ANATOMY
OF THE FEMALE PELVIS

By
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• The primary function of the pelvic girdle is to allow movement of the body, especially walking and running.

• It permit the person to sit and kneel. The women pelvis is adapted for child bearing, because of its increased width and rounded brim women are less speedy than men. The pelvis afford protection to the pelvis organ
The female external reproductive system

- The female reproductive system consists of the external genitalia, known collectively as the vulva and the internal reproductive organs: the vagina, the uterus, two uterine tubes and two ovaries. In the non-pregnant state, the internal reproductive organs are situated within the true pelvis.

- The vulva

  - The vulva includes the

    - The mons pubis is a rounded pad of fat lying over the symphysis pubis. It is covered with pubic hair from the time of puberty.
The female external reproductive system

- **The labia majora** (‘greater lips’) are two folds of fat and areolar tissue covered with skin and pubic hair on the outer surface and have pink smooth inner surface.
- **The labia minora** (‘lesser lips’) are two thin folds of skin lying between the labia majora. Anteriorly they divide to enclose the clitoris; the frenum is formed by the two medial parts; posteriorly they fuse, forming the fourchette.
The clitoris is a small rudimentary sexual organ corresponding to the male penis; the visible knob-like portion is located near the anterior junction of the labia minora, above the opening of the urethra and vagina. The prepuce a retractable piece of skin surrounds and protects the clitoris. Unlike the penis, the clitoris does not contain the distal portion of the urethra and functions solely to induce the orgasm of sexual intercourse.
External genitalia

- Mons pubis
- Labium majus
- Labium minus
- Urethral orifice
- Vaginal orifice
- Vaginal vestibule
- Perineal body
- Anus
The vestibule is the area enclosed by the labia minora in which the openings of the urethra and the vagina are situated.

The urethral orifice lies 2.5 cm posterior to the clitoris and immediately in front of the vaginal orifice.

The vaginal orifice, The orifice is partially closed by the hymen, a thin membrane that tears during sexual intercourse or during the birth of the first child.

Bartholin's glands are two small glands They secrete mucus, which lubricates the vaginal opening.
• **Blood supply**
  The blood supply comes from the internal and the **external pudendal arteries**. The blood drains through corresponding veins.

• **Lymphatic drainage**
  Lymphatic drainage is mainly via the inguinal glands.

• **Nerve supply**
  The nerve supply is derived from branches of the pudendal nerve. The vaginal nerves supply the erectile tissue of the vestibular bulbs and clitoris and their parasympathetic fibres have a vasodilator effect.
The perineum

- The perineum to the outer of the pelvis and is somewhat lozenge-shape: anteriorly it is bounded by the pubic arch, posteriorly by the coccyx, and laterally by the ischiopubic rami, ischial tuberosities and sacrotuberous ligament.
- The perineum divided into two triangular parts:
  - 1. the urogenital triangle
  - 2. the anal triangle
The pelvic floor

- The **pelvic floor** or **pelvic diaphragm** is composed of muscle fibers of the **levator ani**, (paired levator ani muscle LAM) the **coccygeus muscle**, and associated **connective tissue** which span the area underneath the **pelvis**. The pelvic diaphragm is a muscular partition formed by the levatores ani and coccygei, with which may be included the parietal pelvic fascia on their upper and lower aspects. The pelvic floor separates the **pelvic cavity** above from the perineal region (including **perineum**) below.
Function of levator muscles

• 1. maintain constant tone, except during voiding defecation
• 2. have the ability to contract quickly at the time of acute stress such as cough and sneeze
• 3. distended considerably during delivery
The pelvis

- The pelvic girdle, a basin shaped cavity, and consist of two innominate bone (hip bones), the sacrum and the coccyx. It is also a bony ring between the movable vertebrae of the vertebral column which it supports, and the lower limbs that it rests on. It contains and protects the bladder, rectum and internal reproductive organs. Some women experience pelvic girdle pain in pregnancy and need referral to an obstetric physiotherapist.
Pelvis
Pelvis

False pelvis (pelvis major)
True pelvis (pelvis minor)
Innominate bone

- Each innominate bone or (hip bone) is made up of three bones have fused together: the ilium, ischium, and pubis. It is a fixed bone.
HIP BONE

Ileum

Pubis

Ischium
The ilium

- has an upper & lower part. The smaller lower part form part of acetabulum and the upper part is the large flared out part. When the hands is placed on the hip it rests on the iliac crest which known as anterior superior iliac spine.
The ischium

