Only lower pole and lateral surface are not related to fallopian tube, remaining two borders, upper pole and medial surface are related to fallopian tube.

Blood supply and lymphatic drainage
- Ovary is supplied by ovarian artery, a branch of aorta. It also supplies blood to fallopian tube, side of uterus and ovaries. Minor blood supply to ovary also comes from uterine artery.
- Venous drainage is through ovarian vein. Right ovarian vein drains into IVC and left ovarian vein drains into left renal vein.
- Lymphatic drainage is into para-aortic (lateral aortic) nodes at L1.

Nerve supply
- Ovaries are predominantly supplied by sympathetic nerves, from T10 to T12 segments via aortic plexus. Sensory fibers accompany the sympathetic nerves, so that ovarian pain may be referred to periumbilical area. Ovarian pain may also be referred along distribution of obturator nerve on medial side of thigh because obturator plexus lie lateral to ovary in ovarian fossa. Some parasympathetic fibers may also reach ovary from inferior hypogastric plexus.

**FALLOPIAN TUBE (UTERINE TUBE)**
- Fallopian tubes are present in upper free margins of broad ligament of uterus. Each tube is 10 cm long. Each tube is divided into 4 parts, from lateral to medial:
  1. **Infundibulum** (site of fertilization and is the longest part of fallopian tube): It is lateral end and possesses fimbriae, therefore also called as fimbriated end. It opens into abdominal cavity through abdominal ostium. One of the fimbriae is longer and is attached to upper (tubal) pole of ovary. It is known as **ovarian fimbria**.
  2. **Ampulla** (site of fertilization and is the longest part of fallopian tube): It is lateral 2/3rd (6-7 cm) of the tube. Ampulla is the site of fertilization and is the longest part of fallopian tube.
  3. **Isthmus** (uterine or interstitial part): It is about 1 cm long and opens at superior angle of uterine cavity by uterine ostium.
  4. **Living epithelium of uterine cavity is ciliated columnar epithelium**.

The blood supply is through uterine artery (medial 2/3 of tube) and ovarian artery (lateral 1/3 of tube).

Lymphatics drain into para-aortic (lateral aortic) nodes, containing the lymphatics of ovary. The lymphatics from isthmus drain into superficial inguinal nodes.

**UTERUS**
- Uterus is a thick-walled hollow muscular organ, situated obliquely in the lesser pelvis between the urinary bladder (in front) and rectum (behind). Uterus is pear shaped (pyriform). Its dimensions are 7.5 cm (length), 5 cm (breadth) and 2.5 cm (thickness) and weight is 30-40 gms. The uterus is subdivided into three parts from above downwards: fundus, body and cervix.

- **Fundus** is the part of body which lies above the entrance of two uterine tubes. **Body** extends from the fundus to its junction with cervix at **isthmus** which corresponds with internal os of cervix. **Cervix** of uterus lies below the isthmus and is subdivided by vaginal wall into supra-vaginal and vaginal parts.

- The superolateral angle of the body projects outwards at the junction of body and fundus and is called Cornua of uterus. The fallopion (uterine) tube, ligament of ovary and round ligament are attached to it on each side.
Uterine cavity is lined by ciliated columnar epithelium
\(^{SLE}\) and cervical canal is lined by nonciliated simple columnar epithelium
\(^{SLE}\).

**Blood supply and lymphatic drainage**
- The chief blood supply of uterus is through uterine artery
\(^{SLE},\text{MC}\), a branch of anterior division of internal iliac artery
\(^{SLE},\text{MC}\). Partly ovarian arteries also supply uterus.
- Lymphatic drainage is as follows:
  1. **Cervix (lower lymphatics)**: Lymphatics drain into external iliac
\(^{SLE},\text{NEET}\), internal iliac
\(^{SLE},\text{NEET}\), and sacral nodes
\(^{SLE}\).
  2. **Lower part of body (middle lymphatics)**: Lymphatics drain into the external iliac nodes
\(^{SLE}\).
  3. **Fundus and upper part of body (upper lymphatics)**: Lymphatics drain mainly into para-aortic nodes
\(^{Kerala}\) and a few lymphatics from the uterine cornu accompany the round ligaments to reach the superficial inguinal nodes
\(^{Kerala}\).

