश भाग प्रमाण का अर्थ है– ब्रीहि के २० भाग में से १८ भाग जितनी मोटी त्वचा होगी।
- १ यव= २० भाग
- ६ यव= २०x६= १२० भाग कुल त्वचा का प्रमाण मानना चाहिए।
- इस प्रकार १२० भागों में से अलग-अलग त्वचा का प्रमाण बताया गया है।

जैसे– १८+१६+१२+८+५+२० (१ ब्रीहि) + ४० (२ ब्रीहि)= ११९ भाग होते है। जो लगभग १२० भागों के समान ही है।

८. त्वचा के कार्य

शरीर पर वायु, सूर्य की उष्णता, शीत (ठण्ड) इनका नित्य प्रति आघात तथा प्रभाव होता रहता है। उन सबसे शरीर की रक्षा करना ही इस संरक्षक आच्छादन का कार्य है।

१. शरीर की तथा अंग-प्रत्यंगों की सुरक्षा करना।

२. स्पर्श ज्ञान– शीत-उष्ण आदि का ज्ञान।

३. शोषण करना– त्वचा में स्थित असंख्य छिद्रों द्वारा, त्वचा पर लगाये गये स्निग्ध और द्रवरूप द्रव्य का अन्ततः ग्रहण किया जाता है।

४. स्रवण करना– त्वचा की स्नेह ग्रन्थियों से एक स्निग्ध द्रव पदार्थ का स्रवण होता रहता है, जिससे त्वचा को स्निग्ध रखा जाता है।

५. निःस्सरण करना– स्वेद रूपी मल का निःस्सरण त्वचा करती है।

The Skin

1. Introduction

- The skin is the largest organ of the body.
- The average thickness of the skin is about 2 mm.

- Thickest– measuring about 5 mm. in the– Sole, palm and inter- scapular region.
- Thinnest– Measuring about 0.5 mm. in the– Eyelids and penis.
- All other area of the body have got thin skin.

2. The skin is made up of two layers.

(1) Epidermis (Outer layer)

(2) Dermis (Inner layer)

(1) Epidermis–
- It does not have blood vessels.
- The nutrition is provided by the capillaries of dermis.
- It has five layers– Superficial to deep aspect.

1. Stratum corneum (Horney layer)– Thick and non hairy skin. (palm, sole).
2. Stratum lucidum– Thin and hairy skin.
3. Stratum granulosum– Thin and hairy skin.
4. Stratum spinosum or malphgian.
5. Stratum germinatum or stratum basal or germinal layer.

(2) Dermis–
- Made up of connective tissue.
- Blood vessels, lymphatic and nerve supply.
- It has two layers–

1. Superficial papillary layer.
2. Deeper reticular layer.

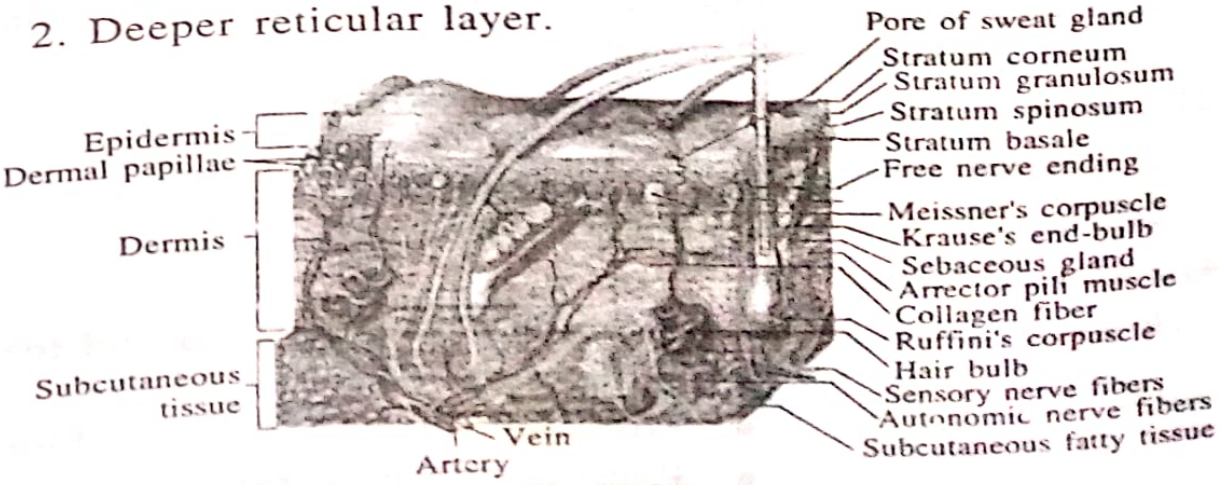

Fig. 4.1 Skin

(1) Epidermis–

1. **Stratum corneum–** Dead cells known as corneocytes are present layers contact with each other with the help of lipids. Due to lipids skin is impermeable to water.
2. **Stratum lucidum–** This layer is made up of homogenous (transparent) cells with ill defined boundary.

   Nuclei are present in traces.

   Known as lucidum (clear) because we can see through it.
3. **Stratum granulosum–** It is multilayer cytoplasm is having keratohyaline granules. These granules stains deep. Due to these granules this layer is known as stratum granulosum.
4. **Stratum spinosum–** It is made up of several layers of polygonal keratinecytes. Comes from basal cells.

   Keratinocytes in this layer are know as prickle cells. These are joined by desmosomes.
5. **Stratum germinatum–** It is the deepest layer. Made up of single ıayer of columnar cells or stem cells. Stem cells undergo mitosis to form keratinocytes.

(2) Dermis–

1. **Superficial papillary layer–** The layer project into the epidermis. This contains blood vessels, lymphatics and nerve fibers.
2. **Deeper reticular layer–** This layer is made up of reticular and elastic fibers. These fibers are found around the hair bulbs, sweat glands and sebaceous glands.

(3) Colour of the skin– It has two important factors.

1. Pigmentation of skin– melanin.
2. Haemoglobin in the blood.

(4) Function of the skin–

1. Protective function–
   - Protection from bacteria and toxic substances.
   - Protection from mechanical blow.
   - Protection from ultraviolet rays.

2. Role of skin as a sense organ.
3. Storage function.
4. Synthesis of vitamin– D.
5. Regulation of body temperture.
6. Regulation of water and electrolyte balance.
7. Excretory function.
8. Absorptive function.
9. Secretory function.

(5) Glands of the skin–

1. Sebaceous glands
2. Sweat glands
   - Ecrine gland.
   - Apocrine gland.

अध्याय- ५

उत्तमांगीय एवं नाड़ी संस्थान शारीर (Nervous System)

१. शिर की परिभाषा एवं महत्ता

प्राणाः प्राणभृतां यत्राश्रिताः सर्वेन्द्रियाणि च ।
यदुत्तमांगमंगानां शिरस्तद्भिधीयते ।। (च.सू. १७/१२)

- सचेतन शरीरों के प्राण तथा उनकी सब इन्द्रियाँ जहाँ आश्रित रहती हैं। तथा जो सब अंगों में उत्तम या प्रधान अंग माना जाता हैं, उसे शिर कहते हैं।
- इस महत्व के अंग की सुरक्षा हेतु प्रकृति ने भी इस प्रत्यंग को शिर: कपालास्थियों की बनी करोटि (Cranial cavity) में सुरक्षित रखा है।
- इस प्रत्यंग को तथा उससे सम्बद्ध सब रचनाओं को तथा वातनाड़ियों को मिलाकर वातनाड़ी संस्थान (Nervous system) कहा जाता है। इस वातनाड़ी संस्थान द्वारा सर्व शरीर पर, उसमें नित्य होने वाली क्रियाओं पर तथा ऐच्छिक या अनैच्छिक गतियों पर नियन्त्रण रखा जाता है। इसलिए इस संस्थान में अनेक विभाग भी होते हैं। जैसे–
- सर्वप्रथम इसमें एक मुख्य केन्द्र (Brain) होता है। फिर उससे सम्बद्ध एक प्रणाली (Spinal cord) शरीर मध्य के अन्त तक रहती है। और इस प्रणाली से सम्बद्ध आज्ञावाहक (Motor) तंतुओं तथा संज्ञावाहक (Sensory) तंतुओं की छोटी-बड़ी शाखाएँ रहती हैं।
- अत: संज्ञावाहक (Sensory) तंतू द्वारा प्राप्त संवेदना केन्द्र स्थान (Brain) तक पहुँचाया जाता है। और केन्द्र निर्णय कर आज्ञा देता है। आज्ञावाहक (Motor) तंतू द्वारा उस आज्ञा का वहन सम्बन्धित प्रत्यंग तक किया जाकर उस प्रत्यंग या रचना द्वारा इच्छित कार्य कराया जाता है।

कभी-कभी अत्यावश्यक कार्य करने का अधिकार उपांगों को दिया गया है। अत: ऐसे समय में संवेदना उसी उपांग तक पहुँचायी जाती है। और वहीं से आज्ञा पाकर इच्छित कार्य किया जाता है। शरीर में जो क्रियाएँ घटित होती हैं। उसमें कुछ तो ऐच्छिक हैं। जैसे–बोलना, चलना, उठना, दौड़ना, हाथ हिलाना आदि। ये क्रियाएँ ऐच्छिक मांसपेशियों द्वारा की जाती है।

कुछ क्रियाएँ अनैच्छिक भी होती हैं, जो अपनी इच्छा पर निर्भर नहीं करती। जैसे– आहार का पाचन, श्वास-उच्छ्वास क्रिया, निद्रा, जागृति आदि। ये क्रियाएँ अपने आप परन्तु मस्तिष्क स्थित सम्बन्धित केन्द्र स्थानों द्वारा करायी जाती है। इस तरह दो प्रकार मुख्यत: इन क्रियाओं के होते हैं। इनके अतिरिक्त भी एक प्रकार देखने को मिलता है। उसे प्रतिक्षिप्त क्रिया (Reflex action) कहते हैं। इसमें संज्ञा या संवेदना का वहन मस्तिष्क स्थित केन्द्र तक न होकर उसका उपांग अर्थात् सुषुम्ना (Spinal cord) तक ही होता है। और तदनुसार सुषुम्ना द्वारा ही आज्ञा प्रदान की जाती है। जैसे– अचानक अपने हाथ या पैर में कोई वस्तु चुभ गई या मच्छर आदि किसी कीट ने दंश किया, तो तुरन्त हमारा हाथ या पैर हिलता है। और चुभने या काटने वाली वस्तु से दूर हटा लिया जाता है।

इस क्रिया की आशंका अपने मन में बिल्कुल नहीं रहती कि हमें इस समय हाथ या पैर हटाना है। कभी-कभी ऐसा भी होता है कि, हम रास्ते पर चल रहे हैं। हमारे सामने से सर्प या अन्य कोई रेंगने वाला प्राणी निकल जाता है। उसे हम देखते भी नहीं। परन्तु हम तुरन्त उसके ऊपर से कूद जाते हैं। और बाद में रूककर, पीछे मुड़कर देखते हैं, कि कौन सा प्राणी निकल गया। यह भी प्रतिक्षिप्त क्रिया है।

प्राचीन आचार्य तो पुरूष शरीर को ऊर्ध्व की ओर मूल और अध: ओर को उसकी शाखाएँ हैं। ऐसा वृक्ष के ठीक विपरित मानते हैं।

इसे वातनाड़ी संस्थान भी कहते हैं। क्योंकि इसका कार्य वायु के समान है। वायु चल है। गर्भ का निर्माण करता है, शब्द का वहन करता है। वातनाड़ियाँ तथा उनकी शाखा-प्रशाखाओं के अतिरिक्त इस संस्थान में कई महत्व के प्रत्यंग होते हैं। जैसे– Cerebrum, cerebellum आदि।

2. Normal structure of the neck (ग्रीवा की सामान्य रचना)

(A) Surface landmarks of the neck

1. The sternocleidomastoid is an important landmark B/w the anterior and posterior triangles.
2. The external jugular vein crosses the sternocleidomastoid obliquely.
3. The greater supraclavicular fossa lies above and behind the middle one-third of the clavicle.
4. The lesser supraclavicular fossa is a small depression B/w the sternal and clavicular parts of the sternocleidomastoid.

5. The mastoid process is large bony projection behind the auricle.
6. The transverse process of the atlas vertebra can be felt on deep pressure midway B/w the angle of the mandible and the mastoid process.
7. The anterior border of trapezius msucle becomes prominent on elevation of the shoulder against resistance.

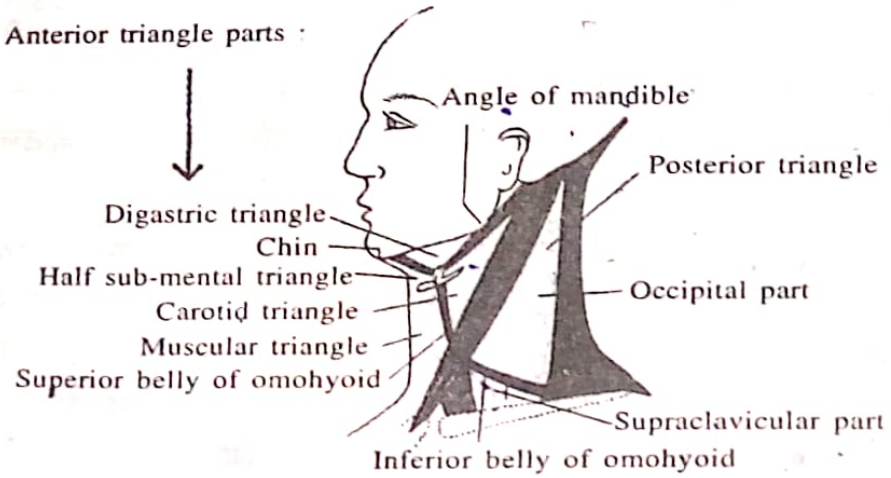

Fig. 5.1 Triangles of the neck

(B) Anterior triangle of neck

* The boundaries of the anterior triangle of the neck–
  1. Anterior– Anterior median line of the neck.
  2. Posterior– Anterior border of sternocleidomastoid muscle.
  3. Base(superior)– Base of mandible and a line joining angle of mandible to mastoid process.
  4. Apex(inferior)– Manubrium sterni.
* Subdivision of anterior triangle–
  - The anterior triangle encloses four suprahyoid and four infrahyoid muscles.
* The suprahyoid muscles are–
  1. Digastric
  2. Stylohyoid
  3. Mylohyoid
  4. Geniohyoid
* The infrahyoid muscles are–
  1. Sternohyoid
  2. Sternothyroid
  3. Thyrohyoid
  4. Omohyoid

* The anterior triangle is subdivided by the digastric muscle and the superior belly of the omohyoid muscle into four parts.
  1. Submental triangle
  2. Digastric triangle
  3. Carotid triangle
  4. Muscular triangle

(1) Submental triangle–

* The boundaries of submental triangle–
  - This is a median triangle.
  1. Base– Base is formed by the body of hyoid bone.
  2. Above and laterally on each side– By anterior belly of digastric muscle.
  3. Floor– It is formed by the right and left mylohyoid muscles and the median raphe uniting them.
  4. Apex– Its apex lies at the chin.

(2) Digastric triangle–

* Boundaries of the digastric triangle–
  1. Anteroinferiorly– Anterior belly of digastric.
  2. Posteroinferiorly– Posterior belly of digastric and the stylohyoid.
  3. Base or superiorly– Base of the mandible and a line joining the angle of the mandible to the mastoid process.
  4. Roof– The roof of the triangle is formed by skin superficial fascia and deep fascia.
  5. Floor– The floor is formed by the mylohyoid muscle anteriorly, and by the hyoglossus posteriorly. A small part of the middle constrictor muscle of the pharynx appears in the floor.

(3) Carotid triangle–

* Boundaries of the carotid triangle–
  1. Anterosuperiorly– Posterior belly of the digastric muscle and the stylohyoid muscle.
  2. Anteroinferiorly–Superior belly of the omohyoid muscle.
  3. Posteriorly– Anterior border of the sternocleidomsatoid muscle.

4. Roof– Skin, superficial and deep fascia.
5. Floor– Floor is formed by–
   - Thyrohyoid muscle
   - Hyoglossus muscle
   - Middle and inferior constrictors of the pharynx.

(4) Muscular triangle–

* Boundaries of the muscular triangle–
  1. Anteriorly– Anterior midline of the neck from the hyoid bone to the sternum.
  2. Posterosuperiorly–Superior belly of the omohyoid muscle.
  3. Posteroinferiorly– Anterior border of the sternocleido-mastoid muscle.

(C) Posterior triangle of the neck

* Boundaries of the posterior triangle of the neck–
  1. Anteriorly– Posterior border of sternocleidomastoid.
  2. Posteriorly– Anterior border of trapezius.
  3. Base– Middle one-third of clavicle.
  4. Apex–Point where trapezius and sternocleidomastoid meet.
  5. Roof– Investing layer of deep cervical fascia.
  6. Floor– Prevertebral layer of deep cervical fascia covering the muscles.

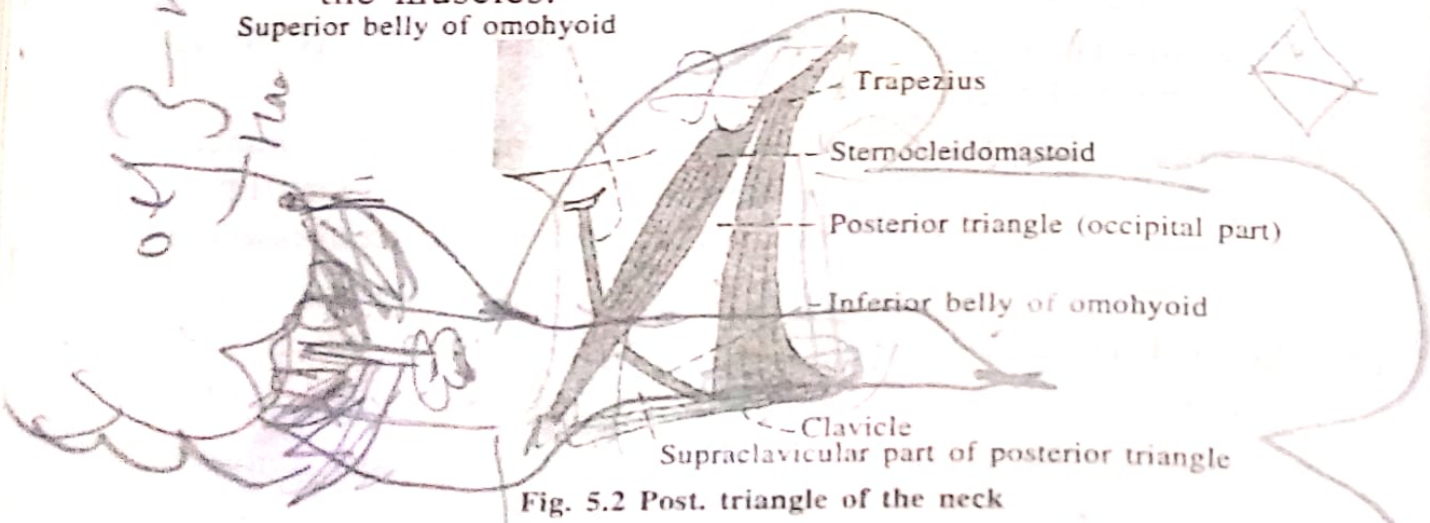

Fig. 5.2 Post. triangle of the neck

(D) Suboccipital triangle of the neck

* Boundaries of the suboccipital triangle–
  1. Superomedially–Rectus capitis posterior major and minor.

2. Superolaterally– Superior oblique muscle.
3. Inferiorly– Inferior oblique muscle.
4. Roof– Medially– Fibrous tissue.
   Laterally– Longissimus capitis.
5. Floor–Posterior arch of atlas and posterior atlanto-occipital membrane.

3. Introduction of nervous system (वातनाड़ी संस्थान का परिचय)

Neurology–Neuro (↓ Nerve) **Logos** (↓ Study of)

- Study of nerve.
- Study of nervous system.

The branch of medical science that deals with the normal functioning and disorders of the nervous system is called neurology.

Nervous system is the chief controlling and coordinating system of the body. It adjusts the body to the surroundings and regulates all bodily activities both voluntary and involuntary. The sensory part of the nervous system collects information from the surroundings and helps in gaining knowledge and experience, whereas the motor part is responsible for responses of the body.

4. Histology of the nervous tissue (वात नाड़ी संस्थान का सूक्ष्म रचनात्मक ज्ञान)

The nervous tissue is composed of–

1. Neurons
2. Neuroglia

1. Neurons

The neuron is the structural and functional unit of nervous system.

And forms the principal nervous tissue. It consists of following parts–

(1) Cell body
(2) Cell process– 1. Axon
                  2. Dendrites

1. **Axon–** Each neuron has only one axon which is a long, slender, thread like process and usually arises from the cell body at the axonhillock but sometimes from the base of the main dendrite.
2. **Dendrites–** These are short process which are directly continuous with the cytoplasm of the body.

Myelin sheath– Most axons are surrounded by an insulating sheath of fatty myelin derived from supporting cells, oligodendrocytes within C.N.S. and schwann cells outside C.N.S.

Classification of neuron

* **Structural classification–**

1. **Multipolar neurons–** Usually have several dendrites and axon. Most in the brain and spinal cord.
2. **Bipolar neurons–** Have one main dendrite and one axon. Found in the retina of eye, inner ear, olfactory region.
3. **Unipolar neurons–** Have just one process extending from the cell body and are always sensory neurons. Found in lower vertebrae.

* **Functional classification of neurons–**

1. **Sensory or afferent neurons–** Transmit sensory nerve impulses from receptor in the skin. Sense organs, muscles, joints and viscera into the C.N.S.
2. **Motor or efferent neurons–** Convey motor nerve, impulses from the C.N.S. to effectors, which may be either muscles or glands.
3. **Association neurons or inter neurons–** All other neurons that are not specifically sensory or motor neuron are termed association neurons.

2. Neuroglia

(1) Introduction–

- The neuroglia are non-excitable cells and form the main supporting tissue of C.N.S.

- C.N.S. consists grey mater and white mater.
- Grey mater– Contains cell bodies of neurons.
- White mater– Contains long processes of nerve cells. The majority being surrounded by myelin sheaths which give it the white colour.

(1) Cell body– It consists of–1. Nucleus 2. Cytoplasm

1. **Nucleus–** Single, central and spherical and contains a nucleolus.
2. **Cytoplasm–** This contains–
   - Nissl's bodies.
   - Mitochondrias.
   - Golgi apparatus.

(2) Cell process– Axon, Dendrites

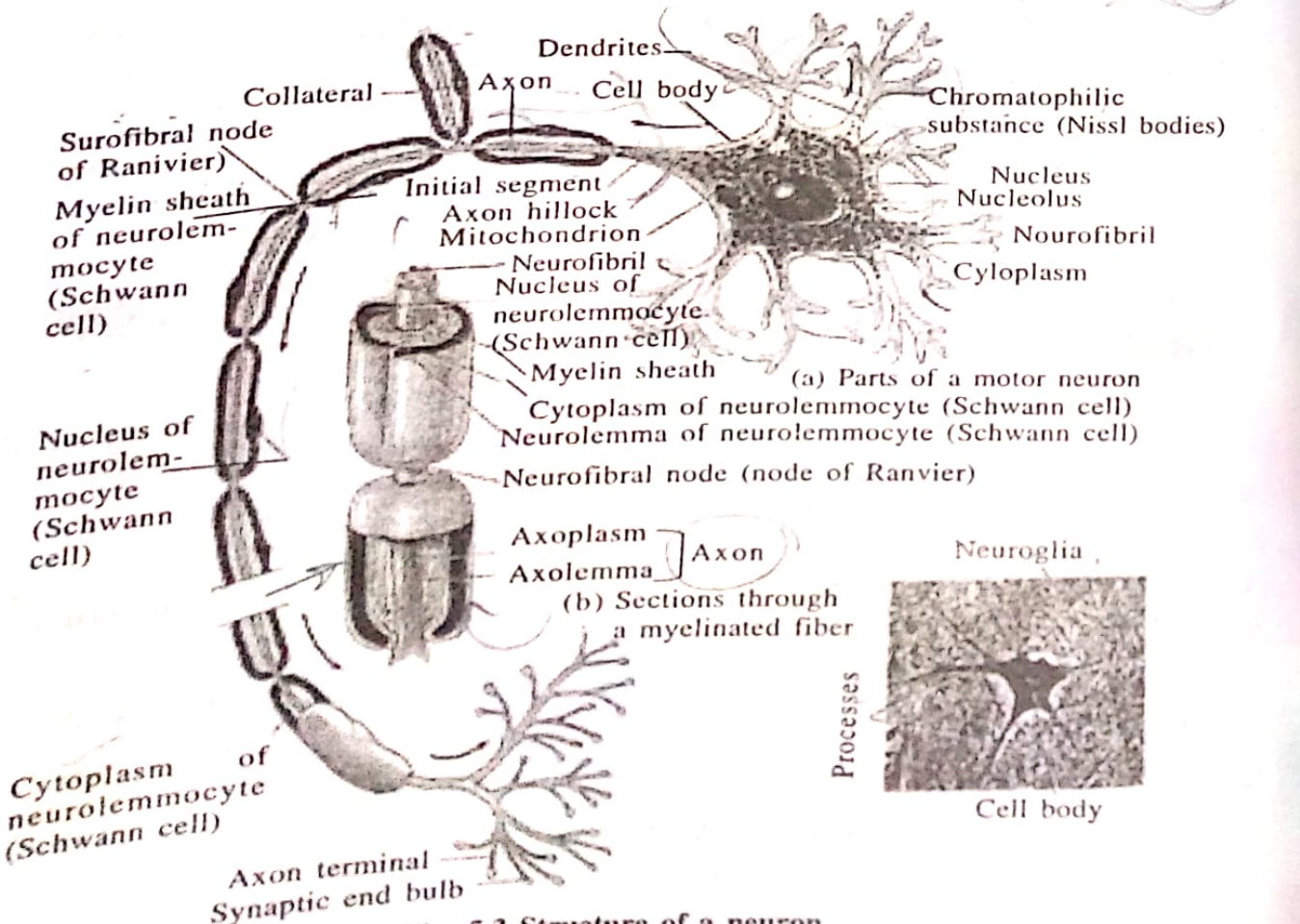

Fig. 5.3 Structure of a neuron

1. **Axon–** Each neuron has only one axon which is a long, slender, thread like process and usually arises from the cell body at the axonhillock but sometimes from the base of the main dendrite.
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P.N.S.

Somatic nervous system (Voluntary)

Autonomic nervous system (Involuntary)

Sympathetic n. s. (Thoraco-lumbar division) T_1-T_{12} and L_1-L_2

Parasympathetic n.s. (Cranio-sacral division) C.N.– 3-7-9-10 and S_2-S_3-S_4

• Skeletal muscles • Cardiac and smooth muscles and glands.

Organization of the nervous system

* Nervous system– Two principal subdivision
  (1) C.N.S.– Central nervous system– Consisting of the brain and spinal cord.
  (2) P.N.S.– Peripheral nervous system– Consisting of cranial and spinal nerves.
  • The P.N.S. has somatic and autonomic components.

6. Subdivision of brain (मस्तिष्क के विभाग)

1. Brain stem
   1. Medulla– सुषुम्ना शीर्षक
   2. Pons– उष्णीषक
   3. Mid brain– मध्य मस्तिष्क
2. Cerebellum– लघुमस्तिष्क या अनुमस्तिष्क
3. Diencephalon– आन्तर प्रमस्तिष्क
4. Cerebrum– बृहद् मस्तिष्क या प्रमस्तिष्क

*** Parts of brain–**

1. Fore brain (अग्र मस्तिष्क)
   - Cerebrum– बृहद् मस्तिष्क
   - Diencephalon– आन्तर प्रमस्तिष्क
2. Mid brain (मध्य मस्तिष्क) ——— Mid brain– मध्य मस्तिष्क
3. Hind brain (पश्च मस्तिष्क)
   - Medulla oblongata– सुषुम्ना शीर्ष
   - Pons– उष्णीषक
   - Cerebellum– लघु मस्तिष्क

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- Neuroglia– [Neuro– nerve, glia-glue] or glia fill about half of C.N.S. There name derives from the notion of early microscopists that they were the 'glue' that held nervous tissue together.
- Neuroglia are generally smaller than neurons.

(2) Types of neuroglia– Six types of neuroglia.

- Four Types– 1. Astrocytes 3. Microglia
  2. Oligo dendrocytes 4. Ependymal

'These cells are found in the C.N.S.'

- The remaining two types of neuroglia or supporting cells are found in the P.N.S.

1. Neurolemmocytes or schwann cells– Which produce myelin sheath around P.N.S. neuron.
2. Satellite cells– Which support neuron in ganglia of the P.N.S.

* **Dermatomes–**

A dermatome is an area of skin supplied by the dorsal (sensory) root of spinal nerve

* **Myotome–**

A myotome is the segmental innervation of skeletal muscles.

5. Division of nervous system (वातनाड़ी संस्थान के भाग)

Nervous system

Central nervous system (C.N.S.)	Peripheral nervous system (P.N.S.)
• C.N.S. is made up–	• P.N.S. is made up– Nerves, which arises from the brain (**Cranial nerves–** 12 pairs) and spinal cord (**spinal nerves-** 31 pairs)
1. Brain– Lying in the cranial cavity	
2. Spinal cord– Lying in the vertebral canal	

* P.N.S. is further subdivided–
  1. Somatic nervous system (S.N.S.)
  2. Autonomic nervous system (A.N.S.) (Visceral or splanchnic)

P.N.S.

- **Somatic nervous system (Voluntary)**
  - Skeletal muscles
- **Autonomic nervous system (Involuntary)**
  - **Sympathetic n. s. (Thoraco-lumbar division)** T_1-T_{12} and L_1-L_2
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   - Medulla oblongata– सुषुम्ना शीर्ष
   - Pons– उष्णीषक
   - Cerebellum– लघु मस्तिष्क

* Spinal cord– सुषुम्नाकाण्ड

Occupies upper two-thirds of the vertebral canal.

* Spinal nerves– (सुषुम्ना से सम्बन्धित नाड़ियाँ)

1. Cervical nerves–	8	pairs
2. Thoracic nerves–	12	pairs
3. Lumbar nerves–	5	pairs
4. Sacral nerves–	5	pairs
5. Coccygeal nerve–	1	pairs
Total	31	pairs

* **Cranial nerves–** 12 pairs= शीर्षण्य नाड़ियाँ

1. Olfactory nerve
2. Optic nerve
3. Oculomotor nerve
4. Trochlear nerve
5. Trigeminal nerve
6. Abducent nerve
7. Facial nerve
8. Auditory–Vestibulocochlear nerve
9. Glossopharyngeal nerve
10. Vagus nerve
11. Accessory nerve
12. Hypoglossal nerve

* **Sympathetic nervous system (अनुकम्पी नाड़ियाँ)**

(Thoraco-Lumbar-Division)— T_1-T_{12} and L_1-L_2

* **Parasympathetic nervous system–(परानुकम्पी नाड़ियाँ)**

(Cranio-Sacral Division)–Cranial nerve– 3-7-9-10 and S_2-S_3-S_4

Nervous system division

- Two principal division of the nervous system are the–
  1. C.N.S.– Central nervous system– केन्द्रीय नाड़ी संस्थान
  2. P.N.S.– Peripheral nervous system– परिसरीय नाड़ी संस्थान

* The C.N.S. consists of the brain and spinal cord.

7. Brain (मस्तिष्क)

1. Embryological parts of brain and their derivatives

Primary brain vesicles	Secondary brain vesicles	Derivatives	Cavities
1. Prosencephalon (Fore brain)	1. Telencephalon 2. Diencephalon	1. Cerebrum 1. Thalamus 2. Metathalamus	Lateral ventricles Third ventricle

Primary brain vesicles	Secondary brain vesicles	Derivatives	Cavities
		3. Epithalamus 4. Subthalamus 5. Hypothalamus	
2. Mesencephalon (Midbrain)	3. Mesencephalan	1. Mid Brain	Cerebral aqueduct
3. Rhombencepha-lon (Hind brain)	4. Metencephalon	1. Pons 2. Cerebellum	Fourth ventricle
	5. Myelencephalon	1. Medull oblongata	

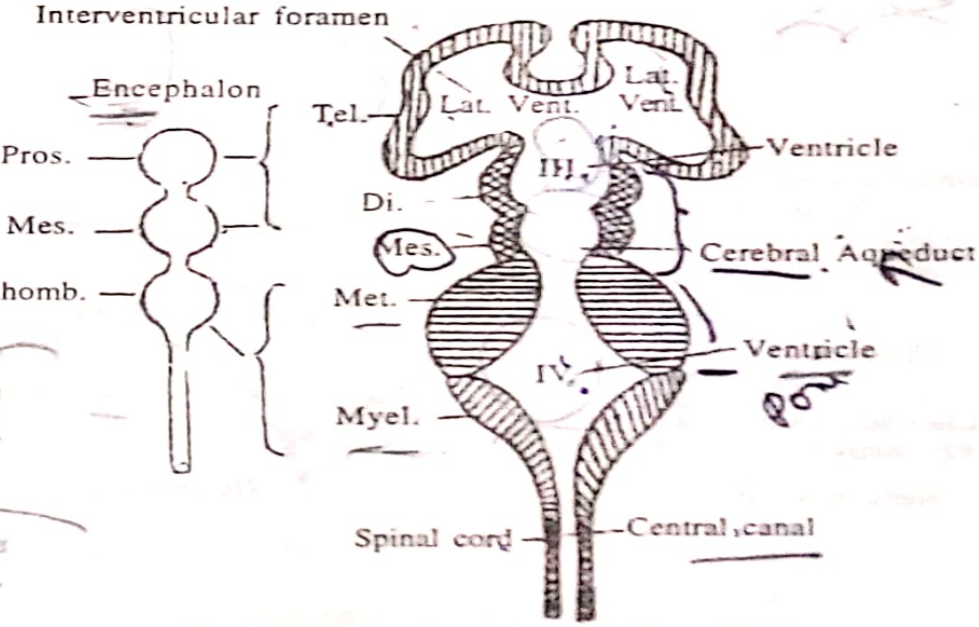


Fig. 5.4 Embryological parts of the brain

2. Introduction of brain

- The adult brain is made up of about 100 billion neurons and 1000 billion neuroglia. It is one of the largest organs of the body averaging 1.3 kg weight, and can be divided four principal part.
  1. Brainstem
  2. Cerebellum
  3. Diencephalon
  4. Cerebrum
- The brainstem is continuous with the spinal cord and consists of the medulla-oblongata, pons and mid brain.
- Posterior to the brainstem is the cerebellum.

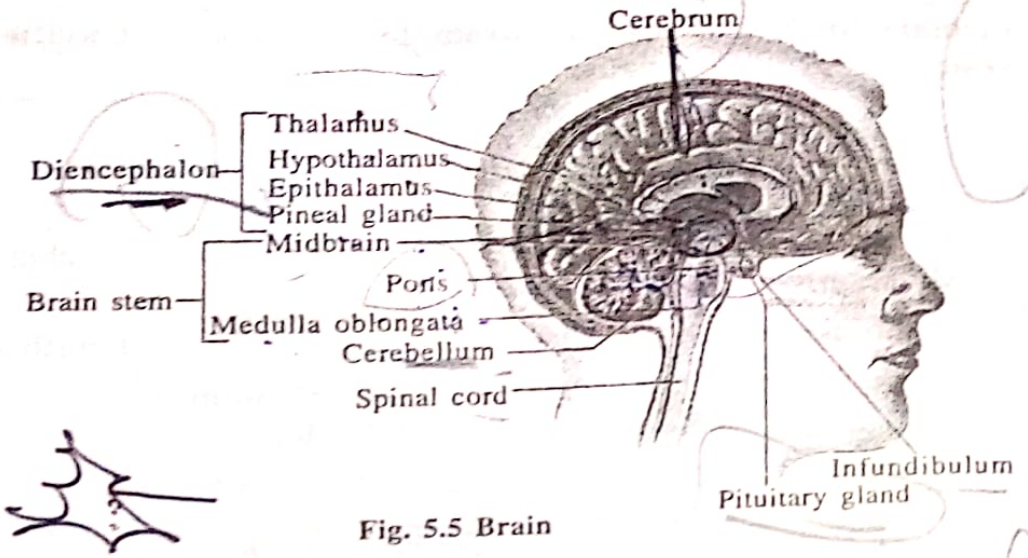


Fig. 5.5 Brain

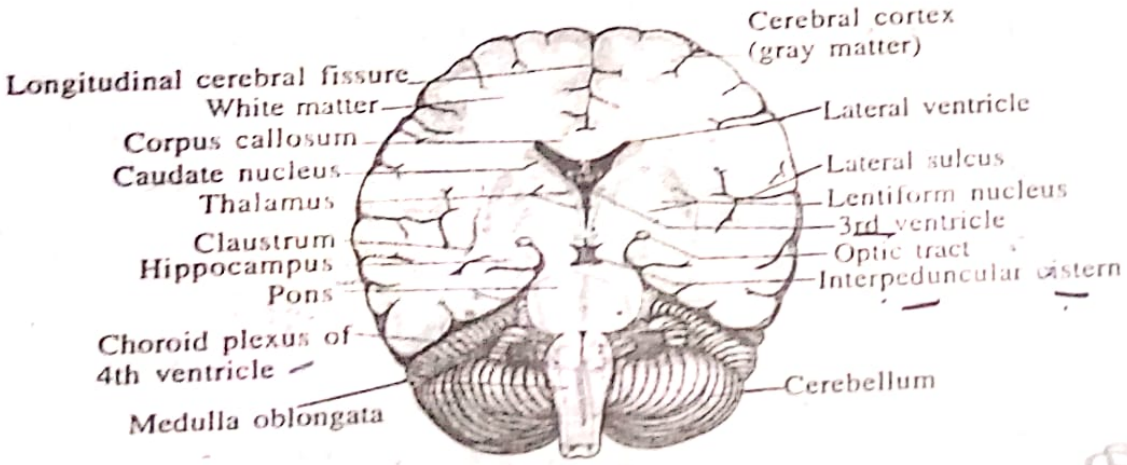


Fig. 5.6 Brain-Coronal section

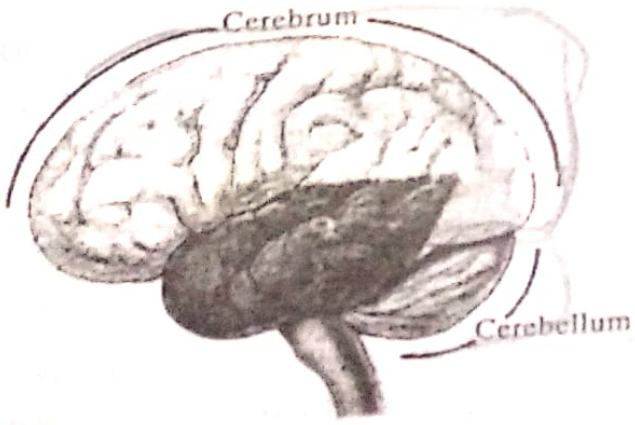


Fig. 5.7 Lobes of the brain

- Superior to the brainstem is the diencephalan.
- The cerebrum spreads over the diencephalon like the cap of mushroom. It occupies most of the cranium and has right and left halves called cerebral hemispheres.

3. Protection and coverings

- The brain is protected by the cranial bones and cranial meninges.
- The cranial meninges surround the brain. They are continuous with the spinal meninges, have the same basic structure and bears the same name.
- The duramater– Outer layer
- The arachnoid mater– Middle layer
- The piamater– Inner layer

* **An extension of the duramater–**

(1) **Falx cerebri–** Separates the two hemispheres of the cerebrum.

(2) **Falx cerebelli–** Separates the two hemispheres of the cerebellum.

(3) **Tentorium cerebelli–** Separates the cerebrum from the cerebellum.

(4) **Diaphragma sellae–** Small horizontal fold.

4. Cerebrospinal fluid (C.S.F.)

- The C.S.F. is a modified tissue fluid.
- The brain and spinal cord are nourished and protected against chemical or physical injury by C.S.F. This fluid continuously circulates through the subarachnoid space (B/w arachnoid and piamater) around the brain and spinal cord and through cavities within the brain and spinal cord.
- Four C.S.F. filled cavities within the brain, which are called ventricles.
- Each of the two lateral ventricles is located in a hemisphere of the cerebrum.
- The third ventricle is a narrow cavity at the midline superior to the hypothalamus and B/w the right and left halves of the thalamus.

- The fourth ventricle lies B/w the brainstem and the cerebellum.
  - **Total quantity of CSF–** About 150 ml.
  - **Formation of CSF–** About 200 ml/hour.
    – About 5000 ml/day.
  - **Normal pressure of CSF–** 60 to 100 mm of CSF or water.

Applied aspect–
- CSF can be obtained by– Lumbar puncture. It is done by passing a needle in the inter space B/w the third and fourth lumbar spines.
- Biochemical analysis of CSF is of diagnostic value in various diseases. Like bone T.B.

Brainstem

- The brainstem connects the spinal cord to the diencephalon.
- It consists of the medull- oblongata, pons and mid brain.

8. Medulla-Oblongata (सुषुम्ना शीर्षक)

1. Embryological part

- Primary brain vesicles– Rhombencephalon
- Secondary brain vesicles– Myelencephalon
- Derivatives– Medulla-oblongata

2. Introduction

- Medulla develop from the myelencephalon.
- It is a continuation of the superior portion of the spinal cord and form the inferior part of the brainstem.
- The medulla begins at the foramen magnum and extends upwards to the inferior border of the pons.
- It's length about 3 cm.
- **Location–** It lies in the anterior part of the posterior cranial fossa.
- **Relations–**Anterior–It is related to the clivus and meninges.
  Posterior– To the vallecula of the cerebellum.

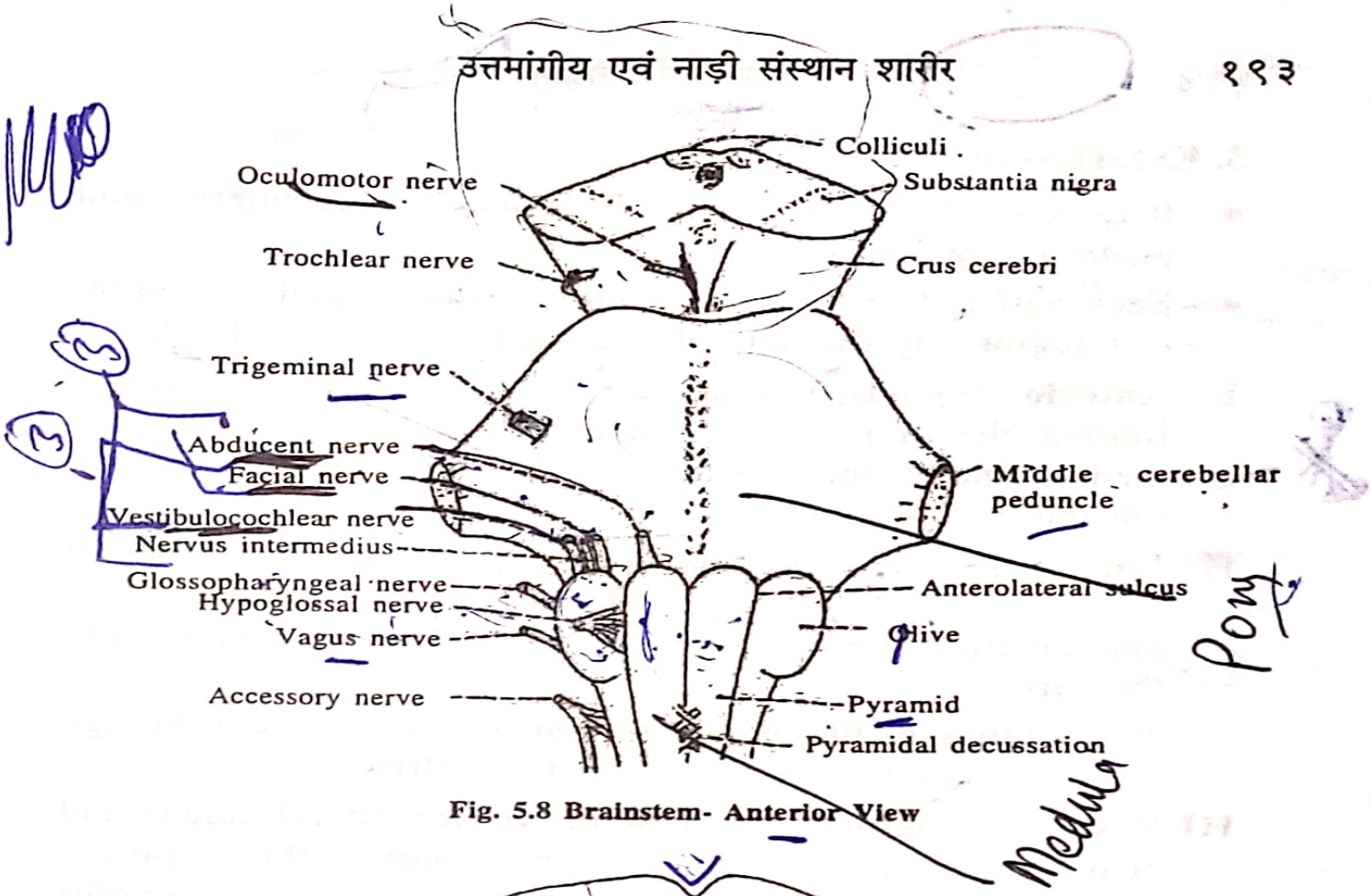


Fig. 5.8 Brainstem- Anterior View

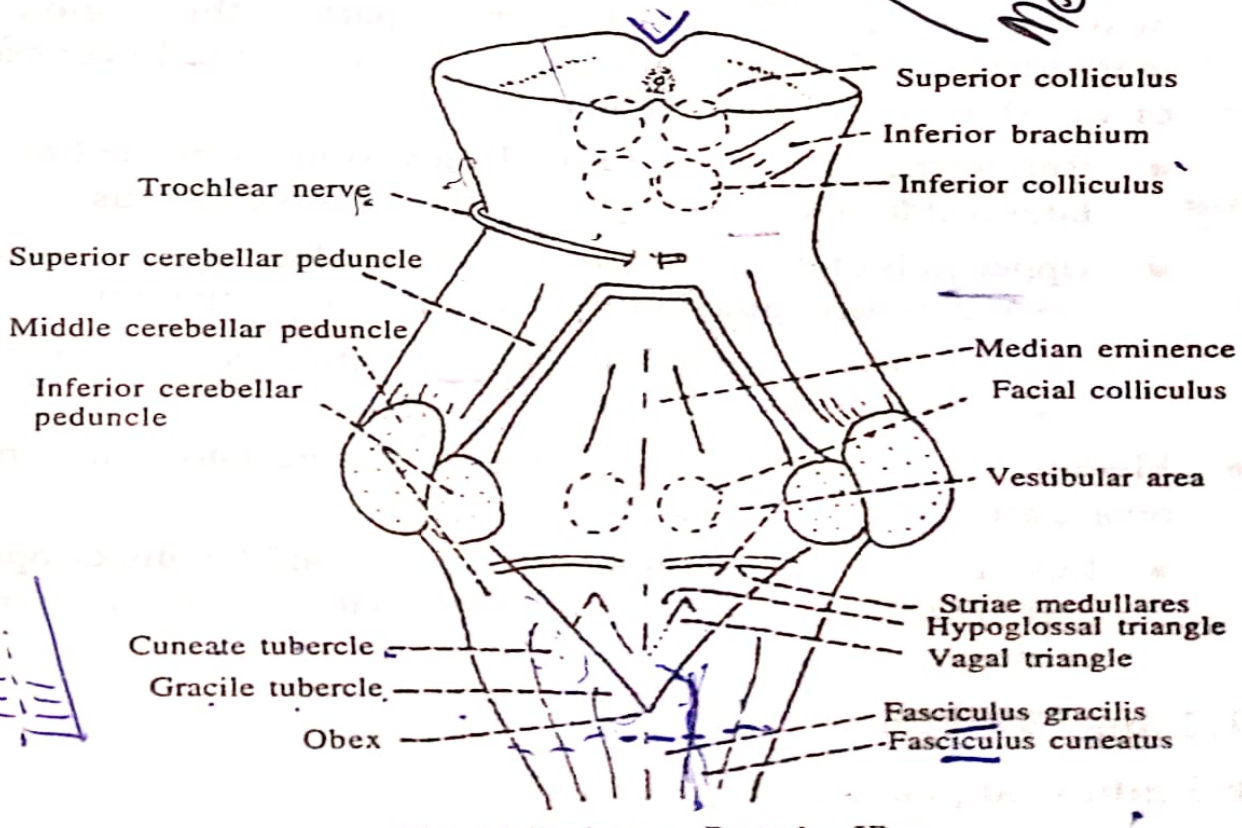


Fig. 5.9 Brainstem- Posterior View

3. External features

- It is divided into right and left halves by the anterior and posterior median fissures.
- Each half is further divided into-anterior, lateral and posterior regions by the anterolateral and posterolateral sulci.

I. **Anterior region–** The anterior region is in form of a longitudinal elevation called pyramids. In the lower part of the medulla many fibres of the right and left pyramids cross in the midline forming the pyramidal decussation.

II. **Lateral region–** The upper part of lateral region shows an oval elevation the olive. The rootlets of the hypoglossal nerve emerge from the anterolateral sulcus B/w the pyramid and the olive.

The rootlets of the 9-10-11th cranial nerve emerge through the posterolateral fissure, behind the olive.

III. **Posterior region–** Lies B/w the posterolateral sulcus and posterior median fissure. The upper part of this region is marked by a 'v' shaped depression. which is the lower part of the floor of fourth ventricle.

- Below the floor longitudinal elevation from medial to lateral side- Fasciculus gracilis, fasciculus cuneatus.
- Upper ends of the fasciculus gracilis and fasciculus cuneatus expand to form gracile tubercle and cuneate tubercle.
- These tubercle formed by nucleus gracilis and nucleus cuneatus.

- Medulla is divided two parts– Lower closed part and upper open part.
  - Lower closed part with a central canal and the upper open part. Where the central canal open out to form the fourth ventricle.

9. Pons (उष्णीषक)

1. Embryological development

- Primary brain vesicle– Rhombencephalon.

- Secondary brain vesicle– Metencephalon.
- Derivatives– Pons.
- Cavity–Fourth ventricle.

2. Introduction

- Pons means- Bridge
- Pons develop from the metencephalon.
- The pons is the middle part of the brainstem.
- Connecting the medulla to mid brain.
- **Position**– It lies directly superior to the medulla and anterior to the cerebellum.
- It's length about 2.5 cm.

3. External features

- The pons has two surfaces– 1. Ventral or anterior surface.
  2. Dorsal or posterior surface.

(1) Ventral surface–

- It is convex in both direction and is transversely striated. In the median plane, it shows a vertical basilar sulcus which lodges the basilar artery.
- Laterally, the surface is continuous with the middle cerebellar peduncle.
- The trigeminal nerve is attached to this surface at the junction of the pons with the peduncle.
- The abducent, facial and vestibulocochler nerve are attached at the lower border of the ventral surface or junction of pons and medulla-oblongata.

(2) Dorsal surface– It is hidden by the cerebellum, and forms the upper half of the floor of fourth ventricle.

10. Mid Brain (मध्य मस्तिष्क)

1. Embryological development

- Primary brain vesicles– Mesencephalon.
- Secondary brain vesicles– Mesencephalon.

- Derivatives– Mid brain.
- Cavity– Cerebral aqueduct.

2. Introduction

- The mid brain develop from the mesencephalon.
- It is shortest part of brainstem.
- It connects the pons with the diencephalon.
- It's cavity is known as the cerebral aqueduct.
- It connects third ventricle with the fourth ventricle.
- **Location**–Upwards and forwards from the upper part of the pons.
- **Relation**–Anteriorly–It is related interpedunclar structures.
  Posteriorly–Splenium of corpus callosum, great cerebral vein, pineal body.
  Laterally– It is related on each side to parahipocampal gyri, optic tracts, posterior cerebral artery, basal vein, trochlear nerve.
- It's length about 2 cm.

3. External features

It is divides two parts by cerebral aqueduct–

1. Ventral part or anterior.
2. Dorsal part or posterior.

(1) Ventral part–A pair of cerebral peduncle. Each peduncle is made up three parts.

(A) Crus cerebri– Anterior
(B) Substantia nigra– Middle
(C) Tegmentum– Posterior

(A) Crus cerebri– They form the ventral part of the midbrain. They are white ropelike structures.

(B) Substantia nigra– It is a lamina of grey mater made up deeply pigmented nerve cells.
B/w the crus cerebri and tegmentum.

(C) Tegmentum– It lies dorsal to the substantia nigra and ventral to the tectum.

- **Red nuclei–** It is a large ovoid mass of grey mater. lies in the anterior part of tegmentum.

2. Dorsal part– The posterior portion of the mid brain is called the tectum (roof) and contains four rounded elevation, the corpora quadrigemina.

- The two superior elevation are known as the– Superior colliculi.
- The two inferior elevation are known as the– Inferior colliculi.
- The nuclei in the mid brain are associated with cranial nerves.
  - Oculomotor nerve– Arises ventral part (middle) of mid brain.
  - Trochlear nerve– Arises both lateral side of mid brain.

11. Cerebellum (लघु मस्तिष्क)

1. Embryological development

- Primary brain vesicles– Rhombencephalon
- Secondary brain vesicles– Metencephalon
- Derivatives– Cerebellum
- Cavity– Fourth ventricle

2. Introduction

- It is develop from metencephalon.
- It is also called little brain.
- The cerebellum is the second largest portion of the brain.
- And the largest part of the hind brain.
- **Situation–**
  - It is situated in the posterior cranial fossa.
  - Inferior and posterior aspect of the cranial cavity.
  - Behind the pons and medulla.
  - And inferior to the posterior portion of cerebrum.
- **Shape–** It's shape like butterfly.
- **Measurment–**
  - Weight– 150 gm.
  - Length– 7 cm.
  - Width– 8-10 cm.

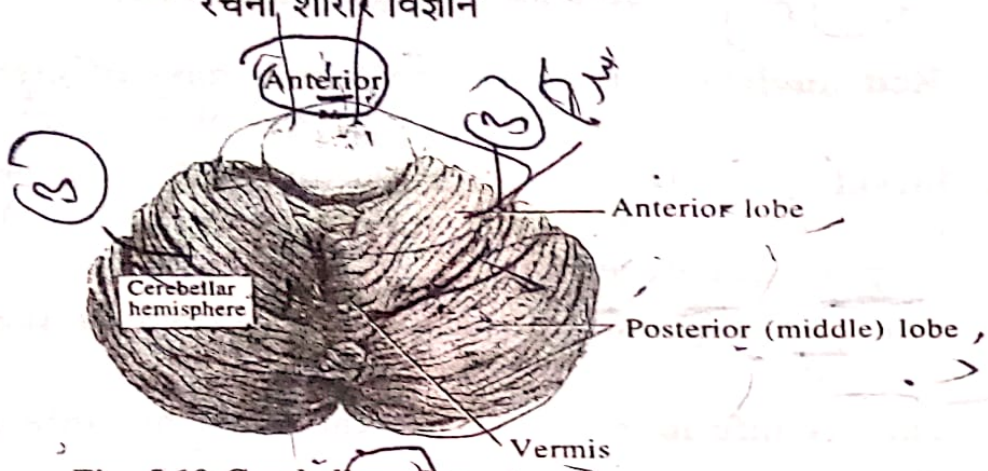


Fig. 5.10 Cerebellum-Superior View

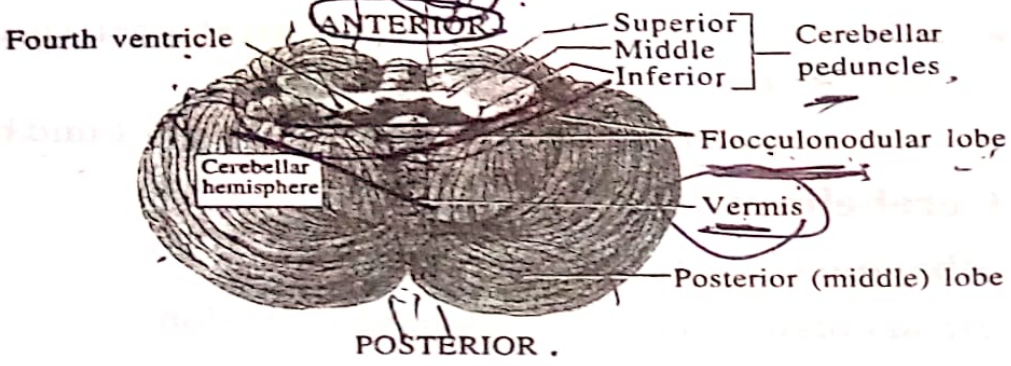


Fig. 5.11 Cerebellum-Inferior View

- **Relation–**
  - Anteriorly– Fourth ventricle, pons and medulla.
  - Posteroinferiorly– Squamous part of occipital bone.
  - Superiorly– Tentorium cerebelli

3. External features

- The cerebellum consists of two cerebellar hemispheres that are united to each other through a median vermis.

(A) It has two surfaces– 1. Superior surface 2. Inferior surface

1. Superior surface– It is convex, the two hemispheres are continuous with each other on this surface.
2. Inferior surface–Shows a deep median notch called the vallecula which separates the right and left hemispheres.

(B) It has two aspects– 1. Anterior aspect 2. Posterior aspect

1. Anterior aspect– Anterior aspect of the cerebellum is marked by a deep notch in which the pons and medulla are lodged.
2. Posterior aspect– Posteriorly, there is a narrow and deep notch in which the falx cerebelli.

(C) Lobe of the cerebellum–

- Each hemispheres is divided into three lobes.
  1. Anterior lobe
  2. Middle or posterior lobe
  3. Flocculo nodular lobe

1. **Anterior lobe–** Lies on the anterior part of the superior surface. It is separated from the middle lobe by the fissure prima.
2. **Middle lobe–** It is the largest of the three lobes. It is limited infront by the fissure prima on the superior surface and by the posterior lateral fissure on the inferior surface.
3. **Flocculo nodular lobe–** It is the smallest lobe of the cerebellum. It lies on the inferior surface, infront of the posterolateral fissure.

(D) Main fissure of the cerebellum–

Each hemispheres is divided by fissures.

