Chapter

1 Pregnancy and Prenatal Care

PREGNANCY

Pregnancy is the state of having products of conception implanted normally or abnormally in the uterus or occasionally elsewhere. Pregnancy is terminated by spontaneous or elective abortion or delivery. A myriad of physiologic changes occur in a pregnant woman, which affect every organ system.

Diagnosis

In a patient who has regular menstrual cycles and is sexually active, a period delayed by more than a few days to a week is suggestive of pregnancy. Even at this early stage, patients may exhibit signs and symptoms of pregnancy. The classic finding of "morning sickness" can begin this early and often continues through 12 to 16 weeks of gestation. On physical examination, a variety of findings indicate pregnancy (Table 1-1).

Many over-the-counter (OTC) urine pregnancy tests have a high sensitivity and will be positive around the time of the missed menstrual cycle. These urine tests and the hospital laboratory serum assays test for the beta subunit of human chorionic gonadotropin (β-hCG). This hormone produced by the placenta will rise to a peak of 100,000 mIU/mL by 10 weeks of gestation, decrease throughout the second trimester, and then level off at approximately 20,000 to 30,000 mIU/mL in the third trimester.

A viable pregnancy can be confirmed by ultrasound, which may show the gestational sac as early as 5 weeks, or at a β-hCG of 1500 to 2000 mIU/mL, and the fetal heart as soon as 6 weeks, or a β-hCG of 5000 to 6000 mIU/mL.

Terms and Definitions

From the time of fertilization until the pregnancy is 8 weeks along (10 weeks gestational age [GA]), the conceptus is called an **embryo**. After 8 weeks until the time of birth, it is designated a **fetus**. The term **infant** is used for the period between delivery and 1 year of age. Pregnancy is divided into trimesters. The **first trimester** lasts until 12 weeks but is also defined as up to 14 weeks GA, the **second trimester** from 12 to 14 until 24 to 28 weeks GA, and the **third trimester** from 24 to 28 weeks until delivery. An infant delivered prior to 24 weeks is considered to be **previable**, from 24 to 37 weeks is considered **preterm**, and from 37 to 42 weeks is considered **term**. A pregnancy carried beyond 42 weeks is considered **postdate** or **postterm**.

Gravidity (G) refers to the number of times a woman has been pregnant, and **parity** (P) refers to the number of pregnancies that led to a birth beyond 20 weeks GA or of an infant weighing more than 500 g. A more specific designation of pregnancy outcomes divides them into **term** and **preterm** deliveries, number of **abortuses**, and number of **living** children. This is known as the TPAL designation. A woman who has given birth to one set of preterm twins, one term infant, and with two miscarriages would be a G4 P1-1-2-3. A multiple gestation is just one delivery but obviously may change the number of living children by more than one. In this designation, abortuses includes both therapeutic and spontaneous abortions.

Dating of Pregnancy

The GA of a fetus is the age in weeks and days measured from the last menstrual period (LMP).

TABLE 1-1

Signs and Symptoms of Pregnancy

Signs
Bluish discoloration of vagina and cervix (Chadwick's sign)
Softening and cyanosis of the cervix at or after 4 weeks (Goodell's sign)
Softening of the uterus after 6 weeks (Ladin's sign)
Breast swelling and tenderness
Development of the linea nigra from umbilicus to pubis
Telangiectasias
Palmar erythema
Symptoms
Amenorrhea
Nausea and vomiting
Breast pain
Quickening—fetal movement

Developmental age (DA) is the number of weeks and days since fertilization. Because fertilization usually occurs about 14 days after the first day of the prior menstrual period, the GA is 2 weeks more than the DA.

Classically, **Nägele's rule** for calculating the **estimated date of confinement** (EDC), or estimated date of delivery (EDD), is to subtract 3 months from the LMP and add 7 days. Thus, a pregnancy with an LMP of 4/13/02 would have an EDC of 1/20/03. Exact dating uses an EDC calculated as 280 days after a certain LMP. If the date of ovulation is known, as in assisted reproductive technology (ART), the EDC can be calculated by adding 266 days. This dating can be confirmed and should be consistent with the examination of the uterine size at the first prenatal appointment.