**Nerve supply**
- The uterus is supplied by both systems, sympathetic and parasympathetic. Sympathetic system fibers arise from T11-L1 segments and carry painful sensations from the body of uterus. Parasympathetic fibers arise from S2-S4
\(^{309}\) (pelvic splanchnic nerve) and carry painful sensations from cervix.

**Supports of the uterus**
- The normal position of the uterus is one of the anteflexion and anteversion, i.e., the fundus and upper part of the body bent forward in relation to the long axis of the cervix (angle of anteflexion: normal 125°), while the organ thus leans forward as a whole from the vagina (angle of anteversion: normal 90°).

![Diagram](attachment:diagram.png)

(a) Angulations of the uterus and vagina, and their axes, (b) angle of anteversion and (c) angle of anteflexion

- The most fixed part of the uterus is the cervix, because of its attachment to the back of the bladder and to the vaginal fornix and a number of structures help directly or indirectly to maintain the normal position. The supports of uterus are -
Supports of uterus

Primary supports

- Pelvic diaphragm (levator ani and ischiopubic rami)
- Perineal body
- Distal urethral sphincter mechanism

Secondary supports

- Uterine ligaments
- Round ligament of uterus
- Uterosacral ligaments (ATTACHMENTS 69, 67)
- Transverse cervical ligaments of Mackenrodt (ATTACHMENTS 69, 67)
- Pubocervical ligaments
- Uterine axis

These are of doubtful value and are formed by peritoneal ligaments. These are broad ligaments, vesicouterine pouch and rectovaginal (rectouterine) pouch.

Broad ligament

The right and left broad ligaments are folds of peritoneum which attach the uterus to lateral pelvic wall. The ovary is attached to posterior surface of broad ligament through the mesovarium. The part of broad ligaments between the uterine tube and ligament of ovary is called the mesosalpinx, while the part below the ligament of ovary is called the mesometrium. The part of the broad ligament that stretches from the upper pole of the ovary and the infundibulum of uterine tube to lateral pelvic wall is called the suspensory ligament of the ovary (or infundibulopelvic ligament).

The broad ligament contains (i) Fallopian (uterine) tube, (ii) Ligament of ovary (ATTACHMENTS 69), (iv) Uterine vessels (ATTACHMENTS 69), (v) Ovarian vessels (in infundibulopelvic ligament), (vi) Uterovaginal and ovarian nerve plexuses (vii) Epithelium and its duct (Gartner’s duct (ATTACHMENTS 69)), (viii) Paraphyses, (ix) Lymphatics and others.

VAGINA

- The vagina is a fibromuscular canal forming the female copulatory organ. It extends from vulva to uterus. Mucous membrane is lined by nonkeratinized stratified squamous epithelium. There are no glands in vaginal mucosa. It is kept moist by the cervical glands from above and great vestibular gland below. The anterior wall is about 8 cm long and the posterior wall is about 10 cm long. The lumen is circular at the upper end because of the protrusion of the cervix into it. Below the cervix, anterior and posterior walls are in contact. The interior of the upper end of the vagina (or vaginal vault) is in the form of a circular groove that surrounds the protruding cervix. The groove becomes progressively deeper form backwards and is arbitrarily divided into four parts called the vaginal fornices:
  - Anterior fornix lies in front of the cervix and is shallowest.
  - Posterior fornix lies behind the cervix and is deepest.
  - Two lateral fornices lie one on each side of the cervix. Lateral fornix is related to the transverse cervical ligament (ATTACHMENTS 69) of pelvic fascia in which are embedded a network of vaginal vein and the ureter gets crossed by the uterine artery (ATTACHMENTS 69).

Relations of vagina

Anterior wall
- Upper half is related to the base of the bladder.
- Lower half to the urethra.

Posterior wall
- Upper one-fourth is separated from the rectum by the rectouterine pouch.
- Middle two-fourth are separated from the rectum by loose connective tissue.
- Lower one-fourth is separated from the anal canal by the perineal body and the muscles attached to it.

