Assessment for Risk Factors

LEARNING OBJECTIVES

• Explore physiologic and psychologic aspects of high risk pregnancy.
• Discuss regionalization of health care services.
• Examine risk factors identified through history, physical examination, and diagnostic techniques.
• Differentiate among diagnostic techniques, including when they are used in pregnancy and for what purposes.
• Develop a teaching plan to explain diagnostic techniques and implications of findings to patients and their families.

KEY TERMS AND DEFINITIONS

acoustic stimulation test: Antepartum test to elicit fetal heart rate response to sound; performed by applying sound source (laryngeal stimulator) to maternal abdomen over the fetal head
alpha-fetoprotein (AFP): Fetal antigen; elevated levels in amniotic fluid and maternal blood are associated with neural tube defects
amniocentesis: Procedure in which a needle is inserted through the abdominal and uterine walls to obtain amniotic fluid; used for assessment of fetal health and maturity
amniotic fluid index (AFI): Estimation of amount of amniotic fluid by means of ultrasound to determine excess or decrease
biophysical profile (BPP): Noninvasive assessment of the fetus and its environment using ultrasonography and fetal monitoring; includes fetal breathing movements, gross body movements, fetal tone, reactive fetal heart rate, and qualitative amniotic fluid volume
chorionic villus sampling (CVS): Removal of fetal tissue from placenta for genetic diagnostic studies
daily fetal movement count (DFMC): Maternal assessment of fetal activity; the number of fetal movements within a specified time are counted; also called “kick count”
doppler blood flow analysis: Use of ultrasound for noninvasive measurement of blood flow in the fetus and placenta
magnetic resonance imaging (MRI): Noninvasive nuclear procedure for imaging tissues with high fat and water content; in obstetrics, uses include evaluation of fetal structures, placenta, and amniotic fluid volume
nonstress test (NST): Evaluation of fetal response (fetal heart rate) to natural contractile uterine activity or to an increase in fetal activity
percutaneous umbilical blood sampling (PUBS): Procedure during which a fetal umbilical vessel is accessed for blood sampling or for transfusions
uteroplacental insufficiency (UPI): Decline in placental function (exchange of gases, nutrients, and wastes) leading to fetal hypoxia and acidosis; evidenced by late decelerations of the fetal heart rate in response to uterine contractions

ELECTRONIC RESOURCES

Additional information related to the content in Chapter 21 can be found on the companion website at http://evolve.elsevier.com/Lowdermilk/Maternity/ or on the interactive companion CD:
• NCLEX Review Questions
• WebLinks
A high risk pregnancy is one in which the life or health of the mother or fetus is jeopardized by a disorder coincidental with or unique to pregnancy. For the mother, the high risk status arbitrarily extends through the puerperium (30 days after childbirth). Postbirth maternal complications are usually resolved within 1 month of birth, but perinatal morbidity may continue for months or years.

High risk pregnancy is a critical problem for modern medical and nursing care. The new social emphasis on the quality of life and the wanted child has resulted in a reduction of family size and the number of unwanted pregnancies. At the same time, technologic advances have facilitated pregnancies in previously infertile couples. As a consequence, emphasis is on the safe birth of normal infants who can develop to their potential. Scientific and technologic advances have allowed perinatal health care to reach a level far beyond that previously available.

The diagnosis of high risk imposes a situational crisis on the family (e.g., loss of pregnancy before the anticipated date, development of gestational diabetes mellitus with its potential complications, or birth of a neonate who does not meet cultural, societal, or familial norms and expectations).

**Maternal Health Problems**

The leading causes of maternal death attributable to pregnancy differ over the world. In general, three major causes have persisted for the last 50 years: hypertensive disorders, infection, and hemorrhage. The three leading causes of maternal mortality today are gestational hypertension, pulmonary embolism, and hemorrhage. Factors that are strongly related to maternal death include age (younger than 20 years and 35 years or older), lack of prenatal care, low educational attainment, unmarried status, and nonwhite race. African-American maternal mortality rates are more than three times higher than those for Caucasian women (Kochanek, Murphy, Anderson, & Scott, 2004). Reaching the goal set by Healthy People 2010 of no more than 3.3 maternal deaths per 100,000 live births (USDHHS, 2000) will be a significant challenge.

Although the overall number of maternal deaths is small, maternal mortality remains a significant problem because a high proportion of deaths are preventable, primarily through improving the access to and use of prenatal care services. Nurses can be instrumental in educating the public about the importance of obtaining early and regular care during pregnancy.

**Fetal and Neonatal Health Problems**

The leading cause of death in the neonatal period is congenital anomalies (Atias, MacDorman, Strobino, & Guyer, 2003). Other causes of neonatal death include disorders related to short gestation and low birth weight, sudden infant death, respiratory distress syndrome, and the effects of maternal complications. Racial differences in the infant mortality rates continue to challenge public health experts. Increased rates of survival during the neonatal period have resulted largely from high-quality prenatal care and the improvement in perinatal services, including technologic advances in neonatal intensive care and obstetrics.

What can be done to prevent antepartum fetal deaths? Some factors are presumed avoidable, such as failure to respond appropriately to abnormalities of pregnancy and labor. Such abnormalities may include results of fetal growth or fetal well-being assessments, significant maternal weight loss, or decreased fetal movements (Druzin, Gable, & Reed, 2002). In addition, commitment at national, state, and local levels is required to reduce the infant mortality rate. More research is needed to identify the extent to which financial, educational, sociocultural, and behavioral factors individually and collectively affect perinatal morbidity and mortality. Barriers to care must be removed and perinatal services modified to meet contemporary health care needs.

**Regionalization of Health Care Services**

Early and ongoing risk assessment is a crucial component of perinatal care. Conditions associated with perinatal morbidity and mortality can be prevented, treated, or referred to more skilled health care providers. Factors to consider when determining a patient’s risk status include resources available locally to treat the condition, availability of appropriate facilities for transport if needed, and determination of the best match for the patient’s needs.

Not all facilities develop and maintain the full spectrum of services required for high risk perinatal patients. As a consequence, regionalization of hospital-based perinatal health care services—facilities within a geographic region organized to provide different levels of care—emerged. This system of
coordinated care was also applied to preconception and ambulatory prenatal care services.

Guidelines have been established regarding the level of care that could be expected at any given facility. In ambulatory settings, providers must distinguish themselves by the level of care they provide. Basic care is provided by obstetricians, family physicians, certified nurse-midwives, and other advanced practice clinicians approved by local governance. Routine risk-oriented prenatal care, education, and support is provided. Providers offering specialty care are obstetricians who must provide fetal diagnostic testing and management of obstetric and medical complications in addition to basic care. Subspecialty care is provided by maternal-fetal medicine specialists and includes the aforementioned in addition to generic testing, advanced fetal therapies, and management of severe maternal and fetal complications (American Academy of Pediatrics [AAP] & American College of Obstetricians and Gynecologists [ACOG], 2002).

In hospital settings, perinatal services also are designated as basic, specialty, or subspecialty. Criteria for basic perinatal services include care of all patients admitted to the service, with an established triage system for high risk patients who should be transferred to a higher level of care; ability to perform a cesarean birth within 30 minutes of a decision to do so; availability of blood and blood products; availability of radiology, anesthesiology, and laboratory services on a 24-hour basis; presence of nursery and postpartum care; resuscitation and stabilization of all neonates born in the hospital; availability of transport for all sick neonates; family visitation; and data collection and retrieval (AAP & ACOG, 2002).

Subspecialty hospital care includes these requirements in addition to care of high risk mothers and fetuses, stabilization of ill neonates before transfer, and care of preterm infants with a birth weight of 1500 g or more. Women in preterm labor or those with impending births at 32 weeks of gestation or less should be transferred for subspecialty care. Additional criteria for subspecialty care include provision of comprehensive perinatal care for women and infants of all risk categories, evaluation and use of new high risk technologies and therapies, and data collection and retrieval. Collaboration among providers to meet the patient’s needs is the key in reducing perinatal morbidity and mortality (AAP & ACOG, 2002).

**Assessment of Risk Factors**

Pregnancies can be designated as high risk for any of several undesirable outcomes. Those considered to be at risk for uteroplacental insufficiency (UPI; the gradual decline in delivery of needed substances by the placenta to the fetus) carry a serious threat for fetal growth restriction, intrapartum fetal death, intrapartum death, intrapartum fetal distress, and various types of neonatal morbidity. In the past, risk factors were evaluated only from a medical viewpoint; therefore only adverse medical, obstetric, or psychologic conditions were considered to place the woman at risk. Today, a more comprehensive approach to high risk pregnancy is used, and the factors associated with high risk childbearing are grouped into broad categories based on threats to health and pregnancy outcome (see Guidelines/Guías box). Categories of risk are biophysical,
BOX 21-1

Categories of High Risk Factors

**BIOPHYSICAL FACTORS**

- Genetic considerations. Genetic factors may interfere with normal fetal or neonatal development, result in congenital anomalies, or create difficulties for the mother. These factors include defective genes, transmissible inherited disorders and chromosomal anomalies, multiple pregnancy, large fetal size, and ABO incompatibility.
- Nutritional status. Adequate nutrition, without which fetal growth and development cannot proceed normally, is one of the most important determinants of pregnancy outcome. Conditions that influence nutritional status include the following: young age; three pregnancies in the previous 2 years; tobacco, alcohol, or drug use; inadequate dietary intake because of chronic illness or food fads; inadequate or excessive weight gain; and hematocrit value less than 33%.
- Medical and obstetric disorders. Complications of current and past pregnancies, obstetric-related illnesses, and pregnancy losses put the patient at risk (see Box 21-2).

**PSYCHOSOCIAL FACTORS**

- Smoking. A strong, consistent, causal relation has been established between maternal smoking and reduced birth weight. Risks include low-birth-weight infants, higher neonatal mortality rates, increased miscarriages, and increased incidence of premature rupture of membranes. These risks are aggravated by low socioeconomic status, poor nutritional status, and concurrent use of alcohol.
- Caffeine. Birth defects in humans have not been related to caffeine consumption. High intake (three or more cups of coffee per day) has been related to a slight decrease in birth weight.
- Alcohol. Although its exact effects in pregnancy have not been quantified and its mode of action is largely unexplained, alcohol exerts adverse effects on the fetus, resulting in fetal alcohol syndrome, fetal alcohol effects, and pregnancy losses put the patient at risk (see Box 21-2).

