chapter 4

Antepartum Care

A comprehensive antepartum-care program involves a coordinated approach to medical care and psychosocial support that optimally begins before conception and extends throughout the antepartum period. Health care professionals should integrate the concept of family-centered care into antepartum care (see "Family-Centered Care" in Chapter 1). Care should include an assessment of the parents' attitudes toward the pregnancy, the support systems available, and the need for parenting education. Couples should be encouraged to work with their caregivers in developing a birthing plan and in making well-informed decisions about pregnancy, labor, delivery, and the postpartum period.

Preconception Care

Preconception care consists of the identification of those conditions that could affect a future pregnancy or fetus and that may be amenable to intervention. For example, adverse effects on the fetus, including spontaneous abortion or congenital anomalies, caused by maternal phenylketonuria or poorly controlled diabetes mellitus can be reduced if strict metabolic control is achieved before conception and continued throughout pregnancy. Conversely, establishing metabolic control of these conditions later in pregnancy is believed to be of lesser benefit. Alternatively, prenatal diagnosis of fetal genetic abnormalities can provide parents with options regarding the continuation of the pregnancy and permit targeted prenatal and neonatal care to optimize outcomes.

All health encounters during a woman's reproductive years, particularly those that are a part of preconception care, should include counseling on appropriate medical care and behavior to optimize pregnancy outcomes. The following maternal assessments may serve as the basis for such counseling:

- Family planning and pregnancy spacing
- Family history

- Genetic history (both maternal and paternal)
- Medical, surgical, psychiatric, and neurologic histories
- Current medications (prescription and nonprescription)
- Substance use, including alcohol, tobacco, and illicit drugs
- Domestic abuse and violence
- Nutrition
- Environmental and occupational exposures
- Immunity and immunization status
- Risk factors for sexually transmitted diseases
- Obstetric history
- Gynecologic history
- General physical examination
- Assessment of socioeconomic, educational, and cultural context

Vaccination(s) should be offered to women found to be at risk for or susceptible to rubella, varicella, and hepatitis B. Special vaccination, such as Pneumovax, may be indicated for patients who have undergone splenectomy for any reason (trauma, idiopathic thrombocytopenic purpura) or have functional asplenia caused by sickle cell disease. All pregnant women should be tested for human immunodeficiency virus (HIV) infection with patient notification as part of the routine battery of prenatal blood tests unless they decline the test (ie, opt-out approach) (see "Routine Testing" in this chapter and Chapter 9 for further discussion of viral infections). Physicians should be aware of and follow their states' prenatal HIV-screening requirements. A number of tests can be performed for specific indications:

- Screening for sexually transmitted diseases
- Testing for maternal diseases based on medical or reproductive history
- Mantoux test with purified protein derivative for tuberculosis
- Screening for genetic disorders based on racial and ethnic background:
  — Sickle hemoglobinopathies (African Americans)
  — β-thalassemia (Mediterraneans, Southeast Asians, and African Americans)
  — α-thalassemia (Southeast Asians, Mediterraneans, and African Americans)
  — Tay–Sachs disease (Ashkenazi Jews, French Canadians, and Cajuns)

—Canavan disease and familial dysautonomia (Ashkenazi Jews)

—Cystic fibrosis (CF) (while carrier frequency is higher among Caucasians of European and Ashkenazi Jewish descent, carrier screening should be made available to all couples)

• Screening for other genetic disorders on the basis of family history (eg, fragile X syndrome for family history of nonspecific, predominantly male-affected, mental retardation; Duchenne's muscular dystrophy)

Patients should be counseled regarding the benefits of the following activities:

• Exercising

• Reducing weight before pregnancy, if obese

• Increasing weight before pregnancy, if underweight

• Avoiding food faddism

• Avoiding pregnancy within one month of receiving a live attenuated viral vaccine (eg, rubella)

• Preventing HIV infection

• Determining the time of conception by an accurate menstrual history

• Abstaining from tobacco, alcohol, and illicit drug use before and during pregnancy

• Taking folic acid, 0.4 mg per day, while attempting pregnancy and during the first trimester of pregnancy for prevention of neural tube defects (NTD); women who have had a prior NTD-affected pregnancy are at high risk of having a subsequent affected pregnancy and should consume 4 mg of folic acid per day in the periconception period (see "Preconception Nutritional Counseling" later in this chapter)

• Maintaining good control of any preexisting medical conditions (eg, diabetes, hypertension, systemic lupus erythematosus, asthma, seizures, thyroid disorders, and inflammatory bowel disease)

Preconception Nutritional Counseling

Consumption of a balanced diet with the appropriate distribution of the basic food pyramid groups is especially important during pregnancy. Diet can be affected by food preferences, cultural beliefs, and eating patterns. A woman who is a vegan or food faddist or who has special dietary restrictions secondary to medical illnesses, such as phenylketonuria, diabetes mellitus, inflammatory bowel disease, or renal disease, may require special dietary measures as well as

vitamin and mineral supplements. Women who frequently diet to lose weight, fast, skip meals, or have eating disorders or unusual eating habits should be identified and counseled. The patient's access to food and the ability to purchase food can be pertinent. One way to evaluate nutritional status is to calculate the woman's body mass index at the preconception visit (Table 4–1). Additional risk factors for nutritional problems include adolescence, tobacco and substance abuse, history of pica during a previous pregnancy, high parity, and mental illness.

Neural tube defects, such as anencephaly and spina bifida, have multifactorial origins, but their etiology often may involve abnormalities in homocysteine metabolism that are potentially remediable by folic acid dietary supplementation. Indeed, the first occurrence of NTDs may be reduced by as much as 36% if women of reproductive age take 0.4 mg of folic acid daily both before conception and during the first trimester of pregnancy as recommended by the Centers for Disease Control and Prevention and the U.S. Public Health Service. A woman with a history of a prior NTD-affected pregnancy (recurrence risk 2–5%) or who is being treated with anticonvulsive medication may reduce the risk of NTDs by more than 80% if she supplements her daily diet with 4 mg of folic acid for the months in which conception is attempted and for the first trimester of pregnancy. This daily dose should be achieved by adding a separate supplement to a single multivitamin tablet to provide a total of 4 mg of folate while avoiding excessive intake of fat-soluble vitamins (see "Vitamin and Mineral Toxicity" in this chapter). The U.S. Food and Drug

Table 4–1. Recommended Ranges of Total Weight Gain for Pregnant Women by Prepregnancy Body Mass Index for Singleton Gestation*

Weight-for-Height Category		Recommended Total Weight Gain	
Category	Body Mass Index	kg	lb
Low	<19.8	12.5–18	28–40
Normal	19.8–26	11.5–16	25–35
High	26–29	7–11.5	15–25
Obese	>29	At least 7	At least 15

*The range for women carrying twins is 35–45 lb (16–20 kg). Young adolescents (<2 years after menarche) and African-American women should strive for gains at the upper end of the range. Short women (<62 in or <157 cm) should strive for gains at the lower end of the range.

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Administration has established rules under which specified grain products are required to be fortified with folic acid at levels ranging from 0.43 mg to 1.4 mg per pound of product. These amounts are designed to enable women to more easily consume 0.4 mg of folic acid daily. However, these amounts of fortified folic acid are intended to keep the daily intake of folic acid less than 1 mg. Because the amount of folic acid consumed in fortified grain products may be less than the amount recommended to prevent NTDs, supplementation still is recommended.

Routine Antepartum Care

Women who receive early and regular prenatal care are more likely to have healthier infants. The early diagnosis of pregnancy is important in establishing a management plan. This plan of care should take into consideration the medical, nutritional, psychosocial, and educational needs of the patient and her family, and it should be periodically reevaluated and revised in accordance with the progress of the pregnancy.

All pregnant women should have access in their community to readily available and regularly scheduled obstetric care, beginning in early pregnancy and continuing through the postpartum period. Pregnant women also should have access to unscheduled or emergency visits on a 24-hour basis. Timing of access varies depending on the nature of the problem.

Incarcerated Women

Generally, pregnant inmates, because of their disadvantaged background, are at a higher risk for poor pregnancy outcomes than the general population. Many facilities do not offer adequate prenatal care. Incarcerated women should receive adequate prenatal care. Applying physical restraints to pregnant women should be needed only very rarely, in extreme situations, for short periods. If restraint is needed after the first trimester, it should be performed with the individual on her side, not flat on her back or stomach. If she needs to be restrained for more than several minutes, she should be allowed to be on her side, preferably on her left side. Pressure should not be applied to the abdomen either directly or indirectly while restraining the patient.

Women With Physical Disabilities

Pregnancy and parenting for women with physical disabilities pose unique medical and social challenges but rarely are precluded by the disability itself.

Few, if any, physical disabilities directly limit fertility. Health care professionals have the responsibility to provide appropriate reproductive health services to these women or arrange adequate consultation or referral. Nonbiased preconception counseling for couples in which one partner has a physical disability may decrease subsequent psychosocial and medical complications of pregnancy. Screening and provision of disability-specific information, such as folate supplementation for women who have spina bifida, is highly desirable.

Once pregnancy occurs, the patient should have early contact with an obstetrician. Counseling about prenatal testing and options should be comprehensive and nondirective. Regular consultation or referral may be required to achieve the optimum outcome, such as in cases of spinal cord injury or multiple sclerosis. Detailed pregnancy care plans should be developed in negotiation with managed care plans and other insurers to increase access to and use of prenatal care services, ensure appropriate postpartum hospital length of stay, and arrange postpartum home care services, if necessary. Cesarean delivery should be done for obstetric indications. Community resources for childbirth, breastfeeding, and parenting education should be identified early in the pregnancy, and timely referrals should be made for the pregnant woman and her family.

General Patient Education

Patient education is an essential element of prenatal care. The physician or other providers participating in antepartum care should discuss the following information with each patient:

- Scope of care that is provided in the office (see Appendix G)
- Laboratory studies that may be performed
- Expected course of the pregnancy
- Signs and symptoms to be reported to the physician (eg, vaginal bleeding, rupture of membranes, or decreased fetal movements)
- Anticipated schedule of visits
- Physician coverage of labor and delivery
- Cost to the patient of prenatal care and delivery (eg, insurance plan participation)
- Practices to promote health maintenance (eg, use of safety restraints, including lap and shoulder belts)
- Educational programs available
- Options for intrapartum care

- Planning for hospital discharge and child care
- Encouraging breastfeeding (see Chapter 7)
- Choosing the child's physician

Specialized Counseling

Sauna and Hot Tub Exposure

There are extensive animal data to indicate that hyperthermia induced during organogenesis is teratogenic. The major malformations most commonly thought to result from human maternal febrile illnesses are NTDs. Many early studies were troubled with methodologic problems of recall bias and most could not distinguish etiologically between the fever and the infectious agent that caused it or the medications that were used to treat it. Some prospective studies now suggest that it is the fever per se that is teratogenic. Studies in the late 1970s suggested that sauna and hot tub use also might cause hyperthermia and congenital malformations. The probability of significantly increasing core body temperature depends on the temperature of the sauna or hot tub, duration of exposure, and for hot tubs, the extent of submersion. Many women will not voluntarily remain in a hyperthermic environment long enough to increase their core temperatures, but some may. Pregnant women might reasonably be advised to remain in saunas for no more than 15 minutes and hot tubs for no more than 10 minutes. As an additional precaution, there is less surface area to absorb heat and more surface area to radiate it if the head, arms, shoulders and upper chest are not submerged in a hot tub.

Nutrition in Pregnancy

Each pregnant woman should be provided with information about balanced nutrition, as well as ideal caloric intake and weight gain. Height and weight should be recorded for all women at the initial prenatal visit to allow calculation of body mass index. Maternal nutrition can contribute positively to maintaining or improving the woman's health, as well as to the delivery of a healthy, term newborn of an appropriate weight. Nutrition counseling is an integral part of perinatal care for all patients. It should focus on a well-balanced, varied, nutritional food plan that is consistent with the patient's access to food and food preferences. Nutrition consultation should be offered to all obese women, and they should be encouraged to follow an exercise program. Patient educational materials on nutrition are available from the American College of Obstetricians and Gynecologists (www.acog.org), the U.S. Public Health

Service (www.dhhs.gov/phs), and the March of Dimes Foundation (www.marchofdimes.org). Dietary counseling and intervention based on special or individual needs usually are most effectively accomplished by referral to a nutritionist or registered dietitian.

