

# Interpretation of Electronic Fetal heart rate Monitoring

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# Introduction

Continuous electronic fetal monitoring was introduced to enable clinicians diagnose fetal hypoxia in time to prevent perinatal neurologic damage.

Recently, the Cochrane Collaboration concluded that EFM do not have any superior advantage to intermittent auscultation. It does not reduce perinatal deaths, number of neonates with Apgar scores  $<7$  or number of infants admitted to neonatal intensive care units. Rather, EFM resulted in significantly higher rates of CS & total operative deliveries.



# Indications

## A-Maternal Indications:

- 1-Gestational diabetes
- 2-Hypertensive disorders of pregnancy
- 3-Bronchial asthma

## B-Fetal Conditions:

- 1-Meconium stained AF
- 2-Post-term
- 3-Isoimmunization
- 4-Decreased fetal movements

# Indications (Cont.)

## C-Obstetric Indications:

1-Induction / Augmentation of labor

2-Prolonged rupture of membranes, preterm labor

3-Antepartum hemorrhage

4-Malpresentations

6-Multiple gestations

8-Abdominal trauma

10-Tobacco and drug abuse

5-Oligohydramnios

7-Previous CS

9-Hypertonic uterus

11-Lack of antenatal care



# Characteristics of Fetal Heart Rate

I-**Baseline Fetal Heart Rate (FHR)**: It is the average FHR that occurs when there is no stress/stimulation to the fetus. It is determined over a 10-20 mins period not including the tracing during periodic changes. Normal baseline FHR ranges between 120-160/min between contractions. Abnormalities are either:

A-**Bradycardia**: A FHR  $<60$ /min will eventually leads to fetal decompensation which will manifest as loss of variability. A mild bradycardia (100-120/min) with normal variability signifies mild hypoxia.



# Characteristics of Fetal Heart Rate (Cont.)

## Causes of baseline bradycardia:

1-Post-dates, drugs such as anesthetic agents. E.g. epidural anesthetics cause bradycardia indirectly due to a reflex mechanism or as a result of hypotension. They produce bradycardia 5 mins following the block & lasts up to 10 mins. The heart rate then usually returns to normal baseline rate.

2-Arrhythmias, hypothermia (increased Vagal Tone)

3-Cord Compression.

4-Idiopathic



# Characteristics of Fetal Heart Rate (Cont.)

The primary intervention to correct bradycardia will be through the following:

- 1-Check maternal temperature
- 2-Stop Oxytocin
- 3-Change position to left lateral
- 4-Increase intravenous fluids
- 5-Oxygen 8-10 liters/face mask
- 6-Notify physician



# Characteristics of Fetal Heart Rate (Cont.)

B-Tachycardia: Either mild (160-180/minute) or severe (more than 180/min).  
Normal FHR variability usually precludes ominous interpretation.

## Causes of baseline tachycardia:

1-Prematurity (immature nervous system), Drugs such as  $\beta$  sympathomimetic tocolytics. E.g. terbutaline.

2-Fetal infection: fetal response to stress (sepsis)

3-Asphyxia

4-Maternal Fever/anxiety

5-Maternal thyrotoxicosis

6-Idiopathic



## Characteristics of Fetal Heart Rate (Cont.)

The primary intervention to correct tachycardia will be through the following:

1-Check for maternal hypotension and correct if present

2-Stop oxytocin

3-Change position to left lateral

4-Increase intravenous fluids

5-Oxygen 8-10 liters/face mask

6-Notify physician



# Characteristics of Fetal Heart Rate

## II-Fetal heart rate variability:

A-Short term variability (STV): It is the beat to beat variability. It is either absent or present.

B-Long term variability (LTV): represents the amplitude changes of the normal baseline over time, with a cyclic changes occurring in  $< 1$  min. It appears as irregular crude sine waves. It is absent during fetal sleep. The baby sleeps in 20-40 minutes cycles.



