

Medications Affecting Coagulation

Pharmaceutical agents that modify coagulation are used to prevent clot formation or break apart an existing clot. These medications work in the blood to alter the clotting cascade, prevent platelet aggregation, or dissolve a clot. All carry a significant risk of bleeding.

The goal of medications that alter coagulation is to increase circulation and perfusion, decrease pain, and prevent further tissue damage.

The groups of medications used include oral and parenteral anticoagulants, direct thrombin inhibitors, direct inhibitors of factor Xa, antiplatelet medications, and thrombolytic agents.

Parenteral anticoagulants

SELECT PROTOTYPE MEDICATION: Heparin

Low molecular weight heparins

SELECT PROTOTYPE MEDICATION: Enoxaparin

OTHER MEDICATIONS: Dalteparin

Activated factor Xa inhibitor

SELECT PROTOTYPE MEDICATION: Fondaparinux

PURPOSE

EXPECTED PHARMACOLOGICAL ACTION

These parenteral anticoagulants prevent clotting by activating antithrombin, thus indirectly inactivating both thrombin and factor Xa. This inhibits fibrin formation.

THERAPEUTIC USES

Heparin

- Conditions necessitating prompt anticoagulant activity (evolving stroke, pulmonary embolism, massive deep-vein thrombosis)
- An adjunct for clients having open heart surgery or renal dialysis
- Low-dose therapy for prophylaxis against postoperative venous thrombosis (for example, hip/knee or abdominal surgery)
- Treatment of disseminated intravascular coagulation

Low molecular weight heparins

- Prevent deep-vein thrombosis (DVT) in clients who are postoperative.
- Treat DVT and pulmonary embolism.
- Prevent complications in angina, non-Q wave MI, and ST elevation MI.

Activated factor Xa inhibitor (fondaparinux)

- Prevent DVT and pulmonary embolism in postoperative clients.
- Treat acute DVT or pulmonary embolism in conjunction with warfarin.

COMPLICATIONS

Heparin

Hemorrhage secondary to heparin overdose

NURSING CONSIDERATIONS

- Monitor vital signs.
- Advise clients to observe for bleeding: increased heart rate, decreased blood pressure, bruising, petechiae, hematomas, black tarry stools.
- In the case of overdose, stop heparin, administer protamine, and avoid aspirin.
- Monitor activated partial thromboplastin time (aPTT). Keep value at 1.5 to 2 times the baseline. **QEBP**

Heparin-induced thrombocytopenia

- Evidenced by low platelet count and increased development of thrombi: mediated by antibody development (white clot syndrome)
- **NURSING CONSIDERATIONS**
 - Monitor platelet count periodically throughout treatment, especially in the first month.
 - Stop heparin if platelet count is less than 100,000/mm³. Nonheparin anticoagulants, such as lepirudin or argatroban, can be used as a substitute if anticoagulation is still needed.

Hypersensitivity reactions (chills, fever, urticaria)

NURSING CONSIDERATIONS: Administer a small test dose prior to the administration of heparin.

Toxicity/overdose

NURSING CONSIDERATIONS

- Administer protamine, which binds with heparin and forms a heparin–protamine complex that has no anticoagulant properties.
- Protamine should be administered slowly IV, no faster than 20 mg/min or 50 mg in 10 min.
- Do not exceed 100 mg in a 2-hr period. Administer carefully to prevent protamine overdose (excessive anticoagulation).

Enoxaparin

Hemorrhage

NURSING CONSIDERATIONS

- Monitor vital signs.
- Advise clients to observe for bleeding: increased heart rate, decreased blood pressure, bruising, petechiae, hematomas, black tarry stools.
- Monitor platelet count. Instruct client to avoid aspirin.

Neurologic damage from hematoma formed during spinal or epidural anesthesia

NURSING CONSIDERATIONS: In clients who have spinal or epidural anesthesia: Assess insertion site for indications of hematoma formation, such as redness or swelling. Monitor sensation and movement of lower extremities. Notify provider of abnormal findings.

Thrombocytopenia evidenced by low platelet count

NURSING CONSIDERATIONS

- Monitor platelets. Discontinue medication for platelet count less than 100,000/mm³.

Toxicity/overdose

NURSING CONSIDERATIONS

- Administer protamine (heparin antagonist)
- Protamine should be administered slowly IV, no faster than 20 mg/min or 50 mg in 10 min.

Fondaparinux

Hemorrhage

NURSING CONSIDERATIONS

- Monitor vital signs.
- Advise clients to observe for bleeding: increased heart rate, decreased blood pressure, bruising, petechiae, hematomas, black tarry stools.
- Monitor platelet count. Instruct clients to avoid aspirin.

Neurologic damage from hematoma formed during spinal or epidural anesthesia

NURSING CONSIDERATIONS: In clients who have spinal or epidural anesthesia: Assess insertion site for indications of hematoma formation such as redness or swelling. Monitor sensation and movement of lower extremities. Notify provider of abnormal findings.

