



EDITION

obstetrics & gynaecology

ED.08

APPLIED ANATOMY : INTRODUCTION AND UTERINE ARTERY

----- Active space -----

khanirfan0392@gmail.com

Sex Differentiation & Lymphovascular Supply

00:01:18

SEX DIFFERENTIATION

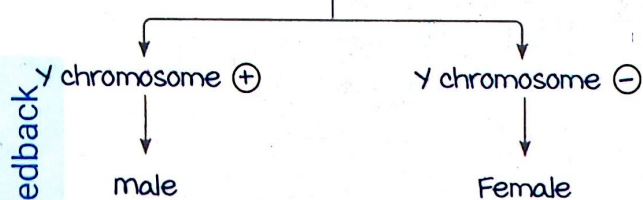
	Females	males
Karyotype	46(XX) / 44 + XX	46(XY) / 44 + XY
Barr body (No. of X chromosome - 1)	1	0
Internal genitalia	Fallopian tube • Uterus • Cervix • Vagina	mnemonic : SEED • Seminal vesicle • Epididymus • Ejaculatory duct • Vas deferens
External genitalia : Homologous organs : Organs with same embryological origin in males & females)		
	Females	males
	Labia majora	Scrotum
	Labia minora	Penile urethra
	Clitoris	Penis
	Bartholin glands/ Greater vestibular gland	Bulbourethral / Cowpers gland
	Paraurethral / Skene gland	Prostate

Sex determination :

m/c method : Assessment of external genitalia.

Drawback : Not applicable in ambiguous genitalia.

Best method : Karyotyping



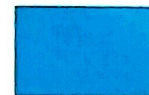
Gynaecology • v1.0 • Marrow 8.0 • 2024

Feedback

----- Active space ----- **LYMPHOVASCULAR SUPPLY**

	Blood Supply	Nerve Supply	Lymphatic Drainage
Ovary	Arterial drainage : Ovarian artery (Branch of abdominal aorta at L _a) Venous drainage : • Left ovarian vein → Renal vein. • Right ovarian vein → IVC.	T ₁₀ , T ₁₁ via Ovarian plexus ↓ Also supplies • Fallopian tube (Lateral). • Broad ligament.	Paraaortic lymph nodes
Fallopian tube	• medial 2/3 rd : uterine artery. • Lateral 1/3 rd : Ovarian artery.	T ₁₁ , T ₁₂ , L ₁ Applied aspect : Pain in ruptured ectopic (d/t stretching of fallopian tube)	• Major : Paraaortic lymph node (L.N.) • Intramural + Round ligament } Superficial inguinal lymph node (S.I.L.N.)
uterus	• 80% → uterine artery (Branch of anterior division of internal iliac artery) • 20% → Anastomotic branch of ovarian artery	T ₁₀ - L ₁ via Frankenhauser ganglion (Uterovaginal plexus)	• Cornua } S.I.L.N. • Round ligament } • Fundus : Paraaortic L.N. • Body : External + Internal iliac L.N.
Cervix	Descending cervical artery, Branch of uterine artery	S _a - S ₄	mnemonic : HOPE Hypogastric L.N. (Internal iliac) Obturator L.N. Paracervical L.N. External iliac L.N.
Vagina	Vaginal artery : Branch of Internal pudendal artery	• upper vagina : S _a - S ₄ . • Lower vagina : Pudendal N.	• upper 2/3 rd : HOPE • Lower 1/3 rd : S.I.L.N
Vulva	Internal pudendal artery • mons pubis : External pudendal artery.	Pudendal nerve + Anterior superior part of : • Ilioinguinal nerve • Genito-femoral nerve Posterior-inferior part of : • Posterior cutaneous nerve of thigh • Pudendal nerve	• S.I.L.N → Deep I.L.N (Femoral) • Clitoris Glans : Lymph node of cloquet/ Rosenmuller LN (Part of deep inguinal LN) Body } S.I.L.N → Deep I.L.N Crura }

Note : vulva is AKA pudendum and is the external genitalia of females



Lining Epithelium, Embryological Derivatives, P/S Examination

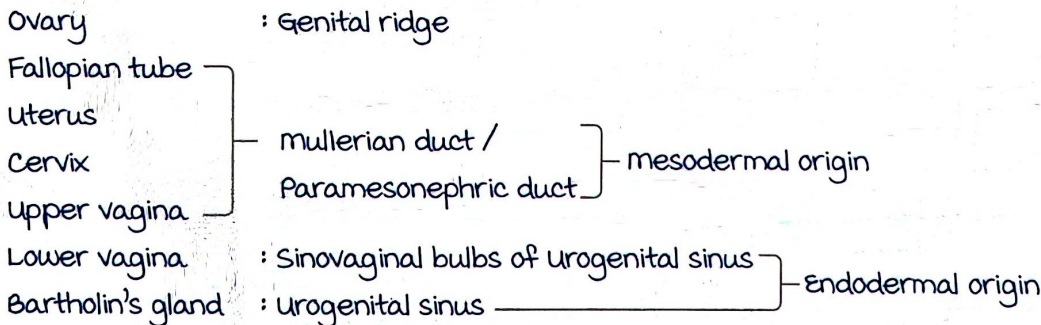
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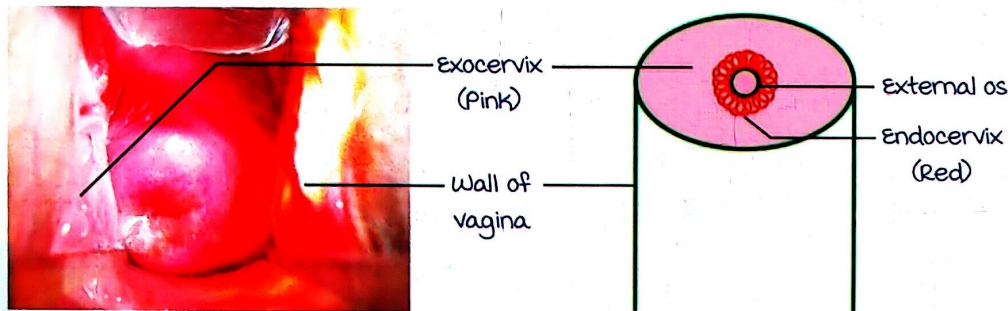
LINING EPITHELIUM OF FEMALE GENITALIA

