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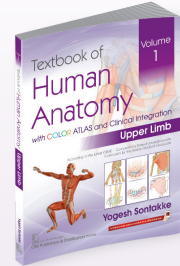
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# Textbook of Human Anatomy

6 Volume Series by Dr Yogesh Sontakke

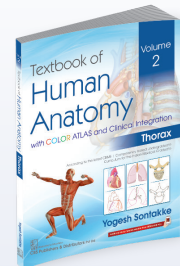
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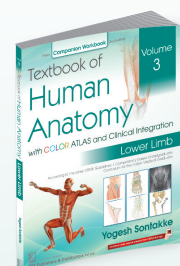
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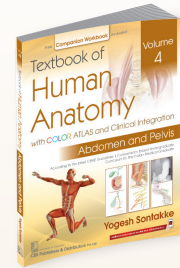
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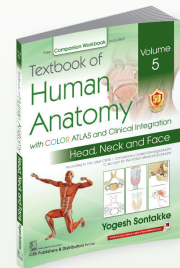
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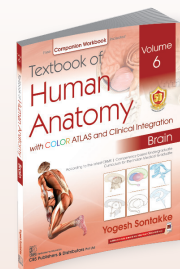
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# eSmartQuiz – Online MCQ Test

Are you ready for the “eSmartQuiz – Online MCQ test”?

After attending the class, students should go through the “eSmartQuiz – Online MCQ test” for the following reasons:

- *Reinforcement of Learning*: The “eSmartQuiz – Online MCQ test” provide an opportunity to reinforce learning after attending a class or reading a book. It helps to assess understanding and retention of concepts, to solidify knowledge and identify areas that need further revision or clarification.
- *Assessment of Comprehension*: The “eSmartQuiz – Online MCQ test” is an effective tool to assess comprehension of the subject matter and to demonstrate the ability to apply the concepts learned in the class.
- *Enhancement of Attention and Critical Thinking*: The “eSmartQuiz – Online MCQ test” will help to make students attentive for the class and to enhance critical thinking skills by selecting the most appropriate answer among the given options.

Each eSmartQuiz test consists of 10 MCQs, mostly image-based, and the student can see their scores at the end of each test. These questions will be modified after a certain interval. Use the given links or scan the QR code (given in each chapter) for the test. One student can solve each test only one time.

Chapter	Link for eSmartQuiz	Chapter	Link for eSmartQuiz
1	<a href="https://forms.gle/sG1zWDaDpGQtGo9q9">https://forms.gle/sG1zWDaDpGQtGo9q9</a>	11	<a href="https://forms.gle/QB9cZGiCNd5Dhnxm9">https://forms.gle/QB9cZGiCNd5Dhnxm9</a>
2	<a href="https://forms.gle/d2yg574ms7UpQ6uZ8">https://forms.gle/d2yg574ms7UpQ6uZ8</a>	12	<a href="https://forms.gle/rZuqXKBfz86Qrty68">https://forms.gle/rZuqXKBfz86Qrty68</a>
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# Early Clinical Exposure

## Case Scenario 1

*Reference: Chapter 2: Anatomical Terminology*

A 30-year-old woman was admitted at the medical college for delivery. She was kept for observation for 6 hours. Then, she was shifted to the labor room for delivery. After delivery, she was moved to the ward and kept under observation for a few hours.

### Question:

Q. What are different positions of body used during the hospital stay of the woman as mentioned above?

### Answer (anatomical explanations):

In this case scenario, the woman admitted at the medical college underwent several changes in the body position. Some of them are as follows:

1. During initial observation period: Supine position, which is helpful for routine observations and medical examinations and monitoring. It also provides comfort and support to the patient.
2. During labor (for delivery of baby): Lithotomy position to facilitate the delivery process. These positions allow healthcare providers better access to the perineal area for delivery.
3. Post-delivery observation period: After delivery, the woman might have been placed in a supine position or a side-lying position for recovery and observation. These positions can provide comfort and support to patient.

