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

Professor Name: Dr. Barnali Ghosh

Department Name: Multidisciplinary

Institute Name: IIT Kharagpur

Week:07

Lecture:02

Antenatal Assessment of Fetal Well-Being (part 3)

Good morning students. Welcome you all to 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 assistant professor at B.C.Roy Multispeciality Hospital and Medical Research Center, IIT Kharagpur. So today we are in the last lecture for the antenatal fetal assessment topic. In the previous two classes we have discussed the clinical part that is the daily fetal movement count and also the biophysical profile which consists of five criteria.

Number one criteria is the CTG tracing of the non-stress test, then other four USG parameters that is the fetal gross body movements, fetal breathing movements, fetal tone and the amniotic fluid index or the single vertical pocket measurement of the amniotic fluid right. So, all these five criteria has been given a score of 2 that says it is normal or 0 which says it is abnormal and the total biophysical profile score out of 10 will help us to know regarding the fetal well-being. If it is 8 or more than 8 out of 10 then the fetus is normal and we can repeat the biophysical profile once or twice weekly. If it is less than 8 then it means that the there is fetal compromise and we need to expedite the delivery and you know depending upon the gestational age and sometimes when it is less than 4 then irrespective of the gestational age we need to deliver the baby.

So, that was the biophysical profile scoring system or the Manning scoring system. Now, next we come to other ultrasound parameters mainly the Doppler velocimetry studies which are done also in cases of fetal compromise and other instances of fetal growth retardation inside the uterus right. So, coming to Doppler ultrasound velocimetry various vessels are studied in the ultrasound scan right. Number one is the umbilical artery, then the middle cerebral artery. These are the two arterial systems we also see the ductus venosus I will write in full for you umbilical artery flow, middle cerebral artery flow, then the two venous system that is the ductus venosus flow and the umbilical vein.

So, flow in these vessels will help us to diagnose any type of fetal compromise right and from

them we will deduce the resistance or the resistive index and the pulsatility index right. So, these two parameters will help us to know whether there is any resistance inside the blood vessels or there is any change in the pulsatile motion of the blood inside these blood vessels which will help us to diagnose any utero placental supply compromise right. So, coming to one by one. So, this is the arterial sorry. So, it was inside it arterial Doppler that is the umbilical artery and the middle cerebral artery and the venous Doppler is the ductus venosus and the umbilical vein.

So, all total four right umbilical artery, middle cerebral artery, ductus venosus and umbilical vein. Coming to one by one the arterial Doppler that is the umbilical artery Doppler. So, what we study most importantly is the diastolic flow right. So, as pregnancy progresses the diastolic flow the diastolic flow will decrease right. So, as no sorry diastolic flow will increase that means, the resistance will decrease.

So, diastolic flow increases. So, high velocity actually indicates a healthy fetus that is there is no fetal compromise the fetus is normal and we can continue with the pregnancy until term right. So, immediate there is no compromise of the fetus. So, that is high velocity diastolic flow in the umbilical artery. Now say if there is decrease in the diastolic flow what is it that is the systolic by diastolic ratio S / D ratio.

This S /D ratio actually as the diastolic flow increases the S / D ratio decreases as pregnancy continues right, but say the diastolic flow there is some changes instead of increase in the diastolic flow there is decrease or absence or reversal of flow all these indicate fetal compromise right. So, maybe the diastolic flow is decreased or in the later stage this is the initial stages of fetal compromise. Then if it is aggravates or no intervention is done and there is more compromise then the diastolic flow will become absent and ultimately there will be reversed end diastolic flow reversed end diastolic flow and this is a very grave condition and it requires immediate delivery immediate delivery mostly by cesarean section reversed end diastolic flow means that the fetus is heavily compromised and it will undergo intrauterine fetal death if not delivered at you know emergency basis right. So, this is the diastolic flow. Now coming to the resistive index what is the resistive index it is the systolic flow minus diastolic flow by systolic flow (S - D / S) and the pulsatility index is defined as systolic flow minus diastolic flow by the mean right.

So, all these this resistive index pulsatility index of the umbilical artery will also help to note the blood supply right. Now coming to the MCA Doppler Middle Cerebral Artery Doppler where is the middle cerebral artery it is in the circle of willis of the fetus. So, in case of fetal compromise there will be you know preferential preferential supply of blood to the brain supply of blood to the brain of fetus in case of fetal compromise. So, you know the fetus itself it arranges it is blood supply in such a way that the brain of the fetus at least gets maximum blood

supply at the cost of other abdominal and peripheral organs right because it needs to survive even at that case of decreased uteroplacental supply. So, thus MCA Doppler when it shows that there is increased blood flow through the middle cerebral artery right increased blood flow increased blood flow in MCA in middle cerebral artery it hints towards fetal compromise right this is called as the brain sparing effect brain sparing effect.

