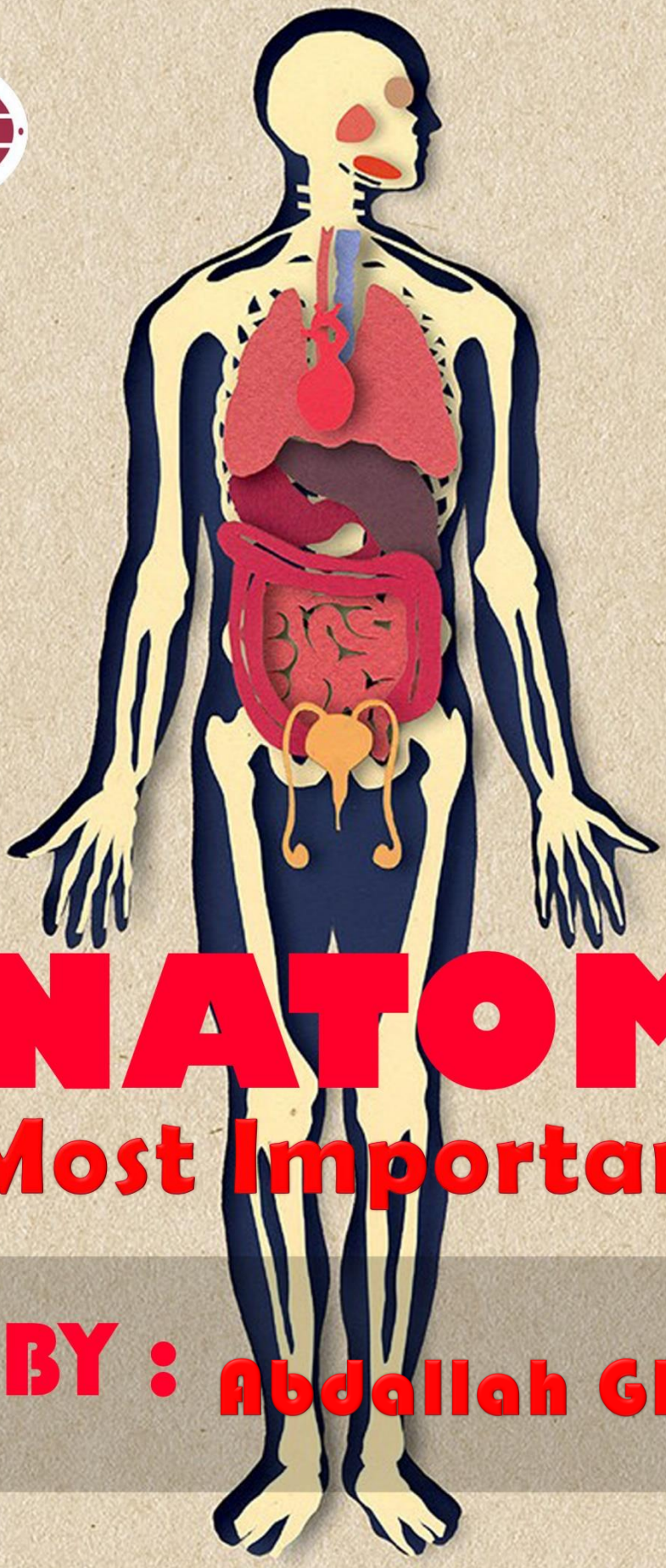

ANATOMY

Most Important

DONE BY : Abdallah Ghwiry

Genitourinary system

التلخيص يشمل most important ، علما انه سوف يضاف ما ركز عليه الدكتور اثناء المحاضرات لاحقا

Kidneys

Position of the kidneys:

They lie retroperitonealy in the posterior abdominal wall, on each side of the vertebral column.

	Upper pole	Lower pole	Hilum
Position	opposite – T12 vertebra	opposite – L3 vertebra	opposite – L1 vertebra or transpyloric plane
far from the midline	2.5 cm	7.5 cm	5 cm

Relations (anterior and posterior).

	Anterior relations	Posterior relations	
Right Kidney	▪ The **upper pole** is covered by suprarenal gland. ▪ **Three-fourth** of this surface below suprarenal gland is related to right lobe of liver. ▪ **The remaining area** is related to the right colic flexure. ▪ The 2nd (descending) part of duodenum descends along the medial border of right kidney	▪ devoid of the peritoneal covering. ▪ related to the *Diaphragm *medial arcuate ligaments *lateral arcuate ligaments *the psoas major *quadratus lumborum *transversus abdominis .M *the subcostal vessels *the subcostal .N *iliohypogastric .N *ilioinguinal .N	**upper pole** is related to the twelfth rib
Left Kidney	suprarenal gland، spleen,stomach, pancreas, left colic flexure, and coils of jejunum.		**Upper pole** related to the eleventh and twelfth ribs.

Sagittal section.

▪ A frontal (sagittal) section through the kidney reveals two distinct regions:

1-superficial, paler area called the cortex,which is granular to the naked eye

2-deep darker area called the medulla that is composed of about 12 – 20 conical masses termed the renal pyramids,

Each having its base oriented toward the cortex, and its apex, the renal papilla,projects medially into the interior of a minorcalyx.

▪ Renal pyramids are separated by cortical tissue called renal (cortical) column.

▪ The region of the cortex between the bases of the pyramids and fibrous capsule are called the cortical arches or cortical lobules.

▪ Extending from the bases of renal pyramids into cortical arches are striations of medullary tissue called the medullary rays.

▪ The hilum of the kidney leads into a large cavity in the kidney devoid of renal tissue called the renal sinus.

▪ The renal sinus is occupied by the renal pelvis, (the dilated upper part of ureter).

▪ Renal pelvis is divided into 2 – 3 major calyces, each of which divides into 2 – 3 minor calyces.

▪ Each minor calyx receives from 1 – 3 renal papillae.

Blood supply.

▪ Renal artery – Branch of descending abdominal aorta – Opposite **L2 vertebra**.

▪ Divides into five segmental arteries that enter the hilum of the kidney, four in front and one behind the renal pelvis.

▪ Lobar arteries arise from each segmental artery, one for each renal pyramid.

▪ Before entering the renal lobes, each lobar artery gives off 2 – 3 interlobar arteries, which run through the renal (cortical) column between the renal pyramids.

▪ At the junction of the cortex and the medulla, the interlobar arteries becomes the arcuate arteries, which arch over the bases of the pyramids.

▪ Arcuate arteries give off several interlobular arteries that ascend in the cortex.

▪ These arteries are so named because they pass between lobules of kidney.

▪ A renal lobule is a group of nephrons that open into branches of the same collecting duct.

▪ The afferent glomerular arteries arise as branches of the interlobular arteries.

▪ Each nephron receives one afferent arteriole, which divides into a tangled, ball-shaped capillary network called the glomerulus.

▪ The glomerular capillaries then reunite to form an efferent arteriole that carries blood out of the glomerulus.

▪ The efferent arterioles divide to form the peritubular capillaries, which surround the tubular part of the nephron in the cortex.

▪ Extending from some efferent arterioles are long loop-shaped capillaries called vasa recta that supply the tubular portions of the nephron in the renal medulla.

▪ The peritubular capillaries eventually reunite to form peritubular venules and then interlobular veins, which also receive blood from vasa recta.

▪ Then the blood drains through the arcuate veins to the interlobar veins running between the renal pyramids.

▪ Blood leaves the kidney through a single renal vein that exits at the renal hilum and drains into the inferior vena cava.

Nephrons

▪ Each kidney is composed of 1 – 4 million nephrons.The nephron is the functional unit of the kidney.It consists of renal (malpighion) corpuscle and renal tubules.

a. Renal (Malpighion) corpuscle

▪ Is the dilated proximal portion of the nephron.

▪ It consists of tuft capillaries, the glomerulus, surrounded by a double layer of epithelial capsule called glomerular (Bowmans) capsule.

▪ The external layer (parietal layer) of the glomerular capsule consists of simple flattened squamous epithelium supported by basement membrane.

▪ The internal layer (visceral layer) of the Bowman's capsule envelops the glomerulus.

▪ This layer is made up of very specialized epithelial cells called the podocytes, have a cell body from which arise several primary processes.

▪ Each primary process gives rise to numerous secondary processes called pedicles.

▪ The pedicles interdigitate, defining elongated spaces, the filtration slits.

▪ Between the two layers of the glomerular capsule is the urinary space, which receives fluid filtrated through the capillary wall and the visceral layer.

▪ Between endothelial cells of glomerular capillaries and podocytes that cover their external surface is a thick basement membrane.

▪ This membrane is believed to be the filtration barrier that separates urinary space and blood in the capillaries.

▪ This basement membrane has a selective macromolecular filter.

▪ Particles greater than 10 nm in diameter do not readily pass through the basal lamina.

▪ The glomeruli are composed of arterial capillaries in which hydrostatic pressureabout 4.5 mm Hg– which is higher than that found in other capillaries.

▪ The endothelial cells of glomerular capillaries are of fenestrated capillaries.

▪ In addition to endothelial cells and podocytes, the glomerular capillaries have mesangial cells adhering to their walls.

▪ These cells are contractile and have receptors for angiotensin II.When these receptors are activated, the glomerular flow is reduced.

▪ Mesangial cells also have receptors for natriuretic factor produce by cardiac atria cells.This factor is a vasodilator and relaxes.

▪ The mesangial cells, probably increasing the blood flow and the effective surface area available for filtration.

▪ The renal corpuscle has a vascular pole, where the afferent arteriole enters and the efferent arteriole leaves, and a urinary pole, where the proximal tubule begins.

b. Renal tubules:

▪ These are tubules into which the filtered fluid passes.It is concerned with the selective resorption of substances from the glomerular filtrate until it approaches the composition of urine .It consists: The proximal convoluted tubule, the Henle's loop, and the distal convoluted tubule.

(1) Proximal convoluted tubule:

▪ Is lined by simple cuboidal or low columnar epithelium.

▪ The upper border of these cells has abundant microvilli, which form a brush border, indicating that these cells have a resorptive function.

▪ Substances resorbed actively in this part of the tubule include glucose, amino acid, sodium, chloride, and phosphate.

