As a medical professional, there are many things on your plate, and fetal monitoring is only one of them.

It might seem that a disproportionate amount of time and energy is dedicated to this one area of medicine.

But that is because fetal monitoring...

1. Is the most common procedure you will perform in obstetrics.
2. Involves the potential for preventable lifelong brain damage.
3. Represents an overwhelmingly disproportionate share of the medicolegal risk you will face throughout your career.
4. Our primary goal is to optimize outcomes... a secondary goal is to minimize risks.
The most effective way to optimize outcomes AND minimize medical-legal risk is to practice according to...

“Standard of Care”

Define “Standard of Care”

- Level of care provided by best practitioners in the community?
- Level of care provided by average practitioners in the community?
- Level of care provided by most practitioners in the community?
- Minimally acceptable level of care?
- Level of care dictated by AWHONN and ACOG?
- Level of care dictated by standard textbooks?

“Standard of Care”

Level of care expected of a reasonable practitioner

Who makes that determination?
How do they decide?

“"I don’t know the specific definition, but I know it when I see it.”'

Factual accuracy and ability to articulate are NOT optional

Even if you never encounter a legal challenge in your career, if you cannot communicate adequately to obtain appropriate informed consent, you have not met the standard of care
Intrapartum FHR monitoring is one of the most common obstetric procedures in the US, impacting the lives of almost 8 million mothers and babies every year.

However, for 40 years, a lack of standardized training and competency testing in intrapartum FHR monitoring has led to:

- Ill-defined, confusing, controversial terms ("perinatal asphyxia", "fetal distress")
- Unsubstantiated theories, hypotheses... unscientific dogma
- Myths, urban legends and folklore passed down from resident to resident, nurse to nurse and generation to generation
- A breakdown in communication that jeopardizes patient safety challenges the credibility of our profession

<table>
<thead>
<tr>
<th>New Technology</th>
<th>Pioneering phase</th>
<th>Mature technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theories and Hypotheses</td>
<td>Scientific Process</td>
<td>False, True</td>
</tr>
</tbody>
</table>
Since 1997 there have been several important consensus publications that have reshaped the fetal monitoring landscape:

- 1997 – First NICHD Consensus Statement
- 1999 – International Cerebral Palsy Task Force Consensus Statement
- 2003 – ACOG-AAP Cerebral Palsy Task Force Consensus Statement
- 2005 – ACOG/AWHONN endorsement
- 2006 – ACNM endorsement
- 2008 – Second NICHD consensus report
- 2009 – ACOG Practice Bulletin 106
- 2010 – ACOG Practice Bulletin 116

Why the need to standardize?
WHAT CAN THE TECHNOLOGY REALLY DO?
A FHR tracing with minimal-absent variability and late decelerations accurately predicts cerebral palsy 1 time out of 500 (99.8% false positive rate)

The population incidence of cerebral palsy is ~1 per 500


The fact is... most “non-reassuring” FHR tracings predict neurologic injury no better than randomly selecting a name from the telephone book

Electronic FHR monitoring is NOT a diagnostic test

It is a screening test

Except in the most extreme cases, it has never been capable of reliably diagnosing fetal injury or “impending injury”
Start with the basics

Undertake the simple exercise of deconstructing fetal heart rate monitoring into its essential components

FHR monitoring consists of three components:

- Intrapartum FHR Monitoring
  - Definition
  - Interpretation
  - Management

Normal baseline rate 110-160 bpm

Mean FHR rounded to increments of 5 bpm in a 10-minute window
Variability is defined as fluctuations in the baseline that are irregular in amplitude and frequency...

The fluctuations are measured from peak-to-trough in bpm.

No distinction is made between short-term (beat-to-beat) variability and long-term variability because in actual practice they are visually determined as a unit.

**Acceleration**

Abrupt increase (onset to peak < 30 sec) from baseline

- 32 weeks and beyond: 15 x 15
- Before 32 weeks: 10 x 10

**Decelerations**

Early
Late
Variable
Prolonged
Late versus variable

**Late Deceleration**

*Gradual* decrease in FHR associated with a contraction

Onset, nadir, and recovery occur *after* the beginning, peak, and ending of the contraction

**Variable Deceleration**

Abrupt decrease in FHR at least 15 bpm for at least 15 seconds
Why have we been taught to believe that late decelerations are "ominous" but variable decelerations are "benign"?

As early as the 1970s, elegant research demonstrated that late decelerations reflect a protective reflex response to transient fetal hypoxemia during a uterine contraction.

During a uterine contraction, decreased maternal perfusion of the placenta can cause the fetal PO2 to fall below the lower limit of normal.

Decreased fetal PO2 (hypoxemia) during a uterine contraction is detected by... chemoreceptors.

