

**Course Name :An Overview on Maternal Health Antenatal, Intranatal and Postnatal Care**

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### **Anatomy of Uterus**

Welcome students. Welcome to yet another class on the NPTEL certified online course on the topic an overview on maternal health, the antenatal, intranatal and postnatal care. Myself Dr. Barnali Ghosh a practicing obstetrician and gynecologist working at B.C. Roy Medical College and Research Center IIT Kharagpur. In the previous class we discussed the anatomy of cervix, today the class will be on the anatomy of uterus. So, the concepts to be covered on today's class are the anatomy of uterus, its dimensions, the layers of the uterus, blood supply, anti flexion and anteversion, ligaments of uterus and the topographic anatomy of uterus as a whole.

In the end we will discuss some of the MCQs. Key words are as follows female internal genitalia, uterus, blood supply of uterus, anti-version and deflection, ligaments of uterus. So, coming to the anatomy, uterus is actually the extent from the fundus above and isthmus below. So, starting from the fundus it continues up to the isthmus and below it is continued as the cervix, this is the cervical canal.

Now coming to the isthmus, isthmus is actually the part at the lower end of the uterus and this isthmus is bounded above by the anatomical internal os, A for above, above lies the anatomical internal os and below lies the histological internal os. What does that mean? It means that when the uterus it from outside when we look at the uterus it gets constricted to form the cervical canal, this broad pear shaped organ it gets constricted at this end and then it continues at the cervical canal. This is the anatomical internal os which we can appreciate from outside and below is the histological internal os. That means, the endometrial lining of the uterus the epithelium of the endometrium it continues a little further down, it continues a little further down and then after a little below it gets converted to the endometrium of the cervical canal. So, this transition from the endometrial epithelium to endocervical epithelium this point is known as the histological internal os.

That means, the histological internal os is below and this part in between the anatomical internal os and the histological internal os this is known as the isthmus which is actually lined by

endometrial epithelium and that signifies that during menstrual periods this gets shed off as the rest part of the endometrium. Isthmus the length of isthmus is 0.5 centimeter or 5 millimeter. This is a specimen after hysterectomy where we can appreciate that this is the uterus, this is the fundus and from outside we see this constriction which is known as the anatomical internal os and below it is continued as the cervical canal. Cervical canal we have already discussed this will be the attachment of vagina this has not been excised vagina will remain inside the female body only the uterus the tubes and the cervix has been excised outside and as in case of total hysterectomy ovaries have been kept in situ as in this specimen.

So, the cervix this is the attachment of the vagina and the part of the cervix above the vagina this is known as supra vaginal part and the part of the cervix which is below the attachment of vagina is the infra vaginal part this is also called as the ectocervix which we can see and the endo cervix remains inside the cervical canal which is not visible. So, coming to the significance of isthmus, what is the significance of this isthmus? If we draw the structure this is the uterus with the cervix and this is the urinary bladder and the rectum behind here is the vagina. So, the peritoneal covering will be covering the superior surface of the bladder then it folds on to the anterior surface of the uterus the fundus the posterior surface of the uterus the supra vaginal part of the cervix posteriorly the posterior upper part of the vaginal wall and then it goes on to the anterior wall of the rectum right. So, this isthmus lies here. This is the position of the isthmus. This in pre in normal non pregnant state it measures 5 millimeter and it becomes 10 centimeter 5 millimeter becoming 10 centimeter during pregnancy at term. What is the significance of this? This isthmus is actually the part which forms the lower uterine segment in pregnancy this is identified by the loose fold of peritoneum this loose fold of peritoneum this is known as the uterovesical fold of peritoneum this loose fold of peritoneum is the demarcation that isthmus lies below during cesarean section we identify this loose fold of peritoneum and thus we know that the lower uterine segment which is actually formed from the isthmus is below the loose fold of peritoneum and this is the site of incision during LSCS.