1. Horizontal fissure
2. Primary fissure (fissure prima)
3. Posterolateral fissure

1. Horizontal fissure– Separates the superior surface from the inferior surface.
2. Primary fissure– Separates the anterior lobe from the middle lobe on the superior surface of the cerebellum.
3. Posterolateral fissure– Separates the middle lobe from the flocculonodular lobe on the inferior surface.

4. Functional division of the cerebellum

1. Archi cerebellum
2. Paleo cerebellum
3. Neo cerebellum

(1) Archi cerebellum–

1. The oldest part of the cerebellum.
2. It is made up of the flocculonodular lobe.

3. It controls the axial musculature and the bilateral movements used for locomotion and maintenance of equilibrium.

(2) Paleo cerebellum–

1. It is the next part of the cerebellum to appear.
2. It is made up of the anterior lobe.
3. It controls tone, posture and crude movements of the limbs.

(3) Neo cerebellum–

1. It is the newest part of the cerebellum to develop.
2. It is made up of the middle lobe.
3. Regulation of fine movements of the body.

5. Connections of the cerebellum

The fibres entering or leaving the cerebellum are grouped to form three paired peduncles which connect the cerebellum to the mid brain. The pons and medulla.

(1) Superior cerebellar peduncles–

1. Cerebellum connected to mid brain.
2. Contains– Mostly motor axon.
3. That conduct out put from the cerebellum in to the mid brain.

(2) Middle cerebellar peduncles–

1. Cerebellum connected to the pons.
2. Contains– Only sensory axon.
3. Which conduct input from the pons into the cerebellum.

(3) Inferior cerebellar peduncles–

1. Cerebellum connected to medulla oblongata.
2. Contains– Both sensory and motor axon.
3. That carry information into and out of the cerebellum.

- **Gray mater**–The superficial layer of the cerebellum, called the cerebellar cortex, consists of gray mater in a series of slender, parallel ridges called folia.

- **White mater**–Deep to the gray matter are white mater tracts called arbor vitae that resemble branches of tree.

12. Diencephalon (आन्तर प्रमस्तिष्क)

1. Embryological development

- Primary brain vesicles– Prosencephalon
- Secondary brain vesicles– Diencephalon
- Derivatives–
  - Thalamus– चेतक या आज्ञाकन्द
  - Metathalamus– पश्च चेतक
  - Epithalamus– अधिचेतक
  - Subthalamus– अवचेतक
  - Hypothalamus– अधः चेतक
- Cavity– Third ventricle.

2. Introduction

- The diencephalon begins where the mid brain ends and surrounds the third ventricle.
- It is a midline structure which is largely embedded in the cerebrum and therefore hidden from surface view.
- It's cavity forms greater part of the third ventricle.
- The hypothalamic sulcus, extending from the interventricular foramen to the cerebral aqueduct, divides each half of the diencephalon in to dorsal and ventral part.

(1) Dorsal part of diencephalon–

1. Thalamus
2. Metathalamus (including medial and lateral geniculate bodies.)
3. Epithalamus (including pineal body and habenula)

(2) Ventral part of diencephalon– 1. Hypothalamus
2. Subthalamus

(1) Dorsal part of diencephalon–

Thalamus (चेतक या आज्ञाकन्द)

(1) Introduction–

- Thalami are two large ovoid masses of grey mater.

- Situated one on each side of the third ventricle.
- B/w the cerebral hemispheres (above) and the cerebral peduncles (below).

(2) External feature–

- It has two ends– 1. Anterior end 2. Posterior end
- Four surfaces– 1. Superior surface 3. Medial surface
  2. Inferior surface 4. Lateral surface

Ends–

1. **Anterior end–** It is narrow, rounded and lies close to the median plane. It forms the posterior boundary of the interventricular foramen. (foramen of monro).
2. **Posterior end–** It is large and expanded and is known as the pulvinar. It is directed backwards and laterally and overhangs the superior colliculus and its brachium.

Surfaces–

1. **Superior surface–** It is free, slightly convex and is covered by layer of white mater. It is divided into lateral ventricular part and medial extra ventricular part.
2. **Inferior surface–** Rests on the subthalamus and hypothalamus.
3. **Medial surface–** Forms the posterosuperior part of the lateral wall of third ventricle.
4. **Lateral surface–** Forms the medial boundary of the posterior limb of the internal capsule.

* **Function of thalamus–** Relays all sensory input to the cerebral cortex provide crude appriciation of touch, pressure, pain and temp.

Metathalamus (पश्च चेतक)

(1) Introduction–

- The metathalamus consists of the medial and lateral geniculate bodies, which are situated on each side of the mid brain, below the thalamus.

1. **Medial geniculate body–** It is an oval elevation situated just below the pulvinar of the thalamus and lateral to the

superior colliculus. The inferior brachium connects the medial geniculate body to the inferior colliculus.

2. **Lateral geniculate body–** This is a small oval elevation, situated anterolateral to the medial geniculate body, below the thalamus. It is overlapped by the medial part of the temporal lobe and is connected to the superior colliculus by the superior brachium.

* **Function of metathalamus–**
  - It is the final relay center in the visual pathway.

Epithalamus (अधिचेतक)

- **Introduction–**

The epithalamus occupies the caudal part of the roof of the diencephalon and consists of–

1. Right and left habenular nuclei.
2. Pineal body or epiphysis cerebri.
3. Habenular commissure.
4. Posterior commissure.

(2) Ventral part of diencephalon–

Hypothalamus (अधः चेतक)

(1) Introduction–

The hypothalamus is a part of the diencephalon. It lies in the floor and lateral wall of the third ventricle.

(2) Parts of hypo thalamus– 1. Optic part. 2. Tuberal part. 3. Mamillary part.

(3) Functions–
- Control of autonomic nervous system. (ANS)
- Control of pituitary gland.
- Regulation of emotional and behavioral patterns.
- Regulation of eating and drinking.
- Control of body temp.

Subthalamus (अवचेतक)

- **Introduction–**

The subthalamus lies B/w the mid brain and the thalamus.

13. Cerebrum (बृहद् मस्तिष्क)

1. Embryological development

- Primary brain vesicles– Prosencephalon
- Secondary brain vesicles– Telencephalon
- Derivatives– Cerebrum
- Cavity– Lateral ventricle

(2) Introduction

- It is develop from telencephalon.
- The cerebrum is the largest part of the brain and consists of two cerebral hemispheres connected by a mass of white mater called the corpus callosum.
- Each hemisphere extends from the frontal to the occipital bones. Above the anterior and middle cranial fossa, and posteriorly, above the tentorium cerebelli.
- The hemispheres are separated by a deep cleft, the longitudinal fissure, into which projects the falx cerebri.

3. External features

(A) Surfaces– 1. Superolateral surface 2. Medial surface
3. Inferior surface

(B) Borders– 1. Superomedial border 2. Inferolateral border
3. Inferomedial border

(C) Poles– 1. Frontal pole 2. Occipital pole
3. Temporal pole

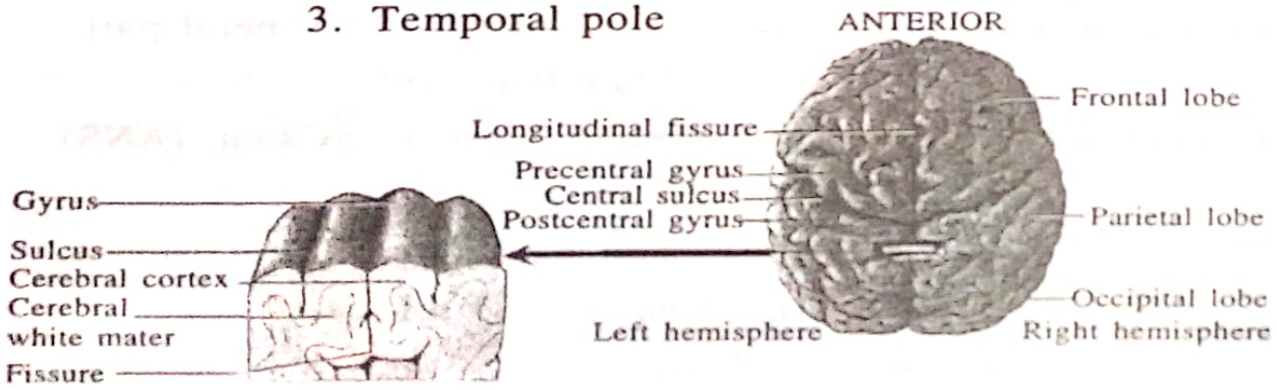


Fig. 5.12 Cerebrum-Superior View

(A) Surfaces–

1. **Superolateral surface–** It is convex and is related to the cranial valut.

2. **Medial surface–** It is flat and vertical. It is separated from the corresponding surface of the opposite hemisphere by the falx cerebri and the longitudinal fissure.
3. **Inferior surface–** It is ir-regular.

(B) Borders–

1. **Superomedial border–** Separates the superolateral surface from the medial surface.
2. **Inferolateral border–** Separates the superolateral surface from the inferior surface.
3. **Inferomedial border–** Separates the medial surface from the inferior surface.

(C) Poles–

1. Frontal pole– At the anterior end.
2. Occipital pole– At the posterior end.
3. Temporal pole– At the anterior end of the temporal lobe.

4. Sulci and gyri

- The surface layer of each hemisphere is called the cortex, and is composed of grey mater.
- The cortex is folded in a complex manners, so that there are a number of raised area called gyri and the area separated by fissure called sulci.

* **Main sulci–**
  1. Central sulcus
  2. Lateral sulcus
  3. Parietooccipital sulcus
* **Main gyri–**
  1. Pre central gyrus– Lies anterior to the central sulcus.
  2. Post central gyrus– Lies posterior to the central sulcus.
  3. Superior temporal gyrus– Below the lateral sulcus.

5. Lobes of cerebral hemispheres

- Each cerebral hemisphere is divided into four lobes.
  1. Frontal lobe
  2. Parietal lobe
  3. Occipital lobe
  4. Temporal lobe

- Their positions corresponding bones.
- The lobes are best appreciated on the superolateral surface. The sulci separating the lobes on this surface.

1. **Frontal lobe–** It is situated infront of the central sulcus and above the lateral sulcus.
2. **Parietal lobe–** It is situated behind the central sulcus and above the lateral sulcus.
3. **Occipital lobe–**It lies below the parieto-occipital sulcus.
4. **Temporal lobe–** It lies below the lateral sulcus is situated the temporal lobe.

6. Main functional area of the cerebral cortex

1. Motor area– Anterior to the central sulcus → Frontal lobe
2. Premotor area or psychomotor area–Anterior to the motor area → Frontal lobe
3. Sensory area–Posterior to the central sulcus → Parietal lobe
4. Auditory (Acoustic) area– Below the lateral sulcus → Temporal lobe
5. Broca's or motor speech area– Above the lateral sulcus → Frontal lobe
6. Visual area– Situated on the posterior pole → Occipital lobe
7. **Cranial nerve emerge–**1.Olfactory nerve 2. Optic nerve

14. Spinal Cord (सुषुम्ना काण्ड)

1. Introduction and external features

The spinal cord is a cylindrical, greyish white structure of the central nervous system. It occupies the upper two-thirds of the vertebral canal.

It begins above at the foramen magnum. Where it is continuous with the medulla-oblongata of the brain. and below the level of the lower border of vertebra L_1 or the upper border of vertebra L_2.

It is about 45 cm. long. The lower end is conical and is called the conus medullaris. Which end at the intervertebral disc B/w the vertebrae L_1 and L_2.

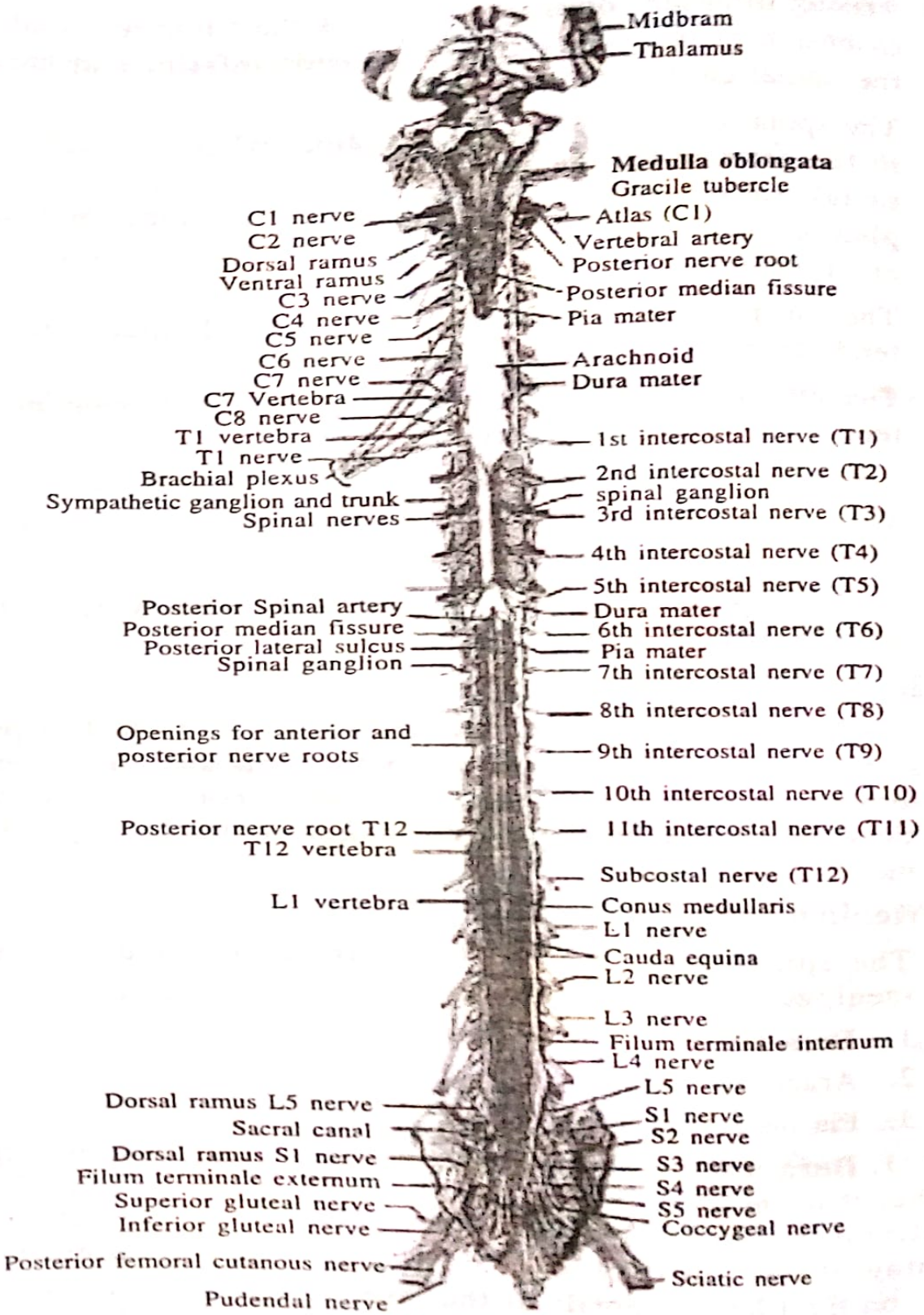


Fig. 5.13 Spinal cord

- Arising from the conus medullaris is the filum terminale, an extension of the piamater that extends inferior and anchors the spinal cord to the coccyx.
- The spinal cord in the cervical region, where it gives origin to the cervical and brachial plexus, and in the lumbar and sacral region, where it gives origin to the lumbar and sacral plexus. When the spinal cord is viewed externally two enlargments can be seen.
- The superior enlargment called the cervical enlargment, extends from the C_4-T_1 vertebrae.
- The Inferior enlargment called the lumbar enlargement, extends from the T_9-T_{12} vertebra.
- Two grooves divide the cord into right and left sides.
- The antero median fissure is a deep, wide groove on the anterior side.
- And the postero-median sulcus is a shallower, narrow groove on the posterior surface.

2. Root of the spinal nerves

Along the whole length of spinal cord are attached 31 pairs of spinal nerves by the anterior or motor roots and the posterior or sensory roots. Each root is attached to the cord by a series of rootlets. Which extend the whole length of the corresponding segment of the cord.

3. Meninges of spinal cords

- The spinal cord like the brain is surrounded by three meninges.
  1. Dura mater
  2. Arachnoid mater
  3. Pia mater

1. Dura mater– The duramater is the most external membrane, that encloses the spinal cord and cauda equina. It is continuous above through the foramen magnum with the meningeal layer of duramater covering the brain. Inferior, it ends on the filum terminale at the level of the lower border of the S_2 vertebra. The dural sheath lies loosely in vertebral canal

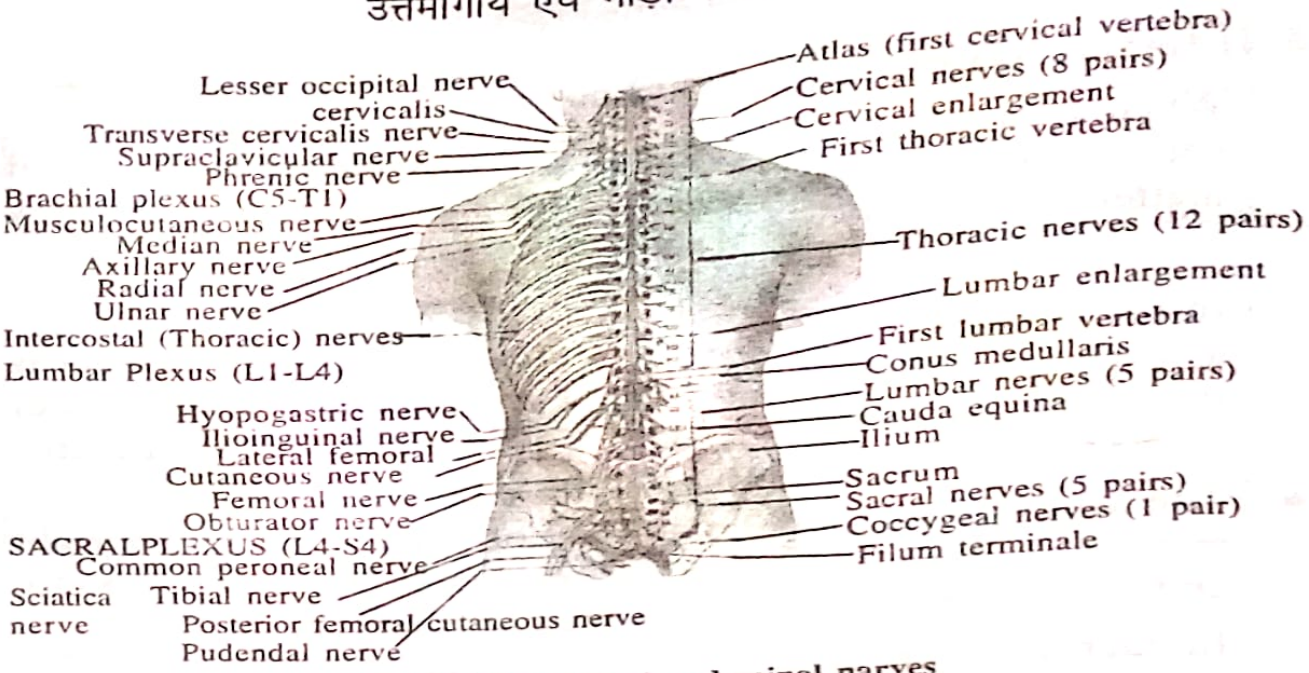


Fig. 5.14 Spinal cord and spinal narves

and is separated from the wall of the canal by the extradural space. The duramater extends along each nerve root and becomes continuous with connective tissue surrounding each spinal nerve at the intervertebral foramen. The inner surface of the duramater is separated from the arachnoid mater by the potential subdural space.

2. Arachnoid mater– The arachnoid mater is a delicate impermeable membrane covering the spinal cord and lying B/w the piamater internally and the duramater externally. It is separated from the dura mater by the subdural space, that contains a thin film of the tissue fluid. The arachnoid separated piamater by a wide space– The subarachnoid space, which is filled with cerebrospinal fluid. The arachnoid is continuous above through the foramen magnum with the arachnoid covering the brain. Inferior it ends on the filum terminale at the level of the lower border of the S_2 vertebra.

3. Piamater– The piamater is a vascular membrane that closely covers the spinal cord. It is continuous above through the foramen magnum with the piamater covering the brain. Below, it fuses with the filum terminale. The piamater is thickened on either side B/w the nerve roots to form the ligamentum denticulatum. Which passes laterlly to be attached to the duramater.

4. Internal structure of spinal cord

When seen a transverse section the grey matter of the spinal cord forms H-shaped mass. In each half of the cord the grey matter is divided into–1. The anterior grey column (Horn)

2. Posterior grey column. (Horn)

In some parts of spinal cord a small lateral grey column is also present. The grey matter of the right and left halves of the spinal cord is connected across the midline by the grey commissure which is traversed by the central canal.

- The white matter of the spinal cord is divisible into right and left halves, infront by a deep anterior-median fissure and behind by the posterior-median septum.

In each half the white matter is divided into–

1. The posterior white column.
2. The lateral white column.
3. The anterior white column.

- The whitematter of the right and left sides is continuous across the midline through the white commissure which lies anterior to the grey commissure.
- The spinal cord gives attachment on each side, to a series of spinal nerves. Each spinal nerve arises by two roots- ventral and dorsal. Each root is made up of a number of rootlets. The length of the spinal cord giving origin to the rootlets for one spinal nerve constitutes one spinal segment.

5. Tracts of spinal cord

A collection of nerve fibres that connected to masses of grey matter within the central nervous system called a tract. Tracts may be ascending or descending.

- Length– 45 cm.
- Width– 1.25 cm.
- Weight– 30 gm.
- Cervical enlargement– C_4-T_1
- Lumbar enlargement– T_9-T_{12}

- Fissures ┌ Ant. median fissure
  └ Post. median fissure
- Conus medullaris– Vertebral level L_1-L_2
- Filum terminale– Coccygeal (Coc_1)
- Meninges ┌ Duramater
  ├ Arachnoid mater
  └ Pia mater
- Subdural space– B/w dura and arachnoid= Serous fluid.
- Subarachoid space– B/w arachnoid and pia= CSF.

6. Blood supply of the spinal cord

* Three longitudinal arteries– • Anterior spinal artery.
  • Two posterior spinal arteries.

7. Venous drainage

* Six longitudinal channels.
  - Anteromedian– Single channel.
  - Posteromedian– Single channel.
  - Anterolateral– Paired channels.
  - Posterolateral– Paired channels.

15. Ventricles of the brain (मस्तिष्कगत गुहाएँ)

- The four CSF filled cavities within the brain which are called ventricles.

1. Right lateral ventrical– प्रमस्तिष्क स्थित दक्षिण पार्श्वगुहा
2. Left lateral ventrical– प्रमस्तिष्क स्थित वाम पार्श्वगुहा
3. Third ventrical– मस्तिष्कगत तृतीय गुहा
4. Fourth ventrical– मस्तिष्कगत चतुर्थ गुहा

(1,2) **Lateral ventricals**– is located in each hemisphere of cerebrum.

(3) **Third ventrical**– is a narrow cavity along the mid line superior to the hypothalamus and B/w the right and left halves of the thalamus.

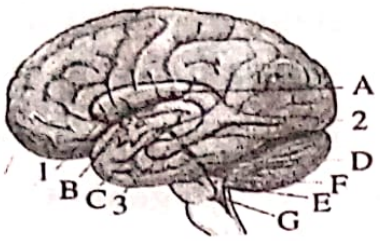


Fig. 5.15 Ventricles of the brain

Key

A	Lateral ventricle	**B**	Interventricular (Monro)	**E**	Lateral aperture (Luschka)
	1 Anterior horn				
	2 Posterior horn	**C**	3rd ventricle	**F**	4th ventricle
	3Inferior horn	**D**	Cerebral aquduct	**G**	Median aperture (Magendie)

(4) Fourth ventrical–Lies B/w the brainstem and the cerebellum.

(II) Formation, circulation and absorption of CSF

* **The formation, circulation and absorption of cerebrospinal fluid–**

Choroid plexuses secrete CSF → Lateral ventricles

CSF flows through the inter-ventricular foramina into the

Choroid Plexus secretes CSF → Third ventricle

and then through the cerebral aqueduct into the

Choroid Plexus secretes CSF → Fourth ventricle

where it exits through the lateral and median apertures into the

Subarachnoid space

where it can pass through the

Arachnoid villi of dural venous sinuses

to enter

Venous blood

which flows to the

Heart and lungs

and then is delivered to all body tissues as

Arterial blood

(III) Blood supply of the brain–

- The arteries supplying the brain are the internal carotid and vertebral arteries and their branches.

* **Internal carotid artery–** It has five branches.
  - Three large branches– 1. Ophthalmic atery
    2. Anterior cerebral artery
    3. Middle cerebral artery
  - Two small branches– 4. Posterior communicating artery
    5. Anterior choroidal artery

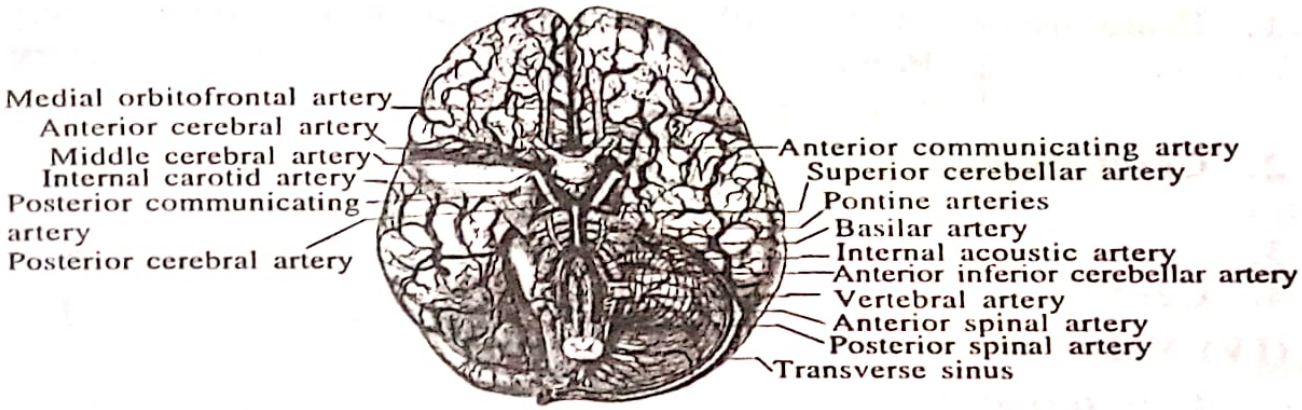


Fig. 5.16 Vessels of the brain

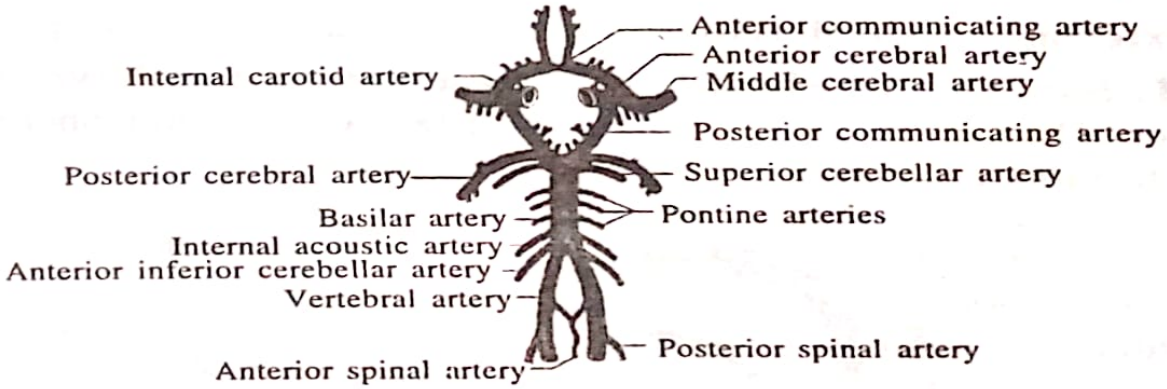


Fig. 5.17 Circle of willis

- **Anterior cerebral artery–** Arises from the internal carotid artery.
- **Middle cerebral artery–** Arises from the internal carotid artery.

* **Vertebral artery–** It has five branches.

  1. Meningeal artery 2. Anterior spinal artery

3. Posterior spinal artery 4. Posterior inferior cerebellar artery
5. Medullary artery

* **Basilar artery–** The basilar artery is formed by the union of the right and left vertebral arteries.

- It has five branches–

1. Pontine artery
2. Labyrinthine artery
3. Anterior inferior cerebellar artery
4. Superior cerebellar artery
5. Posterior cerebral artery

1. Brain stem
   - Medulla oblongata– Branches of vertebral artery.
   - Pons– Branches of basilar artery.
   - Mid brain– Branches of basilar artery.
2. Cerebellum–
   - Branches of vertebral artery.
   - Branches of basilar artery.
3. Diencephalon– Branches of internal carotid artery.
4. Cerebrum– Branches of internal carotid artery.

(IV) Veins of the brain–

1. External cerebral veins.
2. Internal cerebral veins.

(1) External cerebral veins–

1. Superior cerebral veins–These are six to twelve in number. They drain the superolateral surface of the hemisphere. They terminate in the superior sagittal sinus.

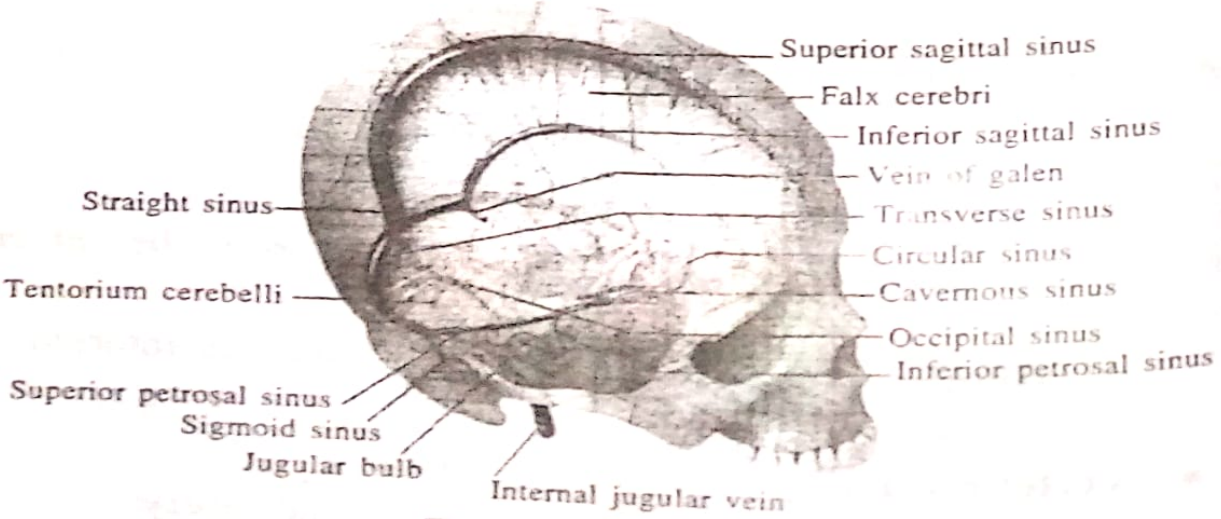


Fig. 5.18 Venous sinus

2. Superficial middle cerebral vein– This drains the area round the post. ramus of the lateral sulcus. It terminates in the cavernous sinus or at times into the sphenoparietal sinus. Through the sup. and inf. anastomotic veins, it communicates with the sup. sagittal and transverse sinuses. It also communicates with the deep middle cerebral vein.

3. Deep middle cerebral vein– This drains the surface of the insula and terminates in the basal vein.

4. Inferior cerebral veins– These are several in number. They are divided into orbital and tentorial veins. The orbital veins terminate in the superior cerebral veins or in the posterior sagittal sinus. The tentorial veins terminate in the cavernous or any other surrounding sinus.

5. Anterior cerebral veins– These are small veins, which drain the corpus callosum and the anterior part of the medial surface of the hemisphere. They terminate in the basal vein.

(2) Internal cerebral veins–

There is one vein on each side. It is formed by the union of the thalamostriate and choroidal veins at the apex of the tela choroidal of the third ventricle. The right and left veins run posterioly parallel to each other in the tela choroidea and unite together to form the **greatcerebral vein** below the splenium of the corpus callosum.

- **Great cerebral vein–** This is a single median vein. It is formed by union of the two internal cerebral veins. It terminates in the straight sinus. Its tributaries include the basal veins and veins from the pineal body, the colliculi, the cerebellum and the adjoining part of the occipital bones of the cerebrum.
- **Basal vein–** There is one vein on each side. It is formed at the anterior perforated substance by the union of the deep middle cerebral vein, the anterior cerebral veins and the striate veins. It runs posteriorly, winds round the cerebral peduncle and terminates by joining the great cerebral vein. Its tributaries include small veins from the cerebral peduncle, interpeduncular structures, the tectum of the midbrain and the parahippocampal gyrus.

Ultimately all veins drain into the various cranial venous sinuses which, inturn, drain into the internal jugular vein.

Intra cranial vascular sinuses ← Superior sagittal sinus, inferior sagittal sinus, straight sinus, transverse sinus.

↓

Right sigmoid sinus

↓

Right internal jugular vein

16. Limbic System (सीमान्त संस्थान)

1. Introduction

- Encircling the brainstem is a ring of structures on the inner border of the cerebrum and floor of the diencephalon that form the limbic (Limbus–Border) system.
- The main objects of primitive life are food and sex. Food is necessary for survival of the individual, and sex, for survival of the species.
- The primitive brain is, therefore, adapted to control and regulate behaviour of the animal with regards to seeking and procuring of food, courtship, mating, housing, rearing of young, rage, aggression and emotions.
- The parts of the humen brain controlling such behavioural patterns constitute the limbic system.

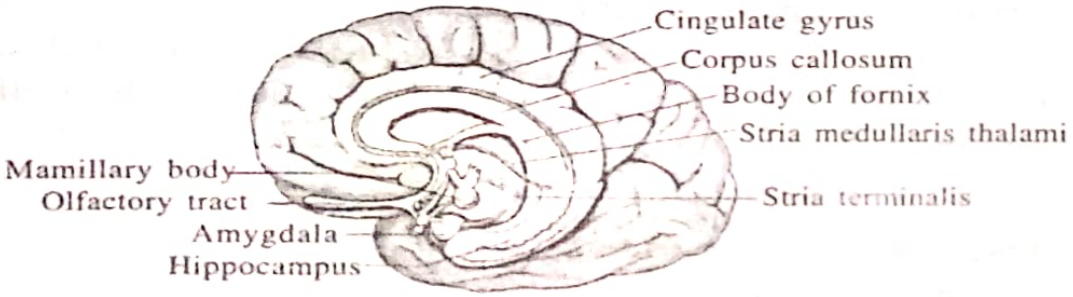


Fig. 5.19 Limbic system

2. Constituent parts of the limbic system

1. Olfactory nerve, bulb, tract, striae and trigone.
2. Anterior perforated substance.
3. Piriform lobe.

4. Anterior part of parahippocampal and cingulate gyri.
5. Hippocampal formation.
6. Amygdaloid nuclei.
7. Septal region.
8. Fornix, stria terminalis, stria habenularis.

3. Functions of the limbic system

It controls–

1. Food habits.
2. Sex behaviour.
3. Emotional behaviour.
4. Retention of recent memory.
5. Integration of olfactory, visceral and somatic impulses.

17. Cranial Nerves (शीर्षण्य नाड़ियाँ)

- There are twelve pairs of cranial nerves. Each cranial nerve has a number and a name.

1. Olfactory nerve–	घ्राण तन्त्रिका
2. Optic nerve–	दृष्टि तन्त्रिका
3. Oculomotor nerve–	नेत्रप्रेरक तन्त्रिका
4. Trochlear nerve–	चक्रक तन्त्रिका
5. Trigeminal nerve–	त्रिधारा तन्त्रिका
6. Abducent nerve–	अपवर्तनी तन्त्रिका
7. Facial nerve–	आनन तन्त्रिका
8. Auditory or vestibulocochlear or statoacoustic nerve–	प्रघाणकर्णावर्त तन्त्रिका
9. Glossopharyngeal nerve–	जिह्वाग्रसनी तन्त्रिका
10. Vagus nerve–	प्राणदा तन्त्रिका
11. Accessory nerve–	सहायिका तन्त्रिका
12. Hypoglossal nerve–	अधोजिह्विका तन्त्रिका

* The cranial nerve emerge from the brain and are transmitted through foramina and fissure in the base of the skull.

- All the nerve are distributed in the head and neck except the vagus.

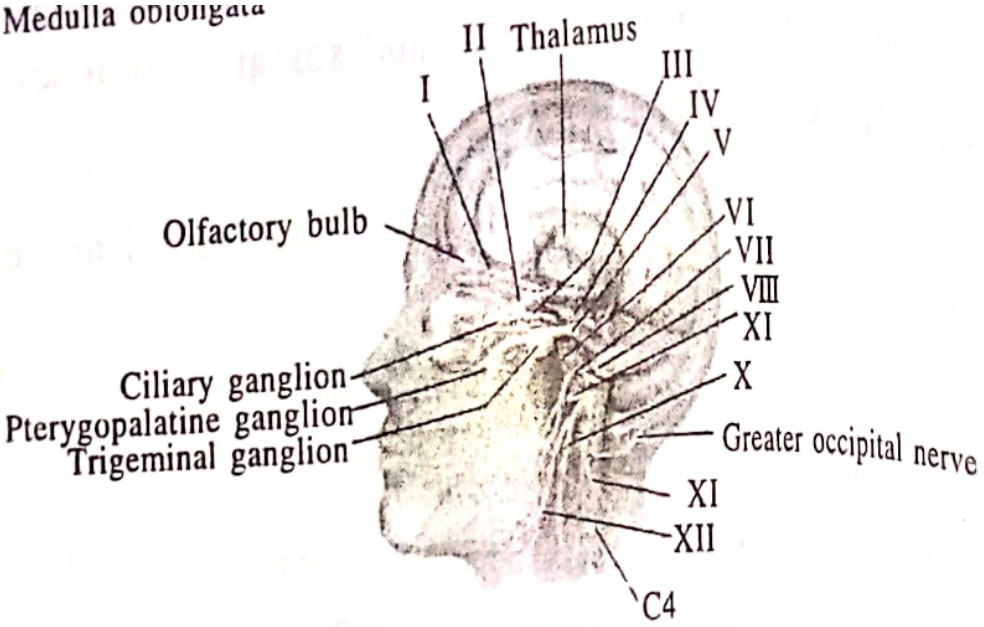


Fig. 5.21 Cranial nerve

Key

Cranial nerves

I	Olfactory nerve	VII	Facial nerve
II	Optic nerve	VIII	Vestibulocochlear nerve
III	Oculomotor nerve	IX	Glossopharyngeal nerve
IV	Trochlear nerve	X	Vagus nerve
V	Trigeminal nerve	XI	Accessory nerve
VI	Abducens nerve	XII	Hypoglossal nerve

- Vagus– Which also supplied structure in the thorax and abdomen.

•	I^{th} and II^{th} cranial nerve are attached to the– Cerebrum.
•	III^{rd} and IV^{th} " " " Mid brain.
•	V^{th}-VI^{th}-VII^{th}-$VIII^{th}$ " " " Pons.
•	IX^{th}-X^{th}-XI^{th}-XII^{th} " " " Medulla oblongata

* **Classification–**

•	Sensory nerves– I^{st} – II^{nd} – $VIII^{th}$ – 3
•	Motor nerves– III^{rd} – IV^{th} – VI^{th} – XI^{th} – XII^{th} – 5
•	Mixed nerves– V^{th} – VII^{th} – IX^{th} – X^{th} – 4
•	= 12 pairs of cranial nerves

Cranial nerves

N.	Name	Compo-nent or type	Location or opening in skull	Originate part	Functions	Applied aspect
I	Olfactory	Sensory	Cribriform plate of ethmoid bone	Cerebrum	Smell	Anosmia– loss of the sense of smell.
II	Optic	Sensory	Optic foramen	cerebrum	vision	Anopsia– loss of the vision.
III	Oculo-motor	Motor	Superior orbital fissure	Mid brain	Lift upper eyelids. Turn eye ball.	Diplopia– Double vision
					Constricts pupil.	
IV	Trochlear	Motor	Sup.orbital fissure	Mid brain	Movement of eye ball	Diplopia
V	Trigem-inal	**Mixed**		Pons	Chewing, convey sen-sation for touch, pain, temp. from structures supplied muscle sense	• Trigeminal neural-gia. (pain) • Paralysis of muslces of mastication.
1.	Ophthalmic	Sensory	Superior orbital fissure			
2.	Maxillary	Sensory	foramen rotundum			• Loss of sensation of touch and temp.
3.	Mandi-bular	Mixed	Foramen ovale			
VI	*Abducent*	*Motor*	*Superior orbital fissure*	*Pons*	• *Eye ball movement* • *Muscle sense*	• *Damage nerve* • *Affacted eye ball can not move laterally*

VII	Facial	Mixed	Internal acoustic meatus	Pons	• Facial expression and secretion of saliva and tears. • Muscles sense.	• Paralysis of facial nerve– Bell's palsy. • Loss of taste, loss of ability to close the eyes.
VIII	Auditory	Sensory	Internal acoustic meatus	Pons	• Hearing • Equilibrium	• Tinnitus (Ringing) • Deafness • Vertigo
IX	Glosso-pharyn-geal	Mixed	Jugular foramen	Medulla	• Secretion of saliva. • Taste, regulation of blood pressure.	• Difficulty during swallowing, • Loss of taste.
X	Vagus	Mixed	Jugular foramen	Medulla	• Smooth muscles contr-action and relaxtion. • Secretion of digestive fluid, sensation from visceral organ supplied.	• Paralysis vocal cord.
XI	Accessory	Motor	Jugular foramen	Medulla	• Cranial portion mediate swallowing movement. • Spinal portion mediate movement of head. • Muscles sense.	Paralysis of sterno-cleidomastoid and Trapezius muscles.
XII	Hypog-lossal	Motor	Hypoglosal canal	Medulla	Movement of tongue during speech and swallowing • Muscles sense	• Difficulty in chew-ing, speaking swa-llowing. • Thick speech.

18. Spinal nerves (सुषुम्ना से सम्बन्धित नाड़ियाँ)

- Spinal nerves connect the C.N.S. to receptors, muscles and glands and are part of the P.N.S.
- The 31 pairs of spinal nerves are named and numbered according to the region and level of the vertebral colomn from which they emerge.
- The first cervical pair emerges B/w the atlas (C1) and the occipital bone.
- All other spinal nerves emerge from the vertebral column through the intervertebral foramina B/w adjoining vertebrae.
- Thus there are– Cervical nerves– 8 pairs
  Thoracic nerves– 12 pairs
  Lumbar nerves– 5 pairs
  Sacral nerves– 5 pairs
  Coccygeal nerves– 1 pairs

(A) Cervical plexus (ग्रीवानुगा तन्त्रिका प्रवेणी)– $C_1-C_2-C_3-C_4$

(B) Brachial plexus (कक्षानुगा तन्त्रिका प्रवेणी)– $C_5-C_6-C_7-C_8-T_1$

(C) Intercostal– (thoracic) nerves $T_2-T_3-T_4-T_5-T_6-T_7-T_8-T_9-T_{10}-T_{11}-T_{12}$

(अन्तरापर्शुकिय नाड़ियाँ)

(D) Lumbar plexus (कटि तन्त्रिका प्रवेणी)– $L_1-L_2-L_3-L_4$

(E) Sacral plexus (त्रिक तन्त्रिका प्रवेणी)– $L_4-L_5-S_1-S_2-S_3-S_4$

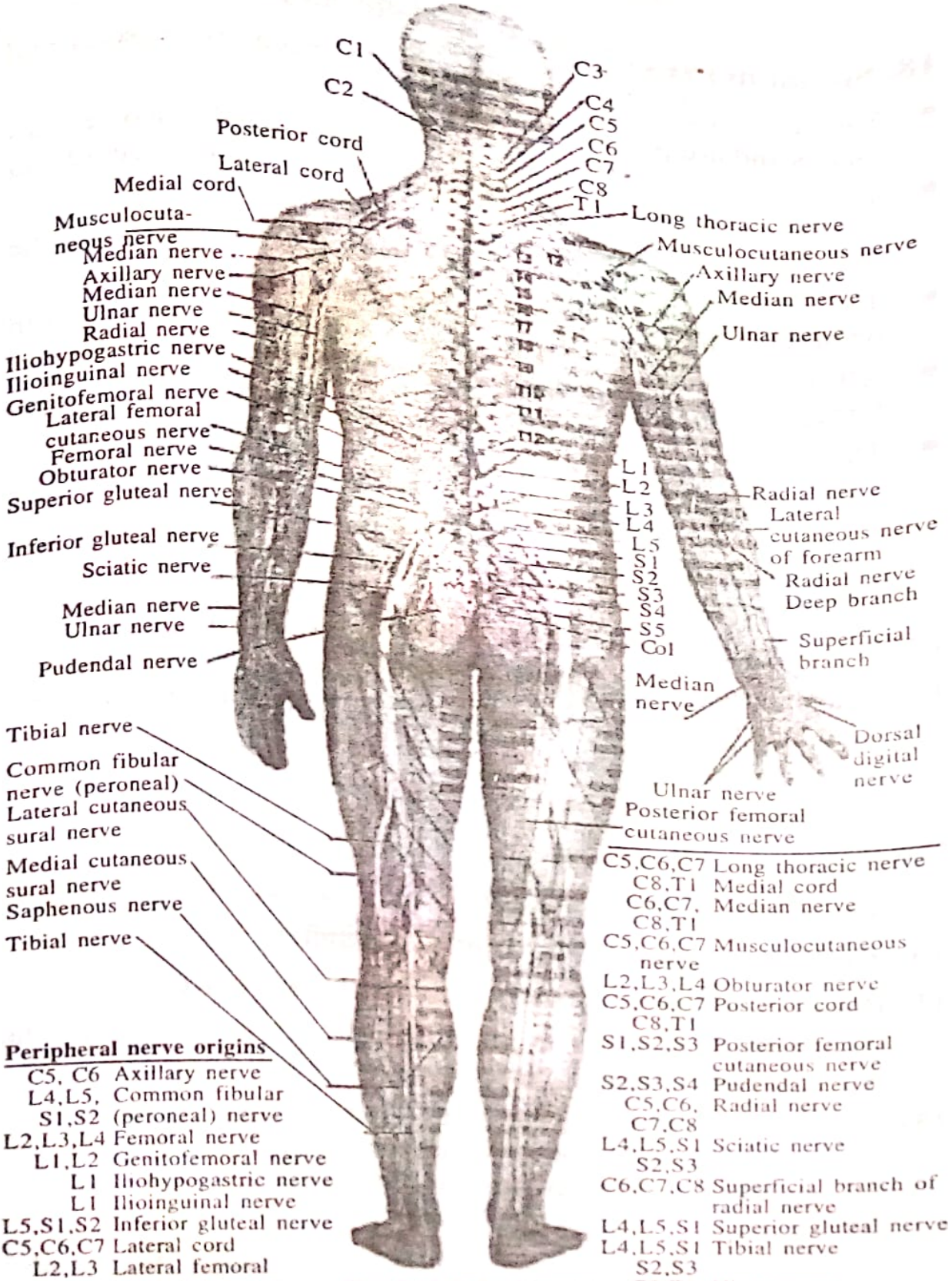
(A) Cervical plexus (ग्रीवानुगा तन्त्रिका प्रवेणी)

(1) Roots– $C_1-C_2-C_3-C_4$ with contributions from C_5.

(2) Situation– It is situated on each side of the neck alongside the first four cervical vertebrae.

(3) Supply– The cervical plexus supplied the skin and muscles of the head, neck and superior part of the shoulders. Branches of the cervical plexus also run parallel to cranial nerves XI and XII.

The phrenic nerve arises from the cervical plexuses and supply motor fibers to diaphragm.



Peripheral nerve origins

C5, C6	Axillary nerve
L4,L5, S1,S2	Common fibular (peroneal) nerve
L2,L3,L4	Femoral nerve
L1,L2	Genitofemoral nerve
L1	Iliohypogastric nerve
L1	Ilioinguinal nerve
L5,S1,S2	Inferior gluteal nerve
C5,C6,C7	Lateral cord
L2,L3	Lateral femoral cutaneous nerve
C5,C6,C7	Long thoracic nerve
C8,T1	Medial cord
C6,C7, C8,T1	Median nerve
C5,C6,C7	Musculocutaneous nerve
L2,L3,L4	Obturator nerve
C5,C6,C7 C8,T1	Posterior cord
S1,S2,S3	Posterior femoral cutaneous nerve
S2,S3,S4	Pudendal nerve
C5,C6, C7,C8	Radial nerve
L4,L5,S1 S2,S3	Sciatic nerve
C6,C7,C8	Superficial branch of radial nerve
L4,L5,S1	Superior gluteal nerve
L4,L5,S1 S2,S3	Tibial nerve
C8,T1	Ulnar nerve

Fig. 5.22 Spinal nerve

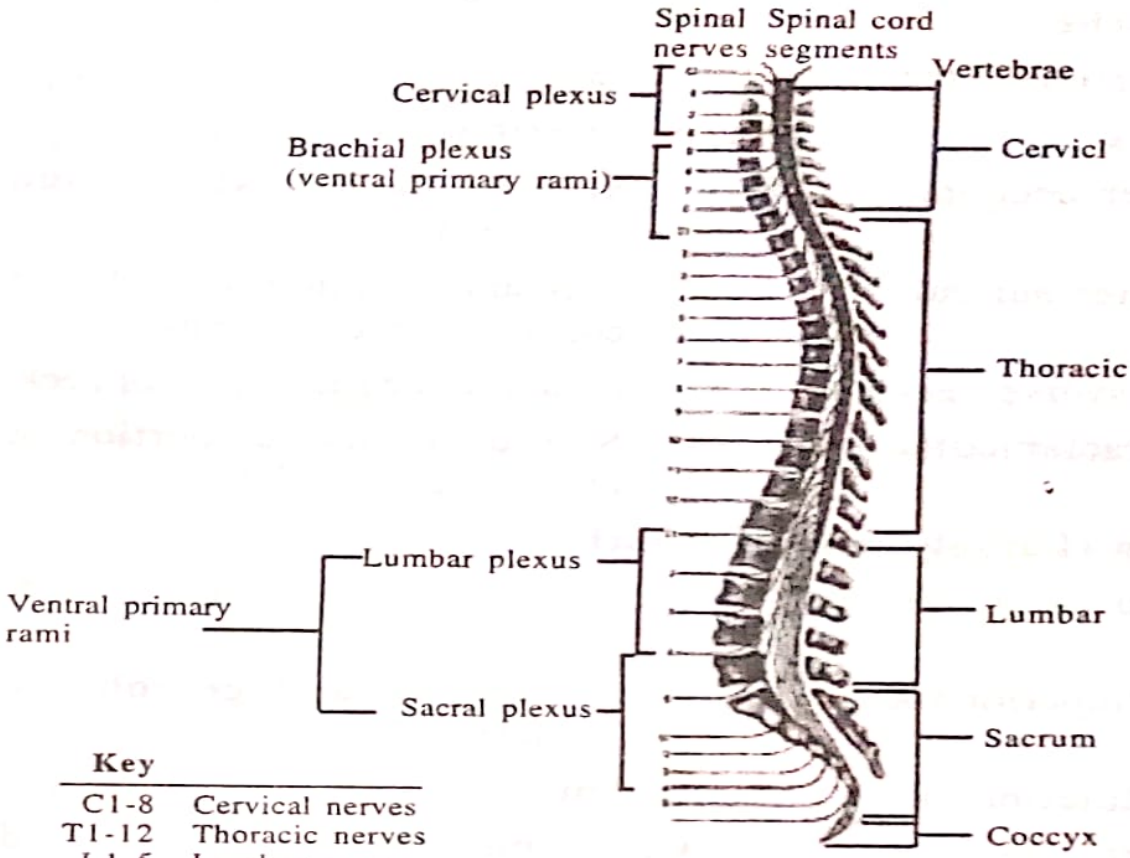


Fig. 5.23 Spinal nerve

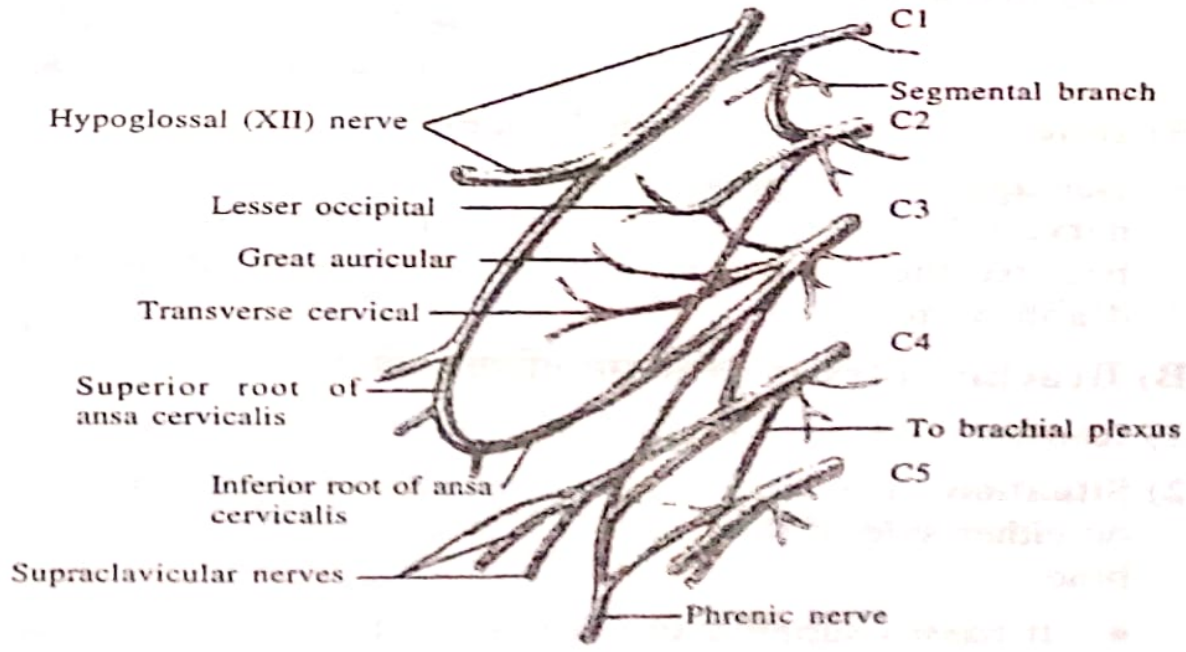


Fig. 5.24 Cervical plexus

(4) Branches–

(A) Superficial (sensory) branches–

	Nerve	origin	Distribution
1.	Lesser occipital	C_2	Skin of scalp posterior and superior to ear.
2.	Greater auricular	C_2–C_3	Skin anterior, inferior and over ear and parotid glands.
3.	Transverse cervical	C_2–C_3	Skin over anterior aspect of neck.
4.	Supraclavicular	C_3–C_4	Skin over superior portion of chest and shoulder.

(B) Deep (Largely motor) branches–

1.	Ansa cervicalis		This nerve divides into a superior root and an inferior root.
	• Superior root	C_1	Infrahyoid and geniohyoid muscles of neck.
	• Inferior root	C_2–C_3	Infrahyoid muscles of neck.
2.	Phrenic nerve	C_3–C_5	Diaphragm B/w thorax and abdomen.
3.	Segmental branches	C_1–C_5	Prevertebral (deep) muscles of neck, levator scapulae and middle scalene muscles.

(5) Damage of cervical spinal cord–

Damage to the spinal cord above the origin of the phrenic nerve (C_3–C_4–C_5) causes respiratory arrest, breathing stops because the phrenic nerves no longer send impulses to the diaphragm.

(B) Brachial plexus (कक्षानुगा तन्त्रिका प्रवेणी)

(1) Roots– C_5–C_6–C_7–C_8 and T_1

(2) Situation– The brachial plexus extends inferiorly and laterally on either side of the last four cervical and first thoracic vertebrae.

- It passes superior to the first rib behind the clavicle and then enters the axilla.

(3) Supply– The brachial plexus supplied of the shoulder and upper limb.

(4) The plexus consists of **roots, trunks, divisions and cords.**

1. **Roots–** C_5–C_6–C_7–C_8– T_1
2. **Trunks–**
   - C_5–C_6 = Upper trunk
   - C_7 = Middle trunk
   - C_8– T_1 = Lower trunk
3. **Divisions–** Each trunk has two division–
   1. Ventral division. 2. Dorsal division.
   - Ventral division of upper trunk+ventral division of middle trunk=Lateral cord.
   - Ventral division of lower trunk= Medial cord.
   - Dorsal division of all three trunk= Posterior cord.

