ANTEPARTUM ASSESSMENT OF FETAL WELLBEING

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The obstetrician is responsible for 2 patients during pregnancy and labor, one of them being the fetus. The hidden patient is guarded by the following barriers:
Anatomical: **which can be overcome to some extent by U/S imaging.**
Physiological: **these need an understanding of the interaction between fetal and maternal physiology.**

Fetal assessment begins in the 1st trimester by the confirmation of viability and determining the gestational age.
In the 2nd trimester the fetus should be evaluated by its genetic and structural development.
In the 3rd trimester the assessment involve the evaluation of fetal growth and wellbeing in anticipation of labor.

After determining the GA of the fetus and confirmation of its viability we have to exclude congenital anomalies (in high risk mothers of having congenital anomalies) by biochemical screening tests:

Screening for NTD and Down syndrome:

1- Serum α fetoprotein: NTD account for 50% of all congenital anomalies, serum α fetoprotein can be measured in the 15 – 17 weeks in the maternal blood.

2- The triple test: serum α fetoprotein, hCG, estriol are the 3 parameters measured in the maternal blood for detection of risk of down syndrome when the serum α fetoprotein is lower than the mean, hCG is higher, and estriol is lower the probability of down syndrome is high so we have to do amniocentesis to take fetal cells for kariotypic diagnosis.

* nuchal translucency by U/S:

measurement of the nuchal fat pad of the baby(behind its neck)

The measurement is done in the 11-13 weeks, it gives a risk like the triple test, for the detection of fetal trisomies and congenital hrt defects, so the definitive diagnosis is by genetic kariotyping by doing chorionic villous sampling.

*Routine anomaly U/S scanning (18-20) weeks(MIDPREGNANCY):

This is done to assess the following:

-GA (by measuring the biparietal diameter) the GA is accurate within 2 weeks

-Localization of the placenta

-Diagnose multiple pregnancies

-Exclude congenital anomalies:

- ***Neural tube defects and anencephaly**
- ***Double bubble sign of duodenal atresia**
- ***Cardiac abnormalities**
- ***Hydrocephaly**
- ***Renal abnormalities**
- ***Sacral agenesis in diabetic mothers**
- ***Major limbs defects**

In the 3rd trimester:

A major risk to the continuation of normal fetal development is believed to occur when the increasing fetal requirement for growth is no longer obtained (secondary to uteroplacental insufficiency).

The onset of such failure of transplacental supply is usually gradual and recognition only occurs when fetal adaptation (tolerance) is exceeded. Thus the onset of fetal growth retardation due to nutritional deprivation and development of chronic hypoxia due to inadequate respiratory function of the placenta are gradual. The coexistence of these features becomes evident when fetoplacental reserve has been exhausted.

Fetal monitoring during the 3rd trimester aims to recognize this reduction in placental function by identifying alteration in fetal growth, placental perfusion, liquor volume, fetal movement and / or fetal heart rate.

***Tests used to assess fetal wellbeing* in the 3rd tm:**

Obstetricians have searched for tests which could be applied during the antenatal period to identify fetuses at risk of intrauterine hypoxia and death:

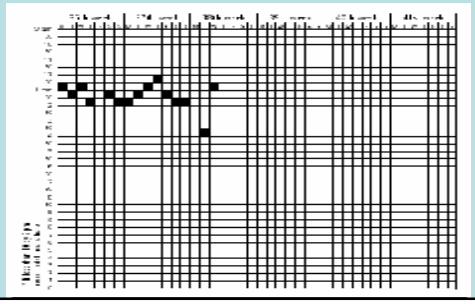
Previously biochemical assessment of placental function by measuring plasma human placental lactogen and oesteriol were used but these tests are now out of use as they are poor predictors of fetal outcome.

Third trimester assessment

Maternal assessment of fetal movement

- The mother counts ten fetal movements entering them on a chart . She is asked to start counting fetal movements from 9.00 a.m. and then to record the time by which she has felt ten movements. If this is later than 9.00 p.m. she is asked to report for further examination with a cardiotocograph (CTG).

The Cardiff count-to-ten
Fetal activity chart



The most widely used tests of fetal wellbeing in late pregnancy are:

1- Antenatal cardiotocography (CTG).
2- Biophysical profile.
3- Doppler U/S.