## Characteristics of Fetal Heart Rate (Cont.)

Both STV & LTV are considered together as a unit when the FHR is interpreted. They react synchronously in response to autonomic changes & thus differentiation between LTV & STV does not provide additional information regarding fetal oxygenation. An exception is the sinusoidal pattern that characterizes a fetus with Rh isoimmunization, severe anemia & asphyxia, which show absent STV but preserved LTV. Persistent minimal or absent FHR variability appears to be the most significant intrapartum sign of fetal compromise. Long term variability can be :

1. Increased/Marked  $>25$  bpm  
3. Minimal undetected to  $\leq 5$

2. Present/Average 6-25 bpm  
4-Absent



## Characteristics of Fetal Heart Rate (Cont.)

III-Changes in the fetal heart rate (FHR): are either periodic associated with uterine contractions or episodic with no relation to contractions (variable).

A-Early deceleration (Type I): Begins with onset & ends with the completion of a uterine contraction. It does not require intervention in the absence of other heart rate changes. Early decelerations may occur in many clinical situations including vertex presentation, cephalopelvic disproportion, vaginal examinations, after rupture of membranes, pushing during the 2nd stage of labor & during application of internal FHR electrode.



## Characteristics of Fetal Heart Rate (Cont.)

B-Late deceleration (Type II): Begins after the onset of contraction & persists after its end. It is due to uteroplacental insufficiency leading to fetal hypoxemia. Repetitive late decels increases risk of umbilical artery acidosis & Apgar score  $<7$  at 5 mins & increased risk of cerebral palsy.



## Characteristics of Fetal Heart Rate (Cont.)

### C-Variable deceleration (Type III):

Common in late labor. They lack consistency in duration, intensity or time relationship to contractions. They are often associated with oligo with/without rupture of membranes which lead to compression of the cord with subsequent reflex bradycardia & decreased  $Po_2$ . Other causes include prolapsed cord, short cord, nuchal cord and cord entanglement.

They are harmless unless accompanied by increasing tachycardia or decreased variability. They are considered ominous if the Rule of 60 is exceeded (i.e. decrease of 60 bpm, or rate of 60 bpm and longer than 60 sec)



## Characteristics of Fetal Heart Rate (Cont.)

An important consideration in differentiating variable decels from early and late decels is to look first to the shape of decel. Variable decel is abrupt and takes the shape of U, V or W, while early and late decels are gradual.

The primary intervention to correct late & variable decels will be through:

