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

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Hormones in pregnancy (continue)

Good morning students. Welcome to yet another session for the NPTEL online certified course on the topic and overview on maternal health, the antenatal, intranatal and postnatal care. So, today it is a continuation of our previous class on the hormones in pregnancy. In the previous class, we have already discussed the placenta acting as an endocrinal organ. Endocrine organ during pregnancy, you know secretes number of hormones which helps in the continuation of pregnancy and you know it helps in growth and development of fetus as a whole by bringing about certain physiological changes inside the mother's body. We have discussed regarding the human chorionic gonadotropin hormone and its utilization in pregnancy confirmation.

We did have discussion regarding the human placental lactogen and also a little bit regarding the insulin like growth factor which helps in the growth of the fetus in the intrauterine life. In this class now, we will continue our discussion with corticotropin releasing hormone. This is also a placental peptide hormone right. So, this corticotropin hormone is secreted by the maternal corticosteroids.

The maternal corticosteroids will stimulate the placenta and the placenta will be secreting the corticotropin releasing hormone throughout pregnancy, but throughout pregnancy it is bound to the corticotropin releasing hormone binding protein. So, it remains in the bound form throughout pregnancy and towards the end of pregnancy, towards the end of pregnancy this binding hormone decreases right. So, there is decrease in the binding hormone, it will decrease further decrease and thereby the corticotropin releasing hormone free form will come into the circulation. So, this free corticotropin releasing hormone in the circulation plays a important role in the initiation of labor right. So, get my point that this hormone has a role in the initiation of labor which means it helps in you know inducing the uterine contraction during labor right.

So, this is what I was telling that yes the free corticotropin releasing hormone, the free form this will be you know increase towards the end of the pregnancy and there will be more production from the placenta right. And this will induce the fetal adrenal gland, it will activate the fetal adrenal gland, it will activate the actually the fetal HPA axis. The hypothalamopituitary adrenal axis will get activated and the fetal adrenal gland will be secreting DHEA, DHEAS into

the circulation. Also it will cause release of cyclic AMP from the placenta and the prostaglandins you know there will be also release of the prostaglandins and all these three together they will lead to uterine contraction which signifies the onset of labor right. So, this is the pictorial representation you know you can see here this corticotropin releasing hormone which is being secreted from the placenta, it increases in concentration in the late pregnancy right.

Towards the end of the pregnancy, the late pregnancy this corticotropin releasing hormone free form will be going into the this is the fetus will be going into the fetus and will activate the hypothalamopituitary and adrenal axis. And all this together will lead to the secretion of cortisol and DHEA and DHEAS from the fetal adrenal gland. And they inside the placenta will be converted to estrogen right. And all these these estrogen they then the prostaglandins then the cyclic AMP all these will be acting on the uterine myometrium and will lead to myometrial contraction. The myometrium will start contracting and this will signify the onset of true labor pain right.

So, that was regarding the corticotropin releasing hormone. Now, coming to the other growth factors that is the vascular endothelial growth factor and the placental growth factor. The vascular endothelial growth factor helps in angiogenesis in the first trimester whereas, the placental growth factor will be you know responsible for angiogenesis in the third trimester right. Coming to soluble FMT like tyrosine kinase 1. In short it is written like SFLT 1 right.

So, this is the soluble FMT like tyrosine kinase 1. This is a molecular marker right. So, if it is you know increases in mother's blood so, what will it do? It will bind to the VEGF and placental growth factor and it will prevent angiogenesis. And this you know this angiogenesis by the vascular endothelial growth factor they will have a vasodilatory effect. That means, it decreases the placental resistance thereby increasing placental circulation and ultimately increasing no supply of nutrients to the fetus required for its growth.

But the soluble FMT like tyrosine kinase will bind the VEGF and placental growth factor preventing angiogenesis and thereby preventing the vasodilatory effect. So, there will be vasospasm and ultimately lead to increase in blood pressure right. So, it will cause a preeclampsia in a pregnant female with raised soluble FMT like tyrosine kinase. And also there will be abnormal angiogenesis vasospasm and thus lead to hypoxia fetal hypoxia. So, from here we can deduce that in preeclampsia what will happen? There will be raised SFLT1 and decreased VEGF decreased placental growth factor.