Organ	Lining Epithelium	m/c Cancer
Ovary	Surface epithelium : Single layer of Cuboidal epithelium	Epithelial cell tumor
Fallopian tube	Ciliated columnar epithelium	Adenocarcinoma
uterus	Ciliated columnar epithelium (Onset of menstruation : Cilia lost)	Endometrial ca : Adenocarcinoma
Cervix	Endocervix → Columnar epithelium	Adenocarcinoma
	Exocervix → Stratified squamous epithelium	Squamous cell carcinoma (m/c)
Vagina	Non-keratinized stratified	Squamous cell carcinoma
Hymen	Non-keratinized stratified squamous epithelium	Squamous cell carcinoma
Bartholin gland	• Gland : Cuboidal epithelium.	→ Adenocarcinoma (m/c)
	• Duct : Transitional epithelium.	→ Transitional cell ca
	• Opening : Squamous epithelium.	→ Squamous cell carcinoma

EMBRYOLOGICAL DERIVATIVES



PER SPECULUM EXAMINATION

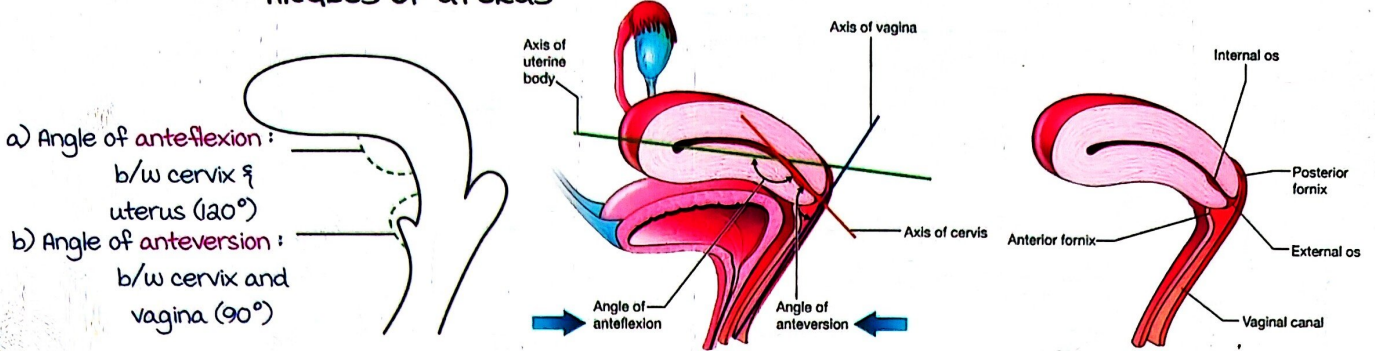


structures visible on per speculum examination

Feedback



ANGLES OF UTERUS



Anteverted vs retroverted uterus :

	Anteverted uterus	Retroverted uterus
Direction of uterine fundus	Towards pubic symphysis : 80 % : Anteverted Eg : Anteverted uterus ⊕	Towards sacral promontory : 20 % retroverted & retroflexed uterus ⊕
PV examination		
Part easily felt	Fundus	Cervix
Difficult to palpate :	Cervix	Fundus
Part of cervix easily felt	Anterior lip	Posterior lip

Significance :

a. Prevent prolapse.

b. mechanical support of uterus

ROUND LIGAMENT

Attachments : **Cornua of uterus** & anterior 1/3rd of labia majora

Function : Indirect support / 2^o support (keeps uterus in anteverted position).

Origin : **Gubernaculum**

Blood supply : **Sampson's artery** (branch of uterine artery).

UTERINE ARTERY

Branch of anterior division of internal iliac artery (Posterior division supplies lower limb muscles).

Structures supplied :

1. Uterus
2. Fallopian tube (medial 2/3rd)
3. Round ligament (Sampson's artery)
4. Cervix (Descending cervical branches)
5. Ureter

Note : **Devascularization** in PPH

1. uterine artery
↓ fails
2. Ovarian artery
↓ fails
3. Anterior division of internal iliac artery

Applied Anatomy : Introduction and Uterine Artery

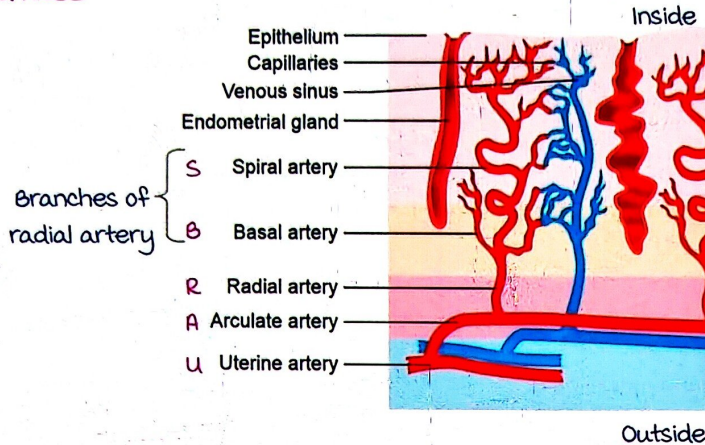
Vagina : Not supplied by uterine artery

↓ hence

uterine artery embolization : vaginal blood supply intact

Branches of uterine artery (Outside → Inside) :

mnemonic : **U ARBS**

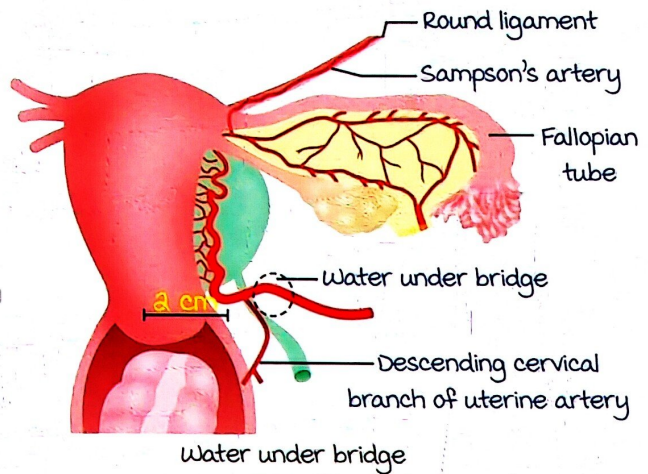


Note :
Sampson's artery :
Responsible for menstrual blood.

