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

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Umbilical cord and Fetal membranes (Part – 2)

Hello students. I welcome you to the NPTEL online 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 assistant professor at B.C.Roy Medical College and Research Center, IIT Kharagpur. In today's class, we will be continuing the previous discussion that is umbilical cord and the fetal membranes. In this class, we are going to discuss regarding the single umbilical artery.

So, we have already read that the umbilical cord contains two umbilical arteries and one umbilical vein, right. So, this is normal, but there are instances where there can be a single umbilical artery, right. So, this is the single umbilical artery. So, this is a cause of concern when we see a single umbilical artery in our ultrasound scan done antenatally, you know that is not an insignificant finding.

It is a cause of concern and the female or the mother needs to be evaluated very closely to exclude other complications associated with single umbilical artery. Coming to the incidence, incidence is 0.521 percent, right and this increases to 5 percent in twins. So, incidence in singleton pregnancy is 0.521 percent and in twins it increases to 5 percent, right.

So, single umbilical artery is more common, yes we have read just now, it is more common in twin pregnancy if the mother is a smoker in case of increased maternal age. If mother is a patient of diabetes mellitus or is having hypertension or has a history of seizure disorder and also it is common in European females. Now, coming to the USG scan of a normal umbilical artery, here you can see that this is the C is cord, this is the cord and within the cord there is one umbilical vein and two umbilical arteries, these are the two umbilical arteries, right. So, this cross section when we see on the ultrasound this is normal and you know this picture reminds us of Mickey Mouse. So, this is also called as the Mickey Mouse sign, right and another thing to note that this can be appreciated from 16 weeks of gestation.

We have already read about it, the 4 vessel cord converts to the 3 vessel cord from 16 weeks of

gestation. Now, the scan of a single umbilical artery, here you see this is a single umbilical artery and this is the umbilical vein, right in the cross section of the umbilical cord and this is known as soda can tab sign, that is this is the opener of a soda can. So, this is the vein and this is the artery. So, this sign is called as soda can tab sign. Now coming to the types of single umbilical artery, there are different types type 1, type 2, type 3 and type 4 of which type 1 is the most important.

It is the most common and present in 98 percent cases of single umbilical artery, where the single umbilical artery is of allantoic origin, right. And why it is not insignificant? I have been stressing you know we need to evaluate the patient, why? Because it is associated with 20 to 25 percent cases of congenital anomalies. So, one-fifth cases will be having or will be associated with congenital anomaly of the fetus, right. So, we need to look into the congenital anomalies. What are the most common anomalies? Number 1 is the genitourinary anomalies that is the renal anomalies and next common is the CVS anomaly, right.

And it is also associated with increase in perinatal mortality, there is increase in intrauterine growth retardation and preterm labour, why? Because single umbilical artery there is more chance of compression which will cause you know less blood supply to the fetus and there will be fetal hypoxia. So, growth retardation explained. Why preterm labour? Due to fetal hypoxia the fetus is always in stress and due to this fetal stress there will be premature activation of the fetal hypothalamo adrenal axis. What will happen for that? There will be release of fetal corticosteroids which will cause you know premature activation of the labour process and will lead to preterm labour, right. So, this is type 1.

Type 2 is in less percentage of cases only 1.5 percent cases and here the single umbilical artery is white line in origin and the anomalies associated with type 2 are caudal regression syndrome and syringomyelia, right. Now coming to the evaluation, when we see a single umbilical artery in a ultrasound scan of a patient we need to be very cautious and we need to evaluate further how we will then go to level 2 scan or anomaly scan, right. Why to rule out congenital anomalies of which most common is the renal anomalies, right. So, we need to look into the anomalies of the fetus.

Say there are presence of anomalies, the anomalies are present. Now the risk of aneuploidy, fetal aneuploidy it increases and for that we need to go for karyotyping, right. So, if there is presence of any fetal congenital anomalies it you know it will we will we need to suspect that there may be associated fetal aneuploidy. We know the zygote normally is deployed and the fetus is deployed. In case of fetal aneuploidies know there is this scenario with single umbilical artery.

