

## Anticoagulant and Thrombolytic Drugs

### Key Terms

<i>fibrolytic drugs</i>	<i>prothrombin</i>
<i>hemostasis</i>	<i>thrombolytic drugs</i>
<i>Homans' sign</i>	<i>thrombosis</i>
<i>protamine sulfate</i>	<i>thrombus</i>

### Chapter Objectives

On completion of this chapter, the student will:

- Discuss hemostasis and thrombosis.
- Discuss the uses, general drug actions, adverse reactions, contraindications, precautions, and interactions of warfarin, heparin preparations, and the thrombolytic drugs.
- Discuss important preadministration and ongoing assessment activities the nurse should perform on the patient taking an anticoagulant or thrombolytic drug.
- List some nursing diagnoses particular to a patient taking an anticoagulant or thrombolytic drug.
- Discuss ways to promote an optimal response to therapy, how to manage common adverse reactions, and important points to keep in mind when educating patients about the use of an anticoagulant or thrombolytic drug.

**A**nticoagulants are used to prevent the formation and extension of a **thrombus** (blood clot). Anticoagulants have no direct effect on an existing thrombus and do not reverse any damage from the thrombus. However, once the presence of a thrombus has been established, anticoagulant therapy can prevent additional clots from forming. Although they do not thin the blood, they are sometimes called blood thinners by patients. The anticoagulants are a group of drugs that include warfarin (a coumarin derivative), anisindione (an indandione derivative), and fractionated and unfractionated heparin.

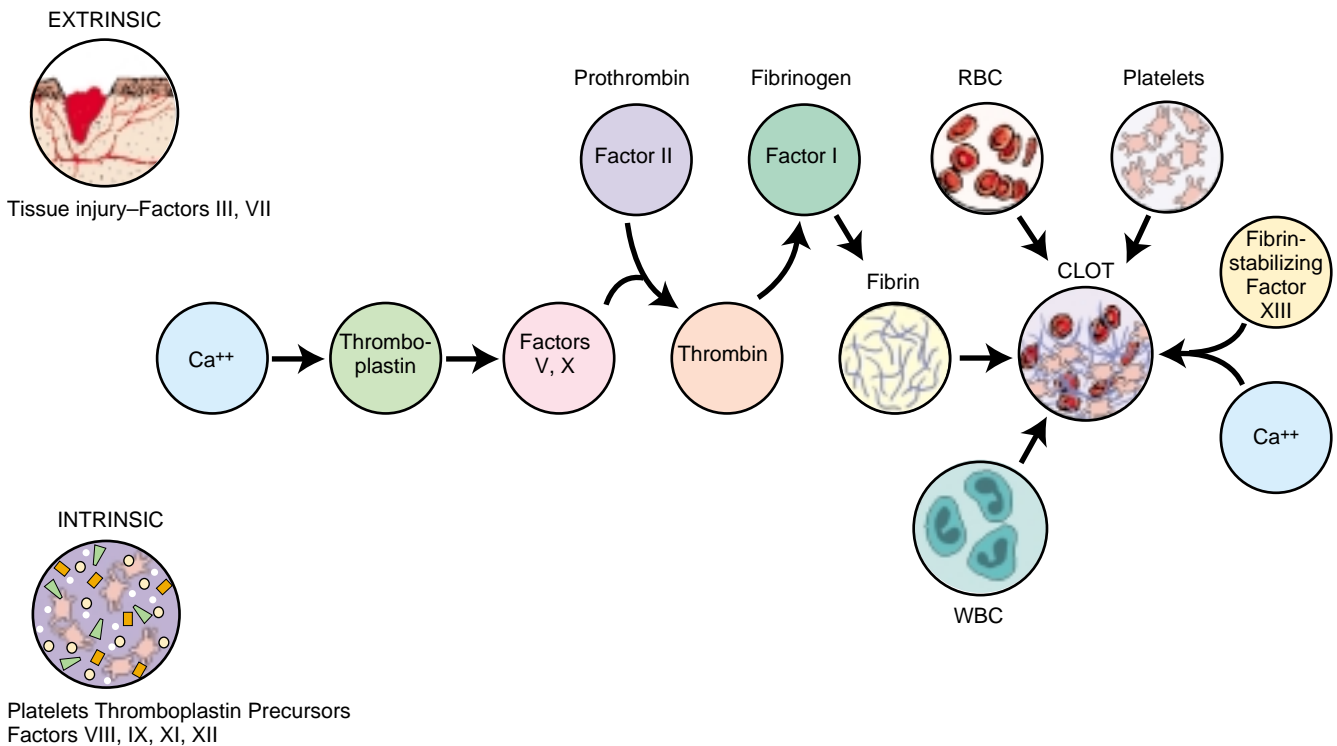
Whereas the anticoagulants prevent thrombus formation, thrombolytic drugs dissolve blood clots that have already formed within the walls of a blood vessel. These drugs reopen blood vessels after they become occluded. Another term used to identify the thrombolytic drugs is **fibrolytic drugs**. Each of these groups of drugs is discussed in this chapter. Before these drugs are discussed, a basic understanding of hemostasis and thrombus formation is needed.

### HEMOSTASIS

**Hemostasis** is the process that stops bleeding in a blood vessel. Normal hemostasis involves a complex process of extrinsic and intrinsic factors. Figure 44-1 shows the coagulation pathway and factors involved. The coagulation cascade is so named because as each factor is activated it acts as a catalyst that enhances the next reaction, with the net result being a large collection of fibrin that forms a plug in the vessel. Fibrin is the insoluble protein that is essential to clot formation.

### THROMBOSIS

**Thrombosis** is the formation of a clot. A thrombus may form in any vessel, artery, or vein when blood flow is impeded. For example, a venous thrombus can



**FIGURE 44-1.** The blood-clotting pathway. Blood coagulation results in the formation of a stable fibrin clot. Formation of this clot involves a cascade of interactions of clotting factors, platelets, and other substances. Clotting factors exist in the blood in inactive form and must be converted to an active form before the next step in the clotting pathway can occur. Each factor is stimulated in turn until the process is complete and a fibrin clot is formed. In the intrinsic pathway, all of the components necessary for clot formation are in the circulating blood. Clot formation in the intrinsic pathway is initiated by factor XII. In the extrinsic pathway, coagulation is initiated by release of tissue thromboplastin, a factor not found in circulating blood.

develop as the result of venous stasis (decreased blood flow), injury to the vessel wall, or altered blood coagulation. Venous thrombosis most often occurs in the lower extremities and is associated with venous stasis. Deep vein thrombosis (DVT) occurs in the lower extremities and is the most common type of venous thrombosis. Arterial thrombosis can occur because of atherosclerosis or arrhythmias, such as atrial fibrillation. The thrombus may begin small, but fibrin, platelets, and red blood cells attach to the thrombus, increasing its size and shape. When a thrombus detaches itself from the wall of the vessel and is carried along through the bloodstream, it becomes an embolus. The embolus travels until it reaches a vessel that is too small to permit its passage. If the emboli goes to the lung and obstructs a pulmonary vessel, it is called a pulmonary embolism (PE). Similarly, if the embolus detaches and occludes a vessel supplying blood to the heart, it can cause a myocardial infarction (MI). The anticoagulant drugs are used prophylactically in patients who are at high risk for clot formation.

