

Table 1: FHR patterns in early labor and composite neonatal outcomes.

| FHR Patterns (11 tested) | Composite Neonatal Outcome* (n, %) | OR (95% CI)† | P-value† |
|---|------------------------------------|-------------------|----------|
| Any (≥1) of 11 FHR patterns (2130) | 91 (4.3%) | 1.28 (0.96, 1.70) | 0.09 |
| 1 Severe variable decelerations (183) | 13 (7.1%) | 2.19 (1.21, 3.98) | 0.008 |
| 2 Late decelerations (400) | 21 (5.3%) | 1.59 (0.98, 2.57) | 0.06 |
| 3 Bradycardia (128) | 9 (7.0%) | 2.17 (0.94, 4.41) | 0.04 |
| 4 Poor beat-to-beat variability (132) | 8 (6.1%) | 1.85 (0.76, 3.89) | 0.14 |
| 5 Variable decelerations and tachycardia (56) | 3 (5.4%) | 1.62 (0.32, 5.14) | 0.44 |
| 6 Recurrent prolonged variable decelerations (67) | 6 (9.0%) | 2.82 (0.97, 6.70) | 0.03 |
| 7 Tachycardia (250) | 9 (3.6%) | 1.07 (0.54, 2.14) | 0.85 |
| 8 Variable decelerations + poor beat-to-beat variability (41) | 2 (4.9%) | 1.47 (0.17, 5.81) | 0.65 |
| 9 Sinusoidal pattern (50) | 2 (4.0%) | 1.19 (0.14, 4.66) | 0.89 |
| 10 Variable decelerations >30 minutes (1564) | 63 (4.0%) | 1.20 (0.88, 1.65) | 0.25 |
| 11 Increased variability (31) | 1 (3.2%) | 0.96 (0.02, 5.86) | 1.0 |
| None of the 11 FHR patterns (3175) | 107 (3.4%) | 1 (Ref) | ---- |
| Cumulative FHR Patterns | | | |
| Only one FHR pattern (1581) | 62 (3.9%) | 1.17 (0.85, 1.61) | 0.33 |
| Two FHR patterns (392) | 19 (4.9%) | 1.46 (0.89, 2.41) | 0.14 |
| ≥3 FHR patterns (157) | 10 (6.4%) | 1.95 (1.00, 3.81) | 0.05 |

* The neonatal outcome occurred in 198 patients (3.7%): Apgar at 5 or 10 minutes ≤4 (18), UA pH <7.0 or BD >12 mmol/L (133), HIE (1), resuscitation at birth requiring intubation or chest compressions (37), hypotension in 30 mins of birth (6), seizures (8), CPR or ventilator support in the first 24 hours (13), proven early sepsis (17), NN death (1), pressor support (9), extreme hypotonia (3).

† OR and p-value is comparing those with a specific FHR pattern (or group of patterns) vs. those with none of the listed patterns.

Table 2: FHR groups (A/B) and neonatal outcomes.

| | Primary Neonatal Outcome n (%) | OR (95% CI) | P-value |
|--|--------------------------------|-------------------|---------|
| Group A – one pattern (700) | 34 (4.9%) | 1.46 (0.99, 2.17) | 0.06 |
| Group A – two or more patterns (122) | 10 (8.2%) | 2.56 (1.30, 5.03) | 0.006 |
| Group B – one pattern (1254) | 46 (3.7%) | 1.09 (0.77, 1.55) | 0.62 |
| Group B – two or more patterns (54) | 1 (1.9%) | 0.54 (0.07, 3.95) | 0.54 |
| No FHR pattern [referent group] (3175) | 107 (3.4%) | 1.0 (Ref) | |

198 Application of fetal heart rate (FHR) algorithms to predict acidemia at birth

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OBJECTIVE: To compare published intrapartum FHR monitoring algorithms for the prediction and early identification of fetal acidemia (arterial cord pH <7.1 at birth) and their effect on cesarean delivery (CD).

STUDY DESIGN: Cases and controls were randomly selected from term, singleton deliveries between 2010 and 2014 with ≥2 hours of FHR monitoring and arterial cord blood gas results. Cases had pH <7.10 without a documented unpreventable cause of acidemia such as cord prolapse. We created rules for intervention from each of 3 published FHR interpretation systems (the 3 Tier (3T), 5 Tier (5T) and Clark systems)[references 1-3] that clearly defined when intervention was indicated, based on recommendations by the authors of each algorithm (figure 1). FHR tracings were reviewed in their entirety in 30-minute intervals by 10 NCC-certified MFM physicians or fellows who were blinded to the outcome. Sensitivity, specificity, false positive and false negative rates were calculated for each algorithm as well as the number of additional CDs that would be expected.