Lateral walls

One each side:
- Upper one-third is related to the transverse cervical ligament (ATTACHMENTS 69) of pelvic fascia in which are embedded network vaginal veins, and the ureter gets crossed by the uterine artery (ATTACHMENTS 69).
- Middle one-third is related the pubococcygeus part of the levator ani.
- Lower one-third pierces the perineal membrane, below which it is related to the bulb of the vestibule, the bulbospongiosus and the duct of greater vestibular gland of Bartholin (ATTACHMENTS 69).

Arterial supply
- Vaginal branch of internal iliac (main supply)
GENITAL ORGANS [ 181 ]

- Cervicovaginal branch of uterine artery (in upper party).
- Middle rectal and internal pudendal arteries (in lower part).

DEVELOPMENT OF UROGENITAL ORGANS

<table>
<thead>
<tr>
<th>Embryonic structure</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genital tubercle</td>
<td>Clitoris</td>
<td>Penis</td>
</tr>
<tr>
<td>Urogenital folds</td>
<td>Labia minora</td>
<td>Ventral aspect of penis</td>
</tr>
<tr>
<td>Labioscrotal swelling</td>
<td>Labia majora</td>
<td>Scrotum</td>
</tr>
<tr>
<td>Urogenital sinus</td>
<td>Urinary bladder, urethral</td>
<td>Urinary bladder, urethra its</td>
</tr>
<tr>
<td></td>
<td>glands lower ¼ vagina,</td>
<td>glands and prostate</td>
</tr>
<tr>
<td></td>
<td>Bartholin’s glands</td>
<td>Bulbourethral glands</td>
</tr>
<tr>
<td>Paramesonephric duct</td>
<td>Uterus (cervix, fallopian</td>
<td>Appendix of testis</td>
</tr>
<tr>
<td>(mullerian duct)</td>
<td>tubes, upper ¼ of vagina)</td>
<td></td>
</tr>
<tr>
<td>Mesonephric duct</td>
<td>Duct of Gartner</td>
<td>Epididymis, vas deferens,</td>
</tr>
<tr>
<td>(Wolffian duct)</td>
<td>(Duct of epoophoron)</td>
<td>Appendix of epididymis</td>
</tr>
<tr>
<td></td>
<td>Trigone of urinary bladder</td>
<td>Seminal vesicle</td>
</tr>
<tr>
<td>Mesonephric tubules</td>
<td>Epoophoron (organ of</td>
<td>Trigone of urinary bladder</td>
</tr>
<tr>
<td>(Wolffian duct)</td>
<td>Rosenmüller)</td>
<td></td>
</tr>
<tr>
<td>Gubernaculum</td>
<td>Ligament of ovary</td>
<td>Efferent ductules</td>
</tr>
<tr>
<td></td>
<td>Round ligament of uterus</td>
<td>Paradidymis</td>
</tr>
<tr>
<td>Mullerian tubercle</td>
<td>Hymen</td>
<td>Gubernaculum Testis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seminal colliculus</td>
</tr>
</tbody>
</table>

Note
- Paramesonephric (Mullerian) duct is the main genital duct in females and mesonephric (Wolffian) duct is main genital duct in males.

