Maternal pelvis and fetal skull

The maternal pelvis

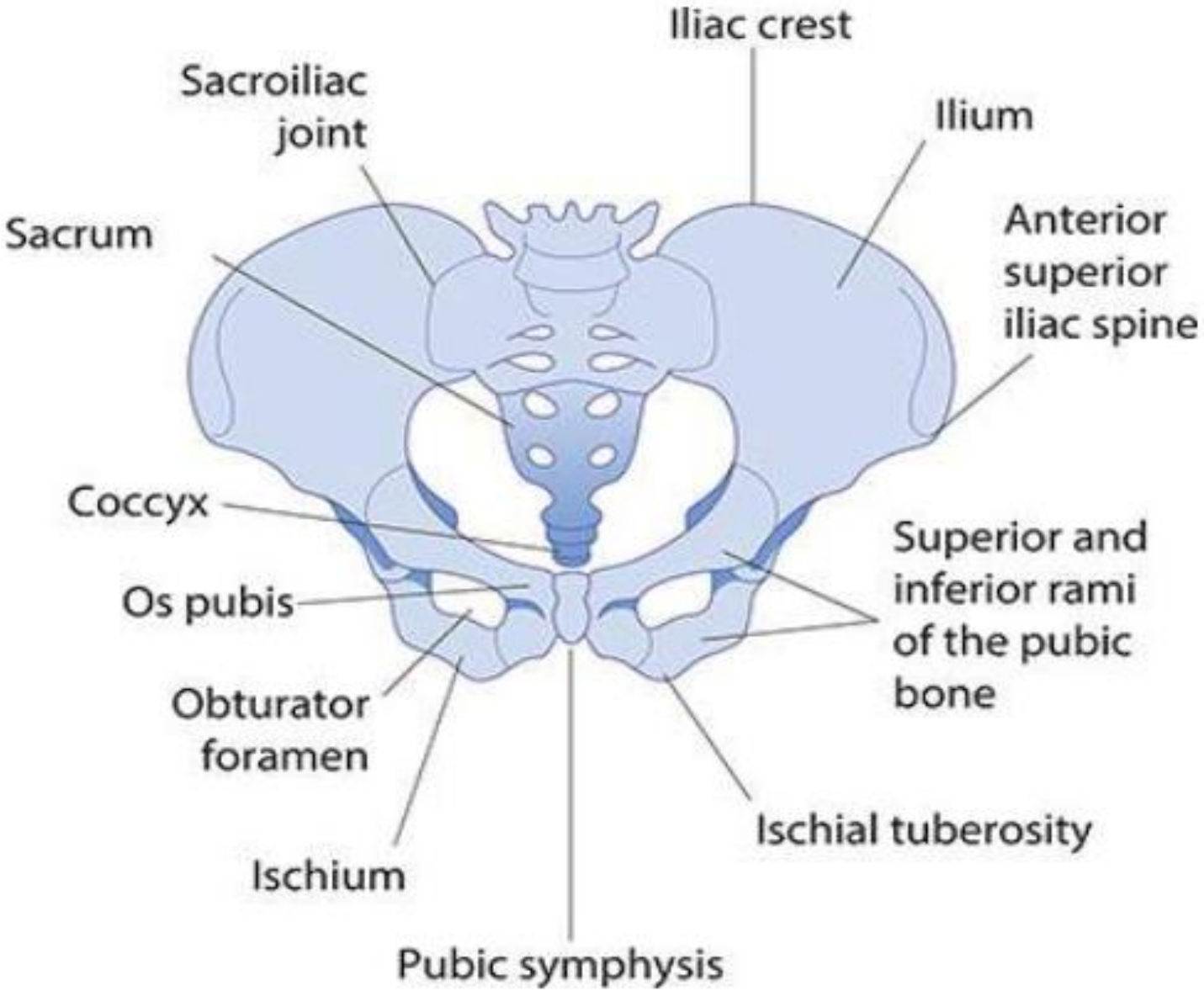
The pelvic inlet

The pelvic inlet or brim is bounded anteriorly by the upper border of the symphysis pubis (the joint separating the two pubic bones), laterally by the upper margin of the pubic bone, the ileopectineal line and the ala of the sacrum, and posteriorly by the promontory of the sacrum

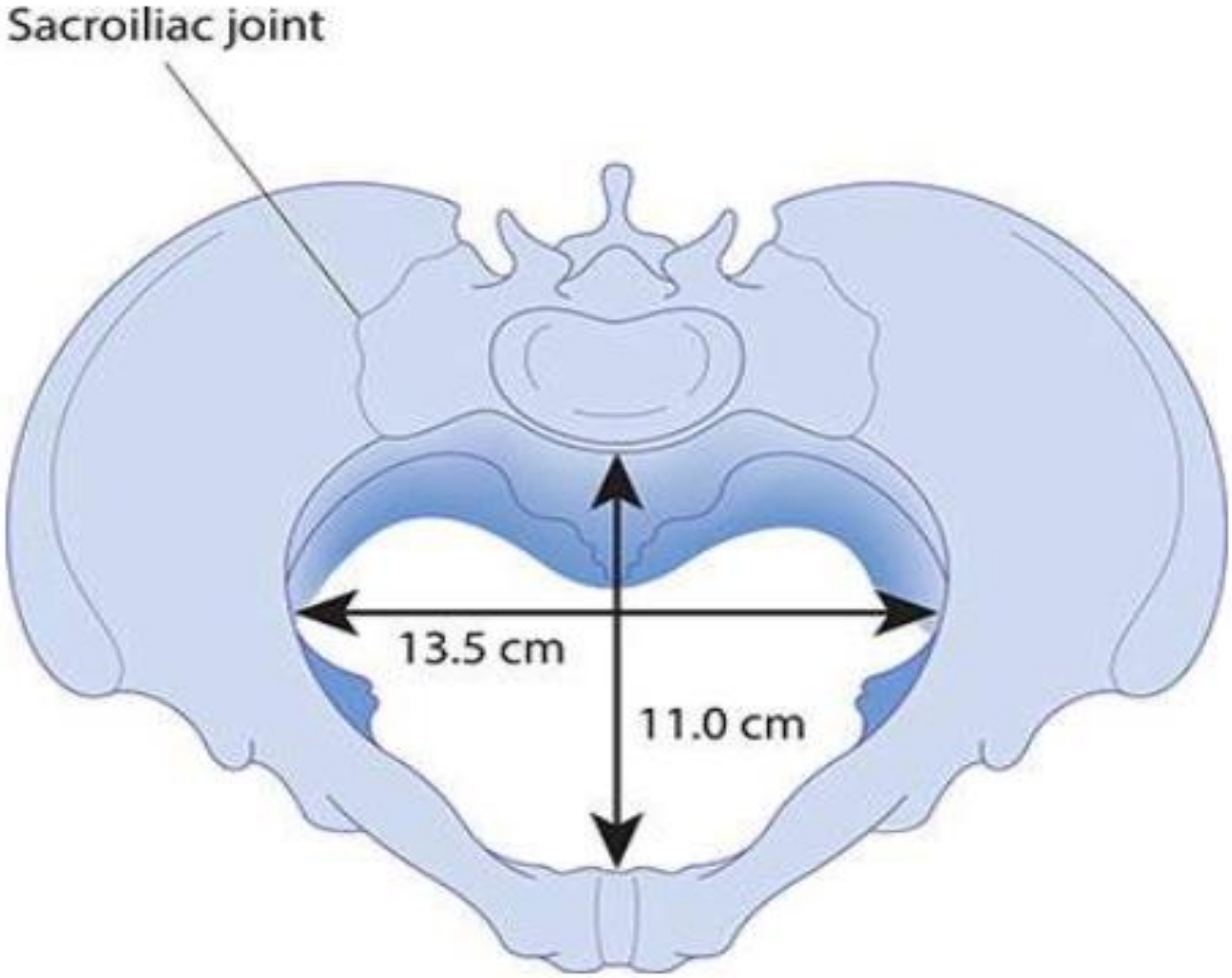
The normal transverse diameter in this plane is 13.5 cm and is wider than the anterior–posterior (A–P) diameter, which is normally 11.0 cm.