**SOCIODEMOGRAPHIC FACTORS**

- Low income. Poverty underlies many other risk factors and leads to inadequate financial resources for food and prenatal care, poor general health, increased risk of medical complications of pregnancy, and greater prevalence of adverse environmental influences.
- Lack of prenatal care. Failure to diagnose and treat complications early is a major risk factor arising from financial barriers or lack of access to care; dispersonalization of the system resulting in long waits, routine visits, lack of ability in health care personnel, and unpleasant physical surroundings; lack of understanding of the need for early and continued care or cultural beliefs that do not support the need; and fear of the health care system and its providers.
- Age. Women at both ends of the childbearing age spectrum have a higher incidence of poor outcomes; however, age may not be a risk factor in all cases. Both physiologic and psychologic risks should be evaluated.
  a. Adolescents. More complications are seen in young mothers (younger than 15 years), who have a 60% higher mortality rate than those older than 20 years, and in pregnancies occurring less than 6 years after menarche. Complications include anemia, preeclampsia, prolonged labor, and contracted pelvis and cephalopelvic disproportion. Long-term social implications of early motherhood are lower educational status, lower income, increased dependence on government support programs, higher divorce rates, and higher parity.
  b. Mature mothers. The risks to older mothers are not from age alone but from other considerations such as number and spacing of previous pregnancies; genetic disposition of the parents; and medical history, lifestyle, nutrition, and prenatal care. The increased likelihood of chronic diseases and complications that arise from more invasive medical management of a pregnancy and labor combined with demographic characteristics put an older woman at risk. Medical conditions more likely to be experienced by mature women include hypertension and preeclampsia, diabetes, extended labor, cesarean birth, placenta previa, abruptio placenta, and mortality. Her fetus is at greater risk for low birth weight and macrosomia, chromosomal abnormalities, congenital malformations, and neonatal mortality.
  c. Poverty. The number of previous pregnancies is a risk factor associated with age and includes all first pregnancies, especially a first pregnancy at either end of the childbearing age spectrum. The incidence of preeclampsia and dystocia is higher with a first birth.
  d. Marital status. The increased mortality and morbidity rates for unmarried women, including a greater risk for preeclampsia, are often related to inadequate prenatal care and a younger childbearing age.
  e. Residence. The availability and quality of prenatal care varies widely with geographic residence. Women in metropolitan areas have more prenatal visits than do those in rural areas, who have fewer opportunities for continued.
No single test can provide this information. Assessment measures to prevent or minimize adverse perinatal outcomes. Asphyxia of the fetus so that the health care provider can take technique used identifies fetal compromise before intrauterine detection of potential fetal compromise. Ideally the technique used identifies fetal compromise before intrauterine asphyxia of the fetus so that the health care provider can take measures to prevent or minimize adverse perinatal outcomes. No single test can provide this information. Assessment tests

BIOPHYSICAL ASSESSMENT

ANTEPARTUM TESTING: CATEGORY OF HIGH RISK FACTORS—CONT'D

SOCIO DEMOGRAPHIC FACTORS—CONT'D

- Ethnicity. Although ethnicity by itself is not a major risk, race is an indicator of other sociodemographic risk factors. Nonwhite women are more than 3 times as likely as Caucasian women to die of pregnancy-related causes. African-American babies have the highest rates of prematurity and low birth weight, with the infant mortality rate among African-Americans being more than double that among Caucasians.

ENIRONMENTAL FACTORS

- Various environmental substances can affect fertility and fetal development, the chance of a live birth, and the child’s subsequent mental and physical development. Environmental influences include infections, radiation, chemicals such as pesticides, therapeutic drugs, illicit drugs, industrial pollutants, cigarette smoke, stress, and diet. Paternal exposure to mutagenic agents in the workplace has been associated with an increased risk of miscarriage.

psychosocial, sociodemographic, and environmental (Gilbert & Harmon, 2003) (Box 21-1). Biophysical risks include factors that originate within the mother or fetus and affect the development or functioning of either one or both. Examples include genetic disorders, nutritional and general health status, and medical or obstetric-related illnesses.

Psychosocial risks consist of maternal behaviors and adverse lifestyles that have a negative effect on the health of the mother or fetus. These risks may include emotional distress and disturbed interpersonal relationships, as well as inadequate social support and unsafe cultural practices.

Sociodemographic risks arise from the mother and her family. These risks may place the mother and fetus at risk. Examples include lack of prenatal care, low income, marital status, and ethnicity (see Box 21-1). Environmental factors include hazards in the workplace and the woman’s general environment and may include environmental chemicals (e.g., pesticides, lead, and mercury), radiation, and pollutants (Silbergeld & Patrick, 2005).

Risk factors are interrelated and cumulative in their effects. Box 21-2 lists specific pregnancy problems and risk factors. Risk factors for the postpartum woman and newborn are shown in Box 21-3.

The development of a comprehensive database for pregnancy risk assessment will help generate appropriate nursing diagnoses. For example, use of functional health patterns can be the basis for an assessment tool (Box 21-4).

ANTEPARTUM TESTING: BIOPHYSICAL ASSESSMENT

The major expected outcome of all antepartum testing is the detection of potential fetal compromise. Ideally the technique used identifies fetal compromise before intrauterine asphyxia of the fetus so that the health care provider can take measures to prevent or minimize adverse perinatal outcomes. No single test can provide this information. Assessment tests should be selected based on their effectiveness, and the results must be interpreted in light of the complete clinical picture. The most reliable evidence for effectiveness is provided by randomized controlled trials. Nurses can be informed about the most recent research on fetal assessment by using an up-to-date systematic review such as the Cochrane Database of Systematic Reviews (Enkin et al., 2001). Table 21-1 lists the evidence for recommending care for fetal assessment screening based on this database.

Daily Fetal Movement Count

Assessment of fetal activity by the mother is a simple yet valuable method for monitoring the condition of the fetus. The daily fetal movement count (DFMC) (also called “kick counts”) can be done at home, is noninvasive, is simple to understand, and usually does not interfere with a daily routine. The DFMC is frequently used to monitor the fetus in pregnancies complicated by conditions that may affect fetal oxygenation. These conditions include but are not limited to gestational hypertension or chronic hypertension and diabetes. The presence of movements is generally a reassuring sign of fetal health.

Several protocols are used for counting. One recommendation is to count once a day for 60 minutes and another common recommendation is that mothers count fetal activity two or three times daily for 60 minutes each time. Except for establishing a very low number of daily fetal movements or a trend toward decreased motion, the clinical value of the absolute number of fetal movements has not been established, except in the situation in which fetal movements cease entirely for 12 hours (the so-called fetal alarm signal). A count of fewer than three fetal movements within 1 hour warrants further evaluation by a nonstress test (NST) or contraction stress test (CST), biophysical profile (BPP), or a combination of these (see later discussion). Women should be taught the significance of the presence and/or absence of fetal movements, the procedure for counting that is to be used, how to record findings on a DFMC record, and when to notify the health care provider.
Assessment for Risk Factors

CHAPTER 21

Specific Pregnancy Problems and Related Risk Factors

PRETERM LABOR

- Age younger than 16 or older than 35 years
- Low socioeconomic status
- Maternal weight below 50 kg
- Poor nutrition
- Previous preterm birth
- Incompetent cervix
- Uterine anomalies
- Smoking
- Drug addiction and alcohol abuse
- Pyelonephritis, pneumonia
- Multiple gestation
- Anemia
- Abnormal fetal presentation
- Preterm rupture of membranes
- Placental abnormalities
- Infection
- Abdominal surgery in current pregnancy
- History of cervical surgery

POLYHYDRAMNIOS

- Diabetes mellitus
- Multiple gestation
- Fetal congenital anomalies
- Isoimmunization (Rh or ABO)
- Nonimmune hydrops

INTRAUTERINE GROWTH RESTRICTION (IUGR)

- Multiple gestation
- Poor nutrition
- Maternal cyanotic heart disease
- Prior pregnancy with IUGR
- Chronic hypertension
- Preeclampsia
- Recurrent antepartum hemorrhage
- Smoking
- Maternal diabetes with vascular problems
- Fetal infections
- Fetal cardiovascular anomalies
- Drug addiction and alcohol abuse
- Fetal congenital anomalies
- Hemoglobinopathies

OLIGOHYDRAMNIOS

- Renal agenesis (Potter's syndrome)
- Prolonged rupture of membranes
- IUGR
- Intrauterine fetal death

POSTTERM PREGNANCY

- Anencephaly
- Placental sulfatase deficiency
- Perinatal hypoxia, acidosis
- Placental insufficiency

CHROMOSOMAL ABNORMALITIES

- Maternal age 35 years or older
- Balanced translocation (maternal and paternal)

Factors That Place the Postpartum Woman and Neonate at High Risk

MOTHER

- Hemorrhage
- Infection
- Abnormal vital signs
- Traumatic labor or birth
- Psychosocial factors

INFANT (FOR ADMISSION TO NICU)

- High Risk
- Infants who continue with or develop signs of RDS or other respiratory distress
- Asphyxiated infants (Apgar score less than 6 at 5 min), resuscitation required at birth
- Preterm infants, dysmature infants
- Infants with cyanosis or suspected cardiovascular disease, persistent cyanosis
- Infants with major congenital malformations requiring surgery, chromosomal anomalies
- Infants with convulsions, sepsis, hemorrhagic diathesis, or shock
- Meconium aspiration syndrome

- Moderate Risk
- CNS depression for more than 24 hr
- Hypoglycemia
- Hypocalcemia
- Hyperbilirubinemia

- High Risk
- CNS depression for less than 24 hr

CNS, Central nervous system; NICU, neonatal intensive care unit; RDS, respiratory distress syndrome.
UNIT SEVEN
COMPLICATIONS OF CHILDBEARING

Assessment for High Risk Pregnancy with Functional Health Patterns

For each of the following functional health patterns, the nurse includes questions that will provide data about the woman, her family, her community, and her cultural practices and beliefs:

- **Health perception or health management pattern.** Current health, medical history, family medical history, environmental or chemical exposure, family decision making about health, community resources, beliefs about health care during pregnancy
- **Nutritional-metabolic pattern.** Nutritional status, knowledge of pregnancy needs, pregnancy discomforts, community resources (WIC), cultural eating practices
- **Elimination pattern.** Urinary and bowel patterns, family or cultural practices (laxatives), community waste and sanitation services
- **Activity-exercise pattern.** Usual exercise, recreation, community resources, cultural practices or taboos for activities during pregnancy
- **Sleep-rest pattern.** Usual sleep patterns, use of remedies, family sleep arrangements, cultural beliefs about sleep and rest in pregnancy
- **Cognitive-perceptual pattern.** Communication problems, knowledge deficits about pregnancy and birth (individual and family), community resources for support for high risk pregnant patients, cultural beliefs about pain and its management
- **Role-relationship pattern.** Feelings of security, occupation, hobbies, family living arrangements, community resources
- **Sexuality-reproductive pattern.** Sexual activities, problems, restrictions, obstetric history, current obstetric status, cultural beliefs about sexual practices during pregnancy
- **Self-perception or self-concept pattern.** Body image, responses of family to high risk pregnancy, housing conditions, cultural practices about parenting

References:

WIC, special Supplemental Nutrition Program for Women, Infants, and Children.