▪ Because the cells are large, each transverse section of a proximal tubule contains only 3– 5 spherical nuclei.

(2) Henle's loop:

▪ Is a U-shaped structure consisting of: 1-descending thick limb2- descending thin limb 3- scending thin limb 4- ascending thick limb.

▪ The thick limbs of the Henle's loop are very similar in structure to the distal convoluted tubules.

▪ Whereas the thin segments are lined by simple squamous epithelium whose nuclei bulge into the lumen.

(3) Distal convoluted tubule:

▪ Is shorter than the proximal convoluted tubule and differ from it (both found in cortex).

▪ The lining epithelium has no brush border and the cells are smaller.

▪ Since the distal convoluted tubule cells are flatter and smaller than those of the proximal tubule, more nuclei are seen in transverse section of a distal convoluted tubule.

▪ The first coil of distal convoluted tubule lies in angle between afferent and efferent arterioles.

▪ The cells of the tunica media of the afferent arteriole in this region are differ from the usual smooth muscle fibers in that they are large rounded epithelioid cells containing a large spherical nucleus and a granular cytoplasm.

▪ These cells are called juxta-glomerular cells and they are in close contact with cells of distal convoluted tubule, which in this region approach the columnar form and are aggregated so that the nuclei appear close together.

▪ This region of the tubule is called the macula densa .

▪ The two groups of cells (juxta-glomerular cells and macula densa) constitute juxtaglomerular complex or apparatus of the kidney.

▪ Approximately 1/7 of all nephrons is located near the corticomedullary junction, and are therefore called juxtamedullary nephrons.

▪ The other nephrons are called cortical nephrons.

▪ The collecting tubules are lined with simple cuboidal epithelium.

▪ The collecting ducts are lined with simple columnar epithelium.

▪ A long their entire extent, collecting tubules and ducts are composed of cells that stain weakly with the usual stains.

▪ They have an electron-lucent cytoplasm with few organelles.

Radiographic Anatomy

1. Standard Anteroposterior Radiograph of Abdomen

-This type of x-ray is done with the patient in the supine position.

-Kidneys are usually visible on a standard anteroposterior radiograph of abdomen, because the perirenal fat surrounding the fibrous capsule of the kidney produces a transradiant line.

-Renal calyces, renal pelvis, and ureter are not normally visible on a standard radiograph.

-The lumen can be demonstrated by the use of radiopaque iodine–containing compound in intravenous pyelography or retrograde pyelography.

2. Intravenous Pyelography (IVP)

*When iodine-containing compound is injected into a subcutaneous arm vein, it is excreted and concentrated by kidneys, thus renders the calyces and ureters opaque to x-ray.

*When enough of opaque media has been excreted, the bladder is also revealed.

*The ureters are seen superimposed on the transverse processes of lumbar vertebrae.

*They cross sacroiliac joint and enter pelvis.

* At ischial spines, the two ureters turn forwards and slightly medially to enter bladder.

*The three normal constrictions of ureters can be recognized.

3. Retrograde Pyelography (RGP):

- A cystoscope is passed through urethra into the bladder, and a ureteric catheter is inserted into the ureter.
- A solution of sodium iodide is then injected along catheter into ureter.

- When minor calyces become filled with radiopaque medium, the dilated anatomic features of minor and major calyces and the pelvis of the ureter can be clearly seen.
- Each minor calyx has a cup-shaped appearance caused by the renal papilla projecting into it.

Pronephrous

-Are rudimentary and non functional.

-Appear at beginning of 4th week of embryonic life.

-They are represented by 7 – 12 cell clusters in the cervical region.

-The pronephric ducts run caudally and open into the cloaca.

-Soon degenerate, and by end of 4th week, all indications of pronephric system have disappeared.

-However most of the pronephric ducts persist and are utilized by next set of kidneys, the mesonephroi.

Mesonephros

Appear late in 4th week of development.

They are located caudal to rudimentary pronephroi.

They are derived from intermediate mesoderm from upper thoracic to upper lumbar (L3).

They functions for short time during early fetal life, until permanent kidneys develop.

Each consists of glomeruli and mesonephric tubules, which open into mesonephric ducts, originally pronephric ducts.

The mesonephric ducts open into cloaca.

Mesonephroi degenerate at end of 1st trimester. However, in male, the mesonephric tubules become efferent ductules of testes, and mesonephric ducts have several adult derivatives.

metanephrous

Begin to develop early in 5th week, and start to function at 9th week of the fetal life.Develop from two structures, both of mesodermal origin:

a. Metanephric diverticulum (ureteric bud):

An outgrowth from mesonephric duct near cloaca,It is primordium of ureter, renal pelvis, minor and major calices, and collecting tubules.

b. Metanephric mass of intermediate mesoderm or metanephric blastema:

Derived from caudal part of nephrogenic cord ,It is primordium of nephrons.

Metanephric diverticulum elongates and penetrates the metanephric mass

The stalk of diverticulum forms ureter.

The cranial part of diverticulum becomes renal pelvis, which splits into cranial and caudal portions, future of major calyces

- Each major calyx subdivides repeatedly until 12 or more generations of tubules have formed.
- The first four generations coalesce to form the minor calyces
- The remaining generations of tubules form the collecting tubules
- The end of each newly formed tubule induces clusters of mesenchymal cells in metanephric mass to form a small metanephric vesicle
- These vesicles elongate and give rise to S-shaped tubules
- Capillaries grow into proximal end of these S-shaped tubules
- The latter become invaginated by glomerulus to form glomerular (Bowman's) capsule
- The glomerulus and glomerular capsule constitute a renal (malpighion) corpuscle.
- Continuous lengthening of remaining part of each S-shaped tubule results in formation of proximal convoluted tubule, Henle's loop, and distal convoluted tubule
- The distal end of each distal convoluted tubule forms an open connection with one of collecting tubules, establishing a passageway from the renal corpuscle to collecting tubules

EXTRA NOTE – Lecture 3

الدكتور حكى ممكن يخربط ب origin عن mesonephrone يجيب انها ectoderm or endoderm فالجواب الصح هو mesoderm

Positional Changes of Kidneys,,,,Permanent kidneys lie close to each other in pelvis Embryonic body caudal to kidneys grows. As a result kidneys gradually come to lie in the abdomen and more further a part Positional change of kidneys is associated by 90˚ degree rotation, so that hilum is directed anteromedially الدكتور حكى مهم عن الي بالاحمر

Renal Pain

▪ Visceral afferent fibers ascend to T12 segment of the spinal cord through the lowest splanchnic nerve.

▪ Pain is commonly referred along the distribution of the subcostal nerve (T12) to the flank and the anterior abdominal wall.

▪ Pain varies from a dull to sever pain, and can results from stretching of renal capsule or spasm of the smooth muscle in renal pelvis.

Ureters

Relations.

	Anterior	Posterior
Right Ureter	Related to 2nd (descending) part and beginning of 3rd (horizontal) part of duodenum. Near superior aperture of lesser pelvis, it is related to lower part of root of mesentery of small intestine and terminal part of ileum. It is crossed by right colic, ileocolic, and right gonadal vessels	*Psoas major muscle Separates the ureter from the transverse processes of lumbar vertebrae. *Cross corresponding common iliac artery.
Left Ureter	It is crossed by left colic and gonadal vessels. Near the superior aperture of lesser pelvis, it is related to sigmoid colon and mesocolon.	

Constrictions.

a. At pelviureteral junction.

b. Where it crosses pelvic brim.

c. Where it passes through muscular wall of bladder.

Blood supply.

Upper part – Renal artery.

Middle part – Gonadal artery.

Lower part – Superior vesical artery.

venous drainage

Venous blood drains into veins that correspond to the arteries.

Ureteric colic (pain).

- Renal colic due to stone in renal pelvis or upper part of ureter – Colicky pain referred to skin areas that are supplied by these segments of spinal cord (flank, loin, and groin).
- When a stone enters lower part of ureter – colicky pain is felt at a lower level and is often referred to testis and/or tip of penis (male), or (labium majus in female).Sometime pain is referred along femoral branch of genitofemoral nerve (L1 and 2), to upper part of the front of the thigh.
- The pain is often sever that afferent pain impulse spread within CNS, giving rise to nausea.
- Colicky pain is due to spasm of smooth muscle.

Histology

1-Outer fibrous coat: Is continuous with the fibrous capsule of the kidney in the renal sinus.

2-Middle muscular coat:

In the upper two-thirds of ureter this coat is made up of an outer circularly disposed smooth muscle fibers, and an inner longitudinally arranged muscle fibers.

In the lower third, the ureter acquires an additional outer longitudinal layer of smooth muscle.

3-Inner mucous coat:

Present 5 – 6 longitudinal folds. Continuous with the mucous membrane of bladder.

Consists of lamina propria, which has many elastic fibers, lined by transitional epithelium, 4 – 5 cells thick.

Urinary Bladder

Position

Situated behind pubic bones.

Size, shape, position and relations vary with amount of urine it contains.

Empty bladder is pyramidal in shape, located within pelvic cavity, immediately behind pubic bones.The superior wall of a distended bladder may rises up into hypogastric region.

surfaces.+Relations of each surface.

Apex:
Lies at junction of upper end of anterior border and anterior angle of superior surface.
It is connected to umbilicus by median umbilical ligament Which is the fibrous remains of the embryonic urachus.

Superior surface:	Posterior surface:	Inferolateral surface:
Is covered with peritoneum and is related in **male** to terminal coils of ileum and to sigmoid colon. The posterior part of superior surface in **female** is related to uterus. The space between this surface and uterus is known as the uterovesical pouch.	Is related in **male** to rectum, but separated from it above by rectovesical pouch of peritoneum, below by two vas deferens two seminal vesicles rectovesical fascia. In **female**, is separated from rectum by the vagina.	Anterior part is separated from pubic bones by retropubic pad of fat. The posterior part lies in contact above with obturator internus muscle and below with levator ani muscle with their covering fascia.

Neck
Lowest region of bladder, lies behind lower part of symphysis pubis.
In the male, rests on superior surface of prostate. **In female,** rests on pelvic fascia.

Blood Supply

Superior and inferior vesical arteries.

Veins form a complicated venous plexus on the inferolateral surface called vesical venous plexus, which drains on each side into internal iliac vein.