## COUMARIN AND INDANDIONE DERIVATIVES

Warfarin (Coumadin), a coumarin derivative, is the oral anticoagulant most commonly prescribed. Although given by the oral route, warfarin is available for parenteral administration. Because it can be given orally, it is the drug of choice for patients requiring long-term therapy with an anticoagulant. Peak activity is reached 1.5 to 3 days after therapy is initiated. Anisindione (Miradon), an indandione derivative, is less frequently used but an effective anticoagulant. For more information on anisindione, see the Summary Drug Table: Anticoagulants.

## ACTIONS

All anticoagulants interfere with the clotting mechanism of the blood. Warfarin and anisindione interfere with the manufacturing of vitamin K-dependent clotting factors

## SUMMARY DRUG TABLE ANTICOAGULANTS

GENERIC NAME	TRADE NAME*	USES	ADVERSE REACTIONS	DOSAGE RANGES
<b>Coumadin and Indandione Derivatives</b>				
anisindione <i>ah-nis-in-dye'-on</i>	Miradon	Prophylaxis and treatment of venous thrombosis and its extension; prevention and treatment of atrial fibrillation with embolization, prophylaxis and treatment of pulmonary embolism	Hemorrhage, nausea, alopecia, dermatitis, vomiting, anorexia, abdominal cramping, nausea,	25–300 mg/d PO, dose individualized based on PT or INR
warfarin sodium <i>war'-far-in</i>	Coumadin, <i>generic</i>	Venous thrombosis, atrial fibrillation with embolism, pulmonary embolism (PE), prophylaxis of systemic embolism after acute MI	Nausea, alopecia, hemorrhage, urticaria, dermatitis, vomiting, anorexia, abdominal cramping, priapism	2–10 mg/d PO, IV; individualized dose based on PT or INR
<b>Unfractionated Heparin</b>				
heparin <i>hep'-ah-rin</i>	<i>Generic</i>	Thrombosis/embolism, diagnosis and treatment of disseminated intravascular coagulation (DIC), prophylaxis of deep vein thrombosis (DVT), clotting prevention	Hemorrhage, chills, fever, urticaria, local irritation, erythema, mild pain, hematoma or ulceration at the injection site (IM or SC), bruising	10,000–20,000 units SC in divided doses q8–12h; 5000–10,000 units q4–6h intermittent IV; 5000–40,000 units/d IV infusion; 5000 units SC q2h before surgery and 5000 units SC after surgery q8–12h
heparin sodium lock flush solution <i>hep'-ah-rin</i>	<i>Generic</i>	Clearing intermittent infusion lines (heparin lock) to prevent clot formation at site	None significant	10–100 units/mL heparin solution
<b>Fractionated Heparins: Low-Molecular-Weight Heparins (LMWHs)</b>				
dalteparin sodium <i>dal-tep'-a-rin</i>	Fragmin	Unstable angina/non-Q-wave MI, DVT prophylaxis	Hemorrhage, bruising, thrombocytopenia, chills, fever, pain, erythema and irritation at site of injection	Angina/MI: 120 IU/kg, SC q12h with concurrent oral aspirin; DVT: 2500 IU SC daily
danaparoid sodium <i>da-nap'-a-royd</i>	Orgaran	Prophylaxis of DVT, after hip replacement surgery	Hemorrhage, bruising, thrombocytopenia, hyperkalemia, hypersensitivity, fever, pain and erythema at injection site	750 anti-Xa units BID SC
enoxaparin sodium <i>en-ocks'-a-par-in</i>	Lovenox	DVT and prophylaxis, DVT and pulmonary embolism (PE) treatment, unstable angina/non-Q-wave MI	Hemorrhage, bruising, thrombocytopenia, hyperkalemia, hypersensitivity, fever, pain and erythema at injection site	DVT prophylaxis: 30 mg q12h SC or 40 mg once daily SC; in abdominal surgery for patients at risk for thromboembolic complications: 40 mg/d SC; DVT/PE treatment: 1 mg/kg SC q12h; unstable angina, non-Q-wave MI: 1 mg/kg SC q12h

(continued)

## SUMMARY DRUG TABLE ANTICOAGULANTS (Continued)

GENERIC NAME	TRADE NAME*	USES	ADVERSE REACTIONS	DOSAGE RANGES
tinzaparin sodium <i>ten-zah'-pear-in</i>	Innohep	Treatment of acute, symptomatic DVT with or without pulmonary emboli when given with warfarin sodium	Hemorrhage, bruising, thrombocytopenia, hyperkalemia, hypersensitivity, fever, pain and erythema at injection site	175 anti-Xa IU/kg/d SC once daily; 175 IU/kg/d SC once daily until the patient has been successfully anticoagulated with warfarin
<b>Anticoagulant Antagonists</b>				
phytonadione (vitamin K) <i>fye-toe-na-dye'-on</i>	Aqua-mephyton, Mephyton, <i>generic</i>	Prevention and treatment of hypoprothrombinemia associated with excessive doses of oral anticoagulants	Gastric upset, unusual taste, flushing, rash, urticaria, erythema, pain and/or swelling at injection site	PO, IM, 2.5–10 mg, may repeat PO in 12–48 h or in 6–8 h after parenteral dose
protamine sulfate <i>proe'-ta-meen</i>	<i>Generic</i>	Acute management of heparin overdosage (neutralizes heparin)	Dyspnea, bradycardia, hypotension, hypertension, bleeding, hypersensitivity reactions	Dose is determined by amount of heparin in body and the time that has elapsed since the heparin was given; the longer the interval, the smaller the dose required. Adult and pediatric: 1mg IV neutralizes 90 USP units of heparin derived from lung tissue or 115 USP units of heparin derived from intestinal mucosa

\*The term *generic* indicates the drug is available in generic form.

by the liver. This results in the depletion of clotting factors II (**prothrombin**), VII, IX, and X. It is the depletion of prothrombin (see Fig. 44-1), a substance that is essential for the clotting of blood, that accounts for most of the action of warfarin.

## USES

Warfarin is used for:

- Prevention (prophylaxis) and treatment of DVT
- Prevention and treatment of atrial fibrillation with embolization
- Prevention and treatment of PE
- As part of the treatment of MI
- Prevention of thrombus formation after valve replacement

In most situations, warfarin is the drug of choice, with anisindione reserved for those who are unable to take warfarin.

## ADVERSE REACTIONS

The principal adverse reaction associated with warfarin is bleeding, which may range from very mild to severe. Bleeding may be seen in many areas of the body, such as the bladder, bowel, stomach, uterus, and mucous membranes. Other adverse reactions are rare but may include nausea, vomiting, alopecia (loss of hair), urticaria (severe skin rash), abdominal cramping, diarrhea, rash, hepatitis (inflammation of the liver), jaundice (yellowish discoloration of the skin and mucous membranes), and blood dyscrasias (disorders).

## CONTRAINDICATIONS

Warfarin is contraindicated in patients with known hypersensitivity to the drug, hemorrhagic disease, tuberculosis, leukemia, uncontrolled hypertension, gastrointestinal (GI) ulcers, recent surgery of the eye or

central nervous system, aneurysms, or severe renal or hepatic disease, and during pregnancy and lactation. Use during pregnancy (Pregnancy Category X) can cause fetal death.