Water under bridge :

- Uterine artery directly crosses over ureter.
- 2 cm lateral to internal os.
- m/c site of ureteric injury during hysterectomy.

↓
Clamp applied as close to the uterus as possible



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APPLIED ANATOMY : FALLOPIAN TUBES, OVARY AND UTERUS

Fallopian Tube & Ovary

00:00:15

FALLOPIAN TUBE

Length : 10cm.

Parts of fallopian tube :

medial to lateral.

1. Interstitium :

- Intramural part (Inside uterus).
- **Narrowest** part.
- Anatomical sphincter : Circular muscle fibres (+).

2. Isthmus :

- 2nd narrowest part.
- Physiological sphincter : Product of conception moves → Isthmus (Narrow).
from ampulla (Widest)
- Site for female sterilization (Tubal ligation).

3. Ampulla :

- Widest & longest part.
- Site for → **Fertilization**
→ **Ectopic pregnancy**
- maximum mucosal folds, aka plicae.

4. Infundibulum :

- AKA fimbrial part of fallopian tube.

Note :

1. Adnexa : Ovary + fallopian tube

- Peg cells : + in lining of fallopian tube.

2. Genital TB :

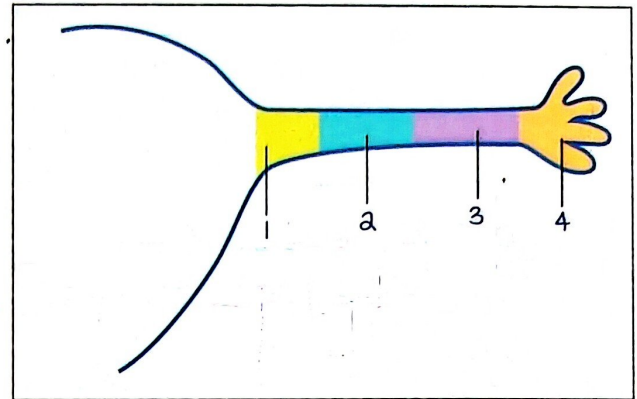
- m/c affects fallopian tube (**Ampulla**).
- Can lead to b/l cornual block.

3. Gonococcal infection → leads to → Fimbrial block.

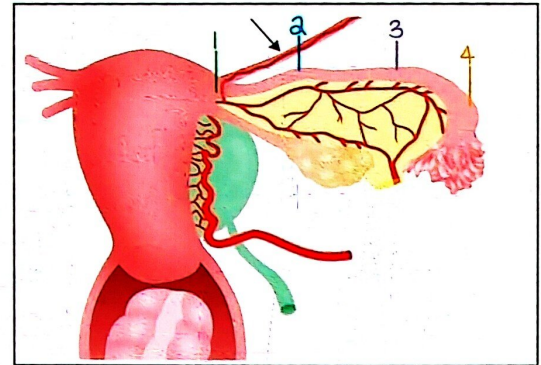
4. IOC for tubal patency : **HSG** (Hysterosalpingography).

5. Site for tubal ligation → Laparoscopic : Isthmus

khairfan0392@gmail.com → Hysteroscopic (Using Essure) : Interstitium.



Parts of fallopian tube



Parts of fallopian tube

OVARY

Present posteriorly

General features :

Size : 3 x 2 x 1 cm

Volume : 6-7 cc (≥ 10 cc : PCOS).

Location : Ovarian fossa of Waldeyer (Lateral pelvic wall).

Intrauterine life : Abdominal organ
 ↓
 With the help of gubernaculum

Descends into the pelvis

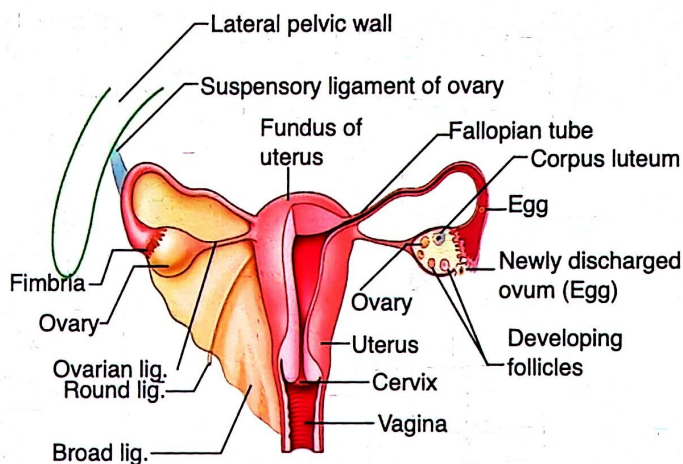
Applied aspect :

uterus : Prevents further descent of ovary.

Gubernaculum $\xrightarrow{\text{divided by uterus}}$ Ovarian ligament
 $\xrightarrow{\hspace{10em}}$ Round ligament.

Ligaments related to ovary :

1. Ovarian ligament : Attaches ovary to cornua of uterus.
2. Infundibulopelvic ligament :
 - AKA suspensory ligament of ovary.
 - Connects ovary to lateral pelvic wall.
 - Contains **ovarian vessels & nerves**.
 - Preserved during hysterectomy without oophorectomy.
3. mesovarium : Part of broad ligament near the ovary.



Ligaments related to ovary

Relations of ovary :

Superior/anterior : External iliac artery.

Posterior : Ureter & internal iliac artery.

Lateral : Obturator nerve & infundibulopelvic ligament.

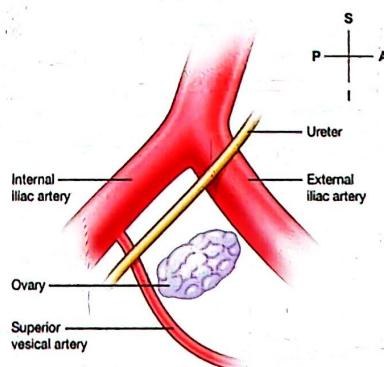
Applied aspect :

Large ovarian mass

↓
 d/t pressure on obturator nerve

Pain along medial side of thigh

Medial : Ovarian ligament.