Chemoreceptors signal the brain stem.

In order to shunt oxygenated blood to the vital organs of the brain, heart, adrenal glands and placenta...

Sympathetic outflow causes peripheral vasoconstriction to redistribute oxygenated blood away from the extremities, gut and kidneys. Peripheral vasoconstriction causes the blood pressure to rise.
Rising blood pressure is detected by baroreceptors.

Baroreceptors signal the brain stem.

Parasympathetic (vagal) outflow slows the FHR to reduce cardiac output and lower blood pressure.
This reflex can be seen in the fetal heart rate tracing as a late deceleration.

As the uterine contraction subsides, oxygenated maternal blood enters the intervillous space.

Fetal PO2 rises. The autonomic reflex subsides and the FHR returns to baseline.
If this description is accurate, what would you expect to see?

**Blood Flow in Fetal Lamb in response to hypoxemia**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Kidney</th>
<th>Body</th>
<th>BP</th>
<th>Brain</th>
<th>Heart</th>
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</tr>
</tbody>
</table>

↑ = Increase
↓ = Decrease
эфф = no change

---

**Variable Deceleration**

---

Occlusion of the umbilical cord causes the blood pressure to...
RISE
Rising blood pressure is detected by baroreceptors.

Baroreceptors signal the brain stem.

Parasympathetic (vagal) outflow slows the FHR to reduce cardiac output and lower blood pressure.
Late decelerations and variable decelerations are protective autonomic reflex responses

Neither is inherently “ominous”

Neither is inherently “benign”

The 2008 NICHD Workshop Report on Electronic Fetal Monitoring

A very brief update

Previous classification system

“Reassuring”

“Non-reassuring”

Reassuring: (adj)

“Restoring confidence and relieving anxiety”
New “Three-Tier” Fetal Heart Rate Classification System

Category I – “Normal”
Baseline rate: 110-160 bpm
Variability: Moderate
Decelerations: No late, variable or prolonged

Category II – “Indeterminate”

Category III – “Abnormal”
1. Absent variability with recurrent late decelerations
2. Absent variability with recurrent variable decelerations
3. Absent variability with bradycardia for at least 10 min
4. Sinusoidal pattern for at least 20 min
Category II?

Everything Else

Definitions:  
• Baseline  
• Variability  
• Accelerations  
• Decelerations  
• Changes or trends over time  
• “CATEGORY”  

Factual Accuracy
Interpretation

Patient Safety
+ Standard of Care

• Standard
• Simple
• Factually Accurate
• Articulate

“Ominous overshoot pattern”
“Variable with a late component”
“Checkmark pattern”
“V-volume-variable = oligohydramnios”
“W variable = nuchal cord”
“Icicle deceleration”
“Carrot-stick deceleration”
“Uniform accelerations = umbilical vein compression”
“Atypical variables”
“Ominous Conversion Factor”
“Wandering baseline”
“Variability at the base of a late decel is reassuring”
“Classifying decelerations as mild-moderate-severe”
Level II evidence REQUIRES “appropriate control of confounding factors”, including baseline rate, variability, accelerations and frequency of decelerations.

In the next few minutes, 40 years of research in intrapartum FHR interpretation will be distilled into 3 central principles that are evidence based, reflect consensus in the literature and most importantly are simple, practical and teachable.
Intrapartum FHR monitoring is intended to assess **fetal oxygenation**

Fetal oxygenation involves the transfer of oxygen from the environment to the fetus...

And the subsequent fetal physiologic response if oxygen transfer is interrupted...
What does the fetal heart rate tracing reveal about this pathway?

What information does the FHR tracing provide regarding oxygen transfer?

Start at the top

Interruption of the oxygen pathway by compression of the umbilical cord can result in a variable deceleration
Interruption of the oxygen pathway at the level of the uterus or placenta can result in a late deceleration.

Interruption of the oxygen pathway at any point can result in a prolonged deceleration.

ALL clinically significant FHR decelerations (late, variable, prolonged) HAVE EXACTLY THE SAME TRIGGER...

Interruption of the oxygen pathway at one or more points...
It's a variable! It's a LATE!!! It's a VARIABLE!!!

VARIABLE!!! LATE!!! It's a LATE!!!

It's a LATE!!!
Make it easy for yourself and your team...

All FHR decelerations that have any potential clinical significance have the same common trigger...

Interruption of oxygen transfer from the environment to the fetus at one or more points along the oxygen pathway

Principle #1
Variable, late or prolonged decelerations signal interruption of the oxygen pathway at one or more points
What information can the FHR tracing provide regarding the fetal response to interruption of the oxygen pathway?