So, this will happen in case of a pregnant female suffering from preeclampsia. So, these are the molecular markers in the maternal serum and this will indicate that this patient or this mother is more prone to preeclampsia. So, we have to intervene and you know do the necessary

management right. So, these were all regarding the peptide hormones being secreted from the placenta. Now, coming to the steroid hormones right.

So, estrogen, progesterone are the very important steroid hormones being secreted from the placenta which helps in the continuation of pregnancy. Regarding estrogen, to note here that estrogen you know cannot be produced from the maternal precursors right. So, we know that estrogen is actually produced from the cholesterol or the 17-hydroxypregnanelone right. So, these are C21, 21 carbon compounds right and these you know gradually in step by step it has to be acted upon by various enzymes of which the 17 alpha hydroxylase. Hydroxylase this is a enzyme in this pathway which you know helps in the conversion of 21 carbon compound to 19 carbon compound that is the androstenedione from where estrogen is being produced.

This 17 alpha hydroxylase is absent in placenta, it is not present in placenta, it is absent. So, what happens the maternal precursors you know which are 21 carbon compounds they cannot be converted to estrogen due to the absence of 17 alpha hydroxylase in the placenta. So, the fetal adrenal gland products right, fetal precursors are to be used. The fetal adrenal gland produces DHEA and DHEAS. So, these are actually 19 carbon compound and they get converted to androstenedione, actually they get converted to this estrogen, they get converted to this estrogen by the action of certain enzymes of the placenta right.

What are they? The sulfatase, the aromatase and the beta hydroxy steroid dehydrogenase of placenta. So, they will be converting this fetal DHEA and DHEAS to estrogen right. So, that is what it is written that placenta lacking 21 sorry 17 this will be 17 alpha hydroxylase cannot use the maternal precursors and thus depends on the DHEAS produced from the fetal adrenal gland which will be converted to estrogen by the sulfatase, aromatase and 3 beta hydroxy steroid dehydrogenase present in the placenta. And as pregnancy progresses this estrogen levels in the maternal serum increases right and estrogen receptors on the uterus also increases with the continuation of pregnancy right. Now, coming to the most common estrogen, most common or the maximum form of estrogen which is present in maximum amount that is estradiol E2.

But to know which is the most specific estrogen in pregnancy, this estrogen is found only during pregnancy that most specific estrogen is estradiol or E3 right. So, this is regarding estrogen. Now, coming to the cases where there is increased levels of estrogen yes in case of erythroblastosis fetalis or RH negative pregnancy where there is increased placental mass. So, increased placental production of estrogen leading to a estrogen excess right. So, in comparison to the gestational age and second is a androgen or a estrogen producing tumor present in the mother.

What are the cases where there is decreased levels of estrogen? Number 1, IUFD. Number 2, anencephaly right. Why? Because in anencephaly what happens the fetal adrenal gland, fetal

adrenal gland is either absent or hypoplastic. So, what happens there is no production of DHEAS, no estrogen. So, estrogen levels are less and you know this estrogen which was increasing at term it will help in the initiation of labor you know just you know at the end of pregnancy.

So, if estrogen is less so, there is no initiation of labor and there is you know more chances of post term pregnancy. In anencephaly there is less estrogen and this will you know make the mother with anencephaly more prone to a post term pregnancy right. Third is the aromatase deficiency, yes in case of aromatase deficiency the DHEAS will not be converted to estrogen. So, estrogen levels will be low. And lastly is the Down syndrome in second trimester there is increase in unconjugated estriol.

So, this you know sorry there will be decrease in unconjugated I will clear this write it for you again there will be decrease in unconjugated estriol. And this is a marker you know it is included in the triple test which is a screening test for Down syndrome. Here I would like to add that in case of aromatase deficiency what happens number one decreased estrogen. So, more chance of post term pregnancy or delayed onset of labor that we already know. Another thing is increase in androgen levels the DHEA, DHEAS are not being converted to estrogen or estradiol or estriol.

And so, what happens there is increase in androgen levels which can lead to maternal hirsutism. Increase in androgen can lead to maternal hirsutism and number two it can cause virilization of the female fetus. So, there is increased androgen and this can result in these clinical features they are seen in case of aromatase deficiency in the placenta right. So, this was regarding the estrogen. Now, coming to progesterone, progesterone unlike estrogen it can be produced from the maternal precursor like the cholesterol or 17-hydroxypregnenolone.

