MEDICINE

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A. Understanding a printed text (1)

The following text describes the anatomy of the eyeball. Read it through to gain a general idea of its contents. As you read, look for the answers to the questions below. Remember that you do not have to understand every word in order to answer the questions.

1. What is the diameter of the eyeball?
2. What are the three coats of the eye?
3. Which condition results when the cornea is cylindrical?
4. What is the blood supply to the cornea?
5. What is the nerve supply to the cornea?
6. What sort of joint does the eyeball make with Tenon's capsule?

THE EYEBALL

1. The globe of the eye is spherical in shape with a diameter of approximately 3.5 cm. It does not lie centrally in the orbit, but is closer to the roof and the lateral wall. The front surface of the eye projects forwards to a plane joining the superior and inferior orbital margins which therefore protect the eye from injury from a frontal blow. Laterally the eye is not so well protected since about one-third of the globe lies in front of a line joining the lateral and medial orbital margins. On the medial side, however, the eye is protected by the nose. This leaves the lateral side as the least protected part.

2. On the other hand the field of view is greatest laterally. It is possible to detect movement taking place at the sides behind the head. Try this yourself. Look straight ahead and move a pencil at arm's length farther and farther round to the side. You will find that your lateral visual field extends through an angle of about 110°, that is 20° more than the plane running laterally through the cornea.

STRUCTURE OF THE EYE

3. The eye is usually considered to have three coats, a fibrous outer coat (sclera and cornea), a vascular middle coat (the uveal tract), and a nervous inner coat (the retina) [Fig. 18.03].

4. The eye is divided internally into two compartments by the lens and its suspensory ligaments. The space in front of the lens is filled with aqueous humour. This space is further divided by the iris into the anterior chamber and the posterior chamber of the eye. Note that the posterior chamber lies in front of the lens. The space behind the lens is filled with vitreous humour.

SCLERA

5. The posterior five-sixths of the outer coat is strong and resistant and is termed the sclera (Greek = hard). It is white in colour and opaque. The sclera extends as far forward as the anterior chamber of the eye where it joins the cornea at the corneoscleral junction.

6. The weakest point of the sclera is the optic disc where the optic nerve enters. This is termed the lamina cribrosa since the membrane has perforations here for the fibres of the optic nerve.

7. When the intra-ocular pressure is raised in glaucoma the optic disc is pushed backwards. It is then said to be cupped. In childhood, where the sclera is less strong, the entire eye may swell in this condition and in addition the cornea may protrude forwards. The condition is termed hydrophthalmos or buphthalmos since it then resembles an ox's eye (bous = Greek = ox; ophthalamos = Greek = eye).
The anterior one-sixth of the outer coat is the cornea. This is the transparent window which allows light to enter the eye. Its curvature is greater than that of the sclera and as a result the two are separated by a slight furrow on the outside of the anterior chamber of the eye. This curvature is of great importance, since, as will be seen later, most of the lens focusing power of the eye is due to the fact that the cornea has air in front and water (aqueous humour) behind and therefore acts as a powerful lens.

The curvature is usually the same in all directions, that is, the front surface is spherical. Any refraction errors can be corrected by the use of additional spherical lenses.

If the curvature is greater in one direction than another (say more curved vertically than horizontally) the cornea will be cylindrical. As a result, although it may still be possible to focus clearly either on vertical lines or on horizontal lines, it will not be possible to do so simultaneously as when viewing the letter E. As a result print will appear blurred. This condition is termed astigmatism. It is corrected by the use of a cylindrical lens to make up the deficiency of refraction in one plane only.

The cornea is a fixed lens. In addition there is a lens in the eye. Although this is not so powerful as the cornea, since it has aqueous humour in front and vitreous humour behind both with similar refractive indices as the lens itself, it is a variable lens and allows focusing to occur.

The cornea consists of a transparent layer of fibrous tissue termed the substantia propria. This is covered in front by the anterior elastic membrane and stratified epithelium. Behind is the posterior elastic membrane (Descemet's membrane) and the endothelium which lines the whole of the anterior chamber. The posterior elastic membrane may become involved in inflammation of the ciliary body (keratitis punctata or descemetitis) in leprosy and syphilis. White blood cells from the ciliary body then appear at the back of Descemet's membrane.

Blood supply to cornea

Nil. The cornea has no blood supply. The cells receive their nutrients from the aqueous humour behind and tears in front. They probably absorb oxygen from the air. Vascularization of the cornea leads to blindness.

The absence of a blood supply may account for the fact that corneal grafting may be carried out without the problem of rejection. Presumably the absence of a blood supply prevents the lymphocyte reaching the tissue and producing antibodies.

Nerve supply of cornea

The ciliary and conjunctival branches of the ophthalmic division of the trigeminal nerve (V1) supply the cornea, which is very sensitive to touch. Without this sensory innervation, the cornea will be injured by foreign particles leading to corneal ulceration. The sclera is not nearly so sensitive.

