Monitoring the Preterm Fetus During Labor

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ABSTRACT

The purpose of this article is to discuss special challenges in monitoring the preterm fetus during labor, review implications of preterm fetal heart rate (FHR) patterns, and highlight appropriate nursing interventions that contribute to the best outcomes for mothers and babies. With the current incidence of preterm birth, monitoring the preterm fetus during labor is a common perinatal nursing responsibility. Most of the published research on this topic was conducted in the 1980s; there has been little attention to FHR monitoring during preterm labor in recent studies. There has been much more accumulated evidence about antepartum testing techniques involving electronic fetal monitoring (EFM) for the preterm fetus in contrast to FHR patterns during labor. Thus, this is an area of opportunity for nursing research. The perinatal nurse has a key role in promoting positive outcomes when caring for women during preterm labor. The condition of the fetus during labor and birth has a significant impact on the likelihood of survival and the odds of developing serious complications of prematurity.

Key Words: Fetal monitoring; Premature fetus; Premature labor.

According to the latest natality data (Martin et al., 2003), the rate of preterm birth in the United States (US) was 12.1% in 2002, the highest rate ever recorded since these data began to be routinely collected from certificates of live births. Thus, monitoring the preterm fetus during labor is a common perinatal nursing responsibility. A review of the literature about characteristics of fetal heart rate (FHR) patterns of during preterm labor revealed few recent studies. Most of the published research on this topic was conducted in the 1980s, when obstetrical conditions were different than today. For example, the rates of cervical ripening, oxytocin induction/augmentation, and epidural analgesia have risen significantly since the 1980s, and agents used for these procedures were not available at that time. There has been much more accumulated evidence about antepartum testing techniques involving electronic fetal monitoring (EFM) for the preterm fetus in contrast to FHR patterns during labor. This is an area of opportunity for nursing research.

The perinatal nurse has a key role in promoting positive outcomes when caring for women during preterm labor. The condition of the fetus during labor and birth has a significant impact on the likelihood of survival and the odds of developing serious complications of prematurity (Freeman, Garite, & Nageotte, 2003). The purpose of this article, therefore, is to discuss special challenges in monitoring the preterm fetus during labor, review implications of preterm FHR patterns, and highlight appropriate nursing interventions that contribute to the best outcomes for mothers and babies.

Significance

Although the principles of EFM are the same for the preterm fetus as for the term fetus, there are differences in FHR patterns of preterm fetuses when compared to those in term labor, and there are unique clinical implications for obtaining and interpreting EFM data during preterm labor. Perinatal complications such as preeclampsia, intraamniotic infection, oligohydramnios, umbilical cord compression, placental abruption, intrauterine growth restriction, uteroplacental insufficiency, and multiple gestation are more common during preterm labor. These complications are often associated with nonreassuring FHR patterns. There is evidence to suggest that nonreassuring FHR patterns have greater significance for outcomes for the preterm fetus (Matsuda, Maeda, & Kouno, 2003). At term, approximately 20% of infants with nonreassuring FHR patterns will be neurologically depressed; however, in preterm infants less than 33 weeks gestation, approximately 70% to 80% of nonreassuring FHR patterns will result in the birth of a neurologically depressed, hypoxemic, or acidemic infant (Freeman et al., 2003).

The preterm fetus is more susceptible to hypoxic insults and more likely to develop and die from complications of prematurity if born depressed, hypoxemic, or acidemic (Freeman et al., 2003). An abnormal or nonreassuring FHR pattern (minimal to absent variability, late decelerations, persistent variable decelerations, and

tachycardia) is predictive of perinatal asphyxia and long-term neurological outcome for the preterm fetus (Braithwaite, Milligan, & Shennan, 1986; Douvas, Meeks, Graves, Walsh, & Morrison, 1984; Low et al., 1992; Low, Killen, & Derrick, 2002; Shy et al., 1990; Matuda et al., 2003; Westgren, Malcus, & Svenningsen, 1986). Compared to the term fetus, the progression from reassuring to nonreassuring status occurs more often and more quickly (Freeman et al., 2003). Thus, timely identification and initiation of interventions for nonreassuring FHR patterns is more critical and of more lasting consequences when the fetus is preterm.

Guidelines for Maternal-Fetal Assessment During Preterm Labor

Although there are guidelines (American Academy of Pediatrics [AAP] & American College of Obstetricians and Gynecologists [ACOG], 2002) suggesting that there are no differences in perinatal outcomes between the use of intermittent auscultation of the FHR and electronic fetal monitoring, in the United States, high-risk labor will very likely involve continuous EFM. ACOG (1998, 1999a) recommends continuous EFM during labor for the fetus with abnormal antepartum testing results and for multiple gestation. When continuous EFM is used after maternal-fetal risk factors are identified, AAP and ACOG (2002) recommend evaluation of the FHR every 15 minutes during the active phase of the first stage of labor and every 5 minutes during the second stage of labor. An evaluation of the FHR includes baseline rate, variability, and presence or absence of accelerations and decelerations.