Relations of ovary

Histological features :

Surface epithelium : Single layer of cuboidal epithelium

Tunica albuginea : Below surface epithelium

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----- Active space ----- Ovarian cortex : Contains follicles in various stages

Note :

Parts of broad ligament :

- a. mesosalpinx : Close to fallopian tube.
- b. mesovarium : Close to ovaries.
- c. mesometrium : Close to uterus.

medulla :

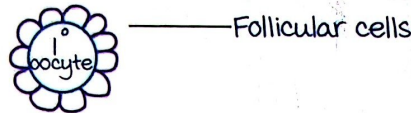
Contains → Blood vessels
 → Hilar cells → Homologous to interstitial cells of testes.
 → Hilar cell tumor of ovary : Rare.

- Secretes androgens.
- masculinizing tumour of ovary.

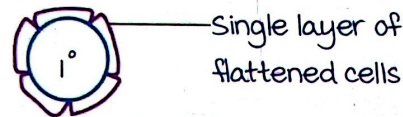
Folliculogenesis

00:18:45

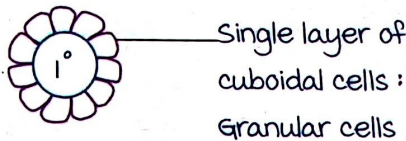
Follicle : 1° oocyte surrounded by follicular cells of ovary.



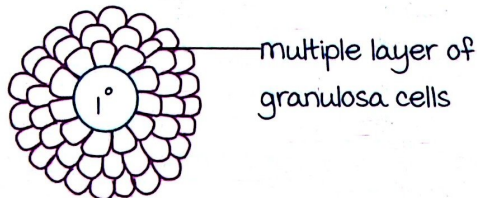
Primordial follicle :



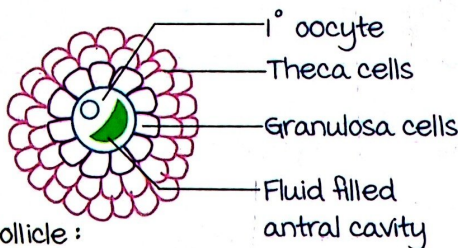
Primary follicle :



Secondary follicle :



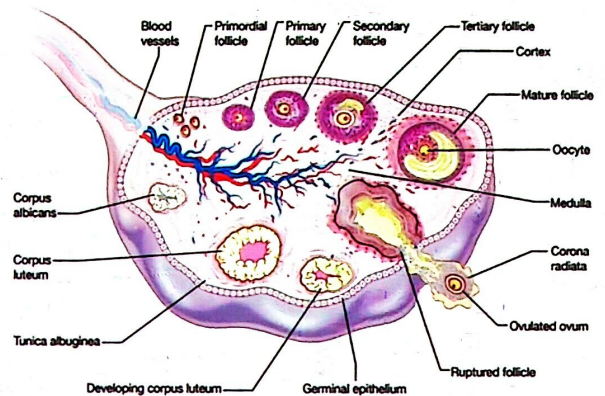
Antral follicle/ tertiary follicle :



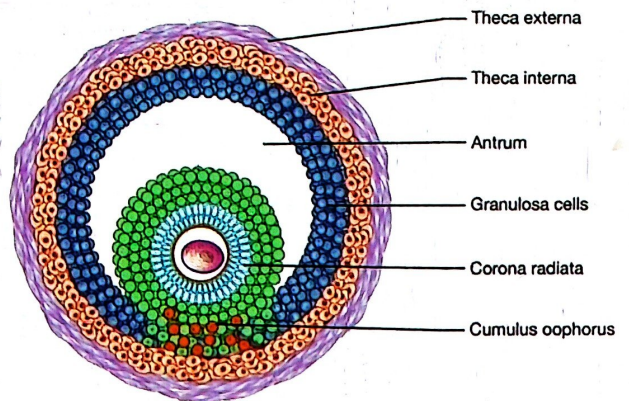
Graafian/mature follicle :

- Ovoid/spherical shape.
- Size : 18-20mm (≥17mm).
- Cavity : Liquor folliculi/antral cavity.
- Cell layers surrounding 1° oocyte (outside to inside) :

- Theca externa.
- Theca interna.
- Granulosa cells.

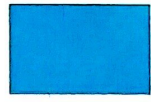


Various follicles of ovary



Graafian follicle

Feedback



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- **Cumulus oophoricus.**
 - AKA discus proligerus.
 - Cells which project into the cavity.
 - Separate 1° oocyte from the cavity.

Uterus

00:26:45

General features :

Shape : Pear shaped

Size : 3 x 2 x 1 inches

Weight → Non-pregnant : 60 - 80 g
 → Pregnant : 1000 g (w/t hypertrophy >> hyperplasia)

Composition : Smooth muscle fibers

Applied aspect :

Progesterone (Smooth muscle relaxant) : used in the prevention of preterm labour

uterine cavity : Potential cavity (Anterior & posterior walls opposed to each other)

- Volume → Non-pregnant : 10 ml
 → Pregnant : 5L

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- Shape → Coronal : Triangular
 → Sagittal : Slit-like

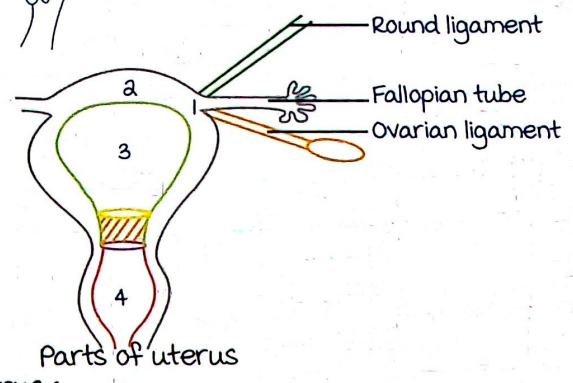
Position : Anteverted & ante-flexed

IOC (To look inside uterus) : **Hysteroscopy**



PARTS OF UTERUS

1. Cornua/angle of uterus
2. Fundus (Dome shaped)
3. Body (corpus)
4. Cervix



Structure attached at cornua of uterus :

a. Anterior → Posterior (mnemonic: **RTO**)