The second half of the pathway

The 2008 NICHD consensus statement identified two fetal heart rate characteristics that reliably predict the absence of fetal metabolic acidemia at the time they are observed.

**Principle #2**

Moderate variability or accelerations reliably predict the absence of fetal metabolic acidemia at the time they are observed.
What is the physiologic significance of excluding metabolic acidemia?

Supporters included:
1. American College of Obstetricians and Gynecologists
2. American Gynecological and Obstetrical Society
3. Australian College of Midwives
4. Hong Kong Society of Neonatal Medicine
5. Institute of Obstetrics and Gynaecology of the Royal College of Physicians of Ireland
6. International Society of Perinatal Obstetricians
7. New Zealand College of Midwives
8. Paediatric Society of New Zealand
9. Perinatal Society of Australia and New Zealand
10. Royal Australasian College of Physicians, Paediatric Division
11. Royal Australian College of General Practitioners
12. Royal Australian College of Obstetricians and Gynaecologists
13. Royal College of Obstetricians and Gynaecologists
14. Royal College of Pathologists of Australasia
15. Royal New Zealand College of Obstetricians and Gynaecologists
16. Society of Obstetricians and Gynaecologists of Canada
The publication was endorsed by:

1. American College of Obstetricians and Gynecologists
2. American Academy of Pediatrics
3. Centers for Disease Control and Prevention
4. Child Neurology Society
5. March of Dimes Birth Defects Foundation
6. National Institute of Child Health and Human Development
7. Royal Australian and New Zealand College of Obstetricians and Gynecologists
8. Society for Maternal-Fetal Medicine
9. Society of Obstetricians and Gynaecologists of Canada

Metabolic acidemia is an essential prerequisite to intrapartum hypoxic neurologic injury (pH < 7, BD ≥ 12 mmol/L)
Is this simple enough to be taught and retained?

In 2009, the Los Angeles County Department of Health mandated FHR competency testing (OVMC, HUCLA, LAC+USC)

After a series of training sessions on standard NICHD FHR definitions, NICHD categories and 3 simplified principles of interpretation, a formal written test was administered to all care providers at all levels

A two-year quality improvement initiative to standardize the methods by which obstetric team members interpret, communicate, document and manage fetal heart rate tracings

400 representatives from 90 of New York’s 140 hospitals

Pre and post-test mean percent correct responses

<table>
<thead>
<tr>
<th>Test</th>
<th>Pre 6/7-09</th>
<th>Post 6/7-09</th>
<th>Post 12-09</th>
<th>Post 12-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Correct</td>
<td>49%</td>
<td>85%</td>
<td>80%</td>
<td>84%</td>
</tr>
</tbody>
</table>
Reviewers demonstrated agreement on:

- Baseline rate: 0.97
- Moderate variability: 0.80
- Accelerations: 0.62
- Decelerations: 0.63
- Category: 0.68
- Exclude fetal metabolic acidemia: 0.82

Kappa value Agreement:

- < 0.40 Poor
- 0.41 – 0.60 Moderate
- 0.61 – 0.80 Substantial
- 0.81 – 1.0 Excellent

Interobserver Reliability of Fetal Heart Rate Pattern Interpretation Using NICHD Definitions

Kappa value Agreement on all components:

- Baseline rate...130 bpm
- Variability...moderate
- Accelerations...present
- Decelerations...absent
- Changes or trends over time...none

Category I

Does it have a practical application?
What does it mean?

“Happy baby”?  
“Baby’s fine”?  
“Nothing to worry about”?
“Reassuring”?

What does it mean?

What do I do about it?

Standardized management coming up next
1. Definition

2. Interpretation
- Baseline rate... 150 bpm
- Variability... moderate
- Accelerations... absent
- Decelerations... present
- Changes or trends... yes

Category II

3. Management

What do I call it?

What does it mean?

“Ominous”?
“Concerning”?
“Problematic”?
“Pathologic”?
“Reassuring”?
“Non-reassuring”

What does it mean?
What do I do about it?

Management coming up next

The far end of the FHR spectrum

1. Definition
2. Interpretation
3. Management

What do I call it?
Baseline rate...165
Variability...absent
Accelerations...absent
Deceleration...present, recurrent
Changes or trends...yes
Category III

What does it mean?
What does it mean?

Management coming up

What do I do about it?

Factual Accuracy

Standard Definitions
We have achieved consensus in the United States on the terminology used to describe the five components of a FHR tracing

Standard interpretation
Three central concepts of FHR interpretation are evidence-based and reflect consensus in the literature
Ability to Articulate

Standardized management is the next challenge

This will be the topic of the breakout sessions

Standardized management is NOT intended to replace individual clinical judgment

On the contrary...

