Anatomy of fallopian tubes and ovary

Hello students, hope you are all doing good. Welcome you to our NPTEL certified course on the topic, An overview on maternal health, the antenatal, intranatal and postnatal care. Myself Dr. Barnali Ghosh, an obstetrician and gynecologist working as an assistant professor at B.C.Roy Medical College and Research Center, IIT Kharagpur. We have dealt with the female external genitalia, its anatomy and the internal genitalia we have covered the uterus and the cervix. Today our topic of discussion is the anatomy of the fallopian tubes and ovary.

Concepts to be covered in today's lecture are the parts of the fallopian tube, the blood supply, its detailed structure, tubal sterilization and a short note on the ostia of the tubes. Keywords are parts of the fallopian tube, histology, tubal sterilization and tubal ostia. Coming to the pictorial representation of the fallopian tubes, parts of the fallopian tube can be you know divided from medial to lateral, the intramural part, isthmus, ampulla, infundibulum and fimbriae. The fallopian tube extends from the uterine cornu and it extends laterally to open into the lateral pelvic wall or within the peritoneum.

From medial to lateral as we have told first is the intramural part also called as the interstitial part, then comes the isthmus, then the ampulla and infundibulum and lastly this is the fimbria. So, this is the osteo or known as the uterine ostea. It is a junction of the endometrial cavity with the intramural part of the tube. So, medial most is the intramural part, it is covered with the muscles same as that of the uterine myometrium. These are thick muscles surrounding the intramural part, then comes the isthmus, then followed by the ampulla and the infundibulum and it opens in through the fimbria into the peritoneal cavity.

So, I will draw it for you depending on the diameter of the tube. Along the length of the tube the diameter changes and the length of the different parts has to be you know noted. So, first this is the uterine end of the fallopian tube and starting from here first is the interstitial part which is covered or surrounded by thick muscle layer. This is the interstitial part or the intramural part which is the medial most part. Next comes the isthmus right, this is the isthmus.

Next is the ampulla. This is just a pictorial representation for easy remembrance. It is from exteriorly into the abdomen it looks like that tube we cannot delineate like this difference in diameter, but pictorial representation the ampulla has larger diameter. This is the ampulla and then comes the infundibulum and ultimately the fimbria. Coming to the length of each of these parts intramural part is 1.

25 centimeter, immediately double is the isthmus that is 2.5 centimeters, the ampulla is 5 centimeter, infundibulum again becomes 1.25 centimeter and the fimbria is approximately 2 centimeter. So, the length of the tube if we say a starting from the corner of the uterus up to the infundibulum excluding the fimbria comes out to be 10 centimeters.

1.25 plus 2.5 plus 5 plus 1.25 comes out to be 10 centimeters and if fimbria is included it comes out to be 12 centimeters. Another thing to note is due to the presence of these muscles this is the narrowest part of the tube. Intramural part is the narrowest part and the widest part of the tube is the ampulla right, longest part of the tube is the ampulla, shortest part of the tube is the intramural or interstitial part.

Sfinter of the tube there are two types anatomical sphincter which is due to the increased muscle mass this part is known as the anatomical sphincter, but actually the isthmus is surrounded by circular muscles these are the circular muscles and when they contract they have that sphincteric action. So, the physiological sphincter of the tube is the isthmus right. Next fertilization site of fertilization here the ovum and the sperm fertilizes within the ampulla. So, site of fertilization is the ampulla and the embryo formed from this fertilization will pass through this tube into the endometrial cavity right in day 4 after fertilization. So, it remains within the tube in the first 3 days of fertilization.

So, the most common site of ectopic is the ampulla. Next most common site is the isthmus right. So, these are the different questions from the tube we will look into them one by one. One liners narrowest part of the tube we have discussed narrowest part of the tube is the interstitial or intramural part. Coming to next the largest part of the tube largest part is the ampulla 5 centimeter widest part is also the ampulla.

Anatomical sphincter containing thick muscle layer all around is the intermural or interstitial part. Physiological sphincter containing the circular muscles which contracts forms a sphincteric action. So, this is the isthmus. Site of fertilization, yes we recapitulate it is the ampulla. Most common site of ectopic pregnancy yes it will be ampulla because fertilization occurs in the ampulla and if the embryo is not brought to the uterine cavity.