## Case Scenario 2

*Reference: Chapter 3: Cell and Tissues*

A 25-year-old male, presenting with chronic respiratory issues and recurrent sinus infections since childhood, seeks medical attention for fertility issues. He had a history of chronic cough, wheezing, and difficulty in breathing. Frequent sinusitis has led to multiple courses of antibiotics over the years.

*Clinical examination:* Examination revealed diminished lung sounds, persistent nasal congestion, and a history of frequent ear infections. Semen analysis showed reduced sperm motility.

### Questions:

- Q.1. What is the likely diagnosis of this patient's condition?
- Q.2. Which structure is affected?
- Q.3. What is the underlying cause of the patient's recurrent respiratory tract infections and sinusitis?
- Q.4. What is the primary cause of infertility observed in this case?

### Answer (anatomical explanations):

1. Based on the provided information, the likely diagnosis of this patient's condition is Kartagener syndrome or primary ciliary dyskinesia (PCD).
2. It has affected the cilia, which led to impaired ciliary movement. It occurs primarily due to mutation of DNAH5 and DNAI1 genes.
3. Recurrent respiratory tract infections and sinusitis are caused by the impaired movement of cilia. The ineffective movement of cilia fails to clear mucus and bacteria from the respiratory tract, leading to frequent infections.
4. The primary cause of infertility in this case is likely due to diminished sperm motility, which can result from the impaired functioning of cilia in the reproductive system. Proper ciliary movement is essential for the normal transport of sperm, and when cilia are dysfunctional, it can lead to fertility issues.

## Case Scenario 3

*Reference: Chapter 4: Skeleton*

An 8-year-old boy is brought to the hospital by his parents due to persistent pain and swelling in his right leg. He has been limping and has had a fever for the past week. The parents report that the boy had a minor injury to his right shin (below the knee joint) a few weeks ago while playing outdoors. The wound initially seemed superficial but did not heal properly.

*Clinical examination:* On examination, there was localized tenderness, redness, and swelling over the right shin. The affected leg was warm to touch. The boy localized the tenderness and pain in the movement of the right leg. He could not bear weight on the affected leg and had a limited range of motion in the nearby joints.

### Questions:

- Q.1. What is the likely diagnosis of this patient's condition?
- Q.2. What is the anatomical basis for this condition in childhood?
- Q.3. Is this condition common in adults?

### Answer (anatomical explanations):

1. The likely diagnosis is osteomyelitis, an infection of the bone often caused by bacteria. In this case, the infection possibly originated from the inadequately healed wound.
2. In children, osteomyelitis commonly occurs due to the spread of bacteria from nearby soft tissues or skin wounds. In typical young bones, due to hairpin bends

of arteries in the metaphysis, circulating bacteria get trapped, resulting in osteomyelitis.

3. In adult long bones, there are no hairpin bends in arteries at the metaphysis. Hence, osteomyelitis is more common in children than adults.

#### Case Scenario 4

*Reference: Chapter 5: Joints*

A 35-year-old individual presents with a history of sharp, localized pain in the right shoulder following a recent fall. The patient reports limited mobility and discomfort when moving the shoulder.

On examination, the physician identified tenderness and swelling around the right shoulder joint. The patient experienced muscle spasms and guarding of the muscles around the shoulder joint, especially during certain movements. The patient reported pain over the skin covering the affected shoulder area.

#### Questions:

- Q.1. Which anatomical principle or law is applicable or demonstrated in this patient's symptoms?
- Q.2. Why were there muscle spasms and restrictions during certain movements in this case?
- Q.3. Why was pain over the skin covering the affected area?

#### Answer (anatomical explanations):

1. The anatomical principle demonstrated in this case is Hilton's Law. Hilton's Law states that the nerves supplying a joint also supply the muscles that act on that joint and the skin covering the joint.
2. The muscle spasms and restrictions during certain movements occurred due to irritation of the nerves supplying the shoulder joint following the fall. This irritation leads to reflex spasm of the muscles around the joint, restricting movement and causing discomfort. The muscles guarding the joint aim to protect it from further injury.
3. The pain over the skin covering the affected area was due to the same irritated nerves supplying the joint, as per Hilton's Law. When the joint's nerves are irritated, the pain is referred to the specific area of skin innervated by the same set of nerves.