Thrombocytopenia evidenced by low platelet count

NURSING CONSIDERATIONS: Monitor platelets. Discontinue medication for platelet count less than 100,000/mm³.

CONTRAINDICATIONS/PRECAUTIONS

- Parenteral anticoagulants are contraindicated in clients who have low platelet counts (thrombocytopenia) or uncontrollable bleeding. **Qs**
- These medications should not be used during or following surgeries of the eye(s), brain, or spinal cord; lumbar puncture; or regional anesthesia.
- Use cautiously in clients who have hemophilia, increased capillary permeability, dissecting aneurysm, peptic ulcer disease, severe hypertension, hepatic or kidney disease, or threatened abortion.

INTERACTIONS

Antiplatelet agents such as aspirin, NSAIDs, and other anticoagulants can increase risk for bleeding.

NURSING CONSIDERATIONS

- Avoid concurrent use when possible.
- Monitor carefully for evidence of bleeding.
- Take precautionary measures to avoid injury (limit venipunctures and injections).

NURSING ADMINISTRATION

These medications cannot be absorbed by the intestinal tract and must be given via subcutaneous injection or IV infusion.

Heparin **QEBP**

- Obtain baseline vital signs.
- Obtain baseline and monitor complete blood count (CBC), platelet count, and hematocrit levels.
- Read label carefully. Heparin is dispensed in units and in a variety of concentrations.
- Check dosages with another nurse before administration.
- Use an infusion pump for continuous IV administration. Monitor rate of infusion every 30 to 60 min. **Qs**
- Monitor aPTT every 4 to 6 hr until appropriate dose is determined, then monitor daily.
- For subcutaneous injections, use a 20- to 22-gauge needle to withdraw medication from the vial. Then, change the needle to a smaller needle (25- or 26-gauge, 1/2 to 5/8 inches long).
- Administer deep subcutaneous injections in the abdomen, ensuring a distance of 2 inches from the umbilicus. Do not aspirate.
- Apply gentle pressure for 1 to 2 min after the injection. Rotate and record injection sites.
- Instruct clients to monitor for indications of bleeding: bruising, gums bleeding, abdominal pain, nose bleeds, coffee-ground emesis, and tarry stools.
- Instruct clients to avoid the use of over-the-counter (OTC) NSAIDs, aspirin, or medications containing salicylates.
- Advise clients to use an electric razor for shaving and to brush with a soft toothbrush.

Enoxaparin/fondaparinux

- Monitoring is not required. These medications are acceptable for home use.
- Provide instruction regarding self-administration. Medications can be available in prefilled syringes.
- For subcutaneous injections when a prefilled syringe is not available, use a 20- to 22-gauge needle to withdraw medication from the vial. Then, change to a small needle (25- or 26-gauge, 1/2 to 5/8 inches long). Deep subcutaneous injections should be administered in the abdomen, ensuring a distance of 2 inches from the umbilicus. Do not aspirate.
- Prefilled syringes are available in various dosages for subcutaneous injection. Rotate sites between right and left anterolateral and posterolateral abdominal walls at least 2 inches from umbilicus. Do not expel the air bubble in the syringe unless adjustments must be made to the dose. Pinch up an area of skin, inject at a 90° angle, and insert needle completely. Do not aspirate. Inject entire contents of syringe. **QEBP**
- Do not rub the site for 1 to 2 min after the injection. Rotate and record injection sites.
- Instruct clients to monitor for indications of bleeding, such as bruising, gums bleeding, abdominal pain, nose bleeds, coffee-ground emesis, and tarry stools.
- Instruct clients to avoid the use of OTC NSAIDs, aspirin, or medications containing salicylates.
- Advise client to use an electric razor for shaving and to brush with a soft toothbrush.

NURSING EVALUATION OF MEDICATION EFFECTIVENESS

Depending on therapeutic intent, effectiveness can be evidenced by the following.

Heparin: aPTT levels of 60 to 80 seconds

Heparin, enoxaparin, and fondaparinux: No development or no further development of venous thrombi or emboli

Oral anticoagulant

SELECT PROTOTYPE MEDICATION: Warfarin

PURPOSE

EXPECTED PHARMACOLOGICAL ACTION:

Oral anticoagulants antagonize vitamin K, thereby preventing the synthesis of four coagulation factors: factor VII, IX, X, and prothrombin.

THERAPEUTIC USES

- Treatment of venous thrombosis
- Treatment of thrombus formation in clients who have atrial fibrillation or prosthetic heart valves
- Prevention of recurrent myocardial infarction, transient ischemic attacks, pulmonary embolus, and DVT

COMPLICATIONS

Hemorrhage

NURSING CONSIDERATIONS

- Monitor vital signs.
- Advise clients to observe for bleeding (increased heart rate, decreased blood pressure, bruising, petechiae, hematomas, black tarry stools).
- Obtain baseline prothrombin time (PT), and monitor levels of PT and international normalized ratio (INR) periodically.
- In the case of a warfarin overdose, discontinue administration of warfarin, and administer vitamin K₁.

