CARDIO TOCOGRAPHY

Nadia Awais

Abstract: Cardio Tocography means recording of fetal heart and utrine contraction during pregnancy. During labour the maternal and fetal energy and oxygen requirement changes. If the baby is already compromised before the onset of labour due to some underlying maternal, fetal or placental pathology, the additional stress of uterine contractions diminishes the energy and oxygen flow from mother to such an extent that fetal compromise can happen. Two traces comes on CTG paper one of fetal heart rate and second of uterine activity. Baseline heart rate is with in range of 110-160 bpm. Normal variability is between 10 to 25 bpm.

Key words: Cardio Tocography, Early deceleration, Late deceleration, Fetal hypoxia.

Cardiotocography is continuous tracing of fetal heart rate is used during antenatal period and labour also. CTG monitoring provides an indirect assessment of fetal well being.

Cardio Tocography means recording of fetal heart and uterine contraction during pregnancy.

Fetal cardiac function is regulated by autonomic nervous system. Generally CTG gives sound re-assurance of fetal well being at the time of recording but physiological responses may produce abnormalities, so an abnormal CTG may or may not represent the underlying fetal compromise that is why the negative predictive value for pathology is good but positive predictive value is poor.

This combination of risks of over intervention; leads to further testing with fetal scalp sampling for diagnosis of fetal compromise.

NON STRESS TEST

a. Done in antenatal period

Stress test

a. During labour
b. By oxytocin low dose infusion (obsolete now)

Methods of monitoring

External monitoring

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This can be used for continuous or intermittent monitoring. The fetal heart rate and activity for uterine muscles are detected by two transducers placed on mother abdomen. One above fetal heart to monitor heart rate and other at the fundus of uterus to monitor frequency of contruction. It is performed by abdominal probe.

Internal monitoring

It uses an electronic transducers connected directly to fetal scalp. Internal monitoring provides a more accurate transmission of fetal heart rate. It is performed by Fetal scape electrode

During labour the maternal and fetal energy and oxygen requirement changes. If the baby is already compromised before the onset of labour due to some underlying maternal, fetal or placental pathology, the additional stress of uterine contractions diminishes the energy and oxygen flow from mother to such an extent that fetal compromise can happen.

Following factors should be considered while dealing with CTG report;

Pre-existing medical conditions in mothers
a. DM
b. Renal disease

Hypertensive disorders of pregnancy
Pregnancy related disease like Rh incompatibility

Risk factors occur in pregnancy;
a. Antepartum haemorrhage
b. Fetal malformation
c. IUGR
Gestational period
Progress in labour
Drugs administration to mother e.g.
a. Benodizipines
b. Tocolytic agents
c. Analgesics
d. Anesthetics drugs
Maternal posture during CTG:
a. Lying supine reduces uterine blood flow to the fetus.

Recording should be done while a woman is comfortable in left lateral or semirecumbant position. An external ultrasound transducer for monitoring the fetal heart and a tocodynometer stretch gauge for recording uterine activity are used. Two traces comes on CTG paper one of fetal heart rate and second of uterine activity.

Information necessary to record on CTG

1. Name registration no. of mother
2. Date and time
3. Speed of paper 1cm/min
4. Maternal pulse
5. Posture of mother
6. Any drug administered to mother
7. If in labour vaginal findings e.g. cx dilation, membranes intact or ruptured, liquor color
8. Method of fetal heart monitoring

INTERPRETATION OF CTG

Interpretion of CTG is different during antenatal period and labour. It requires description of:

Basic pattern:
Uterine activity
Baseline fetal heart rate (FHR)
Baseline FHR variability
Periodic changes
Accelerations
Decelerations
Changes of FHR over time

UTERINE ACTIVITY

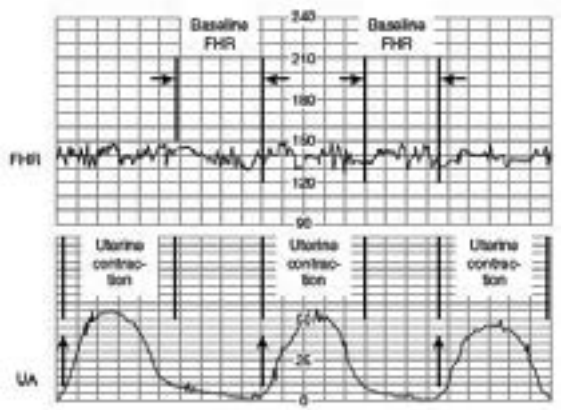
There are several factors used in assesing uterine activity.