**TABLE 21-1**
Fetal Assessment Screening: Recommendations for Care

<table>
<thead>
<tr>
<th>FETAL ASSESSMENT TEST</th>
<th>RECOMMENDATION OR CONCLUSION</th>
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<tbody>
<tr>
<td>Doppler ultrasound use in pregnancy at high risk for fetal compromise</td>
<td>Beneficial effects</td>
</tr>
<tr>
<td>Ultrasound use to estimate gestational age in first and early second trimesters</td>
<td>Effects likely to be beneficial</td>
</tr>
<tr>
<td>Ultrasound use to confirm suspected multiple pregnancy</td>
<td>Benefits likely to be beneficial</td>
</tr>
<tr>
<td>Ultrasound use for placental location in suspected placenta previa</td>
<td>Trade-off between beneficial and adverse effects</td>
</tr>
<tr>
<td>Ultrasound use to assess amniotic fluid volume</td>
<td>Unknown effectiveness</td>
</tr>
<tr>
<td>Early second trimester amniocentesis for identification of chromosomal abnormalities</td>
<td>Unlikely to be beneficial</td>
</tr>
<tr>
<td>Transabdominal instead of transvaginal chorionic villus sampling (CVS)</td>
<td>Likely to be ineffective or harmful</td>
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<tr>
<td>Formal systems of risk scoring</td>
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<tr>
<td>Routine use of early ultrasound</td>
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<tr>
<td>CVS versus amniocentesis for diagnosing chromosomal abnormalities</td>
<td></td>
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<tr>
<td>Serum alpha-fetoprotein screening for neural tube defects</td>
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<tr>
<td>Triple screen test for Down syndrome and neural tube defects</td>
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<tr>
<td>Placental grading by ultrasound to improve perinatal outcome</td>
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<tr>
<td>Biophysical profile for fetal surveillance</td>
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<tr>
<td>Routine fetal movement counts to improve perinatal outcome</td>
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<tr>
<td>Routine use of ultrasound for fetal anthropometry (body measurements) in late pregnancy</td>
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<tr>
<td>Use of Doppler ultrasound screening in all pregnancies</td>
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<tr>
<td>Measurement of placental hormones (estriol and human placental lactogen)</td>
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<tr>
<td>Nipple stimulation test to improve perinatal outcome</td>
<td></td>
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<tr>
<td>Nonselective nonstress test to improve perinatal outcome</td>
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<tr>
<td>Contraction stress test to improve perinatal outcome</td>
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</table>

Ultrasound may be performed with the woman in a lithotomy position or with her pelvis elevated by towels, cushions, or a folded pillow. This pelvic tilt is optimal to image the pelvic structures. A protective cover such as a condom, the finger of a clean rubber surgical glove, or a special probe cover provided by the manufacturer is used to cover the transducer probe. The probe is lubricated with a water-soluble gel and placed in the vagina either by the examiner or by the woman herself. During the examination, the position of the probe or the tilt of the examining table may be changed so that the complete pelvis is in view. The procedure is not physically painful, although the woman will feel pressure as the probe is moved. Transvaginal ultrasonography is optimally used in the first trimester to detect ectopic pregnancies, monitor the developing embryo, help identify abnormalities, and help establish gestational age. In some instances it may be used as an adjunct to abdominal scanning to evaluate preterm labor in second- and third-trimester pregnancies.

Levels of ultrasonography

Perinatal care providers and ultrasonographers have come to a tentative agreement on terminology describing two different levels of ultrasonography. The basic screening or limited examination is used most frequently and can be performed by ultrasonographers or other health care professionals, including nurses, who have had special training. Indications for limited ultrasonography are described in detail in the next section; its primary use is to detect fetal viability, determine the presentation of the fetus, assess gestational age, locate the placenta, examine the fetal anatomy for malformations, and determine amniotic fluid volume (AFV). Targeted or comprehensive examinations are performed if a woman is suspected of carrying an anatomically or a physiologically abnormal fetus. Indications for a comprehensive examination include abnormal findings on clinical examination, especially with polyhydramnios or oligohydramnios, elevated alpha-fetoprotein (AFP) levels, and a history of offspring with anomalies that can be detected by ultrasound examination. Comprehensive ultrasonography is performed by highly trained and experienced personnel.

Indications for use

Major indications for obstetric sonography appear by trimester in Table 21-2. During the first trimester, ultrasound examination is performed to obtain information regarding (1) number, size, and location of gestational sacs; (2) presence or absence of fetal cardiac and body movements; (3) presence or absence of uterine abnormalities (e.g., bicornuate uterus or fibroids) or adnexal masses (e.g., ovarian cysts or an ectopic pregnancy); (4) date of pregnancy (by measuring the crown-rump length); and (5) presence and location of an intrauterine contraceptive device.

During the second and third trimesters, information regarding the following conditions is sought: (1) fetal viability; number, position, gestational age, growth pattern, and anomalies; (2) AFV; (3) placental location and maturity;...
Uterine fibroids and anomalies; adnexal masses; and cervical length.

Ultrasonography provides earlier diagnoses, allowing therapy to be instituted early in the pregnancy, thereby decreasing the severity and duration of morbidity, both physical and emotional, for the family. For instance, early diagnosis of a fetal anomaly gives the family choices such as (1) intrauterine surgery or other therapy for the fetus, (2) termination of the pregnancy, or (3) preparation for the care of an infant with a disorder.

Fetal heart activity. Fetal heart activity can be demonstrated as early as 6 to 7 weeks by real-time scanners and at 10 to 12 weeks by Doppler mode. By 9 to 10 weeks, gestational trophoblastic disease can be diagnosed. Fetal death can be confirmed by lack of heart motion, the presence of fetal scalp edema, and maceration and overlap of the cranial bones.

Gestational age. Gestational dating by ultrasonography is indicated for conditions such as (1) uncertain dates for the last normal menstrual period, (2) recent discontinuation of oral contraceptives, (3) bleeding episode during the first trimester, (4) uterine size that does not agree with dates, and (5) other high risk conditions.

During the first 20 weeks of gestation, ultrasonography provides an accurate assessment of gestational age because most normal fetuses grow at the same rate. Accuracy is increased as the fetus ages because more than one variable is measured. The four methods of fetal age estimation used include: (1) determination of gestational sac dimensions (at about 8 weeks), (2) measurement of crown-rump length (between 7 and 12 weeks), (3) measurement of the biparietal diameter (BPD) after 12 weeks, and (4) measurement of femur length (after 12 weeks). Fetal BPD at 36 weeks should be approximately 8.7 cm. Term pregnancy and fetal maturity can be diagnosed with some confidence if the biparietal measurement by ultrasound examination is greater than 9.8 cm (Fig. 21-1), especially when this is combined with appropriate femur length measurement.

In later gestational periods, serial measurements can provide a more accurate determination of fetal age. Two and preferably three composite measurements are recommended, at least 2 weeks apart, and these are plotted against standard fetal growth curves. This method, when applied between 24 and 32 weeks of gestation, yields an estimation error of 10 days more or less than the actual age (Manning, 2004).

Fetal growth. Fetal growth is determined by both intrinsic growth potential and environmental factors. Conditions that require ultrasound assessment of fetal growth include: (1) poor maternal weight gain or pattern of weight gain, (2) previous intrauterine growth restriction (IUGR), (3) chronic infections, (4) ingestion of drugs (tobacco, alcohol, over-the-counter, and street drugs), (5) maternal diabetes mellitus, (6) hypertension, (7) multifetal pregnancy, and (8) other medical or surgical complications.

Serial evaluations of BPD, limb length, and abdominal circumference (AC) (Fig. 21-2) can allow differentiation among size discrepancy resulting from inaccurate dates, true IUGR, and macrosomia. IUGR may be symmetric (the fetus grows uniformly), asymmetric (one body part grows excessively), or isolated (only part of the fetal body grows abnormally). Macrosomia may be defined as a birth weight greater than 4000 gm (8.8 lb). Macrosomia may be associated with increased risk for both cesarean section and shoulder dystocia.