1-Stop oxytocin, increase IV. Fluids

2-Change maternal position to left lateral

3-Exclude cord prolapse

4-Oxygen by mask

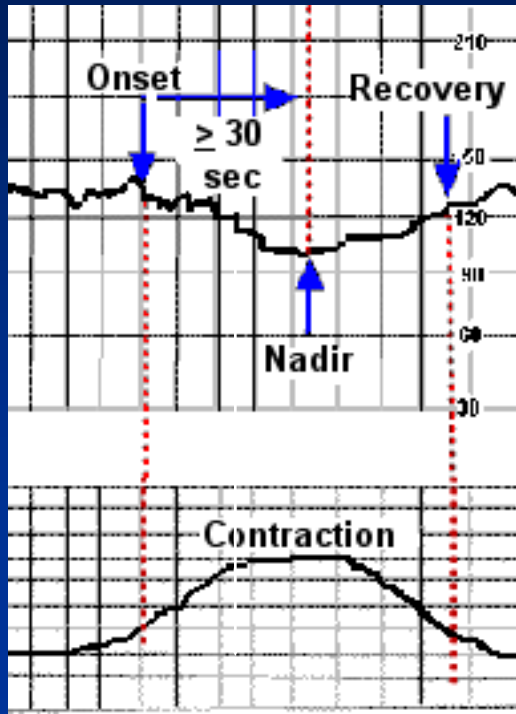
5-Notify physician

6-Amnio-infusion may alleviate severe variable decels

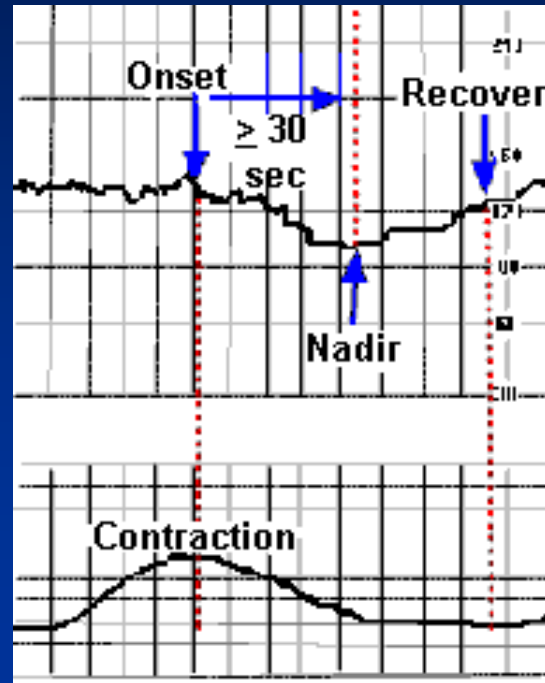
7-Tocolytics in cases of increased uterine activity with late decels.



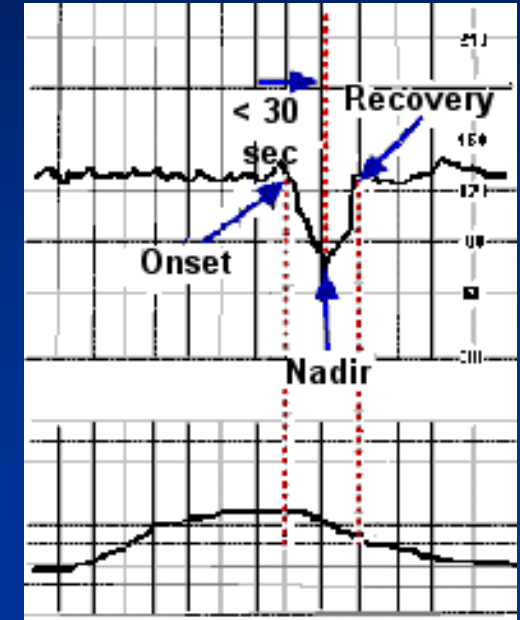
# Characteristics of Fetal Heart Rate (Cont.)



**Early decel**



**Late Decel**



**Variable Decel**

(From intrapartum fetal monitoring in obfocus by Mark Curran M.D.)

## Characteristics of Fetal Heart Rate (Cont.)

D-Accelerations: Transient increase in FHR which occur in response to fetal movement, tactile stimulation or uterine contraction due to stimulation of the sympathetic nervous system. The presence of Accelerations have a favorable outcome but their absence on an otherwise normal CTG remains unclear.

Adequate accelerations are defined as:

- <32 weeks :  $\geq 10$  BPM above baseline for  $\geq 10$  seconds
- >32 weeks :  $\geq 15$  BPM above baseline for  $\geq 15$  seconds

Prolonged acceleration is defined as an increase in FHR for 2-10 minutes. The absence of accelerations >80 mins correlates with increased neonatal morbidity



# Disadvantages of the Routine Use of EFM

- 1-Different recording techniques
- 2-The tracing requires expertise to interpret
- 3-Significant intra & inter observer variability
- 4-Absent standardized classification system
- 5-High false-positive finding rate of non-reassuring pattern with subsequent increased rate of instrumental and Cesarean deliveries
- 7-No standard criteria on how, when and who to monitor
- 8-Increase medico-legal vulnerability of Obstetricians