The recommended dietary allowances for most vitamins and minerals increase during pregnancy (Table 4–2). The National Academy of Sciences recommends 27 mg of iron supplementation (present in most prenatal vitamins) be given to pregnant women daily because the iron content of the standard American diet and the endogenous iron stores of many American women are not sufficient to provide for the increased iron requirements of pregnancy. The U.S. Preventive Services Task Force recommends that all pregnant women be routinely screened for iron-deficiency anemia. The treatment of frank iron-deficiency anemia requires dosages of 60–120 mg of elemental iron each day. Iron absorption is facilitated by or with vitamin C supplementation or ingestion between meals or at bedtime on an empty stomach. See Table 4–3 for examples of vitamin and mineral food sources. Women should supplement their diets with folic acid before and during pregnancy (see "Preconception Nutritional Counseling" in this chapter). Women should be cautioned to keep these supplements and any other medications out of the reach of children.

Women also should be instructed about appropriate weight gain. See Table 4–1 for the Institute of Medicine guidelines for weight gain associated with optimal outcomes by maternal prepregnancy weight. In general, caloric intake is calculated at 25–35 kcal/kg of optimal body weight. An additional 100–300 kcal per day is recommended during pregnancy. Because optimal outcome can occur over a relatively wide range of weight gain, the provider can be flexible. These recommendations can be adjusted to specific subgroups of patients, such as adolescents and women who are obese, of lower socioeconomic status, or short. Following the Institute of Medicine weight-gain guidelines for singleton gestations improves the likelihood of delivering a normal-weight newborn. Assessment of weight gain during pregnancy is important and should be documented appropriately, preferably on a form specifically designed for that purpose (see example in Appendix A). If a patient is financially unable to meet nutritional needs, she should be referred to federal food and nutrition programs, such as the Special Supplemental Food Program for Women, Infants, and Children.

Pregnant and nursing women should be reminded not to eat certain fish with high levels of mercury, including shark, swordfish, king mackerel, and tile-

Table 4–2. Recommended Daily Dietary Allowances for Adolescent and Adult Pregnant and Lactating Women

	Pregnant			Lactating		
	14–18 years	19–30 years	31–50 years	14–18 years	19–30 years	31–50 years
Fat-soluble vitamins						
Vitamin A	750 µg	770 µg	770 µg	1,200 µg	1,300 µg	1,300 µg
Vitamin D*	5 µg	5 µg	5 µg	5 µg	5 µg	5 µg
Vitamin E	15 mg	15 mg	15 mg	19 mg	19 mg	19 mg
Vitamin K	75 µg	90 µg	90 µg	75 µg	90 µg	90 µg
Water-soluble vitamins						
Vitamin C	80 mg	85 mg	85 mg	115 mg	120 mg	120 mg
Thiamin	1.4 mg	1.4 mg	1.4 mg	1.4 mg	1.4 mg	1.4 mg
Riboflavin	1.4 mg	1.4 mg	1.4 mg	1.6 mg	1.6 mg	1.6 mg
Niacin	18 mg	18 mg	18 mg	17 mg	17 mg	17 mg
Vitamin B_6	1.9 mg	1.9 mg	1.9 mg	2 mg	2 mg	2 mg
Folate	600 µg	600 µg	600 µg	500 µg	500 µg	500 µg
Vitamin B_{12}	2.6 µg	2.6 µg	2.6 µg	2.8 µg	2.8 µg	2.8 µg
Minerals						
Calcium*	1,300 mg	1,000 mg	1,000 mg	1,300 mg	1,000 mg	1,000 mg
Phosphorus	1,250 mg	700 mg	700 mg	1,250 mg	700 mg	700 mg
Iron	27 mg	27 mg	27 mg	10 mg	9 mg	9 mg
Zinc	12 mg	11 mg	11 mg	13 mg	12 mg	12 mg
Iodine	220 µg	220 µg	220 µg	290 µg	290 µg	290 µg
Selenium	60 µg	60 µg	60 µg	70 µg	70 µg	70 µg

*Recommendations measured as Adequate Intake (AI) instead of Recommended Daily Dietary Allowance (RDA). An AI is set instead of an RDA if insufficient evidence is available to determine an RDA. The AI is based on observed or experimentally determined estimates of average nutrient intake by a group (or groups) of healthy people.

Data from Institute of Medicine. Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride. Washington, DC: National Academy Press; 1997; Institute of Medicine (US). Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, pantothenic acid, biotin, and choline. Washington, DC: National Academy Press; 1998; Institute of Medicine (US). Dietary reference intakes for vitamin C, vitamin E, selenium, and carotenoids. Washington, DC: National Academy Press; 2000; and Institute of Medicine (US). Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington, DC: National Academy Press; 2002.

Table 4–3. Vitamin and Mineral Food Sources

Nutrient	Food Source
Vitamin A	Green leafy vegetables; dark yellow vegetables (eg, carrots and sweet potatoes); whole, fortified skim and low-fat milks; liver
Vitamin C	Citrus fruits (eg, oranges, lemons, grapefruit), strawberries, broccoli, tomatoes
Vitamin D	Fortified milk, fish liver oils, exposure to sunlight
Vitamin E	Vegetable oils, whole-grain cereals, wheat germ, green leafy vegetables
Folate	Green leafy vegetables, orange juice, strawberries, liver, legumes, nuts
Calcium	Milk and milk products; sardines and salmon with bones; collard, kale, mustard, and turnip greens
Iron	Meat, liver, dried beans and peas, iron-fortified cereals, prune juice

fish. The U.S. Food and Drug Administration and the U.S. Environmental Protection Agency advise pregnant and nursing women to consume no more than 12 ounces (two average meals) per week of a variety of fish and shellfish that are low in mercury content (guidance available at www.cfsan.fda.gov/~dms/admehg3.html). Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock, and catfish. Pregnant and nursing women should consume no more than two 6-ounce cans of tuna per week (total fish consumption should not exceed 12 ounces per week). Because albacore tuna also is high in mercury, it is advisable to choose light tuna instead. Pregnant and nursing women also should check local advisories about the safety of fish caught in local lakes, rivers, and coastal areas. If no advice is available, they should consume no more than 6 ounces (one average meal) per week of fish caught in local waters and no other fish during that week.

Nausea and Vomiting of Pregnancy

Nausea and vomiting of pregnancy affects more than 70% of pregnant women and can diminish the woman's quality of life. Most mild cases of nausea and vomiting can be resolved with lifestyle and dietary changes. Effective treatments for mild cases include consuming more protein, vitamin B_6, or vitamin B_6 with doxylamine. Effective and safe treatments for more serious cases include antihistamine H1-receptor blockers and phenothiazines. The most severe form of pregnancy-associated nausea and vomiting is hyperemesis gravidarum, which occurs in less than 2% of pregnancies. This may require more intense therapy,

including hospitalization, additional medications, intravenous hydration and nutrition, and if refractory, total parenteral nutrition.

Vitamin and Mineral Toxicity

Although vitamin A is essential, excessive vitamin A (more than 10,000 international units per day) may be associated with fetal malformations. The amount of vitamin A in standard prenatal vitamins (4,000–5,000 international units) is considered the maximum recommended dose before and during pregnancy and is well below the probable minimum human teratogenic dose. Dietary intake of vitamin A in the United States is adequate to meet the needs of most pregnant women throughout gestation. Therefore, additional supplementation besides a prenatal vitamin during pregnancy is not recommended except in women in whom the dietary intake of vitamin A may not be adequate, such as strict vegetarians. Vitamin tablets containing 25,000 international units or more of vitamin A are available as over-the-counter preparations; however, pregnant women or those planning to become pregnant who use high doses of vitamin A supplements (and retinol) should be cautioned about the potential teratogenicity, as excess vitamin A is associated with anomalies of bones, the urinary tract, and the central nervous system. The use of beta carotene, the precursor of vitamin A found in fruits and vegetables, has not been shown to produce vitamin A toxicity.

Excessive vitamin and mineral intake (ie, more than twice the recommended dietary allowances) should be avoided during pregnancy. For example, excess iodine is associated with congenital goiter. There also may be toxicity from excessive use of other fat-soluble vitamins (D, E, and K).

Exercise in Pregnancy

In the absence of either medical or obstetric complications, 30 minutes or more of moderate exercise per day on most if not all days of the week is recommended for pregnant women. Generally, participation in a wide range of recreational activities appears to be safe during pregnancy; however, each sport should be reviewed individually for its potential risk, and activities with a high risk of falling or those with a high risk for abdominal trauma should be avoided. Pregnant women also should avoid supine positions during exercise as much as possible.

Recreational and competitive athletes with uncomplicated pregnancies can remain active during pregnancy and should modify their usual exercise routines as medically indicated. Pregnant competitive athletes may require close obstet-

ric supervision. Women should not take up a new strenuous sport during pregnancy, and previously inactive women and those with medical or obstetric complications should be evaluated before recommendations for physical activity participation during pregnancy are made. Additionally, a physically active woman with a history of or risk for preterm delivery or intrauterine growth restriction should be advised to reduce her activity in the second and third trimesters. Warning signs to terminate exercise while pregnant include:

- Chest pain
- Vaginal bleeding
- Dizziness
- Headache
- Decreased fetal movement
- Amniotic fluid leakage
- Muscle weakness
- Calf pain or swelling
- Preterm labor
- Regular uterine contractions

Tobacco Use

Inquiry into tobacco use and smoke exposure should be a routine part of the prenatal visit. Patients should be strongly discouraged from smoking. Multiple studies have demonstrated a clear association between maternal smoking and perinatal morbidity and mortality. Placenta previa, abruptio placentae, and preterm rupture of membranes are factors in many pregnancy losses in smokers. It is estimated that there would be a 5% reduction in perinatal mortality if smoking during pregnancy were eliminated. Infant health risks include sudden infant death syndrome, hospitalization, and neurodevelopmental abnormalities. For pregnant women who smoke fewer than 20 cigarettes per day, the provision of a 5–15-minute five-step counseling session and pregnancy-specific educational materials increases cessation rates. Physicians should use the following five smoking cessation guidelines for all patients who continue to smoke during pregnancy:

1. Ask about smoking status. Providers should ask the patient at the first prenatal visit to choose a statement that best describes her smoking status from a list of statements on smoking behavior. Using this multiple-choice method is more likely to elicit an accurate response than asking

a question that elicits a simple "yes" or "no" answer. A smoking-cessation chart, a tobacco-use sticker, or a vital-signs stamp that includes smoking status may be useful in the medical record to remind providers to ask patients about smoking status at follow-up visits.

2. Advise patients who smoke to stop by providing clear, strong advice to quit with personalized messages about the benefits of quitting and the effect of continued smoking on the woman, fetus, and newborn. Congratulate patients who report having stopped smoking and affirm their efforts with a statement about the benefits of quitting.

3. Assess the patient's willingness to attempt to quit smoking within the next 30 days. One approach to this assessment is to say, "Quitting smoking is one of the most important things you can do for your health and your baby's health. If we can give you some help, are you willing to try?" If the patient is willing, the provider can move to the next step. If the patient is unwilling to try, the provider may consider having a brief discussion with the patient to educate and reassure her about quitting. Quitting advice, assessment, and assistance should be offered at subsequent prenatal care visits.

4. Assist patients who are interested in quitting by providing pregnancy-specific, self-help smoking cessation materials. Enhance the patient's problem-solving skills by asking when and where she typically smokes and suggesting how she might avoid these situations that trigger the desire to smoke. Offer support on the importance of 1) having a smoke-free space at home, 2) seeking out a "quitting buddy," such as a former smoker or nonsmoker, both at work and at home, and 3) understanding nicotine withdrawal, such as irritability and cravings. Communicate caring and concern and encourage the patient to talk about the process of quitting. The provider also may refer the patient to a smoker's quitline. Telephone quitlines offer information, direct support, and ongoing counseling and have been very successful in helping pregnant smokers quit and remain smoke free. Great Start (1-866-66-START) is a national pregnancy-specific smoker's quitline operated by the American Legacy Foundation. Some states also have proactive, direct fax referral capability for providers to connect pregnant smokers directly to their state quitline. By dialing the national quitline network (1-800-QUIT NOW), callers are routed immediately to their state smoker's quitline.