The fetal head typically enters the pelvis orientated in a transverse position in keeping with the wider transverse diameter.

The angle of the inlet is normally 60° to the horizontal in the erect position, but in Afro-Caribbean women this angle may be as much as 90°. This increased angle may delay the head entering and descending through the pelvis during labour compared to labour in Caucasian women.



The bony pelvis.



The pelvic brim.

The **midpelvis**, also known as the midcavity, can be described as an area bounded anteriorly by the middle of the symphysis pubis, laterally by the pubic bones, the obturator fascia and the inner aspect of the ischial bone and spines, and posteriorly by the junction of the second and third sections of the sacrum.

The**midpelvis** is almost round, as the transverse and anterior diameters are similar at12 cm. The ischial spines are palpable vaginally and are used as important landmarks for two purposes:

To assess the descent of the presenting part on vaginal examination (e.g. station zero is at the level of the ischial spines, -1 is 1 cm above the spines and +1 is 1 cm below the spines)

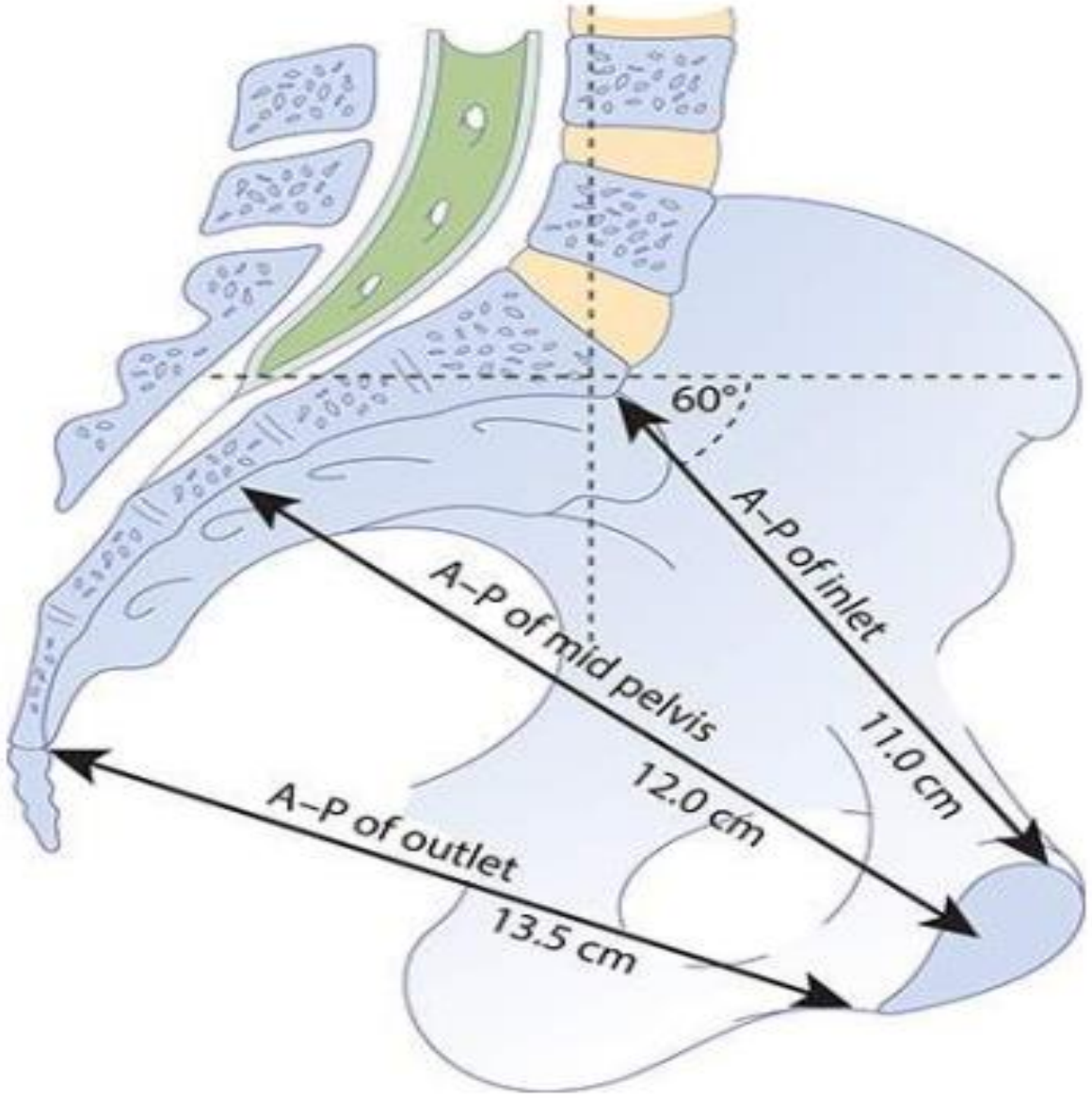


Figure 12.3 Sagittal section of the pelvis demonstrating the anterior–posterior (A–P) diameters of the inlet and outlet.

*To provide a local anaesthetic pudendal nerve block. The pudendal nerve passes behind and below the ischial spine on each side. A pudendal nerve block may be used for a vacuum or forceps-assisted delivery.

*Station zero is an important landmark clinically because instrumental delivery can only be performed if the fetal head has reached the level of the ischial spines or below

