ANTENATAL AND INTRA PARTUM FETAL SURVEILLANCE

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Antenatal Fetal Surveillance

- Refers to ongoing monitoring of a fetus's well-being during pregnancy, typically after 28 weeks of gestation, to identify & address any potential risks of fetal distress or death

- ACOG suggests initiating surveillance at 32, 36, or 39 weeks of gestation

- Shared decision making is important especially between patient and Clinician

Introduction….

- These surveillance methods must be tailored to individual, weighing potential risks such as iatrogenic preterm delivery & increased healthcare costs against benefits

- Consider other clinical factors that may influence findings when interpreting antenatal fetal surveillance tests.

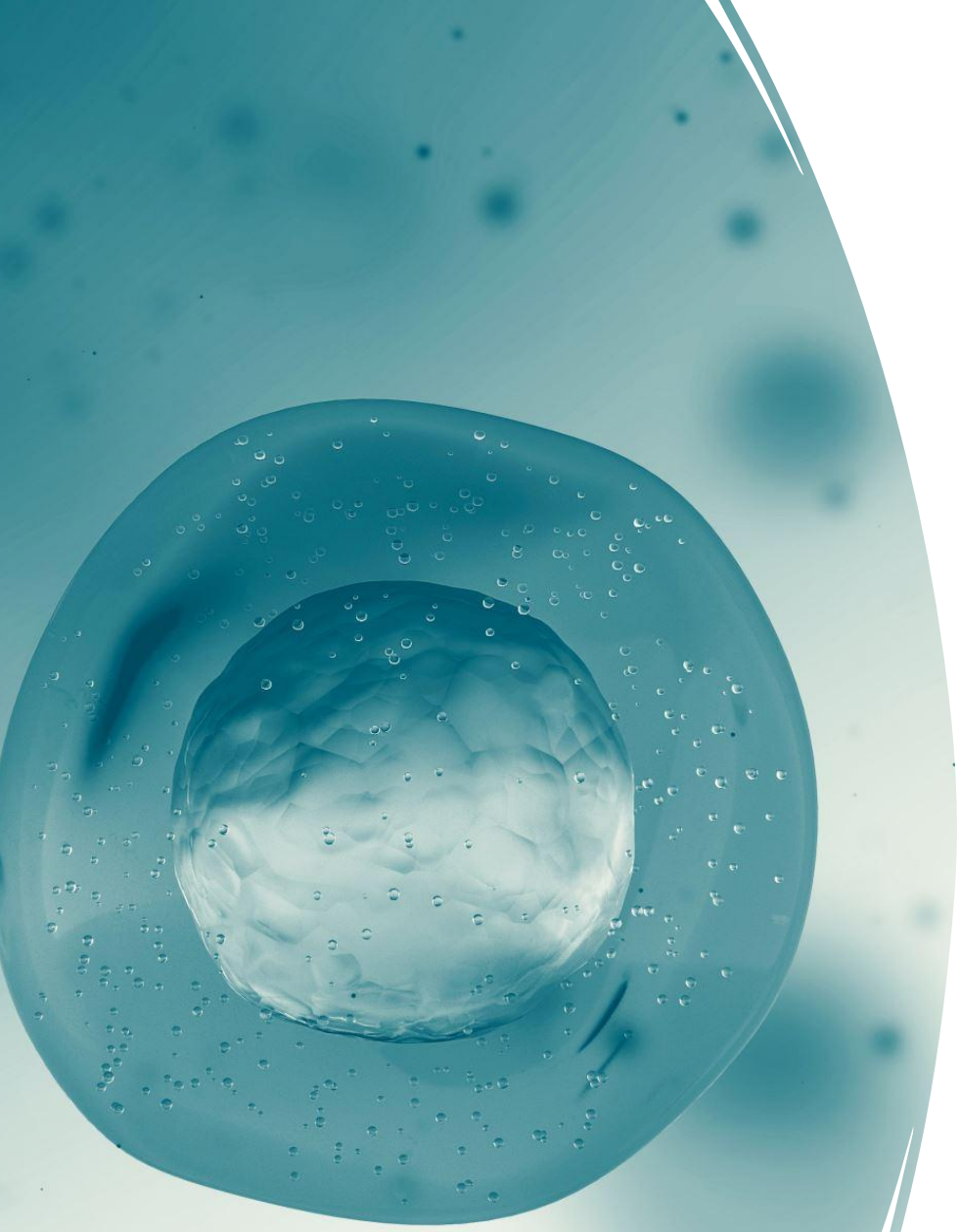
Objective of Antenatal Fetal Surveillance

- To mitigate the risk of still Birth especially in pregnancies with pre existing maternal conditions such as DM,preeclampsia or those complicated by issues such as IUGR

Indications

Maternal Factors:

- Chronic hypertension
- Gestational hypertension or preeclampsia
- Diabetes
- Systemic lupus erythematosus
- Antiphospholipid syndrome
- Sickle cell disease
- Renal disease
- Thyroid disease
- Substance abuse
- In vitro fertilization
- Maternal age 35 or older
- Obesity



Indications….

Fetal Factors:

- Growth restriction
- Multiple gestations
- Fetal anomalies
- Decreased fetal movement

Indications….

Obstetric Factors:

- History of previous adverse pregnancy outcomes, such as preterm delivery due to preeclampsia or growth restriction
- Previous stillbirth
- Post term pregnancy
- Abnormal serum markers
- Chronic placental abruption
- Vasa previa
- Velamentous cord insertion
- Polyhydramnios
- Single umbilical artery
- Oligohydramnios

Equipment

- External fetal monitor: This device, also called the cardiotocograph, records FHR and uterine contractions.
- Intravenous oxytocin: This may be used during CST.
- Vibroacoustic stimulator: This device may be used during NST to elicit FHR accelerations.
- Ultrasound with Doppler velocimetry: This device is used for BPP, modified BPP and umbilical artery Doppler velocimetry.

TECHNIQUES

 Antenatal Fetal Surveillance includes Several Modalities including:

- Maternal perception of fetal movements
- NSTs
- CST
- BPP
- Modified BPP
- Umblical Doppler velocimetries

Maternal Perception of fetal movements

- A standard method involves the mother lying on her side & counting movements until 10 distinct movements are felt within a 2-hour period.
- Overall decrease in fetal movement is more predictive of adverse outcomes compared to a cutoff of a specified number of kicks.
- Slight increases in preterm delivery, labor induction & cesarean delivery were noted in the kick counts group.