Maternal vital signs should be evaluated and recorded at regular intervals based on clinical signs and symptoms (AAP & ACOG, 2002). Most perinatal unit protocols include recommendations for maternal vital sign assessment at least every hour during labor, especially if the woman has developed a high-risk condition. The recommended nurse-to-patient ratio for women with high-risk obstetrical conditions is one to one (AAP & ACOG, 2002; Schofield, 2003). Maintaining one-to-one nursing care is not always easy in today's busy labor and delivery environments. It is important to have systems in place to allow flexibility to provide more intensive care as needed based on acuity.

Obtaining EFM Data

It is often challenging to maintain a continuous tracing of the preterm FHR during labor, even with one-to-one nursing care. A very small fetus and/or the presence of two or more fetuses can require frequent repositioning of the external fetal monitoring devices. It is important to accurately palpate the uterine fundus and place the external tocodynamometer appropriately to detect uterine contractions. Remembering that fundal height is related to fetal size and gestation age, Leopold maneuvers can assist in determining placement of the external ultrasound device to detect the FHR(s) by identification of the smooth surface of the back of the fetus(es), where the FHR(s) are usually easier to detect.

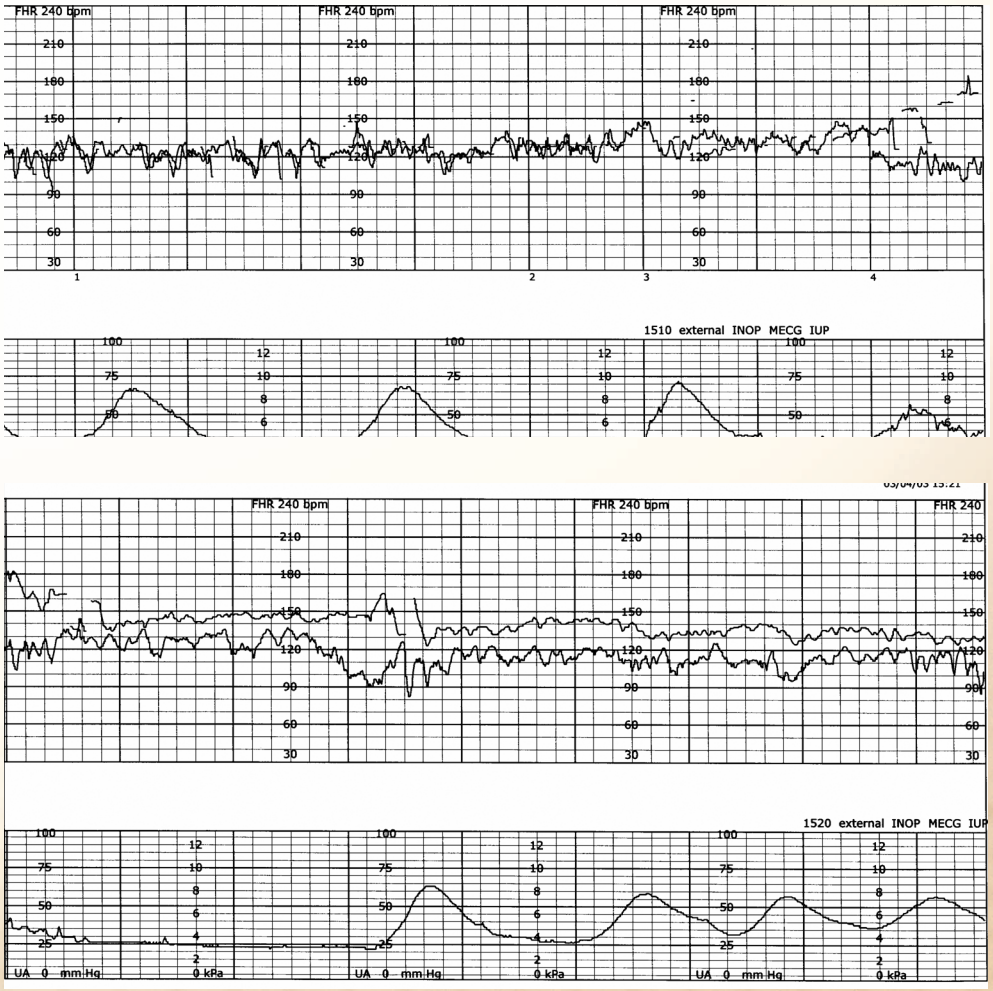
There are some clinical situations that can cause maternal tachycardia, and thus create the potential to mistakenly interpret a tracing as the FHR when it is really being generated from the maternal heart rate. Examples are beta mimetic administration, maternal anxiety, and maternal fever. Confirmation that the heart rate tracing is fetal can be accomplished by assessing the maternal pulse and comparing the maternal pulse with the FHR. There is no need to use maternal pulse oximetry to continuously assess the maternal heart rate along with the FHR. Pulse oximetry is designed to measure oxygen saturation (SpO_2) rather than heart rate. There is neither evidence nor standards supporting this practice, and no need to add further technology to the labor process. For women receiving magnesium sulfate and/or epidural analgesia/anesthesia, periodic assessment of maternal SpO_2 according to unit policy is adequate. In unusual cases where there may be clinical signs and symptoms of respiratory distress, more intensive monitoring of maternal SpO_2 may be appropriate.