***
MALE REPRODUCTIVE ORGANS

1. Lymph from glans penis drains into -
   a) Superficial inguinal nodes (NEET/DNB Pattern)
   b) Deep inguinal lymph nodes (NEET/DNB Pattern)
   c) Obturator nodes
   d) Internal iliac nodes
2. Which of the following is the correct order of pathway for a sperm - (AI 08)
   a) Straight tubules → Rete testis → Efferent tubules
   b) Rete tubules → Efferent tubules → Straight tubules
   c) Efferent tubule → Rete testis → Straight tubules
   d) Staright tubule → Efferent tubules → Rete tubules
3. The lymphatic drainage of testes is - (NEET/DNB Pattern)
   a) Inguinal L.N.
   b) Mesenteric L.N.
   c) Para-aortic L.N.
   d) Obturator L.N.
4. All of the following statements regarding vas deference are true except - (AI 05)
   a) The terminal part is dilated to form ampulla
   b) It crosses ureter in the region of ischial spine
   c) It passes lateral to inferior epigastric artery at deep inguinal ring
   d) It is separated from the base of bladder by the peritoneum
5. The artery to the ductus deferens is a branch of - (AI 08)
   a) Inferior epigastric artery
   b) Superior epigastric artery
   c) Superior vesical artery
   d) Cremasteric artery
6. The artery of the ductus deferens arises from which of the following structures - (MAHA 05)
   a) Aorta
   b) Inferior epigastric artery
   c) Inferior vesical artery
   d) Pudendal artery
7. In fracture of penis involving rupture of tunica albuginea with intact Buck's fascia following would be noted clinically - (AIIMS Nov. 07)
   a) Hematoma involving only shaft of penis
   b) Hematoma involving scrotum and perineal region
   c) Hematoma in penis, scrotum & abdominal wall
   d) Hematoma in penis, scrotum and thigh
8. All of the following median erection of penis except - (AIIMS 01)
   a) Pudendal nerve
   b) Sacral plexus
   c) Hypogastric plexus
   d) Nervi erigentes (S2-3,4)
9. After herniotomy loss of sensation of the scrotum, root of penis is due to injury of - (AIIMS 01)
   a) Iliohyoginal nerve
   b) Iliohypogastric nerve
   c) Genitofemoral nerve
   d) Obturator nerve
10. All are contents of spermatc cord except - (PGI Dec. 07)
    a) Pampiniform plexus
    b) Ilio-inguinal nerve
    c) Genital branch of genitofemoral nerve
    d) Cremasteric arteries
    e) Sympathetic plexus

11. All are component of Spermatic cord except - (AI 2k)
    a) Pauparts ligament
    b) Genito-femoral nerve
    c) Vas deferens
    d) Pampiniform plexus
12. The intricately and prodigiously looped system of veins and arteries that lie on the surface of testis is known as - (AI 04)
    a) Choroid plexus
    b) Tuberal plexus
    c) Pampiniform plexus
    d) Pectiniform septum
13. Corpora amylacea is seen in (NEET/DNB Pattern)
    a) Prostate
    b) Seminal vesicle
    c) Thymus
    d) Testis
14. A 50 year old man suffering from carcinoma of prostate showed areas of sclerosis and collapse of T10 and T11 vertebrae in X-ray. The spread of this cancer to the above vertebrae was most probable through - (AIIMS 03)
    a) Sacral canal
    b) Lymphatic vessels
    c) Inferior vertebral plexus of veins
    d) Superior rectal veins

FEMALE GENITAL ORGANS

15. All are parts of vulva except -(NEET/DNB Pattern)
    a) Labia minora
    b) Labia majora
    c) Perineal body
    d) Clitoris

Ovary & fallopian tubes

16. Pain of ovarian pathology is referred to - (AIIMS Nov. 10)
    a) Back of thigh
    b) Anterior thigh
    c) Medial thigh
    d) Gluteal region
17. Lymphatic drainage of ovary -(NEET/DNB Pattern)
    a) Deep inguinal
    b) Superficial inguinal
    c) Obturator
    d) Paraortic
18. Ovarian artery is a branch of - (NEET/DNB Pattern)
    a) Abdominal aorta
    b) Anterior iliac artery
    c) Common iliac artery
    d) Posterior iliac artery
19. Lining epithelium of fallopian tube is a) Simple columnar (NEET/DNB Pattern)
    b) Pseudo-stratified columnar
    c) Ciliated columnar
    d) Simple cuboidal
20. Order of the following structures of fallopian tube from lateral to medial - (NEET/DNB Pattern)
    a) Ampulla-Infundibulum-Isthmus-Interstitial
    b) Infundibulum-Ampulla-Isthmus-Interstitial
    c) Isthmus-Infundibulum-Ampulla-Interstitial
    d) Ampulla-Isthmus-Infundibulum-Interstitial
Uterus =

Development

Mesenchyme of Nephrogenic shield

Ovarian ar. m. Enzymatic LIG.