#### Case Scenario 5

*Reference: Chapter 6: Muscular System*

A forensic medical expert, Dr Sarah, has been called to a crime scene at a remote farmhouse. The body of a middle-aged man, identified as Mr. Robert, has been discovered in the living room by a concerned neighbor. Mr Robert was last seen alive approximately 12 hours ago, according to his family members.

The forensic expert observed the body closely. She observed the muscle stiffness in the smaller muscle groups, such as the face and neck, which made them

difficult to manipulate. There was slight muscle stiffness in larger muscle groups, allowing for limited movement.

#### Questions:

- Q.1. What is rigor mortis?
- Q.2. What is the anatomical and physiological basis of rigor mortis?
- Q.3. What may be the time since death in this case, and why?

#### Answer (anatomical explanations):

1. Rigor mortis, a Latin term meaning "stiffness of death," is a natural post-mortem phenomenon that occurs in a deceased body.
2. After death, there is the depletion of ATP, which is essential for muscle relaxation.
3. In this case, the time since death of Mr Robert may be less than 2 hours. The rigor mortis typically starts within 1 to 2 hours after death. It begins in smaller muscle groups and facial muscles before progressing to larger muscles. Rigor mortis reaches its peak stiffness around 6 hours after death, making the body difficult to move or manipulate. The rigor mortis gradually resolves. The process of resolution starts within 24 to 48 hours after death. The muscles become pliable again, and the body returns to a relaxed state. Rigor mortis fades completely, allowing the body to be moved freely.

#### Case Scenario 6

*Reference: Chapter 7: Cardiovascular System*

A 45-year-old male surgeon presents with complaints of swollen, twisted veins in his legs, particularly noticeable during prolonged standing or after a day of surgeries. He mentions experiencing occasional aching and discomfort in his legs, especially after long hours in the operating room.

On examination, visible, dilated veins are observed on both legs, with significant prominence and discoloration. The affected veins are tender to the touch.

#### Questions:

- Q.1. What is the likely diagnosis of this patient's condition?
- Q.2. What was the risk factor for development of this condition?
- Q.3. What is the anatomical basis for this condition?
- Q.4. Which are the other professions that may have this disease?

#### Answer (anatomical explanations):

1. The likely diagnosis for this patient is varicose veins.
2. The primary risk factor for the development of varicose veins, in this case, is prolonged periods of standing.
3. Varicose veins occur when the valves in the veins, which usually prevent blood from flowing backward, become weak or damaged. This weakening of the valves allows blood to pool in the veins, causing them

to enlarge and become varicose. The condition often affects the superficial veins of the legs, leading to a visible, twisted appearance.

- Professions that involve prolonged periods of standing, such as nurses, teachers, retail workers, and flight attendants, are at an increased risk of developing varicose veins.

### Case Scenario 7

Reference: Chapter 8: Lymphatic System

A 7-year-old girl is brought to the pediatric clinic by her parents due to complaints of sore throat, difficulty swallowing, and fever for the past few days. The parents reported that their daughter had been experiencing throat pain, particularly while eating and drinking. She also had a mild fever.

On clinical examination of the throat, the pediatrician observed enlarged, red, and inflamed tonsils at the back of the throat. On palpation, the tender, firm masses on both sides of the neck were found.

#### Questions:

- What is the likely diagnosis of this patient's condition?
- What were the structures in the neck involved in this clinical condition?
- What is the anatomical basis for this condition?