With an uncertain LMP, ultrasound is often used to determine the EDC. Ultrasound has a level of uncertainty that increases during the pregnancy but it is rarely off by more than 7% to 8% at any GA. A safe rule of thumb is that the ultrasound should not differ from LMP dating by more than 1 week in the first trimester, 2 weeks in the second trimester, and 3 weeks in the third trimester. The dating done with crown-rump length in the first half of the first trimester is probably even more accurate, to within 3 to 5 days.

Other measures used to estimate gestational age include pregnancy landmarks such as auscultation of the fetal heart (FH) at 20 weeks by nonelectronic fetoscopy or at 10 weeks by Doppler ultrasound, as well as maternal awareness of fetal movement or "quickening," which occurs between 16 and 20 weeks.

Physiology of Pregnancy

Cardiovascular

During pregnancy, **cardiac output** increases by 30% to 50%. Most increases occur during the first trimester, with the maximum being reached between 20 and 24 weeks gestation and maintained until delivery. **Systemic vascular resistance** decreases during pregnancy, resulting in a fall in arterial blood pressure. This decrease is most likely due to the elevated progesterone leading to smooth muscle relaxation. There is a decrease in systolic blood pressure of 5–10 mm Hg and in diastolic blood pressure of 10–15 mm Hg that nadirs at week 24. Between 24 weeks gestation and term, blood pressure slowly returns to prepregnancy levels but should never exceed them.

Pulmonary

There is an increase of 30% to 40% in tidal volume (V_T) during pregnancy (Figure 1-1) despite the fact that the total lung capacity is decreased by 5% due to the elevation of the diaphragm. This increase in V_T decreases the expiratory reserve volume by about 20%. The increase in V_T with a constant respiratory rate leads to an increase in minute ventilation of 30% to 40%, which in turn leads to an increase in alveolar (PAo_2) and arterial (Pao_2) Po_2 levels and a decrease in $PAco_2$ and $Paco_2$ levels.

$Paco_2$ decreases to approximately 30 mm Hg by 20 weeks gestation from 40 mm Hg prepregnancy. This change leads to an increased CO_2 gradient between mother and fetus and is likely caused by elevated progesterone levels that either increase the respiratory system's responsiveness to CO_2 or act as a primary stimulant. Dyspnea of pregnancy occurs in 60% to 70% of patients. This is possibly secondary to decreased $Paco_2$ levels, increased V_T, or decreased total lung capacity (TLC).

Gastrointestinal

Nausea and vomiting occur in more than 70% of pregnancies. This has been termed **"morning sickness"** even though it can occur anytime throughout the day. These symptoms have been attributed to the

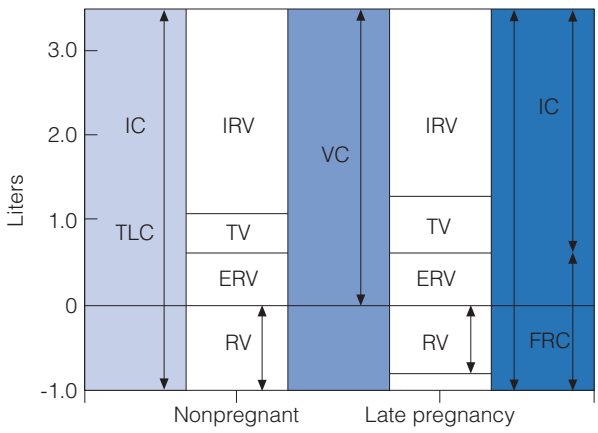

Figure 1-1 • Lung volumes in nonpregnant and pregnant women.

elevation in estrogen, progesterone, and hCG. The nausea and vomiting should routinely resolve by 14 to 16 weeks gestation. During pregnancy, the stomach has prolonged gastric emptying times, and the gastroesophageal sphincter has decreased tone. Together, these changes lead to reflux and possibly combine with decreased esophageal tone to cause ptyalism, or spitting, during pregnancy. The large bowel also has decreased motility, which leads to increased water absorption and constipation.

Renal

The kidneys actually increase in size and the ureters dilate during pregnancy, which may lead to increased rates of pyelonephritis. The glomerular filtration rate (GFR) increases by 50% early in pregnancy and is maintained until delivery. As a result of increased GFR, blood urea nitrogen and creatinine decrease by about 25%. An increase in the renin-angiotensin system leads to increased levels of aldosterone. This ultimately results in increased sodium resorption. However, plasma levels of sodium do not increase because of the simultaneous increase in GFR.