Hepatitis

NURSING CONSIDERATIONS: Monitor liver enzymes. Assess for jaundice.

Toxicity/overdose

NURSING CONSIDERATIONS

- Administer vitamin K₁ to promote synthesis of coagulation factors VII, IX, X, and prothrombin.
- Administer IV vitamin K₁ slowly and in a diluted solution to prevent anaphylactoid-type reaction. **Qs**
- Administer small doses of vitamin K₁ (2.5 mg PO, 0.5 to 1 mg IV) to prevent development of resistance to warfarin.
- If vitamin K₁ cannot control bleeding, administer fresh frozen plasma or whole blood.

CONTRAINDICATIONS/PRECAUTIONS

- Classified as Pregnancy Risk Category X due to high risk of fetal hemorrhage, fetal death, and CNS defects. Advise clients to notify the provider if they become pregnant during warfarin therapy. If anticoagulation is needed during pregnancy, heparin can be safely used. **Qs**
- Contraindicated in clients who have low platelet counts (thrombocytopenia) or uncontrollable bleeding.
- Contraindicated during or following surgeries of the eye(s), brain, or spinal cord; lumbar puncture; or regional anesthesia.
- Contraindicated in clients who have vitamin K deficiencies, liver disorders, and alcohol use disorder due to the additive risk of bleeding.
- Use cautiously in clients who have hemophilia, dissecting aneurysm, peptic ulcer disease, severe hypertension, or threatened abortion.

INTERACTIONS

Concurrent use of heparin, aspirin, acetaminophen, glucocorticoids, sulfonamides, and parenteral cephalosporins increases effects of warfarin, which increases the risk for bleeding.

NURSING CONSIDERATIONS

- Avoid concurrent use if possible.
- Instruct clients to observe for inclusion of aspirin in OTC medications.
- If used concurrently, monitor carefully for indications of bleeding and increased PT, INR, and aPTT levels.
- Medication dosage should be adjusted accordingly.

Concurrent use of phenobarbital, carbamazepine, phenytoin, oral contraceptives, and vitamin K decreases anticoagulant effects.

NURSING CONSIDERATIONS

- Avoid concurrent use if possible.
- If used concurrently, monitor carefully for reduced PT and INR levels.
- Medication dosage should be adjusted accordingly.

Foods high in vitamin K, such as dark green leafy vegetables (lettuce, cooked spinach), cabbage, broccoli, Brussels sprouts, mayonnaise, and canola and soybean oil, can decrease anticoagulant effects with excessive intake.

NURSING CONSIDERATIONS

- Provide clients with a list of foods high in vitamin K.
- Instruct clients to maintain a consistent intake of vitamin K to avoid sudden fluctuations that could affect the action of warfarin. **Qs**

Multiple other medications interact with warfarin.

NURSING CONSIDERATIONS: Take a complete medication history for clients taking warfarin, and advise clients to inform the provider if any new medication is started.

NURSING ADMINISTRATION

- Administration is usually oral, once daily, and at the same time each day.
- Obtain baseline vital signs.
- Monitor PT levels (therapeutic level 18 to 24 seconds) and INR levels (therapeutic levels 2 to 3). INR levels are the most accurate. Hold dose and notify the provider if these levels exceed therapeutic ranges. **QEBP**
- Obtain baseline and monitor CBC, platelet count, and Hct levels.
- Instruct clients that anticoagulant effects can take 8 to 12 hr, and full therapeutic effect is not achieved for 3 to 5 days. For clients in the hospital setting, explain the need for continued heparin infusion when starting oral warfarin.
- Advise clients that anticoagulation effects can persist for up to 5 days following discontinuation of medication due to a long half-life.
- Advise clients to avoid alcohol and OTC and nonprescription medications to prevent adverse effects and medication interactions, such as risk of bleeding.
- Advise clients to employ nonpharmacological measures to avoid development of thrombi, including avoiding sitting for prolonged periods of time, not wearing constricting clothing, and elevating and moving legs when sitting.
- Advise clients to wear a medical alert bracelet indicating warfarin use.
- Be prepared to administer vitamin K₁ for warfarin overdose.
- Teach clients to self-monitor PT and INR at home as appropriate. **Qpcc**
- Plan for frequent PT monitoring for clients who are prescribed medications that interact with warfarin. The client is at greatest risk for harm when the interacting medication is being deleted or added. Frequent PT monitoring allows for dosage adjustments as necessary.
- Advise clients to record dosage, route, and time of warfarin administration on a daily basis.
- Advise clients to notify the provider regarding warfarin use.
- Advise clients to use a soft-bristle toothbrush to prevent gum bleeding and an electric razor for shaving.

NURSING EVALUATION OF MEDICATION EFFECTIVENESS

Depending on therapeutic intent, effectiveness can be evidenced by the following.