Non Stress Test

- NST monitor FHR using external abdominal transducers for a set amount of time (20 mins.)
- FHR is monitored using Doppler USS transducer & tocodynamometer applied to detect fetal movement.
- Variability, constant fluctuations from baseline FHR, decelerations & a slowing of FHR
- Normal: Accelerations and Moderate variability with an amplitude that ranges from 6 to 25 bpm
- Interpreted as Reactive or non-reactive

Non Stress Test…

- A reactive NST is characterized by 2 FHR accelerations that each increase by at least 15 bpm above the baseline for a minimum of 15 seconds -suggesting fetal well-being
- Nonreactive NST, lacking sufficient accelerations, may require further evaluation with either a CST or BPP
- Other findings, including variable & prolonged decelerations, may also be observed & must be interpreted in conjunction with other clinical factors.

Non Stress Test….

- Repetitive variable decelerations, defined as 3 variable decelerations within 20 minutes, and prolonged FHR decelerations, lasting ≥1 minute, are associated with a non-reassuring intrapartum FHR pattern and potential fetal demise.

Contraction Stimulation Tests

- CST are typically performed in pts with an abnormal NST.
- CST assesses FHR response to uterine contractions to identify compromised fetal oxygenation, which can result in late FHR decelerations.
- During a CST, FHR and uterine contractions are recorded simultaneously.
- If spontaneous contractions are insufficient, they may be spontaneous or induced by nipple stimulation or intravenous oxytocin.
- Caution: where labor or vaginal delivery is contraindicated

Contraction Stimulation Tests…

ACOG provides the following interpretations for CST findings:

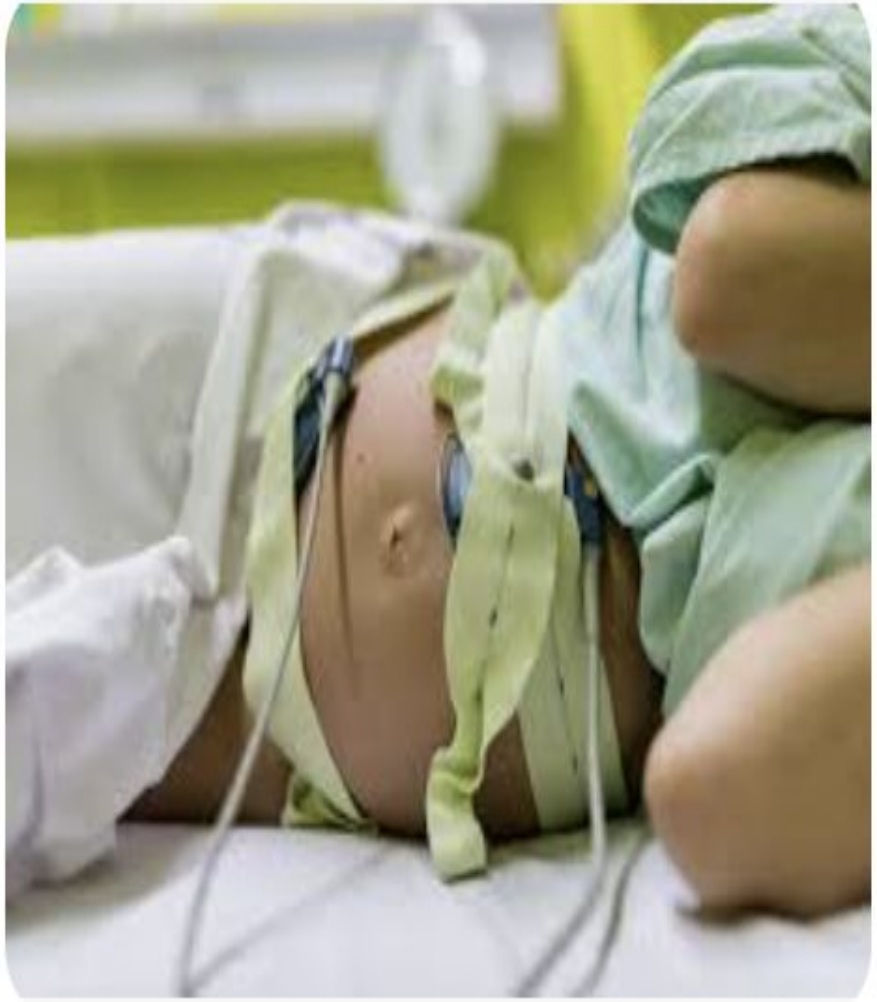
Negative CST: No late or variable decelerations are observed.

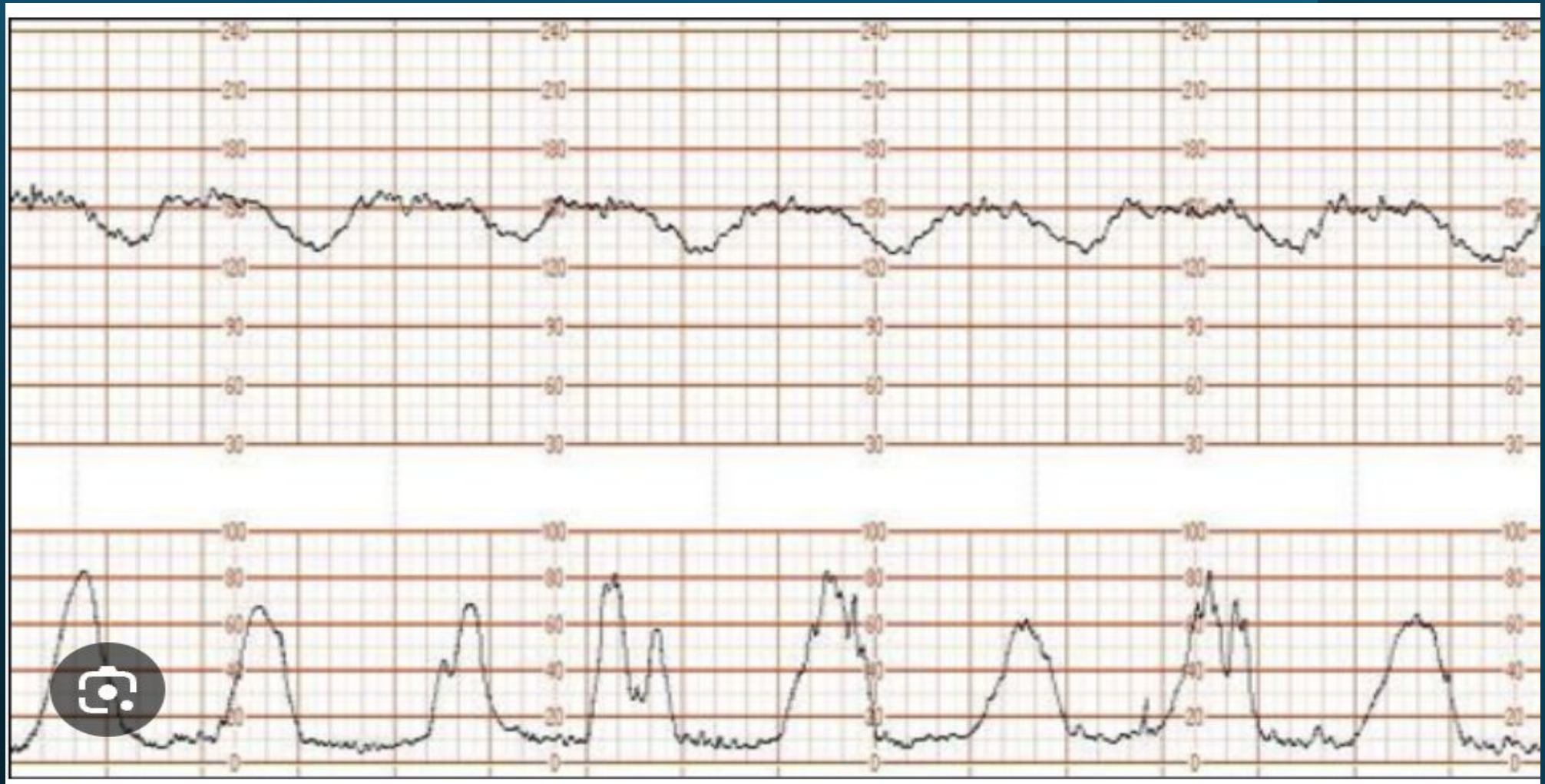
Positive CST: Late decelerations are observed following ≥50% of contractions.

