Female Reproductive Cycle I: Pregnancy and Preterm Labor Drugs
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Outline

**Objectives**

- Explain potential health-promoting and detrimental effects of substances ingested by the woman during the prenatal period.
- Describe the drugs that alter uterine muscle contractility.
- Describe drug therapy used during preterm labor to decrease the incidence or severity of neonatal respiratory dysfunction.
- Describe systemic and regional medications for pain control during labor.
- Describe the drugs used in gestational hypertension.
- Describe the nursing process, including client teaching, associated with the drugs used during pregnancy and preterm labor.

**Terms**

- Iron
- Folic Acid
- Multiple Vitamins
- Drugs for Minor Discomforts of Pregnancy

**Physiology of Pregnancy**

**Therapeutic Drug and Herbal Use in Pregnancy**

**Nursing Process: Antepartum Drugs**

**Drugs that Decrease Uterine Muscle Contractility**

- Preterm Labor
- Tocolytic Therapy
- Nursing Process: Beta-Adrenergic Agonists: Brethine (Terbutaline)

**Corticosteroid Therapy in Preterm Labor**

- Betamethasone (Celestone)
- Dexamethasone

**Nursing Process: Betamethasone (Celestone)**

**Drugs for Gestational Hypertension**

**Nursing Process: Gestational Hypertension**

**Key Websites**

**Critical Thinking Case Study**

**NCLEX Study Questions**
This chapter focuses on the pharmacologic aspects of pregnancy in cycle I and labor and delivery in cycle II. Topics include prenatal health promotion and drugs used for uterine dysfunction during labor and delivery, pain control during labor, and gestational hypertension.

### Physiology of Pregnancy

Because pregnancy is a change in the normal physiology of the body, the normal and expected pharmacokinetics and pharmacodynamics of medications also change. Some of the changes in drug action during pregnancy include (1) the effect of circulating steroid hormones on the liver’s metabolism of drugs, (2) a woman’s reduced gastrointestinal motility and increased gastric pH, (3) increased glomerular filtration rate and increased renal perfusion, resulting in more rapid renal excretion of drugs, (4) expanded maternal circulating blood volume, resulting in dilution of drugs, and (5) alteration in the clearance of drugs in later pregnancy, resulting in a decrease in serum and tissue concentrations of drugs. Because of the alteration in the normal physiology of the body, medications should not be ordered in lower doses with longer intervals between doses because of the possibility of subtherapeutic serum and tissue concentrations.

In addition to the aforementioned effects on medication during pregnancy, other factors, such as late pregnancy and labor, can alter the half-lives of some medications. Antibiotics and barbiturates are examples of medications that have shorter half-lives during pregnancy. In contrast to later pregnancy, labor can actually increase the half-life of some medications—analgesics, hypnotics, and antibiotics, for example. Labor affects half-life, because it is believed that drug clearance decreases as a result of transient reduced blood flow associated with uterine contractions when the mother is in a supine position. In certain disease states during pregnancy, concern arises as to the effects of these conditions on medication. Disorders such as diabetes and gestational hypertension may result in decreased renal perfusion and subsequent drug accumulation.

The placenta plays an important role in drug use and metabolism. It was thought for some time that the placenta played a barrier role, but it is now known that the placenta plays a major role as the organ of exchange for numerous substances, including medications. It allows some substances to transfer quickly or slowly between mother and fetus, depending on variables such as (1) maternal and fetal blood flow, (2) the molecular weight of the substance (low-molecular-weight substances cross more readily than do higher-molecular-weight substances, and most medications fall into the low-molecular-weight class, which means they would readily cross the placenta), (3) the degree of ionization of the drug molecule (the more ionized the molecule, the less readily it crosses the placenta), (4) the degree of protein-binding (highly bound drugs do not cross readily), (5) the metabolic activity of the placenta (the metabolic activity can biotransform molecules into active metabolites that can affect the fetus), and (6) maternal dose.

Guidelines for medication administration during pregnancy must include determination that the benefits of prescribing a drug outweigh potential short- or long-term risks to the maternal-fetal system. Careful selection and monitoring for the minimum effective dose for the shortest interval in the therapeutic range are required. Consideration must be given to alterations related to the physiologic changes of pregnancy.

Liver metabolism of medications is much slower in the fetus as a result of the immaturity of the liver. Therefore drug metabolism is slower in the fetus, which can cause more evident or longer drug effects than on the mother. The degree of fetal exposure to a drug and its breakdown products are more important to fetal outcome than the rate at which the drug is transported to the fetus.

The mechanisms by which drugs cross the placenta are analogous to the way in which drugs infiltrate breast tissue. Lactation results in increased blood flow to the breasts, and drugs accumulate in adipose breast tissue through simple diffusion. Long-term effects on infants from drugs in breast milk are unknown, but medications that do accumulate in breast milk are known, and the breastfeeding mother should be alerted to the potential accumulation.

Despite prenatal education, public service announcements, and information conveyed through the media, use of legal and illicit drugs by pregnant women continues. Additionally, health care providers may prescribe drugs for maternal disorders that indirectly affect the fetus. However, it is important to note that most drugs required by pregnant women can be used safely. It is estimated that half the medications taken by pregnant women are over-the-counter (OTC) drugs. The drugs most commonly ingested during pregnancy (other than illicit drugs) are iron supplements and vitamins, antiemetics, antacids, stool softeners, nasal decongestants, mild analgesics, and antibiotics. Pregnant women who use or have questions regarding the use of OTC medications should be discouraged from using such medications until they consult with their health care provider or their pharmacist.
Drugs conclusively determined to be safe for the embryo are limited in number. Clinical trials can be resources for reliable drug information; however, it is unethical to test for the safety and efficacy of medications in pregnant women. Animal studies are required during drug testing, but the information obtained from such studies is difficult to extrapolate to humans. Case reports used for such information can be of limited value because they usually present isolated occurrences. A commonly used source of information about drug safety in pregnancy is the Food and Drug Administration’s (FDA) category system. The categories were created to assist with safe prescribing and informed counseling of the pregnant patient requiring medication.

There are many known teratogens (substances that cause developmental abnormalities). Timing, dose, and duration of exposure are of crucial importance in determining the teratogenicity of a given drug. In humans the teratogenic period begins 2 weeks after conception. During the first 2 weeks, the embryo is not susceptible to teratogenesis. At this time of development, exposure to teratogens may result in either death of the embryo or minor cellular damage without congenital birth defects. From 2 gestational weeks through the next 10 weeks is the period of organogenesis (development of major structures and organs). Examples of adverse effects of selected illicit substances commonly used during pregnancy are presented in Table 52–1.

**Therapeutic Drug and Herbal Use in Pregnancy**

The most common indications for use of medications during pregnancy are nutritional supplementation with iron, vitamins, and minerals and treatment of nausea and vomiting, gastric acidity, and mild discomforts, but caution must be exercised (Herbal Alert 52–1).

**Herbal ALERT 52–1**

**Pregnancy**

Just as prescription and over-the-counter (OTC) medications are not generally recommended during pregnancy, herbal preparations are also to be avoided. The following herbs in particular should be avoided:

- **Sage:** stimulates uterus
- **Kava kava:** decreases platelets
- **Garlic** and **gingko biloba:** increase bleeding when used with anticoagulants
- **Ginseng:** may decrease action of anticoagulants
- **St. John’s wort:** mutagenic risk to cells of developing embryo and fetus

Use of these herbal products may be especially deleterious during pregnancy.

**Iron**

During pregnancy, approximately twice the normal amount of iron is needed to meet fetal and maternal daily requirements: 27 mg daily during pregnancy compared with 18 mg daily for nonpregnant women 19 to 30 years of age. Supplementation with iron is not generally necessary until the second trimester, when the fetus begins to store iron; the goal is to prevent maternal iron deficiency anemia, not to supply the fetus. The fetus is adequately supplied through the placenta, although the mother is deficient. The time of greatest iron demand is during the third trimester: 22.4 mg daily compared with 6.4 mg daily and 18.8 mg daily for the first and second trimesters (National Academy of Sciences, 2000, p. 347).

Although a normal diet generally provides the 18-mg recommended daily allowance (RDA) of iron for nonpregnant clients, nonanemic pregnant women are usually instructed to supplement using a dosage that provides 60 mg of elemental iron; anemic clients should receive 120 mg of elemental iron. The elemental iron content of the most common iron salts includes ferrous sulfate 20% (300 mg of ferrous sulfate is equivalent to 60 mg elemental iron), exsiccated ferrous sulfate 30%, ferrous gluconate 12%, and ferrous fumarate 33%. The estimated net iron cost of pregnancy is approximately 800-1000 mg. This iron cost is calculated as 250 mg basal losses + 320 mg deposition in fetal and placental tissue + 500 mg increased hemoglobin mass + 350 mg iron loss in blood associated with delivery (National Academy of Sciences, 2000, pp. 345-346). Clients are advised to continue supplements for 6 weeks postpartum.

Pregnant women generally have a decreased hematocrit early in the third trimester. Those with levels less than 30% will have their supplemental iron dosages increased and complete blood counts with platelet and ferritin measured. In those found to have true iron-deficiency anemia, response to iron supplementation is usually noted in 5 to 7 days, with a modest reticulocytosis and a rise in the hemoglobin in 3 weeks. No teratogenic effects have been reported with physiologic doses. Numerous OTC and prescription iron products are available in varying dosages, which differ in the amount of elemental iron contained in the form of iron salts. Examples are listed in Table 52–2.

**Adverse Reactions**

Common side effects of iron supplements include nausea, constipation, black tarry stools, gastrointestinal irritation, epigastric pain, vomiting, and diarrhea.

