Review of Category I, II, and III Fetal Heart Rate Classifications

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Abstract

Interpretation of fetal heart rate (FHR) tracings has been difficult because of the lack of agreement in definitions and nomenclature. Studies have shown that the interpretation of FHR tracings is unreliable. The American College of Obstetricians and Gynecologists (ACOG) developed a new three-tiered classification system of fetal heart rate abnormalities and a system for interpreting these abnormalities. ACOG published classifications and recommendations based on the appearance of the fetal heart tracing to provide some basis of decision making. Difficulty may exist because the guidelines are not clear-cut and there is room for subjectivity when labeling tracings as a specific category and implementing further medical management. The ACOG guidelines for categorization of fetal heart rate tracings still leave some question as how to definitely label each tracing.

Introduction

The detection of the fetal heart beat dates back to 1650 with the French physician Marsac (20). Fetal heart rate monitoring during labor was first described by Evory Kennedy, a British physician in 1833 (20). The fetoscope to detect the fetal heart beat was invented by David Hillis in 1917 and Joseph DeLee in 1922 (20). Phonocardiography to detect the fetal heart rate was developed in 1931 (20). In 1958 Edward Hon introduced continuous fetal heart rate (FHR) monitoring to identify heart rate patterns associated with hypoxic changes during labor that caused cerebral palsy and stillbirths so that the baby could be delivered expeditiously when these patterns were present (1, 2, 5, 6). Continuous FMR monitoring was proposed as a screening test for asphyxia to reduce perinatal morbidity and mortality (2, 3, 8, 10). Fetal heart rate monitoring has increased the number of cesarean sections and operative vaginal deliveries but has made no impact on the incidence of cerebral palsy (4, 5, 6). In 1970, intrapartum asphyxia was demonstrated not to be a major cause of cerebral palsy and only accounts for 10% of the cases (3, 5). The incidence of cerebral palsy has remained stable over time at an incidence of 2 in 1,000 live births (3).

FHR monitoring is the most commonly used obstetric procedure in this country (6). Continuous electronic fetal heart rate monitoring consists of an electrode attached directly to the fetal head or a maternal abdominal ultrasound to detect the fetal heart rate plus an external tocodynamometer to identify contractions (8). Electronic fetal monitoring has increased over time and most women in labor (84%) today undergo FHR monitoring despite no demonstrated benefit (6). Ananth et al in 2013 have published data that suggests that FHR monitoring may decrease neonatal morbidity and low 5 minute APGAR scores (6). Defensive medicine and fear of litigation have also increased the rate of cesarean section (4).

Fetal Heart Rate Tracing Categories

The American College of Obstetricians and Gynecologists (ACOG), the Eunice Kennedy Shriver National Institute of Child Health and Human Development, and the Society for Maternal-Fetal Medicine developed a new three-tiered classification of fetal heart rate abnormalities and a system for interpreting these abnormalities (1). Category I FHR tracings are normal tracings which are not associated with fetal asphyxia (1). They include a baseline heart rate between 110-160, moderate variability defined as

"fluctuations in the baseline heart rate that are irregular in amplitude and frequency of 6-25 bpm", no late or variable decelerations, possible early decelerations, and possible accelerations (1).

Category II FHR tracings are indeterminate and include a wide variety of possible tracings that do not fit in either Category I or Category III (1, 7). The classification of Category II tracings includes the following: bradycardia with variability, tachycardia, minimal variability, no variability with no recurrent decelerations, marked variability, absence of induced accelerations even after fetal stimulation, recurrent variable decelerations with minimal or moderate baseline variability, prolonged decelerations lasting more than two minutes, but less than ten minutes, recurrent late decelerations with moderate variability, variable decelerations with other characteristics such as slow return to baseline, overshooting the baseline, or 'shoulders' (1). Williams Obstetrics reports that reduced FHR variability is the most reliable indicator of fetal compromise (8). A flat FHR tracing with no variability may reflect neurologic damage to the fetus that has already occurred (8).

Category III FHR tracings are abnormal and indicative of hypoxic risk to the fetus and possible acidemia (1, 7). They include either no baseline variability or the presence of recurrent late decelerations, variable decelerations, bradycardia, or a sinusoidal pattern (1). According to a study by Jackson et al, Category I and Category II patterns are common in labor and Category III are unusual (2). Perinatal morbidity is associated with an increase in time in Category II during the last two hours of labor (2).