Standardized management is intended to encourage the systematic application of individual clinical judgment

Risk factors for error

Random recall

Lack of a checklist

Unnecessary complexity
Random recall

One end of the FHR spectrum – Category I

What do I call it?
Baseline rate... 130 bpm
Variability... moderate
Accelerations... present
Decelerations... absent
Changes or trends over time... none

What does it mean?
Standardized Management

**Intrapartum Fetal Heart Rate Management Decision Model**

1. **Confirm FHR and uterine activity**
2. **FHR Category: I**
   - Is the patient low-risk?
     - Yes: **Routine Surveillance**
       - Every 30 min in the 1st stage of labor
       - Every 15 min in the 2nd stage of labor
     - No: **Heightened Surveillance**
       - FHR Category?
3. **Heightened Surveillance**
   - Every 15 min in the 1st stage of labor
   - Every 5 min in the 2nd stage of labor

**“ABCD”**

- **“A”**
- **“B”**
- **“C”**
- **“D”**
- **“E”**
- **“F”**
- **“G”**
- **“H”**
- **“I”**
- **“J”**
- **“K”**
- **“L”**
- **“M”**
- **“N”**
- **“O”**
- **“P”**
- **“Q”**
- **“R”**
- **“S”**
- **“T”**
- **“U”**
- **“V”**
- **“W”**
- **“X”**
- **“Y”**
- **“Z”**
Standardized Intrapartum FHR Management

Four Elements

“ABCD”

A – Assess the oxygen pathway
B – Begin corrective measures

Intrapartum Fetal Heart Rate Management Decision Model

Confirm FHR and uterine activity

FHR Category:

I

II or III

Is the patient low risk?

Routine Surveillance

“ABCD”

• Every 30 min in the 1st stage of labor
• Every 15 min in the 2nd stage of labor

Heightened Surveillance

• Every 15 min in the 1st stage of labor
• Every 5 min in the 2nd stage of labor
Intrapartum Fetal Heart Rate Management Decision Model

**Confirm FHR and uterine activity**

- **FHR Category?**
  - I or II
  - III

- Is the patient low-risk?
  - Yes: Routine Surveillance
  - No: Heightened Surveillance

**Routine Surveillance**
- Every 15 min in the 1st stage of labor
- Every 5 min in the 2nd stage of labor

**Heightened Surveillance**
- Every 15 min in the 1st stage of labor
- Every 5 min in the 2nd stage of labor

**Expediting Delivery**
- "A" - Assess oxygen pathway
- "B" - Begin corrective measures if indicated
- "C" - Supplement oxygen
- "D" - Monitor breathing pattern

- **Lungs and airway**
- Supplement oxygen
- **Heart rate and rhythm**
- Supplement oxygen
- **Position change**
- Supplement oxygen
- **Fluid bolus**
- Supplement oxygen
- **Vasculature blood pressure**
- Supplement oxygen
- **Baseline uterine tone**
- Supplement oxygen
- **Uterus contraction strength**
- Supplement oxygen
- **Uterus contraction frequency**
- Supplement oxygen
- **Exclude uterine rupture**
- Supplement oxygen
- **Stop or reduce stimulant**
- Supplement oxygen
- **Consider uterine relaxant**
- Supplement oxygen
- **Placenta separation bleeding**
- Supplement oxygen
- **Exclude cord prolapse**
- Supplement oxygen
- **Consider amnioinfusion**
- Supplement oxygen

Is the patient low-risk?
What fetal heart rate characteristics tell you it is safe to continue surveillance?

Step away from the edge...

Make it easy for yourself and your team...
If you have *any question*...

...the safest approach is to proceed to the next step

“C”

Cesarean Section
NO

“C”
Cesarean?
Call for Cesarean?
Crash Cesarean?
Call for the vacuum?
Commit to cesarean?
Commit to delivery?
Cancel clinic?

Standardized Intrapartum Management

“ABCD”
A – Assess the oxygen pathway
B – Begin corrective measures
C – Clear obstacles to rapid delivery
Clear obstacles to rapid delivery

If conservative measures do not correct the FHR tracing, it is prudent to plan ahead for the possible need for rapid delivery

*This does NOT commit the patient to delivery*

It simply identifies common sources of unnecessary delay in a systematic way so they can be addressed in timely fashion.

By doing this, it demonstrates reasonableness and prudence—two elements that define the standard of care.
Consider individual characteristics of Facility, Staff, Mother, Fetus, Labor.