THERE IS EVIDENCE TO SUGGEST THAT NONREASSURING FHR PATTERNS HAVE GREATER SIGNIFICANCE FOR OUTCOMES FOR THE PRETERM FETUS.

Cervical Ripening, Labor Augmentation, and Induction

It is critically important to maintain a continuous FHR tracing if pharmacologic agents are being administered to ripen the cervix or induce or augment labor. The dinoprostone/PGE_2 (Cervidil) insert should be removed if uterine hyperstimulation occurs. Oxytocin must be titrated to the maternal-fetal response and to the labor progress. The preterm fetus is particularly susceptible to hypoxemia, thus uterine hyperstimulation should be avoided. Uterine hyperstimulation is characterized by a series of contractions lasting 2 minutes or more; a contraction frequency of 5 or more in 10 minutes; and/or contractions of normal duration occurring within 1 minute of each other (ACOG, 1999b; Simpson, 2002).

FIGURE 1. (A) AND (B). SYNCHRONOUS AND ASYNCHRONOUS FETAL HEART RATE PATTERNS OF TWINS.



Internal Monitoring

There are very little data to support or refute the use of internal monitoring via a spiral electrode or intrauterine pressure catheter (IUCPC) during preterm labor. As with the term fetus, as long as useful data can be obtained via external monitoring devices, use of internal monitoring should be avoided. According to ACOG (2003a), current evidence does not support the routine use of an IUPC during labor; however, in selected cases (such as maternal obesity when it is difficult to accurately monitor uterine activity), it may be beneficial. The Food and Drug Administration (FDA) has not approved the use of fetal pulse oximetry for fetuses less than 36 weeks gestation.

Monitoring Preterm Multiple Gestations

When monitoring more than one fetus, it is important to maintain two distinct FHRs. Erroneously monitoring the same fetus results in loss of ability to detect evolving problems in the unmonitored fetus (Ramsey & Repke, 2003). Newer generation monitors have the ability to indicate when the FHRs appear to be from the same fetus. These system cues can be helpful, but they do not replace careful nursing assessment of each FHR pattern. The mother may be able to provide assistance in determining the position of each baby by indicating where she feels fetal movement.

Although some fetuses, particularly monoamniotic/monochorionic twins, may have synchronous FHR patterns at times, most fetuses in multiple gestations will not have completely synchronous FHR patterns during labor (Figures 1A and B) (Eganhouse, 1992). Some twin fetuses will have asynchronous FHR patterns over the course of labor, especially if there are differences in fetal well-being. Accelerations and decelerations usually occur within the same time frame, but will not be identical in duration or in excursion from the baseline (Gallagher, Costigan, & Johnson, 1992). Tactile communication occurs between twins in utero, and these movements often result in simultaneous accelerations of the FHR during nonstress testing (Sherer, Nawrocki, Peco, Metlay, & Woods, 1990). Periods of FHR reactivity and nonreactivity are similar as well during nonstress

FIGURE 2. TACHYCARDIA, ABSENT VARIABILITY.