Hematology

Although the plasma volume increases by 50% in pregnancy, the red blood cell volume increases by only 20% to 30%, which leads to a decrease in the hematocrit. The white blood cell (WBC) count increases during pregnancy to a mean of 10.5 million/mL with a range of 6 to 16. During labor, stress may cause the WBC count to rise to over 20 million/mL. There is a slight decrease in the concentration of platelets, probably secondary to increased plasma volume and an increase in peripheral destruction. Although 7% to 8% of patients' platelets may be between 100 and 150 million/mL, a drop in the platelet count below 100 million/mL or over a short time period is not normal and should be investigated promptly.

Pregnancy is considered to be a hypercoagulable state, and the number of thromboembolic events increases. There are elevations in the levels of fibrinogen and factors VII–X. However, the actual clotting and bleeding times do not change. The increased rate of thromboembolic events in pregnancy may be secondary to an increase in venous stasis and vessel endothelial damage.

Endocrine

Pregnancy is a hyperestrogenic state. The increased estrogen is produced primarily by the placenta, with the ovaries contributing to a lesser degree. Unlike estrogen production in the ovaries, where estrogen precursors are produced in ovarian theca cells and transferred to the ovarian granulosa cells, estrogen in the placenta is derived from circulating plasma-borne precursors produced by the maternal adrenal glands. Fetal well-being has been correlated with maternal serum estrogen levels with low estrogen levels being associated with conditions such as fetal death and anencephaly.

The hormone hCG is composed of two dissimilar alpha and beta subunits. The alpha subunit of hCG is identical to the alpha subunits of luteinizing hormone (LH), follicle-stimulating hormone (FSH), and thyroid-stimulating hormone (TSH), whereas the beta subunits differ. The placenta produces hCG, which acts to maintain progesterone production by the corpus luteum. Levels of hCG double approxi-

mately every 48 hours during early pregnancy, reaching a peak at approximately 10 to 12 weeks, and thereafter declining to reach a steady state after week 15.

Human placental lactogen (hPL) is produced in the placenta and is important for ensuring a constant nutrient supply to the fetus. hPL, also known as human chorionic somatomammotropin (hCS), causes lipolysis with a concomitant increase in circulating free fatty acids. hPL also acts as an insulin antagonist, along with various other placental hormones, thereby having a diabetogenic effect. This leads to increased levels of insulin and protein synthesis.

Progesterone is produced by the corpus luteum during early pregnancy, after which time biosynthesis occurs primarily in the placenta. Progesterone precursors are derived from low-density-lipoprotein cholesterol and progesterone levels increase over the course of pregnancy. Progesterone causes relaxation of smooth muscle, which has multiple effects on the gastrointestinal, cardiovascular, and genitourinary systems.

High estrogen levels cause an increase in thyroid binding globulin (TBG). Placental hormones such as hCG may also have thyroid-stimulating properties that lead to an elevation in total T3 and T4. Together, these changes lead to a relatively euthyroid state, although free T3 and T4 levels may decrease slightly during pregnancy. Levels of prolactin are markedly increased during pregnancy. These levels paradoxically decrease after delivery but later increase in response to suckling.

Musculoskeletal and Dermatologic

The obvious change in the center of gravity during pregnancy can lead to a shift in posture and lower back strain. Numerous changes in the skin occur during pregnancy, including spider angiomata and palmar erythema secondary to increased estrogen levels and hyperpigmentation of the nipples, umbilicus, abdominal midline (the **linea nigra**), perineum, and face (**melasma** or **chloasma**) secondary to increased levels of α-melanocyte-stimulating hormone and the steroid hormones.

Nutrition

Nutritional requirements increase during pregnancy and breastfeeding. The average woman requires 2000 to 2500 kcal/day. The caloric requirement is increased by 300 kcal/day during pregnancy and by 500 kcal/day when breast-feeding. Most patients should gain between 20 and 30 pounds during pregnancy. Obese women are advised to gain less, between 15 and 20 pounds; thin women are advised to gain slightly more, 25 to 35 pounds.

