

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

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Fetal Skull

Good morning students. Welcome you all to our today's session for the NPTEL online certified course on the topic and overview on maternal health, the antenatal, intranatal and postnatal care. I am Dr. Barnali Ghosh, an obstetrician and gynecologist working as an assistant professor at B.C. Roy Medical College and Research Center, IIT Kharagpur. Today we will be discussing regarding the fetal skull. In the previous class we did have a discussion regarding the various diameters of the maternal pelvis as well as know that anterior and posterior diameters, the transverse diameters and the parts of the maternal pelvis that is the true pelvis which is below and false pelvis which is above.

True pelvis has been divided into the inlet, the pelvic cavity proper and the outlet, right, inlet cavity and the outlet. And we did discuss the various diameters of the inlet, the cavity and the outlet. So today we will be going to discuss about the fetal skull, right. So the concepts covered in today's class are the parts of the fetal skull, the diameters, the attitude of the fetal skull, depending upon the attitude, the various presenting parts of the fetal skull, a little bit discussion regarding molding, caput-succedaneum and cephal hematoma, right.

So these are the key words which are as follows, right. So coming to fetal skull. So this is a fetal skull. You can see this is the fetal skull and at first I will be identifying the bones which are present in the fetal skull. So you know that when the fetal head is below, right, so this is the mother's pelvis.

This is the mother's pelvis and we have discussed regarding the lie of the fetus. Lie meaning it can be lie meaning the relation of the fetal spine with the maternal spine, right. So that is lie which can be longitudinal, which can be transverse, which can be oblique. Coming to longitudinal lie, why? Because that is the most common lie of the fetus in utero. So longitudinal lie, it can be that the fetus in longitudinal lie can be in this position where the head is below and the podalic end or the bridge is above or it can be like this, right.

So where the bridge or the podalic end is below and the head is above, right. So in longitudinal

lie that there can be two possibilities. One is that it is a breech presentation, the part of the fetus which overlies the lower uterine segment that is the presentation. So in breech presentation, the podalic end is overlying the lower uterine segment and the fetal head is above. In the fundal grip, we did discuss the obstetrical examination.

In the fundal grip, we will palpate the globular, you know, round, ballotable structure which is the fetal head and in the pelvic grip, we will palpate a irregular, smooth, non-ballotable structure which is the podalic end of the fetus. So this will be in case of breech, but the most common presentation in longitudinal lie is the cephalic presentation which means that the head of the fetus is below, it overlies the lower uterine segment. This is the most common presentation in case of fetus in utero. Why? Because number one, the head is heavier. It is made up of skull bones, right? Mostly it is a bony structure.

So this part will be heavier and it goes down. Number two, the fundus which is broad. The uterine fundus is broad and it will accommodate the, you know, broader part of the fetus which is the podalic end, whereas the lower uterine segment is narrow and here the head gets, you know, it gets, it is well placed in the lower uterine segment. So all these together makes this presentation, the cephalic presentation, the most common presentation in case of longitudinal lie, right? Now why we are interested? So we need to know the fetal skull in case the, in cephalic presentation, the fetal skull will be the part to pass through the maternal pelvis first and by, you know, during the labor by par vaginal examination, we will palpate the parts of the fetal skull and thereby, you know, we need to assess the position, the flexion, attitude meaning the amount of flexion. Fetus is flexed inside the mother's womb.

All the joints are flexed. The neck is also flexed, right? So this is the well flexed position of the fetus. So we need to know the fetal skull. Now coming to this skull, this is the fetal skull and it is composed of certain bones from anteriorly. This is the two frontal bones.

You can see here, this is the true frontal bones and in between the frontal bone, this is the suture, which is called as the frontal suture, right? You can see this is the frontal suture or the metopic suture. Now just behind the frontal bones, these are the two parietal bones. You can also palpate. So this is the frontal bone and these are the two parietal bones, right? So in between the two parietal bone is another suture. This is called as the sagittal suture, right? In between the two parietal bones, this is the sagittal suture and between the frontal and the parietal bone, this suture, this suture is called as the coronal suture, right? So now you see that these two suture lines, the sagittal suture and the coronal suture meets at a point.