## PRECAUTIONS

Warfarin is used cautiously in patients with fever, heart failure, diarrhea, malignancy, hypertension, renal or hepatic disease, psychoses, or depression. Women of childbearing age must use a reliable contraceptive to prevent pregnancy.

## INTERACTIONS

The effects of warfarin may increase when administered with acetaminophen, NSAIDs, beta blockers, disulfiram, isoniazid, chloral hydrate, loop diuretics, aminoglycosides, cimetidine, tetracyclines, and cephalosporins. Oral contraceptives, ascorbic acid, barbiturates, diuretics, and vitamin K decrease the effects of warfarin. Because the effects of warfarin are influenced by many drugs, the patient must notify the nurse or the primary health care provider when taking a new drug or discontinuing

use of any drug, both prescription and over-the-counter preparations.

## NURSING PROCESS

### ● The Patient Receiving Warfarin

#### ASSESSMENT

##### *Preadministration Assessment*

Before administering the first dose of warfarin, the nurse questions the patient about all drugs taken during the previous 2 to 3 weeks (if the patient was recently admitted to the hospital). If the patient took any drugs before admission, the nurse notifies the primary health care provider before the first dose is administered. Usually, the prothrombin time (PT) is ordered and the international normalized ratio (INR) determined before therapy is started. The first dose of warfarin is not given until blood for a baseline PT/INR is drawn. The dosage is individualized based on the results of the PT or the INR.

If the patient has a DVT, it usually occurs in a lower extremity. The nurse examines the extremity for color and skin temperature. The nurse also checks for a pedal pulse, noting the rate and strength of the pulse. It is important to record any difference between the affected extremity and the unaffected extremity. The nurse notes areas of redness or tenderness and asks the patient to describe current symptoms. The affected extremity may appear edematous and exhibit a positive **Homans' sign** (pain in the calf when the foot is dorsiflexed). A positive Homans' sign is suggestive of DVT.

##### *Ongoing Assessment*

During the course of therapy, the nurse continually assesses the patient for any signs of bleeding and hemorrhage. Areas of assessment include the gums, nose, stools, urine, or nasogastric drainage (see “Promoting an Optimal Response to Therapy”).

The nurse examines the skin temperature and color in the patient with a DVT for signs of improvement. The nurse takes and records vital signs every 4 hours or more frequently, if needed.

Patients receiving warfarin for the first time often require daily adjustment of the dose, which is based on the daily PT/INR results. The nurse withholds the drug and notifies the primary health care provider if the PT exceeds 1.2 to 1.5 times the control value or the INR ratio exceeds 3. A daily PT is performed until it stabilizes and when any other drug is added to or removed from the patient's drug regimen. After the PT has stabilized, it is monitored every 4 to 6 weeks.

See Display 44-1 for more information on the laboratory examinations for monitoring warfarin.

### Herbal Alert: Warfarin Interaction

*Warfarin, a drug with a narrow therapeutic index, has the potential to interact with many herbal remedies. For example, warfarin should not be combined with any of the following herbs because they may have additive or synergistic activity and increase the risk for bleeding: celery, chamomile, clove, dong quai, feverfew, garlic, ginger, ginkgo biloba, ginseng, green tea, onion, passion flower, red clover, St. John's wort, and turmeric. Any herbal remedy should be used with caution in patients taking warfarin.*

*Much of the information on drug–herb interactions is speculative. Herb–drug interactions are sporadically reported and difficult to determine. Because herbal supplements are not regulated by the Food and Drug Administration (FDA), products lack standardization, purity, and potency. In addition, multiple ingredients in products and batch-to-batch variation make it difficult to determine if reactions occur as the result of the herb. To assist with the identification of herb–drug interactions, nurses should report any potential interactions to the FDA through its MedWatch program (see Appendix A). Because the absorption, metabolism, distribution, and elimination characteristics of most herbal products are poorly understood, many herb–drug interactions are speculative. It is especially important to take special care when patients are taking any drugs with a narrow therapeutic index (the difference between the minimum therapeutic and minimum toxic drug concentrations is small—such as warfarin) and herbal supplements.*

**DISPLAY 44-1 • Understanding Prothrombin Time and International Normalized Ratio**

Prothrombin time (also called protime) and the International Normalized Ratio are used to monitor the patient's response to warfarin therapy. The daily dose of the oral anticoagulant is based on the patient's daily PT/INR. In the past, recommended therapeutic ranges for PT were 1.5 to 2.5 times the control value. However, today most laboratories use less sensitive substances for testing, and adjustments must be made to reflect this decreased sensitivity. When using the less sensitive substance, the therapeutic range of the PT is 1.2 to 1.5 times the control value. Studies indicate that levels greater than 2 times the control value do not provide additional therapeutic effects in most patients and are associated with a higher incidence of bleeding.

Most laboratories report results for the INR along with the patient's PT and the control value. The INR was devised as a way to standardize PT values and represents a way to "correct" the routine PT results from different laboratories using various sources of thromboplastin and methods of preparation for the test. The INR is determined by a mathematical equation comparing the patient's PT with the standardized PT value. Some institutions may use only PT, others PT/INR, and some may use INR. The INR is maintained between 2 and 3.

**NURSING DIAGNOSES**

Drug-specific nursing diagnoses are highlighted in the Nursing Diagnoses Checklist. Other nursing diagnoses applicable to these drugs are discussed in depth in Chapter 4.

**PLANNING**

The expected outcomes for the patient may include an optimal response to therapy, management of common adverse drug reactions, and an understanding of the postdischarge drug regimen.

**IMPLEMENTATION****Promoting an Optimal Response to Therapy**

Before administering each dose of warfarin, the nurse checks the prothrombin flow sheet or the laboratory report to determine the current PT or INR (PT/INR) results (see Nursing Alerts below). The patient also is checked for any evidence of bleeding.

To hasten the onset of the therapeutic effect, a higher dosage (loading dose) may be prescribed for 2 to 4 days, followed by a maintenance dosage adjusted according to the daily PT/INR. Otherwise, the drug takes 3 to 5 days to reach therapeutic levels. When rapid anticoagulation is required, heparin is preferred as a loading dose, followed by maintenance dose of warfarin based on the PT or INR.

**Nursing Diagnoses Checklist**

- ✓ **Risk for Injury** related to adverse drug effects
- ✓ **Ineffective Tissue Perfusion** related to adverse drug reactions

**Nursing Alert**

Optimal therapeutic results are obtained when the patient's PT is 1.2 to 1.5 times the control value. In certain instances, for example as in recurrent systemic embolism, a PT of 1.5 to 2 may be prescribed. Studies indicate that diet can influence the PT/INR values. In patients receiving warfarin, a diet high in vitamin K may decrease the PT/INR and increase the risk of clot formation. A diet low in vitamin K may prolong the PT/INR and increase the risk of hemorrhage. Significant changes in vitamin K intake may necessitate warfarin dosage adjustment. The key to vitamin K management for patients receiving warfarin is maintaining a consistent daily intake of vitamin K. To avoid large fluctuations in vitamin K intake, patients receiving warfarin should be aware of the vitamin K content of food (see Home Care Checklist: Ensuring Appropriate Vitamin K Intake). For example, green leafy vegetables and some vegetable oils (soybean and canola oil) are high in vitamin K. The use of these oils in food preparation may increase the intake of vitamin K enough to cause the PT/INR results to fluctuate. Root vegetables, fruits, cereals, dairy products, and meats are generally low in vitamin K.