Consider factors such as:
- Estimated fetal weight
- Gestational age
- Presentation
- Position

Infection
- Meconium

Placenta
- Placental separation
- Bleeding
  - Vasa previa

Cord
- Vaginal exam
  - Exclude cord prolapse
  - Consider amnioinfusion

Labor
- Consider factors such as:
  - Arrest disorder
  - Protracted labor
  - Remote from delivery
  - Poor expulsive efforts

Heart rate and rhythm
- Position changes
- Fluid bolus
  - Correct hypotension
Staff
- Notify Obstetrician
  - Surgical assistant
  - Anesthesiologist
  - Neonatologist
  - Pediatrician
  - Nursing staff
Consider:
- Availability
- Training
- Experience

Vasculature
- Blood pressure
- Volume status
Mother
- Informed consent
- Anesthesia options
- Laboratory tests
- Blood products
- Intravenous access
- Urinary catheter
- Abdominal prep
- Transfer to OR
Consider:
- Surgical considerations
  - (prior abdominal or uterine surgery)
  - Medical considerations (obesity, hypertension, diabetes, SLE)
  - Obstetric considerations (parity, pelvimetry, placental location)

Uterus
- Contraction strength
- Contraction frequency
- Baseline uterine tone
Exclude uterine rupture
- Stop or reduce stimulant
- Consider uterine relaxant
Fetus
- Confirm Estimated fetal weight
- Gestational age
- Presentation
- Position

Infection
- Meconium

Placenta
- Placental separation
- Bleeding
  - Vasa previa
<table>
<thead>
<tr>
<th></th>
<th>Assess Oxygen Pathway</th>
<th>Begin Corrective Measures if Indicated</th>
<th>Clear Obstacles to Rapid Delivery</th>
<th>Determine Decision to Delivery Time</th>
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<tr>
<td>Lung</td>
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<td>Supplemental oxygen</td>
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<tr>
<td>Heart</td>
<td>Heart rate and rhythm</td>
<td>Corrective measures</td>
<td>Oxygen availability / equipment availability</td>
<td>Oxygen delivery time</td>
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<td>Patient changes Written orders Corrective measures</td>
<td>Oxygen saturation / chest x-ray</td>
<td>Oxygen response time</td>
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<td>Maternal</td>
<td>Internal review</td>
<td>Maternal response time</td>
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<tr>
<td>Uterus</td>
<td>Uterine contractions Position changes Cervical changes</td>
<td>Cervical changes</td>
<td>Internal review</td>
<td>Cervical response time</td>
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<tr>
<td>Hemorrhage</td>
<td>Hemorrhage status</td>
<td>Maternal</td>
<td>Internal review</td>
<td>Maternal response time</td>
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</tbody>
</table>

Intrapartum Fetal Heart Rate Management Decision Model

**“ABCD”**

- **“A”** - Assess oxygen pathway
- **“B”** - Begin corrective measures
- **“C”** - Clear obstacles to rapid delivery
- **“D”** - Determine decision to delivery time

**Confirm FHR and uterine activity**

- **FHR Category: I**
  - Presence of moderate variability or accelerations
  - Absence of clinically significant decelerations

- **FHR Category: II or III**
  - Presence of moderate variability or accelerations
  - Absence of clinically significant decelerations

- **Is the patient low risk?**
  - Yes: Routine Surveillance
  - No: Heightened Surveillance

**Routine Surveillance**
- Every 30 min in the 1st stage of labor
- Every 15 min in the 2nd stage of labor

**Heightened Surveillance**
- Every 15 min in the 1st stage of labor
- Every 5 min in the 2nd stage of labor

**Expedite Delivery**

This is sometimes a very tough decision to make

No matter what our decision is, we’ll never be able to guarantee a good outcome

Having a bad outcome despite a well-thought out plan is not necessarily unreasonable

It is much more difficult to convince someone that our actions were reasonable if we neglect to make a plan... fail to make a decision at a critical point
Deciding to wait is distinctly different from Waiting to decide.

Kickin’ the can down the road.
**Intrapartum Fetal Heart Rate Management Decision Model**

**Confirm FHR and uterine activity**

**FHR Category?**

- II or III
- I or II
- I

- Is the patient low-risk?
- Is vaginal delivery likely before the onset of metabolic acidemia and potential injury?

- **A** – Assess oxygen pathway
- **B** – Begin corrective measures if indicated
- **C** – Clear obstacles to rapid delivery
- **D** – Determine decision to delivery time

**Routine Surveillance**

- Every 30 min in the 1st stage of labor
- Every 15 min in the 2nd stage of labor

**Heightened Surveillance**

- Every 15 min in the 1st stage of labor
- Every 5 min in the 2nd stage of labor

**Expedite Delivery**

- Confirm FHR and uterine activity
- 

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<td>I</td>
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</tbody>
</table>

- **Urgent**
  - Consider additional oxygen
  - Consider IUPC
  - Notify obstetrician, surgical assistant, anesthesiologist, neonatologist, pediatrician, nursing staff
  - Consider factors such as estimated fetal weight, gestational age, presentation, position

---

How do you document this?