#### Answer (anatomical explanations):

- The likely diagnosis for this patient is *acute tonsillitis*, an inflammation of the tonsils. The presence of tender masses on both sides of the neck indicates *cervical lymphadenopathy*, which is an enlargement of the lymph nodes.
- In this clinical condition, the cervical lymph nodes were involved. The cervical lymphadenopathy occurs in response to infections like acute tonsillitis.
- Acute tonsillitis occurs due to the inflammation of the tonsils. When pathogens, such as viruses or bacteria, infect the tonsils, the immune system triggers inflammation. The tonsils are drained by lymphatic vessels that lead to the cervical lymph nodes. Infections can spread from the tonsils to the nearby lymph nodes, causing their enlargement.

### Case Scenario 8

Reference: Chapter 9: Nervous System

A 42-year-old woman presented with fluctuating muscle weakness and fatigue for six months, worsening gradually. She had drooping eyelids (ptosis), double vision (diplopia), and difficulty speaking and swallowing, especially while eating. Muscle weakness intensified with activity but improved with rest.

Neurological examination showed weakness in eye muscles, and repetitive movements caused quick fatigue of muscles.

#### Questions:

- What is the likely diagnosis of this patient's condition?
- What were the ultrastructure affected in this clinical condition?
- Explain the anatomical basis behind the worsening of symptoms with repetitive movements and improvement with rest.
- Explain the anatomical basis behind the drooping eyelids (ptosis), double vision (diplopia), and difficulty speaking (dysarthria) and swallowing (dysphagia).

#### Answers (anatomical explanations):

- The likely diagnosis for this patient's condition is myasthenia gravis, an autoimmune neuromuscular disorder.
- In myasthenia gravis, the acetylcholine receptors at the neuromuscular junctions are affected. Auto-antibodies attack these receptors, leading to impaired neuromuscular transmission.
- Worsening of symptoms with repetitive movements occurs in myasthenia gravis due to the depletion of available acetylcholine at the neuromuscular junction. Rest allows acetylcholine levels to replenish, improving muscle function temporarily.
- Ptosis (drooping eyelids), diplopia (double vision), and difficulty in speaking and swallowing occur due to weakness in the extraocular muscles and muscles involved in speech and swallowing.

### Case Scenario 9

Reference: Chapter 10: Skin and Fasciae

A 50-year-old male presented with progressive nail changes over six months, marked by convex, bulbous swelling of the nail beds. He reported no respiratory or cardiac symptoms, denying breathing difficulties or chest pain. His medical history lacked chronic lung diseases, heart conditions, or other significant illnesses.

Clinical examination revealed clubbing in multiple fingers, evident by an increased angle between cuticles and nail plates.

#### Questions:

- What is the likely diagnosis of this patient's condition?
- Which clinical test is employed for detecting this particular finding?
- Explain the anatomical basis behind this clinical condition.
- What are the common causes of this clinical condition?

#### Answers (anatomical explanations):

- The likely diagnosis for this patient's condition is nail clubbing.
- The clinical test for detection of nail clubbing is Schamroth's window test. In this test, a small diamond-shaped window should be visible between

the nail plates of corresponding fingers. The absence of this window indicates positive clubbing.

3. Anatomical basis for nail clubbing: Nail clubbing is associated with chronic hypoxia (low oxygen levels), leading to increased vascularization and connective tissue growth in the nail bed.
4. Clubbing is indicative of an underlying condition causing prolonged hypoxia. Common causes of nail clubbing include various respiratory and cardiovascular diseases, such as chronic obstructive pulmonary disease (COPD), bronchiectasis, congenital heart diseases, lung cancer, inflammatory bowel diseases, liver diseases, and endocrine disorders.

### Case Scenario 10

*Reference: Chapter 11: Principles of Radiology*

A 30-year-old pregnant woman in her 28th week of gestation presents to the antenatal clinic for a routine prenatal checkup and fetal examination. Earlier, she delivered a healthy baby boy with normal vaginal delivery. She had presented now with the complaint of reduced fetal movement.

She expressed concern about the pregnancy and is curious to see her developing baby.

#### *Questions:*

- Q.1. To assess the situation, which imaging technique would be suitable for further evaluation?
- Q.2. Why to use this specific imaging technique?
- Q.3. Which imaging techniques should be avoided and why?