Management of Fetal Heart Rate Tracing Categories

The management of FHR abnormalities is based upon the classification of the FHR tracing in accordance with the patient and other risk factors. Category I FHR tracings are considered to be "normal" and are not typically associated with fetal complications, such as acidemia and can be managed either through continuous monitoring or through periodic monitoring. ACOG suggests that these patients be monitored every 30 minutes during the first stage of labor and every 15 minutes during the second stage of labor and changes in management are only necessary if the category of the FHR changes.

Category II FHR tracings are indeterminate and contain many possibilities and management is typically determined by which of the possibilities exist. These tracings typically require closer supervision, more frequent evaluation, documentation and correction of abnormalities by conservative management and intrauterine resuscitation (1). Accelerations and moderate variability suggest normal acid-base balance (1).

Category III FHR tracings are abnormal and these tracings have been associated with adverse neurologic abnormalities, although the predictive value is poor (1, 7). When intrauterine resuscitation of these abnormalities fails, delivery should be expedient (1). Studies are lacking to demonstrate how soon the delivery should be effected. The traditional “decision-to-incision time” of thirty minutes to perform a cesarean section has not been proven (1).

Efficacy and Reliability of Fetal Heart Rate Monitoring

There is controversy over the efficacy of fetal heart rate monitoring (7). Interpretation of FHR tracings is difficult because of lack of agreement in definitions and nomenclature (8, 10). In a low risk pregnancy there is no data demonstrating that FHR monitoring is superior to intermittent auscultation (7). The majority of women in this country are monitored during labor with no known benefit (6). Studies have

shown that the interpretation of FHR tracings is unreliable (7). There is both interobserver (21%) and intraobserver (22%) variability in FHR interpretation (7, 11). When the FHR tracing is not normal, the significance of the tracing is difficult to ascertain (11). Obstetricians interpret FHR tracings similarly only 29% of the time (7). The false positive rate is 99% (4). Even when an obstetrician reviews a tracing he has previously interpreted, 21% of the time, he interprets it differently later (7). Interpretation of FHR tracings are most consistent when the tracing is normal (2, 7). If the neonatal outcome is known, obstetricians interpret tracings differently (7). So, there is variability in interpretation of FHR tracings (7).

Reproducibility of interpretation of fetal heart rate tracings may be difficult. The variability and possible patterns of Category II tracings increase the difficulty of interpretation of FHR tracings (2). Chiossi et al reported that interpretation of FHR nonreassuring patterns are fraught with both uncertainty and fear of missing a decompensating pregnancy (4). The quality of the FHR tracing and scaling used on the monitor also affect interpretation (8). There is also variation in response to nonreassuring patterns depending on whether the interpretation is by a nurse, resident or attending obstetrician (4). In reviewing perinatal deaths, approximately 50% of FHR interpretations have been questioned in one study (3). There is also variation in FHR patterns depending on gestational age, maternal conditions, medications, etc (10). In summary, physicians are usually in agreement with FHR tracings that are normal (Category I) and those that demonstrate severe fetal compromise (Category III) (10). It is those tracings in Category II with all the possibilities that exist that pose the problem.

Training in FHR monitoring is an integral component of clinical obstetrical care that improves interpretation, communication and management skills, interobserver consistency, emergency response, improved safety and fewer adverse events (3). In a study by Ayres-de-Campos, baseline estimation which is an important aspect of analyzing FHR tracing patterns, can be reproduced with prior training (9). Interobserver agreement of FHR baseline can be improved with prior education (9). Reliability can be improved with instruction and training in the classification system (10).

Conclusions

Some physicians are simply unaware of the classification requirements for each category as well as true meanings of the terms of absent beat-to-beat variability and recurrent late decelerations. While ACOG guidelines for evaluating fetal heart rate tracings exist, there is still a gray area present in the Class II fetal heart tracings and how to manage the fetal heart tracings in the context of the patient. For those who are aware of the recommendations, this gray area of management still leads to variability in how delivery may ensue. This variability is only increased for those who are unaware of ACOG's recommendations and classification guidelines. This, in turn, leads to differences in fetal outcomes and cost of management of the delivery and care of the mother and child after delivery.

In conclusion, the ACOG guidelines for categorization of fetal heart rate tracings still leave some question as how to definitely label each tracing. This supports the hypothesis that tracing categorization is subjective and there are many more variables that must be taken into account when managing a laboring patient.

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