**Nursing Implications**

Liquid forms can cause temporary discoloration of the teeth and therefore should be diluted and administered through a plastic straw. Iron supplements are best absorbed on an empty stomach and when administered with water or juice (concurrent administration of 200 mg ascorbic acid/vitamin C per 30 mg of elemental iron increases...
## Table 52–1

<table>
<thead>
<tr>
<th>Substance</th>
<th>Maternal Effects</th>
<th>Fetal Effects*</th>
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<tbody>
<tr>
<td>Alcohol (high risk: 6 oz or more/d)</td>
<td>1 oz (2 drinks) absolute alcohol 2 ×/wk: increased risk of spontaneous abortion (2-4 times)</td>
<td>Fetal alcohol syndrome (FAS): mild to moderate mental retardation, altered facial features, growth retardation, low birth weight, small head circumference, hypotonia, and poor motor coordination. Full FAS seen only in some children; others display only fetal alcohol effect (FAE)</td>
</tr>
<tr>
<td>Caffeine</td>
<td>2 cups increase epinephrine concentrations after 30 min and decrease intervillous blood flow with potential for spontaneous abortion (dosage and gestational period related)</td>
<td>Excess consumption (&gt;6-8 cups/d) likely toxic to embryo. No evidence of teratogenicity</td>
</tr>
<tr>
<td>Cocaine</td>
<td>48-h clearance via urine. Increased incidence of spontaneous abortion in first trimester. Continued use or sporadic use related to premature delivery and abruptio placentae secondary to placental vasoconstriction and hyperextension</td>
<td>4-5 d clearance time via urine of newborn because of liver immaturity and lack of cholinesterase. Intrauterine growth retardation, decreased head circumference, intrauterine cerebral infarction. No true withdrawal syndrome, but increased irritability, hyperreflexia, and tremulousness. Deficient organization and interactive abilities. By month 4, still exhibits hypertonicity, tremulousness, and impaired motor development. By month 6, effects may appear to be self-limited, but long-term research needed</td>
</tr>
<tr>
<td>Heroin</td>
<td>First trimester spontaneous abortion, premature delivery, inadequate maternal calorie and protein intake</td>
<td>Neonatal meconium aspiration syndrome; decreased weight and length through postnatal month 9 (weight and length catch up by month 12); smaller head circumference (with no catch up); impaired interactive abilities (hard to console and engage); inconsistent behavioral responses; increased tremulousness and irritability</td>
</tr>
<tr>
<td>Marijuana</td>
<td>Heavy use (5 or more marijuana cigarettes per week): shortened gestation (&lt;37 wk); may hasten delivery through uterine stimulation</td>
<td>No higher incidence of serious birth defects caused solely by marijuana. Higher incidence of meconium passage during labor</td>
</tr>
<tr>
<td>Tobacco/nicotine</td>
<td>Degenerative placental lesions with areas of poor oxygen exchange; higher incidence of abruptio placentae; placenta previa, vaginal bleeding during pregnancy; possible PROM; possible amnionitis; less likely to choose to breastfeed</td>
<td>Short stature, smaller head and arm circumferences; no increase in mortality rate or congenital anomalies (some evidence of increased oral clefts); increased respiratory infections beyond the perinatal period; possible shorter attention span beyond perinatal period</td>
</tr>
<tr>
<td>Methadone</td>
<td>If taken before pregnancy, will need to slow detoxification during pregnancy and decrease dose 5 mg every 2 wk. Do not detoxify before week 14 of gestation because of increased risk of spontaneous abortion</td>
<td>Smaller weight and length through postnatal month 9 (catch up on weight and length by month 12); smaller head circumference (no catch up); withdrawal-induced fetal distress if mother detoxifies after week 32 of gestation</td>
</tr>
<tr>
<td>Barbiturates</td>
<td>CNS depression; lethargy; sleepiness; subtle mood alterations and impaired judgment/ fine motor skills for 24 h</td>
<td>Rapidly cross placenta; with excessive use/high doses cause CNS depression, leading to respiratory depression, hyperactivity, and decreased sucking reflex</td>
</tr>
<tr>
<td>Tranquilizers</td>
<td>Dose-dependent; toxic reactions include ataxia, syncope, vertigo, and drowsiness; control of acute eclamptic seizures during labor</td>
<td>Benzodiazepine (diazepam [Valium]) use in first trimester not associated with oral clefts or other anomalies. Chronic third trimester or labor exposure in high doses associated with hypotonia, hypothermia, hyperbilirubinemia, and poor sucking reflex. Effects may be enhanced if systemic analgesics also given to mother. Fetal effects are prolonged</td>
</tr>
</tbody>
</table>

*Inner city children with prenatal drug exposure scored significantly lower on measures of language, school readiness skills, impulse control and visual attention span/sequencing at 5 years of age when compared to nondon drug exposed children from a comparable environment (Pulsifer, Butz, Forzen & Belcher, 2008).

CNS, Central nervous system; d, day; h, hour; min, minute; PROM, premature rupture of fetal membranes; wk, week; <, less than; >, greater than.
the absorption of iron). However, if gastric irritation does occur, administer with food. Iron supplementation may inhibit the absorption of several medications, and appropriate separation of the doses should be followed. For example, iron supplementation should be administered 2 hours before or 4 hours after antacids. Additional examples of medications that may require separation in dose include levodopa, levothyroxine, methyldopa, penicillamine, quinolones, and tetracyclines. For the same reasons, do not administer iron with milk, cereals, tea, coffee, or eggs.

**Folic Acid**

Folic acid supplementation as part of pre-conception planning improves the outcome of pregnancy. During pregnancy, folic acid (vitamin B₉, folate) is needed in increased amounts. Folic acid deficiency early in pregnancy can result in spontaneous abortion or birth defects, especially neural tube defects (failure of the embryonic neural tube to close properly, leading to spina bifida or skull and brain malformations). Deficiency of folic acid may also contribute to premature birth, low birth weight, and premature separation of the placenta (*abruptio placenta*). In the United States, approximately 4000 pregnancies a year are affected by neural tube defects. Controlled clinical trials have demonstrated that folic acid supplementation can reduce this incidence by as much as 50%.

The RDA for folic acid in the nonpregnant client is 180 mcg, but the American College of Obstetricians and Gynecologists (ACOG) recommends that all women of childbearing age ingest 400 mcg of folic acid daily for birth defect prevention. (During pregnancy the RDA rises to 600 mcg.) The reason behind ACOG’s recommendation is the high incidence of unplanned and unrecognized pregnancies. The neural tube closes within the first 4 weeks of pregnancy (18-26 days after conception); therefore it is important that women consume the recommended amounts of folic acid per day. For women who have had a pregnancy that was affected by a neural tube defect, higher doses of folic acid are recommended: 4 mg starting 1 to 3 months before conception.

The recommended amount should be ingested from folate-enriched foods and supplementation, because the amount of naturally occurring folic acid ingested in foods will vary from day to day, and the folic acid from these sources is not well absorbed. Examples of folate-enriched foods include bread, rolls, flour, cornmeal, rice, pasta, and cereals.

**Adverse Reactions**

Side effects of folic acid supplementation are not common but include allergic bronchospasm, rash, pruritus, erythema, and general malaise. Clients should be aware that

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### Table 52–2

**Iron Products**

<table>
<thead>
<tr>
<th>Generic (Brand)</th>
<th>Route and Dosage</th>
<th>Uses and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrous sulfate (Fer-In-Sol, Feosol, Fero-Gradumet, Mol-Iron, Fer-Iron)</td>
<td>A: PO: 300-600 mg/d in divided doses 325 mg/d sufficient to meet needs of non-iron-deficient pregnant client; with iron deficiency, should receive 325 mg 2-3 ×/d</td>
<td>Hematinic; for iron deficiency anemia; prophylaxis for iron deficiency in pregnancy. Replaces iron stores needed for RBC development Absorption PO is 5%-30% in intestines; therefore GI side effects. Toxic reactions include pallor, hematemesis, shock, cardiovascular collapse, and metabolic acidosis. Contraindicated in hypersensitivity and peptic ulcer. Decreased absorption of tetracycline, penicillamine, and antacids; increased absorption with ascorbic acid; decreased absorption with eggs, milk, coffee, and tea. Can reduce availability of zinc from the diet Nursing implications: Taking iron at bedtime helps avoid GI upset. Absorption of iron is promoted when taken with orange juice or other vitamin C source. Use straw (elixir); swallow tablet/capsule whole; take with water on empty stomach. Sit upright 30 min after dose to decrease reflux. Increase fluids, activity, and dietary bulk. Keep away from children Peak reticulocytosis: 5-10 d; hemoglobin values increase: 2-4 wk Pregnancy category: A; PB: UK; t½: UK; onset: 3-10 d; duration: 3-4 mo</td>
</tr>
<tr>
<td>Ferrous gluconate (Fergon)</td>
<td>A: PO: 200-600 mg t.i.d.</td>
<td>Same as above</td>
</tr>
<tr>
<td>Ferrous fumarate</td>
<td>A: PO: 200 mg t.i.d. or q.i.d.</td>
<td>Same as above</td>
</tr>
</tbody>
</table>

*A, Adult; d, day; GI, gastrointestinal; min, minute; mo, month; PB, protein-binding; PO, by mouth; q.i.d., four times a day; RBC, red blood cell; t½, half-life; t.i.d., three times a day; UK, unknown; wk, week.*
folic acid supplementation may cause urine to turn more intensely yellow.

**Multiple Vitamins**

Prenatal vitamin preparations are routinely recommended for pregnant women. These preparations generally supply vitamins A, D, E, C, B complex (B1, B2, B3, B5, B6), B12, iron, calcium, and other minerals. The role of prenatal vitamins in preventing congenital defects (e.g., cleft lip or palate, limb defects) remains undetermined.

Poor food habits cannot be rectified through supplements alone; vitamins are used most effectively by the body when taken with meals. Calories and protein are not supplied by supplements.

Megadoses of vitamins and minerals during pregnancy will not improve health and may cause harm to the fetus, the pregnant client, or both. Large doses of vitamin A can be teratogenic, and excessive ingestion of vitamins D, E, and K may also be toxic.

Practitioners should consider cultural food practices and beliefs in regard to the use of prenatal vitamins. For example, in Mexico some people view vitamins as a hot food that should not be ingested during pregnancy (Darby 2007). Cultural sensitivity is important in assessment and teaching regarding herbs, foods, and nonprescription and prescription drugs.

**Drugs for Minor Discomforts of Pregnancy**

The average prenatal client uses three drugs during pregnancy, two of which are vitamin and mineral supplements. Drug ingestion is most likely during the first and the third trimesters, when the minor discomforts of pregnancy tend to be most bothersome. Many of the complaints associated with pregnancy will be related to the gastrointestinal (GI) tract (nausea and vomiting, heartburn, constipation). The etiology of nausea and vomiting is unclear. Physiologically, nausea is purported to be related to increased human chorionic gonadotropin (hCG) levels of pregnancy. The increased progesterone of pregnancy, which relaxes smooth muscle, contributes to the discomforts of heartburn and constipation. The physiologic reason is that elevated female sex hormones during pregnancy change the motility of the GI tract. Additionally, the enlarging uterus displaces the bowel.