Duration: The amount of time between start of one contraction to the end of same contraction.

Intensity: A measure of how strong a contractions is.

Frequency: The time span between the start of contraction to the start of next contraction.

Normally there are less than or equal to five contraction in 10 minutes, averaged our a 30 minute window.



BASELINE FETAL HEART RATES

The baseline is the average heart rate of fetus with in a 10 minute window.

This is an illustration of fetal heart rate controlled mainly by autonomic nervous system. Sympathic activity results in tachycardia and parasympathetic activities by vagus nerve mainly results in bradycardia.

Normal conditions vagal activities is dominant keeps the heart rate within range of 110-160 bpm (Beats per minute).

Baseline heart rate is related to gestational age with increasing gestational age results in mature vagal supply.

FETAL BRADYCARDIA

It is defined as baseline heart rate less than 120 bpm or Persistently low baseline of below 110 bpm.

Causes

Mild bradycardia (FHR 100-110 bpm)

- Gestational age more than 40 weeks

Severe prologed bradycardia (<80 bpm for more than 3 minutes

- Cord compression acute hypoxia
- Congenital heart malformation
- Drugs e.g benzodiazepines
- Maternal seizures
- Epidural and spinal anesthesia

Management

If patient is in labour: hypoxia is suspected fetal blood sampling can be done to estimate PH value.

Perform vaginal examination to exclude cord prolapsed.

Manage according to gestational age and underlying pathology if present

FETAL TACHYCARDIA

It is defined as baseline heart rate greater than 160 bpm.

Common causes

- Excessive fetal movements
- Maternal stress or anxiety
- Gestational age below 32 wks when autonomic system not mature enough and sympathetic system is dominant
- Maternal pyrexia
- Fetal infection
- Chronic hypoxia

Management
Rule out maternal or fetal causes manage accordingly.

VARIABILITY
Baseline variability refers to variation of fetal heart from 1 beat to the next beat.

It is due to interaction between sympathetic and parasympethitic system results in beat to beat changes in the heart rate of fetus.

It is a good indicator of how healthy the fetus is at particular moment in time.

Normal variability it between 10 to 25 bpm.

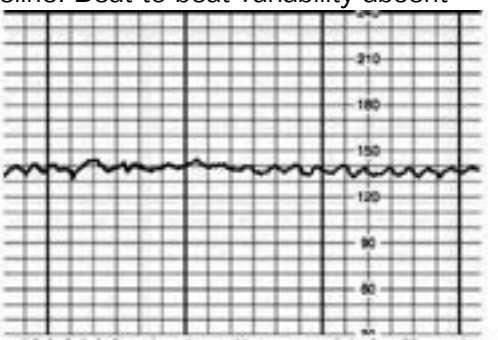
Variability can be categorised as:
- Reassuring > 5bpm.
- Non reassuring < 5 bpm between 40-50 minutes
- Abnormal < 5 bpm for > 90 minutes

It is measured by analysis of 1 min portion of a CTG and assessment of amplitude of change in the heart rate during that period, i.e. the difference in highest and lowest rate of heart beat (e.g. if highest 160 bpm and lower is 155 bpm the difference is 5 bpm)

Decreased variability may be due to acute hypoxia.
Decreased variability should not exceed more than 40 minutes. After 40 minutes variability should return to normal values. This is due to fetal sleep.

SINUSOIDAL PATTERN
A sinusiodal fetal FHR pattern is defined as a pattern of fixed uniform fluctuation of the FHR it creates a pattern resembling successive sine wave. Incidence is less than 0.3%

It is smooth, undulating sine wave like baseline. Beat to beat variability absent



•Sinusoidal fetal heart rate pattern associated with maternal intravenous meperidine administration.
•Sine waves are occurring at arate of 6 cycles/min.

It is associated with high rates of fetal morbidity and mortality.

Due to reduced and eventual cessation of umbilical venous blood flow. Significant fetal hypoxia will occur.

Causes
- Severe hypoxia
- Anemia (Rheus incompatibility, twin twin transfusion syndrome (TTS)
- Idiopathic sometimes due to narcotic drugs pattern ends with 20-30 minutes + returns to normal.

Management
In case of sinosidal pattern with other abnormalities of heart rate, immediate delivery should be done.