The pelvic outlet

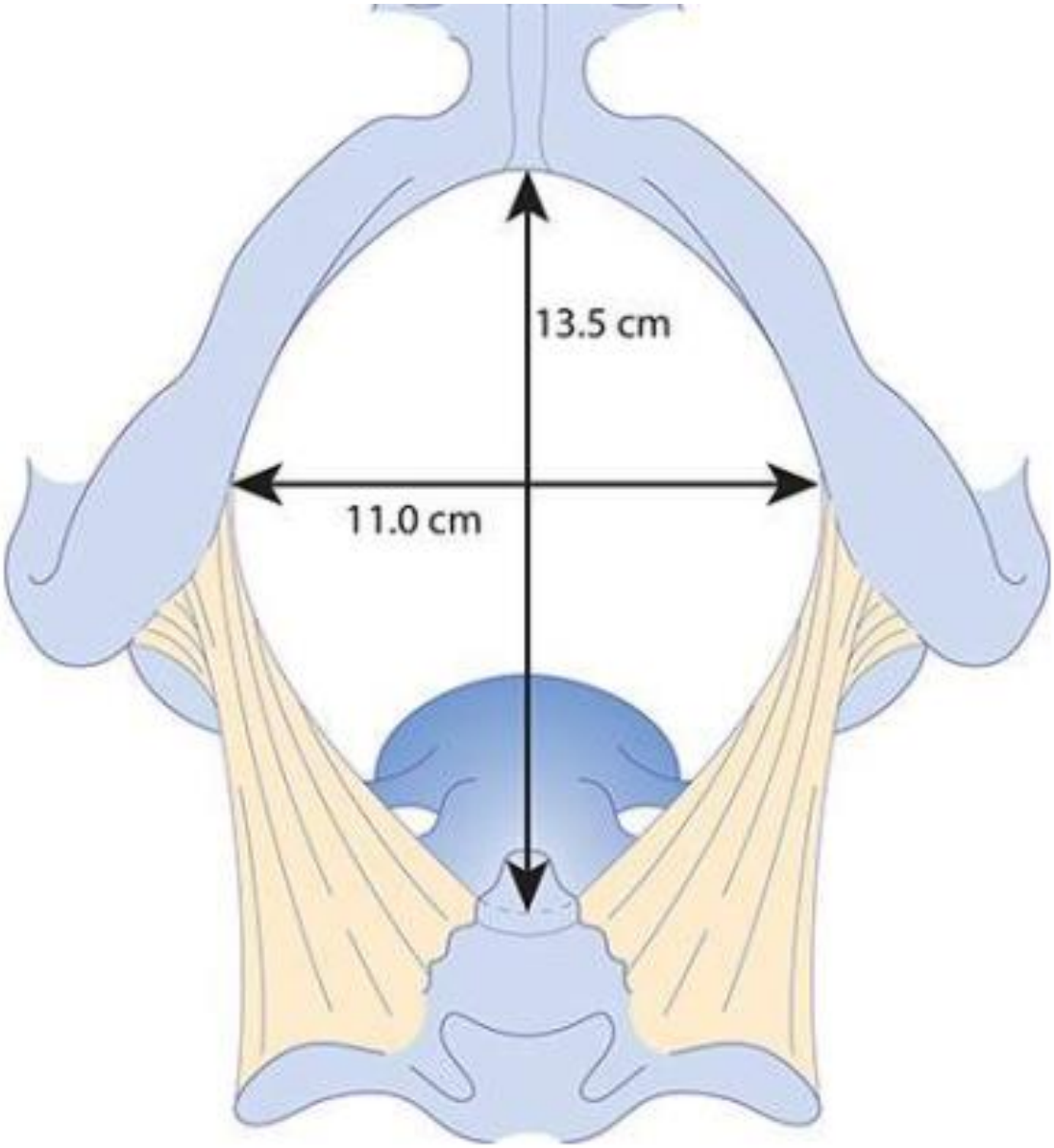
The pelvic outlet is bounded anteriorly by the lower margin of the symphysis pubis, laterally by the descending ramus of the pubic bone, the ischial tuberosity and the sacrotuberous ligament, and posteriorly by the last piece of the sacrum.

The AP diameter of the pelvic outlet is 13.5 cm and the transverse diameter is 11cm

Therefore, the transverse is the widest diameter at the inlet, but at the outlet it is the AP diameter, and the fetal head must rotate from a transverse to an AP position as it passes through the pelvis. Typically, this happens in the midpelvis where the transverse and AP diameters are similar.

the pelvic axis describes an imaginary curved line, a path that the centre of the fetal head must take during its passage through the pelvis, from entry at the inlet, descent and rotation in the midpelvis and exit at the outlet.

Recognizing the important features of the maternal pelvis is central to understanding the mechanism of labour.



The pelvic outlet.

Pelvic shape

The pelvic measurements described above are average values and relate to bony points. Maternal stature, ethnicity, previous pelvic fractures and metabolic bone disease, such as rickets, may all be associated with measurements less than the population average.

Furthermore, as the pelvic ligaments at the pubic ramus and the sacroiliac joints loosen towards the end of the third trimester, the pelvis becomes more flexible and these diameters may increase during labour

It is also possible to enhance the pelvic dimensions with more favourable maternal positions in labour (e.g. squatting or kneeling).

It is now uncommon to perform Xrays or computed tomography (CT) or magnetic resonance imaging (MRI) of the pelvis to measure the pelvic dimensions because they have, on the whole, proven to be of little clinical use in predicting the outcome of labour.

A variety of pelvic shapes are described, and these may contribute to difficulties encountered in labour.

1.The gynaecoid pelvis is the most favourable for labour, and also the most common .

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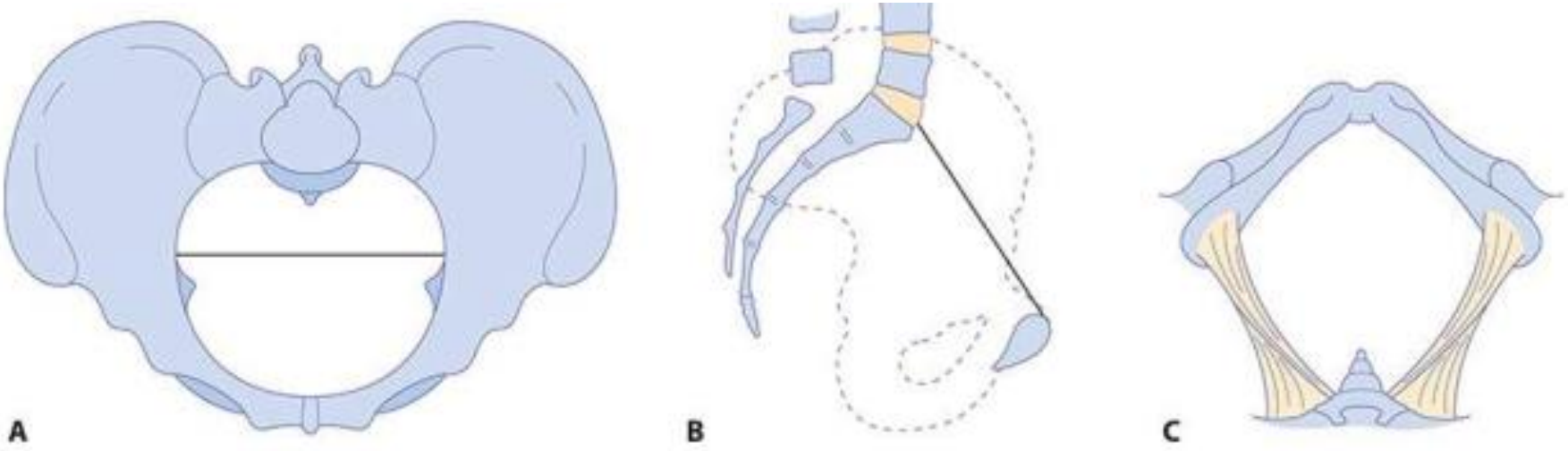


Figure 12.5 The gynaecoid pelvis: (**A**) brim; (**B**) lateral view; (**C**) outlet.

2.An android-type pelvis is said to predispose to failure of rotation and deep transverse arrest

3.anthropoid shape encourages an occipito-posterior (OP)position.

4.A platypelloid pelvis is also associated with an increased risk of obstructed labour due to failure of the head to engage, rotate or descend.