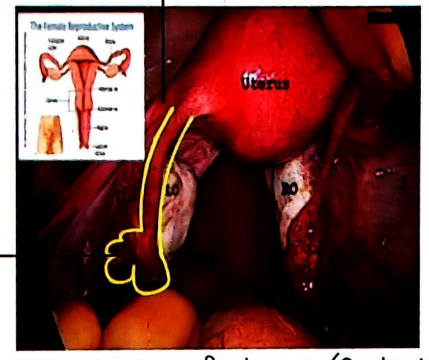
- Round ligament
- Fallopian tube
- Ovarian ligament

b. Superior → Inferior

Fallopian tube ○

Round ligament ○ ○ Ovarian ligament

Round ligament



Left fallopian tube

Laparoscopic view of uterus (Posterior)

Feedback



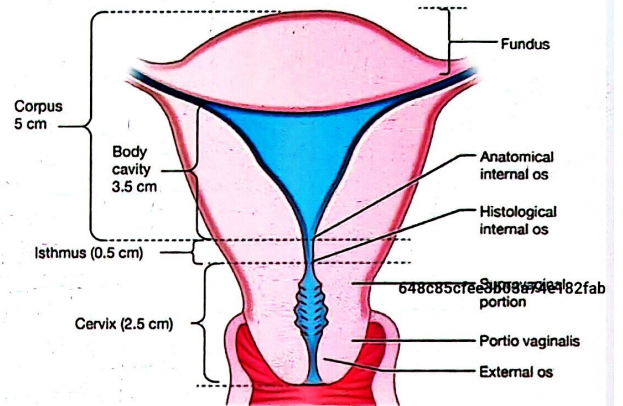
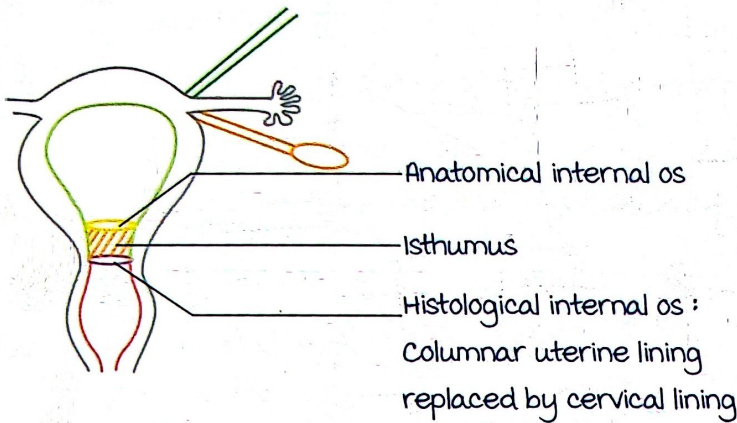
----- Active space ----- Note

- Cervical fibroid : Extrauterine fibroids.
- m/c cause of failure of female sterilization : Identification of wrong structure.

Cervix to Corpus ratio :

Stage	Cervix : Corpus ratio
Before puberty	2:1 (Cervix larger than uterus)
At puberty	1:2
Reproductive age	1:3 or 1:4
menopause	1:1 (d/t atrophy)

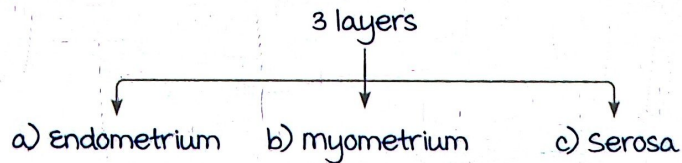
Isthmus :



Coronal section of uterus

- Lower part of uterus b/w anatomical & histological internal os.
- Length
 - Non-pregnant : 0.5 cm.
 - During pregnancy : Forms lower uterine segment (LUS) identified by loose fold of peritoneum
 - At term : 5 cm
 - At labour : 10 cm (5 cm + 5 cm cervix d/t effacement).

Body / Corpus :



Endometrium :

- 3 layers :
- 1. Zona compacta
 - 2. Zona spongiosa
 - 3. Zona basalis
- Functional layers : Shed during menstruation.

Endometrial thickness during various phases :

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Time of cycle	Endometrial thickness
Immediately after menstruation	1-2 mm
Early proliferative phase	5-7 mm
Late proliferative phase / preovulatory phase	Until 11 mm
Secretory phase	7-16 mm
Post menopausal females	< 4 mm

myometrium :

made of smooth muscle fibers.

middle layers : AKA **living ligature**.

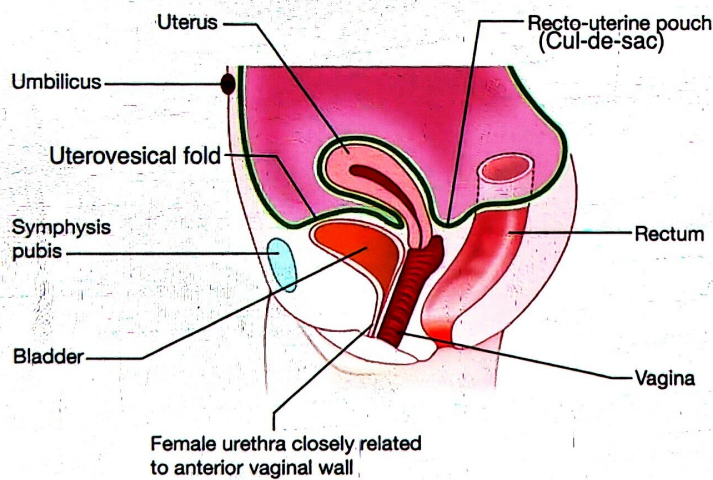
Peritoneal reflections :

utero-vesical fold : Peritoneum from bladder
↓
reflected to uterus

At the level of isthmus (LUS)

Pouch of Douglas/cul-de-sac : Posterior peritoneal reflections b/w uterus & rectum

Applied aspect : **Culdocentesis** done for ruptured ectopic.



Peritoneal reflections of uterus

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APPLIED ANATOMY : CERVIX AND VAGINA

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Cervix

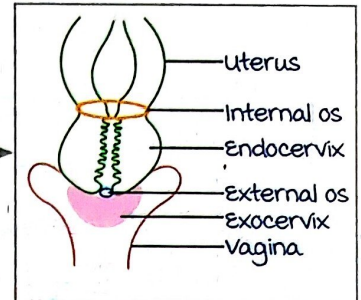
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Composition :

- major : Collagen (Connective tissue).
- 10-15% : Smooth muscle fibers.

