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Fetal Monitoring of Twins

Perinatal mortality for twins is five to seven times that for singletons. This disparity is related to a variety of risk factors that may alter the health of the woman and her fetuses. With twin pregnancies, antepartum surveillance frequently begins earlier in gestation. Although extensive antepartum and intrapartum nursing care is required for women with twins, little has been published in the nursing literature to provide direction for caregivers. Factors such as zygosity and gestational age influence monitoring in twin pregnancies. Current clinical and technical nursing issues are reviewed and related to the antepartum and intrapartum electronic fetal monitoring of twins.

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Multiple pregnancy poses significant challenges for perinatal nurses. The perinatal mortality for twins is five to seven times that of singletons (Jones, Sbarra, & Cetrulo, 1990; Newton, 1986). One reason for this disparity is that approximately 50% of multiple gestations are complicated by preterm birth, and 50% to 70% of perinatal deaths occur in infants born before 30 weeks (American College of Obstetricians and Gynecologists [ACOG], 1989). Another reason is the higher incidence of genetic or developmental abnormalities resulting from twin-to-twin transfusion and congenital defects, uteroplacental insufficiency, and birth trauma such as cord prolapse (Newton, 1986). Twinning also increases maternal complications, such as polyhydramnios, pregnancy-induced hypertension, anemia, and hyperemesis. These factors require close maternal and fetal surveillance antepartum and intrapartum. Unfortunately, the nursing literature provides scant information about this important aspect of obstetric nursing. The purpose of this article is to review current clinical and technical nursing concerns related to the antepartum and intrapartum electronic fetal monitoring of twins.

Zygosity

With twins, zygosity influences perinatal outcome to a great extent. Monozygotic (identical) twins form from the division of one fertilized ovum, whereas dizygotic (fraternal) twins arise from two fertilized ova. Monozygotic twins are usually 100% similar in their genetic defects and 2% to 10% similar in developmental abnormalities. Thus, monozygotic twins have an incidence of perinatal mortality and morbidity two to three times that of dizygotic twins. The primary problem relates to the failure of the vascular beds to separate completely, leading to the formation of circulatory connections within the placenta (ACOG, 1989; Newton, 1986). The resulting twin-to-twin transfusion leads to growth differences, polyhydramnios, and intrauterine hypoxia in 5% to 10% of monozygotic twins. Of these problems, unequal or discordant fetal growth is the most significant predictor of severe uteroplacental insufficiency. A weight difference of 25% between the twins is predictive of an increase in fetal death by 6.5 times and an increase in perinatal death rate by 2.5 times (Jones et al., 1990; Newton, 1986). Serial ultrasound measurements are used to determine growth retardation and discordance. Fortunately, two thirds of twins are dizygotic and genetically dissimilar, so genetic risks are decreased. The incidence of dizygotic twins is higher in blacks, in mature gravidas, in multiparas, and when fertility drugs have been used (ACOG, 1989). Regardless of whether they are mono-

gotic or dizygotic, however, all twins are at increased risk for hypoxia because of potential prematurity, abnormal presentation, and operative intervention, as well as complications that create a risk of uteroplacental insufficiency, for example, pregnancy-induced hypertension and discordant growth patterns.

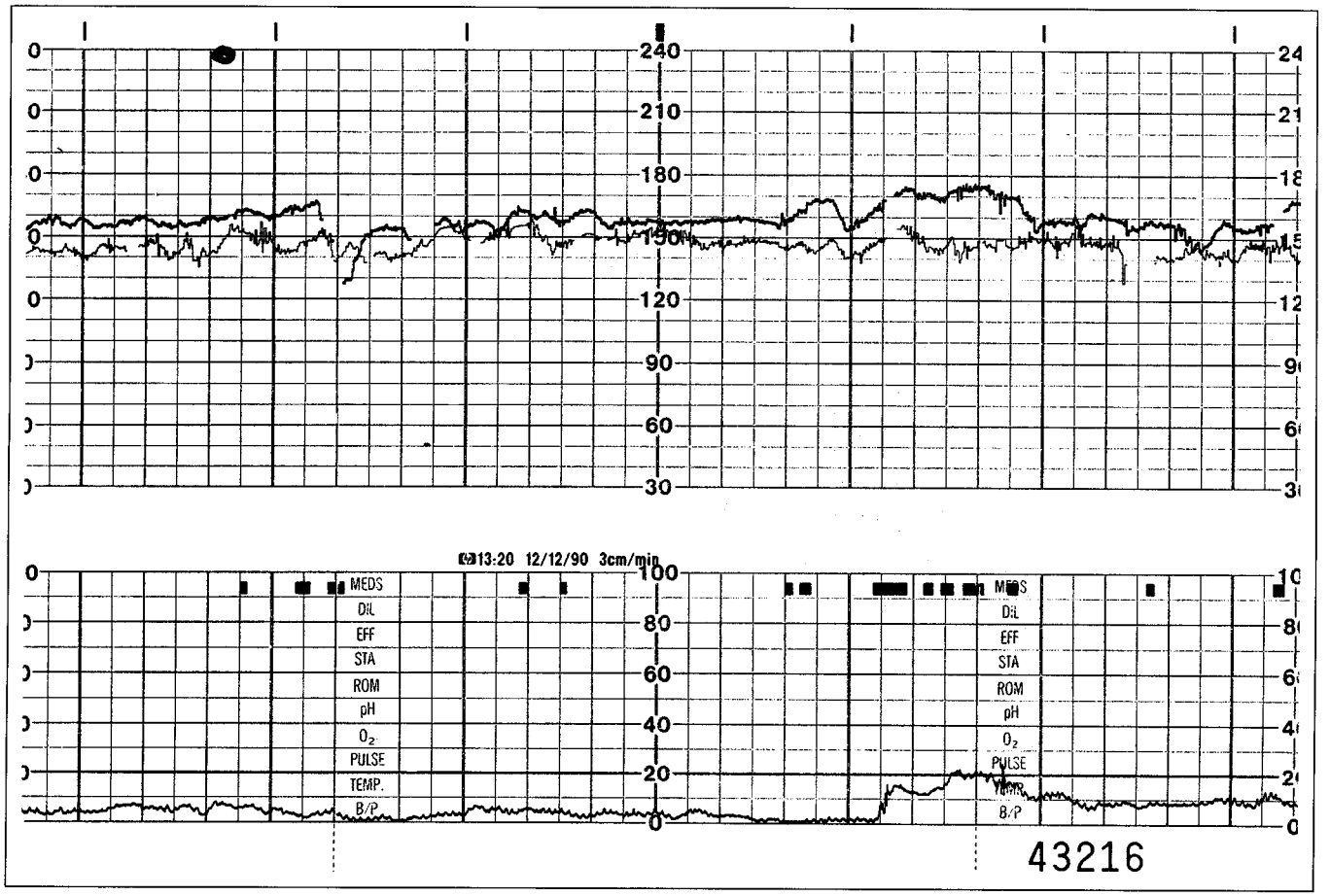
Synchrony in Simultaneous Nonstress Test Tracings