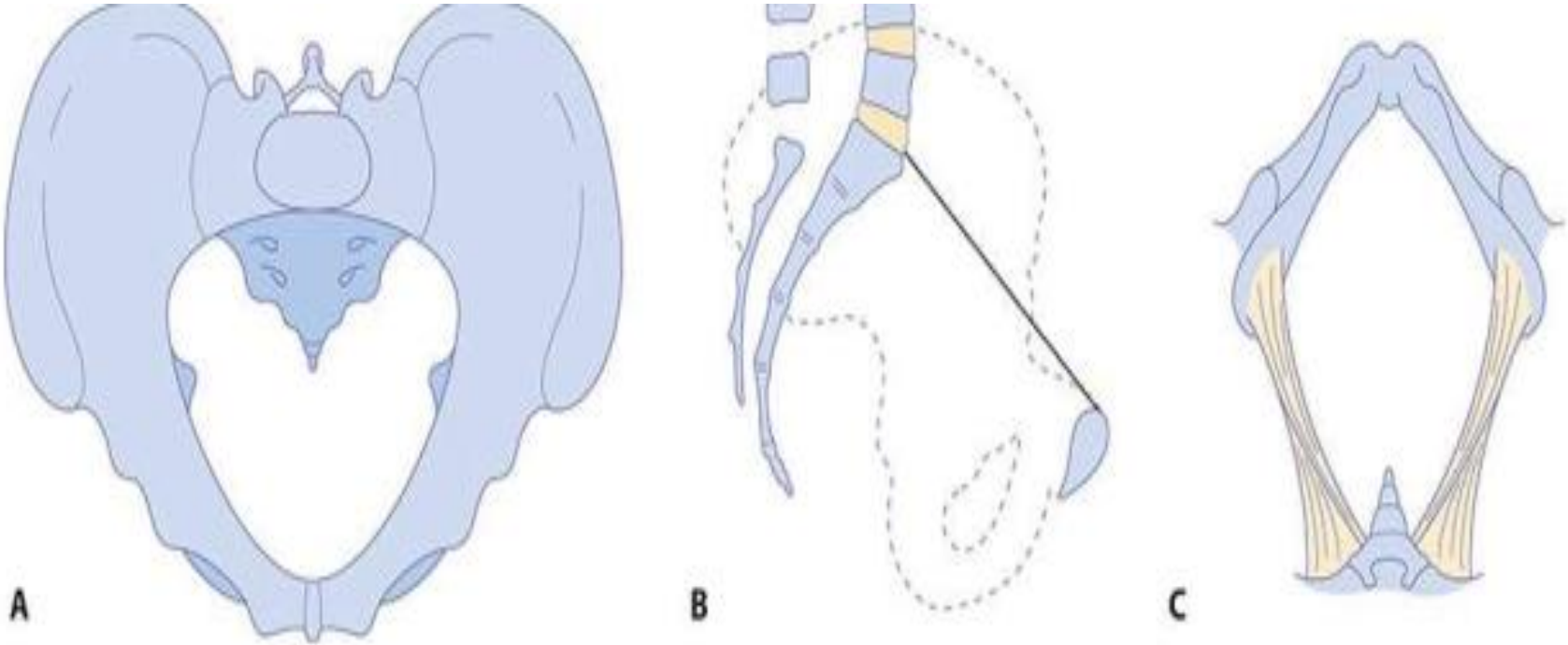


Figure 12.6 The android pelvis: (**A**) brim; (**B**) lateral view; (**C**) outlet.

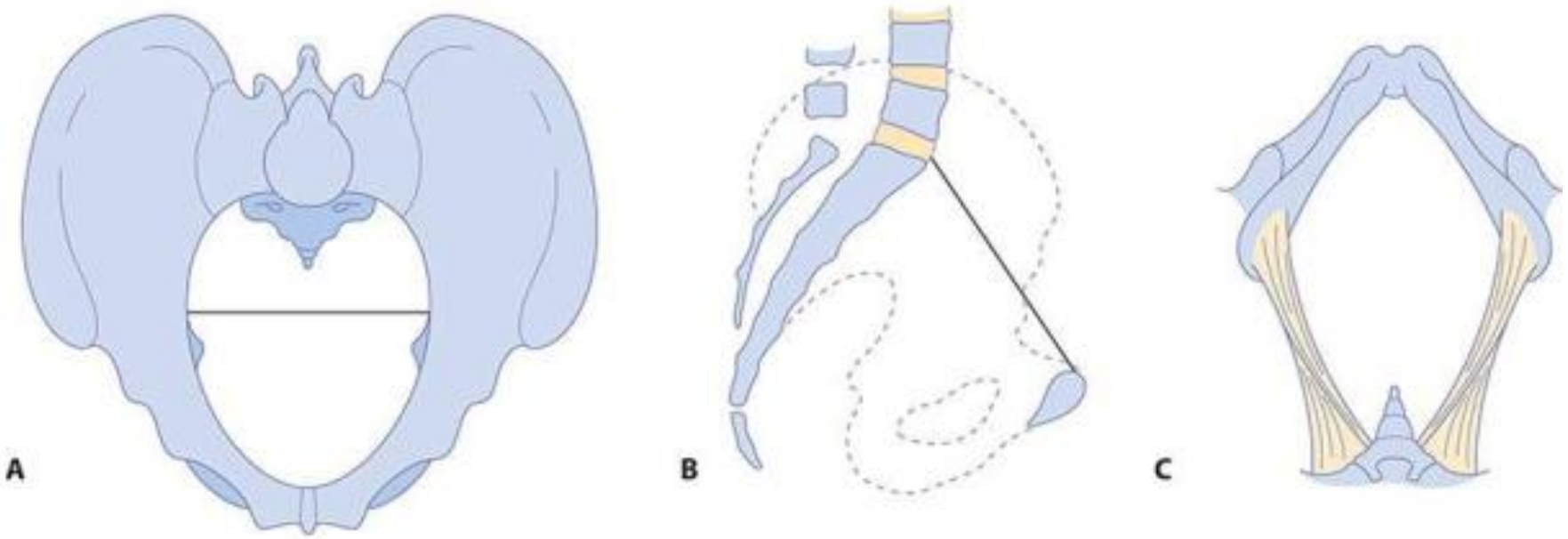


Figure 12.7 The anthropoid pelvis: (**A**) brim; (**B**) lateral view; (**C**) outlet.

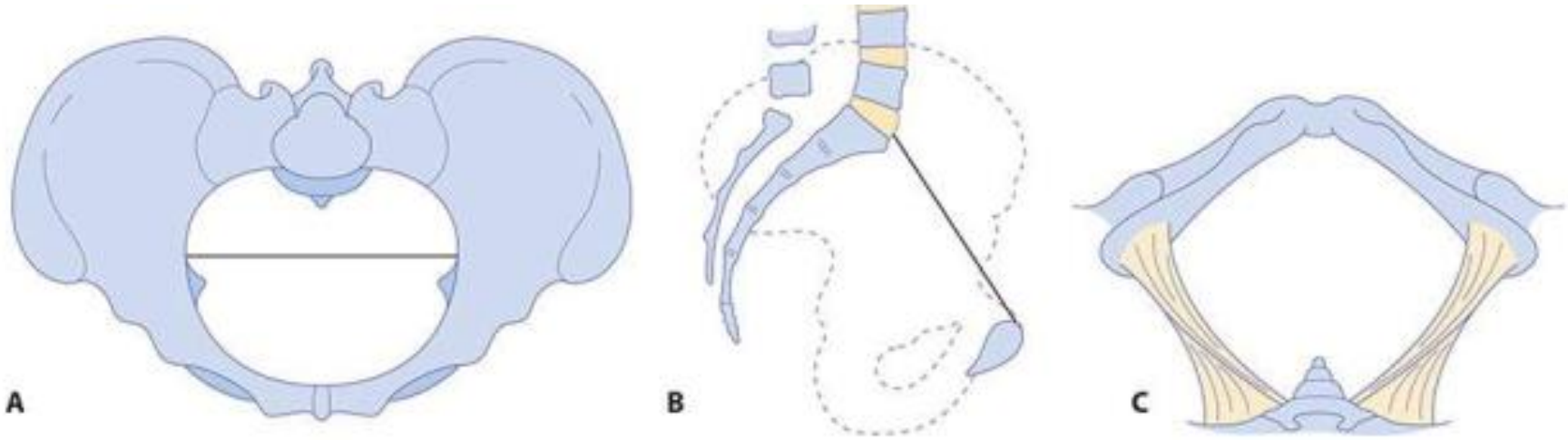


Figure 12.8 The platypelloid pelvis: (**A**) brim; (**B**) lateral view; (**C**) outlet.