5. Arrange follow-up visits to track the progress of the patient's attempt to quit smoking. For current and former smokers, smoking status should

be monitored throughout pregnancy, providing opportunities to congratulate and support success, reinforce steps taken toward quitting, and advise those still considering a cessation attempt.

Although nicotine-replacement products or other pharmaceuticals, such as smoking cessation aids, are effective for reducing smoking in nonpregnant women, they have not been sufficiently evaluated to determine their effectiveness and safety in pregnancy. Nicotine gum and patches should be considered in pregnant women only after non-pharmacologic treatments (eg, counseling) have failed and if the increased likelihood of smoking cessation, with its potential benefits, outweighs the unknown risk of nicotine replacement and potential concomitant smoking.

Substance Use and Abuse

All pregnant women should be questioned at their first prenatal visit about their past and present use of alcohol, nicotine, and other drugs, including the recreational use of prescription and over-the-counter medications. Use of specific screening questionnaires may improve detection rates. A woman who acknowledges the use of alcohol, nicotine, cocaine, opioids, amphetamines, or other mood-altering drugs should be counseled about the perinatal implications of their use during pregnancy and offered referral to an appropriate drug-treatment program if chemical dependence is suspected. Large numbers of women of childbearing age abuse potentially addictive and mood-altering drugs. Use of cocaine, marijuana, diazepam, opioids (including morphine, heroin, codeine, meperidine, methadone, and oxycodone), other prescription drugs, and approximately 150 other substances can lead to chemical dependency. Depending on geographic location, it is estimated that 1–40% of pregnant women have used one of these substances during pregnancy. Data suggest that approximately 1 in 10 neonates is exposed to one or more mood-altering drugs during pregnancy; the number varies only slightly for publicly versus privately insured patients.

Women should be dissuaded from alcohol consumption during pregnancy because there is no known safe threshold. Patients should be informed that prenatal alcohol consumption is a preventable cause of birth defects, including mental retardation and neurodevelopmental deficits. Fetal alcohol syndrome is characterized by three findings: 1) growth restriction, 2) facial abnormalities, and 3) central nervous system dysfunction. Although fetal alcohol syndrome is more prevalent among chronic alcoholics (prevalence 6–50%), it has been reported with lesser amounts of alcohol use.

Chemical dependency is likely to be a chronic, relapsing, and progressive disease. Many drug-dependent pregnant women do not seek early prenatal care and therefore are at increased risk for medical and obstetric complications. Drug-exposed neonates often go unrecognized and are discharged from the newborn nursery to homes where they are at increased risk for a complex of medical and social problems, including abuse and neglect.

To reinforce and encourage continued abstinence, periodic questioning or drug or metabolite testing may be desirable for a pregnant woman who reports substance use before or during pregnancy. Testing of the mother or the neonate or both also may be useful in some clinical situations, even when substance use has not been suspected previously. Such circumstances include the presence of unexplained intrauterine growth restriction, third-trimester stillbirth, unexpected preterm birth, or abruptio placentae in a woman not known to have hypertensive disease. Because positive test results have implications for patients that transcend their health, patients should give informed consent before testing. The requirements for consent to test vary from state to state, and practitioners should be familiar with the testing and the reporting requirements in their states.

Warning signs of drug abuse include noncompliance with prenatal care (eg, late entry to care, multiple missed appointments, or no prenatal care), evidence of poor nutrition, encounters with law enforcement, and marital and family disputes during the pregnancy. Screening of all patients at delivery is not recommended. Screens are likely to be negative when drugs were used early in pregnancy, and a urine screen can be negative even when women have taken certain drugs during the 48 hours before delivery. Toxicologic analysis of hair and meconium have been reported to be more sensitive methods of identifying illicit drug use, although urine remains the most frequently used specimen for screening. Because the components of urine toxicology screens vary among laboratories, physicians should verify with their laboratory which metabolites are included in its screen.

To identify drug-exposed neonates, the child's physician should obtain a thorough maternal history from all new mothers in a nonthreatening, organized manner. Practitioners also should be aware that laws in some states consider in utero drug exposure to be a form of child abuse or neglect and require reporting of positive drug test results in pregnant women or their newborns to the state's child protection agency. Although most over-the-counter medications pose no risk to pregnant women, patients also should consult with their health care providers before using nonprescription drugs or herbal remedies.

Domestic Violence

Risk assessment during pregnancy universally should include identification of women who are victims of domestic violence. Domestic violence, including intimate-partner violence, has been identified as a significant public health problem, affecting millions of American women each year. Trauma, including trauma caused by domestic violence, is one of the most frequent causes of maternal death in the United States. There is no single profile of an abused woman. Victims come from all racial, economic, educational, religious, ethnic, and social backgrounds. Victims are both adolescents and adults. In pregnant adolescents, the prevalence of abuse, particularly sexual abuse, may be greater than for adult pregnant women.

Research indicates that most abused women continue to be victimized during pregnancy. Violence against women also may begin or escalate during pregnancy and affects both maternal and fetal well-being. The prevalence of violence during pregnancy ranges from 1% to 20%, with most studies identifying rates between 4% and 8%. The presence of violence between intimate partners also affects the children in the household. Studies demonstrate that child abuse occurs in 33–77% of families in which there is abuse of adults. Among women who are being abused, 27% have demonstrated abusive behavior toward their children while living in the violent environment.

Abuse may involve threatened or actual physical, sexual, verbal, or psychologic abuse. The fundamental issues at play are power, control, and coercion. There is no clearly established set of symptoms that signal abuse. However, listed as follows are some of the obstetric presentations of abused women:

- Unwanted pregnancy
- Late entry into prenatal care or missed appointments
- Substance abuse or use
- Poor weight gain and nutrition
- Multiple, repeated somatic complaints

With the possible exception of preeclampsia, domestic violence is more prevalent than any major medical condition detected through routine prenatal screening. Detection may be possible by discussing with the patient that pregnancy sometimes places increased stress on a relationship and then by asking how the woman and her partner resolve their differences. In many cases, however, women will not disclose their abuse unless asked directly. Abused women usually are forthright when asked directly in a caring, nonjudgmental manner. The likelihood of disclosure increases with repeated inquiries.

Screening should be conducted in private with only the patient present. Translation services may be helpful in inquiring about these issues with women who have limited English proficiency. It is important to avoid using a family member or friend as an interpreter. Screening can be accomplished by prefacing the following questions with the simple statement that "because violence against women is so common, I ask all of my patients the following questions:"

- Within the past year, have you been threatened or actually hit, slapped, kicked, or otherwise physically hurt by anyone?
- Since you have been pregnant, have you been threatened or actually hit, slapped, kicked, or otherwise physically injured by anyone?
- Within the past year, has anyone forced you into sexual relations when you were not willing?

If a patient confides that she is being abused, verbatim accounts of the abuse should be recorded in the patient's medical record. The clinician should inquire about her immediate safety and the safety of her children. Clinicians should become familiar with local resources, and referrals to appropriate counseling, legal, and social-service advocacy programs should be made. Additionally, physicians should be familiar with state laws that may require reporting of domestic violence. Child abuse is always reportable. When the clinician suspects abuse, whether or not it is corroborated by the woman, supportive statements should be offered, and the need for follow-up should be addressed. It is important to encourage abused women, with the assistance of social services, to begin to create an "escape" plan, with a reliable safe haven for retreat, particularly if they believe the violence is escalating.

Antepartum Surveillance

Antepartum surveillance begins with the first prenatal visit, at which time the physician or nurse begins to compile an obstetric database. Appendix A contains a format for documenting information and the database recommended by the American College of Obstetricians and Gynecologists.

The frequency of follow-up visits is determined by the individual needs of the woman and an assessment of her risks. The frequency and regularity of scheduled prenatal visits should be sufficient to enable providers to accomplish the following activities:

- Monitor the progression of the pregnancy
- Provide education and recommended screening and interventions
- Reassure the woman

- Assess the well-being of the woman and her fetus
- Detect medical and psychosocial complications and institute indicated interventions

Generally, a woman with an uncomplicated pregnancy is examined every 4 weeks for the first 28 weeks of pregnancy, every 2–3 weeks until 36 weeks of gestation, and weekly thereafter. Women with medical or obstetric problems, as well as younger adolescents, may require closer surveillance; the appropriate intervals between scheduled visits are determined by the nature and severity of the problems (see Appendix G).

During each regularly scheduled visit, the health care provider should evaluate the woman's blood pressure, weight, urine for the presence of protein levels, uterine size for progressive growth and consistency with the estimated date of delivery, and fetal heart rate. After the patient reports quickening and at each subsequent visit, she should be asked about fetal movement. She should be queried about contractions, leakage of fluid, or vaginal bleeding at the appropriate point in pregnancy, given her potential risk factors.

Estimated Date of Delivery

Management of pregnancy requires establishing an estimated date of delivery. Problems such as intrauterine growth restriction, preterm labor, and postterm pregnancy are managed most effectively when an accurate estimated date of delivery is known. In addition, accurate gestational dating is important for the application and interpretation of certain antepartum tests (eg, maternal serum screening for trisomy 21 and NTDs or assessment of fetal maturity). If there is a size–date discrepancy or if menstrual dates are uncertain, an ultrasound examination is indicated for the purpose of dating. Such an examination is most accurate when performed before 20 weeks of gestation. Ultrasound examination results are considered to be consistent with menstrual dates if there is gestational age agreement to within 3 days by crown–rump length (CRL) measurement obtained at 6–10 weeks of gestation, within 5 days by CRL measurement obtained at 10–14 weeks of gestation, or within 7 days by the average of multiple biometric measurements obtained at 14–20 weeks of gestation. If dates are not consistent, refer to ultrasound examination results.

Routine Testing

Certain laboratory tests should be performed routinely in pregnant women. The following tests are performed early in pregnancy, as appropriate, and the

results are made available to the physician responsible for care of the newborn:

- Hematocrit or hemoglobin levels
- Urinalysis, including microscopic examination
- Urine testing to detect asymptomatic bacteriuria (eg, urine culture, or urine dip for esterase and leukocytes followed by a urine culture if results are positive)
- Determination of blood group and CDE (Rh) type
- Antibody screen
- Determination of immunity to rubella virus
- Syphilis screen (Rapid plasma regain testing should be performed at first visit for populations at risk for poor prenatal care. Women at high risk or in high-prevalence areas should be rescreened in the third trimester.)
- Chlamydia screen (Women younger than 25 years or at high risk should be rescreened in the third trimester.)
- Cervical cytology (as needed)
- Hepatitis B virus surface antigen
- Human immunodeficiency virus antibody testing

Pregnant women universally should be tested for HIV infection with patient notification as part of the routine battery of prenatal blood tests unless they decline the test (ie, opt-out approach), as permitted by local and state regulations. Refusal of testing should be documented. In some states, it is necessary to obtain the woman's written authorization before disclosing her HIV status to health care providers who are not members of her health care team (see Chapter 9 for management). Women at high risk for HIV infection should be retested during the third trimester, ideally before 36 weeks of gestation. Repeat testing in high-HIV-prevalence areas and using rapid HIV testing in patients with unknown HIV status in labor and delivery also should be considered.

For couples planning pregnancy or seeking prenatal care, it is recommended that screening be offered to those at higher risk of having children with CF (Caucasians, including Ashkenazi Jews, and anyone with a family history of CF) and in whom the testing is most sensitive in identifying carriers of a CF mutation. It is further recommended that screening should be made available to couples in other racial and ethnic groups who are at lower risk and in whom the tests may be less sensitive. To ensure that they are aware of the availability

of CF-carrier screening, couples in these lower-risk groups should be provided with written information about testing. For those couples to whom screening will be offered, it is recommended that this be done when they seek preconception counseling or infertility care or during the first and early second trimester of pregnancy.