The nonstress test (NST) is the most widely used method of evaluating twins for any of the aforementioned risk factors. Normative data for simultaneous twin NSTs show synchrony or similarity in the tracings with incidences of 57.14% and 58% in twins monitored from 27 weeks until term (Devoe & Azor, 1981; Sherer, Nawrocki, Peco, Metlay, & Woods, 1990). Although the results of studies are, in general, inconsistent, synchronous fetal heart rate (FHR) patterns have been reported to be associated with similar-sized twins and monochorionic or fused dichorionic placentas (Devoe & Azor, 1981; Sherer et al., 1990).

Although extensive antepartum and intrapartum nursing care is required for women with twins, little has been published in the nursing literature to provide direction for caregivers.

Among the characteristics of synchronous tracings are similar frequency and timing of accelerations, similar baseline oscillations, and similar periodic changes with contractions (see Figure 1). In one study, asynchrony or dissimilarity occurred in 42% of the tracings and was identified by marked differences in reactivity and long-term variability (see Figure 2) (Devoe & Azor, 1981). Although asynchronous FHR tracings have been attributed to separate placentas and differences in fetal weight, results from two of the aforementioned studies conflict (Devoe & Azor, 1981; Sherer et al., 1990). Synchrony is thought by some to occur because the first twin's movement produces a vibration and stimulates movement and FHR accelera-

Figure 1.
Synchronous fetal heart rate tracings have similar frequency and timing of accelerations, baseline oscillations, and periodic changes.