We give an incision on the lower uterine segment on the anterior wall of the uterus and this incision has been named under after the scientist Monroe Carr known as Carr incision. There are different types of incision on the skin, Fanelstern incision, modified Fanelstern incision, then Czerny's incision, Melan's incision these are all incisions on the skin after we go we give incision on the rectus sheet we then enter the peritoneum and the incision on the anterior wall of the uterus that is on the lower uterine segment that is the Carr incision and it is you know developing from this isthmus. Coming to the peritoneal reflections which we have already discussed this is the peritoneal lining the parietal peritoneum lining the anterior abdominal wall then it is going reflected on the superior surface of the bladder from the bladder it is reflected to the anterior surface of the uterus. This is the loose fold of peritoneum known as the uterovesical fold and this is the demarcation during cesarean section that below beneath it below this fold is the lower uterine segment. So, in non pregnant state below this fascicular uterovesical fold this

lies the isthmus.

Then the peritoneum covers the fundus covers the posterior surface covers the posterior supravaginal part of cervix it covers the posterior upper part of the vaginal wall anterior vaginal wall does not have any peritoneal covering, but posterior upper part is covered with peritoneum and then the peritoneum is reflected onto the anterior surface of the rectum. This forms the recto uterine pouch this is also called as the pouch of douglas this is important because this is the most dependent part in a female pelvis and any collection in form of blood in form of pus in form of fluid will be first collected in this pouch of douglas right. So, we have discussed the uterovesical fold the loose that is of loose fold of peritoneum below lies the isthmus and it is the site of lower uterine segment cesarean section incision right ok. Now, coming to the dimensions of the uterus. So, I will draw the picture of the uterus.

So, this uterus is a pure shaped organ this is easy to remember 3 into 2 into 1 inches and when you convert it into centimeters you multiply it into 2.5 inch into 2.5 gives you the value in centimeters right. So, 3 that means, it comes out to be 7.5 approximately you need to remember 8, 8 into 5 into 2.

5 centimeters. How it goes? 8 centimeter is the length, length means this full length from the fundus to the external os. This 8 centimeter can be divided into the cervix which is 2.5 centimeters and this is the isthmus which is 0.

5 centimeters. So, from the fundus to the isthmus this length, this length of the uterus is rest 5 centimeter this is 3 centimeter. So, left is 5 centimeter of which the fundus, fundus does not have any cavity this is 1.5 centimeter and the remaining that is the uterine cavity proper this is the length of the uterine cavity, this cavity proper has a length of 3.5 centimeters. So, you can understand the cervical length we have discussed it is 2.

5 centimeter isthmus just now we discussed 0.5 centimeter rest the uterus from the fundus to the isthmus. This uterine length will be 5 8 minus 3 that is 5 centimeter out of which the fundus which does not have any cavity it is solely muscular that thickness is 1.5 centimeter and the cavity proper that length is 3.

5 centimeter. Anterior vaginal wall we know 7 centimeter posterior vaginal wall 9 centimeter. Ovary, ovary dimension ovary is actually a almond shaped structure then this also is easy to remember 3 into 1 into 3 into 2 into 1 centimeter. Uterus 3 into 2 into 1 inches ovary 3 into 2 into 1 centimeter length 3 centimeter, breadth 2 centimeter and thickness is 1 centimeter and the rest remaining is the fallopian tube this fallopian tube length is 10 to 12 centimeter. Coming to the layers of the uterus serosa, serosa is the outermost peritoneal layer covering of the uterus then comes the myometrium. So, this is the peritoneal lining which is known as the serosa.

Next the myometrium the muscle layer and inside is the endometrium that is the epithelial lining, this is the endometrium inside. Discussing about the myometrium, myometrium has 3 layers, the layers of uterine muscles what are they? Outer, inner and intermediate. So, this outer is longitudinal muscle fibers outside the uterus this is the anterior wall, this is the posterior wall the outer layer of uterine muscles they are placed longitudinally and they cover the anterior and posterior wall and in the fundus it forms a hood. So, this longitudinal muscle layer is covering the uterus as a hood innermost layer this is longitudinal coming to the innermost layer this is circular around the cavity inside this is the cavity. So, this is the circular layer and in between is the crisscross muscle layer.