# Fetal Tracings-Examples

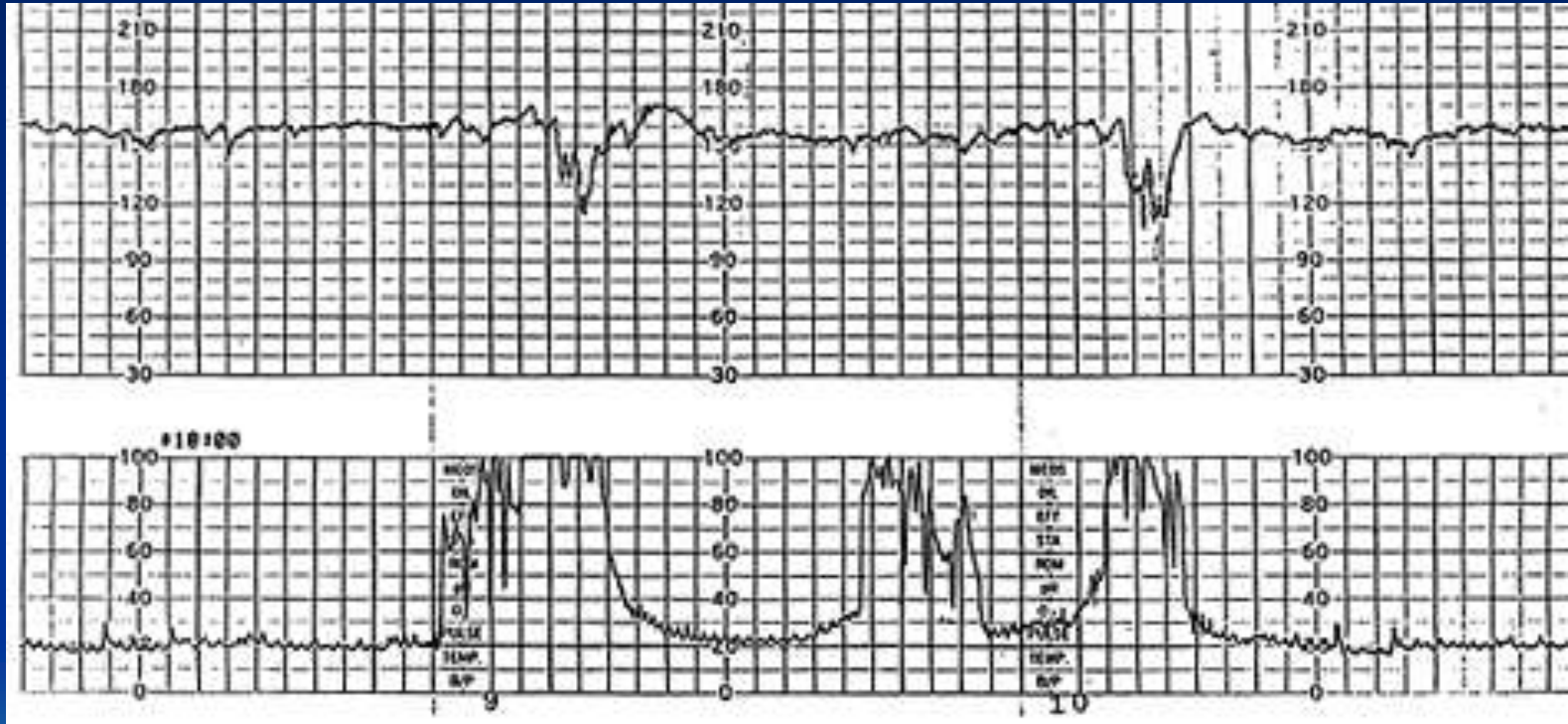
## 1- Reassuring FHR Tracing



**1-Baseline FHR 130bpm-preserved short and long term variability with accelerations.**

# Fetal Tracings-Examples (Cont.)

## 1- Reassuring FHR Tracing (Cont.)



2-Reassuring variable deceleration with shouldering (pre & post-accelerations)

Average FHR is 150 bpm & preserved short term variability.