Suspicious CST: Intermittent late decelerations or prolonged variable decelerations are observed.

Equivocal CST: FHR deceln. > 2 minutes or lasting longer than 90 seconds assoc. with contractions.

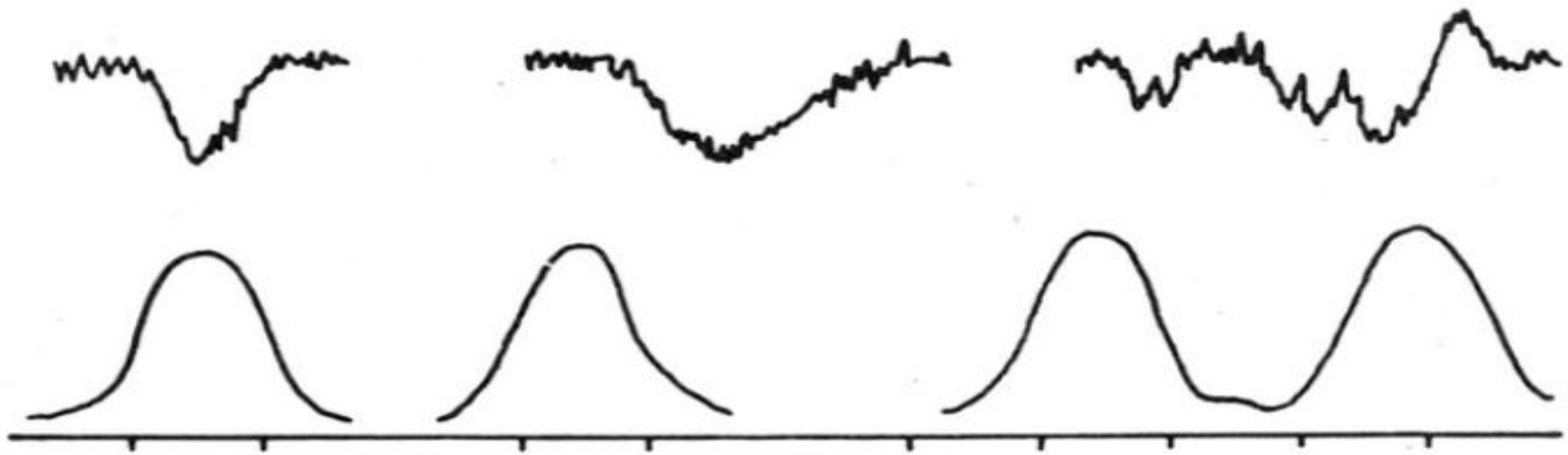
Unsatisfactory CST: <3 contractions within 10 minutes or FHR with inadequate tracing





Fetal CTG tracing suggestive of late decelerations (fetal distress). | Download Scientific Diagram

PERIODIC VARIATIONS



	Early deceleration	Late deceleration	Variable deceleration
Caldeyro Barcia	Type 1	Type 2	
Hon	V dip	U dip	
Principal cause	Head compression (HC)	Uteroplacental insufficiency (UPI)	Umbilical cord compression (ml)

BIOPHYSICAL PROFILE

- Scores of 8 & 10 consistently had normal cord pH levels

 Combines 5 components:

- A reactive NST

Specific ultrasound findings :

- Fetal breathing movements
- Fetal movements
- Fetal tone
- Amniotic fluid volume

 Each component is scored as either a 2 if observed to a sufficient degree or 0 if absent.

Biophysical Profile….

A BPP score of 6 is equivocal, and ≤4 is abnormal.

6 out of 10: equivocal; delivery should be strongly considered in patients 37 0/7 weeks of gestation or more.

In patients less than 37 weeks of gestation, further evaluation through a repeat BPP within 24 hours - recommended.

4 out of 10: Delivery is recommended for patients 32 weeks of gestation or more; extended monitoring may be considered for those less than 32 weeks of gestation.

2 out of 10: Delivery is recommended in most cases

Modified Biophysical profile

Often used in the late 2^{nd} or 3^{rd} trimester

Includes an NST and amniotic fluid volume assessment to evaluate short-term fetal acid-base status & long-term placental function

Normal findings for a modified BPP comprise a reactive NST and an amniotic fluid volume >2 cm in deepest vertical pocket.

If either of these components is abnormal, modified BPP is reported as abnormal & should prompt further evaluation with a full BPP or CST.

Umbilical Artery Doppler Velocimetry

- Used in pregnancies complicated by fetal growth restriction, assesses vascular resistance by analyzing flow velocity waveforms.
- It is used in addition to NST or BPP
- Studies have shown that umbilical vascular resistance progressively decreases in placentas with physiologically normal function as gestational age increases.

Umbilical Artery Doppler Velocimetry….

Abnormal waveforms, such as absent or reversed end-diastolic flow indicate increased perinatal mortality & morbidity

These are linked to placental pathology & fetal hypoxemia.