**Nausea and Vomiting**

Nausea and vomiting (morning sickness) during early pregnancy are major complaints for most (about 88%) pregnant women, but hyperemesis gravidarum (severe nausea and vomiting which may require hospitalization for hydration and nutrition) occurs with much lower incidence (1% to 3%). Nausea and vomiting are common, possibly because of increased levels of hCG, estrogens, and progesterone, and changes in the metabolism of carbohydrates. Nonpharmacologic measures to decrease nausea and vomiting include (1) eating crackers, dry toast, bread, dry cereal, or other complex carbohydrates before rising; (2) avoiding fatty or highly seasoned foods; (3) eating small, frequent meals; (4) drinking fluids between rather than with meals; (5) drinking apple juice or flat carbonated beverages between meals; (6) eating a high-protein bedtime snack; (7) stopping or cutting down on smoking; and (8) taking an iron supplement at bedtime. These measures work well for most women, but if vomiting is severe, fluid replacement and pharmacologic measures may be necessary.

The Food and Drug Administration (FDA) has not approved any drug for morning sickness, nor is there consensus among health care providers who do prescribe drug therapy as to the best agents. Antiemetic drug studies often find that affected women rate even placebo agents as helpful. Examples of commonly used antiemetics include phenothiazines (promethazine), antihistamines (doxylamine), anticholinergics (scopolamine), prokinetic agents (metoclopramide), and ginger. Table 52–3 presents examples of the most commonly used drugs for management of nausea and vomiting during pregnancy.

Many women may choose to use ginger to help treat nausea and vomiting associated with pregnancy, but there is insufficient evidence to determine the safety and efficacy of its use during pregnancy. Recent studies suggest that ginger can be safely used, but as with all medications and herbal supplements, encourage the pregnant client to discuss the use of ginger with her health care provider.

Women who experience nausea and vomiting may experience gastric distress if they are also taking supplemental iron; taking the iron supplement with food, at bedtime, or temporary suspension of therapy may help. It is suggested that prenatal vitamins be taken at the time of day the client is least likely to experience emesis, because there is a high incidence of nausea and vomiting associated with prenatal vitamins. For clients with continued iron-induced gastric distress, many health care providers recommend taking two Flintstones vitamins with iron. Salting food to taste may help to replace vomited chloride; foods rich in potassium and magnesium may also help replace lost nutrients.

Clients whose symptoms persist and who experience weight loss and dehydration may require intravenous (IV) rehydration, including replacement of electrolytes and vitamins. Antiemetic therapy (probably with phenothiazines) may be used.

**Heartburn**

Heartburn (pyrosis) is a burning sensation in the epigastric and sternal regions that occurs with reflux of acidic stomach contents. The incidence of heartburn during pregnancy is common, up to 80%. Pregnant clients experience decreased motility in the GI tract as a result of the normal increase in the hormone progesterone. Progesterone also relaxes the cardiac sphincter (the sphincter leading into the stomach from the esophagus, also called the lower esophageal sphincter), making reflux activity (reverse peristalsis)
## Drugs for Management of Nausea and Vomiting during Pregnancy (Recommendation not Implied)

<table>
<thead>
<tr>
<th>Generic (Brand)</th>
<th>Route and Dosage</th>
<th>Uses and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antihistamines</strong></td>
<td></td>
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<tr>
<td>meclizine (Antivert)</td>
<td>PO: 20-50 mg/d</td>
<td>Mechanism of action: Considered mild; available as OTC drug. Sites of action: labyrinth and CNS. Blocks CTZ, which acts on vomiting center. Side effects: Dizziness, drowsiness, dry mouth and nose, blurred vision, diplopia, urinary retention, urticaria, rash, and headache. Cardiovascular effects can include hypotension, palpitations, and tachycardia. Contraindications: Hypersensitivity to drug or any component. Warnings/precautions: Use with closed-angle glaucoma. Increased effect of alcohol, tranquilizers, and narcotics. Pregnancy category: B; metabolized in liver and excreted unchanged in feces and as metabolites in urine. t½: 6 h; onset: 1-2 h; duration: 8-24 h</td>
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</table>

| **Phenothiazines** | PO, IV, IM, PR: 12.5-25 mg q4-6h prn | Mechanism of action: Blocks postsynaptic mesolimbic dopaminergic receptors in the brain; exhibits a strong alpha-adrenergic blocking effect and depresses the release of hypothalamic and hypophyseal hormones; competes with histamine for the H₁ receptor. Adverse reactions: Dizziness, drowsiness, excitation, fatigue, insomnia, photosensitivity reactions, nausea, vomiting, and constipation. Contraindications: Hypersensitivity to drug or any component of the formulation; CNS depression or coma. Warnings/precautions: Use caution in cardiovascular disease, not for subQ or intraarterial administration; injection may contain sulfites which may cause allergic reactions in some clients. Pregnancy category: C, t½: 9-16 h; onset IM 20 min, IV 3-5 min, duration 2-6 h |

| **Anticholinergics** | PO, IM, IV, subQ: 0.3-0.65 mg q4-6h | Mechanism of action: Antagonizes histamine and serotonin. Adverse reactions: Confusion, drowsiness, headache, fatigue, dry skin, constipation, vomiting, bloated feeling. Cardiovascular side effects include orthostatic hypotension, ventricular fibrillation, tachycardia, palpitations. Contraindications: Hypersensitivity to the active ingredient or any component of the formulation. Narrow-angle glaucoma, acute hemorrhage, GI or GU obstruction, tachycardia secondary to cardiac insufficiency, and myasthenia gravis. Warnings/precautions: Use with caution in hepatic or renal impairment. Pregnancy category: C; onset IM 0.5-1 h, duration 4-6 h |

| **Prokinetic Agents** | PO: 10-15 mg QID 30 min a.c. | Mechanism of action: Blocks dopamine receptors in chemoreceptor trigger zone of the CNS, causes enhanced motility and accelerated gastric emptying without stimulating secretions. Adverse reactions: Restlessness, drowsiness, diarrhea, weakness, insomnia. Contraindications: Hypersensitivity to metoclopramide or any component of the formulation. GI obstruction, perforation or hemorrhage; pheochromocytoma; history of seizure disorder. Pregnancy category: B; t½: 4-7 h; onset 0.5-1 h, duration 1-2 h |

| **Other** | 200 mg rectally q6-8h | Mechanism of action: Obscure action; may be mediated through CTZ. Does not inhibit direct impulse to vomiting center. Chemically classified as an ethanolamine derivative. Precautions include use in client with cardiac dysrhythmias, narrow-angle glaucoma, asthma, and pyloroduodenal obstruction. Rectal doses of the drug are more unpredictable. Side effects: Drowsiness, headache, blurred vision, diarrhea, depression, hypotension, muscle cramps, allergic reactions, and extrapyramidal symptoms; blood dyscrasias. Contraindications: Benzocaine, hypersensitivity to drug. Use suppository form in neonates or preterm infants. Warning/precaution: Avoid use in acute emesis to avoid masking of symptoms. Drug interactions: Phenothiazines/barbiturates, belladonna. Pregnancy category: C; t½: UK; onset: PO/PR: 10-40 min; IM: 15-35 min; duration: 3-4 h |

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*a.c., Before meals; CNS, central nervous system; CTZ, chemoreceptor trigger zone; d, day; GI, gastrointestinal; GU, genitourinary; H₁, histamine; h, hour; IM, intramuscular; IV, intravenous; min, minute; OTC, over-the-counter; PO, by mouth; PR, by rectum; PRN, as needed; subQ, subcutaneous; t½, half-life; UK, unknown.*
more likely. Digestion and gastric emptying are slower 
than in the nonpregnant state. Heartburn is common 
when a pregnant client sits or lies down soon after eating 
a normal meal, only to have her gravid uterus exert upward 
pressure on her stomach, causing increased reflux activity 
and the perception of hyperacidity. Heartburn is a disorder 
of the second and third trimesters of pregnancy.

Nonpharmacologic measures are preferred in the man-
gement of heartburn. These include (1) limiting the size 
of meals; (2) avoiding highly seasoned, fried, or greasy 
foods; (3) avoiding gas-forming foods (e.g., cabbage, 
beans, onions); (4) eating slowly and chewing thoroughly; 
(5) avoiding citrus juices; (6) drinking adequate fluids, but 
not with meals; and (7) avoiding reclining immediately 
after eating.

Antacids should be considered first-line therapy if the 
client does not respond to nonpharmacologic therapy. The 
antacids of choice for the pregnant client include nonsys-
temic low-sodium products (those considered dietetically 
sodium-free) containing aluminum and magnesium (in 
the form of hydroxide) in combination. These two ingredi-
ents can be found in the combined form of magaldrate 
also called hydroxymagnesium aluminate). Discourage the 
long-term use or large doses of magnesium antacids, be-
cause fetal renal, respiratory, cardiovascular, and muscle 
problems may result. Some products also include simethi-
cone (Mylicon), an antiflatulent used to decrease the sur-
fase tension of GI gas bubbles, burst the bubbles, and 
promote rapid gas expulsion. Additionally, sucralfate is 
likely safe during pregnancy, because the drug is not sys-
temically absorbed. Calcium carbonate antacid prepara-
tions may be avoided in pregnancy because of the rebound 
effect following acid neutralization. Tums are frequently 
taken by pregnant women for heartburn, but because 
Tums are calcium-based, excessive use may contribute to the 
constipation of pregnancy.

Most clients do not realize that remedies commonly 
used by nonpregnant women (e.g., baking soda [sodium 
bicarbonate], antacids such as Alka-Seltzer, Bromo-Seltzer, 
Rolaids) can be harmful during pregnancy. Selection of the 
wrong antacid can result in diarrhea, constipation, or elec-
trolyte imbalance. The combination of nonpharmacologic 
measures plus minimal use of safe antacids should effect-
ively meet the pregnant client’s needs.

Liquid antacids are the preparations most commonly 
used in pregnancy because of their uniform dissolution, 
rapid action, and greater activity. Tablets are also accept-
able, particularly for convenience, provided these are thor-
oughly chewed and the client maintains an adequate fluid 
intake.

Histamine₂ receptor antagonists (H₂RAs) can be used 
during pregnancy, but only if the client has failed initial 
treatment with antacids, and their use is recommended by 
a health care provider. The teratogenicity of these medica-
tions is unknown; however, cimetidine, ranitidine, famoti-
dine, and nizatidine have received the FDA’s pregnancy 
category B rating. H₂RAs work by competitively and revers-
ibly binding to the histamine receptors of the parietal cells, 
causing a reduction in gastric acid secretion. The onset 
of action is generally in 1 hour and can persist for 6 to 
12 hours.