- is the inferoposterior part of the innomiate bone and consist of a body and ramus. Above it form part of acetabulum. It has a large prominence known as the ischial tuberosity on which the body rests when sitting. Behind and a little above the tuberosity is an inward projection, the ischial spine. In labour, the station of the fetal head is estimated in relation to the ischial spines.
The pubis

- forms the anterior part. It has a body and two oar-like (blade) projections, the superior ramus and the inferior ramus. The two pubic bones meet at the symphysis pubis and the two inferior rami form the pubic arch, merging into a similar ramus on the ischium. The space enclosed by the body of the pubic bone, the rami and the ischium is called the obturator foramen. The innominate bone contains a deep cup to receive the head of the femur termed the acetabulum, which is composed of the three fused bones in the following proportions: two-fifths ilium, two-fifths ischium and one-fifth pubis.
The sacrum

- The sacrum is a wedge-shaped bone consisting of five fused vertebrae. The upper border of the first sacral vertebra, which juts forward, is known as the **sacral promontory**. The anterior surface of the sacrum is concave and is referred to as the hollow of the sacrum. Nerves from the cauda equina emerge to supply the pelvic organs. The posterior surface is roughened to receive attachments of muscles.
Sacral promontory

2

Innominate bone

coccyx

sacrum

Ischial spine

Symphysis pubis
The coccyx

The coccyx is a vestigial tail. It consists of four fused vertebrae, forming a small triangular bone, which articulates with the fifth sacral segment.
Pelvic joints

There are four pelvic joints:

1. one symphysis pubis
2. two sacroiliac joints
3. one sacroccocygeal joint.

The symphysis pubis is the midline cartilaginous joint uniting the rami of the left and right pubic bones.

The sacroiliac joints are strong, weight-bearing synovial joints. They join the sacrum to the ilium and as a result connect the spine to the pelvis. The joints allow a limited backward and forward movement of the tip and promontory of the sacrum, sometimes known as ‘nodding’ of the sacrum.

The sacroccocygeal joint is formed where the base of the coccyx articulates with the tip of the sacrum. It permits the coccyx to be deflected backwards during the birth of the fetal head.
Pelvic ligaments

- The ligaments connecting the bones of the pelvis with each other can be divided into four groups:
  - **Sacroiliac ligament**
  - those connecting the sacrum and ilium – the sacroiliac ligaments
  - **Sacrospinous ligament**
  - those passing between the sacrum and ischium –
  - **Sacroccocygeal ligaments**
  - those uniting the sacrum and coccyx
  - **Interpubic ligaments**
  - those between the two pubic bones

The ligaments that are important to midwifery practice are the sacrotuberous and the sacrospinous ligaments as they form the posterior wall of the pelvic outlet.
Fig. 8-3. Posterior view of the pelvis showing the ligaments.
Classification of pelvis

Divided into:

1) **False pelvis** (pelvis major; greater pelvis)
   - Part of abdominal cavity

2) **True pelvis** (pelvis minor; lesser pelvis)
   - Is the true pelvic cavity
   - Bony canal through which fetus must pass during labor
   - It divided into a brim, a cavity, and outlet
The pelvic brim

- The pelvic brim called pelvic inlet: Pelvic inlet ( = pelvic brim)
- The brim is rounded except where the sacral promontory projects into it.

The midwife need to know the fixed point on the pelvic brim that are known as the landmarks.
1 - Sacral Promotory
2 - Sacral ala (wing)
3 - Sacral iliac joint
4 - Illiopectineal line-
5 - Illiopectineal eminence
6 - Superior pubic ramus
7 - Body of pubic bone
8 - Symphysis pubis

Fig. 8-8. Brim of female pelvis.
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Fig. 8-8. Brim of female pelvis.
The pelvic cavity

• The cavity extended from the brim superior to the outlet inferiorly.
The pelvic outlet

The anatomical outlet is formed by the lower borders of each of the bones together with the sacrotuberous ligament. It include the narrow pelvic strait which the fetus must pass.
## Diameter of the pelvic inlet

<table>
<thead>
<tr>
<th>Diameters</th>
<th>Inlet</th>
<th>Cavity</th>
<th>Outlet - anatomical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anteroposterior</td>
<td>11</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Oblique</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Transverse</td>
<td>13</td>
<td>12</td>
<td>11</td>
</tr>
</tbody>
</table>
Inlet cavity

Anterior posterior 11 cm

Transfer 13 cm

obliquely 12 cm
The Cavity...!!!