RESULTS: 265 tracings were reviewed. There were 41 cases (15.5%) with a pH <7.1 and 224 (84.5%) with a pH ≥7.1. Figure 2 shows the sensitivity, specificity, false positive and false negative rate for each algorithm. The algorithm recommended early intervention (≥30 minutes prior to actual delivery) in 4/10 cases identified by the 5T system and in 5/9 cases identified by the Clark algorithm. Application of the 5T algorithm would have resulted in 17 additional CDs (increase of 6.4%) while the Clark algorithm would have resulted in 24 additional CDs (increase of 9%).

CONCLUSION: The 3T system does not effectively identify fetal acidemia. The 5T and Clark algorithms perform poorly in identifying fetal acidemia at birth, with detection rates of only 24% and 22%, respectively. Use of either system would result in 4 to 5 additional CD for every case of early detection. Improved methods of predicting fetal acidemia are needed.

Figure 1: Algorithms for Intervention

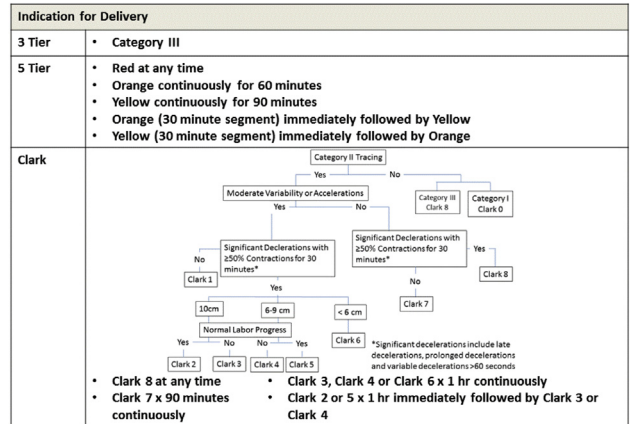


Figure 2: Sensitivity and Specificity of 3-Tier, 5-Tier and Clark Algorithms for Fetal Acidemia

| 3 Tier ¹ | pH <7.1 (N=41) | pH ≥7.1 (N=224) | 5 Tier ² | pH <7.1 (N=41) | pH ≥7.1 (N=224) |
|------------------------|---------------------------|-----------------|------------------------|---------------------------|-----------------|
| Intervention Indicated | 1 | 0 | Intervention Indicated | 10 | 37 |
| No Intervention | 40 | 224 | No Intervention | 31 | 187 |
| Sensitivity: 0.02 | False Positive Rate: 0 | | Sensitivity: 0.24 | False Positive Rate: 0.17 | |
| Specificity: 1 | False Negative Rate: 0.98 | | Specificity: 0.83 | False Negative Rate: 0.76 | |

| Clark ³ | pH <7.1 (N=41) | pH ≥7.1 (N=224) |
|------------------------|---------------------------|-----------------|
| Intervention Indicated | 9 | 54 |
| No Intervention | 32 | 170 |
| Sensitivity: 0.22 | False Positive Rate: 0.24 | |
| Specificity: 0.76 | False Negative Rate: 0.78 | |

References:

- Intrapartum fetal heart rate monitoring: nomenclature, interpretation, and general management principles. ACOG Practice Bulletin No. 106. American College of Obstetricians and Gynecologists. Obstet Gynecol 2009;114:192-202.
- Parer JT, Ikeda T. A framework for standardized management of intrapartum fetal heart rate patterns. Am J Obstet Gynecol 2007;197:26.e1-26.e6.
- Clark SL, Nageotte MP, Garite TJ et al. Intrapartum management of category II fetal heart rate tracings: towards standardization of care. Am J Obstet Gynecol 2013;209(2):89-97.

199 Withdrawn

200 Delayed pushing is associated with increased frequency of cesarean delivery and NICU admission

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OBJECTIVE: To examine the relationship between delayed pushing and perinatal outcomes in nulliparas with singleton term gestations. **STUDY DESIGN:** Cohort study of data from deliveries at 25 U.S. hospitals from 2008-2011. Nulliparous women with singleton, cephalic, term births who achieved 10 cm cervical dilation were included for analysis. Women in whom pushing was delayed by ≥60 minutes (delayed group) were compared to those who initiated pushing within 30 minutes (early group). Multivariable regression analyses were used to assess the independent association of delayed pushing with mode of delivery, length of second stage and other maternal and perinatal outcomes.

RESULTS: Of 21,034 analyzable women, pushing was delayed in 18.4% (N=3870). Women who were older, privately insured, or