This all these 3 are designed to you know decrease the blood loss from uterus following vaginal delivery when they contract this outer longitudinal will contract like a hood and it will compress a uterine cavity. The inner circular layer allow around the uterine cavity will come and compress the uterine cavity and the crisscross layer in between that is the middle layer of the uterine muscle they have blood vessels in between and when they contract they will compress the blood vessels passing in between them these are the blood vessels and when they contract they will compress the blood vessels and will decrease the bleeding. So, the crisscross layer this is also known as the living ligature ok. So, 3 layers of muscle with the middle layer being the most important called as the living ligature because when it contracts it will compress the blood vessels passing in between endometrial lining of the uterus is stratified sorry not stratified it is columnar columnar epithelium columnar columnar epithelium and in the cervix it is lined by tall or high columnar in the endometrium it is simple columnar epithelium without cilia. Coming to the endometrium this is the endometrial picture this is the lumen and we have the endometrial epithelial lining which is columnar epithelium these are the glands the various glands of the endometrium different types of glands and this is the stroma.

This endometrial thick total can be divided into two parts stratum basally and stratum functionally right stratum functionally. During menstruation the stratum functionally is shed off, but the stratum basally remains and this is responsible for regeneration of the endometrium following menses. The functional layer of the endometrium can be divided again into two parts upper part is known as stratum spongiosum and below is the stratum compactum this two together form the stratum functionally. These are the blood supply these are the spiral arteries these are end arteries which supply the functional layer of endometrium this is the functional layer of the endometrium which is shed during menstruation and this is the basal layer this is supplied by basal arteries this is supplied by the basal arteries. We will come to the blood supply later in the class.

Endometriosis a short note like the glands and the stroma which we have already discussed these are present within the endometrium when they are present outside the endometrium it is

known as endometriosis. This is a very common with day to day with increasing time we are seeing this endometriosis becoming more prevalent among the reproductive age group females. This means that the glands and stroma are present outside the endometrium at an ectopic site and they are responsive to the hormones estrogen and progesterone of a female body. Thus during menstruation they also bleed at ectopic sites it can be in the intestine it can be in the pouch of Douglas it can be on the ovary it can be even in the lungs or in the nasal mucosa presenting as epistaxis during menstrual cycles. So, it can be present anywhere in the body except three places brain, bone and spleen right and glands and stroma when they are present in the myometrium glands and stroma are present in the endometrium, but when these glands are present in the myometrium this is known as adenomyosis ok.

Now, coming to the blood supply blood supply of the uterus most important artery is the uterine artery ok. So, this uterine artery this is the uterine artery which is traversing at the lateral border of the uterus it will be traversing along the lateral border of the uterus. This is a branch of the internal iliac artery anterior division of the internal iliac artery branch is uterine artery and below is vaginal artery which occasionally can be a branch of uterine artery or the anterior division of the internal iliac artery and it will be supplying the vaginal angle and the lower part of the vagina. So, this uterine artery this uterine artery traverses along the lateral border of the uterus and it gives branches thereby supplying the whole muscle of the uterus from the lateral side the supply is coming towards the middle right. So, the lateral wall are most vascular highly vascular are the lateral wall whereas, the middle part of the uterus this middle part this is the middle part of the uterus this is other side this is the other side.

So, middle part of the uterus is least vascular lateral wall is highly vascular any tear any extension of that tear during caesarean section in the lateral wall is a cause of concern because it will cause more bleeding whereas, middle portion of the uterus is least vascular ok. So, and coming to the ovarian artery, ovarian artery is a direct branch of the aorta and this ovarian artery passing through the IP ligament or the suspensory ligament of the ovary it will give supply to the ovary and then traverse through the mesosalpings and mesovarium where it will anastomose with the uterine artery. So, uterine artery coming from the lateral and ovarian artery these will anastomose in this layers of the broad ligament. So, this is the blood supply we see that the uterine artery it gives branches it gives branches like this is if we can see this is the uterine cavity and the uterine artery is passing through the lateral wall of the uterus this is the muscle layer of the uterus. Uterine artery first will give branch the arcuate artery right then the radial artery.

