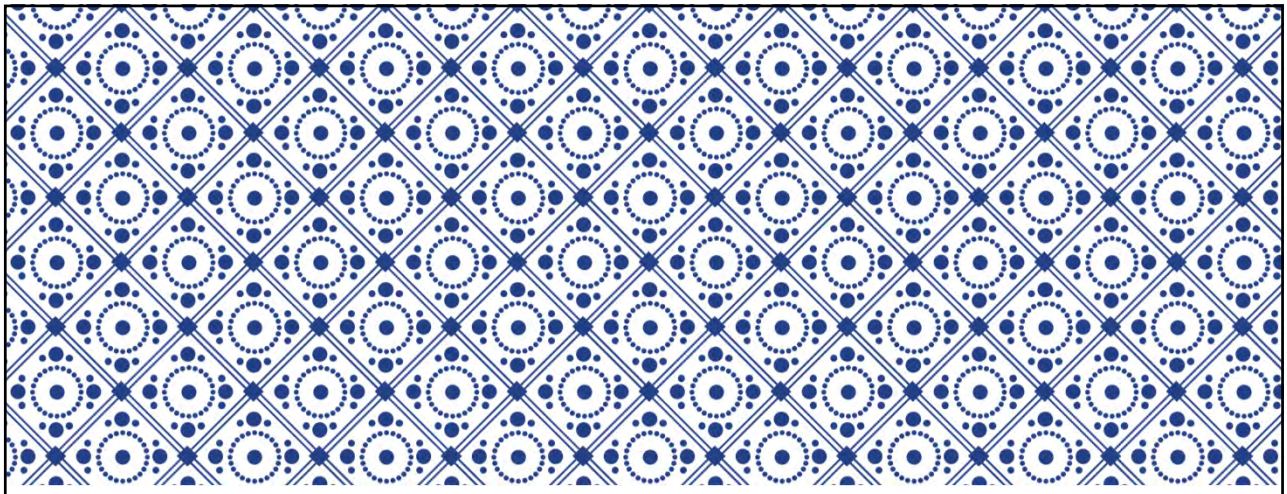


WHEN TIME IS OF THE ESSENCE:
CRITICAL THINKING IN EFM INTERPRETATION & MANAGEMENT

with
Lisa A. Miller, CNM, JD

1

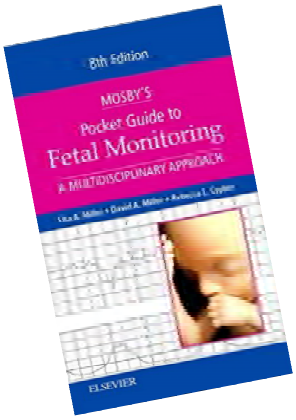
DISCLOSURE

In the interest of full disclosure, I wish to disclose my relationship with Clinical Computer Systems, Inc., as a consultant and co-developer of their "E-Tools" software.

I was also on the AWHONN board of directors from 2016-2018, however nothing I present today should be construed as the position or opinion of AWHONN. I present information today as a perinatal educator.

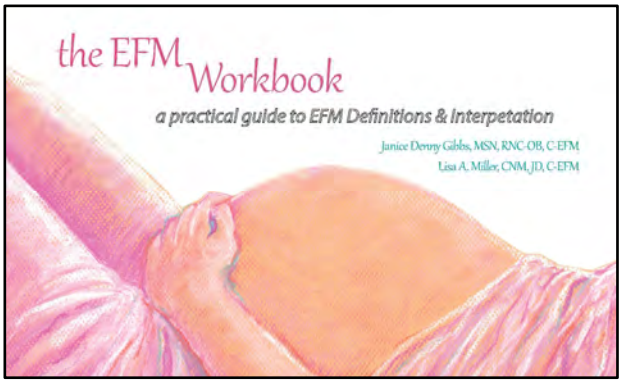
2

ADDITIONALLY, I AM CO-AUTHOR OF TWO EFM TEXTBOOKS - MOSBY'S POCKET GUIDE: "FETAL MONITORING: A MULTIDISCIPLINARY APPROACH", AND "FETAL MONITORING" BY LIPPINCOTT



3

And the EFM workbook, a companion workbook to the Mosby Pocket Guide, allowing practice with NICHD terminology & tracing interpretation



4

DISCLAIMER

Although I am a member of the Illinois State Bar Association and a licensed attorney in the state of Illinois, I am here today as a *nurse educator*, not a lawyer.

Nothing in the program should be construed as legal advice. In other words, if you need legal advice, retain a practicing attorney!