#### *Answers (anatomical explanations):*

1. To assess the situation, a suitable imaging technique for further evaluation would be a fetal ultrasound.
2. Fetal ultrasound is a safe and non-invasive imaging technique commonly used during pregnancy to visualize the developing fetus. It can provide real-time images of the baby to assess fetal movements, heart rate, growth, and overall well-being.
3. Imaging techniques involving ionizing radiation, such as X-rays and CT scans, should be avoided during pregnancy unless absolutely necessary due to potential risks of mutation to the developing fetus.

# Derivation of Anatomical Terms

- Most of the anatomical terms are derived from the ancient words from Greek, Latin, Arabic, Italian, and Sanskrit languages.
- *Terminologica Anatomica* is current international standard for human anatomical terminology. It is developed by the *Federative International Programme for Anatomical Terminology, a Programme of International Federation of Association of Anatomists (IFAA)*.
- The *International Anatomical Nomenclature Committee (IANC)* is currently working on updating of *Terminologica Anatomica*. The author of this book, Dr Yogesh Sontakke, is a member of IFAA working group for *Terminologica Histologica* (group for updating histological terms).
- Some of the anatomical terms and their meaning are described here for understanding of students.  
L: Latin, Ar: Arabic, G: Greek, FR: French, GR: German

Term		Meaning			
Amygdala	G	amygdale = almond	Cribriform	L	cribrum = a sieve
Artery	L	aer = air, terein = to keep	Cuneiform	L	cuneus = wedge, + forma = shape likeness
Articulation	L	articulatio = joint	Cyst	G	kystis = bag, bladder, pouch
Atavistic	L	atavus = ancestor	Decidua, deciduous	L	deciduous = falling off
Atlas	G	atlas was a titan who was condemned to hold up the sky for eternity. Similarly, atlas vertebra	Deltoid	G	delta = letter in Greek alphabet, triangular – shaped
Auditory	L	audire = to here	Demilune	FR	half-moon
Autonomic	G	autos = to here, nomos = law	Dermatitis	G	derma = skin + -itis = inflammation (inflammation of the skin)
Axilla	L	axilla = armpit	Dermis	G	derma = skin
Azygos	G	zygos = a yoke or paired structure	Diaphragm	G	dia = through + phragma = well
Bipennate	L	bis = two, pinna = feather	Duodenum	L	duodeni = twelve (twelve finger breadths)
Brachial	L	arm	Dyspepsia	G	dys = difficult or painful + pepsia = digestion (difficult or painful digestion)
Branchia	G	gills of fishes (example: Branchial arches)	Ectoderm	G	ecto = outside + derma = skin
Bregma	G	bregma = front of the head	Emissary	L	e = out + mittere = to send escape channels
Bursa	L	bursa = a purse any closed sac	Endo(prefix)	G	within
Cadaver	L	cadere = to fall dead body	Enteric	G	gut
Calyx	G	kalyx = husk or cup	Falciform	L	sickle shape
Cancellous	L	cancelli = latticework	Fasciculus	L	a passage
Cancer	L	crab-like	Femur	L	thigh
Capillary	L	capillaries = pertaining to hair	Fovea	L	fovea = small pit
Carotid	G	karoun = stypefy, drowsiness	Glenoid	G	glene = socket + eidos = form, likeness
Cauda	L	tail	Hematology	G	hemato = blood + ology = study of (study of blood)
Cephalic	G	to head	Hepatitis	G	hepato = liver + -itis = inflammation (inflammation of the liver)
Cervix	L	cervix = neck	Hydrocele	G	hydro = water + cele = hernia
Choroid	L	chorion = skin, eidos = resemblance	Hymen	G	hymen = membrane
Circumflex	L	circum = around + flexere = to bend	Hypothyroidism	G	hypo = under + thyroid = thyroid gland + -ism = condition
Clavicle	L	clavis = a key-shaped			
Coccyx	G	kokkux = 'cuckoo'			
Corona	L	crown			
Corrugator	L	corrugare = to wrinkle very much			
Costal	L	costa = rib			
Cranium cranial	G	kranion = skull, head			