The pelvic floor

This is formed by the two levator ani muscles which, with their fascia, form a musculofascial gutter during the second stage of labour .

The configuration of the bony pelvis together with the gutter-shaped pelvic floor muscles encourage the fetal head to flex and rotate as it descends through the midpelvis towards the pelvic outlet

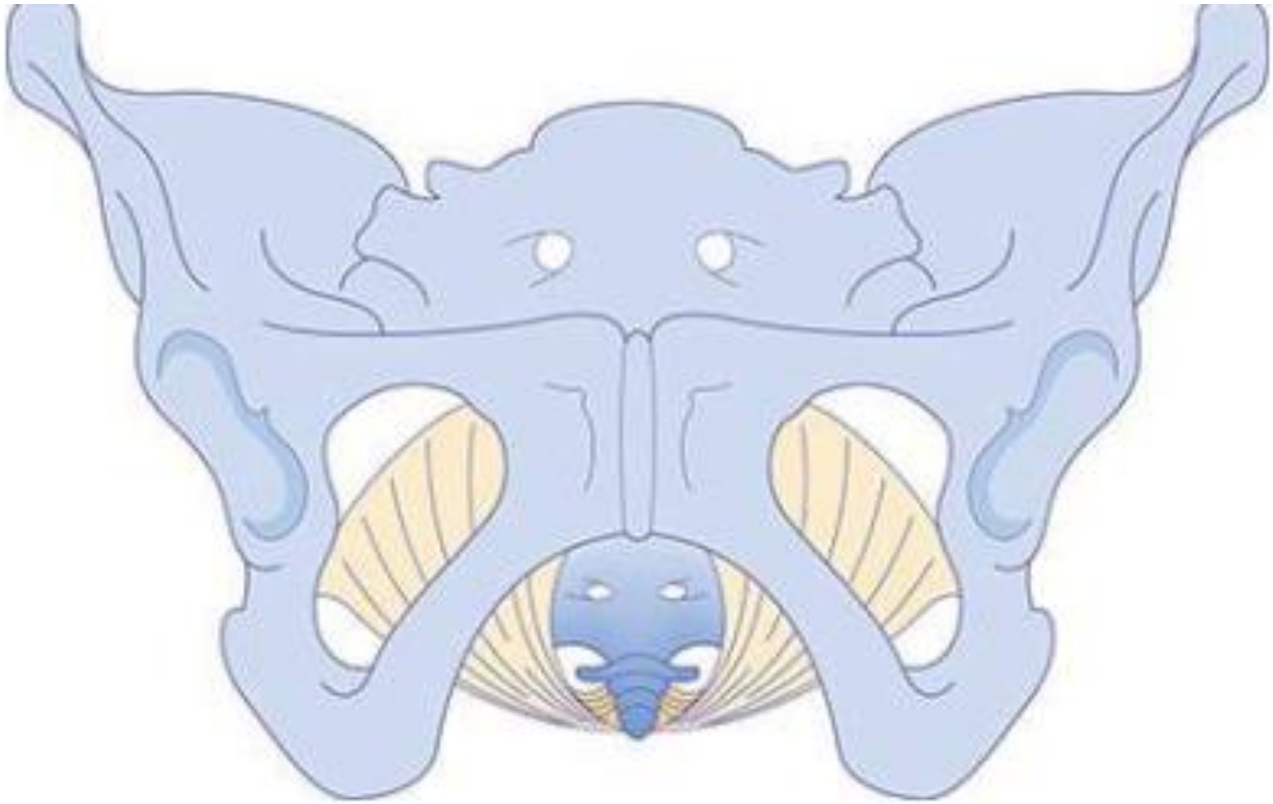
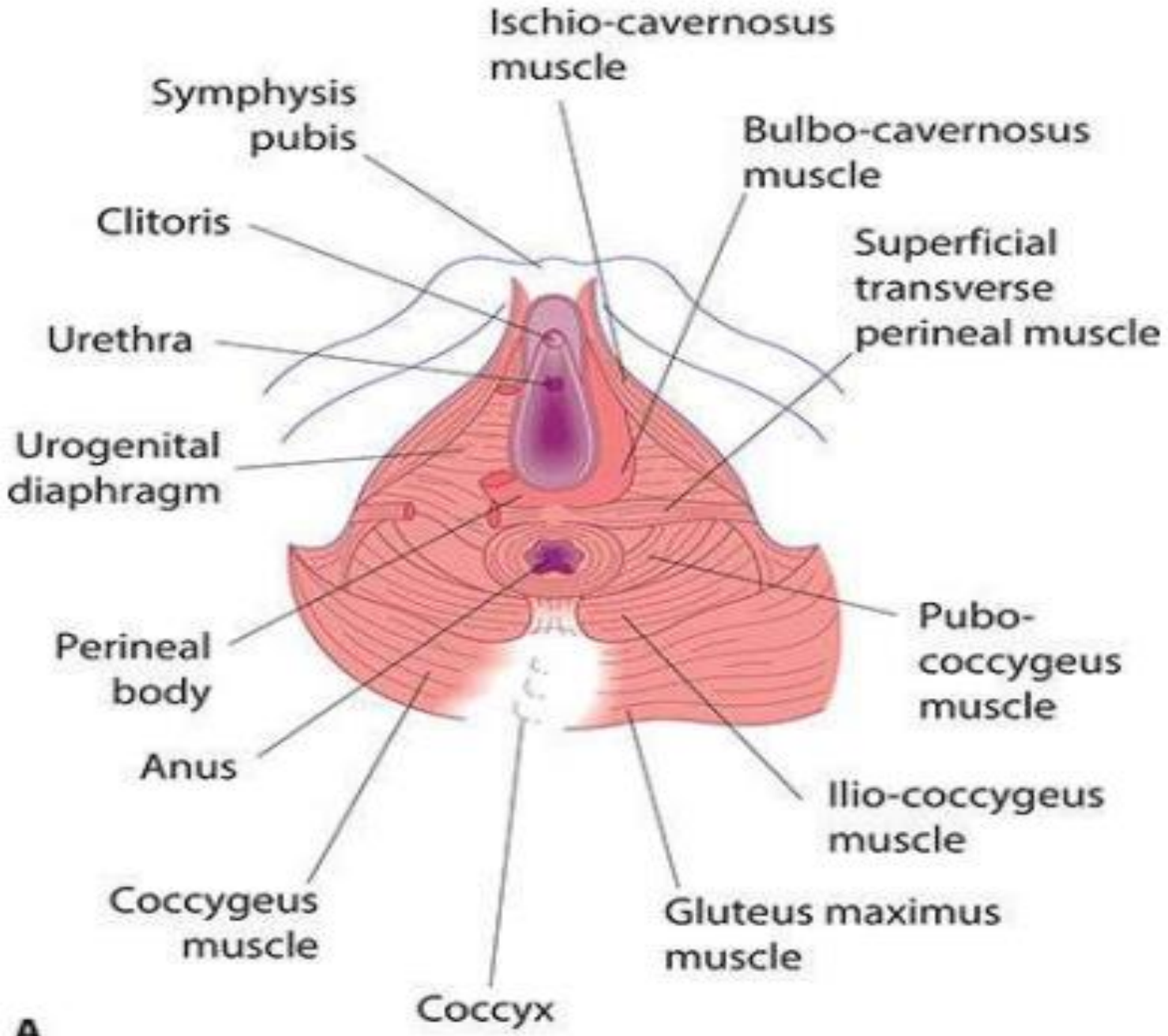


Figure 12.9 The musculofascial gutter of the levator sling.