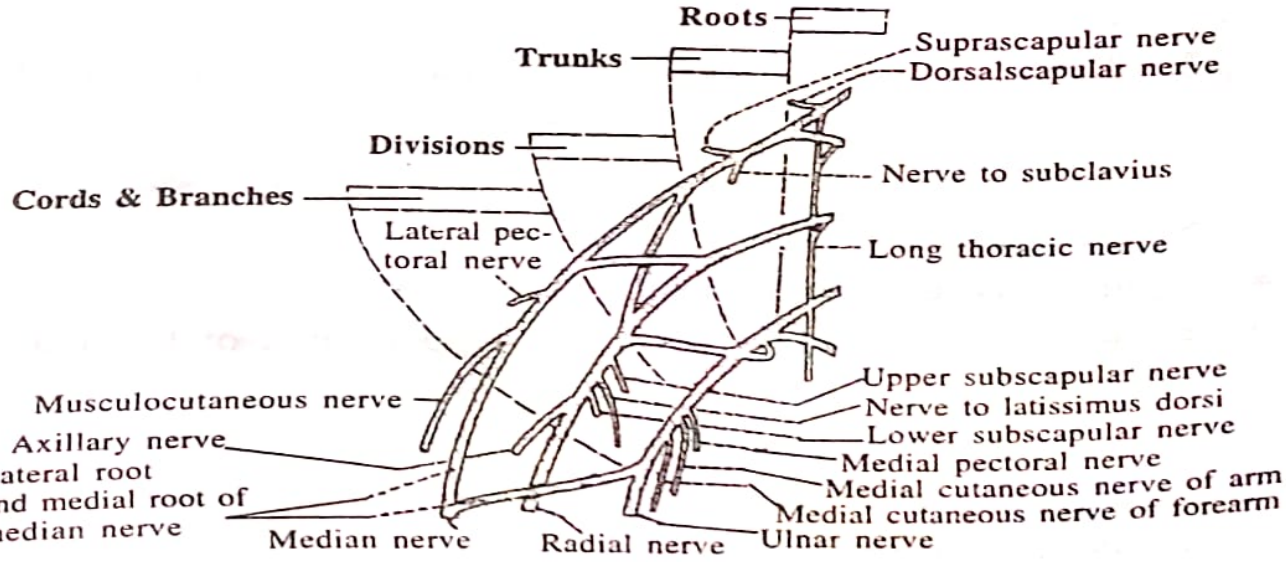


Fig. 5.25 Brachial plexus

4. **Cords–** 1. Lateral cord 2. Medial cord 3. Posterior cord
5. **Main branches–** 1. Median nerve 2. Ulnar nerve 3. Radial nerve
6. **Branches of the roots–**
   1. Nerve to serratus anterior (Long thoracic nerve)–C_5–C_6–C_7
   2. Dorsal scapular nerve (Nerve to rhomboideus)– C_5
7. **Branches of the upper trunk–**
   1. Suprascapular neve– C_5–C_6
   2. Nerve to subclavius– C_5–C_6

8. Branches of the cords–

(A) Branches of the lateral cord–

1. Lateral pectoral nerve– C_5–C_6–C_7
2. Musculocutaneous nerve– C_5–C_6–C_7
3. Lateral root of median nerve– C_5–C_6–C_7

(B) Branches of the medial cord–

1. Medial pectoral nerve– C_8–T_1
2. Medial cutaneous nerve of arm– C_8–T_1
3. Medial cutaneous nerve of forearm– C_8–T_1
4. Ulnar nerve– C_7–C_8–T_1
5. Medial root of median nerve– C_8–T_1

(C) Branches of the posterior cord–

1. Upper subscapular nerve– C_5–C_6
2. Thoracodorsal nerve (Nerve to latissimus dorsi)–C_6–C_7–C_8
3. Lower subscapular nerve– C_5–C_6
4. Axillary nerve– C_5–C_6
5. Radial nerve– C_5–C_6–C_7–C_8–T_1

* **Applied aspect of brachial plexus–**

1. **Erb's paralysis**–Injury to the upper trunk of brachial plexus.
2. Klumpke's paralysis– Injury to the lower trunk.
3. Winging of scapula– Injury to the long thoracic nerve.
4. Police man's tip hand / or / Porter's tip hand / or / Waiter's tip hand → Median nerve palsy.
5. Wrist drop– Radial nerve injury.
6. Claw hand– • Injury to the lower trunk of brachial plexus.
   • Median nerve injury.
7. Ape like hand– Median nerve palsy.

(C) Intercostal nerves (अन्तरापर्शुकिय नाड़ियाँ)

- The ventral rami of spinal nerves T_2–T_{12} do not enter into the formation of plexuses and are known as intercostal nerves.
- These nerves directly innervate the structures they supply in the intercostal spaces. After leaving its intervertebral foramen.
- The ventral ramus of nerve T_2 supplies the intercostal muscles of the second intercostal space and the skin of the axilla and posteromedial aspect of the arm.
- Nerves T_3–T_6 passes in the costal grooves of the ribs and than to the intercostal muscles and skin of the anterior and lateral chest wall.
- T_7–T_{12} supply the intercostal muscles and the abdominal muscles and overlying skin.
- The dorsal rami of the intercostal nerves supply the deep back muscles and skin of the dorsal aspect of the thorax.

(D) Lumbar plexus (कटि तन्त्रिका प्रवेणी)

(1) Roots– L_1–L_2–L_3–L_4

(2) Situation– The lumbar plexus passes obliquely outward posterior to the psoas major muscles and anterior to the quadratus lumborum muscles.

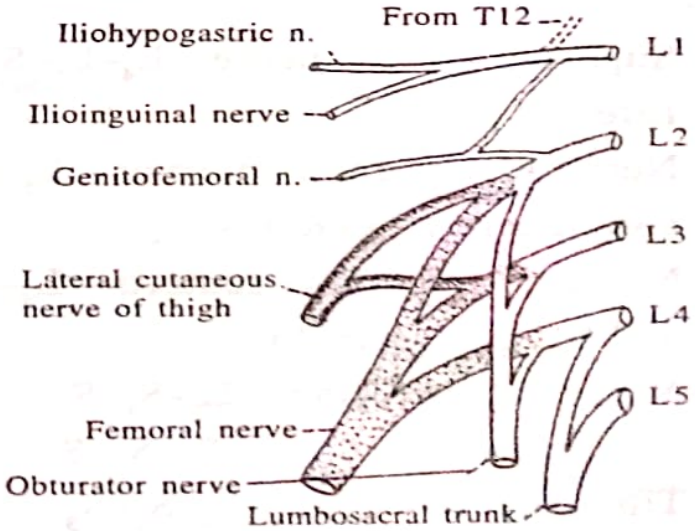


Fig. 5.26 Lumbar plexus

(3) Supply– The lumbar plexus supplies the anterolateral abdominal wall, external genitals and part of the lower limbs.

(4) Branches–

1. Iliohypogastric nerve– L_1
2. Ilioinguinal nerve– L_1
3. Genitofemoral nerve– L_1–L_2
4. Lateral cutaneous nerve of thigh– L_2–L_3
   or lateral femoral cutaneous nerve
5. Femoral nerve– L_2–L_3–L_4
6. Obturator nerve– L_2–L_3–L_4

(5) Applied aspect–

* Femoral nerve injury– The largest nerve arising from the lumbar plexus is the femoral nerve.

  injury to the femoral nerve is indicated by an inability to extend the leg and by loss of sensation in the skin over the anteromedial aspect of the thigh.

(E) Sacral plexus (त्रिक तन्त्रिका प्रवेणी)

(1) Roots– L_4–L_5 and S_1–S_2–S_3–S_4

(2) Situation– It is situated largely anterior to the sacrum.

(3) Supply– The sacral plexus supplies the buttocks, perineum, and lower limbs.

(4) Branches–

1. Superior gluteal nerve– L_4–L_5–S_1
2. Inferior gluteal nerve– L_5–S_1–S_2
3. Nerve to obturator internus– L_5–S_1–S_2
   and superior gemellus
4. Nerve to quadratus femoris– L_4–L_5–S_1
   and inferior gemellus
5. Nerve to piriformis– L_5–S_1–S_2
6. Sciatic nerve– L_4–L_5–S_1–S_2–S_3
7. Tibial nerve– L_4–L_5–S_1–S_2–S_3
8. Medial plantar nerve

9. Lateral plantar nerve
10. Common peroneal nerve– L_4–L_5–S_1–S_2
11. Superficial peroneal nerve
12. Deep peroneal nerve
13. Pudendal nerve– S_2–S_3–S_4

Sciatic nerve

Tibial nerve — Common peroneal nerve

Medial plantar n. — Lateral plantar n. — Superficial peroneal n. — Deep peroneal n.

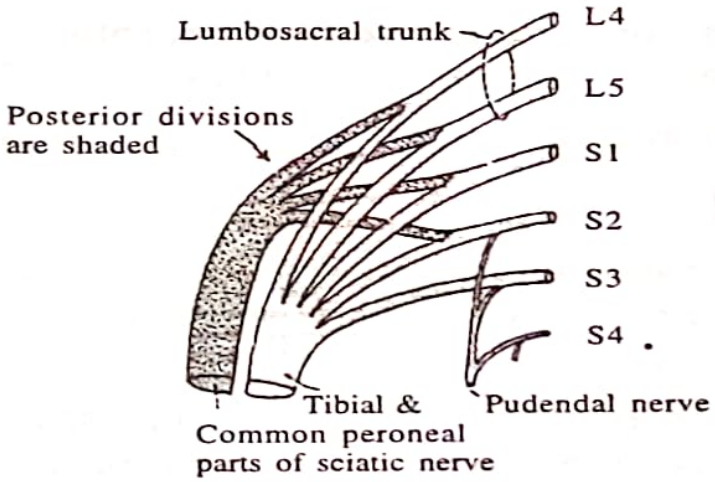


Fig. 5.27 Sacral plexus

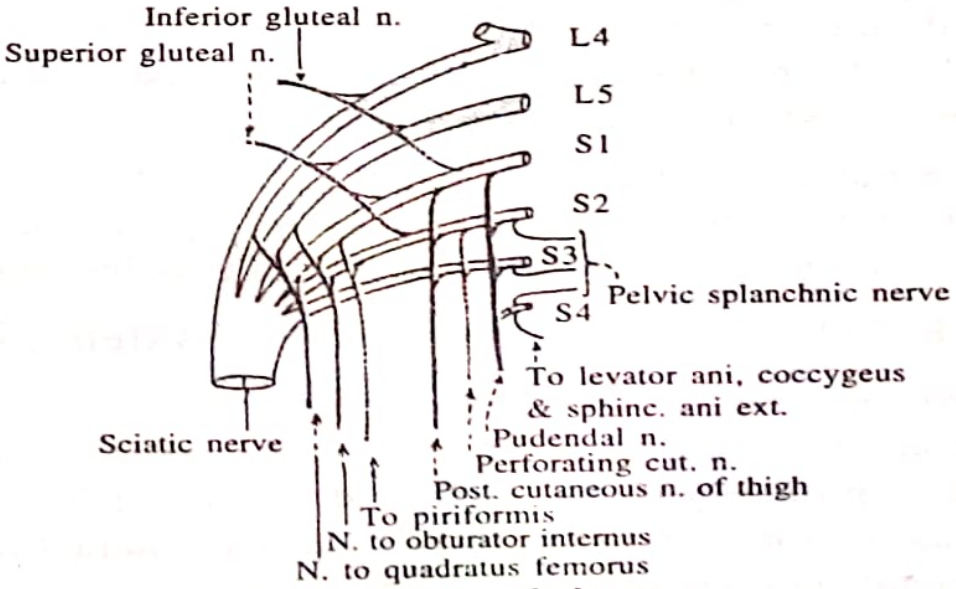


Fig. 5.28 Sacral plexus

(5) Applied aspect–

1. Sciatic nerve injury– Back pain.
2. Common peroneal nerve injury– Foot drop.

१९. केन्द्रीय नाड़ी संस्थान [Central Nervous System (C.N.S.)]

- The C.N.S. consists of the brain and spinal cord within the CNS, many different kinds of incoming sensory information are integrated and correlated thoughts and emotions are generated and memories are formed and stored. Most nerve impulses that stimulated muscles to contract and glands to secrete originate in the CNS.
- The CNS is connected to sensory receptors, muscles and glands in peripheral parts of the body by the PNS.

२०. परिसरीय नाड़ी संस्थान [Peripheral Nervous System (P.N.S.)]

- The PNS consists of 12 pairs of cranial nerves that arises from the brain and 31 pairs of spinal nerves that emerge from the spinal cord.
- Portion of these nerve carry nerve impulses into the CNS while other portions carry impulses out of the CNS.
- The input component of the PNS consists of nerve cells called sensory (afferent) neurons. They conduct nerve impulses from sensory receptors in various parts of the body to the C.N.S. and end within the CNS.
- The output component consists of nerve cells called motor or efferent neurons. They originate within the CNS. and conduct nerve impulses from the CNS to muscles and glands.

२१. दैहिक नाड़ी संस्थान [Somatic Nervous System (S.N.S.)]

- The somatic nervous system consists of sensory neurons that convey information from cutaneus and special sense receptors primarily in the head, body wall and limbs to the CNS and motor neurons from the CNS that conduct impulses to skeletal muscles only.

- Because these motor responses can be consciously controlled, this portion of the somatic nervous system is voluntary.

२२. स्वतन्त्र नाड़ी संस्थान [Autonomic Nervous System (A.N.S.)]

The ANS consists of sensory neurons that convey information from receptors primarily in the viscera to the CNS and motor neurons from the CNS that conduct impulses to smooth muscle, cardiac muscle and glands. Since its motor responses are not normally under conscious control, the ANS is involuntary.

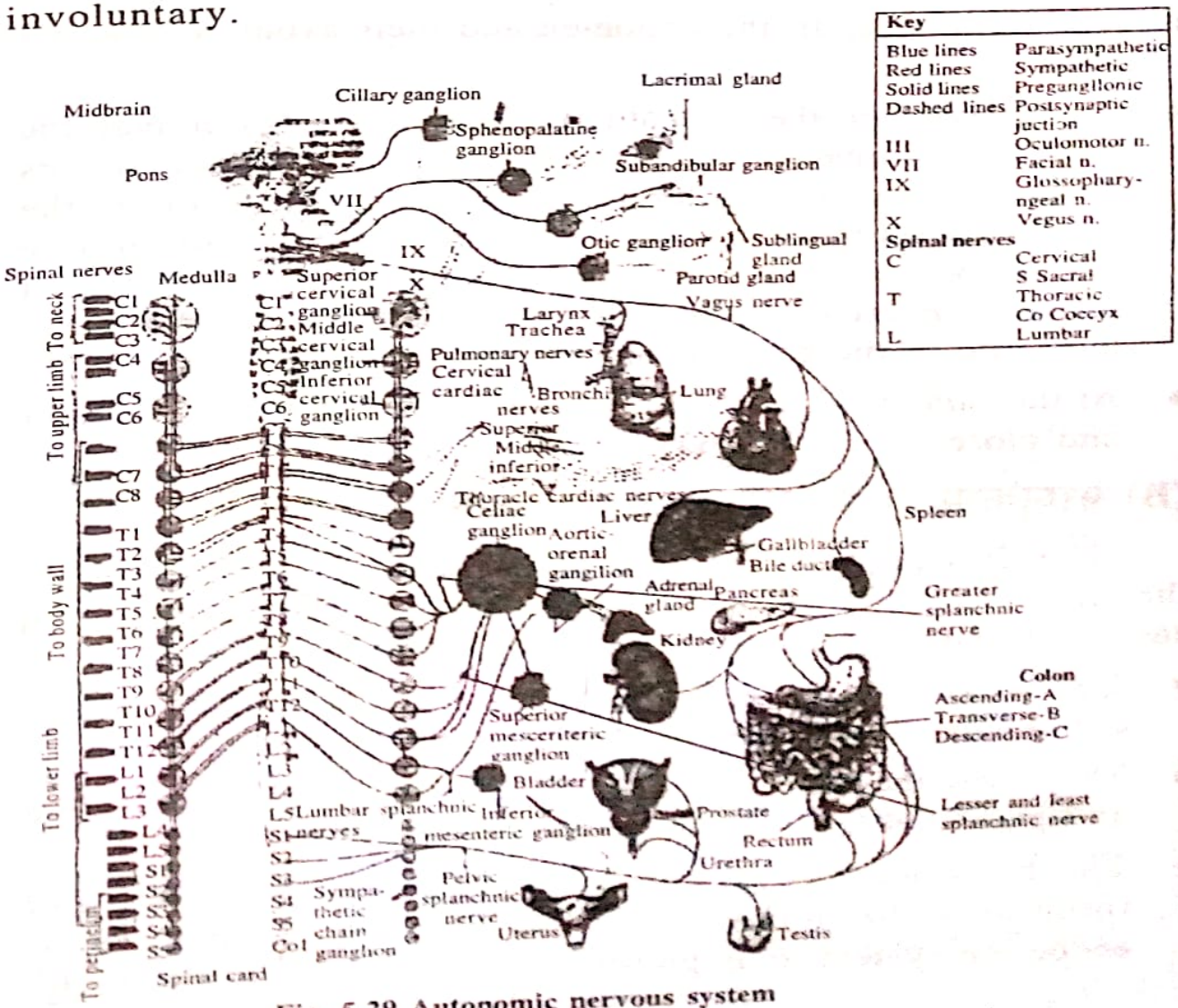


Fig. 5.29 Autonomic nervous system

- The motor portion of the ANS consists of two branches–

(A) अनुकम्पी नाड़ी तन्त्र– Sympathetic division–(T_1–T_{12} and L_1–L_2) or thoraco-lumbar division

(B) परानुकम्पी नाड़ी तन्त्र– Parasympathetic division– or cranio-sacral division (C.N. 3–7–9–10 and S_2–S_3–S_4)

(A) अनुकम्पी नाड़ी तन्त्र (Sympathetic Division)

It consists of the paired chains of ganglia on either side of the backbone, their connections with the thoracic and lumbar segments of the spinal cord, the splanchnic nerve, coeliac and mesenteric ganglia in the abdomen and their axons to visceral effectors.

- The activites to the sympathetic and of the ANS prepare the body for an emergency. It accelerates the heart-rate, causes constriction of the peripheral blood vessels and raises the blood pressure. The sympathetic part of the autonomic system brings about a redistribution of the blood so that it leaves the areas of the skin and intestine and becomes available to the brain, heart and skeletal muscles.
- At the same time, it inhibits peristalsis of the intestinal tract and closes the sphincters.

(B) परानुकम्पी नाड़ी तन्त्र (Parasympathetic Division)

Consists of some fibers of the cranial nerves 3–7–9–10, the fibers of some sacral S_2–S_3–S_4 spinal nerves and ganglia and short axon near or in the visceral effectors

- The activites of the parasympathetic part of the ANS aim at conserving and restoring energy.
- They slow the heart rate, increase peristalsis of the intestine and glandular activity and open the sphincters.
- The hypothalmus of the brain controls the ANS and integrates the activities of the autonomic and neuro-endocrine system, thus preserving homeostasis in the body.

Important Nerves (महत्वपूर्ण नाड़ियाँ)

1. Vagus Nerve (प्राणदा नाड़ी)

(A) Introduction

- The vagus nerve arises from the lateral side of the **medull oblongata**. By about ten rootlets which are attached to the groove between the olive and the inferior cerebellar peduncle, below the rootlets of the glossopharyngeal nerve. Thus formed the nerve leaves the skull through the **jugular foramen.**

  The part of the nerve within the jugular foramen shows an enlargement called the superior ganglion. Just below the foramen the nerve has a much larger enlargement called the inferior ganglion.

  - The vagus nerve descends vertically in the **neck.** It is enclosed within the **carotid sheath;** lying at first between the **internal jugular** vein and the **internal carotid** artery and then between the **internal jugular** vein and the **common carotid artery.**

    At the root of the neck, the nerve accompanies the **common carotid artery** and lies anterior to the **first part of the subclavian artery,** and enters the **thorax.**

- In the superior mediastinum the right vagus nerve lies on the right side of the trachea. Here it is posteromedial first to the right brachiocephalic vein and then to the superior vena cava. The nerve passes deep to the azygos vein to reach the posterior side of the root of the right lung.

  In the superior mediastinum the left vagus nerve descends between the left common carotid and left subclavian arteries. It passes behind the left brachiocephalic vein and then crosses the left side of the arch of the aorta to reach the posterior aspect of the root of the left lung.

  The nerve is related laterally to the left lung and pleura. Above the arch of the aorta the vagus is crossed by the left phrenic nerve. Over the root it is crossed by the left superior intercostal vein.

  Having reached the root of the lung each vagus nerve divides into a number of branches.

- In the thorax fibres of the right and left vagus nerves emerge from the posterior pulmonary plexuses and descend on the oesophagus forming an anterior and a posterior oesophageal plexus. Although both plexuses receive fibres from the nerves of both sides the anterior plexus is formed mainly by fibres from the left vagus and the posterior plexus mainly by fibres from the right vagus. Fibres emerging from the lower end of the anterior oesophageal plexus collect to form the anterior vagal trunk which is made up mainly of fibres from the left vagus. Similarly fibres arising from the posterior oesophageal plexus (mainly right vagus) collect to form the posteior vagal trunk. The anterior and posterior vagal trunks enter the abdomen through the oesophageal opening in the diaphragm.
- **The anterior vagal** trunk supplies the anterosuperior surface of the stomach, the superior and descending parts of the duodenum, the head of the pancreas and the liver.
- **The posterior vagal trunk** supplied the posteroinferior surface of the stomach. This trunk gives a large coeliac branch which ends in the coeliac plexus. This plexus surrounds the coeliac trunk and stretches between the right and left coeliac ganglia.
- Fibres from the coeliac plexus pass into several secondary plexuses that surround branches of the abdominal aorta. These are the splenic, hepatic, renal, suprarenal and superior mesenteric plexuses.

(B) Branches

1. Meningeal nerve– मस्तिष्कावरण नाड़ी
2. Auricular nerve– बहि:कर्ण नाड़ी
3. Pharyngeal nerve– ग्रसनी नाड़ी
4. Superior laryngeal nerve– ऊर्ध्व स्वरयन्त्र नाड़ी
5. Internal laryngeal nerve– अन्त: स्वरयन्त्र नाड़ी
6. External laryngeal nerve– बाह्य स्वरयन्त्र नाड़ी
7. Recurrent laryngeal nerve– पुनरावर्ती स्वरयन्त्र नाड़ी
8. Cardiac nerve– हार्दिकी नाड़ी
9. Pulmonary nerve– फुफ्फुसीय नाड़ी

10. Oesophageal nerve– ग्रासनली नाड़ी
11. Gastric nerve– जठर नाड़ी
12. Coeliac nerve– कुक्षि नाड़ी
13. Hepatic nerve– याकृति नाड़ी
14. Renal nerve– वृक्कीय नाड़ी

(C) Applied aspect

* The vagus nerve innervates many important organs; but the examination of this nerve depends on testing the function of the branches to the pharynx, soft palate and larynx.

I. Ask the patient to open the mouth wide and say 'aah' observe the movement of the soft palate. In a normal person the soft palate is elevated. When one vagus nerve is paralysed the palate is pulled towards the normal side. When the nerve is paralysed on both sides the soft palate does not move at all.

II. In injury to the superior laryngeal nerve the voice is weak due to paralysis of the cricothyroid muscle. At first there is hoarseness but after some time the opposite cricothyroid compensates for the deficit and hoarseness disappears.

III. Injury to the recurrent laryngeal nerve also leads to hoarseness, but this hoarseness is permanent. On examining the larynx through a laryngoscope it is seen that on the affected side the vocal fold does not move. It is fixed in a position midway between adduction and abduction. In case where the recurrent laryngeal nerve is pressed upon by a tumour. It is observed that nerve fibres that supply abductors are lost first.

IV. In paralysis of both recurrent laryngeal nerves voice is lost as both vocal folds are immobile.

V. It can be involved in bronchial or oesophageal carcinoma, or by secondary growth in mediastinal lymph nodes.

2. Phrenic Nerve (मध्यच्छद नाड़ी)

(A) Introduction

- This is a mixed nerve carrying motor fibres to the diaphragm and sensory from the diaphragm, the pleura, the pericardium and part of the peritoneum.

- The phrenic nerve arises chiefly from the 4th cervical nerve but receives contribution from 3rd and 5th cervical nerves. The contribution from C5 may come directly from the root or indirectly through the nerve to the subclavius.

(B) Course and relations

- The nerve is formed at the lateral border of the scalenus anterior, opposite the middle of the sternocleidomastoid, at the level of the upper border of the thyroid cartilage.
- It runs vertically downwards on the anterior surface of the scalenus anterior. Since the muscle is oblique the nerve appears to cross it obliquely from its lateral to its medial border. In this part of its course, the nerve is related anteriorly to the prevertebral fascia, the inferior belly of the omohyoid, the transverse cervical artery, the suprascapular artery, the internal jugular vein, the sternocleidomastoid and the thoracic duct on left side.
- After leaving the anterior surface of the scalenus anterior, the nerve runs downwards on the cervical pleura behind the commencement of the brachiocephalic vein. Here it crosses the internal thoracic artery from lateral to medial side and enters the thorax behind the first costal cartilage. On the left side the nerve crosses the medial margin of the scalenus anterior at a higher level and crosses infront of the first part of the subclavian artery.
- The right phrenic nerve descends in the thorax along the right side of the right brachiocephalic vein and the superior vena cava. It passes infront of the root of the right lung and runs along the right side of the pericardium, which separates the nerve from the right atrium. It then descends on the right side of the inferior venacava to the diaphragm. Its terminal branches pass through the caval opening in the diaphragm to supply the central part of the peritoneum on its under aspect.
- The left phrenic nerve descends in the thorax along the left side of the left subclavian artery. It crosses the left side of the aortic arch and here crosses the left side of the left vagus nerve. It passes infront of the root of the left lung and then descends over the left surface of the pericardium, which

separates the nerve from the left ventricle. On reaching the diaphram, the terminal branches pierce the muscle and supply the central part of the peritoneum on its under aspect.

(C) Applied aspect

Inflammation of peritoneum under diaphragm causes referred pain in the area of supraclavicular nerves supply, especially tip of the shoulder as their root value is also ventral rami of C_3 and C_4.

* **Accessory Phrenic Nerve (सहायक मध्यच्छद नाड़ी)–**

The root of the phrenic nerve from C_5 may sometimes follow a complicated course. Instead of arising from C_5 itself it may arise from the nerve to the subclavius. From here the root descends through the neck lateral to the main phrenic nerve and joints it in the upper part of the thorax. Such a root from C_5 constitutes the accessory phrenic nerve.

3. Musculocutaneous Nerve (पेशीत्वक् नाड़ी)

(A) Introduction

- The musculocutaneous nerve is so named as it supplies muscles of front of arm and skin of lateral side of forearm.
- Root value– Ventral rami of C_5–C_6–C_7 segments of spinal cord.
- The musculocutaneous nerve is a branch of the lateral cord of brachial plexus. lies lateral to axillary and upper part of brachial artery. It supplies coracobrachialis pierces the muscle to lie in the intermuscular septum between biceps brachii and brachialis muscles both of which are supplied by this nerve. At the crease of elbow it becomes cutaneous. This nerve is called the lateral cutaneous nerve of forearm which supplies skin of lateral side of forearm both on the front and back.

(B) Branches

(1) Muscular–(i) Coracobrachialis. (ii) Biceps brachii. (iii) Brachialis.

(2) Cutaneous– Lateral cutaneous nerve of forearm.

(3) Articular– Branch to elbow joint.

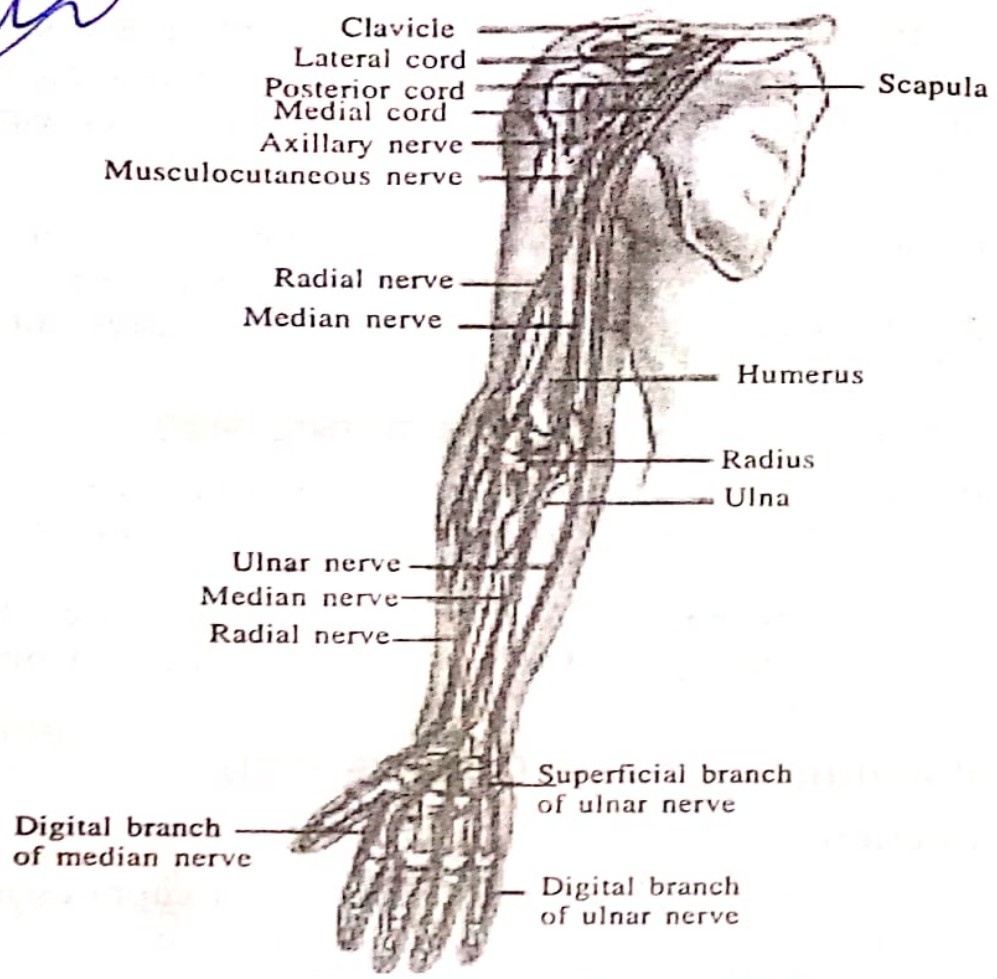


Fig. 5.30 Nerves of the upper limb

4. Axillary Nerve (कक्षाधरा नाड़ी)

(A) Introduction

- It is also called circumflex nerve. Its root value is ventral rami of C_5–C_6 segment of spinal cord.
- It is the smaller terminal branch of posterior cord. It passes backwards through the quadrangular space. Here it lies below the capsule of the shoulder joint. As it is about to pass behind the surgical neck of humerus it divides into an anterior and posterior divisions.

(B) Branches

(1) Muscular– (i) Deltoid. (ii) Teres minor.

(2) Cutaneous– Upper lateral cutaneous nerve of the arm.

(3) Articular– Branch to shoulder joint.

5. Radial Nerve (बहिः प्रकोष्ठिका नाड़ी)

(A) Introduction

It is the thickest branch of brachial plexus. Its root value is ventral rami of C_5–C_6–C_7–C_8–T_1 segments of spinal cord.

Axilla–

- The radial nerve lies against the muscles forming the posterior wall of the axilla. It then lies in the lower triangular space between teres major, long head of triceps brachii and shaft of humerus.

Radial sulcus–

- The radial nerve enters through the lower triangular space into the radial groove, where it lies between the long and medial heads of triceps brachii along with profunda brachii vessels. Long and lateral heads form the roof of the radial groove.

Front of arm–

- The radial nerve enters the lower lateral part of arm and lies between brachialis on the medial side and brachioradialis with extensor carpi radialis longus on the lateral side.

  It supplies the latter two muscles and also brachialis. The nerve descends deep in this interval to reach the lateral epicondyle, where it ends by dividing into its two terminal branches--the superficial and deep or posterior interosseous branches.

Posterior interosseous branch– lies in the lateral part of cubital fossa, where it supplied extensor carpi radialis brevis and supinator muscles. Then it enters into the back of forearm by passing through supinator muscle. There the nerve supplies abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor digitorum, extensor indicis, extensor digiti minimi and extensor carpi ulnaris. It ends in a branches of which supply the wrist joint.

Superficial branch– is given off in the cubital fossa and runs on the lateral side of forearm accompanied by radial artery in the upper 2/3 of forearm. Then it bends posteriorly to supply the lateral half of dorsum of hand and lateral two and a half digits till distal interphalangeal joints. Its branches cross over the anatomical snuff box.

(B) Branches

* **Above the radial groove–**

(1) Muscular– (i) Long head of triceps.
(ii) Medial head of triceps.

(2) Cutaneous– Posterior cutaneous nerve of arm.

* **In the radial groove–**

(1) Muscular– (i) Lateral head of triceps.
(ii) Medial head of triceps.

(2) Cutaneous–(i) Lower lateral cutaneous nerve of forearm.
(ii) Posterior cutaneous nerve of forearm.

* **Below the radial groove–**

(1) Muscular– (i) Brachialis.
(ii) Brachioradialis.
(iii) Extensor carpi radialis longus.

6. Ulnar Nerve (अन्त: प्रकोष्ठिका नाड़ी)

(A) Introduction

It is also called **musicians nerve.** Ulnar nerve is named so as it runs along the medial or ulnar side of the upper limb.

Root value– Ventral rami of C_8–T_1. It also manages fibres from C_7 from the lateral root of median nerve. It is the branch of the brachial plexus.

(B) Course

Axilla– Ulnar nerve lies in the axilla B/w the axillary vein and axillary artery on a deeper plane. Runs downwards with the brachial artery in its proximal part. At the middle of humerus it pierces the medial intermuscular septum to lie on its back and descends on the back of medial epicondyle where it can be palpated; palpation causes tingling sensation.

Forearm– Ulnar nerve enters the forearm by passing B/w two heads of flexor carpi ulnaris. There it lies on medial part of flexor digitorum profundus. It gets the company of ulnar artery in lower 2/3 of forearm. It gives two muscular and two cutaneous branches. Finally it lies to the medial part of flexor retinaculum to enter palm. At the distal border of retinaculum the nerve divides into its superficial and deep branches.

Palm– Superficial branches supplies palmaris brevis and digital branches to medial one and a half digits. Deep branch supplied most of the intrinsic muscles of the hand. At first it supplies three muscles of hypothenar eminence, running in the concavity of deep palmar arch it gives branches to 4th and 3rd lumbricals. 4–3–2–1 dorsal interossei and 4–3–2–1 palmar interossei to end in adductor pollicis, since it supplies intrinsic muscles of hand responsible for fine movement,

7. Median Nerve (मध्यम नाड़ी)

(A) Introduction

It is also called **labourer's nerve.** Median nerve is called median as it runs in the median plane of the forearm.

Root value– Ventral rami of C_5–C_6–C_7–C_8–T_1 segments of spinal cord. It is the branch of the brachial plexus.

(B) Course

In axilla– It is formed by two roots, lateral root from lateral cord and medial root from medial cord of brachial plexus. Medial root crosses the axillary artery to join the lateral root. The median nerve runs on the lateral side of axillary artery.

In arm– Median nerve continues to run on the lateral side of brachial artery till the middle of arm, where it crosses in front of the artery, passes anterior to elbow joint into the forearm.

In forearm– Median nerve passes through cubital fossa, leaves it B/w two heads of pronator teres, then deep to fibrous arch of flexor digitorum superficialis. Adheres to deep surface of the muscle, leaves the muscle, along its lateral border, lastly it is placed deep to palmaris longus to enter palm under the flexor retinaculom. It gives plenty of branches in cubital fossa and forearm.

In palm– Median nerve lies medial to the muscles of thenar eminence, which it supplies, It also gives cutaneous branches to lateral three and a half digits and their nail beds and skin of distal phalanges on dorsum.

8. Femoral Nerve (और्वी नाड़ी)

(A) Introduction

The femoral nerve is the nerve of anterior compartment of thigh. Its cutaneous branch, the saphenous nerve extends to the medial side of leg.

(B) Root value

L_2–L_3–L_4

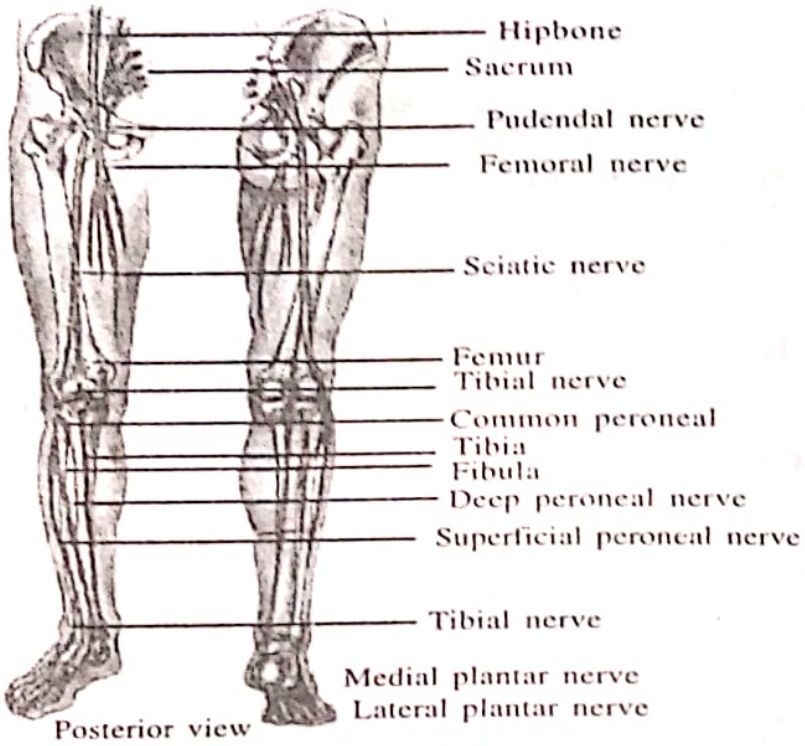


Fig. 5.31 Nerves of the lower limb

(C) Course

It emerges at the lateral border of psoas major muscle in abdomen. It passes downwards B/w psoas major and iliacus muscles. The nerve enters the thigh behind the inguinal ligament, lateral to femoral sheath. It is not a content of femoral sheath.

(D) Terminal branches

It ends by dividing into two divisions about 4 cm. below the inguinal ligament. Both these divisions end in number of branches.

9. Obturator Nerve (गवाक्षिका नाड़ी)

(A) Introduction

It is a branch of lumbar plexus. It is the chief nerve of the medial compartment of the thigh.

(B) Root value

L_2–L_3–L_4

(C) Course

It emerges on the medial border of psoas major muscle within the abdomen. It crosses the pelvic brim to run downwards and forwards on the lateral wall of pelvis to reach the upper part of obturator foramen.

(D) Terminal branches

1. Anterior division 2. Posterior division

10. Sciatic Nerve (गृध्रसी नाड़ी)

(A) Introduction

The sciatic nerve is the thickest nerve of the body. It is the branch of the lumbo-sacral plexus.

(B) Root value

L_4–L_5–S_1–S_2–S_3

(C) Parts

1. Tibial part– L_4–L_5–S_1–S_2–S_3
2. Common peroneal part– L_4–L_5–S_1–S_2

(D) Course

It arises in the pelvis. Leaves the pelvis by passing through greater sciatic foramen below the piriformis to enter the gluteal region.

In the gluteal region, it lies deep to the gluteus maximus muscle, and crosses superior gemellus, obturator internus, inferior gemellus, quadratus femoris to enter the back of thigh.

During its short course, it lies B/w ischial tuberosity and greater trochanter with a convexity to the lateral side. It gives no branches in the gluteal region.

In the back of thigh, it lies deep to biceps femoris and superficial to adductor magnus.

(E) Terminal branches

1. Tibial nerve 2. Common peroneal nerve

11. Tibial Nerve (अन्त: जंघिका नाड़ी)

(A) Introduction

It is the terminal branch of the sciatic nerve. It is the branch of sacral plexus. The tibial nerve of posterior compartment of leg.

(B) Root value

L_4–L_5–S_1–S_2–S_3

(C) Course

It begins as the larger subdivision of sciatic nerve in the back of thigh. It has a long course first in the popliteal fossa and then in the back of leg.

In popliteal fossa– The nerve descends vertically in the popliteal fossa from its upper angle to the lower angle. It lies superficial to the popliteal vessels. It continues in the back of leg beyond the distal border of popliteus muscle.

In posterior side of leg– The nerve descends as the neuro-vascular bundle with posterior tibial vessels. It lies superficial to tibialis posterior and deep to flexor digitorum longus. Lastly it passes deep to the flexor retinaculum of ankle.

(D) Terminal branches

1. Medial plantar nerve 2. Lateral plantar nerve

12. Plantar Nerve (पादतल नाड़ियाँ)

* The medial and lateral plantar nerves are the terminal branches of the tibial nerve. These nerve begin deep to the flexor retinaculum.
* **Medial plantar nerve (अभिमध्य पादतल नाड़ी)–** It is the larger terminal branch of tibial nerve. Its distribution is similar to median nerve of the hand. It lies B/w abductor hallucis and flexor digitorum brevis and ends by giving muscular, cutaneous and articular branches.
* **Lateral plantar nerve (पार्श्व पादतल नाड़ी)–** It is the smaller terminal branch of tibial nerve. Resembling the ulnar nerve of the hand in its distribution. It runs obliquely B/w the first

and second layers of sole till the tuberosity of fifth metatarsal bone, where it divides into its superficial and deep branches.

13. Common Peroneal Nerve (सामान्य बहि: जंघिका नाड़ी)

(A) Introduction

This is the smaller terminal branch of sciatic nerve.

(B) Root value

L_4–L_5–S_1–S_2

(C) Course

It begins in the back of thigh as a smaller subdivision of the sciatic nerve. It lies in the upper lateral part of popliteal fossa, along the medial border of biceps femoris muscle. It turns around the lateral surface of fibula. Then it lies in the substance of peroneus longus muscle.

(D) Terminal branches

1. Deep peroneal nerve 2. Superficial peroneal nerve

14. Deep Peroneal Nerve (गम्भीर बहि: जंघिका नाड़ी)

(A) Introduction

The deep peroneal nerve is the nerve of the anterior compartment of the leg and the dorsum of the foot. This is the terminal branch of the common peroneal nerve.

(B) Course

The deep peroneal nerve begins on the lateral side of the neck of fibula under cover of the upper fibres of peroneus longus. It enters the anterior compartment of the leg by piercing the anterior intermuscular septum. It then pierces the extensor digitorum longus and comes to lie next to the anteior tibial vessels. In the leg, its accompanies the anterior tibial artery and has similar relations. The nerve lies lateral to the artery in the upper and lower third of the leg, and medial to the artery in the middle one-third.

The nerve ends on the dorsum of the foot, close to the ankle joint, by dividing into the lateral and medial terminal

branches. The lateral terminal branch turns laterally and ends in a pseudoganglion deep to the extensor digitorum brevis. Branches arise from the pseudoganglion and supply the extensor digitorum brevis and the tarsal joints. The medial terminal branch ends by supplying the skin adjoining the first interdigital cleft and the proximal joints of the big toe.

15. Superficial Peroneal Nerve (उत्तान बहिः जंघिका नाड़ी)

(A) Introduction

It is the smaller terminal branch of the common peroneal nerve. It is the nerve of the lateral compartment of the leg.

(B) Course

It arises on the lateral side of the neck of fibula. It descends in the lateral compartment of leg deep to peroneus longus. Then it lies B/w peroneus longus and peroneus brevis muscles and lastly B/w the peronei and extensor digitorum longus. It pierces the deep fascia in distal 1/3 of leg and descends to the dorsum of foot.

16. Pudendal Nerve (गुह्य नाड़ी)

(A) Introduction

The pudendal nerve is the chief nerve of the perineum and of the external genitalia. It is accompanied by the internal pudendal vessels.

Pudendal nerve arises from the sacral plexus.

(B) Root value

S_2–S_3–S_4

(C) Course

In the pelvis– The pudendal nerve descends infront of the piriformis deep to its fascia. It leaves the pelvis, to enter the gluteal region, by passing through the lower part of the greater sciatic foramen, B/w the piriformis and the coccygeus, medial to the internal pudendal vessels.

In the gluteal region– The pudendal nerve crosses the apex of the sacrospinous ligament, under cover of the gluteus

maximus. Here it lies medial to the internal pudendal vessels which themselves cross the ischial spine. Accompanying these vessels, the nerve leaves the gluteal region by passing through the lesser sciatic foramen, and enters the pudendal canal.

In the pudendal canal– The neurovascular bundle lies in the lateral wall of the ischiorectal fossa.

(D) Branches

1. Perineal nerve of the penis or clitoris.
2. Dorsal nerve of the penis or clitors.
3. Inferior rectal nerve.

अध्याय- ६

तन्त्र शारीर या नाड़ी विज्ञान

इड़ा, पिंगला, सुषुम्ना (सरस्वती) आदि प्राचीन नाड़ियों का वर्णन

योग विषयक अनेक ग्रन्थों में नाड़ी विज्ञान का विस्तृत वर्णन प्राप्त होता है। शिव संहिता, घेरण्ड संहिता, गोरक्षसंहिता, योगवशिष्ठ एवं षट्चक्रनिरूपण नामक ग्रन्थों में नाड़ी विभेद, प्रकार एवं शरीर के षट्चक्रों का यथासम्भव वर्णन प्राप्त होता है।

देखा जाये तो सम्पूर्ण विषय आध्यात्मिक एवं योग प्राप्ति के आधारभूत सिद्धान्तों का परिचायक है। तथापि रचना शारीर की दृष्टि से उपयोगी अंश निम्न प्रकार हैं।

नाड़ी वर्णन

शिव संहिता एवं गोरक्षसंहिता में शरीर की समस्त नाड़ी संख्या को चार भागों में विभक्त किया गया है।

१. त्रिविध नाड़ियाँ– इड़ा, पिंगला, सुषुम्ना

२. दशविध नाड़ियाँ– दश नाड़ियाँ

३. चतुर्दश नाड़ियाँ– चौदह नाड़ियाँ

४. और कुल संख्या ७२,००० अथवा ३,५०,००० (साढ़े तीन लाख) बताई जाती हैं।

त्रिविध नाड़ियाँ

यद्यपि उपरोक्त वर्णन से स्पष्ट होता है कि शरीर में अनेक प्रकार की नाड़ियाँ होती हैं। उनमें भी इड़ा, पिंगला और सुषुम्ना तीन प्रमुख बताई गई हैं।

योगिजनों के लिए उन तीन नाड़ियों में भी सुषुम्ना ही मुख्य है। अन्य शरीर की सभी नाड़ियाँ इसी का आश्रय लेकर शरीर में रहती हैं।

* स्वरूप एवं स्थिति

इड़ा वामे स्थिता भागे पिंगला दक्षिणे स्थिता ।
सुषुम्ना मध्यदेशे तु गांधारी वामचक्षुषि ।। (गोरक्ष संहिता)

नासिका के वाम भाग में इड़ा, दक्षिण भाग में पिंगला और दोनों के मध्य में सुषुम्ना स्थित है।

* षटचक्र ग्रन्थ की टीका के अनुसार

१. मेरूदण्ड के वाम भाग में इड़ा नाड़ी स्थित है। इसका देवता चन्द्रमा है।

२. मेरूदण्ड के दक्षिण भाग में पिंगला नाम की नाड़ी स्थित है। इसका देवता सूर्य है।

३. इन दोनों के मध्य सुषुम्ना नाड़ी है। इसका देवता अग्नि है।

१. सुषुम्ना

''इड़ा पिंगलयोर्मध्ये सुषुम्णा या भवेत् खलु ।'' (शिव संहिता)

- इड़ा और पिंगला के मध्य में सुषुम्ना का स्थान बताया गया है।
- सुषुम्ना के मार्ग में छः प्रमुख स्थान बताये गये हैं। जिन्हें षट्चक्र भी कहा जाता है। इन षट्चक्रों की छः शक्तियाँ है।
- सुषुम्ना की उत्पत्ति मेरूदण्ड के अग्रभाग से मानी गई है। सुषुम्ना का देवता अग्नि माना गया है। सुषुम्ना नाड़ी के पास कुण्डलिनी का महापथ मानते हैं।
- कुण्डलिनी जागृत होने पर बिजली की चमक के समान सुषुम्ना नाड़ी में प्रवेश कर जाती है। गोरक्ष पद्धति में नासिका के मध्यभाग को सुषुम्ना का स्थान बताया है। एवं मूलाधार से लेकर ब्रह्मरन्ध्र तक इसका मार्ग बताया है। अन्य नाड़ियों का उत्पत्ति स्थान भी मूलाधार चक्र ही है। जहाँ से उत्पन्न होकर नवद्वार में नौ नाड़ियाँ अधोमुखा हैं।
- कमलतन्तु के समान मुख वाली हैं। तीन नाड़ियों को त्रिवेणी का रूप भी दिया गया है।
- योग शास्त्र में वर्णित इड़ा एवं पिंगला को सुषुम्ना के वाम एवं दक्षिण भाग में स्थित नाड़ियाँ बताया गया है। मध्य भाग में सुषुम्ना रहती है।

२. इड़ा

- प्रमुख तीन नाड़ियों में इड़ा नामक नाड़ी को आवृत करती हुई वाम भाग में स्थित है। एवं यह दाहिनी नासिका तक गई है। इसका देवता चन्द्रमा है।
- इड़ा का वर्ण श्वेत कमल के समान है। एवं यह सुषुम्ना के वाम भाग में स्थित है।
- वाम भाग में धवल (शुक्ल) चन्द्रमा की आभारूपी इड़ा नाड़ी स्थित है। वह शक्ति रूपी देवी साक्षात् अमृत की वर्षा करती है।

- वह चन्द्रमा (रात को) अधोमुख होकर अमृत की वर्षा करके शरीर का पोषण करता रहता है।
- मन्दाकिनी के जल के समान वाम भाग में स्थित इड़ा द्वारा शरीर का पोषण होता है। यह शुद्ध दुग्ध के समान है।

३. पिंगला

- सुषुम्ना के दक्षिण भाग में जो पिंगला नाम की नाड़ी है। वह सुषुम्ना के सहारे नासिका के वाम द्वार में गई है।
- मेरूदण्ड के मूल में अर्थात् नीचे बारहकला संयुक्त सूर्य है। उसकी रश्मि दक्षिण पथ (पिंगला नाड़ी) का आश्रय लेकर ऊपर की ओर जाती है।
- दक्षिण में स्थित पिंगला नाम की नाड़ी कठोर सूर्य की किरणों को बिखरने वाली, रौद्ररूपा, महादेवी, दाडिमी एवं केशर के समान जिसकी प्रभा है, ऐसी नाड़ी है।

४. त्रिवेणी

१. दक्षिण ओर की पिंगला को ही 'असी' या यमुना भी कहते हैं।
   - तथा वाम ओर की इड़ा को ही 'वरणा' या गंगा भी कहते हैं।
   - वाम इड़ा शृंखला यह वाम नासापुट तक और दक्षिण की पिंगला या दक्षिण नासापुट तक सम्बन्धित रहती है। प्राणायाम करते समय इसी कारण से नासापुट बन्द करने का विधान है।

२. इड़ा तथा पिंगला नाड़ियाँ ऊपर जाते समय आपस में लांघकर (Cross करके) विरूद्ध दिशा में जाती हैं। इड़ा दक्षिण की ओर तथा पिंगला वाम की ओर जाती है। उनके इस छेदन (Cross) स्थान को (वरणा+असी) वाराणसी कहते हैं। इड़ा तथा पिंगला इनके बीच में तीसरी नाड़ी रहती है। उसे सुषुम्ना या सरस्वती भी कहते हैं। सुषुम्ना के मध्य में स्थित विवर में जो शक्ति रहती है। उसे चित्रा शक्ति या चित्रा नाड़ी कहते हैं।

३. गंगा, यमुना तथा सरस्वती इन तीन नाड़ियों का संगम होना अर्थात् उनमें प्रभुत्व पाना तथा अपनी इच्छा के अनुसार उन पर नियन्त्रण करना अत्यन्त कठिन है। इस संगम को ही 'त्रिवेणी संगम' कहते हैं।

- इड़ा–बांये–देवता=चन्द्रमा–वरणा या गंगा – वाम
- पिंगला–दांये–देवता=सूर्य–असी या यमुना – दक्षिण
- सुषुम्ना–मध्य–देवता=अग्नि–वाराणसी या सरस्वती – मध्य

५. कुण्डलिनी परिचय

- कुण्डलिनी शक्ति जागृत होने पर मूलाधार, स्वाधिष्ठान तथा मणिपूर चक्रों को लांघकर (Cross करके) अनाहत चक्र में आकर निवास करती है। तब ही उस प्राणी का चैतन्य जाग्रत होता है। और उसे ज्योति-दर्शन होता है।
- वेदों में इन्हीं चक्रों को भूमि कहा गया है।
- जब कुण्डलिनी आज्ञाचक्र में आती है, तब प्राणी को ईश्वर के रूप का दर्शन होता है।
- और जब कुंडलिनी सहस्रार चक्र में आती है, तब उसकी समाधी लगती है।

६. उत्तमांगीय मस्तुलुंग का वर्णन (Brain)

मानव शरीर की करोटि गुहा (Cranial cavity) में स्थित धूसर वर्णयुक्त मेदोधातु द्वारा निर्मित स्निग्ध रचना को मस्तिष्क अथवा मस्तुलुङ्ग (Brain) कहते हैं। जो केन्द्रीय नाड़ी तन्त्र (Central nervous system) का एक भाग है।

प्राणाः प्राणभृतां यत्राश्रिताः सर्वेन्द्रियाणि च ।
यदुत्तमांगमंगाना शिरस्तद्भिधीयते ।। (च.सू. १७/१२)

इसी को शरीर का मूल कहा जाता है, यहीं पर प्राणियों के प्राण तथा सभी इन्द्रियों के केन्द्र स्थित रहते हैं, इसलिए शिर अर्थात् मस्तिष्क को उत्तमाङ्ग की संज्ञा दी गई है। यह चारों ओर से मस्तिष्कावरण कला (Meninges) के द्वारा ढका हुआ रहता है।

- The adult brain is made up of about 100 billion neurons and 1000 billion neuroglia. It is one of the largest organs of the body averaging 1.3 kg (1300 gm.) weight and can be divided three parts.

1. Prosencephalon– Fore brain–अग्र मस्तिष्क
2. Mesencephalon– Mid brain– मध्य मस्तिष्क
3. Rhombencephalon– Hind brain– पश्च मस्तिष्क

- **Further sub-division–**

१. अग्रमस्तिष्क (Fore brain)–
   - १. बृहद् मस्तिष्क (Cerebrum)
   - २. आन्तर प्रमस्तिष्क (Dien cephalon)

२. मध्य मस्तिष्क (Mid brain)– १. मध्य मस्तिष्क (Mid brain)

३. पश्च मस्तिष्क (Hind brain)–
   - १. सुषुम्ना शीर्ष (Medulla-oblongata)
   - २. उष्णीषक (Pons)
   - ३. लघु मस्तिष्क (Cerebellum)

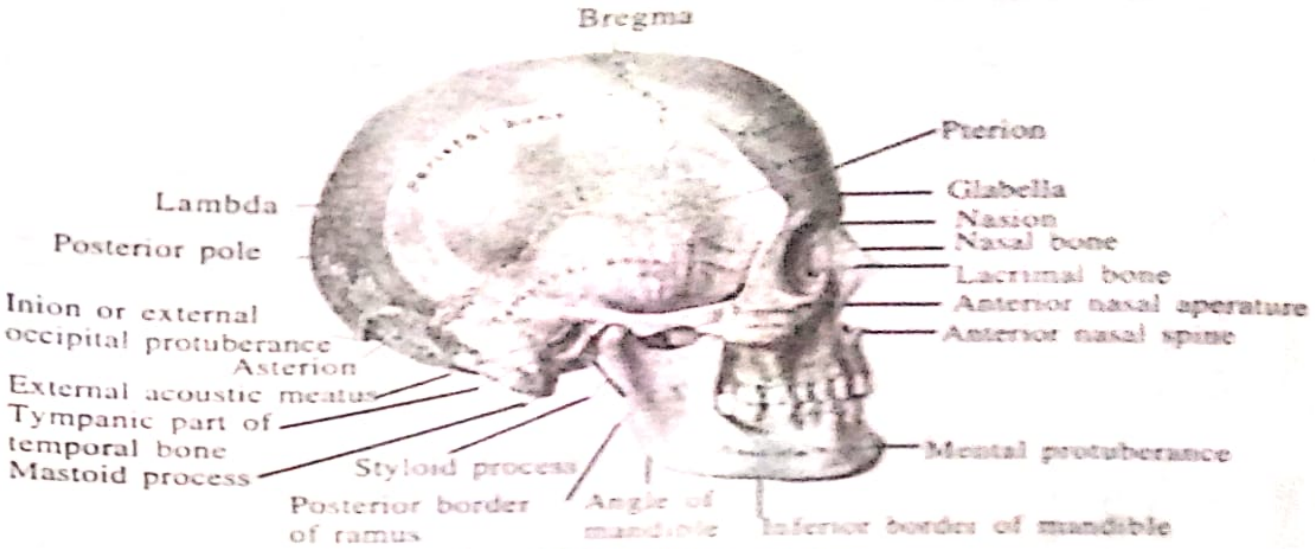


Fig. 6.1 Skull-Lateral view

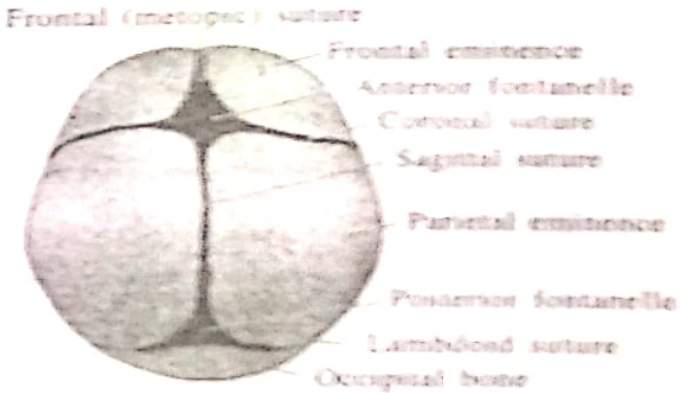


Fig. 6.2 Skull at birth-Superior view

- ये षट्चक्र निम्नानुसार अधः से ऊर्ध्व ओर होते है–

१. मूलाधार चक्र– Pelvic plexus and coccygeum – गुद और मेढ़ के बीच में

२. स्वाधिष्ठान चक्र– Hypogastric शिश्न के मूल में

३. मणिपूर चक्र– Solar plexus – नाभि मूल में

४. अनाहत चक्र– Cardiac plexus– हृत् प्रदेश में

५. विशुद्ध चक्र– Cervical or carotid plexus– कंठ प्रदेश में

६. आज्ञा चक्र– Cavernous plexus– भ्रूमध्य में

मूल-स्वा-मणि-अना-विशु-आज्ञा

* Medulla oblongata, pons and midbrain is also called **brainstem.**

- The brainstem is continuous with the spinal cord and consists of the medulla oblongata, pons and mid brain.
- Posterior to the brainstem is the cerebellum.
- Superior to the brainstem is the diencephalon.
- The cerebrum spreads over the diencephalon like the cap of mushroom. It occupies most of the cranium and has right and left halves called cerebral hemispheres.

७. ब्रह्मरन्ध्र का वर्णन (Bregma-Anterior fontanelle)

The bregma is the meeting point between the coronal suture and sagittal suture.

In the foetal skull, this is the site of a membranous gap, called the anterior fontanelle, which closes at eighteen months of age.

८. शिवरन्ध्र का वर्णन (Lambda-Posterior fontanelle)

The lambda is the meeting point between the sagittal suture and lambdoid suture.