TABLE 21-2

<table>
<thead>
<tr>
<th>Major Uses of Ultrasonography during Pregnancy</th>
<th>FIRST TRIMESTER</th>
<th>SECOND TRIMESTER</th>
<th>THIRD TRIMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirm pregnancy</td>
<td>Confirm viability</td>
<td>Establish or confirm dates</td>
<td>Confirm gestational age</td>
</tr>
<tr>
<td>Determine gestational age</td>
<td>Rule out ectopic pregnancy</td>
<td>Confirm viability</td>
<td>Confirm viability</td>
</tr>
<tr>
<td>Detect multiple gestation</td>
<td>Detect polyhydramnios, oligohydramnios</td>
<td>Detect polyhydramnios</td>
<td>Detect polyhydramnios</td>
</tr>
<tr>
<td>Ultrasound in chorionic villus sampling</td>
<td>Detect congenital anomalies</td>
<td>Detect intrauterine growth restriction (IUGR)</td>
<td>Detect congenital anomalies</td>
</tr>
<tr>
<td>Detect maternal abnormalities such as bicornuate uterus, ovarian cysts, fibroids</td>
<td>Confirm placenta placement</td>
<td>Confirm placenta previa or abruptio placentae</td>
<td>Use for visualization during amniocentesis</td>
</tr>
<tr>
<td>Use for visualization during amniocentesis</td>
<td>Amniotic fluid volume assessment</td>
<td>Use for visualization during amniocentesis, external version</td>
<td>Biophysical profile</td>
</tr>
<tr>
<td>Doppler flow studies</td>
<td>Biophysical profile</td>
<td>Use for visualization during amniocentesis</td>
<td>Amniotic fluid volume assessment</td>
</tr>
<tr>
<td>Detect maternal abnormalities such as bicornuate uterus, ovarian cysts, fibroids</td>
<td>Detect maternal abnormalities such as bicornuate uterus, ovarian cysts, fibroids</td>
<td>Detect maternal abnormalities such as bicornuate uterus, ovarian cysts, fibroids</td>
<td>Detect maternal abnormalities such as bicornuate uterus, ovarian cysts, fibroids</td>
</tr>
</tbody>
</table>

(4) uterine fibroids and anomalies; (5) adnexal masses; and (6) cervical length.
IUGR reflects a chronic or long-standing insult and may be caused by low genetic growth potential, intrauterine infection, undernutrition, heavy smoking, or chromosomal aberration. Asymmetric growth suggests an acute or late-occurring deprivation, such as placental insufficiency resulting from hypertension, renal disease, or cardiovascular disease. Reduced fetal growth is still one of the most frequent conditions associated with stillbirth.

Macrosomic infants (those weighing 4000 g or more) are at increased risk for traumatic injury, and asphyxia during birth. In addition, fetal macrosomia associated with maternal glucose intolerance or diabetes carries an increased risk of intratentineal fetal death. Macrosomia in the infant of a diabetic mother is asymmetric and characterized by increases in fat and muscle in the abdomen and shoulders, while head circumference remains normal. Macrosomia in an infant whose mother is obese without glucose intolerance results in symmetric changes—excessive growth of abdominal and head circumferences (Chervenak & Gabbbe, 2002).

Fetal anatomy. Anatomic structures that can be identified by ultrasonography (depending on the gestational age) include the following: head (including ventricles and blood vessels) (Fig. 21-3), neck, spine, heart, stomach, small bowel, liver, kidneys, bladder, and limbs. Ultrasonography permits the confirmation of normal anatomy, as well as the detection of major fetal malformations. The presence of an anomaly may influence the location of birth (e.g., a delivery room versus a labor-delivery-recovery room or a subspecialty center versus a basic care center) and the method of birth (vaginal versus cesarean) to optimize neonatal outcomes. The number of fetuses and their presentations also may be assessed by ultrasonography, allowing plans for therapy and method of birth to be made in advance.

Fetal genetic disorders and physical anomalies. A prenatal screening technique called fetal nuchal
translucency (FNT) screening uses ultrasound measurement of fluid in the nape of the fetal neck between 10 and 14 weeks of gestation to identify possible fetal abnormalities. A finding of abnormal fluid collection that is greater than 2.5 mm is considered abnormal, whereas a measurement of 3 mm or greater is highly indicative of genetic disorders and/or physical anomalies. If the FNT is abnormal, diagnostic genetic testing is recommended (ACOG, 2004).

Placental position and function. The pattern of uterine and placental growth and the fullness of the maternal bladder influence the apparent location of the placenta by ultrasonography. During the first trimester, differentiation between the endometrium and small placenta is difficult. By 14 to 16 weeks, the placenta is clearly defined; but if it is seen to be low lying, its relation to the internal cervical os can sometimes be dramatically altered by varying the fullness of the maternal bladder. In approximately 15% to 20% of all pregnancies in which ultrasound scanning is performed during the second trimester, the placenta seems to be overlying the os, but the incidence of placenta previa at term is only 0.9%. Therefore the diagnosis of placenta previa can seldom be confirmed before 27 weeks, primarily because of the elongation of the lower uterine segment as pregnancy advances.

Another use for ultrasonography is grading of placental maturation. Calcium deposits are of significance in postterm pregnancies because as they increase, the available surface area that can be adequately bathed by maternal blood decreases. The point at which this results in fetal wastage and hypoxia cannot be determined precisely; however, the effects are usually observable by 42 weeks and are progressive (Gilbert & Harmon, 2003).

Adjunct to other invasive tests. The safety of amniocentesis is increased when the positions of the fetus, placenta, and pockets of amniotic fluid can be identified accurately. Ultrason scanning has reduced risks previously associated with amniocentesis, such as fetal maternal hemorrhage from a pierced placenta. Percutaneous umbilical blood sampling (PUBS) and chorionic villus sampling also are guided by ultrasonography to identify the cord and chorion frondosum accurately (see Fig. 21-3, B).

Fetal well-being. Physiologic parameters of the fetus that can be assessed with ultrasound scanning include AFV, vascular waveforms from the fetal circulation, heart motion, fetal breathing movements (FBMs), fetal urine production, and fetal limb and head movements. Assessment of these parameters, singly or in combination, yields a fairly reliable picture of fetal well-being. The significance of these findings is discussed in the following sections.

Doppler blood flow analysis. One of the major advances in perinatal medicine is the ability to study blood flow noninvasively in the fetus and placenta with ultrasound. Doppler blood flow analysis is a helpful adjunct in the management of pregnancies at risk because of hypertension, IUGR, diabetes mellitus, multiple fetuses, or preterm labor.

When a sound wave is reflected from a moving target, there is a change in frequency of the reflected wave relative to the transmitted wave. This is called the Doppler effect. An ultrasound beam scattered by a group of red blood cells (RBCs) is an example of this effect. The velocity of the RBCs can be determined by measuring the change in the frequency of the sound wave reflected off the cells (Fig. 21-4).

The shifted frequencies can be displayed as a plot of velocity versus time, and the shape of these waveforms can be analyzed to give information about blood flow and resistance in a given circulation. Velocity waveforms from umbilical and uterine arteries, reported as systolic/diastolic (S/D) ratios, can be first detected at 15 weeks of pregnancy. Because of the progressive decline in resistance in both the umbilical and uterine arteries, this ratio decreases as pregnancy advances. Most fetuses will achieve an S/D ratio of 3 or less by 30 weeks. Persistent elevation of S/D ratios after 30 weeks is associated with IUGR, usually resulting from URI (Druzin, Gabbe, & Reed, 2002). In postterm pregnancies evaluated by Doppler umbilical flow studies, an elevated S/D ratio indicates a poorly perfused placenta. Abnormal results also are seen with certain chromosome abnormalities (trisomy 13 and 18) in the fetus and with lupus erythematosus in the mother. Exposure to nicotine from maternal smoking also has been reported to increase the S/D ratio.

Amniotic fluid volume. Abnormalities in AFV are frequently associated with fetal disorders. Subjective determinants of oligohydramnios (decreased fluid) include the absence of fluid pockets in the uterine cavity and the impression of crowding of small fetal parts. An objective criterion of decreased AFV is met if the largest pocket of fluid measured in two perpendicular planes is less than 2 cm (Manning, 2004). In polyhydramnios (increased fluid), subjective criteria include multiple large pockets of fluid, the impression of a floating fetus, and free movement of fetal limbs. The diagnosis may be made when the largest pocket of fluid exceeds 8 cm in two perpendicular planes (Chervenak & Gabbe, 2002).

The total AFV can be evaluated by a method in which the depths (in centimeters) of the amniotic fluid in all four quadrants...
rants surrounding the maternal umbilicus are totaled, providing an amniotic fluid index (AFI). An AFI less than 5 cm indicates oligohydramnios; 5 to 19 cm is considered a normal measurement; and a measurement greater than 20 cm reflects polyhydramnios (Chervenak & Gabbe, 2002). Oligohydramnios is associated with congenital anomalies (such as renal agenesis), growth restriction, and fetal distress during labor. Polyhydramnios is associated with neural tube defects (NTDs), obstruction of the fetal gastrointestinal tract, multiple fetuses, and fetal hydrops.

**Biophysical profile.** Real-time ultrasound permits detailed assessment of the physical and physiologic characteristics of the developing fetus and cataloging of normal and abnormal biophysical responses to stimuli. The biophysical profile (BPP) is a noninvasive dynamic assessment of a fetus that is based on acute and chronic markers of fetal disease. The BPP includes FBMs, fetal movements, fetal tone, fetal heart rate (FHR) patterns by means of an NST, and AFV. The BPP may therefore be considered a physical examination of the fetus, including determination of vital signs. The fetal response to central hypoxia is alteration in movement, muscle tone, breathing, and heart rate patterns. The presence of normal fetal biophysical activities indicates that the central nervous system (CNS) is functional, and the fetus therefore is not hypoxemic (Harman, 2004). BPP variables and scoring are detailed in Table 21-3.

The BPP is an accurate indicator of impending fetal death. Fetal acidosis can be diagnosed early with a nonreactive NST and absent FBMs. An abnormal BPP score and oligohydramnios are indications that labor should be induced (Harman, 2004). Fetal infection in women whose membranes rupture prematurely (at less than 37 weeks of gestation) can be diagnosed early by changes in biophysical activity that precede the clinical signs of infection and indicate the necessity for immediate birth. When the BPP score is normal and the risk of fetal death low, intervention is indicated only for obstetric or maternal factors.

**Nursing role**

Although a growing number of nurses perform ultrasound scans and BPPs in certain centers, the main role of nurses is in counseling and educating women about the procedure (Garcia et al., 2002). Providing accurate information regarding the procedure is imperative to allay the mother’s anxiety. Although ultrasound scanning has become a widely used diagnostic tool, recommendations for the procedure are based on expectations of a fetal problem and therefore may cause concern. Women should be provided ample opportunity to

<table>
<thead>
<tr>
<th>TABLE 21-3</th>
<th>Biophysical Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>VARIABLES</td>
<td>NORMAL (SCORE = 2)</td>
</tr>
<tr>
<td>Fetal breathing movements</td>
<td>One or more episodes in 30 min, each lasting (\geq 30) sec</td>
</tr>
<tr>
<td>Gross body movements</td>
<td>Three or more discrete body or limb movements in 30 min (episodes of active continuous movement are considered as a single movement)</td>
</tr>
<tr>
<td>Fetal tone</td>
<td>One or more episodes of active extension with return to flexion of fetal limb(s) or trunk opening and closing of hand is considered normal tone</td>
</tr>
<tr>
<td>Reactive fetal heart rate</td>
<td>Two or more episodes of acceleration ((\geq 15) beats/min) in 20 min, each lasting (\geq 15) sec and associated with fetal movement</td>
</tr>
<tr>
<td>Qualitative amniotic fluid volume</td>
<td>One or more pockets of fluid measuring (\geq 1) cm in two perpendicular planes</td>
</tr>
</tbody>
</table>

**SCORE**

- Normal: 8-10 (if amniotic fluid index is adequate)
- Equivocal: 6
- Abnormal: \(< 4\)

ask questions and be reassured that the procedure is safe. In the 30 years that diagnostic ultrasonography has been used, no conclusive evidence of any harmful effects on humans has emerged. Although the possibility of unidentified biologic effects exists, the benefits to the patient of prudent use of diagnostic ultrasonography appear to outweigh any possible risk (Chervenak & Gabbe, 2002).