**Nursing Alert**

Patients who have fluctuations in PT/INR levels should be asked about their food intake and any recent dietary changes. A careful assessment of the foods eaten during the last several days is necessary to determine the patient's intake of vitamin K.

Although the drug is most often administered orally, warfarin injection may be used as an alternative route for patients who are unable to receive oral drugs. The intravenous dosage is the same as that for the oral drug. Intravenous warfarin is administered as a slow bolus injection during a period of 1 to 2 minutes. Warfarin is not recommended for intramuscular injection. After the drug is reconstituted, it is stable for 4 hours at room temperature. The vial is not recommended for multiple use, and any unused solution should be discarded.

**Monitoring and Managing Adverse Drug Reactions**

Bleeding can occur any time during therapy with warfarin, even when the PT appears to be within a safe limit (eg, 1.2–1.5 times the control value). All nursing personnel and medical team members should be made aware of any patient receiving warfarin and the observations necessary with administration. The nurse checks the following for signs of bleeding:

- Urinal, bedpan, catheter drainage unit—Inspect the urine for a pink to red color and the stool for signs of GI bleeding (bright red to black stools). Visually check the catheter drainage every 2 to 4 hours and when the unit is emptied. Oral anticoagulants may impart a

red-orange color to alkaline urine, making hematuria difficult to detect visually. A urinalysis may be necessary to determine if blood is in the urine.

- Emesis basin, nasogastric suction units—Visually check the nasogastric suction unit every 2 to 4 hours and when the unit is emptied. Check the emesis basin each time it is emptied.
- Skin, mucous membranes—Inspect the patient's skin daily for evidence of easy bruising or bleeding. Be alert for bleeding from minor cuts and scratches, nosebleeds, or excessive bleeding after intramuscular (IM), subcutaneous (SC), or intravenous (IV) injections or after a venipuncture. After oral care, check the toothbrush and gums for signs of bleeding.

### Nursing Alert

The nurse should withhold the drug and contact the primary health care provider immediately if any of the following occurs:

- The PT exceeds 1.5 times the control value.
- There is evidence of bleeding.
- The INR is greater than 3.

The nurse must apply prolonged pressure to needle or catheter sites after venipuncture, removal of central or peripheral IV lines, and IM and SC injections. Laboratory personnel or those responsible for drawing blood for laboratory tests are made aware of anticoagulant therapy because prolonged pressure on the venipuncture site is necessary. All laboratory requests require a notation stating the patient is receiving anticoagulant therapy.

**MANAGING WARFARIN OVERDOSAGE.** Symptoms of overdosage of warfarin include blood in the stool (melena); petechiae (pinpoint-size red hemorrhagic spots on the skin); oozing from superficial injuries, such as cuts from shaving or bleeding from the gums after brushing the teeth; or excessive menstrual bleeding. The nurse must immediately report to the primary health care provider any of these adverse reactions or evidence of bleeding.

If bleeding occurs or if the PT exceeds 1.5 times the control value or the INR exceeds 3, the primary health care provider may either discontinue the anticoagulant therapy for a few days or order vitamin K<sub>1</sub> (phytonadione), an oral anticoagulant antagonist, which must always be readily available when a patient is receiving warfarin. Because warfarin interferes with the synthesis of vitamin K<sub>1</sub>-dependent clotting factors, the administration of vitamin K<sub>1</sub> reverses the effects of warfarin by providing the necessary ingredient to enhance clot formation and stop bleeding. However, withholding one or two doses of warfarin may quickly bring the PT to an acceptable level.

The nurse must assess the patient for additional evidence of bleeding until the PT is below 1.5 times the control value or until the bleeding episodes cease. The PT generally returns to a safe level within 6 hours of administration of vitamin K<sub>1</sub>. Administration of whole blood or plasma may be necessary if severe bleeding occurs because of the delayed onset of vitamin K<sub>1</sub>.

### *Educating the Patient and Family*










The nurse provides a full explanation of the drug regimen to patients taking warfarin, including an explanation of the problems that can occur during therapy. A thorough review of the dose regimen, possible adverse drug reactions, and early signs of bleeding tendencies help the patient cooperate with the prescribed therapy. The nurse should include the following points in a patient and family teaching plan:

- Follow the dosage schedule prescribed by the primary health care provider.
- The PT or INR will be monitored periodically. Keep all primary health care provider and laboratory appointments because dosage changes may be necessary during therapy.
- Do not take or stop taking other drugs except on the advice of the primary health care provider. This includes nonprescription drugs, as well as those prescribed by a primary health care provider or dentist.
- Inform the dentist or other primary health care providers of therapy with this drug before any treatment or procedure is started or drugs are prescribed.
- Take the drug at the same time each day.
- Do not change brands of anticoagulants without consulting a physician or pharmacist.
- Avoid alcohol unless use has been approved by the primary health care provider. Advise the patient to limit foods high in vitamin K, such as leafy green vegetables, beans, broccoli, cabbage, cauliflower, cheese, fish, and yogurt. Vegetables with large amounts of vitamin K can interfere with the anticoagulant's effect (see Home Care Checklist: Ensuring Appropriate Vitamin K Intake).
- If evidence of bleeding should occur, such as unusual bleeding or bruising, bleeding gums, blood in the urine or stool, black stool, or diarrhea, omit the next dose of the drug and contact the primary health care provider immediately. (Anisindione may cause a red-orange discoloration of alkaline urine.)
- Use a soft toothbrush and consult a dentist regarding routine oral hygiene, including the use of dental floss. Use an electric razor when possible to avoid small skin cuts.
- Women of childbearing age must use a reliable contraceptive to prevent pregnancy.

## Home Care Checklist

### ENSURING APPROPRIATE VITAMIN K INTAKE

Patients receiving oral anticoagulants need to avoid eating excessive amounts of food containing vitamin K. Otherwise, the anticoagulant will not be effective. Be sure your patient knows what foods contain vitamin K. Include the following list in your teaching plan:

-  Green leafy vegetables
-  Cabbage
-  Cauliflower
-  Spinach
-  Yogurt
-  Cheese
-  Liver
-  Molasses
-  Egg yolk

- Wear or carry identification, such as a medical alert tag, Alert, to inform medical personnel and others of therapy with this drug.

### EVALUATION

- The therapeutic drug effect is achieved.
- Adverse reactions are identified, reported to the primary health care provider, and managed successfully using appropriate nursing interventions.
- The patient demonstrates an understanding of the drug regimen.
- The patient verbalizes the importance of complying with the prescribed therapeutic regimen.
- The patient lists or describes early signs of bleeding.

## FRACTIONATED AND UNFRACTIONATED HEPARIN

Heparin preparations are available as heparin sodium and the low-molecular-weight heparins (fractionated heparins). Heparin is not a single drug, but rather a mixture of high and low-molecular-weight drugs. Fragments of heparin with low molecular weights are available as low-molecular-weight heparin (LMWH). Examples of LMWHs are dalteparin (Fragmin), enoxaparin (Lovenox), and tinzaparin (Innohep). LMWHs

produce very stable responses when administered at the recommended doses. Because of this stability, frequent laboratory monitoring, as with heparin, is not necessary. In addition, bleeding is less likely to occur with LMWHs than with heparin.