In the foetal skull, this is the site of the posterior fontanelle, which closes at two or three months of age.

९. षड्चक्र का वर्णन

- योग शास्त्र के अनुसार इड़ा, पिंगला और सुषुम्ना ये नाड़ियाँ प्राणवायु को धारण करती हैं। तथा शरीर में होने वाली सभी क्रियाओं को करती रहती हैं। इन्हीं नाड़ियों के सूत्रों से बने हुए छः चक्र मध्य शरीर के अधः भाग से क्रमशः ऊपर शिर तक रहते हैं।
- शरीर में प्राणवायु का संचार इन्हीं नाड़ियों में तथा चक्रों में होता रहता है। इन चक्रों के स्थानानुसार इनमें कुछ विशेष शक्तियाँ भी रहती हैं।
- योग शास्त्र में चक्रों की इन्हीं शक्तियों पर अधिकार प्राप्त करने की विधियाँ और उपायों का वर्णन किया गया है।
- रचना शारीर के दृष्टि से ये षट्चक्र स्वतन्त्र नाड़ी मण्डल (Autonomic nervous system) के सूत्रों से बने होते हैं। अतः मनुष्य की इच्छा के बिना ही स्वतन्त्रता से इनके कार्य होते रहते हैं। अपनी इच्छा पर ये अवलंबित नहीं होते। इन पर अधिकार पाने के लिए योग शास्त्र में वर्णित साधना प्राणायाम, योगासन आदि उपाय करने पड़ते

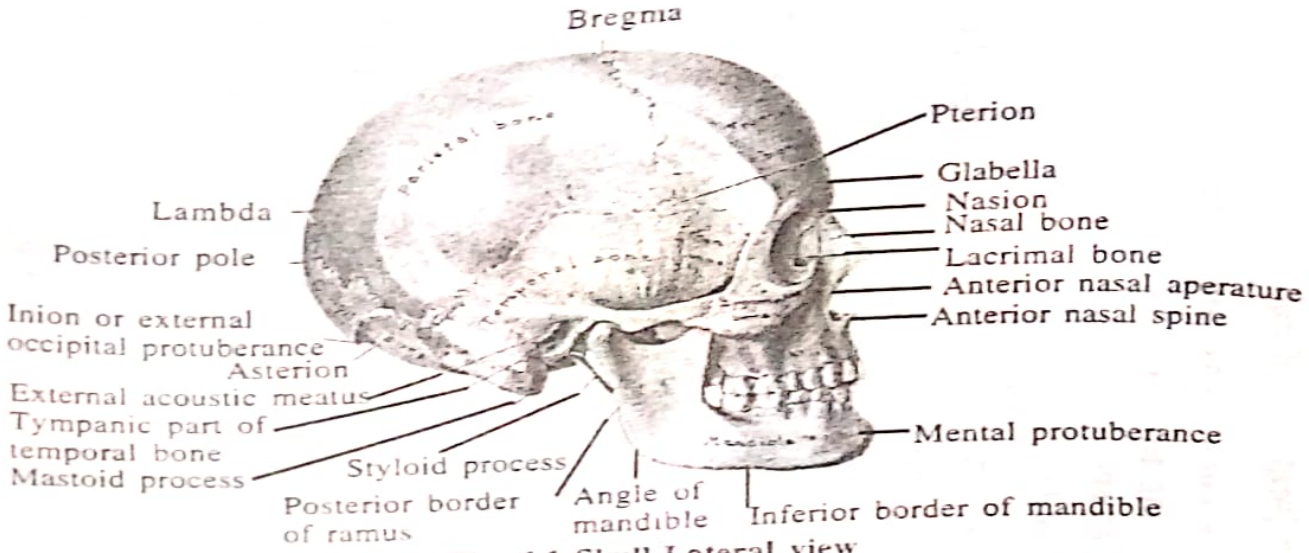


Fig. 6.1 Skull-Lateral view

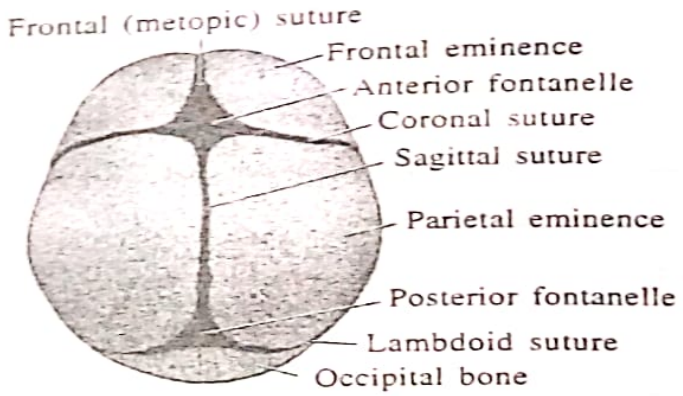


Fig. 6.2 Skull at birth-Superior view

- ये षट्चक्र निम्नानुसार अध: से ऊर्ध्व ओर होते हैं–

१.	मूलाधार चक्र–	Pelvic plexus and coccygeum –	गुद और मेढ्र के बीच में
२.	स्वाधिष्ठान चक्र–	Hypogastric	शिश्न के मूल में
३.	मणिपूर चक्र–	Solar plexus –	नाभि मूल में
४.	अनाहत चक्र–	Cardiac plexus–	हत् प्रदेश में
५.	विशुद्ध चक्र–	Cervical or carotid plexus–	कंठ प्रदेश में
६.	आज्ञा चक्र–	Cavernous plexus–	भ्रूमध्य में

मूला-स्वा-मणि-अना-विशु-आज्ञा

क्रसं.	चक्र का नाम	स्थान	दल	अक्षर	वार	देवता	वायु	उपवायु	रंग	शक्तियाँ Accor-ding to ayur-veda	शक्तियाँ According to modern
१.	मूलाधार चक्र Pelvic ple-xus and co-ccygeum	गुद और मेढ्र के बीच में (कुण्डलिनी नाम की विशेष शक्ति रहती है।)	४	व-श-ष-स	मंगल-वार	गजानन	अपान	-	आरक्त	१. गुप्ता २. प्रासका ३. कराला ४. विकराला	1. Inferior haemorrhoidal plexus. 2. Vesical plexus. 3. Prostatic plexus/vaginal plexus. 4. Spermatic plexus/uterine plexus.
२.	स्वाधिष्ठान चक्र Hypogastric or abdom-inal aortic Plexus.	शिश्न के मूल मे	६	ब-भ म-य र-ल	बुधवार	ब्रह्मा	अपान	धनंजय (शब्द को उत्पन्न करता है।)	पीला	१. अव्यंगता २. शारदा ३. वाणी ४. अमृता ५. पूर्णा ६. रोहिणी	1. Spermatic plexus. 2. Lt. colic plexus. 3. Sigmoid plexus. 4. Superior haemorrhoidal Plexus. 5. Inferior mesenteric plexus. 6. Hypogastric plexus.
३.	मणिपूर चक्र Solar plexus	नाभिमूल में	१०	ड से फ तक	गुरूवार	विष्णु	समान	कृकल (क्षुधा,	नीला	१. सर्वगा २. सोमा	1. Phrenic plexus. 2. Hepatic plexus.

				ड-ढ ण-त थ-द ध-न प-फ				पिपासा)		३. या ४. भद्रा ५. तक्षिणी ६. सौंदर्या ७. शांतमुद्रा ८. विशाखा ९. दक्षिणी १०.रूचिरा	3. Splenic plexus. 4. Superior gastric plexus. 5. Supra-renal plexus. 6. Renal plexus. 7. Spermatic/ovarian plexus. 8. Superior mesenteric plexus. 9. Pancreatic plexus. 10. Colic plexus.
४.	अनाहत चक्र Cardiac Plexus	हत् प्रदेश में (हृदय में)	१२	क से ठ तक क-ख ग-घ ङ-च छ-ज झ-ञ ट-ठ	शुक्रवार	महेश	प्राण	देवदत्त (जृम्भा, निद्रा)	शुक्ल (श्वेत)	१. पद्मिनी २. सदर्भा ३. रतिप्रिया ४. वैजयंति ५. सौभद्रा ६. अत्रिमाया ७. कुह- वासिनी ८. घोकिनी ९. रेखा १०.श्रिया ११.तरंगिणी १२.तारा	1. Rt. deep cardiac plexus. 2. Lt. deep cardiac plexus. 3. Anterior pulmonary plexus. 4. Posterior pulmonary plexus. 5. Superficial plexus. 6. Cardiac ganglion/ lt. cardiac plexus. 7. Rt. coronary plexus. 8. Ventricular plexus. 9. Lt. coronary plexus. 10. Endocardiac plexus. 11. Myocardiac plexus. 12. Rt. cardiac plexus/ bibder's ganglion.

३. संख्या

* कुल मर्म= १०७ = "सप्तोत्तरं मर्मशतम् ।"
* मुख्य मर्म= ३

४. भेद– मर्मों का वर्गीकरण–

(A) षडंगो के अनुसार–

* शाखाओं में–	११x४	=	४४
* मध्य शरीर में–	१२+१४	=	२६
* शिर और ग्रीवा में–		=	३७
कुल मर्म–			१०७

(B) परिणाम के अनुसार या साध्य-असाध्यता के अनुसार–

	नाम	संख्या	महाभूत	मरिक्तकाल
१.	सद्यः प्राणहर मर्म–	१९–	आग्नेय–	१ सप्ताह-या तुरन्त
२.	कालान्तर प्राणहर मर्म–	३३–	सौम्य+आग्नेय–	२-४ सप्ताह
३.	विशल्यघ्न मर्म–	३–	वायव्य–	शल्य निकालते ही मृत्यु हो जाती है।
४.	वैकल्यकर मर्म–	४४–	सौम्य–	विकृति उत्पन्न होती है।
५.	रूजाकर मर्म–	८–	आग्नेय+वायव्य–	पीड़ा लगातार होती रहती है।
	कुल मर्म–	१०७		

(C) रचना के अनुसार–

१.	मांस मर्म–	११
२.	सिरा मर्म–	४१
३.	स्नायु मर्म–	२७
४.	अस्थि मर्म–	८
५.	सन्धि मर्म–	२०
	कुल मर्म–	१०७

(D) परिमाण (प्रमाण) के अनुसार–

- आधा अंगुल प्रमाण
- एक अंगुल प्रमाण
- द्वि-अंगुल प्रमाण
- त्रि-अंगुल प्रमाण
- चतुरंगुल प्रमाण

(A) षडंगो के अनुसार–

* शाखाओं में– ११x४= ४४
  - ११x२= २२ पैर के मर्म– क्षिप्र-तलहृदय-कूर्च-कूर्चशिर-गुल्फ-इन्द्रबस्ति-जानु-आणि-ऊर्वी-लोहिताक्ष-विटप
  - ११x२= २२ बाहु के मर्म– क्षिप्र-तलहृदय-कूर्च-कूर्चशिर-मणिबन्ध-इन्द्रबस्ति-कूर्पर-आणि-ऊर्वी-लाहिताक्ष-कक्षधर
* मध्य शरीर (उदर और उरः में =१२) तथा पृष्ठ (पीठ में= १४) में= २६
- उदर और उरः के मर्म– गुद-बस्ति-नाभि-हृदय= १x४= ४
  स्तनमूल-स्तनरोहित-अपलाप-अपस्तम्भ= २x४= ८
  कुल=: १२
- पृष्ठ (पीठ) के मर्म– कटिकतरुण-कुकुन्दर-नितम्ब-पार्श्वसन्धि-बृहती-अंसफलक-अंस= २x७= १४
* शिर और ग्रीवा के मर्म–
  - चार धमनियाँ (दो नीला, दो मन्या)- आठ मातृकाएँ = १२
  - कृकाटिका-विधुर-फण-अपांग-आवर्त-उत्क्षेप-शंख = २x७= १४
  - पांच सीमन्त-चार शृंगाटक-एक स्थपनी-एक अधिपति = ११
  कुल मर्म = ३७

(B) परिणाम या साध्य-असाध्यता के अनुसार–

१. सद्यःप्राणहर मर्म (१९)–

शृङ्गाटकान्यधिपतिः शङ्खौ कण्ठसिरा गुदम् ।
हृदयं वस्ति नाभी च घ्नन्ति सद्योहतानि तु ।। (सु.शा. ६/९)

- श्रंगाटक ४, अधिपति १, शंख २, कण्ठसिराएँ ८, गुदा १, हृदय १, वस्ति १, नाभि १; इन पर आघात होने से तत्काल मृत्यु होती है।

२. कालान्तर प्राणहर मर्म (३३)–

वक्षोमर्माणि-सीमन्त तल क्षिप्रेन्द्रवस्तयः । कटीकतरूणे सन्धी पार्श्वजौ बृहती च या ।
नितम्बाविति चैतानि कालान्तरहराणि तु ।। (सु.शा. ६/१०)

- वक्षोमर्म ८ (स्तनमूल २-स्तनरोहित २- अपलाप २- अपस्तम्भ २), सीमन्त ५, तलहृदय ४, क्षिप्र ४, इन्द्रवस्ति ४, कटिकतरूण २, सन्धि (पार्श्वसन्धि) २, बृहती २, नितम्ब २; ये कालान्तर प्राणहर मर्म होते हैं।

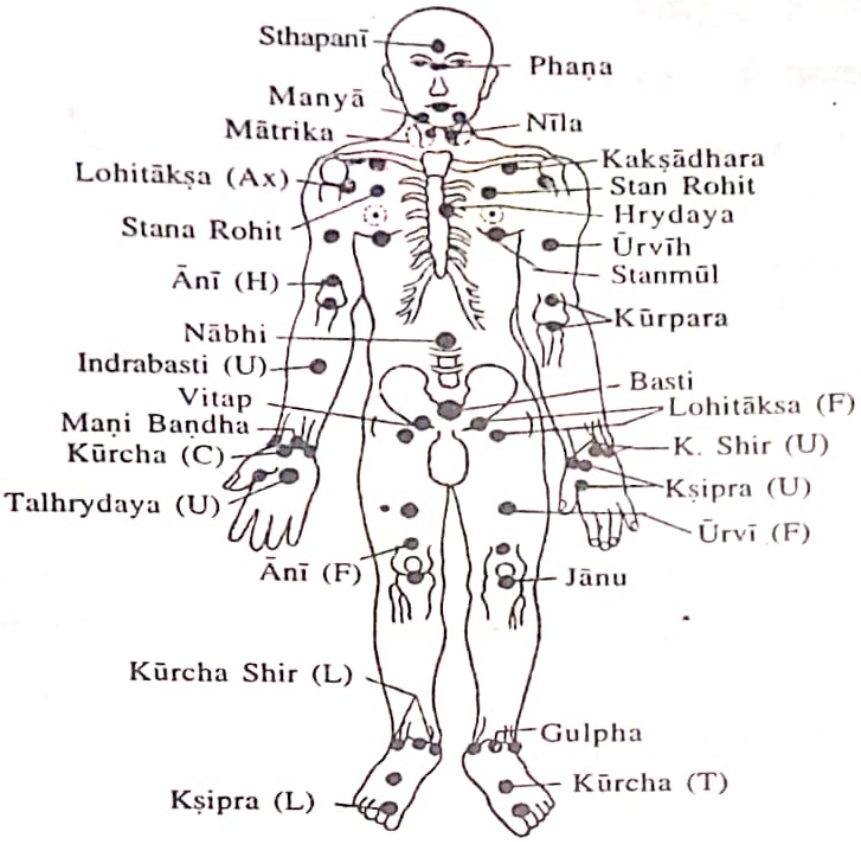


Fig. 7.1 Marma- Anterior View shadang sharir

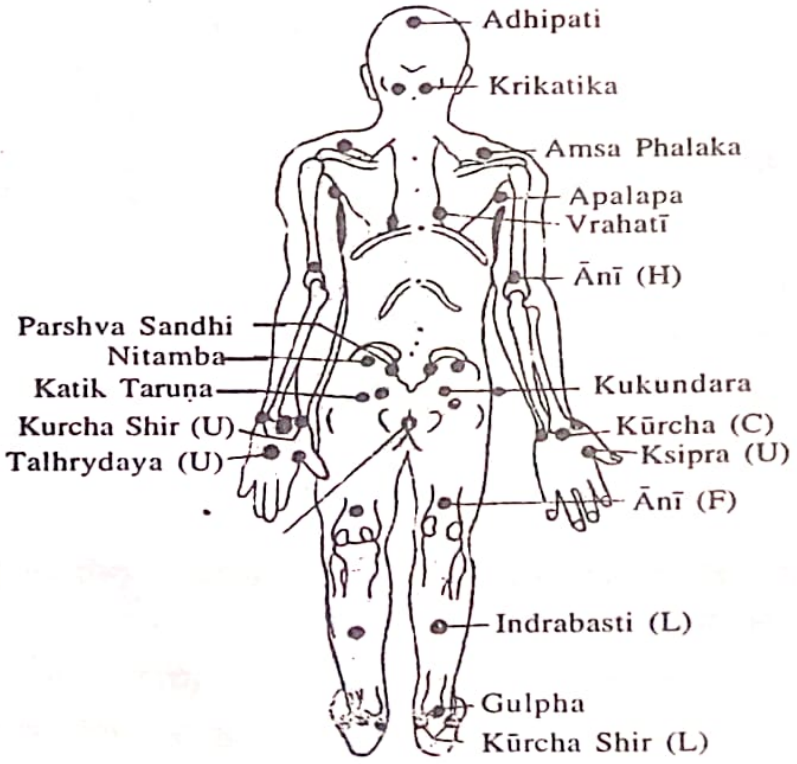


Fig. 7.2 Marma- Posterior view Shadang Sharir

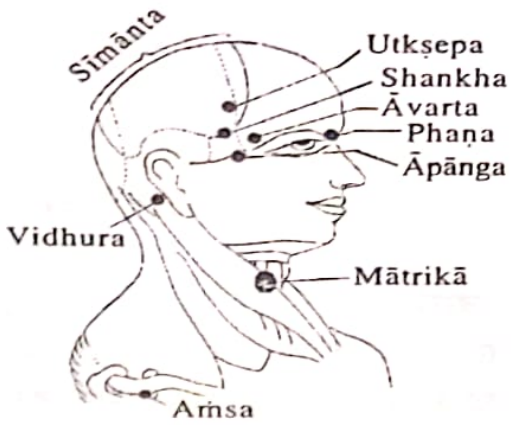


Fig. 7.3 Marma- Head and neck

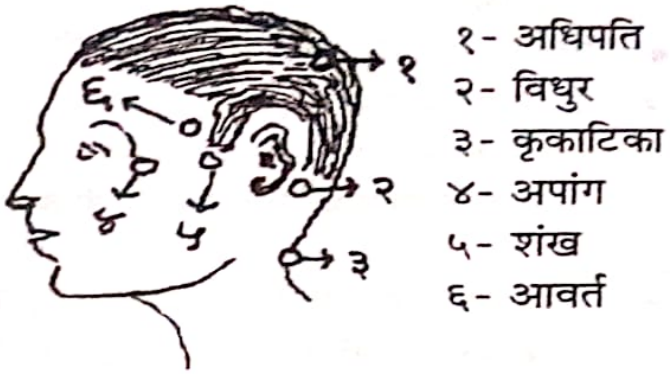


Fig. 7.4 Marma- Head and neck

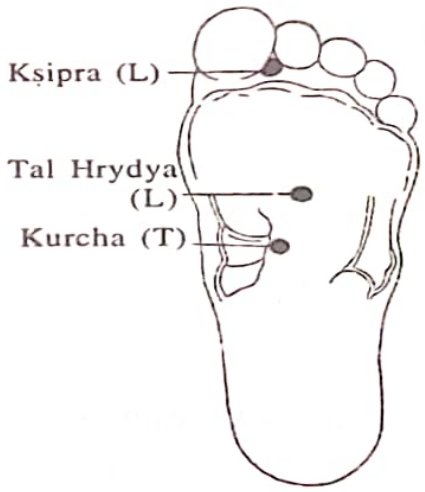


Fig. 7.5 Marma- Foot

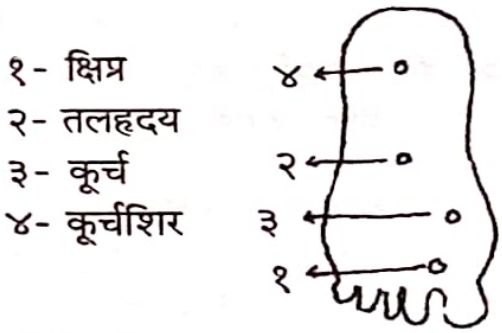


Fig. 7.6 Marma- Foot

३. विशल्यघ्न मर्म (३)–

"उत्क्षेपौ स्थपनी चैव विशल्यघ्नानि निर्दिशेत् ।" (सु.शा. ६/११)

- उत्क्षेप २ और स्थपनी १; ये तीन मर्म विशल्यघ्न होते हैं।

४. वैकल्यकर मर्म (४४)–

लोहिताक्षाणि जानुर्वीकूर्चविटप कूर्पराः । कुकुन्दरे कक्षधरे विधुरे सकृकाटिके ।।
अंसासफलकापाङ्गा नीले मन्ये फणौ तथा । वैकल्यकरणान्याहुरावर्त्तौ द्वौ तथैव च ।।

(सु.शा. ६/१२-१३)

- लोहिताक्ष ४, आणि २, जानु २, ऊर्वी ४, कूर्च ४, विटप २, कूर्पर २, कुकुन्दर २, कक्षधर २, विधुर २, कृकाटिका २, अंस २, अंसफलक २, अपांग २, नीला २, मन्या २, फण २, आवर्त्त २; ये वैकल्यकर मर्म हैं।

५. रूजाकर मर्म (८)–

गुल्फौ द्वौ मणिबन्धौ द्वौ द्वे द्वे कूर्चशिरांसि च ।
रूजाकराणि जानीयादष्टावेतानि बुद्धिमान् ।। (सु.शा. ६/१४)

- गुल्फ २, मणिबन्ध २, कूर्चशिर ४; ये आठ मर्म रूजाकर (पीड़ा देने वाले) समझना चाहिए।

(C) रचना के अनुसार–

१. मांस मर्म (११)–

"तत्र तलहृदय इन्द्रबस्ति गुद स्तनरोहितानि मांस मर्माणि ।" (सु.शा. ६/७)
४ ४ १ २

२. सिरा मर्म (४१)–

"नीला धमनी मातृका शृंगाटक अपांग स्थपनी फण स्तनमूल अपलाप अपस्तम्भ
२ २ ८ ४ २ १ २ २ २ २
हृदय नाभि पार्श्वसन्धि बृहती लोहिताक्ष ऊर्वीः सिरामर्माणि' (सु.शा. ६/७)
१ १ २ २ ४ ४

३. स्नायु मर्म (२७)–

"आणि विटप कक्षधर कूर्च कूर्चशिरो वस्ति क्षिप्र अंस विधुर उत्क्षेपाः स्नायुमर्माणि"।
४ २ २ ४ ४ १ ४ २ २ २ २ (सु.शा. ६/७)

४. अस्थि मर्म (८)–

"कटिकतरुण नितम्ब अंसफलक शंखाः तु अस्थिमर्माणि ।" (सु.शा. ६/७)
२ २ २ २

५. सन्धि मर्म (२०)–

"जानु कूर्पर सीमंत अधिपति गुल्फ मणिबन्ध कुकुंदर आवर्त कृकाटिकाश्चेति संधि
२ २ ५ १ २ २ २ २ २
मर्माणि" (सु.शा. ६/७)

(D) परिमाण (प्रमाण) के अनुसार–

ऊर्व्यः शिरांसि विटपे च सकक्षपार्श्वे एकैकमङ्गुलमितं स्तनपूर्वमूलम् ।
विद्वयङ्गुलद्वयमितं मणिबन्धगुल्फं त्रीण्येव जानु सपरं सह कूर्पराभ्याम् ।।
हृद्वस्ति कूर्चगुदनाभि वदन्ति मूर्ध्नि चत्वारि पञ्च च गले दश यानि च द्वे ।
तानि स्वपाणितलकुञ्चितसंमितानि शेषाण्यवेहि परिविस्तरशोडङ्गुलार्धम् ।।

(सु.शा. ६/२९-३०)

* ऊर्वी - कूर्चशिर - विटप - कक्षधर - स्तनमूल ४ ४ २ २ २= १४ = १-१ अंगुल परिमाण	
* मणिवन्ध - गुल्फ २ २ = ४ = २-२ अंगुल परिमाण	
* जानु - कूर्पर २ २ = ४ = ३-३ अंगुल परिमाण	
* हृदय - बस्ति - कूर्च - गुदा - नाभि १ १ ४ १ १ = २९ = ४-४ अंगुल परिमाण सिर में– शृंगाटक - सीमन्त ४ ५ गले में– नीला - मन्या - मातृका २ २ ८	या स्वपाणितलकुंचित= संकुचित हस्त तल जितना या हथेली के गड्ढे के बराबर
* शेष मर्म–	= ५६ = १/२-१/२ अंगुल
कुल मर्म = १०७	

५. मर्म का शल्य तन्त्रीय महत्व

- आयुर्वेद शास्त्र में चिकित्सा के आठ अंग बताए हैं। धन्वन्तरि सम्प्रदाय के अनुसार व्याधि की चिकित्सा– औषधि, क्षारकर्म, अग्निकर्म, रक्तमोक्षण, शस्त्रकर्म आदि उपक्रमों द्वारा की जाती है।
- अतः शल्य चिकित्सा करने वाले चिकित्सक को शरीर स्थित मर्मों का सूक्ष्म तथा स्पष्ट ज्ञान अवश्य होना चाहिए। ताकि क्षारकर्म-अग्निकर्म-शस्त्रकर्म-रक्तमोक्षण आदि उपक्रमों के करते समय वह मर्म को बचाकर ही इनका प्रयोग कर सके। जिससे शरीर मे अन्य विकृति उत्पन्न न हो और व्याधि कष्टसाध्य न हो जाये।
- मर्माणि शल्य विषयार्थम् उदाहरन्ति ।'' (सु.शा. ६/३५)
- मर्म शल्य तन्त्र का आधा भाग कहलाता है।

त्रिगुण, त्रिदोष, पंचेन्द्रियाँ, भूतात्मा ये बारह प्राण हैं। ये प्राण विशेषतया मर्म स्थानों में रहते हैं। इन पर आघात होने से प्राणी की मृत्यु हो जाती है।

- शल्य कर्म करते समय विशेष रूप से इन मर्मों का बचाव करना चाहिए।

* **शाखा नष्ट होने से मृत्यु नहीं होती**– क्षिप्र, तलहृदय मर्म पर आघात होने से मणिबन्ध और गुल्फ प्रदेशों से हाथ-पैर काट देने चाहिए। क्योंकि सन्धि स्थानों पर काटने से स्थानीय सिराओं का तुरन्त संकोच हो जाता है।

- **क्षिप्र, तलहृदय मर्म का महत्व**– इन मर्मों के स्थान पर First matatarsal or first metacarpal arteries) होती हैं। यहाँ पर आघात लगने से इस जगह Gangrene उत्पन्न होने का भय रहता है। अत: मणिबन्ध (Wrist) और गुल्फ (Ankle) प्रदेशों से हाथ-पैर काट (Amputation) देने चाहिए।

६. त्रिमर्मों की प्रमुखता

त्रिमर्म–

(A) हृदय (B) वस्ति (C) शिर

- शरीर में जो १०७ मर्म कहे गये हैं। उनमें से हृदय, शिर और वस्ति ये तीन प्रधान मर्म माने जाते हैं। क्योंकि इनमें प्राण आश्रय कर रहते हैं।

(A) (१) **नाम**– हृदय

(२) **संख्या**– १

(३) **प्रकार– रचनानुसार**– सिरा मर्म

(४),, – **परिणामानुसार**– सद्य: प्राणहर मर्म

(५),, – **परिमाणानुसार**– ४ अंगुल प्रमाण

(६) **स्थान**– दोनों स्तनों के मध्य में (Middle mediastinum)

(७) **आधुनिक मतानुसार रचना**– Heart

(८) **विद्ध होने पर लक्षण**– तुरन्त मृत्यु (Sudden death)– "सद्योमरणम्"

(B) (१) **नाम**– शिर (अधिपति)

(२) **संख्या**– १

(३) **प्रकार**– **रचनानुसार**– सन्धि मर्म

(४),, – **परिणामानुसार**– सद्य: प्राणहर मर्म

(५),, – **परिमाणानुसार**– १/२ अंगुल प्रमाण

(६) **स्थान**– मस्तिष्क के भीतर ऊपर की ओर सिरा और सन्धियों का सन्निपात, बालों का आवर्त।

(७) **आधुनिक मतानुसार रचना–** Venous sinuses

(८) **विद्ध होने पर लक्षण–** 'सद्योमरणम्'– तुरन्त मृत्यु (Sudden death)

(C) (१) **नाम–** वस्ति

(२) **संख्या–** १

(३) **प्रकार– रचनानुसार–** स्नायु मर्म

(४) ,, **– परिणामानुसार–** सद्य: प्राणहर मर्म

(५) ,, **– परिमाणानुसार–** ४ अंगुल प्रमाण

(६) **स्थान–** मूत्राशय– Pubis के पीछे

(७) **आधुनिक मतानुसार रचना–** Urinary bladder

(८) **विद्ध होने पर लक्षण–** आघात से फटने पर तुरन्त मृत्यु। (Sudden death)

* कुछ आचार्य वस्ति (Urinary bladder) के स्थान पर नाभि (Umbilicus) को प्रधान मर्म (त्रिमर्मों में) मानते हैं। क्योंकि नाभि को शरीर का मूल माना जाता है।
* ये त्रिमर्म सद्य:प्राणहर होने से इन पर आघात लगने से निश्चित रूप से तुरन्त मृत्यु हो जाती है।
* शिर-हृदय-वस्ति ये मध्यम रोग मार्ग हैं।

* According to modern– Vital part–	Heart हृदय	Lungs फुफ्फुस	Brain मस्तिष्क
* According to व्यवहार आयुर्वेद–Vital part–	Coma मूर्च्छा	Asphyxia श्वासावरोध	Syncope बेहोशी
* According to आचार्य चरक– Vital part–	वस्ति Urinary bladder	शिर Brain	हृदय Heart

* पीड़ा या दु:ख से लेकर मृत्यु तक सभी परिणाम इन मर्मों पर आघात होने से देखे जाते हैं। कुछ मर्मों पर आघात लगने से केवल पीड़ा (Pain) उत्पन्न होती है। कुछ मर्म विकृति (Pathology) उत्पन्न करते हैं। तथा कुछ मर्म तुरन्त या कुछ काल के पश्चात् मृत्यु कराते हैं। (Sudden death or after some time death)

७. मर्मों के साथ महाभूतों का सम्बन्ध

- "तत्र सद्य:प्राणहराण्याग्नेयानि, अग्नि गुणेष्वाशु क्षीणेषु क्षपयन्ति ।
- कालान्तर प्राणहराणि सौम्याग्नेयानि, अग्निगुणेष्वाशु क्षीणेषु क्रमेण च सोमगुणेषु कालान्तरेण क्षपयन्ति ।

- विशल्यप्राणहराणि वायव्यानि, शल्यमुखावरूद्धो यावदन्तर्वायुस्तिष्ठति तावज्जीवति उद्धृतमात्रे तु शल्ये मर्मस्थानाश्रितो वायुनिष्क्रामति, तस्मात् सशल्यो जीवत्युद्धृतशल्यो म्रियते । (पाकात्पतित शल्यो वा जीवति)
- वैकल्यकराणि सौम्यानि, सोमो हि स्थिरत्वाच्छैत्याच्च प्राणावलम्बनं करोति ।
- रूजाकराण्यग्निवायुगुण भूयिष्ठानि, विशेषतश्च तौ रूजाकरो, पाञ्चभौतिकी च रूजामाहुरेके ।।'' (सु.शा. ६/१७)

(१) सद्यः प्राणहर मर्म– सद्यः प्राणहर मर्म आग्नेय होते हैं। अग्निगुण शीघ्र कम होने के कारण शरीर को नष्ट कर देते हैं।

(२) कालान्तर प्राणहर मर्म– कालान्तर प्राणहर मर्म सौम्य (सोम-जल) और आग्नेय (अग्नि) होते हैं। अग्नि गुण शीघ्र कम होने से और सोम गुण धीरे-धीरे कम होने के कारण ये मर्म थोड़े समय बाद शरीर को नष्ट कर देते हैं।

(३) विशल्य प्राणहर मर्म– विशल्यघ्न मर्म वायव्य होते हैं। इन मर्मों में मुख में शल्य के होने से जब तक वायु रूकी रहती है, तब तक प्राणी जीवित रहता है, किन्तु शल्य निकालने मात्र से मर्मस्थान से वायु निकल जाती है। इसलिए जितने समय तक शल्य रहता है, तब तक पुरूष जीवित रहता है। किन्तु शल्य निकालने से मृत्यु को प्राप्त होता है।

* व्रण का पाक होने पर शल्य निकल जाये तो मनुष्य जीवित रहता है।

(४) वैकल्यकर मर्म– वैकल्यकर मर्म सौम्य गुण वाले होते हैं। सोम स्थिर होने के कारण और सौम्य होने के कारण प्राणों का अवलम्बन करता है।

(५) रूजाकर मर्म– रूजाकर मर्म अग्नि और वायु गुण युक्त होते हैं। अग्नि और वायु विशेष प्रकार से पीड़ित करने वाले होते है।

कुछ आचार्यों के अनुसार रूजाकर मर्म पाँचभौतिक होते हैं।

*

१.	सद्यः प्राणहर मर्म	सोम गुण प्रधान
२.	कालान्तर प्राणहर मर्म	सोम व अग्नि गुण प्रधान
३.	विशल्य प्राणहर मर्म	वायु गुण प्रधान
४.	वैकल्यकर मर्म	सोम गुण प्रधान
५.	रूजाकर मर्म	अग्नि व वायु गुण प्रधान

८. प्रत्येक मर्म का विस्तृत वर्णन–

क्र. सं.	नाम	संख्या	प्रकार षडंगों के अनुसार	रचनानुसार	परिणामानुसार	परिमाणानुसार	स्थान आयुर्वेद मतानुसार	आधुनिक मतानुसार या आधुनिक पर्याय	विद्ध होने पर लक्षण या आघात होने पर परिणाम
१.	क्षिप्र	४	शाखाओं	स्नायु	कालान्तर प्राणहर	१/२ अंगुल	अंगुष्ठ एवं अंगुलि के मध्य में B/w 1st and 2nd digit	• First inter metacarpal ligament • First inter meta tarsal ligament	• आक्षेप (Convulsion or tetanus) से मृत्यु
२.	तलहृदय	४	,,	मांस	कालान्तर प्राणहर	१/२ अंगुल	हथेली (palm) के मध्य में पांव के तल (Sole) के मध्य में	• Palmar aponeurosis • Long plantar ligament	• वेदना (Acute pain) से मृत्यु
३.	कूर्च	४	,,	स्नायु	वैकल्यकर	४ अंगुल	क्षिप्र मर्म के ऊपर	• Intercarpal ligament • Intertarsal " "	हाथ या पांव में टेढ़ापन तथा कम्पन (Trembling)
४.	कूर्च शिर	४	,,	स्नायु	रुजाकर	१ अंगुल	मणिबन्ध (Wrist) एवं गुल्फ (Ankle)	• Lateral liga. of the **wrist** joint. • " " " **ankle** "	• पीड़ा और सूजन (Pain and swelling)
५.	गुल्फ/ मणिबंध	२+२ =४	,,	सन्धि	रुजाकर	२ अंगुल	•मणिबन्ध सन्धि- (Wrist joint) •गुल्फ सन्धि- (Ankle joint)	• Retinaculam of **wrist** joint • " " " **ankle** "	हाथ एवं पैर में जकड़न (Stiffness) और लंगड़ापन
६.	इन्द्रबस्ति	४	,,	मांस	कालान्तर प्राणहर	१/२ अंगुल	•जंघा के मध्य में (Middle leg) •प्रकोष्ठ के मध्य में (Middle fore arm)	• Lower end of cubital fossa. • Calf muscles	रक्तस्रावजन्य क्षय से मृत्यु (Bleeding होकर Death)

७.	जानु/कूर्पर	२+२ = ४	,,	सन्धि	वैकल्यकर	३ अंगुल	कूर्पर सन्धि- (Elbow joint) जानुसन्धि- (Knee joint)	• Elbow joint • Knee joint	Joint पर विकृति से लूलापन, लंगड़ापन (limping)
८.	आणि	४	,,	स्नायु	वैकल्यकर	१/२ अंगुल	कूर्पर एवं जानु से ३ अंगुल ऊपर	• Tendon of biceps brachii. • Tendon of quadriceps femoris	सूजन (Oedema) की वृद्धि होकर हाथ-पैर जकड़ जाते हैं।
९.	ऊर्वा	४	,,	सिरा	वैकल्यकर	१ अंगुल	•बाहु के मध्य में (Middle arm) •ऊरू के मध्य में (Middle thigh)	• Brachial artery and basilic vein • Femoral vessels	रक्तक्षय (Blood loss) से बाहु और सक्थि का सूख जाना
१०.	लोहिताक्ष	४	,,	सिरा	वैकल्यकर	१/२ अंगुल	•अंससन्धि के नीचे (Below shoulder joint) •वंक्षण सन्धि के नीचे (Below hip joint)	• Axillary vessels • Femoral vessels	Blood loss होकर Paralysis या अंगशेष होकर Death
११.	विटप/ कक्षधर	२+२ ४ ११x४ = ४४	,,	स्नायु	वैकल्यकर	१ अंगुल	•वक्ष (Thorax) और कक्षा (Axilla) के मध्य •वृषण (Testis) और वंक्षण (Inguinal region) के मध्य	• Brachial plexus • Inguinal canal	• ऊर्ध्व शाखा में-Paralysis • षंडता (Sterility) या अल्पशुक्रता (oligospermia)

१.	गुद	१	मध्य शरीर (उदर व उर:)	मांस	सद्य: प्राणहर	४ अंगुल	गुद द्वार एवं गुद नलिका (Anus and anal canal)	Anal canal and anus	तत्कालमृत्यु (Sudden death)
२.	वस्ति	१	,,	स्नायु	सद्य: प्राणहर	४ अंगुल	मूत्राशय (Urinary-bladder)	Urinary bladder	आघात से फटने पर Death
३.	नाभि	१	,,	सिरा	सद्य: प्राणहर	४ अंगुल	आमाशय तथा पक्वाशय के मध्य में	Umbilicus	Sudden Death
४.	हृदय	१	,,	सिरा	सद्य: प्राणहर	४ अंगुल	दोनों स्तनों के मध्य में (Middle mediastinum)	Heart	Sudden Death
५.	स्तनमूल	२	,,	सिरा	कालान्तर प्राणहर	२ अंगुल	स्तनों के दो अंगुल नीचे	Lower portion of pectoralis major with pectoral nerves.	"कफपूर्ण कोष्ठतया" कफ से कोष्ठ भर जाने पर कास-श्वास होकर Death (Tuberculosis, pneumonia)
६.	स्तनरोहित	२	,,	मांस	कालान्तर प्राणहर	१/२ अंगुल	स्तनचुचुकों (Nipples) के दो अंगुल ऊपर	Internal mammary vessels	"लोहितापूर्ण कोष्ठतया" रक्त से कोष्ठ भर जाने पर मृत्यु (Haemothorax or Hemoptysis)

७.	अपलाप	२	,,	सिरा	कालान्तर प्राणहर	१/२ अंगुल	अंसकूटों (Acromian process) के नीचे पार्श्वों के ऊपरी भाग में	Lateral thorax and subscapular vessels.	Blood पूय (Pus) रूप होने से Death. (Empyema or pulmonary tuberculosis)
८.	अपस्तम्भ	२ १२	,,	सिरा	कालान्तर प्राणहर	१/२ अंगुल	वक्ष के दोनों ओर वात-वाही नाड़ियों (कंठनाड़ी-Trachea) के स्थान पर Rt bronchi and lt. bronchi	Two bronchi	"वातपूर्णकोष्टतया" वात से कोष्ठ भर जाने पर कास-श्वास से मृत्यु। (Pneumothorax)

१.	कटिकत-रूण	२	मध्य शरीर (पृष्ठ-पीठ)	अस्थि	कालान्तर प्राणहर	१/२ अंगुल	पृष्ठवंश (Vertebral-column) के दोनों ओर श्रोणिकाण्ड (Ala of the ilium) में	Greater and lesser sciatic notch	रक्त क्षय (Anaemia) होकर शरीर पाण्डु वर्ण होकर Death.
२.	कुकुंदर	२	,,	सन्धि	वैकल्यकर	१/२ अंगुल	पृष्ठवंश (Vertebral-column) के दोनों ओर जघनास्थि (Pubis) के पार्श्व में	Ischial tuberosity	अधःशाखा में चेष्टाओं का नाश (Paralysis) और स्पर्शज्ञान नष्ट
३.	नितम्ब	२	,,	अस्थि	कालान्तर प्राणहर	१/२ अंगुल	श्रोणिकाण्ड (Ala of the ilium) के ऊपर	Ala of the ilium	अधःकाय सूख जाता है और कमजोरी से मृत्यु
४.	पार्श्वसन्धि	२	,,	सिरा	कालान्तर प्राणहर	१/२ अंगुल	जघन पार्श्वों के मध्य में, जघन से तिरछा व ऊपर की ओर	Common iliac vessels	"लोहित पूर्ण कोष्ठतया म्रियते" रक्त से कोष्ठ भर जाने से मृत्यु
५.	बृहती	२	,,	सिरा	कालान्तर प्राणहर	१/२ अंगुल	पृष्ठवंश के दोनों ओर स्तनमूल की दिशा में पीछे	Subscapular and transverse cervical arteries	अधिक रक्तस्राव से Death
६.	अंसफलक	२	,,	अस्थि	वैकल्यकर	१/२ अंगुल	पृष्ठवंश के दोनों ओर त्रिक (Spine of scapula) से सम्बद्ध	Spine of scapula	"बाह्वो स्वापशोषौ" बाहु में सुप्तता (सुन्नता) और शोष (शुष्कता)
७.	अंस	२	,,	स्नायु	वैकल्यकर	१/२ अंगुल	बाहुशिर (Head of humerus) और ग्रीवा के मध्य में अंस पीठ (Glenoid cavity) और कन्धे को बाँधने वाले स्थान पर	Coracoclavicular ligament.	"स्तब्धबाहुता" बाहु जकड़ जाते हैं (Stiffness of extremity)
		१४							

१.	धमनी— (नीला व मन्या)	२×२= ४	शिर और ग्रीवा	सिरा	वैकल्यकर	४ अंगुल	कण्ठनाड़ी (Trachea) के दोनों ओर	Jugular veins. carotid arteries.	स्वर की विकृति, गूँगापन, जिह्वा द्वारा रस ज्ञान का अभाव
२.	मातृका (कंठसिरा)	८	,,	सिरा	सद्यःप्राणहर	४ अंगुल	ग्रीवा के दोनों ओर स्थित सिराएँ	Blood vessels of the neck.	Sudden death
३.	कृकाटिका	२	,,	सन्धि	वैकल्यकर	१/२ अंगुल	शिर एवं ग्रीवा की सन्धि पर	Atlanto-occipital joint.	"चलमूर्धता" सिर हिलता रहता है। (Unstability of head)
४.	विधुर	२	,,	स्नायु	वैकल्यकर	१/२ अंगुल	कर्ण के पीछे अधः ओर	Post. auricular vessels.	बधिरता (Deafness)
५.	फण	२	,,	सिरा	वैकल्यकर	१/२ अंगुल	घ्राणमार्ग के दोनों ओर भीतर	Olfactory region of the nose.	गन्ध ज्ञान का नाश (Anosmia)
६.	अपांग	२	,,	सिरा	वैकल्यकर	१/२ अंगुल	भ्रूपुच्छों (Eyelashes) के अन्त में नीचे आँखों के बाहर की ओर	Zygomatico-temporal vessels	अंधापन अथवा दृष्टि कम हो जाती है। "तत्रान्ध्यं दृष्ट्यपघातो वा"
७.	आवर्त	२	,,	सन्धि	वैकल्यकर	१/२ अंगुल	भ्रूपुच्छों के अन्त में ऊपर ही निम्न भागों में	Junction of the frontal, maxilla and sphenoid bone	"तत्राप्यान्ध्यं दृष्ट्युपघातो वा"
८.	उत्क्षेप	२	,,	स्नायु	विशल्यघ्न	१/२ अंगुल	शंख के ऊपर केश समाप्त होने के स्थान पर	Temporal muscles and fascia	शल्य के साथ बच जाता है, किन्तु शल्य चुभते ही उसे निकालने पर मृत्यु

९.	शंख	२	,,	अस्थि	सद्यःप्राणहर	१/२ अंगुल	भ्रूपृच्छों के सिरों के ऊपर कर्ण और मस्तक के बीच में	Temples	Sudden death
१०.	सीमन्त	५	,,	सन्धि	कालान्तर प्राणहर	४ अंगुल	सिर का विभाजन करने वाली पाँच सन्धियों के स्थान पर	Cranial sutures.	उन्माद-भय-चितनाश से Death
११.	शृंगाटक	४	,,	सिरा	सद्यःप्राणहर	४ अंगुल	नाक, कान, नेत्र और जिह्वा का संतर्पण करने वाली शिराओं के मध्य सिरा सन्निपात के स्थान पर	Cavernous and inter-cavernous sinuses.	Sudden death
१२.	स्थपनी	२	,,	सिरा	विशल्यघ्न	१/२ अंगुल	दोनों भौंहों के मध्य में	Nasal arch of the frontal vein.	शल्य के साथ बच जाता है, किन्तु शल्य चुभते ही उसे निकालने पर मृत्यु
१३.	अधिपति	२	,,	सन्धि	सद्यःप्राणहर	१/२ अंगुल	मस्तिष्क के भीतर ऊपर की ओर सिरा और सन्धियों का सन्निपात, बालों का आवर्त	Venous sinuses.	तत्काल मृत्यु (Sudden death)

९. मर्मों का कार्य करने का काल

''तत्र सद्यः प्राणहराणि सप्तरात्राभ्यन्तरान्मारयन्ति, कालान्तर प्राणहराणि पक्षान्मासाद्वा, तेष्वपि तु क्षिप्राणि क्वदाचिदाशु मारयन्ति, विशल्यप्राणहराणि वैकल्यकराणि च कदाचिदत्यभिहतानि मारयन्ति ।।'' (सु.शा. ६/२४)

- सद्यः प्राणहर मर्म सात दिन के अन्दर मारते हैं।
- कालान्तर-प्राणहर मर्म पन्द्रह दिन अथवा एक महिने में मार डालते हैं।
- कालान्तर-प्राणहर मर्मों में भी क्षिप्र नामक मर्म कभी-कभी शीघ्र ही मार डालते हैं।
- विशल्य-प्राणहर तथा वैकल्यकर मर्मों पर कभी-कभी विशेष आघात होने से वे मार देते हैं।

* सद्यः प्राणहर मर्म–	सात दिन
* कालान्तर प्राणहर मर्म–	पन्द्रह दिन या एक मास

१०. मर्मों पर आघात होने पर होने वाले लक्षण और उपद्रव (Applied aspect of marma)

(A) शाखाओं (Extremities) के मर्म

(१) क्षिप्र– ''तत्र विद्वस्याक्षेपेण मरणम् ।'' (सु.शा. ६/२५)

क्षिप्र मर्म पर आघात होने से आक्षेप (Convulsions or tetanus) से मृत्यु होती है।

(२) तलहृदय– ''तत्र रूजाभिः मरणम् ।'' (सु.शा. ६/२५)

तलहृदय मर्म पर आघात होने से वेदना (Acute pain) से मृत्यु होती है।

(३) कूर्च– ''तत्र पादस्य भ्रमणवेपने भवतः ।'' (सु.शा. ६/२५)

कूर्च मर्म पर आघात लगने से पैर तिरछा अर्थात् टेढ़ापन हो जाता है और उसमें कम्पन (Trembling) पैदा होती है।

(४) कूर्चशिर– ''तत्र रूजा शोफौ ।'' (सु.शा. ६/२५)

कूर्चशिर मर्म पर आघात होने से पीड़ा और सूजन (Pain and swelling) होती है।

(५) गुल्फ और मणिबन्ध–

- ''तत्र रूजः स्तब्धपादता खञ्जता वा ।'' (सु.शा. ६/२५)

गुल्फ मर्म पर आघात लगने से पैर में जकड़न (Stiffness) और लंगड़ापन हो जाता है।

- "मणिबन्धे कुण्ठता ।" (सु.शा. ६/२५)

मणिबन्ध मर्म पर आघात होने से हाथ रूकते हैं।

(६) **इन्द्रबस्ति**– "तत्र शोणितक्षयेण मरणम् ।" (सु.शा. ६/२५)

इस पर आघात होने से रक्तस्राव जन्य क्षय से मृत्यु होती है। अर्थात् (Bleeding) से (Death) होती है।

(७) **जानु और कूर्पर**–

- "तत्र खञ्जता ।" (सु.शा. ६/२५)

जानु मर्म पर आघात से लंगड़ापन होता है।

- "कूर्पराख्ये कुणि: ।" (सु.शा. ६/२५)

कूर्पर मर्म पर आघात होने से लूलापन हो जाता है।

(८) **आणि**– "तत्र शोफाभिवृद्धि: स्तब्धसक्थिता च ।" (सु.शा. ६/२५)

आणि मर्म पर आघात होने से शोफ अर्थात् सूजन (Oedema) की वृद्धि होकर हाथ-पैर जकड़ जाते हैं।

(९) **ऊर्वी**– "तत्र शोणित क्षयात् सक्थिशोष: ।" (सु.शा. ६/२५)

ऊर्वी मर्म पर आघात होने से रक्तक्षय (Blood loss) से बाहु और सक्थि सूख जाती हैं।

(१०) **लोहिताक्ष**– "तत्र लोहितक्षयेण मरणं पक्षाघातो वा ।" (सु.शा. ६/२५)

लोहिताक्ष मर्म पर आघात होने पर रक्त का निर्गम होकर (Blood loss) पक्षाघात (Paralysis) या मृत्यु होती है।

(११) **विटप और कक्षधर**–

- "तत्र षाण्ढयमल्पशुक्रता वा भवति ।" (सु.शा. ६/२५)

विटप पर आघात होने से षण्डता (Steritity) या अल्पशुक्रता (Oligospermia) पैदा होती है।

- "कक्षधरे पक्षाघात: ।" (सु.शा. ६/२५)

कक्षधर मर्म विद्ध होने पर पक्षाघात (Paralysis) उत्पन्न होता है।

(B) मध्य शरीर (उदर व उर:) [Trunk (Abdomen and thorax)] के मर्म

(१) गुद मर्म– "तत्र सद्योमरणम् ।" (सु.शा. ६/२६)

गुद मर्म पर आघात लगने से तत्काल मृत्यु (Sudden death) होती है।

(२) वस्ति मर्म अर्थात् मूत्राशय–

"तत्रापि सद्यो मरणमश्मरीव्रणादृते, तत्राप्युभयतो भिन्ने न जीवति,
एकतो भिन्ने मूत्रस्रावी व्रणो भवति, स तु यत्नेनोपक्रान्तो रोहित ।" (सु.शा. ६/२६)

यह मर्म अश्मरी (Stone) के व्रण के अतिरिक्त अन्य व्रणों से विद्ध होने पर तत्काल मृत्यु करता है। अश्मरी व्रण भी वस्ति के दोनों ओर होगा तो मृत्यु हो जाती है। वस्ति मर्म के एक तरफ व्रण होने से मूत्र का स्रवण करने वाला व्रण होता है। यह व्रण चिकित्सा करने पर कष्ट से ठीक होता है।

(३) नाभि मर्म– "सद्योमरणम् ।" (सु.शा. ६/२६)

नाभि मर्म पर विद्ध होने से प्राणी की तुरन्त मृत्यु (Sudden death) होती है।

(४) हृदय मर्म– "सद्य एव मरणम् ।" (सु.शा. ६/२६)

हृदय मर्म पर आघात होने से प्राणी की तत्काल मृत्यु (Sudden death) होती है।

(५) स्तनमूल– "तत्र कफपूर्णकोष्ठतया (कास श्वासाभ्यां) म्रियते ।" (सु.शा. ६/२६)

स्तनमूल पर आघात होने से कफ से कोष्ठ भर जाने पर कास-श्वास (Tuberculosis-Pneumonia) होकर मृत्यु (Death) हो जाती है।

(६) स्तनरोहित– "तत्र लोहितपूर्णकोष्ठतया (कासश्वासाभ्यां) च म्रियते ।" (सु.शा. ६/२६)

स्तनरोहित पर आघात होने से रक्त (Blood) से कोष्ठ (Cavity) भर जाने पर Haemothorax and hemoptysis से मृत्यु (Death) हो जाती है।

(७) अपलाप– "तत्र रक्तेन पूयभावं गतेन मरणम् ।"

अपलाप पर आघात होने से रक्त (Blood) पूय (Pus) रूप होने से (Empyema and pulmonary tuberculosis) होकर मृत्यु हो जाती है।

(८) अपस्तम्भ– "तत्र वातपूर्ण कोष्ठतयाकासश्वासाभ्यां च मरणम् ।" (सु.शा. ६/२६)

अपस्तम्भ पर आघात होने से वात (Air) से कोष्ठ भर जाने पर कास-श्वास (Pneumothorax) से मृत्यु (Death) हो जाती है।

(C) पृष्ठ अर्थात् पीठ (Back side) के मर्म

(१) कटिकतरूण– "तत्र शोणितक्षयात् पाण्डुविवर्णो हीनरूपश्च म्रियते ।" (सु.शा. ६/२७)

कटिकतरूण पर आघात लगने से रक्त का क्षय होकर शरीर पाण्डु वर्ण (Anaemia) और हीन रूप होकर मृत्यु हो जाती है।

(२) कुकुंदर– "तत्र स्पर्शाज्ञानमधःकाये चेष्टोपघातश्च ।" (सु.शा. ६/२७)

कुकुंदर पर आघात लगने से अधः शाखा में चेष्टाओं का नाश (Paralysis) और स्पर्श ज्ञान नष्ट हो जाता है।

(३) नितम्ब– "तत्राधः कायशोषो दौर्बल्याच्च मरणम् ।" (सु.शा. ६/२७)

नितम्ब मर्म विद्ध होने से अधः काय (Lower limb) सूख जाता है और दुर्बलता (Weakness) से मृत्यु हो जाती है।

(४) पार्श्व सन्धि– "तत्र लोहितपूर्ण कोष्ठतया म्रियते ।" (सु.शा. ६/२७)

पार्श्वसन्धि पर आघात होने से रक्त (Blood) से कोष्ठ (Cavity) भर जाने से मृत्यु (Death) हो जाती है।

(५) बृहती– "तत्र शोणितातिप्रवृत्तिनिमित्तैरूपद्रवैर्म्रियते ।" (सु.शा. ६/२७)

बृहती पर आघात होने से अधिक रक्तस्राव से मृत्यु हो जाती है।

(६) अंसफलक– "तत्र बाह्वोः स्वापशोषौ ।" (सु.शा. ६/२७)

अंसफलक पर आघात होने से बाहु में सुप्तता (सुन्नता) और शोष (शुष्कता) हो जाती है।

(७) अंस– "तत्र स्तब्धबाहुता ।" (सु.शा. ६/२७)

अंस पर आघात होने से बाहु जकड़ जाते हैं। (Stiffness of extremities)

(D) शिर और ग्रीवा (Head and neck) के मर्म

(१) धमनी (नीला-मन्या)– "तत्र मूकता-स्वरवैकृतमरसग्राहिता च ।"(सु.शा६/२८)

धमनी मर्म पर आघात होने पर मूकत्व (गूँगापन), विकृत स्वर तथा जिह्वा द्वारा रस ज्ञान का अभाव हो जाता है।

(२) सिरा मातृका (कंठसिरा)– "तत्र सद्यो मरणम् ।" (सु.शा. ६/२८)

कंठसिरा पर आघात लगने से तुरन्त मृत्यु (Sudden death) होती है।

(३) कृकाटिका– "तत्र चलमूर्द्धता ।" (सु.शा. ६/२८)

कृकाटिका पर आघात लगने से शिर हिलता रहता है। (Unstability of head)

(४) विधुर– "तत्र बाधिर्यम् ।" (सु.शा. ६/२८)

विधुर मर्म पर आघात होने से बधिरता (Deafness) होती है।

(५) फण– "तत्र गन्धाज्ञानम् ।" (सु.शा. ६/२८)

फण पर आघात लगने पर गन्ध ज्ञान का नाश (Anosmia) हो जाता है।

(६) अपांग– "तत्रान्ध्यं दृष्ट्यपघातो वा ।" (सु.शा. ६/२८)

अपांग मर्म पर आघात होने से अन्धता (Blindness) अथवा दृष्टि कम हो जाती है। (Loss of vision)

(७) आर्वत्त– "तत्राप्यान्ध्यं दृष्ट्युपघातो वा ।" (सु.शा. ६/२८)

आर्वत्त पर आघात होने से भी अन्धता अथवा दृष्टि कम हो जाती है।

(८) उत्क्षेप– "तत्र सशल्यो जीवेत् पाकात् पतितशल्यो वा, नोद्धृत शल्यः ।" (सु.शा. ६/२८)

यदि उस स्थान पर शल्य रहने दें अथवा व्रणस्थान पक कर शल्य निकल जावे तो मृत्यु नहीं होती, परन्तु यदि शल्य निकाला जाय तो जीवन नहीं रहता। अर्थात् मृत्यु हो जाती है।

(९) शंख– "तत्र सद्योमरणम् ।" (सु.शा. ६/२८)

शंख पर आघात लगने से तुरन्त मृत्यु (Sudden death) होती है।

(१०) सीमन्त– "तत्र उन्मादभय-चित्तनाशैःमरणम् ।" (सु.शा. ६/२८)

सीमन्त पर आघात लगने से उन्माद-भय और चित्तनाश से मृत्यु हो जाती है।

(११) शृंगाटक– "तत्रापि सद्योमरणम् ।" (सु.शा. ६/२८)

शृंगाटक मर्म पर आघात होने से तुरन्त मृत्यु (Sudden death) होती है।

(१२) स्थपनी– "तत्र सशल्यो जीवेत्, पाकात् पतितशल्यो वा, नोद्धृत शल्यः ।" (सु.शा. ६/२८)

यदि उनमें शल्य रहने दें अथवा व्रणस्थान पक कर शल्य निकल जावे तो मृत्यु नहीं होती, परन्तु यदि शल्य निकाला जाये तो मृत्यु हो जाती है।

(१३) अधिपति– "तत्रापि सद्योमरणम् ।" (सु.शा. ६/२८)

अधिपति मर्म पर आघात लगने से तुरन्त मृत्यु होती है।

*	गुद–	सद्योमरणम्	(Sudden death)
	नाभि–	सद्योमरणम्	(Sudden death)
	हृदय–	सद्योमरणम्	(Sudden death)
	सिरा मातृका–	सद्योमरणम्	(Sudden death)
	शंख–	सद्योमरणम्	(Sudden death)
	श्रृंगाटक–	सद्योमरणम्	(Sudden death)
	अधिपति–	सद्योमरणम्	(Sudden death)

११. मर्मों पर आघात होने से उत्पन्न होने वाले लक्षण

इन्द्रियार्थेष्वसंप्राप्तिः मनो बुद्धि विपर्ययः ।
रूजश्च विविधास्तीव्रा भवन्त्याशुहरे हते ।। (सु.शा. ६/३८)
हते कालान्तरघ्ने तु ध्रुवो धातुक्षयो नृणाम् ।
ततो धातुक्षयाज्जन्तुर्वेदनाभिश्च नश्यति ।। (सु.शा. ६/३९)
हते वैकल्येजनने केवलं वैद्यनैपुणाद् ।
शरीरं क्रियया युक्तं विकलत्वमवाप्नुयात् ।। (सु.शा. ६/४०)
रूजाकराणि मर्माणि क्षतानि विविधारूजः ।
कुर्वन्त्यन्ते च वैकल्यं कुवैद्यवशगो यदि ।। (सु.शा. ६/४१)

(१) **सद्यः प्राणहर मर्म–** सद्यः प्राणहर मर्मों पर आघात होने से रूप-रसादि इन्द्रियार्थों का ज्ञान नहीं होता और मन तथा बुद्धि विपरीत होती है तथा विविध प्रकार की पीड़ा होती है।

(२) **कालान्तर प्राणहर मर्म–** कालान्तर प्राणहर मर्मों पर आघात होने से धातुक्षय निश्चित रूप से होता है। धातुक्षय के बाद वेदनाओं से प्राणी की मृत्यु होती है।

(३) **वैकल्यकर मर्म–** वैकल्यकर मर्मों पर आघात होने से केवल चिकित्सक की निपुणता से शरीर क्रियायुक्त रहते हुए भी विकलता को प्राप्त होता है।

(४) **विशल्यघ्न मर्म–** विशल्यप्राणहर मर्मों पर आघात होने से जब तक शल्य शरीर के अन्दर रहता है, तब तक प्राणी जीवित रहता है। अथवा व्रण पककर शल्य निकल जाता है, तब भी प्राणी जीवित रहता है। शल्य को तुरन्त निकालने से प्राणी की मृत्यु हो जाती है।

(५) **रूजाकर मर्म–** रूजाकर मर्मों पर आघात होने से विभिन्न प्रकार की पीड़ायें होती हैं। यदि अशिक्षित चिकित्सकों द्वारा चिकित्सा की जाय तो विकलता को भी प्राप्त होता है।

अध्याय- ८

अङ्गरेखा शारीर
(Surface Anatomy)

१. अंगरेखांकन का परिचय (Introduction of surface anatomy)

अंग रेखांकन का अर्थ-अंग-प्रत्यंगों की आकृति का शरीर के पृष्ठ (Surface) पर या शरीर की बाह्य त्वचा पर रेखा द्वारा चित्र निकालना ही होता है। इसका उद्देश्य यह है कि शरीर रचना शास्त्र का अध्ययन करने वाले विद्यार्थी, मृतसंशोधन करने के बाद शरीर के कोष्ठ में या अन्य अंगों के आभ्यन्तर स्थित रचनाओं के स्वरूप, स्थान आदि को अच्छी प्रकार समझ लेते हैं। इस ज्ञान का उपयोग उन्हें आत्मायुक्त चेतन पुरूष की व्याधियों की चिकित्सा करने हेतु होना चाहिए। चेतन मनुष्य के शरीर की आभ्यन्तर रचना तथा प्रत्यंगों को और कोष्ठांगों को विद्यार्थी या चिकित्सक त्वचा के बाहर से नहीं देख पाते। अत: शव विच्छेदन करने से जो ज्ञान प्राप्त हुआ होता है, उसको मन में रखकर ही कोष्ठांगों की या प्रत्यंगों की प्राकृत रचना तथा इनके प्राकृत स्थान का ज्ञान अवगत हो सकता है। अत: इन कोष्ठांगों की विकृति जानने के लिए उन अंगों का चित्र त्वचा पर निकालना तथा ऐसे ज्ञान का अध्ययन करना आवश्यक हो जाता है।

ऐसे चित्र निकालने के लिए उन कोष्ठांगों की स्थिति का ज्ञान तथा उनसे सम्बन्धित विशिष्ट स्थिर चिह्न (जैसे– अस्थियाँ, उत्सेध, पर्शुकाएँ आदि) अवगत करा कर उनके द्वारा ही यह रेखाचित्र निकालते हैं।

रचना एवं क्रिया शारीर की दृष्टि से मध्य शरीर को तीन गुहाओं (Cavities) में बाँटा गया है।

१. उरोगुहा– Thoracic cavity

२. उदरगुहा– Abdominal cavity

३. श्रोणिगुहा– Pelvic cavity

अंगरेखांकन काल्पनिक है तथापि अंग एवं मध्य शरीर के अवयवों की स्थिति ज्ञान के लिए किए गए विभाग हैं।

अंगरेखांकन से मध्य शरीर के नौ भाग बनते हैं–

LH	EPG	RH
LL	UMB	RL
LI	HYG	RI

* **मध्य के तीनों भाग–**
  १. अधिजठर प्रदेश– Epigastric region
  २. नाभि प्रदेश– Umbilical region
  ३. अध: जठर प्रदेश Hypogastric region
* **वामपार्श्व के तीनों भाग–**
  १. वाम अध: पर्शुका प्रदेश– Left hypochondric region
  २. वाम कटि प्रदेश– Left lumbar region
  ३. वाम श्रोणि प्रदेश– Left iliac region
* **दाहिने पार्श्व के तीनों भाग–**
  १. दक्षिण अध: पर्शुका प्रदेश– Right hypo chondric region
  २. दक्षिण कटि प्रदेश– Right lumbar region
  ३. दक्षिण श्रोणि प्रदेश– Right iliac region

- अध्ययन की दृष्टि से मध्य शरीर के अवयवों का इन्हीं नौ विभागों द्वारा स्थिति का ज्ञान किया जाता है।
- चिकित्सा की दृष्टि से रोगी द्वारा उदर में कहीं भी कोई वेदना बताये जाने पर चिकित्सक को अंग रेखांकन द्वारा यह पता लग जाता है कि कौनसा अवयव विकृत है।

शरीर के अवयवो का अंगरेखांकन (Surface marking of the organs) निम्न प्रकार से है–

२. हृदय का अंग रेखांकन (Surface marking of the heart)

(1) Apex– It is formed by the left ventricle. Correspond to apex beat and is found in the 5th left intercostal space just medial to the midclavicular line, or 9 cm. from lateral to the midsternal line.