There is even less experience with the use of proton 
pump inhibitors. These medications work to suppress gas-
tric acid secretion by inhibiting the proton pump on the 
surface of the parietal cells. With the recent release of Pri-
losec OTC (omeprazole), pregnant clients may be inquisi-
tive about its use for heartburn during pregnancy. Encourage 
clients to discuss the options with their provider. Currently the 
use of omeprazole is limited to cases in which the benefits of therapy far outweigh the risks.

Table 52–4 presents medications for heartburn com-
monly used during pregnancy.

**Constipation**

Constipation is a frequent occurrence during pregnancy. 
Its cause may be related to hormonal changes, specifically 
progesterone, which decreases GI motility. Like heartburn, 
nonpharmacologic treatments for constipation should be 
tried first. These include (1) increasing fluid intake, (2) 
increasing dietary fiber intake, and (3) moderate physical 
exercise.

If the aforementioned methods do not work, treatment 
is indicated, and the safest agents are considered the bulk-
forming preparations containing fiber (for example, 
Metamucil), because these agents are not systemically ab-
sorbed. Also, docusate sodium, a stool softener, would be 
appropriate as first-line treatment during pregnancy. Agents 
that should be reserved for occasional use include milk of 
magnesia, magnesium citrate, lactulose, sorbitol, bisaco-
dyl, and senna.

Castor oil should be avoided during pregnancy, because 
it can stimulate uterine contractions. Mineral oil should 
also be avoided, because it can reduce the absorption of 
fat-soluble vitamins such as vitamin K. Low levels of vita-
min K in the neonate can result in hemorrhage.

**Pain**

Up through week 26 of pregnancy, headaches resulting 
from hormonally induced body changes, sinus congestion, 
or eye strain are quite common. It is not unusual for the 
pregnant client to experience backaches, joint pains, round 
ligament pain (resulting in mild abdominal aches and 
twinges), and pain from minor injuries. Nonpharmaco-
logic pain relief measures should be tried initially. These 
include rest, a calming environment, relaxation exercises, 
alteration in routine, mental imagery, ice packs, warm 
moist heat, postural changes, correct body mechanics, and 
changes in the height and style of footwear.

**Acetaminophen**

Acetaminophen (Tylenol), a para-aminophenol analgesic, 
is a pregnancy category B drug. It is the most commonly 
ingested nonprescription drug during pregnancy. Acet-
aminophen may be used during all trimesters of pregnancy.
in therapeutic doses on a short-term basis for its analgesic and antipyretic effects. The drug is a weak prostaglandin inhibitor and does not have significant antiinflammatory effects. Refer to Prototype Drug Chart 25–1 in Chapter 25 for the actions, effects, and safe use of acetaminophen.

**Pharmacokinetics**

The rate of absorption is dependent on the rate of gastric emptying. Acetaminophen is 20% to 50% protein-bound and crosses the placenta during pregnancy; it is also found in low concentrations in breast milk. Acetaminophen is partially hepatically metabolized into inactive metabolites; however, a highly active metabolite (N-acetyl-p-benzoquinone)

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### Table 52–4

<table>
<thead>
<tr>
<th>Generic (Brand)</th>
<th>Route and Dosage</th>
<th>Uses and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminum hydroxide (Amphojel)</td>
<td>A: PO: As directed*</td>
<td>Contains aluminum hydroxide gel (320 mg) per 300 mg tablet or per 5 ml; ANC 8; contains saccharin and sorbitol. OTC preparation. <strong>Use:</strong> For heartburn secondary to reflux <strong>Action:</strong> Neutralization of gastric acidity <strong>Side effects:</strong> Constipation <strong>Adverse reactions:</strong> Dehydration, hypophosphatemia (long-term use), GI obstruction <strong>Drug interactions:</strong> Decreased effects with tetracycline, phenothiazine, benzodiazepines,isoniazid, digoxin; follow dose with water</td>
</tr>
<tr>
<td>magnesium hydroxide and aluminum hydroxide with simethicone (Mylanta Extra Strength Liquid, Almacone)</td>
<td>40 to 125 mg PO q.i.d. after meals and at bedtime; up to 500 mg/d</td>
<td>*<em>As directed</em></td>
</tr>
<tr>
<td>magaldrate with simethicone (Riopan Plus tablets, Riopan Plus suspension)</td>
<td>As directed*</td>
<td>Contains aluminum hydroxide gel (320 mg) per 300 mg tablet or per 5 ml; ANC 8; contains saccharin and sorbitol. OTC preparation. <strong>Use:</strong> For heartburn secondary to reflux <strong>Action:</strong> Neutralization of gastric acidity <strong>Side effects:</strong> Constipation <strong>Adverse reactions:</strong> Dehydration, hypophosphatemia (long-term use), GI obstruction <strong>Drug interactions:</strong> Decreased effects with tetracycline, phenothiazine, benzodiazepines,isoniazid, digoxin; follow dose with water</td>
</tr>
</tbody>
</table>

*Dosage recommendations for antacid preparations should be clarified by the health care provider; however, as a general rule, no more than 12 tablets or 12 tsp should be taken in a 24-hour period, depending on the strength of the product. Major side effects are a change in bowel habits (diarrhea or constipation), nausea, vomiting, alkalosis, and hypermagnesemia. Owing to their action on gastric pH (increased) and their propensity to bind with other drugs to form poorly absorbed complexes, antacids figure in numerous drug interactions. Antacids should not be given within 2 hours of iron, digitalis products, tetracycline, or phenothiazine.

A, Adult; ANC, acid-neutralizing capacity (per tablet or 5 ml); d, day; GI, gastrointestinal; h, hour; min, minute; OTC, over-the-counter; PB, protein-binding; PO, by mouth; q.i.d., four times a day; t½, half-life; tsp, teaspoon; UK, unknown.
produced when the drug is taken in large doses can have potential liver and kidney toxicity. The half-life is 2 to 3 hours. To date there is no concrete evidence of fetal anomalies associated with the use of acetaminophen, and no adverse effects have been noted in breastfed infants of mothers who used the drug while pregnant or breastfeeding.

**Pharmacodynamics**

Use of acetaminophen during pregnancy should not exceed 12 tablets per 24 hours of a 325-mg formulation (regular strength) or 8 tablets per 24 hours of a 500-mg (extra strength) formulation (because of the potential for kidney and liver toxicity). The drug should be taken at 4- to 6-hour intervals. Onset of effects following oral ingestion is within 10 to 30 minutes; peak action occurs at 1 to 2 hours; duration lasts from 3 to 5 hours.

**Adverse Reactions**

Most clients without preexisting renal or hepatic disease tolerate acetaminophen well. Clients with hypersensitivity to the compound should not use it. Acetaminophen should be used cautiously in clients at risk for infection because of the possibility of masking signs and symptoms. The most frequent adverse reactions are skin eruptions, urticaria, unusual bruising, erythema, hypoglycemia, jaundice, hemolytic anemia, neutropenia, leukopenia, pancytopenia, and thrombocytopenia.

**Aspirin**

Aspirin (ASA, Bayer, Ecotrin, Halfprin), a salicylate, is classified as a mild analgesic. Aspirin is a pregnancy category C drug (which changes to category D if full-dose aspirin is used in the third trimester). Aspirin is discussed in detail in Chapter 25.

Aspirin is a prostaglandin synthetase inhibitor with antipyretic, analgesic, and antiinflammatory properties. Teratogenic effects have not been shown conclusively, but the risk of anomalies is perceived to be small.

Aspirin can inhibit the initiation of labor and actually prolong labor through its effects on uterine contractility, therefore its use is not recommended during pregnancy. In addition, aspirin use late in pregnancy is associated with greater maternal blood loss at delivery. There may be increased risk of anemia in pregnancy and of antepartum hemorrhage as well. Hemostasis is affected in the newborn whose mother ingested aspirin during the last 2 months of pregnancy (even without use during the actual week of delivery). The platelets are unable to aggregate to form clots, and it appears that this is not a reversible effect after delivery; the infant has to wait for its own bone marrow to produce new platelets.

**NURSING DIAGNOSES**

- Deficient knowledge related to health maintenance needs during pregnancy
- Deficient knowledge related to potential fetal outcomes from exposure to teratogens

**PLANNING**

- Client will use and avoid various drugs during pregnancy as advised.
- Client will discuss drugs (illicit, OTC, prescribed), and herbal use with health care provider or pharmacist prior to use.

**NURSING INTERVENTIONS**

**General**

- Be cognizant that drug use may be part of multiple substance abuse and may also involve maternal-neonatal infections.
- Stress the importance of prenatal care, and discuss fears client may have about health care professionals and concerns about legal action in the event of substance abuse.

**Specific**

- Instruct on nonpharmacologic and pharmacologic measures to relieve common pregnancy discomforts.
- Refer to tobacco, alcohol, or drug treatment program if appropriate.
- Instruct on nutritional and therapeutic supplements needed during pregnancy.
- Monitor hemoglobin/hematocrit of prenatal clients per agency protocol.

**Iron**

- Question client about nausea, constipation, and bowel habit changes if taking iron preparations.
- Give diluted liquid iron preparation through a plastic straw to prevent discoloration of teeth.
- Store iron in a light-resistant container.
- Be cognizant that client may have false-positive result of occult blood in stool if taking iron.
Client Teaching

General
- Advise pregnant woman that tobacco, alcohol, and heavy caffeine use may have adverse effects on the fetus.
- Instruct client that before taking drugs (illicit, OTC, prescribed) to discuss with health care provider secondary to teratogenic potential.
- Advise client planning to breastfeed to discuss drugs (illicit, OTC, prescribed) with health care provider.

Aspirin/Acetaminophen
- Advise client to take acetaminophen rather than aspirin during pregnancy; aspirin is particularly contraindicated during the third trimester.

Antepartum Drugs
- Instruct client not to take nonsteroidal antiinflammatory drugs (NSAIDs) with acetaminophen.