Recommended intervals for additional tests that are indicated after the first prenatal visit are detailed on the ACOG Antepartum Record (see Appendix A). Additional laboratory evaluations, such as testing for sexually transmitted diseases, genetic disorders (see "Preconception Care" in this chapter), and tuberculosis, are recommended or offered on the basis of the patient's history, physical examination, parental desire, or in response to public health guidelines. Pregnancy is not a contraindication for Mantoux test with purified protein derivative for tuberculosis and may be indicated in high-risk areas or for health care workers. Tests for sexually transmitted diseases may be repeated in the third trimester if the woman has specific risk factors for these diseases. These tests may be mandated by local and state regulations. Early in the third trimester, measurement of hemoglobin or hematocrit levels should be repeated.

Fetal Imaging

Ultrasonography is the most commonly used fetal imaging tool and should be performed only by technologists or physicians who have undergone specific training and only when there is a valid medical indication for the examination. Second- and third-trimester ultrasound examinations include three types:

1. Standard—Evaluation of fetal presentation, amniotic fluid volume, cardiac activity, placental position, fetal biometry, and an anatomic survey

2. Limited—Evaluation to address a specific clinical question (eg, fetal presentation)

3. Specialized—A detailed anatomic examination performed when an anomaly is suspected on the basis of history, biochemical screening results, or the results of a limited or standard examination (eg, fetal echocardiogram, biophysical profile, Doppler ultrasound results, additional biometric study results)

Each type of ultrasound examination should be performed only when indicated and should be appropriately documented. First-trimester ultrasonography is becoming more common and can be performed abdominally or vaginally. Patients with an abnormal fetal ultrasound examination result should be referred for evaluation and management of fetal anomalies. Fetal magnetic

resonance imaging does not involve radiation exposure and is being used more often. The most common use of fetal magnetic resonance imaging is to further delineate a fetal anomaly or rule out placenta accreta identified or suspected on ultrasound examination results. Although the safety of ultrasonography has been established, comparatively few studies have analyzed the safety of magnetic resonance imaging, although this technology is being used with increasing frequency in pregnant patients, and there are no known risks.

Immunizations

The risk of exposure to disease and its deleterious effects on the pregnant woman and the fetus must be balanced against the efficacy and potential risks of the vaccine. Preconception immunization is preferred when possible. Avoiding pregnancy within 1 month of receiving a live attenuated viral vaccine (eg, rubella) is recommended. No vaccine has been associated with documented risk to the fetus. Recommendations for immunization during pregnancy are available from the Centers for Disease Control and Prevention (www.cdc.gov/nip). All women who will be pregnant during the influenza season should be offered influenza vaccine, regardless of their stage of pregnancy. Pregnant women with medical conditions that increase their risk for complications from influenza should be offered the vaccine before the influenza season, regardless of the stage of pregnancy. Administration of the injectable, inactivated influenza vaccine is considered safe at any stage of pregnancy. In contrast, the intranasal influenza vaccine employs a live attenuated virus and should not be used in pregnant women. If indicated, other vaccines that are safe in pregnancy include tetanus, hepatitis B, and pneumococcus (recommended for pregnant patients with prior splenectomy or functional asplenia). In studies of meningococcal vaccination with MPSV4 during pregnancy, adverse effects have not been documented among either pregnant women or newborns. On the basis of these data, the Centers for Disease Control and Prevention states that pregnancy should not preclude vaccination with meningococcal polysaccharide vaccine, if indicated. No data are available on the safety of meningococcal conjugate vaccines during pregnancy. Both rubella and varicella vaccinations are not recommended during pregnancy.

Ongoing Risk Assessment and Management

Identification of risk factors for poor outcomes is critical to minimize maternal and neonatal morbidity and mortality. Appendixes B and C provide essential data important for early and ongoing risk assessment. Although a correlation

can be seen between antenatal risk factors and the development of problems, a significant percentage of intrapartum and neonatal problems occur among patients without identified antenatal risk factors. In many instances, special obstetric problems require a multidisciplinary approach to antepartum care. Some conditions may require the involvement of a maternal–fetal medicine subspecialist, geneticist, pediatrician, neonatologist, anesthesiologist, or other medical specialist in the evaluation, counseling, and care of the patient.

Antibody Testing

Antibody tests should be repeated in unsensitized, D-negative patients at 28–29 weeks of gestation (see also "Isoimmunization in Pregnancy" in this chapter). These patients also should receive anti-D immune globulin at a dose of 300 µg prophylactically at that time. In addition, any patient who is unsensitized and D-negative should receive anti-D immune globulin if she has had one of the following conditions or procedures:

- Ectopic gestation
- Abortion (either threatened, spontaneous, or induced)
- Procedures associated with possible fetal-to-maternal bleeding, such as chorionic villus sampling (CVS) or amniocentesis
- Conditions associated with fetal–maternal hemorrhage (eg, abdominal trauma, abruptio placentae)
- Unexplained vaginal bleeding during pregnancy
- Delivery of a newborn who is D-positive

Diabetes Mellitus Screening

All pregnant patients should be screened for gestational diabetes mellitus (GDM), whether by patient history, clinical risk factors, or a laboratory screening test to determine blood glucose levels. Although universal glucose challenge screening for GDM is the most sensitive approach, there may be pregnant women at low risk who are less likely to benefit from testing. Such low-risk women should have all of the following characteristics:

- Age younger than 25 years
- Not a member of a racial or ethnic group with a high prevalence of diabetes mellitus (ie, not of Hispanic, African, Native American, South or East Asian, or Pacific Islands ancestry)
- Body mass index of 25 or less

- No history of abnormal glucose tolerance
- No history of adverse pregnancy outcomes usually associated with GDM
- No known diabetes mellitus in first-degree relative

Teratogens

Major birth defects are apparent at birth in 2–3% of the general population, and their possible occurrence is a frequent cause of anxiety among pregnant women. Many patient inquiries concern the teratogenic potential of environmental exposures. Unfortunately, there often is little scientifically valid information on which a risk estimate in human pregnancy can be based. Patients should be counseled that relatively few agents have been identified that are known to cause malformations in exposed pregnancies. Relatively few patients are exposed to agents that are known to be associated with increased risk for fetal malformations or mental retardation. The health care provider may wish to consult with or refer such patients to health care professionals with special knowledge or experience in teratology and birth defects. The Organization of Teratology Information Services provides information on teratology issues and exposures in pregnancy (www.otispregnancy.org).

Many patients raise questions about the methods of detecting birth defects related to drug exposure. Amniocentesis or CVS for chromosome analysis is not helpful for the diagnosis of birth defects caused by teratogens. Although obstetric ultrasonography has been the mainstay of surveillance for teratogen-induced congenital anomalies, its sensitivity varies with the experience and skill of the imager as well as the specific anatomic abnormality. However, even in expert hands, the overall sensitivity of ultrasonography in the detection of fetal anatomic anomalies is in the range of 50–70%.

Concerns frequently are expressed over the teratogenic potential of diagnostic imaging modalities used during pregnancy, including X-ray, nuclear imaging, contrast agents, and magnetic resonance imaging. The imaging modality that causes the most anxiety for both obstetrician and patient is X-ray or ionizing radiation. Much of this anxiety is secondary to a general misperception that any radiation exposure is harmful and may result in injury to or anomaly of the fetus. This anxiety may lead to inappropriate therapeutic abortion. In fact, most diagnostic X-ray procedures are associated with few, if any, risks to the fetus. Exposure to less than 5 rads has not been associated with an increase in fetal anomalies or pregnancy loss. Moreover, according to the American College of Radiology, no single diagnostic X-ray procedure results in

radiation exposure to a degree that would threaten the well-being of a developing preembryo, embryo, or fetus.

Concern about radiation exposure during pregnancy should not prevent medically indicated diagnostic X-ray studies when these are important for the care of the woman. When such a study is indicated, the minimal dose of radiation should be used. Because magnetic resonance imaging does not use ionizing radiation, it may be the preferred test. Both spiral computed tomography and ventilation–perfusion scanning expose the fetus to only small amounts of radiation. However, most centers avoid the use of iodinated contrast agents in pregnancy because of the risk of neonatal hypothyroidism. Patients concerned about previously performed or planned diagnostic studies should have counseling to allay these concerns.

Most diagnostic studies in which radioisotopes are used are not hazardous to the fetus and result in low levels of radiation exposure. A typical technetium Tc 99m scan results in a fetal dose of less than 0.5 rads, and a thallium 201 scan also results in a low dose. Many of these isotopes are excreted in the urine. Therefore, women should be advised to drink plenty of fluids and to void frequently after a radionuclide study.

One important exception is the use of iodine 131 for the treatment of Graves' disease. The fetal thyroid gland begins to incorporate iodine actively by the end of the first trimester. Administration of iodine 131 after this time can result in concentration of the radiation within, and destruction of, the fetal thyroid gland. Therefore, Iodine 131 is contraindicated for therapeutic use during pregnancy. By comparison, there are few reports on the safety of radioisotope imaging of the maternal thyroid during pregnancy, and such studies should be undertaken only after careful consideration of the risks and benefits of the procedure.

Maternal Serum Screening

There are now several screening options for trisomy 21 and 18, including first-trimester combined serum screening (pregnancy associated plasma protein-A and free β-hCG) with ultrasound assessment of fetal nuchal translucency (10–13 weeks of gestation) and second-trimester triple (alpha-fetoprotein (AFP), estriol, β-hCG) or quadruple (AFP, estriol, β-hCG, inhibin-A) marker serum screening (15–20 weeks of gestation). In addition, there are several combined first- and second-trimester fetal aneuploidy screening approaches, including integrated and contingent testing. Only the second-trimester screening includes a serum screen for NTDs with elevated maternal serum AFP (MSAFP), so women who opt for the first-trimester screening also should be offered sec-

ond-trimester MSAFP testing or ultrasound screening for NTDs. All women presenting for prenatal care before 20 weeks of gestation should be offered screening for aneuploidy. The first-trimester combined screening has similar detection rates to the second-trimester quadruple screen for women younger than 35 years at the time of delivery. All women, regardless of age, should have the option of invasive prenatal diagnosis (ie, CVS or amniocentesis) for fetal aneuploidy. All serum samples should be submitted to a clinical laboratory that has a quality improvement program, normative data specific to each week of gestational age, and interpretations and risk assessment that take into account maternal weight, race, diabetic status, and, for trisomy 21 screening, maternal age. The laboratory should be able to confirm that the specific combination of tests and the particular assays performed will yield a minimum detection rate for trisomy 21 of approximately 70% and a positive rate of screening of 5% or less after ultrasound examination correction of gestational age. Specific training, standardization, use of appropriate ultrasound equipment, and ongoing quality assessment are required to achieve optimal Down syndrome diagnostic accuracy for nuchal translucency measurement, and this procedure should be limited to centers and individuals meeting these criteria.

Trisomy 21

All women should be provided with their specific fetal risk for trisomy 21. A serum marker screening result typically is considered positive if it indicates a midtrimester risk of trisomy 21 that is equal to or greater than that of a 35-year-old woman bearing a fetus with trisomy 21 (ie, 1:270 midtrimester risk). If ultrasound examination results do not reveal an error in gestational dating or diagnose a fetal disorder, amniocentesis should be offered to analyze fetal karyotype. If first-trimester or contingent screening is employed, patients with a positive screen may be offered CVS at 11–12 weeks of gestation.

Neural Tube Defects

The results of second-trimester MSAFP testing may be used to screen for NTDs. The use of a standard screening cutoff (2.5 multiples of the median) will detect approximately 80% of cases of open spina bifida and 90% of cases of anencephaly. Patients with elevated MSAFP levels are evaluated by ultrasonography to detect identifiable causes of false–positive results (eg, fetal death, multiple gestation, underestimation of gestational age) and for targeted study of fetal anatomy for NTDs and other defects associated with elevated MSAFP values (eg, omphalocele, gastroschisis, cystic hygroma). Amniocentesis may be

recommended to confirm the presence of open defects and to obtain a fetal karyotype. Amniocentesis may be offered even when ultrasound examination results do not reveal an identifiable defect or cause for the elevated MSAFP level, particularly if the ultrasound examination was suboptimal because of maternal obesity or abdominal scarring. It is important to remember that periconceptional supplementation with folic acid (0.4 mg/d) significantly decreases the first occurrence of NTDs. Periconceptional supplementation with 4 mg/d of folic acid decreases repeat occurrences of NTDs as well (see "Preconception Nutritional Counseling" in this chapter).