Cardiotocography:

-Antenatal CTG uses external methods of monitoring the FHR.

-The women should be comfortable and resting in the left lateral or semi – recumbent position (avoiding compression of the inferior vena cava).

-An external U/S transducer for monitoring the fetal heart and a tocodynometer for recording uterine activity are secured overlying the uterus.

-Recording is then made for at least 30 minutes.

Fetal cardiac physiology: Fetal cardiac behavior is regulated through sympathetic and parasympathetic signals and by vasomotor, chemoreceptor and baroreceptor mechanisms. Pathological events such as fetal hypoxia modify these signals and also cardiac response.

Fetal heart rate variability

Under normal physiological conditions the interval between successive heart beats (beat to beat) varies. This is called "short term variability" and increases with increasing GA.

This is not visible on a standard CTG; it can be obtained from fetal electrocardiogram (ECG).

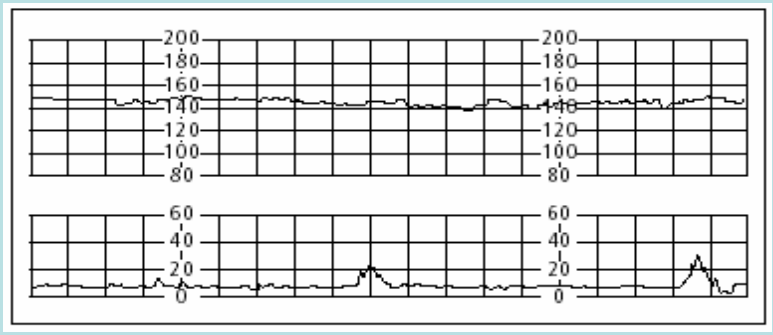
There are long term fluctuations in FHR occurring between 2 – 6 times per minute. This is called "base-line variability"

Normal base line variability reflects normal fetal autonomic nervous system.

Base line variability is modified (reduced) by:

***fetal sleep state and activity.**
***hypoxia.**
***fetal infections.**
***drugs suppressing the fetal CNS, such as opioids and hypnotics.**

Base line variability is considered abnormal when it is less than 10 beats per minute.



Antenatal CTG showing loss of baseline variability.

Baseline fetal heart rate:

Fetal heart rate falls with advancing GA as a result of maturing fetal parasympathetic (vagal tone).
It is best to be determined over a period of 5 – 10 minutes.
The normal FHR at term is 110 – 150 beats per minute (bpm).

Fetal tachycardia can be due to:

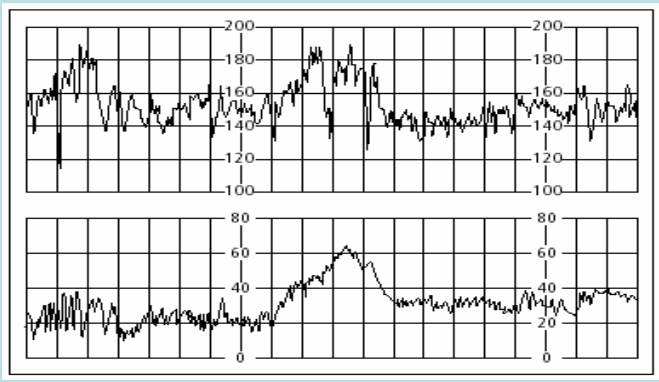
- **Congenital tachycardia.**
- **Maternal or fetal infection.**
- **Acute fetal hypoxia.**
- **Fetal anaemia.**
- **Drugs such as adrenoceptor agonists (ritodrine).**

FHR accelerations:

These are increases in the FHR of at least 15 bpm, lasting for at least 15 seconds.

The presence of two or more accelerations on a 20 – 30 minute CTG defines a reactive trace.

The importance of accelerations is that they are only observed very rarely in the presence of fetal hypoxia i.e. they are a good sign of fetal health.



Acceleration of fetal heart rate (above) with uterine contraction (below).

FHR decelerations:

These are transient reductions in the FHR of 15 bpm or more, lasting for more than 15 seconds.

When occurring in relation to isolated uterine contractions or fetal movements they do not appear to be associated with a poor fetal outcome.