Caffeine/Alcohol/Nicotine
- Advise client to limit coffee and caffeine ingestion from none to 1 to 2 cups per day and to limit other sources of caffeine (tea, cola, soft drinks, chocolate, certain drugs).
- If caffeine is allowed by the health care provider, teach client to space limited caffeine intake evenly throughout the day, because caffeine passes readily to the fetus, who cannot metabolize it. Caffeine can decrease intervillous placental blood flow.
- Advise client to use decaffeinated products or dilute caffeinated products.
- Suggest that client use herbal products carefully because of occasionally harmful ingredients (see Herbal Alert 52–1).
- If client plans to breastfeed, tell her that 1% of the caffeine she consumes will appear in her breast milk within 15 minutes. Therefore, although a cup of coffee is not a problem, it is not wise to drink several cups of coffee in succession; excess caffeine will accumulate in the infant’s tissues. The infant lacks enzymes to adequately clear the caffeine for 7 to 9 months after birth.
- Instruct client not to drink alcohol if she is pregnant, because no safe level of alcohol has been determined, and even minimal exposure has resulted in fetal alcohol effect and moderate/excess exposure has resulted in fetal alcohol syndrome.
- Advise client that smoking can cause the loss of nutrients such as vitamins A and C, folic acid, cobalamin, and calcium. Tobacco use may contribute to a shortened gestation and low-birth-weight infants.

Antacids
- Advise that antacids should not be taken within 1 hour of taking an enteric-coated tablet, because the acid-resistant coating may dissolve in the increased alkaline condition of the stomach, and the medica-

Iron
- Advise client about dietary sources of iron, which include organ meats (liver), red meat, nuts and seeds, wheat germ, spinach, broccoli, prunes, and iron-fortified cereals.
- Explain to client that if supplemental iron is taken between meals, increased absorption (and also increased side effects) may result. Taking iron 1 hour before meals is suggested. Give with juice or water, but not with milk or antacids.

Self-Administration for Iron and Antacids
- Advise client to swallow the iron tablets whole, not to crush them. Liquid iron preparations should be taken with a plastic straw to avoid staining the teeth.
- Caution client not to take antacids with iron, because antacids impair absorption and are generally discouraged during pregnancy. Iron and antacids should be taken 2 hours apart if both are prescribed.

Side Effects for Iron and Antacids
- Advise client that there may be a change in bowel habits when taking antacids. Aluminum and calcium carbonate products can cause constipation, whereas magnesium products can cause diarrhea. Many antacids contain a combination of ingredients to reduce adverse effects.

EVALUATION
- Evaluate the effectiveness of the prescribed drug therapy. Report side effects.
- Evaluate client’s understanding of possible effects on the fetus with maternal use of drugs (prescribed, OTC, and illicit) and the use of tobacco and alcohol.

Drugs that Decrease Uterine Muscle Contractility

Preterm Labor

Preterm labor (PTL) is labor that occurs between 20 and 37 weeks of pregnancy, involving a fetus with an estimated weight between 500 and 2499 g. Regular contractions occur at less than 10-minute intervals over 30 to 60 minutes and are strong enough to result in 2-cm cervical dilation and 80% effacement. Preterm labor occurs in approximately
8% to 10% of all pregnancies. Preterm infants who survive very early delivery have significant physiologic challenges to overcome, so PTL that progresses to preterm delivery accounts for most perinatal morbidity and mortality (excluding fetuses with anomalies) in the United States.

Although PTL has no single known cause, certain risk factors have been identified: maternal age younger than 18 or older than 40 years, low socioeconomic status, previous history of preterm delivery (17% to 37% chance of recurrence), intrauterine infections (e.g., bacterial vaginosis), polyhydramnios, multiple gestation, uterine anomalies, antepartum hemorrhage, smoking, drug use, urinary tract infections, and incompetent cervix. Attempts to arrest PTL are contraindicated in: (1) pregnancy of less than 20 weeks’ gestation (confirmed by ultrasound), (2) bulging or premature rupture of membranes (PROM), (3) confirmed fetal death or anomalies incompatible with life, (4) maternal hemorrhage and evidence of severe fetal compromise, and (5) chorioamnionitis.

Nonpharmacologic treatment measures for PTL include bed rest, hydration (ingestion of six to eight glasses of fluids daily or more, IV fluid bolus), pelvic rest (no sexual intercourse or douching), and screening for intrauterine and urinary tract infections. Client assessment will include uterine activity (frequency, duration, and intensity), vaginal bleeding or discharge, and fetal monitoring.

**Tocolytic Therapy**

When clients in true PTL (with cervical change) have no contraindications, they become candidates for tocolytic therapy (drug therapy to decrease uterine muscle contractions) using beta₂-adrenergic receptor agonists (e.g., terbutaline [Brethine]) or the calcium antagonist magnesium sulfate. The goals in tocolytic therapy are to: (1) interrupt or inhibit uterine contractions to create additional time for fetal maturation in utero, (2) delay delivery so antenatal corticosteroids can be delivered to facilitate fetal lung maturation, and (3) allow safe transport of the mother to an appropriate facility if required.

Table 52–5 lists the most commonly used drugs to decrease preterm uterine contractions.

**Beta-Sympathomimetic Drugs**

Beta-sympathomimetic drugs act by stimulating beta₂-receptors on uterine smooth muscle. The frequency and intensity of uterine contractions decrease as the muscle re-

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**Table 52–5**

**Drugs Used to Decrease Uterine Contractility**

<table>
<thead>
<tr>
<th>Generic (Brand)</th>
<th>Route and Dosage</th>
<th>Uses and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta-Adrenergic Agents</td>
<td>Follow agency protocols for specific directives plus individual health care provider’s order; may be given subQ; usually therapy is 0.25 mg subQ to 0.5 mg subQ every 3 to 4 h</td>
<td>Sympathomimetic beta₂-adrenergic agonist. Partially metabolized in the liver; excreted by the kidneys. 40%-50% rate of tocolytic breakthrough and recurrence of preterm labor 3 wk after start of PO therapy may require repeat therapy (may be due to desensitization of beta receptors over time) Current research focused on use of low-dose continuous subQ pumps that are portable and can deliver intermittent bolus doses based on data reflecting peak need periods. Pumps are cost-effective with high client satisfaction. Increases in maternal pulse and FHR. Rapidly crosses placenta; breastfeeding not contraindicated because of short half-life</td>
</tr>
<tr>
<td>terbutaline (Brethine)</td>
<td></td>
<td>Drug interactions: Additive effect with CNS depressants (narcotics, sedative-hypnotics) and neuromuscular blocking agents Pregnancy category: B; t½: 11-16 h; onset: 15 min IV/subQ and 30-45 min PO; duration: 4-8 h PO and 1.5-4 h subQ; peak serum levels: 0.5-1 h IV/subQ and 1.2 h PO</td>
</tr>
<tr>
<td>Calcium Antagonists</td>
<td>Follow agency protocols for specific directives plus individual physician orders for concentration and ml/h IV. Usual LD: 4-6 g in 100 ml over 15-20 min; maint: 40 g in 1 L of IVF at 2-4 g/h. Dose based on serum magnesium levels, deep tendon reflex assessment, and uterine response</td>
<td>Calcium antagonist and CNS depressant. Relaxes uterine smooth muscle through calcium displacement. Must be given by infusion pump for accurate dosage. Freely crosses placenta. Few contraindications allow for use in clients who exhibit life-threatening complications. Maternal magnesium levels monitored through serum analyses, DTR, respiratory rate, and urinary output. Elevated levels may be evident in newborn for 7 d; observe newborn for 24-48 h for signs of toxicity if mother treated close to delivery; breastfeeding not contraindicated Antidote: calcium gluconate 1 g given IV over 3 min Pregnancy category: B; onset: immediate by IV; duration: 30 min</td>
</tr>
<tr>
<td>magnesium sulfate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CNS, Central nervous system; d, day; DTR, deep tendon reflex; FHR, fetal heart rate; h, hour; IV, intravenous; IVF, intravenous fluid; LD, loading dose; maint, maintenance; min, minute; PO, by mouth; subQ, subcutaneous; t½, half-life; wk, week.
laxatives. Terbutaline (Brethine) is commonly used. It is approved for medicinal use but not specifically as a tocolytic. Terbutaline can effectively decrease uterine contractions; however, the literature indicates that knowledge about the long-term effects of this drug is still lacking.

**Pharmacokinetics**

Clients with mild contractions may be initially given subcutaneous terbutaline (Brethine) followed by a series of subcutaneous (subQ) injections of the drug. Clients are monitored to determine whether and when contractions diminish or cease. Terbutaline is minimally protein-bound (25%) and metabolized via the liver to inactive metabolites. Its half-life is 11 to 16 hours. Oral therapy or subcutaneous pump therapy with terbutaline may be prescribed for longer-term maintenance.

**Pharmacodynamics**

Oral terbutaline has an onset of action of 30 to 45 minutes, a peak plasma/serum concentration of 1 to 2 hours, and a duration of action of 4 to 8 hours. IV and subcutaneous terbutaline have an onset of action within 15 minutes, a peak serum concentration level in 30 to 60 minutes, and a duration of action of 1.5 to 4 hours subQ.

**Adverse Reactions**

Maternal side effects include tremors, malaise, weakness, dyspnea, tachycardia, increased systolic blood pressure, decreased diastolic blood pressure, chest pain, nausea, vomiting, diarrhea, constipation, erythema, sweating, hyperglycemia, and hypokalemia. Many of these effects are associated with terbutaline’s cross-reactivity with beta1-adrenergic receptors. More serious adverse reactions include pulmonary edema, dysrhythmias, ketoacidosis, and anaphylactic shock.

Fetal side effects include tachycardia and potential hyperglycemia resulting from fetal hyperinsulinemia caused by maternal hyperglycemia.

**Drug Interactions**

The increased effects of general anesthetics can produce additive hypotension. Pulmonary edema can occur with concurrent use of corticosteroids. Cardiovascular effects may be additive with other sympathomimetic drugs, such as epinephrine, albuterol, and isoproterenol. Beta-adrenergic blocking agents, such as propranolol HCl, nadolol, pindolol, timolol maleate, and metoprolol tartrate, antagonize beta-sympathomimetics.

**Magnesium Sulfate**

Magnesium sulfate, a calcium antagonist and central nervous system depressant, relaxes the smooth muscle of the uterus through calcium displacement. Administered IV, the drug has a direct depressant effect on uterine muscle contractility. The drug increases uterine perfusion, which has a therapeutic effect on the fetus. This drug, which is also less expensive, may be safer to use than the beta-sympathomimetics, because it has fewer adverse effects. It can also be used when beta-sympathomimetics are contraindicated (e.g., in women with diabetes and cardiovascular disease). The drug is excreted by the kidneys and crosses the placenta. The maintenance dose must be titrated to keep uterine contractions under control, and magnesium levels are drawn based on the clinical response of the client. Magnesium sulfate therapy is contraindicated in clients who have myasthenia gravis; impaired kidney function and recent myocardial infarction are relative contraindications. Clients with renal impairment may require adjusted dosages.