# Differentiation Between Reassuring and Non-Reassuring Variable Decel

## Reassuring

-Very abrupt in onset  
And return to baseline

-May decelerate to any level  
But for less than 30 seconds

## Non-reassuring

-Persistent and progressively  
deeper

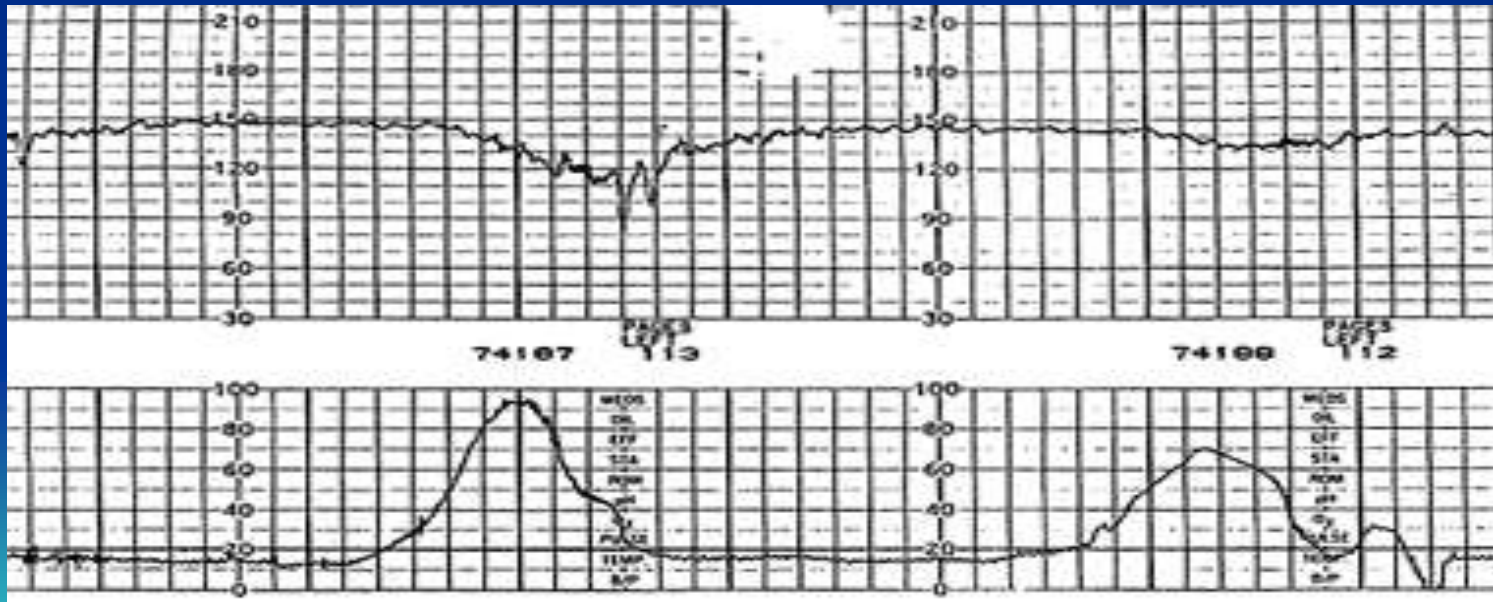
-Last longer with slow return to  
baseline



# Fetal Tracings-Examples (Cont.)

## 2- Non-Reassuring pattern

Non-Reassuring pattern is the one with any of the following: 1-Decreased baseline Variability; 2-Tachycardia (>160bpm); 3-Bradycardia; 4-Intermittent late decels with preserved variability; 5-Persistent variable decels; 6- Moderate-severe variable decels in the 2nd stage; 7-Saltatory pattern