Now at birth, the bones are growing, still growing and these sutures are not, they are covered by membranes and this part, this space, this rhomboid shaped or diamond shaped space, which is, you know, the meeting point of the sagittal suture and the coronal suture, this is called as the

anterior fontanelle, right? So this is the diamond shaped or rhomboid shaped it space, which is covered by a membrane at birth and you can palpate it. It is not ossified, it is membranous at birth and it is diamond shaped it. This is called as the anterior fontanelle or the bregma. Now coming more posteriorly, the parietal bones are here, in between passes the sagittal suture, more posteriorly this is the occipital bone, right? So now the suture, which is passing between the parietal bone and the occipital bone, these two are the lambdoid suture. Yes, so there are on both sides, there are two lambdoid sutures and this space, which is the meeting point of the sagittal suture and the lambdoid suture, this is the posterior fontanelle.

This is the triangular space, it is the posterior fontanelle or the lambda. Very important because by palpating these fontanelle, we will assess the position of the fetal skull in relation to the different quadrants of the maternal pelvis, right? So just behind the posterior fontanelle is the occiput of the occipital bone, right? So these are the vault of the fetal skull, which is composed of these bones. This part is called as the face and below, this is the vault of the fetal skull and you know this through this, this is the foramen magnum through which passes the spinal cord, right? So, here will be the mandible, which is not present here. Here will be the mandible and this part is the face and this below this, this is the base of the skull, right? Below the temporal bone, this is the base of the skull. So above this is the vault of the skull.

We are concerned about these sutures, these fontanelles, the vault of the skull and the anteroposterior and the transverse diameter of the fetal skull, which have to negotiate through the maternal pelvis during the process of engagement and then through the process of labor, there will be further descent and with more flexion, with internal rotation, it will negotiate through the maternal pelvis and will be delivered. After the head is delivered, you know the rest part of the body, which is compressible, this is made up of bones, it is not so much of compressible, right? So it needs to pass through the pelvis. After the head is born, the rest part of the body will automatically get born by the process of lateral flexion, right? So now coming to the areas of the fetal skull, right? So now I will discuss this first. So now this is the vault and this is divided into three parts. Number one is the vertex.

What is which part? What is the definition? What is the vertex? Vertex is, so you see, this is the coronal suture, right? So this is the anterior fontanelle and these two are the lambdoid suture. So this is the posterior fontanelle. In between the anterior fontanelle and the posterior fontanelle, this part is the vertex, right? So this is the vertex. Now from the anterior fontanelle to the root of the nose, to the root of the nose and the supraorbital margins, these are the supraorbital margins and this is the root of the nose. So this part, if you say, see, so between the anterior fontanelle and the root of the nose, this part is the brow, right? Up to the supraorbital regions.

Now if from the supraorbital regions up to the chin, this is the chin, if there was the mandible, then this will be the chin or the mentum. So this part, this part is called as the face. So there are

three parts. First is the vertex, this is the vertex, then this is the brow up to the sinciput. This is the root of the nose or the sinciput.

The brow is actually called as the sinciput. So up to the supraorbital regions, this part is the brow, right? And then more below the supraorbital regions up to the mentum or the chin, this part is the face. So these are the three areas of the fetal skull, the vertex, the brow and the face. Now in this picture, if I mark it for you, this is the frontal bone, right? And this is the parietal bone, right? In between, this is the anterior fontanelle. Now behind the parietal bone, this is the occipital bone.

And the prominence of the occipital bone, this is called as the occiput. Now in between, this is the triangular space which is called as the posterior fontanelle, right? And here if you draw a line, this part is the base of the skull, right? And here you see these two portions, these two places, this is one and another, these are also two fontanelle. They are called as the lateral fontanelle. Actually fontanelle are formed by the meeting point of the suture lines. These suture lines, these suture lines, they are meeting.

And here this part is not still ossified. These are covered by membrane in the uterus when the fetus is growing, when the fetal skull is growing. But at birth, all the fontanelles are ossified except the anterior fontanelle which gets ossified at 18 months of age, that is one and half years, right? This will be the face, these are the supraorbital regions. So this part will be the face. This is the mandible, this is the chin or the mentum.