Prenatal Diagnosis of Genetic Disorders in Patients at Increased Risk

Prenatal genetic diagnosis should be offered in circumstances in which there is a definable increased risk for a fetal genetic disorder that may be diagnosed by one or more methods. Prenatal genetic screening or diagnosis should be voluntary and informed. In most circumstances, test results are normal and provide patients with a high degree of reassurance that a particular disorder does not affect a fetus, although there is no guarantee that it is normal and with no abnormalities. Early prenatal genetic diagnosis also affords patients the option to terminate affected pregnancies. Alternatively, a diagnosis of a genetic disorder may allow a patient to prepare for the birth of an affected child and, in some circumstances, may be important in establishing a plan for care during pregnancy, labor, delivery, and the immediate neonatal period.

Genetic Risk Assessment and Counseling

Many couples at increased risk for having children with genetic disorders can benefit from genetic counseling (see "Preconception Care" in this chapter). An example of current screening criteria is listed in the ACOG Antepartum Record in Appendix A. Health care providers should be aware that many single-gene disorders are discovered each year and may be tracked using Internet databases, such as "Online Mendelian Inheritance in Man" (www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=OMIM).

Sometimes the problem is relatively straightforward. For example, the health care provider can readily explain the well-known relationship between advanced maternal age and autosomal trisomies. The maternal age-adjusted risks for chromosome abnormalities are shown in Table 4–4. Increasing paternal age, particularly after age 50 years, predisposes the fetus to an increase in gene mutations that can affect X-linked recessive and autosomal dominant

Table 4–4. Chromosome Abnormalities in Term, Liveborn Neonates*

Maternal Age	Risk of Trisomy 21 at Delivery	Risk of Chromosomal Abnormalities[†]
20	1/1,667	1/526
21	1/1,667	1/526
22	1/1,667	1/526
23	1/1,429	1/500
24	1/1,250	1/476
25	1/1,250	1/476
26	1/1,176	1/476
27	1/1,111	1/455
28	1/1,053	1/435
29	1/1,000	1/417
30	1/952	1/385
31	1/909	1/385
32	1/769	1/322
33	1/602	1/286
34	1/485	1/238
35	1/378	1/192
36	1/289	1/156
37	1/224	1/127
38	1/173	1/102
39	1/136	1/83
40	1/106	1/66
41	1/82	1/53
42	1/63	1/42
43	1/49	1/33
44	1/38	1/26
45	1/30	1/21
46	1/23	1/16
47	1/18	1/13
48	1/14	1/10
49	1/11	1/8

*Because sample sizes for some intervals are relatively small, 95% confidence limits are sometimes relatively large. Nonetheless, these figures are suitable for genetic counseling.

[†]47,XXX excluded for ages 20–32 years (data not available).

Modified from Hook EB, Cross PK, Schreinemachers DM. Chromosomal abnormality rates at amniocentesis and in live-born infants. JAMA 1983;249:2034–2038. Copyrighted 1983, American Medical Association and Hook EB. Rates of chromosome abnormalities at different maternal ages. Obstet Gynecol 1981;58:282–85.

disorders, such as neurofibromatosis, achondroplasia, Apert's syndrome, and Marfan syndrome. Currently, it is not possible to screen prenatally for all autosomal dominant and X-linked diseases in the presence of advanced paternal age. Fetal ultrasonography may detect some autosomal dominant disorders, but this technique cannot be relied on as a screening modality. Chromosomal analysis cannot be used to detect these disorders. Only genetic counseling on an individual basis is recommended for couples to address their specific concerns if advancing paternal age is an issue.

In other cases, referral to a geneticist may be necessitated by the complexities of determining risks, evaluating a family history of such abnormalities, interpreting laboratory test results, or providing counseling. Regardless of the indication, counseling is essential before genetic screening or antenatal diagnostic tests are performed.

Prenatal genetic counseling addresses the risk of occurrence of a genetic disorder in a family. In this process, the primary health care provider, a medical geneticist, or other trained professional attempts to help the individual or family in the following areas:

- Comprehending the medical facts, including the diagnosis, probable course of the disorder, and available management

- Appreciating the way in which heredity contributes to the disorder and the risk of occurrence or recurrence in specific relatives

- Understanding the options for dealing with the risk of recurrence, including prenatal genetic diagnosis

- Choosing the course of action that seems appropriate in view of the risk and the family's goals and act in accordance with that decision

- Making the best possible adjustment to the disorder in an affected family member and to the risk of recurrence in another family member

The key elements in genetic counseling are accurate diagnosis, communication, and nondirective presentation of options. The counselor's function is not to dictate a particular course of action but to provide information that will allow couples to make informed decisions.

Diagnostic Testing

Amniocentesis

Transabdominal amniocentesis is the technique most commonly used for obtaining fetal cells for genetic studies. This well-established, safe, and reliable

procedure usually is performed at approximately 16 weeks of gestation. The cells obtained via amniocentesis can be used for blood typing or cytogenetic, metabolic, or other DNA testing. Alpha-fetoprotein and acetylcholinesterase levels can be measured in the supernatant amniotic fluid to detect open fetal NTDs. Significant maternal injury from amniocentesis is rare, and the estimated risk of spontaneous abortion caused by amniocentesis at 15 weeks of gestation or later is less than 1%. Increased loss rates are associated with more than three needle insertions. Amniocenteses performed at 11–13 weeks of gestation have been associated with relatively high postprocedure loss rates of 2–5%, an increased occurrence (1.4%) of talipes equinovarus (clubfoot), and increased cell culture failure rates.

Chorionic Villus Sampling

Chorionic villus sampling is a technique for removing a small sample (5–40 mg) of placental tissue (chorionic villi) for performing chromosomal, metabolic, or DNA studies. It generally is performed between 10 weeks and 12 weeks of gestation, either by a transabdominal or a transcervical approach. Chorionic villi, however, cannot be used for the prenatal diagnosis of NTDs. Therefore, women who have undergone cytogenetic testing by CVS should be offered MSAFP, or detailed ultrasound examinations, or both for NTD detection. Most prospective studies have shown that the procedure-related risk of pregnancy loss following CVS is not significantly different from the loss rate following amniocentesis. The possibility that CVS performed before 10 weeks of gestation may cause limb reduction defects remains controversial but should be discussed in counseling. Until further information is available, CVS should not be performed before 10 weeks of gestation.

Invasive Diagnostic Testing in Women Who Are Rh D Negative

Because both amniocentesis and CVS can result in fetal-to-maternal bleeding, the administration of anti-D immune globulin is indicated for women who are D negative and unsensitized and undergo either of these procedures. Chorionic villus sampling should not be performed in women who are red cell antibody sensitized because it may worsen the antibody response.

Tests of Fetal Well-Being

The goals of antepartum fetal surveillance are as follows:

- Identifying patients at increased risk for stillbirth

- Reducing the risk of fetal demise after 24 weeks of gestation
- Avoiding unnecessary intervention

Although there have been no randomized clinical trials that clearly demonstrate improved perinatal outcome with the use of antepartum testing or that determine the optimal time to initiate testing, these tests have become an integral part of clinical care of pregnancies suspected to be at increased risk of fetal demise. Indications for initiating such testing typically include the following conditions:

- Maternal conditions
    — Antiphospholipid syndrome
    — Hyperthyroidism (poorly controlled)
    — Hemoglobinopathies (hemoglobin SS, SC, or S-thalassemia)
    — Significant heart disease
    — Systemic lupus erythematosus
    — Chronic renal disease
    — Insulin-treated diabetes mellitus
    — Hypertensive disorders
- Pregnancy-related conditions
    — Pregnancy-induced hypertension
    — Decreased fetal movement
    — Oligohydramnios
    — Polyhydramnios
    — Intrauterine growth restriction
    — Postterm pregnancy
    — Isoimmunization (moderate to severe)
    — Previous fetal demise (unexplained or recurrent risk)
    — Multiple gestation (with significant growth discrepancy)

There are several tests used in clinical practice to assess fetal status. Commonly available tests (which are described in more detail in the following section) include the following procedures:

- Assessment of fetal movement (eg, kick counts)
- Nonstress test (NST)

- Biophysical profile (BPP)
- Modified biophysical profile (NST plus amniotic fluid index [AFI])
- Contraction stress test (CST) or oxytocin challenge test (OCT)
- Doppler ultrasonography of umbilical artery blood flow velocity

An important consideration in deciding when to begin antepartum testing is the prognosis for neonatal survival if intervention is undertaken for abnormal test results. Initiating testing at 32–34 weeks of gestation is appropriate for most pregnancies at increased risk of stillbirth, although in pregnancies with multiple or particularly worrisome high-risk conditions, testing may be initiated as early as 26–28 weeks of gestation. However, because the potential for iatrogenic harm to pregnancies is highest in preterm gestations, the low specificity of these tests needs to be considered. The implications of a nonreassuring fetal heart rate tracing at these early gestational ages still are unclear.

When the clinical condition that has prompted testing persists, a reassuring test (reactive NST, negative CST, or normal BPP) should be repeated periodically (either weekly or, depending on the test used and the presence of certain high-risk conditions, twice weekly) until delivery to monitor continued fetal well-being. In most clinical situations, a normal test result indicates that intrauterine fetal death is highly unlikely in the next 7 days. The risk of fetal death within 7 days of a reactive NST is approximately 3 per 1,000 fetuses. The risk of fetal death within 7 days of a BPP of 8–10 or a negative OCT or CST result is 0.6–0.8 per 1,000 fetuses. In contrast, an abnormal test result or nonreassuring fetal assessment frequently (50–90%) is falsely positive (ie, worrisome) and, therefore, should be corroborated whenever possible before potentially harmful interventions are undertaken. In the presence of certain high-risk conditions, such as prolonged pregnancy, insulin-treated diabetes mellitus beyond 36 weeks of gestation, intrauterine growth restriction, or pregnancy-induced hypertension, twice-weekly testing may be appropriate.

The sequence of tests to determine fetal well-being may vary by practice and protocol. Each test has advantages and disadvantages, and no single test has been shown to be superior to the others in any specific clinical situation. The NST is the most commonly used screening test for antepartum fetal evaluation. It is easily performed in an outpatient setting with minimal staffing, and it can be easily archived for review. The BPP requires a trained ultrasonographer and ultrasound equipment. However, unless the study is videotaped, it cannot be reviewed. The BPP does have a lower false–positive rate (20%) than NST alone (75–90%) and is supplanting the CST as a supplemental test following a non-

reactive NST because of its ease of performance. Regardless of which antepartum surveillance test is used, the results and interpretation should be noted in the patient's medical record.

Assessment of Fetal Movement

A decrease in the maternal perception of fetal movement may, but does not invariably, precede fetal death, in some cases by several days. This observation provides the rationale for fetal movement assessment by the mother (kick counts) as a means of antepartum fetal surveillance. Whether programs of fetal movement assessment actually can reduce the risk of stillbirth is unclear. Neither the ideal number of kicks nor the ideal duration of daily movement count assessment has been defined. Perhaps more important than any single quantitative guideline is the mother's perception of a decrease in fetal activity in relation to a previous level. One approach to assessing fetal movement is to have the woman count distinct fetal movements on a daily basis after 28 weeks of gestation. The perception of 10 distinct movements in a period of up to 2 hours is considered reassuring. After 10 movements have been perceived, the count can be discontinued for that day. In the absence of a reassuring count, a biophysical means of fetal assessment (NST and AFI, BPP, or CST) should be used.

