A Case of Variables

G1 P0 at 40+6 gestational weeks
16 years old
Unremarkable prenatal or medical history

She has had a normal labor course with continuous EFM that has been “reassuring”

And now she is pushing……
01:30 – 50 minutes later...

01:50 – Decision made to deliver

02:24 – Decision to delivery time is 34 minutes

02:24 Delivery by C/S

3 hour second stage

Umbilical Cord Gases?
- UA 6.82/114/14/-13
- UV 6.93/84/27/-13

Apgars??
3/7/8
Objectives

- Definition of variable decelerations
- Physiologic mechanisms
- Relationship between variable decelerations and neonatal acidemia
- Management of variable decelerations
  - Intrauterine resuscitation techniques
    - Position changes
    - Maternal oxygen therapy
    - Amnioinfusion
    - Pushing every other contraction
  - When to Deliver

2005-06: AWHONN, ACNM and ACOG
Endorse NICHD Terminology

- JCAHO recommends having a common set of definitions (but does not specifically endorse the NICHD guidelines)


Variable Decelerations

- Visually apparent *abrupt* decrease in the FHR below baseline.
- Onset to beginning of nadir is < 30 seconds
- The decrease in FHR below the baseline is ≥15 bpm, lasts ≥15 seconds and <2 minutes from onset to return to baseline
- V shaped
- Variable in relationship to contraction

NICHD 1997
How Often Do Variable Decelerations Occur?

Low risk women at term:
- First stage of Labor
  - 68% will have variable decelerations ≥ 70 bpm
  - 7.3% will have variable decelerations ≤ 70 bpm
- Second stage of Labor
  - 62 % will have variable decelerations ≥ 70 bpm
  - 8.6 % will have variable decelerations ≤ 70 bpm

Variable Decelerations are Associated with Normal Labor Progress and with Acute Events
- Umbilical cord compression
- Head compression (rapid descent)
- Nuchal cord
- Rupture of Membranes/Oligohydramnios
- Uterine contractions
- Pushing efforts
- Fetal position (occiput posterior)

Physiologic Mechanism of Variable Decelerations:

1. Neurogenic
   - Head compression
     - Intracranial pressure
     - Vagal stimulation
     - Rapid drop in FHR

2. Cord Occlusion
   - Decreased umbilical blood flow
     - Arterial blood pressure (fetal)
     - Vagal stimulation
     - Rapid drop in FHR

Ball RH 1992, Rempen A 1991
And….. Sometimes You Get Both

Relationship between Variable Decelerations and Neonatal Acidemia

Variable Decelerations: Mild, Moderate, or Severe?
There is no standard terms for defining the severity of variable decelerations

- **Kubli 1969**
  - Mild: > 80 bpm, < 30 sec duration
  - Moderate: < 70 bpm, >30 sec and < 60 sec duration
  - Severe: < 70 bpm, > 60 sec duration

- **Wood 1969**
  - Mild: < 30 bpm below baseline
  - Moderate: 30-60 bpm below baseline
  - Severe: > 60 bpm below baseline

- **Krebs 1979**
  - Mild: <30 sec duration irrespective of level, >80 bpm irrespective of duration, 70-80 bpm for <60 seconds
  - Mod: <70 bpm for >30 sec and <60 seconds, 70-80 bpm for >60 seconds
  - Severe: <70 bpm for >60 seconds

**Variable Decelerations: Are Atypical Shapes Associated with More or Less Fetal Distress?**

- Spong C et al 1998:
  - Assessed, V shape, W shape, U shape, presence of anterior and posterior shoulders, slow return to baseline, depth in the second stage of labor
  - Neither shape nor presence of shoulders affected subsequent Apgar scores
  - Recurrent variable decelerations that were more frequent in a 10 minute window → lower Apgar scores
  - Variable decelerations with slow return to baseline → more operative deliveries

**Relationship between Variable Decelerations and Neonatal Acidemia**

- No relationship to fetal or neonatal acidemia if:
  - Nadir < 60 bpm below baseline
  - Duration < 60 sec.
  - Variability is retained

- Possible acidemia if recurrent and:
  - Nadir > 60 bpm below baseline
  - Duration > 60 sec.
  - Slow return to baseline
  - Minimal or absent variability
  - Other types of decelerations are present

**Relationship between Variant FHR Patterns and Neonatal Acidemia**

1. Late or variable decelerations with variability:
   - 97% of newborns will have UA pH > 7.0

2. Late or variable decelerations with minimal or absent variability
   - 12%-30% of newborns will have a UA pH < 7.0

3. Positive relationship between the depth of the decelerations and the degree of acidemia

4. It takes ~ 60-90 minutes after loss of variability to develop clinically significant acidemia (eg pH < 7.1, BE > 12mEq/L)

**Pattern evolution: Recurrent variable decelerations result in fetal/neonatal acidemia**

- Variables become deeper
- Variables associated with "late return"
- Tachycardia
- Decreased variability

Management of Variable Decelerations

“Decel in room 6, get her to the OR”

“I don’t hear anything do you hear anything?”