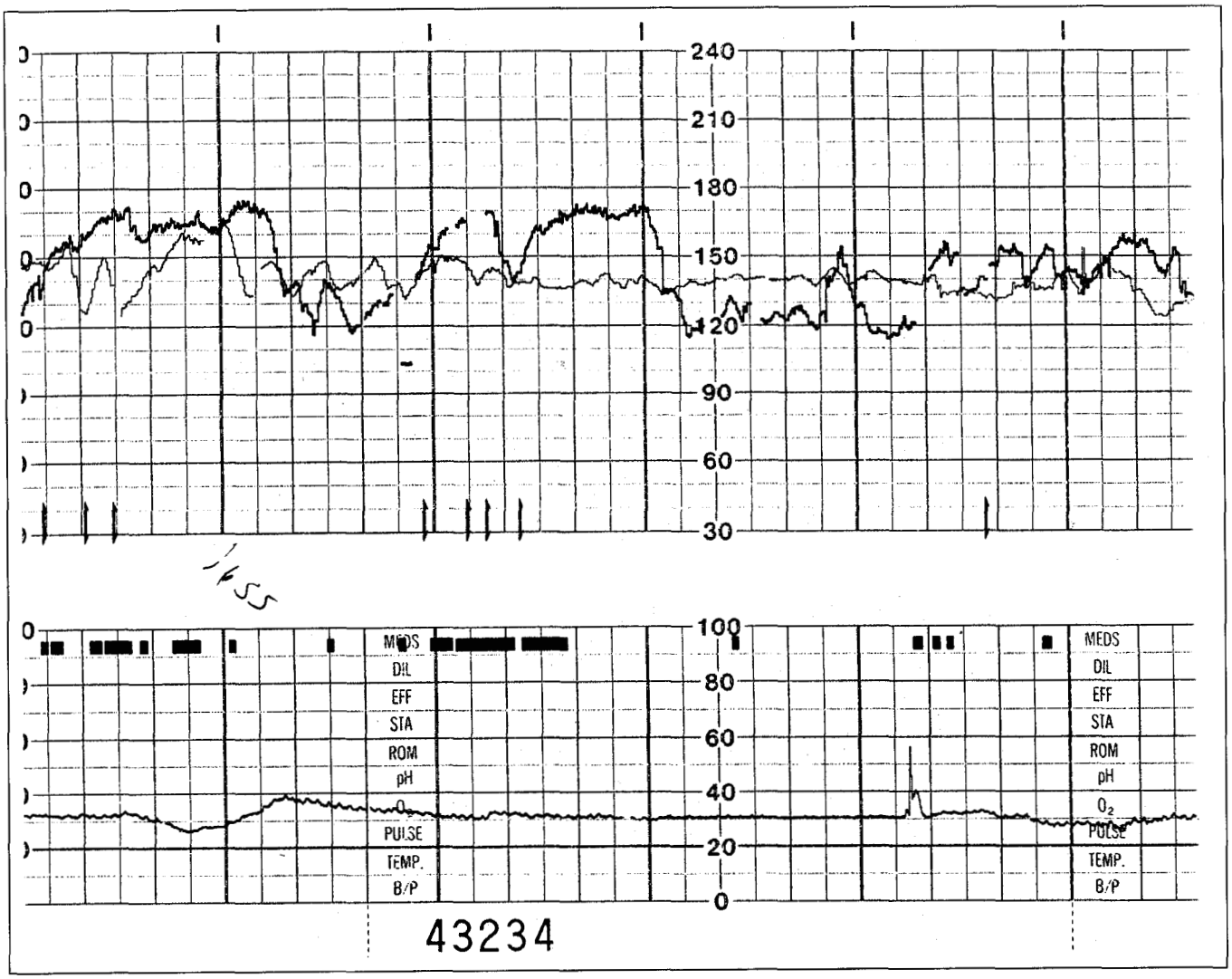


Figure 2.
Asynchronous tracings have differences in reactivity and long-term variability.

tions in the second twin. Recently, this idea was supported in a limited investigation of twins in which vibratory acoustic stimulation evoked an immediate transition from asynchronous to synchronous FHR tracings in all 16 tests carried out in the study (Sherer, Abramowicz, D'Amico, Caverly, & Woods, 1991).

Technical Concerns During Nonstress Tests

Technical concerns during NSTs have not been addressed in the literature on fetal monitoring. Until recently, two separate monitors were universally necessary for NSTs. In many hospitals, this is still the norm. Among the advantages of simultaneous twin monitoring is the increased likelihood that both twins are being monitored with potentially less nursing time. Numerous technical problems may occur during twin NSTs when two monitors are used. First, the recommended lateral maternal position, which improves maternal-fetal gas exchange, is difficult for women to maintain. Maternal discomfort from an overly distended uterus necessitates frequent changes in position, making simultaneous clear FHR tracings difficult to achieve. Polyhydramnios increases this problem. A semi-Fowler's position may contribute to better quality tracings and maternal comfort. Another problem is posed by maternal discomfort from multiple monitor belts and ultrasound gel. Using two monitors with both tocotransducers in place to evaluate uterine activity is technically difficult, but is necessary for observing fetal responses to spontaneous contractions. One or two monitor belts may be eliminated by carefully

tucking a cardio- and tocotransducer under the primary belt (see Figure 3).

Simultaneous monitoring of twins is preferable to nonsimultaneous monitoring to discriminate between their separate FHRs (ACOG, 1989). Synchronizing the internal clocks of both monitors will help produce accurate documentation. Otherwise, time increments should be documented on both monitor tracings for later comparison, to ensure that each twin has been monitored. If the monitor strips are synchronous, portable real-time ultrasound can be used to verify that both twins are being monitored independently (ACOG, 1989; Devoe & Azor, 1981).

Cross talk is an artifact produced by electronic interference when two cardiotransducers are used simultaneously. Cross talk may be reduced by using monitors from two different manufacturers, because the frequency of the ultrasound signals will be different (see Figure 3). Cross talk occurs more frequently with first-generation monitors. In some situations, such as when monitoring is performed in the patient's home, when it is done with limited equipment, and when monitor cross talk precludes an interpretable tracing, a single monitor may be used to test the first twin and then to test the second twin independently. In this case, since the strips cannot be compared later by time increments, care must be taken that one twin is not inadvertently monitored twice. Auscultating one twin's heart rate while electronically monitoring the other twin may help in determining whether there is a difference in the heart rates (J. Harris, personal communication, October 2, 1990). This information, as well as the location at which the FHRs are monitored, should be documented. Hospital protocol or a physician's order should describe the procedures for monitoring twins independently or simultaneously.

Figure 3.
Nonstress testing with two different monitors decreases electronic signal interference. For maternal comfort, only two belts are used to position all four transducers.

Numerous technical problems may arise during twin nonstress tests.

In a recent technologic advance, external monitors with two ultrasound channels permit twins to be monitored simultaneously with one machine. With these monitors, a variety of methods have been used to reduce cross talk. In one of these, the frequencies of the signals are different; in another, the ultrasound beams are narrower. Although in both cases cross talk is reduced, it is not eliminated. The new Hewlett-Packard M1350A (Palo Alto, CA) provides a feature called cross-channel verification in which the clinician is automatically alerted by printed question marks at the top of the tracing when the same FHR signal is being detected by two channels (see Figure 4). In addition, the side-by-side red digital display of the FHR flashes identical numbers. Cross-channel verification assists the clinician in ensuring that both fetuses are monitored independently, thereby reducing the risk that one twin will be monitored twice and the other not at all.

Interpretation of Twin Nonstress Tests

Reactive NSTs for twins are as reassuring as NSTs for singletons. Morbidity or mortality is infrequent within one week of a reactive NST (Devoe & Azor, 1981). In one study of 193 fetuses, a reactive NST was related to uncomplicated perinatal outcomes 86% of the time, whereas nonreactive fetuses were without morbidity only 24% of the time (Blake et al., 1984). In the nonreactive group, morbidity included intrapartum fetal distress, lower Apgar scores, intrauterine growth retardation, and respiratory distress syndrome. Thus, a reactive pattern was highly predictive (96.2%) of fetal ability to tolerate labor without distress (ACOG, 1989; Blake et al., 1984).