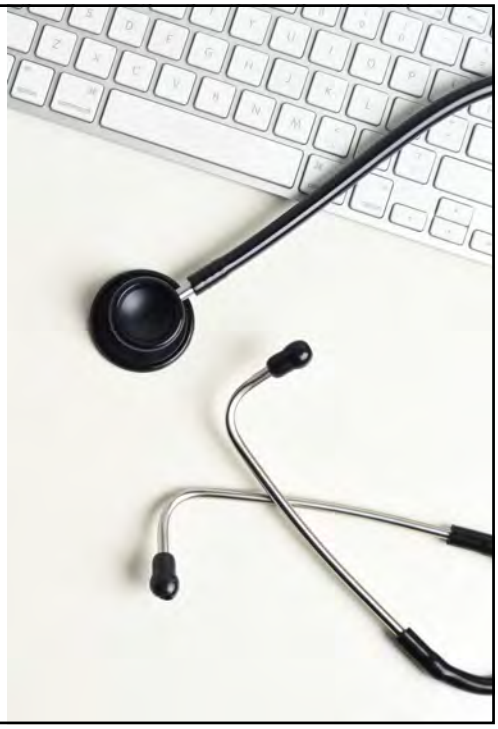
5

OUR OBJECTIVES TODAY

Discuss the importance of using EFM as a screening versus diagnostic tool

Identify 2 principles of standardized interpretation

Describe the role of a Category II management algorithm



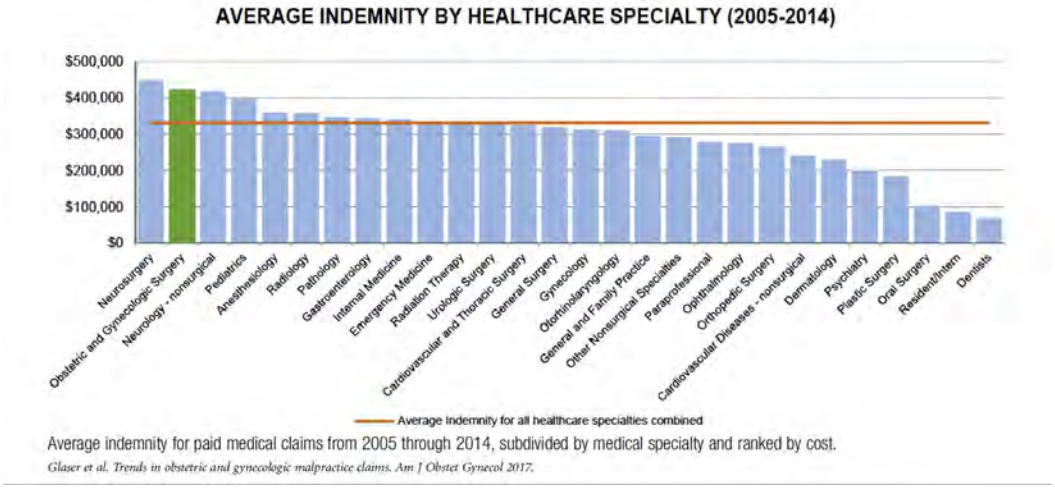
6

CRITICAL THINKING CONCEPTS FOR CLINICIANS

- The examination of beliefs or knowledge in light of the evidence that supports it
- Involves an ability to gather and interpret data and apply principles of logic
- Requires familiarity with cognitive bias and the potential problems with bias in clinical practice
- Requires an ongoing commitment to evaluation of processes and beliefs in light of new and developing evidence; an ability to alter practice patterns and challenge assumptions when the evidence warrants

7

OBSTETRIC PRACTICE REMAINS HIGH LIABILITY



Average indemnity for paid medical claims from 2005 through 2014, subdivided by medical specialty and ranked by cost.

Glaser et al. Trends in obstetric and gynecologic malpractice claims. Am J Obstet Gynecol 2017.

8

COMMUNICATION FAILURES AND LACK OF A SHARED MENTAL MODEL CONTINUE TO BE CORE ISSUES

Results

Of the 211 identified contextual communication failures, errors of omission were the most common (27.0%). More than half of conceptual failures were transfer of information failures (58.4%), while 41.6% demonstrated a lack of shared understanding. Of the 179 identified outcomes, 38.0% were delays in care, 20.1% were physical harm, and 8.9% were dissatisfaction. There was no statistically significant association between failure type category and patient outcomes.

9

THE NICHD ALONE IS NOT ENOUGH!

Although the progress made by adoption of the NICHD definitions must not be minimized, the NICHD standardized only definitions, it did not provide guidelines for detailed interpretation & management.

Additionally, the propensity of many institutions to focus on summary terms, such as FHR Categories and uterine tachysystole, may create unforeseen opportunities for error.

Let's take a look at Categories, which are simply summary terms…

10

NICHD "Three-Tier" Fetal Heart Rate Classification System

Category I – "Normal"

Requires:

- Baseline rate: 110-160 bpm
- Variability: Moderate
- Decelerations: No late, variable or prolonged (i.e., "only earlies")

Obstet Gynecol 2008;112:661-6

11

NICHD "Three-Tier" Fetal Heart Rate Classification System

Category III – "Abnormal"

Requires one of these 4 patterns:

- Absent variability with recurrent late decelerations
- Absent variability with recurrent variable decelerations
- Absent variability with bradycardia for at least 10 min
- Sinusoidal pattern

Obstet Gynecol 2008;112:661-6

12

So What About Category II, "Indeterminate"?

Easy, it is simply…

13

Everything Else!!!!!

14

"Electronic Fetal Monitoring
has the potential to be a source of
constant embarrassment or a
source of liberating
opportunity,
this is entirely dependent upon the
expectations of the user"

- David A. Miller, MD

15

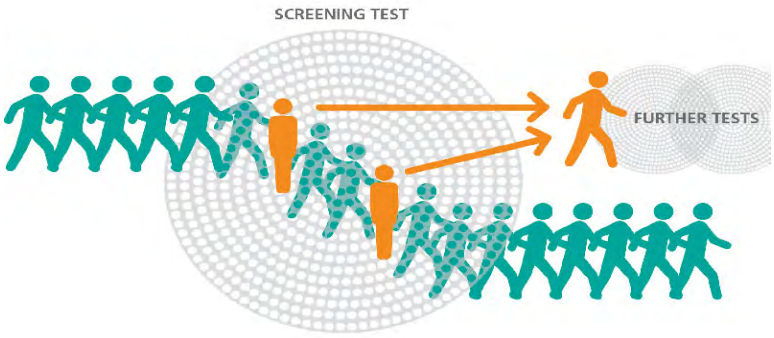
16

SCREENING VS. DIAGNOSTIC

A diagnostic tool identifies disease; it separates the healthy from the sick.

A screening tool culls normal, identifying the healthy and leaving behind a group that *may or may not* be sick…a group that needs further evaluation.

The problem in EFM is that we do not have any adequate tools for *further evaluation.*



17

EFM DECONSTRUCTED - 3 QUESTIONS

What do we call it?

What does it mean?

What should we do about it?

These are the three questions clinicians are faced with *every time* they look at a FHR tracing.

Standardizing our approaches to these questions is crucial to multidisciplinary teamwork, and it will be our focus now.