So, then ectopic results and this most common site of ectopic pregnancy is the ampulla. Second

most common site being the isthmus. Now, most common site of tubal abortion. So, if here there is an ectopic pregnancy ultimately what is the end result this gestational sac may get exteriorized into the peritoneal cavity through the tubal ostea right. So, this is known as tubal abortion.

Most common site of tubal abortion is the ampulla, but if the embryo is present in the isthmus as an ectopic site here the embryo grows and grows and grows. Here this embryo will ultimately the fate of this embryo will be rupture. So, the site of tubal rupture is the isthmus. Most common site of tubal abortion yes it is ampulla whereas, most common site of tubal rupture is the isthmus and another thing is tubectomy for sterilization the most common site for tubectomy is the isthmus. Next coming to the blood supply blood supply of the fallopian tube yes this is the uterine artery and this is the ovarian artery.

So, the uterine artery as we have discussed in the previous class it comes from the internal iliac right. So, this is the common iliac which has divided from the abdominal aorta. This is the common iliac and it divides into internal iliac and external iliac right. So, this is the internal iliac artery it divides into anterior and posterior branches. The anterior branch of internal iliac artery gives a branch that is the uterine artery.

This uterine artery just 2 centimeter lateral to the internal os it crosses the ureter. Ureter is below uterine artery crosses the ureter from above water is underneath the bridge. So, this is this place is important the crossing of the uterine artery over the ureter. Now, the uterine artery passes along the lateral border of the uterus and then it enters the mesosalpinx. So, this part of the broad ligament which covers the tube is known as the mesosalpinx.

It enters within the 2 folds of the broad ligament. Broad ligament has an anterior fold and a posterior fold. So, the uterine artery will ascend up and from the lateral end of the uterus that is the corner of the uterus it will go along the tubes within the 2 layers of the broad ligament and the broad ligament covering the tubes is known as the mesosalpinx. This is the uterine artery whereas, the ovarian artery ovarian artery is a direct branch of abdominal aorta. Ovarian artery will cross or will pass through this IP ligament or the suspensory ligament of ovary and it will supply the ovary.

It will also give some tweaks that will enter the mesosalpinx and there is an anastomosis between the uterine artery and the ovarian artery. So, the medial 2 thirds of the tube medial 2 thirds of the tube is supplied by the uterine artery and the lateral 1 third is supplied by the ovarian artery. Right next coming to the histology of the tubes. This is a cut section of the tubes and we see it under microscope that this is the lumen. This is the lumen of the tube.

The lumen of the tube is first lined by epithelium right. So, this is the lumen, this is the mucosa and lamina propria, this is has epithelium. These epithelium are columnar. These epithelium are

columnar epithelium without sorry with cilia right. So, first the epithelium then point to note is there is no sub mucus layer.

Sub mucus layer here it is deficient. The next layer is the muscularis layer. So, this is the epithelium. Next comes the muscularis layer.

So, you can see these muscles. You can see these muscles these are the muscles of the tube the circular and the longitudinal muscles right and in between the muscles there are blood vessels these are the blood vessels outside the muscularis layer is ultimately the serosal layer which is nothing, but the peritoneum covering the tubes. So, in detail epithelium is columnar epithelium with cilia columnar epithelium with cilia. So, these are columnar epithelium with cilia right and to note is there is no glands it does not have glands tubal epithelium does not have glands, but instead it has a specialized cell these are known as the peg cell. Why there is no glands? Because glandular secretions are thick secretions and if the tubal fluid becomes thick then there is chance of tubal blockade which will cause you know infertility which will it will prevent the transfer of ovum and it will prevent infertility resulting in infertility, but these peg cells they secrete watery secretions and they are present in between the columnar cells. Another thing is the cilia the cilia is very important and the ciliary movement is also important.

So, the ovum will be transferred into the tubes and the sperm they will fertilize to form the embryo and this embryo will be transferred to the uterine cavity it will be transferred to the uterine cavity for implantation. This transfer is it requires the ciliary movement towards the ostea towards the uterine ostea. This ciliary movement should be towards the uterine ostea for the transport of the embryo from the ampulla to the uterine cavity and we have already noted that there is no submucosal layer. So, what is the disadvantage? No submucosal layer, no submucosal glands and no lymphocytes, no immune cells, no neutrophils which are mostly present in the submucous layer thereby the immune response is low and in case of any infection this tubes are more prone to be damaged in PID it causes most commonly salpingitis. This is a laparoscopic picture where we see that the tubes these are the tubes this is inflamed, this is has swollen up and this is a diagnosis of salpingitis.