Lymph Drainage

Drains into the internal and external iliac lymph nodes.

Innervations.

1-Sympathetic nerve fibers:

Preganglionic fibers arise from L1 and 2 segments of spinal cord; fibers enter 1st and 2nd lumbar sympathetic ganglia.

Postganglionic fibers descend through the hypogastric nerve plexus to reach bladder.

Inhibit contraction of detrusor muscle of bladder wall and stimulate closure of sphincter vesicae.

2-Parasympathetic nerve fibers:

Preganglionic fibers (pelvic splanchnic nerves), which arise from the S2, 3 and 4 segments of spinal cord, descend through inferior hypogastric plexus.

Postganglionic fibers supplied bladder.

Stimulate contraction of detrusor muscle and inhibit action of the sphincter vesicae.

3-Visceral afferent fibers:

These fibers enter S2, 3 and 4 segments of spinal cord via the pelvic splanchnic nerves.

However some of afferent fibers pass through hypogastric plexus to enter L1 and 2 segments of spinal cord.

Development.

Cloaca is divided by urorectal septum into a ventral part called urogenital sinus, and a dorsal part called the rectum ,Urogenital sinus consists three parts:

1. Cranial vesical part: Is continuous with allantois. It forms most of bladder.

2. Middle pelvic part: Forms entire female urethra, and in male, prostatic urethra only

3.Caudal phalic part: Grows toward genital tubercle, which is primoridium of penis (male), and clitoris (female)

The bladder develops mainly from the vesical part of the urogenital sinus, but its trigone region is derived from the caudal ends of the mesonephric ducts, which are incorporated into its posterior wall.

These ducts contribute to formation of connective tissue in trigone of the bladder, but the epithelium of entire bladder is derived from endoderm of the vesical part of urogenital sinus.

The other layers of the wall of bladder (except trigone region) are derived from the adjacent splanchnic mesenchyme.

Initially, bladder is continuous with allantois, which soon constricts and becomes a thick fibrous cord called urachus ,Urachus extends from apex of bladder to umbilicus.In adults, urachus is represented by median umbilical ligament.

Histology

(1)Outer serous or peritoneal coat:

Covers only superior surface of bladder.

(2) Middle muscular coat (detrusor muscle):

Consists basically of an outer and inner longitudinally arranged component, and a middle layer of circularly disposed fibers.At neck of bladder, circular layer forms internal urethral sphincter, which surrounds internal urethral orifice.

(3) Inner mucous coat (mucosa):

Is continuous above with that of ureters and below with that of urethra.

The mucosa consists of transitional epithelium and a lamina propria of loose to dense connective tissue. The transitional epithelium of in un-distended state is 5 -6 cells in thickness.

The cells of basal layer are cuboidal in form, while those of intermediate layers are more columnar.The surface cells are called umberella or dome cells.

They are large and ovoid with rounded nucleus and plentiful eosinophilic cytoplasm. When bladder is full of urine, the epithelium is only 3 – 4 cells in thickness, and the superficial cells become squamous.

The Pelvic Cavity

	Male	Female
Distance between pubic tubercle and anterior margin of acetabulum	equal or less than the diameter of acetabulum	longer than the diameter of acetabulum
Greater sciatic notch	50.4˚	74.4˚(Wider)
obturator foramen	oval	triangular
Ischial spine	more inverted	less inverted
subpubic angle	between 50 to 60˚	between 80 to 85˚.
high of the body of pubic bone	more	less
pelvic inlet	heart shaped	wider and more curved being circular shaped
pelvic outlet	small	large
Greater pelvis	deep	shallow
Lesser pelvis	longer and conical	shorter and more cylindrical
ilium	vertical	tilted backwards.
Ala of sacrum	ala is narrower than the body of S1.	same width as the body of S1 vertebra
sacrum	Longer , narrower , more curved	shorter, wider and less curved

Brim of pelvis (Inlet of pelvic cavity)

The pelvis is divided by the pelvic brim (superior pelvic aperture or pelvic inlet) into two parts.

A- above pelvic brim is called false (greater) pelvis,

B- below pelvic brim is called true (lesser) pelvis.

The latter is bounded above by superior pelvic aperture and below by inferior pelvic perture.

Posteriorly: By the promontory of sacrum and the margin of the ala of sacrum.

Anterolaterally: By linea terminalis (arcuate line, pecten pubis, and pubic crest).

Anteriorly: By upper border of pubic symphysis.

Inferior Pelvic Aperture or Pelvic Outlet

It is diamond-shaped.

Its anterior limbs are formed by the lower border of the symphysis pubis and ischiopubic rami.

The posterior limbs of the aperture are formed by the sacrotuberous ligaments, with the coccyx in the midline.

It presents anteriorly the pubic arch (subpubic angle), which lies between the ischiopubic rami.

Laterally, on each side, the aperture exhibits the greater and lesser sciatic notches.

The two notches are converted by means of the sacrospinous and the sacrotuberous into the greater and lesser sciatic foramena.

	Greater (False) Pelvis lies above the superior pelvic aperture.The cavity of the greater pelvis is regarded as part of abdominal cavity.	Lesser pelvis
anterior wall	the lower part of anterior abdominal wall.	the shallowest wall, formed by symphysis pubis, and bodies and rami of pubic bones.
posterior wall	lumbar vertebrae	Is formed by sacrum, coccyx, and the two piriformis muscles and their covering fascia.
lateral wall	iliac fossa of ilium and iliacus muscle	the part of hip bone below pelvic inlet, sacrospinous and sacrotuberous ligaments, obturator membrane, and obturator internus muscle and its covering fascia.
inferior wall		(floor or pelvic diaphragm): *Is stretches between pelvic cavity, above and perineum, below. It is formed anteriorly by levatores ani muscles, posteriorly by coccygeus muscles posteriorly with their covering fascia. The pelvic diaphragm is **incomplete anteriorly** at pubic arch to allow passage of urethra in the males, and urethra and vagina in the females

Greater Sciatic foramen :

1-The piriformis passes through the foramen dividing it into an upper and a lower part.

2-Through the upper part passes the superior gluteal nerve and vessels.

3-Through the inferior part passes the inferior gluteal nerve and vessels, sciatic nerve, posterior cutaneous nerve of thigh, nerve to obturator internus, nerve to quadratus femoris, pudendal nerve, and internal pudendal vessels.

Lesser sciatic foramen :

Through it passes the tendon of the obturator internus, nerve to obturator internus, pudendal nerve, and internal pudendal vessels.

Muscles of the pelvis

Muscle		Nerve supply	Action
Muscles of the lateral walls – The obturator internus	Arises from the internal surface of obturator membrane and adjoining part of hip bone. Muscle fibers converge to a tendon, which leaves the pelvis through lesser sciatic foramen and is inserted into an impression on medial surface of greater trochanter of femur.	Nerve to obturator internus, L5 and S1	lateral rotator of the thigh at hip joint
Muscles of the posterior wall – The piriformis	Arises from the lateral mass of the middle three pieces of sacrum. It extends medially between the anterior sacral foramina; thus the emerging sacral nerves and sacral plexus lie on the muscle. It runs transversely to the greater sciatic foramen to be inserted into the upper border of greater trochanter of femur.	L5, S1 and 2.	It is a lateral rotator of the thigh at hip joint.

Muscles of the floor – Pelvic diaphragm:

(1) Levator Ani:

Arise in continuity from inner surface of body of pubis to inner surface of ischial spine across the obturator fascia, along a condensation of the fascia, the tendinous arch. The muscle consists of two main parts, pubococcygeus and iliococcygeus.

i. The pubococcygeus part:

Is that part of levator ani that arises from body of pubis and anterior half of the tendinous arch

The most anterior fibers that arise from the body of pubis pass backwards alongside the prostate and sphincter urethrae in the male and decussate across the midline behind the urethra to be inserted into perineal body and the sheath of the prostate.

These fibers form a sling around the prostate and are referred to as levator prostate pubourethralis).

In the female, these fibers sling around the posterior wall of the vagina and are referred to as pubovaginalis.

The rest of the posterior fibers which arise from the body of pubis, swing inferomedially around the anorectal junction and join with fibers of opposite side and external anal sphincter.

This part of the muscle is called **puborectalis**, and forms a U-shaped sling that holds the anorectal junction angled forwards.

The bulk of the posterior fibers arising from the anterior half of the tendinous arch are inserted into anococcygeal raphe (a small fibrous mass between the anal canal and the tip of the coccyx). These fibers constitute the pubococcygeus muscle proper.

ii. The iliococcygeus part:

Arises from posterior half of tendinous arch and the ischial spine.

Its fibers are inserted into side of coccyx and anococcygeal raphe, which extends from tip of coccyx to anorectal junction.

Nerve supply:

It is mainly supplied by a branch from S4 spinal nerve. The levator prostate or pubovaginalis, and puborectalis are supplied by the perineal branch of S4 and the inferior rectal branch of the pudendal nerve.

(2) Coccygeus:

Arises from the tip of ischial spine. Fibers fan out to be inserted into the side of coccyx and the lowest piece of sacrum.

It lies edge to edge with the lower border of piriformis and is overlapped anteriorly by iliococcygeus. Its gluteal surface is fibrous tissue, and is indeed the sacrospinous ligament.

Nerve supply: By branches from S4 and 5 spinal nerves.

Actions of the Pelvic Diaphragm

1. Support and maintains the pelvic viscera in position.
2. In both sex, puborectalis part of levator ani has sphincter action on anorectal junction.
3. In the female, the pubovaginalis has sphincter action on the vagina.
4. The pelvic diaphragm contracts during coughing and sneezing to resist the rise in intra-pelvic pressure, and relaxes in micturition, defaecation and partitution.
5. The coccygeus pulls the coccyx forwards after it has been pushed backwards during defaecation.

Perineum

The perineum is diamond shaped area located below pelvic diaphragm ,seen from below in lithotomy position (patient is in supine position with both hip joints flexed and abducted; feet are held in position by stirrups).

It is bounded anteriorly by symphysis pubis; posteriorly by tip of the coccyx, and laterally by ischial tuberosities.

It is divided into an anterior part called urogenital triangle and a posterior part called anal triangle.