18

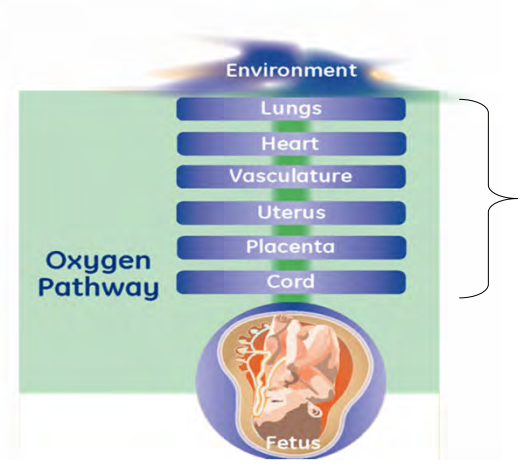
STANDARDIZING EFM FOR CLINICIANS

✓**What do I call it?**
Standardized NICHD terminology & categories

What does it mean?
Standardized principles of interpretation

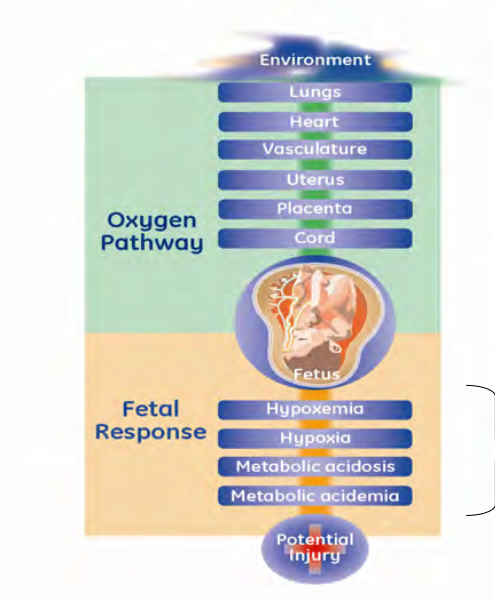
What do I do about it?
Standardized multidisciplinary management using a simple series of questions designed to reduce the risk of error and based on EFM's strength - negative predictive value related to metabolic acidemia

19



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

20



And the subsequent fetal physiologic response if oxygen transfer is interrupted…

21

TO UNDERSTAND THE RELATIONSHIP BETWEEN INTRAPARTUM EVENTS AND NEONATAL ENCEPHALOPATHY, WE NEED TO UNDERSTAND FETAL ACID-BASE, AND THE DIFFERENCES BETWEEN RESPIRATORY, METABOLIC, AND MIXED ACIDEMIA IN CORD GAS ANALYSIS.

Fetal umbilical artery pH less than 7.0, or base deficit greater than or equal to 12 mmol/L, or both, increases the probability that neonatal encephalopathy, if present, had an intrapartum hypoxic component; lesser degrees of acidemia decrease that likelihood.

If the cord arterial gas pH levels are above 7.20, it is unlikely that intrapartum hypoxia played a role in causing neonatal encephalopathy

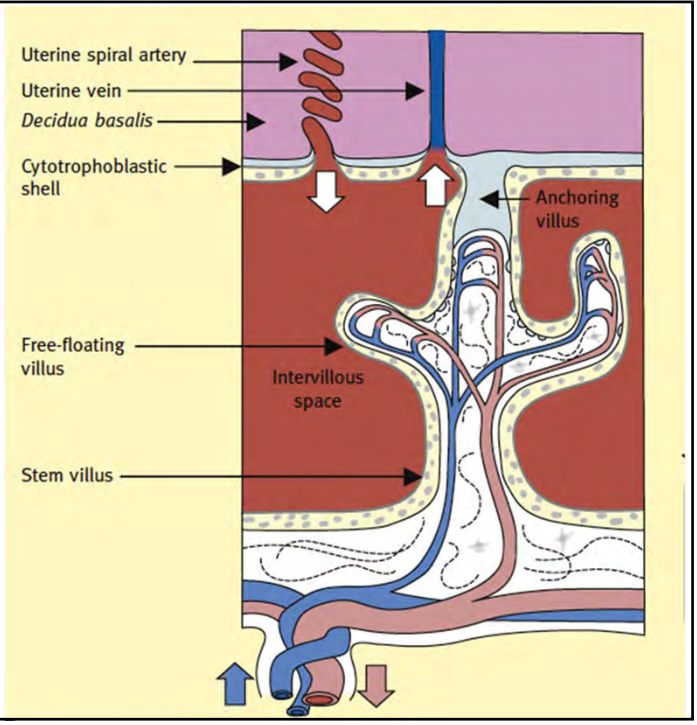
ACOG & AAP, 2013

22

UTEROPLACENTAL PHYSIOLOGY

700-800 ml of blood (10-15% of maternal cardiac output) perfuses the uterus each minute, 70-90% of this passes through the intervillous space

Dependent upon maternal blood pressure



23

FACTORS THAT AFFECT UTERINE BLOOD FLOW

Uterine contractions

Hypertonus (abruption, tetany, pitocin)

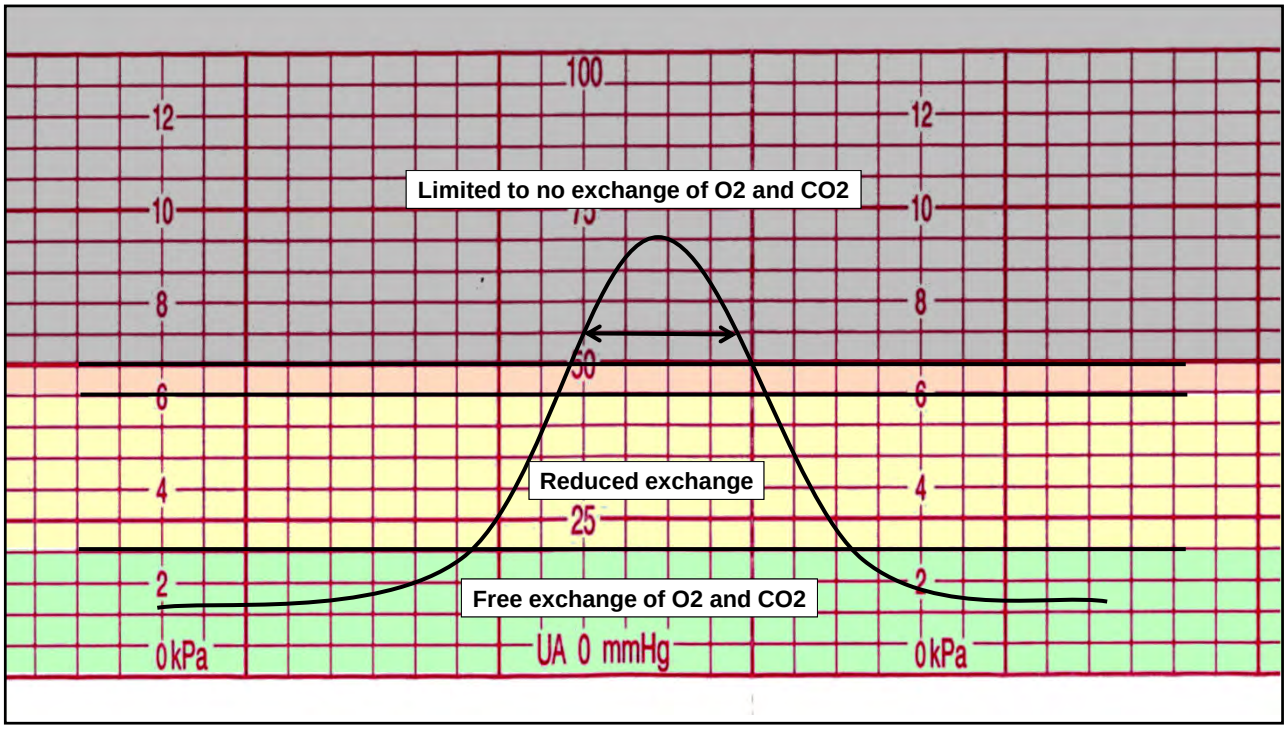
Hypotension (epidural block, supine position, hypovolemic shock)

Hypertension (chronic, PIH)

Vasoconstriction, endogenous (sympathetic discharge)

Vasoconstrictors, exogenous

24



25

WHAT ALLOWS THE FETUS TO WITHSTAND THE EFFECTS OF UTERINE CONTRACTIONS DURING LABOR?