**Adverse Reactions**

Dosage-related side effects in the maternal client include flushing, feelings of increased warmth, perspiration, dizziness, nausea, headache, lethargy, slurred speech, sluggishness, nasal congestion, heavy eyelids, blurred vision, decreased GI action, increased pulse rate, and hypotension. Increased severity is evidenced by depressed reflexes, confusion, and magnesium toxicity (respiratory depression and arrest, circulatory collapse, cardiac arrest). Side effects in the fetus are decreased fetal heart rate variability, and in the neonate, slight hypotonia with diminished reflexes and lethargy for 24 to 48 hours.

If maternal neurologic, respiratory, or cardiac depression is evidenced, the antidote is calcium gluconate (10 mg IV push over 3 minutes).

**Nursing Interventions during Tocolytic Therapy**

- Monitor vital signs, FHR, fetal activity, and uterine activity as ordered. Report respirations fewer than 12 per minute, which may indicate magnesium sulfate toxicity.
- Monitor I & O. Report urinary output less than 30 ml/h.
- Assess breath and bowel sounds as ordered, or at least every 4 hours.
- Assess deep tendon reflexes (DTR) and clonus before initiation of therapy and as ordered. Notify health care provider of changes in DTR (areflexia or hyporeflexia) and clonus.
- Weigh daily.
- Monitor serum magnesium levels as ordered (therapeutic level is 4 to 7 mg/dl).
- Have calcium gluconate (1 g given IV over 3 minutes) available as an antidote.
- Observe newborn for 24 to 48 hours for magnesium effects if drug was given to mother before the delivery.
ASSESSMENT
- Identify risks for preterm labor (PTL) early in pregnancy.
- When a client has preterm uterine contractions, obtain a history, complete physical assessment, vital signs, fetal heart rate (FHR), and urine specimen for screening for intrauterine infection and urinary tract infection.

NURSING DIAGNOSES
- Risk for activity intolerance related to nonpharmacologic and pharmacologic interventions for PTL
- Ineffective health maintenance related to nonpharmacologic and pharmacologic interventions for PTL and the long-term implications for the woman and her fetus/infant
- Deficient knowledge related to etiology and nonpharmacologic and pharmacologic interventions for PTL
- Fear related to potential for early labor and birth

PLANNING
- Client’s preterm uterine contractions will cease by resting in left side-lying position, increasing fluid intake, assuming pelvic rest, and following tocolytic therapy as directed.
- Client has no progressive cervical change.

NURSING INTERVENTIONS
- Monitor and assess uterine activity and FHR.
- Maintain client in left lateral position as much as possible to facilitate uteroplacental perfusion.
- Monitor vital signs per unit protocol, specifically maternal pulse. Report maternal heart rate greater than 110 beats/min.
- Report auscultated cardiac dysrhythmias. An electrocardiogram (ECG) may be ordered.
- Auscultate breath sounds every 4 hours. Notify health care provider if respirations are more than 30 per minute or if there is a change in quality (wheezes, rales, coughing).
- Monitor daily weight to assess fluid overload; strict intake and output (I & O) measurement.
- Report baseline FHR over 180 beats/min or any significant increase in uterine contractions from pretreatment baseline.
- Report persistence of uterine contractions despite tocolytic therapy.

EVALUATION
- Evaluate the effectiveness of the tocolytic drug by noting six or fewer uterine contractions in 1 hour or per provider order.
- Evaluate client’s understanding of nonpharmacologic measures for decreasing preterm contractions: bed rest, increasing oral fluid intake, pelvic rest, and lying on her left side.
- Continue monitoring client’s vital signs, FHR, and uterine activity. Report any change immediately.

Corticosteroid Therapy in Preterm Labor
The desired outcome of tocolytic therapy is prevention or cessation of PTL. Clients at risk for preterm delivery (24 to 34 weeks’ gestation) should receive antenatal corticosteroid therapy with betamethasone (Celestone) or dexamethasone. Administration of corticosteroids accelerates

Report leaking of amniotic fluid, any vaginal bleeding or discharge, or complaints of rectal pressure.
Be alert to presence of maternal hyperglycemia and hypokalemia and hypoglycemia in the newborn delivered within 5 hours of discontinued beta-sympathomimetic drugs.
Assist clients on bed rest and home tocolytic therapy to plan for assistance with self-care and family responsibilities.

Client Teaching
General
- Inform client of the signs and symptoms of PTL (menstrual-type cramps, sensation of pelvic pressure, low backache, increased vaginal discharge, and any abdominal discomfort).
- Instruct client that if she experiences PTL contractions, initial action should be to void, recline on her left side to increase uterine blood flow, and drink extra fluids. Emphasize that she should notify her health care provider if uterine contractions do not cease or if they increase in frequency.
- Explain side effects of beta-sympathomimetic drugs. Report heart palpitations or dizziness to health care provider.
- Instruct client to take drugs regularly and as prescribed.
- Advise client to contact the health care provider before taking any other drugs while on tocolytic drug therapy.

Cultural Considerations
- Provide an interpreter with the same ethnic background and gender if possible, especially with sensitive topics and stress situations.

Corticosteroid Therapy in Preterm Labor
The desired outcome of tocolytic therapy is prevention or cessation of PTL. Clients at risk for preterm delivery (24 to 34 weeks’ gestation) should receive antenatal corticosteroid therapy with betamethasone (Celestone) or dexamethasone. Administration of corticosteroids accelerates...
lung maturation and lung surfactant development in the fetus in utero, thereby decreasing the incidence and severity of respiratory distress syndrome (RDS) and increasing survival of preterm infants. Antenatal therapy decreases infant mortality, RDS, and intraventricular bleeds in neonates born between 24 to 34 gestational weeks (Chan, Johnson 2006). The effects and benefits of corticosteroid administration are believed to begin 24 hours after administration and last for up to 1 week.

Surfactant is made up of two major phospholipids: sphingomyelin and lecithin. Sphingomyelin initially develops in greater quantity (from about the 24th week) than lecithin. However, by the 33rd to 35th weeks of gestation, lecithin production peaks, making the ratio of the two substances about 2:1 in favor of lecithin. This is called the L/S (lecithin/sphingomyelin) ratio, measured in the amniotic fluid. The L/S ratio is a predictor of fetal lung maturity and risk for neonatal RDS.

Clients with gestational hypertension, PROM, placental insufficiency, some types of diabetes, or narcotic abuse may have amniotic fluid with higher than expected L/S ratios for the gestational date because of a stress-induced increase in endogenous corticosteroid production.

Betamethasone (Celestone)

When PTL occurs before the 33rd week of gestation, corticosteroid therapy with betamethasone may be prescribed. The usual dose is 12 mg intramuscularly (IM) every 24 hours for two doses.

Adverse Reactions

Side effects of betamethasone are rare but include seizures, headache, vertigo, edema, hypertension, increased sweating, petechiae, ecchymoses, and facial erythema.

Dexamethasone

In clinical controlled trials, there is insufficient evidence to recommend betamethasone over dexamethasone, because the two have not been compared. Dexamethasone has a rapid onset of action and a shorter duration of action; therefore, it must be prescribed in a shorter frequency compared with betamethasone. The recommended antepartum regimen for dexamethasone is 6 mg IM every 12 hours for four doses. Do not confuse dexamethasone with desoximetasone.

Adverse Reactions

The potential adverse reactions associated with dexamethasone therapy include insomnia, nervousness, increased appetite, headache, hypersensitivity reactions, and arthralgias. Table 52–6 provides information for the reviewed corticosteroids.

### Table 52–6

<table>
<thead>
<tr>
<th>Generic (Brand)</th>
<th>Route and Dosage</th>
<th>Uses and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>betamethasone (Celestone)</td>
<td>IM: 12 mg IM q24h × 2 doses</td>
<td>Corticosteroid. Given to prevent RDS in preterm infants by injecting mother before delivery to stimulate surfactant production in the fetal lung. Not effective in treating preterm infant after delivery. Most effective if given at least 24 h (preferably 48-72 h) but less than 7 d before delivery in week 33 or before. Contraindicated in severe gestational hypertension and in systemic fungal infection. Simultaneous use with terbutaline may enhance risk of pulmonary edema. Drug can mask signs of chorioamnionitis; therefore drug not usually given with ruptured membranes. Metabolized in the liver and excreted by the kidneys; crosses the placenta; enters breast milk. Therapy less effective with multifetal birth and with male infants. No data available related to breastfeeding. Pregnancy category: C; PB: 64%; t½: 6.5 h; onset: 1-3 h; peak: 10-36 min IV; duration: 7-14 d</td>
</tr>
<tr>
<td>Dexamethasone (Decadron)</td>
<td>IM: 6 mg q12h × 4 doses</td>
<td>Same as betamethasone</td>
</tr>
</tbody>
</table>

Nursing Process

**Betamethasone (Celestone)**

**ASSESSMENT**
- Assess for history of hypersensitivity.
- Assess vital signs; report abnormal findings.
- Assess fetal heart rate (FHR).

**NURSING DIAGNOSES**
- Fear related to potential for preterm labor and birth with uncertain fetal outcome secondary to fetal immaturity
- Risk for infection
PLANNING
- Client will not deliver within 24 hours of receiving betamethasone (Celestone).

NURSING INTERVENTIONS
- Shake the suspension well. Avoid exposing to excessive heat or light.
- Inject into large muscle, but not the deltoid, to avoid local atrophy.
- Monitor maternal vital signs.
- Maintain accurate intake and output.
- Check blood glucose if used for client with diabetes.

Cultural Considerations
- Provide an interpreter with the same ethnic background and gender if possible, especially when dealing with sensitive topics and stress situations.

EVALUATION
- Continue monitoring client’s vital signs. Report changes.
- Continue monitoring FHR. Report changes.
- Monitor neonate for hypoglycemia and presence of neonatal sepsis.

### Box 52–1

**Predisposing Factors in Preeclampsia**
- African American
- Primigravida (first pregnancy)
- History of preeclampsia
- Younger than 20 or older than 35 years of age (especially as primigravida)
- Multifetal gestation
- Family history of preeclampsia
- Gestational trophoblastic disease
- Pregestational diabetes mellitus
- Preexisting hypertensive, vascular, or renal disease
- Overweight
- Antiphospholipid antibody syndrome

The two categories of gestational hypertension—preeclampsia and eclampsia—are based on clinical manifestations. Preeclampsia is the presence of hypertension (systolic blood pressure >140 mmHg or diastolic blood pressure >90 mmHg) and proteinuria (≥300 mg in 24-hour urine collection) in a normotensive pre preg nant client after the 20th week of gestation. Preeclampsia is subdivided into mild preeclampsia and severe preeclampsia (Table 52–7 for comparison).