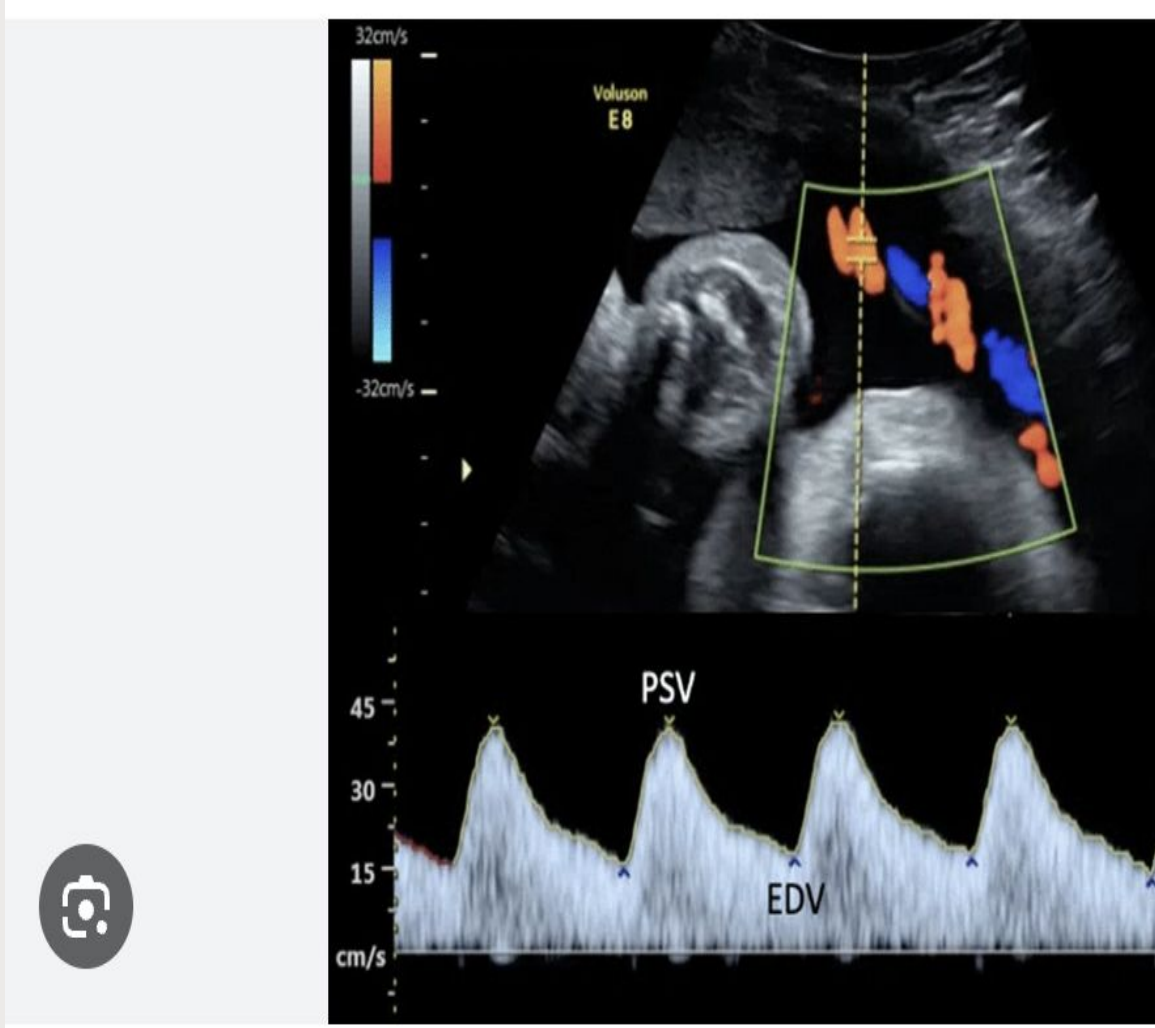
Multiple waveforms are evaluated to ensure accurate assessment

In IUGR with placental insufficiency, umbilical artery resistance increases until absent end-diastolic flow & reversed end-diastolic flow become apparent secondary to flow being redirected to fetal brain.

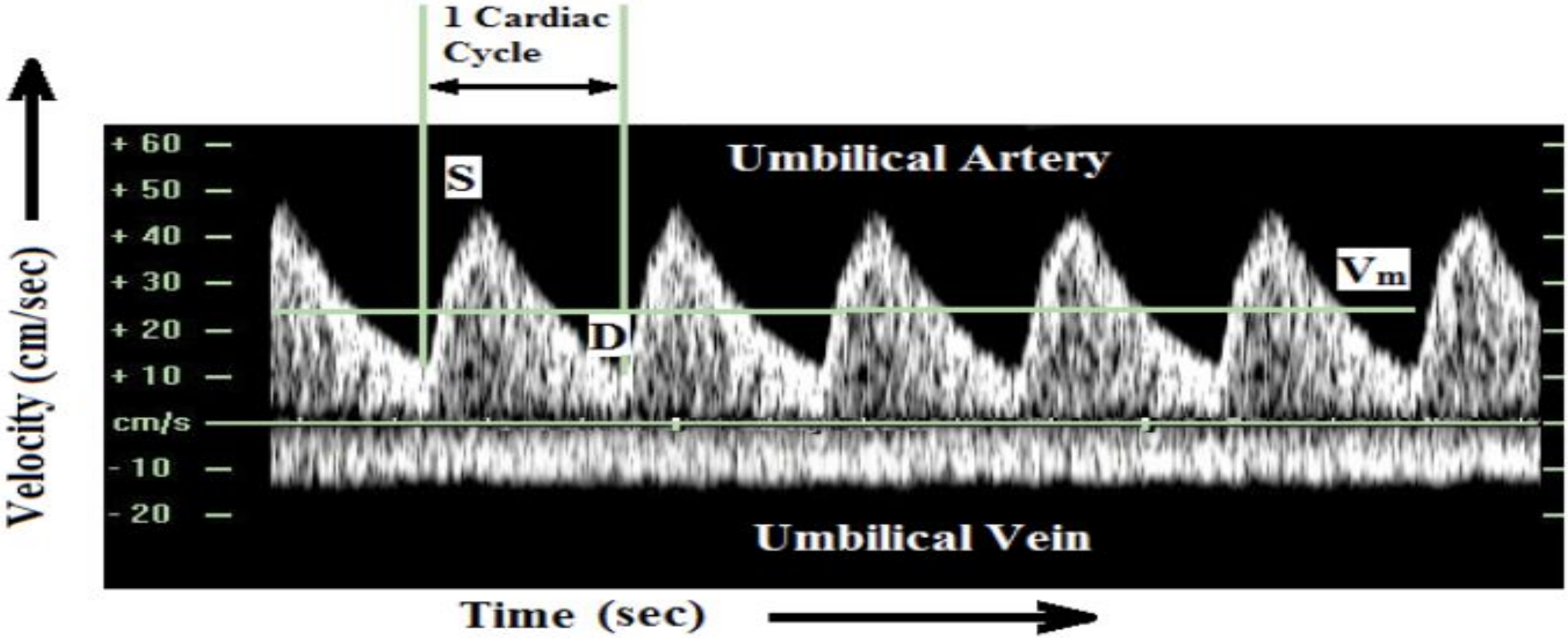
Umbilical Artery Doppler Velocimetry….