### ACTIONS

Heparin inhibits the formation of fibrin clots, inhibits the conversion of fibrinogen to fibrin, and inactivates several of the factors necessary for the clotting of blood. Heparin cannot be taken orally because it is inactivated by gastric acid in the stomach; therefore, it must be given by injection. Heparin has no effect on clots that have already formed and aids only in preventing the formation of new blood clots (thrombi). The LMWHs act to inhibit clotting reactions by binding to antithrombin III, which inhibits the synthesis of factor Xa and the formation of thrombin.

### USES

Heparin is used for:

- Prevention and treatment of venous thrombosis, PE, peripheral arterial embolism;
- Atrial fibrillation with embolus formation;



- Prevention of postoperative venous thrombosis (DVT) and PE in certain patients undergoing surgical procedures, such as major abdominal surgery;
- Prevention of clotting in arterial and heart surgery, in blood transfusions and dialysis procedures, and in blood samples for laboratory purposes;
- Prevention of a repeat cerebral thrombosis in some patients who have experienced a stroke;
- Treatment of coronary occlusion, acute MI, and peripheral arterial embolism;
- Prevention of clotting in equipment used for extracorporeal (occurring outside the body) circulation;
- Diagnosis and treatment of disseminated intravascular coagulation, a severe hemorrhagic disorder.
- Maintenance of patency of IV catheters (very low doses of 10 to 100 units [U]).

The LMWHs are used to prevent DVT after certain surgical procedures, such as hip or knee replacement surgery or abdominal surgery. The drugs are also used for ischemic complications of unstable angina and MI (for specific uses of each drug see the Summary Drug Table: Anticoagulants).

## ADVERSE REACTIONS

Hemorrhage is the chief complication of heparin administration. Hemorrhage can range from minor local bruising to major hemorrhaging from any organ. Thrombocytopenia (low levels of platelets in the blood) may occur, causing bleeding from the small capillaries and resulting in easy bruising, petechiae, and hemorrhage into the tissues.

Other adverse reactions include local irritation when heparin is given via the SC route. Hypersensitivity reactions may also occur with any route of administration and include fever, chills, and urticaria. More serious hypersensitivity reactions include an asthma-like reaction and an anaphylactoid reaction.

The LMWHs cause fewer adverse reactions than heparin. Bleeding related to the LMWHs is possible but has generally been low. See the Summary Drug Table: Anticoagulants for additional adverse reactions associated with the LMWHs.

## CONTRAINDICATIONS

Heparin preparations are contraindicated in patients with known hypersensitivity to the drug, active bleeding (except when caused by disseminated intravascular coagulation), hemorrhagic disorders, severe thrombocytopenia, or recent surgery (except for the LMWHs used after certain surgical procedures to prevent thromboembolic complications) and during pregnancy (Pregnancy Category C).

The LMWHs are contraindicated in patients with a hypersensitivity to the drug, heparin, or pork products and inpatients with active bleeding or thrombocytopenia.

## PRECAUTIONS

Treatment with heparin preparations is approached cautiously in the elderly, in patients with severe renal or kidney disease, diabetes, diabetic retinopathy, ulcer disease, or uncontrolled hypertension, and in all patients with a potential site for bleeding or hemorrhage. The LMWHs are used with caution in patients who are at increased risk of hemorrhage, such as those with severe uncontrolled hypertension, diabetic retinopathy, bacterial endocarditis, congenital or acquired bleeding disorders, GI disease, or hemorrhagic stroke and shortly after brain, spinal, or ophthalmological surgery.

## INTERACTIONS

When heparin is administered with the NSAIDs, aspirin, penicillin, or the cephalosporins, there may be an increase in clotting times, thereby increasing the risk for bleeding. During heparin administration, serum transaminase (aspartate, alanine) levels may be falsely elevated. Careful interpretation is required because these laboratory tests may be used to help diagnose certain disorders, such as liver disease or MI. **Protamine sulfate**, a heparin antagonist, is incompatible with certain antibiotics such as penicillin and the cephalosporins. Use of the LMWHs with the following drugs may increase the risk of bleeding: aspirin, salicylates, NSAIDs, and thrombolytics.

## NURSING PROCESS

### ● The Patient Receiving Heparin

#### ASSESSMENT

##### *Preadministration Assessment*

Before administering the first dose of heparin, the nurse obtains the patient's vital signs. The most commonly used test to monitor heparin is activated partial thromboplastin time (APTT). Blood is drawn for laboratory studies before giving the first dose of heparin to obtain baseline data. (See the discussion on preadministration assessment for the oral anticoagulants.)

##### *Ongoing Assessment*

The ongoing assessment of a patient receiving heparin requires close observation and careful monitoring. The nurse assesses vital signs every 2 to 4 hours or more frequently during administration.

The dosage of heparin is adjusted according to daily APTT monitoring. A therapeutic dosage is attained when the APTT is 1.5 to 2.5 times the normal. The LMWHs have little or no effect on the APTT values. Special monitoring of clotting times is not necessary when administering the drugs.

Periodic platelet counts, hematocrit, and tests for occult blood in the stool should be performed throughout the entire course of heparin therapy.

It is also important that the nurse monitor for any indication of hypersensitivity reaction. The nurse reports reactions, such as chills, fever, or hives, to the primary health care provider. When heparin is given to prevent the formation of a thrombus, the nurse observes the patient for signs of thrombus formation every 2 to 4 hours. Because the signs and symptoms of thrombus formation vary and depend on the area or organ involved, the nurse should evaluate and report any complaint the patient may have or any change in the patient's condition to the primary health care provider.

## NURSING DIAGNOSES

Drug-specific nursing diagnoses are highlighted in the Nursing Diagnoses Checklist. Other nursing diagnoses applicable to these drugs are discussed in depth in Chapter 4.

## PLANNING

The expected outcomes for the patient may include an optimal response to drug therapy, management of common adverse drug reactions, and an understanding of the therapeutic regimen.

## IMPLEMENTATION

### *Promoting an Optimal Response to Therapy*

Heparin preparations, unlike warfarin, must be given by the parenteral route, preferably SC or IV. The onset of anticoagulation is almost immediate after a single dose. Maximum effects occur within 10 minutes of administration. Clotting time will return to normal within 4 hours unless subsequent doses are given.

Blood coagulation tests are usually ordered before and during heparin therapy, and the dose of heparin is adjusted to the test results. Optimal results of therapy are obtained when the APTT is 1.5 to 2.5 times the control value. The LMWHs do not require close monitoring of blood coagulation tests.

A complete blood count, platelets, and stools for occult blood may be ordered periodically throughout therapy. Thrombocytopenia may occur during heparin administration. A mild, transient thrombocytopenia may occur 2 to 3 days after heparin therapy is begun. This early development of thrombocytopenia tends to resolve itself despite continued therapy. The nurse reports a platelet count of less than 100,000 mm<sup>3</sup> immediately because the primary care provider may choose to discontinue the heparin therapy.