**LEGAL TIP**

**Performance of Limited Ultrasound Examinations**

Nurses who have the training and competence may perform limited ultrasound examinations if it is within the scope of practice in their state or area and consistent with regulations of the agencies in which they practice (Manahan, 2000). Limited ultrasound examinations include identification of fetal number, fetal presentation, fetal cardiac activity, location of the placenta, and BPP including APV assessment. Women should be informed about the limited information provided by these examinations. They are not meant to evaluate or identify fetal anomalies, assess fetal age, or estimate fetal weight (Stringer, Miesnik, Brown, Menei, & Macones, 2003). The obstetric health care provider is responsible for obtaining a more comprehensive ultrasound examination when complete patient assessment is necessary (Association of Women’s Health, Obstetric and Neonatal Nurses [AWHONN], 1998).

**Magnetic Resonance Imaging**

Magnetic resonance imaging (MRI) is a noninvasive radiologic technique used for obstetric and gynecologic diagnosis. Like computed tomography (CT), MRI provides excellent pictures of soft tissue. Unlike CT, ionizing radiation is not used; therefore vascular structures within the body can be visualized and evaluated without injection of an iodinated contrast medium, thus eliminating any known biologic risk. Like sonography, MRI is noninvasive and can provide images in multiple planes, but there is no interference from skeletal, fatty, or gas-filled structures, and imaging of deep pelvic structures does not require a full bladder. With MRI, the examiner can evaluate (1) fetal structure and function; (2) placenta (position, density, and presence of gestational trophoblastic disease); (3) quantity of amniotic fluid; (4) maternal structures (uterus, cervix, adnexa, and pelvis); (5) biochemical status (pH, adenosine triphosphate content) of tissues and organs; and (6) soft-tissue, metabolic, or functional anomalies.

The woman is placed on a table in the supine position and slid into the bore of the main magnet, which is similar in appearance to a CT scanner. Depending on the reason for the study, the procedure may take from 20 to 60 minutes, during which time the woman must be perfectly still except for short respirations. Because of the long time needed to produce MRIs, the fetus will probably move, which will obscure anatomic details. The only way to ensure that this does not occur is to administer a sedative to the mother, but this approach should be reserved for selected cases in which visualization of fetal detail is critical.

MRI has little effect on the fetus; concerns that the FHR or fetal movement would decrease have not been supported.

**BIOCHEMICAL ASSESSMENT**

Biochemical assessment involves biologic examination (e.g., as chromosomes in exfoliated cells) and chemical determinations (e.g., lecithin/sphingomyelin [L/S] ratio and bilirubin level) (Table 21-4). Procedures used to obtain the needed specimens include amniocentesis, PUBS, chorionic villus sampling, and maternal sampling (Box 21-5).

**Amniocentesis**

Amniocentesis is performed to obtain amniotic fluid, which contains fetal cells. Under direct ultrasonographic visualization, a needle is inserted transabdominally into the uterus, amniotic fluid is withdrawn into a syringe, and the various assessments are performed (Fig. 21-5). Amniocentesis is possible after week 14 of pregnancy, when the uterus becomes an abdominal organ, and sufficient amniotic fluid is available for testing. Indications for the procedure include prenatal diagnosis of genetic disorders or congenital anomalies (NTDs in particular), assessment of pulmonary maturity, and diagnosis of fetal hemolytic disease.

Complications in the mother and fetus occur in fewer than 1% of the cases and include the following:

- Maternal: Hemorrhage, fetomaternal hemorrhage with possible maternal Rh isoimmunization, infection, labor, abruptio placenta, inadvertent damage to the intestines or bladder, and amniotic fluid embolism. Because of the possibility of fetomaternal hemorrhage, it is standard practice after an amniocentesis to administer RhD immune globulin to the woman who is Rh negative.
- Fetal: Death, hemorrhage, infection (amnionitis), direct injury from the needle, miscarriage or preterm labor, and leakage of amniotic fluid.

Many of the complications have been minimized or eliminated by using ultrasonography to direct the procedure.

**BOX 21-5**

**Fetal Rights**

Amniocentesis, percutaneous umbilical blood sampling (PUBS), and chorionic villus sampling (CVS) are prenatal tests used for diagnosing fetal defects in pregnancy. They are invasive and carry risks to the mother and fetus. A consideration of induced abortion is linked to the performance of these tests because there is no treatment for genetically affected fetuses; therefore the issue of fetal rights is a key ethical concern in prenatal testing for fetal defects.
Indications for use

Genetic concerns. Prenatal assessment of genetic disorders is indicated in women older than 35 years (Box 21-6), with a previous child with a chromosomal abnormality, or with a family history of chromosomal anomalies. Inherited errors of metabolism (such as Tay-Sachs disease, hemophilia, and thalassemia) and other disorders for which marker genes are known also may be detected. Fetal cells are cultured for karyotyping of chromosomes (see Chapter 7). Karyotyping also permits determination of fetal sex, which is important if an X-linked disorder (occurring almost always in a male fetus) is suspected.

### TABLE 21-4

Summary of Biochemical Monitoring Techniques

<table>
<thead>
<tr>
<th>TEST</th>
<th>POSSIBLE FINDINGS</th>
<th>CLINICAL SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERNAL BLOOD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coombs’ test</td>
<td>Titer of 1:8 and increasing</td>
<td>Significant Rh incompatibility</td>
</tr>
<tr>
<td>AFP</td>
<td>See below</td>
<td></td>
</tr>
<tr>
<td>AMNIOTIC FLUID ANALYSIS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>Meconium</td>
<td>Possible hypoxia or asphyxia</td>
</tr>
<tr>
<td>L/S ratio</td>
<td>&gt;2:1</td>
<td>Fetal lung maturity</td>
</tr>
<tr>
<td>Phosphatidylglycerol</td>
<td>Present</td>
<td></td>
</tr>
<tr>
<td>Creatinine</td>
<td>&gt;2 mg/dl</td>
<td>Gestational age &gt;36 weeks</td>
</tr>
<tr>
<td>Bilirubin (LOD, 450 nm)</td>
<td>&lt;0.01</td>
<td>Gestational age &gt;36 weeks, normal pregnancy</td>
</tr>
<tr>
<td>Lipid cells</td>
<td>&gt;10%</td>
<td>Fetal hemolytic disease in Rh is immunized pregnancies</td>
</tr>
<tr>
<td>AFP</td>
<td>High levels after 15-week gestation</td>
<td>Gestational age &gt;35 weeks</td>
</tr>
<tr>
<td>Osmolality</td>
<td>Decline after 20-week gestation</td>
<td>Open neural tube or other defect</td>
</tr>
<tr>
<td>Genetic disorders</td>
<td>Dependent on cultured cells for</td>
<td>Advancing gestational age</td>
</tr>
<tr>
<td>Sex-linked</td>
<td>karyotype and enzymatic activity</td>
<td>Counseling possibly required</td>
</tr>
<tr>
<td>Chromosomal Metabolic</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AFP**, Alpha-fetoprotein; **L/S**, lecithin-sphingomyelin.

![Fig. 21-5](image) A, Amniocentesis and laboratory use of amniotic fluid aspirant. B, Transabdominal amniocentesis. (B, Courtesy Marjorie Pyle, RNC, Lifecircle, Costa Mesa, CA.)
Indication for Invasive Prenatal Diagnosis

Elimination of Maternal Age as an indication for invasive prenatal diagnosis. For example, AFP levels in amniotic fluid are assessed as a follow-up for elevated levels in maternal serum. Though AFP levels in amniotic fluid help confirm the diagnosis of an NTD such as spina bifida or anencephaly or an abdominal wall defect such as omphalocele. The elevation results from the increased leakage of cerebrospinal fluid into the amniotic fluid through the closure defect. AFP levels may also be elevated in a normal multifeetal pregnancy and with intestinal atresia, presumably caused by lack of fetal swallowing.

A concurrent test that finds the presence of acetylcholinesterase almost always indicates a fetal defect (Jenkins & Wapner, 2004). In such instances, follow-up ultrasound examination is recommended.

Fetal maturity. Accurate assessment of fetal maturity is possible through examination of amniotic fluid or its exfoliated cellular contents. The laboratory tests described are determinants of term pregnancy and fetal maturity (see Table 21-4). A quick means of determining an approximate L/S ratio is the shake test, foam test, or bubble stability test. Serial dilutions of fresh amniotic fluid are mixed with ethanol and shaken. After 15 minutes, the amount of bubbles present at different dilutions indicates the presence of surfactant.

Fetal hemolytic disease. Another indication for amniocentesis is the identification and follow-up of fetal hemolytic disease in cases of isoimmunization. The procedure is usually not done until the mother’s antibody titer reaches 1:8 and is increasing. Currently PUBS is the procedure of choice to evaluate and treat fetal hemolytic disease.

Meconium. The presence of meconium in the amniotic fluid is usually determined by visual inspection of the sample. The significance of meconium in the fluid varies depending on when it is found.

Antepartal period. Meconium in the amniotic fluid before the beginning of labor is not usually associated with an adverse fetal outcome. The finding may be the result of acute and subsequently corrected fetal stress, chronic continuing stress, or simply the physiologic passage of meconium. Because there has been some association between the presence of meconium in amniotic fluid in the third trimester and hypotensive disorders and postmaturity, the fetus should undergo further antepartum evaluation if the birth is not imminent (Glantz & Woods, 2004).