About 5% of preeclamptic clients, notably those without adequate prenatal care, progress to eclampsia, in which seizure activity occurs and the perinatal mortality rate is about 20%. Early diagnosis of preeclampsia with appropriate treatment keeps most preeclamptic clients from progressing to this stage. About 25% of eclampsia occurs postpartum.

A severe sequela of preeclampsia is known as HELLP syndrome (defined by Hemolysis, Elevated Liver enzymes, and Low Platelet count), which occurs in about 2% to 12% of clients with gestational hypertension. Clients who manifest severe preeclampsia are most likely to also have HELLP syndrome.

Two primary treatment goals in preeclampsia, in addition to delivery of an uncompromised fetus and psychologic support for the client and her family, are reduction of vasospasm and prevention of seizures.

Delivery of the infant and placenta (products of conception) is the only known cure for preeclampsia. Vaginal delivery is preferred so that anesthesia or surgical risks will not be added. Labor induction via cervical ripening may be initiated to facilitate labor. For a vaginal delivery, epidural or combined epidural and spinal anesthesia are frequently performed for pain management while promoting uteroplacental circulation. Maternal hypotension is a significant concern for hypertensive clients who have epidurals. In contrast, parturients with worsening preeclampsia or fetal distress may be delivered via cesarean section. Clients with HELLP syndrome may have their labor induced for a vaginal delivery at 32 or more weeks’ gestation. For clients with HELLP syndrome who are at less than 32 weeks’ gestation, cesarean delivery may be considered.

### Drugs for Gestational Hypertension

Gestational hypertension (elevated blood pressure without proteinuria after 20 gestational weeks in clients normotensive prior to pregnancy), the most common serious complication of pregnancy, can have devastating maternal and fetal effects (ACOG 2002). Gestational hypertension has replaced the term pregnancy-induced hypertension (PIH), still commonly used in clinical discussions, albeit no longer correct. With proper management of gestational hypertension, the prognosis for both mother and infant is good. Hypertensive disorders are reported in 12% to 22% of all pregnant clients, with 5% to 8% of all pregnancies reflecting incidence of preeclampsia (gestational hypertension with proteinuria) (Chan, Johnson 2006). The condition is most often observed after 20 weeks’ gestation, intrapartum, and during the first 72 hours postpartum. The cause of preeclampsia remains unknown, although numerous hypotheses exist. The pathophysiology of preeclampsia and eclampsia (new-onset grand mal seizures in a client with preeclampsia) is believed to be related to decreased levels of vasodilating prostaglandins with resulting vasospasm (ACOG, 2002). The major predisposing risk factors for the development of preeclampsia are listed in Box 52–1.
If a client’s disease progresses to the point of eclampsia (maternal seizure), delivery is generally postponed for 1 to 3 hours if fetal status allows. The labor induction or cesarean delivery is an additional stressor for the client who exhibits acidosis and hypoxia resulting from seizure. Ideally once vital signs are stabilized with improved urinary output and decreased acidosis/hypoxia, delivery is pursued.

Nonpharmacologic treatments for preeclampsia might potentially include activity reduction, lying on the left side, increased dietary protein (supplemental 90 g/day), psychosocial therapy, and biofeedback, but the aforementioned recommendations have been studied and shown not to have clinically beneficial effects. Therefore, drug therapy is commonly used for treatment.

Methyldopa (Aldomet), hydralazine (Apresoline), and Labetalol (Trandate) are considered first-line therapy for preeclampsia, because they have been most widely used in pregnant women and their safety and efficacy for mother and fetus have been established. Additional alternatives include beta-blockers, prazosin, nifedipine, and clonidine. Beta-blockers are generally considered safe, but there is a potential for impairment of fetal growth if used early in pregnancy. Nifedipine, a calcium channel blocker, has been used with no major problems. Diuretics should be avoided because of the potential alteration in plasma volume. Angiotensin-converting enzyme inhibitors should be avoided in the second and third trimesters because of the potential for fetal renal toxicity.

Table 52–8 presents the drug data for the two most commonly used drugs for treating preeclampsia, magnesium sulfate and hydralazine.

### Adverse Reactions of Methyldopa (Aldomet)

Observe the client for peripheral edema, anxiety, nightmares, drowsiness, headache, dry mouth, drug fever, and mental depression. These are the most common potential adverse reactions.

### Adverse Reactions of Hydralazine (Apresoline)

Observe the client for headache, nausea, vomiting, nasal congestion, dizziness, tachycardia, palpitations, and angina pectoris. Avoid a sudden decrease in maternal blood pressure, which may cause fetal hypoxia. Hydralazine has no known direct adverse effects on the fetus.

### Adverse Reactions of Magnesium Sulfate

Early signs of increased magnesium levels include lethargy, flushing, feelings of increased warmth, perspiration, thirst, sedation, heavy eyelids, slurred speech, hypotension, depressed deep tendon reflexes (DTR), and decreased muscle tone. Adverse reactions generally occur with serum magnesium sulfate levels greater than 10 mEq/L. Therapeutic levels are 4 to 7 mEq/L. Loss of patellar reflexes is often the first sign of magnesium toxicity and may be seen at 8-10 mEq/L. Respiratory depression may manifest at levels greater than 10-15 mEq/L and cardiac arrest at levels greater than 20-25 mEq/L.
Decreased variability is commonly seen on the fetal heart rate tracing. If the client received magnesium sulfate close to the time of delivery, the neonate may exhibit low Apgar scores, hypotonia, lethargy, weakness, and potential respiratory distress. The fetal level of magnesium generally reaches more than 90% of maternal levels within 3 hours of administration. There is no evidence linking congenital defects and maternal hypocalcemia or hypermagnesemia. The greater risk to the fetus is from maternal preeclampsia with resulting decreased placental blood flow and intrauterine growth retardation.

Table 52-8

<table>
<thead>
<tr>
<th>Generic (Brand)</th>
<th>Route and Dosage</th>
<th>Uses and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>magnesium sulfate</td>
<td>LD: 6 g in 20 min IV; piggyback via infusion pump; maint: 2/h IV via infusion pump</td>
<td>Prevention and treatment of seizures related to preeclampsia. Acts as CNS depressant. Decreases acetylcholine from motor nerves, which blocks neuromuscular transmission and decreases incidence of seizures. Secondary effect is reduction in blood pressure as magnesium sulfate relaxes smooth muscle. Secondaryly affects peripheral vascular system with increased uterine blood flow caused by vasodilation and some transient BP decrease during first hour; also inhibits uterine contractions. Depresses DTRs and respiration; maintenance dose depends on reflexes, respiratory rate, urinary output, and magnesium level. Production of abnormally high serum magnesium level is main risk. Therapeutic ranges from 4-7 mEq/L; effective in preventing seizures. Client is at risk if respiratory rate &lt;12/min, urinary output &lt;30 ml/h, DTR is absent or hyporeflexic. Patellar reflexes disappear with serum magnesium levels of 8-10 mEq/L. Maternal respiratory depression may occur with levels greater than 10-15 mEq/L; cardiac arrest with levels &gt;20-25 mEq/L. Notify health care provider of any of the above. Can be given IV or IM (infrequent). Should not be given parenterally to clients with heart block, or myocardial damage. Use with caution in clients with renal impairment. Absorbed magnesium is excreted by kidneys; excreted in breast milk, but not a contraindication to breastfeeding. Contraindications: myasthenia gravis. Relative contraindications: myocardial damage or heart block. Antidote: calcium gluconate 1 g slow IV push over 3 min.</td>
</tr>
<tr>
<td>hydralazine hydrochloride (Apresoline)</td>
<td>IV push: 5-10 mg doses IV every 20 min to maximum cumulative total of 20 mg or until blood pressure is controlled. IM &amp; PO routes not usually used.</td>
<td>Antihypertensive agent. Acts by causing arteriolar vasodilation. Usually lowers diastolic BP more than systolic BP. Objective of treatment is to maintain diastolic BP between 90 and 110 mmHg. Usually not given to pregnant preeclamptic client with diastolic BP &gt;105 mmHg because of risk of reduced intervillous blood flow. Clients with impaired renal function may require lower doses. Parenteral: onset: 5-20 min; peak: 10-80 min; duration: 2-6 h; well tolerated; maternal tachycardia and increased cardiac output and oxygen consumption may occur. Oral: onset: 20-30 min; peak: 1-2 h; duration: 2-4 h.</td>
</tr>
<tr>
<td>methyldopa (Aldomet, Apo-Methyldopa)</td>
<td>IV: 250-1000 mg every 6-8 h, max: 1 gm every 6 h; PO: 250 mg b.i.d., max: 4 gm/d</td>
<td>Mechanism of action: Stimulates central alpha-adrenergic receptors, resulting in decreased sympathetic outflow to heart, kidneys, and peripheral vasculature. Contraindications: Hypersensitivity to methyldopa or any component of formulation. Active hepatic disease, liver disorders previously associated with use of methyldopa, concurrent use with MAOIs. Warnings/precautions: Sedation is usually transient during initial treatment and dosage increases.</td>
</tr>
<tr>
<td>labetalol (Trandate)</td>
<td>IV: 20 mg IV, followed by 40 mg, then 80 mg, then 80 mg every 10 min until blood pressure is controlled or maximum cumulative dose of 220 mg is given.</td>
<td>Pregnancy category: B; υ½: 75-80 min, onset 3-6 h; duration 12-24 h.</td>
</tr>
</tbody>
</table>

b.i.d., Two times a day; BP, blood pressure; CNS, central nervous system; d, day; DTR, deep tendon reflex; h, hour; IM, intramuscular; IV, intravenous; LD, loading dose; maint, maintenance; MAOIs, monoamine oxidase inhibitors; min, minute; PB, protein-binding; PO, by mouth; υ½, half-life; UK, unknown; >, greater than; <, less than, Canadian drug.
Nursing Process

Gestational Hypertension

ASSESSMENT

- Review baseline vital signs from early pregnancy and BP readings during prenatal visits.
- Identify client history that may predispose client to preeclampsia.