The perineum

The final obstacle to be overcome by the fetus during labour is the perineum. The perineal body is a condensation of fibrous and muscular tissue lying between the vagina and the anus. It receives attachments of the posterior ends of the bulbo-cavernous muscles, the medial ends of the superficial and deep transverse perineal muscles and the anterior fibres of the external anal sphincter.

The perineum is taut and relatively resistant in the nulliparous woman, and pushing can be prolonged. Vaginal birth may result in tearing of the perineum and pelvic floor muscles or an episiotomy (surgical cut) may be required. The perineum is stretchy and less resistant in multiparous women, resulting in faster labour and a higher probability of delivering with an intact perineum


Ischio-cavernosus muscle
Symphysis pubis
Bulbo-cavernosus muscle
Clitoris
Superficial transverse perineal muscle
Urethra
Urogenital diaphragm
Perineal body
Pubo-coccygeus muscle
Anus
Ilio-coccygeus muscle
Coccygeus muscle
Gluteus maximus muscle
Coccyx
A

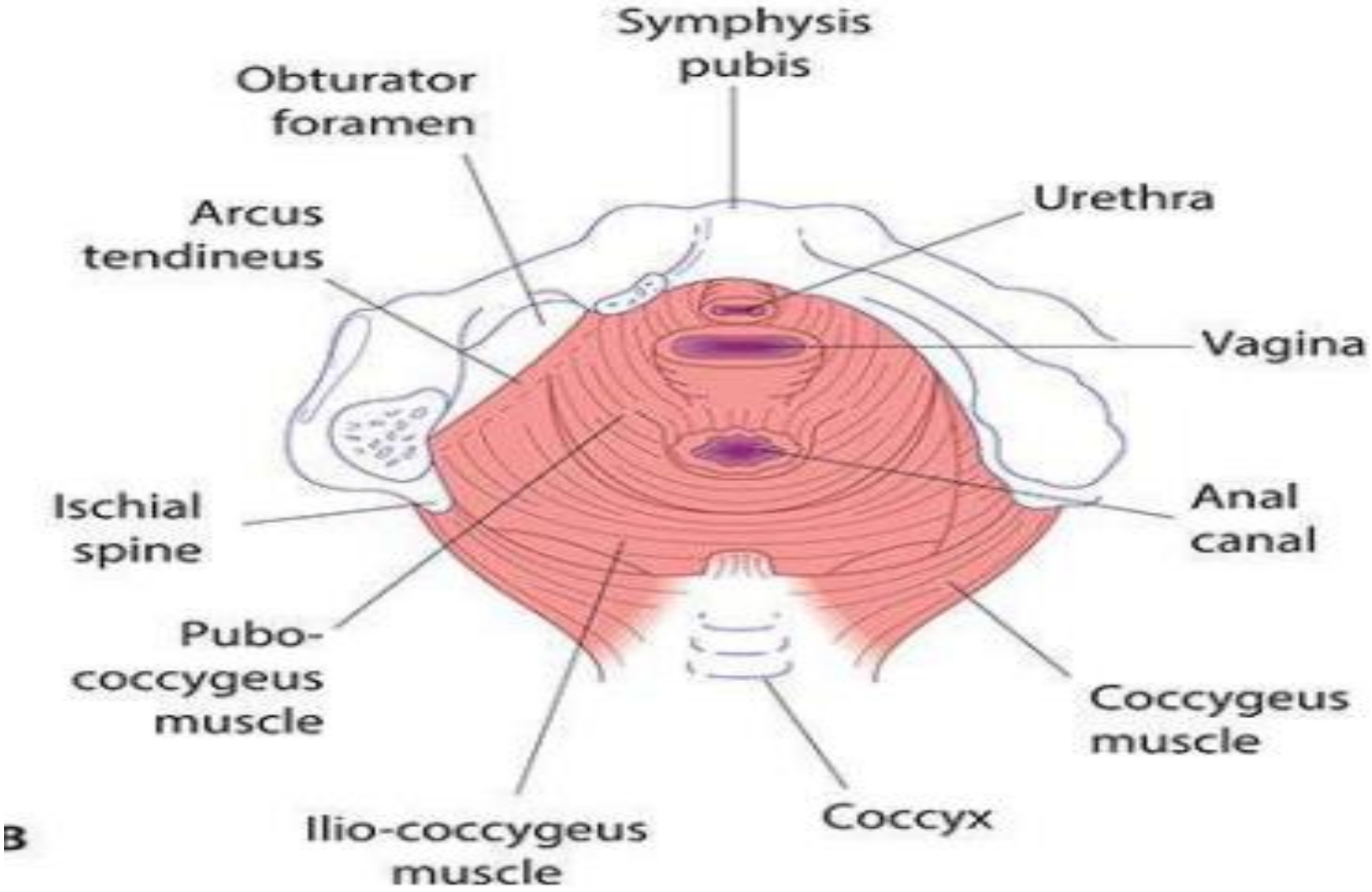

Symphysis pubis
Obturator foramen
Urethra
Arcus tendineus
Vagina
Anal canal
Ischial spine
Pubo-coccygeus muscle
Coccygeus muscle
Ilio-coccygeus muscle
Coccyx

Figure 12.10 The perineum, perineal body and pelvic floor from below, showing superficial (**A**) and deeper (**B**) views. The pelvic floor muscles are made up of the levator ani (pubo-coccygeus and ilio-coccygeus).