- PT 1.5 to 2 times control
- INR of 2 to 3 for treatment of acute myocardial infarction, atrial fibrillation, pulmonary embolism, venous thrombosis, or tissue heart valves
- INR of 3 to 4.5 for mechanical heart valve or recurrent systemic embolism
- No development or no further development of venous thrombi

Direct thrombin inhibitors

SELECT PROTOTYPE MEDICATION: Dabigatran

OTHER MEDICATIONS

- **Hirudin analogs:** Bivalirudin, desirudin, lepirudin
- Argatroban

PURPOSE

EXPECTED PHARMACOLOGICAL ACTION: These medications work by directly inhibiting thrombin, thus preventing a thrombus from developing.

THERAPEUTIC USES

- **Dabigatran** prevents stroke or embolism in clients who have atrial fibrillation not caused by valvular heart disease. It is also used to treat DVT and to prevent pulmonary embolism.
- **Bivalirudin** is given concurrently with aspirin for clients who undergo coronary angioplasty.
- **Argatroban** is used to prevent or treat thrombosis in clients who cannot take heparin due to heparin-induced thrombocytopenia.
- **Desirudin** is administered to clients having hip replacement surgery to prevent DVT.

COMPLICATIONS

Bleeding (GI, GU, cranial, and other sites)

NURSING CONSIDERATIONS

- Teach clients to report manifestations of bleeding to the provider.
- For severe bleeding, no antidote to dabigatran is available. Dialysis or injections of recombinant factor VIIa can be used.
- Clients undergoing elective surgery should stop taking dabigatran before surgery.

GI effects

GI discomfort, nausea, vomiting, esophageal reflux, ulcer formation

NURSING CONSIDERATIONS

- Take dabigatran with food.
- The client might need a proton pump inhibitor, such as omeprazole, or an H₂ receptor antagonist, such as ranitidine, for these manifestations.

Other effects

Bivalirudin can also cause back pain, nausea, hypotension, and headache.

NURSING CONSIDERATIONS: Monitor vital signs and assess for headache when taking this medication.

CONTRAINDICATIONS/PRECAUTIONS

- Dabigatran and argatroban are Pregnancy Risk Category C. Bivalirudin and lepirudin are Pregnancy Risk Category B.
- Contraindicated in clients who have active bleeding or allergy to the medication. **Qs**
- Use cautiously in clients who have liver impairment or who are at risk for bleeding.
- Use dabigatran, bivalirudin, desirudin, and lepirudin cautiously in clients who have kidney impairment.

INTERACTIONS

Rifampin decreases levels of dabigatran.

NURSING CONSIDERATIONS: Use cautiously together, and watch for therapeutic effect.

Other thrombolytics and anticoagulants can increase risk for bleeding with argatroban, desirudin, bivalirudin, or dabigatran.

NURSING CONSIDERATIONS: Monitor coagulation studies carefully with concurrent use.

NURSING ADMINISTRATION

- Dabigatran is available in oral capsules that should be swallowed whole and can be taken with or without food. The container should be used within 30 days of opening. Discontinue other anticoagulants when starting dabigatran.
- Bivalirudin and lepirudin are administered IV by direct bolus or continuous infusion.
- Argatroban is administered IV by continuous infusion to prevent or treat thrombus formation, or as a bolus during percutaneous coronary intervention. Before starting, discontinue heparin and check aPTT.
- Desirudin is administered by deep subcutaneous injection into the abdomen or thigh.

Direct inhibitor of factor Xa

SELECT PROTOTYPE MEDICATION: Rivaroxaban

PURPOSE

EXPECTED PHARMACOLOGICAL ACTION: Provides anticoagulation selectively and directly by inhibiting factor Xa.

THERAPEUTIC USES: Used in clients who have atrial fibrillation and in the prevention of DVT and pulmonary embolism in clients who are undergoing total hip or knee arthroplasty. Also used for prophylaxis for stroke and embolism in clients who have nonvalvular atrial fibrillation.

COMPLICATIONS

Bleeding

GI, GU, cranial, retinal, or epidural bleeding following removal of epidural catheter

NURSING CONSIDERATIONS

- Teach the client to report bleeding, bruising, headache, or eye pain.
- Monitor hemoglobin and hematocrit.
- Wait at least 18 hr following last dose to remove an epidural catheter, and wait 6 hr after removal before starting rivaroxaban again. **Qs**
- No antidote is available for severe bleeding, and dialysis is ineffective in removing the medication from the bloodstream. Activated charcoal can be given to prevent further absorption.

Elevated liver enzymes and bilirubin

Liver enzymes: ALT, AST, and GGT

NURSING CONSIDERATIONS

- Monitor baseline and periodic liver function.
- Report elevated values to provider.