It will directly be converted to progesterone. This is also a hormone of pregnancy and we have already discussed progesterone is produced from in the initial stages of pregnancy this progesterone is produced from corpus luteum. During HCG discussion we had discussed right that this corpus luteum up to day 21 of the cycle is maintained by the maternal LH. And following this from day 21 the LH levels of the mother secreted from the anterior pituitary they will go down due to the feedback inhibition from the raised levels of progesterone right. So, now, the LH cannot you know maintain the corpus luteum and you know in case there is no pregnancy the corpus luteum will gradually you know get destroyed or there will be corpus luteum demise and thus there will be no progesterone and the female will have her next cycle of menses.

But say that in this cycle the female gets pregnant there is no sperm in the genital tract and she gets pregnant. And due to no implantation of the blastocyst there is formation of

syncytiotrophoblast which will ultimately lead to the secretion of HCG which will take over the function of LH from day 22 of the cycle. And it will know prevent or it will rescue the corpus luteum from demise and it will maintain the corpus luteum for another 2 weeks for the secretion of progesterone. Progesterone is a know helps in the maintenance of pregnancy. So, progesterone at first up to 6 weeks up to 6 weeks it is secreted from the corpus luteum right.

Then from 6 to 8 weeks from 6 to 8 weeks this progesterone know will now be secreted from the placenta. For the initial 6 weeks it was being secreted from the corpus luteum and then from after 6 weeks it will be now released from the placenta it will be produced in the placenta right. So, this phase this know production know of progesterone from the placenta of around 6 to 8 weeks right this is called as the luteo placental shift this is called as the luteo placental shift and this occurs at around 6 to 8 weeks of gestation right. So, I think you it thinks are being clear to you right. So, this is regarding the production of progesterone now coming to the functions progesterone yes it is a smooth muscle relaxant it helps in uterine quiescence it prevents uterine myometrial contractility and thus it prevents fetal expulsion right.

So, it will help to continue the pregnancy and just at the end of pregnancy just before the onset of labour there is functional withdrawal very important functional withdrawal of progesterone the quantitative levels of progesterone remains the same, but the progesterone receptors they decrease and there is functional withdrawal of progesterone which leads to the onset of myometrial contractility signifying the onset of labour. It has also anti inflammatory and immunosuppressant function right. So, this will help in decreasing the you know the immunological reaction of the mother in response to the fetal you know autologous graft during its implantation. So, it will help in preventing fetal rejection right. So, this was regarding the progesterone.

Now, coming to another hormone relaxin, relaxin is a peptide hormone right and it is also secreted from corpus luteum corpus luteum it is primarily secreted from corpus luteum and it is also secreted by the placenta and decidua primarily it is secreted from the corpus luteum right. And what is the function? Yes, it relaxes the myometrium and also it relaxes the joints the symphysis pubis and the sacroiliac joints which happens in the mother's body during pregnancy and very important very important is it increases the renal blood flow. How? By causing renal vasodilatation via nitric oxide. So, we have already discussed in the physiological changes of pregnancy that the renal blood flow increases around 400 ml per minute and there is increased GFR and this increase in renal blood flow is brought about by relaxin secreted from the placenta via nitric oxide or mediated via nitric oxide right and also it has a role in cervical ripening and effacement you know required for the progression of labor. So, this was all regarding the hormones secreted from the placenta during the period of pregnancy.

Now, coming to the maintenance of lactation the following delivery the hormonal influence

required for the maintenance of lactation. We will just go through the different you know definition. What is mammogenesis? It is the preparation of the breast occurring during this antenatal period right. So, what happens it has ducts and it has alveoli.

The breast has ducts and alveoli. So, this ducts duct hyperplasia hypertrophy are mostly brought about by estrogen whereas, the lobule and alveoli development or hyperplasia hypertrophy it is mostly brought about by progesterone and also prolactin mainly these two here also estrogen has a role. So, this is the alveoli development and this is the ductal development during the antenatal period and this preparation is of the breast you know for lactation is called as mammogenesis. Now, synthesis and secretion of the milk by the breast alveoli during the lactation period is called as lactogenesis. Ejection of milk is called as galactokinesis and maintenance of lactation is galactopoiesis.