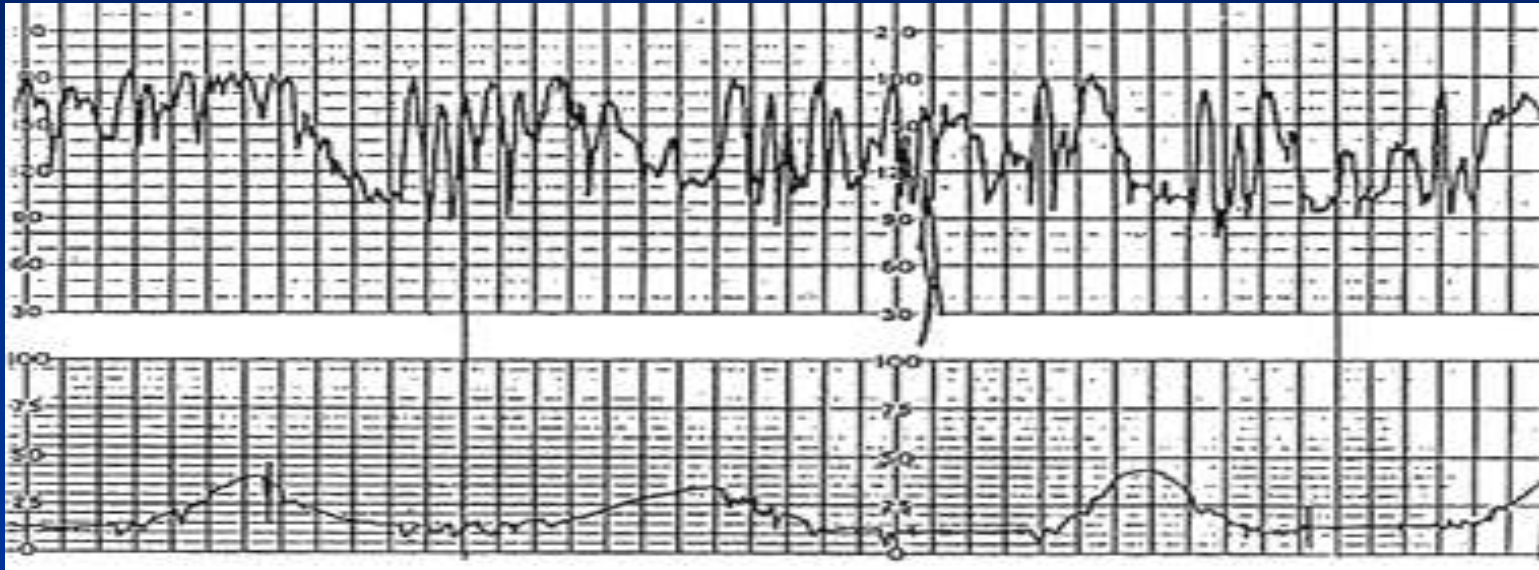


**1-Late deceleration with preserved variability**

# Fetal