So, fetal aneuploidy need to be evaluated by karyotyping and the most common aneuploidy

associated is trisomy 18 or Edwards syndrome, right. And say if there is no presence of congenital anomaly they are absent in the scan we cannot you know find any anomalies. So, only it is a case of you know isolated single umbilical artery then there is no need to go for karyotyping, right. Isolated single umbilical artery is associated with preterm labor we have learned why because it is associated with fetal stress thereby causing release of fetal corticosteroids releasing in premature activation of labor process and it can also lead to intrauterine growth retardation. So, that was the discussion regarding the single umbilical artery, right.

Now coming to cord prolapse. Cord prolapse is a obstetrical emergency very very important topic and if there is a case of cord prolapse everybody starting from the obstetrician everybody in the labor room the nursing staff the OT staff the anesthetist the pediatrician all should be at their toes because it is a emergency we need to intervene as early as possible to save the fetus. The fetus is in jeopardy. Incidence of cord prolapse is 1 in 200 cases that is 0.5 percent though incidence is less, but it is an emergency and if we face such a situation we need to you know inform everyone around us regarding the diagnosis of cord prolapse, right.

And this cord prolapse incidence it is a 0.5 percent in breach presentation. In breach presentation the incidence increases to 1 percent, right. So, in fetal malpresentation the cord prolapse incidence increases. Now the cord prolapse can be of two types, overt cord prolapse and occult cord prolapse.

These are you know the diagnosis during the process of labor or after the onset of labor it is a intranatal diagnosis, right. So, the membranes have already ruptured. When the membranes have ruptured and the cord is seen below the presenting part the cord is seen below and it is coming out of the internal of it is you know coming out through the vagina and can be seen outside the vagina in the external environment then it is called as overt cord prolapse. So, there are many cases where the cord is not seen below the presenting part and it is not felt by per vaginal examination, but it is present beside the presenting part that is a case of occult cord prolapse. So, in occult cord prolapse we cannot diagnose it clinically from outside because we cannot see the cord, but it can be diagnosed by you know intranatal USG.

So, let us say during the process of labor there is fetal distress and we are suspecting a case of cord compression, right. So, we go for a you know immediate USG and in the ultrasound we can see the cord which has prolapsed and gone below the presenting part, but it is still above the internal oss inside the uterus. So, it can be detected by a USG scan and sometimes it is detected intra you know in the OT. During caesarean section, during caesarean section in the OT the patient was having fetal distress and the mother has been taken to caesarean to the OT for caesarean section to deliver the baby and after we enter into the uterus we can look into the uterus and we see that the cord is below the presenting part that is a case of occult cord prolapse,

right. So, this is the picture, this is a case of occult cord prolapse where the cord is by the side of the presenting part, but it has not gone below the internal oss, right, but the membranes have ruptured, membranes have ruptured, there is rupture of membranes, but the cord is still above.

This is a case of occult prolapse and when the cord comes down through the internal oss it comes down into the vagina or outside the vagina in the external environment it is a case of overt cord prolapse, right. Both these conditions will be resulting in fetal distress. How in case of occult cord prolapse there will be compression of the cord by the fetal head or the fetal parts and that will cause you know compression of the blood vessels causing decrease in blood supply to the fetus leading to fetal distress. In case of overt cord prolapse where the cord is outside the vagina in the external environment which is colder, where temperature is less and there the fetal blood vessels inside the cord will undergo vasospasm thereby also decreasing the fetal circulation and resulting in fetal distress, right. Now another thing is cord presentation.

So what is cord presentation? I will tell it here only. This is an antenatal diagnosis, right. The membranes have still not ruptured. Membranes are intact, right. So the cord has come down the fetal presenting part.