Intrapartal period. Intrapartal meconium-stained amniotic fluid is an indication for more careful evaluation by electronic fetal monitoring (EFM) and perhaps fetal scalp blood sampling. The presence of meconium, however, should not be the sole indicator for intervention.

Three possible reasons for the passage of meconium during the intrapartal period are as follows: (1) it is a normal physiologic function that occurs with maturity (meconium passage being infrequent before weeks 23 or 24 with an increased incidence after 38 weeks); (2) it is the result of hypoxia-induced perinatal and splanchnic relaxation; and (3) it may be a sequel to umbilical cord compression-induced vagal stimulation in mature fetuses. Thick, fresh meconium passed for the first time in late labor and in association with nonremediable severe variable or late FHR decelerations is an ominous sign.

Chorionic Villus Sampling

The combined advantages of earlier diagnosis and rapid results have made chorionic villus sampling (CVS) a popular technique for genetic studies, although some risks to the fetus exist. Although indications for CVS are similar to those for amniocentesis, second-trimester amniocentesis appears to be safer than CVS (Alfirevic, Sundberg, & Brigham, 2003). The benefits of earlier diagnosis must be weighed against the increased risk of pregnancy loss and risk of anomalies.

The procedure is performed between 10 and 12 weeks of gestation and involves the removal of a small tissue specimen from the fetal portion of the placenta (Fig. 21-6). Because chorionic villi originate in the yolk sac, this tissue reflects the genetic makeup of the fetus.

CVS procedures can be accomplished either transcervically or transabdominally. In transcervical sampling, a sterile catheter is introduced into the cervix under continuous ultrasonographic guidance, and a small portion of the chorionic villi is aspirated with a syringe. The aspiration cannula and obturator must be placed at a suitable site, and rupture of the amniotic sac must be avoided. If the abdominal approach is used, an 18-gauge spinal needle with stylet is inserted under sterile conditions through the abdominal wall into the chorion frondosum under ultrasound guidance. The stylet is then withdrawn, and the chorionic tissue is aspirated into a syringe (see Fig. 21-6). Complications of the procedure include vaginal spotting or bleeding immediately afterward, miscarriage (in 0.3% of

**BOX 21-6**

Elimination of Maternal Age as an Indication for Invasive Prenatal Diagnosis

Maternal age of 35 years and older has been a standard indication for invasive prenatal testing since 1979 despite a sensitivity of only 30%. The importance of age as a single indication for testing is being reevaluated, as serum screening has evolved. The most effective use of resources involves screening the whole population of pregnant women. Presently many centers offer the option of screening before invasive testing for women over 35 years of age (Jenkins & Wapner, 2004).
cases), rupture of membranes (in 0.1% of cases), and chorioamnionitis (in 0.5% of cases). Because of the possibility of fetomaternal hemorrhage, women who are Rh negative should receive immune globulin to avoid isoimmunization (Gilbert & Hamson, 2003). An increased risk of limb anomalies (transverse digital anomalies) has been noted when CVS is done before 10 weeks of gestation (Wilson, 2000).

Use of amniocentesis and CVS is declining because of advances in noninvasive screening techniques. These techniques include measurement of nuchal translucency, maternal serum screening tests in the first and second trimesters, and ultrasonography in the second trimester (Benn, Egan, Fang, & Smith-Bindman, 2004).

Percutaneous Umbilical Blood Sampling

Direct access to the fetal circulation during the second and third trimesters is possible through percutaneous umbilical blood sampling (PUBS), or cordocentesis, which is the most widely used method for fetal blood sampling and transfusion. PUBS involves the insertion of a needle directly into a fetal umbilical vessel under ultrasound guidance. Ideally, the umbilical cord is punctured 1 to 2 cm from its insertion into the placenta (Fig. 21-7) (Simpson, 2002). At this point the cord is well anchored and will not move, and the risk of maternal blood contamination (from the placenta) is slight. Generally, 1 to 4 ml of blood is removed and tested immediately by the Kleihauer-Betke procedure to ensure that it is fetal in origin. Indications for use of PUBS include prenatal diagnosis of inherited blood disorders, karyotyping of malformed fetuses, detection of fetal infection, determination of the acid-base status of fetuses with IUGR, and assessment and treatment of isoimmunization and thrombocytopenia in the fetus (Jenkins & Wagner, 2004). Complications that can occur include leaking of blood from the puncture site, cord laceration, thromboembolism, preterm labor, premature rupture of membranes, and infection (Simpson, 2002).

In fetuses at risk for isoimmune hemolytic anemia, PUBS permits precise identification of fetal blood type and RBC count and may prevent the need for further intervention. If the fetus is positive for the presence of maternal antibodies, a direct blood test can confirm the degree of anemia resulting from hemolysis. Intrauterine transfusion of severely anemic fetuses can be done 4 to 5 weeks earlier than through the intraperitoneal route. Follow-up includes continuous FHR monitoring for several minutes to 1 hour and a repeated ultrasound examination 1 hour later to ensure that no further bleeding or hematoma formation has occurred.

Maternal Assays

Alpha-fetoprotein (AFP) (MSAFP) levels have been used as a screening tool for NTDs in pregnancy. Through this technique, approximately 80% to 85% of all open NTDs and open abdominal wall defects can be detected early in pregnancy. Screening is recommended for all pregnant women. The cause of NTDs is not well understood, but 95% of all affected infants are born to women with no family history of similar anomalies (Jenkins & Wagner, 2004). The defect occurs in 1 to 2 per 1000 births in most parts of the United States. The birth of one affected child increases the risk of NTD recurrence in future pregnancies to 1% to 5% (Fanaroff, Martin, & Rodriguez, 2004).
EVIDENCE-BASED PRACTICE
Prenatal Diagnostics: Amniocentesis and Chorionic Villus Sampling

BACKGROUND
- Women requesting prenatal genetic diagnostic testing may have anxiety while waiting, receive false-positive results (abnormal results but a normal fetus), and have a lack of options if the test is abnormal. Many women want the testing done early enough that they may consider pregnancy termination if the results are abnormal.
- Amniocentesis is conventionally done around 16 weeks of gestation. Genetic results are returned after 18 weeks, in time for the woman to choose a second-trimester termination. The wait is agonizing for parents, and second-trimester abortion is not always a personal option, nor is it always available.
- There is pressure for earlier diagnostic procedures, such as chorionic villus sampling (CVS) of the placenta, accessed either transabdominally or transcervically. Most clinicians delay this procedure until after 9 weeks of gestation because of some limb reduction (missing or hypoplastic limbs) seen after early CVS. Early amniocentesis is another option, requiring skillful removal of amniotic fluid from the inner amniotic sac only, filtering for fetal cells, and replacing the fluid. Both early procedures may cause pregnancy loss.

OBJECTIVE
- The reviewers’ goal was to compare early and late amniocentesis and chorionic villus sampling (both transabdominal and transcervical) for safety and accuracy. Outcomes were the technical difficulties encountered in sampling, problems with the genetic analysis, pregnancy complications such as bleeding, leaking fluid, preterm labor, any pregnancy losses and still births, and neonatal abnormalities, such as talipes (clubfoot), hemangiomas, limb reduction, respiratory distress syndrome, low birth weight, and admission to special care nursery.

METHODS
Search Strategy
- The reviewers searched Cochrane, MEDLINE, 30 journals, and a weekly awareness search that covered 37 journals. Search keywords included amniocentesis and chorionic villus sampling.
- There were 14 randomized studies that were accepted into this review, ranging in publication dates from 1986 to 1999. The number of women was not reported for every study but totaled more than 15,000. The countries of origin included Denmark, Sweden, Finland, Italy, the United States, and Canada.

Statistical Analyses
- Statistical analyses allowed a weighted estimate of risk for each outcome, and the results were pooled from the studies.

FINDINGS
- The incidence of pregnancy loss after second-trimester amniocentesis was 3%, which was not significantly increased over the general population risk of 2%. However, amniocentesis was associated with an increased risk of spontaneous miscarriage and amniotic fluid leakage.
- Second-trimester amniocentesis was safer and easier than early amniocentesis, with fewer fetal anomalies, fewer needle inserts, fewer lab failures (because of inadequate fetal cells), and fewer false negatives. Transcervical CVS was associated with significantly more pregnancy loss, more lab failures, and more vaginal bleeding than second-trimester amniocentesis. Transabdominal CVS appears to be safer than the transcervical procedure. Early amniocentesis appeared to cause more spontaneous miscarriage than transabdominal CVS. The incidence of anomalies was not increased significantly.

LIMITATIONS
- The expertise of the operators varied, as CVS was fairly new in 1991. This, however, may not necessarily be a limitation, because it reflects the reality that there are always practitioners of varying skill levels practicing. Some studies “randomized” by giving women the choice of procedures. During the course of some of the trials, information became publicized about CVS leading to limb reduction (never replicated in later, larger studies), and so recruitment and dropouts became a problem. None of the trials assessed the laboratory accuracy adequately. One large trial excluded 70% of potential CVS-randomized women because of placental position, thus reducing generalizability.

CONCLUSIONS
- Second-trimester amniocentesis appears to be the safest and most accurate prenatal diagnostic procedure. Amniocentesis should always be considered before 15 weeks of gestation. Transabdominal CVS is preferable if an early procedure is warranted. If the transcervical procedure is contraindicated, then transcervical CVS is preferred in the first trimester and amniocentesis is preferred in the second trimester.

IMPLICATIONS FOR PRACTICE
- Women presented with the possibility of fetal anomalies need to know the risks and benefits of the diagnostic procedures offered. They also need to consider the therapeutic options available, should the results be abnormal, including the availability and acceptability of second-trimester abortion.

IMPLICATIONS FOR FURTHER RESEARCH
- Much more research needs to focus on the acceptability and satisfaction of women with the procedures, and their decision making. The unavailability of second-trimester abortion in some areas creates hardships that deserve re-search. All new prenatal procedures should be rigorously tested before general use. Outcomes should include antenatal and neonatal loss, details about anomalies, and diagnostic accuracy. Neonatal assessors should be blinded as to procedure used.
AFP is produced by the fetal liver, and increasing levels are detectable in the serum of pregnant women from 14 to 34 weeks. Although amniotic fluid AFP is diagnostic for NTD, MSAFP is a screening tool only and identifies candidates for the more definitive procedures of amniocentesis and ultrasound examination. MSAFP screening can be done with reasonable reliability any time between 15 and 22 weeks of gestation (16 to 18 weeks being ideal) (Jenkins & Wapner, 2004).