See these are the adhesions you know peritubal adhesions due to the infection this will result in decreased tubal motility resulting in more chance of ectopic and also the adhesions will cause tubal blockade leading to infertility. So, what we were talking about the watery secretion of the peg cells. So, this watery secretion of the tubal fluid it is important because it contains pyruvate or glucose which maintains the nutrition of the gametes as well as the developing embryo. Next the muscle layer or the muscularis layer it contains the outer longitudinal and inner circular smooth muscle and the serosal layer which is nothing, but the peritoneal covering of the tubes. A short discussion on tubal sterilization.

Nowadays the method used for tubal sterilization is modified Pomeroy's technique where we cut a loop of the isthmus part of the tube approximately 1.5 centimeter of the isthmus is cut and ligated and we can see that after this this is the end result of tubal ligation where it has 2 ends of the isthmus and they are similar in diameter right. So, this is the end result of tubal sterilization why the isthmus part is mostly you know cut because when there is need for recanalization if there is need for recanalization then we need to again suture these 2 ends and as these 2 ends are same in diameter we have noted we have learned that the diameter of the tube is not uniform throughout, but the if the 2 ends which are the remnant following tubal ligation if these 2 ends are same in diameter when we you know anastomose these 2 ends if they are same in diameter then this anastomosis is the best. So, the best prognosis after recanalization operation is in case of isthmo isthmic recanalization. So, chance of successful recanalization is best in case of isthmo isthmic recanalization because you know the anastomosis is more physiological and it is more easy and thereby it will maintain the potency of the tube.

Lastly the ostia fallopian tube has 2 ostea number 1 this is the uterine ostea and this uterine ostea is important clinically because it has a diameter of approximately 1 millimeter. So, in case of you know hysteroscopy where we introduce a probe through the vagina this hysteroscopy will look into the endometrial cavity any pathology any t polyps you know any growth and then it will see the tubal ostia on lateral wall of the uterus. And in case there is block or if we need to pass this you know tube or cannula within the fallopian tube it should be less than 1 millimeter mostly it is 0.7 millimeter or 0.8 millimeter cannula are used for falloscopy to note the inner lining of the tubes you know or it can be to dislodge any tubal block.

And another opening is the abdominal ostia which is through the fimbria. This is the abdominal opening it is opening into the peritoneal cavity. Now, the next part we have discussed the tubes now we will be discussing on the anatomy of the ovaries concepts covered are what are the parts of the ovary what are the ligaments of the ovary and a detailed structure of the ovaries keywords being parts of ovary ligaments of ovary and contents of cortex and medulla of ovary. So, coming to the anatomy we can see from this picture that there are 2 pearly white structures bilaterally these are the 2 ovaries it is you know almond shaped typically called as almond shaped pearly white structure and they are on both sides of the uterus right. Now, what is to note is this ovary is attached to the uterus by a ligament this ligament is called as the ovarian ligament or the ligament of ovary. Another ligament will be attached to the ovary with the lateral pelvic wall this is the lateral pelvic wall right.

So, this ligament will be attaching the ovary to the lateral pelvic wall attaching the ovary to the lateral pelvic wall this is called as the suspensory ligament or the IP ligament or the infundibulopelvic ligament. Why it is important because the blood vessels the ovarian vessels will be passing through this ligament and will be reaching the ovary to supply the ovary right. So, this ligament is vascular it contains the ovarian ligament which is a direct branch of the

abdominal aorta and during hysterectomy with oophorectomy we place a clamp on this ligament and it should be doubly secured. So, that the ovarian ligaments are ligated properly right. In case we keep the ovaries in situ we have to place the clamp on the ovarian ligament because we need to keep the IP ligament and the ovarian vessels patent for the supply of ovary if the ovaries are kept in situ right ok.

Another thing to note from here this is the broad ligament this is the broad ligament these are the two layers of the broad ligament this is the posterior layer which we are seeing this is the posterior layer and anteriorly there is another layer. So, these are two layers of the broad ligament anterior and posterior. The posterior layer of the broad ligament which covers the ovary this part is called as the mesovarium and the part of the broad ligament which covers the tube this part is known as the mesosalpinx. These are only names given to the different parts of the broad ligament to the layers of the broad ligament depending upon the structure it is covering when it covers the tube it is mesosalpinx when it covers the ovary it is mesovarium when it covers you know the uterus to the lateral wall this part is known as mesometrium. So, these are the names given to you know parts of the broad ligament depending upon its position ok.