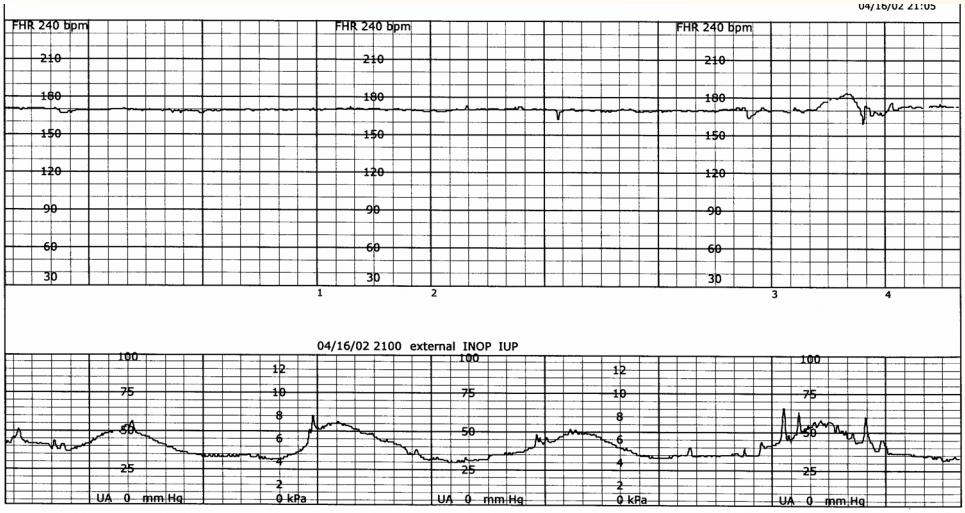


FIGURE 3. VARIABLE DECELERATIONS.

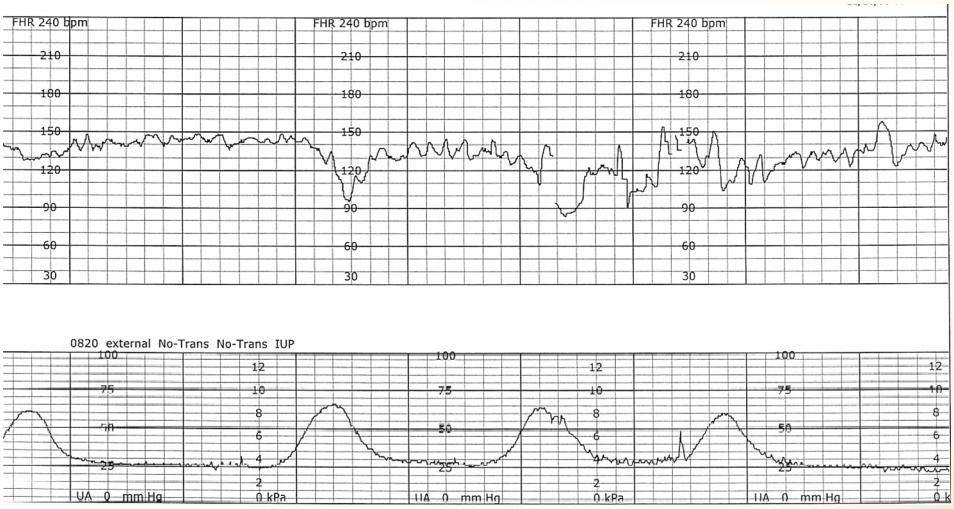
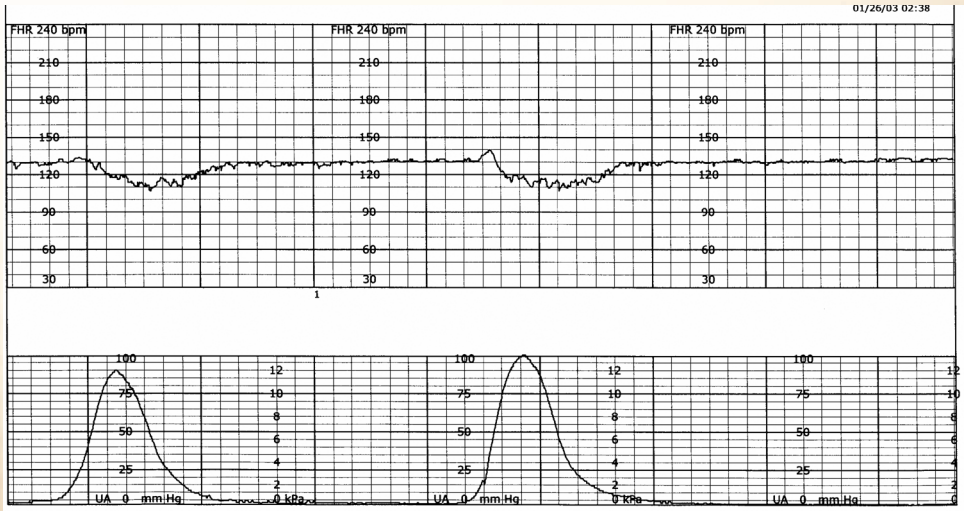


FIGURE 4. LATE DECELERATIONS.



testing (Sherer, Amico, Cox, Metlay, & Woods, 1994). The assumption can be made that these conditions and FHR reactions would apply to the intrapartum period, but there have been no studies to confirm these assumptions. The published data are limited to FHR patterns of twins during antepartum testing. There were no studies found specifically about intrapartum FHR patterns of twins, although authors mentioned incidental data. There were no studies found about intrapartum FHR patterns of triplets and higher order multiples, presumably because these pregnancies almost always result in cesarean birth without labor. However, in selected cases when fetal status is reassuring and fetal presentation is favorable, women with triplets can labor and give birth vaginally.