- Measures peak systolic velocity, end-diastolic frequency shift resistance index & pulsatility index.

- Umbilical placental insufficiency is reflected in these ratios, which increase abnormally as gestational age progresses instead of decreasing



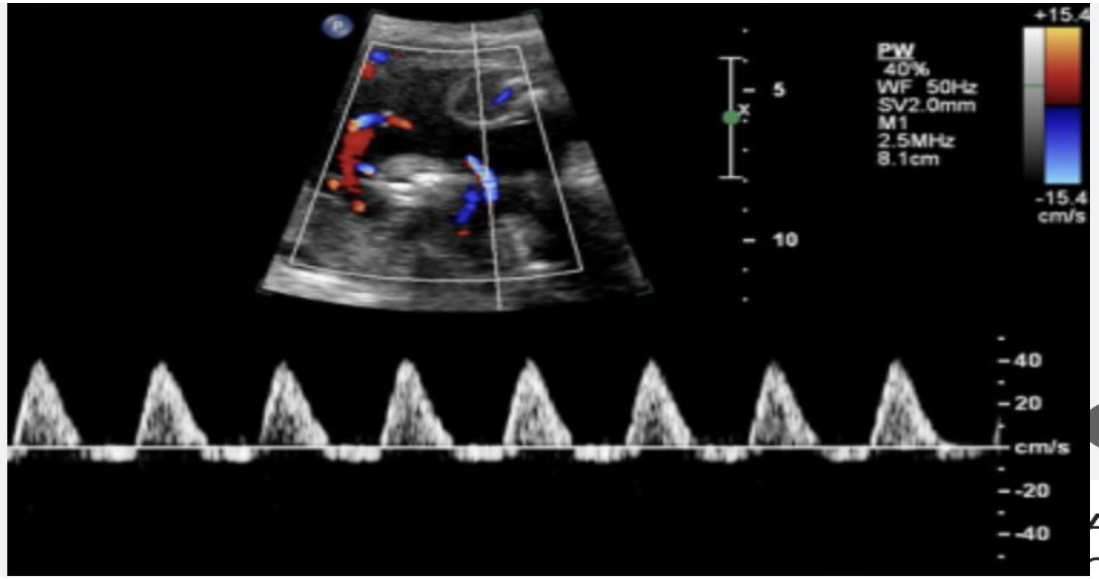
The normal umbilical artery Doppler waveform is characterized by... | Download Scientific Diagram

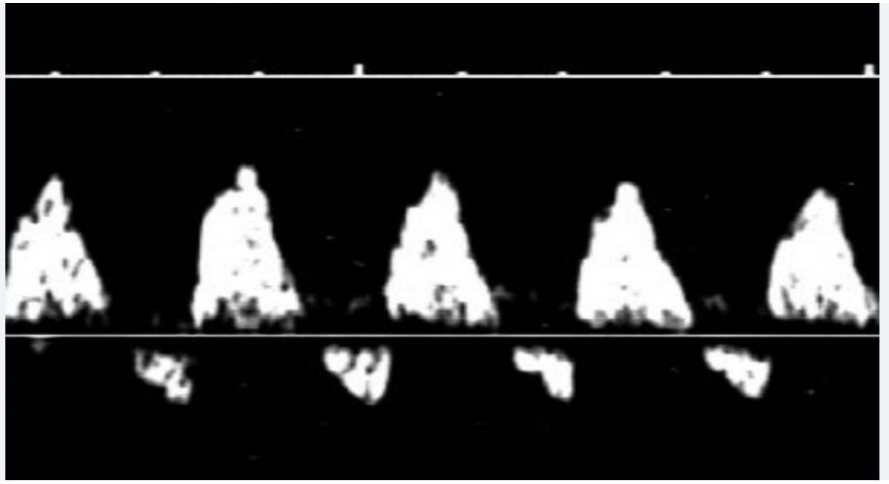


Doppler Indices :

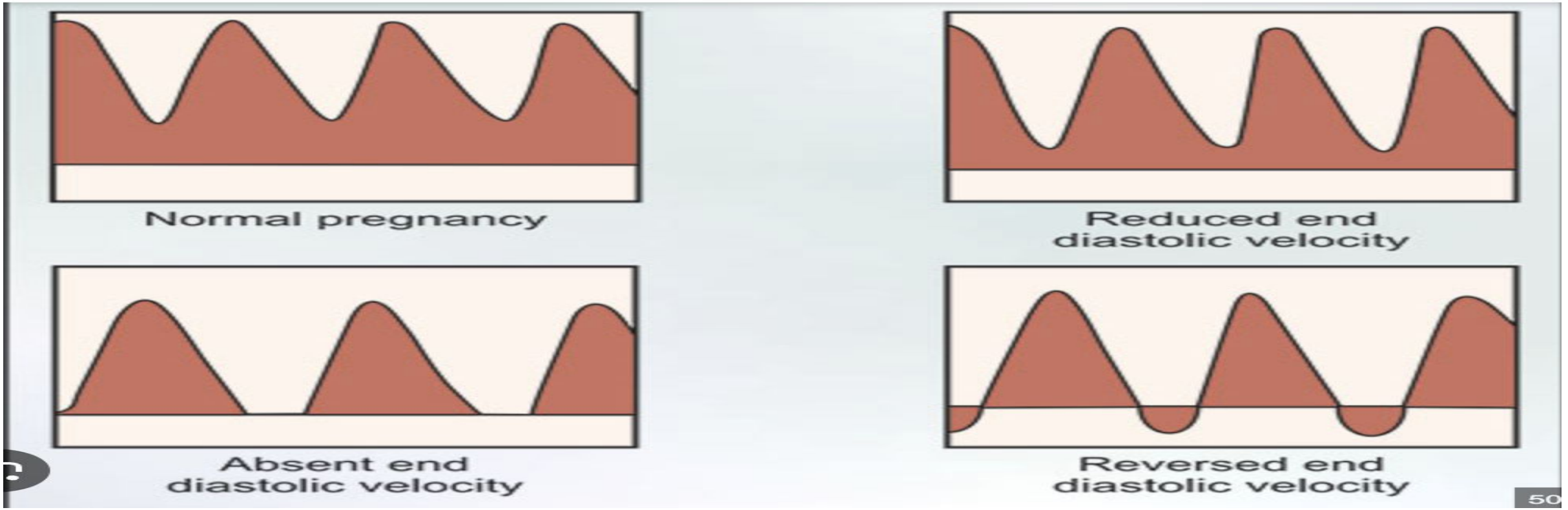
S = Peak Systolic Velocity (PSV)
D = End Diastolic Velocity (EDV)
V_m = Mean Velocity

S/D = Systolic-to-Diastolic Ratio
(S-D)/S = Resistance Index (RI)
(S-D)/V_m = Pulsatility Index (PI)





