

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:01

Antenatal Assessment of Fetal Well-Being (part 2)

Good morning students. Welcome you all to the session for NPTEL online certified course on the topic and overview on maternal health, the antenatal, intranatal and postnatal care. I am Doctor Barnali Ghosh, an obstetrician and gynecologist working at B.C.Roy Medical College and Research Center, IIT Kharagpur. So, today we will be continuing our discussion on antenatal fetal assessment. So, in the last class we did have a discussion regarding the timing of initiation of antenatal fetal assessment, the different tests that are to be done in the antenatal fetal assessment and we had a detailed discussion about the clinical part that is the daily fetal movement count right. So, that is to be perceived by the mother and it is you know the mother is educated regarding the counting and the number of counts which are necessary to assess the fetal well being and if it is less than the count or the normal count that is 10 in 12 hours when the mother is doing her normal activities, if she is counting throughout the day then it should be at least 10 fetal movements in 12 hours right.

If it is less than that then she must present herself in the health center or in the antenatal clinic for assessment. So, today our next discussion will be on the biophysical profile and the biochemical tests which are done for the antenatal fetal assessment. So, coming to the non-stress test right. So, I have already told in the previous class that the biophysical profile, biophysical profile right it consists of two parts.

Number 1 is the CTG tracing right which is the non-stress test and this is the USG parameters. USG parameters what are they number 2 this is number 1, number 2 is the fetal breathing movements, the fetal gross body movement all are seen under the ultrasound scan which are done over a period of 30 minutes. Over a period of 30 minutes USG scan is done and you need to look for the breathing movement, the fetal gross body movement, the fetal tone right and along with this is the amniotic fluid index or most commonly what is measured in ultrasound is the single vertical pocket assessment right. So, first we will discuss about this non-stress test NST and it is a CTG tracing on a paper right and it has 4 subdivisions or 4 criterias the basal fetal heart rate, the baseline fetal heart rate variability, fetal heart rate acceleration and deceleration. So, coming to the basal fetal heart rate if that tracing is like this right it will be on a piece of paper and these are the various you know fetal heart rate.

So, these say these are the markings of the fetal heart rate right 100, 110, 120, 130, 140, 150 right. So, the basal fetal heart rate the baseline you know it may differ it may be sometimes it may become 132 or 135, sometimes it may become 125, but the baseline this is the baseline of this tracing. So, the basal baseline fetal heart rate in this CTG tracing is 130 beats per minute right. So, what is the normal range after this is all done after you know say 30 to 32 weeks of gestation. I have already told that the period of viability we do the antenatal fetal assessment after the period of viability which is 28 weeks in case of India right, but mostly these are done in the third trimester or late third trimester.

So, around 30 to 32 weeks right. So, the you know normal fetal heart rate, normal fetal heart rate varies between 110 to 160 beats per minute. This is normal if it is less than 110 it is called as bradycardia whereas, if it is more than 160 it is called as tachycardia. You need to assess this CTG tracing for a period of 20 minutes minimum 20 minutes you have to look through the CTG tracing paper and then you calculate the baseline fetal heart rate. If it is normal then it is ok, if it is less than 110 it is called as bradycardia and this denotes fetal distress.

So, first the point from the NST tracing is if there is bradycardia then it will denote fetal distress, fetal compromise or fetal depression inside the uterus which will need further evaluation and we need to expedite the delivery to prevent intrauterine fetal death. Tachycardia you know as such it is also abnormal and mostly tachycardia can occur in cases of infection, in case of raised temperature, in case of you know various chorioamnionitis infection of the chorion or the amniotic fluid right. So, these can lead to tachycardia both are abnormal within the range 110 to 160 is normal. Now the next parameter of the NST tracing is baseline fetal heart rate variability. So, if this is the fetal heart rate which is going right some it will not be a straight line there will be certain variations right.

This is the fetal heart rate baseline say it is 130 beats per minute. Now it is not always 130 sometimes it is 125 sometimes it is becoming 136 right. So, it will vary now this fetal heart rate variability ranges between 5 to 25 beats per minute this is a case of fetal acceleration right. This is not variability these along the baseline along the fetal heart rate along this baseline the minimum variations of the fetal heart rate is the variability and this variability may vary from 5 to 25. See here how much is the variability 125 to 136.