Consider this problem as a sinister always. Persistence of pattern, do early delivery.

ACCELERATIONS
It is an abrupt increase in baseline fetal heart rate of 15 bpm or more, lasting at least 15 seconds.

Occurs usually in response to fetal movement

or uterine contraction.

CTG is considered to be reactive if acceleration is present.

DECELERATION

These are transient reduction in fetal heart rate of 15 bpm or more, lasting for more than 15 seconds. It has following types:

1. Early deceleration
2. Late deceleration
3. Variable deceleration
4. Prolonged deceleration

Uterine contraction must be monitored in order to adequately classify the types of deceleration.

EARLY DECELERATION

Early deceleration starts when uterine contraction begins and recover when contraction ends. It is uniform in shape and occurs with each contraction.

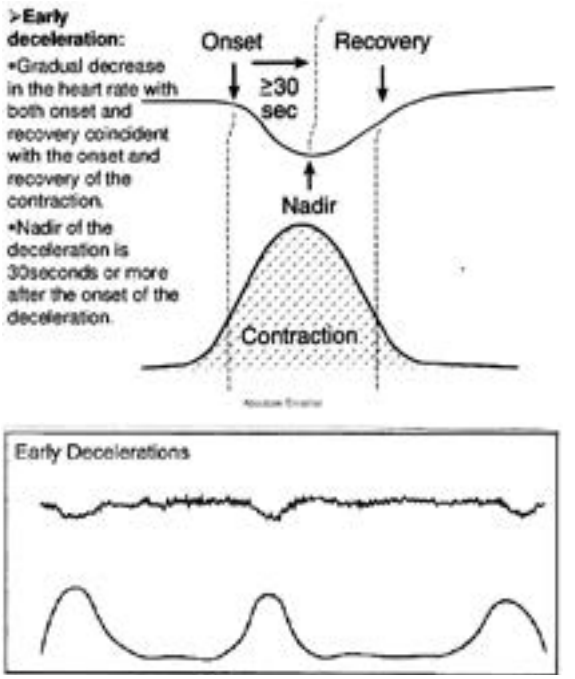
Often appear as mirror image of uterine contraction.

Onset of deceleration is with onset of uterine contraction. Heart rate reaches its lowest point at peak of the contraction and recovers as the contraction ends.

CAUSE

This is due to increased fetal intracranial pressure causing increased vagal tone. Therefore quickly resolves once the contraction and intracranial pressure reducess. Compression of fetal head during contractions causes early deceleration.

These deceleration are caused by mild transient hypoxia and are not associated with poor fetal outcome.



Management

It is considered physiologic and not pathologic. Change of maternal posture usually settles the problem.

LATE DECELERATION

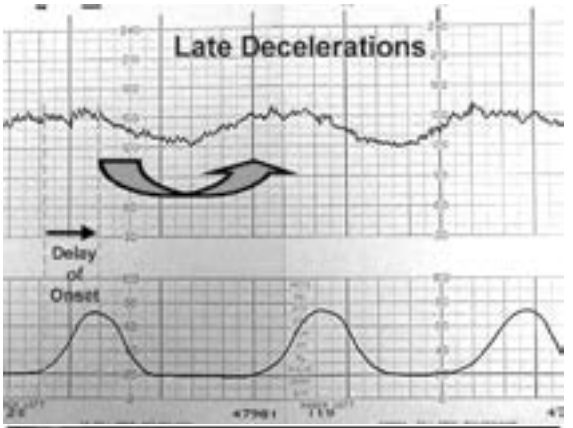
Late deceleration begins at the peak of uterine contraction and recovers after the contraction ends.

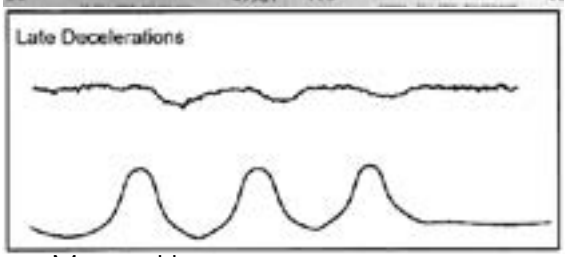
These decelerations occur, uniform in shape, depth and occur often after each contraction. Any deceleration whose lowest point occurs more than 15 seconds then the peak of the contraction is said to be late.