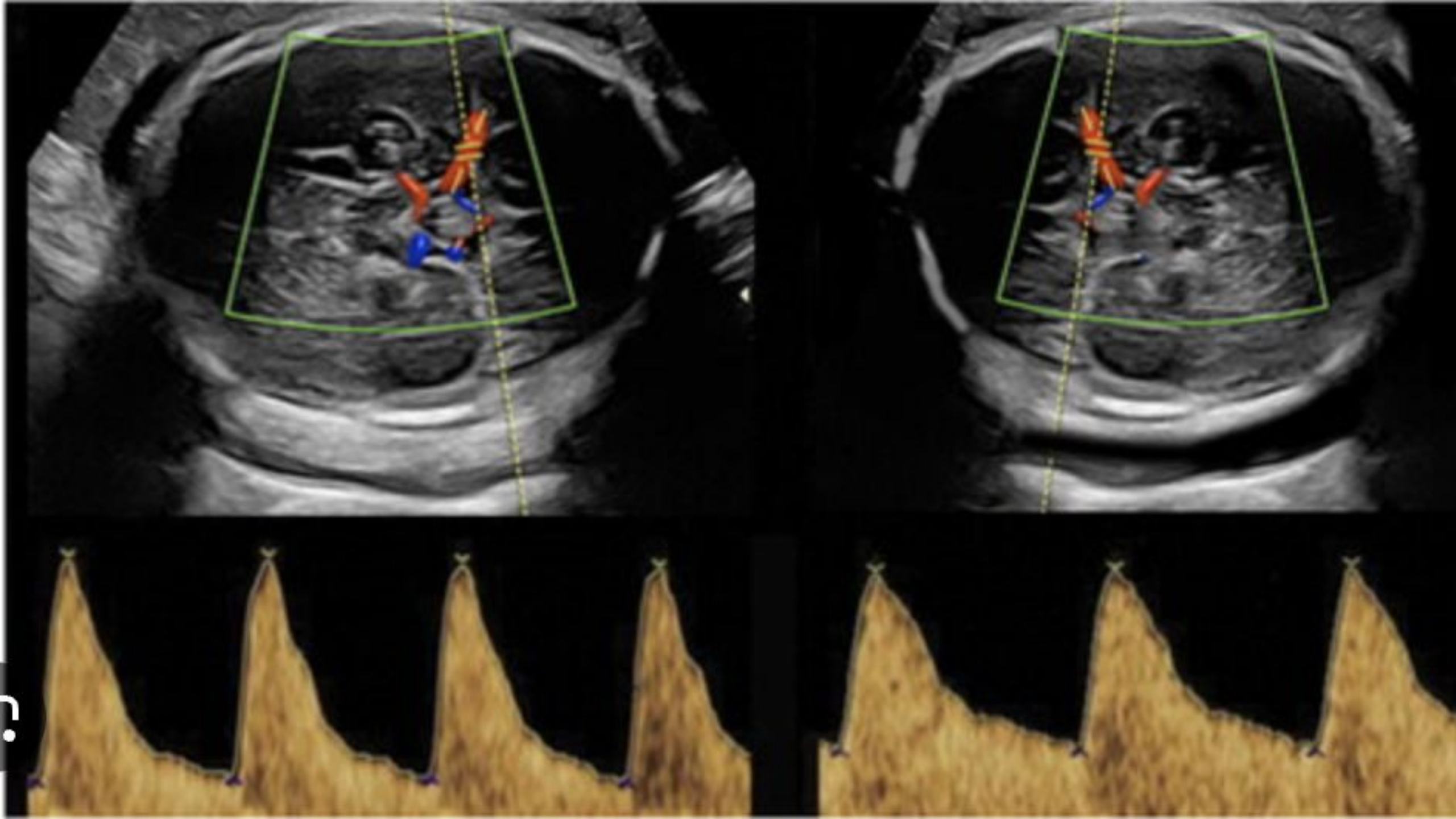
Abnormal umbilical artery Doppler velocimetry with reversed... | Download Scientific Diagram