The cord is below the fetal parts and it is overlying the internal os. This is the internal os, this is the cord and it is overlying the internal os but it is present above the membranes, right. So during the parvaginal examination when we go for per vaginal examination we will feel the cord above the membranes and sometimes we can also feel the cord pulsation. So this is a case of cord presentation and if diagnosed, you know, if diagnosed to be a case of cord presentation we should go for caesarean section because during the process of labor there will be cord compression and there will be more chances of fetal distress and fetal death during the process of labor. So better to go for caesarean section.

Now coming to the cause of cord prolapse. So why cord prolapse occurs? Because there may be, you know, sometimes before engagement of the fetal head or before engagement of the presenting part there can be rupture of membranes known as high rupture of membranes and in that case, you know, the lower uterine segment is still empty. It does not have the presenting part. The presenting part is high above and the cord by the side of the fetus will come down and may come in the lower pole of the uterus and it may sometimes so happen that it will come out of the internal os and into the vagina. So ultimately leading to cord prolapse, right.

Sometimes what happens, you know, these are the pictures where these are the pictures of cord prolapse. See here the fetus is in transverse lie. What is transverse lie? When the fetal spine is at right angles to the uterus, the longitudinal axis of the uterus, when it is in alignment with the fetal spine, this is called as the longitudinal lie and when the fetus is in this position at right angles to the uterine axis, then it is called as transverse lie and in this case, you can also see that

this the lower uterine segment, this is empty, there is no fetal parts and the cord may come down into the lower uterine segment and following rupture of membranes, it can come out through the internal os along with the amniotic fluid and will result in cord prolapse. Cord prolapse here, yes, it can occur in bridge presentation.

So this is a irregular part. This is the lower uterine segment with the irregular part. That means the whole of the lower uterine segment is not covered. Bridge is a irregular part. There are some spaces empty and through those empty spaces, the cord can come down and there will be, you know, a case of cord prolapse. So these cases, you know, we need to be very vigilant.

If there is a case of transverse lie, we should not allow the mother to go into labor. We will tell her that yes, after 37 weeks, we need to deliver you by caesarean section because there is no process of labor in case of transverse lie and you also have a very high chance of cord prolapse. So we will do it by 37 weeks and in case if there is any, you know, you are having labor pain, you immediately come to the hospital. You know, if there is any rupture of membranes, you know, in the preterm labor and, you know, the patient knows that the fetus is in bridge presentation. There is malpresentation of the fetus and we again need to, you know, educate that woman that if there is any rupture of membrane in the very preterm stage, say after 8 months, 32 weeks, you know, there can be sometimes preterm premature rupture of membrane and the patient needs to come immediately to the hospital because there is increased risk of cord prolapse, right.

So these are the cases where we need to be very vigilant. Another thing is iatrogenic cause, you know, where it is cord prolapse is due to some difficult, some defect from our side. What happens, you know, during the process of labor, we sometimes place a catheter. This is the Foley's catheter with the Foley's bulb and this Foley's bulb is filled with normal saline, say 80 ml of normal saline, right. And then we attach this Foley's catheter to the thigh of the mother and with the traction there is dilatation of the cervix.

So this is for induction of labor and with Foley's catheter it is a mechanical method and it is very fruitful. But sometimes, you know, by mistake we fill this Foley's catheter with large amount of normal saline, say by 180 ml, more than 180 ml. So what happens, there is large amount of, you know, the Foley's bulb has swollen up and this will lead to, this will cause the presenting part to dislodge and be pushed up. The presenting part due to this Foley's bulb, it will be pushed up and the lower uterine segment will now be a little bit empty and through that empty space the cord may prolapse, right. So, this is an iatrogenic cause and through this the cord may prolapse and there may be a case of cord prolapse.