- High myocardial glycogen stores
- Vascular shunts in fetal circulation
- Fetal hemoglobin's high oxygen affinity
- High basal cardiac output
- Peripheral chemoreflex (late decelerations)
- Adequate uterine relaxation time

26

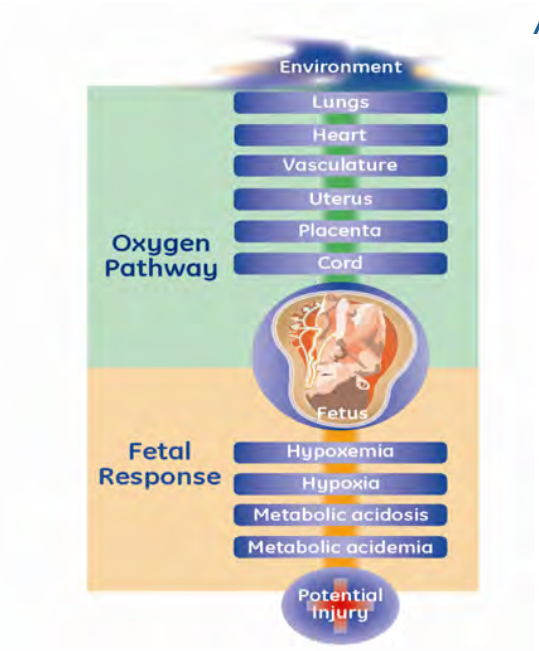
LABOR EFFECTS ON BASE DEFICIT

- Contractions in spontaneous labor have minimal effect on base deficit until about 4cm, when they tend to become more frequent and increase in intensity
- From 4cm-10cm in first stage results in the mean base deficit increasing by approximately 1mmol/L every 3 hours, due to an increase in the frequency and intensity of UCs
- In second stage, with active pushing efforts, base deficit will increase by 1mmol/L every hour
- These effects are greater if uterine activity is greater than normal, making the evaluation of contractions key to fetal acid-base issues

27

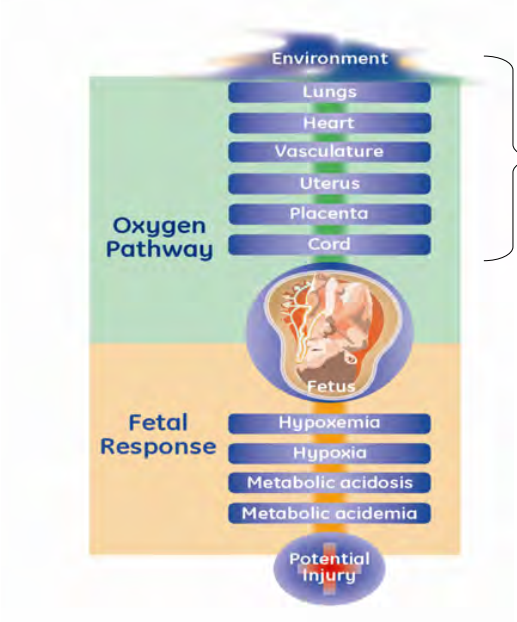
28

And now, back to the oxygen pathway…



What does the fetal heart rate tracing reveal about this pathway?

29



Start at the top

What information does the FHR tracing provide regarding oxygen transfer?

30

NOT ALL FHR DECELERATIONS HAVE A RELATIONSHIP TO THE OXYGEN PATHWAY…

To draw conclusions regarding the significance of *any* FHR deceleration, we must understand the underlying physiology.

But most of us were taught very simplistic phrases, like "head compression", "cord compression" or "uteroplacental insufficiency".

Let's see if we can go a bit deeper and perhaps draw some conclusions about FHR decelerations and fetal oxygenation

31

PHYSIOLOGY: EARLY DECELERATIONS

Transient fetal head compression
↓
Altered intracranial pressure and/or cerebral blood flow
↓
Reflex parasympathetic outflow
↓
Gradual slowing of the FHR
↓
Early deceleration
↓
When head compression is relieved, autonomic reflexes subside

32

Mechanism of Late Deceleration

Transient hypoxemia

Chemoreceptor stimulation

Sympathetic outflow

Peripheral vasoconstriction

Blood pressure rise

Baroreceptor stimulation

Vagal outflow

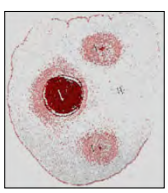
Deceleration

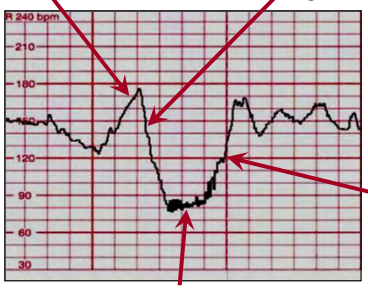
33

MECHANISM OF VARIABLE DECELERATION

<u>VENOUS COMPRESSION</u>
Decreased venous return
Relative hypovolemia
Reflex increase in FHR

<u>ARTERIAL COMPRESSION</u>
Increased SVR, elevated BP
Baroreceptor stimulation
Vagal outflow