Tenon's capsule

The capsule of the eyeball (Tenon's capsule) is a fibrous membrane which covers the posterior two-thirds of the eye. It is continuous behind with the optic nerve sheath. The capsule forms an articular socket which allows the eye to move in any direction. The extraocular muscles pass through the capsule which encloses each muscle in a tubular sheath. The action of the medial and lateral recti muscles are limited by lateral expansions of this capsule to the lateral walls of the orbit which act as check ligaments.

The relationship of the eyeball to Tenon's capsule is that of a perfect ball and socket joint. The joint is lubricated by tissue fluid. The centre of the eyeball remains fixed in position whatever the movement of the eye may be.
B. Check your understanding

Now read the text more carefully. You will find it easier to understand if you refer frequently to the diagram. While you read, look for the answers to these questions:

1. What protects the eye from a frontal blow?
2. What is the main structure separating the aqueous humour from the vitreous humour?
3. What is the name of the point where the optic nerve penetrates the sclera?
4. In which condition may buphthalmos occur in children? What is its cause?
5. Which transparent structure allows light to enter the eyeball?
6. Which two structures are responsible for the focusing power of the eye?
7. In which diseases may Descemet’s membrane become inflamed?
8. Why does the body not make antibodies against corneal grafts?
9. What may result if the nerve supply of the cornea is removed?
10. Which part of the eyeball remains fixed in position?
C. Increase your vocabulary

Remember that you may use a dictionary to help answer these questions:
1. Make sure that you know the meaning of these words and then answer the following questions.
   - sphere
   - plane
   - globe
   - margin
   - junction
   - vertical
   - horizontal
   - branches
   - curvature
   - border
   - capsule
   - sheath
   a. Which words concern things joining or separating?
   b. Which words describe structures which do not have straight edges?
   c. Which words mean things which surround other structures?
   d. Which words concern straight lines in space?
   e. Which words concern edges?

2. Look at the following verb forms. Complete the following sentences using the most appropriate expression:

D. Check your grammar

PREPOSITIONS

Complete the following paragraphs using the correct prepositions:
1. The eyeball is the organ ______ vision. It is situated ______ the anterior part ______ the orbital cavity. It is roughly spherical ______ shape, being distorted anteriorly ______ the projecting bulge ______ the cornea. It is closely surrounded ______ the orbital fascia which separates it ______ the orbital fat. The fascia is pierced ______, and forms a sheath ______ the muscles attached ______ the sclera.

2. Light enters the eye ______ the cornea. It is focused ______ the cornea and the lens. Light rays strike the light receptor cells situated ______ the retina, ______ which information is passed ______ the optic nerve ______ the brain.

E. Understanding a lecture

Listen to the lecture on the anatomy of the kidney and take notes.

1. Answer the following questions:

   Section 1
   - Why is the left kidney higher than the right?
   - What makes the kidneys move up and down?

   Section 2
   - What are the approximate measurements of each kidney?
   - How much does each kidney weigh in the male?
Section 3
- Which three structures join the kidney at the hilum?
- What does the renal vein drain into?

Section 4
- What are the two layers of the kidney called?
- How many nephrons are there in a kidney?

2. From your notes, write a description of the anatomy of the kidney.

F. Understanding a printed text (2)

Read the following text which describes the anatomy of the lower limb.

The lower limb

1. The parts of the lower limb are the hip and buttock, the thigh, the leg, and the foot and toes.

2. The hip and buttock make up what is called the gluteal region. This overlies the side and back of the pelvis, extending from the waist down to the groove (gluteal fold) which limits the buttock anteriorly and to the hollow on the lateral side of the hip. The hip and buttock are not clearly distinguished from each other. The hip (coxal) is the upper part of the region in a lateral view; the buttock (nates) is the rounded bulge behind and below. The natal cleft is the groove between the buttocks. In it can be felt the lower part of the sacrum and coccyx (the end of the backbone). Anterior to this the perineum lies in the depths of the cleft and continues forwards between the thighs.

3. The skeleton of the hip and buttock is the hip bone. It consists of three parts which are fused together at the acetabulum [Fig. 114] where the head of the femur articulates with it. The ilium is the large, upper part with a crest [Fig. 114] which can be felt in the lower margin of the waist. The ischium is the postero-inferior part on which the body rests in a sitting position. The pubis is the anterior part. It can be felt in the lower part of the anterior abdominal wall where it meets its fellow in the pubic symphysis (symphysis = union) and separates that wall from the anterior part of the perineum.

4. The right and left hip bones, together with the sacrum and coccyx, make up the skeleton of the pelvis. The floor of the pelvic cavity is the perineum. The two hip bones together are sometimes called the pelvic girdle. Anteriorly, they articulate with each other at the pubic symphysis. Posteriorly they articulate with the sides of the sacrum at the sacro-iliac joints.

5. The thigh (femur) extends from the hip to the knee. Its bone is the femur which articulates at its upper end with the hip bone to form the hip joint. At the knee joint, the femur articulates with the tibia and with the patella (knee cap) which lies anterior to the knee joint.