CONTRAINDICATIONS/PRECAUTIONS

- Pregnancy Risk Category C. Increased risk of hemorrhage in pregnancy. **Qs**
- Contraindicated clients who have previous allergy to rivaroxaban, or who have active bleeding, severe kidney impairment, or moderate to severe liver impairment.
- Use cautiously in clients taking anticoagulants, antiplatelet medications, or fibrinolytics, and clients who have mild liver or moderate kidney impairment.

INTERACTIONS

Bleeding risk is increased when taking erythromycin, diltiazem, verapamil, quinidine, or amiodarone.

NURSING CONSIDERATIONS: Monitor carefully for bleeding if these medications are taken concurrently.

Rifampin, carbamazepine, phenytoin, and St. John's wort can decrease rivaroxaban levels.

NURSING CONSIDERATIONS: Monitor for therapeutic effect in clients who take medications concurrently.

NURSING ADMINISTRATION

- Administer tablets orally, once daily, with or without food, and at the same time each day. **QEBP**
- For stroke and systemic embolism prevention, administer orally once daily with the evening meal.
- Monitor hemoglobin, hematocrit, and liver and kidney function periodically during treatment.

Antiplatelets

Antiplatelet/salicylic

SELECT PROTOTYPE MEDICATION: Aspirin

Antiplatelet/glycoprotein inhibitors

SELECT PROTOTYPE MEDICATION: Abciximab

OTHER MEDICATIONS: Eptifibatide, tirofiban

Antiplatelet/ADP inhibitors

SELECT PROTOTYPE MEDICATIONS: Clopidogrel

OTHER MEDICATIONS: Ticlopidine

Antiplatelet/arterial vasodilator

SELECT PROTOTYPE MEDICATION: Pentoxifylline

OTHER MEDICATIONS: Dipyridamole, cilostazol

PURPOSE

EXPECTED PHARMACOLOGICAL ACTIONS

- Antiplatelets prevent platelets from clumping together by inhibiting enzymes and factors that normally lead to arterial clotting.
- Antiplatelet medications inhibit platelet aggregation at the onset of the clotting process. These medications alter bleeding time.

THERAPEUTIC USES

- Primary prevention of acute myocardial infarction
- Prevention of reinfarction in clients following an acute myocardial infarction
- Prevention of ischemic stroke or transient ischemic attack
- Acute coronary syndromes (abciximab, tirofiban, eptifibatide, clopidogrel)
- Intermittent claudication (cilostazol, pentoxifylline, dipyridamole)

ROUTES OF ADMINISTRATION

- Aspirin: Oral
- Abciximab: IV
- Clopidogrel: Oral
- Pentoxifylline: Oral

COMPLICATIONS

Aspirin

GI effects (nausea, vomiting, dyspepsia)

NURSING CONSIDERATIONS

- Advise clients to use enteric-coated tablets and to take aspirin with food. **QEBP**
- Concurrent use of a proton pump inhibitor, such as omeprazole, might decrease GI effects.

Hemorrhagic stroke

CLIENT EDUCATION: Advise clients to observe for weakness, dizziness, and headache, and to notify the provider if effects occur.

Prolonged bleeding time, gastric bleed, thrombocytopenia

NURSING CONSIDERATIONS: Monitor bleeding time.

Monitor for gastric bleed, such as coffee-ground emesis or bloody, tarry stools. Monitor for bruising, petechiae, and bleeding gums.

Tinnitus, hearing loss

NURSING CONSIDERATIONS

- Monitor for hearing loss.
- If manifestations occur, withhold the dose and notify the provider.

Abciximab

Hypotension and bradycardia

NURSING CONSIDERATIONS: Monitor heart rate and blood pressure.

Prolonged bleeding time, gastric bleed, thrombocytopenia, bleed from cardiac catheterization site

NURSING CONSIDERATIONS

- Monitor bleeding time.
- Monitor for gastric bleed (coffee-ground emesis or bloody, tarry stools).
- Monitor for bruising, petechiae, and bleeding gums.
- Apply pressure to the cardiac catheter access site.

Clopidogrel

Bleeding

Prolonged bleeding time, gastric bleed, thrombocytopenia

NURSING CONSIDERATIONS

- Monitor bleeding time.
- Monitor for gastric bleed (coffee-ground emesis or bloody, tarry stools).
- Monitor for bruising, petechiae, and bleeding gums.
- Apply pressure to cardiac catheter access.

GI effects (diarrhea, dyspepsia, pain)

CLIENT EDUCATION: Teach the client to monitor for effects and notify the provider.

Pentoxifylline

Dyspepsia, nausea, vomiting

NURSING CONSIDERATIONS

- Take with food.
- Do not crush or chew medication.
- Monitor hydration if GI upset occurs.