So this part is the face, right? Now this is the brow and this is the vertex, right? And this part will be the occiput, right? So these are the parts of the fetal skull. Sutures we have already discussed, the sagittal suture or the longitudinal suture passing in between the two parietal bones. The coronal suture which is the suture which separates the frontal bone from the parietal bone. I hope you understand from what I have discussed already. So just a recap, this is the frontal bone, this is the parietal bone, this is the occipital bone.

So this suture is the sagittal suture in between the two parietal bones. This is the coronal suture, this is the lambdoid suture which passes and this is the frontal suture. This is the frontal suture or also called lambdoid suture and in between this space is the anterior fontanelle and this space is the posterior fontanelle, right? So this is the pictorial diagram I have already discussed. This is the vault of the skull, above vault of the skull and this part the sinciput or the brow from the anterior fontanelle to the supraorbital regions or the base or the root of the nose, right? Which is also called as the glabella. Then the vertex and below the posterior fontanelle, this is also called as lambdoid, right? So this part is the occiput, right? And below is the base of the skull through which passes the foramen magnum which passes the spinal cord.

And from the root of the nose to the main term this part is the face, right? So these are the parts of the fetal skull. Fontanelles we have discussed, they are the meeting points of the suture lines and there are all total 6 fontanelle, right? So two lateral, two lateral on each side, 2 plus 2, 4 and anterior and posterior fontanelle. So total 6 fontanelle of which of obstetrical importance is the anterior fontanelle and the posterior fontanelle. Another one is there which is called as the sagittal fontanelle which is also present along the, you know, your coronal suture, right? I will have, I have the picture, yes.

This is the picture. So this you know, this is the anterior fontanelle, this is the anterior fontanelle and this, you know, length of the anterior fontanelle is 3 centimeter. Each side is 3 centimeter. It is rhomboid in shape or diamond shaped. This is called as anterior fontanelle or bregma and to note is it ossifies at one and half years of age. So at after birth this fontanelle is open, right? So the anterior fontanelle you can palpate on the fetal skull when you palpate, you feel that this part is not ossified.

It is membranous and it helps in the growth of the brain, right? So this is membranous. It can expand and when this membrane is bulged out, it means that the intracranial pressure is high or sometimes it may get depressed. That means that the intracranial pressure is low as in case of dehydration. So this gives an idea regarding the intracranial pressure, right? Also through this as it is not ossified, this is membranous, we can puncture and collect, you know, CSF. You know, sometimes in case of blood transfusion, exchange transfusion, this is the root of transfusion, this anterior fontanelle.

So also during parvaginal examination, if we feel the rhomboid shape anterior fontanelle, we know that this is the anterior part of the fetal head and we are towards the sinciput. And when if we palpate the posterior fontanelle, which is triangular in shape, then we know that we are towards the occiput of the fetal skull, right? So this is the posterior fontanelle also called as the lambda. And here this dimension is 1.2 centimeter and it ossifies at birth. This is sagittal fontanelle, which is at the junction of anterior two-third and posterior one-third and it is of less obstetrical significance, right? Now coming to sinciput and occiput.

Sinciput you know, this is the sinciput, right? So anterior fontanelle just in front is the sinciput, which is a bony prominence of the frontal bones, meeting of the frontal bones. This is the sinciput and behind the bony prominence on the occipital bone is the occiput, right? So when we palpate this, we can assess if the occiput, say when we palpate it by parvaginal, this is the maternal pelvis, this is the fetal head and we will be palpating from below by parvaginal examination, right? So we palpate the occiput and then we assess whether it is occiput anterior or occiput posterior or occiput transverse. So with this palpation, we will assess the position of the fetal head, right? So these are the landmarks of the fetal skull. Now coming to the diameters and there are two diameters, the anteroposterior diameter and the transverse diameter, right?

Coming to the anteroposterior diameter. So anteroposterior diameter of the fetal skull is the diameter of the fetal skull, right? It is the diameter which of the presenting part which crosses the pelvic inlet, right? So say depending upon the attitude of the fetal skull, if it is completely flexed, now you see if it is completely flexed that means the vertex, if it is completely flexed then this part, this is the vertex in between the posterior fontanel and the anterior fontanel.