Urogenital Diaphragm

The urogenital diaphragm is a triangular musculofascial diaphragm, situated in anterior part of the perineum, filling gap of pubic arch.

It is formed by sphincter urethrae and deep transverse perineal muscles, which are enclosed between a superior and inferior layer of fascia of urogenital diaphragm.

The inferior layer of fascia of urogenital diaphragm is called perineal membrane.

Anteriorly, superior and inferior layers of fascia of urogenital diaphragm fuse, leaving a small gap beneath symphysis pubis.

Posteriorly, the two fascial layers fuse with each other and with membranous layer of the superficial fascia and perineal body.

Laterally, the two fascial layers are attached to pubic arch.

The close space that is contained between two fascial layers is known as deep perineal pouch.

The closed space below inferior layer of fascia of urogenital diaphragm (perineal membrane) is called superficial perineal pouch.

	Superficial perineal pouches	deep perineal pouches
	*Closed posteriorly by fusion of upper and lower walls. *Laterally, it is closed by attachment of upper and lower walls to margins of pubic arch. *Anteriorly, space communicates with a potential space lying between the superficial fascia of anterior abdominal wall and anterior abdominal muscles.	*Is the closed space that is contained between superior and inferior (perineal membrane) layers of fascia of urogenital diaphragm.
contents in the male	a. Bulbospongiosus muscles: One on each side of midline, cover bulb of penis. Their action is:	a. Membranous part of urethra.

	i. They compress penile part of urethra and empty it of residual urine or semen; II. They compress deep dorsal vein of penis,thus impeding venous drainage of erectile tissue and there by assisting in process oferection of penis. b. Ischiocavernosus muscles:One on each side, cover corresponding crus penis. Their action is: Assist in process of erection of penis. c. Bulb of penis:It is firmly attached to perineal membrane. d. Crura of penis: One on each side, are firmly attached to margins of pubic arch. e. Superficial transverse perineal muscles: The two muscles lie in posterior part of pouch. f. Perineal body: The perineal body is a fibromuscular mass, occupies: space between anal canals, posteriorly and bulb of penis, anteriorly. The perineal body supports vagina in female. g. Perineal branch of pudendal nerve: Supplies muscles within the superficial perineal pouch and covering skin.	b. Sphincter urethrae muscle:Supplied by the perineal branch of the pudendal nerve. Its function is to compress membranous part of urethra and relaxes during micturition. c. Deep transverse perineal muscles:The two muscles lie behind sphincter urethra muscle. They are clinically unimportant. d. Bulbourethral glands: These are two small glands, situated behind sphincter urethrae muscle. Their ducts pierce perineal membrane and enter penile urethra. e. Internal pudendal artery. f. Dorsal nerve of the penis.
contents in the female.	a. Bulbospongiosus muscles:One on each side of midline, surround orifice and lower part of vagina and cover lateral part of vestibular bulb. Their action is: (1) They reduce the size of vaginal orifice; (2) They compress deep dorsal vein of clitoris, thereby assisting in mechanism of erection of clitoris. b. Ischiocavernosus muscles: c. Bulb of the vestibule:They are identical to that of penis. d. Crura of clitoris: They are identical to that of penis. e. Superficial transverse perineal muscles. f. Perineal body: It is larger than that of male, and situated between lower end of the vagina and anal canal.It supports vagina in female. During childbirth it is liable to be torn, and if repair does not occur, the upper part of vagina together with uterus is liable to descend (prolaps). g. Perineal branch of the pudendal nerve: Supplies muscles within the superficial perineal pouch and covering skin.	a. Part of urethra. b. Part of vagina. c. Sphincter urethrae. d. Deep transverse perineal muscles. e. Internal pudendal artery. f. Dorsal nerve of clitoris.

The Male Genital Organs

Scrotum

The scrotum is a cutaneous fibromuscular sac that contains testis, epididymis, and lower part of spermatic cord. It is situated below root of penis. It is divided by a median fibrous septum into right and left halves.

The septum is indicated on under surface of the scrotum by a median longitudinal raphe, the scrotal raphe, which is continuous with the perineal raphe that extends to anus.

The scrotal skin is very thin, of a brownish color, and often thrown into folds or rugae. It is covered with thinly scattered, curly hairs

The scrotal skin is provided with sebaceous glands, the secretion of which has a peculiar odor. It also contains numerous sweat glands, pigment cells, and nerve endings responding to mechanical stimulation of hairs and skin, and to variations in circumambient temperature.

The tunica vaginalis (lower expanded part of processus vaginalis) lies within spermatic fasciae and covers anterior, medial, and lateral surfaces of testis.Normally, just before birth, it becomes shut off from upper part of processus and peritoneal cavity.

The tunica vaginalis is thus a closed sac, invaginated from behind by testis.It constitutes two layers:

a. Visceral layer:It is closely applied to the testis, epididymis, and inferior part of vas deferens.

b. Parietal layer: Lies adjacent to spermatic fascia. It extends superiorly for a short distance into the distal part of spermatic cord.The small amount of fluid in cavity of tunica vaginalis separates visceral and parietal layers, allowing testis to move freely within its side of scrotum.

Testes

These are two ovoid, firm and mobile organs that produce spermatozoa and hormones, principally testosterone hormone. Each testis is suspended within corresponding half of scrotum.

The left testis usually lies at a lower level than right. The testis is surrounded by a tough fibrous capsule called the tunica albuginea, which is thickened on the posterior surface of the testis to form the mediastinum of the testis.

Numerous incomplete fibrous septa arise from the mediastinum testis pass inward through the substance of the testis, dividing it into about 250 pyramidal-shaped lobules.Because septa are incomplete, inter-communications between lobules are expected.Each lobe is occupied by 1 – 3 seminiferous tubules.

Excretory Genital Ducts

A. Ductus Epididymis:

It is a firm coma-shaped structure, closely applied to posterior margin of testis, with vas deferens lying on its medial side. It is formed by minute convolution of duct of the epididymis (4 – 6 m long), so highly compact that appear solid. It has an expanded upper end, head, a middle portion, body, and a pointed lower portion, tail.

Laterally, a distinct groove, sinus of epididymis lies between testis and epididymis, which is lined with visceral layer of tunica vaginalis. The major function of epididymis is storage and maturation of spermatozoa; in epididymis spermatozoa develop motility.

B. Ductus (Vas) Deferens:

Is a cordlike structure that can be palpated between finger and thumb in upper part of the scrotum. It is a thick walled muscular tube about 45 cm long that conveys mature sperm from epididymis to ejaculatory duct.It is at first very tortuous, but, becoming gradually straighter.

It merges from tail of epididymis and ascends over posterior border of testis, along the medial side of epididymis, to reach upper pole of testis.It leaves the canal at deep ingunal ring and turns round lateral side of inferior epigastric artery and pass medially behind this artery and across external iliac vessels.

Next it descends to pelvic brim, where it continue downward along lateral wall of lesser pelvis deep to parietal layer of peritoneum, crossing ureter.

About level of ischial spine, it bends at an acute angle and runs downwards, medially, and slightly forwards between posterior surface of bladder and rectum, along medial side of corresponding seminal vesicle and come to lie alongside vas deferens of other side.

Its terminal part is dilated, the ampulla of vas deferens. The inferior end of ampulla joins duct of seminal vesicle to form ejaculatory duct.

Penis

It is composed of three cylindrical column of erectile cavernous tissue: the paired corpora cavernosa, dorsally placed and the single corpus spongiosum in middle, ventral to them. The three cylindrical masses of erectile tissue are enclosed within, and separated by a dense connective tissue, tunica albuginea.

Superficial to tunica albuginea is deep fascia of penis, Buck fascia, which contains prominent blood vessels.The corpus spongiosum contains penile urethra.The corpora cavernosa are closed to each other except proximally where they diverge to form crura of penis.

The penis has a fixed part termed root, and a free pendulous part known as body.

A. Root: Lies in superficial perineal pouch.

B. Body: Is the free part that is suspended from pubic symphysis.

The corpora cavernosa form greater part of body, and are placed in dorsal part. Proximally, each is continuous with corresponding crus of penis.

The corpus spongiosum lies in middle ventral to corpora cavernosa. Proximally, it is continuous with bulb of penis. Distally, it expands in front of corpora cavernosa forming glans penis (head of penis).

The margin of glans projects beyond end of corpora cavernosa to form corona of gland. The corona overhangs the neck of glans. Neck separates the glans from body of penis. The penile urethra traverses bulb of penis and corpus spongiosum and opens on tip of glans penis forming external urethral meatus, which is a slit-like orifice.

The thin skin and fascia of the penis are prolonged as a hood like double layer (fold) of skin, the prepuce (foreskin) that covers glans to a variable extent.It is connected to glans penis just below external urethral meatus by a median fold known as frenulum of penis.

- The body of penis is supported by two condensations of deep fascia:

(1) Fundiform ligament of penis:Descends in midline from linea alba just above pubic symphysis. Inferiorly, it splits to surround penis and then unite to form scrotal septum.

(2) Suspensory ligament of penis: Descends from anterior surface of pubic symphysis and splits to form a sling that is attached to deep fascia of penis at junction of its root and body.

Histology :

The three cylindrical masses are composed of erectile tissue consists of a large number of venous spaces (sinuses) lined with endothelial cells and separated by trabeculae of connective tissue fibers contains few smooth muscle fibers.

The sinuses are supplied by numerous anastomosing thick-walled arteries and arterioles called helicine arteries, which are branches of deep arteries of penis. Blood drains from the sinuses via veins which lie immediately beneath the tunica albuginea

The deep arteries of the penis also provide several nutritive arteries which supply oxygen and nutrients to the trabeculae.

During erection, dilatation of the helicine arteries, mediated by parasympathetic nervous system, results in engorgement of vascular arteries, which enlarged, compressing and restricting venous outflow.

This process is enhanced by relaxation of smooth muscle cells in the trabeculae. After ejaculation and orgasm, the para-sympathetic activity declines, and the penis returns to its flaccid state.

Accessory Genital Glands

A. Seminal Vesicles:

The seminal vesicles are two symmetrical lobulated organs situated obliquely on posterior surface of bladder. Each seminal vesicle is about 5 cm long extends from the termination of ureter to base of prostate.