CONTRAINDICATIONS/PRECAUTIONS

Aspirin

- Pregnancy Risk Category D in the third trimester.
- Contraindicated in clients who have bleeding disorders and thrombocytopenia.
- Use cautiously in clients who have peptic ulcer disease and severe kidney or hepatic disorders. Do not give to children or adolescents who have fever or recent chickenpox.
- Use with caution in older adults. **Ⓒ**

Abciximab

- Pregnancy Risk Category C.
- Contraindications include clients who have bleeding disorders, thrombocytopenia, recent stroke, AV malformation, aneurysm, uncontrolled hypertension, and recent major surgery.
- Use cautiously in clients who have peptic ulcer disease and severe kidney or hepatic disorders.

Clopidogrel

- Pregnancy Risk Category B
- Contraindications include clients who have bleeding disorders, thrombocytopenia, peptic ulcer disease, and intracranial bleed.
- Use cautiously in clients who have peptic ulcer disease and severe kidney or hepatic disorders. Clients who are breastfeeding should not take this medication.

Pentoxifylline

- Pregnancy Risk Category C.
- Contraindicated for clients who have bleeding disorders or retinal or cerebral bleeds.

INTERACTIONS

Aspirin

Concurrent use of other medications that enhance bleeding (NSAIDs, heparin, warfarin, thrombolytics, antiplatelets) increases risk for bleeding.

NURSING CONSIDERATIONS

- Advise clients to avoid concurrent use.
- If used concurrently, monitor carefully for indications of bleeding.

Urine acidifiers (ammonium chloride) can increase aspirin levels.

NURSING CONSIDERATIONS: Monitor for aspirin toxicity (hearing loss, tinnitus).

Concurrent use of aspirin can reduce hypertensive action of beta blockers.

NURSING CONSIDERATIONS: Monitor blood pressure.

Corticosteroids can increase aspirin excretion and decrease aspirin effects. These medications can increase risk for GI bleed.

NURSING CONSIDERATIONS

- Monitor for decreased aspirin effectiveness.
- Monitor for gastric bleed (coffee-ground emesis and tarry or bloody stools).

Caffeine can increase aspirin absorption.

NURSING CONSIDERATIONS: Monitor for toxicity.

Abciximab

Concurrent use of other medications that enhance bleeding (NSAIDs, heparin, warfarin, thrombolytics, antiplatelets) increases risk for bleeding.

NURSING CONSIDERATIONS

- Advise clients to avoid concurrent use.
- If used concurrently, monitor carefully for indications of bleeding.

Clopidogrel

Concurrent use of other medications that enhance bleeding (NSAIDs, heparin, warfarin, thrombolytics, antiplatelets) increases risk for bleeding.

NURSING CONSIDERATIONS

- Advise clients to avoid concurrent use.
- If used concurrently, monitor carefully for indications of bleeding.

Proton pump inhibitors decrease effectiveness.

NURSING CONSIDERATIONS: If needed for GI effects, pantoprazole interferes the least with platelet inhibition.

Pentoxifylline

Concurrent use of anticoagulants increases risk for bleeding.

NURSING CONSIDERATIONS: Monitor PT and INR. Clients can require reduced dosage.

Pentoxifylline can increase levels of theophylline.

NURSING CONSIDERATIONS: Monitor theophylline level. Clients can require reduced dosage.

NURSING ADMINISTRATION

- Advise clients that prevention of strokes, myocardial infarctions, and reinfarction can be accomplished with low-dose aspirin (81 mg).
- Aspirin 325 mg should be taken during initial acute episode of myocardial infarction.
- Advise clients to notify the provider regarding aspirin use. 
- Clopidogrel is sometimes prescribed concurrently with aspirin, which increases the risk for bleeding. Clopidogrel should be discontinued 7 days before an elective surgery.

NURSING EVALUATION OF MEDICATION EFFECTIVENESS

Depending on therapeutic intent, effectiveness can be evidenced by absence of arterial thrombosis, adequate tissue perfusion, and blood flow without occurrence of abnormal bleeding.

Thrombolytic medications

SELECT PROTOTYPE MEDICATION: Alteplase, often called tPA (tissue plasminogen activator)

OTHER MEDICATIONS

- Tenecteplase
- Reteplase

PURPOSE

EXPECTED PHARMACOLOGICAL ACTION: Thrombolytic medications dissolve clots that have already formed. Clots are dissolved by conversion of plasminogen to plasmin, which destroys fibrinogen and other clotting factors.

THERAPEUTIC USES

- Treat acute myocardial infarction (all three medications).
- Treat massive pulmonary emboli (alteplase only).
- Treat acute ischemic stroke (alteplase only).
- Restore patency to central IV catheters (alteplase only).

ROUTE OF ADMINISTRATION: IV only

COMPLICATIONS

ALTEPLASE

Bleeding

Serious risk of bleeding from different sites

- Internal bleeding: GI or GU tracts and cerebral bleeding
- Superficial bleeding: wounds, IV catheter sites

NURSING CONSIDERATIONS

- Limit venipunctures and injections.
- Apply pressure dressings to recent wounds.
- Monitor for changes in vital signs, alterations in level of consciousness, weakness, and indications of intracranial bleeding.
- Notify the provider if manifestations occur.
- Monitor aPTT and PT, Hgb, and Hct.