In addition to the increased caloric requirements, there are increased nutritional requirements for protein, iron, folate, calcium, and other vitamins and minerals. The protein requirement increases from 60 g/day to 70 or 75 g/day. Recommended calcium intake is 1.5 g/day. Many patients develop iron deficiency anemia because of the increased demand on hematopoiesis both by the mother and the fetus. Folate requirements increase from 0.4 to 0.8 mg/day and are important in preventing neural tube defects.

All patients are advised to take prenatal vitamins during pregnancy. These are designed to compensate for the increased nutritional demands of pregnancy. Furthermore, any patient whose hematocrit falls during pregnancy is advised to increase iron intake with oral supplementation (Table 1-2).

KEY POINTS

1. A urine pregnancy test will often be positive at the time of the missed menstrual cycle.
2. Physiologic changes during pregnancy, mediated by the placental hormones, affect every organ system.
3. Cardiovascular changes include a decrease in systemic vascular resistance and blood pressure and a 50% rise in total blood volume.
4. Elevation in serum progesterone levels is responsible for smooth muscle relaxation in the vascular system, GI tract, and genitourinary system, leading to many of the concomitant physiologic changes.

PRENATAL CARE

Prenatal visits are designed to screen for various complications of pregnancy and to educate the patient. They include a series of outpatient office visits that involve routine physical examinations and various screening tests that occur at different points in the prenatal care. Important issues of prenatal care include initial patient evaluation, routine patient evaluation, nutrition, disease states during the pregnancy, and preparing for the delivery.

TABLE 1-2

Recommended Daily Dietary Allowances for Nonpregnant, Pregnant, and Lactating Women

	Nonpregnant Women by Age						
	11–14	15–18	19–22	23–50	51+	Pregnant Women	Lactating Women
Energy (kcal)	2400	2100	2100	2000	1800	+300	+500
Protein (g)	44	48	46	46	46	+30	+20
Fat-soluble vitamins							
Vitamin A activity (RE)	800	800	800	800	800	1000	1200
(IU)	4000	4000	4000	4000	4000	5000	6000
Vitamin D (IU)	400	400	400	—	—	400	400
Vitamin E activity (IU)	12	12	12	12	12	15	15
Water-soluble vitamins							
Ascorbic acid (mg)	45	45	45	45	45	60	80
Folacin (µg)	400	400	400	400	400	800	600
Niacin (mg)	16	14	14	13	12	+2	+4
Riboflavin (mg)	1.3	1.4	1.4	1.2	1.1	+0.3	+0.5
Thiamin (mg)	1.2	1.1	1.1	1	1	+0.3	+0.3
Vitamin B_6 (mg)	1.6	2	2	2	2	2.5	2.5
Vitamin B_{12} (µg)	3	3	3	3	3	4	4
Minerals							
Calcium (mg)	1200	1200	800	800	800	1200	1200
Iodine (µg)	115	115	100	100	80	125	150
Iron (mg)	18	18	18	18	10	+18	18
Magnesium (mg)	300	300	300	300	300	450	450
Phosphorus (mg)	1200	1200	800	800	800	1200	1200
Zinc (mg)	15	15	15	15	15	20	25

Source: From Gabbe SG, Niebyl JR, and Simpsen JL, Obstetrics: Normal and Problem Pregnancies. 4th ed. New York: Churchill Livingstone, 2002:196.
Note: IU = International Unit.

Initial Visit

This is often the longest of the prenatal visits because it involves obtaining a complete history and doing a physical as well as a battery of initial laboratory tests. It should occur early in the first trimester, between 6 and 10 weeks, although occasionally patients will not present for their initial prenatal visit until later in their pregnancy.

History

The patient's history includes the present pregnancy, the last menstrual period, and symptoms during the pregnancy. After this, an obstetric history of prior pregnancies including date, outcome (e.g., SAB [spontaneous abortion], TAB [therapeutic abortion], term delivery), mode of delivery, length of time in labor and second stage, birth weight, and any complications. Finally, a complete medical, surgical, family, and social history should be obtained.

Physical Examination

A complete physical examination is performed, paying particular attention to the patient's prior medical and surgical history. The pelvic examination includes a Pap smear, unless one has been done in the past 6 months, and cultures for gonorrhea and chlamydia. On bimanual examination, the size of the uterus should be consistent with the gestational age from the LMP.