And this if we see that the MCA Doppler is more than 2.5 multiples of mean that means, that it is a case of fetal compromise and there is some kind of fetal distress right. So, that was regarding the MCA Doppler. Now coming to another terminology that is cerebral placental ratio what does that mean it is the ratio of pulsatility index of middle cerebral artery pulsatility index of umbilical artery and if this ratio comes less than 1.08 that is less than fifth percentile right fifth percentile in third trimester right if it is less than that.

So, that means, low cerebral placental ratio this hints towards placental insufficiency right. So, there is placental insufficiency there is fetal compromise that can cause late onset fetal growth retardation. This CPR this cerebral placental ratio is an independent marker for the fetal well being right. So, we do the Doppler of MCA we do the Doppler of umbilical artery we measure the pulsatility index we calculate the ratio and the cerebral placental ratio if it is low then it will hint towards fetal growth retardation due to placental insufficiency and this requires early delivery of the fetus. So, this is the Doppler study diagram right.

So, in ultrasonography you can see this is the systolic flow and this is the diastolic flow. This diastolic flow this part is the diastolic flow and it should be always positive that is normal this is normal this is positive that means, it is normal. Now see this diastolic flow it has decreased it has decreased. So, this hints towards fetal compromise due to increased resistance the end diastolic velocity is present, but it has decreased in amount. So, that is hinting towards fetal compromise.

More fetal compromise meaning absent end diastolic flow and if there is reversal see it has gone negative. So, if there is reversal of end diastolic flow we need to immediately deliver the baby or we will lose the baby inside the mother's womb right. So, that were the arterial Doppler. Now coming to the venous Doppler actually venous Doppler helps us to give an idea regarding the cardiac function of the fetus right cardiac function of the fetus. And we have two veins that is the umbilical vein and your ductus venosus.

What we see in the umbilical vein we see the pulsatility motion and if it is monophasic that means, it is normal right if it is monophasic, but say monophasic meaning that the cardiac function is normal monophasic meaning that this flow will be in one phase say this is the x and y. So, this blood flow is in one phase, but say there is pulsatile motion sometimes it is positive sometimes it is negative like this motion in the umbilical vein this is a case of fetal distress.

Another important blood flow vessel right so, that is ductus venosus this is important when we see a middle cerebral artery sparing effect when we see increased blood flow in the middle cerebral artery in case of IUGR that will hint that there is some you know insult of the fetus and so, the middle cerebral artery flow has increased right. And if it is more than 2.5 multiples of million median then we will now see the ductus venosus flow and in ductus venosus we actually see the A wave these are all the wave patterns of blood flow through the vessel and if A wave is absent or there is reversal of A wave then it will indicate that there is fetal distress and it requires immediate delivery.

So, all these are criteria of the ultrasound Doppler study right. So, this is the total schematic picture where we see the umbilical artery I have told yes in the umbilical artery we see the end diastolic flow it should always be positive and if it is reduced or absent or reversed that means, that there is resistance in the fetal placental circulation there is placental insufficiency and fetal distress. Next number 2 is the middle cerebral artery in the middle cerebral artery there is the brain sparing effect in response to hypoxemia all the organs in case of hypoxemia there is decreased oxygen supply to the fetus and all the other peripheral organs will get decreased blood supply at the cost of the brain the brain needs more blood supply to sustain the fetus. So, there is brain sparing effect and dilatation of the cerebral blood vessels most in the mainly the middle cerebral artery and the diastolic velocity or the pulsatility index will decrease right. So, if it is less than 2.

5 millions of mean then it is a case of fetal compromise. Third is the ductus venosus ductus venosus flow I have told yes it has the Doppler index absent or reversed flow A wave absent or reversed A wave that is also hinting towards fetal acidemia this will also need immediate delivery immediate delivery mostly by caesarean section and lastly the umbilical vein. Umbilical vein the pulsatility motion will hint towards fetal acidemia right. So, these were the ultrasound feature of the Doppler studies of the various blood vessels right that will help in fetal assessment. Now the summary of the fetal antenatal fetal assessment this is the screenshot taken from the Desi Datta book of obstetrics and here it is the gist right.