Decelerations that occur in the presence of other abnormal features such as reduced variability or baseline tachycardia are more likely to reflect fetal hypoxia.

From the above descriptions a normal antepartum fetal CTG can therefore be defined as:

- **A baseline of 110 – 150 bpm**
- **Variability of 10 – 25 bpm**
- **2 accelerations within 20 minutes**
- **No decelerations**

Suspicious CTG when there is:

- **Absence of accelerations**
- **Abnormal baseline rate (<110, or >150)**
- **Reduced variability (<10 bpm)**
- **Variable decelerations.**

STRESS AND NON-STRESS CARDIOTOCOGRAPHY:

Non- stress test: is done for woman, who is positioned comfortable, CTG is done over 20 minutes. A reactive test considered when there are at least 2 fetal movements with accelerations in FHR as mentioned above. Absence of accelerations defines a non – reactive test and it is an indication for further evaluation.

Contraction stress test: an oxytocin infusion is administered intravenously to induce uterine contractions a positive test result is fetal cardiac decelerations in response to uterine contractions, which is abnormal.

This test is not recommended because it may cause fetal distress and preterm labor.

It is a poor predictor of fetal outcome, have high false-positive rate, too time consuming and invasive.

Biophysical profile:

These include U/S assessment of:

-Breathing movements

-Gross body movements

-Fetal tone

-Accelerations in FHR related to movements

-Amniotic fluid volume

*** A score of either 2 (= normal) or 0 (= suboptimal) is given to each variable.**

*** A score of < 6 is an indication to terminate pregnancy.**

Biophysical profile scoring:

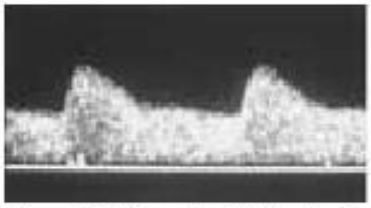
Biophysical variable	Normal (score2)	Abnormal (score0)
Fetal breathing movement	>1 episode for 30s in 30 min	Absent/ <30 sec in 30 min
Gross body movements	> 3 body/limb move in 30 min	<3 body/limb movements in 30 min
Fetal tone	> 1 episode body/limb extension followed by return to flexion, open-close cycle of fetal hand	Slow or absent extension-flexion of body or limbs
Reactive FHR	> 2 acceleration with fetal move in 30 min.	< 2 acceleration or 1+deceleration in 30 min
Amniotic fluid volume	>1pool of fluid at least 1cm×1cm	Either no measurable pool, or a pool<1cm×1cm

DOPPLER INVESTIGATION:

Umbilical artery: waveforms from this vessel provide information on feto-placental blood flow and should be performed on high risk mothers, e.g. hypertension.

Normally diastolic flow in the umbilical artery increases (i.e. resistance falls) throughout gestation.

Absent or reversed end diastolic flow in the umbilical artery is a particularly serious development with strong correlation with fetal distress and intrauterine death.



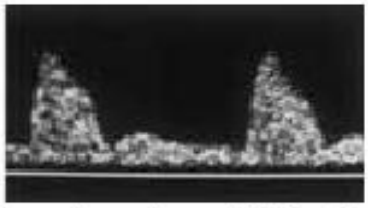
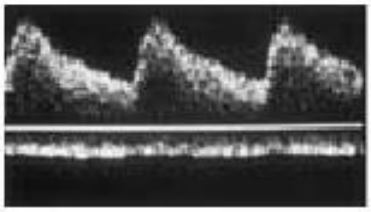


Figure 4.11 Doppler studies showing the waveforms of normal (left) and narrowed (right) arcuate arteries of the placental bed



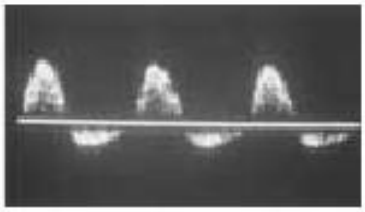


Figure 4.12 Left: Normal waveforms of the umbilical artery. Right: Severely abnormal waveforms of the umbilical artery showing reduced and even reversed flow in the diastolic phase, which suggests that the fetus is compromised

thank you