So we need to be very cautious during the Foley's bulb inflation for cervical dilatation and it should not be more than 80 ml. 80 ml is sufficient to cause the gradual cervical dilatation and

effacement, right. So now coming to the risk factors, we have already discussed malpresentation is a risk factor because the lower uterine segment is not fully covered with the fetal parts as in case of cephalic presentation where the fetal head which is globular and smooth from all around will occupy the lower uterine segment fully so that the cord cannot prolapse. There is no space, but in case of bridge, there is, it is irregular and there are some empty spaces. Most common malpresentation associated with cord prolapse is transverse lie.

Then is footling, it is a type of bridge presentation and after footling comes the knee presentation, right. Now, next is preterm labor. Preterm labor, yes, I have already told because there is more chance that the in preterm labor the fetus have not still descended, it has not engaged and there is high rupture of membranes . Number two, preterm or prematurity is often associated with bridge presentation. So these are the risk factors for cord prolapse.

In case of polyhydramnios, large amount of liquor and after you know sudden rupture of the membranes, there is gush of liquor running out of the vagina and when this gush of liquor is coming out of the vagina, it will take the cord along with it and cause in prolapse of the cord. In twin pregnancy where there is more chance of you know malpresentation, there is more chance of cord prolapse. There are two placenta and two cords and can be associated with long cord and there may be cord prolapse. In multiparity, yes, why? Because the maternal abdomen is lax, the uterus is flabby and you know that cord may descend through the lower uterine segment, through the os and result in cord prolapse.

So these are the risk factors. Coming to cord presentation, we have already know that we have also discussed this is the membranes are intact. So this is our antenatal finding. The membranes are intact, membranes are intact and in the antenatal period or just at the onset of labour. In the early stages of labour, just to assess with our fingers during the parvaginal examination, we feel some cord like structures you know above the membranes and we can sometimes palpate the cord pulsation.

So this is a case of cord presentation. In cord prolapse, the membranes have ruptured, membranes have ruptured, labour mostly have you know started, their onset of labour has already been initiated, right. So this is intranatal during the process of labour and you know there can be prolapse of the cord during the descent or you know due to some mishap there is a cord prolapse. So this is a case of catholic presentation but also in catholic presentation we sometimes end up in cord prolapse, right. Now coming to the management of cord prolapse, I have been stressing on the fact that cord prolapse is a emergency and we need to intervene very early. What to do? We will first you know change the position of the mother to left lateral position, right.

So this left lateral position, we will change the position to left lateral so as to you know shift

the foetal presenting part away from the cord and thus will relieve the cord compression, right. Number two is call for help. Inform everyone in the labour room, inform other gynocologist, inform the paediatrician, the anaesthetist that this is a case of cord prolapse and we need to intervene very early. We will next give oxygen inhalation to the mother. To the mother oxygen is being given and that will increase the placental oxygen supply which will ultimately increase the foetal oxygen supply, right and also IV fluid to the mother.

Ringer lactate can be started, infusion can be started, right. Now in utero resuscitation has been done. Now we will look for the cord. Now whether the cord is outside the vagina or inside the vagina. So we have already seen that the vessels of the cord are you know prone to vasospasm.

In the outside environment in cold temperature they will undergo vasospasm and there will be decreased circulation to the foetus. Even minimum handling of the cord with our fingers can also lead to reflex vasospasm. So minimum handling, try not to touch the cord. If the cord is outside the vagina we just take a wet gauge with normal saline and hold the cord very you know deliciously. It should be very gentle and just push the cord inside the vagina.

That's it. Very important to note not to push the cord inside the uterus. No need for that. We just put the cord inside the vagina, right. And if the cord is already inside the vagina then no need to touch the cord, right. And then after doing this we will go for per vaginal examination and that should be done also very smoothly without touching the cord.