So, we start from early pregnancy early pregnancy I have already discussed know that is the biophysical biophysical meaning the USG parameters right. Now, USG parameters I have discussed the NT scan the dating scan in the first trimester right. So, these NT scan these will help to screen congenital malformation of the fetus right and biochemical we will discuss the various prenatal diagnosis which we do to screen any aneuploidy or congenital malformation of the fetus. It has some biochemical parameters like blood test of the mother you know measuring the various markers right beta HCG, pap A all markers that will help to screen the high risk population who are more prone to have anomalous baby right. So, that is number 1 the biochemical markers and number 2 the USG parameters when we combine them we actually screen the possibility of congenital malformation of the fetus.

So, that is done in early pregnancy that is first trimester between 11 to 13 6 by 7 weeks right and say if it is all normal congenital malformation are absent then no need to worry continue as a case of normal pregnancy continue clinical monitoring and ask the mother to note the daily fetal movement count right from 28 weeks. So, she should count the daily fetal movement and you know I have told that yes in 12 hours in a case of normal activity of the mother in 12 hours at least 10 fetal movement should be perceived by the mother and if the mother is in resting condition lying down in left lateral position focusing on only on the fetal movements then in 2 hours at least she should perceive 10 fetal movements right. So, continue with the daily fetal movement count and if it is normal then continue monitoring as a case of normal pregnancy right. So, that was a case of normal pregnancy now say if there is a present no possibility of congenital malformation then we can ask for pregnancy termination if it is not compatible for the you know life of the fetus sometimes some congenital malformations are detrimental to the life of the fetus in that case we opine for pregnancy termination and say if the mother is having decreased fetal movement the first complaint should be from the mother that she is perceiving less number of fetal movements in that case in that case we will go for the NST this is the first test the non stress test right and if NST is reactive that means, there is no normal fetal heart rate maintaining between 110 to 160 beats per minute number 2 there is fetal heart rate variability between 5 to 25 beats per minute and number 3 there are accelerations at least 2 accelerations are present in a 20 minute tracing of the CTG and decelerations are mostly absent and even if they are present they revert back to the normal fetal heart rate baseline in less than 2 minutes of time right. So, all these are we have discussed in the NST and if the NST is reactive that means, the fetus is healthy and repeat test as and when necessary right, but if it is non reactive then we will go for the more advanced test that is the modified biophysical profile test which is NST plus AFI.

Now, if this is normal then repeat it as and when necessary and monitor the pregnancy, but if this is abnormal then go for detailed BPP. Detailed BPP is all the 5 criteria NST, AFI that is modified biophysical profile plus also the 3 criteria that is the gross fetal movement then fetal breathing movement and fetal tone all these taken together is the detailed BPP and we calculate the biophysical score and if necessary we will go for the Doppler velocimetry studies of all the artery and venous supply. And then depending upon this report we will manage the case right if there is compromise and it needs immediate delivery we will go for caesarean section and if there is some time then we will repeat it twice weekly or more early and no intervene as the scenario goes right it is an individualized approach. So, that was all regarding the antenatal assessment of fetal well being. Now, coming to the lung maturity and it should know this is a criteria for before the delivery of the fetus because the fetus after the delivery needs to know be needs to have the ability to independently have the respiration inside the womb it was under the mother's blood supply through the placental supply it was getting the oxygen and excreting the carbon dioxide, but after birth it needs to have its own respiration.

So, lung maturity pulmonary lung maturity is an important criteria for delivery if there is preterm delivery then we give administration of steroids steroid injection for lung maturity right and mostly it is injection betamethasone right, but we try to go for term delivery this is in case of preterm delivery steroid injection for lung maturity, but in case of term delivery after 37 weeks the lungs are mature and we can very well go for delivery. So, pulmonary lung maturity needs to be assessed. So, this is the picture of a preterm lung the lung alveoli are still not developed. So, you can see this is the pulmonary lung alveoli these are still not developed, but this is a full term lungs where the alveoli are totally developed right. So, these alveoli these alveoli actually have type 2 surfactant type 2 sorry surfactant surfactant is synthesized surfactant is synthesized by type 2 pneumocytes pneumocytes which are present in the alveoli right.