(2) **Superior border–** Formed by the root of great vessels. The superior border is marked by a oblique line joining–

(A) A point at the lower border of the second left costal cartilage about 1 cm. from the sternal margin to,

(B) A point at the upper border of the third right costal cartilage about 1 cm. from the sternal margin.

(3) **Inferior border–** Formed by the right ventricle. The inferior border is marked by a straight line joining–

(A) A point at the lower border of the sixth right costal cartilage about two cm. from the sternal margin to,

(B) A point at the apex of the heart in the left fifth intercostal space about nine cm. from the midsternal line.

(4) **Left border–** Formed by left ventricle. The left border is marked by a line, fairly convex to the left. Joining the left ends of the upper and lower borders.

(5) **Right border–** It is formed by the right atrium. The right border is marked by a line, slightly convex to the right. Joining the right ends of the upper and lower borders.

३. फुप्फुस का अंगरेखांकन (Surface marking of the lungs)

(1) **Apex–**
- One inch above the medial 1/3 of the clavicle.
- Above the level of anterior end of first rib.

(2) Anterior border of right lung– Corresponds very closely to the anterior margin of the pleura and is obtained by joining–

(A) A point at the sternoclavicular joint.

(B) Another point in the median plane at the sternal angle.

(C) A third point in the median plane just above the xiphisternal joint.

(3) **Anterior border of the left lung–** Corresponds to the anterior margin of the pleura up to the level of fourth costal cartilage.

- Cardiac notch– Below the level of fourth costal cartilage.
- From the level of fourth costal cartilage, it passage laterally for 3.5 cm. from the sternal margin.
- Then curves downwards and medially to reach the sixth costal cartilage four cm. from the median plane.

(4) **Posterior border–** It extend from the level of C7-T10 spine.

(5) **Inferior border–** The inferior border of each lung lie two ribs higher than the pleural reflection.

- It crosses the–
- **Surface marking of the–**

		lungs	pleura
(A)	Mid clavicular line–	upto 6th rib.–	8th rib.
(B)	Mid axillary line–	upto 8th rib.–	10th rib.
(C)	Lateral border of the erector spinae	upto 10th rib.–	12th rib.

(6) **Oblique fissure–**

(A) A point two cm. lateral to the– Third thoracic spine (T_3).

(B) Another point on the fifth rib in the– Midaxillary line.

(C) A third point on the sixth costal cartilage– 7.5 cm. from median line.

(7) **Horizontal fissure–**

(A) A point on the anterior border of right lung at the level of fourth costal cartilage.

(B) A second point on the fifth rib in the midaxillary line.

४. आमाशय का अंगरेखांकन (Surface marking of the stomach)

(1) **Pyloric orifice–** Pyloric orifice is marked by two short parallel lines two cm. apart, directed upwards and to the right, on transpyloric plane, about one cm. to the right of the median plane.

(2) **Cardiac orifice–** Cardiac orifice is marked by two short parallel lines two cm. apart, directed downwards and to the left on the seventh costal cartilage, about 2.5 cm. to the left of the median plane.

(3) **Lesser curvature–** This curvature is marked by joining the right margin of the cardiae orifice with upper margin of the pyloric orifice by a 'j'– Shaped curved line. The lowest point of this line reaches a little below the transpyloric plane.

(4) **Greater curvature–** This curvature is marked by a curved line convex to the left and downwards, drawn from the fundus to the lower margin of the pyloric orifice.

It cuts the left costal margin B/w the tips of the 9th and 10th costal cartilages and extends down to the subcostal plane.

(5) **Fundus–** The fundus is marked by a line convex upwards drawn from the left margin of the cardiac orifice to highest point in the left 5th intercostal space just below the nipple.

५. ग्रहणी का अंगरेखांकन (Surface marking of the duodenum)

(1) **First part–** is marked by two parallel lines 2.5 cm. apart extending from the pyloric orifice upwards and to the right for 2.5 cm.

(2) **Second part–** is marked by similar lines on the right lateral vertical plane extending from the end of the first part downwards for 7.5 cm.

(3) **Third part–** is marked by two transverse parallel lines 2.5 cm. apart on the subcostal plane, extending from the lower end of the second part towards the left for 10 cm. It crosses the median plane above the umbilicus.

(4) **Fourth part–** is marked by two lines extending from the left end of the third part to the duodenojejunal flexure, which lies one cm. below the transpyloric plane, and three cm. to the left of the median plane.

६. उण्डुक पुच्छ का अंगरेखांकन (Surface marking of the appendix)

(1) The appendicular orifice is marked at a point 2 cm. below the ileocaecal orifice.

(2) **Mc. Burney's point** is the side of maximum tenderness in appendicitis. The point lies at the junction of lateral one-third and medial two-thirds of the line joining the right anterior superior iliac spine to the umbilicus.

७. यकृत का अंगरेखांकन (Surface marking of the liver)

(1) **Upper border–** The upper border is marked by joining the following points–

(A) First points in the left 5th intercostal space 9 cm. from the median plane.

(B) Second point at the xiphisternal joint.

(C) Third point at the upper border of the right 5th costal cartilage in the right lateral vertical plane.

(D) Fourth point at the 6th rib in the midaxillary line.

(E) Fifth point at the inferior angle of the right scapula.

(F) Sixth point at the 8th thoracic spine.

(2) **Lower border**– The lower border is marked by a curved line joining the following point.

(A) First point in the left 5th intercostal space 9 cm. from the median plane.

(B) Second point at the tip of the 8th costal cartilage on the left costal margin.

(C) Third point at the transpyloric plane in the midline.

(D) Fourth point at the tip of the 9th costal cartilage on the right costal margin.

(E) Fifth point one cm. below the right costal margin at the tip of the 10th costal cartilage.

(F) Sixth point at the 11th thoracic spine.

(3) **Right border**– The right border is marked on the front by a curved line convex laterally, drawn from a point little below the right nipple to a point one cm. below the right costal margin at the tip of the 10th costal cartilage.

८. प्लीहा का अंगरेखांकन (Surface marking of the spleen)

(1) It is marked on the left side of the back, with its long axis corresponding with that of the 10th rib.

(2) The upper border correspondes to the upper border of the 9th rib, and the lower border to the lower border of the 11th rib.

(3) The medial end lies 4-5 cm. from the midline. and the lateral end on the mid axillary line.

९. अग्न्याशय का अंगरेखांकन (Surface marking of the pancreas)

(1) **The head** is marked with in the concavity on the duodenum.

(2) **The Neck** passes upwards and to the left behind the pylorus in the transpyloric plane.

(3) **The body** is marked by two parallel lines 3 cm. apart, drawn upwards and to the left for 10 cm. from the neck. Occupying the upper 2/3 of the space B/w the transpyloric and subcostal planes.

१०. पित्ताशय का अंगरेखांकन (Surface marking of the gall-bladder)

The fundus of the gall bladder is marked at the right angle B/w the right costal margin and the outer border of the rectus abdominis.

११. वृक्कौ का अंगरेखांकन (Surface marking of the kidneys)

(1) On the back, it is marked two horizontal lines are drawn, one at the level of the 11th thoracic spine and the other at the level of the third lumbar spine.

(2) On the front, the bean shaped kidney is marked with following specifications.

(A) On the right side the centre lies 5 cm. from the median plane a little below the transpyloric plane and on the left side it lies 5 cm. from the median plane a little above the transpyloric plane, just medial to the tip of the 9th costal cartilage.

(B) The upper pole lies 4-5 cm. from the midline, half way B/w the xiphisternum and the transpyloric plane.

(C) The lower pole lies 6-7 cm. from the midline on the right side at the umbilical plane and on the left side at the subcostal plane.

१२. गवीनियों का अंगरेखांकन (Surface marking of the ureters)

(1) To mark the ureter on the front of the abdomen locate.

(A) The tip of the 9th costal cartilage.

(B) The pubic tubercle.

A line joining these two points marks the position of the abdominal part of the ureter.

(2) To mark the ureter on the back, locate the second lumbar spine. Take a point about 4 cm. lateral to the spine. From here draw a line downwards to reach the posterior superior iliac spine.

अध्याय- ९

इन्द्रिय विज्ञान शारीर

१. परिचय

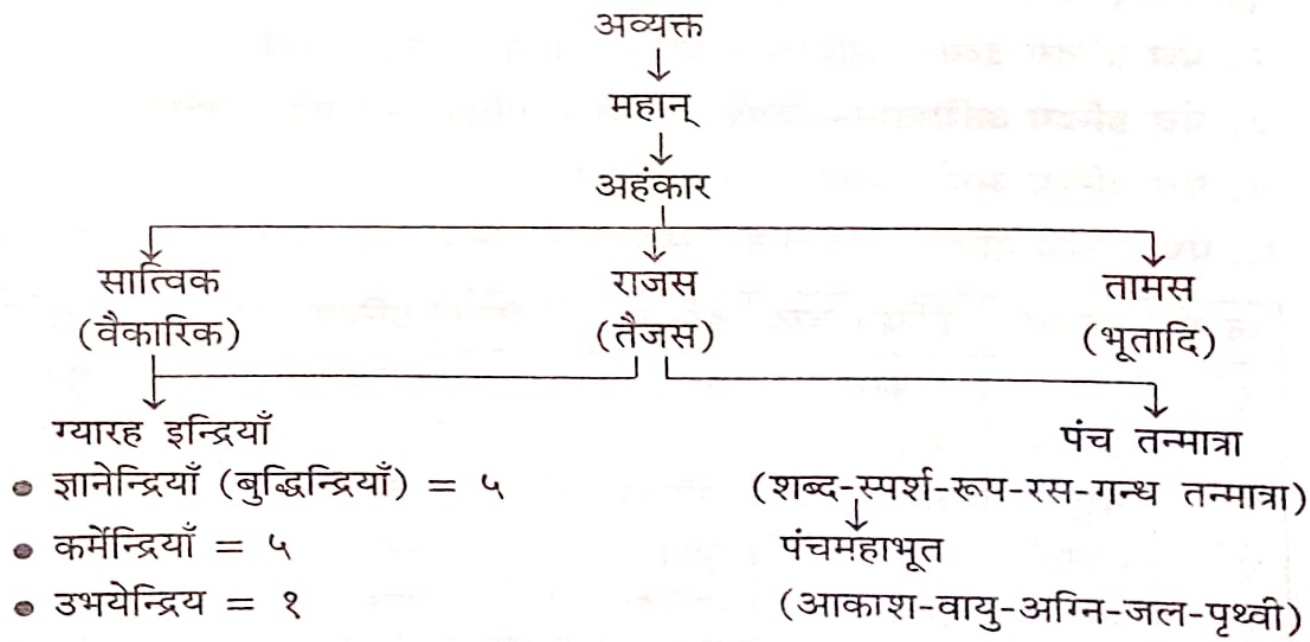
- सम्पूर्ण शरीर के लिए विषयों का ग्रहण एवं परित्याग इन्द्रियों द्वारा ही होता है।
- कोई भी कार्य करने वाला प्रत्यंग या किसी वस्तु का सार भाग प्राप्त करने वाला प्रत्यंग ही इन्द्रिय कहा जाता है।

२. इन्द्रिय शब्द की निरूक्ति

''इन्द्र आत्मा तस्य साधनं इन्द्रियम् ।''

- यहाँ इन्द्रिय शब्द से इन्द्र, आत्मा एवं उसके साधन रूप विषयों का आभास होता है।
- आत्मा को शरीररूपी सम्पत्ति के सम्पूर्ण ऐश्वर्य सम्पन्न होने के कारण इन्द्र कहा जाता है।
- एवं आत्मा की सत्ता का ज्ञान कराने वाले साधन को इन्द्रिय कहा जाता है।

३. इन्द्रियों की उत्पत्ति



* **ज्ञानेन्द्रियाँ–** श्रोत्रेन्द्रिय-स्पर्शनेन्द्रिय-चक्षुरेन्द्रिय-रसनेन्द्रिय-घ्राणेन्द्रिय

* **ज्ञानेन्द्रियों के विषय–**

शब्द – स्पर्श – रूप – रस – गन्ध
(सुनना) (स्पर्श को जानना) (देखना) (रसों का ज्ञान) (गन्ध का ज्ञान)

* **कर्मेन्द्रियाँ–** वाक्-पाणि-पाद-पायु-उपस्थ

* **कर्मेन्द्रियों के विषय–**

वचन – आदान – विहरण – विसर्ग – आनंद
(बोलना) (ग्रहण करना) (चलना) (मल विसर्जन) (मूत्र, शुक्र विसर्जन)

* **उभयेन्द्रिय–** मन

* **मन के विषय–** ज्ञानेन्द्रियों द्वारा प्राप्त संवेदना के अनुकूल, वह मन कर्मेन्द्रियों से क्रिया (कार्य) करवाता है।

इस प्रकार दसों इन्द्रियों पर नियन्त्रण रहता है।

- मन का मूल स्थान (अधिष्ठान)– हृदय।
- मन के कार्य करने का स्थान– शिर।
- मन का संचार करने का स्थान– सर्व शरीर।

४. इन्द्रिय पंचपंचक का वर्णन

१. पंच इन्द्रियाँ– श्रोत्र - स्पर्शन - चक्षु - रसना - घ्राण

२. पंच इन्द्रिय द्रव्य– आकाश - वायु - अग्नि - जल - पृथ्वी

३. पंच इन्द्रिय अधिष्ठान– कर्णौ - त्वक् - अक्षिणी - जिह्वा - नासिका

४. पंच इन्द्रिय अर्थ– शब्द - स्पर्श - रूप - रस - गन्ध

५. पंच इन्द्रिय बुद्धि– शब्द ज्ञान - स्पर्श ज्ञान - रूप ज्ञान - रस ज्ञान - गन्ध ज्ञान

क्र.सं.	इन्द्रियाँ	इन्द्रिय द्रव्य	इन्द्रिय अधिष्ठान	इन्द्रिय अर्थ	इन्द्रिय बुद्धि
१.	श्रोत्र	आकाश	कर्णौ	शब्द	शब्द ज्ञान
२.	स्पर्शन	वायु	त्वक्	स्पर्श	स्पर्श ज्ञान
३.	चक्षु	अग्नि	अक्षिणी	रूप	रूप ज्ञान
४.	रसना	जल	जिह्वा	रस	रस ज्ञान
५.	घ्राण	पृथ्वी	नासिका	गन्ध	गन्ध ज्ञान

५. पंच ज्ञानेन्द्रियों का वर्णन

श्रोत्र — स्पर्शन — चक्षु — रसना — घ्राण
(Ears) (Skin) (Eyes) (Tongue) (Nose)

(१) श्रोत्र-कर्ण (Ear)–

पर्याय– कान, कर्ण, श्रुति, श्रवणेन्द्रिय, श्रोत्रेन्द्रिय।

आयुर्वेदिक संहिता ग्रन्थों में निम्नानुसार कर्ण के सन्दर्भ में वर्णन मिलता है।

१. **''द्वे कर्ण शष्कुलिके, द्वौ कर्णपूत्रकौ ..... ।''** (च.शा. ७/११)

आचार्य चरक ने बाह्य प्रत्यंगों का वर्णन करते समय दो कर्ण शष्कुली (**कर्णपाली**- Pinna of ear, बाह्य कर्ण का फनल के आकार का चौड़ा भाग) तथा दो कर्णपुत्रक (Tragus) बताये हैं।

२. **अंतरिक्षास्तु– शब्दः शब्देन्द्रियं सर्वच्छिद्र समूहो विविक्तता च ।** (सु.शा. १/२६)

पंचमहाभूतों से उत्पन्न होने वाले भावों का वर्णन करते समय आचार्य सुश्रुत ने आकाश महाभूत से शब्द एवं शब्देन्द्रिय की उत्पत्ति बताई है।

३. **''कर्णनेत्र-भ्रू-शंख ..... बाहुरू प्रभृतयो द्वे द्वे ।''** (सु.शा. ५/४)

मनुष्य के प्रत्यंगों के वर्णन में सुश्रुताचार्य ने दो कर्णों को बताया है।

४. **''श्रोत्र-त्वक्-चक्षु-जिह्वा-घ्राण ..... पंचबुद्धीन्द्रियाणि।''** (सु.शा. १/६)

इन्द्रियों का वर्णन करते समय पंच ज्ञानेन्द्रियों में श्रोत्र को भी एक ज्ञानेन्द्रिय माना गया है।

५. **''श्रवण-नयन-वदन-घ्राण-गुद-मेढ्राणि नव स्त्रोतांसि नराणां बहिर्मुखानि।''** (सु.शा. ५/१०)

शरीर के बहिःमुख स्त्रोतसों का वर्णन करते समय उनमें दो कर्ण बताये हैं।

६. **''घ्राण-कर्ण-ग्रीवा-अक्षिकोषेषु तरूणानि।''** (सु.शा. ५/२२)

आचार्य सुश्रुत ने अस्थियों के प्रकारों को बताते हुए नासा-कर्ण-ग्रीवा एवं अक्षिकोटर में तरूणास्थियाँ होती हैं। ऐसा कहा है।

७. **''गण्ड कर्ण शंखेषु एकैकं।''** (सु.शा. ५/२१)

अस्थियों की सन्धियों का वर्णन करते समय गण्ड-कर्ण एवं शंख में एक-एक सन्धि होती है। ऐसा आचार्य सुश्रुत कहते हैं।

८. **''श्रोत्र श्रंगाटकेषु शंखावृताः ।''** (सु.शा. ५/३२)

सन्धियों के प्रकारों का वर्णन करते समय आचार्य सुश्रुत ने श्रोत्र एवं श्रंगाटक में शंखावर्त सन्धियाँ होती हैं। ऐसा उल्लेख किया है।

The Ear

- The ear is an organ of hearing.
- It is also concerned in maintaining the equilibrium (a state of balance) of the body.
- It consists of three part–1. The external ear– Outer.
  2. The middle ear– Tympanic cavity or middle.
  3. The internal ear– Inner or labyrinth.

(1) External ear–

1. Auricle (Pinna)– Helix (Superior), and lobule (Inferior)
2. External auditory meatus (Canal)
3. Eardrum (Tympanic membrane)

(2) Middle ear–

1. Tympanic antrum
2. Auditory tube
3. Auditory ossicles– 1. Malleus (Hammer)
   2. Incus (Anvil)
   3. Stapes (Stirrup)

(3) Internal ear or labyrinth–

It consists of two main division– 1. Bony labyrinth (Outer)
2. Membranous labyrinth (Inner)

1. Bony labyrinth– It can be divided three areas–

1. Vestibule - Middle
2. Semicircular canal - Posteriorly and superiorly
3. Cochlea - Anteriorly

1. External ear–

- The external ear collects sound waves and channels them inward.

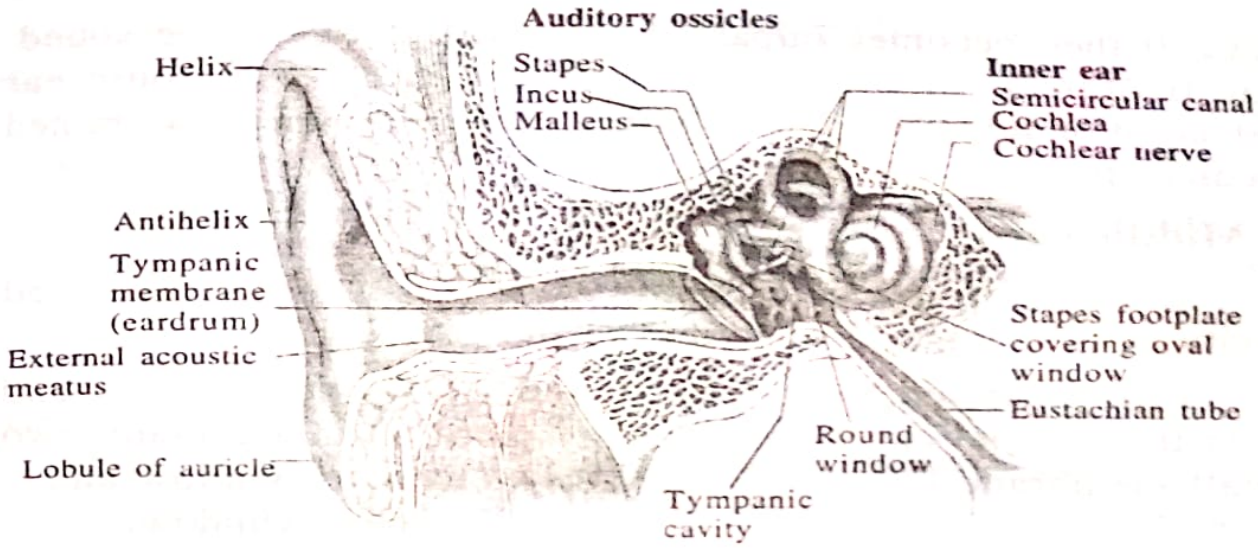


Fig. 9.1 Ear structures

- It consists of the auricle, external auditory meatus (canal) and eardrum (Tympanic membrane).

(A) The auricle (pinna) is a flap of elastic cartilage shaped like the flared and of a trumpet and covered by skin. The rim of the auricle is called the helix.

The inferior portion is the lobule.

The auricle is attached to the head by ligament and muscles.

(B) External auditory meatus is a covered tube about 2.5 cm. long that lies in the temporal bone and leads from the auricle to the eardrum.

(C) Eardrum or tympanic membrane is a thin, semitransparent partition B/W the external auditory canal and middle ear. The eardrum is covered by epidermis and lined by simple cuboidal epithelium.

B/W the epitheliar layers is connective tissue composed of collagen and elastic fibers and fibroblasts.

Near the exterior opening, the external auditory canal/contains a few hairs and specialized sebaceous (oil) glands called ceruminous glands that secrete cerumen. The combination of hairs and cerumen helps prevent dust and foreign objects from entering the ear.

Usually, cerumen dries up and falls out of the ear canal. Some people, however, produce an abnormal amount of cerumen (ear

vax). It then becomes impacted and muffles in coming sound. The treatment for impacted cerumen is usually periodic ear irrigation or removal of wax with a blunt instrument by trained medical person.

2. Middle ear–

The middle ear or tympanic cavity is a small, air filled cavity in the temporal bone that is lined by epithelium.

It is separated from the external ear by the eardrum and from the internal ear by a thin bony partition that contains two small membrane - covered openings– The oval window and the round window.

The posterior wall of the middle ear communicates with the mastoid air cells of the temporal bone through a chamber called the tympanic antrum.

The anterior wall of the middle ear contains an opening that leads directly into the auditory (Eustachian) tube. The auditory tube consists of both bone and hyaline cartilage and connects the middle ear with the nasopharynx (upper portion of the throat). It is normally closed at its medial (pharyngeal) end, during swallowing and yawning, it open. Then atmospheric air from the throat enters or leaves the middle ear until the internal pressure equals the external pressure. When the pressure are balanced. The eardrum vibrates freely as sound waves strike it. If the pressure is not equalized, intense pain, hearing impairment, ringing in the ears and vertigo could develop. Sudden pressure changes against the eardrum may be equalized by yawning. Swallowing or pinching the nose closed, closing the mouth and gently forcing air from the lungs into the nasopharynx. The auditory tube also is a route whereby pathogens may travel from the nose and throat to the middle ear.

Extending across the middle ear and attached to it by ligaments are three tiny bones called auditory ossicles. The bones named for their shapes, are the **malleus, incus** and **stapes.** They are connected by synovial joints. The handle of the malleus is attached to the internal surface of the eardrum. Its head articulate with the

body of the incus. The incus is the intermediate bone in the series and articulates with the head of stapes. The base of foot plate of the stapes. Fits into a membrane-covered opening in the thin bony partition B/W the middle and inner ear. The opening is called the oval window.

Directly below the oval window is another opening, the round window. This opening is enclosed by a membrane called the secondary tympanic membrane.

Auditory ossicles–

(A) Malleus (Hammer)–
- Largest ear bone.
- Placed on the lateral side.

Parts– 1. Head 2. Neck 3. Anterior process 4. Lateral process 5. Handle

(B) Incus (Anvil)–
- It resembles a molar tooth.
- Used by blacksmith.

Parts– 1. Body 2. Long process 3. Short process

(C) Stapes (Stirrup)–
- Smallest ear bone.
- Placed on the medial side.

Parts– 1. Head 2. Neck
3. Two limbs or crura ┌ Anterior
└ Posterior
4. Foot plate (Base)

Muscles–
1. Tensor tympani muscle– Mandibular branch of trigeminal nerve.
2. Stapedius muscle– Facial nerve.

Ligaments–

1. Posterior ligament of incus
2. Superior ligament of malleus
3. Lateral ligament of malleus
4. Anterior ligament of malleus
5. Annular ligament of base of stapes

3. Interior ear

- The internal ear is also called the labyrinth because of its complicated series of canals.

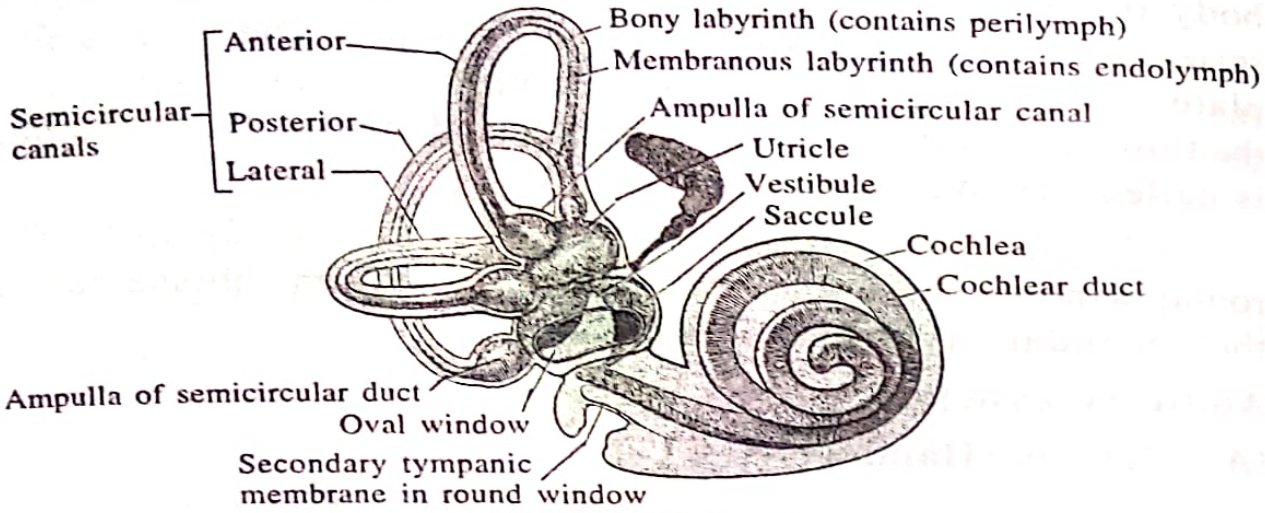


Fig. 9.2 Internal ear

- Structurally, it consists of two main division an outer bony labyrinth that encloses an inner membranous labyrinth.

The bony labyrinth is a series of cavities in the petrous portion of the temporal bone.

It can be divided into three areas–

(1) The semicircular canals

(2) The vestibule

- Both of which contain receptors for equilibrium.

(3) The cochlea.

- Which contains receptor for hearing.
- The bony labyrinth is lined with periosteum and contains a fluid called **perilymph.** This fluid, which is chemically similar to C.S.F.
- Surrounds the membranous labyrinth, a series of sacs and tubes inside the bony labyrinth and having the same general form. The membranous labyrinth is lined with epithelium and contains a fluid called **endolymph,** which is chemically similar to intracellular fluid.

(1) Vestibule–

- The vestibule is the oval central portion of the bony labyrinth.
- The membranous labyrinth in the vestibule consists of two sac called the **utricle** (little bag) and **saccule** (little sac).
- These structures are connected to each other by a small duct.

(2) Semicircular canals–

Projecting superiorly and posteriorly from the vestibule are the three bony semicircular canals. Each lies at approximately right angles to the other two. Based on their positions, they are called the anterior, posterior and lateral canals.

The anterior and posterior semicircular canals are oriented vertically, the lateral one is oriented horizontally. One end of each canal is a swollen enlargement called the ampulla (little jar). The portions of the membranous labyrinth that lie inside the bony semicircular canals are called the semicircular ducts (membranous semi circular canals). These structures communicate with the utricle of the vestibule.

(3) Cochlea–

- Anterior to the vestibule is the cochlea (snail's shell). This bony spiral canal resembles a snail's shell and makes almost three turns around a central bony core called the modiolus.

*** Structures of the ear related to hearing and equilibrium**

(1) External ear–

(A) Auricle (pinna)– Collects sound waves.

(B) External auditory canal– Directs sound waves to eardrum.

(C) Ear drum– Sound waves cause it to vibrate, which in turn, causes the malleus to vibrate.

(2) Middle ear–

(A) Auditory ossicles– Transmit and amplify vibration from tympanic membrane to oval window.

(B) Auditory tube– Equalizes air pressure on both sides of the tympanic membrane.

(3) Internal ear–

(A) Cochlea– Contains a series of fluids, channels and membranes that transmit vibrations to the spiral organ (organ of corti) the organ of hearing; hair cells in the spiral organ produce receptor potentials, which elicit nerve impulses in the cochlear branch of the vestibulocochlear nerve.

(B) Semicircular ducts– Contain cristae, site of hair cells for dynamic equilibrium.

(C) Utricle– Contains macula, site of hair cells for static and dynamic equilibrium.

(D) Saccule– Contains macula, site of hair cells for static and dynamic equilibrium.

(२) स्पर्शन-त्वचा (Skin)

(A) According to ayurveda–

१. **परिभाषा–** सम्पूर्ण शरीर के अंग-प्रत्यंगों को बाहर से आवृत (ढकने) करने वाला एवं शरीर में सर्वप्रथम दिखाई देने वाला अंग त्वचा है।

२. **उत्पत्ति–** "तस्य खलु एवं प्रवृत्तस्य शुक्र शोणितस्य अभिपच्यमानस्य, क्षीरस्येव सन्तानिका:, सप्त त्वचा भवन्ति ।" (सु.शा. ४/४)

जैसे दूध के उबलने से मलाई बनती है, उसी प्रकार निश्चित रूप से प्रवृत्त हुए शुक्र-शोणित के अभिपाच्य से त्वचा बनती है। सात त्वचाएँ होती हैं।

३. **स्वरूप–** त्वचा मृदु-कठिन-खुरदरी-अल्प केश युक्त-अधिक केश युक्त या रोमयुक्त-स्निग्ध-रूक्ष, स्वभावत: शीत या उष्ण, पतली या मोटी होती है।

४. **वर्ण–** यह त्वचा कृष्ण-श्याव-रक्त-पीत ऐसे विभिन्न वर्णों की होती है।

५. **भेद–** आचार्य चरक के अनुसार त्वचाएँ छ: प्रकार की होती हैं।

(I) उद्कधरा– त्वचा के बाहरी मार्ग में होती है। यह जल को धारण करती है।

(II) असृग्धरा– यह रक्त को धारण करती है।

(III) सिध्म-किलास– यह सिध्म व किलास रोगों को धारण करती है।

(IV) दद्रु-कुष्ठ– यह दद्रु व कुष्ठ की उत्पत्ति का स्थान है।

(V) अलजी-विद्रधि– यह अलजी व विद्रधि की उत्पत्ति का स्थान है।

(VI) षष्ठी त्वचा– इसके काटने या कटने से अंधकार छा जाता है।

आचार्य सुश्रुत के अनुसार त्वचाएँ सात प्रकार की होती हैं।

१. **अवभासिनी–** प्रथम अवभासिनी नामक त्वचा है, जो सभी वर्णों को प्रकट करती है और पाँच प्रकार की छाया को प्रकाशित करती है। वह व्रीहि के १८वें भाग के समान मोटी होती है। इसमें सिध्म, पद्मकण्टक आदि रोग होते हैं।

२. **लोहिता–** द्वितीय त्वचा का नाम लोहिता है। वह व्रीहि के १६वें भाग के बराबर मोटी होती है। इसमें तिलकाल्क, न्यच्छ, व्यङ्ग आदि रोग होते हैं।

३. श्वेता– तृतीय त्वचा का नाम श्वेता है। वह ब्रीहि के १२वें भाग के बराबर मोटी होती है। उसमें चर्मदल, अजगल्लिका, मषक आदि रोग होते हैं।

४. ताम्रा– चतुर्थ त्वचा ताम्रा नाम की है। वह ब्रीहि के ८वें भाग के बराबर मोटी होती है। उसमें अनेक प्रकार के किलास और कुष्ठ रोग होते हैं।

५. वेदिनी– पंचम त्वचा का नाम वेदिनी है। वह ब्रीहि के ५वें भाग के बराबर मोटी होती है। इसमें कुष्ठ और विसर्प रोग होते हैं।

६. रोहिणी– षष्ठी त्वचा का नाम रोहिणी है। वह ब्रीहि के बराबर मोटी होती है। इसमें ग्रन्थि, अपची, अर्बुद, श्लीपद और गलगण्ड आदि रोग होते हैं।

७. मांसधरा– सप्तमी मांसधरा नाम की त्वचा है। इसकी मोटाई दो ब्रीहि के बराबर होती है। इसमें भगन्दर, विद्रधि, अर्श आदि रोग होते हैं।

६. त्वचा के कार्य–

१. स्पर्श ज्ञान– शीत-उष्ण आदि का ज्ञान ।

२. शरीर की तथा अंग-प्रत्यंगों की सुरक्षा करना।

३. स्रवण करना– त्वचा की स्नेह ग्रन्थियों से एक स्निग्ध द्रव पदार्थ का स्रवण होता रहता है, जिससे त्वचा को स्निग्ध रखा जाता है।

४. नि:स्सरण करना– स्वेद रूपी मल का नि:स्सरण त्वचा के द्वारा होता है।

५. शोषण करना– त्वचा में स्थित असंख्य छिद्रों द्वारा, त्वचा पर लगाये गये स्निग्ध और द्रवरूप द्रव्य का अन्ततः ग्रहण किया जाता है।

(B) According to modern–

1. Introduction– The skin is the largest organ of the body. The average thickness of the skin is about 2 mm.

2. Types of skin– The skin is made up of two layers.

(I) Outer layer– Epidermis
(II) Inner layer– Dermis

(I) Epidermis– It does not have blood vessels. The nutrition is provided by the capillaries of dermis. It has five layers.

1. Stratum corneum (Horney layer)–Thick and non hairy skin.
2. Stratum lucidum– Thin and hairy skin.
3. Stratum granulosum– Thin and hairy skin.
4. Stratum spinosum or malphgian.
5. Stratum germinatum or stratum basal or germinal layer.

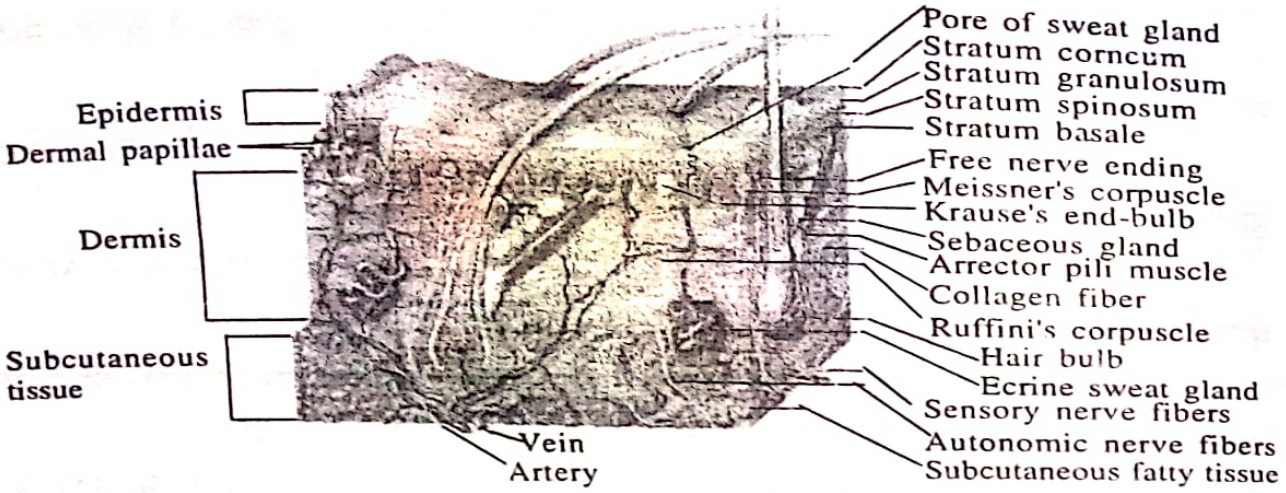


Fig. 9.3 Skin

(II) Dermis– It is made up of connective tissue. It bears blood vessels, lymphatic and nerve supply. It has two layers.

1. Superficial papillary layer.
2. Deeper reticular layer.

3. Function of the skin–

1. Protective function.
2. Strorage function.
3. Regulation of body temperture.
4. Role of skin as sense organ.
5. Synthesis of vitamin-D.
6. Absorptive function.
7. Secretory function.
8. Regulation of water and electrolyte balance.
9. Excretory function.

(4) Colour of the skin–

1. Pigmentation of skin– Melanin.
2. Haemoglobin in the blood.

३. चक्षु-अक्षि (Eye)

(१) पर्याय– अक्षि, चक्षु, दृष्टि, चक्षुरिन्द्रय, दर्शनेन्द्रिय।

(२) नेत्रगोलक (अक्षिगोलक– Eye-ball) की उत्पत्ति एवं स्थिति–

नेत्र गोलक गोल, गोस्तन के आकार का, पंचमहाभूतों से निर्मित अवयव है।

इसमें–
- पृथ्वी से– मांसल भाग
- अग्नि से– रक्तवर्ण का भाग
- वायु से– कृष्ण भाग
- जल से– श्वेत भाग
- आकाश से – अश्रु मार्गों की उत्पत्ति होती है।

नेत्र में दोषों की स्थिति निम्नानुसार है–
- प्राणवायु– रूप के ज्ञान को वहन करती है।
- व्यान वायु– गति या हलचल करती है।
- आलोचक पित्त– रूप का ग्रहण करता है।
- तर्पक कफ– नेत्र को प्रसन्न, स्वस्थ एवं गीला रखता है।

(३) नेत्र गोलक का प्रमाण–
- नेत्रगोलक की लम्बाई (आयाम)= २½ अंगुल= ५/२ अंगुल
- कृष्णमण्डल– नेत्र के आयाम का तृतीयांश= ५/२x१/३= ५/६ अंगुल
- दृष्टि– कृष्णमण्डल का सातवाँ भाग दृष्टि= ५/६x१/७= ५/४२ अंगुल

(४) नेत्र के विभाग–

मंडलानि च संधीश्च पटलानि च लोचने ।
यथाक्रमं विजानीयात् पञ्चषट् च षडेव च ।। (सु. उतर तन्त्र १/१४)

नेत्र में मण्डल पाँच, सन्धियाँ छः और पटल छः होते हैं।

* **मण्डल–५**

पक्ष्म – वर्त्म – श्वेत – कृष्ण – दृष्टि

१. पक्ष्म मण्डल– Eye lashes
२. वर्त्म मण्डल– Eye lids
३. श्वेत मण्डल– Conjunctive
४. कृष्ण मण्डल– Cornea
५. दृष्टि मण्डल– Pupil-Lens-Iris

* **सन्धि– ६**

१. पक्ष्म वर्त्मगत सन्धि
२. वर्त्म श्वेतगत सन्धि
३. श्वेत कृष्णगत सन्धि
४. कृष्ण दृष्टिगत सन्धि
५. कनीनक सन्धि– Inner canthus
६. अपांग सन्धि– Outer canthus

* **पटल– ६**
- दो वर्त्मपटल– नेत्र के बाहर होते हैं।

- शेष चार पटल– नेत्र के अन्दर होते हैं।
- प्रथम– तेजोजलाश्रित पटल
- द्वितीय– मांसाश्रित पटल
- तृतीय– मेदोश्रित पटल
- चतुर्थ– अस्थि आश्रित पटल
- इन चारों पटलों की मोटाई दृष्टि के पञ्चम भाग के बराबर है–

  ५/४२x१/५= १/४२ अंगुल।

The Eye

(1) Definition of Ophthalmology–

- The study of the structure, function and disease of the eye is known as ophthalmology.

  [Opthalmos– Eye, Logus– Study of]

- A physician who specializes in the diagnosis and treatment of eye disorders with drugs, surgery and corrective lenses is known as an ophthalmologist.

(2) The structures related to vision– are the eyeball, the optic nerve, the brain and several accessory structures of the eye.

(3) Accessory structures of the eye– are eyelids, eyelashes, eye-brows, lacrimal (tearing) apparatus and extrinsic eye muscles.

(4) Surface anatomy of the eye– are eyebrows, eyelids (palpebrae), eyelashes, pupil, iris, cornea, sclera, conjunctiva.

(5) Lacrimal apparatus–

Flow of tears–

Lacrimal gland
↓
Excretory lacrimal duct
↓
Superior and inferior lacrimal canal
↓
Lacrimal Sac
↓
Naso lacrimal duct
↓
Nasal cavity

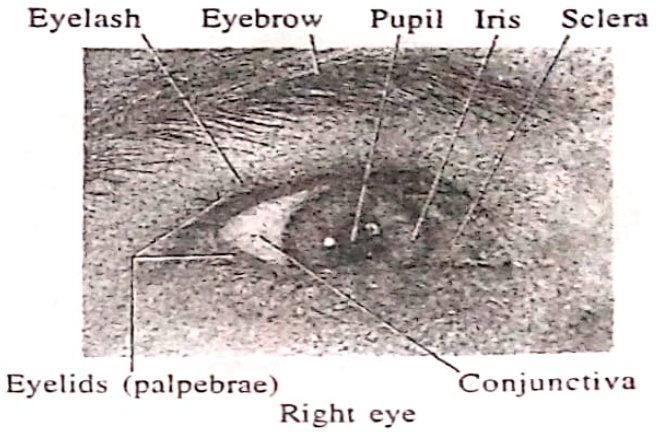


Fig. 9.4 Surface anatomy of eye

Fig. 9.5 Lacrimal apparatus

(6) Muscles of eye ball and eyelids–

1. Extrinsic muscles of eye ball–

* Four recti muscles–
  1. Superior rectus muscles– Oculomotor nerve.
  2. Inferior rectus muscles– Oculomotor nerve.
  3. Medial rectus muscles– Oculomotor nerve.
  4. Lateral rectus muscles– Abducens nerve.
* Two oblique muscles–
  1. Superior oblique muscles– Trochlear nerve
  2. Inferior oblique muscles– Oculomotor nerve

2. Muscles of eye lids–

1. Orbicularis oculi muscles– Facial nerve.
2. Levator palpebrae superioris muscles– Oculomotor nerve.

(7) Anatomy of eye ball–

- The eyeball is the organ of sight. It measures about 2.5 cm. in diameter.

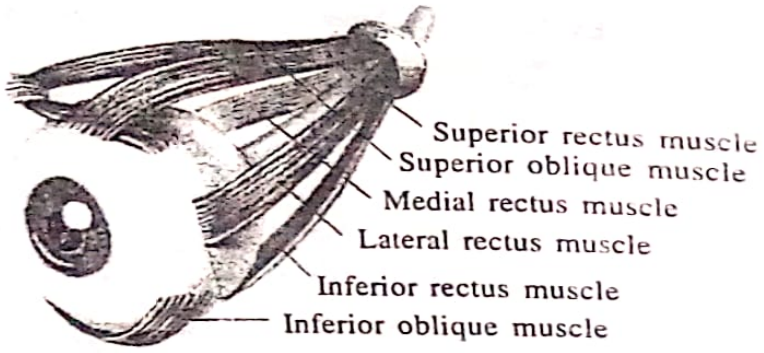


Fig. 9.6 Eye muscles

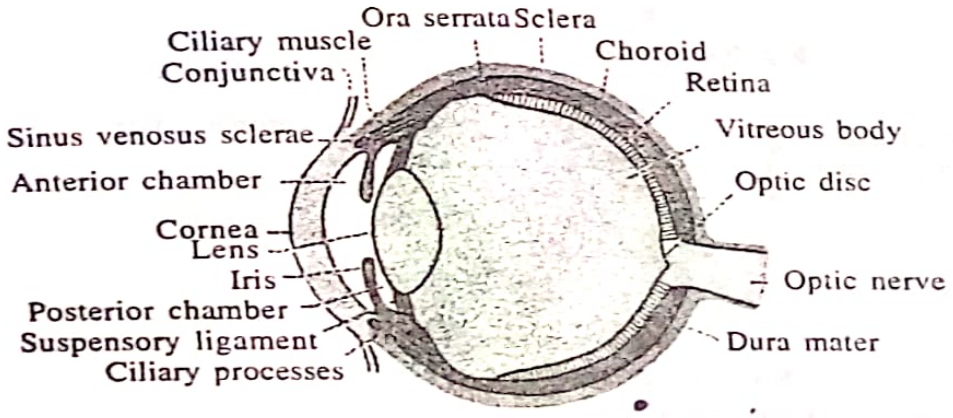


Fig. 9.7 Eye ball

- It closely resembles a camera in its structure. It is almost spherical in shape and has a diameter of about 2.5 cm.
- Anatomically, the wall of the eyeball can be divided into three layers.
  1. Fibrous tunic/coat/outer layer– Sclera (post. 5/6), cornea (ant. 1/6)
  2. Vascular tunic/coat/middle layer– Choroid, ciliary body, iris
  3. Nervous tunic/coat/inner layer– Retina

1. Fibrous coat– The fibrous tunic is the superficial coat of the eyeball. It is avascular and consists of the anterior cornea and posterior sclera.

The cornea is a nonvascular, transparent coat that covers the coloured iris. Because it is curved, the cornea helps focus light. Its outer surface consists of nonkeratinized stratified squamous epithelium.

The middle coat of the cornea consists of collagen fibers and fibroblasts. The inner surface is simple squamous epithelium.

The sclera (hard), the white of the eye, is a coat of dense connective tissue made up mostly of collagen fibers and fibroblasts. The sclera covers all the eyeball except the cornea, gives shape to the eyeball, makes it more rigid, and protects its inner parts.

At the junction of the sclera and cornea is an opening known as the scleral venous sinus (canal of schlemm).

2. Vascular coat–

The vascular tunic is the middle layer of the eyeball. It has three portions– Choroid, ciliary body and iris. The highly vascularized choroid is the posterior portion of the vascular tunic and lines most of the internal surface of the sclera. It provides nutrients to the posterior surface of the retina. Melanocytes, which produce the dark pigment melanin, give the choroid a brown-black appearance.

In the anterior portion of the vascular tunic, the choroid becomes the ciliary body. It extends from the ora serrata, the jagged anterior margin of the retina, to a point just posterior to the sclero-corneal junction. The ciliary body consists of the ciliary processes and ciliary muscles. The ciliary processes are protrusions or folds on the internal surface of the ciliary body. They contain blood capillaries that secrete a watery fluid called aqueous humour. The ciliary muscle is a circular band of smooth muscle that alters the shape of the lens for near or far vision.

The iris (coloured circle) is the coloured portion of the eyeball and is shaped like a flattened donut. It is suspended B/w the cornea and the lens and is attached at its outer margin to the ciliary processes. It consists of circular and radial smooth muscle fibers. The hole in the centre of the iris is the pupil. A principal function of the iris is to regulate the amount of light entering the vitreous chamber of the eyeball through the pupil. When bright light stimulates the eye, parasympathetic neurons stimulate the circular muscles (constrictor or sphincter pupillae) of the iris to contract, causing a decrease in the size of the pupil (constriction).

In dim light, sympathetic neuron stimulate the radial muscles (Dilator pupillae) of the iris to contract, causing an

increase in the pupil's size (Dilation). These responses are autonomic reflexes.

(3) Nervous coat–

The third and inner coat of the eyeball, the **retina** (Nervous tunic) lines the posterior three-quarters of the eyeball and is the beginning of the visual pathway. By using an ophthalmoscope to peer through the pupil, one can see a magnified image of the retina and the blood vessels that course across its anterior surface.

Here blood vessels can be viewed directly and examined for pathological changes such as occur with hypertension or diabetes. Several landmarks are visible.

The optic disc is the site where the optic nerve exits the eyeball. Bundled together with the optic nerve are the central retinal artery, a branch of the ophthalmic artery and central retinal vein. Branches of the central retinal artery fan out to nourish the anterior surface of the retina. The central retinal vein drains blood from the retina through the optic disc.

- The macula lutea (Macula–spot and lutea– yellow) is in the exact centre of the posterior portion of the retina, at the visual axis of the eye.
- The central fovea, a small depression in the centre of the macula lutea.
- The optic disc is also called the blind spot.

* **Contents of eyeball–**

1. **Aqueous humour–** This is a clear fluid which fills the space B/w the cornea infront and the lens behind. (Anterior segment.)
2. **Vitreous body–** It is a colourless, jelly like transparent mass which fills the posterior segment of the eye ball.
3. **Lens–** It is a transparent bi-convex structure which is placed B/w the anterior and posterior segments of the eye.