It is related posteriorly to rectum, from which it is separated by rectovesical fascia, and medially to vas deferens.The vertical axis of each seminal vesicle is directed downwards and medially, so that their lower ends are closer than upper.

The inferior end of each seminal vesicle joins vas deferens of same side to form ejaculatory duct.The seminal vesicles secrete up to 85% of total volume of seminal fluid, most of rest being secreted by prostate.

Histology :

Consists of highly tortuous tubes about 15 cm long. Each tubule has a folded mucosa, which is lined with cuboidal or pseudostratified columnar epithelium rich in brown lipofuscin granules. These granules have the ultrastructural characteristics similar to those found in protein-synthesizing cells.

B. Prostate:

It is a walnut size gland that surrounds prostatic part of urethra. The organ is enclosed by a dense fibrous capsule that incorporates prostatic plexus of nerves and veins. The capsule is surrounded by visceral layer of pelvic fascia, which is continuous anterolaterally with puboprostatic ligaments, and posteriorly with rectovescical septum.

- It is somewhat conical in shape, consists of an apex, a base, and four surfaces: anterior, posterior, and two inferolateral.

The anterior muscular surface is connected to pubic bone by the puboprostatic ligaments.It is separated from pubis symphysis by retropubic pad of fat in retropubic space.

The posterior surface is separated from ampula of rectum by rectovesical septum. At upper border of this surface, the two ejaculatory ducts enter prostate.

Each inferolateral surface is clasped by the anterior fibers of the corresponding levator ani muscle (levator prostate), which forming a sling around prostate.

The base of the gland being applied to neck of bladder and is perforated near its center by urethra. The urethra traversed gland from base to apex.

The apex (inferior aspect) lies against superior aspect of sphincter urethrae and deep transverse perineal muscles (urogenital diaphragm).

- The prostate is completely divided into five lobes:

a. Anterior lobe (Isthmus): Lies in front of urethra.It is primarily muscular and represents superior continuation of urethral sphincter muscle. It contains no glandular tissue.

b. Middle lobe: Lies behind urethra and above ejaculatory duct.

C. Posterior lobe: Lies behind urethra and below ejaculatory duct.

d. Right and left lateral lobes: Lie on either side of urethra. They form major part of prostate.

Blood Supply of the Prostate

The prostate is supplied by inferior vesical, middle rectal and internal pudendal arteries.

Veins form plexus within the capsule called the prostatic venous plexus, which drains into internal iliac veins.

Lymph vessels from prostate end in internal iliac and sacral lymph nodes. Few vessels however drain into external iliac lymph nodes.

Histology :

It consists of 30 – 50 branched tubulo-acinar glands embedded in a fibromuscular stroma (collagenous stroma and smooth muscle fibers). The tubulo-acinar glands are formed by cuboidal or columnar psedostratified epithelium. These secretory cells are characterized by a prominent round basal nuclei and pale staining cytoplasm.

The prostate has three zones:

1-The central zone: Occupies 25% of the glands volume.

2. The peripheral zone: Occupies 70% of the gland volume; it is the major site for prostatic cancer.

3. The transition zone: Occupies 5% of the gland volume.It is of medical importance, because it is the site at which most benign prostatic hyperplasia originates.

Paraurethral glands

Correspond to prostate in male, open into vestibule on either side of external urethral orifice.

Spermatogenesis

Spermatogenesis is the process by which spermatids are formed. Sperm production begins at periphery of seminiferous tubules in primitive germ cells called spermatogonium, which are situated next to the basal lamina of epithelium.These cells begin dividing by mitosis, producing successive generations of cells.

The newly formed cells can follow one of two paths:

(1) they can continue dividing as stem cells called spermatogonia type A

Spermatogonia type A, characterized by a large round or oval nucleus with condensed chromatin; peripheral nucleoli and a nuclear vacuole may be prominent.

(2) they can differentiate during progressive mitotic division to form spermatogonia type B.

Spermatogonia type B have dispersed chromatin, central nucleoli, and no nuclear vacuole.

Spermatogonia type B undergo further mitotic divisions to produce primary spermatocytes, which have 46 (44 + XY) chromosomes.These migrate towards the lumen of seminiferous tubule. Soon after their formation, the primary spermatocytes enter the prophase of the first meiotic division, which takes about 22 days.

The primary spermatocytes are the largest cells of spermatogenic lineage and are characterized by presence of chromosomes in various stages of coiling within their nuclei. From first meiotic division arise smaller cells called secondary spermatocytes, which have 23 chromosomes (22 + X or 22 + Y).

The smaller secondary spermatocytes rapidly undergo second meiotic division to form spermatids and are therefore seldom seen.Each secondary spermatocyte divides into two spermatids that contain 23 chromosomes.

Spermiogenesis

Is process by which spermatids are transformed into motile mature spermatozoa. It involves the following major stages:

(1) The Golgi complex elaborates a large vesicle, acrosomal vesicle, which accumulates carbohydrates and hydrolytic enzymes.

(2) The acrosomal vesicle spreads to cover anterior half of progressively elongating and condensing nucleus to form acrosomal head cap.

(3) Meanwhile, both centrioles migrate to end of cell opposite to acrosomal head cap. One of the centrioles elongates to form a flagellum.

(4) The cytoplasm migrates to surround the proximal part of flagellum forming a thickened region known as middle piece. Mitochondria aggregate around flagellum in this region.

(5) As the flagellum elongates, excess cytoplasm is shed and phagocytosed by Sertoli cell prior to release of sperm into lumen.

The Female Genital Organs

Ovaries

The ovaries are homologous with testes in males. They are responsible for production of female germ cells (ova), and female sex hormones (estrogen and progesterone) in sexually mature female.

They vary in size and shape according to age and stage of menstrual cycle. In young adult each ovary is a flattened ovoid, pinkish-grey in color, measuring about 4 cm long, 2 cm wide, and less than 1 cm thick.

They are situated one on each side of uterus in a shallow depression (ovarian fossa) on lateral pelvic wall. **This fossa is bounded** anteriorly by obliterated umblical ligament; posteriorly by ureter and internal iliac vessels; and superiorly by external iliac vessels.

The ovary has a medial and a lateral surface, an anterior (mesovarian) and a posterior free borders, an upper (tubal) and lower (uterine) poles.

The medial surface is in contact with coils of intestine and on right side frequently with vermiform appendix.

The lateral surface is in contact with ovarian fossa.

The anterior border contains the hilum of the organ.The mesovarium is a double-layered fold of peritoneum, which connect anterior border of ovary to broad ligament. Through this ligament vessels and nerves enter and leave ovary.

The posterior border is directed toward the uterus. The uterine tube curves down over this border. The suspensory ligament connects tubal pole to lateral wall of pelvis.

The ovarian ligament connects uterine pole of ovary to lateral margin of uterus. After menopause the ovary becomes shrunken and its surface is pitted with scars.

Blood Supply of Ovary

Ovarian artery (branch of abdominal aorta) at level of L1 vertebra.

The right ovarian vein drains into inferior vena cava; the left ovarian vein drains into left renal vein.

Uterine Tubes (Fallopian Tubes, or Oviduct)

One on each side, about 10 cm long situated in free upper border of broad ligament of uterus. They transmit ova from ovary to cavity of uterus.The tube ascends along upper part of anterior border of ovary to tubal pole, over which it arches; then it turns downwards along posterior border of ovary.

The lateral end of each tube connects peritoneal cavity in region of ovary with cavity of uterus.

It is divided into four parts:

a. Infundibulum: Is funnel-shaped lateral end, the circumference of which has several finger-like processes the fimbriae.

b. Ampula: Is the widest and longest potion, making about 2/3 of whole length of uterine tube.In it fertilization of ova takes place.

c. Isthmus: Is the narrow, thick-walled medial portion that joins uterus.

d. Intramural (Uterine) Part: Is the segment of the tube, which runs through uterine wall.

Blood Supply of Uterine Tube

Ovarian artery (branch of descending abdominal aorta). Uterine arteries (branch of internal iliac artery).

Veins correspond to arteries and drain into ovarian and uterine veins.

Uterus

Parts

a. Body:

Forms upper 2/3 of organ, includes fundus of uterus and isthmus. The **fundus** is the dome-shaped part of body that lies above enterance of uterine tubes. The **isthmus** is the lower constricted region of body (about 1 cm) just above cevix.

The uterine horns (L–cornua) are the superolateral regions where uterine tubes enter.The body of the uterus lies between the two layers of broad ligament and is freely movable.

The cavity of body (uterine cavity) is **triangular** in coronal section. It is continuous inferiorly with cervical canal.

b. Cervix

It is the cylindrical, narrow inferior part of uterus that extends from internal os, above to external os, below.

It has a supravaginal part extends from isthmus to vagina and a vaginal part that protrudes into vagina and surrounds external os.

The supravaginal part lies between the bladder and rectum. The cavity of cervix (cervical canal) is continuos through internal os with uterine cavity, and through external os with vaginal cavity.

The peritoneum passes from anterior surface of rectum on to posterior surface of uterus, forming **rectouterine pouch (pouch of Douglas),** and then curves over fundus to reach anterior surface, where it descends as far as junction of body and cervix.

Peritoneum is reflected then forwards on to superior surface of urinary bladder, forming a shallow recess, called **vesicouterine pouch**.

Relations

Anteriorly, the body of uterus is separated from superior surface of bladder by peritoneum and vesicouterine pouch.The isthmus and cevix lie in direct contact with bladder without intervening peritoneum.This allows cervical cancer to invade urinary bladder.

Posteriorly, the body of uterus and supravaginal part of cervix are separated from rectum by pouch of Douglas containing coils of sigmoid colon.

Laterally, the uterus is related to broad ligament of uterus and uterine vessels.The vaginal cervix is related laterally to the lateral vaginal fornix..

Supports of Uterus

The uterus is maintained in position mainly by the tone of pelvic diaphragm and fibromuscular (true) ligaments of uterus. These ligaments formed by condensation of pelvic fascia:

(1) Pubocervical Ligaments: Connect cervix and upper part of vagina to pubic bones.

(2) Sacrocervical Ligaments: Connect cervix and upper part of vagina to lower end of sacrum.

(3) Transverse Cervical (Cardinal) Ligaments: Connect cervix and upper part of vagina to lateral walls of pelvis.