NURSING DIAGNOSES

- Deficient fluid volume related to shift of intravascular fluid to extravascular space as outcome of vasospasm with subsequent elevated arterial hypertension
- Deficient knowledge related to preeclampsia, diagnosis, treatment modalities, common outcomes for mother and infant
- Risk for inadequate tissue perfusion and risk to fetal well-being secondary to vasospasm
- Risk for maternal injury related to seizure activity and magnesium toxicity
- Anxiety related to possible preterm hospitalization and delivery with possible adverse fetal or maternal outcomes

PLANNING

- Client’s blood pressure will be maintained within acceptable ranges.
- Client will verbalize understanding of preeclampsia, etiology, signs and symptoms and nonpharmacologic and pharmacologic treatment measures.
- Client will comply with planned preeclampsia treatment regimen.
- Fetus will tolerate impaired uteroplacental perfusion and subsequent delivery without injury.
- Therapeutic magnesium levels will be maintained.
- Plan for magnesium sulfate infusion for at least 24 hours postpartum.

Client Teaching

General
- Teach client about preeclampsia and implications for mother, fetus, and newborn.
- Provide client with information about nonpharmacologic and pharmacologic treatment measures for preeclampsia.

Safety
- Instruct client to lie in the left lateral recumbent position, and explain the rationale.
- Teach client signs and symptoms of progressive preeclampsia and when to seek medical assistance.
- Explain to client that fetal well-being will be assessed through biophysical profile (BPP), nonstress test (NST), or contraction stress test at frequent intervals, depending on the health care provider and preeclampsia severity (e.g., NST and/or BPP 1-2 ×/week).
- Educate family regarding possibility of seizures and appropriate actions to take if seizures occur.

Diet
- Provide nutritional counseling in regard to need for additional protein intake (90 g) to make up for urinary protein losses, normal sodium diet, and importance of adequate fluid intake.
- Explain to client the rationale for daily weights.

Magnesium Sulfate
- Explain to client why she will have a Foley catheter, infusion pump, continuous fetal monitoring, and assessment of deep tendon reflex (DTR) and clonus. Explain that therapy will extend into the postpartum period 24 to 48 hours, depending on the agency and health care provider.
- Explain to client about visitor restrictions and that she will be in a low-stimulation environment.
- Tell client that she will likely experience flush, warm sensation, and possibly nausea and vomiting during the initial loading dose.
- Tell client that evidence of magnesium levels that are within therapeutic range include decreased appetite, some speech slurring, double vision, and weakness.

Hydralazine
- Explain to client that nurses will be monitoring pulse and BP almost constantly until they become stable after administration, then every 15 minutes thereafter. Explain that an electronic BP monitor may be used to obtain constant readings. Some providers will request manual BP measurements.
- Explain to client the need for careful measuring of I & O.
- Tell client she may experience headache as a side effect of the drug.

NURSING INTERVENTIONS

Magnesium Sulfate
- Continuous electronic fetal monitoring.
- Monitor for maternal toxicity. Lethargy and weakness result from blocking of neuromuscular transmission. Diaphoresis, flushing, feeling of warmth, and nasal congestion are results of vasodilation from relaxation of smooth muscle.
- Have airway suction, resuscitation equipment and emergency drugs available.
- Have antidote available. Calcium gluconate (1 g) IV is given over 3 minutes.
- Maintain client in left lateral recumbent position in low-stimulation environment. Provide close observation.
- For IM administration, use Z-track technique and rotate sites (drug is painful and irritating).
Monitor BP, pulse, and respiratory rate per agency protocol; monitor DTR, clonus, and I & O (with urimeter) every hour. Some providers will request manual BP measurements.

- Monitor temperature, breath sounds, and bowel sounds every 4 hours.
- Check urine for protein every hour.
- Assess for epigastric pain, headache, visual symptoms (blurred vision and scotoma), sensory changes, edema, level of consciousness, and seizure activity on ongoing basis.
- Monitor serum magnesium levels according to agency protocol for range between 4 to 7mEq/L.
- Notify physician if following are observed:
  - Respirations less than 12/min
  - Absence of DTR
  - Urinary output less than 30 ml/h
  - Systolic BP greater than or equal to 160 mm Hg, unless ordered otherwise
- Magnesium level greater than 7 mEq/L
- Absent bowel sounds or altered breath sounds
- Epigastric pain or right upper quadrant pain (associated with hepatic edema causing stretching of the liver capsule), headache, visual symptoms (blurred vision and scotoma), sensory changes, change in affect or level of consciousness, seizure activity
- Monitor laboratory reports for low platelet count, elevated liver enzymes (AST, LDH), bilirubin levels. Observe for evidence of excessive bleeding.
- Monitor fetal status. FHR baseline should remain 110 to 160 beats per minute (bpm).
- Monitor 24-hour urinary protein lab results if ordered ($\geq$300 mg/24 h is abnormal).
- Monitor client for magnesium toxicity.
- Monitor newborn for effects of placental exposure to excess magnesium sulfate. Although infrequent, newborn side effects include lethargy, neurologic or respiratory depression, and muscle hypotonia.

**Hydralazine**

- Take pulse and BP every 5 minutes when drug is administered or monitor with an electronic BP device until stabilized, then every 15 minutes. Some providers will request manual BP measurements.
- Observe for maintenance of diastolic BP between 90 and 110 mm Hg or as ordered.
- Observe for change in level of consciousness and headache.
- Monitor I & O to avoid hypotensive episodes or overload.
- Monitor fetal heart rate (FHR).

**Cultural Considerations**

- Provide an interpreter with the same ethnic background and gender if possible, especially with sensitive topics and stress situations.

**Client Teaching**

**General**

- Instruct client to avoid exposure to infection.
- Remind client with diabetes to check her glucose level as ordered.

**Side Effects**

- Instruct client to report immediately any breathing difficulty, weakness, or dizziness.
- Instruct client to report changes in stool, easy bruising, bleeding, blurred vision, unusual weight gain, and emotional changes.

**EVALUATION**

- Evaluate the effectiveness of therapy to reduce BP (hydralazine).
- Continue monitoring vital signs. Report changes.
- Document the effect of teaching and learning opportunities on client’s knowledge deficit about preeclampsia treatment modalities and outcomes.
- Note fetal well-being secondary to treatment with drugs as evidenced by fetal monitoring and fetal movement assessment.
- Monitor maternal physiologic changes in relation to magnesium sulfate levels.
- Continue monitoring FHR. Report changes.
Critical Thinking Case Study

TA (gravida 3, para 0) has a history of spontaneous abortion at 10 weeks’ gestation and a preterm delivery and demise of a neonate at 21 weeks’ gestation. At her 28-week prenatal visit, she reports increased clear vaginal discharge and feelings of pelvic pressure. Examination of her cervix reveals 2-cm dilation and a presenting fetal part low in the pelvis. TA is admitted to the hospital and uterine activity is documented. Terbutaline therapy is ordered for treatment of preterm labor. The nurse prepares for terbutaline administration by the subQ route.

1. How will terbutaline therapy be initiated? What intervals and dosages should be anticipated?
2. What maternal and fetal side effects should the nurse expect to observe?
3. What should TA be told about the drug effects she will experience?
4. How should the nurse respond to TA’s questions about the risks of preterm delivery?

After 24 hours of terbutaline subQ therapy, uterine contractions have been reduced to two to three per hour. TA is to be discharged home after oral terbutaline therapy is initiated. The nurse is preparing TA’s discharge teaching.

5. What dose and administration schedule would the nurse expect to be ordered?
6. What should TA be advised to do if she forgets or misses an oral dose of terbutaline?
7. What instructions should be given to TA about her activity and diet?
8. TA asks whether the side effects of terbutaline will continue. What is an appropriate nursing response?
9. What signs and symptoms should TA be advised to report?

NCLEX Study Questions

1. A serum alpha fetal protein (AFP) is done to detect:
   a. gestational diabetes  
   b. preeclampsia  
   c. neural tube defects  
   d. group B strep

2. Ms. James is Rh negative. Following her amniocentesis the nurse would administer:
   a. RhoGAM  
   b. rubella  
   c. hepatitis B  
   d. Motrin

3. A nurse is teaching a prenatal client how best to decrease the gastrointestinal distress she experiences with her prenatal vitamins. The nurse tells the client to:
   a. take the prenatal vitamin between meals  
   b. take the prenatal vitamin with food  
   c. take the prenatal vitamin with orange juice  
   d. take the prenatal vitamin with milk

4. A nurse employed in an infertility clinic is working with a pre-conceptual couple. The nurse advises the woman to take _____ for at least 3 months prior to becoming pregnant to prevent fetal neural tube defects.
   a. iron  
   b. ginger  
   c. folic acid  
   d. pyridoxine

5. A nurse in the prenatal clinic is reviewing telephone messages she needs to return that afternoon. Of the following, which one should the nurse call first?
   a. A primigravida, 10 gestational weeks, with nausea and vomiting and requesting information about ginger
   b. A gravida 2, 35 gestational weeks, with Braxton Hicks contractions and requesting information about caffeine
   c. A gravida 2, 32 gestational weeks, gestational diabetic with a blood sugar of 132 and requesting information about her insulin
   d. A primigravida, 28 gestational weeks, with preeclampsia and requesting information about taking Motrin for a headache

6. The therapeutic level for magnesium sulfate is:
   a. 4-7 mEq/L  
   b. 7-10 mEq/L  
   c. 10-15 mEq/L  
   d. 15-20 mEq/L

7. The first sign of magnesium toxicity is:
   a. lethargy  
   b. respirations less than 12/minute  
   c. loss of patellar reflexes  
   d. positive clonus

8. Camella has been receiving magnesium sulphate IV for 24 hours to treat her severe preeclampsia. On assessment you find the following: temperature 37.3° C, pulse 88, respirations 14, BP 138/76, 21 patellar reflexes and negative ankle clonus. Your priority nursing intervention is:
   a. obtain a stat magnesium sulfate level  
   b. discontinue magnesium sulfate  
   c. contact the physician  
   d. continue to monitor

9. Patrice, an 19-year-old primigravida, 8 gestational weeks, is in the prenatal clinic for her first exam. She complains of nausea and vomiting “every morning.” Which comment made by Patrice would indicate the need for further instruction?
   a. “My friend gave me gingersnap cookies to eat.”
   b. “I have been eating dry crackers before I get up.”
   c. “I have tried to avoid foods with strong smells.”
   d. “I have been drinking chamomile tea to help the nausea and vomiting.”