* Structures of sagittal section through the eyeball

- Cornea
- Iris
- Choroid
- Sclera
- Ciliary body
- Retina

- Conjunctiva
- Lens
- Aqueous humour
  - Anterior chamber
  - Posterior chamber
- Ciliary muscles
- Ora serrata
- Optic disc (Blind spot)
- Macula lutea (yellow spot)
- Pupil
- Suspensory ligaments
- Ciliary processes
- Vitreous body
- Optic nerve
- Central retinal artery and vein
- Dural sheath

४. रसना-जिह्वा (Tongue)

(१) **पर्याय**– रसना, जिह्वा, जिह्विका, गोजिह्वा, वागिन्द्रिय, रसनेन्द्रिय।

(२) **परिचय**– यह मुखगुहा (Mouth cavity) में स्थित है। इसका पश्चिम सिरा (Posterior end) कंठिका अस्थि (Hyoid bone) से सम्बद्ध तथा स्थिर रहता है। पूर्व सिरा (Anterior end) खुला (Open) है और चल होता है।

- जिह्वा मांस निर्मित प्रत्यंग है।
- चारों ओर से यह श्लेष्मल कला से आच्छादित है।

(३) **उत्पत्ति**– "कफशोणित मांसानां सारो जिह्वा प्रजायते।" (सु.शा. ४/२७)

- कफ, रक्त, मांस के सार भाग से जिह्वा की उत्पत्ति होती है।

(४) **संख्या**– "एकागोजिह्विका.....।" (च.शा. ७/११)

- एक जिह्वा रसनेन्द्रिय का अधिष्ठान है।

(५) **आश्रय**–
- बोधक कफ का स्थान है– जिससे रस का ज्ञान होता है।
- प्राण वायु का स्थान है– प्राणवायु का वहन मस्तिष्क तक होता है।
- उदान वायु का स्थान है– इससे बोलने का ज्ञान होता है।

(६) **महाभूत**– जल (आप) तत्व प्रधान है।

(७) **गो यानि वाणी**– इसकी कारणभूत जिह्वा ही है, अतः इसे गोजिह्वा कहते हैं।

(८) आचार्य वाग्भट ने जिह्वा बंधन को प्राणायतन भी माना है।

(९) आचार्य सुश्रुत ने सात सीवनियों में से एक जिह्वा को माना है।

(१०) प्राकृत जिह्वा लम्बी तथा चौड़ी, चिकनी, पतली, पाटला के पुष्प के वर्ण की अर्थात् रक्त वर्ण की होनी चाहिए।

(११) दो पृष्ठ होते है– १. ऊर्ध्व पृष्ठ (Superior surface)
२. अध: पृष्ठ (Inferior surface)

(१२) कार्य–

- जिह्वा यह षड रसों का ज्ञान करने वाला, बोलने में सहायक, चबाने में सहायक, ग्रास निगलने में सहायक तथा लेह्य पदार्थों को चाटने वाला इन्द्रिय है।
- श्लेष्मलकला से आवृत होने के कारण आभ्यंतर औषधि प्रयोग देने के लिए यह एक मार्ग है। जिह्वा पर औषधि द्रव्य मलने से उनका तुरन्त शोषण होता है।
- अत: मर्माघात की अवस्था में, तन्द्रा, भ्रम, बेहोशी इन अवस्थाओं में जिह्वा द्वारा आभ्यन्तर औषधि देते हैं।

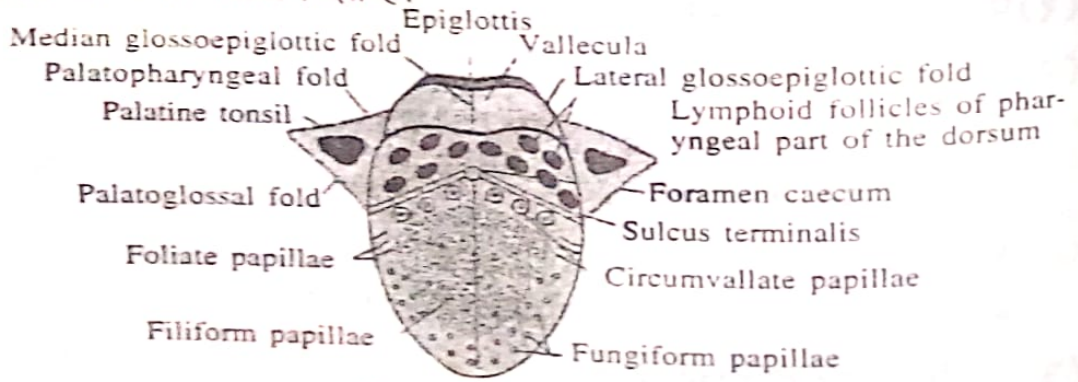


Fig. 9.8 Tongue

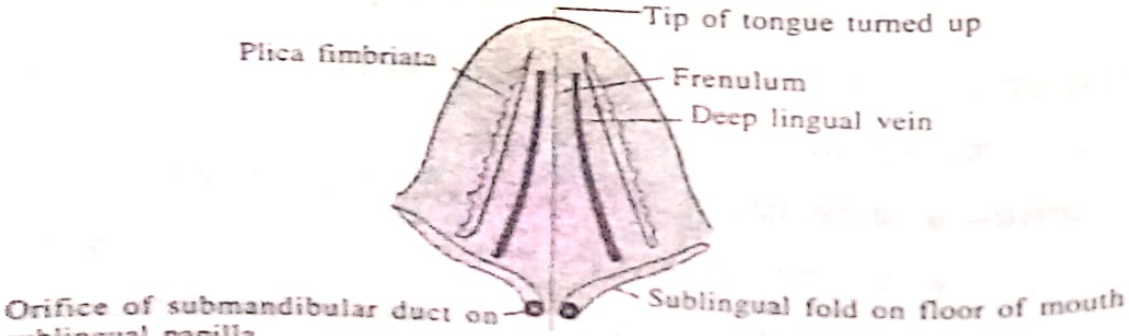


Fig. 9.9 Tongue

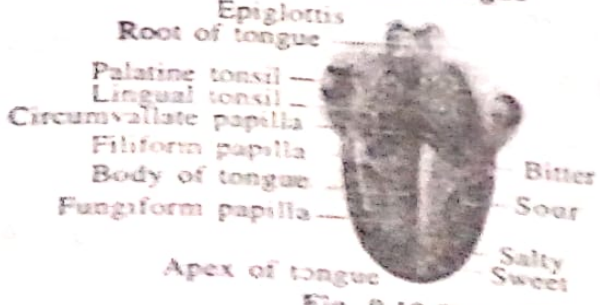


Fig. 9.10 Tongue

The Tongue

(1) Introduction– The tongue is a muscular organ covered with mucous membrane of mouth. It is associated with the function of taste, speech, mastication (chewing) and deglutition. (swallowing)

(2) External features– It has three parts.

1. Body 2. Root 3. Tip

1. Body of the tongue– It has two surfaces.

(I) Superior surface or dorsum– It is divided two parts–

(A) Oral part

(B) Pharyngeal part

(II) Inferior surface– Only oral part.

(I) Dorsum of the tongue– is convex in all direction, It is divided into– **An oral part–** Anterior 2/3, that lies in the mouth. **A pharyngeal part–** Posterior 1/3, that lies in the pharynx. The oral and pharyngeal parts are separated by a 'V'-shaped sulcus, the sulcus terminalis.

(A) The oral or papillary part of the tongue– is placed on the floor of the mouth. Its margin are free and in contact with gums and teeth.

- Just infront of the palatoglossal arch each margin shows four to five vertical folds, named the foliate papillae.
- The superior surface of the oral part shows a median furrow and is covered with papillae which make it rough–

Vallate papillae.

Fungiform papillae.

Filiform papillae.

(B) The pharyngeal (Lymphoid) part of the tongue– Lies behind the palatoglossal arches and the sulcus terminalis. Its posterior surface forms the anterior wall of the oropharynx. The mucous membrane has no papillae but has many lymphoid follicles that collectively constitute the lingual tonsil. Mucous gland are also present.

The posterior part of the tongue is connected to the epiglottis by three folds of mucous membrane. These are the median glossoepiglotic fold and the right and left lateral glossoepiglottic folds. On either side of median fold there is a pouch called the valleculla. The lateral folds separate the valleculla from the piriform fossa.

(II) The inferior surface (only oral part)–

It is covered with a smooth mucous membrane, which shows a median fold called the frenulum linguae.

- On either side of the frenulum there is a prominence produced by the deep lingual veins.
- More laterally there is a fold called the plica fimbriate, that is directed forwards and medially towards the tip of tongue.

(2) Root of the tongue– The root is attached to the mandible above and the hyoid bone below.

- In B/w the two bones it is related to the geniohyoid and mylohyoid muscles.

(3) Tip of the tongue– The tip of the tongue forms the anterior free end which, at rest, lies behind the upper part incisor teeth.

- Muscles of the tongue–
- A middle fibrous septum divides the tongue in to right and left halves.
- Each half contain four intrinsic and four extrinsic muscles.
- **Intrinsic muscles–** It is not attached the bone.

1. Superior longitudinal– Hypoglossal nerve.
2. Inferior longitudinal– " "
3. Transverse– " "
4. Vertical– " "

- **Extrinsic muscles–** • It is attached bones and palate.

1. Genioglossus– Attached tongue to mandible– Hypoglossal nerve.
2. Hyoglossus– Attached tongue to hyoid bone– " "
3. Styloglossus– Attached tongue to styloid process–" "

4. Palatoglossus– Attached tongue to palate– pharyngeal plexus.

* **Blood supply–**
  - Lingual artery branch of external carotid artery.
  - Tonsillar artery.
  - Ascending pharyngeal artery.
* **Venous drainage–**
  - Lingual vein.
  - Common facial vein.
* **Lymphatic drainage–**
  - Sub mental nodes.
  - Sub mandibular nodes.
  - Jugulo omohyoid nodes.
* **Nerve supply–**
  - Lingual nerve
  - Chorda tympani branch of facial nerve
  - Hypoglossal nerve
  - Glosso pharyngeal nerve
  - Vagus nerve

५. घ्राण-नासा (Nose)

(१) **पर्याय–** नासा, घ्राण, नासिका, गन्धेन्द्रिय, घ्राणेन्द्रिय।

(२) "नासा घ्राणेन्द्रिय स्थानम् ।"

नासा घ्राणेन्द्रिय का स्थान है।

(३) "नासा हि शिरसो द्वारम् ।"

- नासा शिर का द्वार है।
- शिरोरोगों में नस्य से औषधि दी जाती है।

(४) "नासायां त्रीणि ।" (सु.शा. ५/२१)

नासा में तीन अस्थियाँ होती हैं।

(५) "घ्राण गन्धास्थिपार्थिवम् ।"

घ्राण, गन्ध एवं अस्थि पृथ्वी तत्व से बने हैं।

(६) "मेदो घ्राणं च जिह्वा च कफस्य सुतरामुरः ।"

घ्राण में कफ का स्थान बताया है।

(७) "स्वांगुली प्रमाणेन चतुरंगुला नासिका ।"

नासिका का प्रमाण चार अंगुल होता है।

(८) "बहिः मुखे द्वे स्त्रोतांसि ।" (सु.शा. ५/१०)

बर्हिमुख स्त्रोतसों के वर्णन में दो नासा के स्त्रोतस हैं।

(९) "आभ्यन्तरतः तत्र फणे मर्माणि ।" (सु.शा. ६/२८)

नासा के अन्दर दोनों ओर फण मर्म रहते हैं।

(१०) नासा यह सीधी, बड़े छिद्र वाली, नासावंश स्पष्ट हो तथा नासाग्र किंचित् झुका हो, ऐसी नासा अच्छी मानी जाती है।

(११) **कार्य–** यह प्राणवह स्त्रोतस् का श्वासोच्छवास करने का मुख्य अंग है। तथा गन्ध का ज्ञान कराने वाला एक प्रमुख ज्ञानेन्द्रिय है।

The Nose

- The nose is consists of two portions–
  (1) External nose (External portion)
  (2) Nasal cavity (Internal portion)

(1) External nose–The external portion consists a following structure–

1. Root (Bridge)
2. Apex (Tip)
3. Dorsum
4. Nares (Nostril)
5. Columella
6. Nasal septum
7. Ala

1. **Root–** The upper narrow end of the nose (just below the forehead) is the root of the nose.
2. **Apex–** The lower end of the nose. (Rounded tip)
3. **Dorsum–** Rounded anterior border connecting root and apex.
4. **Nostril–** External opening into the nose.
5. **Columella–** The two nostril are separated by a soft median partition called the columella.
6. **Nasal septum–** This is continuous with the nasal septum which separates the two nasal cavities.

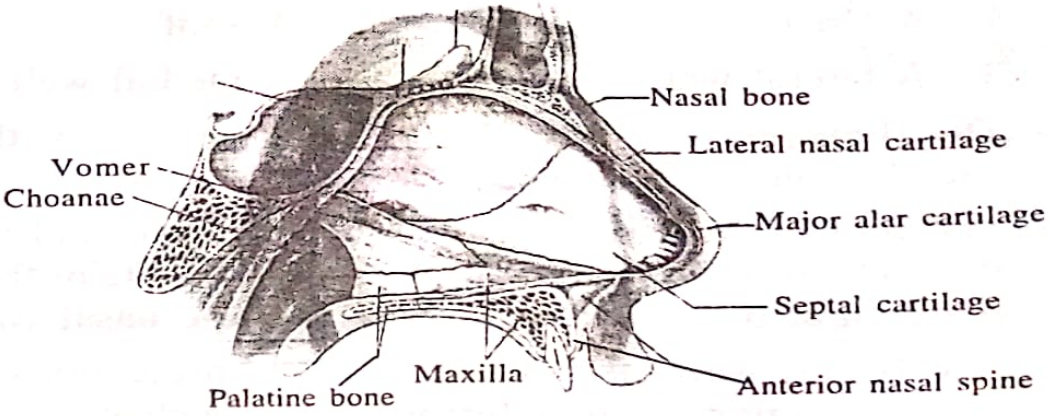


Fig. 9.11 Nasal septum

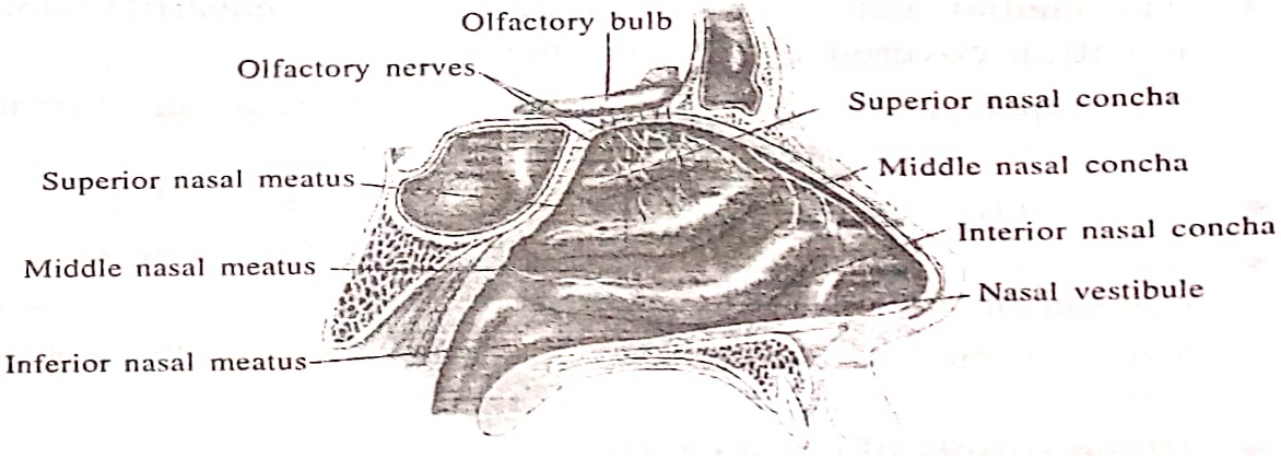


Fig. 9.12 Lateral wall of nose

7. **Ala**– Each nostril is bounded laterally by the ala.

- The external nose has a skeletal framework that is partly bony and partly cartilaginous.
- The framework of the external nose is made up above by the nasal bone. The frontal process of maxilla and the nasal part of the frontal bone.
- Below the framework is formed of plates of hyaline cartilage which include the upper and lower nasal cartilages and the septal cartilage.

(2) Internal portion (Nasal cavity)–

- It is divided into right and left halves by the nasal septum
- Each half has–

1. A floor
2. A roof
3. A lateral wall
4. A medial wall

1. The floor– is formed by the palatine process of the maxilla and the horizontal plate of the palatine bone.
2. The roof– is narrow and is formed from behind forward by the body of the sphenoid. The cribriform plate of the ethmoid, the frontal bone, the nasal bone and the nasal cartilages.
3. The lateral wall– is marked by three projections called the superior, middle and inferior nasal conchae.

   The area below each conchae is referred to as a meatus.
4. The medial wall or nasal septum– is an osteocartilaginous partition covered by mucous membrane.

   The upper part is formed by the vertical plate of the ethmoid and its posterior part is formed by the vomer.

- The anterior portion is formed by the septal cartilage.
- The mucous membrane lines the nasal cavities with the exception of the vestibules, which are lined by modified skin.

  The two types of mucous membrane are olfactory and respiratory.

* **Blood supply of nasal cavity–**
  - Sphenopalatine artery branch of maxillary artery.
  - Facial artery.
* **Venous drainage–**
  - Facial vein.
  - Pharyngeal plexus of veins.
  - Pterygoid plexus of veins.
* **Lymphatic drainage–**
  - Submandibular node.
  - Deep cervicle node.
* **Nerve supply–**
  - Olfactory nerve.
  - Trigeminal nerve.

अध्याय- १०

धमनी संस्थान
(Arterial System)

१. महाधमनी (Aorta)

(A) Introduction

The aorta is the largest artery of the body and has a diameter of 2-3 cm. It begins at the left ventricle and contains a valve at its origin, called the aortic semilunar valve, which prevent backflow of blood into the left ventricle during its diastole.

(B) Branches

The principal division of the aorta are the –

1. Ascending aorta → आरोही महाधमनी
2. Arch of aorta → तोरणी महाधमनी
3. Thoracic aorta → औरसी महाधमनी
4. Abdominal aorta → औदरी महाधमनी

Division of aorta	Arterial branches	Supplied
1. Ascending Aorta (आरोही महाधमनी)	1. Right coronary artery 2. Left coronary artery	Heart
2. Arch of aorta (तोरणी महाधमनी)	1. Brachiocephalic trunk → Right common carotid artery → Right subclavian artery	Rt. side of head & neck. Rt. upper limb.
	2. Left common carotid artery	Lt. side of head & neck.
	3. Left subclavian artery	Lt. upper limb
3. Thoracic aorta (औरसी महाधमनी)	1. Pericardial	Post. aspect of pericardium.

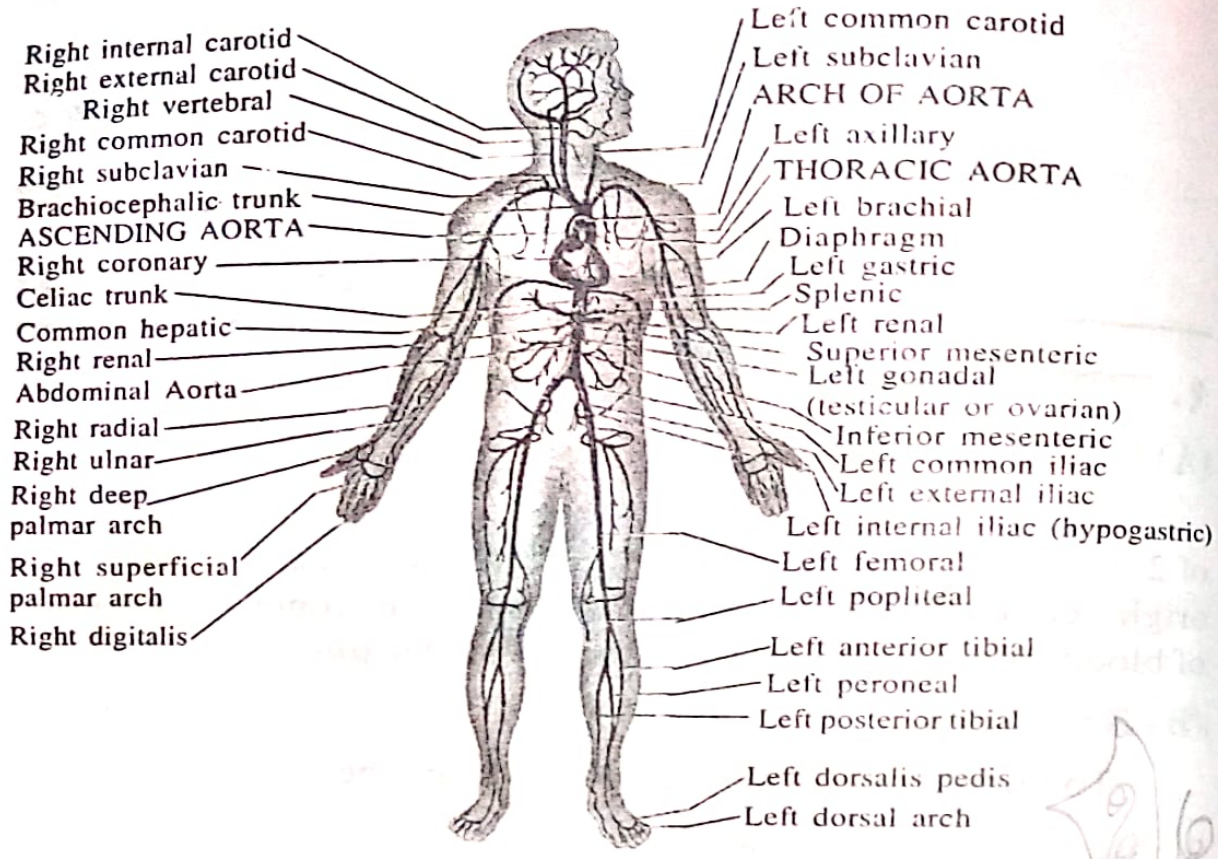


Fig. 10.1 Major arteries

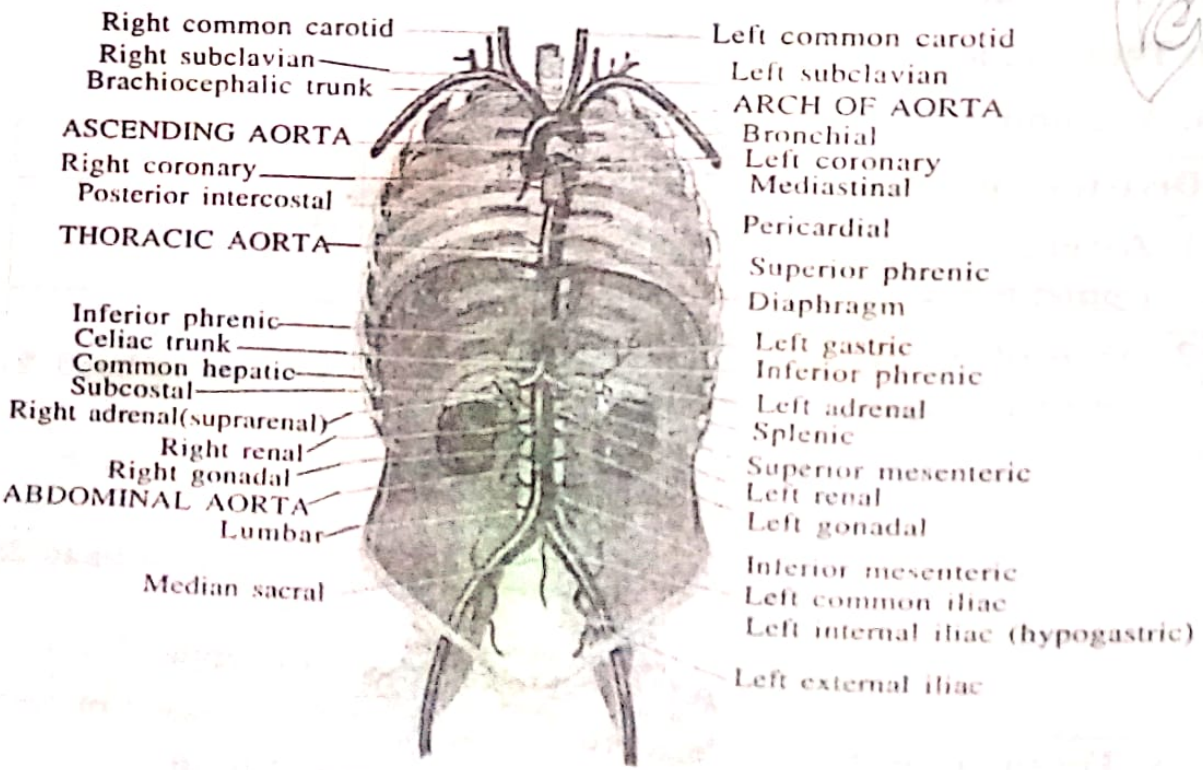


Fig. 10.2 Aorta and its branches

धमनी संस्थान

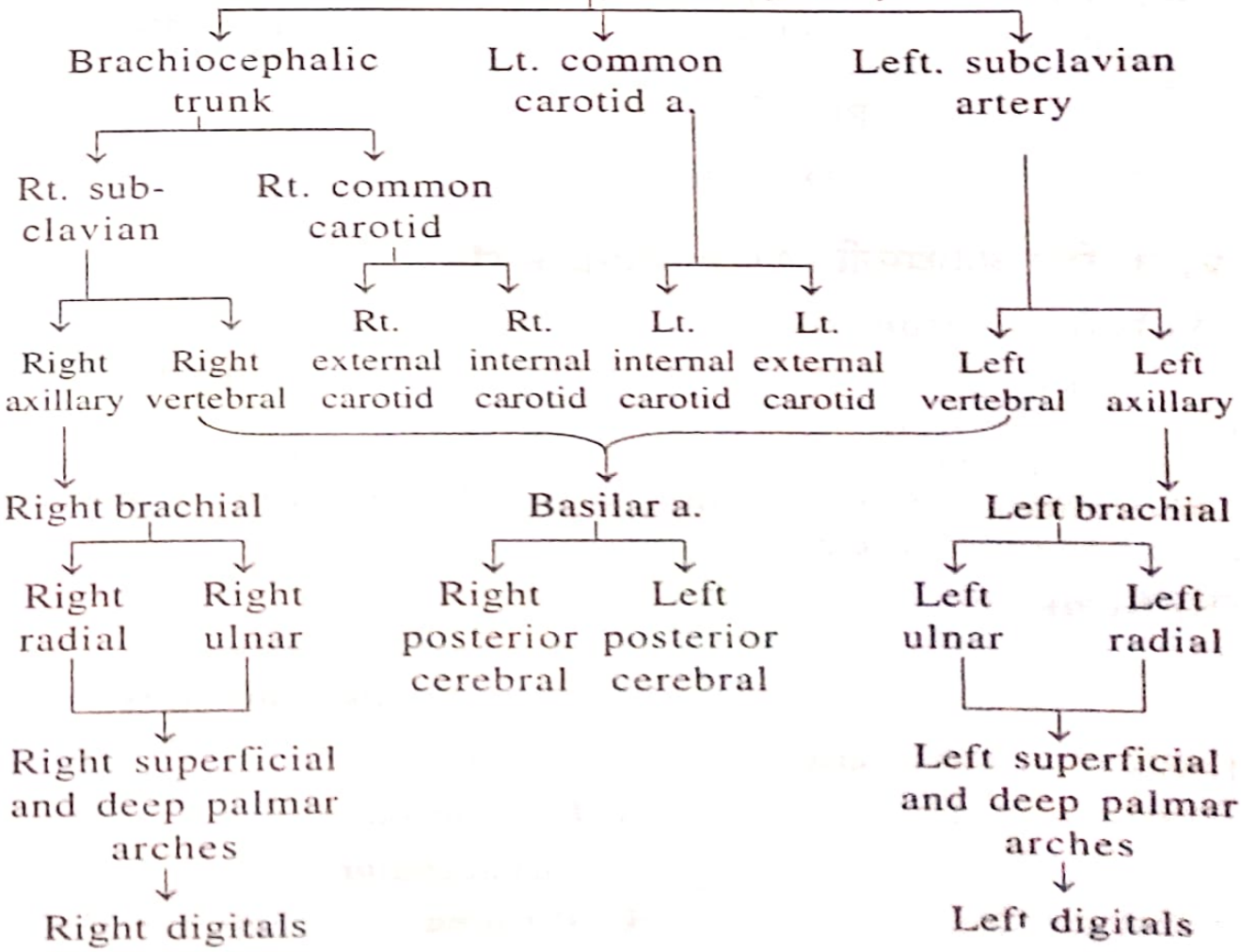
Division of aorta	Arterial branches	Supplied
	2. Bronchial	Bronchi of lungs
	3. Esophageal	Esophagus
	4. Mediastinal	Post. mediastinum
	5. Sup. phrenic	Post. and sup. surface of diaphragm
	6. Intercostals	Intercostal and chest muscles and pleura.
	7. Subcostal	Chest muscles and pleura.
4. Abdominal aorta (औदरी महाधमनी)	1. Inf. phrenic	Inf. surface of diaphragm.
	2. Coeliac– → Common hepatic → Left gastric → Splenic	Liver Stomach and esophagus Spleen, pancreas, stomach
	3. Sup. mesenteric	Small intestine, caecum, ascending colon, transverse colon and pancreas.
	4. Suprarenals	Adrenal (suprarenal) glands
	5. Renals	Kidneys
	6. Gonadals	
	1. Testicular	Testis
	2. Ovarian	Ovaries
	7. Inf. mesenteric	Transverse, descending, sigmoid colon and rectum.
	8. Lumbars	Spinal cord, its meninges, muscles and skin of lumbar region.

Division of aorta	Arterial branch	Supplied
	9. Common iliac	
	→ Ext. iliac	Lower limb
	→ Int. iliac	Uterus, prostate gland, U. bladder, muscles of buttock
	10. Median sacral	Sacrum, coccyx, rectum
• Coeliac trunk (कुक्षि धमनी)	1. Common hepatic	
	→ Rt. gastric	Stomach
	→ Gastroduodenal	Duodenum, stomach
	• Sup. pancreatico-duodenal	Duodenum, pancreas
	• Rt. gastroepiploic	Stomach
	→ Supraduodenal	Duodenum
	→ Cystic	Gall bladder
	2. Lt. gastric	Stomach
	3. Splenic	
	→ Pancreatic branches	Pancreas
	→ Short gastric arteries	Stomach
	→ Lt. gastroepiploic	Stomach
	→ Splenic branches	Spleen
• Superior mesenteric artery (ऊर्ध्व आन्त्रयोजनी धमनी)	1. Ileocolic	Appendix, caecum, lower 1/3 of ascending colon.
	→ Ant. caecal	Caecum
	→ Post. caecal	Caecum
	→ Appendicular	Appendix
	2. Rt. colic	Upper 2/3 of ascend ing colon
	3. Middle Colic	Rt. 2/3 of transverse colon
	• Inf. pancreaticoduodenal	Pancreas, duodenum

	4.Jejunals and ileals branches	Jejunum and ileum
• Inferior mesenteric artery (निम्न आन्त्रयोजनी धमनी)	1. Lt. Colic artery	Lt. 1/3 of transverse colon, descending colon
	2. Sigmoid arteries	Sigmoid colon
	3. Sup. rectal	Rectum
• Internal iliac artery (अन्त: जघनिका धमनी)	1. Sup. vesical artery	Urinary bladder
	2. Inf. vesical artery	Urinary bladder

Scheme of distribution

Arch of aorta (तोरणी महाधमनी)



Scheme of distribution

Abdominal aorta (औदरी महाधमनी)

- Right common iliac
  - Right external iliac
    - Right femoral
      - Right popliteal
        - Right anterior tibial
          - Right dorsalis pedis
        - Right posterior tibial
          - Right peroneal
          - Right medial and lateral plantar
  - Right internal iliac (hypogastric)
- Left common iliac

Plantar arch

Digitalis

२. आरोही महाधमनी (Ascending aorta)

(A) Introduction

It is the first division of the aorta, about 5 cm. in length. It is directed superiorly slightly anteriorly and to the right and ends at the level of the sternal angle, where it become the arch of the aorta. The beginning of the ascending aorta is hidden by the pulmonary trunk and right auricle.

(B) Branches

1. Right coronary artery (दक्षिण हृद्धमनी)
   1. Marginal
   2. Posterior interventricular
   3. Nodal
   4. Right atrial
   5. Infundibular
   6. Terminal

2. Left coronary artery (वाम हृद्धमनी)
   - 1. Anterior interventricular
   - 2. Left ventricle
   - 3. Diagonal
   - 4. Left atrial
   - 5. Pulmonary
   - 6. Terminal

३. तोरणी महाधमनी या महाधमनी चाप (Arch of aorta)

(A) Introduction

It is about 5 cm. in length and is the continuation of the ascending aorta. It emerges from the pericardium posterior to the sternum at the level of the sternal angle. The arch is directed superiorly, posteriorly, and to the left and than inferiorly on the left side of the body of the 4th thoracic vertebra.

Actually, the arch is directed not only from right to left but from anterior to posterior as well. The arch of the aorta ends at the level of the intervertebral disc B/W the 4th and 5th thoracic vertebrae, where it becomes the thoracic aorta. The thymus gland lies anterior to the arch of the aorta, while the trachea lies posterior to it.

(B) Branches

1. Brachiocephalic trunk (प्रगण्डशीर्ष धमनी)
2. Left common carotid artery (वाम महामातृका धमनी)
3. Left Subclavian artery (वाम अधोजत्रुक धमनी)

1. Brachiocephalic artery (प्रगण्डशीर्ष धमनी)

(A) Introduction–

It is found only on the right side, is the first and largest branch of the arch of aorta.

(B) Branches–

1. Right common carotid artery (दक्षिण महामातृका धमनी)
2. Right subclavian artery (दक्षिण अधोजत्रुक धमनी)

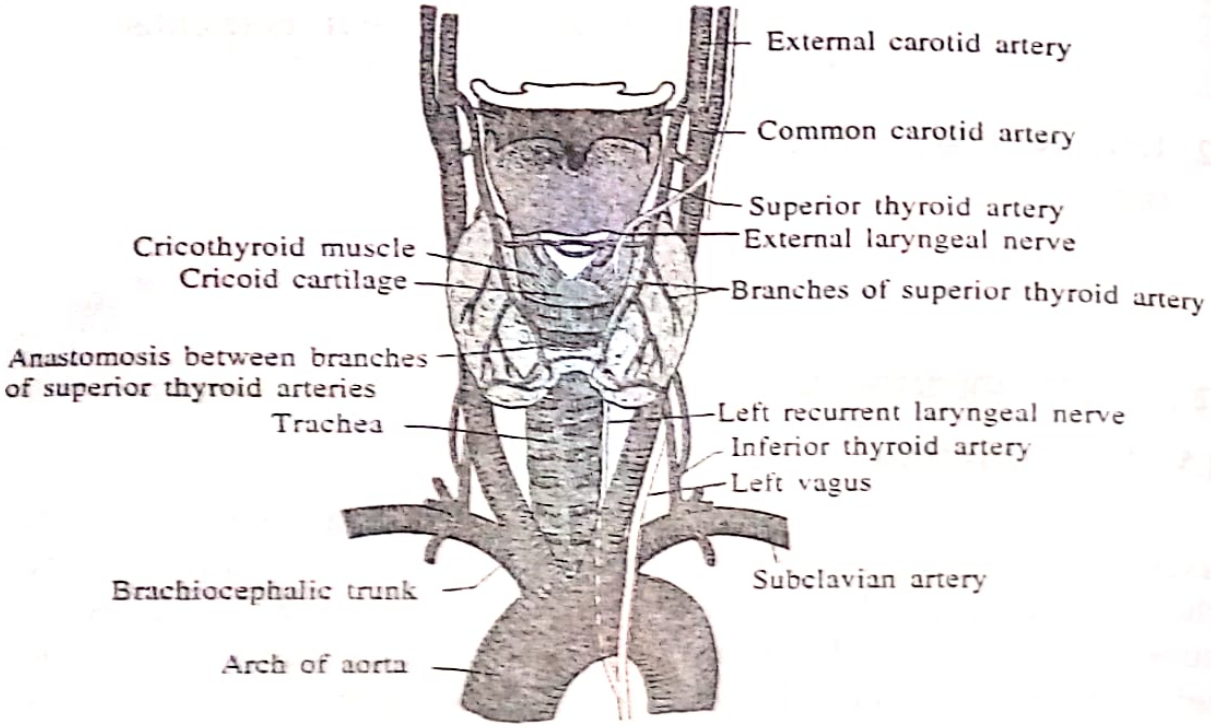


Fig. 10.3 Arch of aorta and its branches

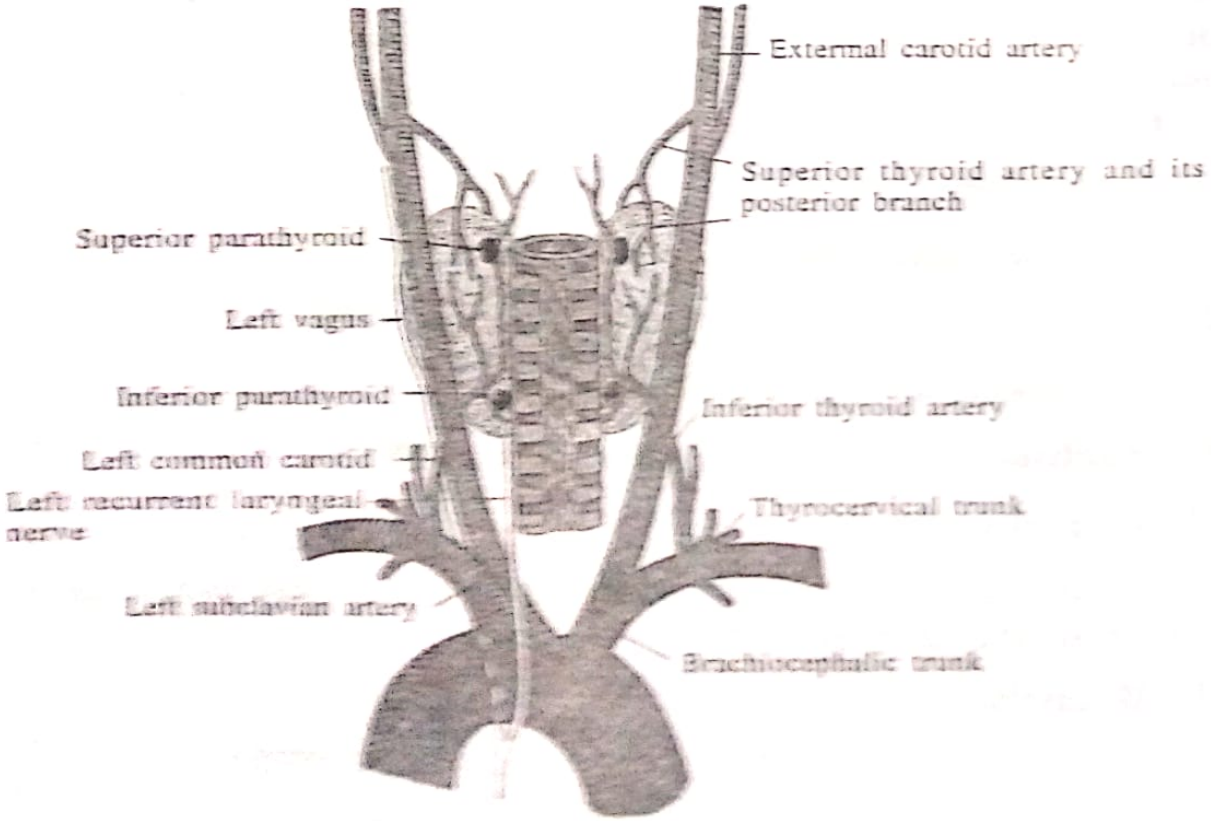


Fig. 10.4 Arch of aorta and its branches

४. सामान्य महामातृका धमनी (Common carotid artery)

Branches–

1. External carotid artery (बहि:मातृका धमनी)
2. Internal carotid artery (अन्त:मातृका धमनी)

५. बहि:मातृका धमनी (External carotid artery)

Branches–

1. Superior thyroid artery (ऊर्ध्व अवटु धमनी)
2. Ascending pharyngeal artery (आरोही ग्रसनी धमनी)
3. Lingual artery (जिह्वा धमनी)
4. Facial artery (आनन धमनी)
5. Occipital artery (पश्चकपाल धमनी)
6. Post. auricular artery (पश्च बहि: कर्ण धमनी)
7. Superficial temporal artery (उपरिस्थ शंखिक धमनी)
8. Maxillary artery (ऊर्ध्वहनु धमनी)

६. ऊर्ध्व अवटु धमनी (Superior thyroid artery)

Branches–

1. Anterior thyroid (अग्र अवटु)
2. Posterior thyroid (पश्च अवटु)
3. Infrahyoid (अवकण्ठिका)
4. Sternocleidomastoid (उरोजत्रुककर्णमूलिका)
5. Superior laryngeal (ऊर्ध्वस्वरयन्त्र)
6. Cricothyroid (मुद्रिका अवटु)

७. आरोही ग्रसनी धमनी (Ascending pharyngeal artery)

Branches–

1. Pharyngeal (ग्रसनी)
2. Palatine (तालु)
3. Inferior tympanic (अधोमध्यकर्ण)
4. Posterior meningeal (पश्च तानिका)

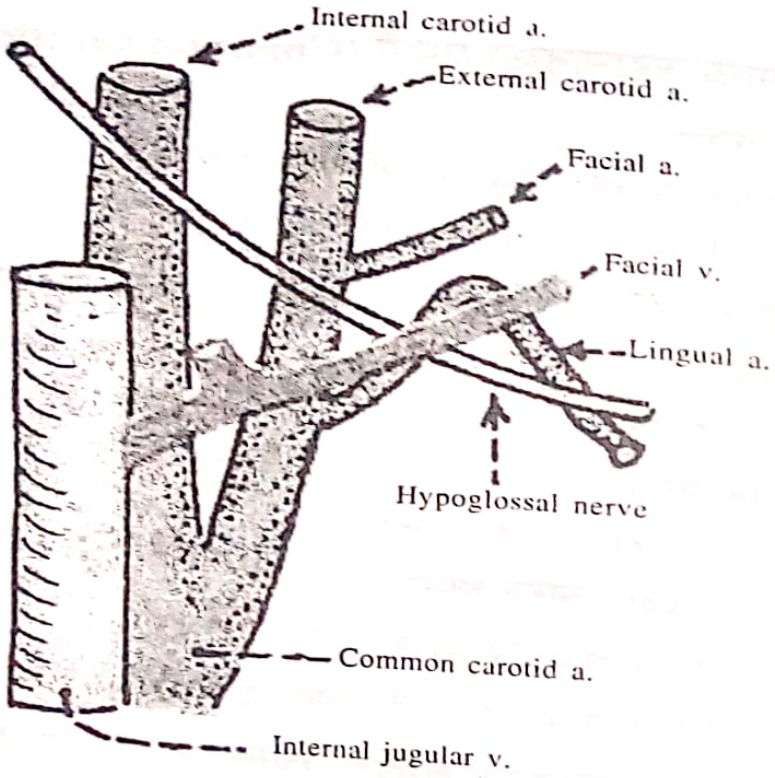


Fig. 10.5 Common carotid artery

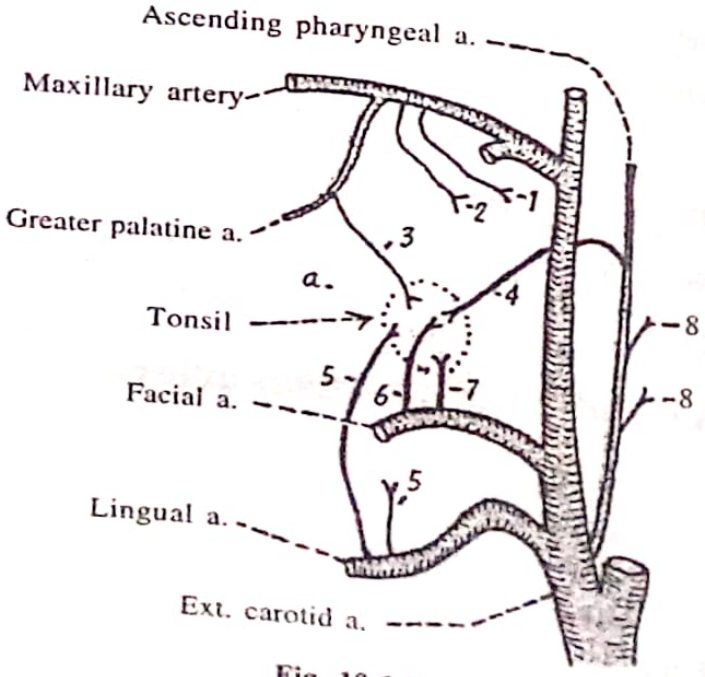


Fig. 10.6 Branches of external carotid artery

८. जिव्हा धमनी (Lingual artery)

Branches–

1. Suprahyoid (अधिकण्ठिका) 2. Dorsal lingual (अभिपृष्ठ जिव्हा)
3. Sublingual (अधोजिव्हा)

९. आनन धमनी (Facial artery)

Branches–

1. Ascending palatine (आरोही तालु) 2. Tonsilar (तुण्डीकेरी)
3. Glandular (लालास्रावी ग्रन्थि) 4. Submental (अवचिबुक)
5. Inferior labial (अधरोष्ठ) 6. Superior labial (ऊर्ध्वोष्ठ)
7. Lateral nasal (पार्श्वनासा)

१०. पश्चकपाल धमनी (Occipital artery)

Branches–

1. Sternocleidomastoid (उरोजत्रुककर्णमूलिका)
2. Mastoid (कर्णमूलिक)
3. Descending (अवरोही)
4. Auricular (बहि:कर्ण)
5. Meningeal (तानिका)
6. Occipital (पश्चकपाल)
7. Muscular branches (पेशी शाखाएँ)

११. पश्च बहि: कर्णधमनी (Posterior auricular artery)

Branches–

1. Muscular branches (पेशी शाखाएँ) 2. Stylomastoid (शरकर्णमूल)
3. Auricular (बहि: कर्ण) 4. Occipital (पश्चकपाल)

१२. उपरिस्थ शंखिक धमनी (Superficial temporal artery)

Branches–

1. Transverse facial (अनुप्रस्थ आनन)
2. Anterior auricular (अग्रबहि:कर्ण)

3. Zygomatico-orbital (गण्ड-नेत्रगुहा)
4. Middle temporal (मध्यशंखिक)
5. Frontal (ललाटिका)
6. Parietal (पार्श्वकपालिका)

१३. ऊर्ध्वहनु धमनी (Maxillary artery)

Sub-division–

(A) Mandibular portion (अधोहनु भाग)
(B) Pterygoid portion (पक्षाभिका भाग)
(C) Pterygopalatine portion (पक्षाभतालु भाग)

(A) अधोहनु भाग (Mandibular portion)

Branches–

1. Deep auricular (गम्भीर वहि:कर्ण)
2. Anterior tympanic (अग्रमध्य कर्ण शाखा)
3. Middle meningeal (मध्य तानिका)
4. Accessory meningeal (सहायक तानिका)
5. Inferior alveolar (अधोदन्त वेष्ट)

(B) पक्षाभिका भाग (Pterygoid portion)

Branches–

1. Deep temporal (गम्भीर शंखिक)
2. Pterygoid (पक्षाभिका)
3. Masseteric (चर्वणिका)
4. Buccinator (कपोलिका)

(C) पक्षाभतालु भाग (Pterygopalatine portion)

Branches–

1. Posterior superior alveolar (पश्च ऊर्ध्वदन्तवेष्ट)
2. Infraorbital (अवनेत्रगुहा)
3. Greater palatine (बृहद् तालु)
4. Pharyngeal (ग्रसनी)

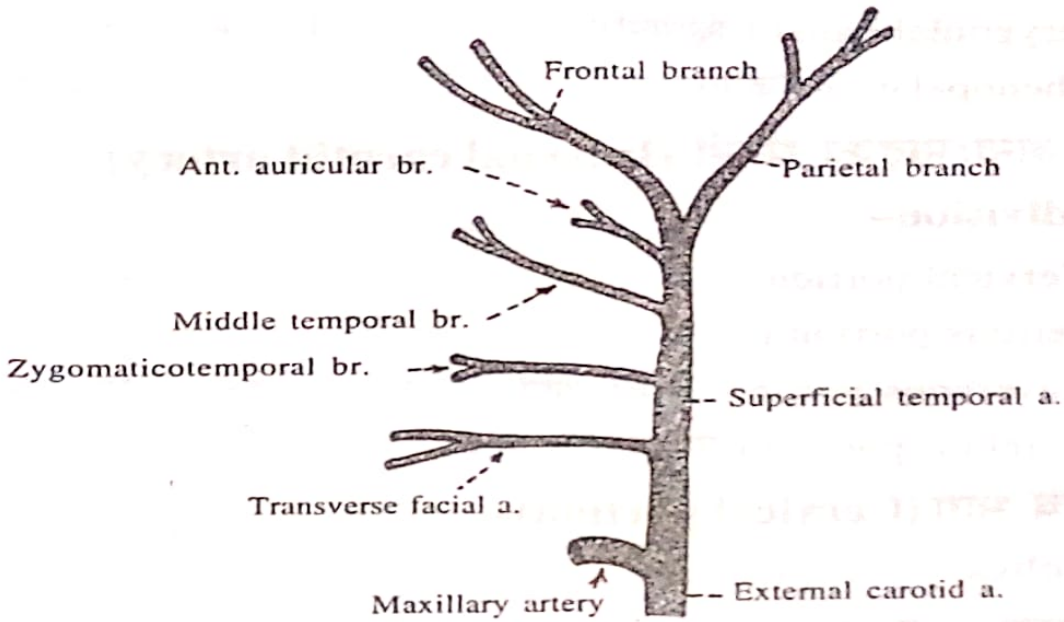


Fig. 10.7 Branches of superficial temporal artery

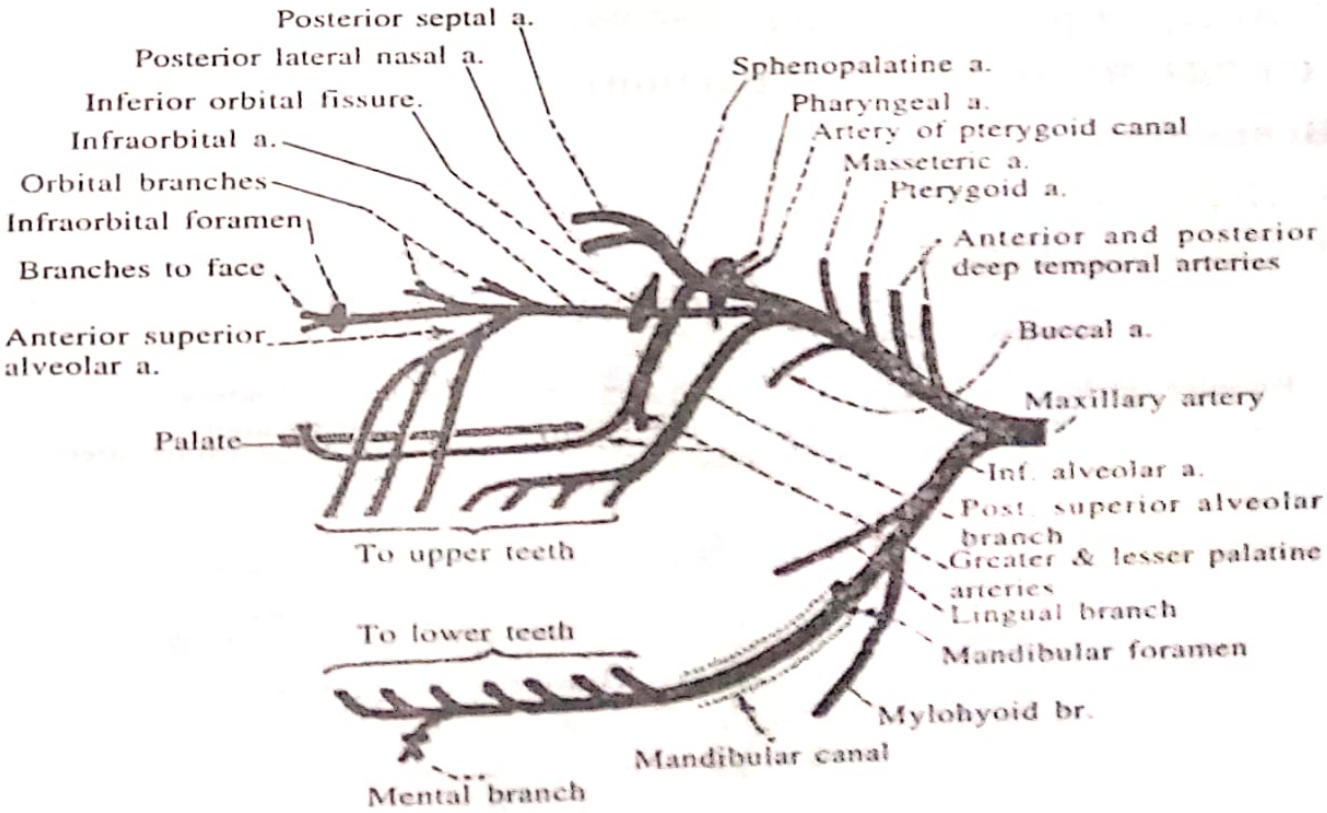


Fig. 10.8 Branches of maxillary artery

5. Pterygoidal canal (पक्षाभनलिका)

6. Sphenopalatine (जतूकतालु)

१४. अन्तःमातृका धमनी (Internal carotid artery)

Sub-division–

(A) Cervical portion (ग्रैव भाग)

(B) Petrous portion (अश्म भाग)

(C) Cavernous portion (गव्हर भाग)

(D) Cerebral portion (प्रमस्तिष्कीय भाग)

(A) ग्रैव भाग (Cervical portion)–

Branches– No branches

(B) अश्म भाग (Petrous portion)–

Branches–

1. Corticotympanic (मातृकमध्यकर्ण)

2. Artery of peterygoid canal (पक्षाभिकानाल धमनी)

(C) गह्वर भाग (Cavernous portion)–

Branches–

1. Hypophyseal (पीयूषिका)
2. Meningeal (तानिका)
3. Cavernous (गह्वर)
4. Ophthelmic (नेत्र)

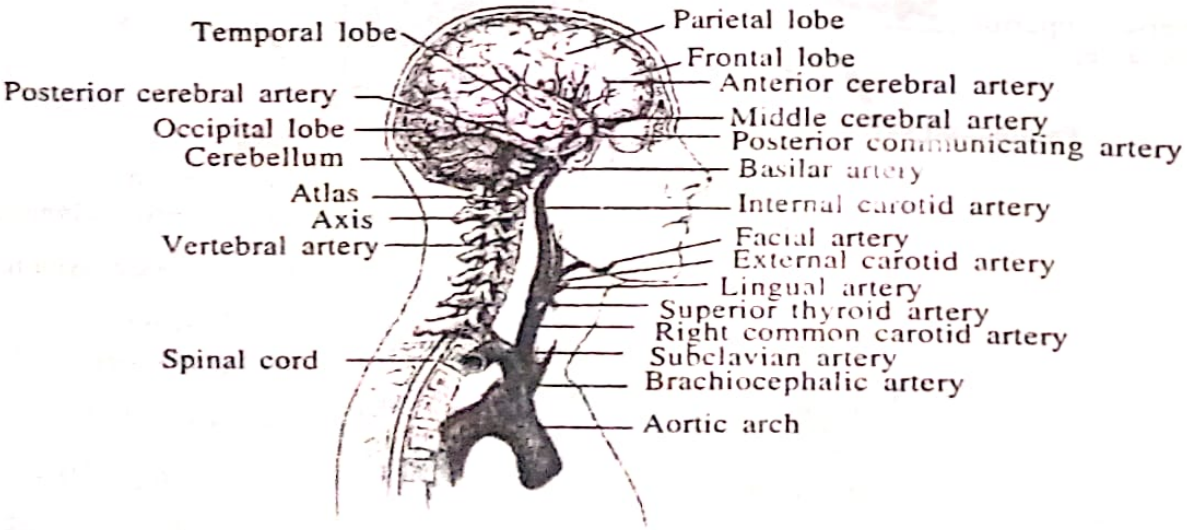


Fig. 10.9 Internal carotid and vertebral arteries

(D) प्रमस्तिष्कीय भाग (Cerebral portion)–

Branches–

1. Anterior cerebral (अग्रप्रमस्तिष्क)
2. Middle cerebral (मध्य प्रमस्तिष्क)
3. Posterior communicating (पश्च संयोजी)
4. Anterior choroidal (अग्र कोरोइड)

१५. अधोजत्रुक धमनी (Subclavian artery)

(A) Introduction

- This is the principal artery of the upper limb. It also supplies a part of the neck and brain through its branches.
- Each artery arches laterally from the sternoclavicular joint to the outer border of the first rib, where it ends by becoming continuous with the axillary artery.
- The scalenus anterior muscles crosses the subclavian artery anteriorly and divides it into three parts.
  1. The first part – Medial
  2. The second part – Posterior
  3. The third part – Lateral to the scalenous anterior muscles.

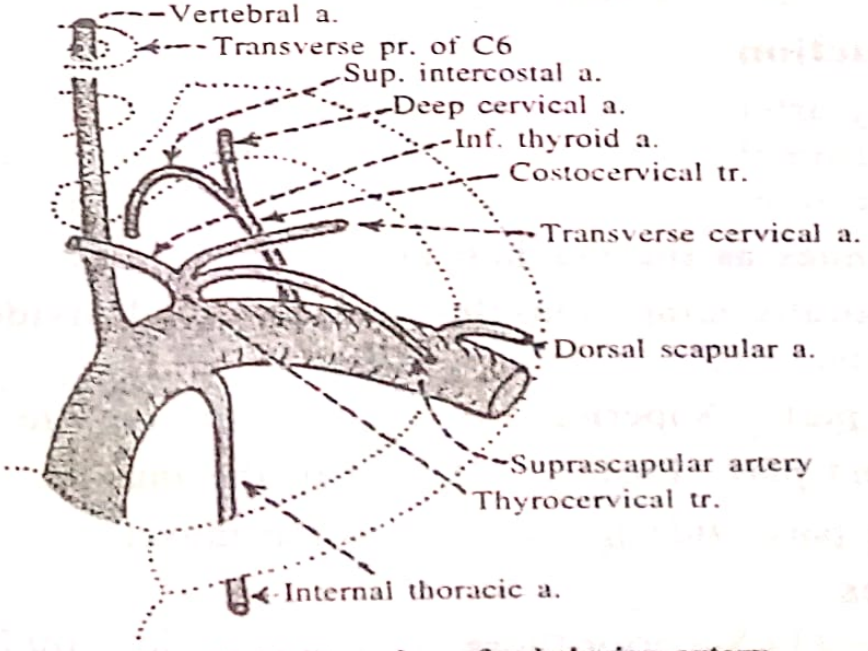


Fig. 10.10 Branches of subclavian artery

(B) Branches

1. First part– (1) Vertebral artery (कशेरूका धमनी) → Basilar A. (आधारी धमनी)

(2) Internal thoracic a. (अंत: वक्ष धमनी)
- → Musculophrenic a. (पेशीमध्यच्छद धमनी)
- → Sup. epigastric a. (ऊर्ध्वअधिजठर धमनी)

(3) Thyrocervical trunk (अवटु ग्रैव धमनी)
- → Inferior thyroid a. (अधोअवटु धमनी)
- → Transverse cervical a. (अनुप्रस्थ ग्रैव धमनी)
- → Suprascapular a. (ऊर्ध्वअंसफलक धमनी)

2. Second part–

(4) Costocervical trunk (पर्शुक ग्रैव धमनी)
- → Sup. intercostal artery (ऊर्ध्वपर्शुकान्तरा धमनी)
- → Deep cervical artery (गम्भीर ग्रैव धमनी)

3. Third part–

(5) Dorsal scapular artery (अभिपृष्ठ अंसफलक धमनी) → Occasionally found

१६. कक्षाधरा धमनी (Axillary artery)

(A) Introduction

Axillary artery is the continuation of the subclavian artery. It extends from the outer border of the first rib to the lower border of the teres major muscle.

It continues as the brachial artery.

- The pectoralis minor muscles crosses it and divides it into three parts.
  1. First part – Superior (Proximal) to the muscle.
  2. Second part– Posterior (Deep) to the muscle.
  3. Third part– Inferior (Distal) to the muscle.