If the “Objective” section of your SOAP note indicates:

“145 bpm, mod var, occ accels, occ late decels”

Does the “Assessment” section need to read:

“Late decelerations indicate interruption of the oxygen pathway, however moderate variability and accelerations reliably exclude metabolic acidemia, therefore reliably exclude hypoxic neurologic injury at this time”
Of course not

How about this?
If the “Objective” section of your SOAP note indicates:

“145 bpm, mod var, occ accel, occ late decels”

Why not write:

“Occasional late decelerations. Moderate variability and accelerations confirm adequate oxygenation”

Or even simpler

“Adequate oxygenation”

What would be your indication for cesarean?

“Fetal distress”?

“Fetal intolerance to labor”?

“Non-reassuring fetal status”?

Why not...

“Recurrent decelerations, minimal variability, remote from delivery”? 
Myth Busting 101
Separating Fact from Fiction

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“It ain’t so much the things we don’t know that get us into trouble.
It’s the things we know that just ain’t so,”

LEVELS OF SCIENTIFIC EVIDENCE
- Randomized Controlled Trial
- Cohort
- Case-control Multiple time series
- Case reports, case series Expert opinion

Analytic evidence: capable of establishing relationships
Descriptive evidence: incapable of establishing relationships
“Atypical variable decelerations”

“Overshoot”

No consensus regarding:
- Definition
- Clinical significance
- Management

The term “overshoot” has been used to describe a FHR pattern characterized by persistently absent variability, absent accelerations and a variable deceleration followed by a smooth, prolonged rise in the FHR above the previous baseline with gradual return.

As with the “wandering baseline”, essential elements of this uncommon pattern include the persistent absence of variability and the absence of accelerations.
The “overshoot” pattern has been attributed to a range of conditions, including:

- mild fetal hypoxia above the deceleration threshold
- chronic fetal distress
- repetitive transient central nervous system ischemia

However, all of these associations are speculative and none has been substantiated by available scientific evidence.

The physiologic mechanisms responsible for the “overshoot” pattern are not known. However, the pattern has been described in association with abnormal neurologic outcome with or without metabolic acidemia, suggesting that it might indicate preexisting neurologic injury.
“Overshoot”
Because of the wide variation in reported associations and the total lack of agreement regarding the definition and clinical significance of “overshoot”, it is best to avoid the use of this term in favor of specific terminology.

All evidence regarding the “overshoot” pattern in humans is Level III.

“Atypical variable decelerations”

LEVELS OF SCIENTIFIC EVIDENCE

Level II evidence requires “appropriate control of confounding factors”. Evidence that does not rise to this level does not satisfy criteria for Level II.
Known confounding factors in fetal monitoring

- Presence or absence of normal baseline rate
- Presence or absence of moderate variability
- Presence or absence of accelerations
- Presence or absence of antecedent decelerations

Studies that do not control for these known sources of confounding bias do not meet criteria for inclusion in Level II. - US Preventive Services Taskforce

http://www.uspreventiveservicestaskforce.org/uspstf08/methods/procmanual.htm

“Atypical variable decelerations”
“Variable deceleration with a late component”

The specific physiologic mechanism has not been studied systematically.

There is no Level I supporting evidence

There is no Level II evidence with appropriate control of confounding factors

In the absence of a standard definition of this pattern, its use is best avoided in favor of standard terminology. For example: “variable deceleration with gradual return to baseline”
“Variable decelerations may be accompanied by other characteristics, the clinical significance of which requires further research investigation.”

“Some examples include a slow return of the FHR after the end of the contraction (variable with a late component)....

“Atypical variable decelerations”

“Mild”, “Moderate” and “Severe” variable decelerations

The depth and duration of variable decelerations have been suggested as predictors of newborn outcome

Kubli and colleagues proposed three categories of variable decelerations based upon these characteristics

“Atypical variable decelerations”

“Mild”, “Moderate” and “Severe” variable decelerations

According to this classification system, a mild variable deceleration was defined by a duration < 30 seconds regardless of depth, a depth no lower than 80 bpm or a depth of 70-80 bpm lasting < 60 seconds

A moderate variable deceleration was defined by a depth < 70 bpm lasting 30-60 seconds or a depth of 70-80 bpm lasting more than 60 seconds.