- Round cavity of greatest dimensions.
- Anteroposterior diameter
- Oblique diameter
- Transverse diameter

12 cm
Outlet cavity diameter
- Bones are lighter, thinner
- False pelvis is shallow
- Pelvic cavity is wide & shallow
- Pelvic inlet round/oval
- Pelvic outlet comparatively large
- Subpubic angle large
- Coccyx more flexible, straighter
- Ischial tuberosities more everted

- Bones heavier, thicker
- False pelvis is deep
- Pelvic cavity is narrow & deep
- Pelvic inlet heart-shaped + smaller
- Pelvic outlet comparatively small
- Subpubic angle more acute
- Coccyx less flexible, more curved
- Ischial tuberosities longer, face more medially
Female pelvis shapes may be subdivided as follows:

1. Normal and its variants
   - Gynaecoid – most common type, suited for delivery
   - Android – the male type of pelvis
   - Platypelloid – flat pelvis; short AP diameter & wide transverse diameter
   - Anthropoid – resembling that of anthropoid ape, AP diameter is greater than the transverse

2. Symmetrically contracted pelvis
   - That of a small women but with a symmetrical shape
3. **Rachitic pelvis**
   - This deformity is caused by rickets (due to Vit D deficiency)
   - Sacrum is rotated so that the sacral promontory projects forward and coccyx tips backward
   - AP diameter of inlet is therefore narrowed but the outlet is increased

4. **Asymmetrical pelvis**
   - Asymmetry pelvis can be due to variety of causes such as scoliosis, poliomyelitis, pelvic fracture, congenital abnormality due to thalidomide etc
Pelvic Variations and Abnormalities

- Gynaecoid
- Android
- Symmetrically contracted
- Platypelloid
- Rachitic
- Anthropoid
- Asymmetrical
Pelvic Types
Gynaecoid pelvis

- Is a typical female pelvis. Ideal for vaginal delivery
  - Found in 80% of Asian women; 50-70% white women

- Rounded or slightly oval inlet

- Straight pelvic sidewalls with roomy pelvic cavity

- Good sacral curve

- Subpubic arch is wide 90 degrees
Android pelvis

- Present in most male and also in few females
- Heart shaped (or triangular) pelvic inlet - due to prominent sacrum
- The problem in delivery head occiptoposter most common
- Narrow subpubic angle less than 90°
Anthropoid pelvis

- Present in some males and females
  - 15% in Asian women; 15-30% in white women
- Pelvic inlet is long oval
- AP diameter > tranverse diameter
- Long & narrow sacrum
- Women with this type tend to be tall.

Less labor complications
Platypelloid pelvis

- Uncommon in both sexes
- Pelvic inlet appears slightly flattened (kidney shape)
  - Transverse diameter is greater than AP diameter
- Sacral promontory pushed forwards
# Normal Pelvic Variants

<table>
<thead>
<tr>
<th>Feature</th>
<th>Gynaecoid</th>
<th>Android</th>
<th>Anthropoid</th>
<th>Platypelloid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brim</td>
<td>Round</td>
<td>Heart-shaped / triangular</td>
<td>Long oval</td>
<td>Flat (kidney)</td>
</tr>
<tr>
<td>For pelvis</td>
<td>Generous</td>
<td>Narrow</td>
<td>Narrow</td>
<td>Wide</td>
</tr>
<tr>
<td>Side walls</td>
<td>Straight</td>
<td>Convergent</td>
<td>Divergent</td>
<td>Divergent</td>
</tr>
<tr>
<td>Ischial spine</td>
<td>Not prominent (blunt)</td>
<td>Prominent</td>
<td>Not prominent</td>
<td>Not prominent</td>
</tr>
<tr>
<td>Subpubic angle</td>
<td>90</td>
<td>Less 90</td>
<td>&gt;90</td>
<td>&gt; 90</td>
</tr>
<tr>
<td>Incidence in Asian women</td>
<td>50 %</td>
<td>20%</td>
<td>25%</td>
<td>5%</td>
</tr>
</tbody>
</table>
The female reproductive system

Vagina

Is hollow, distensible fibromuscular tube that extend from the vestibule of the external genitalia to the cervix. Its long about 10 cm in length & 2.5 cm in diameter. The anterior wall of the vagina is 1.5-2cm shorter than the posterior wall.
Function of vagina

- Allow escape of menses
- Place for sexual relation
- Provide exist for the fetus during delivery
Uterus

- The uterus is a hollow pear-shaped muscular organ located in the true pelvis between the bladder and the rectum. The position of the uterus within the true pelvis is one of anteversion and anteflexion that it bends forwards upon itself. When the woman is standing, the uterus is in an almost horizontal position with the fundus resting on the bladder.
Retroversion  Retroflexion  Anterflexion
Uterus Function

- The main function of the uterus is to nourish the developing fetus prior to birth.
- It prepares for pregnancy each month and following pregnancy expels the products of conception.
The structure of uterus