As a result of decrease in uterine blood flow, oxygenation to fetus during uterine contractions is reduced causing fetal hypoxia and acidosis.

Causes

- Placenta abruption





- Maternal hypertension
- Excessive uterine activity

Placental Pathologies Like

- Diabetes mellitus
- PIH
- Renal Disease
- IUGR
- Prematurity
- Rh- Incompatibility
- Twin twin transfusion syndrome

Late deceleration is always associated with fetal hypoxia

Management

Change maternal posture
Give oxygen
Give fluid to avoid dehydration
Stop oxytocin infusion if patient is in labour
Fetal scalp sampling can be done to assess PH
Prepare for early easy safe delivery

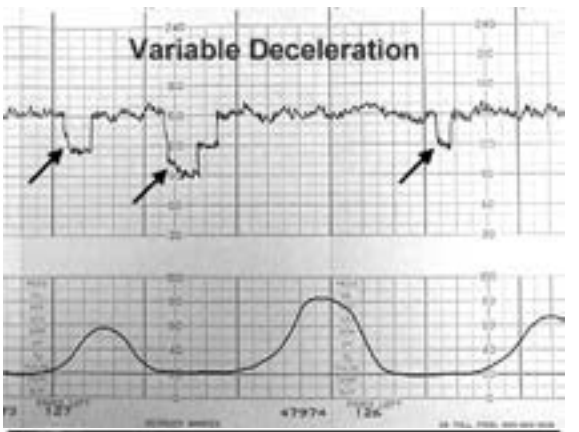
Variable Decelerations

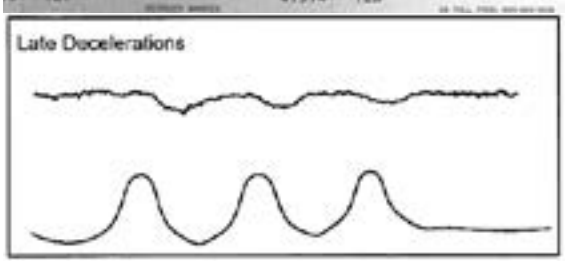
They are variable in there duration and may not have any relationship to uterine contraction.

These decelerations are in consistent in shape and in their relationship to uterine contractions.

Acceleration often proceed and follow uterine contractions.

It is due to transient compression of umbilical cord because of uterine contraction.





Variable deceleration are usually cause of by umbilical cord compression. The umbilical vein is often occluded first causing an acceleration in response, then the umbilical artery is occluded causing a subsequent rapid deceleration when pressure on the cord is reduced another acceleration occur and baseline returns to nromal.

Causes
- Umbilical cord around fetal neck
- True knot in umbilical cord
- Cord prolapse

Management
Maternal posture of left lateral side
Give I/V fluid
Give oxygen if paitent in labour
Stop oxytocin infusion
Do vaginal examination to assess labour progress and cord prolapsed exclusion.

If variability reduced between deceleration or fetal tachycardia or bradycardia develops than plan delivery.

PROLONGED DECELERATION
If persistent drop in fetal heart rate of 30 bpm and persist for 2 minuts.

Causes
- Total cord occlusion eg. In cord prolaps
- Due to epidural anesthesia (maternal hypotension)
- After artificial rupture of membranes

Management
Do measures to increase blood flow from mother to fetus.

Prepare mother for delivery.

REPORTING OF CTG
The reporting of CTG is graded as normal, suspicious or pathological.

The FHR trace is categorised as reassuring, non-reassuring or abnormal

Table 1 Definition of normal, suspicious and pathological FHR traces

Category	Definition
Normal	All four features are classified as reassuring
Suspicious	One feature classified as non-reassuring and the remaining features classified as reassuring
Pathological	Two or more features classified as non-reassuring or one or more classified as abnormal

Table 2 Classification of FHR trace features

Feature	Baseline (bpm)	Variability (bpm)	Decelerations	Accelerations
Reassuring	110–160	≥ 5	None	Present
Non-reassuring	100–109 161–180	< 5 for 40–90 min	Typical variable decelerations with over 50% of contractions, for over 90 min Single prolonged deceleration for up to 3 min	The absence of accelerations with otherwise normal trace is of uncertain significance
Abnormal	< 100 > 180 Sinusoidal pattern ≥ 10 min	< 5 for 90 min	Either atypical variable decelerations with over 50% of contractions or late decelerations, both for over 30 min Single prolonged deceleration for more than 3 min	