Applied aspect :

effacement during labour : D/t breakdown of collagen + ↑ water content

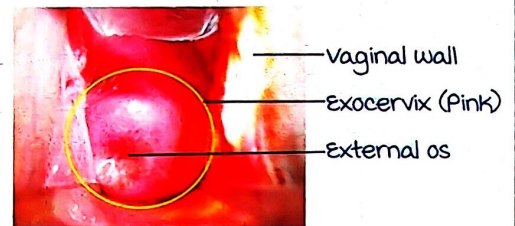


CERVIX

PER SPECULUM (P/S) FINDINGS

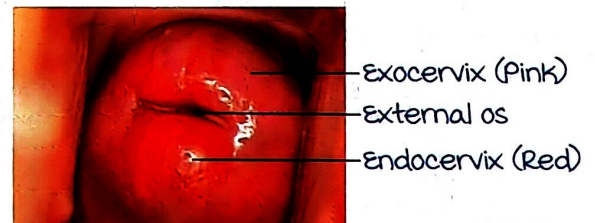
Endocervix :

- Part of cervix close to the uterus.
- Lining : Columnar epithelium.
- Aka supravaginal part of cervix.
- P/S : Appears red.



Exocervix :

- Part of cervix inside the vagina.
- Lining : Stratified squamous epithelium.
- Aka portio vaginalis.
- P/S : Appears pink.



Ectropion/Eversion :

- Red epithelium (Endocervix) (+) outside external os.
(Normally : Only pink epithelium(+))
- Physiological : m/c in pregnancy.
- C/o : Post coital bleeding.
- Biopsy : Not required.



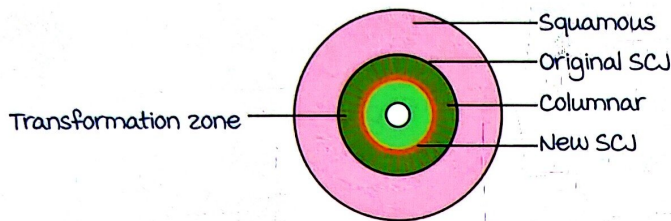
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Squamo-columnar junction (SCJ) :

- Columnar epithelium $\xrightarrow{\text{Change into}}$ Squamous epithelium.
(Endocervix) (Exocervix)
- Site :
 - Pre-puberty : External os (Originally).
 - Puberty : New SCJ formed (D/t estrogen & doderlein's bacteria).

Transformation zone :

- Area b/w new & old SCJ.
- Dynamic area.



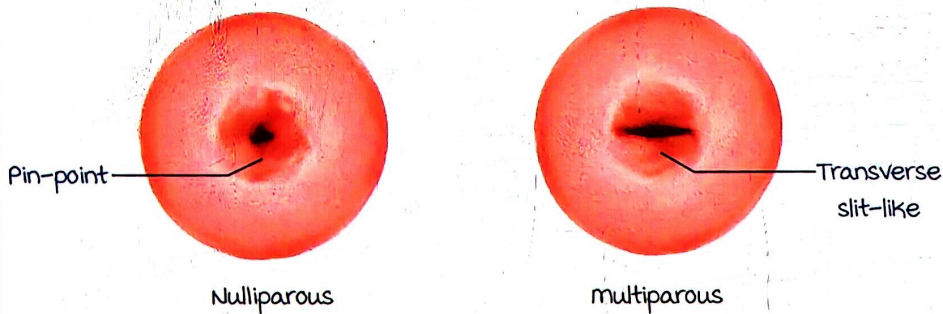
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Applied aspect : Cancer cervix.

- m/c type : Squamous cell carcinoma (SCC).
- m/c site
 - SCC : Transformation zone > SCJ
 - Adenocarcinoma : Endocervix

External os :

Point where cervix opens into vagina.



Internal os :

Point where cervix connects to uterus.

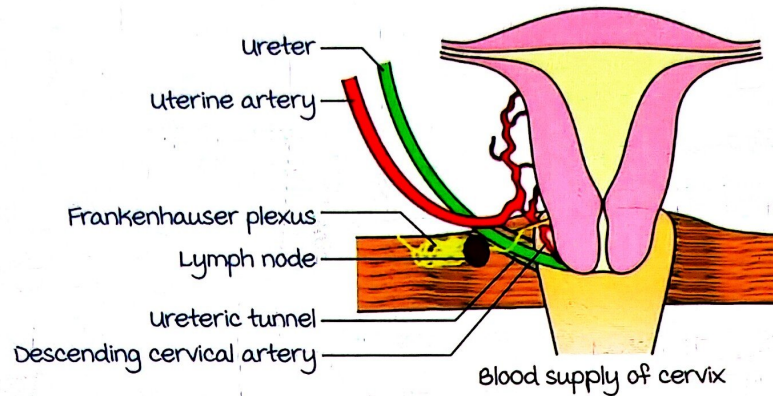
Feedback



CERVIX**Blood supply :**

Descending cervical artery ; Branch of uterine artery

(+) at 3 o'clock & 9 o'clock position

**Applied aspect :**

Paracervical block — Given : 2 & 4 o'clock / 8 & 10 o'clock positions
 — C/I : 3 & 9 o'clock position

Lymphatic drainage :

Mnemonic : **HOPE**.

Hypogastric lymph nodes (AKA internal iliac lymph nodes).

Obturator lymph node.

Paracervical lymph node.

External iliac lymph node.

Applied aspect :

Cancer cervix + superficial inguinal node involvement $\xrightarrow{\text{Implies}}$ Distant metastases (Stage 4B)

Nerve supply :

- S2-S4.
- Sensory supply : Franken Hauser ganglion.