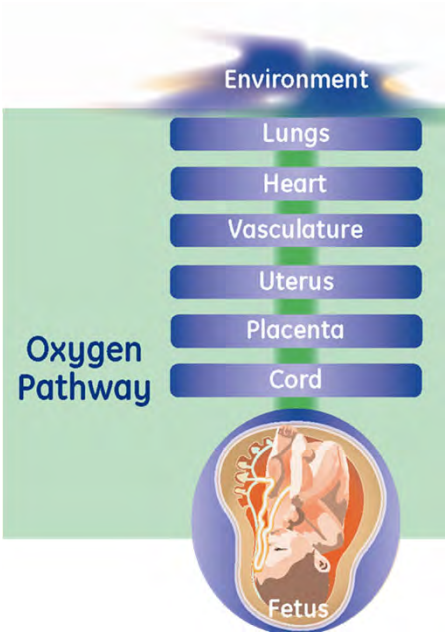
Reverse

Junctional / Idioventricular Rate

34

Make it easy for yourself and your team…

35

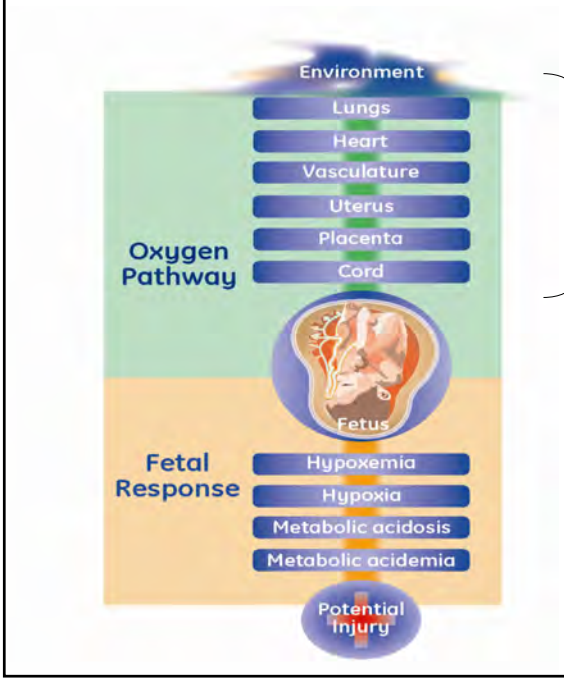


All FHR decelerations that have any potential clinical significance have ***the same common trigger…***

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

So, when we see a late, variable, or prolonged decel, we can agree …

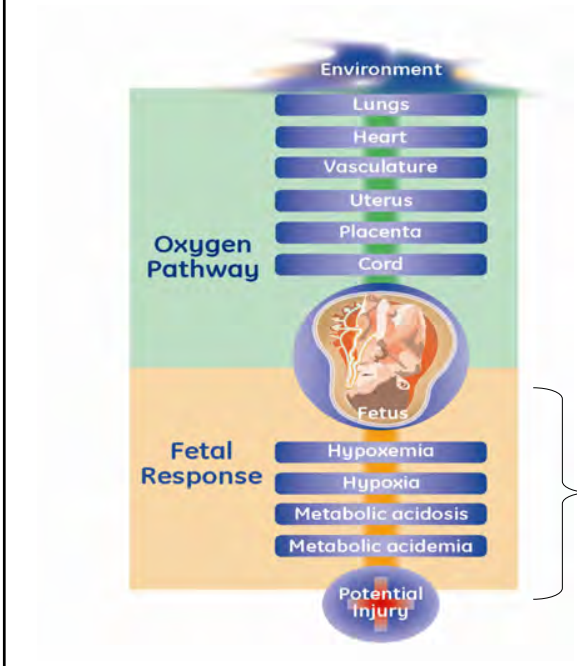
36



Principle #1

Variable, late or prolonged decelerations signal interruption of the oxygen pathway at one or more points

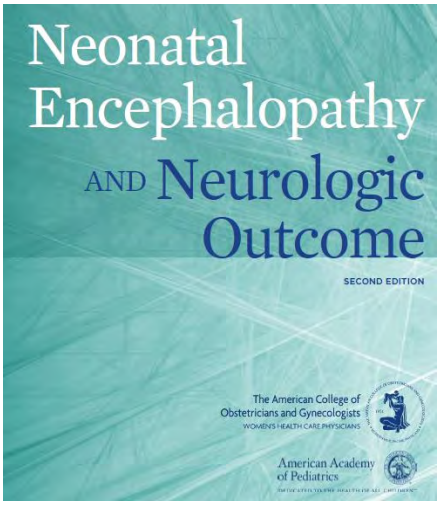
37



The second half of the pathway

What information can the FHR tracing provide regarding the fetal response to interruption of the oxygen pathway?

38



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American Gynecological and Obstetrical Society
American Society for Reproductive Medicine
Association of Women's Health, Obstetric and Neonatal Nurses
Australian Collaborative Cerebral Palsy Research Group
Child Neurology Society
Japan Society of Obstetrics and Gynecology
March of Dimes Foundation
Royal Australian and New Zealand College of ObGyn
Royal College of Obstetricians and Gynaecologists
Society for Maternal Fetal Medicine
Society of Obstetricians and Gynaecologists of Canada

39

"In a fetus exhibiting either moderate variability or accelerations of the FHR, damaging degrees of hypoxia-induced metabolic acidemia can reliably be excluded"

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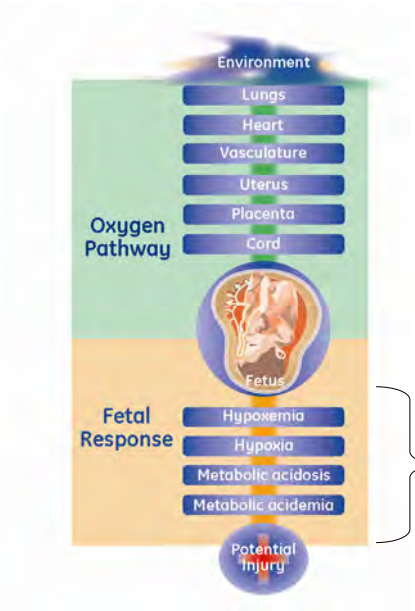

Principle #2

Moderate variability or accelerations exclude ongoing hypoxic injury

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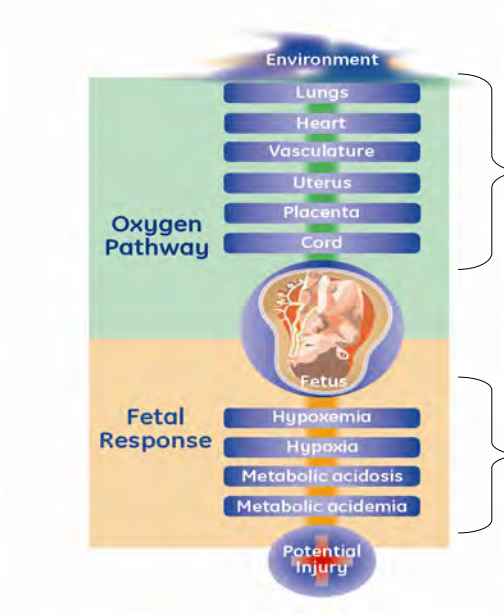