ACOG (1998) recommends an ultrasound evaluation to determine fetal number and presentation as soon as possible after admission for labor. In addition, ultrasound should be used during the second stage of labor after the birth of the first baby to identify orientation of the second twin (ACOG, 1998). There should be experienced neonatal/pediatric personnel attending the birth to resuscitate the babies if needed. A full surgical team should be in-house, standing by in case an emergent cesarean birth is indicated (ACOG, 1998). Births of multiples should occur in the surgical suite under a double set-up procedure so that an emergent cesarean birth can proceed as quickly as possible if required.

Evaluation of EFM Data

It is critically important that all healthcare providers use the same terminology in professional communication and medical record documentation when describing FHR patterns. A common set of definitions for the characteristics of the FHR enhances both interdisciplinary communication and patient safety (Simpson, 2004). For the purposes of this article, the terminology suggested by the National Institute of Child Health and Human Development (NICHD, 1997), of the National Institutes of Health (NIH), will be used to describe common FHR patterns.

Baseline Rate

The normal range of the FHR is 110 to 160 beats per minute (bpm). The baseline rate decreases over the course of gestation as the fetus matures (Kisilevsky, Hains, & Low, 2001). In the preterm fetus, the rate is likely to be in the higher range, up to 160 bpm. A FHR greater than 160 bpm may be an indication of evolving fetal hypoxemia, maternal fever, intra-amniotic infection, or the side effects of terbutaline administration (Figure 2). Development of tachycardia (baseline rate greater than 160 bpm) is more common in the preterm fetus (Westgren, Holmquist, Svenningsen, & Ingemarsson, 1982). In one study, 78% of fetuses less than 33 weeks had periods of tachycardia as compared to only 20% of fetuses greater than 33 weeks (Westgren, Holmquist, Ingemarsson, & Svenningsen, 1984). The presence of fetal tachycardia is more predictive of acidemia, low Apgar scores, and adverse neonatal outcomes in the preterm fetus compared to the term fetus (Burrus, O'Shea, Veille, & Mueller-Heubach, 1994; Westgren et al., 1982). Therefore, baseline rate, as well as other features of the FHR, merit special attention by the nurse responsible for monitoring the labor of a woman with a preterm pregnancy.

Baseline Variability

Minimal to absent FHR variability is more common in the preterm fetus (To & Leung, 1998). Loss of variability is significant when the fetus is preterm because this FHR change is more predictive of hypoxemia and academia as compared to the term fetus (Douvus, Meeks, Graves, Walsh, & Morrison, 1984; Freeman et al., 2003). If the FHR is tachycardic, variability may be decreased secondary to the tachycardia (Freeman et al., 2003); however, frequently in the preterm fetus, minimal to absent variability is indicative of progressive hypoxemia and acidemia (Zanini, Paul, & Huey, 1980). The combination of tachycardia and loss of variability is more often associated with low Apgar scores and acidemia in the preterm fetus (Freeman et al., 2003).

Preterm labor and birth may be indicated for women in with preeclampsia. These patients receive intravenous (IV) magnesium sulfate as seizure prophylaxis. Preterm labor often proceeds during and despite IV magnesium sulfate tocolysis. The variability of the baseline FHR pattern may decrease during magnesium sulfate administration, although this change is not usually clinically significant (Atkinson, Belfort, Saade, & Moise, 1994; Hiett, Devoe, Brown, & Watson, 1995; Wright, Ridgway, Wright, Covington, & Bobbitt, 1996). Antenatal steroids are indicated when there is a risk that preterm contractions will lead to active labor and preterm birth. Both betamethasone and dexamethasone cause a transient increase in baseline variability for about 24 hours followed by a suppression of variability up to 96 hours after administration; however, these changes are not indicative of deterioration in fetal status (Rotmensch et al., 1999; Subtil et al., 2003). Intravenous or intramuscular (IM) pain medications may result in decreased variability. It is important to know the duration of the effects of any pain medication given to be able to accurately distinguish between expected FHR side effects and evolving fetal hypoxemia.