Round Ligaments of the Uterus

The two round ligament of uterus, each extends from the front of uterus, immediately below enterance of uterine tube through deep inguinal ring and inguinal canal to subcutaneous tissue of labium majus.

They play a part in maintaining uterus in an anteversion and anteflexion.

Broad ligaments

The peritoneum covers anterior and posterior surfaces of uterus. On each side, the two peritoneal layers are expanded laterally from lateral borders of uterus to lateral pelvic walls.

Superiorly the two layers are continuous and form an upper free border. The uterine tube is contained in this free upper border.

The ovary is attached to posterior layer of broad ligament by mesovarium.

The part of broad ligament which extends from infundibulum of uterine tube and upper pole of ovary to lateral pelvic wall, called **suspensory ligament**, which contains ovarian blood and lymph vessels, and nerves in between its two layers.

The part of broad ligament forming mesentery of uterine tube is called **mesosalpinx**.

The major part of broad ligament serves as a mesentery for uterus is mesometrium, which lies inferior to mesosalpinx and mesovarium.At base of ligament, uterine artery crosses ureter.

The following structures lie between two layers of broad ligament:

(1) Uterine tube.

(2) Round ligament of the ovary.

(3) Round ligament of the uterus.

(4) Uterine and ovarian blood and lymphatic vessels, and nerves.

(5) Epoophoron, which is the remains of mesonephros.

(6) The paraophoron, which is a mesonephric remnant.

Position of the Uterus

The long axis of uterus in most women is bent forwards on long axis of vagina. This position is referred to as anteversion of uterus.

The long axis of uterus is bent forward at level of internal os. This position is referred to as anteflexion of uterus.

Blood Supply of the Uterus

(1) Uterine artery (branch of internal iliac artery), which forms main arterial supply.

(2) Uterine branch of ovarian artery which assists in supplying uterus.

The uterine vein follows the artery and ends into internal iliac vein.

Lymph Drainage of Uterus

(1) Fundus portion follow ovarian artery and drain into para-aortic lymph nodes at level of L1 vertebra.

(2) Body and cervix drain into internal and external iliac lymph nodes.

Few vessels, however follow round ligament of uterus via inguinal canal and drain into superficial inguinal nodes.

Histology :

The wall of uterus is relatively thick composed of three layers, an outer layer (perimetrium), a middle muscular layer (myometrium), and an inner layer (endometrium):

(1)Perimetrium: Depending on part of uterus, there is either an outer serosa (connective tissue and mesothelium) or adventitia (connective tissue only).

(2) Myometrium: Makes up bulk of uterus.It is composed of bundles of smooth muscle fibers that form four ill-defined layers.

The 1st and 4th layers are composed mainly of fibers disposed longitudinally. In middle layers (2nd and 3rd layers) fibers disposed circularly.

Branches of uterine artery pass to middle layers of myometrium and immediately divide into two different types of arteries, straight arteries and spiral arteries.

During pregnancy, in response to increased level of estrogens, myometrium increases greatly in size, mainly by increasing cell size (hypertrophy), although some increase in cell numbers (hyperplasia) due to cell division may also occur.

(3) Endometrium: Consists of:

i. Epithelium: Is simple columnar epithelium contains two types of cells, ciliated and non-ciliated secretory cells.

ii. Lamina propria: Consists of a connective tissue, which is rich in fibroblast and contains abundant ground substance.Simple tubular glands are embedded in the CT. they sometimes branch in their deeper portions.

The epithelial lining of glands is similar to lining epithelium of endometrium except ciliated cells are rare within gland.The endometrium can be subdivided in to two zones:

a. Stratum basalis:Supplied by straight arteries.Region adjacent to myometrium; it contains lamina propria and closed tips of uterine glands.It undergoes little change during menstrual cycle and is not shed during menstruation.

b. Stratum functionalis: Supplied by spiral arteries.Contains surface epithelium, remaining part of lamina propria, and uterine glands. It exhibits dramatic changes throughout menstrual cycle and is shed during menstruation.

Vagina.

About 8 cm long, situated between bladder and urethra anteriorly, and rectum, posteriorly. It extends downward and forward from cervix to vulva, where it opens into a space between labia minora, the vestibule.

Its upper half lies above pelvic diaphragm, while its lower half lies within perineum.

It anterior wall is short, pierced superiorly by cervix, which projects downwards and backwards into vagina.

The area of vaginal lumen that surrounds cervix is divided into four recesses called **vaginal fornices** (anterior, posterior, and right & left lateral vaginal fornices). The posterior fornix is deeper than other.In virgins, the vaginal orifice contains a thin mucosal fold called hymen

that is perforated at its center.The mucosal lining of vagina presents a series of transverse ridges in its lower third called **rugae**.

Relations:

Anteriorly, above to bladder and below to urethra.

Posteriorly, in its upper part to pouch of Douglas, in its middle part to ampulla of rectum, and in its lower part to perineal body.

Laterally, upper part to ureter, middle part to levator ani muscle, and lower part to urogenital diaphragm and bulb of vestibule.

Support:

(1)Upper part is supported by tone of levator ani muscles.

(2) Middle part is supported by urogenital diaphragm.

(3) Lower part is supported by perineal body.

Blood supply:

(1) Vaginal artery (branch of internal iliac artery).

(2) Vaginal branch of uterine artery.

Vaginal vein forms a plexus around vagina that drains into internal iliac vein.

Lymph Drainage of Vagina

(1) Upper part of drain into internal and external iliac lymph nodes.

(2) Middle part drain into internal iliac lymph nodes.

(3) Lower part drain into superficial inguinal lymph nodes.

Histology :The wall of vagina consists of three layers, an inner mucosa layer, a middle muscular layer, and an outer dense connective tissue layer, adventitia:

(1) Mucosa

Lined by stratified squamous epithelium. The lamina propria is composed of loose connective tissue that contains many elastic fibers, plexus of small veins, and is devoid of glands.In relaxed state, vaginal mucosa is thrown up into folds (ruge).

Under stimulus of estrogen, vaginal epithelium synthesizes and accumulates a large quantity of glycogen, which is excreted into lumen of vagina.Bacteria metabolize glycogen and form lactic acid, which is responsible for usually low pH of vagina.

This acidic environment provides a protective action against growth of pathogenic microorganisms.

(2) Muscular layer

The smooth muscle bundles of this layer are arranged in ill-defined inner circular and outer longitudinal layers.

(3) Adventitia

Composed of dense connective tissue, rich in elastic fibers, and contains an extensive venous plexus, nerve bundles, and groups of nerve cells. The great elasticity of vagina is related to large number of elastic fibers in connective tissues of its wall.

The vagina is lubricated by cervical mucus, a fluid transudate from rich vascular network of lamina propria, and mucus secreted by glands of labia minora.

Ovary

Composed of four layers; from out and in:

(1)Germinal epithelium: Covers surface and consists of a simple squamous or cuboidal or columnar epithelium. It is continuous with mesothelial lining of peritoneal cavity.

(2) Tunica albuginea: Consists of dense connective tissue.

(3) Cortical region: Consists of ovarian follicle embedded in a connective tissue (stroma). Each follicle contains an oocyte surrounded by one or more layers of follicular cells. The connective tissue is composed of spindle-shaped fibroblasts-like cells that respond in different way to hormonal stimuli. Bundles of smooth muscle cells are also scattered throughout stroma.

(4) Medullary region: Consists of a loose connective tissue rich in vascular bed. No sharp limit between cortical and medullary regions.

Vulva

Includes mons pubis, labia majora and minora, clitoris, vestibule of vagina, vestibular bulb, greater and lesser vestibular glands, and paraurethral glands

Labia Majora

Are two prominent, thick hair-bearing folds of skin, which pass backwards from mons pubis.

Each has a core filled with subcutaneous fat containing smooth muscle and termination of round ligament of uterus. They are homologue of male scrotum, and the labial muscle fibers are homologue of dartos muscle of scrotum.

The external aspect of the labia in adult are covered with pigmented skin containing many sebaceous and sweat glands and are covered with coarse, curly hair. The internal aspect of labia is smooth, pink, and hairless. They are thicker anteriorly where they join to form anterior commissure.

Posteriorly, they merge to form posterior commissure, which usually diappears after first vaginal birth.

Labia Minora

These are two smaller, hairless folds of soft skin that lie between labia majora. Their anterior ends split to enclose clitoris, forming two folds an anterior, prepuce and a posterior, frenulum.Their posterior ends are united to form fourchette.

The external surface has a keratinizing stratified squamous epidermis and scattered sebaceous glands which open directly onto skin surface rather than into necks of hair follicles as they do in hair-bearing skin.

The inner aspect of the labia minora has a thinner epidermis and keratin layer.

Vestibule

It is a smooth triangular cleft, bounded at its apex by clitoris, laterally by the labia minora, and at its base by fourchett. It exhibits two orifices, external urethral orifice, which lies 2.5 cm behind glans of clitoris, and vaginal orifices, which lies immediately behind external urethral orifice.

The orifices of ducts of greater vestibular glands are two small orifices, one on each side, lies in groove between hymen and posterior part of labia minora.

Greater vestibular (Bartholin's) glands

These are a pair of small mucous secreting glands, situated on either side of vagina, under cover of posterior end of bulb of vestibule and labia majora. They are homologous to bulbourethral glands in male.

Each gland drains its secretion into vestibule by a small duct, which opens into groove between the labia minora and hymen or its remains.

Lesser vestibular glands

They are very small mucous glands situated within mucosa of vestibule. They have minute opening lying between urethral and vaginal orifice.

5. Information about the vulva, including labia majora and minora, vestibule, and greater and lesser vestibular glands.

Reproductive cycle

During this cycle there are several changes occur in ovary (ovarian cycle) and uterus (uterine or menstrual cycle)

(1)Ovarian cycle consists of two phases, usually of about equal duration – follicular phase and luteal phase.

a. The follicular phase: Is characterized by growth, maturation and rupture (ovulation) of an ovarian follicle.

b. The luteal phase: Is characterized by development of a corpus luteum derived from ruptured follicle

Follicular Phase

Follicular growth is stimulated by FSH (lasts about 90 days)

(1) Primordial follicles:

At birth in human ovary, there are about 500000 primordial follicles. They occupy superficial part of cortical region. They are formed during fetal life.Each follicle consists of a primary oocyte surrounded by a single layer of flattened follicular cells.