So, it is 11 right. So, 5 to 25 is normal. If there is no variations or less than 5 fetal heart rate tracing comes out to be like this. So, decreased variability is also a feature of fetal distress right. When can this variability get reduced? Reduced variability occurs in cases of fetal hypoxia, in case of certain maternal drug intake like in case of sedatives, opioids, sedatives, benzodiazepines all these will cause decrease in the fetal heart rate variability.

And number 3 is steroid injection for fetal lung maturity can cause reduction in fetal heart rate in the next 2 days after the injection. So, 48 hours after the injection it can show a reduction in fetal heart rate variability. So, these are you know some of the cases, but reduced variability is abnormal and it denotes fetal distress. Sometimes the heart rate tracing will be like a sinusoidal pattern right. So, this is the fetal heart rate.

So, this is called as sine wave or sinusoidal pattern of fetal heart rate. This occurs in case of fetal anemia. And what are the cases of fetal anemia? Number 1 is twin-twin transfusion syndrome. Next is in case of vasa previa, we have already discussed in types of placenta where the fetal blood vessels will be exposed and will over lie the internal oses and minimum trauma or bleeding from these fetal blood vessels can lead to fetal anemia. And then if you go for an antenatal CTG tracing, it will show a sinusoidal pattern of fetal heart rate right and that will help you in the diagnosis of vasa previa right.

And also in RH incompatibility in that case also sometimes it leads to fetal anemia in extremes of you know damage. And all these if this fetal anemia diagnosis is known is if we know that yes there is fetal anemia from the CTG tracing, then it will require emergency LSCS immediate termination of pregnancy and immediate delivery of the baby to know at least help the baby to resuscitate itself outside. Fetal anemia is an emergency and it requires immediate termination of pregnancy mostly by caesarean section. Now two criteria have been dealt with. Now coming to acceleration, this is very important criteria of the NST tracing and this acceleration right say this is the fetal heart rate.

It is going and then there will be certain cases of acceleration right. Why these acceleration occurs? Due to fetal movements with fetal movement there can be increase in the fetal heart rate during say uterine contraction. Sometimes fetal scalp stimulation right fetal scalp stimulation in these cases there will be acceleration of the fetal heart rate. What is acceleration? Increase of fetal heart rate by 15 beats per minute and it is you know it is sustained or it is maintained for a period of equal to or more than 15 seconds. This is increase of fetal heart rate by 15 or more beats per minute and it persists for or lasts for at least 15 seconds right.

So, this is one episode of acceleration and this fetal heart rate acceleration is the surest sign very important. If fetal heart rate acceleration is present in the CTG tracing then it is a surest sign of fetal well being. So, accelerations must be present absence of acceleration is a negative factor right. So, that is all regarding acceleration. Another thing is we do as NST tracing over a period of 20 minutes and it must have at least 2 or more than 2 acceleration in a CTG tracing over a period of 20 minutes.

If it is less than 2 acceleration are present in the tracing then we continue the NST tracing for another 20 minutes. So, total 40 minutes and then also if the acceleration are less than 2, if less

than 2 then you continue for another 20 minutes and in the next 20 minutes also it is less than 2 acceleration then you say that yes there is a chance of fetal distress and the NST non stress test is non reactive right. This is the picture of the mother she has come to the clinic with the complaint of reduced fetal movement and we have you know gone for the NST test for the NST test and here is the CTG machine. This is the CTG machine which this paper which comes out of the machine this is the CTG tracing right and see here this is a transducer this will measure the uterine contraction uterine contraction measurement and here this transducer will measure the fetal heart rate right. And here this is the bell given to the mother and she will press this this bell whenever she perceives fetal movement whenever she perceives fetal movement she will press the bell and that will represent as a line on the tracing.

This is the NST tracing paper right. So, this is the fetal heart rate this is the fetal heart rate this tracing is the fetal heart rate and see these are the movements. The mother has pressed the bell that the transducer which she is holding and these are the lines which shows that mother perceives fetal movement right and when she perceives fetal movement there is also acceleration being shown in the fetal heart rate tracing. So, this is normal this is fetal heart rate accelerations are present when the fetal movement occurs right. So, presence of fetal heart rate acceleration is a good indication of fetal well being.