Diagnostic Evaluation

The panel of tests in the first trimester includes a complete blood count, primarily for hematocrit, blood type, antibody screen, rapid plasma reagin

(RPR), rubella antibody screen, hepatitis B surface antigen, urinalysis, and urine culture. If a patient has no history of chickenpox, a titer for varicella zoster virus (VZV) antibodies is sent. A purified protein derivative (PPD) is usually placed during the first or second trimester. A urine pregnancy test should be sent if the patient is not entirely certain she is pregnant. If there has been any bleeding or cramping, a β-hCG level should be obtained. While there is some debate over the use of routine toxoplasma titers, they are often ordered as well. All patients are counseled about human immunodeficiency virus (HIV) and testing should be offered routinely (Table 1-3). In addition to this battery of tests, there are a variety of other screens offered to high-risk patients (Table 1-4).

Routine Prenatal Visits

On each follow-up prenatal care visit blood pressure, weight, urine dipstick, measurement of the uterus, and auscultation of the fetal heart are performed and assessed. Maternal blood pressure decreases during the first and second trimester and slowly returns to baseline during the third trimester; elevation may be a sign of preeclampsia. Maternal weight is followed serially throughout the pregnancy as a proxy for adequate nutrition. Also, large weight gains toward the end of pregnancy can be a sign of fluid retention and preeclampsia. Measurement of the uterine fundal height in centimeters corresponds roughly to the weeks of gestation. If the fundal height is progressively decreasing or is 3 cm less than gestational age, an ultrasound is done to more accurately assess fetal growth. After 10 to 14 weeks, Doppler ultrasound is used to auscultate the fetal heart rate. Urine is routinely dipped for protein, glucose, blood, and leukocyte esterase. Protein may be indicative of preeclampsia, glucose of diabetes, and leukocyte esterase of urinary tract infection.

At each visit, the patient is asked about symptoms that indicate complications of pregnancy. These symptoms include vaginal bleeding, vaginal discharge or leaking of fluid, and urinary symptoms. In addition, after 20 weeks, patients are asked about contractions and fetal movement. Vaginal bleeding is a sign of miscarriage or ectopic pregnancy in the first trimester, and of placental abruption or previa as the pregnancy advances. Vaginal discharge may be a sign of infection or cervical change, whereas leaking fluid can indicate ruptured fetal membranes. While irregular (Braxton-Hicks) contractions are common throughout the third trimester, regular contractions more frequent than five or six per hour may be a sign of preterm labor and should be assessed. Changes in or absence of fetal movement should be evaluated by auscultation of the fetal heart in the previable fetus and with further testing such as a nonstress test or biophysical profile in the viable fetus.

First-Trimester Visits

During the first trimester—patients, particularly nulliparous women—need to be familiarized with pregnancy. The symptoms of pregnancy and what will occur at each prenatal visit should be reviewed. At the second prenatal visit, all of the initial labs should

TABLE 1-3

Routine Tests in Prenatal Care

Initial Visit and First Trimester	Second Trimester	Third Trimester
Hematocrit	MSAFP/triple screen	Hematocrit
Blood type and screen	Ultrasound	RPR
RPR	Amniocentesis in AMA patients	GLT
Rubella antibody screen		Repeat gonorrhea and chlamydia
Hepatitis B surface antigen		Chest x-ray if PPD + IP Group B strep culture
Gonorrhea culture		
Chlamydia culture		
PPD		
Pap smear		
Urinalysis and culture		
VZV titer in patients with no history of exposure		
HIV offered		

TABLE 1-4

Initial Screens in Specific High-Risk Groups

High-Risk Group	Specific Test
African American	Sickle-cell prep/Hgb electrophoresis
Age 35 or older at time of EDC	Prenatal genetics referral
Prior gestational diabetic, family history of diabetes, Hispanic, Native American, Southeast Asian	Glucose loading test
Pregestational diabetic, unsure dates, recurrent miscarriages	Dating sonogram
Hypertension, renal disease, pregestational diabetic, prior preeclampsia, renal transplant, SLE	24 hour urine collection for protein and creatinine clearance
Pregestational diabetic, prior cardiac disease, hypertension	Electrocardiogram (ECG)
Pregestational diabetic	Hgb A1C, ophthalmology for eye exam
Graves' disease	Thyroid-stimulating immunoglobulins
All thyroid disease	TSH, possibly free T4
Systemic lupus erythematosus (SLE)	Anti-Rho, anti-La antibodies

be reviewed with the patient. Patients with poor weight gain or decreased caloric intake secondary to nausea and vomiting may be referred to a nutritionist. Patients treated for infections noted at the initial prenatal visit should be cultured for test of cure.