The oocyte is spherical-shaped cell with large nucleus, and is in prophase of 1st meiosis.There are numerous mitochondria. A basal lamina surrounds the follicular cells and marks boundary between follicle and surrounding stroma.

Beginning from puberty, during each ovarian cycle, a group of up to 20 primordial follicles is activated to begin maturation process.However, usually only one follicle reaches full maturity and undergoes ovulation while remaining follicles undergo atresia.

(2) Unilaminar primary follicles:

Oocyte has greatly enlarged with an increasment in number of mitochondria. Golgi complex occupies apical cytoplasm. Follicular cells divide by mitosis and form a single layer of cuboidal cells; they are now known as granulose cells.

Thick homogenous layer of glycoprotein and acid proteoglycans, zona pellucida develops between oocyte and follicular cells; both cell types probably contribute to its formation.

(3) Multilaminar primary follicles:

With further follicular growth, fibroblast-like cells of ovarian stroma surrounding follicle begin to form an organized layer around follicle called theca folliculi separated from granulose cells by a basement membrane.

The granulose cells continue to proliferate, forming a stratified epithelium called zona granulose.

(4) Secondary (antral) follicle

Zona granulose continues to proliferate and within it small fluid-filled spaces appear; these fuse to form follicular antrum, in which follicular fluid accumulates.At this stage, oocyte has almost reached its full size and becomes situated eccentrically in thickened area of granulose called cumulus oophorus.

Theca folliculi has developed two layers, theca interna, comprising several layers of rounded cells, and less well-defined theca externa consisting of spindle-shaped cells that merge with surrounding stroma.

Cells of theca interna have features of typical steroid-secreting cells and synthesize androstenedione hormone that transported to granulose layer. Cells of granulose, under influence of FSH synthesize an enzyme, aromatase that transforms androstenedione into estrogen, which returns to stroma, enters blood vessels, and is distributed throughout body.

Small blood vessels enter theca interna.They provide a rich capillary plexus around secretory cells of this region, which like all organs of endocrine function, is richly vascularized. There are no blood vessels in granulose cell layer during stage of follicular growth.

(5) Mature (graafian) follicle

By this stage follicle becomes so large (between 1.5 and 2.5 cm in diameter) that it protrudes from surface of ovary and can be detected with ultrasound. As a result of accumulation of liquid, follicular cavity increases in size.

The cumulus oophorus diminishes leaving the oocyte surrounded by a group of granulose cells termed corona radiate, which remains attached to zona granulose by thin bridges of cells. Until this moment oocyte was in prophase of 1st meiosis, initiated during fetal life.

Approaching maturity, further growth of oocyte ceases and first meiotic division is completed just before ovulation.The chromosomes are equally divided between the daughter cells, but one of secondary oocytes retains almost all of cytoplasm.

The other becomes 1st polar body (very small cell containing a small nucleus and a minimal amount of cytoplasm). Secondary oocyte begins second meiotic division, which stops in metaphase, and is not completed until after penetration of ovum by spermatozoa.

At time of ovulation, which is controlled by LH (lutenizing hormone) secreted by anterior pituitary gland in response to high levels of circulating estrogen produced by growing follicles, the mature follicle rupture and ovum, made up of secondary oocyte and first polar body, enclosed by zona pellucida, corona radiate, and some follicular fluid, is expelled to enter uterine tube where oocyte may be fertilized.

If this does not happen within 1st 24 hours after ovulation, it degenerates and phagocytosed. Ovulation takes place in approximately middle of menstrual cycle.Although granulose cells and oocytes undergo degeneration during follicular atresia, the theca interna cells frequently persist in small groups throughout cortical stroma and are called interstitial cells. These cells are active steroid secretors, stimulated by LH.

Luteal Phase

After ovulation, ruptured follicle collapses and fills with blood clot.Granulose cells and cells of theca interna reorganize to form a temporary endocrine gland called **corpus luteum of menstruation,** which becomes embedded in cortical region.

Under influence of LH, granulose cells increase greatly in size, but not in number.They make up about 80% of parenchyma of corpus luteum and are then called **granulose lutein cells.** These cells acquire characteristics of steroid-secreting cells.

This is in contrast to their structure in preovulatory follicle, where they appear to be protein-secreting cells.Progesterone promotes changes in endometrium that make it ready for implantation of fertilized ovum.

The cells of theca interna also increase somewhat in size and acquire similar cytoplasmic features to lutenised granulose cell; these cells continue to secrete estrogens, which are necessary to maintain thickened uterine mucosa. The cells become known as **theca lutein cells.**

Blood capillaries from theca interna and large vessels from theca externa grow into interior of corpus luteum and form a rich vascular network characteristic of endocrine glands.**Corpus luteum** produces progesterone, estrogens, relaxin, and inhibin.Progesterone production by corpus luteum is dependent on LH from anterior pituitary, but rising progesterone levels inhibit LH production.

If no further LH stimulation takes place and pregnancy does not occur, cells of corpus luteum cannot be maintained, and in 12 – 14 days after ovulation, they degenerate by apoptosis. Cellular remnants are phagocytosed by macrophages.

Neighboring fibroblasts invade area and produce a scar called **corpus albicans**. Once corpus luteum regresses, secretion of both estrogene and progesterone ceases.Without these two hormones endometrial lining of uterus collapses, resulting in onset of menstruation.

If pregnancy occurs, corpus luteum persists for 4 – 5 months and then degenerates, and it is called **corpus luteum of pregnancy.**

Menstrual Cycle

The cycle of changes in endometrium proceeds through three distinct phases, menstrual, proliferative, and secretory:

(1) Menstrual phase

The first day of menstruation is taken as 1st day of cycle simply because it is easily identified. It lasts 3 – 4 days on average. Failure of fertilization ovum leads to inhibition in production of progesterone by corpus luteum.

In the absence of progesterone, endometrium cannot be maintained, leads to breakdown of blood vessel wall and basement membranes.Consequently, part of functional layer of endometrium becomes detached. The amount of blood lost varies between women and even in same woman at different times.

At end of menstrual phase, endometrium is usually reduced to a thin layer of lamina propria, deep ends of uterine glands, and some covering epithelium.

(2) Proliferative phase

Takes about 10 days on average.Estrogens produced by theca interna of growing ovarian follicles act on endometrium, inducing cell proliferation and replace endometrium lost during menstruation. As a result:

i. The endometrium becomes covered by a simple columnar epithelium.

ii. The lamina propria becomes thicker and richly vascularized.

The glands, formed by simple columnar epithelial cells, are straight tubules with narrow lumen.The cells of glands gradually accumulate more cisternae of RER, and the Golgi complex increase in size in preparation for secretory activity.

(3) Secretory phase

Start at ovulation and lasts about 14 days. It results from action of progesterone secreted by corpus luteum. Epithelium of glands, start to accumulate glycogen below their nuclei. Later, glycoprotein secretory products dilate lumens of glands. Glands become highly coiled.

In this phase endometrium reaches its maximum thickness as a result of accumulation of secretions and of edema in stroma. Mitosis is rarely seen during this phase.

Breasts or Mammary Glands

The breasts are two modified sweat glands that produce milk instead of sweat. Each breast has one pigmented projection called nipple, which is surrounded by a colored area of skin termed areola. Tiny tubercles on areola are produced by underlying areolar glands.

The breast tissue consists of little more than a system of ducts embedded in connective tissue that does not extend beyond margin of areola.At puberty in female, mammary glands gradually enlarge and assume their hemispherical shape under influence of pituitary, ovarian, and other hormones.

The ducts elongate, but increase in size of glands is mainly from deposition of fat.

The superficial surface of breast is convex.

The deep surface (base) is slightly concave and overlies pectoralis major and to a less degree, serratus anterior and external oblique muscles. The base extends vertically from 2nd – 6th rib, and horizontally from sternal border to mid-axillary line. The base is separated from deep fascia covering underlying muscles by an area of loose connective tissue called retromammary space.

The upper outer quadrant is prolonged upward and laterally over lower border of pectoralis major muscle to enter axilla, forming axillary tail. Each breast consists of 15 – 20 independent units called breast lobes separated by fibrous septa.

Septa in upper part of breast are well developed and they served as suspensory ligaments. A lobe consists of several ducts that empty into one terminal distal duct, lactiferous ducts, which open onto nipple.

Immediately before emerge in nipple, lactiferous duct forms a dilatation called lactiferous sinus.Within each lobe smallest proximal ducts leads to a lobule consisting of multiple alveoli, which are spherical collection of epithelial cells.

Lobules are separated by moderately dense connective (collagen bundles) interlobular tissue. With the exception of lactiferous sinus, ducts are lined by simple cuboidal epithelium covered by closely packed myoepithelial cells.

The lactiferous sinuses are lined with stratified squamous epithelium at their external openings.This epithelium very quickly changes to stratified columnar or cuboidal epithelium.

The connective tissue surrounding alveoli contains many lymphocytes and plasma cells.Plasma cells population increases significantly toward end of pregnancy; it is responsible for secretion of immunoglobulins that confer passive immunity on newborn.

Externally, nipple is covered by keratinized stratified squamous epithelium, rests on a layer of connective tissue rich in smooth muscle fibers, disposed in circles around deeper lactiferous ducts. Contraction of this muscle causes erection of nipple.

The skin of areola is pigmented and contains sebaceous glands that are not associated with hair follicles. The color of areola darkens during pregnancy, as a result of local accumulation of melanin. After delivery, areola may become lighter in color but rarely returns to its original color.

During pregnancy, under influence of estrogen, progesterone, prolactin, and human placental lactogen hormones, there is a great increase in number of alveoli. Under E/M, a few lipid droplets and secretory vacuoles containing milk proteins can be seen in apical cytoplasm of alveolar cells.

During lactation, the number of secretory vacuoles and lipid droplets greatly increased in apical cytoplasm of alveolar epithelium.

Blood Supply of Breast

(1)Perforating arteries: Branches of internal thoracic artery and intercostals arteries.

(2) External mammary artery: Branch of lateral thoracic artery, which arises from axillary artery.