Nonstress Test

For the NST, the fetal heart rate is monitored with an external transducer for at least 20 minutes. The tracing is observed for fetal heart rate accelerations peaking at least 15 beats per minute higher than the baseline and acceleration lasting 15 seconds from baseline to baseline. The testing can be continued for an additional 40 minutes or longer to take into account the typical fetal sleep–wake cycle. Because fetal heart rate reactivity is a function of fetal maturity, more than 15% of NSTs performed before 32 weeks of gestation may be nonreactive in the absence of fetal compromise. Before 32 weeks of gestation, accelerations usually peak at 10 beats per minute and persist for 10 seconds. The results of an NST are considered reactive (reassuring) if two or more fetal heart rate accelerations are detected within a 20-minute period, with or without fetal movement discernible by the mother. A nonreactive tracing is one without sufficient fetal heart rate accelerations in a 40-minute period. Vibroacoustic stimulation (lasting 1 second) of a fetus that elicits fetal heart rate accelerations also is reassuring. The use of such stimulation can safely reduce overall testing time.

Contraction Stress Test

For a CST, the fetal heart rate is obtained using an external transducer, and uterine contraction activity is monitored with a tocodynamometer. A baseline tracing is obtained for 10–20 minutes. If at least three contractions of 40 seconds or more are present in a 10-minute period, uterine stimulation is not necessary. If the contractions are not present, they are induced with either nipple stimulation or intravenously administered oxytocin. With nipple stimulation, the patient is instructed to rub one nipple gently through her clothing for 2 minutes or until a contraction begins. Stimulation is then stopped and restarted after 5 minutes if an adequate contraction frequency has not been attained. The cycle is repeated until an adequate contraction pattern is obtained. If the use of oxytocin is preferred by the patient or if nipple stimulation is unsuccessful, an intravenous infusion of low-dose oxytocin can be initiated, usually at a rate of 0.5–1 mU/min, and increased every 15–20 minutes until an adequate contraction pattern occurs (ie, three contractions in 10 minutes). The results of the CST can be categorized as follows:

- Negative—No late or significant variable decelerations
- Positive—Late decelerations following 50% or more of contractions, even if the frequency of contractions is less than three in 10 minutes
- Equivocal-suspicious—Intermittent late or significant variable decelerations
- Equivocal-hyperstimulatory—Fetal heart rate decelerations that occur in the presence of contractions more frequent than every 2 minutes or lasting longer than 90 seconds
- Unsatisfactory—Fewer than three contractions within 10 minutes or a tracing that cannot be interpreted

Both oxytocin and nipple stimulation can produce tachysystole (contractions that occur more frequently than every 2 minutes or exceed 90 seconds in duration). If fetal heart rate decelerations occur in the presence of hyperstimulation, retesting is appropriate to ensure correct interpretation. Relative contraindications to inducing contractions for CSTs generally include the following conditions:

- Preterm labor or certain patients at high risk for preterm delivery
- Preterm rupture of membranes
- Classic uterine incision scar or history of extensive uterine surgery
- Known placenta previa

Biophysical Profile

Biophysical profile testing consists of an NST with the addition of four observations using real-time ultrasonography. The five components of a reassuring BPP are:

1. Nonstress test, if result is reactive—Because the probability of fetal well-being is identical with scores of 10 out of 10 and 8 out of 10, the NST may be excluded if all other parameters of the BPP are reassuring in more than 97% of cases without adverse consequences.

2. Fetal breathing movements—One or more episodes of rhythmic fetal breathing movements of 30 seconds or more within 30 minutes

3. Fetal movement—Three or more discrete body or limb movements within 30 minutes

4. Fetal tone—One or more episodes of fetal extremity extension with return to flexion, or opening or closing of a hand within 30 minutes

5. Quantification of amniotic fluid volume—A pocket of amniotic fluid that measures at least 2 cm in two planes perpendicular to each other

With BPP testing, a score of 2 (present) or 0 (absent) is assigned to each of the five observations. A score of 8 or 10 is reassuring. A score of 6 is equivocal and generally should lead to delivery if the patient is at term, whereas retesting within 12–24 hours may be appropriate for a preterm fetus. A score of 4 or less is nonreassuring and warrants further evaluation and consideration of delivery. Irrespective of the score, more frequent BPP testing or consideration of delivery may be warranted when oligohydramnios is present.

Modified Biophysical Profile

As another approach to fetal surveillance, the modified BPP combines the use of an NST as a short-term indicator of fetal status with the assessment of AFI as an indicator of long-term placental function. The AFI is a semiquantitative, four-quadrant assessment of amniotic fluid depth. A value of less than or equal to five is considered indicative of oligohydramnios. The modified BPP is less cumbersome than complete BPP assessment and appears to be as predictive of fetal well-being as other approaches of biophysical fetal surveillance. Indeed, the rate of stillbirth within one week of a normal modified BPP is the same as that with the full BPP.

Doppler Ultrasonography of Umbilical Artery

Umbilical artery Doppler flow ultrasonography is a noninvasive technique to assess resistance to blood flow in the placenta. It is not a screening test for detecting fetal compromise in the general population, but it can be used in conjunction with other biophysical tests in high-risk pregnancies associated with suspected intrauterine growth restriction. Umbilical artery Doppler flow velocimetry is based on the characteristics of the systolic blood flow and the diastolic blood flow. The most commonly used index to quantify the flow velocity waveform is the systolic/diastolic ratio. As peripheral resistance increases, diastolic flow decreases and may become absent or reversed, and the systolic/diastolic ratio increases. Reversed end-diastolic flow can be seen with severe cases of intrauterine growth restriction secondary to uteroplacental insufficiency and may suggest impending fetal demise.

Assessment of Fetal Pulmonary Maturation

Fetal pulmonary maturity always should be taken into consideration when delivering a fetus electively or preterm in high-risk pregnancies. Fetal lung maturity should be confirmed before all elective deliveries at less than 39 weeks of gestation for patients who are not infected with HIV. All efforts should be made to administer a course of antenatal corticosteroids to women whose pregnancies are at high risk for preterm delivery between 24–34 weeks of gestation to promote fetal lung maturation (see Chapter 6). The following fetal maturity tests are available:

- Surfactant/albumen ratio (fetal lung maturity index)
- Lecithin/sphingomyelin ratio
- Phosphatidylglycerol
- Foam stability index
- Fluorescence polarization
- Optical density at 650 nm
- Lamellar body counts
- Saturated phosphatidylcholine

Although the lecithin/sphingomyelin ratio as first used is the industry standard for determining fetal lung maturity, the other tests rapidly are replacing the lecithin/sphingomyelin ratio in clinical practice because of their technical ease. Regardless of the test used, the probability of respiratory distress syndrome

after a mature test result beyond 34 weeks of gestation is less than 5%. In contrast, all available tests that show immature results are relatively poor in predicting respiratory distress syndrome. However, because no test indicating maturity can completely eliminate the risk of respiratory distress syndrome or other neonatal complications, the risk of adverse neonatal outcome following delivery must be weighed against the potential risk of allowing the pregnancy to remain in utero.

Issues to Discuss With Patients Before Delivery

Working

A woman with an uncomplicated pregnancy usually can continue to work until the onset of labor. Women with medical or obstetric complications of pregnancy may need to make adjustments based on the nature of their activities, occupations, and specific complications. It also has been reported that pregnant women whose occupations require standing or repetitive, strenuous, physical lifting have a tendency to give birth earlier and have smaller-for-gestational-age infants. Although a period of 4–6 weeks generally is required for a woman's physiologic condition to return to normal, the patient's individual circumstances should be considered when recommending resumption of full activity. It also is important for the development of children and the family unit that adequate family leave be available for parents to be able to participate in early childrearing. The federal Family and Medical Leave Act and state laws should be consulted to determine the family and medical leave that is available.

Air Travel During Pregnancy

In the absence of obstetric or medical complications, pregnant women can observe the same general precautions for air travel as the general population and can fly safely up to 36 weeks of gestation. However, most airlines provide liberal maternity leave policies allowing flight attendants to stop flying with confirmation of pregnancy. Some restrict the working air travel of flight attendants after 20–24 weeks of gestation and restrict commercial airline pilots from flying once pregnancy is diagnosed. Air travel is not recommended at any time during pregnancy for women who have medical or obstetric complications for which likely emergencies cannot be predicted. Such complications may include increased risks for or evidence of preterm delivery, pregnancy-induced hypertension, poorly controlled diabetes mellitus, or sickle cell disease, which may be exacerbated by high altitude.

In-craft environmental conditions, such as low cabin humidity and changes in cabin pressure, coupled with the physiologic changes of pregnancy, do result in maternal adaptations that could have transient effects on the fetus. These changes should not affect normal pregnant women; however, pregnant women with medical problems that may be exacerbated by a hypoxic environment who must travel by air should be prescribed supplemental oxygen during air travel.

The risks of lower extremity edema and venous thrombotic events are increased by long hours of air travel immobilization and may be minimized by the use of support stockings, periodic movement of the lower extremities and staying well hydrated. Pregnant air travelers may help minimize in-flight discomfort by avoiding gas-producing foods and drinks before and during flight. Additionally, preventive antiemetic medication should be considered for pregnant women with increased nausea. Because air turbulence cannot be predicted and the risk for trauma is significant, pregnant women, as well as all air travelers, should be instructed to continuously use their seat belts while seated. The seatbelt should be belted low on the hipbones, between the protuberant abdomen and pelvis.

Childbirth Education Classes and Choosing a Newborn Care Provider

Couples should be referred to appropriate educational literature and urged to attend childbirth education classes. Studies have shown that prepared childbirth education programs can have a beneficial effect on performance in labor and delivery. The prenatal period should be used to expose the prospective parents to information about labor and delivery, pain relief, obstetric complications and procedures, breastfeeding, normal newborn care, and postpartum adjustment. Other family members also should be encouraged to participate in childbirth education programs. Adequate preparation of family members may benefit the mother, the neonate, and, ultimately, the family unit. Many hospitals, community agencies, and other groups offer such educational programs. The participation of physicians, certified nurse midwives, and hospital obstetric nurses in educational programs is desirable to ensure continuity of care and consistency of instruction. National organizations, such as the Childbirth Education Association, are available for assistance as well. Integration of parenting education in prenatal education is beneficial in facilitating transition to parenthood. If a patient has a birth plan, she should be encouraged to review it with her provider before labor. Sometime in the third trimester, it should be determined if the patient has a newborn care provider. If she does not have one,

she should be referred to the appropriate resources to identify her newborn care provider before delivery, if possible.

Anticipating Labor

As pregnancy progresses into the third trimester, all women should be informed of what to do if contractions become regular, if membrane rupture is suspected, or if vaginal bleeding occurs. Patients should be given a telephone number to call where assistance is available 24 hours per day. Patients should be encouraged to refrain from consumption of solid food when active labor ensues. Pregnant women are at highest risk of aspiration pneumonitis when stomach contents are greater than 25 mL and when the pH of those contents is less than 2.5. Pregnancy slows gastric emptying, and labor can delay it further. The type of aspiration pneumonitis that produces the most severe physiologic and histologic alteration is partially digested food. A detailed discussion of the analgesic and anesthetic options available for labor and delivery should be held during the third trimester.

Breech Presentation at Term

If the fetus persists in a breech presentation at 36–38 weeks of gestation, women should be offered an external cephalic version. Contraindications to the procedure include multifetal gestation, nonreassuring fetal testing, müllerian duct anomalies, and suspected placental abruption or previa. Relative contraindications include intrauterine growth restriction and oligohydramnios. The success rate of external cephalic version ranges from 35–86%, with an average success rate of approximately 58%. Planned cesarean delivery is the most common and safest route of delivery for fetuses at term in breech presentations. However, planned vaginal delivery of a term singleton breech may be reasonable under hospital-specific protocol guidelines for both eligibility and labor management if the care provider is experienced in vaginal breech deliveries. Before embarking on a plan for a vaginal breech delivery, women should be informed that the risk of perinatal or neonatal mortality or short-term serious neonatal morbidity might be somewhat higher than if a cesarean delivery is planned. Informed consent for vaginal delivery should be obtained and documented. In those instances in which breech vaginal deliveries are pursued, great caution should be used.

Vaginal Birth After Cesarean Delivery

If the patient has had a prior cesarean delivery, the risks and benefits of a trial of labor versus repeat cesarean delivery should be discussed with the patient.