Second-Trimester Visits

During the second trimester, much of the screening for genetic and congenital abnormalities is done. This allows a patient to obtain an elective termination if there are abnormalities. Screening for **maternal serum alpha fetoprotein** (MSAFP) is usually performed between 15 and 18 weeks. An elevation in MSAFP is correlated with an increased risk of neural tube defects and a decrease is seen in some aneuploidies including Down syndrome. The sensitivity of aneuploidy screening is augmented using β-hCG and estriol along with MSAFP called the **triple screen**. Between 18 and 20 weeks gestation, most patients are offered a screening ultrasound. This provides the opportunity to do a thorough fetal anatomic survey. Also noted are the amniotic fluid volume, placental location, and gestational age.

The fetal heart is usually first heard during the second trimester and the first fetal movement, or "quickening," is felt late in the second trimester. Most patients have resolution of their nausea and vomiting by the second trimester, although some continue with these symptoms throughout their pregnancy. Because the risk of spontaneous abortions decreases after 12 weeks of gestation, childbirth classes and tours of the labor floor are usually offered in the second and third trimesters.

Third-Trimester Visits

During the third trimester, the fetus is viable. Patients will begin to have occasional Braxton Hicks contractions and, if these contractions become regular, the cervix is examined to rule out preterm labor. Prenatal visits increase to every 2 to 3 weeks from 28 to 36 weeks and then to every week after 36 weeks. In addition, patients who are Rh negative should receive RhoGAM at 28 weeks. Beyond 32 to 34 weeks Leopold's maneuvers (Figure 3-1) are performed to determine fetal presentation. Beyond 37 weeks, which is considered term, the cervix is usually examined at each visit.

Third-Trimester Labs

At 27 to 29 weeks, the third-trimester labs are ordered. These consist of the hematocrit, RPR, and **glucose loading test** (GLT). At this time, the hematocrit is getting close to its nadir. Patients with a hematocrit below 32% to 33% (hemoglobin less than 11 mg/dL) are usually started on iron supplementation. Because this will cause further constipation, stool softeners are given in conjunction. The GLT is a screening test for gestational diabetes. It consists of giving a 50-g oral glucose loading dose and checking a serum glucose 1 hour later. If this value is greater than or equal to 140 mg/dL, a **glucose tolerance test** (GTT) is administered.

The GTT consists of a fasting serum glucose measurement and then administration of a 100-g oral glucose loading dose. The serum glucose is then measured at 1, 2, and 3 hours after the oral dose is given. This test is indicative of gestational diabetes if the fasting glucose is over 105 mg/dL or if any two of three values are over 190, 165, or 145 mg/dL, respectively.

In high-risk populations, vaginal cultures for gonorrhea and chlamydia are repeated late in the third trimester. These infections are transmitted vertically during birth and should be treated if cultures or DNA tests return positive. At 36 weeks, many institutions perform screening for group B streptococcus. Patients who have a positive culture should be treated with intravenous penicillin when they present in labor.

KEY POINTS

1. The initial prenatal visit is used to screen for many of the problems that can occur in pregnancy and to verify dating of the pregnancy.
2. Much of the screening for genetic and congenital abnormalities is performed in the second trimester.
3. Blood pressure, weight gain, fundal height, fetal heart rate, and symptoms including contractions, vaginal bleeding, or discharge are assessed at each prenatal visit.

ROUTINE PROBLEMS OF PREGNANCY

Back Pain

Low back pain in pregnancy is quite common, particularly in the third trimester when the patient's center of gravity has shifted and there is increased strain on the lower back. Mild exercise—particularly stretching—may release endorphins and reduce the amount of back pain. Gentle massage, heating pads, and Tylenol can be used for mild pain. For patients with severe back pain, muscle relaxants or occasionally narcotics can be used.