So, this is the arcuate artery, this is the radial artery and from the radial artery again there will be branches supplying the endometrium from the radial artery there will be basal artery and the spiral artery. So, A R B S uterine artery giving to arcuate artery which branches on this is the anterior part and this is the posterior part. This uterine artery will be branching into

anterior and posterior branches called as the radial artery and these radial artery along its course will be giving branches to basal and spiral artery. Basal artery supplies the basal layer of the endometrium this basal artery will be supplying the basal layer of the endometrium and the spiral artery will be supplying the functional layer of the endometrium. So, from here we can also deduct that the middle portion of the uterus is least vascular, middle portion is least vascular, lateral portion where the blood supply comes these are most vascular.

Next anti flexion and anteversion. So, what is anteversion? Anteversion is actually the angle between the vagina and the cervix. This is the angle of version, this is the vaginal axis and this is the cervical canal. So, this angle is the angle of version and this is 90 degree in normal females whereas, there is also an angle between the uterus uterine axis and the cervical canal. This angle is the angle of anteflexion. It varies you know different books have different degrees given 120 degree some books I have given and some 125.

So, 120 to 125 degree is the angle of flexion. So, in normal cases the uterus is anteverted and anteflexed this is vagina, this in standing position the vagina is straight vertical and the cervix is at 90 degree. This is the angle of version and the uterus is at an angle of 120 degree with the cervix this is the angle of flexion. This is the position in a standing female this is normally anteverted and anteflexed. In this next picture we can appreciate this is the vagina and this angle is the angle of anteversion and this is the angle between the cervical canal and the uterine axis this angle is the angle of anteflexion.

So, the uterus will drop on the superior surface of the bladder right. In some cases we see that the uterus is retroverted, that means, that the uterus has gone behind instead of going forward it is going behind. So, this vagina the cervix is going behind and the uterus will fall below like this posteriorly here this is here this the sacrum. So, this is called retroverted and retroflexed uterus.

This is the sacrum. So, the uterus is impinging on the sacrum on the sacral hollow. During pregnancy in non-pregnant state if it is retroverted nothing to worry during pregnancy the uterus itself slowly becomes a abdominal organ from the second trimester and this retroversion gets automatically corrected. So, that also then also nothing to worry, but if it is fixed it can be mobile or fixed. If it is fixed that is it is fixed to the surrounding structures fixed due to adhesions in case of infection PID or endometriosis. Then during pregnancy when the uterus grows as it is fixed the uterus cannot automatically revert back to its normal position it remains fixed in the retroverted position and it grows it grows and grows and it gets impacted in the sacral hollow.

There it is known as incarcerated uterus and ultimately it will result in miscarriage. So, fixed retroverted uterus is a cause of miscarriage right. Next coming to the corpus to cervix ratio the corpus to cervix ratio before puberty the corpus to cervix ratio is like this that means, corpus 1 is

to 2 cervix is longer. After puberty may not be this much right after puberty the uterus enlarges and cervix is decreased it gets reversed corpus to cervix ratio becomes 2 is to 1 and during the reproductive years the uterus will enlarge and it may become 3 is to 1 or 4 is to 1 ok. Coming to the pregnancy changes the pregnancy changes from non pregnant state to pregnant state at turn pregnant state at turn what it becomes isthmus.

Isthmus we have already discussed it is 0.5 centimeter or 5 millimeter becoming 10 centimeter which forms the lower uterine segment. Weight of the uterus in non pregnant state is approximately 60 to 80 grams it becomes 1000 grams at turn right. Length of the uterus length we have already just now discussed it is total 8 centimeter in non pregnant state it becomes 36 centimeter at pregnant state at turn that is up to the xiphisternum from the symphysis pubis to the xiphisternum comes out to be 36 centimeter. Blood flow to the uterus it becomes 50 ml per minute in non pregnant state whereas, in pregnant state there is more blood flow to the uterus becoming 750 ml per minute. Coming to the ligaments of uterus ligaments of uterus there are different ligaments.