We will go for the per vaginal examination and there we will assess the cervical dilatation. What is the cervical dilatation? What is the station of the presenting part? And you know from that examination we will decide whether to go for cesarean section or for vaginal delivery, right. How if we see that the cervix is more or less fully dilated 10 centimeter dilatation the presenting part is you know low down plus 2 station just you know above the pelvic at the pelvic floor then we can go for vaginal delivery with forceps that is called as instrumental delivery which will expedite the second stage of labor and it will cut short the second stage of labor and we will deliver the fetus very quickly. That will be beneficial also for the mother. It will decrease the blood loss and also the fetus will be expelled out very quickly so as to hand it over to the pediatrician for resuscitation.

In case the cervical os is very you know not fully dilated say 4, 5 centimeters and the presenting part is high up and there is a very long time before the process of vaginal delivery can commence then we should not wait and we will go for cesarean section, right. So, in cord prolapse the mortality rate is as high as 15 to 50 percent. So, 50 percent half of the cases in half of the cases we will be losing the baby. So, it is very important to know deliver the baby as fast as possible. If it is seen that if it is delivered within 10 to 30 minutes of diagnosis then you know

fetal survival rate is better, right.

And after this is the assessment of cervical dilatation number 2 is pushing the presenting part above. During the per vaginal examination itself we try to push the presenting part a little above and here also the you know the cause is to relieve the compression over the cord, right. And sometimes we keep the fingers in that position only keeping the presenting part you know above. So, but you know this is not very good for the doctor as well as the patient.

Both are not comfortable in that position. So, sometimes we push the fetal presenting part with the per vaginal examination and then certain maneuvers are done to keep the presenting part above. Number 1 by feeling the bladder, we feel the bladder by retrograde fashion we put the Foley's catheter inside the bladder and then we feel the bladder with say 500 ml of normal saline and then we feel you know we inflate the balloon and then clamp the bladder. So, you know clamp the catheter. So, the bladder is full and this full bladder will help to keep the presenting part above thereby relieving the cord compression. Sometimes we tell although it is not feasible most of the times we tell the mother to go for knee chest position which will also relieve the cord compression.

Next we can go for trendelenburg position which is the lower limb end elevation. So, the lower limb is elevated and this will help in the fetus to go towards the head end and relieve the cord compression. So, these are the maneuvers taken to relieve cord compression. Now coming to the thing that is whether the baby is alive or not. If the baby is alive most of the times we deliver by caesarean section and it should be done very quickly within 30 to 10 to 30 minutes and if the cervix is fully dilated yes we can go for vaginal delivery with the help of forceps.

If the baby is dead, you know it is confirmed with ultrasound that the baby is dead then we you know just wait for spontaneous vaginal delivery. We will not go for caesarean section because it will do nothing, but increase the morbidity of the mother. So, we will wait for spontaneous vaginal section or can go for destructive operations. Very important point to note here that before caesarean section for the indication of cord prolapse just before putting the incision on the skin we need to note the fetal heart rate by Doppler to you know confirm that yes the fetal heart rate is normal and the fetus is alive.

Then only we will go with the procedure of caesarean section. It is mostly done under GA. So that was all regarding the cord prolapse. Now we will be discussing some of the MCQs regarding the placenta as well as the umbilical cord. Okay. So, number one question is human placenta is best described as discoidal, hemochoroidal, deciduate, all of the above.

Answer will be all of the above. We know human placenta is discoid, disc like in shape. It is hemochoroidal that means the maternal blood will come in direct contact with the chorionic

villi. So it is called as hemochoroidal. Number three is deciduate. Why because during the placental separation after the birth of the baby a part of the deciduate, the spongy layer of deciduate, basalis will also be shed along with the placenta.

So it is all of the above. Next uterine flow at term. Right. So, we know uterine flow in non-pregnant state and uterine flow in pregnant state. In non-pregnant state uterine flow is 80 ml per minute. Right. In pregnancy at term it becomes 750 ml per minute.

So this is approximately 2 percent of the cardiac output. And at pregnancy, at term pregnancy, approximately 15 percent of the cardiac output will be given to the uterus. Now blood flow in the intervillous space at term. So we have drawn this picture many times in the placental class. So this is the fetal surface with the chorionic villi and this is the maternal surface with the decidua basalis.