CONTRAINDICATIONS/PRECAUTIONS

- Pregnancy Risk Category C.
- Because of the additive risk for serious bleeding, use is contraindicated in clients who have the following. 
 - Any prior intracranial hemorrhage (hemorrhagic stroke)
 - Known structural cerebral vascular lesion (arteriovenous malformation)
 - Active internal bleeding
 - History of significant closed head or spinal trauma within past 2 months
 - Acute pericarditis or bacterial endocarditis
 - Brain tumors
 - Severe hepatic or kidney disorders
- Use cautiously in clients who have severe hypertension, cerebral vascular disorders, recent GU or GI bleeding, or major surgery within past 10 days, and in older adult clients.

INTERACTIONS

Concurrent use of other medications that enhance bleeding (NSAIDs, heparin, warfarin, thrombolytics, antiplatelets) increases risk for bleeding.

NURSING CONSIDERATIONS: If used concurrently, monitor the client carefully for indications of bleeding.

NURSING ADMINISTRATION

- Use of thrombolytic agents should take place as soon as possible after onset of manifestations (within 3 hr is best). **QESBP**
- Clients receiving a thrombolytic agent should be monitored in a setting that provides for close supervision and continuous monitoring during and after administration of the medication.
- Obtain baseline platelet counts, hemoglobin (Hgb), hematocrit (Hct), aPTT, PT, INR, and fibrinogen levels. Monitor periodically.
- Obtain baseline vital signs (heart rate, blood pressure), and monitor frequently per protocol.
- Nursing care includes continuous monitoring of hemodynamic status to assess for therapeutic and adverse effects of thrombolytic (relief of chest pain, indications of bleeding). Follow facility protocol.
- Provide for client safety per facility protocol.
- Ensure adequate IV access for administration of emergency medications and availability of emergency equipment.

- Do not mix any medications in an IV with thrombolytic agents.
- Minimize bruising or bleeding by limiting venipunctures and subcutaneous/IM injections. Hold direct pressure to injection site or ABG site for up to 30 min until oozing stops. **Qs**
- Discontinue thrombolytic therapy if life-threatening bleeding occurs. Treat blood loss with whole blood, packed red blood cells, and/or fresh frozen plasma. Ensure that IV aminocaproic acid is available for administration in the event of excessive fibrinolysis.
- Following thrombolytic therapy, administer heparin or aspirin as prescribed to decrease the risk of rethrombosis.
- Following thrombolytic therapy, administer beta blockers as prescribed to decrease myocardial oxygen consumption and to reduce the incidence and severity of reperfusion arrhythmias.
- Administer H₂ antagonists, such as ranitidine, or proton pump inhibitors, such as omeprazole, as prescribed to prevent GI bleeding.

NURSING EVALUATION OF MEDICATION EFFECTIVENESS

Depending on therapeutic intent, effectiveness can be evidenced by evidence of thrombus lysis and restoration of circulation (relief of chest pain, reduction of initial ST segment injury pattern as shown on ECG 60 to 90 min after start of therapy).

Application Exercises

1. A nurse is planning to administer subcutaneous enoxaparin 40 mg using a prefilled syringe of enoxaparin 40 mg/0.4 mL to an adult client following hip arthroplasty. Which of the following actions should the nurse plan to take?
 - A. Expel the air bubble from the prefilled syringe before injecting.
 - B. Insert the needle completely into the client's tissue.
 - C. Administer the injection in the client's thigh.
 - D. Aspirate carefully after inserting the needle into the client's skin.
2. A nurse is caring for a hospitalized client who is receiving IV heparin for a deep-vein thrombosis. The client begins vomiting blood. After the heparin has been stopped, which of the following medications should the nurse prepare to administer?
 - A. Vitamin K₁
 - B. Atropine
 - C. Protamine
 - D. Calcium gluconate
3. A nurse is planning to administer IV alteplase to a client who is demonstrating manifestations of a massive pulmonary embolism. Which of the following interventions should the nurse plan to take?
 - A. Administer IM enoxaparin along with the alteplase dose.
 - B. Hold direct pressure on puncture sites for up to 30 min.
 - C. Administer aminocaproic acid IV prior to alteplase infusion.
 - D. Prepare to administer alteplase within 8 hr of manifestation onset.
4. A nurse is monitoring a client who takes aspirin 81 mg PO daily. The nurse should identify which of the following manifestations as adverse effects of daily aspirin therapy? (Select all that apply.)
 - A. Hypertension
 - B. Coffee-ground emesis
 - C. Tinnitus
 - D. Paresthesias of the extremities
 - E. Nausea
5. A nurse is caring for a client who has atrial fibrillation and a new prescription for dabigatran to prevent development of thrombosis. Which of the following medications is prescribed concurrently to treat an adverse effect of dabigatran?
 - A. Vitamin K₁
 - B. Protamine
 - C. Omeprazole
 - D. Probenecid

Application Exercises Key

- A. The nurse should not expel the air bubble in the prefilled syringe prior to injection because the medication has been premeasured, and expelling the air could cause medication to be lost. An exception would be if the dosage needed to be adjusted prior to the injection.