When we go for parvaginal examination, this part overlies the internal os. So the presenting part is the vertex. If it is slightly partially, you know, flexed, complete flexion or partial flexion, then also we feel the vertex, right? But if it is deflexed, then what happens? We go for parvaginal examination, yes, it is the vertex. So in all these three attitudes, complete flexion, incomplete flexion or deflection, the presentation or the presenting part is the vertex. Now say there is partial extension, then what we feel? When we go, this is the brow presentation.

So in case of partial extension, the presenting part is the brow, but if there is extension, incomplete or complete extension, then the part we feel by parvaginal examination is the face of the fetus. So in that case, the presenting part is the face. Now depending upon the presentation or the degree of flexion, it changes the anterior posterior diameter, which is also called as the engaging diameter, which passes the pelvic inlet. In case of complete flexion, it is the suboccipitobregmatic. So this is the subocciput, the subocciput is below, here is the neck.

So at the neck of the neck, this is the subocciput, right, this is the nape of the neck. So sub-occipito and this is the bregma. So this line, this line, this is the suboccipitobregmatic diameter, which is equal to 9.5 centimeter and it occurs in case of complete flexion of the fetal head. Now coming to suboccipito frontal, suboccipito frontal again from the nape of the neck, nape of the neck, right.

So suboccipito frontal, this is the subocciputo frontal. This in case of incomplete flexion, this is the anterior posterior diameter of the fetal head for engagement, right. Engaging anterior posterior diameter is subocciputo frontal, which is 10 to 10.5 centimeters. Now next is occipitofrontal, that means this is the occiput and this frontal, so this diameter, this is the occipitofrontal diameter and it occurs in case of deflection, right, deflection occipitofrontal, which is 11.5 centimeters. So all these three diameters are of the vertex presentation, but they are the engaging diameters depending upon the degree of flexion of the fetal head. Now coming to in case of partial extension, right. So here the presenting part is not vertex, but it is brow. So presenting part is brow and there the diameter anterior posterior engaging diameter of the fetal skull is mento, this is mentum and vertical.

Vertical is the highest point on the sagittal suture. So this is the mento vertical diameter, which is 14 centimeters, right, in case of partial extension. Now you see this 14 centimeter, this large diameter, the maternal pelvis, the inlet anterior posterior diameter, you know we have already

dealt it is 11 centimeter, the transverse diameter is 13 centimeter and the oblique diameter is 12 centimeter. So nowhere this 14 centimeter can pass through the maternal pelvis and thus in case of brow presentation delivery is always by LSCS, right. So this is partial extension. Now coming to more there is more extension, incomplete extension, right.

Incomplete extension, then in incomplete extension and full extension both the presenting part is the face. So this is face presentation and here the anterior posterior diameter is submento vertical. Submento is just behind the mentum. So this is submento vertical.

So this diameter, this is submento vertical. What is the length? It is 11.5 centimeters. And lastly in case of full extension, this is also a case of face presentation and in this case the diameter is submento bregmatic. This diameter, this is bregma, submento bregmatic, right.

And this is also 9.5 centimeters. So in case of full flexion, full flexion it is subocciputo, it is occiput subocciputo bregmatic. This is the anterior posterior diameter of engagement of the fetal skull and this is also 9.5 centimeter. And when the fetus head is fully extended, then the diameter of engagement is submento bregmatic. This submento bregmatic, this is in case of full extension, the engaging diameter of the fetal skull and this is also 9.5 centimeters. To note that in full extension and full flexion, both cases the anterior posterior diameter length of fetal skull is same that is 9.5 centimeters. But still the process of labor will be smooth when the fetal head is fully flexed that is in case of full flexion with vertex presentation, but in case of full extension if the fetal head is fully extended the presenting part is the face and in that case the process of labor is difficult and sometimes it may so happen that it is a it goes into abnormal labor and we have to go for caesarean section. The cause for this we will discuss in case of the process of labor, right. So this we have discussed all regarding the anterior posterior diameters, okay.

So now, in this chart in a nutshell we have now discussed this is the subocciputobregmatic. Now we are coming from flexion to extension. Complete flexion, so subocciputobregmatic 9.5 centimeters it is vertex. These three complete flexion and deflection in these three all the presentation is vertex, but the anteroposterior diameters of engagement they change from subocciputobregmatic to subocciputofrontal to occipitofrontal and the measurements also change, right.