A severe deceleration was defined as a deceleration below 70 bpm lasting more than 60 seconds
“Atypical variable decelerations”

“Mild”, “Moderate” and “Severe” variable decelerations

There is no level I or level II evidence in the literature that the depth of any type of deceleration (early, variable, late or prolonged) is predictive of fetal metabolic acidemia or newborn outcome independent of other important FHR characteristics such as baseline rate, variability, accelerations and frequency of decelerations.

Therefore, “mild”, “moderate” and “severe” categories are not included in standard NICHD definitions of FHR decelerations.

Consistent with NICHD terminology, all decelerations are quantitated by depth in beats per minute and duration in minutes and seconds.

2008 NICHD

“Some authors have suggested grading of decelerations (mild, moderate, severe) based on the depth of the deceleration or absolute nadir in beats per minute and duration.”

“These grading systems require further investigation as to their predictive value.”

This categorization system was specifically addressed by the 2008 NICHD consensus panel and specifically rejected for lack of evidence.
“Atypical variable decelerations”
“V-shaped variables” and “W-shaped variables”

The visual appearance of a variable deceleration has been suggested to predict the underlying cause.

For example, a “V-shaped” variable deceleration has been suggested to indicate umbilical cord compression due to oligohydramnios.

A “W-shaped” variable deceleration has been suggested to reflect umbilical cord compression due to a nuchal cord.
“Atypical variable decelerations”
“V-shaped variables” and “W-shaped variables”

Although such claims likely have little impact on patient care, there is no supporting evidence in the literature. These terms are not included in standardized NICHD terminology.

2008 NICHD

“Variable decelerations may be accompanied by other characteristics, the clinical significance of which requires further research investigation.”

“Some examples include biphasic decelerations”
(W-shaped)

Other myths...

“Good variability within the deceleration”

At the nadir of a variable or late deceleration, the FHR frequently appears irregular, similar to the appearance of moderate variability. The visual similarity has led some to suggest that “variability” during a deceleration has the same clinical significance as baseline variability.
While the concept is not physiologically implausible, there is no supporting Level I or Level II evidence—the only levels of evidence that are capable of establishing such a relationship.

Other myths...

“Good variability within the deceleration”

In addition, it is inconsistent with standard terminology. Variability is a characteristic of the FHR baseline.

The term “variability” is not used to qualify periodic or episodic decelerations that interrupt the baseline.

In the absence of evidence, the safest approach is to avoid assigning undue significance to this observation.

Other myths...

“The constant pounding of the fetal head on the maternal pelvis causes local cerebral ischemia and brain damage WITHOUT systemic metabolic acidemia and WITHOUT the necessity of neonatal encephalopathy”
Scenario

- Term labor
- Uncomplicated vaginal delivery
- Normal Apgar scores
- Normal umbilical artery blood gas results
- Normal newborn course
- Home with mother on PPD 2
- Neurologic symptoms noted at 18 months

Claim

“Silent” cerebral ischemia...
Not global hypoxia

Mechanical head compression

There are no analytic studies in the literature to support this hypothetical mechanism of injury

Analytic (case-control) studies evaluating risk factors for cerebral palsy have never identified any degree of uterine activity as a risk factor
Case-control Studies Failing to Identify Uterine Activity as a Risk Factor


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The New England Journal of Medicine

Table 1. Singleton Infants Born to Nulliparous Women in California Between 1983 and 1994, According to the Mode of Delivery.*

<table>
<thead>
<tr>
<th>Year</th>
<th>Spontaneous Delivery</th>
<th>Vacuum Extraction</th>
<th>Cesarean Section</th>
<th>Forceps Delivery</th>
<th>Vacuum Extraction and Forceps Delivery</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>103,486 (68.3)</td>
<td>18,667 (9.3)</td>
<td>41,042 (26.0)</td>
<td>6,820 (3.2)</td>
<td>1105 (0.6)</td>
<td>201,279</td>
</tr>
<tr>
<td>1993</td>
<td>122,737 (68.6)</td>
<td>19,499 (10.1)</td>
<td>39,245 (20.8)</td>
<td>4,948 (2.6)</td>
<td>920 (0.6)</td>
<td>201,399</td>
</tr>
<tr>
<td>1994</td>
<td>205,679 (66.5)</td>
<td>21,198 (11.2)</td>
<td>36,680 (19.4)</td>
<td>4,478 (2.4)</td>
<td>792 (0.4)</td>
<td>188,722</td>
</tr>
<tr>
<td>Total</td>
<td>432,902 (68.3)</td>
<td>59,364 (10.2)</td>
<td>117,267 (20.1)</td>
<td>15,246 (2.7)</td>
<td>2817 (0.4)</td>
<td>588,744</td>
</tr>
</tbody>
</table>

*Data are restricted to live-born infants weighing 2500 g or more.
One of the latest myths...
MORE CATEGORIES ARE BETTER

Risk categories for lethal accidents related to TRAV, baseline risk, and presence of recurrent determinations:

![Risk categories table]

TABLE 5
Risk of scoliosis, evolution of FRR patterns to more serious risk, and recommended action

<table>
<thead>
<tr>
<th>Variable</th>
<th>Risk of scoliosis</th>
<th>Risk of evolution</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Low</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>Moderate</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td>Borderline/acceptably low</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>Unacceptably high</td>
<td>Not a consideration</td>
<td></td>
</tr>
</tbody>
</table>
Most studies have ignored the difference between respiratory and metabolic acidemia.