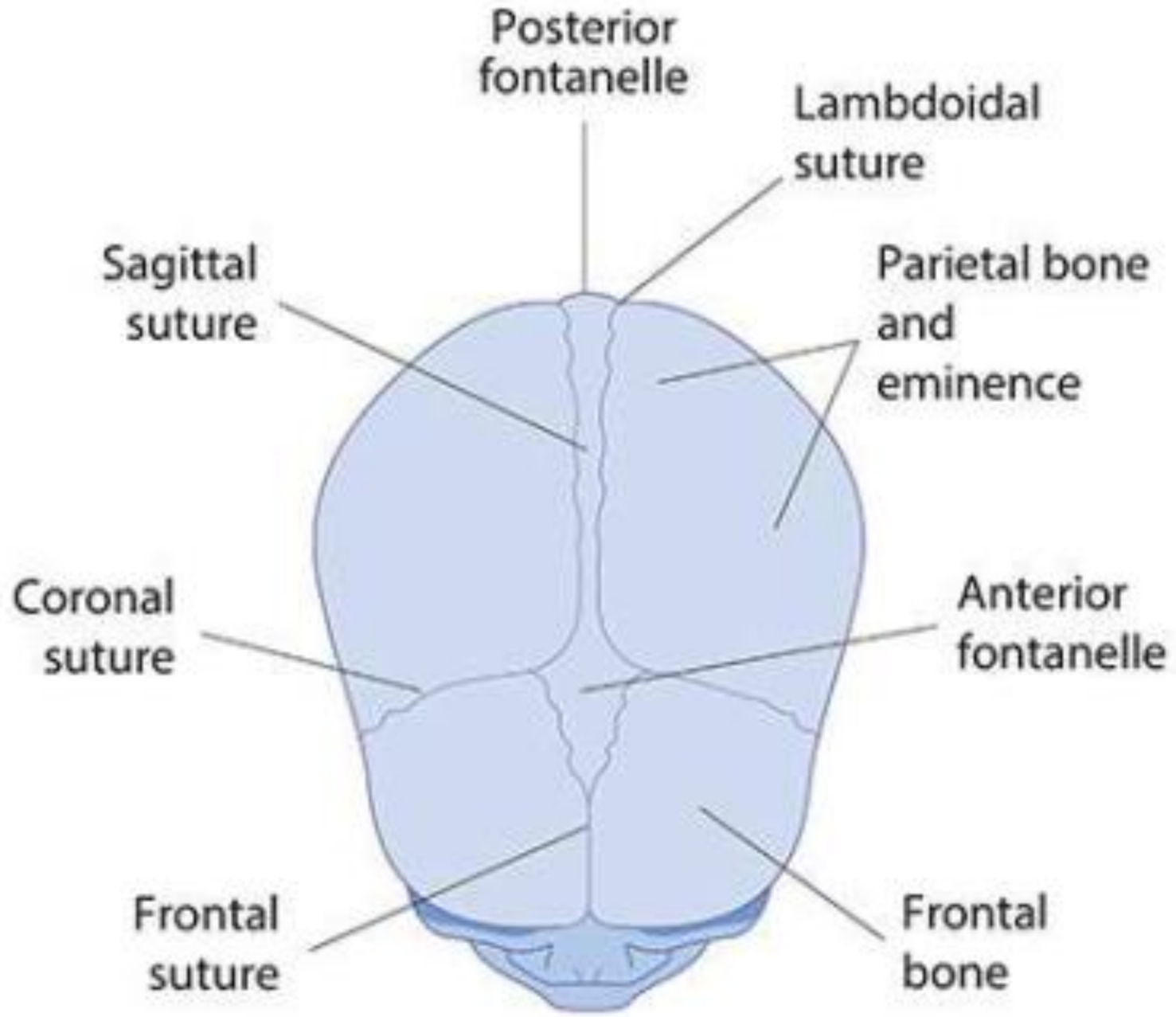
The fetal skull

The skull bones, sutures and fontanelles

The fetal skull is made up of the vault, the face and the base. The sutures are the lines formed where the individual bony plates of the skull meet one another.

At the time of labour, the sutures joining the bones of the vault are soft, unossified membranes, whereas the sutures of the fetal face and the skull base are firmly united .

The vault of the skull is composed of the parietal bones and parts of the occipital, frontal and temporal bones. Between these bones there are four membranous sutures: the sagittal, frontal, coronal and lambdoidal sutures.


Posterior fontanelle
Lambdoidal suture
Sagittal suture
Parietal bone and eminence
Coronal suture
Anterior fontanelle
Frontal suture
Frontal bone

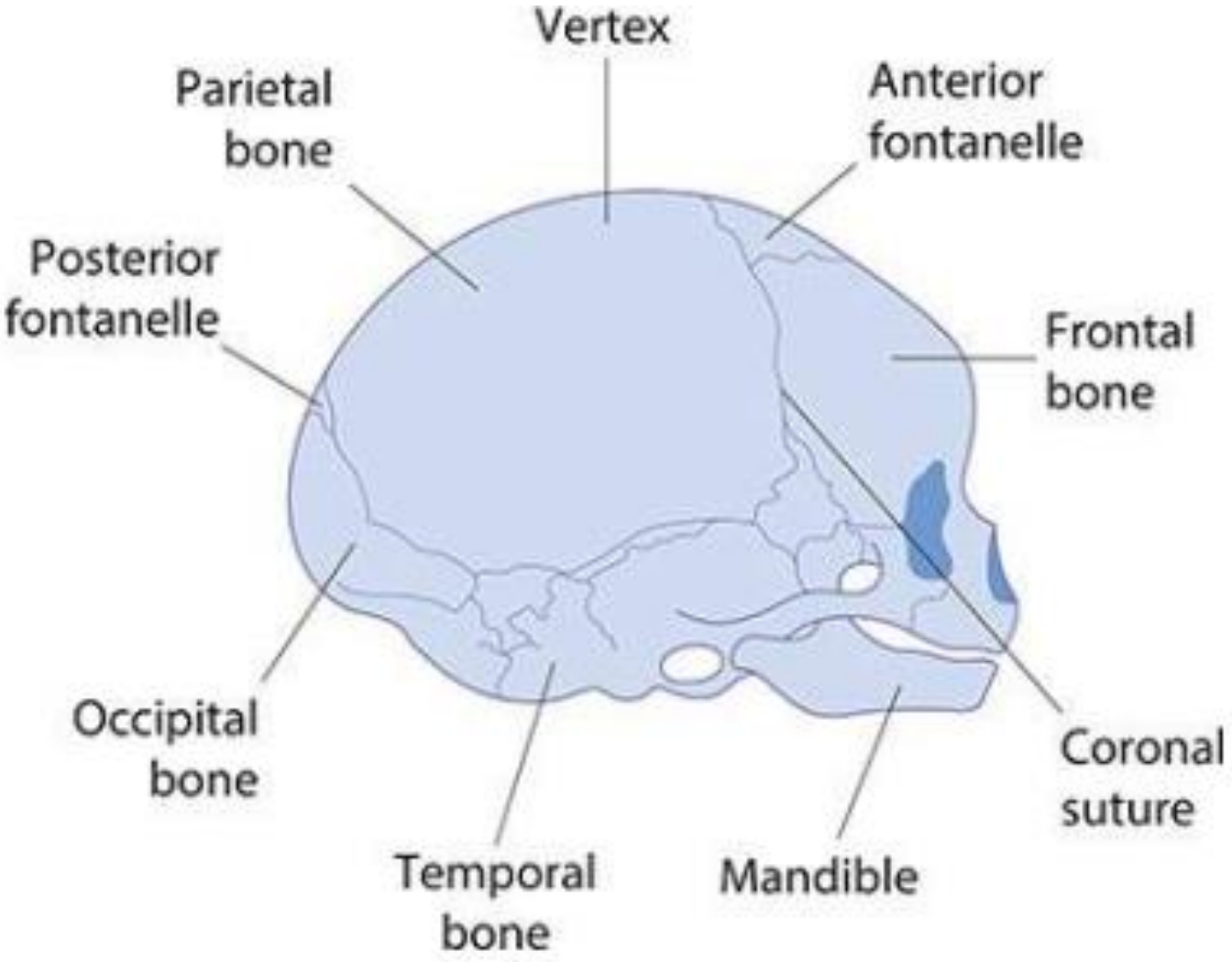


Figure 12.11 The fetal skull from the superior and lateral views.

The fontanelles are the junctions of the various sutures.

The anterior fontanelle,also known as bregma, is at the junction of the sagittal, frontal and coronal sutures,and is diamond shaped. On vaginal examination four suture lines can be felt.

The posterior fontanelle lies at the junction of the sagittal suture and the lambdoidal sutures between the two parietal bones and the occipital bone, and is smaller and triangular shaped. On vaginal examination three suture lines can be felt

The fact that the sutures are not fixed is important for labour. It allows the bones to move together and even to overlap. The parietal bones usually slide over the frontal and occipital bones.

Furthermore, the bones themselves are compressible. Together,these characteristics of the fetal skull allow a process called ‘moulding’ to occur,which reduces the diameters of the fetal head and encourages progress through the bony pelvis, while still protecting the underlying brain .

However, severe moulding, or moulding early in labour, can be a sign of obstructed labour due to a fetal malposition (failure of the head to rotate) or cephalopelvic disproportion (a mismatch between the size of the fetal head and maternal pelvis)

The area of the fetal skull bounded by the two parietal eminences and the anterior and posterior fontanelles is termed the ‘vertex’. In normal labour the vertex of the fetal head is the presenting part and the posterior fontanelle (indicating the occiput) is used to define the position of the fetal head in relation to the pubic symphysis.