Once the maternal level of AFP is determined, it is compared with normal values for each week of gestation. Values also should be correlated with maternal age, weight, race, and whether the woman has insulin-dependent diabetes. If findings are abnormal, follow-up procedures include genetic counseling for families with a history of NTD, repeated AFP, ultrasound examination, and possibly, amniocentesis.

Down syndrome and probably other autosomal trisomies are associated with lower-than-normal levels of MSAFP and amniotic fluid AFP. The triple-marker test also is performed at 16 to 18 weeks of gestation and uses the levels of three maternal serum markers, MSAFP, unconjugated estriol, and human chorionic gonadotropin (hCG), in combination with maternal age, to calculate a new risk level. In the presence of a fetus with Down syndrome, the MSAFP and unconjugated estriol levels are low, whereas the hCG level is elevated. With these two additional screening tests, approximately 60% of cases of Down syndrome can be identified. Other maternal markers are being investigated as predictors of fetal abnormalities as well. Serum pregnancy-associated plasma protein A (PAPP-A) is low in Down syndrome, whereas another substance, inhibin-A, is elevated in Down syndrome and other trisomies (Simpson, 2002).

As with MSAFP, these tests are screening procedures only and are not diagnostic. A definitive examination of amniotic fluid for AFP and chromosomal analysis combined with ultrasound visualization of the fetus is necessary for diagnosis.

Coombs' Test

The indirect Coombs' test is a screening for Rh incompatibility. If the maternal titer for Rh antibodies is greater than 1:8, amniocentesis for determination of bilirubin in amniotic fluid is indicated to establish the severity of fetal hemolytic anemia. Coombs' test also can detect other antibodies that may place the fetus at risk for incompatibility with maternal antigens.

Critical Thinking Exercise

Down Syndrome

Patty and David, both 37 years old, are expecting their first baby. Patty is 8 weeks pregnant and is worried about the risk of their baby being born with Down syndrome. She tells the nurse that she is relieved to be having an ultrasound done today because the procedure will show whether or not the baby has Down syndrome and she won’t have to have other tests. What response by the nurse to Patty’s statement would be appropriate?

1. Evidence—Is there sufficient evidence to draw conclusions about what response the nurse should give?
2. Assumptions—Describe underlying assumptions about the following issues:
   a. Maternal age and risk of Down syndrome
   b. Ultrasound use by trimester
   c. Screening versus diagnosis for Down syndrome
   d. What implications and priorities for nursing care can be made at this time?
3. Does the evidence objectively support your conclusion?
4. Are there alternative perspectives to your conclusion?
UNIT SEVEN
COMPLICATIONS OF CHILDBEARING

Fetal Responses to Hypoxia and Asphyxia

Observable fetal responses to hypoxia or asphyxia are the clinical basis for testing with EFM. Hypoxia or asphyxia elicits a number of responses in the fetus. Blood flow is redistributed to certain vital organs. This series of responses (re-distribution of blood flow favoring vital organs, decrease in total oxygen consumption, and switch to anaerobic glycolysis) is a temporary mechanism that enables the fetus to survive up to 30 minutes of limited oxygen supply without death. Other conditions in which the CST may be contraindicated are multifetal pregnancy, previous preterm labor, hydramnios, more than 36 weeks of gestation, and incompetent cervix. As a rule, reactive patterns with the NST or negative results with the CST are associated with favorable outcomes.

Variability

Considerable evidence supports the clinical belief that FHR variability indicates an intact nervous pathway through the cerebral cortex, midbrain, vagus nerve, and cardiac conduction system. With 98% accuracy in predicting fetal well-being, the presence of normal FHR variability is a reassuring indicator. Inputs from various areas of the brain decrease after cerebral asphyxia, leading to a decrease in variability after failure of the fetal hemodynamic compensatory mechanisms to maintain cerebral oxygenation (Parer & Nageotte, 2004).

Nonstress Test

The nonstress test (NST) is the most widely applied technique for antepartum evaluation of the fetus. It is an ideal screening test and is the primary method of antepartum fetal assessment at most sites. The basis for the NST is that the normal fetus will produce characteristic HR patterns in response to fetal movement. In the healthy fetus with an intact CNS, 90% of gross fetal body movements are associated with accelerations of the FHR. The acceleration with movement response may be blunted by hypoxia, acidosis, drugs (analgesics, barbiturates, and beta-blockers), fetal sleep, and some congenital anomalies (Tucker, 2004). The NST can be performed easily and quickly in an outpatient setting because it is noninvasive, is relatively inexpensive, and has no known contraindications. Disadvantages center around the high rate of false-positive results for nonreactivity as a result of fetal sleep cycles, chronic tobacco smoking, medications, and fetal immaturity. The test also is slightly less sensitive in detecting fetal compromise than are the CST or BPP.

Procedure

The woman is seated in a reclining chair (or in semi-Fowler position) with a slight left tilt to optimize uterine perfusion and avoid supine hypotension. The FHR is recorded with a Doppler transducer, and a tocodynamometer is applied to detect uterine contractions or fetal movements. The tracing is observed for signs of fetal activity and a concurrent acceleration of FHR. If evidence of fetal movement is not apparent on the tracing, the woman may be asked to depress a button on a hand-held event marker connected to the monitor when she feels fetal movement. The movement is then noted on the tracing. Because almost all accelerations are accompanied by fetal movement, the movements need not be recorded for the test to be considered reactive. The test is usually completed within 20 to 30 minutes, but it may take longer if the fetus must be awakened from a sleep state. It has been suggested that the woman drink orange juice or be given glucose to increase her blood sugar level and thereby stimulate fetal movements. This practice is common; however, research has not proven this practice to be effec-

INDICATIONS FOR ELECTRONIC FETAL MONITORING ASSESSMENT USING NST AND CST

- Maternal diabetes mellitus
- Chronic hypertension
- Hypertensive disorders in pregnancy
- Intrauterine growth restriction
- Sickle cell disease
- Maternal cyanotic heart disease
- Postmaturity
- History of previous stillbirth
- Decreased fetal movement
- Isoimmunization
- Meconium-stained amniotic fluid at third-trimester amniocentesis
- Hyperthyroidism
- Collagen disease
- Older pregnant woman
- Chronic renal disease

NST: nonstress test; CST: contraction stress test.
Some sources suggest that fetal movements increase when maternal glucose levels are low. Other methods that have been used to stimulate fetal activity, such as manipulating the woman’s abdomen or using a transvaginal light, have not been very effective either. Only vibroacoustic stimulation has had some impact (Tan & Smyth, 2001).

**Interpretation**

Generally accepted criteria for a reactive tracing are as follows:

- Two or more accelerations of 15 beats/min lasting for 15 seconds over a 20-minute period
- Normal baseline rate
- Long-term variability amplitude of 10 or more beats/min

If the test does not meet the criteria after 40 minutes, it is considered nonreactive (Tucker, 2004). If the baseline pattern is nonreactive, the sound source (usually a laryngeal stimulator) is then activated for 3 seconds on the maternal abdomen over the fetal head. Monitoring continues for another 5 minutes, after which the monitor tracing is assessed. A test is considered reactive if there is an immediate and sustained increase in long-term variability and HR accelerations. The accelerations produced may have a significant increase in duration. The test may be repeated at 1-minute intervals up to 3 times when there is no response. Further evaluation weekly (after 28 weeks of gestation) with women who have diabetes or are at risk for having a fetal death (Druzin, Gabbe, & Reed, 2002).

**Vibroacoustic Stimulation**

Vibroacoustic stimulation (also called fetal acoustic stimulation test) is another method of testing antepartum FHR response and is sometimes used in conjunction with the NST. The test takes approximately 15 minutes to complete, with the fetus monitored for 5 to 10 minutes before stimulation to obtain a baseline FHR. If the fetal baseline pattern is nonreactive, the sound source (usually a laryngeal stimulator) is then activated for 3 seconds on the maternal abdomen over the fetal head. Monitoring continues for another 5 minutes, after which the monitor tracing is assessed. A test is considered reactive if there is an immediate and sustained increase in long-term variability and HR accelerations. The accelerations produced may have a significant increase in duration. The test may be repeated at 1-minute intervals up to 3 times when there is no response. Further evaluation

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**TABLE 21-5**

Interpretation of the Nonstress Test

<table>
<thead>
<tr>
<th>RESULT</th>
<th>INTERPRETATION</th>
<th>CLINICAL SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive</td>
<td>Two or more accelerations of FHR of 15 beats/min lasting ≥ 15 sec, associated with each fetal movement in 20-min period</td>
<td>As long as twice-weekly NSTs remain reactive, most high risk pregnancies are allowed to continue</td>
</tr>
<tr>
<td>Nonreactive</td>
<td>Any tracing with either no FHR accelerations or accelerations &lt;15 beats/min or lasting &lt;15 sec throughout any fetal movement during testing period</td>
<td>Further indirect monitoring may be attempted with abdominal fetal electrocardiography in effort to clarify FHR pattern and quantitate variability; external monitoring should continue, and CST or BPP should be done</td>
</tr>
<tr>
<td>Unsatisfactory</td>
<td>Quality of FHR recording not adequate for interpretation</td>
<td>Test is repeated in 24 hr or CST is done, depending on clinical situation</td>
</tr>
</tbody>
</table>

is needed with BPP or CST if the pattern is still nonreactive (Druzin, Gabbe, & Reed, 2002).

**Contraction Stress Test**

The **contraction stress test** (CST) is one of the first electronic methods to be developed for assessment of fetal health. It was devised as a graded stress test of the fetus, and its purpose was to identify the jeopardized fetus that was stable at rest but showed evidence of compromise after stress. Uterine contractions decrease uterine blood flow and placental perfusion. If this decrease is sufficient to produce hypoxia in the fetus, a deceleration in FHR will result, beginning at the peak of the contraction and persisting after its conclusion (late deceleration).

**NURSE ALERT** In a healthy fetoplacental unit, uterine contractions usually do not produce late decelerations, whereas if there is underlying uteroplacental insufficiency, contractions will produce late decelerations.