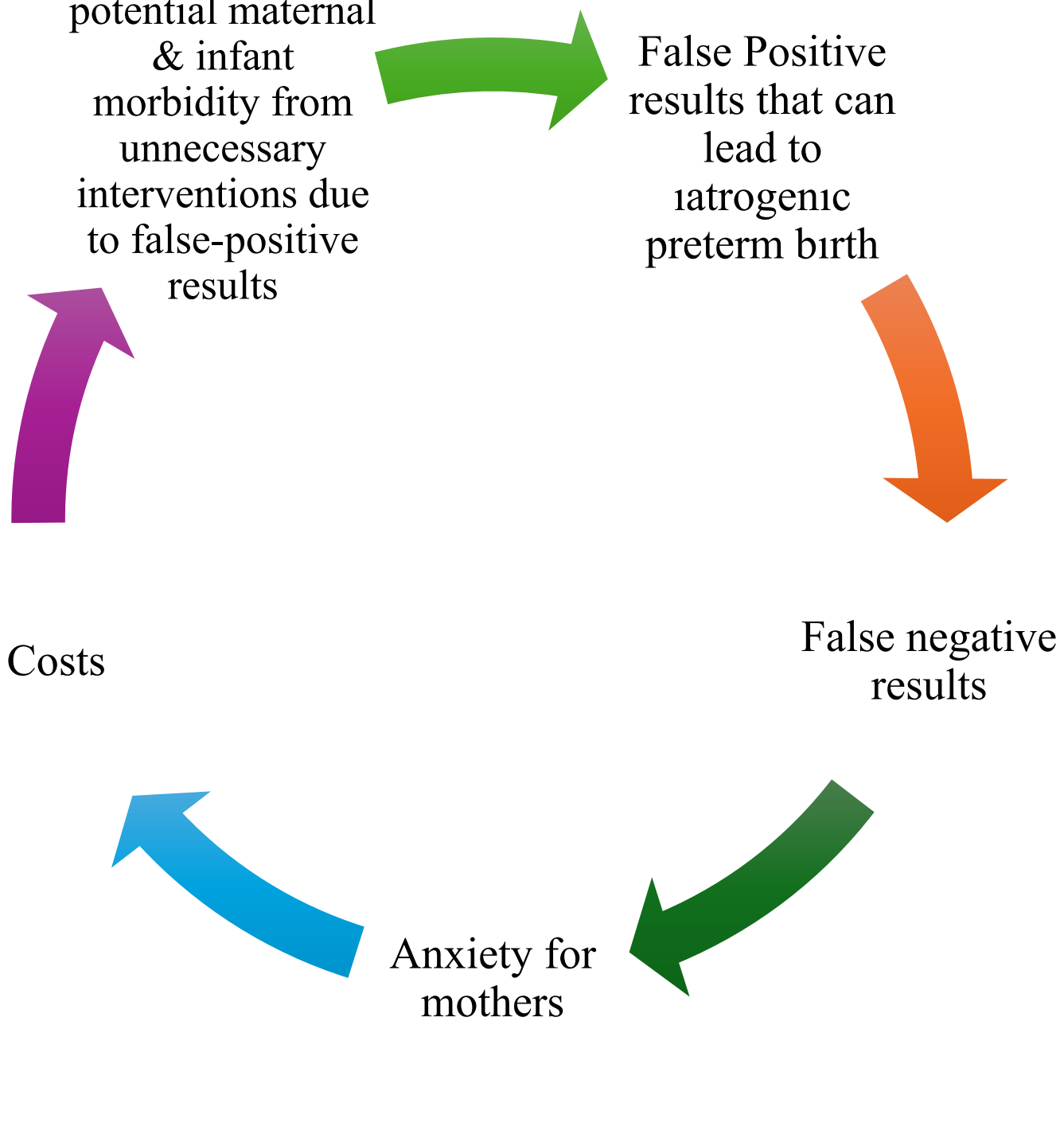
MCA Doppler velocimetry

Positive relationship between decreased vascular resistance in MCA & fetal growth restriction and hypoxemia

Reduced Pulsatility index due to MCA dilatation



COMPLICATIONS OF ANTENATAL FETAL SURVEILLANCE



INTRA PARTUM FETAL MONITORING

The purpose of FHR monitoring is to evaluate fetal oxygenation.

Hypoxia causes changes in parameters : baseline , variability, presence or absence of accelerations and decelerations…

Maternal or fetal pathologies related to pregnancy, stage and progression of labor, use of some drugs, etc may impact EFM interpretation

Intrapartum EFM has a low sensitivity but high specificity.

CLASSIFICATION OF FETAL HEART RATCLACLASSCLAE TRACING (2008 CONSENSUS)

Category I: is normal or reassuring & it is strongly predictive of a normal fetal acid-base status.

Category II: not predictive of an abnormal fetal acid-base status, but still do not have enough evidence to be classified as category I or III

Category III: considered non-reassuring & are associated more frequently to abnormal fetal base acid status.

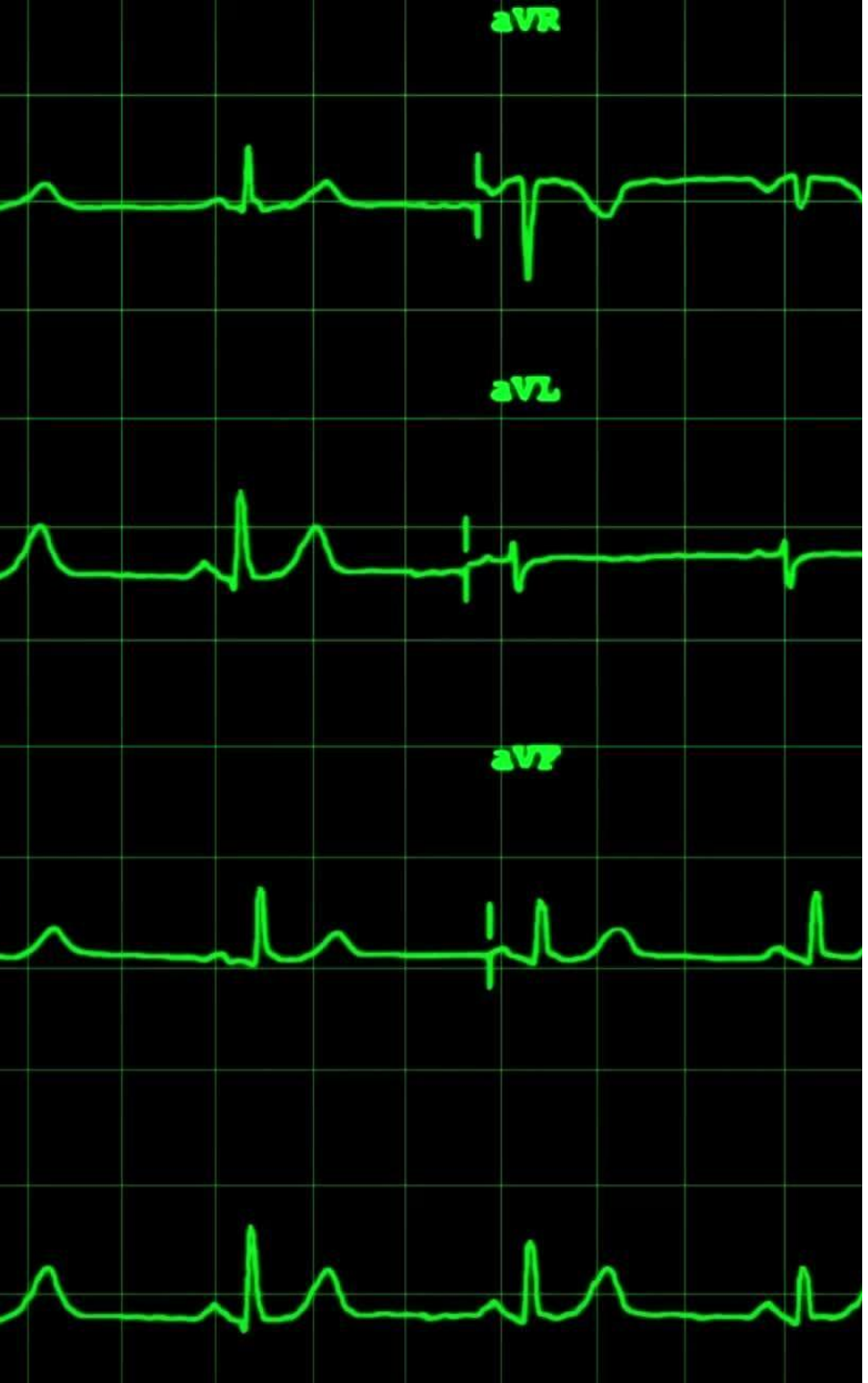
Table 2 Interpretation of the fetal heart rate monitoring by the NIH.

Category	Definition
Category I	• Baseline of 110–160 heartbeats per min. • Variability: moderate. • Accelerations: present or absent. • Early decelerations: present or absent. • Variable or late decelerations: absent.
Category II	This category includes all of those that cannot be included in categories I and III. Baseline: • Bradycardia with presence of variability. • Tachycardia. Baseline variability: • Baseline minimal variability. • Absence of baseline variability without recurrent decelerations. • Baseline marked variability.

Category III	Traces of category III include any of the following: Absent or minimal variability in the baseline with any of the following characteristics: • Recurrent late decelerations*. • Recurrent variable decelerations*. • Bradycardia. Sinusoidal pattern.