6. The proximal extent of the thigh is at the gluteal fold posteriorly, at the groove of the groin (inguinal region) anteriorly, at the perineum medially, and at the hollow on the side of the hip laterally. The greater trochanter of the femur [Fig. 115] can be felt through the skin immediately anterior to the hollow. The ham (popliteus) is the lower part of the back of the thigh and the back of the knee where the hollow of the ham is the popliteal fossa.

The leg (cruze) extends from the knee joint to the ankle joint. The
Fig. 114. Right hip bone seen from the lateral side.

Fig. 250. Right tibia and fibula (anterior aspect).

Fig. 252. Right tibia and fibula (posterior aspect).
term 'leg' is never used in anatomical descriptions to refer to the entire lower limb as it frequently is in colloquial speech. The soft, fleshy part of the back of the leg is the **calf** (*tursa*). The bones of the leg are the **tibia** or shin bone and the **fibula**. They lie side by side, with the slender fibula laterally, and articulate with each other (tibiotibial joints) only at their upper and lower ends. Elsewhere they are united by an **intertrochlear membrane**. The lower ends of the tibia and fibula form prominences at the sides of the ankle (medial and lateral malleoli) which are readily felt; and which clasp the first bone of the foot (the **talus**) to form the **ankle joint**. The flattened superior surface of the expanded proximal end of the tibia (condyles of the tibia) articulates with the femur at the knee joint. The proximal end of the fibula (head) only reaches as far proximally as the intertarsal surface of the lateral tibial condyle and does not take part in the knee joint. A large part of the tibia is subcutaneous and readily felt; this includes the anterior [Fig 250] and medial [Fig 252] borders, the medial surface [Fig 250] between these borders, and the parts of the condyles visible in [Fig 250].

9 The fibula is mainly an attachment for muscles which cover it so that only its head and distal quarter [Fig 250] are easily felt. Some of the muscles attached to the fibula are called **peroneal muscles** from *perone*—the Greek equivalent of the Latin *fibula* (¼a pin or skewer).

10 The **foot** extends from the point of the heel to the roots of the toes. Its superior surface is the **dorsum**, its interior surface is the **sole** (*planus*). The foot is divided into tarsus and metatarsus. The **tarsus** is the posterior half formed by the tarsal bones. The **tarsal bones** are in two rows. The proximal row consists of two large bones set one (the **talus**) above the other (the **calcaneus**). The calcaneus is the largest bone of the tarsus and forms the skeleton of the heel. The talus articulates with the superior surface of the calcaneus and separates it from the ankle joint which the talus forms with the tibia and fibula. The distal row consists of the **cuboid bone** laterally and the three wedge-shaped **cuneiform bones** (*cuneus* = a wedge) set side by side, medially. The cuboid articulates proximally with the calcaneus and distally with the lateral two metatarsals. The cuneiforms articulate distally with the medial three metatarsals but are separated from the talus by the **navicular bone** which lies between the two rows. The navicular articulates proximally with the talus and distally with the three cuneiforms. Between the tarsal bones are the intertarsal joints [Fig 254, 255].

11 The five **metatarsal bones** are set side by side. They are numbered 1–5 from the medial side. The proximal ends (bases) articulate with the tarsal bones (tarsometatarsal joints) and with each other (intermetatarsal joints—lateral four only). Each has a distal end (head) which articulates with the base of the proximal phalanx of the corresponding toe (metatarsophalangeal joint). The **toes** (digits) are numbered from the medial side. The first is the big toe or **hallux**, the fifth is the little toe or **digenus minus**. The bones of the toes are the **phalanges**. The hallux has two phalanges, each of the other toes has three, though the middle and distal phalanges of the little toe may be fused together. The phalanges articulate at **interphalangeal joints**. The proximal end of the phalanx is its base, the distal end is its head.

12 There are several **sesamoid bones** in the lower limb. The largest is the patella. The remainder are small and inconstant except for two which are always present on the plantar surface of the metatarsophalangeal joint of the big toe. They produce grooves on the plantar surface of the head of the first metatarsal [Fig 255].
G. Check your understanding

Answer the following questions:

1. What is the gluteal region made up of?

2. Which are the three parts of the hip bone?

3. What is the floor of the pelvic cavity?

4. With which bones does the femur articulate at the knee joint?

5. What can be felt through the skin anterior to the hollow of the hip?

6. What is united by the interosseous membrane?

7. Which bones form the ankle joint?

8. What separates the cuneiforms from the talus?

9. What number is given to the big toe?

10. Which is the largest of the sesamoid bones in the lower limb?
H. Understanding discourse

Listen to a conversation between a new student and an older colleague about ways of learning anatomy.

1. What difficulty is the younger student experiencing?
2. Which three ways of aiding memory does the older student suggest?
3. The older student suggests a mnemonic to remember a list. What was the list of?
4. What are the two advantages of flow diagrams?
5. What is suggested as the only way to keep on remembering things?