Constipation

The decreased bowel motility secondary to elevated progesterone levels leads to increased transit time in the large bowel. In turn, there is greater absorption of water from the gastrointestinal tract. This can result in constipation. Increased PO fluids, particularly water, should be recommended. In addition, stool softeners or bulking agents may help. Laxatives can be used, but are usually avoided in the third trimester because of the theoretical risk of preterm labor.

Contractions

Occasional irregular contractions are considered Braxton Hicks contractions and will occur several times per day. Patients should be warned about these and assured that they are perfectly normal. Dehydration may cause increased contractions, and patients should be advised to drink many (10 to 14) glasses of water and juice per day. Regular contractions, as often as every 10 to 15 minutes, should be considered a sign of preterm labor and should be assessed by cervical examination. If a patient has had several days of contractions and no documented cervical change, this is reassuring to both the obstetrician and the patient that delivery is not imminent.

Dehydration

Because of the expanded intravascular space and increased third spacing of fluid, patients have a difficult time maintaining their intravascular volume status. Dietary recommendations should include increased fluids. As mentioned above, dehydration may lead to uterine contractions, possibly secondary to cross-reaction of vasopressin with oxytocin receptors.

Edema

Compression of the inferior vena cava (IVC) and pelvic veins by the uterus can lead to increased hydrostatic pressure in the lower extremities and eventually to edema in the feet and ankles. Elevation of the lower extremities above the heart can ease this. Also, patients should be advised to sleep on their sides to decrease compression. Severe edema of the face and hands may be indicative of preeclampsia and merits further evaluation.

Gastroesophageal Reflux Disease

Relaxation of the lower esophageal sphincter and increased transit time in the stomach can lead to

reflux and nausea. Patients with reflux should be started on antacids, advised to eat multiple small meals per day, and avoid lying down within an hour of eating. For patients with continued symptoms, H_2 blockers or proton pump inhibitors can be given.

Hemorrhoids

Patients will have increased venous stasis and IVC compression, leading to congestion in the venous system. Congestion of the pelvic vessels combined with increased abdominal pressure with bowel movements secondary to constipation can lead to hemorrhoids. Hemorrhoids are treated symptomatically with topical anesthetics and steroids for pain and swelling. Prevention of constipation with increased fluids, increased fiber in the diet, and stool softeners may prevent or decrease the exacerbation of hemorrhoids.

Pica

Rarely, a patient will have cravings for nonedible items such as dirt or clay. As long as these substances are nontoxic, the patient is advised to maintain adequate nutrition and encouraged to stop ingesting the inedible items. However, if patients have been consuming toxic substances, immediate cessation along with a toxicology consult is advised.

Round Ligament Pain

Usually late in the second trimester or early in the third trimester, there may be some pain in the adnexa or lower abdomen. This pain is likely secondary to the rapid expansion of the uterus and stretching of the ligamentous attachments, such as the round ligaments. This is often self-limited but may be relieved with Tylenol.

Urinary Frequency

Increased intravascular volumes and elevated glomerular filtration rate (GFR) can lead to increased urine production during pregnancy. However, the most likely cause of urinary frequency during pregnancy is that as the uterus grows, it increasingly compresses the bladder. A urinary tract infection may also be present with isolated urinary frequency but is often accompanied by dysuria. A urinalysis and culture should therefore be ordered to rule out infection. If no infection is present, patients can be assured that the increasing voiding is normal. Patients should be advised to keep up PO hydration despite urinary frequency.

Varicose Veins

The lower extremities or the vulva may develop varicosities during pregnancy. The relaxation of the venous smooth muscle and increased intravascular pressure probably both contribute to the pathogenesis. Elevation of the lower extremities or the use of pressure stockings may help reduce existing varicosities and prevent more from developing. If the problem does not resolve by 6 months postpartum, patients may be referred for surgical therapy.

KEY POINTS

1. Many of the routine problems of pregnancy are related to hormonal effects of the placenta.
2. It is important to discuss the side effects of pregnancy in order to best prepare the patient.
3. While pregnancy is often the cause of many somatic complaints, other causes should still be ruled out as in the nonpregnant patient.