- The cornea
- The fundus
- The body 2/3 of uterus
- Cavity
- The isthmus
- The cervix
- Internal OS
- External OS
The uterus layers

- The uterus has three layers: the
  1. endometrium
  2. the myometrium
  3. the perimetrium, of which the myometrium, the middle muscle layer, is by far the thickest.
• 1. The endometrium

forms a lining of ciliated epithelium (mucous membrane) on a base of connective tissue or stroma. In the uterine cavity, this endometrium is constantly changing in thickness throughout the menstrual cycle. Called as compact layer {response to hormone periodically}
2. The myometrium

is thick in the upper part of the uterus and is sparser in the isthmus and cervix. Its fibers run in all directions and interlace to surround the blood vessels and lymphatics that pass to and from the endometrium. In the cervix, the muscle fibers are embedded in collagen fibers, which enable it to stretch in labour.
• The perimetrium
• is a double serous membrane, an extension of the peritoneum, which is draped over the fundus and the anterior surface of the uterus to the level of the internal os.
Cervix

1. **lower 1/3 of uterus.** connects uterus to vagina via endocervical canal

2. **External os:** os is a small round opening at the lower end of the cervix

3. **Internal os:** is the narrow opening between the isthmus and the cervix.
Uterine malformations:

1. Double uterus with duplication of body of uterus, cervix and vagina.
2. Duplication of uterus and cervix with single vagina.
3. Duplication of uterus with single cervix and vagina.
Fallopian tubes

Anatomy

1) **Interstitial portion:** 1.25 cm long
2) **Isthmic portion:** narrow its 2.5 cm from the uterus
3) **Ampulla:** wide is 5 cm long place for fertilization
4) **Fimbria:** funnel-shaped mouth which is attached to the ovary.
Fallopian tubes

- also known as fallopian tubes, oviducts and salpinges, are two very fine tubes leading from the ovaries into the uterus
- Function
  - The uterine tube propels the ovum towards the uterus, receives the spermatozoa as they travel upwards and provides a site for fertilization. It supplies the fertilized ovum with nutrition during its continued journey to the uterus.
Ovary

• The ovaries are components of the female reproductive system and the endocrine system.
• Function
• The ovaries produce oocytes and the hormones oestrogen and progesterone.
**Relations**
- **Anterior** to the ovaries are the broad ligaments.
- **Posterior** to the ovaries are the intestines.
- **Lateral** to the ovaries are the infundibulopelvic ligaments and the side walls of the pelvis.
- **Superior** to the ovaries lie the uterine tubes.
- **Medial** to the ovaries lie the ovarian ligaments and the uterus.
Structure of ovary

Covered by cuboid or low columnar epithelium
Consist of a cortex and a medulla
Cortex: oocytes in various stages of maturity.
Medulla: fibers, smooth muscle cells, blood vessel, nerves.
Vessel and nerve and lymph

• **Blood vessel**
  1. The ovarian artery
  1) Originated as branches of the abdominal aorta, (left: left renal artery).
  2) Turn over the common iliac artery and ureter, descend into the pelvis. Enter into ovary through the mesovarium
2. **The uterine artery**
   1) a terminal branch of the hypogastric artery
   2) Cross the ureter near the cervix (2cm)
   3) Ascend along the lateral border of the uterus
   4) uterine body branch and cervix-vagina branch
Male reproductive system

• The male hormones

• The control of the male gonads is similar to that in the female, but it is not cyclical. The hypothalamus produces gonadotrophin-releasing factors. These stimulate the anterior pituitary gland to produce FSH and luteinizing hormone (LH).
• FSH acts on the seminiferous tubules to bring about the production of sperm, whereas LH acts on the interstitial cells that produce testosterone.
• Testosterone is responsible for the secondary sex characteristics: deepening of the voice, growth of the genitalia and growth of hair on the chest, pubis, axilla and face.
Formation of the spermatozoa

• Production of sperm begins at puberty and continues throughout adult life. Spermatogenesis takes place in the seminiferous tubules under the influence of FSH and testosterone. The process of maturation is a lengthy one and takes some weeks. The mature sperm are stored in the epididymis and the deferent duct until ejaculation. If this does not happen, they degenerate and are reabsorbed. At each ejaculation, 2–4 mL of semen is deposited in the vagina.
• The seminal fluid contains about 100 million sperm/mL, of which 20–25% are likely to be abnormal. The remainder move at a speed of 2–3 mm/min. The individual spermatozoon has a head, a body and a long, mobile tail that lashes to propel the sperm along. The tip of the head is covered by an acrosome; this contains enzymes to dissolve the covering of the oocyte in order to penetrate it.