However, since antepartum surveillance may begin earlier for twins than for singletons, the influence of gestational age in FHR reactivity must be considered. In one study of 530 NSTs from multifetal gestations, the incidence of FHR reactivity using the standard criteria of 15 bpm and 15 seconds of FHR acceleration improved dramatically after 32 weeks of gestation. From 26 to 31 weeks, 68.1% of the fetuses were reactive; from 32 to 36 weeks, 87.9% were reac-

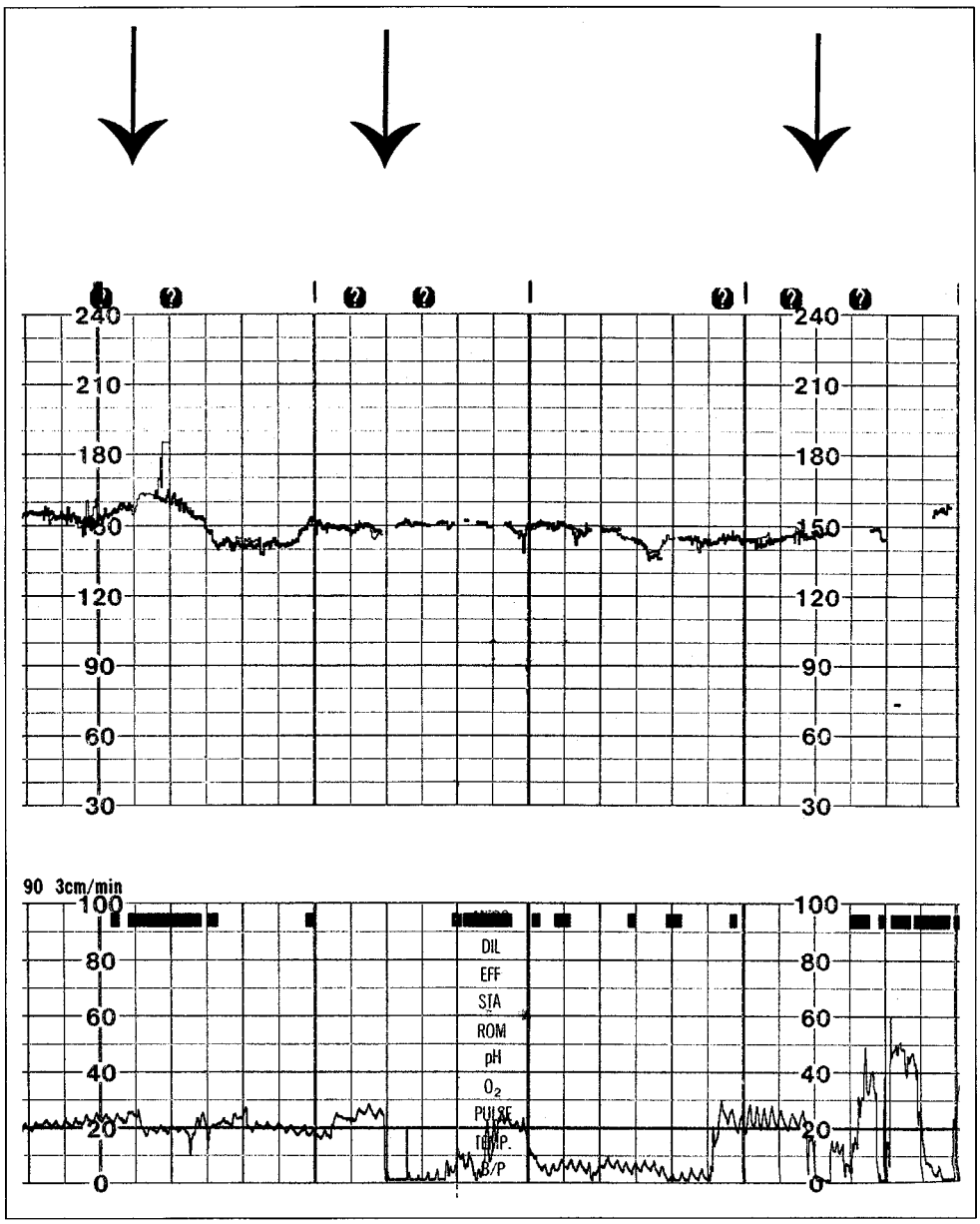


Figure 4.
Question marks at the top of the tracing (note arrows) indicate that similar signals are being detected during dual monitoring.

tive; and from 37 to 42 weeks, 93.8% were reactive. Thus, the likelihood of a false nonreactive NST was 31.9% in fetuses younger than 32 weeks' gestation (Patkos, Boucher, Broussard, Phelan, & Platt, 1986). With advancing fetal age, characteristics of central nervous system maturity due to parasympathetic development can be observed in the FHR tracing. Parasympathetic maturity influences characteristics of the tracings by lowering the baseline FHR, increasing variability, and increasing the amplitude and frequency of accelerations. Changes in fetal state from rest to activity become more pronounced (Pillai & James, 1990; Schifrin & Clements, 1990). Normal responses of the immature fetus include a higher baseline FHR, less baseline variability, less change in variability between active and quiet states, and lower amplitude accelerations. Normative data suggest that, before 30 weeks, accelerations of 10 bpm sustained for 10 seconds are observed more commonly than accelerations meeting the 15 bpm, 15-second criteria (Pillai & James, 1990).

In a second study of 150 NSTs from low-risk singletons between 24 and 32 weeks, nonreactivity using the 15 bpm, 15-second criteria declined from 50% at 24 weeks to 6.7% at 32 weeks. Extending the length of the NSTs to 90 minutes achieved 91% reactivity using the 15-bpm criterion, although 100% of the tests were reactive by 60 minutes using a 10-bpm criterion. Investigators concluded that lengthening the time of the

test or reducing the required amplitude of FHR accelerations is appropriate before 32 weeks' gestation to reduce the number of false nonreactive tests (Castillo et al., 1989). Thus, the interpretation of the data or length of the testing period may need to be adjusted to allow for fetal immaturity when surveillance begins at earlier gestational periods.