Now coming to deceleration what is the definition of deceleration it is decrease of fetal heart rate right. Why decrease meaning it may be gradual or abrupt abrupt or gradual decrease of fetal heart rate by at least 15 beats per minute 15 or more beats per minute over a period of 15 seconds. It must you know revert back revert back to normal fetal heart rate by less than 2 minutes even though there is some decrease in the fetal heart rate it will revert back to the normal fetal heart rate by you know within 2 minutes if more than 2 minutes then it is also abnormal. Deceleration you know it shows some of the fetal distress criteria like cord compression or the fetal hypoxia or head compression all these from the deceleration tracings we can deduce and these will be discussed in the CTG class right cardiotocography. Here we are only discussing the NST or the non stress test right.

So, the non stress test here decelerations are mostly absent even if they are present they must revert back to the normal fetal heart rate level by 2 minutes right. So, that was the non stress test and the 4 criteria the fetal heart rate baseline fetal heart rate variability then the acceleration and the deceleration. Now what is the rationale for the non stress test because it is non stress no stress that means, there is no uterine contraction right. So, in absence of uterine contraction we go for the fetal heart rate stressing and to note that fetal heart rate temporarily will accelerate with fetal movement. In hypoxia or in cases of fetal a compromise or depression there is no acceleration in the stressing.

So, absence of acceleration is a important indicator of fetal distress also bradycardia will hint

towards fetal distress then decreased variability less than 5 beats per minute will hint towards fetal distress. What are the cases when there is absence of acceleration in case of fetal sleep? Say when the fetus is sleeping there is no movement so, there is no acceleration. So, we need to follow the NST tracing over a period of minimum 20 minutes of no acceleration or less than 2 accelerations are being seen then we continue again for another 20 minutes total over a 40 minutes duration so, as to note for these acceleration right in case the fetus is sleeping. In case of ingestion of narcotic drugs or sedatives by the mother in fetal hypoxia fetal acidosis there will be absence of acceleration in prematurity when the nerve roots are not so much developed there may be absence of acceleration in case of sepsis in case of different fetal cardiac or neurological defect there may be absence of acceleration. So, all these should be taken into account during the reading of an NST tracing right.

Now coming to the interpretation of NST it has 2 that is reactive and non reactive. Reactive we have already told that more than 2 more than or equal to 2 acceleration 2 fetal heart rate acceleration if present right if present over 20 minutes of NST tracing right. So, if it is present over 20 minutes of NST tracing we see more than 2 or 2 fetal heart rate acceleration then it is reactive. If it is non reactive that means, it is less than 2 fetal heart rate acceleration over a period of 20 minutes over a period of 20 minutes it is less than 2 fetal heart rate acceleration then what to do we will ask the mother you know to take some fluid like glucose, glucose water right and some fluids and then lie down in you know left lateral position and then we will again continue with the NST tracing for another 20 minutes. Now if it is less than 2 acceleration of fetal heart rate less than 2 acceleration what does this acceleration mean? That means, that the fetal heart rate increase in fetal heart rate by 15 beats per minute and lasting for at least 15 seconds these episodes are missing right.

So, it is less than 2 fetal accelerations over a period of 40 minutes then we will go if it is so, then it is non reactive NST and then we will need to evaluate. Then we will need to evaluate we will need to go for the total biophysical profile and sometimes you know we go for VAS, VAS is visual acoustic stimulation right. So, we give sound stimulation to the fetus in case the fetus is sleeping to stimulate the fetus we do some auditory or stimulus to the fetus through you know stimulator acoustic stimulator and thus we need to again reassess the NST tracing and otherwise in some cases we go for contraction stress test where oxytocin is being infused to elicit uterine contractions which through then we will during the uterine contraction we will go for the NST tracing and then we will read the NST graph right or the paper. So, these if the NST is non reactive. So, what the conclusion of this in non stress test that is fetal movement, fetal movement will actually lead to fetal heart rate acceleration and this non stress test if it is reactive then we can very well say that yes the fetus is you know normal or the fetus is well oxygenated reactive non stress test has a higher predictive value right.