Tracings-Examples (Cont.)

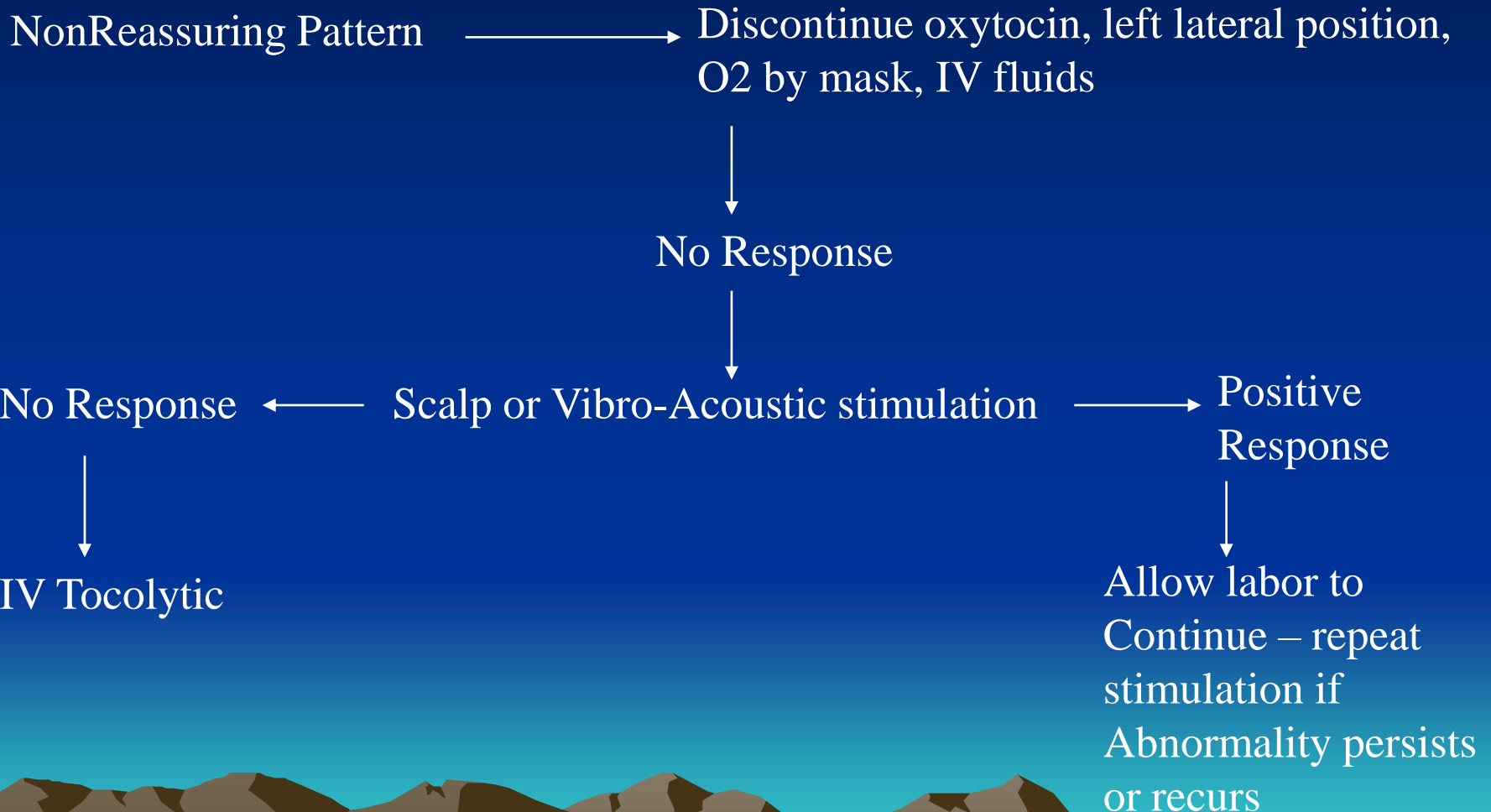
## 2- Non-Reassuring pattern (Cont.)