And we have the fetal blood vessels inside the chorionic villi. These are the fetal blood vessels. Right. And in the intervillous space, in the intervillous space we have the maternal blood. Right. There are the septa, these are the septa and these septa will be carrying the maternal spiral arterioles which will give blood in the intervillous space.

Right. So what is the question blood flow in the intervillous space. So we know at a point of time blood in placenta, blood in placenta is how much 500 ml out of which 350, 350 is inside the villi. Right. So 350 is inside the villus and in the intervillous space this is 150 ml.

Right. So, answer will be 150 ml. Decidual space is obliterated by. So this also we have seen this is the uterus, uterine cavity and say this is the embryo. Right. And we know it is a case of interstitial implantation that means, this is the decidua basalis on which the implantation or the blastocyst will get implanted and the decidua will be covering the blastocyst on all sides in interstitial implantation and this is the decidua on the opposite side. So this is the decidual space, this space is the decidual space.

This decidual space will get obliterated by. So as pregnancy progresses this embryo will be growing, embryo will be growing like this and the decidua capsularis will merge with the decidua parietalis and this occurs at 16th week. Right. So, at 16th week of gestation decidual space is obliterated. Next placentomegaly is diagnosed on USG if size of placenta is more than it is more than 4 centimeter or 40 millimeter.

Now normally it is normally it is 2.5 centimeters. If more than 4 centimeter it is a case of placentomegaly and it needs to be investigated because there are certain cases like intra uterine infections right. In these cases there is placentomegaly in case of syphilis, in case of diabetes mellitus, in case of RH incompatibility there will be placentomegaly. So all placentomegaly

needs to be investigated further. Coming to the process of labor it is initiated by. So, just now discussed that the process of labor it is initiated by the fetal corticosteroids, fetal HPA axis, hypothalamopituitary adrenal axis gets activated causing release of fetal corticosteroids which will cause the onset of labor.

So, it is initiated by fetal ACTH. Folds of Hoboken yes they are found in the umbilical cord. Wharton's jelly, Wharton's jelly is a content of the umbilical cord it is a protective covering to the umbilical vessels and derived from the mesoderm. Which of the following statements related to single umbilical artery is true? It is more common in singleton gestation.

No it is more common in twins. Singleton gestation the incidence is approximately 0.5 percent and in twins it is 1 percent. So, more in twins. Always associated with congenital anomalies no. Only one-fifth cases are associated with congenital anomalies of the fetus.

Most common trisomy associated is trisomy 18 yes this is correct or Edwards syndrome right. And last option is presence of SUA is insignificant. No it is not insignificant it is a significant finding and we need to evaluate it further. Last question consequence of placental abnormality shown in the picture. What is the picture showing? This is the membranes and this is the cord this is the membrane and thus the cord is inserted to the membrane and then to the main bulk of the placenta.

So, this is a membranous insertion of the cord. Membranous insertion of the cord. So, what will be the consequence? Antepartum hemorrhage, postpartum hemorrhage, abruption and cord compression. So, yes antepartum hemorrhage can occur from bleeding from these vessels overlying the membrane any trauma any rupture of the membrane can cause rupture of the fetal blood vessels leading to antepartum hemorrhage. Abruption yes there can be abruption there can be compression of the cord.

So, all these three can happen. Postpartum hemorrhage is cannot happen right. So, A C D will be the answer. This is you know not single best, but multiple correct answers right. So, with this we come to the end of the class and we have dealt regarding the umbilical cord, the fetal membranes, the different insertions of the cord, vasapraevia, single umbilical artery and cord prolapse. So, just go through them take keeping notes during the lecture classes and references of today's class have been taken from D.C. Dutta textbook of obstetrics, Williams obstetrics and James book on high risk pregnancy. So, take care and keep reading. Thank you.