Principle #1

Variable, late or prolonged decelerations signal interruption of the oxygen pathway at one or more points

Principle #2

Moderate variability or accelerations exclude ongoing hypoxic injury

42

STANDARDIZING EFM FOR CLINICIANS

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Standardized NICHD terminology & categories

✓ **What does it mean?**

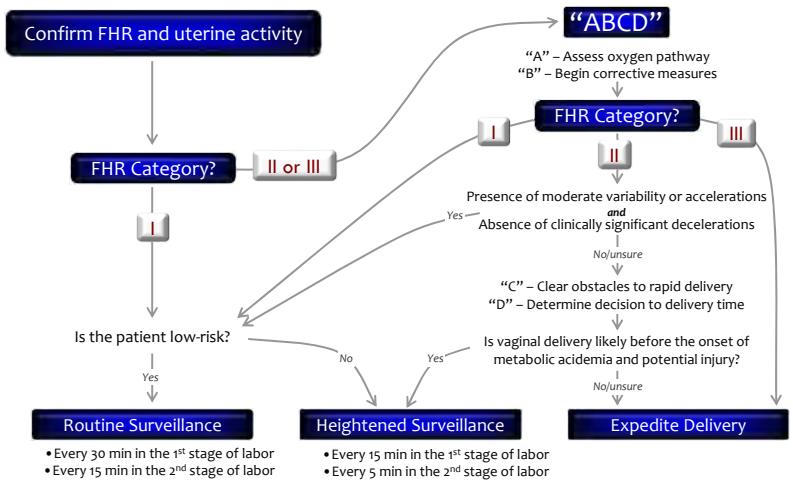
Standardized principles of interpretation

What do I do about it?

Standardized multidisciplinary management using a simple series of questions designed to reduce the risk of error and based on EFM's strength - negative predictive value related to metabolic acidemia

43

Intrapartum Fetal Heart Rate Management Decision Model



44

CLINICAL OPINION www.AJOG.org

OBSTETRICS

Intrapartum management of category II fetal heart rate tracings: towards standardization of care

Steven L. Clark, MD; Michael P. Nageotte, MD; Thomas J. Garite, MD; Roger K. Freeman, MD; David A. Miller, MD; Kathleen R. Simpson, RN, PhD; Michael A. Belfort, MD, PhD; Gary A. Dildy, MD; Julian T. Parer, MD; Richard L. Berkowitz, MD; Mary D'Alton, MD; Dwight J. Rouse, MD; Larry C. Gilstrap, MD; Anthony M. Vintzileos, MD; J. Peter van Dorsten, MD; Frank H. Boehm, MD; Lisa A. Miller, CNM, JD; Gary D. V. Hankins, MD

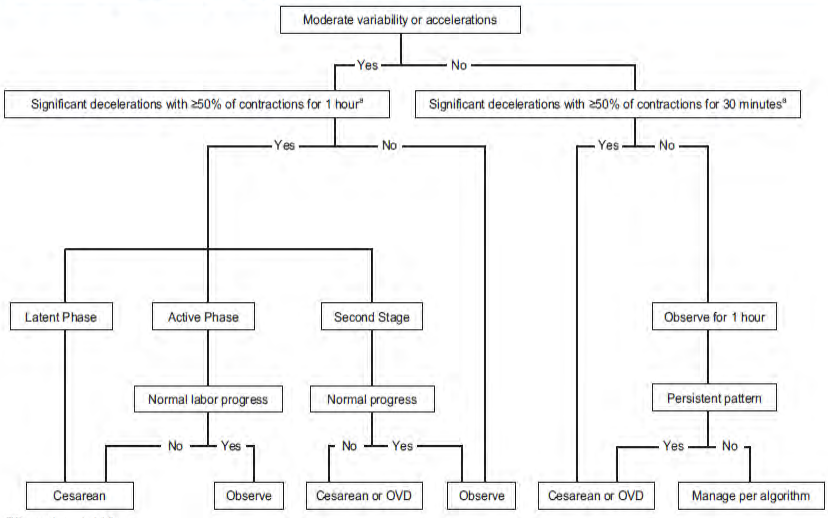
Interpretation and management of fetal heart rate (FHR) patterns during labor remains one of the most problematic issues in obstetrics. Multiple basic science investigations and clinical trials have been published since the introduction of this technique in the late 1950s.[1-7] Unfortunately, this body of work has primarily served to raise more questions than it has answered—as a medical community, we seem to know less than we thought we did 30 years ago regarding the utility of this ubiquitous technique.

There is currently no standard national approach to the management of category II fetal heart rate (FHR) patterns, yet such patterns occur in the majority of fetuses in labor. Under such circumstances, it would be difficult to demonstrate the clinical efficacy of FHR monitoring even if this technique had immense intrinsic value, since there has never been a standard hypothesis to test dealing with interpretation and management of these abnormal patterns. We present an algorithm for the management of category II FHR patterns that reflects a synthesis of available evidence and current scientific thought. Use of this algorithm represents one way for the clinician to comply with the standard of care, and may enhance our overall ability to define the benefits of intrapartum FHR monitoring.

Key words: fetal heart rate monitoring, neonatal encephalopathy, patient safety

45

Algorithm for management of category II fetal heart rate tracings



OVD, operative vaginal delivery.

[a]That have not resolved with appropriate conservative corrective measures, which may include supplemental oxygen, maternal position changes, intravenous fluid administration, correction of hypotension, reduction or discontinuation of uterine stimulation, administration of uterine relaxant, amnioinfusion, and/or changes in second stage breathing and pushing techniques.

Clark. Category II FHRT. Am J Obstet Gynecol 2013.