This pattern is seen with fetal thumb sucking but may indicate fetal hypoxia

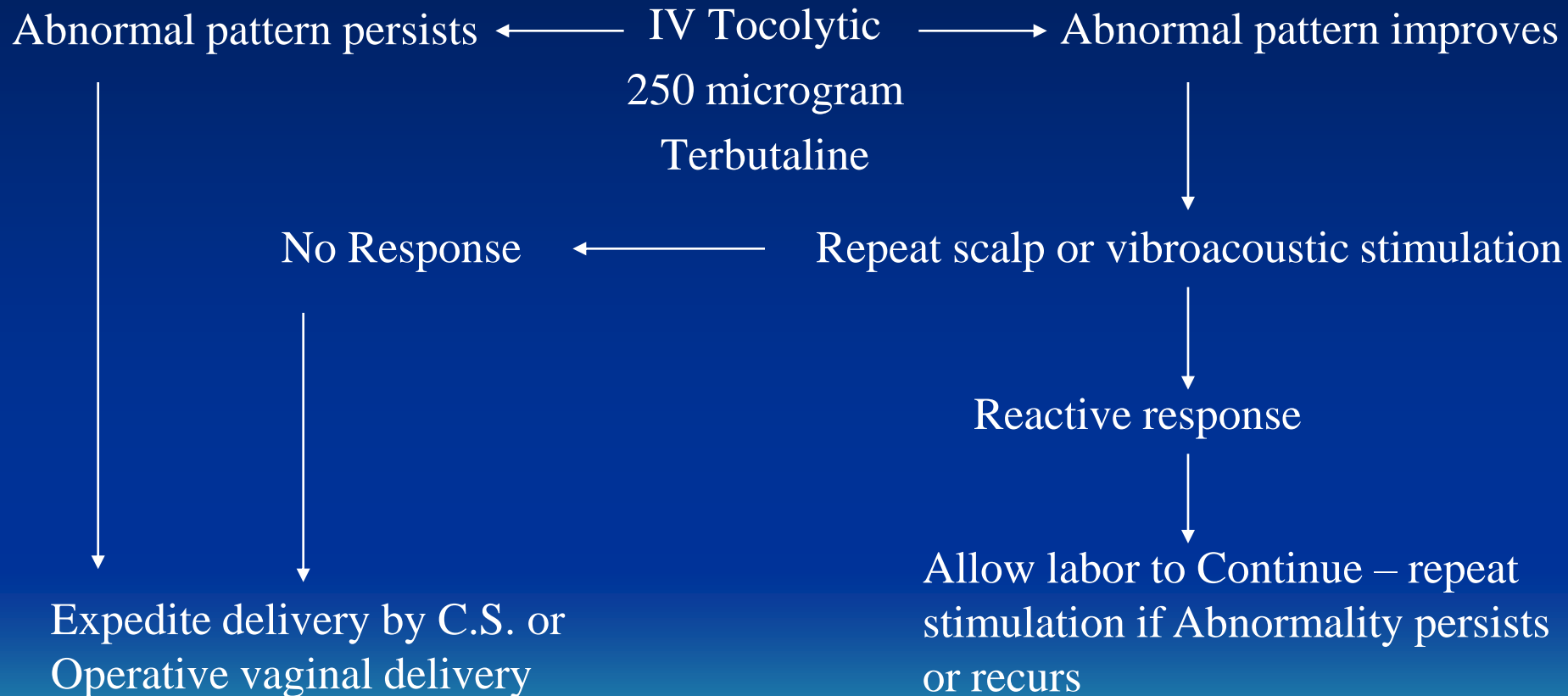


**2-Saltatory pattern with wide variability.  
Oscillations of the FHR above & below the baseline >25 bpm.  
Saltatory means marked by dancing or jumping**

# Intervention in case of non-reassuring FHR tracing



# Intervention in case of non-reassuring FHR tracing (Cont.)



# Fetal Tracings-Examples (Cont.)

## 3-Ominous FHR pattern

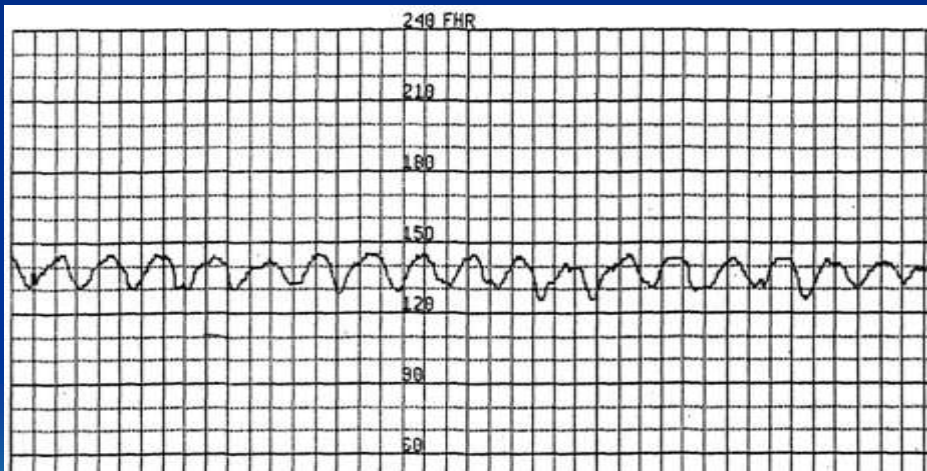
- 1-Persistent late decels especially with absent/decreased variability
- 2-Absent/markedly decreased variability & variable decels with slow recovery
- 3-Absent variability & variable decels
- 4-Absent or markedly decreased variability with prolonged/severe bradycardia
- 5-Sinusoidal pattern



# Fetal Tracings-Examples (Cont.)

## 3- Ominous pattern

A sinusoidal pattern is a smooth undulating pattern lasting at least 10 mins with a fixed period of 3-5 cycles/min & an amplitude of 5 -15 bpm with no accelerations & absent STV. High amplitude sinusoidal patterns are usually associated with fetal sucking and fetal well being. Low amplitude pattern is associated with high perinatal morbidity & mortality.



**Sinusoidal pattern**

## Fetal Tracings-Examples (Cont.)

The pseudo-sinusoidal FHR pattern appears very similar to the sinusoidal pattern; however, it shows less regularity in the shape and amplitude of the variability waves with the presence of beat-to-beat variability. This type of pattern is benign and transient, and can occur in the presence of narcotics.



**Thank you**