Accelerations

Accelerations of the preterm FHR are generally lower in amplitude and less frequent than of the term fetus, although most preterm fetuses, even at 24 to 26 weeks and beyond, will have accelerations of at least 15 bpm lasting 15 seconds (Freeman et al., 2003). The number and amplitude of accelerations increase over the course of gestation as the fetus matures (Kisilevsky et al., 2001). An acceleration of the FHR of at least 10 bpm lasting 10 seconds is considered reassuring in fetuses less than 32 weeks (NICHD, 1997).

If the woman is receiving magnesium sulfate, there may be fewer accelerations of the FHR of 10 to 15 bpm. These changes are not usually clinically significant (Atkinson et al., 1994; Hiett et al., 1995; Wright et al., 1996). Antenatal steroids may result in a transient increase in fetal movement and FHR accelerations within the first 24 hours after

administration followed by a reduction in fetal movement and FHR accelerations for the next 96 hours; however, these changes are not nonreassuring findings (Rotmensch et al., 1999; Subtil et al., 2003; van Iddekinge et al., 2003). Pain medication given IV or IM may temporarily depress the fetal neurological system, resulting in fewer FHR accelerations and/or FHR accelerations of lower amplitude.

Decelerations

Variable decelerations are more common in preterm fetuses during the antepartum period (Sorokin et al., 1982) and during labor (Freeman et al., 2003). Approximately 70% to 75% of preterm fetuses will have variable decelerations compared to about 30% to 50% of fetuses at term (Westgren et al., 1982) (Figure 3). Variable decelerations during preterm labor are associated with a higher rate of hypoxemia, acidemia, neurological abnormalities, and adverse long-term outcomes (Holmes, Oppenheimer, Gravelle, Walker, & Blayney, 2001; Westgren et al., 1982). There is evidence to suggest variable decelerations are associated with intraventricular hemorrhage through a mechanism independent of fetal acidemia (Holmes et al., 2001).

THE THRESHOLD FOR INTERVENTION VIA CESAREAN BIRTH FOR NONREASSURING FHR PATTERNS IS LOWER FOR THE PRETERM FETUS AS COMPARED TO THE TERM FETUS.

Although there does not appear to be an increased incidence in late decelerations during preterm labor, the conditions that are more likely to result in late decelerations are more common (Freeman et al., 2003). These include uteroplacental insufficiency, intra-amniotic infection, preeclampsia, intrauterine growth restriction, and placenta abruption (Figure 4). Late decelerations have more significance for the preterm fetus because there is an association between late decelerations during preterm labor and adverse outcomes such as hypoxemia, acidemia, and long-term neurological abnormalities (Westgren et al., 1984; Zanini et al., 1980). Prolonged decelerations occur at a similar frequency for the preterm and term fetus (Freeman et al., 2003).

Interventions for Nonreassuring FHR Patterns

The standard interventions for nonreassuring FHR patterns in the term fetus are applicable to the preterm fetus as well. Usual intrauterine resuscitation techniques such as lateral maternal position changes, reduction of uterine activity, an IV fluid bolus, oxygen administration at 10 liters per face mask, and amnioinfusion are indicated based on the characteristics of the FHR pattern. Unfortunately, there are minimal data on the efficacy of these interventions either individually or collectively, however theoretically they promote fetal well-being by maximizing intravascular volume, maternal oxygenation, uterine perfusion, placental exchange, umbilical cord perfusion, and ultimately, oxygen delivery to the fetus. Although there may not be a solid body of evidence to support these interventions, in general they are not considered to be harmful. Until more rigorous data are available, erring on the side of fetal safety is suggested. Because it is known that the preterm fetus is particularly susceptible to hypoxia, timeliness of intrauterine resuscitation is critical.

Lateral Maternal Position Changes

Changing maternal position alters the relationship between the umbilical cord and fetal parts or the uterine wall, and is usually done to minimize or correct cord compression and decrease the frequency of uterine contractions (Clark et al., 1991). Maternal position change can resolve variable and/or prolonged decelerations. Position change could also modify late decelerations if the etiology of this pattern is decreased uterine blood flow (usually secondary to supine positioning and inferior vena caval compression). In general, the supine position should be avoided to prevent compression of the vena cava and supine hypotensive syndrome.