46

A Standardized Approach for Category II Fetal Heart Rate with Significant Decelerations: Maternal and Neonatal Outcomes

Laurence E. Shields, MD[1,2] Suzanne Wiesner, RN, MBA[2] Catherine Klein, RN, CNM[2]
Barbara Pelletreau, RN, MPH[2] Herman L. Hedriana, MD[3]

[1]Department of Maternal-Fetal Medicine, Marian Regional Medical Center, Santa Maria, California
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47

STUDY DESIGN

- Patients with Category 2 tracings from 6 hospitals, prospectively managed using an adapted algorithm
- Looked at outcomes pre-implementation (6 mos) and post-implementation (11 mos)
- Newborn outcomes studied included 5-minute APGAR scores less than 7, less than 5, and less than 3 as well as "severe unexpected newborn complications" (UNC); maternal outcomes evaluated were primary C-section rates and operative vaginal delivery
- Adapted algorithm focused on variability of FHR baseline and presences of significant decelerations

48

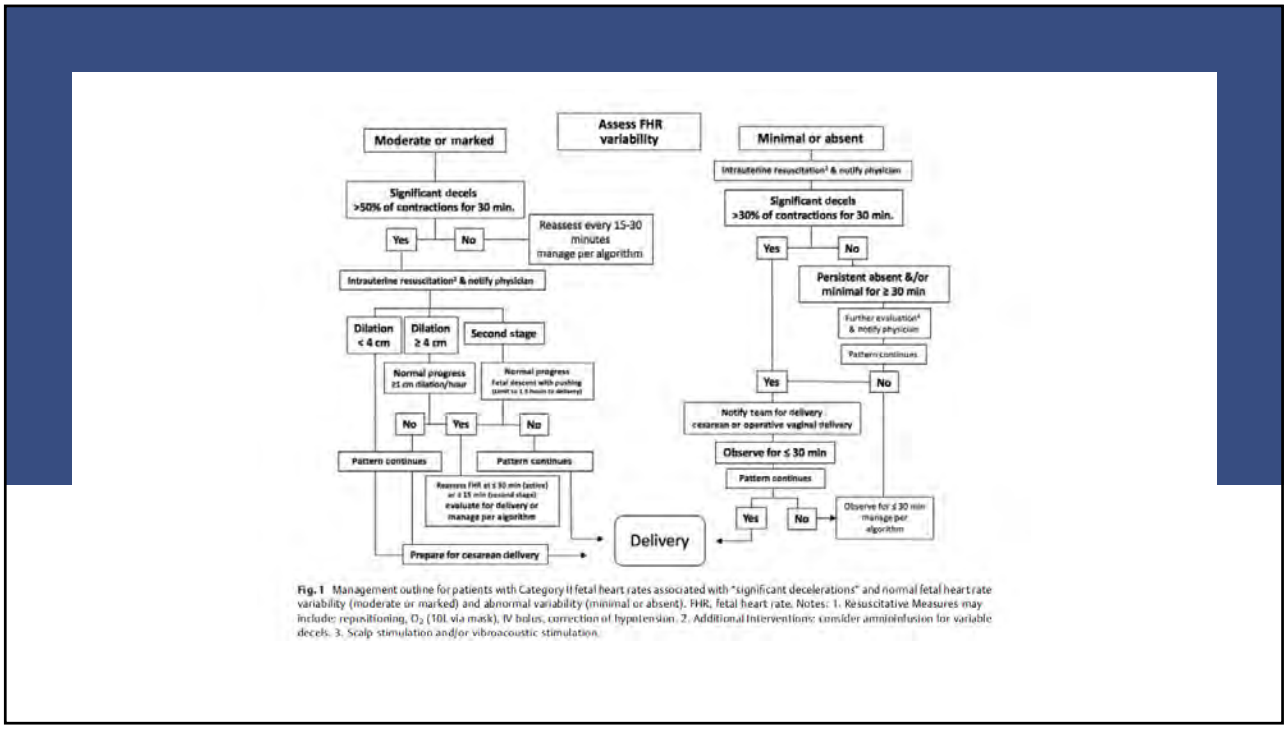
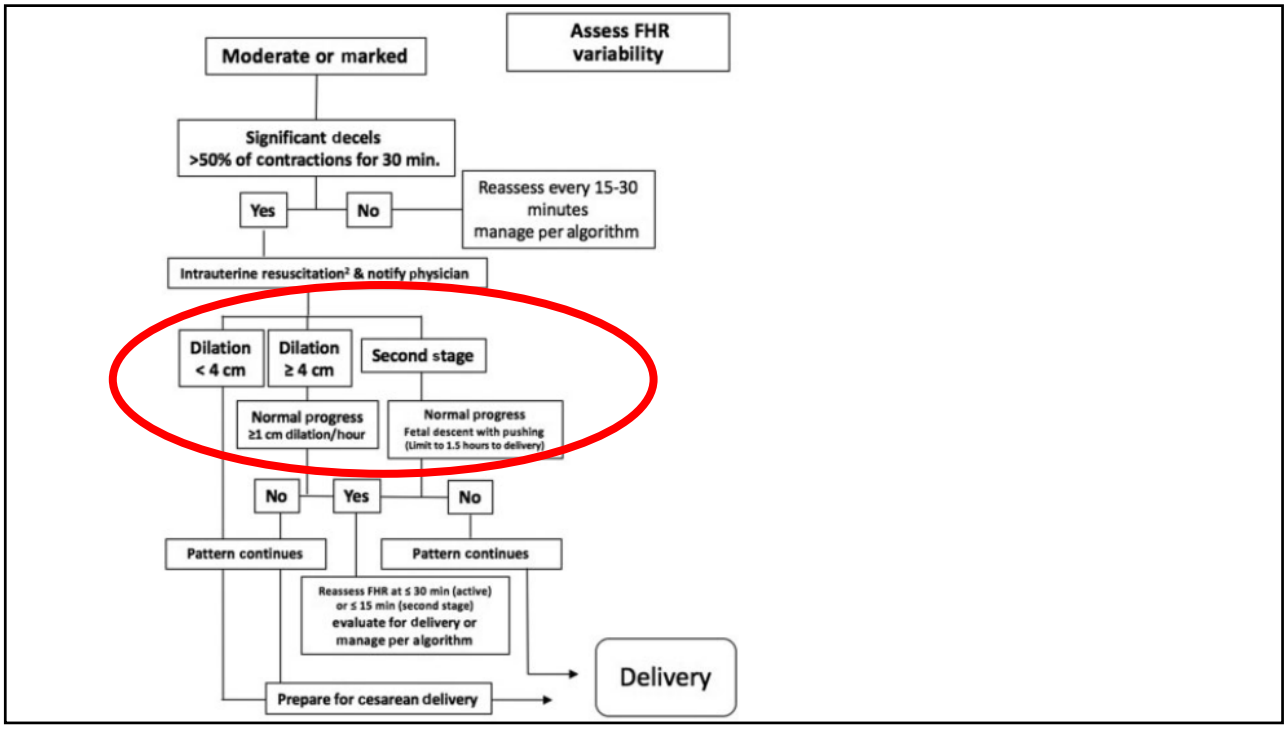


Fig. 1 Management outline for patients with Category II fetal heart rates associated with "significant decelerations" and normal fetal heart rate variability (moderate or marked) and abnormal variability (minimal or absent). FHR, fetal heart rate. Notes: 1. Resuscitative Measures may include: repositioning, O_2 (10L via mask), IV bolus, correction of hypotension. 2. Additional Interventions: consider amnioinfusion for variable decels. 3. Scalp stimulation and/or vibroacoustic stimulation.