The primary advantage of the biophysical profile in twin surveillance is its ability to differentiate the sleeping from the sick fetus when a nonreactive nonstress test occurs in one or both twins.

Another clinical dilemma occurs when only one of the twin fetuses has an abnormal test. In that case, expediting delivery may increase the risk of morbidity for the healthy twin. However, delaying delivery may result in further compromise of the unhealthy twin (Newton, 1986). Perinatal morbidity among twins delivered second is significantly greater—73% higher—than for delivered first twins. Further surveillance using other methods, such as ultrasound, biophysical profile testing, and oxytocin challenge tests, may clarify an ambiguous clinical picture.

Biophysical profile testing is particularly helpful, since oxytocin challenge tests are technically difficult and may be contraindicated in preterm pregnancies. The biophysical profile includes a real-time scanning of gross fetal movements, breathing movements, fetal tone, and amniotic fluid volume, as well as the NST results. In one study of biophysical profiles performed on twins, 34 fetuses with nonreactive NSTs were evaluated. A biophysical profile with a score of 8 or higher correctly predicted a good outcome for 28 fetuses. A biophysical profile with a score of 7 or lower correctly predicted fetal distress and accurately differentiated between a healthy and a distressed twin (Lodiero, Vintzileos, Feinstein, Campbell, & Nochimson, 1986). Measures of fetal distress included Apgar scores lower than 7 and cord pHs lower than 7.2 at birth. The primary advantage of the biophysical profile in twin surveillance is its ability to differentiate the sleeping from the sick fetus when a nonreactive NST occurs in one or both twins.

Intrapartum Monitoring

Recently, fetal monitors were developed with the capability of monitoring twins simultaneously with one monitor. Initially, these monitors were used only during intrapartum care after amniotomy, since a spiral electrode was needed to monitor the first fetus. The second fetus was monitored externally through the maternal abdomen with the cardiotransducer. Now, with the new machines simultaneously monitoring twins externally with one monitor, the procedure is easier for nurses and more comfortable for patients. Regardless of whether internal or external dual monitoring is performed, clinicians must be aware of two potential problems: First, it is possible to inadvertently monitor the first twin twice; and second, the maternal heart rate may be mistaken for fetal bradycardia.

Corometrics (Wallingford, CT) and Hewlett-Packard monitors use paper with a single longitudinal scale for monitoring both FHRs. With these monitors, the presence of a single fetal heart tracing may indicate that the same fetus is being monitored twice. Another clue is that the tracing may be darker than normal (see Figure 5). Before assuming that the monitor is not working, the nurse should reauscultate the heart rates with a fetoscope and readjust the cardiotransducers (see Figure 6). Litton and PPG monitors (Lenexa, KS) use paper with separate fetal heart scales for each fetus. If the FHR tracings are identical, the cardiotransducer needs to be adjusted until two distinct tracings appear (see Figures 7 and 8) (Litton Datamedix, 1984). Although synchronous FHR tracings have been reported, synchronous tracings are similar, but not identical (compare Figures 1 and 7).

Regardless of whether internal or external dual monitoring is performed, clinicians must be aware that it is possible to inadvertently monitor the first twin twice.

The onset of bradycardia with the second twin monitored via the cardiotransducer may indicate the maternal pulse rather than fetal compromise. Accordingly, the maternal pulse should be reassessed and the FHR reevaluated with a fetoscope. If the FHR is normal, the monitor should be readjusted, with all assessments documented on the monitor strip as well as in the nurses' notes (see Figures 5 and 6). The mother and support person should be reassured that these common technical problems do not indicate that the fetuses are compromised.

Second-Stage Monitoring

Historically, a higher morbidity and mortality for second twins has encouraged physicians to expedite the delivery of the second twin within 15 minutes or, at most, 30 minutes of the delivery of the first twin.