(B) Branches

1. First part– (1) Superior thoracic artery (ऊर्ध्ववक्ष धमनी)

2. Second part–(2) Thoracoacromial artery (अंसकूट वक्ष धमनी)

or

acromiothoracic artery

- →Pectoral branch
- →Deltoid branch
- →Acromial branch
- →Clavicular branch

(3) Lateral thoracic artery (पार्श्ववक्षच्छदा धमनी)

3. Third part– (4) Subscapular artery (अधो अंसफलक धमनी)

→ Circumflex scapular a. (परिवेष्टक अंसफलक धमनी)

(5) Anterior circumflex artery (अग्रपरिवेष्टकप्रगण्ड धमनी)

(6) Posterior circumflex artery (पश्चपरिवेष्टकप्रगण्ड धमनी)

१७. प्रगण्डिका धमनी (Brachial artery)

(A) Introduction

Brachial artery is the continuation of the axillary artery. It extends from the lower border of the teres major muscle to a point in front of the elbow, at the level of the neck of the radius, just medial to the tendon of the biceps brachii.

(B) Branches

1. Profunda brachii artery (गम्भीर प्रगण्डिका धमनी)
2. Superior ulnar collateral artery (ऊर्ध्व अन्तःप्रकोष्ठिक समपार्श्वी धमनी)
3. Inferior ulnar collateral artery (अधोऽन्तःप्रकोष्ठिक समपार्श्वी धमनी)
4. Nutrient artery to the humerus (पोषक प्रगण्डिका धमनी)
5. Un-named muscular branches (पेशी शाखाएं)
6. Terminal branches → Radial artery (बहिः प्रकोष्ठिका धमनी)
   → Ulnar artery (अन्तः प्रकोष्ठिका धमनी)

- Profunda brachii artery
  - → Radial collateral (Ant. descending a.)
  - → Middle collateral (Post. descending a.)
  - → Deltoid branch (Ascending)
  - → Nutrient artery to the humerus.

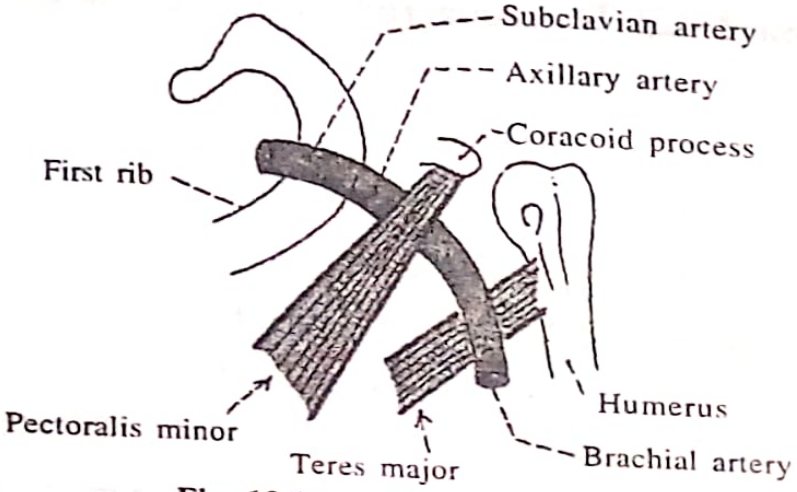


Fig. 10.11 Axillary artery

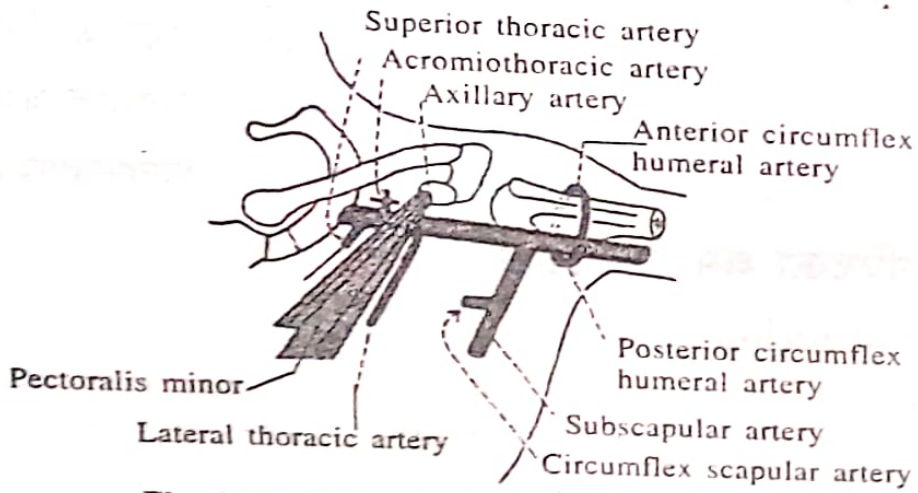


Fig. 10.12 Branches of axillary artery

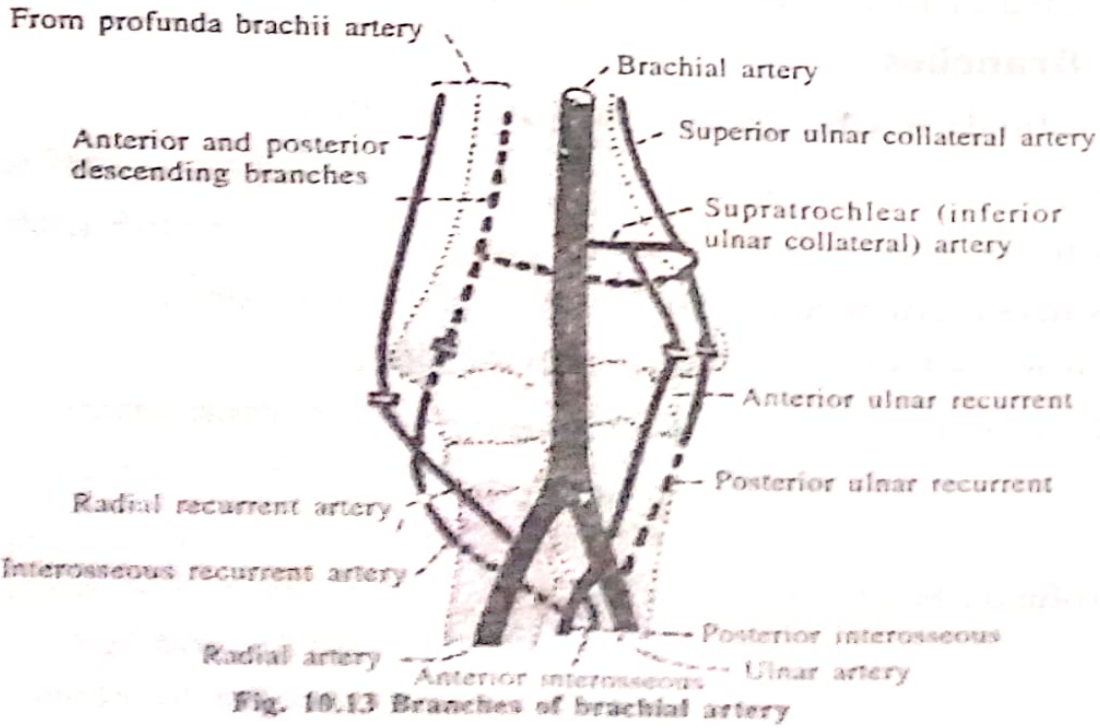


Fig. 10.13 Branches of brachial artery

१८. बहि: प्रकोष्ठिका धमनी (Radial artery)

(A) Introduction

Radial artery is the smaller terminal branch of the brachial artery in the cubital fossa. It runs downwards to the wrist with lateral convexity.

(B) Branches

1. Muscular branches (पेशी शाखाएं)
2. Radial recurrent branch (बहि:प्रकोष्ठिका पुनरावर्तक शाखा)
3. Palmar carpal branch (करतल मणिबन्ध शाखा)
4. Superficial palmar branch (उपरिस्थ करतल शाखा)
5. Dorsal carpal branch (अभिपृष्ठमणिबन्ध शाखा)
6. First dorsal metacarpal artery (प्रथम अभिपृष्टकरभ धमनी)
7. Princeps pollicis artery (मुख्य अंगुष्ठ धमनी)
8. Radialis indicis artery (तर्जनी बहि: प्रकोष्ठिका धमनी)

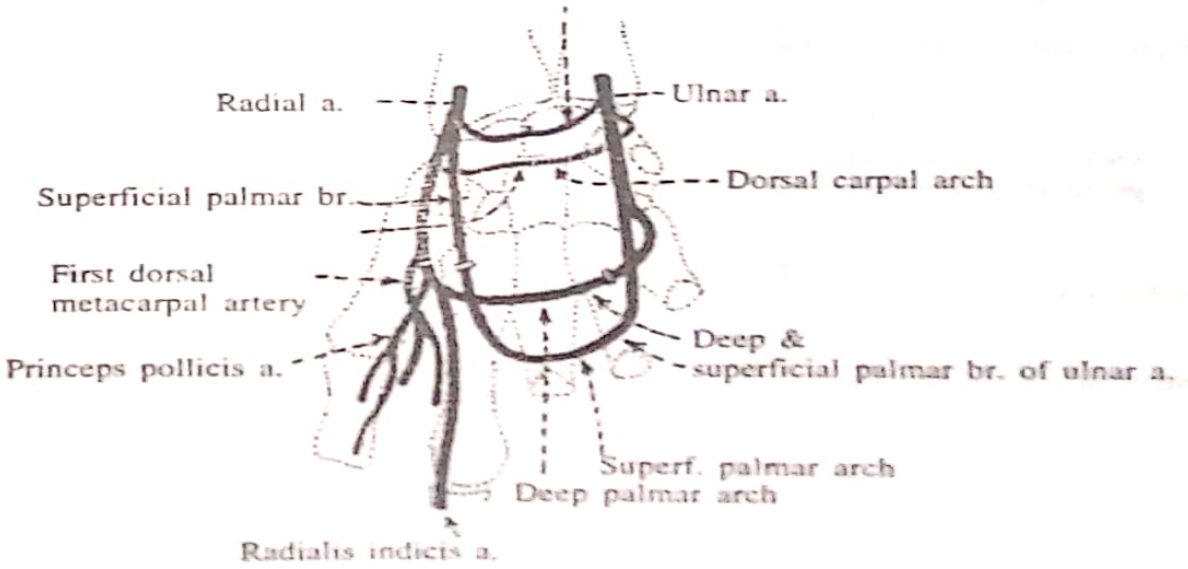


Fig. 10.14 Branches of radial, ulnar artery in the hand

१९. अन्त: प्रकोष्ठिका धमनी (Ulnar artery)

(A) Introduction

Ulnar artery is the larger terminal branch of the brachial artery and begins in the cubital fossa.

The artery run obliquely downwards and medially in the upper 1/3 of the forearm but in the lower 2/3 of the forearm, its course is vertical. It enters the palm by passing superficial to the flexor retinaculum. (Pisiform)

(B) Branches

1. Muscular branches (पेशी शाखाएं)
2. Anterior ulnar recurrent branches (अग्र अन्त:प्रकोष्ठिका पुनरावर्तक शाखाएं)
3. Posterior ulnar recurrent branches (पश्च अन्त:प्रकोष्ठिका पुनरावर्तक शाखाएं)
4. Palmar carpal branch (करतल मणिबन्ध शाखा)
5. Dorsal carpal branch (अभिपृष्ठ मणिबन्ध शाखा)
6. Common interosseous artery (अस्थ्यन्तरा धमनी)
   - → Ant. common interosseous a. (अग्र अस्थ्यन्तरा धमनी)
   - → Post. common interosseous a. (पश्च अस्थ्यन्तरा धमनी)
7. Superficial palmar branch (उपरिस्थ करतल शाखा)
8. Deep palmar branch (गम्भीर करतल शाखा)

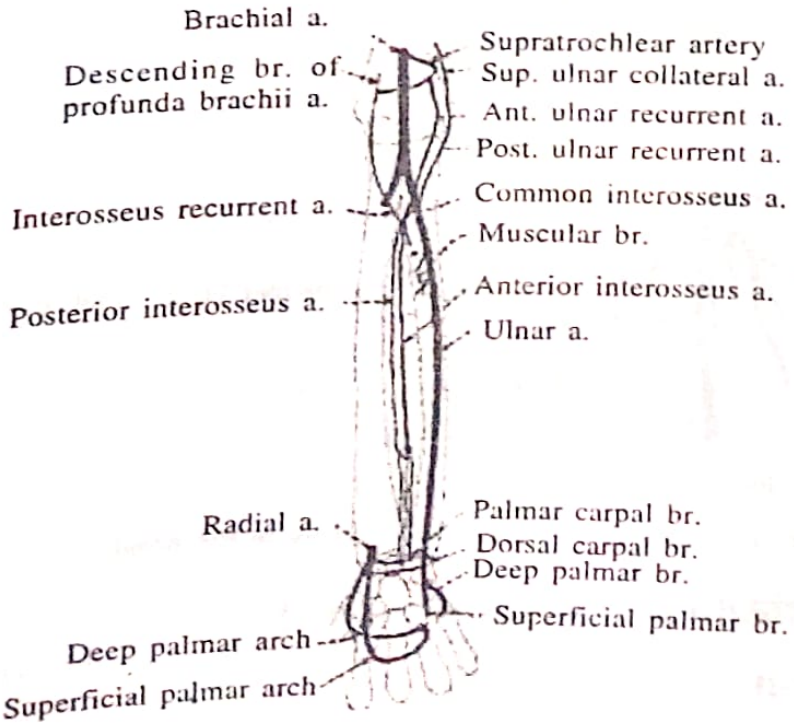


Fig. 10.15 Branches of ulnar artery

२०. औरसी महाधमनी (Thoracic aorta)

(A) Introduction

It is about 20 cm. long and is a continuation of the arch of the aorta. It begins at the level of the intervertebral disc between the 4th and 5th thoracic vertebrae, where it lies to the left of the vertebral column. As it descends, it moves closer to the midline and ends at an opening in the diaphragm anterior to the vertebral column at the level of the intervertebral disc between the 12th thoracic and 1st lumbar vertebrae.

(B) Branches

1. Pericardial arteries (परिहृद् धमनियाँ)
2. Bronchial arteries (श्वसनी धमनियाँ)
3. Esophageal arteries (ग्रासनली धमनियाँ)
4. Mediastinal arteries (फुफ्फुसान्तरालीय धमनियाँ)
5. Sup. phrenic arteries (ऊर्ध्वमध्यच्छद धमनियाँ)
6. Intercostal arteries (पर्शुकान्तरा धमनियाँ)
7. Subcostal arteries (अध:पर्शुक धमनियाँ)

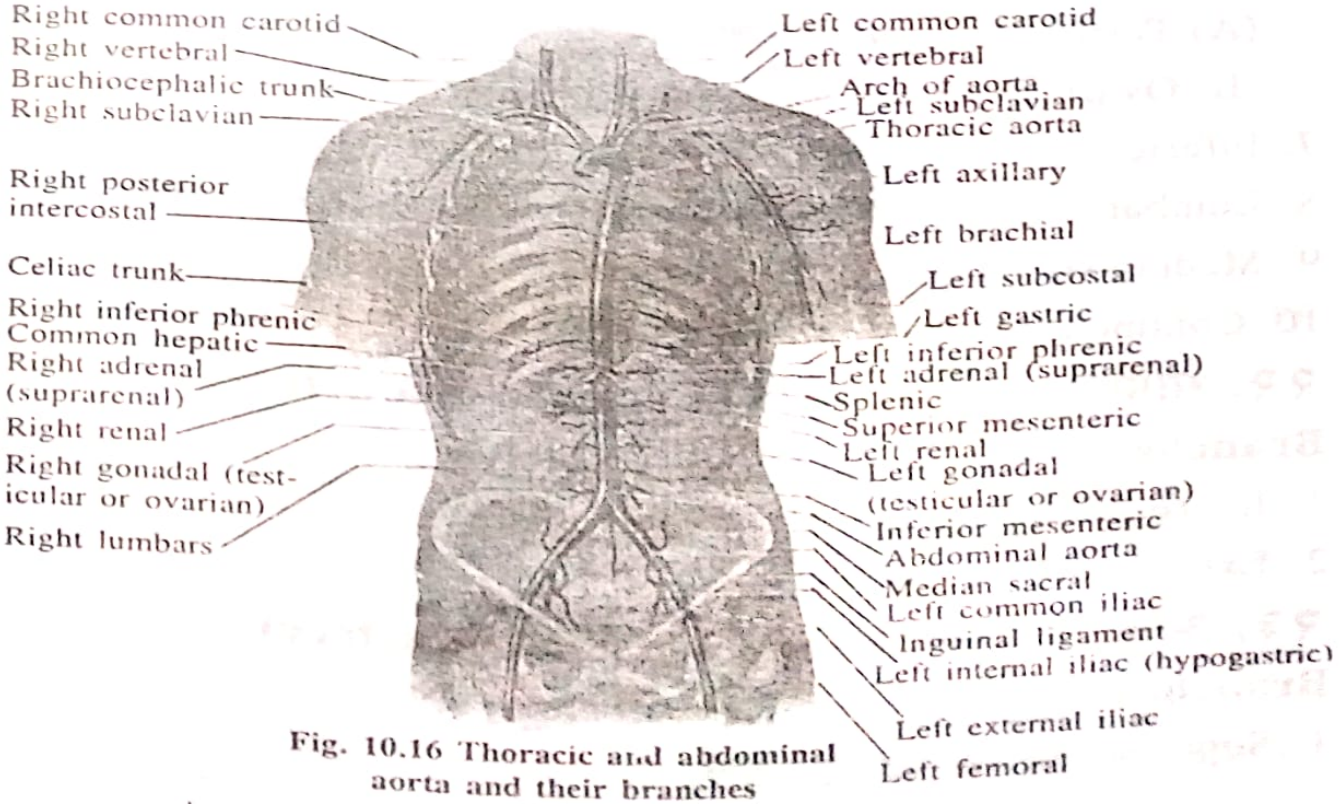


Fig. 10.16 Thoracic and abdominal aorta and their branches

२१. औदरी महाधमनी (Abdominal aorta)

(A) Introduction

It is the continuation of the thoracic aorta. It begins at the aortic hiatus in the diaphragm and ends at about the level of the 4th lumbar vertebra, where it divides into right and left common iliac arteries. The abdominal aorta lies anterior to the vertebral column.

(B) Branches

1. Inferior phrenic arteries (निम्न मध्यच्छद धमनियाँ)
2. Coeliac artery (कुक्षि धमनी)
   (A) Common hepatic artery (सामान्य याकृति धमनी)
   (B) Left gastric artery (वाम जठर धमनी)
   (C) Splenic artery (प्लैहिक धमनी)
3. Superior mesenteric artery (ऊर्ध्व आन्त्रयोजनी धमनी)
4. Supra renal arteries (अधिवृक्क धमनियाँ)
5. Renal arteries (वृक्क धमनियाँ)
6. Gonadal arteries (जननांग धमनियाँ)
   (A) Testicular arteries (वृषण धमनियाँ)
   (B) Ovarian arteries (डिम्ब धमनियाँ)
7. Inferior mesenteric artery (निम्न आन्त्रयोजनी धमनी)
8. Lumbar arteries (कटि धमनियाँ)
9. Median sacral artery (मध्यम त्रिक् धमनी)
10. Common iliac artery (सामान्य जघनिका धमनी)

२२. सामान्य जघनिका धमनी (Common iliac artery)

Branches

1. Internal iliac artery (अन्त: जघनिका धमनी)
2. External iliac artery (बहि: जघनिका धमनी)

२३. अन्त: जघनिका धमनी (Internal iliac artery)

Branches

1. Superior vesical artery (ऊर्ध्व बस्ति धमनी)

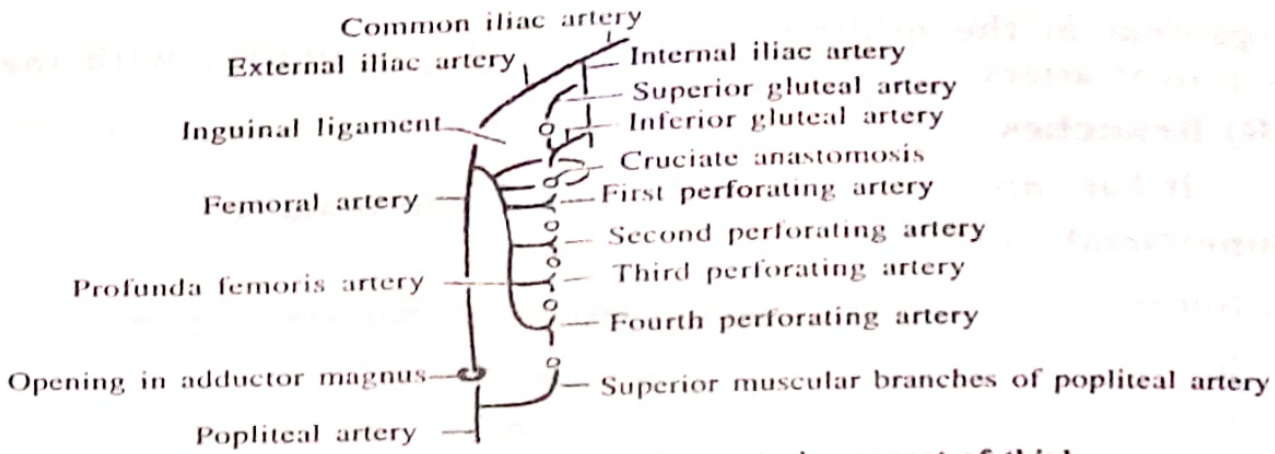


Fig. 10.17 Anastomoses on the posterior aspect of thigh

2. Inferior vesical artery (निम्न बस्ति धमनी)
3. Middle rectal artery (मध्य मलाशय धमनी)
4. Uterine artery (गर्भाशय धमनी)
5. Vaginal artery (योनि धमनी)
6. Obturator artery (गवाक्ष धमनी)
7. Internal pudendal artery (आभ्यन्तर गुह्य धमनी)
8. Inferior gluteal artery (निम्न नितम्ब धमनी)
9. Ileo-lumbar artery (जघन कटि धमनी)
10. Lateral sacral artery (पार्श्व त्रिक् धमनी)
11. Superior gluteal artery (ऊर्ध्व नितम्ब धमनी)

२४. बहि: जघनिका धमनी (External iliac artery)

(A) Introduction

It arises from the mid inguinal point, passage under the inguinal ligament and ends in the thigh as femoral artery.

(B) Branches

1. Inferior epigastric artery (निम्न अधिजठर धमनी)
2. Deep circumflex iliac artery (गम्भीर परिवेष्टक जघनिका धमनी)

२५. और्वी धमनी (Femoral artery)

(A) Introduction

This is the chief artery of the lower limb. It is the continuation of external iliac artery. It begins behind the inguinal

ligament at the midinguinal point. It continuous with the popliteal artery.

(B) Branches

It has three superficial and three deep branches.

Superficial branches–

1. Superficial external pudendal artery (उपरिस्थ वहि: गुह्य धमनी)
2. Superficial epigastric artery (उपरिस्थ अधिजठर धमनी)
3. Superficial circumflex iliac artery (उपरिस्थ परिवेष्टक जघनिका धमनी)

Deep branches–

1. Profunda femoris artery (गम्भीर ऊरू धमनी)
2. Deep external pudendal artery (गम्भीर वहि: गुह्य धमनी)
3. Muscular arteries (पेशी धमनियाँ)

Profunda femoris artery → Medial circumflex femoral artery
→ Lateral circumflex femoral artery
→ Four perforating branches

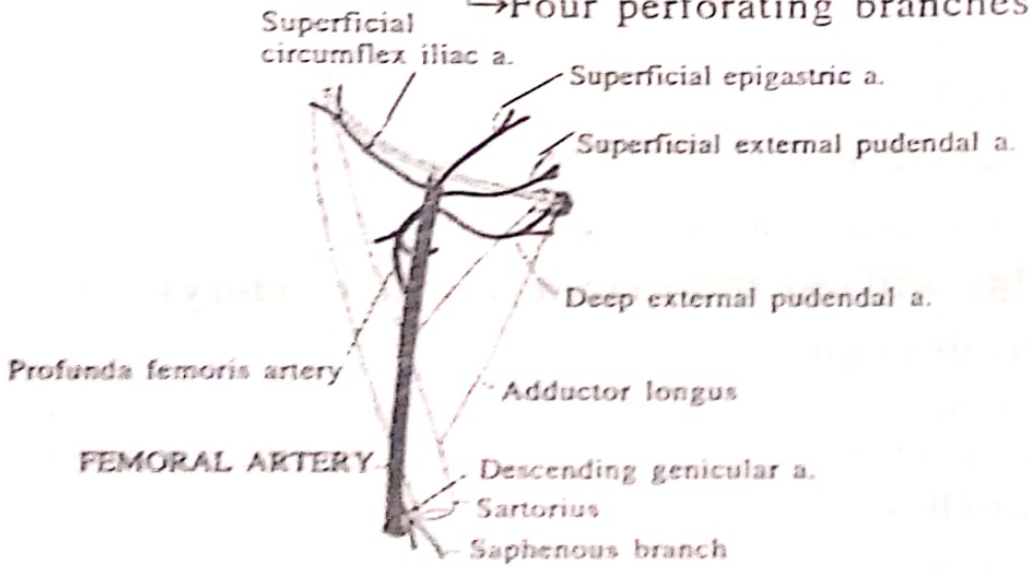


Fig. 10.18 Branches of femoral artery

२६. जानुपृष्ठिका धमनी (Popliteal artery)

(A) Introduction

This artery is the continuation of the femoral artery. It begins at the opening in the adductor magnus. It runs downwards and slightly laterally to reach the lower border of

the popliteus, where it terminates by dividing into the anterior and posterior tibial arteries.

(B) Branches

1. Cutaneous branches (त्वक् शाखाएँ)
2. Superior muscular branches (ऊर्ध्व पेशी शाखाएँ)
3. Sural arteries (जंघापिण्डिका धमनियाँ)
4. Superior genicular arteries (ऊर्ध्वजानु धमनियाँ)
5. Middle genicular arteries (मध्यजानु धमनियाँ)
6. Inferior genicular arteries (निम्न जानु धमनियाँ)
7. Terminal branches
   - → Anterior tibial artery (अन्त:जंघिका अग्रिमा धमनी)
   - → Posterior tibial artery (अन्त:जंघिका पश्चिमा धमनी)

२७. अन्त: जंघिका अग्रिमा धमनी (Anterior tibial artery)

(A) Introduction

This is the main artery of the anterior compartment of the leg.

- The anterior tibial artery is the smaller terminal branch of the popliteal artery.
- It begins on the back of the leg at the lower border of the popliteus, opposite the tibial tuberosity.
- It runs downwards to a point midway between the two malleoli where it changes its name to become the dorsalis pedis artery.

(B) Branches

1. Muscular branches (पेशी शाखाएँ)
2. Anterior tibial recurrent branch (अग्र अन्त:जंघिका पुनरावर्तक शाखा)
3. Posterior tibial recurrent branch (पश्च अन्त:जंघिका पुनरावर्तक शाखा)
4. Anterior medial malleolar branch (अग्र अन्त: गुल्फ शाखा)
5. Anterior lateral malleolar branch (अग्र बहि: गुल्फ शाखा)

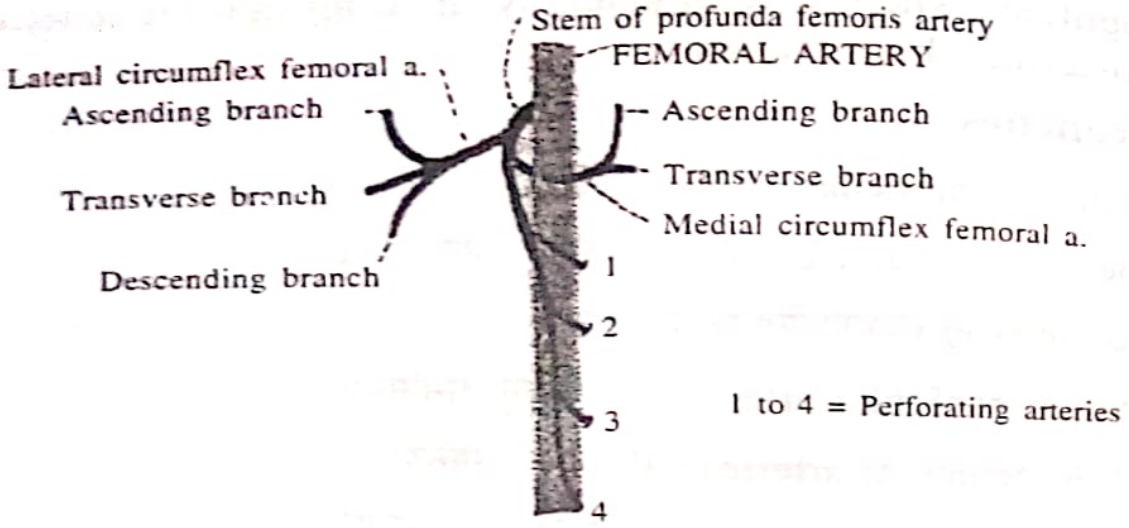


Fig. 10.19 Branches of profunda femoris artery

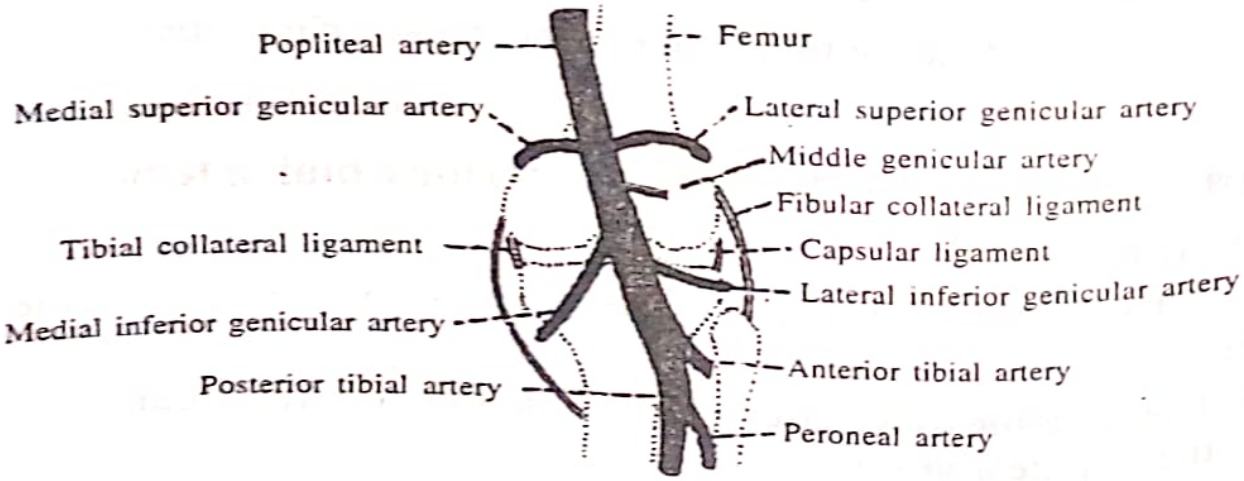


Fig. 10.20 Branches of popliteal artery

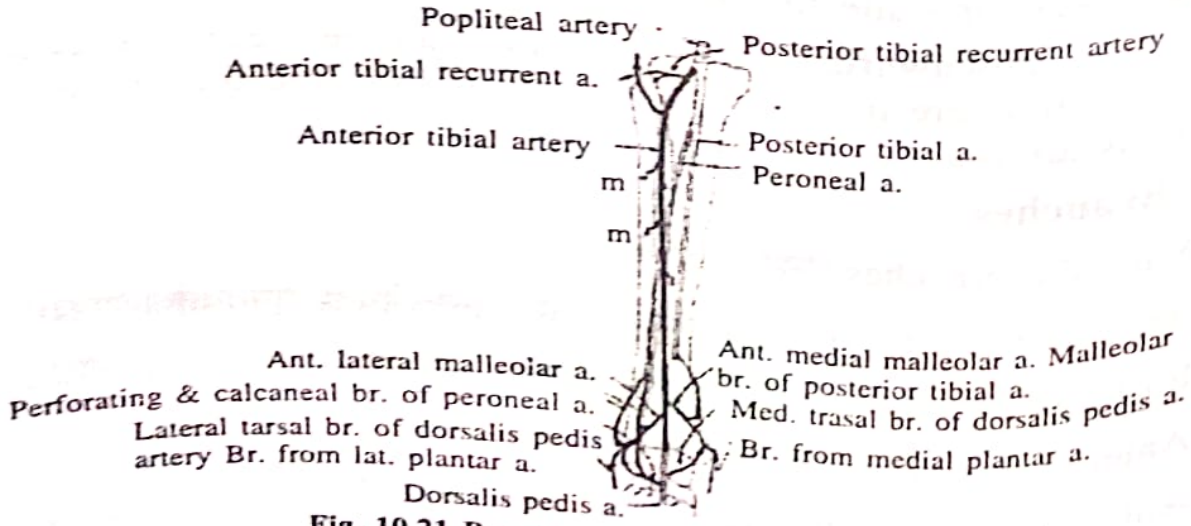


Fig. 10.21 Branches of anterior tibial artery

२८. पादाभिपृष्ठ धमनी (Dorsalis pedis artery)

(A) Introduction

It is the continuation of anterior tibial artery infront of ankle between the two malleoli.

(B) Branches

1. Lateral tarsal artery (पार्श्व पादकूर्च धमनी)
2. Medial tarsal artery (अभिमध्य पादकूर्च धमनी)
3. Arcuate artery (चापाकार धमनी)
4. First dorsal metatarsal artery (प्रथम अभिपृष्ठ प्रपद धमनी)

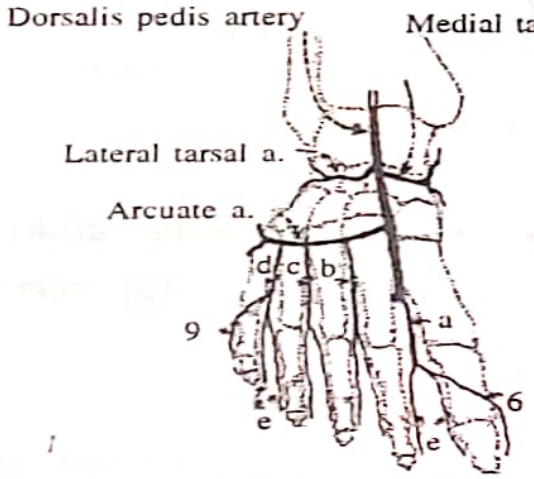


Fig. 10.22 Branches of dorsalis pedis artery

२९. अन्तः जंघिका पश्चिमा धमनी (Posterior tibial artery)

(A) Introduction

This is the larger terminal branch of the popliteal artery. Its branches also supply the lateral compartment of the leg and the sole of the foot.

It begins at the lower border of the popliteus. Between the tibia and fibula deep to the gastrocnemius. It runs downwards posteromedial side of the ankle.

(B) Branches

1. Peroneal artery (पादविवर्तिका धमनी)
2. Muscular branches (पेशी शाखाएँ)
3. Nutrient artery to tibia (पोषक धमनी)

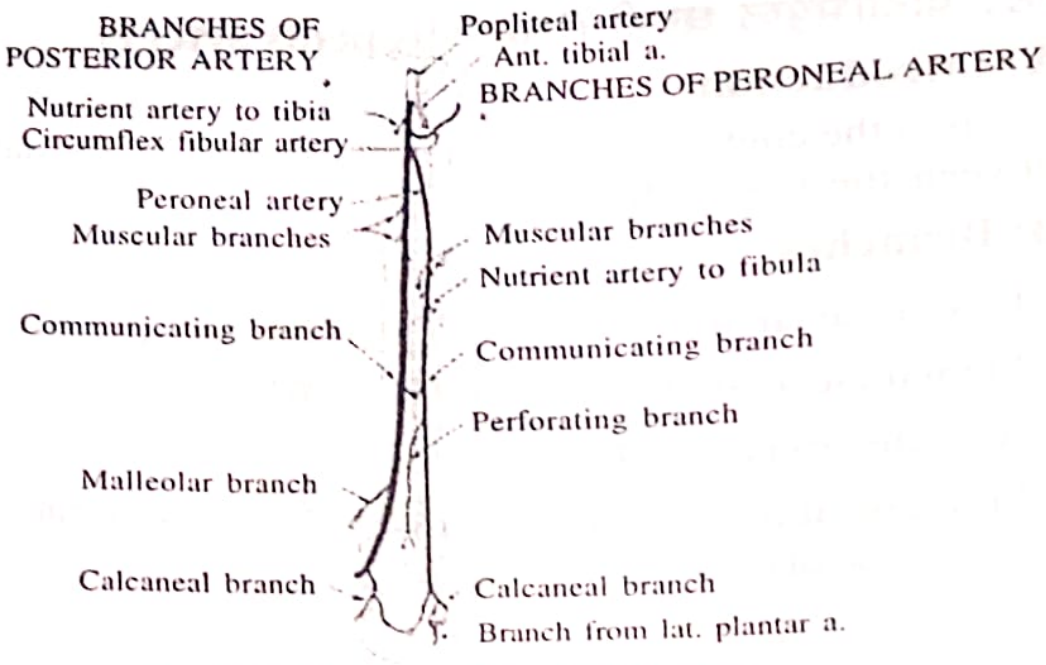


Fig. 10.23 Branches of Post. Tibial artery

4. Anastomotic branches–
   - I. Circumflex fibular artery (परिवेष्टक बहि:जंघिका धमनी)
   - II. Communicating branch to peroneal (संयोजी शाखा)
   - III. Malleolar branches (गुल्फ शाखाएं)
   - IV. Calcaneal branches (पार्ष्णिका शाखाएं)
5. Terminal branches — Medial plantar artery (अन्त: पादतल धमनी)
   Lateral plantar artery (बहि: पादतल धमनी)

३०. फुफ्फुसीय प्रकाण्ड (Pulmonary trunk)

(A) Introduction

Pulmonary trunk is a great vessel arising from right ventricle to carry **deoxygenated** blood to lungs, 5 cm. long and 3

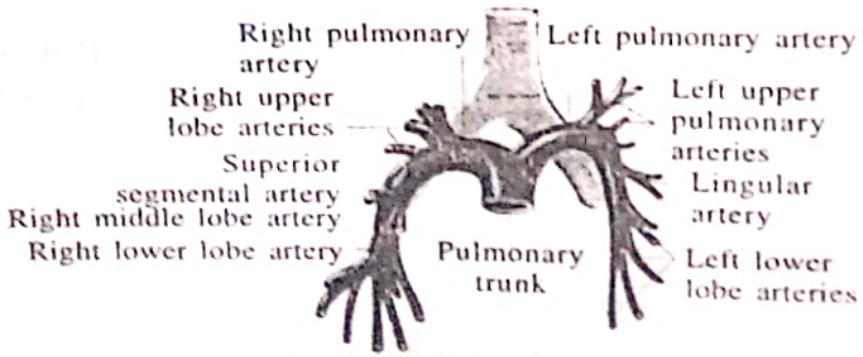


Fig. 10.24 Pulmonary arteries

cm. diameter, lie infront of ascending aorta, courses first above and the behind and left. At the arch of aorta it bifurcates as two part.

(B) Branches

1. Right pulmonary artery (दक्षिण फुफ्फुसीय धमनी)
2. Left pulmonary artery (वाम फुफ्फुसीय धमनी)

The pulmonary arteries are the only postnatal arteries that carry deoxygenated blood.

अध्याय- ११

सिरा संस्थान
(Venous System)

१. दैहिक सिराएँ (Systemic veins)

Deoxygenated blood returns to the right atrium from three veins.

1. Cardiac veins (Coronary sinus) (हृद् सिराएँ)
2. Superior venacava (उत्तरा महासिरा)
3. Inferior venacava (अधरा महासिरा)

१. हृद् सिराएँ (हृद् सिरा नाल) Cardiac veins (Coronary sinus)

The coronary sinus receives blood from the cardiac veins.

२. उत्तरा महासिरा (Superior venacava)

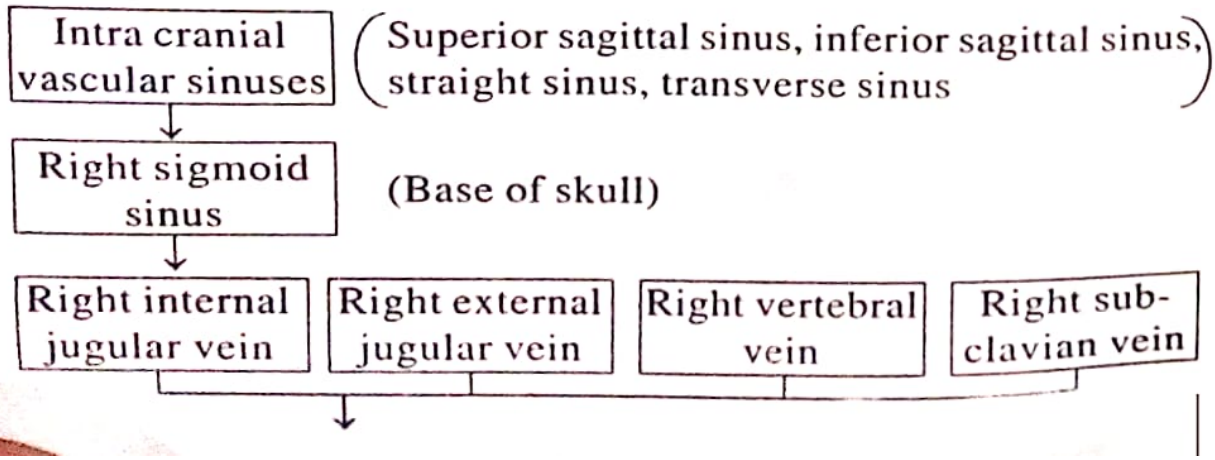
The superior venacava receives blood from other veins superior to the diaphragm, except the air sacs (alveoli) of the lungs. This includes the head, neck, upper limbs and thoracic wall.

३. अधरा महासिरा (Inferior venacava)

The inferior venacava receives blood from veins inferior to the diaphragm. This includes the lower limbs, most of the abdominal walls, and abdominal viscera.

(I) Veins of the head and neck

Scheme of drainage



↓

Right brachiocephalic vein

↓

Superior venacava

↓

Rt. atrium of the heart

(II) Veins of the thorax

Scheme of drainage

Right atrium of the heart

↑

Superior venacava

↑

Azygos vein

↑

(1) Right superior intercostal vein formed by union of the second, third and fourth posterior intercostal veins.

(2) 5-11th right posterior intercostal veins.

(3) Right bronchial vein.

(4) Esophageal, mediastinal and pericardial veins.

(5) Accessory hemiazygos vein←

(i) 5-8th left posterior intercostal veins.

(ii) Left bronchial vein.

(6) Hemiazygos vein ←

(i) Left ascending lumbar vein.

(ii) Left subcostal vein.

(iii) 9-11th left posterior intercostal veins.

(7) Lumbar azygos vein

(8) Right ascending lumbar vein

(9) Right subcostal vein

(III) Veins of the heart

Scheme of drainage

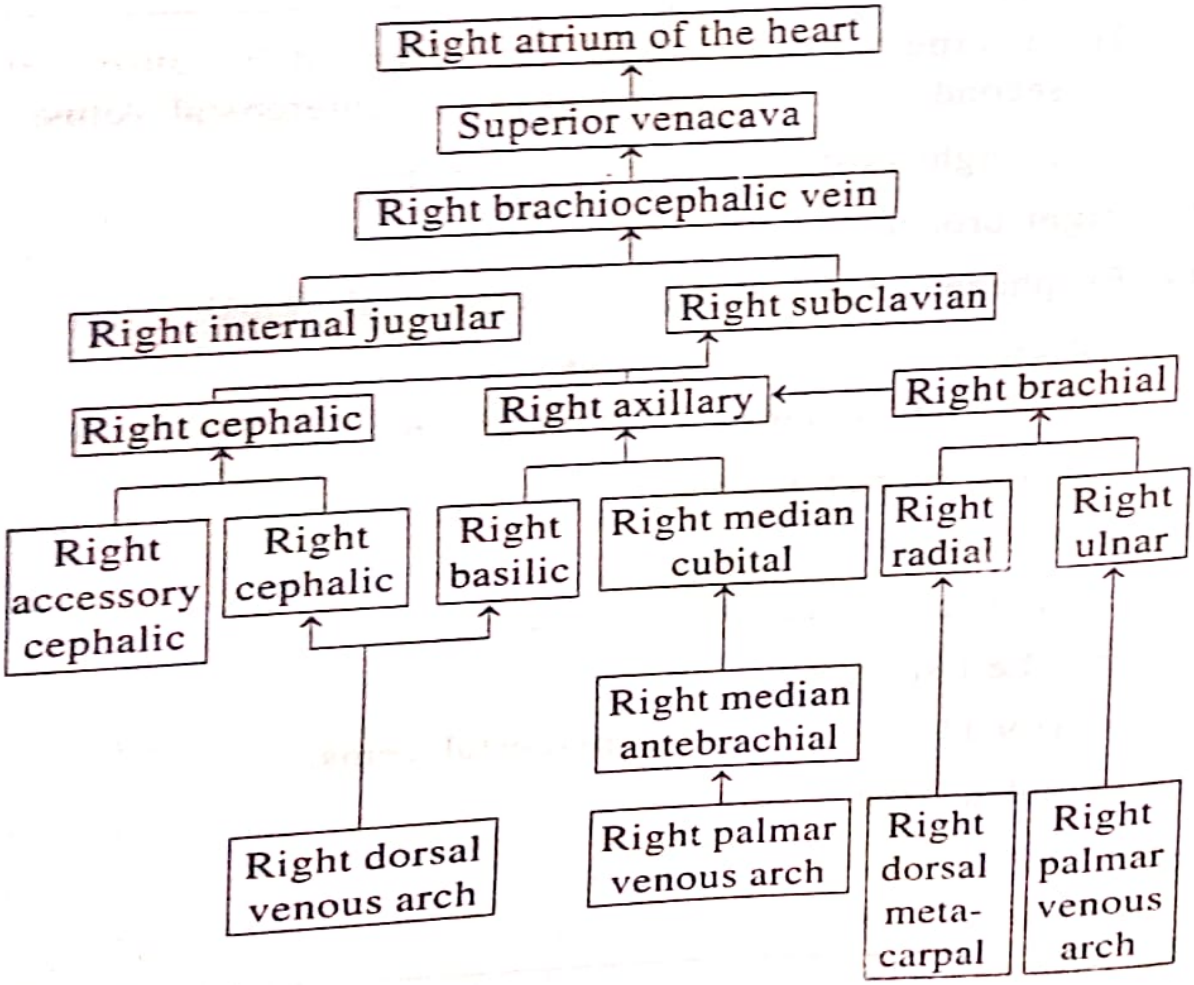
Right atrium

1. Coronary sinus
2. Anterior cardiac veins
3. Venae cordis minimi

1. Great cardiac vein
2. Middle cardiac vein
3. Small cardiac vein
4. Posterior vein of the left ventricle
5. Oblique vein of the left atrium
6. Right marginal vein

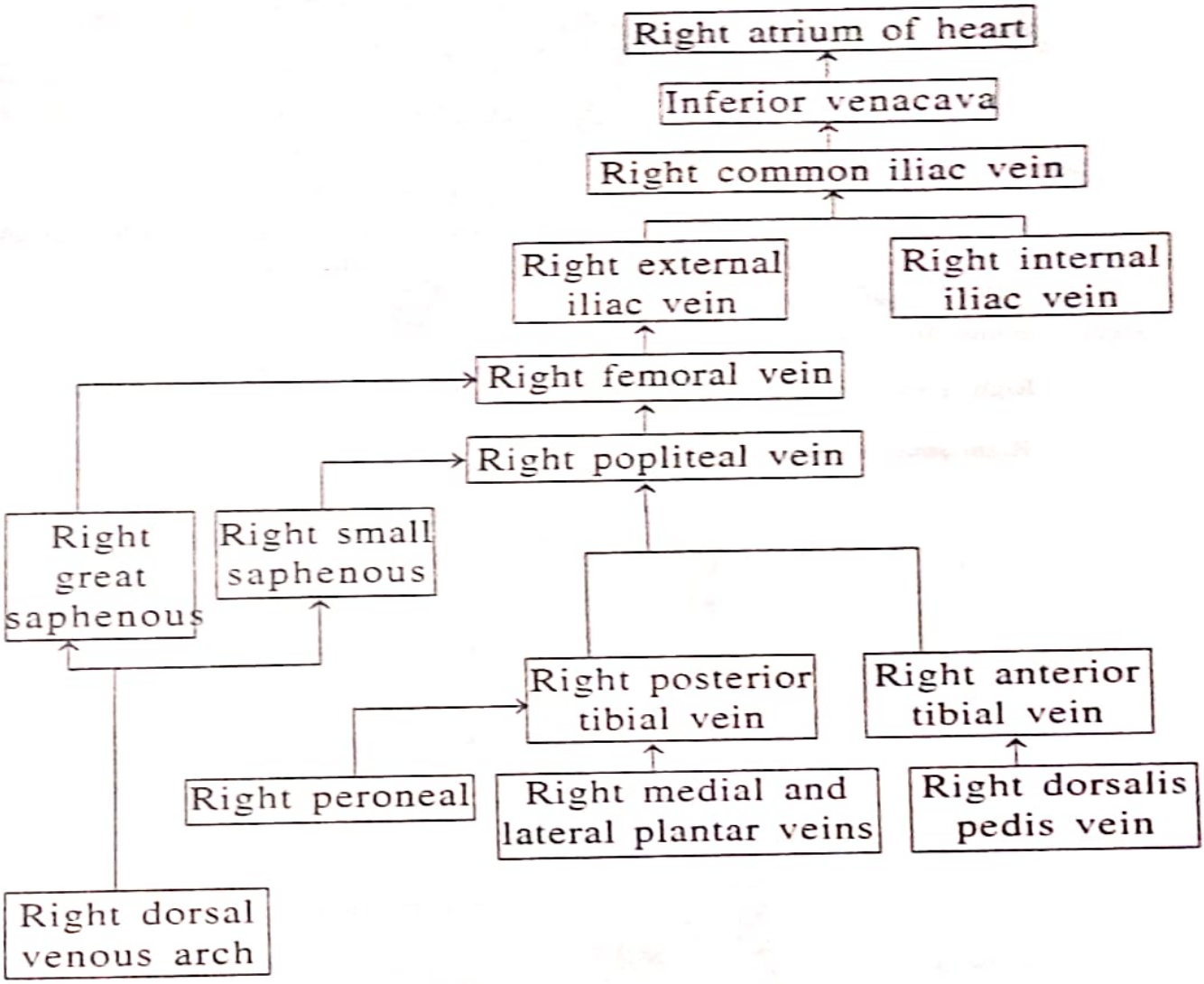
(IV) Veins of the upper limbs

Scheme of drainage



(V) Veins of the lower limbs

Scheme of drainage



Veins of systemic circulation

२. हृद् सिराएं (Cardiac veins)

I. Coronary sinus (हृद् सिरा नाल)

(A) Introduction

The coronary sinus is the largest vein of the heart. It is situated in the left posterior coronary sulcus. It is about 3 cm. long. It ends by opening into the posterior wall of the right atrium between the orifice of the inferior venacava and the tricuspid valve.

It receives blood from the cardiac veins.

(B) Tributaries

1. Great cardiac vein (वृहद् हृद् सिरा)
2. Middle cardiac vein (मध्य हृद् सिरा)
3. Small cardiac vein (लघु हृद् सिरा)
4. Posterior vein of the left ventricle (वाम निलय की पश्च सिरा)
5. Oblique vein of the left atrium (वाम अलिन्द की तिर्यक् सिरा)
6. Right marginal vein (दक्षिण उपान्त सिरा)

II. Anterior cardiac veins (अग्र हृद् सिराएँ)

III. Venae cordis minimi (सूक्ष्म हृद् सिराएँ)

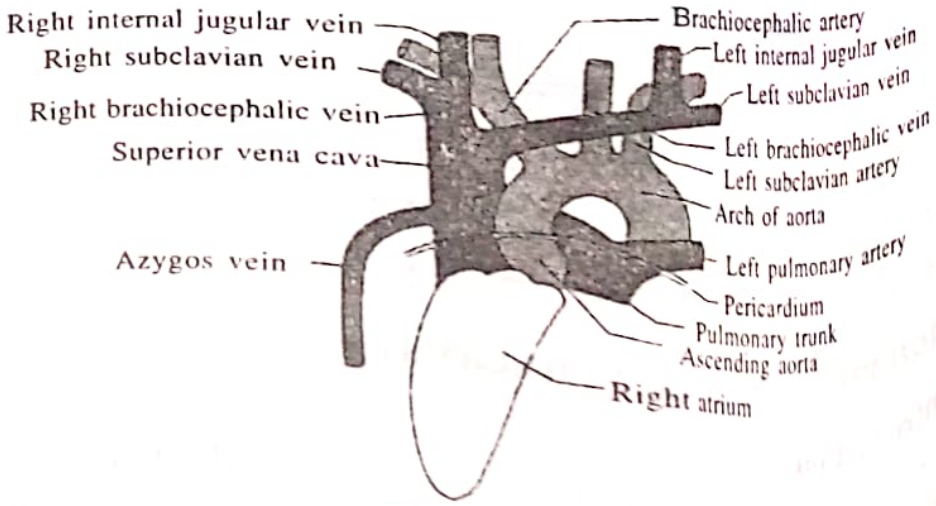


Fig. 11.3 Superior venacava

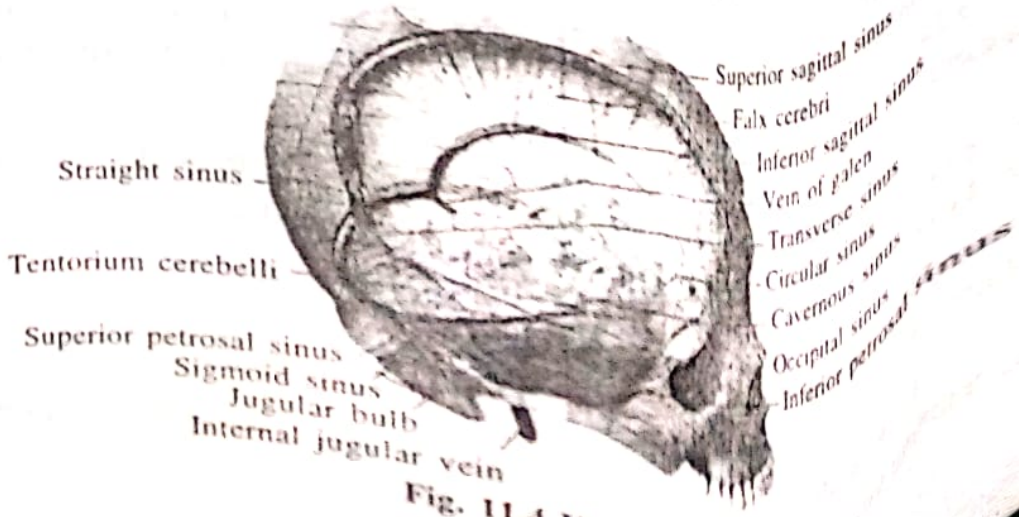


Fig. 11.4 Venous sinuses

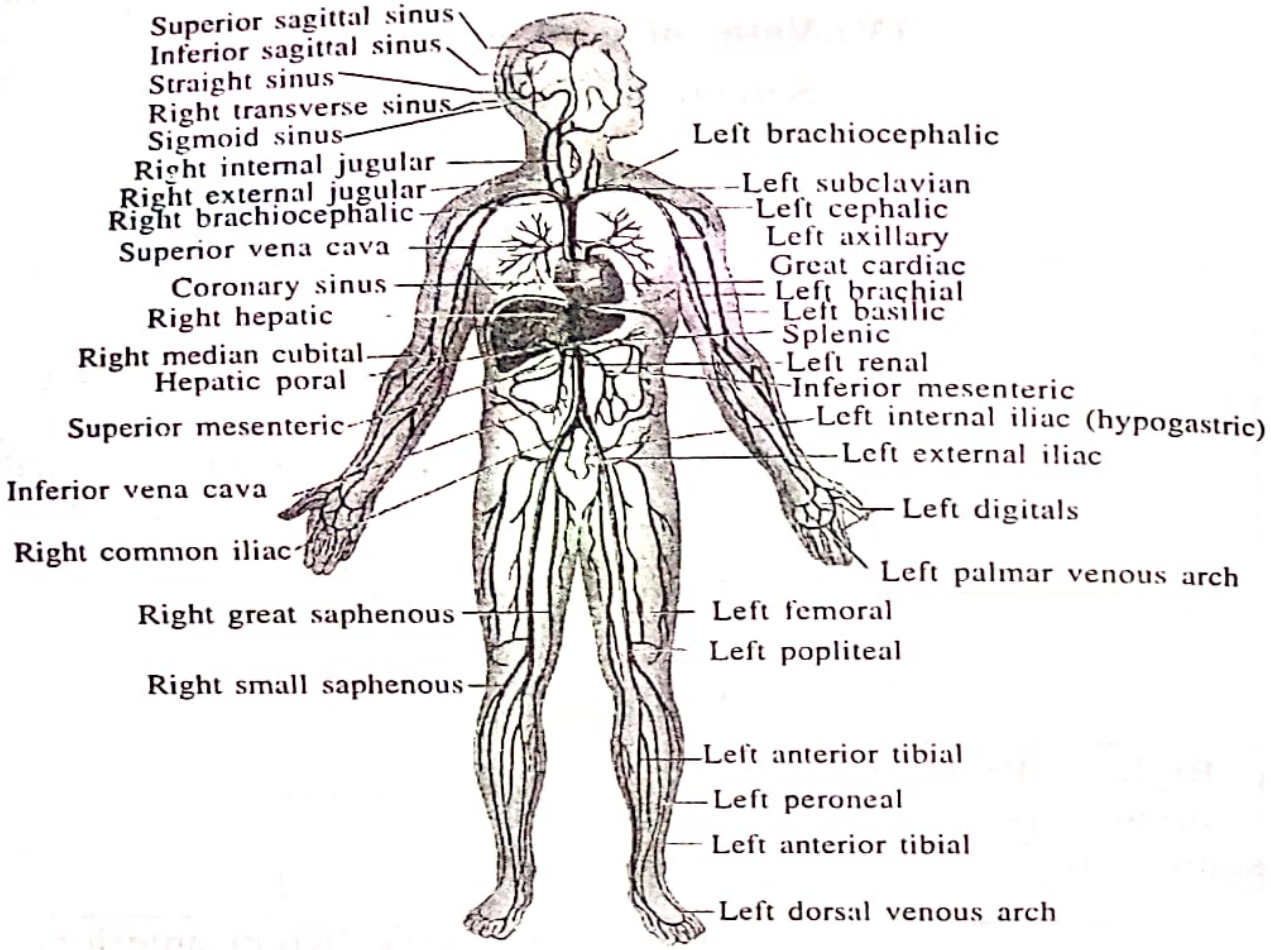


Fig. 11.1 Major veins

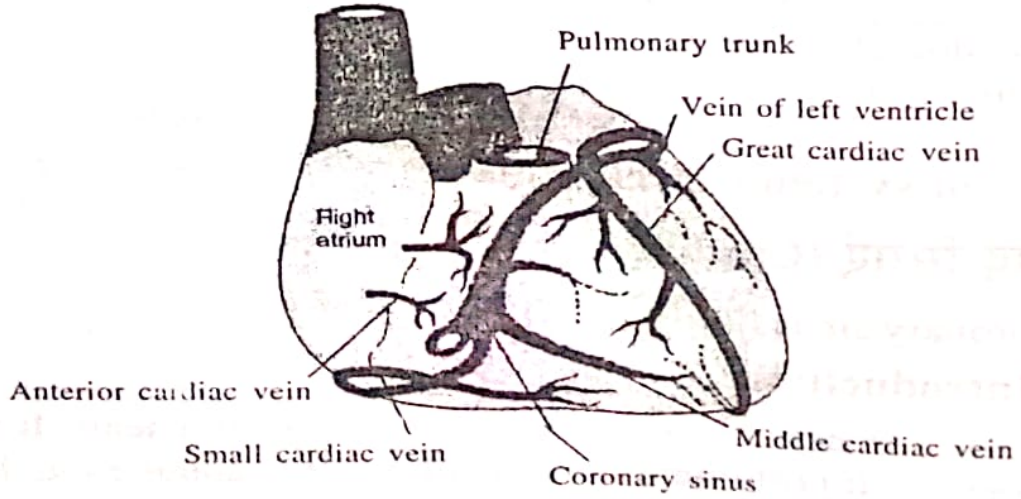


Fig. 11.2 Cardiac veins

It receives blood from the cardiac veins.