**ADMINISTERING HEPARIN PREPARATIONS.** The dosage of heparin is measured in units and is available in various dosage strengths as units per milliliter (U/mL), for example, 10,000 U/mL. When selecting the strength used for administration, choose the strength closest to the prescribed dose. For example, if 5000 U is ordered, and the available strengths are 1000, 5000, 7500, 20,000, and 40,000 U/mL, use 1 mL of the 5000 U/mL for administration.

Heparin may be given by intermittent IV administration, continuous IV infusion, and the SC route. Intramuscular administration is avoided because of the possibility of the development of local irritation, pain, or hematoma (a collection of blood in the tissue). A solution of dilute heparin may be used to maintain patency of an IV site used for intermittent administration of any drug given by the IV route.

Intermittent IV administration requires the use of an adapter or heparin lock to provide ready access to a vein without having to maintain a continuous infusion. A solution of dilute heparin consisting of 10 to 100 U/mL may be ordered for injection into the heparin lock before and after the administration of the intermittent dose of heparin or any other drug administered by the intermittent IV route. This is called a heparin lock flush. The lock flush solution aids in preventing small clots from obstructing the needle of the intermittent administration set. To prevent incompatibility of heparin with other drugs, the heparin lock set is flushed with sterile water or sterile normal saline before and after any drug is given through the IV line. The primary health care provider or institutional policy dictates the use and type of lock flush solution.

Each time heparin is given, the nurse inspects the needle site for signs of inflammation, pain, and tenderness along the pathway of the vein. If these should occur, the use of this site is discontinued and a new intermittent set is inserted at a different site. Coagulation tests are usually performed 30 minutes before the scheduled dose and from the extremity opposite the infusion site.

An infusion pump must be used for the safe administration of heparin by continuous IV infusion. The nurse checks the infusion pump every 1 to 2 hours to ensure that it is working properly. The needle site is inspected for signs of inflammation, pain, and tenderness along

### Nursing Diagnoses Checklist

- ✓ **Ineffective Tissue Perfusion** related to adverse drug effects
- ✓ **Risk for Injury**

the pathway of the vein. If these should occur, the infusion is discontinued and restarted in another vein.

### Nursing Alert

*Blood coagulation tests for those receiving heparin by continuous IV infusion are taken at periodic intervals (usually every 4 hours) determined by the primary health care provider. If the patient is receiving long-term heparin therapy, blood coagulation tests may be performed at less frequent intervals.*

### Nursing Alert

*If the patient is receiving heparin by intermittent or continuous IV infusion, other drugs administered by the IV route are not given through the IV tubing or injection port or piggy-backed into the continuous IV line unless the primary health care provider orders the drug given in this manner. In addition, the nurse should never mix other drugs with heparin when heparin is given by any route.*

When heparin is given by the SC route, administration sites are rotated and the site used is recorded on the patient's chart. The recommended sites of administration are those on the abdomen, but areas within 2 inches of the umbilicus are avoided because of the increased vascularity of that area. Other areas of administration are the buttocks and lateral thighs. The nurse gives the injection at a 90-degree angle. The site is not massaged after giving the injection, but the nurse applies firm pressure to the injection site until all oozing of blood has stopped.

The “bunch” technique may be used when administering heparin SC. When using the bunch method, the nurse grasps the tissue around the selected site to form a tissue roll that is about 0.5 inch in diameter. The nurse inserts the needle into the tissue roll at a 90-degree angle and injects the drug. The nurse then releases the tissue roll. It is not necessary to aspirate before injecting the drug. The application of firm pressure after the injection helps to prevent hematoma formation. Each time heparin is given by this route, the nurse inspects all recent injection sites for signs of inflammation (redness, swelling, tenderness) and hematoma formation. When administering heparin by the SC route, an APTT test is performed 4 to 6 hours after the injection.

#### ADMINISTERING THE LOW-MOLECULAR-WEIGHT HEPARIN.

The LMWHs are administered by the SC route only. Dalteparin is given by the SC route 1 to 2 hours before surgery and once daily for 5 to 10 days after surgery. The first dose of enoxaparin is administered via the SC route within the first 12 to 24 hours after surgery and continued for 7 to 10 days. When enoxaparin is administered in patients having abdominal surgery, the first

dose is via the SC route 2 hours before surgery and as long as 12 days after surgery. Tinzaparin is administered via the SC route within 12 to 24 hours after surgery with administration continuing as long as 14 days.

The nurse gives these drugs deep into the SC tissue in the abdomen (avoiding the navel) with the site rotated at the time of each injection. Alternate sites are the buttocks or upper thighs. The nurse places the patient in a supine position. To avoid the loss of the drug, the air bubble is not expelled from the syringe before injection. The drug is administered alternately between left and right anterolateral and left and right posterolateral abdominal wall. The injection site is varied daily. When the drug is administered, the skin is lifted between the thumb and forefinger (as in the bunch technique). The entire length of the needle is inserted into the skin fold at a 45- to 90-degree angle, with the skin fold held throughout the injection. To minimize bruising, the injection site is not rubbed after the drug is administered. Bruising may be decreased by using an ice cube to massage the site before injection of the drug. Prefilled syringes or enoxaparin are available for patients taking the drug at home.

#### Monitoring and Managing Adverse Drug Reactions

Bleeding at virtually any site can occur during therapy with any heparin preparation, even the LMWHs. The nurse monitors the patient's vital signs every 2 to 4 hours or as ordered by the primary health care provider.

### Nursing Alert

*The nurse should immediately report evidence of bleeding in any patient receiving heparin: bleeding gums, epistaxis (nose-bleed), easy bruising, black tarry stools, hematuria (blood in the urine), oozing from wounds or IV sites, or decrease in blood pressure.*

### Gerontologic Alert

*There is an increased incidence of bleeding in individuals older than 60 years (particularly older women) when heparin is administered. The nurse should carefully monitor older patients for evidence of bleeding.*

**MANAGING OVERDOSAGE.** If a decided drop in blood pressure or rise in the pulse rate occurs, the nurse notifies the primary health care provider because this may indicate internal bleeding. Because hemorrhage may begin as a slight bleeding or bruising tendency, the nurse frequently observes the patient for these occurrences (see discussion of warfarin). At times, hemorrhage can occur without warning. If bleeding should occur, the primary health care provider may decrease the dose, discontinue

the heparin therapy for a time, or order the administration of protamine sulfate.

In most instances, discontinuation of the drug is sufficient to correct overdosage because the duration of action of heparin is short. However, if hemorrhaging is severe, the primary health care provider may order protamine sulfate, the specific heparin antagonist or antidote. Protamine sulfate is also used to treat overdosage of the LMWHs. Protamine sulfate has an immediate onset of action and a duration of 2 hours. It counteracts the effects of heparin and brings blood coagulation tests to within normal limits. The drug is given slowly via the IV route during a period of 10 minutes.

### Nursing Alert

*Protamine sulfate can result in severe hypotension and anaphylactic reaction. When administering protamine sulfate, the nurse should make sure that resuscitation equipment is readily available.*

If administration of this drug is necessary, the nurse monitors the patient's blood pressure and pulse rate every 15 to 30 minutes for 2 hours or more after administration of the heparin antagonist. The nurse immediately reports to the primary health care provider any sudden decrease in blood pressure or increase in the pulse rate. The nurse observes the patient for new evidence of bleeding until blood coagulation tests are within normal limits. To replace blood loss, the primary health care provider may order blood transfusions or fresh frozen plasma.