<table>
<thead>
<tr>
<th>Respiratory Acidemia</th>
<th>Metabolic/mixed Acidemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Common</td>
<td>• Uncommon (&lt; 2 %)</td>
</tr>
<tr>
<td>• Low pH</td>
<td>• Low pH</td>
</tr>
<tr>
<td>• PCO2 &gt; 50 mmHg</td>
<td>• Normal or high PCO2</td>
</tr>
<tr>
<td>• Base deficit &lt; 12</td>
<td>• Base deficit ≥ 12</td>
</tr>
</tbody>
</table>

**Clinically benign**

Prerequisite to injury

If a study does not differentiate between benign respiratory acidemia and potentially pathologic metabolic acidemia, no meaningful conclusions can be made regarding a relationship between “5-tiers” and adverse outcome.

The studies that have assessed metabolic acidemia have never demonstrated more than 2-3 separate categories of risk.

Statistically identical rates of metabolic acidemia

“5 tiers” = Only 2 distinct categories of risk for metabolic acidemia


“5-tier system”


The system does not include management recommendations not already published in the model presented here, by AWHONN and in ACOG Practice Bulletin 116 using the much simpler 3-tier system.

“3-tier” versus “5-tier system”

The current 3-tier system is not perfect, but it is simple and practical. Minor refinements are certainly worth considering.

However, the solution to the imperfections of a simple, standard 3-tier system is NOT to replace it with a cumbersome, highly complex 5-tier system that does not identify 5 tiers of risk and offers no new recommendations for management.
SIX FATAL FLAWS OF A “5-TIER SYSTEM”

Patient Safety
- Not standard (rejected by 2008 NICHD)
- Not simple (134 combinations?)

Standard of Care
- Factually inaccurate (“mild, moderate, severe”)
- Cannot be articulated

Common Sense
- Does not identify 5 risk tiers
- Offers no new management recs

WHY IS THIS SO IMPORTANT?

After multiple highly-publicized broad-based consensus reports, we are finally making meaningful headway in fetal monitoring standardization and simplification, factual accuracy and ability to articulate a rational plan

WHY IS THIS SO IMPORTANT?

Continued refusal to accept and adopt standard fetal monitoring principles endorsed by our professional societies not only arrests this forward progress...

... it sends us back to the past when EFM was dominated by unproven myths, lacked standardization and consensus, was unnecessarily complex and inconsistent to the point of threatening patient safety
Fetal Heart Rate Monitoring

The days are over when individual practitioners, individual hospitals or individual hospital systems can make up their own approaches to fetal monitoring that directly contradict the standard, evidence-based consensus of all major organizations representing providers of obstetric care in the United States.
Summary
Fetal monitoring is a SCREENING TEST
Fetal monitoring CANNOT diagnose cerebral palsy
Use standard definitions and interpretation

Summary
Develop and maintain a “shared mental model”
KEEP IT SIMPLE
Unnecessary complexity predisposes to error
Don’t hesitate to use flow charts and checklists

Summary
A standardized approach to intrapartum FHR definition, interpretation and management demonstrates reasonableness

The essential element that defines the standard of care
Cord gas?

“Physicians should attempt to obtain venous and arterial cord blood samples in the following situations:

- Cesarean delivery for fetal compromise
- Low 5-minute Apgar score
- Severe growth restriction
- Abnormal fetal heart rate tracing
- Maternal thyroid disease
- Intrapartum fever
- Multifetal gestations”

Other myths...

Intrapartum asphyxia is a leading cause of cerebral palsy
Intrapartum hypoxia is a leading cause of mental retardation
Intrapartum events are responsible for autism and ADD
The FHR tracing can define the timing of fetal stroke
The “30‐minute rule” defines the standard of care

Other myths...

Minimal‐absent variability diagnoses fetal metabolic acidemia and asphyxia
Late decelerations are caused by fetal asphyxia
Late decelerations are always “ominous”
Meconium is a sign of asphyxia
Checklists on L&D just get you into trouble
Standardized training in intrapartum FHR monitoring is part of residency training
Amnioinfusion causes amniotic fluid embolism