The anatomical differences between the anterior and posterior fontanelles on vaginal examination facilitate correct diagnosis of the fetal head position in labour. The occipito-anterior (OA) position is the most favourable for a spontaneous vaginal birth. The occipito-transverse (OT) position or OP position is a malposition and may result in prolonged labour, instrumental delivery orcaesarean section.

The diameters of the skull

The fetal head is ovoid in shape.

The attitude of the fetal head refers to the degree of flexion and extension at the upper cervical spine.

Different longitudinal diameters are presented to the pelvis in labour depending on the attitude of the fetal head .

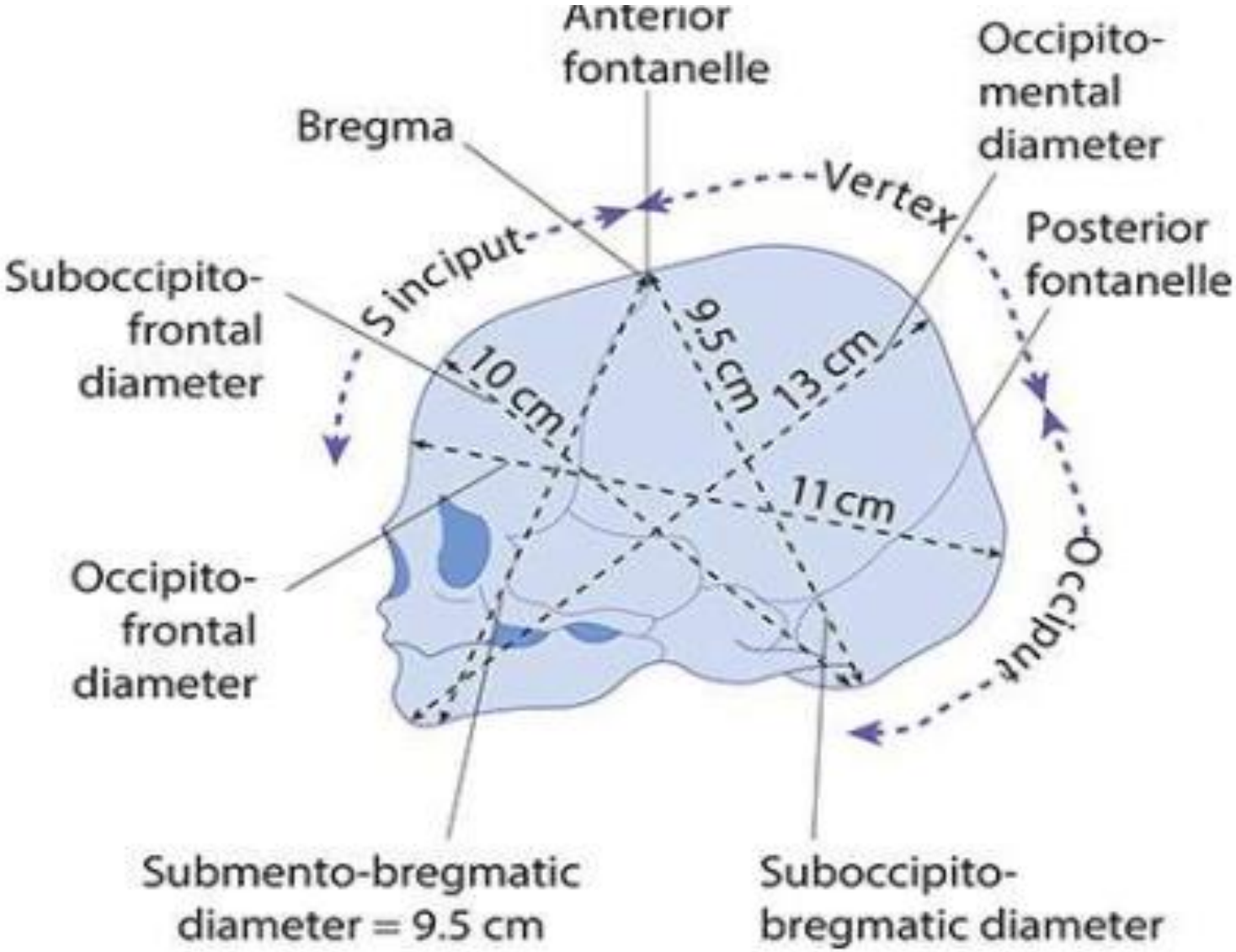
The longitudinal diameter that presents with a flexed attitude of the fetal head (chin on the chest) is the **suboccipito-bregmatic** diameter. This is usually 9.5 cm and is measured from beneath the occiput (suboccipital) to the centre of the anterior fontanelle (bregma).

The longitudinal diameter that presents in a less well-flexed head, such as is found in an OP position, is the **suboccipito-frontal** diameter. It is measured from the suboccipital region to the prominence of the forehead and measures 10 cm

With further extension of the head, the **occipito-frontal** diameter presents (deflexed OP). This is measured from the root of the nose to the posterior fontanelle and is 11.5 cm.

The greatest longitudinal diameter that may present is the **mento-vertical**, which is taken from the chin to the furthest point of the vertex and measures 13 cm. This is known as a brow presentation and it is usually too large to pass through the normal pelvis.

Extension of the fetal head beyond this point results in a smaller diameter. The **submento-bregmatic** diameter is measured from below the chin to the anterior fontanelle and is 9.5 cm. This is termed a face presentation. A face presentation can deliver vaginally when the chin is anterior(mento-anterior position)



2.13 The diameters of the fetal skull.

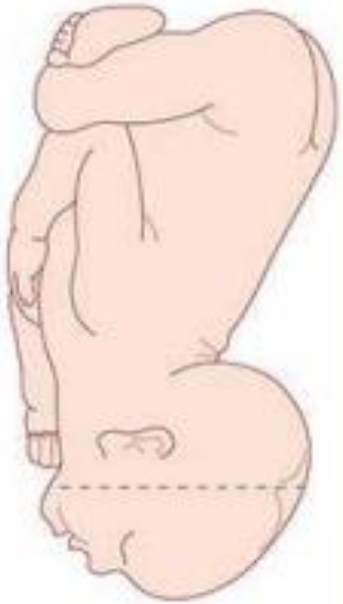
	Flexed → Extended			
Attitude	Well flexed	Less well flexed (partially extended) or deflexed	Extended 'brow presentation'	Hyperextended 'face presentation'
Diameter	Suboccipito-bregmatic	Occipito-frontal	Occipito-mental	Submento-bregmatic
Measurement	9.5 cm	11.5 cm	13.0 cm	9.5 cm
				

Figure 12.14 The effect of fetal attitude on the presenting diameter.

KEY LEARNING POINTS

1.The pelvic inlet is wider in the transverse than in the AP diameter.

2.The pelvic outlet is wider in the AP than in the transverse diameter.

3.The ischial spines are located in the midpelvis and denote station zero.

4.The fetal head enters the pelvis in a transverse position, rotates in the midpelvis and delivers in an AP position.

5.Pelvic dimensions may increase during labour due to pelvic ligament laxity.

6.The shape of the pelvis and pelvic floor muscles aid flexion and rotation of the fetal head.
7.The sutures and fontanelles are used to assess the position and attitude of the fetal head.
8.Moulding of the skull bones during labour reduces the measurements of the fetal head.
9.A fetus in a flexed OA position with a gynaecoid pelvis is most favourable for vaginal birth.
10.Perineal tissues offer resistance to delivery especially in a nulliparous woman.