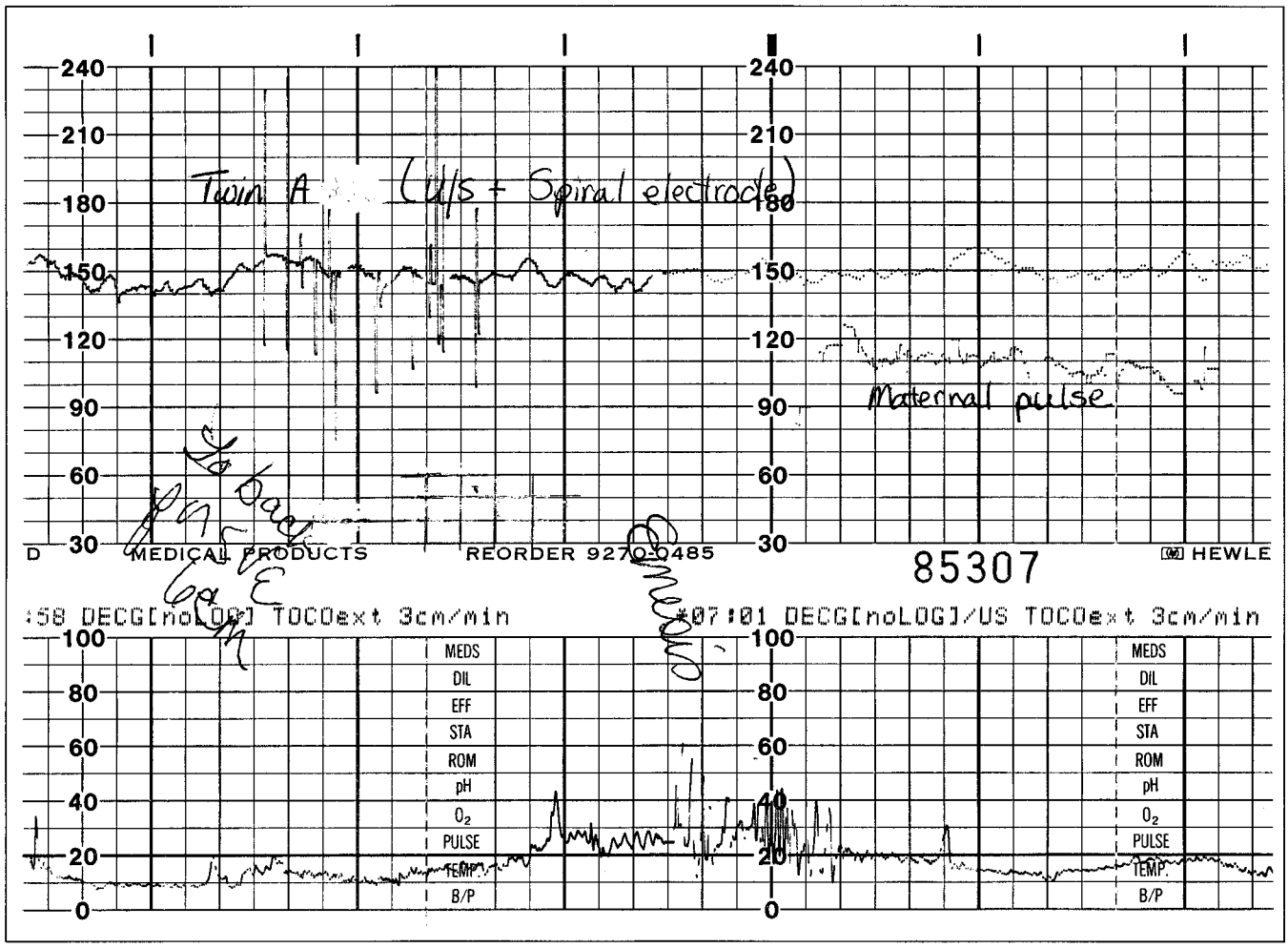


Figure 5.
During intrapartal monitoring, a single dark fetal heart rate tracing should alert the nurse to readjust the cardiotransducer.

Among the significant risks to the second twin are uterine inertia, malpresentation, umbilical cord prolapse, abruption, and stillbirth. However, obstetric advances—including continuous FHR monitoring and portable real-time ultrasound—are beginning to equalize survival rates for first and second twins. Currently, the goal is delivery of the second twin atraumatically, even when the 30-minute time interval is exceeded (ACOG, 1989; Rayburn, Lavin, Miodovnik, & Varner, 1984). Regardless of the mode of delivery, the first twin generally is favored with higher pO_2 and lower pCO_2. This finding was consistent, regardless of presentation (vertex-vertex, vertex-nonvertex, or nonvertex) or mode of delivery (vaginal or cesarean section) and irrespective of the interval between deliveries. Carbon dioxide retention was highest in the group requiring cesarean section for the second twin only (Brown, Miller, Neumann, Sarpong, & Gabert, 1990).

During second-stage labor, clear FHR tracings must be maintained for both twins. After the birth of the first twin, the physician will immediately want to verify the presentation of the second twin. If available, portable real-time ultrasound equipment should be in the delivery room. Such equipment will allow the physician rapidly to verify the presentation, the FHR, and the status of the umbilical cord of the second twin. Intrauterine manipulation or external version of a breech is improved when ultrasound is used to visualize the physician's hand in relation to fetal anatomic parts.

Once the second twin settles into the pelvis, an amniotomy and spiral electrode application can be accomplished. Extra equipment, including a hand-held Doppler, should be available so that the physician can hear the FHR until a cardiotransducer or spiral electrode can be applied (ACOG, 1989). Evaluation of uterine activity is critical. Uterine inertia may need to