The more the length or more the anteroposterior diameter of anteroposterior engaging diameter the more the length it will be difficult there will be difficulty in engagement. Smaller diameter will pass through the maternal pelvis, but larger diameter there will be difficulty and there will be delay in engagement, right. Then in case of extension this is partial extension it is brow and it is mento vertical which is 14 centimeter and I have told that it does not have any mechanism of labor delivery is always by caesarean section. Next in extension incomplete extension or complete extension both the presenting parties face, but in an incomplete it was submento

vertical which was 11.5 and in complete extension it is submento bregmatic which is 9.5. So, complete extension and complete flexion both the anteroposterior diameter is 9.5 centimeters. So, these I have already drawn this is just a pictorial presentation of the different anteroposterior diameters.

Now coming to the transverse diameters, right. So, the transverse diameters you can already feel on yourself. So, you know from below I will go the smallest is the bi mastoid then the bi temporal. So, in between the two mastoid process this is the bi mastoid then the bi temporal between the two temporal bones supero subparietal that means, these are the parietal eminence. So, one above the parietal one point above the parietal eminence and other side it is below the parietal eminence super subparietal, right. So, this is the third diameter and the fourth longest transverse diameter is the biparietal diameter which is in between the two parietal eminences.

Now, this is the most important, right. This is the most important diameter and this is the transverse diameter of the fetal skull during engagement. Now, the measurements start from 7.5, 7.5 centimeter, 8 centimeter, 8.5 centimeter and this is 9.5 centimeters, right. So, these are the four types of and transverse diameter of the fetal skull. This picture you know same. So, these is the parietal eminence, ok. So, these are the two parietal eminence on the parietal bone these are the two parietal eminence you can palpate.

So, this is the biparietal diameter this is actually this is the biparietal diameter which is 9.5 centimeter and this diameter which is a one point is above the parietal eminence and other side the point is below the parietal eminence this is super subparietal diameter, right. And we have discussed it is 8.5. Why this diameter is important? Say when the fetal skull it is passing like this.

Now, the biparietal diameter these are the two parietal bones these are the two parietal bones and this is the parietal eminence. So, this is the biparietal diameter. Now, the biparietal diameter has to negotiate between inside the maternal pelvis. Say the biparietal diameter cannot negotiate the maternal pelvis is more contracted the pelvic diameters are you know not are contracted or less. So now, the fetal skull will you know negotiate or it will try to attain a position where one parietal bone will be below and other parietal bone will be above it will the head will slightly rotate the head will slightly rotate.

And now the engaging diameter is the super subparietal diameter and here we have seen that it is 1 centimeter less than the biparietal diameter and so, it can pass through the smaller diameters of the maternal pelvis, right. So, these we have done with the diameters of the maternal fetal skull and another important is the concept of molding which means that when the fetal skull passes through the resistant birth canal of the maternal pelvis during the process of labor, right. There is alteration in the shape of the fetal skull. Why? Because the fetal skull bones they can come because they are not fully ossified. So, they there will be you know when it passes through

the birth passage there will be you know resistance to the fetal skull and these skull bones will overlap with each other and this concept is called as molding and helps to decrease the different diameters of the fetal skull so, as to you know helping it to pass through the maternal pelvis and after birth it disappears.

There are you know these are the you know pictures of molding. So, see the diameters with molding the diameters get decreased, right. Now there are grades of molding grade 1 is just the skull bones are touching each other then there is no overlapping. Sometimes it may so happen that the skull bones will overlap, but they can be separated that is grade 2 sorry this is grade 2, right and grade 3 is there is so much of overlapping that they cannot be separated, right. So, these grade 2 and grade 3 if associated with slow progress of labor it hints towards the diagnosis of cephalopelvic disproportion. So, more grading these are pathological this is normal grade 1 is normal, but these 2 grades are pathological and it you know gives the diagnosis of cephalopelvic disproportion in that case normal delivery cannot be allowed, right.