Note :

Peritoneal covering — Posterior surface (+)
 — Anterior surface (-)

VAGINA**Blood supply :****Vaginal artery :**

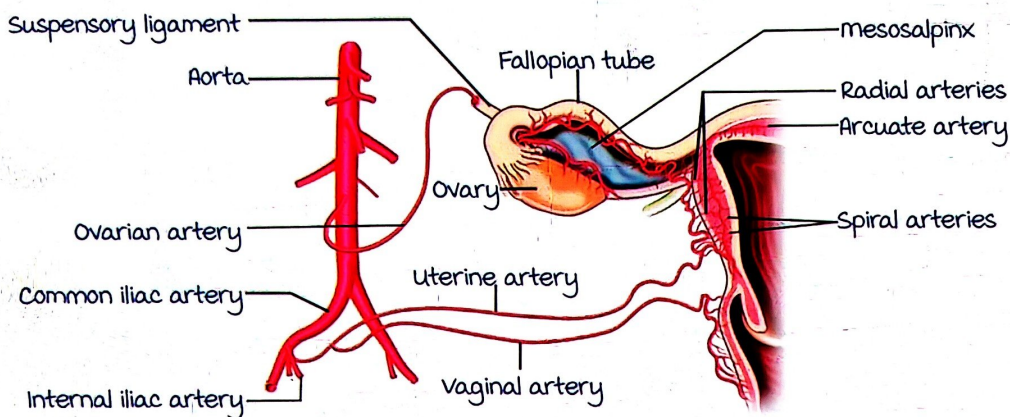
- Branch of internal iliac artery.
- Homologous to inferior vesical artery in males.
- Supplies : Vagina + Base of bladder.

Nerve supply :

- Upper part : S2 - S4.
- Lower part : Pudendal nerve.

Lymphatic drainage :

- Upper part : "HOPE".
- Lower part : Superficial inguinal nodes.



Blood supply of vagina

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General Points & Anatomical Relations of Vagina

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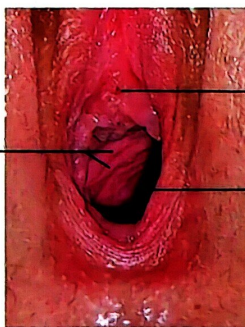
General points :

Description : Fibromuscular hollow tube

Walls : { Anterior
Posterior (Longer by 2cm)

Angle of anteversion : 90° angle made with cervix

Angle with horizontal : 45°.



Rugae :

- Transverse folds.
- most specific feature.

urethra

Vagina

Feedback

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Fornices : 4 (Posterior : Deepest fornix)

Peritoneal covering :

(+) Only on upper 1/3rd posterior wall

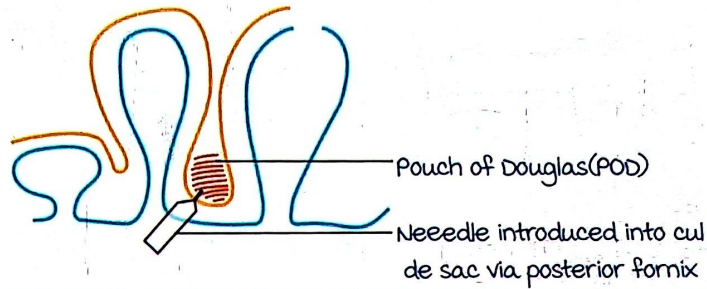
↓ Called as

Pouch of Douglas/Rectouterine pouch/Cul-de-sac

Applied aspect : Culdocentesis

↓ Done for

Ruptured ectopic



VAGINA

Relations :

Anterior :

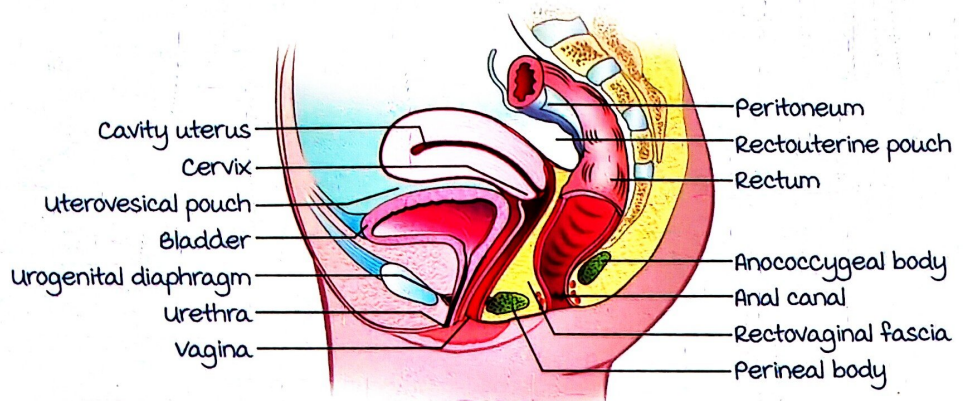
- Bladder
- Urethra

Posterior :

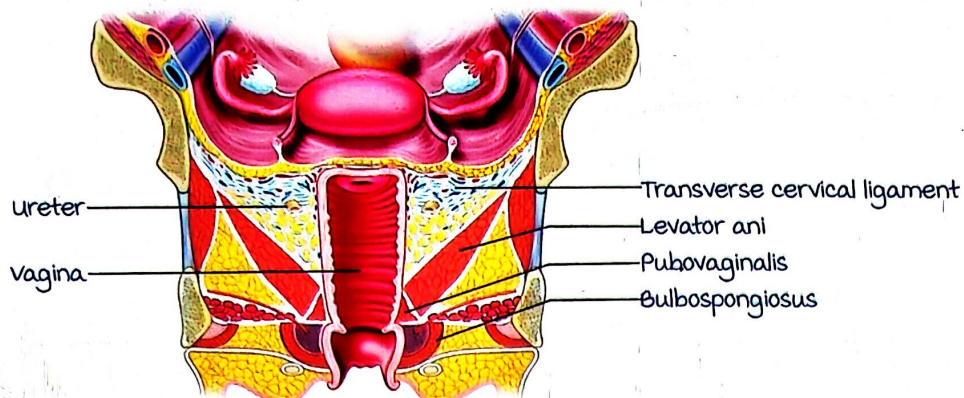
- POD
- Ampulla of rectum
- Perineal body

Lateral :

- Transverse cervical/mackenrodt's/Cardinal Ligament
- Ureter
- Bartholin gland



Relations of vagina



Lateral relations of vagina

----- Active space -----

Histology of Vagina

00:32:17

Lining :

- Non Keratinized stratified squamous epithelium.
- Glands (-).

Applied aspect :

Vaginal discharge : Cervical discharge (mainly) +
Endometrial gland discharge +
Bartholin gland discharge
(Only during intercourse).

Doderlein bacilli :

- Inhabitant bacteria of vagina.
- Lactobacilli.
- Glycogen(d/t estrogen)
↳ Lactic acid
- Appear : At puberty.
- Disappear : menopause.