So, we have discussed the ligaments of the ovary and rest the parts of the ovary it is two parts ovarian cortex which is outside and the ovarian medulla which is inside we will look into it in the next slides. So, coming to the size of the ovary yes the size of the ovary is 3 into 2 into 1 centimeters 3 into 2 into 1 inches is the size of uterus right and 3 into 1 2 into 1 this is the length this is the breadth this is the thickness this is size of the ovary which volume coming approximately 6 to 7 cc. If it is increased in case of polycystic ovarian disease the volume of the ovaries are increased they can be as big as 20 cc then we term it as polycystic ovarian syndrome. Location of the ovary they are present in the lateral pelvic wall and it is known as the fossa of wall dare right. Descent regarding the descent of ovary it is interesting the ovary is descending from above it will it is descending from above you know this is the lateral pelvic wall and this is the ovary.

So, the ovary was descending from above by the pull of gubernaculum this is called as gubernaculum, but its descent gets arrested its descent gets arrested because of the attachment of the gubernaculum to the lateral wall of the uterus. Due to the attachment of the gubernaculum this was getting a descending from above and in the lateral pelvic wall this is at this level the descent gets arrested because this gubernaculum which was causing the ovarian descent it gets attached to the lateral angle of the uterus and it is divided into 2 parts now. This is called the ovarian ligament and below it is called as the round ligament. So, these 2 are parts of the gubernaculum and as they are attached to the lateral angle for the descent of the ovary is hampered and ovary remains in the lateral pelvic wall. Coming to the structure of the ovary it is composed of number 1 cortex and number 2 medulla.

We can see from this picture that the cortex contains various ovarian follicles. Follicles in different stages of development starting from the primordial follicle it there are there are primary follicles then the antral follicles you know this is the mature graphian follicle and this graphian follicle ruptures to release the ovum right during ovulation. Following ovulation it forms corpus luteum and ultimately the corpus luteum will get atretic by autolysis forming the corpus albicans. All these follicles in their various stages of development remain in the ovarian cortex and it also has the epithelium of the cortex on the outer lining of the epithelium which is the cuboidal epithelium right. So, whole of that is surrounded by the epithelium this is the cortex and the medulla.

So, these are containing the follicles ovarian follicles and the medulla contains this is the medulla. So, this part is the medulla it will be containing the neurovascular bundle nerves as well as the vessels ovarian artery, ovarian vein these vessels as well as the nerves will be present in the ovarian medulla ok. Now, coming to the lymphatic drainage of the female external as well as the internal genitalia. So, we will go to the lymphatic drainage of the female external genitalia.

So, this is the uterus, the cervix and the vagina. So, coming to it this is the fundus right. Fundus will be directly draining into the para aortic lymph nodes para aortic lymph nodes. This is the abdominal aorta these are the para aortic lymph nodes dividing into the common iliac artery which divides into the internal iliac and the external iliac. So, these are the para aortic lymph nodes and the fundus directly drains into the para aortic lymph nodes. Rest this uterus and the upper two-third of vagina these have same lymphatic drainage and in between I will draw this the cervix right.

So, the cervix first will drain into the obturator lymph nodes. First lymph nodes to drain the cervix is obturator lymph nodes they are nothing, but the pelvic lymph nodes it will then ultimately drain into the internal iliac lymph nodes then the common iliac lymph nodes and ultimately into the para aortic lymph nodes. And the rest part the uterus the upper two-third of the vagina they will be draining into the pelvic lymph nodes. Pelvic lymph nodes means there are many there are the parametrial lymph nodes here right. So, these will drain into the pelvic lymph nodes which will gradually follow the same course draining into the internal iliac then the common iliac and ultimately into the para aortic lymph nodes.

But to note is the cornu cornu of the uterus and medial part of the tubes this part is you know draining its lymphatics into the round ligament this is the round ligament. So, the round ligament of the uterus will attach the lateral angle of the uterus to the labia majora anterior end of labia majora. So, we know that labia majora drains into the superficial this drains into the superficial inguinal lymph nodes right, that will drain into the deep inguinal lymph nodes right.

And from the deep inguinal lymph nodes it will go into the external iliac it will go into the external iliac lymph nodes, it will go into the internal iliac lymph nodes, then to the common iliac and ultimately to the para-aortic lymph nodes. So, the cornu and the medial part of the fallopian tube will be draining into the superficial group of inguinal lymph nodes and the rest tubes and ovary will be draining into the para-aortic lymph nodes.