So, false negative is less in case of NST only 0.5 percent. So, 99.5 percent if the NST is

reactive then in 99.5 percent cases you can say that yes the fetus is normal it is well oxygenated no need to worry, but false positive false positive is 50 percent.

So, what does that mean that if it is non reactive that does not mean that the fetus is not well oxygenated only 50 percent of the fetus is you know compromised rest 50 percent it is false positive right. So, what is the predictive value? Predictive value when we do a NST today NST stressing will predict the fetal status over the next 72 hours right. So, it for the next 3 days we know that the fetus is you know if it is reactive then the fetus is normal. So, in high risk cases it should be repeated twice weekly and a reactive NST has a high predictive value I have already discussed that it will say that fetal well being we can very well say that the yes the fetus fetal well being is assessed and the fetus is normal if the NST is reactive, but if it is non reactive that means, 50 percent of the fetus is normal and 50 percent is compromised. So, this requires further testing right.

So, to detect these compromised fetus it will require further testing with I have already told visual acquired stimulation VAS test where auditory stimulus is given and then we go for the NST test right. So, what VAS will do? It will help to decrease the time of NST, it decrease the duration of NST because the fetus is being stimulated by various auditory stimulus by you know the acoustic stimulator right. So, that will decrease the duration of NST and also it helps to evaluate a non reactive NST test right. So, then we go for visual acoustic stimulation test and another one is the contraction test test which is not done nowadays because uterine contraction in the antenatal period may risk for preterm labour PROM, sometimes you know rupture of a scarred uterus you know bleeding from a placenta previa. So, contraction stress test now is not done. So, that was regarding the NST. Now coming to the biophysical profile this biophysical profile is a complete test not only the NST it will detect both acute fetal hypoxia as well as chronic hypoxia right. So, how chronic hypoxia? Chronic hypoxia is detected from the AFI amniotic fluid index or the single deepest vertical pocket of the amniotic fluid a measurement right this is an ultrasound feature. And acute hypoxia can be detected from the NST non stress test which is a CTG tracing then others are the fetal fetal body movements gross body movement then breathing movement and your fetal tone right. So, these three these three are also USG parameters, but these all taken together will detect acute fetal hypoxia right.

So, this is the fetal biophysical profile. Now this five these there are five criteria and every five criteria has a score of 2 or 0. So, total score of the biophysical profile is 5 into 2 that is 10 right. Now coming to the different scores parameters, parameters is number 1 is your non stress test. If non stress test is reactive then score is 2 here score 0, score 0 meaning 2 or 0 meaning the non stress test is non reactive. Fetal breathing movement so, this is done over a period of 20 minutes and rest are all USG parameter which are done over a period of 30 minutes.

USG over a period of 30 minutes if we see one episode of fetal breathing movement lasting

for at least 30 second then the score is 2 and if it is less than 1 know then the score will be 0 less than 1 episode. Gross body movement over a period of 30 minutes at least 3 or more than 3 discrete body or limb movement should be visible and then the score will be 0 or else if it is less than 3 then the score will be 0 right. Fetal muscle tone fetus is actually in a position of flexion. So, one episode at least one episode will be present where there will be active extension of the limbs or the trunk and then return to the flexion position right. You can see in the ultrasound when done over a period of 30 minutes it should have at least one episode of such or the hand, hand is in closing posture.

So, opening and then again closing of the hand at least 1. So, that if present it is normal and then the score will be 0, but if there is no movement of the limbs or the hand is constantly open then the score will be 0 right. Amniotic fluid amniotic fluid here we are measuring the single vertical pocket right. So, when we measure a single vertical pocket at least it should be 2 centimeters in 2 perpendicular planes right the longitudinal and the transverse. So, if it is 2 centimeters then the score is normal that is 2 and if it is less than 2 then the score will be 0.

So, total score is 10 and the 5 parameters are given and they each one has a score of 2. So, total score is 10. Now, out of 10 what is the score for that particular patient? If it is 10 on 10 then it is normal no need to worry and just go on repeating at weekly interval or more or you can also not do the NST any further that depends upon the assessment of the patient right. If it is 8 by 10 with the amniotic fluid index which is normal that means, that there is low risk of fetal hypoxia amniotic fluid index will give an assessment of chronic hypoxia. So, that means, that if it is 8 by 10 there is low risk of fetal asphyxia or hypoxia and so, we can just repeat the test weekly or twice weekly and then assess further.