Firstly the broad ligament which is the peritoneal covering covering the posterior and the anterior layers of the uterus. This broad ligament is a two layer this is the posterior layer and this is the anterior layer. Two layer of peritoneum covering the uterus and then this is attached to the lateral pelvic wall right. So, this is the broad ligament this is a loose fold of peritoneum and it contains blood vessels, it contains lymphatics, it contains the round ligament, it contains the ovarian ligament, but it does not give support to the uterus as such. What are the supports of the uterus? I will draw a picture for you.

So, this is the uterus, this is the lateral pelvic wall, this is the ischial spine, ischial spine is at the level of external oss. So, what are the ligaments? First coming to the ovarian ligament, ovarian ligament is the ligament which joins the ovary with the uterus this is the ovarian ligament number 1. Number 2 is the IP ligament, this joins the ovary to the lateral pelvic wall. IP ligament is also known as the infundibulopelvic ligament or the suspensory ligament of ovary. It contains the ovarian vessels that is the ovarian artery and the ovarian vein which are coming from the abdominal aorta they will pass through this ligament to supply the ovary.

Broad ligament I have already discussed this is the broad ligament, this is the fold of peritoneum which is covering the uterus on both sides and up to the lateral pelvic wall. And the most important ligament is the McEnrods ligament, this is the McEnrods ligament, this is the most important ligament it is very thick, very strong and the most important one preventing prolapse helping to keep the uterus, the vagina, the cervix in position this is the McEnrods ligament. It attaches the cervix and also the apex of the vagina to the lateral pelvic wall this is also known as the cardinal ligament which means the most important ligament. It is also known as the transverse cervical ligament because it connects the cervix transversely to the lateral

pelvic wall it is also known as the Bony's ligament right. And lastly is the round ligament, round ligament is actually connecting the cornu.

The cornu of the this is there is two bilateral on both sides is the round ligament it passes laterally and then traverses through the deep inguinal ring comes out through the superficial inguinal ring and is attached to the labia majora anterior part right. So, this is the round ligament. A little bit of discussion on the round ligament, round ligament is the anterior most structure. So, at the cornu there are three structures one is the round ligament, then is the tubes and behind is the IP ligament which connects the ovary. So, from anterior to posterior RTO round ligament, then the fallopian tubes, then the ovarian ligament.

So, round ligament is the anterior most structure at the cornu. It is approximately 10 to 12 centimeter in length and this is attached to the labia majora. It is comparable to the gubernaculum of testis, it is mainly composed of smooth muscle cells, it is a part of the inguinal canal and its blood supply is from the uterine artery. This is the cervix vagina and here is the uterine artery and this uterine artery traverses along the lateral wall of the uterus this gives branches called as the samson's artery which supplies the round ligament. This is important during ligation of the round ligament during hysterectomy we need to carefully tie this artery or there can be chance of hemorrhage and it can carry lymphatics from the cornu to the superficial inguinal ring because it is attached to the anterior labia majora anterior part of labia majora and labia majora will be draining to superficial inguinal lymph nodes.

So, also the round ligament carries lymphatics to superficial inguinal lymph nodes. Coming to triradiate cartilage of the cervix, now the cervix supports of the cervix supports of the cervix this is the cervix and this is the ischial spine, this is the pubic symphysis anterior and the sacrum posterior. Number 1 support is the macandross which is traversing transversely from the lateral borders of the cervix to the ischial spine to the lateral pelvic wall this is the macandross ligament or the cardinal ligament. In front is the pubocervical ligament this is pubocervical ligament and behind is the utero sacral ligament. So, this is the triradiate ligament of the cervix laterally is the cardinal ligament anteriorly pubocervical and behind is the utero sacral ligament.