External genitalia just for recapitulation mostly external genitalia drains into the superficial inguinal lymph nodes, but this clitoris clitoris and the your clitoris and your bartholin gland these two will drain directly into the pelvic lymph nodes. These are have a separate lymphatic drainage you know root that is directly into the pelvic lymph nodes ok. So, now coming to the questions. So, identify the structure marked with an arrow. First see this is a laparoscopic feature where this is the uterus, this is the uterus ok.

We identify anteriorly the bladder, posteriorly this is the pouch of douglas and this is the rectum with the pre rectal pad of fat. Now we can see the ovary right ovary. So, to identify the structures at the cornu we have told from anterior to posterior they are the round ligament anteriorly, then the tubes and posteriorly is the ovary and ligament. On the left side you see there is no ovary. So, ovary has been excised the tubes are identified by the fimbrial end on the right side we can very well see, but on the left side there are no fimbrial end.

So, that means, that patient has undergone left sided salpingo oophorectomy. So, we have to be very cautious and have to identify the round ligament first which is not very well appreciated in this picture, but by manipulation of the uterus we can see the round ligament anteriorly it is passing. So, this is the medial end of the tube the cut end the medial cut end of the tube after left sided salpingo oophorectomy. So, the identify the structure this is the fallopian tube medial end. Longest part of the tube yes we know it is the ampulla 5 centimeter.

Most common cause of bilateral fimbrial pair this is a histo salpingography HSG picture which is done in case of infertile woman to assess the tubal factor right. So, we see that there is no spillage of dye on both sides there is bilateral cornual block or fimbrial block why the most common cause is physiological spasm due to the deities and foreign object and the muscles of the tube are become spasmodic and this prevents the spillage of the tube. So, after application of antispasmodics the spasm goes away and there is spillage of the tubes on both sides. So, most common cause being physiological spasm we need to wait we need to again take serial HSG plates following administration of antispasmodics. Another thing is infections of PID can also cause fimbrial block TB causes mostly no proximal tubal block proximal tubal block whereas, chlamydia causes distal tubal block.

So, PID is notorious for salpingitis and it has to be treated early. Ovary is attached to the posterior layer of broad ligament by mesovarium right has hilus cells in the cortex this is wrong

because hilus cells are in the medulla. Ovary and vein drains into the inferior vena cava, but it drains into the inferior vena cava on the right side right on the right side. On the left side it drains into the inferior vena cava in the left side it drains into the left renal vein and lastly is connected to the uterus by the IP ligament no it is connected by the ovarian ligament. So, answer is A. Maximum number of mucosal folds, mucosal folds are of the fallopian tube they gradually increase as we go laterally.

So, maximum number will be present in the infundibulum. Contents of the broad ligament are all except ovarian vessels in the infundibulo IP ligament yes fallopian tube in its upper part yes, ovarian ligament in its anterior fold and gartner's duct. So, these three are correct, but ovarian ligament yes, but it is in the posterior fold of the broad ligament this is the wrong statement. Peg cells yes we have discussed peg cells are seen in fallopian tubes. Ovarian pathology is referred to the medial part of thigh this is important clinically because in the ovarian fossa this is the lateral pelvic wall and this is you know the uterus. In the ovarian fossa nerve comes in relation to the lateral ovarian fossa this is the obturator nerve and this nerve supplies the medial part of thigh and so, any pathology of the ovary will compress this nerve and this nerve will be sensitized it will carry the sensation to the medial part of thigh.

So, pain in the medial part of thigh occurs in case of adnexal SOL. Another important structure in the posterior ovarian fossa is you know coming in relation to the posterior ovarian fossa this is the ureter. Cortex of ovary consists of all of the following except cortex contains follicles, hilus cells are present in the medulla which is true regarding ovary. Mesovarium contains ovarian vessels mesovarium no mesovarium no ovarian vessels are present in the IP ligament. So, this is false ovarian ligament connects ovary to the uterus yes. Ovarian fossa is related to the ilioinguinal nerve no it is related to the obturator nerve.

Suspensory ligament of ovary connects ovary to the uterus no it connects ovary to the lateral pelvic wall. So, the correct statement will be B.

Ok. So, this is the end references has been taken from D.C. Dutta, Gray's anatomy, Novak's gynaecology and Williams's gynecology. So, thank you all for your patient hearing.