Mesonephric duct

Gonad
Anomaly

1. Duplicated of uterus & vagina
2. Bilobed
3. Septum
4. Unilobed

Support of Uterus

Active mechanisms:

- Muscular
  - Levator ani
    - Perineal body
    - Distal urethral sphincter
  - Anterior muscular: Uterovaginal axis
    - Pubo-cervical trans. Cervical
    - Utero sacral round ligament of uterus

Secondary
- Broad ligament, uterosacral, rectovaginal fossa
DEVELOPMENT OF THE PROSTATE

This gland develops from a large number of buds that arise from the epithelium of the prostatic urethra, i.e. from the caudal part of the vesico-urethral canal, and from the pelvic part of the definitive urogenital sinus. These buds form the secretory epithelium of the gland. The buds that arise from the mesodermal part of the prostatic urethra (i.e. posterior wall, above the openings of the ejaculatory ducts) form the inner glandular zone of the prostate. Buds arising from the rest of the prostatic urethra (endoderm) form the outer glandular zone.

The outer zone differentiates earlier than the inner zone. In later life the outer zone is frequently the site of carcinomatosus change, while the inner zone is affected in senile hypertrophy of the organ.

The muscle and connective tissue of the gland are derived from the surrounding mesenchyme which also forms the capsule of the gland.

The secretory elements of the prostate are rudimentary at birth. They undergo considerable development at puberty. The organ undergoes progressive atrophy in old age, but in some men it undergoes benign hypertrophy.

The prostate may, rarely, be absent.

Female Homologues of Prostate

Endodermal buds, similar to those that form the prostate in the male, are also seen in the female. The buds that arise from the caudal part of the vesico-urethral canal give rise to the urethral glands, whereas the buds arising from the urogenital sinus form the paraurethral glands of Skene.
**FIG. 16.16:** Mesodermal and endodermal derivatives of the prostate. The glands of the median lobe, which open onto the posterior wall of the prostatic urethra (above the opening of the ejaculatory ducts), are mesodermal. Fig. A shows a transverse section above the level of the opening of ejaculatory ducts. Fig. B is a sagittal section.

**PARAMESONEPHRIC DUCTS**

We have seen that these ducts are present in the intermediate mesoderm. They are formed by invagination of coelomic epithelium (Fig. 16.17). They lie lateral to the mesonephric ducts in the cranial part of the nephrogenic cord (Fig. 16.18A).

When traced caudally, they cross to the medial side of the mesonephric ducts. Here the ducts of the two sides meet and fuse in the middle line to form the \textit{utero-vaginal canal} (or \textit{uterine canal}) (Fig. 16.18B). The caudal end of this canal comes in contact with the dorsal wall of the definitive urogenital sinus. We have already seen that, in the female, this part of the sinus gives rise to the vestibule. In the female, the paramesonephric ducts give origin to the uterine tubes, the uterus, and part of the vagina (Fig. 16.19A).

**DEVELOPMENT OF UTERUS AND UTERINE TUBES**

The epithelium of the uterus develops from the fused paramesonephric ducts (uterovaginal canal: 1 in Fig. 16.19A). The myometrium is derived from surrounding mesoderm (3).
As the thickness of the myometrium increases, the unfused horizontal parts of the two paravesical ducts come to be partially embedded within its substance, and help to form the fundus of the uterus (2). The cervix can soon be recognised as a separate region. In the fetus the cervical part is larger than the body of the uterus.

The uterine tubes develop from the unfused parts of the paravesical ducts. The original points of invagination of the ducts into the coelomic epithelium remain as the abdominal openings of the tubes. Fimbriae are formed in this situation.
**Clinical Correlation**

**Anomalies of the Uterus**
- The uterus may be completely, or partially, duplicated (Figs. 16.20A, B). Complete duplication is referred to as **uterus didelphys**.
- The lumen may be partially, or completely, subdivided by a septum (Fig. 16.20C).
- The entire uterus may be absent.
- One half of the uterus may be absent (**unicornuate uterus**) (Fig. 16.20D).
- The uterus may remain rudimentary.
- There may be atresia of the lumen either in the body or in the cervix.

**Anomalies of the Uterine Tubes**
- The uterine tubes may be absent, on one or both sides.
- The tubes may be partially, or completely, duplicated on one or both sides.
- There may be atresia of the tubes.

**Development of Vagina**

We have noted that the lower end of the uterovaginal canal comes in close contact with the dorsal wall of the phallic part of the urogenital sinus (Fig. 16.21A). However, the uterovaginal canal and the urogenital sinus are soon separated from each other by the formation of a solid plate of cells called the **vaginal plate**. The vagina is formed by the development of a lumen within the vaginal plate (Fig. 16.21D).