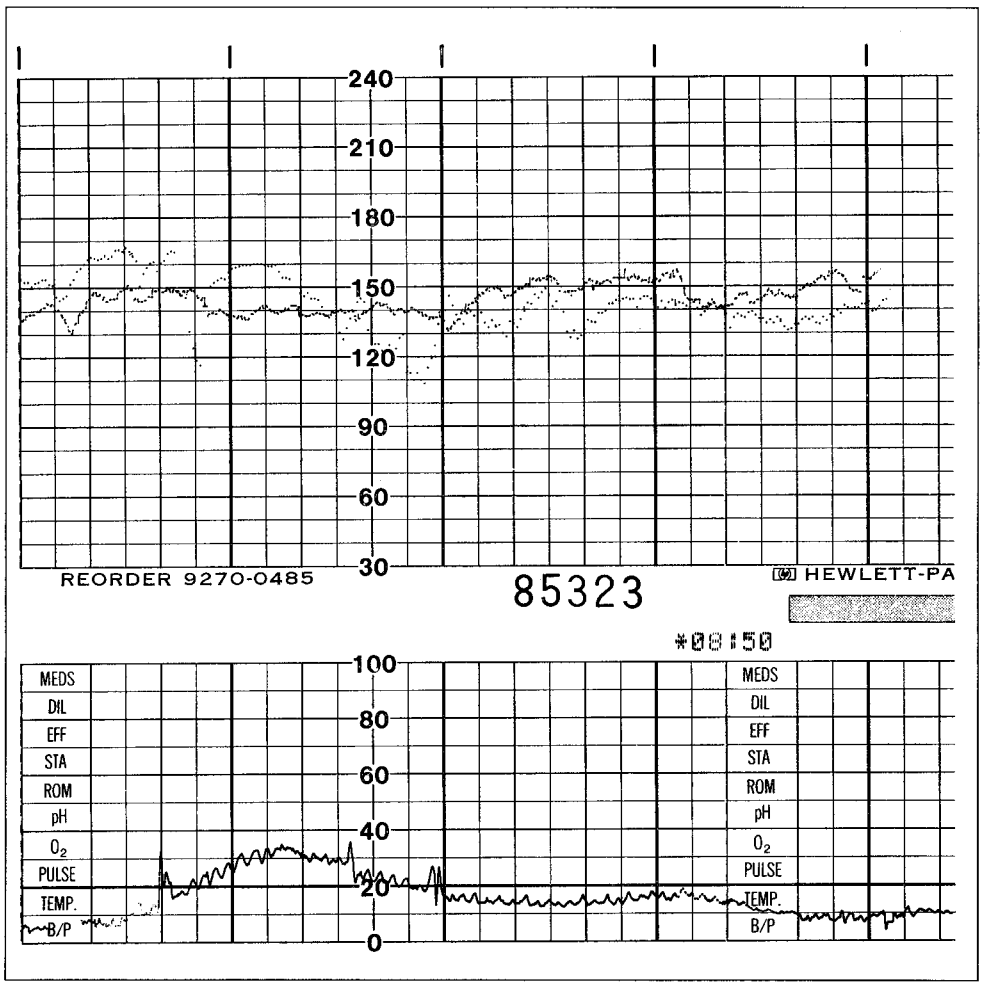


Figure 6.
After adjustment of the cardiotransducer (see Figure 5), two distinct fetal heart rate tracings are recorded.

be treated with oxytocin. Correcting the maternal position with a lateral tilt may improve uterine perfusion and function. This position also improves fetal oxygenation during this critical period of augmentation of labor. The external tocotransducer should be applied during augmentation, as well as a cardiotransducer or spiral electrode.

Delivery of the second twin by cesarean section is always a possibility. Failed version or extraction of a fetus in transverse or oblique lie, a prolapsed umbilical cord, fetal distress, or constriction of the cervix may necessitate a cesarean section. Electronic fetal monitoring should be continued during preparation for the procedure. Also, all necessary equipment and personnel, as well as preparation of the patient, should be anticipated and available before second-stage labor.

Nursing Implications

Antepartum and intrapartum surveillance of twins is a high-risk aspect of obstetric nursing. Although the risks related to twin pregnancy are amply described in the literature, little information addresses the electronic fetal monitoring of twins. Obstetric nurses have a preeminent role in evaluating women who are pregnant with twins. To be effective in this role, these nurses need current information about the clinical and technical aspects of monitoring twins. The effect of preterm gestation on interpreting antepartum data is essential information for providing high-quality nursing care. This paper describes instrumentation techniques and precautions designed to alert nurses to potential inaccuracies that may result while monitoring twins. These techniques have been incorporated into an intrapartum nursing care plan for pregnancies with twins to provide direction for obstetric nurses (see

Instrumentation techniques and precautions are designed to alert nurses to potential inaccuracies that may occur while monitoring twins.

Figure 7.
The first twin is accidentally monitored by spiral electrode and cardiotransducer. Monitor paper with separate scales shows identical fetal heart rate tracings.

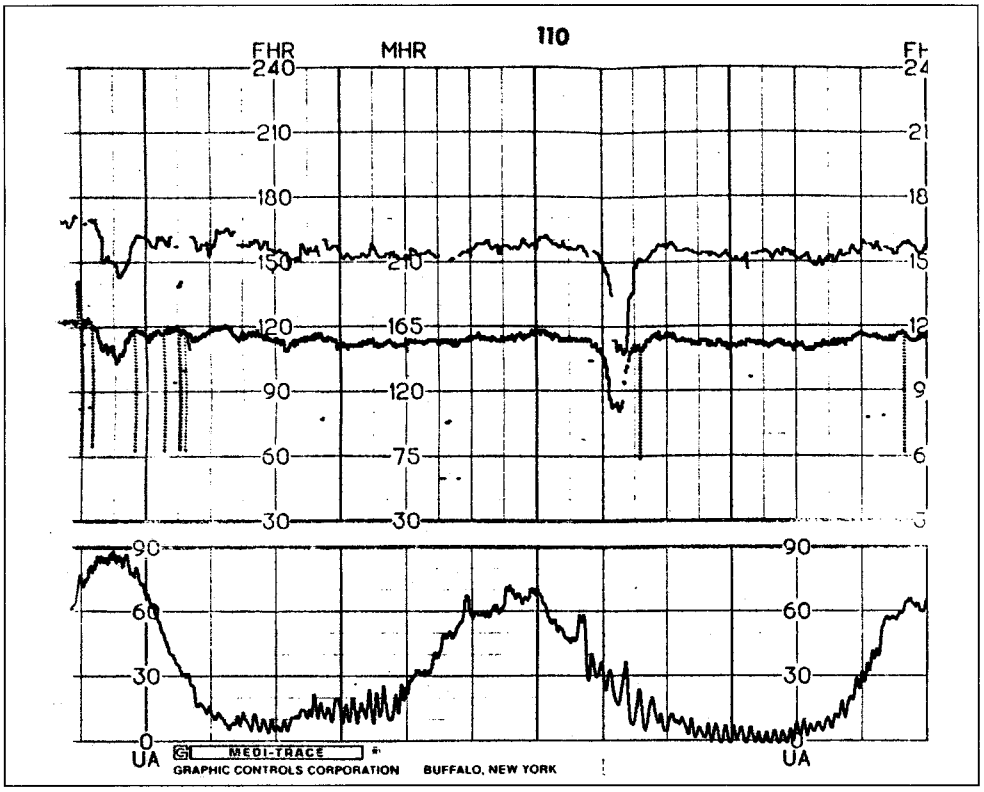
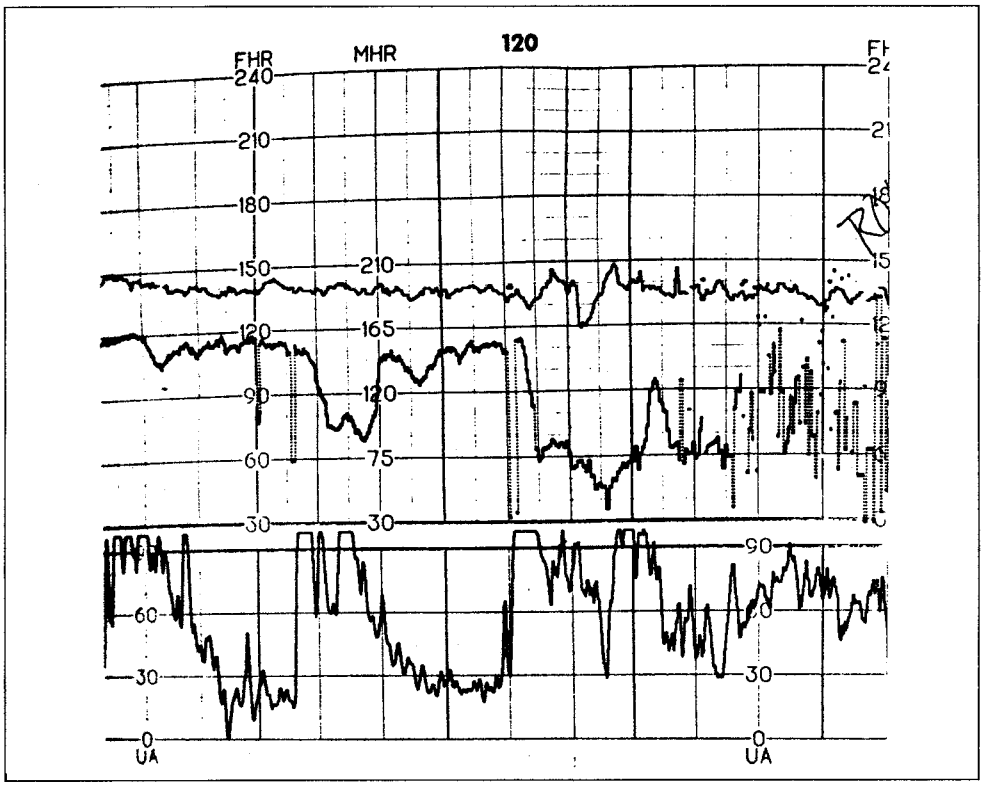