So, and this surfactant will be synthesized in type 2 pneumocyte in a term fetus. So, in case it is preterm less than 37 weeks at 35 weeks or 36 weeks if there is no requirement for expedited delivery right in that case there is no surfactant and that will lead to respiratory distress syndrome of the newborn after birth of the baby right. So, we need to ascertain that the lungs are mature and if not mature with steroid injection we try to know help in maturity of the lungs and sometimes we also give surfactant in the injection for the functioning you know artificially we give this surfactant for functioning of the lungs right. So, this is the respiratory distress syndrome. Now coming to one by one the pulmonary surfactant, pulmonary surfactant actually these surfactants are produced by the type 2 pneumocytes in the lung alveoli and these surfactant are packaged you know they are stacked as lamellar bodies and these lamellar bodies from the lung alveoli they reach the pulmonary fluid from where they are carried to the amniotic fluid.

So, by amniocentesis amniocentesis we will get the pulmonary surfactant and the lecithin sphingomyelin ratio lecithin sphingomyelin ratio will help us to note the maturity of the lungs. How if it is 1 if the ratio is 1 that means, you know maturity is at 31 to 32 weeks. So, lungs are not mature if it is 2 then maturity is around the gestational age of 35 weeks, but if it is more than 2 that means, that the lungs are mature and the fetus can be delivered without the risk of respiratory distress syndrome. Next test is the shake test or the bubble test what we do here we take the amniotic fluid and we add 96 percent ethanol and then we shake we shake the test tube for 15 seconds and take the reading after 15 minutes right and what we see we see a clear you know rim of bubble around the meniscus. So, this clear rim of bubble at the meniscus this depicts that the lungs are mature right.

So, this depicts that there is amount the surfactant amount quantity is you know sufficient and lungs are mature. So, this was regarding the shake test or the bubble test which was under the name of the scientist Clements. Now, the foam stability test actually this is to quantitate the amount of surfactant present in the amniotic fluid by serial dilution of the amniotic fluid we try to quantitate the amount of surfactant present and that will help us to determine the lung

maturity. So, foam stability index if it is more than 47 this indicates that the it has mature lungs right of the fetus.

So, we can very well go for delivery. Presence of phosphatidylglycerol. phosphatidylglycerol is also a component of the surfactant and phosphatidylglycerol presence will also help in detecting lung maturity. Phospho saturated phosphatidylcholine these are all you know tests for lung maturity it has certain values that is phosphatidylcholine is more than 500 500 nanogram per ml this is phosphatidylcholine right. So, that will also help in lung maturity assessment. Fluorescence polarization in automatic analyzer we you know detect the amount of surfactant. So, you know that is a ratio per gram of albumin amount of surfactant present that will also help in assessment.

So, that is you know amount of the surfactant will be a very important it is 55 nanogram per gram of albumin 55 nanogram of surfactant that will all be as a you know measured in that fluorescence polarization and if it is so, if that is amount is present lungs are mature. Amniotic fluid optical density yes you know at 650 nanometer you know that optical density is measured and if the optical density is more than 0.15 then also the lungs are mature right. Next lamellar body I have already told that the surfactant are packaged in the form of lamellar body which are stored in the alveoli they come to the pulmonary fluid and then to the amniotic fluid and this lamellar body count will help to note the amount of surfactant. If it is more than 30,000 per micro liter that means, the lungs are mature.

Orange colored cells so, you know with addition with addition of 0.1 percent Nile blue sulphate Nile blue sulphate these are all tests which are not done nowadays, but still you know you need to know the test the Nile blue sulphate when it is added there is orange colored cells and this orange colored cells if it is more than 50 percent then also it means that the lungs are mature. Amniotic fluid turbidity in case of preterm amniotic fluid is clear total clear, but at term amniotic fluid is turbid it is you know due to Vernix Vernix caseosa it is turbid and that will depict that yes the fetus is mature. So, these are the various tests of the fetal lung maturity assessment and so, we need to know we get an idea just before delivery whether the fetus is mature whether the lungs is mature and so, that we can go for delivery without the risk of respiratory distress syndrome. And if the fetus is preterm if the lungs are not yet mature then we should anticipate respiratory distress syndrome and then we need some NICU facility better SNCU facility for the survival of the baby after delivery.

So, this was all for today's class references are from D.C.Dutta textbook of obstetrics the Williams obstetrics and a James book on high risk pregnancy. So, antenatal fetal assessment is very important mostly in the third trimester to assess the fetal well being and whether there is any compromise and if compromise is present we need to intervene and also decide the time of delivery. So, these are all the tests which are included in the assessment and you know each

mother needs to you know educate them regarding the daily fetal movement count measurement and if it is decreased movement they must come to the clinic and get assessed right. So, that was all for today. Thank you, keep reading, keep taking notes and we will now next meet in the next video regarding prenatal diagnosis. Thank you.