“An Ounce of Prevention…….”

1. Avoid amniotomy
2. Avoid hyperstimulation

Think pathophysiology…….

1. Avoid amniotomy
2. Avoid hyperstimulation

Position Changes

- Alters the relationship between the umbilical cord and fetal parts and/or the uterine wall
- Can relieve variable decelerations
- Lateral positions increase fetal oxygen saturation in fetus without non-reassuring FHR pattern
- There is no difference in fetal oxygenation between the left side and the right side

Maternal Oxygen Therapy

- Haden et al: Maternal oxygen inhalation improved fetal oxygenation in a fetus with a non-reassuring FHR tracing
- Thorp: Possible adverse effects
  - ↑ in neonatal acidosis when O2 administered for > 10 minutes in second stage
- Fawole (meta-analysis): Insufficient data
  - Increased rates of UA pH<7.2 in newborns exposed to O2 therapy [RR 3.51, 95% CI 1.3-9.2] in fetuses without fetal distress

Garite TJ 1993, Goffinet F 1997
Haden et al: Maternal oxygen inhalation improved fetal oxygenation in a fetus with a non-reassuring FHR tracing
Thor: Possible adverse effects
Fawole (meta-analysis): Insufficient data

**Maternal Oxygen Therapy: Summary**
- O₂ via non-rebreather face mask at 10 L/min provides 80-100% FiO₂
- O₂ via nasal cannula provides 27-40% FiO₂
- Greater ↑ in fetal oxygenation if baseline FSPO₂ was lower
- 15 to 30 min. maximum as based on FHR pattern
- Use with maternal pulse oximetry and titrate to maintain oxygen saturation at 100%


**Amnioinfusion for Variable Decelerations**
Meta-analysis of 14 RCTs
- ↓ FHR decelerations
  - (N= 227 women; RR 0.54; CI 0.43- 0.68)
- ↓ C/S
  - (N = 953; RR 0.52; CI 0.40 to 0.69)
- ↓ Apgar score < 7 at 5 min
  - (N = 828; RR 0.54; CI 0.30-0.97)
- ↓ Low umbilical cord (UA) pH values
  - (N = 660; RR 0.45; CI 0.31- 0.64)
- ↓ postpartum endometritis
  - (N = 619; RR 0.45; CI 0.25 to 0.81)

Hofmeyer GJ 1998

**Pushing Every Other Contraction**
- Push every other contraction
- Avoid sustained closed-glottis pushing


**Tocolytics**
- β-agonists (terbutaline) more effective than magnesium
  - Dose of terbutaline
    - Terbutaline 0.25 mg SC or 0.125 mg IV
  - Side effects of terbutaline
    - Maternal and fetal tachycardia
  - Contraindications to terbutaline
    - Women with heart disease or tachycardia
    - Fetus with tachycardia
- Sublingual nitroglycerin may be as effective
  - Dose of nitroglycerin
    - Nitroglycerin 100 mcg SL
  - Side effect of nitroglycerin
    - Maternal hypotension

Thurlow JA 2002, Kuler R 2006
1. Intermittent variable decelerations with variability are almost NEVER associated with newborn acidemia.

2. Recurrent variable decelerations that have a late return and are associated with increasing baseline (tachycardia) signal significant risk for respiratory acidosis.

3. Variable decelerations with absent variability signal significant risk for metabolic acidosis.

**Conclusion: Variable Decelerations**

1. The pattern evolution from recurrent variable decelerations to decelerations with slow return to baseline, tachycardia and decreasing variability reflects the presence of respiratory acidemia shifting to metabolic acidemia.

2. Position changes, amniinfusion, tocolytics during the first stage of labor and pushing every other contraction in the second stage of labor will decrease the frequency of variable decelerations.

**Conclusion: Management of Variable Decelerations**

- Recurrent variable decelerations
  - Position Change, Amnioinfusion, Tocolytics
  - Observe closely
  - Scalp stim and/or prepare for delivery