The CST provides an earlier warning of fetal compromise than the NST and with fewer false-positive results. In addition to the contraindications described earlier, the CST is more time consuming and expensive than the NST. It also is an invasive procedure if oxytocin stimulation is required. It is infrequently used.

**Procedure**

The woman is placed in semi-Fowler position or sits in a reclining chair with a slight left tilt to optimize uterine perfusion and avoid supine hypoten- sion. She is monitored electronically with the fetal ultrasound transducer and uterine tocodynamometer. The tracing is observed for 10 to 20 minutes for baseline rate, long-term variability, and the possible occurrence of spontaneous contractions. The two methods of CST are the nipple-stimulated contraction test and the oxytocin-stimulated contraction test.

**Nipple-stimulated contraction test.** Several methods of nipple stimulation have been described. In one approach the woman applies warm, moist washcloths to both breasts for several minutes. The woman is then asked to massage one nipple for 10 minutes. Massaging the nipples causes a release of oxytocin from the posterior pituitary. An alternative approach is for her to massage the nipple for 2 minutes, rest for 5 minutes, and repeat the cycles of massage and rest as necessary to achieve adequate uterine activity. When adequate contractions or hyperstimulation (defined as uterine contractions lasting more than 90 seconds or five or more contractions in 10 minutes) occurs, stimulation should be stopped (Druzin, Gabbe, & Reed, 2002).

**Oxytocin-stimulated contraction test.** Exogenous oxytocin also can be used to stimulate uterine contractions. An intravenous (IV) infusion is begun with a scalp needle. The oxytocin is diluted in an IV solution (e.g., 10 units in 1000 ml of fluid), infused into the tubing of the main IV device through a piggyback port, and delivered by an infusion pump to ensure accurate dosage. One method of oxytocin infusion is to begin at 0.5 milliunits/min and increase the dose by 0.5 milliunits/min at 15- to 30-minute intervals until three uterine contractions of good quality are observed within a 10-minute period. A rate of 10 milliunits/min is usually adequate to elicit uterine contractions (Druzin, Gabbe, & Reed, 2002).

**Interpretation**

If no late decelerations are observed with the contractions, the findings are considered negative (Fig. 21-9, A). Repeated late decelerations render the test results positive (Fig. 21-9, B, and Table 21-6).

After interpretation of the FHR pattern, the oxytocin infusion is halted, and the maintenance IV solution infused until uterine activity has returned to the prestimulation level. If the CST is negative, the IV device is removed, and the fetal monitor disconnected. If the CST is positive, continued monitoring and further evaluation of fetal well-being are indicated.

**Nursing Role in Antepartal Assessment for Risk**

The nurse’s role is that of educator and support person when the woman is undergoing such examinations as ultrasonography, MRI, CVS, PUBS, and aminocentesis. In some instances, the nurse may assist the physician with the procedure. In many settings, nurses perform NSTs, CSTs, and BPPs; conduct an initial assessment; and begin necessary interventions for non reassuring patterns. These nursing procedures are accomplished after additional education and training, under guidance of established protocols, and in collaboration with obstetrics providers (Menihan, 2000; Stringer et al., 2003). Patient teaching, which is an integral component of this role, involves preparing the woman for the procedure, interpreting the findings, and providing psychosocial support when needed.

**Psychologic considerations**

All women who undergo antepartal assessments are at risk for real and potential problems and may be in an anxious frame of mind. In most instances, the tests are ordered because of suspected fetal compromise, deterioration of a maternal condition, or both. In the third trimester, pregnant women are most concerned about protecting themselves and their fetuses and consider themselves most vulnerable to outside influences. The label of high risk will increase this sense of vulnerability.

When a woman is diagnosed with a high risk pregnancy, she and her family will likely experience stress related to the diagnosis. The woman may exhibit various psychologic responses including anxiety, low self-esteem, guilt, frustration, and inability to function. The development of a high risk pregnancy also can affect parental attachment, accomplishment of the tasks of pregnancy, and family adaptation to the pregnancy (Ramer & Frank, 2001). Women with complicated pregnancies perceive their risks as higher than do women with uncomplicated pregnancies.
(Gupton, Heaman, & Cheung, 2001). If the mother has to be placed on bed rest for pregnancy complications, separation from family, finances, and worry about children and home create further stress (Maloni, Brezinski-Tomas, & Johnson, 2001).

If the woman is fearful for her own well-being, she may continue to feel ambivalence about the pregnancy or may not accept the reality of the pregnancy. She may not be able to complete preparations for the baby or go to childbirth classes if she is on bed rest or hospitalized. The family may become frustrated because they cannot engage in these activities that prepare them for parenthood.

Antepartal hospitalization is an added stressor for the high risk pregnant woman and her family. The woman may be lonely because she is separated from her home and family. She may feel powerless and unable to make decisions for herself because her care is out of her control. Likewise, preparation for the birth process may be out of control of the woman and her family. Unexpected procedures and care for the woman or fetus may take priority over the usual birth plan and may not allow choices that would have been selected if the pregnancy had been normal.

Attachment to the newborn can be affected if the mother or newborn is ill after the birth. Early contact may not be possible. Time, support, and intervention by the health care team may be necessary to help the family begin the attachment process.

The nurse can help the woman and her family regain control and balance in their lives by providing support and encouragement, providing information about the pregnancy problem and its management (see Resources list at the end of this chapter), and providing opportunities to make as many choices as possible about the woman’s care (Coffman & Ray, 2002).

The impact of the effects of a specific pregnancy complication and its management is discussed in the following chapters in this unit.

**COMMUNITY ACTIVITY**

Contact the nearest March of Dimes Birth Defects Foundation office to assess the resources available for parents (e.g., pamphlets, websites for high risk pregnancies) and what screening is recommended during pregnancy to identify problems. How can pregnant women get access to the March of Dimes information? What information or resources are available in your community for the problems identified?
TABLE 21-6
Guide for Interpretation of the Contraction Stress Test

<table>
<thead>
<tr>
<th>INTERPRETATION</th>
<th>CLINICAL SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEGATIVE</td>
<td>No late decelerations, with minimum of three uterine contractions lasting 40 to 60 sec within 10-min period (see Fig. 21-9, A)</td>
</tr>
<tr>
<td>POSITIVE</td>
<td>Persistent and consistent late decelerations occurring with more than half of contractions (see Fig. 21-9, B)</td>
</tr>
<tr>
<td>SUSPICIOUS</td>
<td>Late decelerations occurring in less than half of uterine contractions once adequate contraction pattern established</td>
</tr>
<tr>
<td>HYPERSTIMULATION</td>
<td>Late decelerations occurring with excessive uterine activity (contractions more often than every 2 min or lasting &gt;30 sec) or persistent increase in uterine tone</td>
</tr>
<tr>
<td>UNSATISFACTORY</td>
<td>Inadequate uterine contraction pattern, or tracing too poor to interpret</td>
</tr>
</tbody>
</table>


BPP, Biophysical profile; CST, contraction stress test; FHR, fetal heart rate; NST, nonstress test.

*Applies to results noted as suspicious, hyperstimulation, or unsatisfactory.

Key Points

- A high risk pregnancy is one in which the life or well-being of the mother or infant is jeopardized by a biophysical or psychosocial disorder coincidental with or unique to pregnancy.
- Biophysical, sociodemographic, psychosocial, and environmental factors place the pregnancy and fetus or neonate at risk.
- Psychosocial perinatal warning indicators include characteristics of the parents, the child, their support systems, and family circumstances.
- Maternal and perinatal mortality rates for Caucasians are considerably lower than for other ethnic groups in the United States.
- Mortality rate decreases when risk is identified early and intensive care is applied.
- Biophysical assessment techniques include fetal movement counts, ultrasonography, and MRI.
- Biochemical monitoring techniques include amniocentesis, PUBS, CVS, and MSAFP.
- Reactive NSTs and negative CSTs suggest fetal well-being.
- Most assessment tests have some degree of risk for the mother and fetus and usually cause some anxiety for the woman and her family.

Answer Guidelines to Critical Thinking Exercise

Down Syndrome

1. Yes, there is sufficient evidence about use of ultrasound in the first trimester to obtain information about the pregnancy other than detecting fetal anomalies.

2. There is an increased risk of having a child with Down syndrome with increased maternal age, especially after age 40. For example, the incidence is 1 in 400 at age 35 and 1 in 30 at age 45.
h. Ultrasound is used in the first trimester for determining size and number of fetuses, presence of fetal cardiac and body movements, presence of uterine abnormalities, dating pregnancy, and identifying the presence and location of an intrauterine device (IUD). Fetal anomalies may be detected in the second trimester.

c. The triple-screen test—maternal serum alpha-fetoprotein (MSAFP), unconjugated estriol, and beta-human chorionic gonadotropin (β-hCG)—at 16 to 18 weeks may predict up to 60% of cases of Down syndrome, although follow-up diagnostic testing with amniocentesis is needed to confirm the diagnosis. Lower-than-normal MSAFP and unconjugated estriol levels and elevated β-hCG levels in the second trimester are associated with Down syndrome.

3. The priority is to teach Patty what information the ultrasound examination at 8 weeks will provide. Information about other options (e.g., chorionic villus sampling [CVS]) to identify Down syndrome in the first trimester and the screening tests available in the second trimester may also be appropriate.

Yes, there is sufficient evidence to support this conclusion. After hearing the choices, Patty and David may decide to have a CVS done or may wait until the second trimester for screening tests and then have amniocentesis if the screening tests warrant follow-up. They may also wait for a second-trimester ultrasound examination.

References


Resources

Healthy Mothers, Healthy Babies Coalition
409 12th St., SW
Washington, DC 20024
202-463-2458

March of Dimes Birth Defects Foundation
National Foundation/March of Dimes
1275 Mamaronck Ave.
White Plains, NY 10605
914-428-7100
888-663-4637 (MODIMES)

www.modimes.org

National Clearinghouse for Human Genetic Disease (provides information about inherited diseases)
National Center for Education in Maternal and Child Health
38th and R Sts., NW
Washington, DC 20037
202-863-2458
Washington, DC 20024
409 12th St., SW

Healthy Mothers, Healthy Babies Coalition
409 12th St., SW
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202-863-2458
Washington, DC 20024
409 12th St., SW

Spina Bifida Association of America
4590 McaArthur Blvd., NW, Suite 250
Washington, DC 20007-4226
800-621-3141