B. **CORRECT:** The nurse should inject the needle on the prefilled syringe completely when administering enoxaparin in order to administer the medication by deep subcutaneous injection.

C. A deep subcutaneous injection should be administered into the subcutaneous tissue of the abdomen, at least 2 inches away from the umbilicus.

D. The nurse should not aspirate when administering enoxaparin or other heparin products subcutaneously.

NCLEX® Connection: Pharmacological and Parenteral Therapies, Medication Administration
- A. Vitamin K₁ is used to reverse the effects of warfarin.

B. Atropine is used to reverse bradycardia caused by beta adrenergic blockers.

C. **CORRECT:** Protamine reverses the anticoagulant effect of heparin.

D. Calcium gluconate is used to treat magnesium sulfate toxicity.

NCLEX® Connection: Pharmacological and Parenteral Therapies, Parenteral/Intravenous Therapies
- A. Enoxaparin is only available in a subcutaneous form. Subcutaneous and IM injections and other punctures should be avoided due to bleeding risk when alteplase is administered.

B. **CORRECT:** The nurse should plan to hold direct pressure on puncture sites for 10 to 30 min or until oozing of blood stops.

C. Aminocaproic acid is an antidote to alteplase and should only be administered in the event of serious bleeding that does not stop after blood products are administered or other remedies are tried. It would not be given prior to alteplase administration.

D. Alteplase must be administered as soon as possible after manifestations of myocardial infarction, pulmonary embolism, or cerebral vascular accident begin. Three hours is often the limit; client outcomes would be decreased if 8 hr elapsed before beginning alteplase.

NCLEX® Connection: Pharmacological and Parenteral Therapies, Medication Administration
- A. Hypotension and shock can result if severe aspirin allergy occurs, but hypertension is not an adverse effect of aspirin therapy.

B. **CORRECT:** GI bleeding with dark stools or coffee-ground emesis can be an adverse effect of aspirin therapy.

C. **CORRECT:** Tinnitus and hearing loss can occur as an adverse effect of aspirin therapy.

D. Paresthesias of the extremities are not adverse effects of aspirin therapy.

E. **CORRECT:** Nausea, vomiting, and abdominal pain can occur as a result of aspirin therapy.

NCLEX® Connection: Pharmacological and Parenteral Therapies, Adverse Effects/Contraindications/Side Effects/Interactions
- A. Vitamin K₁ is used to treat hemorrhage or overdose of warfarin, but it is not an antidote for dabigatran.

B. Protamine is used to treat severe hemorrhage or overdose of heparin, but is not an antidote for dabigatran.

C. **CORRECT:** Omeprazole or another proton pump inhibitor is prescribed for a client who is taking dabigatran and has abdominal pain and other GI findings that can occur as adverse effects of dabigatran. The nurse should advise the client who has GI effects to take dabigatran with food.

D. Probenecid is used to treat gout and gouty arthritis, and is not indicated to treat an adverse effect of dabigatran.

NCLEX® Connection: Pharmacological and Parenteral Therapies, Medication Administration

PRACTICE Active Learning Scenario

A nurse is teaching a client who has a new prescription for clopidogrel following a myocardial infarction. What should the nurse teach the client about this medication? Use the ATI Active Learning Template: Medication to complete this item.

THERAPEUTIC USES: Identify for clopidogrel in this client.

COMPLICATIONS: Identify two adverse effects for this medication.

NURSING INTERVENTIONS: Describe three, including one test the nurse should monitor periodically.

PRACTICE Answer

Using the ATI Active Learning Template: Medication

THERAPEUTIC USES: Clopidogrel inhibits platelet aggregation and prolongs bleeding time. It is used to prevent myocardial infarction (MI) or stroke in clients who have already had an MI or stroke.

COMPLICATIONS: Like other platelet inhibitors, clopidogrel can cause bleeding due to thrombocytopenia. It can also cause GI effects, such as abdominal pain, nausea, and diarrhea.

NURSING INTERVENTIONS

- The nurse should plan to monitor the platelet count periodically while the client takes clopidogrel.
- Teach the client to monitor for bleeding. The client should watch for black stools, coffee-ground emesis, blood in the urine, nose bleeds, unusual bruising, or petechiae. The client should inform the provider if these occur and about GI effects.
- The nurse should be aware of all medications the client is taking, because risk for bleeding increases if the medication is taken with anticoagulants or antiplatelet medications. Clopidogrel is sometimes administered concurrently with aspirin, and that increases the risk for bleeding. The medication should be discontinued 7 days before any elective surgery.

NCLEX® Connection: Pharmacological and Parenteral Therapies, Medication Administration