Table 3 FIGO fetal heart rate monitoring interpretation.

	Normal	Suspicious	Pathological
Baseline	110–160 bpm.	Loss of at least one characteristic of normality, but without the pathological characteristics.	<100 bpm.
Variability	5–25 bpm.	Loss of at least one characteristic of normality, but without the pathological characteristics.	Reduced variability, increased variability or sinusoidal pattern.
Decelerations	No recurrent decelerations.	Loss of at least one characteristic of normality, but without the pathological characteristics.	Recurrent deceleration of more than >30 min or 20 min with reduced variability or a prolonged deceleration longer than 5 min.
Interpretation	Fetus without hypoxia or acidosis.	Fetus with little chance of hypoxia/acidosis.	Fetus with high chance of hypoxia/acidosis.
Clinical management	No intervention needed to improve fetal oxygenation status.	Identify and correct reversible causes strict monitoring and/or another method for fetal oxygenation evaluation.	Take immediate action to correct reversible causes, use different methods to evaluate fetal oxygenation. If this is not possible, unobstructed birth.



Management of Fetal Heart Tracing

- A normal tracing must be managed as established by routine follow-up of patients in labor.
- During first phase of labor, EFM tracing must be evaluated every 30 min, & every 15 min during second phase of labor
- Some category 1& category 2 are considered non-reassuring fetal states.
- Identification of causes of a non-reassuring fetal state is key to determine if those causes can be modified or not.

- Reversible causes that can be associated to a suspicious tracing can be corrected with intrauterine resuscitation maneuvers

Management of Fetal Heart Tracing cont…

- If irreversible causes are identified in normal or suspicious tracings appropriate management is immediate & safest delivery of fetus.
- Pathological tracing manage by intrauterine resuscitation maneuvers & an expedited birth if they are ineffective.
- Operative room should be prepared for a prompt vaginal delivery or an emergency caesarean section.
- Caution: Use of medications such as opiates, corticosteroids & especially $MgSO_4$, have an effect on variability & accelerations

INTRAUTERINE FETAL RESUSCITATION

Aims: To facilitate & improve fetal oxygenation through different mechanisms, decreasing the risk for a hypoxic state & fetal acidosis.

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1. Maternal re-position: most patients during labor are in a supine decubitus position, which favors compression of the aorta & inferior vena cava.

- Favourable posıtion is maternal left lateral
- In special cases, such as a cord prolapse, the knee-to-thorax position is used.

2. Hydration with intravenous crystalloids: because fetal oxygenation is highly dependent on placental perfusion & optimal intravascular volume is required to keep it normal.

- Maternal administration of 1000cc of intravenous crystalloids increases fetal oxygen saturation in about 14% in non-hypoxic fetuses vs. 10% after administration of 500cc volume

(Simpson KR, James DC. E cacy of intrauterine resuscitation techniques in improving fetal oxygen status during labor. Obstet Gynecol 2005;105(6):1362–8.)

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3. Discontinuation or decrease of uterotonic agents : during induction of labor or delivery

- Adjuvant use of tocolytic agents in the following conditions:
  - Tachysystole from normal labour with abnormal FHR tracings not responding IFR manouvres
  - Following induction of labour with abnormal FHR tracings despite discontinuation of oxytocics
- Tocolytic drugs: Terbutaline or intravenous fenoterol- take caution of secondary effects

Nitroglycerin- alternative with less maternal S/Es. Dosage I.V 100-200mcgs

Pullen KM, Riley ET, Waller SA, et al. Randomized comparison of intravenous terbutaline vs. nitroglycerin for acute intrapartum fetal

- *resuscitation. Am J Obstet Gynecol 2007;197(4):414.e1–6.*

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4. Oxygen administration:

- Normal fetal saturation is approx. 40% - 60%.

- It has been demonstrated that maternal administration of high O2 conc. (FiO2 of 60% in 10–15 l per min) with devices such as a mask with NRM , increase the spO2 in hypoxic fetuses approx. from 26% - 37%.

(Simpson KR, James DC. Efficacy of intrauterine resuscitation techniques in improving fetal oxygen status during labor. Obstet Gynecol 2005;105(6):1362–8, Haydon ML, Gorenberg DM, Nageotte MP, et al. The effect of maternal oxygen administration on fetal pulse oximetry during labor in fetuses with nonreassuring fetal heart rate patterns. Am J Obstet Gynecol 2006;195(3):735–8.).

- Never the less concern about the possible deleterious effects of oxygen-free radicals in the fetus & the newborn secondary to a prolonged use of high oxygen concentrations *(Hamel MS, Anderson BL, Rouse DJ. Oxygen for intrauterine resuscitation: of unproved bene t and potentially harmful. Am J ObstetGynecol 2014;211(2):124–7).*

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O2 therapy…

- There are controversial results regarding the effect of the oxygen administration duration, proposing its use only for short periods of time (15 to 30 min).

Goodlin RC. Is oxytocin the culprit? Am J Obstet Gynecol 1985;153(8):928–9.

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- Possibility of maternal harmful effects a result of an oxidative stress process following high oxygen inspired fractions

- This condition can be characterized by mucous inflammation, hypoperfusion, and pneumonitis, as well as cerebral vasoconstriction.

(Bullens LM, Hulsenboom ADJ, Moors S, et al. Intrauterine resuscitation during the second stage of term labour by maternal hyperoxygenation versus conventional care: study protocol for a randomised controlled trial (INTEREST O2). Trials 2018;19(1):195.)

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O2 therapy Recommendation:

- Only in fetuses with signs of fetal distress, such as in pathological tracings (or category III) or suspicious tracings (category II) that show prolonged or late recurrent decelerations, variable decelerations of poor prognosis, bradycardia, or minimal or absent variability 30–60 min or Cases of maternal hypoxia

Maternal Hypotension

- Modify maternal position
- Administer I.V Crystalloids bolus
- If maternal systolic BP < 100mmHg Vasopressors are recommended.
- Choice of Vasopressors: Phenylephrine (preferred) or ephedrine

- If hypotension is related to Neuraxial analgesia- inform anaesthesiologist

Amnioinfusion

- Infusion of Crystalloids in amniotic cavity proposed in cases of non-reassuring FHR with recurrent variable decelerations that suggest Umblical Cord compression due to oligohydramnios.

- Limited evidence regarding improvement in short & long term neonatal results

- However has proven to decrease recurrence of variable decelerations as well as rate of Cesarean section

(Hofmeyr GJ, Lawrie TA. Amnioinfusion for potential or suspected umbilical cord compression in labour. Cochrane Database Syst Rev2012;1(1):Cd000013.)

CAESACREAN SECTION

- Acceptable period of time between decision to incision time by arbitrary standard -30 mins
- However Scientific evidence to support such a threshold is insufficient

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