Now, coming to the last part that is caput succedaneum, right. What is caput succedaneum? Caput succedaneum is actually you know when the fetal head passes through the maternal pelvis there is accumulation, right. There is accumulation of fluid, fluid accumulation, but this accumulated fluid or edematous fluid is present just beneath the you know skin and subcutaneous tissue, right. So, skin and subcutaneous tissue this space is filled with fluid, right, but the periosteum this is the periosteum and this is the fetal skull bones. There is no collection beneath the periosteum the collection is above the periosteum and this fluid collection this is due to you know when the fetal skull it gets trapped at that at a level in the maternal pelvis during the process of labor for a period of time there is no the venous flow the venous return is decreased and this causes accumulation of fluid in the subcutaneous tissue, but immediately after birth it is present at birth, but immediately after birth it gets resolved.

No intervention are required in caput succedaneum, right. So two points one is cephal hematoma and caput succedaneum. I have discussed caput succedaneum why it occurs because the fetal head gets obstructed or say it is present at us at the same position for a prolonged period of time in the maternal pelvis during the process of labor leading to hampering of the venous return causing fluid accumulation in the skin and subcutaneous tissue of the fetal skull, but it goes away within a few hours after birth needs no treatment, but in case of cephal hematoma there is blood accumulation beneath the periosteum and this occurs in case of traumatic instrumental deliveries as in case of forceps or you know venous. In that case there is blood accumulation this is the picture there is blood accumulation below the periosteum this is the periosteum. So blood gets accumulated below the periosteum and you know this is due to some trauma from forceps delivery from venous delivery and immediately at birth during the process of delivery when you pull the baby by forceps at birth this cephal hematoma may not be present, but it you know appears after a few hours of birth and it presents for say some days or some

months after delivery. This also does not require any treatment it will resolve by itself, but to note is what is the importance it may be associated with fracture of skull bones underlying skull bones there may be associated fracture.

So, we need to look into that also this blood when it gets resolved it produces biliverdin which can lead to production of jaundice in the baby right and this is the picture of caput succedaneum caput succedaneum and here this is fluid accumulation above the periosteum below the skin and this fluid accumulation this can pass through the sutures it is present this fluid accumulation this is due to the process of labor and it is present at birth, but it resolves within few hours after delivery. So, these are the two differentiating points it is edema which passes or extends across the suture lines it is present at birth it has poorly defined borders and it disappears within 48 hours of delivery, but in case of cephal hematoma it is accumulation of blood below the periosteum between the periosteum and the skull bones and it does not cross suture line it is not present at birth, but it arises after few hours from first day of birth and it will take some time say months to resolve and when it resolves it may lead to formation of jaundice in the newborn, but as a whole it also does not require any treatment does not require any drainage it will resolve with time right. So, these were all about the fetal skull.

Now what I want I have missed this part in the maternal pelvis the different types of maternal pelvis I will just say in a nutshell these are the four types of maternal pelvis this is the gynecoid you can go into the books and read on your own gynecoid this is no see this is the anteroposterior diameter is more this is anthropoid here next is the android and lastly this transverse diameter is more this is called as platypelloid pelvis. So, these are the types of the pelvis most common is the gynecoid and it has diameters reasonable for normal delivery to you know allow normal delivery, but android pelvis is you know not good for normal delivery most cases we need to go for caesarean section and here you know it is contracted pelvis the all the spines this ischial spine is prominent the side walls are converging right and this the sciatic foramen they are all contracted right.

So, this is not good for vaginal delivery not good, but platypelloid you see after engagement only during the process of engagement there is some difficulty, but after engagement all the side walls are divergent right and it is shallow this notch is also wide and it helps in vaginal delivery right. Anthropoid pelvis most commonly is associated with face to pubis delivery. So, depending upon the structure or the type of the maternal pelvis we can assess beforehand whether there will be any difficulty in the process of labour and associated complications right. So, we need to be cautious during the process of labour.

So, this was all regarding maternal pelvis and the fetal skull the diameters. Next we will again go through them and in detail during the discussion of mechanism of labour. So, references are mostly from D.C. Dutta book of obstetrics the Williams obstetrics the James book on high risk

pregnancy and Oxon foote book right. So, that was all for today keep reading and hoping to meet you in the next video. Thank you.