Utero sacral ligament will have a pull on the cervix posteriorly and this helps to maintain the anteversion and anteflexion of the uterus. This is a schematic diagram we can note from here this is the fundus this is a laparoscopic view when we give I mean have that port inside the abdomen we will see the pelvis like this. This is the fundus of the uterus this anteriorly from the cornu from the cornu this is the cornu of the uterus and this is anterior this is posterior. So, anteriorly RTO RTO this is the round ligament which is going anteriorly and laterally to you know end gain entry into the deep inguinal link. So, this is round ligament then is the tubes these are the tubes that is depicted by the femoral end.



So, this is the tubes and behind is the ovarian ligament right and behind this is the two ligament which will attach the cervix to the sacrum this is the utero sacral ligament. This is the pearly white structure this is the ovary this is the IP ligament or the infundibulopelvic ligament that is connecting the ovary to the lateral pelvic wall and this is the tubes. Tubes means the femoral end which will be diagnosing that these are the tubes right. These are again laparoscopic views in various ligaments this is the utero sacral we can very well see this is the uterus and we will go from anterior to behind this is the ovary. So, this is the ovarian ligament this is the tubes we have to detect it from the femoral end and somewhere in anterior will be the round ligament.

Here we can clearly see the round ligament going anteriorly these are the tubes and this is the ovarian ligament. This is the pouch of Douglas this is the bladder. Here also picture is more clear this is the ovarian ligament this is the anteriorly round ligament these are the two tubes and behind this is the utero sacral ligament going behind ok. Now coming to the topographic anatomy we can just go through this key this is uterus the uterus and the cervix with the ovary right. Now where to give the clamps during hysterectomy which I need to tell you if the ovaries are kept if the ovaries are kept then where to give the clamp and if ovaries are not kept then where to give the clamp.

So, if ovaries are kept we give the clamp on the IP ligament right this is ovary and it is attached to the lateral pelvic wall on the IP ligament we give the clamp here and if the ovaries are preserved then we give the clamp on the ovarian ligament. That is the difference ok. So, coming to the MCQs quickly go through them angle of ante flexion. Anti flexion is at the level of internal os between the cervix and the uterus. Next ligament carrying the ovarian artery I have just now told suspensory ligament of the ovary or the IP ligament.

Most common lymph node in involved in case of CA cervix. CA cervix cervical lymph node mostly they are draining into the parametrium parametrial lymph nodes that is the obturator lymph node this is the most common lymph node in involved in uterine cervical CA. Uterine artery is a branch of anterior division of internal iliac artery. All are supports of uterus except broad ligament. Broad ligament is only a fold of peritoneum it does not give support to the uterus which ligament maintains anteversion and ante flexion it is utero sacral which gives a pull on the cervix behind thereby causing the uterus to fall forward maintaining the angles of anteversion and ante flexion.

Falls regarding the anatomy of cervix. Cervix is 2 times longer in children than uterus. Cervix is equal in size to uterus in puberty fundus of uterus drains into the para aortic lymph nodes uterine artery is lateral to cervix and passes anterior to the ureter. So, all is correct except B in puberty the corpus is to cervical ratio is 2 is to 1. So, cervix is half in size of the uterus this is the fall statement. Following lymph nodes receive lymphatics from uterus except so that means, uterus it goes to the pelvic lymph nodes these are all pelvic lymph nodes the fundus the cornu

from the cornu the line round ligament will carry lymphatics to the superficial inguinal nodes the remaining is the deep inguinal node which will be the answer it does not drain the uterus.

Next is lymphatic drainage of cervix is by all lymph nodes except cervix also same parametrial lymph nodes yes obturator lymph nodes yes external islet lymph nodes yes deep inguinal lymph nodes it does not drain the cervix this will be the answer. So, references are from DC Dutta, Gray's Anatomy, Novak's Gynecology and William's Gynecology. Thank you all for your patient hearing.