Reduction of Uterine Activity

When uterine contractions are too frequent, there may be insufficient time for blood flow through the intervillous space. If FHR decelerations occur with hyperstimulation, reduction of contraction activity will optimize fetal oxygenation. Reduction of uterine activity can occur by reducing oxytocin dosage or discontinuing oxytocin administration, which will decrease contraction frequency. The next dose of pharmacologic agents used to ripen the cervix or stimulate contractions should be delayed until uterine activity returns to normal and the FHR is reassuring. An IV fluid bolus is often used to reduce uterine activity, although no studies were found that specifically evaluate the efficacy of this technique during active labor. Administration of tocolytics is another option that is occasionally used as a temporary measure to provide intrauterine resuscitation for a prolonged deceleration or other nonreassuring FHR patterns secondary to endogenous or exogenous uterine hyperstimulation. Although there have been no reports of adverse fetal outcomes related to administration of terbu-

taline, there are maternal conditions for which terbutaline is contraindicated. Because terbutaline increases maternal pulse, stroke volume, systolic blood pressure, and blood glucose, and decreases diastolic blood pressure and serum potassium, terbutaline should not be given to women with cardiac disease, arrhythmias, hypertension, hemorrhage, diabetes (relative contraindication), and hypothyroidism (Freeman et al., 2003).

Intravenous Fluid Administration

Administration of IV fluids is thought to maximize maternal intravascular volume and is therefore protective against decreases in uteroplacental perfusion. A reduction in uterine blood flow can occur following administration of regional anesthesia because the sympathectomy causes dilation of peripheral vessels, lower peripheral resistance, and a potential drop in uteroplacental blood flow. However, there are no data to suggest that increasing IV fluids will positively affect uterine blood flow in a woman who is well hydrated, and fluid administration will not correct fetal hypoxemia per se.

As opposed to periodic IV fluid boluses, it is important to maintain adequate hydration over the course of labor. Recent evidence suggests that the usual amount of IV fluids given during labor (125 mL/h) is a gross underestimation of the fluids needed to promote adequate labor progression and replace fluids lost (Garite, Weeks, Peters-Phair, Pattillo, & Brewster, 2000). Caution should be used when increasing IV fluids. It is important to remember that some clinical situations, such as severe preeclampsia, preterm labor treated with magnesium sulfate, or preterm labor treated with corticosteroids and beta-sympathomimetic drugs, carry an increased risk for pulmonary edema that might necessitate fluid restriction (ACOG, 2003b).

Treatment for Anesthesia-Related Hypotension

Conduction anesthetics increase the risk of decreased placental blood flow secondary to maternal hypotension due to sympathetic blockade. If maternal repositioning and IV fluid bolus are not successful in resolving the nonreassuring FHR pattern, ephedrine may be given to increase maternal blood pressure. Ephedrine is the recommended agent because it is least likely to reduce uterine blood flow (Freeman et al., 2003).

Oxygen Administration

There are no data from randomized controlled trials showing that administering oxygen during labor will improve fetal outcomes. There is evidence that fetal PO_2 will increase in the presence of maternal hyperoxia, but the rates of oxygen administration rarely reach the 100% that is required in usual practice (Aldrich, Wyatt, Spencer, Reynolds, & Delpy, 1994; Bartnicki & Saling, 1994; Didly, Clark, & Loucks, 1994). Some manufacturers suggest that 10 liters of oxygen per minute through an appropriately used high-concentration tight-fitting nonrebreather mask can provide 90% to 100% fractional inspired oxygen concentration (FiO_2) (Airlife, 2000). Using this type of system, which is available in most perinatal units, there is potential to increase fetal SpO_2 ($FSpO_2$) (Dildy et al., 1994). Despite the lack of cumulative evidence, administering oxygen is a common practice and is suggested for improving fetal oxygenation by ACOG (1995; 1999). Because maternal oxygen administration is such a standard practice during nonreassuring FHR patterns, notwithstanding the current state of knowledge, unless there is evidence that it could be harmful to the mother or fetus, it will continue to be recommended as an intrauterine resuscitation technique (Freeman et al., 2003).

Amnioinfusion

Amnioinfusion has been used to attempt to resolve variable FHR decelerations by correcting umbilical cord compression as a result of oligohydramnios. During amnioinfusion, normal saline or lactated Ringer's solution is introduced transcervically into the uterus, either by gravity flow or through an infusion pump. When the fetus is preterm, a warmed solution is recommended (Nageotte, Freeman, Garite, & Dorchester, 1985). Amnioinfusion resolves variable decelerations but does not affect late decelerations or FHR patterns with absent variability (Mino, Puerta, Miranda, & Herruzo, 1999, Miyazaki & Naravez, 1985). The procedure appears to be safe for women who are attempting a vaginal birth after a previous cesarean birth (Ouzounian, Miller, & Paul, 1996). Careful monitoring and documentation of fluid infused and fluid returned are important to avoid iatrogenic polyhydramnios.