Now, coming to one by one. So, what happens lactation milk secretion? Milk secretion or you know initiation this initiation of milk secretion from the alveoli this initiation is brought about by prolactin right. So, just to note that in the antenatal period prolactin is secreted from the anterior pituitary right in the antenatal period say this is the antenatal period and here is the delivery and in the postnatal period this prolactin will also you know in the postnatal period this prolactin will also be present, but it will slightly decrease in amount right and it will be present also in the postpartum period right. So, to note here is even if prolactin is present in the antenatal period there is no lactation in the period of pregnancy. Lactation occurs only following the delivery why because here the prolactin is under the inhibitory action of dopamine and this is brought about by estrogen right. So, I will clearly write here this estrogen will be you know act via this dopamine which will inhibit the prolactin and so, there is no lactogenesis or milk secretion during the antenatal period, but following delivery though the level of prolactin somewhat decreases, but still it is sufficient to maintain this lactation or lactogenesis or milk secretion why because there is no estrogen there is no estrogen no progesterone following delivery estrogen and progesterone levels will decrease and so, that inhibitory effect of dopamine will also go away and prolactin can act in the postpartum period right.

So, prolactin helps in the initiation of milk secretion. Now, what is the maintenance of milk secretion? This maintenance of milk secretion yes I have told that this is also brought about by prolactin and this is due to the absence or you know estrogen and progesterone declining in the postpartum period dopamine effect has gone away and prolactin can continue to maintain the lactation in the postpartum period. Also growth hormone thyroxine and cortisol have a role to play. Now, what is milk ejection? What is milk ejection? Milk ejection is galactokinesis. Milk ejection from the alveoli you know from the nipple that is via the milk ejection reflex which is brought about by the fetal suckling, fetal suckling and oxytocin from posterior pituitary.

So, these two will be helping in the milk ejection right. So, this is oxytocin. So, that is about

the process of lactation. So, here you see this picture ideally you know depicts or it tells us that the most important is the suckling of the baby following delivery. As the baby suckles mother's nipple there is positive feedback.

This is via the emotions and also the neural pathways which are passing from the nipple they will lead to a positive feedback at the level of pituitary and the pituitary will be secreting oxytocin. The posterior pituitary will be secreting oxytocin which will increase the you know ejection of milk more galactokinesis. As the fetus suckles there is more ejection of milk and also the anterior pituitary will be releasing prolactin so, more milk production right. So, sometimes you know the mothers have a very common complaint that there is decreased milk production and that is not sufficient for the fetus you know to you know quench the thirst of the fetus. But it is to you know reassure the mother that no you know take the baby to your breast and help in latching of the baby with the breast.

Now be patient and allow the baby to suck as the baby sucks that stimulus that is the main stimulus and that is going to give a positive feedback to both the anterior and posterior pituitary which will be you know releasing both prolactin and oxytocin helping in milk production as well as milk ejection right. So, this was regarding the lactation and the hormonal changes required for the maintenance of lactation. So, in a nutshell we have covered the hormones of placenta, the main hormone that is the human chorionic gonadotropin hormone, then the human placental lactogen and the various growth factors you know secreted from the placenta and also the relaxing hormone that is the peptide hormone helping in increase of renal blood flow and also maintaining the you know smooth muscle relaxation and joint laxity of the mother during pregnancy. Next regarding the steroid hormones we have discussed estrogen and progesterone production from the placenta and in the end we have discussed in a nutshell the lactation process and the hormones involved in lactation right. So, this is all about today's class keep reading keep taking notes and you know all the things cannot be covered in the slide as I am speaking you keep on taking notes and things will be you know slowly slowly clear.

Pregnancy is a very complicated you know process and various changes you know they are occurring inside the mother as well as inside the fetus and both are synchronizing you know this both the changes in mother and fetus they will be synchronizing so as to help in the development and growth of the fetus and also help the mother you know be ready to cope with the stress, the blood loss, the complications that is going to occur during the process of delivery and also you know the things that is necessary following delivery that is lactation and breastfeeding right. So, this was all for today and the references taken are from the D.C Dutta textbook of obstetrics, the Williams obstetrics and the James book on high-risk pregnancies right. So, this was in nutshell and you know thank you all for your patient hearing and I look forward to meet you all again in the next class. Thank you.