VAGINA

pH of vagina :

Acidic in nature d/t → Doderlein bacilli
↳ Estrogen (glycogen)

Nature of vaginal pH in different age groups :

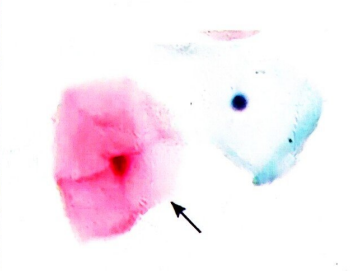
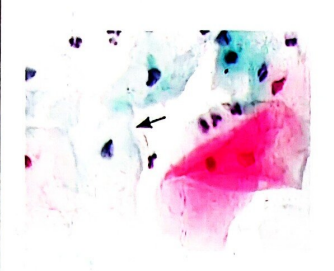
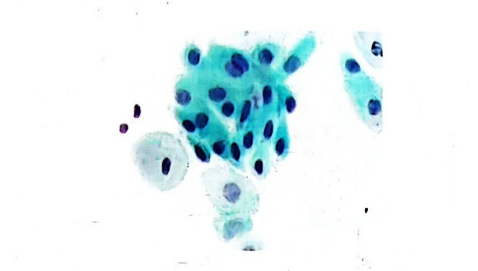
Age group	pH of vagina	Reason
Birth - 2 wks	Slightly acidic	maternal estrogen
2 wks - puberty	Alkaline : 6-8	Cervical secretions
At puberty	Acidic : 4-5	Doderlein bacilli
Reproductive age	↑ Acidic : 4-4.5	↑ Doderlein bacilli
menopause	Alkaline : 6-8	↓ Doderlein bacilli
menstruation	Alkaline : 6-8	Blood : Alkaline
Pregnancy	↑ Acidic : 3.5-4	↑ Doderlein bacilli

Feedback

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Types of vaginal epithelial cells :

Type	(1) Superficial cells	(2) Intermediate cells	(3) Parabasal cells
Nature	 Pink, eosinophilic cells	 Blue, basophilic cells	 Blue, basophilic cells, hazy outline
Nucleus	Pyknotic nuclei	Small nucleus	Big nuclei
Seen when	Estrogen predominates	Progesterone predominates	No hormone predominates

Vaginal cytology :

- Can predict hormonal profile of patient.
- Sample : upper 1/3rd of lateral wall of vagina (Hormonally sensitive).

TYPES OF HYSTERECTOMY

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Applied Anatomy

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URETER

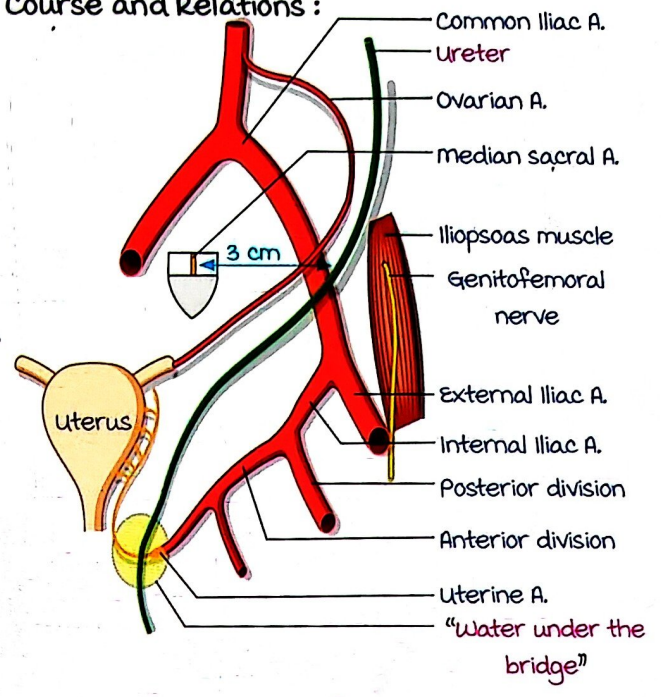
Arterial relations of ureter :

1. Arteries anterior to ureter :
 - Ovarian artery (Direct branch of abdominal aorta).
 - Uterine artery (Branch of Anterior division of Internal Iliac A).
2. Arteries posterior to Ureter :
 - Common Iliac A. (Divides after ureteric crossing).
 - Internal Iliac A.

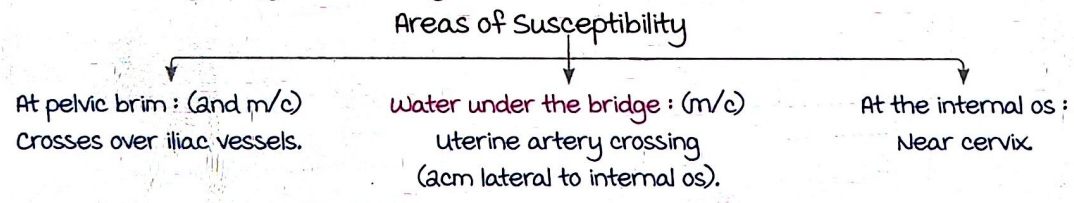
Note : Landmark for entry of ureter into pelvis → Distance between median sacral artery & ureter = 3cm.

- Lateral relation of external iliac artery : Iliopsoas muscle + Genitofemoral Nerve.
- Best way to identify ureter during surgery : visualize peristalsis of ureter.

Course and Relations :



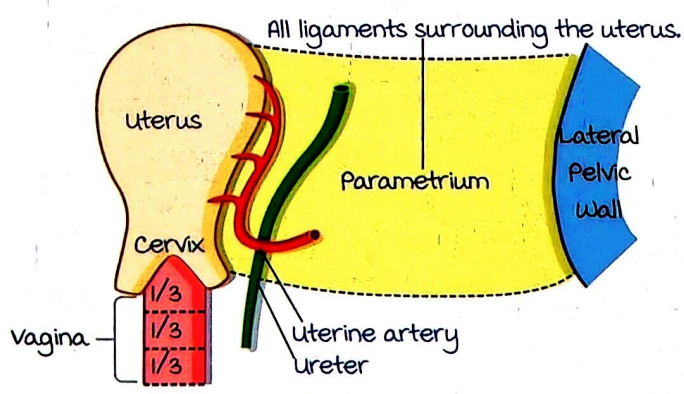
Ureteral Injury in Hysterectomy :



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Types of Hysterectomy

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Feedback