Advantages of a successful vaginal delivery include decreased risks for hemorrhage and infection, a shorter postpartum hospital stay, and a less painful, more rapid recovery. The patient should be informed of contraindications to a trial of labor (eg, prior classic or T-shaped cesarean incision, previous uterine rupture, lack of resources to perform emergency cesarean delivery during labor) as well as relative contraindications (eg, two prior uterine surgeries with no previous vaginal delivery). The patient also should be informed that although uterine rupture occurs more often in women undergoing a trial of labor than in women who elect repeat cesarean delivery, rupture rates during attempted vaginal birth after cesarean delivery generally are less than 1%. Uterine rupture has been associated with fetal death as well as severe neonatal neurologic injury and may occur no matter what resources are available to manage it. Risk of uterine rupture increases with multiple uterine surgeries, uterine tachysystole, use of cervical ripening agents, or induction of labor with oxytocin. Hospitals that offer vaginal trial of labor in women with prior cesarean delivery should have the personnel necessary to monitor labor and to perform a cesarean delivery—including the obstetrician and operating room and anesthesia staff—immediately available during active labor. No woman should be mandated to undergo a trial of labor. The ultimate decision to attempt vaginal delivery after cesarean delivery or to undergo a repeat cesarean delivery should be made by the informed patient and her physician.

Childbearing for Women Older Than 50 Years

Because of advances in assisted reproductive technology, it is now possible for women aged 50 years and older to become pregnant and to have successful obstetric outcomes. Nonetheless, pregnancy in this age group is rare, and because of the small number of patients, recommendations for pregnancy management are based on retrospective studies, case series, and expert opinion. Before starting fertility treatment, these women should be counseled about the complications associated with pregnancy in this age group. Risks include multiple gestation, preeclampsia, gestational diabetes, abnormal placentation, stillbirth, cesarean delivery, and, possibly, cardiac complications. These risks also are associated with women aged 40 years and older. These women also should have a medical workup before undergoing fertility treatment to determine that they are healthy. Once these women are pregnant, their blood pressure should be monitored frequently. Most often, these pregnancies are secondary to egg donation, and the risk of fetal aneuploidy is that of the egg donor. First-trimester screening, chorionic villus sampling, and amniocenteses are all

options for these women. Invasive testing may not be as critical for egg-donor recipients because the egg donors are usually young. An anatomical survey should be performed at approximately 18–20 weeks gestation. Also, glucose-tolerance testing in the early third trimester is suggested. Cesarean delivery can be reserved for obstetric indications. Long-term outcomes regarding parenting that affect pediatric and maternal outcomes of childbearing by women older than 50 years are unknown.

Umbilical Cord Blood Banking

Prospective parents may seek information regarding umbilical cord blood banking. Balanced and accurate information regarding the advantages and disadvantages of public versus private banking should be provided. Health care providers should dispense the following information:

- There is clinical potential of hematopoietic stem cells found in cord blood.
- The indications for autologous transplantation are limited.
- Banking should be considered if there is a family member with a current or potential need to undergo stem cell transplantation.
- Where logistically possible, collection and support of umbilical cord blood for public banking is encouraged.

Support of Breastfeeding

During prenatal visits, the patient should be counseled regarding the nutritional advantages of human breast milk. Human milk is the most appropriate nutrient for newborns and provides significant immunologic protection against infection. Newborns who are breastfed have a decreased incidence of infection and require fewer hospitalizations than formula-fed neonates. Women should be provided with information regarding available lactation consultation services and organizations (see "Breastfeeding" in Chapter 7). Maternal benefits start in the immediate postpartum period with the release of oxytocin during milk letdown. This results in increased uterine contractions, aiding with uterine involution, and a decrease in maternal blood loss.

Circumcision

The topic of newborn male circumcision should be discussed. Newborn circumcision is an elective procedure to be performed, at the request of the parents, on newborn boys who are physiologically and clinically stable. The American Academy of Pediatrics 1999 Task Force suggests that existing scien-

tific evidence demonstrates potential medical benefits of newborn male circumcision (eg, reduced incidences of phimosis, urinary tract infection, and penile cancer). However, the data are not sufficient to recommend routine neonatal circumcision. Appropriate anesthesia must be provided for the procedure (see "Circumcision" in Chapter 7).

Newborn Screening

Newborn screening is a public health issue that has moved into the spotlight because of advances in genetic medicine. Although newborn screening tests are designed to detect infants with specific metabolic disorders who would benefit from early diagnosis and treatment, they also may identify couples who are carriers of disorders. Because of advances in genetics and technology, newborn screening programs are capable of testing for approximately 30 disorders, including infections, genetic diseases, and inherited and metabolic disorders.

Newborn hearing screening can detect possible hearing loss in the first days of a baby's life. If a possible hearing loss is found, further tests will be done to confirm the results. If a hearing loss is confirmed, treatment and early intervention can start promptly. Early intervention helps babies with hearing loss and their families learn important communication skills. For more specific information on this screening, see "Hearing Screening" in Chapter 7.

Newborn screening programs are designed for maximal sensitivity and specificity; the false-negative rate must be kept at an absolute minimum so that no cases will be missed. However, this results in significant false–positive rates. Therefore, confirmatory testing is essential. A false-positive test result can cause parental anxiety. Counseling by the obstetric provider can be of great value. Prenatal education about newborn screening not only provides parents with an understanding of the reasons for obtaining their newborn's blood specimen but also informs them that an initial positive test result does not necessarily mean that their child will be affected. For more information, see "Newborn Screening" in Chapter 7.

Dental Care in Pregnancy

Caries, poor dentition, and periodontal disease may be associated with an increased risk for preterm delivery. It is very important that pregnant women continue usual dental care in pregnancy. This dental care includes routine brushing and flossing, scheduled cleanings, and any medically needed dental work. Many dentists will require a note from the obstetrician stating that dental care requiring local anesthesia, antibiotics, or narcotic analgesia is not con-

traindicated in pregnancy. The dentist should be aware that pregnant women's gums do bleed more easily.

Preparation for Discharge

Prospective parents should be aware of the timing of hospital discharge after delivery. The couple should be encouraged to prepare for discharge by setting up required resources for home health services and acquiring a newborn car seat, newborn clothing, and a crib that meets standard safety guidelines. The prospective parents should be apprised of proper newborn positioning during sleep. Reports have shown a significant reduction in the incidence of sudden infant death syndrome among newborns that are placed on their backs (as opposed to the prone position) during sleep (see Chapter 7, "Care of the Neonate" for more information). The patient should be informed of the various options of pregnancy prevention and birth control. This may be done by individual instruction, reading material, or a variety of films or videotapes.

Psychosocial Services

Confronting psychosocial issues, such as providing appropriate childcare, the need for simultaneous employment, guilt associated with unintended pregnancy, and other family conflicts, may be the most distressing aspect of a woman's pregnancy and postpartum recovery. A woman with ambivalent feelings about her pregnancy may benefit from additional support from the health care team. Patients should be informed that postpartum "blues" are a normal phenomenon that occur in more than 70% of women. Women may manifest a wide range of symptoms, including weeping, depression, restlessness, mood lability, and negative feelings toward their newborns. The blues are transient (lasting less than 2 weeks) and mild, not interfering with the patient's ability to care for herself or her child. All patients should be followed for the development of more severe postpartum depression and offered culturally appropriate treatment or referral to community resources (see also "Follow-up Care" in Chapter 5). Women with a history of depression or a family history of depression are at increased risk for postpartum depression.

A woman with negative feelings about her pregnancy should receive additional support from the health care team, and she may need professional advice on the alternatives to completing the pregnancy and keeping the newborn. Family members and their interactions with the pregnant woman should be considered in whatever recommendations are made to the woman. Physicians

should be aware of individuals and community agencies to which patients can be referred for additional counseling and assistance when necessary. More information is available at the American Psychiatric Association web site (www.psych.org).

Conditions of Special Concern

Adolescent Pregnancy

Pregnancy, birth, and abortion rates in teenagers have declined 30–40% since 1990 and are now at record lows. In the 2003 *National Vital Statistics Report*, only 6,471 births occurred in minors younger than 15 years. Approximately 82% of women younger than 20 years who give birth are unmarried. Approximately 2–4% of unmarried adolescents relinquish their newborns for adoption.

The status of laws requiring mandatory parental involvement in a minor's abortion decision currently is in flux. Most states have statutes addressing this issue, although the content and degree of enforcement of these laws vary considerably. Minors typically have legal rights protecting their privacy regarding the diagnosis and treatment of pregnancy. The clinician should assess the adolescent's ability to understand the implications of the diagnosis of pregnancy and the options available. The duration of the pregnancy should be determined and documented. The following three options are available:

1. Continuation of the pregnancy with the intent of raising the child

2. Continuation of the pregnancy with the intent of relinquishing the newborn for adoption

3. Termination of the pregnancy

The patient should be informed about the options available, return for visits as needed, and understand the importance of a timely decision. She should be encouraged to include her parents (or a surrogate parent) and the father of the fetus. The patient's right to decide the outcome of the pregnancy and who should be involved should be respected. Many states have laws regarding adolescent rights, and the physician should be aware of these state laws when making health care decisions.

If the adolescent chooses to continue the pregnancy, she should be referred for psychosocial support. There is an increased incidence of delivery of low birth weight neonates, neonatal death, preterm delivery, preeclampsia, anemia,

and sexually transmitted diseases (STD) among pregnant adolescents, necessitating increased monitoring and appropriate medical management. Pregnant adolescents should be counseled about the effects of STDs on themselves and their fetuses. They should receive repetitive reinforcement that condoms should be used during pregnancy for STD protection.

Postterm Gestation

Approximately 10% (3–14%) of pregnancies extend beyond 42 weeks of gestation (294 days or more from the first day of the last menstrual period) and are considered postterm. Although some apparent cases of postterm pregnancy are the result of an inability to define the time of conception accurately, some patients clearly progress to excessively long gestations that can represent a significant risk to the fetus. Accurate assessment of gestational age will minimize the misdiagnosis of postterm gestation.

Antepartum assessments by cervical examination, fetal heart rate testing (NST or CST), ultrasound evaluation of amniotic fluid volume, BPP, or a combination of these tests may be initiated between 41 weeks and 42 weeks of gestation. Although no firm recommendation can be made on the basis of published research regarding the frequency of antenatal surveillance among postterm patients, many practitioners use twice-weekly testing. If fetal testing is not reassuring, delivery is indicated. Even when fetal testing is reassuring but reliable dating establishes a gestational age of 41–42 weeks, induction of labor is an acceptable management strategy.

Antepartum Hospitalization

Pregnant patients with complications who require hospitalization before the onset of labor should be admitted to a designated antepartum area, either inside or near the labor and delivery area. Obstetric patients with serious and acute complications should be assigned to an area where more intensive care and surveillance are available, such as the labor and delivery area or an intensive care unit. An obstetrician–gynecologist or a specialist in maternal–fetal medicine should be involved, either as the primary or the consulting physician, in the care of an obstetric patient with complications. When sufficiently recovered, the pregnant patient should be returned to the obstetric service, provided that her return does not jeopardize her care.

Acutely ill obstetric patients who are likely to give birth to neonates requiring intensive care should be cared for in specialty or subspecialty perinatal care centers, depending on the medical needs of the maternal–fetal dyad. When fea-

sible, antepartum transfer to specialty or subspecialty perinatal care centers should be encouraged for these women.

Written policies and procedures for the management of pregnant patients seen in the emergency department or admitted to nonobstetric services should be established and approved by the medical staff and must comply with the requirements of federal and state transfer laws. When warranted by patient volume, a high-risk antepartum care unit should be developed to provide specialized nursing care and facilities for the mother and the fetus at risk. When this is not feasible, written policies are recommended that specify how the care and transfer of pregnant patients with obstetric, medical, or surgical complications will be handled and where these patients will be assigned.

Whether an obstetric patient is admitted to the antepartum unit or to a nonobstetric unit, her condition should be evaluated soon thereafter by the primary physician or appropriate consultants. The evaluation should encompass a complete review of current illnesses as well as a medical, family, and social history. The condition of the patient and the reason for admission should determine the extent of the physical examination performed and the laboratory studies obtained. A copy of the patient's current prenatal record should become part of the hospital medical record as soon as possible after admission. These policies also must comply with the requirements of federal and state transfer laws.