PRENATAL ASSESSMENT OF THE FETUS

Throughout pregnancy, the fetus is screened and diagnosed by a variety of modalities. Parents can be screened for common diseases such as cystic fibrosis, Tay-Sachs, sickle-cell disease, and thalassemia. If both parents are carriers, the fetus is then diagnosed. Fetal karyotype can be obtained via amniocentesis or chorionic villus sampling (CVS). The fetus can be imaged and many of the congenital anomalies diagnosed via second trimester ultrasound. First and second trimester genetic screening and prenatal diagnosis is discussed further in Chapter 3. Other fetal testing includes fetal blood sampling, fetal lung maturity testing, and assessment of fetal well-being.

Fetal Blood Sampling

Percutaneous umbilical blood sampling (PUBS) is performed by placing a needle transabdominally into the uterus and phlebotomizing the umbilical cord. This procedure may be used when the fetal hematocrit needs to be obtained, particularly in the setting

of Rh isoimmunization, other causes for fetal anemia, and hydrops. PUBS is also used for rapid karyotype analysis and to assess fetal platelet count in alloimmune thrombocytopenia.

Fetal Lung Maturity

There are many tests for fetal lung maturity. Classically, the lecithin to sphingomyelin (L/S) ratio has been used as a predictor of fetal lung maturity. Type II pneumocytes secrete a surfactant that uses phospholipids in its synthesis. Commonly, lecithin increases as the lungs mature, whereas sphingomyelin decreases beyond about 32 weeks. The L/S ratio should therefore increase as the pregnancy progresses. Repetitive studies have shown that a L/S ratio of greater than 2 is associated with only rare cases of **respiratory distress syndrome** (RDS). With a L/S ratio below 1.5, the risk of RDS is 70%. Examples of other fetal lung maturity tests include measuring the levels of phosphatidylglycerol, saturated phosphatidyl choline (SPC), the presence of lamellar bodies, and surfactant to albumin ratio (S/A).

Ultrasound

Ultrasound can be used to date a pregnancy with an unknown or uncertain LMP, and is most accurate in the first trimester. In the setting of prenatal diagnosis of fetal malformations, most patients undergo a routine screening ultrasound at 18 to 20 weeks. Routinely, an attempt is made to identify placental location, amniotic fluid volume, gestational age, and any obvious malformations. In high-risk patients, careful attention is paid to commonly associated anomalies such as cardiac anomalies in pregestational diabetics. Fetal echocardiography and, rarely, MRI are used to augment assessment of the fetal heart and brain, respectively.

In the third trimester, ultrasound can be used to monitor high-risk pregnancies by obtaining **biophysical profiles** (BPP), fetal growth, and fetal Doppler studies. The BPP looks at five categories and gives a score of either 0 or 2 for each: amniotic fluid volume, fetal tone, fetal activity, fetal breathing movements, and the **nonstress test** (NST), which is a test of the fetal heart rate. A BPP of 8 to 10 or better is reassuring. Ultrasound can also be used to assess the blood flow velocity in the umbilical cord. A decrease, absence, or reversal of diastolic flow in the umbilical artery is progressively more worrisome.

Antenatal Testing of Fetal Well-being

Formal antenatal testing includes the NST, the oxytocin challenge test (OCT), and the BPP. The NST is considered formally reactive if there are two accelerations of the fetal heart rate in 20 minutes that are at least 15 beats above the baseline heart rate and last for at least 15 seconds. An OCT or contraction stress test (CST) is obtained by getting at least three contractions in 10 minutes and analyzing the fetal heart rate (FHR) tracing during that time. The reactivity criteria are the same as for the NST. In addition, late decelerations with at least half of the contractions constitute a positive test and is worrisome. Commonly, most antenatal testing units use the NST beginning at 32 to 34 weeks of gestation in high-risk pregnancies and at 40.5 to 41 weeks for undelivered patients. If the NST is nonreactive, the fetus is assessed via ultrasound. If the fetal heart tracing has any worrisome decelerations or the BPP is not reassuring, an OCT is performed.

KEY POINTS

1. Common screening tests for fetal abnormalities include MSAFP and the triple screen.
2. The fetus may be diagnosed with abnormalities using amniocentesis, CVS, and ultrasound.
3. Fetal status can be assessed antepartum with ultrasound, NST, BPP, and OCT.