(3) Pectoral artery: Branch of thoracoacromial artery (branch of axillary artery).

Veins correspond to arteries.

Lymph Drainage of Breast

(1)Lateral half of breast: Drains into anterior (pectoral) group of axillary lymph nodes situated just deep to lower border of pectoralis major.

(2)Medial half of breast: Drains into internal thoracic group of lymph nodes situated along course of internal thoracic artery.

(3)A few lymph vessels: Drain into posterior intercostals lymph nodes situated along course of posterior intercostals arteries.

(4)Some vessels: Communicate with lymph vessels of opposite breast and with those of anterior abdominal wall.

Development of Male and Female Reproductive Organs

Indifferent gonads.

The gonads appear initially at 5th W of development, as a pair of longitudinal ridges, genital or gonadal ridges, on medial side of mesonephrous.

They are formed by proliferation of epithelium and a condensation of underlying mesenchyme. Primordial germ cells migrate from wall of yolk sac to reach primitive gonads at beginning of 5th W, and invading genital ridges in 6th W.

Shortly before and during arrival of primordial germ cells, the epithelium of gonadal ridge proliferates, and penetrates underlying mesenchyme to form a number of irregularly shaped cords, gonadal cords.

The indifferent gonad now consists of an external cortex and internal medulla. In embryos with XY sex chromosome complex, medulla differentiates into testis, while cortex regresses.

In embryo with XX sex chromosome complex, cortex differentiates into ovary, while medulla regresses. Until 7th W, gonads of two sexes are identical and called indifferent gonads.

Development of Testes

- If embryo is genetically male, under influence of testis-determining factor (TDF), the gonadal cords continue to proliferate and penetrate deep into medulla to form medullary or seminiferous cords.
- Toward hilum of gonad, the cords break up into a network of tiny cell strands that later give rise to tubules of rete testis.
- During further development a dense layer of fibrous connective tissue, tunica albuginea that separate seminiferous cords from surface epithelium.
- In 4th Mon., seminiferous cords become continuous at their extremities with rete testis.Seminiferous cords are now composed of spermatogonia derived from primordial germ cells and Sertoli cells derived from surface epithelium of gland.
- The Sertoli cells produce a glycoprotein known as mullerian inhibiting substance (MIS) until puberty, at which time level of MIS decrease.MIS suppress development of paramesonephric ducts, which form uterus and uterine tubes.

- Interstitial (leydig) cells , derived from original mesenchyme of gonadal ridge, lie between semineferous cords.They begin development shortly after onset of differentiation of these cords.
- By 8th W, leydig cells begin production of androgenic hormones (testosterone). Testosterone production is stimulated by human chorionic gonadotropin (GTH).
- It reaches peak amount during the 8 – 12 W period of fetal development.Seminiferous cords remain solid until puberty, when they acquire a lumen, thus forming seminiferous tubules.
- Once seminiferous tubules are canalized, they join rete testis tubules, which in turn become continuous with 15 – 20 mesonephric tubules.The latter become efferent ducts.

Development of the Ovaries

- In female with an XX sex chromosome, the gonadal cords extend into medulla and then dissociate into irregular cell clusters containing groups of primitive germ cells.
- Latter, cell clusters degenerate and disappear, and are replaced by a vascular stroma that forms ovarian medulla.The surface epithelium of female gonad, unlike that of male, continues to proliferate.
- In 7th W it gives rise to a 2nd generation of cords, cortical cords, which penetrate underlying mesenchyme but remain close to surface. In 4th Mon, these cords split into isolated cell clusters called primordial follicles.
- Each follicle consists of an oogonium derived from primordial germ cells, surrounded by a single layer of follicular cells derived from surface epithelium. Active mitosis of oogonia give rise to thousands primordial follicles.
- However, many oogonia degenerate before birth, and the two million or so, remain enlarge to become primary oocytes before birth. No oogonia form postnatally.
- After birth the surface epithelium of ovary flattens to a single layer of cells that is continuous with mesothelium of peritoneum at hilum. Epithelium becomes separated from the follicles in the cortex by a thin fibrous capsule, the tunica albuginea.

Development of Male Genital Ducts

+The fetal testes produce testosterone and MIS.Testosterone stimulates mesonephric ducts to form male genital ducts.

+MIS results in degeneration of paramesonephric ducts.As mesonephros degenerates, some mesonephric tubules persist and are transformed into efferent ductules.

+These ductules open into cranial part of mesonephric duct. The cranial part of each mesonephric ducts elongate and become highly convoluted, forming epididymis.

+From tail of epididymis to outbudding of seminal vesicle, the mesonephric ducts obtain a thick muscular coat and form the ductus (vas) deferens. The region of duct beyond seminal vesicles forms ejaculatory duct.

+The seminal vesicles are a lateral outgrowth from caudal end of each mesonephric duct.

Development of Female Genital Ducts

*In female, mesonephric ducts regress because of lack of testosterone.The paramesonephric ducts develop because of the absence of MIS and form most of female genital duct.

*The uterine tubes develop from unfused cranial parts of paramesonephric ducts.The caudal, fused portions of these ducts form uterovaginal primordium, which gives rise to uterus and the superior portion of vagina.The endometrial stroma and myometrium are derived from surrounding mesenchyme.

*Fusion of paramesonephric ducts also brings together two peritoneal folds that form right and left broad ligament and two peritoneal compartments, rectouterine pouch and vesicouterine pouch.

*The vaginal lining epithelium is derived from endoderm of urogenital sinus, whereas fibromuscular wall of vagina develops from surrounding mesenchyme.

*The tip of uterovaginal primordium reaches urogenital sinus, and shortly after they make contact, two solid endodermal evaginations, sinovaginal bulbs, grow out from pelvic part of urogenital sinus.

*The central cells of this plate break down, forming lumen of vagina. The peripheral cells of the plate form vaginal lining epithelium. By 5th Mon the vaginal outgrowth is entirely canalized.The vaginal fornices are of paramesonephric origin.

*Thus the vagina has a dual origin, with upper portion derived from uterovaginal primordium and lower portion derived from urogenital sinus.The lumen of vagina remains separated from cavity of urogenital sinus by a thin tissue plate or membrane called hymen, which is formed by invagination of posterior wall of urogenital sinus.

*The hymen consists of epithelial lining of the sinus and a thin layer of vaginal cells. It usually develops a small opening during perinatal life.

Development of Genital Glands

Buds grow from urethra into surrounding mesenchyme, forming mucus-secreting urethral and paraurethral glands.Outgrowths from urogenital sinus form bilateral great vestibular (Bartholin) glands.These tubuloalveolar glands also secrete mucous.

Development of Male External Genitalia

- Development of external genitalia in male is under influence of testosterone and is characterized by rapid enlargement and elongation of genital tubercle, to become penis, and is now called phallus.
- During this elongation phallus pulls urethral folds forward so that they form lateral walls of urethral groove. This groove extends on ventral aspect of elongated phallus, but does not reach most distal part, glans penis.

- The epithelial lining of the groove, which is endodermal in origin, forms urethral plate.At end of 3rd Mon, the two urethral folds fuse with each other and close over urethral plate to form penile urethra. This canal does not extend to tip of phallus (glans penis).
- The most distal portion of urethra is formed during the 4th Mon, when ectodermal cells from tip of glans penetrate inward to form a solid ectodermal cord, which meets penile urethra.
- During 12th W, a circular ingrowth of ectoderm occurs at periphery of glans penis. When this ingrowth breaks down, it forms prepuce.The corpora cavernosa and corpus spongiosum develop from mesenchyme in phallus.
- The genital swelling, known in male as scrotal swellings, arise in inguinal region.With further development they move caudally toward each other and fuse to form scrotum.
- The line of fusion of these scrotal swellings is clearly visible as scrotal raphe. This raphe indicates position of scrotal septum, which divides scrotum into two halve.

Development of Female External Genitalia

- Factors controlling development of external genitalia of female are not clear, but estrogens play a role. Genital tubercle elongates only slightly and forms clitoris.The clitoris develops in same way as penis, but urethral folds do not fuse and form labia minora.
- The urethral groove remains open and forms vestibule. The genital (labial) swelling enlarged and fuse anteriorly to form anterior labial commissure and mons pubis, and posteriorly to form posterior labial commissure. Between anterior and posterior commissures, labial swellings remain unfused and form two large folds of skin called labia majora.
- Although genital tubercle does not elongate extensively in female, it is larger than in male during early stages of development.In fact, using tubercle length as a criterion (as monitored by ultrasound) has resulted in mistakes in identification of sexes during 3rd & 4th Mon of gestation.

The Spermatic Cord

The testis descends from abdominal wall into scrotum and pulls with it vas deferens, nerves and vessels. These structures meet at deep inguinal ring and together form spermatic cord, which suspends the testis in scrotum, and extends from deep inguinal ring to posterior border of testis. The left spermatic cord is a little longer than right.

Contents.

(1)Vas deferens.

(2) Testicular artery: Branch of abdominal aorta.

(3) Artery to vas deferens: Branch of superior or inferior vesicle artery.

(4) Cremasteric artery: Branch of inferior epigastric artery.

(5) Testicular vein (pampiniform plexus): The pampiniform plexus ascends from posterior border of testis and enters inguinal canal.At about level of deep inguinal ring, a single testicular vein is formed, which drains into left renal vein, on left side and into inferior vena cava, on right side.

(6) Genital branch of genitofemoral nerve L1 and 2: Supplies cremaster muscle.

(7) Testicular sympathetic plexus: These fibers are derived from the renal or aortic plexus of nerves. They follow the testicular artery.

(8) Testicular lymph vessels: Follow the testicular artery and drain into para-aortic lymph nodes.

(9) Fibrous remains of processus vaginalis.

Spermatic fascia.

The spermatic cord enters inguinal canal by passing through deep inguinal ring. Within canal it acquires three fascial covering from fibers of muscles between which it lies. This facial covering continues downwards into scrotum:

(1)Internal spermatic fascia: Acquired from fascia transversalis at deep inguinal ring.

(2) Cremasteric fascia: Acquired from internal oblique muscle within inguinal canal.

(3) External spermatic fascia: Acquired from aponeurosis of external oblique muscle at superficial inguinal ring.