Isoimmunization in Pregnancy

The pathogenesis of blood group isoimmunization resulting in hemolytic disease of the newborn has been well described. Rational methods of assessing the extent of the disease, including amniocentesis, umbilical cord blood sampling, and middle cerebral artery Doppler ultrasound measurements and of treating the fetus have been developed. Since 1967, preventive therapy has been available for Rh D isoimmunization in the form of anti-D immune globulin (RhoGAM), which has been associated with a decrease in the incidence of Rh D isoimmunization. However, despite the decreased incidence, Rh D isoimmunization remains the most common cause of serious hemolytic disease of the fetus and newborn. Among the etiologies of residual Rh D isoimmunization cases are failure to accurately type the patient's blood, transfusion of mismatched blood, early or severe fetal-to-maternal hemorrhage, and failure to administer a sufficient amount of anti-D immune globulin at delivery. Other RBC antigens associated with hemolytic disease of the fetus and newborn include c, Kell, E, e, C^w, C, Ce, Kp^a, Kp^b, cE, k, Jk^a, s, Wr^a, and Fy^a.

If isoimmunization is noted during routine prenatal testing, the genotype of the father can be determined, or in the case of anti-D, estimated. In the case of paternal heterozygosity for the offending antigen, the fetal blood type often can be determined by DNA analysis of fetal cells obtained at amniocentesis. Should such a study reveal the absence of the target gene, the fetus has a 98.5% probability of not being at risk. Discordance between the apparent fetal amniocyte genotype and RBC phenotype can result from rearrangement of the paternal Rh (D) gene locus (2% of patients). If the fetus is affected, the patient should be referred for consultation with a maternal–fetal medicine specialist with experience in the management of such cases (see also "Antibody Testing" in this chapter).

Pregnancy Outcomes in Women Older Than 35 Years as of the Estimated Delivery Date

In 2003, birth rates for women in their 30s were the highest in more than three decades (95.2 per 1,000 for ages 30–34; 43.8 per 1,000 for ages 35–39) and continue to increase. The birth rate for women aged 40–44 years increased to 8.7 per 1,000 births in 2003, a greater than 200% increase since 1981. In 2003, more than 100,000 births occurred in women older than 39 years. Several factors have contributed to this increase in older pregnant women, including delayed childbearing because of career, aging of the "baby boom" generation, and assisted reproductive technologies (ART). With increasing maternal age, there is an increase in the presence of underlying medical conditions. It is important to review the potential additional risks that advanced maternal age may pose and counsel the patient accordingly:

- Cesarean delivery—In nearly all studies, an increase in the prevalence of cesarean delivery in older pregnant women has been noted. This increase persists despite similar labor management of older nulliparous women compared with nulliparous women aged 20–29 years.

- Stillbirth and growth restriction—After correcting for the higher prevalence of aneuploidy in older pregnant women, results from the preponderance of published reports fail to demonstrate an increase in perinatal morbidity or mortality in previously healthy women.

- Assisted reproductive technology and multiple gestation—Women older than 35 years are more likely to conceive via some form of ART than women younger than 35 years. With ART, there is a well-reported increase in multiple gestations.

- Aneuploidy—The incidence of fetal aneuploidy increases with increasing maternal age. This increased risk has been well reported. Advanced paternal age, particularly after age 50 years, is implicated in an increase in gene mutations that can affect X-linked recessive and autosomal dominant disorders, such as neurofibromatosis, achondroplasia, Apert's syndrome, and Marfan syndrome.

- Medical conditions—There is no consensus in the literature as to whether older patients without preexisting medical conditions have a higher prevalence of preeclampsia, placenta previa, breech presentation, preterm delivery, or operative vaginal delivery. In general, increases in perinatal and maternal morbidity are likely because of the increased risk of developing medical disorders with advancing age.

Nonobstetric Surgery in Pregnancy

Nonobstetric surgery is sometimes necessary during pregnancy, and there are no data to support specific recommendations. However, obstetric consultation to confirm gestational age and make recommendations about fetal monitoring is highly recommended. The decision to use fetal monitoring should be individualized and depends on fetal age and type of surgery. Pregnant patients who undergo nonobstetric surgery are best managed with communication between involved services, including obstetrics, anesthesia, surgery, and nursing.

Multifetal Gestations

The incidence of twin and higher-order multiple gestations has increased significantly over the past 20 years primarily because of the availability and increased use of ovulation-inducing drugs and ART, such as in vitro fertilization. Between 1971 and 2002, the number of triplet births increased more than fourfold, from 1,034 to 6,898. In addition, there were 434 quadruplet births in the United States in 2002. There is increased fetal, neonatal, and maternal morbidity and mortality associated with multifetal gestations. The practicing obstetrician managing these high-risk patients should be familiar with their special antepartum and intrapartum problems, but consultation with maternal–fetal medicine specialists may be necessary. Methods to limit high-order multiple pregnancies include monitoring hormone levels and follicle numbers during superovulation and limiting transfer to two embryos during in vitro fertilization cycles. Transferring two embryos can limit the occurrence of triplets in younger candidates who have a good prognosis without significantly decreasing the overall pregnancy rate. The American Society for Reproductive

Medicine and the Society for Assisted Reproductive Technology have developed updated recommendations on the number of embryos per transfer to reduce the risk of multiple gestation.

Antepartum Management

Counseling. Ideal antepartum care requires recognition of the following four issues in management and a frank discussion with the patient regarding how these issues may affect her pregnancy:

1. Nutritional considerations—It is recommended that maternal dietary intake in a multiple gestation be increased by approximately 300 kcal per day more than that for a singleton pregnancy. Supplementation should include iron and folic acid. Although optimal weight gain for women with multiple gestations has not been determined, it has been suggested that women with twin gestations gain 35–45 lb.

2. Prenatal diagnosis—The usual indications for prenatal diagnosis and counseling in a singleton pregnancy apply to twin and higher-order gestations. Because the incidence of twin gestation increases with maternal age, women with multiple gestations often are candidates for prenatal genetic diagnosis. Genetic counseling should make clear to the patient the need to obtain a sample from each fetus, the risk of chromosomal abnormalities, potential complications of the procedure, the possibility of discordant results, and the ethical and technical concerns when the chromosomes of one fetus are found to be abnormal. There is evidence that the combined risk of fetal chromosome abnormality is higher in dizygotic twin gestations than a singleton gestation.

   Maternal serum alpha-fetoprotein screening programs contribute to the early detection of multiple gestations. Depending on the laboratory, a value greater than 4.5 multiples of the median in an uncomplicated twin gestation is abnormal, requiring further comprehensive ultrasound evaluation by an experienced ultrasonographer and possible amniocentesis for the detection of amniotic fluid AFP and acetylcholinesterase. Although maternal serum screening with MSAFP for NTDs can be useful in twin pregnancies, the effectiveness of serum screening with other analytes for trisomy 21 or trisomy 18 is less well established in multiple gestations.

   There is no clear evidence of an increased risk of amniocentesis in twin versus singleton gestations, except that the patient may have the risk of at least two procedures. Chorionic villus sampling is an appropriate method of first-trimester prenatal diagnosis in multiple gesta-

tions. Difficulties that can arise with CVS in twin gestations include the inability to obtain an adequate sample and contamination of one sample with tissue from the second. In approximately 1% of patients, tissue can be obtained from only one placenta. When CVS is performed at centers with experienced operators, twin–twin contamination occurs in approximately 4–6% of samples, leading to possible prenatal diagnostic errors.

3. Multifetal reduction—The greater the number of fetuses within the uterus, the greater the risk of preterm delivery and adverse perinatal outcome. Multifetal pregnancy reduction may be performed to decrease the risk of serious perinatal morbidity and mortality associated with preterm delivery by reducing the number of fetuses. Unintended pregnancy loss is the main risk of multifetal pregnancy reduction, varying with both the number of starting fetuses and the number of "finishing" viable fetuses from 2.5% to nearly 17%. Most studies have concluded that the risks associated with continuation of a quadruplet or higher pregnancy clearly outweigh the risks associated with fetal reduction. Multifetal pregnancy reduction of triplet gestations to twin gestations results in outcomes comparable to those seen in unreduced twin gestations.

4. Management of other complications—The patient carrying a multiple gestation should be informed that she is at risk for a number of other potential complications including, but not limited to, preterm labor, preterm premature rupture of membranes, discordant fetal growth and intrauterine growth restriction, abnormal fluid volumes, preeclampsia, death of one fetus, and discordancy for fetal anomalies. Twin–twin transfusion syndrome, monoamniotic twinning, conjoined twins, and acardia (or twin reversed arterial perfusion sequence) are complications of monochorionic gestations. The most significant, common, and likely unpreventable complication of multiple pregnancy is preterm delivery. Women pregnant with multiple gestations are at a higher risk for complications of tocolysis, such as the development of pulmonary edema, because of higher blood volume, lower colloid osmotic pressure, and anemia. No benefit has been shown from the use of oral tocolysis in multiple gestations to prevent the onset of preterm labor or preterm birth. Antenatal corticosteroids should be administered for induction of fetal lung maturation to women with multiple pregnancies who experience preterm labor or preterm membrane rupture at less than 34 weeks of gestation.

Antepartum Surveillance. When intrauterine growth restriction, abnormal fluid volumes, growth discordance, pregnancy-induced hypertension, fetal anomalies, monoamnionicity, or other pregnancy complications occur, fetal surveillance, including NSTs or the modified or standard BPP, is indicated. The BPP is as reliable in multiple gestations as in singleton gestations. Although some patients may find it difficult to distinguish fetal movements between twins, fetal movement counting can be an adjunct to these antepartum surveillance techniques. Umbilical cord velocimetry may be helpful in evaluating the severely growth-restricted fetus, but its role in antepartum fetal surveillance of the singleton or multiple gestation is yet to be determined.

Ultrasonography. Ultrasonography can be useful in both prenatal diagnosis and surveillance of multiple gestations. Ultrasonography has a role in evaluating fetal growth and amniotic fluid volume once the diagnosis is established. Beginning at viability, serial estimations of fetal growth by ultrasonography (every 4–6 weeks after viability) are a prudent measure because physical examination is less reliable.

Controversies in Management

There are many diagnostic or therapeutic modalities used in the care of multiple gestations that are of unclear or unproven benefit. Some examples of these modalities are listed as follows:

- Vaginal ultrasonography—This procedure has been used to measure cervical width, length, and funneling and to examine the relationship of these measurements to the risk of preterm birth. Although this is a promising technique, further evaluation of transvaginal ultrasonography by a prospective randomized study is necessary to determine its role in the prevention of preterm birth.

- Prophylactic cerclage—This procedure is not recommended as a routine prophylactic measure in multiple gestations because in prospective trials in twins it has not been associated with any benefit and has been associated with increased risk of preterm labor.

- Bed rest—Not only is hospital bed rest costly, stressful, and disruptive, there is no clear consensus that it is of any benefit. Numerous studies have failed to show that bed rest in hospital decreases the incidence of preterm delivery, lengthens gestation, or reduces neonatal morbidity in multiple gestations.

- Home uterine activity monitoring—Home uterine activity monitoring has been shown in a large randomized controlled trial not to improve perinatal outcome in multiple gestations.

- Maintenance or prophylactic tocolysis—There are no consistent data to support efficacy of maintenance or prophylactic tocolysis for prolonged gestation or improving neonatal outcome.

Resources

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Guidelines for Perinatal Care was developed through the cooperative efforts of the American Academy of Pediatrics (AAP) Committee on Fetus and Newborn and the American College of Obstetricians and Gynecologists (ACOG) Committee on Obstetric Practice. The guidelines should not be viewed as a body of rigid rules. They are general and intended to be adapted to many different situations, taking into account the needs and resources particular to the locality, the institution, or the type of practice. Variations and innovations that improve the quality of patient care are to be encouraged rather than restricted. The purpose of these guidelines will be well served if they provide a firm basis on which local norms may be built.

Orders to purchase copies of *Guidelines for Perinatal Care* or inquiries regarding content can be directed to the respective organizations.

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