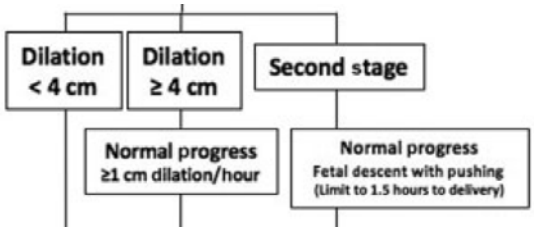
49



50

KEY IS STRICT PARAMETERS FOR THE SUBGROUP OF CATEGORY 2 TRACINGS (<10%)

This is a very different approach than how we look at normal labor, it has nothing to do with the new labor curves, nor is the mandated progress in labor what we would use for typical situations – these strict criteria and use of 4cm dilation reflect understanding of the effects of contractions on base deficit and ongoing labor over time, *specifically in a fetus exhibiting evidence of interrupted oxygenation.*



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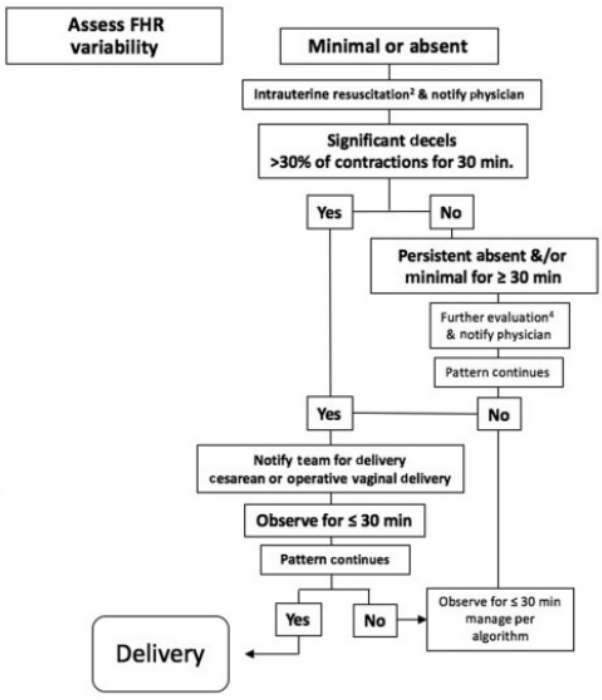


52

Post implementation there were 8,515 eligible deliveries, 3,799 (44.6%) were screened, and 361 (9.5%) met criteria for recurrent SigDecels. Compliance with the algorithm was 97.8%. The algorithm recommended delivery in 68.0% of cases.

Screening did not occur in all eligible patients. The primary reasons provided included other competing nursing demands, time constraints for the documentation process, and physicians concerns about the possible impact on their individual cesarean delivery rates.

Even though we screened > 3,700 patients with Category II fetal heart rate tracings, the number that ultimately had "significant decels" was small. (9.5%). This limited our ability to test for the most clinically relevant outcomes such as hypoxic–ischemic encephalopathy, which would require a much larger dataset.

53

Table 2 Neonatal outcomes at trial and nontrial hospitals

6 Trial hospitals			23 Nontrial hospitals		
Pre-standardization time period	Post-standardization time period	% Change, *p*-Value[a]	Pre-standardization time period	Post-standardization time period	% Change, *p*-Value[b]
5-min APGAR < 7			5-min APGAR < 7		
102/4,471 (2.3%)	146/8,515 (1.7%)	−24.6%, $p < 0.05$	2,554/16,478 (1.55%)	6,545/39,906 (1.64%)	+5.8%, $p = 0.08$
5-min APGAR < 5			5-min APGAR < 5		
474/4,471 (1.1%)	66/8,515 (0.78%)	−26.4%, $p = 0.11$	1,236/16,478 (0.76%)	3,352/39,906 (0.84%)	+12.0%, $p = 0.01$
5-min APGAR < 3			5-min APGAR < 3		
25/4,471 (0.57%)	49/8,515 (0.57%)	0%, $p = 0.9$	87/16,478 (0.53%)	227/39,906 (0.57%)	+7.5%, $p = 0.6$
Severe UNC[c]			Severe UNC[c]		
71/4,471 (1.6%)	98/8,515 (1.2%)	−27.2%, $p < 0.04$	247/16,478 (1.5%)	559/39,906 (1.4%)	−6.7%, $p = 0.4$

[a]Comparison between pre- and post-standardization times for six trial sites.
[b]Comparison between pre- and post-standardization times for 23 nontrial sites.
[c]Severe unexplained newborn complications (UNC) (National Quality Forum [NQF] healthy newborn measure #716): includes severe respiratory complications, sepsis, birth trauma, neonatal shock, or neurologic injury.

54

AUTHORS' CONCLUSION

"In summary, the use of a standardized management approach that addresses the more significant abnormalities of Category II fetal heart rates appears to be both feasible, and when used, was associated with a high level of physician support for the management of recommendations."

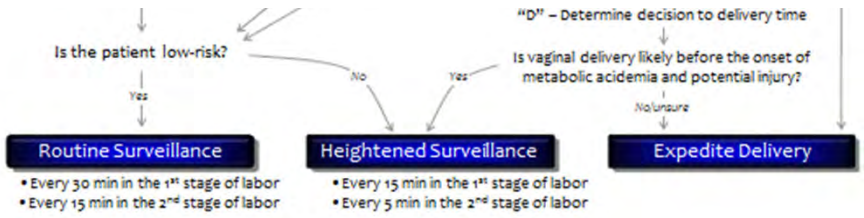
55

SO WHERE DOES THE CATEGORY II ALGORITHM FIT IN OUR MODEL?

"D"- Determine decision to delivery time

↓

Is vaginal delivery likely before the onset of metabolic acidemia and potential injury?



56