(B) Tributaries

1. Great cardiac vein (बृहद् हृद् सिरा)
2. Middle cardiac vein (मध्य हृद् सिरा)
3. Small cardiac vein (लघु हृद् सिरा)
4. Posterior vein of the left ventricle (वाम निलय की पश्च सिरा)
5. Oblique vein of the left atrium (वाम अलिन्द की तिर्यक् सिरा)
6. Right marginal vein (दक्षिण उपान्त सिरा)

II. Anterior cardiac veins (अग्र हृद् सिराएँ)

III. Venae cordis minimi (सूक्ष्म हृद् सिराएँ)

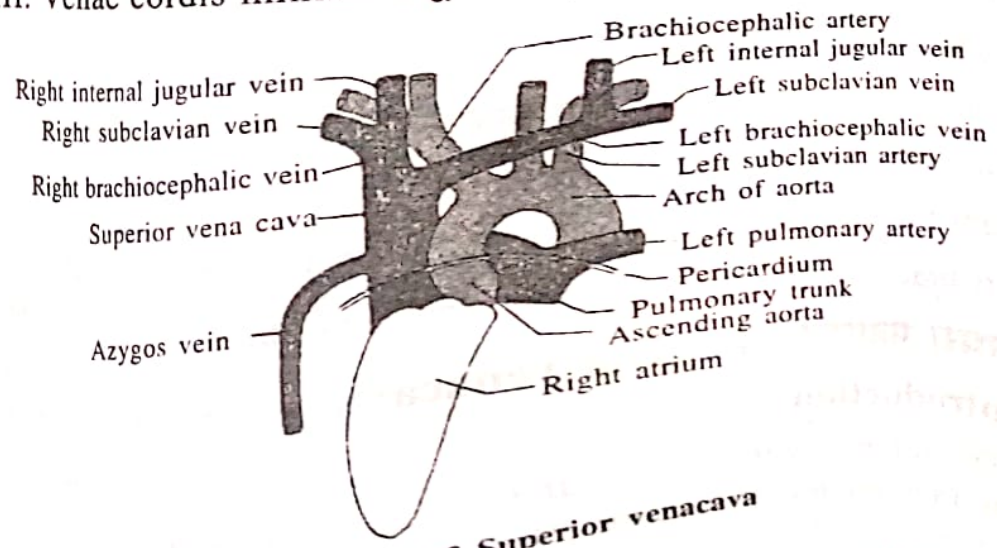


Fig. 11.3 Superior venacava

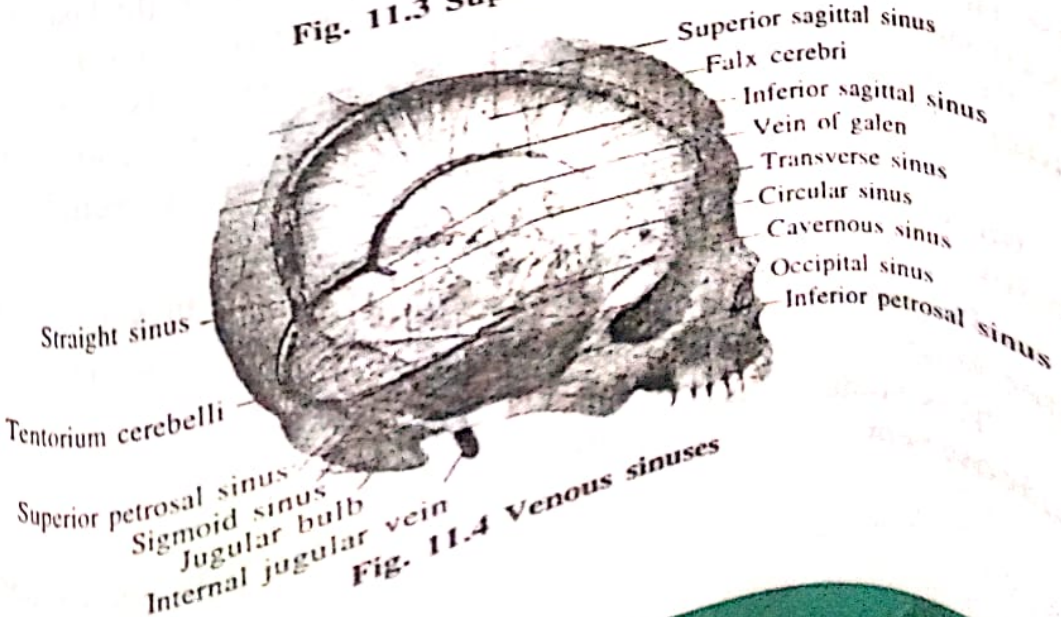


Fig. 11.4 Venous sinuses

३. उत्तरा महासिरा (Superior venacava)

(A) Introduction

The superior venacava is about 7 cm. long and empties its blood into the superior part of the right atrium. It begins posterior to the right first costal cartilage by the union of the right and left brachiocephalic veins and ends at the level of the right third costal cartilage, where it enters the right atrium.

The superior venacava receives blood from other veins superior to the diaphragm except the air sacs (alveoli) of the lungs. This includes the head, neck, upper limbs and thoracic wall.

(B) Tributaries

1. Azygos vein (अयुग्म सिरा)
2. Small mediastinal veins (लघु फुफ्फुसान्तराल सिराएँ)
3. Small pericardial veins (लघु परिहृद् सिराएँ)
4. Right brachiocephalic vein (दक्षिण प्रगण्डशीर्ष सिरा)
5. Left brachiocephalic vein (वाम प्रगण्डशीर्ष सिरा)

४. अधरा महासिरा (Inferior venacava)

(A) Introduction

The inferior venacava is the largest vein in the body about 3.5 cm. in diameter. It begins anterior to the fifth lumbar vertebra by the union of common iliac veins, ascends behind the peritoneum to the right of the midline, pierce the costal tendon of the diaphragm at the level of the 8th thoracic vertebra and enters the inferior part of the right atrium.

The inferior venacava receives blood from veins inferior to the diaphragm. This includes the lower limbs, most of the abdominal walls, and abdominal viscera.

The inferior venacava is commonly compressed during the later stages of pregnancy by the enlarging uterus.

This produces oedema of the ankles and feet and temporary varicose veins.

(B) Tributaries

1. Hepatic veins (याकृति सिराएँ)
2. Right suprarenal vein (दक्षिण अधिवृक्क सिरा) (The left suprarenal vein drain into the left renal vein)
3. Renal veins (वृक्क सिराएं)
4. Right testicular vein (दक्षिण वृषण सिरा) or right ovarian vein (दक्षिण डिम्ब ग्रन्थि सिरा) (The left testicular or ovarian vein drain in to the left renal vein)
5. Inferior phrenic vein (निम्न मध्यच्छद सिरा)
6. Four lumbar veins (कटि सिराएं)
7. Right common iliac vein (दक्षिण सामान्य जघनिका सिरा)
8. Left common iliac vein (वाम सामान्य जघनिका सिरा)
9. Median sacral vein (मध्यम त्रिक् सिरा)

Veins of the head and neck

Introduction– The majority of blood draining from the head passes into three pairs of veins–

1. Internal jugular vein
2. External jugular vein
3. Vertebral vein

Within the brain, all veins drain into the internal jugular veins.

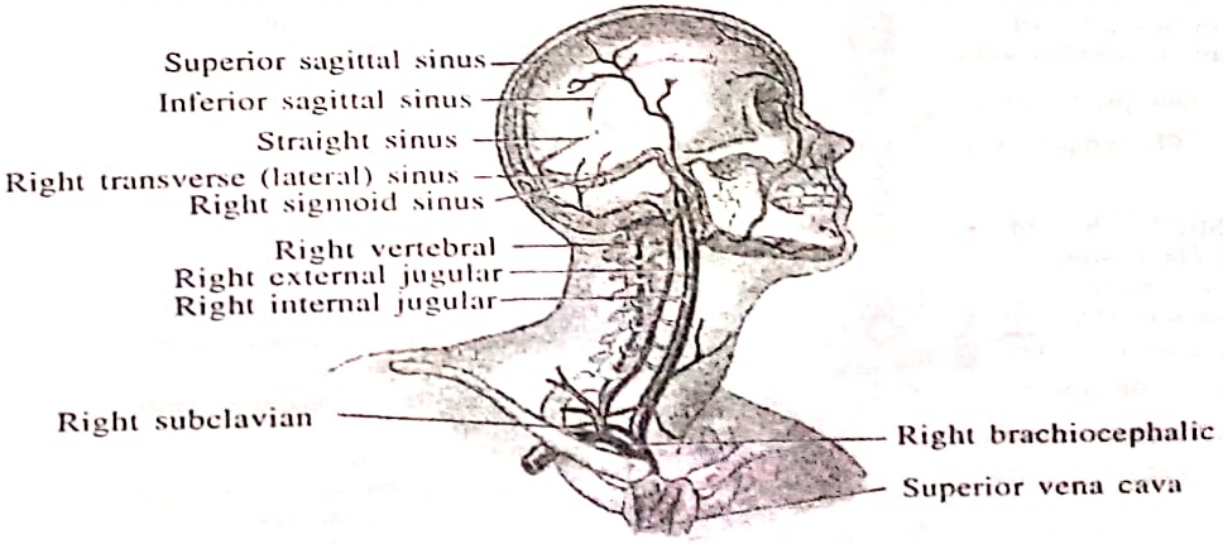


Fig. 11.5 Veins of the head and neck

५. आभ्यन्तर ग्रीवा सिरा (Internal jugular vein)

(A) Introduction

The right and left internal jugular veins receive blood from the face, brain and neck.

They arise as a continuation of the sigmoid sinuses at the base of the skull.

Intracranial vascular sinuses are located between layers of the duramater and receive blood from the brain.

Other sinuses that drain into the internal jugulars include the superior sagittal sinus, inferior sagittal sinus, straight sinus and transverse sinuses.

The internal jugulars descend on either side of the neck and pass behind the clavicles, where they joint with the right and left subclavian vein. Unions of the internal jugulars and subclavians from the right and left brachiocephalic veins. Form here blood flows into the superior venacava.

(B) Tributaries

1. Inferior petrosal sinus (निम्न अश्म सिरानाल)
2. Common facial vein (आनन सिरा)
3. Lingual vein (जिह्वा सिरा)
4. Pharyngeal vein (ग्रसनी सिरा)

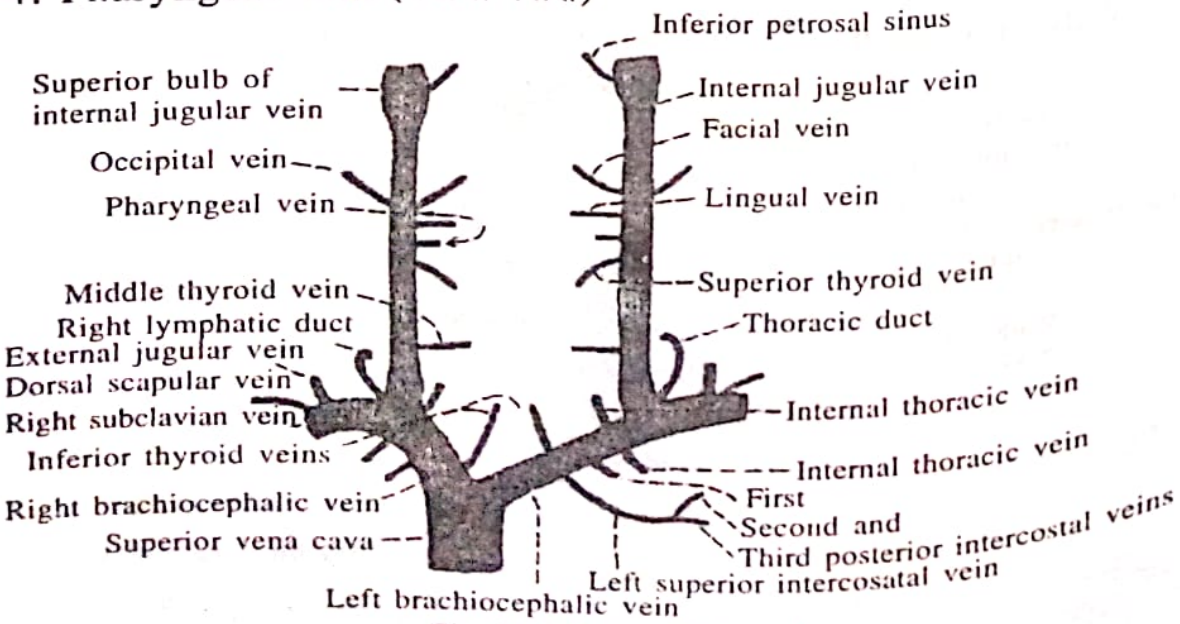


Fig. 11.6 Veins of the neck

5. Superior thyroid vein (ऊर्ध्व अवटु सिरा)
6. Middle thyroid vein (मध्य अवटु सिरा)
7. Occipital vein (पश्च कपाल सिरा)

The **thoracic duct** opens into the angle of union between the left internal jugular vein and the left subclavian vein.

The **right lymphatic duct** opens into the angle of union between the right internal jugular vein and the right subclavian vein.

६. बाह्य ग्रीवा सिरा या मन्या सिरा (External jugular vein)

(A) Introduction

Right and left external jugular veins run inferiorly in the neck along the out side of the internal jugulars. They drain blood from the parotid glands, facial muscles, scalp and other superficial structures into the subclavian veins.

(B) Tributaries

1. Posterior auricular vein (पश्च कर्ण सिरा)
2. Retromandibular vein (पश्च अधोहनुसिरा)
3. Post. external jugular vein (पश्च बाह्य ग्रीवा सिरा)
4. Transverse cervical vein (अनुप्रस्थ ग्रीवा सिरा)
5. Suprascapular vein (अधिअंसफलक सिरा)
6. Anterior jugular vein (अग्र ग्रीवा सिरा)
7. Occipital vein (पश्च कपाल सिरा)

७. कशेरूका सिरा (Vertebral vein)

(A) Introduction

Right and left vertebral veins descend through the transverse foramina of the cervical vertebrae and enter the subclavian veins. They drain deep structures of the neck such as the vertebrae and muscles.

In cases of heart failure, the venous pressure in the right atrium may rise. In such patients the pressure in the column of blood in the external jugular vein rises so that, even with the patient at rest and sitting in a chair, the external jugular vein will be visibly distended.

Temporary distention of the vein is often seen in healthy adults when the intrathoracic pressure is raised during coughing and physical exertion.

८. आनन सिरा (Facial vein)

(A) Introduction

The facial vein begins near the medial angle of the eye, by the union of two superficial veins of the forehead,

The supra trochlear (अधिचक्रक सिरा) and the supra orbital veins. (अधिनेत्रगुहा सिरा) The vein runs downwards and backwards across the face and terminates by joining the anterior branch of the retromandibular vein to form the common facial vein which ends in the internal jugular vein.

Sometimes the common facial vein is described as part of the facial vein, which is then described as ending in the internal jugular vein.

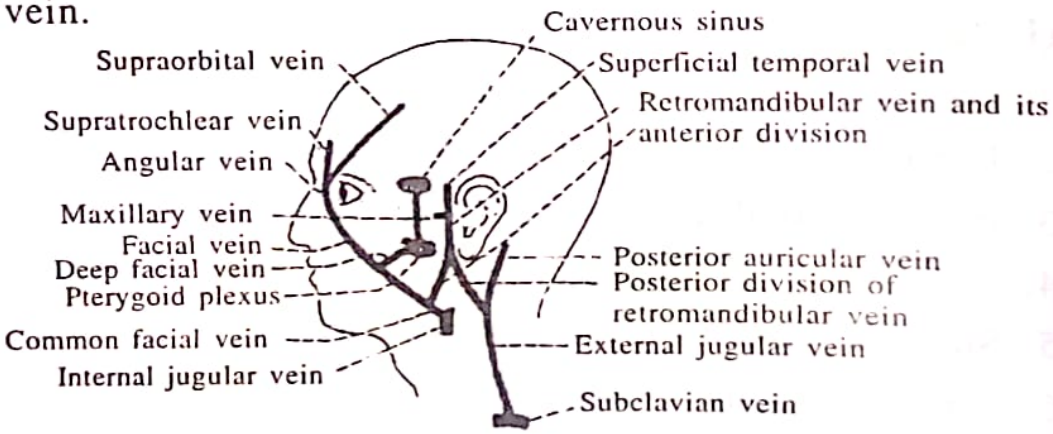


Fig. 11.7 Veins of the face

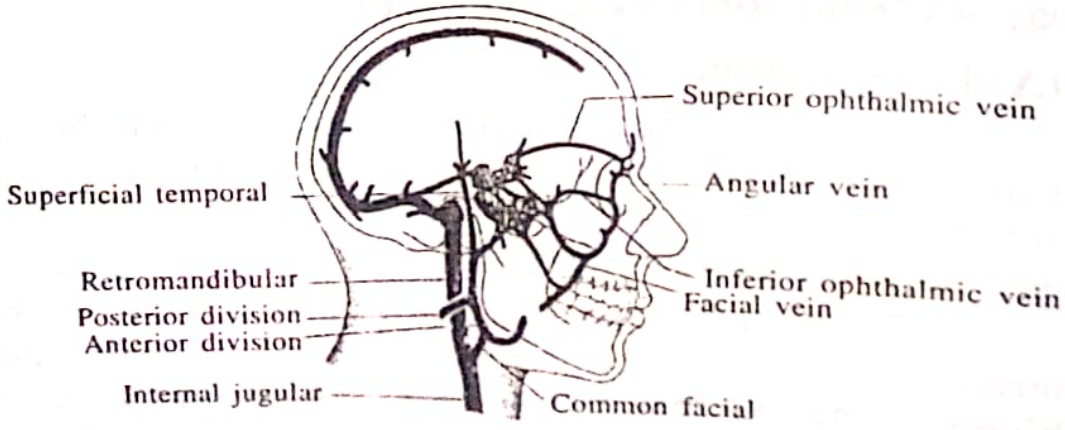


Fig. 11.8 Veins of the face

(B) Tributaries

1. Superior ophthalmic vein (ऊर्ध्वनेत्र सिरा)
2. Inferior palpebral vein (निम्न वर्त्म सिरा)
3. Superior labial vein (ऊर्ध्व ओष्ठ सिरा)
4. Inferior labial vein (अध: ओष्ठ सिरा)
5. Buccinator vein (कपोलिका सिरा)
6. Parotid glandular vein (कर्णाग्रवर्ती ग्रन्थि सिरा)
7. Masseteric vein (चर्वणिका सिरा)
8. Submental vein (अधोचिबुक सिरा)
9. Tonsillar vein (तुण्डीकेरी सिरा)
10. External palatine vein (बाह्य तालु सिरा)
11. Submandibular vein (अव-अधोहनु सिरा)
12. Pharyngeal vein (ग्रसनी सिरा)
13. Superior thyroid vein (ऊर्ध्व अवटु सिरा)

Veins of the upper limbs

Introduction– Blood from each upper limb is returned to the heart by superficial and deep veins. Both sets of veins contain valves.

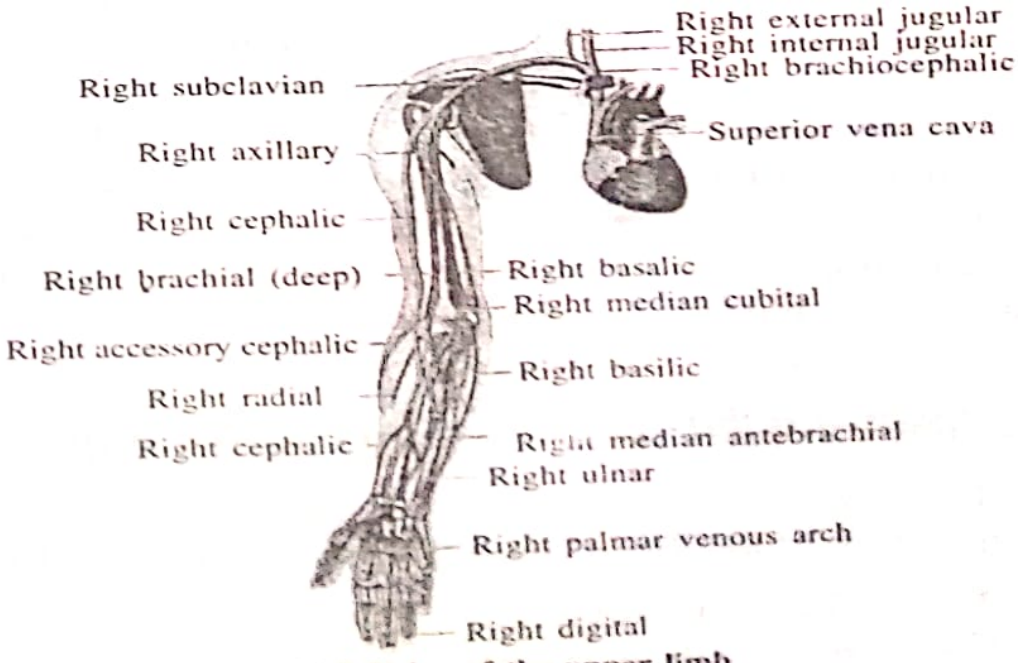


Fig. 11.9 Veins of the upper limb

Superficial veins– are located just deep to the skin and are often visible. They anastomose extensively with one another and with deep veins.

Deep veins– are located deep in the body. They usually accompany arteries, and many have the same names as corresponding arteries.

Superficial vein of the upper limbs

९. बहि: बाहुका सिरा (Cephalic vein)

The cephalic vein is the preaxial vein of the upper limb. The cephalic vein of each upper limb begins in the lateral part of the dorsal venous arch and winds superiorly around the radial border of forearm. Anterior to the elbow, it is connected to the basilic vein by the median cubital vein. just inferior to the elbow, the cephalic vein unites with the accessory cephalic vein to form the cephalic vein of the upper limb. Ultimately, the cephalic vein empties into the axillary vein.

१०. अन्त: बाहुका सिरा (Basilic vein)

The basilic vein is the postaxial vein of the upper limb. The basilic vein of each upper limb originates in the medial part of the dorsal venous arch. It extends along the posterior surface of the ulna to a point near the elbow where it receives the median cubital vein. After receiving the median cubital vein, the basilic continues ascending on the medial side until it reaches the middle of the arm. There it penetrates the tissues deeply and runs along side the brachial artery until it joins the brachial vein. As the basilic and brachial veins merge in the axillary area, they form the **axillary vein.**

११. मध्यम कफोणि सिरा (Median cubital vein)

The median cubital vein is a large communicating vein which shunts blood from the **cephalic to the basilic.**

The median cubital vein is the vein of choice for intravenous injections, for withdrawing blood from donors and for cardiac catheterisation.

१२. प्रकोष्ठ की मध्यम सिरा (Median vein of the forearm or median antebrachial vein)

The median antebrachial veins drain the palmar venous arch, ascend on the ulnar side of the anterior forearm, and end in the median cubital veins.

Deep veins of the upper limbs

१३. बहि: प्रकोष्ठिका सिरा (Radial vein)

Radial veins receive the dorsal metacarpal veins.

१४. अन्त: प्रकोष्ठिका सिरा (Ulnar vein)

Ulnar veins receive tributaries from the palmar venous arch. Radial and ulnar veins unite in the bend of the elbow to form the brachial veins.

१५. प्रगण्डिका सिरा (Brachial vein)

Located on either side of the brachial arteries, the brachial veins join into the axillary veins.

१६. कक्षा सिरा (Axillary vein)

The axillary veins are a continuation of brachial and basilic veins.

Axillary veins end at the first rib, where they become the subclavian veins.

१७. अधोजत्रुक सिरा (Subclavian vein)

The right and left subclavian veins unite with the internal jugulars to form brachiocephalic veins.

The thoracic duct of the lymphatic system delivers lymph into the left subclavian vein at the junction with the internal jugular vein.

The right lymphatic duct delivers lymph into the right subclavian vein at the junction with the internal jugular vein.

Veins of the thorax

Introduction– Although the brachiocephalic veins drain some portions of the thorax, most thoracic structures are drained

by a network of veins called the azygos system. This is a network of veins on each side of the vertebral column.

Azygos, hemiazygos and accessory hemiazygos. They show considerable variation in origin, course, tributaries, anastomoses and termination. Ultimately, they empty into the superior venacava.

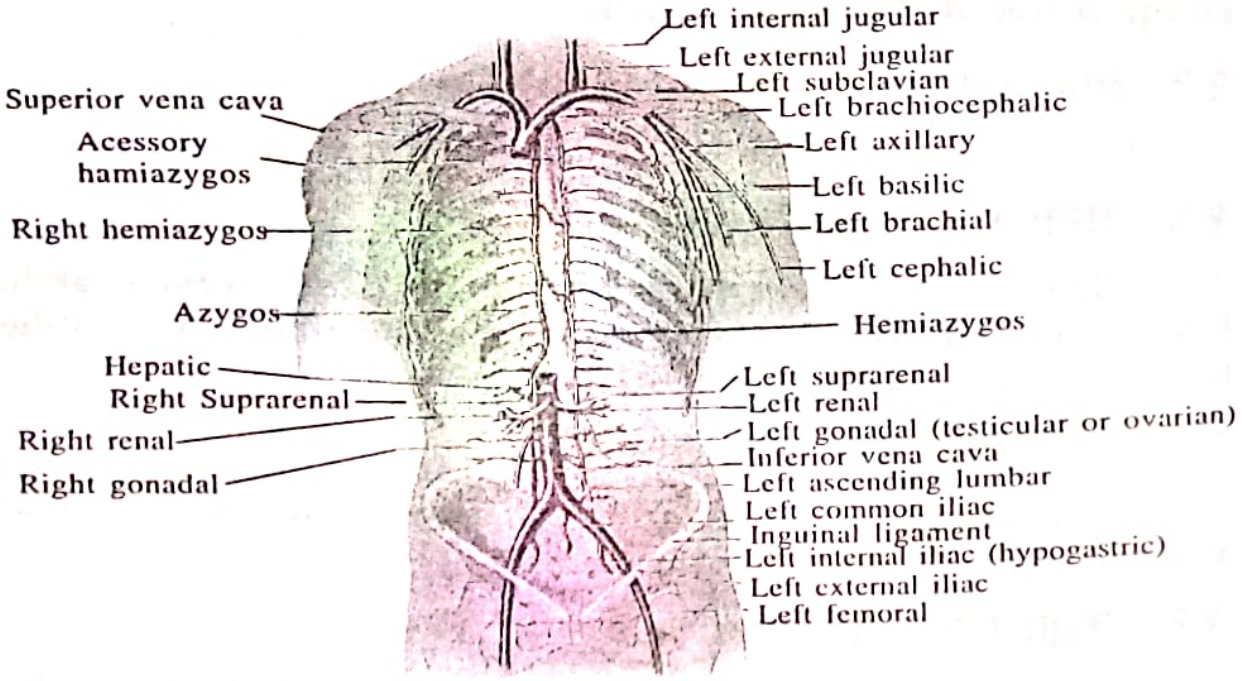


Fig. 11.10 Veins of the thorax, abdomen and pelvis

१८. प्रगण्डशीर्ष सिरा (Brachiocephalic vein)

(A) Introduction

The right and left brachiocephalic veins, formed by the union of the subclavians and internal jugulars, drain blood from the head, neck, upper limbs, mammary glands and superior thorax. Brachiocephalics unite to form the superior venacava.

The right brachiocephalic vein (2.5 cm. long) is shorter than the left (6 cm. long)

(B) Tributaries

- **Right brachiocephalic vein (दक्षिण प्रगण्डशीर्ष सिरा)–**

1. Right vertebral vein (दक्षिण कशेरूका सिरा)
2. Right internal thoracic vein (दक्षिण आभ्यन्तर वक्षीय सिरा)
3. Right inferior thyroid vein (दक्षिण निम्न अवटु सिरा)

4. Right first posterior intercostal vein (प्रथम दक्षिण पश्च पर्शुकान्तरा सिरा)

- **Left brachiocephalic vein (वाम प्रगण्डशीर्ष सिरा)—**

1. Left vertebral vein (वाम कशेरूका सिरा)
2. Left internal thoracic vein (वाम आभ्यन्तर वक्षीय सिरा)
3. Left inferior thyroid vein (वाम निम्न अवटु सिरा)
4. Left first posterior intercostal vein (प्रथम वाम पश्च पर्शुकान्तरा सिरा)

Azygos system

- Azygos means unpaired.

The azygos system besides collecting blood from the thorax, may serve as a bypass for the inferior venacava that drains blood from the lower body. Several small veins directly link the azygos system with the inferior venacava. Large veins that drain the lower limbs and abdomen dump (throw down) blood into the azygos system. If the inferior venacava or hepatic portal vein becomes obstructed, the azygos system can return blood from the lower body to the superior venacava.

१९. अयुग्म सिरा (Azygos vein)

(A) Introduction

The azygos vein drains the thoracic wall and the upper lumbar region. It forms an important channel connecting the superior and inferior venacava.

The vein occupies the upper part of the posterior abdominal wall and the posterior mediastinum.

The azygos vein is formed by union of the lumbar azygos, right subcostal and right ascending lumbar veins.

The azygos vein enters the thorax by passing through the **aortic opening** of the diaphragm.

The azygos vein then ascends up to 4th thoracic vertebra where it arches forwards over the root of the right lung and ends by joining the posterior aspect of the superior venacava. Just before the latter pierces the pericardium.

(B) Tributaries

1. Right superior intercostal vein (दक्षिण ऊर्ध्व पर्शुकान्तरा सिरा) (Formed by union of the 2-3-4th posterior intercostal veins)
2. 5-11th right posterior intercostal vein (दक्षिण पश्च पर्शुकान्तरा सिरा)
3. Right bronchial veins (दक्षिण श्वसनी सिराएँ)
4. Esophageal vein (अन्नवाहिनी सिरा)
5. Mediastinal vein (फुफ्फुसान्तराल सिरा)
6. Pericardial vein (परिहृद् सिरा)
7. Accessory hemiazygos vein (सहायक अर्धायुग्म सिरा)
8. Hemiazygos vein (अर्धायुग्म सिरा)
9. Lumbar azygos vein (कटि अयुग्म सिरा)
10. Right ascending lumbar vein (दक्षिण आरोही कटि सिरा)
11. Right subcostal vein (दक्षिण अध:पर्शुका सिरा)

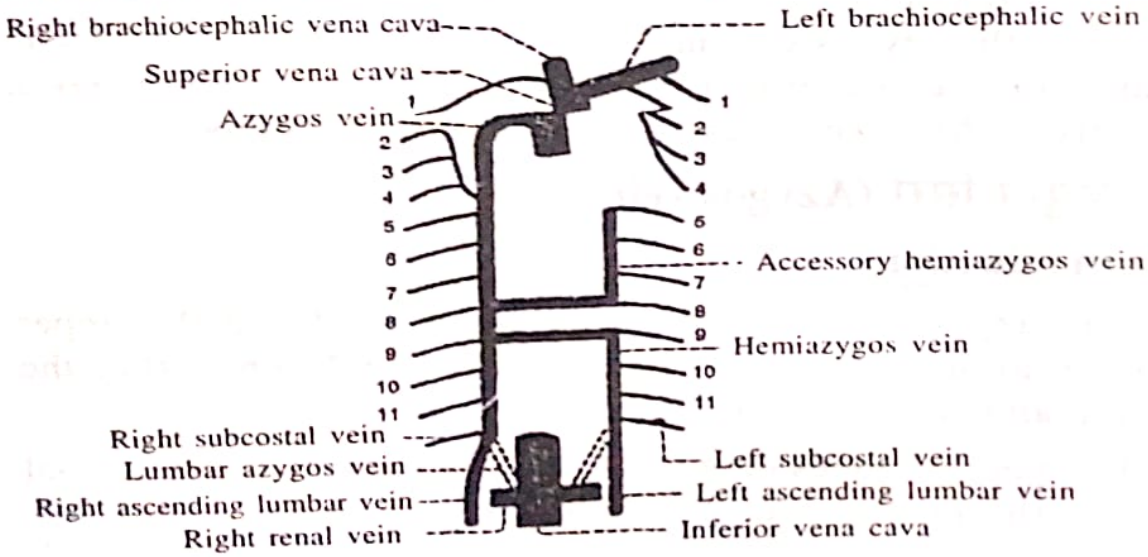


Fig. 11.11 Azygos, hemiazygos and accessory hemiazygos veins

२०. अर्धायुग्म सिरा (Hemiazygos vein or inferior hemiazygos vein)

(A) Introduction

The hemiazygos vein is anterior to the vertebral column and slightly to the left of the midline. It begins as a continuation of the left ascending lumbar vein.

The hemiazygos vein pierces the left crus of the diaphragm asc-ends on the left side of the vertebra overlapped by the aorta. At the level of eighth thoracic vertebra, it turns to the right, passes behind the esophagus and the thoracic duct, and joins the azygos vein.

(B) Tributaries

1. Left ascending lumbar vein (वाम आरोही कटि सिरा)
2. Left subcostal vein (वाम अधः पर्शुका सिरा)
3. 9-11th left posterior intercostal veins (वाम पश्च पर्शुकान्तरा सिराएँ)

२१. सहायक अर्धायुग्म सिरा (Accessory hemiazygos vein or superior hemiazygos vein)

(A) Introduction

The accessory hemiazygos vein is also anterior and to the left of the vertebral column.

Accessory hemiazygos vein begins at the medial end of the 4th or 5th intercostai space, and descends on the left side of the vertebral column. At the level of 8th thoracic vertebra it turns to the right, passes behind the aorta and the thoracic duct and joins the azygos vein.

(B) Tributaries

1. Left bronchial veins (वाम श्वसनी सिराएं)
2. 5-8th left posterior intercostal veins (वाम पश्च पर्शुकान्तरा सिराएं)

Veins of the abdomen and pelvis

Introduction– Blood from the abdominopelvic viscera and abdominal wall returns to the heart via the inferior venacava (I.V.C.).

Many small veins enter the inferior venacava. Most carry return flow from parietal branches of the abdominal aorta and their names correspond to the names of the arteries.

The inferior venacava does not receive vein from the gastro-intestinal tract, spleen, pancreas and gall bladder. These organs pass their blood into a common vein, the hepatic portal vein, which

delivers the blood to the liver. This special flow of venous blood is called hepatic portal circulation.

After passing through the liver, blood drains into the hepatic veins, which empty into the inferior venacava.

- **Inferior venacava (अधरा महासिरा)–**

The inferior venacava is formed by the union of the right and left common iliac veins on the right side of the body of L_5 vertebra. It ascends infront of the vertebral column, on the right side of the aorta, grooves the posterior surface of the liver, pierces the central tendon of the diaphragm at the level of T_8 vertebra and opens into the lower and posterior part of the right atrium.

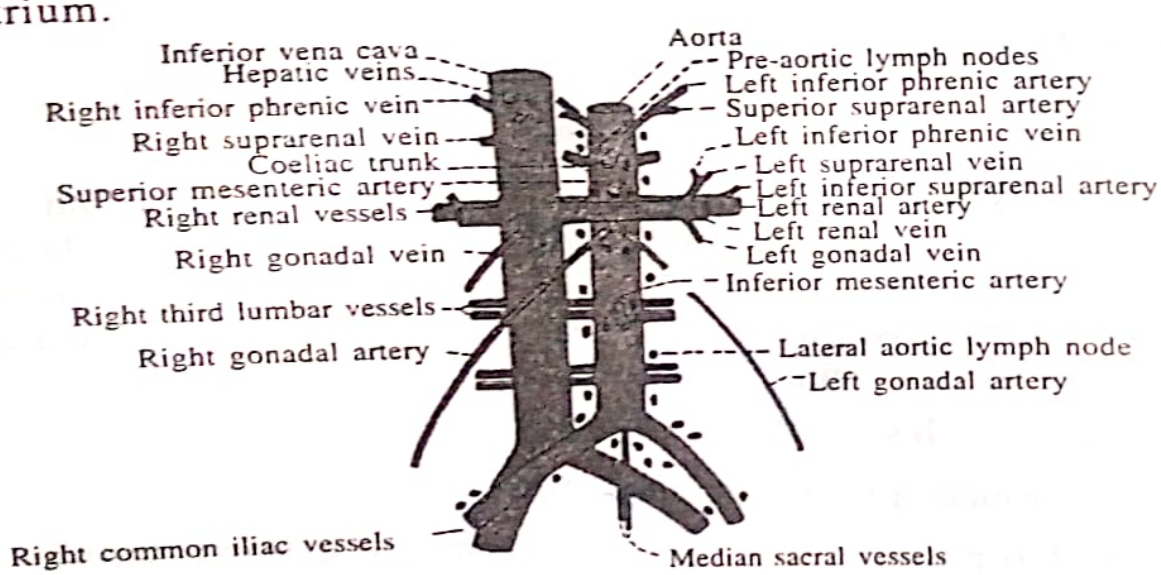


Fig. 11.12 Abdominal aorta and inferior venacava

२२. सामान्य जघनिका सिरा (Common iliac vein)

The common iliac veins are formed by the union of the internal and external iliac veins and represent the distal continuation of the inferior venacava at its bifurcation.

२३. आभ्यन्तर जघनिका सिरा (Internal iliac vein)

(A) Introduction

Tributaries of the internal iliac veins basically correspond to branches of internal iliac arteries. The internal iliacs drain the gluteal muscles, medial side of the thigh, urinary bladder, rectum, prostate gland, ductus deferens, uterus and vagina. It

ascends posteromedial to the internal iliac artery, and joins the external iliac vein to form the common iliac vein at the pelvic brim, infront of the lower part of the sacroiliac joint.

(B) Tributaries

1. Superior gluteal vein (ऊर्ध्व नितम्ब सिरा)
2. Inferior gluteal vein (अध: नितम्ब सिरा)
3. Internal pundendal vein (आभ्यन्तरउपस्थ सिरा)
4. Obturator vein (गवाक्ष सिरा)
5. Lateral sacral vein (पार्श्व त्रिक् सिरा)
6. Rectal venous plexus (मलाशय सिरा जालिका)
   It is drained by the superior, middle and inferior rectal veins.
7. Prostatic venous plexus (अष्ठीला सिरा जालिका)
   It is drained into the vesical and internal iliac veins.
8. Vesical venous plexus (मूत्राशय सिरा जालिका)
   It is drained by the vesical veins.
9. Uterine venous plexuses (गर्भाशय सिरा जालिकाएँ)
   The uterine venous plexuses are drained by the uterine veins.
10. Vaginal venous plexuses (योनि सिरा जालिकाएँ)
    The vaginal venous plexuses are drained by the vaginal veins.

२४. बाह्य जघनिका सिरा (External iliac vein)

The external iliac veins are a continuation of the femoral veins and receive blood from the lower limbs and inferior part of the anterior abdominal wall.

२५. वृक्क सिरा (Renal vein)

The renal veins drain the kidneys.

२६. वृषण सिरा (Testicular vein)

The testicular veins drains the testes (The left testicular vein empties into the left renal vein and the right testicular vein drains into the inferior vena cava.)

२७. डिम्ब ग्रन्थि सिरा (Ovarian vein)

The ovarian veins drain the ovaries (The left ovarian vein empties into the left renal vein and the right ovarian vein drains into the inferior venacava).

२८. अधिवृक्क सिरा (Suprarenal vein)

The suprarenal veins drains the adrenal glands (The left supra- renal vein empties into the left renal vein and the right suprarenal vein empties into the inferior venacava.)

२९. निम्न मध्यच्छद सिरा (Inferior phrenic vein)

The inferior phrenic veins drain the diaphragm. (The left inferior phrenic vein sends a tributary to the left renal vein and the right inferior phrenic vein empties into the inferior venacava.)

- Left testicular vein → Drains the left renal vein.
  Left ovarian vein → Drains the left renal vein.
  Left suprarenal vein → Drains the left renal vein.
  Left inferior phrenic vein → Drains the left renal vein.

- Right testicualr vein → Drains the inferior venacava.
  Right ovarian vein → Drains the inferior venacava.
  Right suprarenal vein → Drains the inferior venacava.
  Right inferior phrenic vein → Drains the inferior venacava.

३०. याकृति सिरा (Hepatic vein)

The hepatic veins drain the liver.

३१. प्रतिहारिणी सिरा (Portal vein)

(A) Introduction

This is a large vein which collects blood from the abdominal part of the alimentary tract (gastrointestinal tract), the gall bladder, the pancreas, the spleen and conveys it to the liver.

In the liver, the portal vein break up into sinusoids which are drained by the right and left hapatic veins to the inferior venacava.

It is called the portal vein because it begins in one set of capillaries in the gut and ends in another set of capillaries in the liver.

The portal vein is about 8 cm. long.

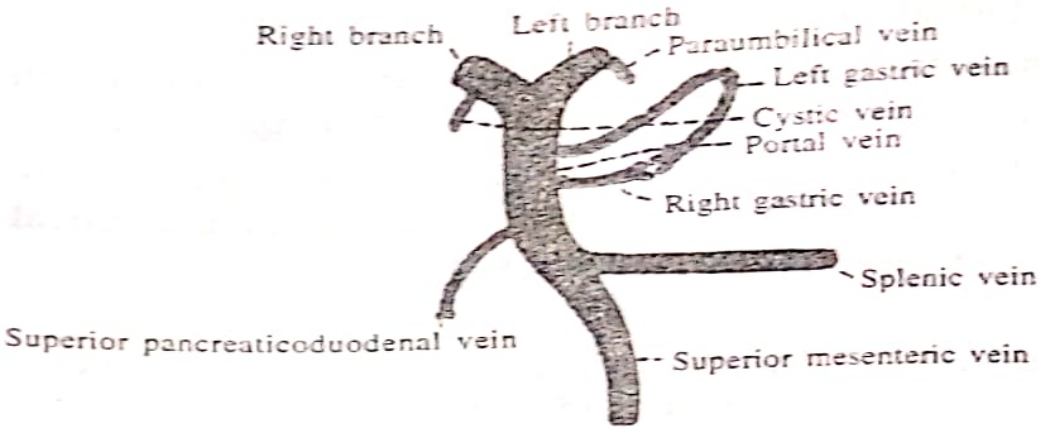


Fig. 11.13 Tributaries of the portal vein

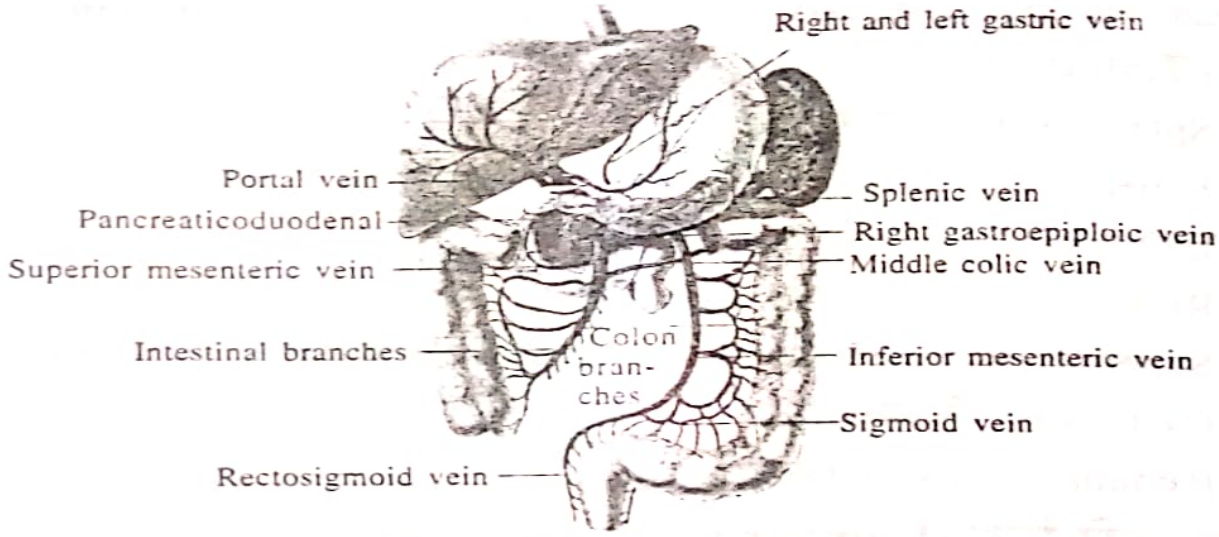


Fig. 11.14 Portal venous system

It is formed by the union of the superior mesenteric and splenic veins behind the neck of pancreas at the level of L_2 vertebra. It runs upwards and to the right, first behind the neck of pancreas, next behind the first part of the duodenum and lastly in the right free margin of the lesser omentum. The portal vein can be divided into infraduodenal, retroduodenal and supraduodenal parts. The vein ends at the right end of the porta hepatis by dividing into right and left branches which enter the liver.

Relation– Anterierly– Neck of pancreas, first part of duodenum, common bile duct, gastroduodenal artery and hepatic artery.

Posteriorly– Inferior venacava (I.V.C.)

Branches of portal vein–

Right branch– It is shorter and wider than the left branch after receiving the cystic vein, it enters the right lobe of liver.

Left branch– It is longer and narrower than the right branch. Just before entering the left lobe of liver, it receives paraumbilical vein, ligamentum teres and ligamentum venosum.

Applied aspect–

- **Portal pressure–** The normal pressure in the portal vein is about 5-15 mm hg.
- **Portal hypertension–** Pressure above 40 mm hg.
  Caused by– Cirrhosis of liver, thrombosis of portal vein.

(B) Tributaries

1. Splenic vein (प्लैहिक सिरा)
2. Superior mesenteric vein (ऊर्ध्व आन्त्रयोजनी सिरा)
3. Left gastric vein (वाम जठर सिरा)
4. Right gastric vein (दक्षिण जठर सिरा)
5. Superior pancreaticoduodenal vein (ऊर्ध्व अग्न्याशय ग्रहणी सिरा)
6. Cystic vein (पित्ताशय सिरा)
7. Paraumbilical vein (परानाभि सिरा)

३२. कटि सिरा (Lumbar vein)

A series of parallel lumbar veins drain blood from both sides of the posterior abdominal wall. The lumbars connect at right angles with the right and left ascending lumbar veins, which from the origin of the corresponding azygos or hemiazygos vein. The lumbars drain blood into the ascending lumbars and then run to the inferior venacava.

Veins of the lower limbs

Introduction– Blood from each lower limb is drained by superficial and deep veins.

The superficial veins often anastomose with each other and with deep veins along their length.

Deep veins for the most part, have the same name as then companion arteries.

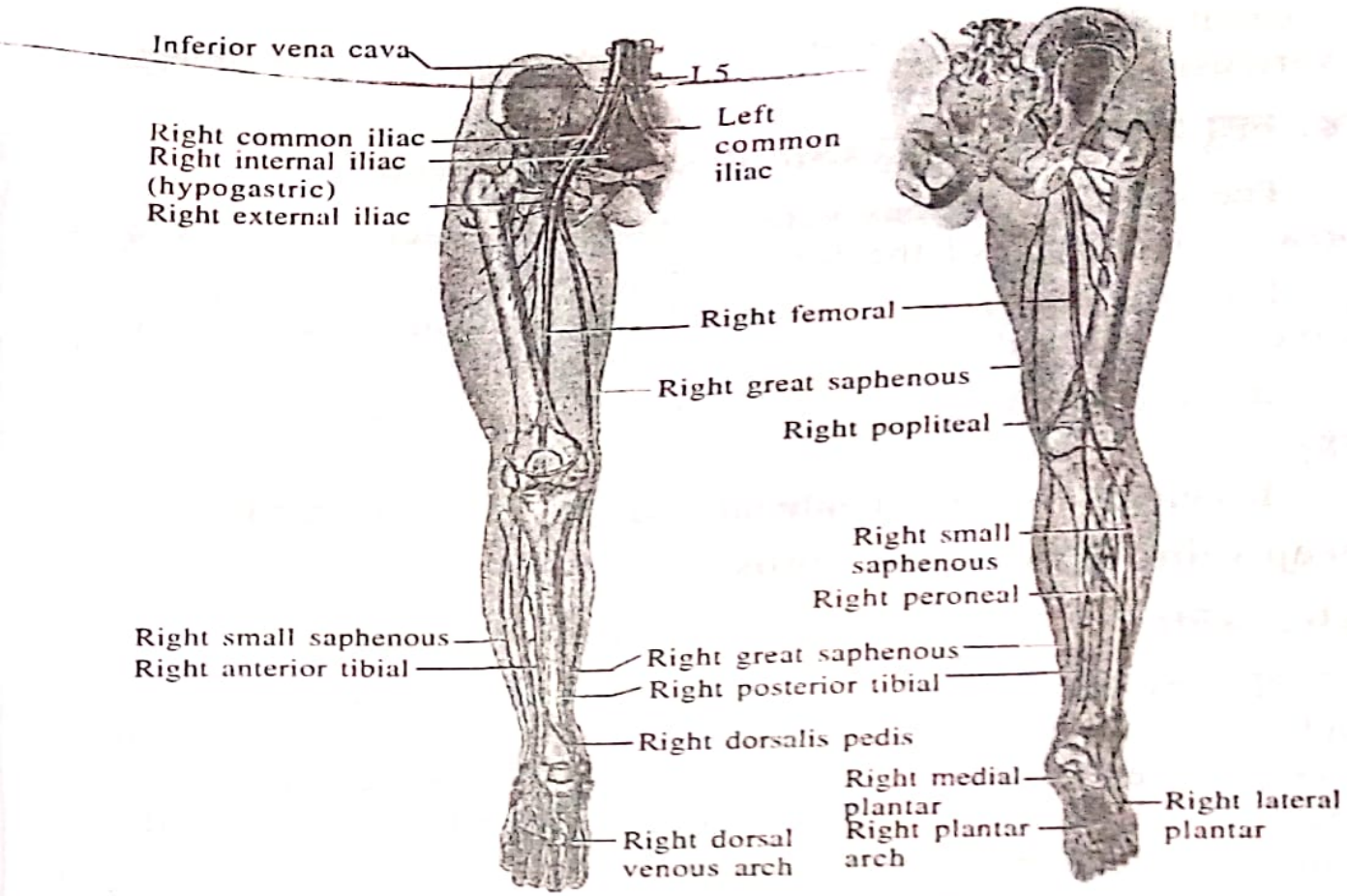


Fig. 11.15 Veins of the lower limb

Superficial veins of the lower limbs

३३. दीर्घ अध:शाखा सिरा (Great saphenous vein or long saphenous vein)

Saphens means easily seen.

The great saphenous vein is the **longest vein in the body.** It begins at the medial end of the dorsal venous arch of the foot. It passes anterior to the medial malleolus and then superiorly along the medial aspect of the leg and thigh just deep to the skin. It receives tributaries from superficial tissues and connects with the deep veins as well. It empties into the femoral vein in the groin.

The great saphenous vein is often used for prolonged administration of intravenous fluids. This is particularly important in very young babies and in patients of any age who are in shock and whose veins are collapsed.

Great saphenous vein and small saphenous vein are subject to varicosity.

३४. लघु अधःशाखा सिरा (Small saphenous vein)

The small saphenous vein begins at the lateral end of the dorsal venous arch of the foot.

It passes posterior to the lateral malleolus and ascends deep to the skin along the posterior aspect of the leg.

It receives blood from the foot and posterior portion of the leg.

It empties into the popliteal vein posterior to the knee.

Deep veins of the lower limbs

३५. अन्तः जंघिका पश्चिमा सिरा (Posterior tibial vein)

The posterior tibial vein is formed by the union of the medial and lateral plantar veins, posterior to the medial malleolus. It ascends deep in the muscle at the posterior aspect of the leg, receives blood from the peroneal vein and unites with the anterior tibial vein just inferior to the knee.

३६. अन्तः जंघिका अग्रिमा सिरा (Anterior tibial vein)

The anterior tibial vein is the superior continuation of the dorsalis pedis veins in the foot. It extends between the tibia and fibula and unites with the posterior tibial to form the popliteal vein.

३७. जानु पृष्ठिका सिरा (Popliteal vein)

The popliteal vein just posterior to the knee, receives blood from the anterior and posterior tibials and the small saphenous vein.

३८. और्वी सिरा (Femoral vein)

(A) Introduction

The femoral vein is the superior continuation of the popliteal vein just superior to the knee. The femorals extends up the posterior surface of the thigh and drain the deep structures of the thighs. After receiving the great saphenous veins in the groin, they continue as the right and left external iliac veins.

(B) Tributaries

1. Great saphenous vein (दीर्घ अध:शाखा सिरा)
2. Venae profunda femoris (गम्भीर और्वी सिरा)
3. Deep external pudendal vein (गम्भीर बाह्य उपस्थ सिरा)
4. Muscular veins (पेशी सिराएँ)
5. Lateral circumflex femoral vein (पार्श्व परिवेष्टक और्वी सिरा)
6. Medial circumflex femoral vein (अभिमध्य परिवेष्टक और्वी सिरा)
7. Descending genicular vein (अवरोही जानु सिरा)

३९. फुफ्फुसीय सिरा (Pulmonary vein)

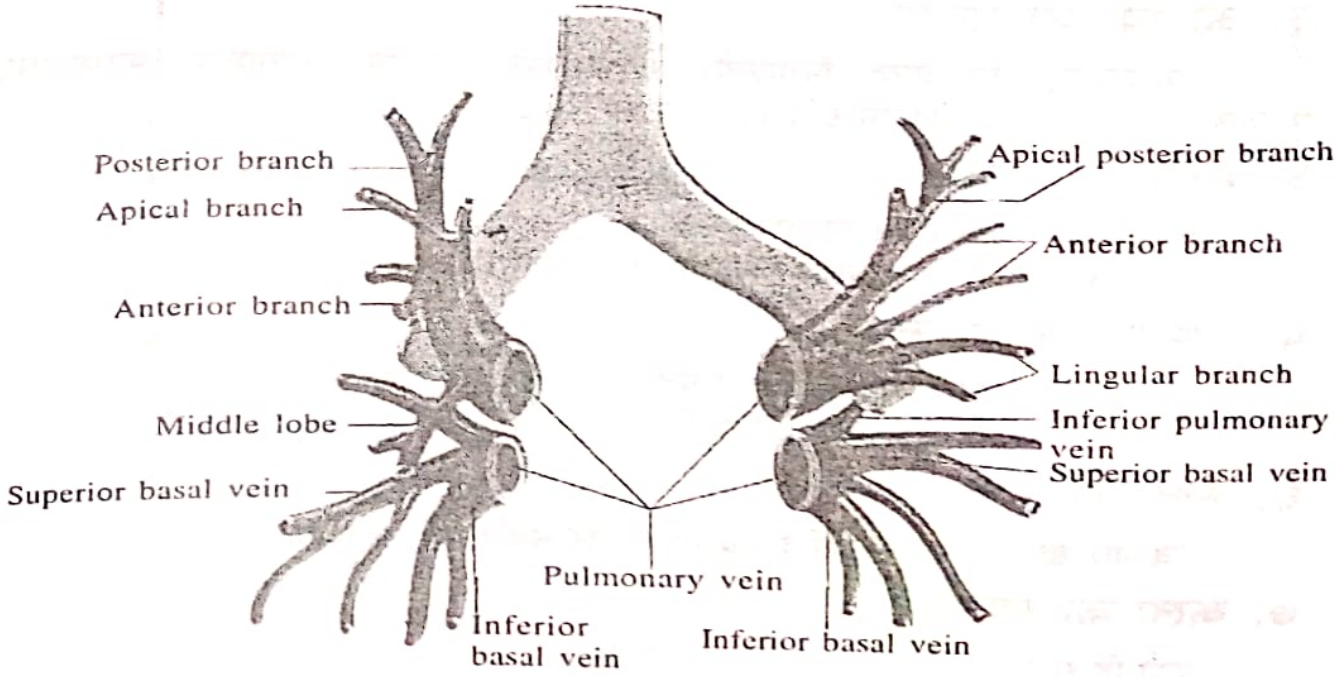


Fig. 11.16 Pulmonary veins

These are two from each lung (Four pulmonary vein) carry oxygenated blood from lungs to the left atrium of the heart. These veins do not contain valves, all the alveolar capillaries which encircle the alveoli of lungs get filled up with the inhaled oxygen that reaches the alveoli and merge together to form pulmonary veins. This oxygenated blood after reaching the left atrium through these veins passes into left ventricle and from there is pumped out into the systemic circulation through aorta.