Figure 8.
Readjustment of the ultrasound transducer (see Figure 7) results in two distinct tracings.



Patient/Family Care Plan: Intrapartum Multiple Gestation

Discharge Goal: _____

Date	Number	Nursing Diagnosis	Short-Term Goal/ Target Dates	Nursing Interventions	Evaluation
	1	Potential for fetal injury related to multiple gestation. a. Prematurity. b. Malpresentation. c. Cord compression/ prolapse. d. Forceps. e. Cesarean section.	1. During labor a. Baseline FHRs for both fetuses will be 120–160 with average variability. b. Consistent late, severe variable, or prolonged decelerations will be absent or treated.	1. Apply EFM externally with mother in the lateral position or semi-Fowler's. a. Use two different brands of monitors to improve signal quality. b. Synchronize internal clocks of both monitors. c. Auscultate twin A and apply the cardiotransducer. d. Apply the tocotransducer. e. Auscultate twin B and discriminate from A's tracing. Apply cardiotransducer for twin B. f. Adjust belts to hold transducers in place. Try to accomplish monitoring with two or three belts rather than four. g. Observe FHR tracings carefully to ascertain that both fetuses are being monitored. h. Document location of FHRs. 2. Assist physician in applying a spiral electrode to twin A as soon as possible. a. Ascertain that U/S and spiral electrode produce different tracings. (It is possible to monitor the twin A using two modes.) b. If only one tracing appears, reauscultate and readjust the cardiotransducer for twin B. 3. Observe for nonreassuring FHR patterns, including decreased variability, late, severe variable, or prolonged decelerations. a. Alert physician to nonreassuring patterns. b. Institute nursing interventions for nonreassuring FHR patterns as needed based upon unit guidelines.	
			2. Fetuses will display no preventable signs of compromise related to mode of birth.	1. Per physician order, obtain flat plate or U/S to determine fetal positions. Be alert for increased incidences of breech presentation/cord prolapse. 2. Initiate usual procedures per physician order including intravenous, blood type and cross match, and activity limits. 3. Set up operative suite for twin birth including a. Two warmers. b. Blankets. c. Cord clamps. d. Cord gas equipment. e. Forceps, both Piper and regular (physician's choice). f. Bulb syringes.	

Figure 9.

Nursing care plans should include pertinent information to assist nurses in monitoring twins. FHR: fetal heart rate; U/S: ultrasound.

Figure 9). Further direction for monitoring twins antepartally and intrapartally should be included in textbooks on electronic fetal monitoring, and advanced nursing practice should address the issues of monitoring twins.

Summary

The management of fetal twins antepartum and intrapartum poses multiple challenges for nurses. Among the technical advances in this area are electronic fetal monitoring, portable real-time ultrasound, and safer techniques for augmenting labor and performing a cesarean section. These advances have improved perinatal outcomes for twins; however, they only add information for use in clinical decision making. The reliability of the information obtained depends on the proper use of equipment and knowledge about potential errors in that equipment. In addition, errors in interpreting the fetal heart tracing may occur. The influence of gestational age on the characteristics of the tracing and the results of nonstress tests are important areas of knowledge and skill for obstetric nurses. Current clinical and technical concerns related to antepartum and intrapartum monitoring have been described to assist nurses in providing care for twins.

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