### Educating the Patient and Family

Although heparin is given in the hospital, the LMWHs can be administered at home by a home health nurse, the patient, or a family member. The patient or a family member is taught how to administer the drug by the SC route (see technique under Promoting an Optimal Response to Therapy). Prefilled syringes are available, making administration more convenient. The nurse instructs the patient to apply firm pressure after the injection to prevent hematoma formation. Each time the drug is given, the nurse inspects all recent injection sites for signs of inflammation (redness, swelling, tenderness) and hematoma formation.

The nurse includes the following in a patient and family teaching plan:

- Report any signs of active bleeding immediately.
- Regular coagulation blood tests are critical for safe monitoring of the drug (except the LMWHs).
- Avoid IM injections while receiving anticoagulant therapy.
- Use a soft toothbrush when cleaning the teeth and an electric razor for shaving.
- Do not take any prescription or nonprescription drugs without consulting the primary health care

provider. Drugs containing alcohol, aspirin, or ibuprofen may alter the effects of heparin.

- Advise your dentist or primary health care provider of anticoagulant therapy before any procedure or surgery.
- Carry appropriate identification with information concerning drug therapy or wear a medical alert tag at all times.

### EVALUATION

- The therapeutic drug effect is achieved.
- Adverse drug reactions are identified, reported to the primary health care provider, and managed successfully through appropriate nursing interventions.
- No evidence of bleeding is seen.
- The patient verbalizes an understanding of treatment modalities.

## THROMBOLYTIC DRUGS

**Thrombolytics** are a group of drugs used to dissolve certain types of blood clots and reopen blood vessels after they have been occluded. Examples of thrombolytics include alteplase\* recombinant (Activase), reteplase recombinant (Retavase), streptokinase (Streptase), tenecteplase (TNKase), and urokinase (Abbokinase). Before these drugs are used, their potential benefits must be carefully weighed against the potential dangers of bleeding.

### ACTIONS

Although the exact action of the thrombolytic drugs is slightly different, these drugs break down fibrin clots by converting plasminogen to plasmin (fibrinolysin). Plasmin is an enzyme that breaks down the fibrin of a blood clot. This reopens blood vessels after their occlusion and prevents tissue necrosis.

### USES

These drugs are used to treat an acute MI by lysing (dissolving) a blood clot in a coronary artery. These drugs are also effective in lysing clots causing PE and DVT. Urokinase is also used to treat PE and to clear IV

\*Alteplase is a tissue plasminogen activator (tPA) that is produced by recombinant DNA. Recombinant DNA is obtained by using gene splicing. Specific DNA segments of one organism are placed in the DNA of another organism. The genetic material of the recipient organism then reproduces itself and contains genetic material of its own plus the genetic material from the donor organism.

## SUMMARY DRUG TABLE THROMBOLYTICS

GENERIC NAME	TRADE NAME*	USES	ADVERSE REACTIONS	DOSAGE RANGES
alteplase, recombinant <i>al'-te-plaz</i>	Activase	Acute myocardial infarction (AMI), acute ischemic stroke, pulmonary embolism (PE)	Bleeding (GU, gingival, retroperitoneal), and epistaxis, ecchymosis	AMI: total dose of 100 mg IV given as 60 mg 1st h, 20 mg 2nd h and 20 mg over 3rd h; for patients < 65 kg, decrease dose to 1.25 mg/kg
reteplase, recombinant <i>ret'-ah-plaze</i>	Retavase	AMI	Bleeding (GI, GU, or at injection site), intracranial hemorrhage, anemia	10 plus 10 U double bolus IV over 2 min each with the 2nd bolus given 30 min after the 1st
streptokinase <i>strep-toe-kye'-nase</i>	Streptase	AMI, DVT, PE, embolism	Minor bleeding (superficial and surface) and major bleeding (internal and severe)	Lysis of coronary artery thrombosis, 20,000 IU directly into vein; PE, DVT, embolism: 250,000 IU IV over 30 min followed by 100,000 IU for 24–72 h
tenecteplase <i>teh-nek'-ti-plaze</i>	TNKase	AMI	Bleeding (GI, GU, or at injection site), intracranial hemorrhage, anemia	Dosage based on weight, not to exceed 50 mg IV
urokinase <i>yoor-oh'-kye-nase</i>	Abbokinase	PE, lysis of coronary artery thrombi, IV catheter clearance	Minor bleeding (superficial and surface) and major bleeding (internal and severe)	PE: 4400 IU/kg IV over 10 min, followed by 4400 IU/kg/hr for 12 h; lysis of thrombi: 6000 IU/min IV for 2 h; IV catheter clearance: see packaged instructions

\*The term *generic* indicates that drug is available in generic form.

catheter cannulas obstructed by a blood clot. See the Summary Drug Table: Thrombolytics for a more complete listing of the use of these drugs.

## ADVERSE REACTIONS

Bleeding is the most common adverse reaction seen with the use of these drugs. Bleeding may be internal and involve areas such as the GI tract, genitourinary tract, and the brain. Bleeding may also be external (superficial) and may be seen at areas of broken skin, such as venipuncture sites and recent surgical wounds. Allergic reactions may also be seen.

## CONTRAINDICATIONS

Thrombolytic drugs are contraindicated in patients with known hypersensitivity, active bleeding, history of stroke, aneurysm, and recent intracranial surgery.

## PRECAUTIONS

These drugs are used cautiously in patients who have recently undergone major surgery (within 10 days or less), such as coronary artery bypass graft, or experienced stroke, trauma, vaginal or cesarean section delivery, GI bleeding, or trauma within the last 10 days; those who have hypertension, diabetic retinopathy, or any condition in which bleeding is a significant possibility; and patients currently receiving oral anticoagulants. All of the thrombolytic drugs discussed in this chapter are classified in Pregnancy Category C, with the exception of urokinase, which is a Pregnancy Category B drug.

## INTERACTIONS

Administration of the thrombolytic drugs with aspirin, dipyridamole, or the anticoagulants may increase the risk of bleeding.

## NURSING PROCESS

## ● The Patient Receiving a Thrombolytic Drug

## ASSESSMENT

*Preadministration Assessment*

During the preadministration assessment the nurse interviews the patient or family and notes any history of conditions that might contraindicate the use of a thrombolytic drug (see Contraindications). The nurse identifies any history of bleeding tendencies, heart disease, or allergic reactions to any drugs. In addition, a history of any drugs currently being taken is obtained. The nurse reports any relevant information to the primary health care provider before the drug is administered. Initial patient assessments include vital signs and a review of the diagnostic tests performed to establish a diagnosis. Most of these patients are admitted or transferred to an intensive care unit because close monitoring for 48 hours or more after therapy is necessary.

*Ongoing Assessment*

The most important aspect of the ongoing assessment is the possibility of bleeding. The nurse must assess the patient for bleeding every 15 minutes during the first 60 minutes of therapy, every 15 to 30 minutes for the next 8 hours, and at least every 4 hours until therapy is completed. Vital signs are taken at least every 4 hours for the duration of therapy.

The nurse must continually assess the patient for anaphylactic reactions (difficulty breathing, wheezing, fever, swelling around the eyes, hives, or itching) particularly with anistreplase or streptokinase. Resuscitation equipment is immediately available.