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<b>Term</b>		<b>Meaning</b>
Innominate	L	<i>in</i> = not + <i>nominates</i> = named (unnamed)
Jugular	L	throat
Lingual	L	<i>lingua</i> = tongue
Lipoma	G	<i>lipo</i> = fat + <i>oma</i> = tumor or mass
Lunate	L	<i>luna</i> = moon
Macula	L	<i>macula</i> = spot
Malleus	L	hammer
Mammary	L	<i>mamma</i> = breast
Mandible	L	<i>mando</i> = i chew
Merocrine	G	<i>meros</i> = portion + <i>krinein</i> = to separate
Mesentery	G	<i>mesos</i> = midway between + <i>enteron</i> = gut
Myocardium		<i>myo</i> = muscle; <i>cardium</i> = heart (heart muscles)
Notochord	G	<i>noto</i> = back + <i>chord</i> = a string
Oculomotor	L	<i>oculus</i> = eye + <i>moto</i> = mover
Osteocyte	G	<i>osteo</i> = bone + <i>cyte</i> = cell (bone cell)
Osteoporosis	G	<i>osteo</i> = bone + <i>poro</i> = porous + <i>-osis</i> = condition (condition of porous bones)
Perichondrium	L, G	<i>peri</i> = around + Greek <i>khondros</i> = cartilage
Periosteum	G	<i>peri</i> = around + <i>osteon</i> = bone
Peritoneum	L	<i>peri</i> = around + <i>toneum</i> = stretching, membrane
Phagocytosis	G	<i>phagos</i> = eat + <i>cytos</i> = cell + <i>osis</i> = fullness (eating cells)
Pisiform	L	<i>pisum</i> = a pea + <i>forma</i> = form
Platysma	G	flat

Pons	L	<i>pons</i> = a bridge
Porta	L	<i>porta</i> = gate
Profundus	L	<i>pro</i> = before + <i>fundus</i> = the bottom
Prosencephalon	GR	<i>prosen</i> = forward + <i>cephalon</i> = brain
Pulmonary	L	<i>pulmo</i> = lung + <i>aris</i> = pertaining to (relating to the lungs)
Quadriceps	L	<i>quattuor</i> = a square in shape
Sesamoid	L	<i>sesamen</i> = sesame plant, or seed + <i>eidos</i> = shape, likeness
Sigmoid	G	<i>sigma</i> = the greek letter s + <i>eidos</i> = resemblance.
Splenomegaly	L	<i>spleno</i> = spleen + <i>megaly</i> = enlargement, (enlargement of the spleen)
Sphenoid	G	<i>sphen</i> = wedge, and <i>eidos</i> = resemblance
Styloid	G	<i>stylos</i> = pillar + <i>eidos</i> = resemblance
Synarthrosis	G	<i>sun</i> = together + <i>arthrosis</i> = joining
Synovia	G	<i>syn</i> = along with + <i>ovia</i> = egg
Sydesmosis	G	<i>sundesmos</i> = binding, fastening
Thyroid	G	<i>thyreos</i> = a shield+ <i>eidos</i> = resemblance
Topography	GR	<i>topo</i> = place + <i>graphy</i> = description
Trachea	G	<i>tracheia</i> = windpipe
Triceps	L	<i>tres</i> = three + <i>caput</i> = head
Trigeminal	L	three + twin-like (3 divisions)
Tuberosity	L	<i>tuber</i> = knob or localized collection + <i>osity</i> = condition
Vagina	L	<i>vagina</i> = sheath
Vermiform		<i>vermis</i> = worm, <i>forma</i> = form
Vitamin	L	<i>vita</i> = life + <i>amine</i>
Vitelline	L	<i>vitellus</i> = yolk of egg
Xiphoid	GR	sword-like