If it is 8 by 10 with amniotic fluid index low that means, it suggests that it is chronic hypoxia then we must repeat the test more frequently and try to deliver the fetus as early as possible right after 24 hours. If it is already at term then go for delivery, but if it is preterm then we can wait for the steroid injection to act for the next 24 hours and then deliver. If it is 6 by 10 6 by 10 that means, there is a significant possibility of fetal hypoxia if it is more than 36 weeks go for delivery, but less than 36 weeks and the lecithin-sphingomyelin ratio is less than 2 that means, it is premature then we will need to wait right. We need to wait give steroid injection and repeat the biophysical profile test in next 4 to 6 hours and then again reevaluate and say if the amniotic fluid is normal then the less chance of chronic hypoxia, but 6 by 10 it indicates acute hypoxia.

So, we need to consider delivery. So, 4 also highly hypoxia then also go for delivery if 2 less than 4 obviously, go for delivery as quick as possible regardless of the gestational age or we will lose the fetus right. So, we can see that up to 8 up to 8 with liker normal with amniotic fluid liker assessment normal we can wait, but less than 8 or 8 with amniotic fluid index low we cannot wait and we need to deliver. So, this was the interpretation of biophysical profile. Now

we have another term called as modified biophysical profile which you know includes only the non stress test and the amniotic fluid test. So, non stress test is for acute fetal distress and amniotic fluid index is for chronic fetal hypoxia.

Both these taken together rests which are the fetal movement, the fetal breathing movement, fetal tone these are not taken because why? Because this takes less time and it has been shown that this modified biophysical profile is comparable or it gives the same result or same interpretation as the total biophysical profile score. So, only these 2 we can assess this is an USG parameter and this is from the CTG. Say if the NST is abnormal non reactive or non reassuring and AFI amniotic fluid index is less than 5. How to reduce the amniotic fluid index? Say this is the abdomen we divide the abdomen into 4 quadrants and in each quadrant say this is the fetus it is this is the fetus and this is the abdominal whole abdomen with the amniotic sac. So, in each quadrant we will measure the deepest pocket this is one deepest pocket in this we will measure the deepest pocket.

So, these 4 readings we get the 4 readings and we add these 4 readings we add this 4 readings this will give the amniotic fluid index and amniotic fluid index will vary from 5 to 22 if less than 5 then it is oligohydramnios or reduced amniotic fluid right. So, that is also abnormal. So, amniotic fluid if less than 5 it is abnormal and this single vertical pocket single vertical pocket in each quadrant should be more than 2 centimeters right it ranges between 2 to 8 centimeters. So, if less than 2 centimeter it also hints towards less like a that means, chronic fetal hypoxia and you need to deliver the baby early. So, this is the picture of the fetal cardiography where you have 2 transducers one formation in the uterine contraction one for the fetal heart rate and this is the CTG machine and this is the tracing of the paper where you get to see the fetal heart rate variations.

Now coming to the ultrasound. ultrasound we have already done that is the amniotic fluid index right. So, ultrasound is an important parameter important device to assess the fetal well being by amniotic fluid index or the single vertical pocket assessment right this is number 1. Mostly done in third trimester so, we will look for the femur length the biparietal diameter and the head circumference these are the fetal parameters and of which the femur length will give an estimate of the gestational age of the fetus and number 3 is the abdominal circumference. This abdominal circumference is the single measurement which best reflects the fetal nutrition. Abdominal circumference if less than it means that there is IUGR or growth restriction of the fetus.

Now coming to the amniotic fluid I have already discussed it normal ranges between 5 to 25 less than 5 is oligohydramnios and more than 25 is polyhydramnios right. And single vertical pocket of the 4 quadrants when added together will give the amniotic fluid index right. And this

single vertical pocket in each quadrant should range between 2 to 8 centimeters which we do for fetal lung maturity assessment. So, that was all for today. Thank you.