Cesarean Birth

If efforts to improve fetal status with the use of intrauterine resuscitation techniques are unsuccessful, a cesarean birth is indicated. The threshold for intervention via cesarean birth for nonreassuring FHR patterns is lower for the preterm fetus as compared to the term fetus (Freeman et al., 2003). Although some preterm babies are born electively via cesarean birth before labor, there is not enough evidence to suggest a policy of routine elective cesarean birth for preterm babies (Grant & Glazener, 2001).

Summary

During preterm labor, accurate assessment of the preterm fetus and appropriate timely clinical interventions are critical to enhance perinatal outcomes. Characteristics of FHR patterns and their implications for the preterm fetus differ from those of the term fetus. The fragility of the preterm fetus and susceptibility to the effects of hypoxemia and acidemia can result in neurological depression, asphyxia, and the potential for long-term adverse outcomes. An adequate knowledge of the physiologic basis for fetal heart rate monitoring and the unique aspects of monitoring the preterm fetus during labor are requisite for perinatal nurses. ✣

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PURPOSE

To provide registered professional nurses with the latest information on the special challenges of monitoring the preterm fetus during labor, and to highlight those nursing interventions that contribute to the best possible outcomes for mothers and babies.

OBJECTIVES

After reading the article(s) and taking the test, you will be able to:
1. List key indicators of fetal compromise, especially during preterm labor.
2. Outline the recommendations for monitoring a preterm and/or high-risk fetus during labor.
3. Discuss appropriate interventions for monitoring and managing a high-risk labor.

1.	What percentage of nonreassuring fetal heart rate (FHR) patterns in preterm infants of less than 33 weeks' gestation will result in neurologically depressed, hypoxemic, or acidemic infants?
○	a. 60% to 70%
○	b. 70% to 80%
○	c. 80% to 90%

2.	Which of the following FHR decelerations are more common in the preterm fetus during labor?

○	a. early
○	b. variable
○	c. prolonged

3.	During the second stage of labor when the mother or fetus is at risk, the American Academy of Pediatrics (AAP) and the American College of Obstetricians and Gynecologists (ACOG) both recommend evaluating the FHR every
○	a. five minutes.
○	b. 10 minutes.
○	c. 15 minutes.

4.	Optimal placement of the external ultrasound device depends on accurate identification of the smooth surface of the fetal
○	a. head.
○	b. chest.
○	c. back.

5.	A recommended method of distinguishing maternal tachycardia from the FHR is
○	a. using maternal pulse oximetry.
○	b. comparing the fetal heart rate with the mother's radial pulse.
○	c. identifying a possible cause of maternal tachycardia.

6.	Uterine hyperstimulation is characterized by
○	a. a contraction frequency of three or more in 10 minutes.
○	b. a contraction frequency of five or more in 10 minutes.
○	c. contractions of normal duration within two minutes of each other.

7.	An intrauterine pressure catheter is recommended
○	a. during preterm labor.
○	b. routinely during any high-risk labor.
○	c. in select cases when maternal obesity interferes with external monitoring.

8.	During a twin gestation labor
○	a. FHR monitoring is only necessary when there are other maternal-fetal risk factors.
○	b. it is only necessary to monitor one FHR, as they are usually synchronous.
○	c. the FHR pattern of each fetus must be identified and monitored.

9.	During labor, for women with multiple gestation, ACOG recommends
○	a. routine cesarean birth.
○	b. ultrasound on admission.
○	c. frequent nonstress testing.

10.	An FHR greater than 160
○	a. is within the expected range for preterm fetuses.
○	b. is a more ominous finding in a full-term infant.
○	c. might be a sign of evolving fetal hypoxemia.

11.	During magnesium sulfate administration, a decrease in the variability of the baseline FHR pattern is
○	a. not usually clinically significant.
○	b. predictive of progressive acidemia.
○	c. a reflection of maternal tachycardia.

12.	Which situation is most likely to result in late decelerations?
○	a. administration of antenatal steroids
○	b. uteroplacental insufficiency
○	c. pressure on the fetal head

13.	Intravenous fluid restriction might be indicated when
○	a. uteroplacental perfusion is decreased.
○	b. regional anesthesia is administered.

○	c. preterm labor is treated with magnesium sulfate.

14.	If maternal repositioning and IV fluid bolus are not successful in resolving a nonreassuring FHR pattern resulting from administration of conduction anesthetics, the agent of choice for increasing maternal blood pressure is
○	a. ephedrine.
○	b. terbutaline.
○	c. epinephrine.

15.	Amnioinfusion is used to correct
○	a. late decelerations.
○	b. absent variability.
○	c. variable decelerations.

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