## NURSING DIAGNOSES

Drug-specific nursing diagnoses are highlighted in the Nursing Diagnoses Checklist. Other nursing diagnoses applicable to these drugs are discussed in depth in Chapter 4.

## PLANNING

The expected outcomes for the patient may include an optimal response to therapy (which includes a decrease in pain), management of common adverse reactions, and an understanding of the therapeutic regimen.

## Nursing Diagnoses Checklist

- ✓ **Ineffective Tissue Perfusion** related to adverse drug reactions
- ✓ **Risk for Injury** related to adverse drug reactions
- ✓ **Pain** related to obstruction of blood vessel

## IMPLEMENTATION


*Promoting an Optimal Response to Therapy*

For optimal therapeutic effect the thrombolytic drugs are used as soon as possible after the formation of a thrombus, preferably within 4 to 6 hours or as soon as possible after the symptoms are identified. The greatest benefit in mortality is seen when the drugs are administered within 4 hours, but studies indicate that significant benefit has been reported when the agents were used within the first 24 hours. The nurse must follow the primary health care provider's orders precisely regarding dosage and time of administration. These drugs are available in powder form and must be reconstituted according to the directions in the package insert.

Tenecteplase (TNKase) is the first thrombolytic drug that can be administered during a period of 5 seconds in a single dose. The drug is administered intravenously only and offers the fastest administration of a thrombolytic in the treatment of an acute MI. Specific instructions for reconstitution come with the drug. The drug is reconstituted immediately before use because it contains no antibacterial preservatives.

If pain is present, the primary health care provider may order a narcotic analgesic. Once the clot is dissolved and blood flows freely through the obstructed blood vessel, severe pain usually decreases.

When using urokinase to clear an occluded IV catheter, the nurse follows the manufacturer's instructions in the packaged insert. The nurse avoids using excessive pressure when the drug is injected into the catheter. Excessive force could rupture the catheter or expel the clot into the circulation. It is important to remember that if the catheter is occluded by substances other than blood fibrin clots, such as drug precipitates, urokinase is not effective.

 **Nursing Alert**

*Streptokinase is not used for restoring IV catheter patency. Serious adverse reactions, including hypotension, hypersensitivity apnea, and bleeding, have occurred when the drug is used for this purpose.*

*Monitoring and Managing Adverse Drug Reactions*

Bleeding is the most common adverse reaction. Throughout administration of the thrombolytic drug, the nurse assesses for signs of bleeding and hemorrhage (see earlier discussion on warfarin). Internal bleeding may involve the GI tract, genitourinary tract, intracranial sites, or respiratory tract. Symptoms of internal bleeding may include abdominal pain, coffee-ground emesis, black tarry stools, hematuria, joint pain, and spitting or coughing up of blood. Superficial bleeding

may occur at venous or arterial puncture sites or recent surgical incision sites. As fibrin is lysed during therapy, bleeding from recent injection sites may occur. The nurse must carefully monitor all potential bleeding sites (including catheter insertions sites, arterial and venous puncture sites, cutdown sites, and needle puncture sites). For minor bleeding at a puncture site, the nurse can usually control bleeding by applying pressure for at least 30 minutes at the site, followed by the application of a pressure dressing. The puncture site is checked frequently for evidence of further bleeding. Intramuscular injections and nonessential handling of the patient are avoided during treatment. Venipunctures are done only when absolutely necessary.

### Nursing Alert

*Heparin may be given along with and/or after administration with a thrombolytic drug to prevent another thrombus from forming. However, administration of an anticoagulant increases the risk for bleeding. The patient must be monitored closely for internal and external bleeding.*

If uncontrolled bleeding is noted or the bleeding appears to be internal, the nurse stops the drug and immediately contacts the primary health care provider because whole blood, packed red cells, or fresh, frozen plasma may be required. Vital signs are monitored every hour or more frequently for at least 48 hours after the drug use is discontinued. The nurse contacts the primary health care provider if there is a marked change in one or more of the vital signs. Any signs of an allergic (hypersensitivity) reaction, such as difficulty breathing, wheezing, hives, skin rash, and hypotension, are reported immediately to the primary health care provider.

### Educating the Patient and Family

The nurse includes the following in the patient and family teaching plan:

- Explains the purpose of the drug and the method of administration.
- Explains the need for continuous monitoring before and after administration of the thrombolytic drug.
- Instructs the patient to report any evidence of hypersensitivity reaction (rash, difficulty breathing) or evidence of bleeding or bruising.
- Explains the need for bed rest and minimal handling during therapy.

### EVALUATION

- The therapeutic effect achieved; lysis of thrombi or emboli occurs and the catheter or cannula is patent.
- Pain is relieved.

- Adverse reactions are identified, reported to the primary health care provider, and managed using appropriate nursing interventions.
- The patient and family demonstrate an understanding of treatment and techniques necessary to monitor therapy.

### ● Critical Thinking Exercises

1. *Ms. Jackson, age 56 years, is hospitalized with a venous thrombosis. The primary health care provider orders SC heparin. In developing a care plan for Ms. Jackson, discuss the nursing interventions that would be most important to prevent complications while administering heparin. Provide a rationale for each intervention.*
2. *Mr. Harris, age 72 years, is a widower who has lived alone since his wife died 5 years ago. He has been prescribed warfarin to take at home after his dismissal from the hospital. Determine which questions concerning the home environment would be important to ask Mr. Harris to prepare him to care for himself and prevent any complications associated with the warfarin.*
3. *A patient enters the emergency department with an acute MI. Thrombolytic therapy is begun with streptokinase. Discuss ongoing assessments that are important for the nurse to perform.*
4. *Discuss the use of laboratory tests in monitoring heparin administration.*

### ● Review Questions

1. The patient is receiving the first dose of warfarin. Before administering the drug, the nurse \_\_\_\_\_.
  - A. administers a loading of heparin
  - B. has the laboratory draw blood for a serum potassium level
  - C. takes the apical pulse
  - D. checks to see that blood has been drawn for a baseline prothrombin time
2. The nurse monitors the prothrombin time (PT) during therapy. Optimal PT for warfarin therapy is \_\_\_\_\_.
  - A. more than 15 seconds
  - B. less than 25 seconds
  - C. 1.8 to 2 times the control value
  - D. 1.2 to 1.5 times the control value
3. There is an increased risk for bleeding when the patient receiving heparin is also taking \_\_\_\_\_.
  - A. allopurinol
  - B. an NSAID
  - C. digoxin
  - D. furosemide

4. In which of the following situations would the nurse expect a LMWH to be prescribed?
- A. to prevent a DVT
  - B. for a patient with disseminated intravascular coagulation
  - C. to prevent hemorrhage
  - D. for a patient with atrial fibrillation
5. If bleeding is noted while a patient is receiving a thrombolytic drug, the patient may receive \_\_\_\_\_.
- A. heparin
  - B. whole blood or fresh, frozen plasma
  - C. a diuretic
  - D. protamine sulfate

### ● **Medication Dosage Problems**

1. The patient is prescribed 5000 U heparin. The drug is available as a solution of 7500 U/mL. The nurse administers \_\_\_\_\_.
2. Warfarin 5 mg is prescribed. On hand are 2.5-mg tablets. The nurse administers \_\_\_\_\_.