Introduction to Clinical Pharmacology

Chapter 36 Anticoagulant and Thrombolytic Drugs

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Learning Objectives

1. Describe hemostasis and thrombosis.
2. Explain the uses, general drug actions, adverse reactions, contraindications, precautions, and interactions of anticoagulant, antiplatelet, and thrombolytic drugs.
3. Distinguish important preadministration and ongoing assessment activities the nurse should perform on the client taking an anticoagulant, antiplatelet, or thrombolytic drug.
4. List nursing diagnoses particular to a client taking an anticoagulant, antiplatelet, or thrombolytic drug.
5. Examine ways to promote an optimal response to therapy, how to manage common adverse reactions, and important points to keep in mind when educating clients about the use of anticoagulant, antiplatelet, and thrombolytic drugs.

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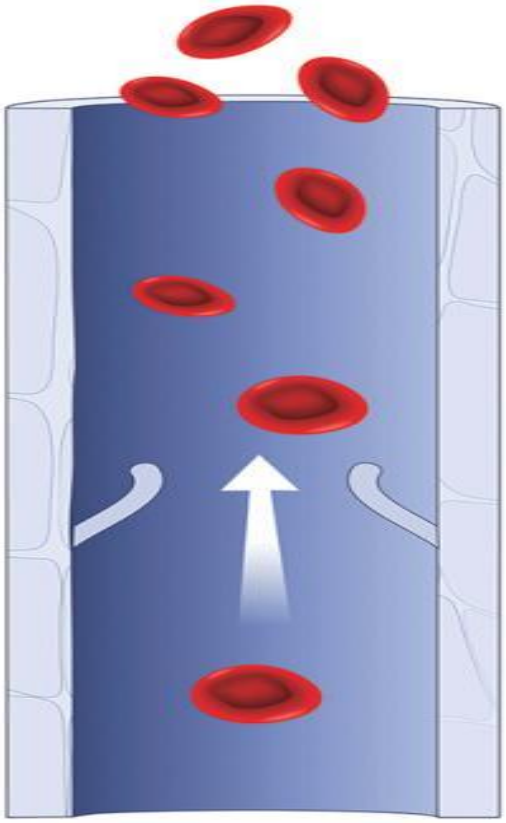
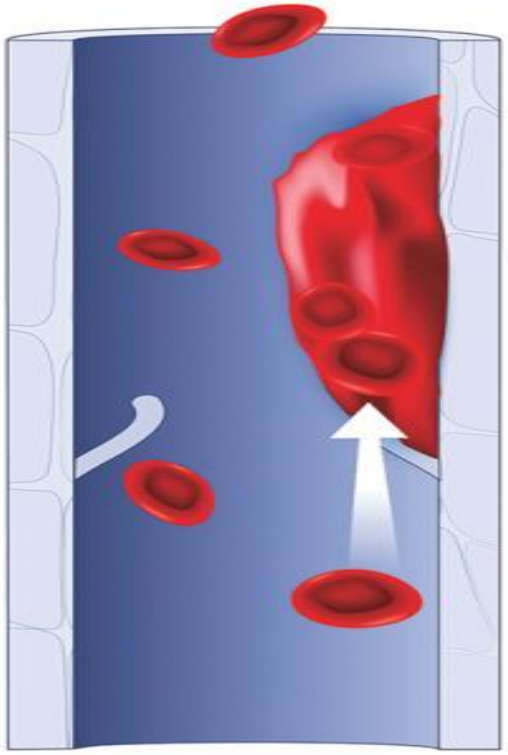
Hemostasis

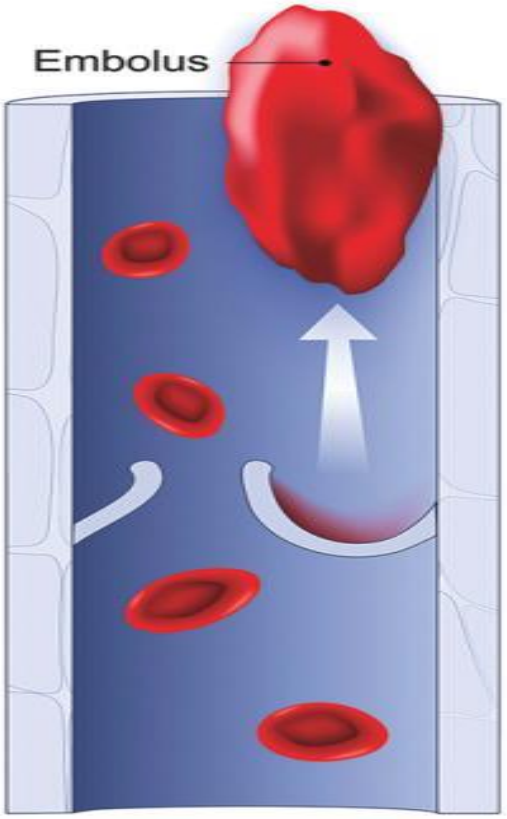
- A complex process by which fibrin forms and blood clots



Normal blood flow



Blood clot formation



Blood clot, that travels through the bloodstream

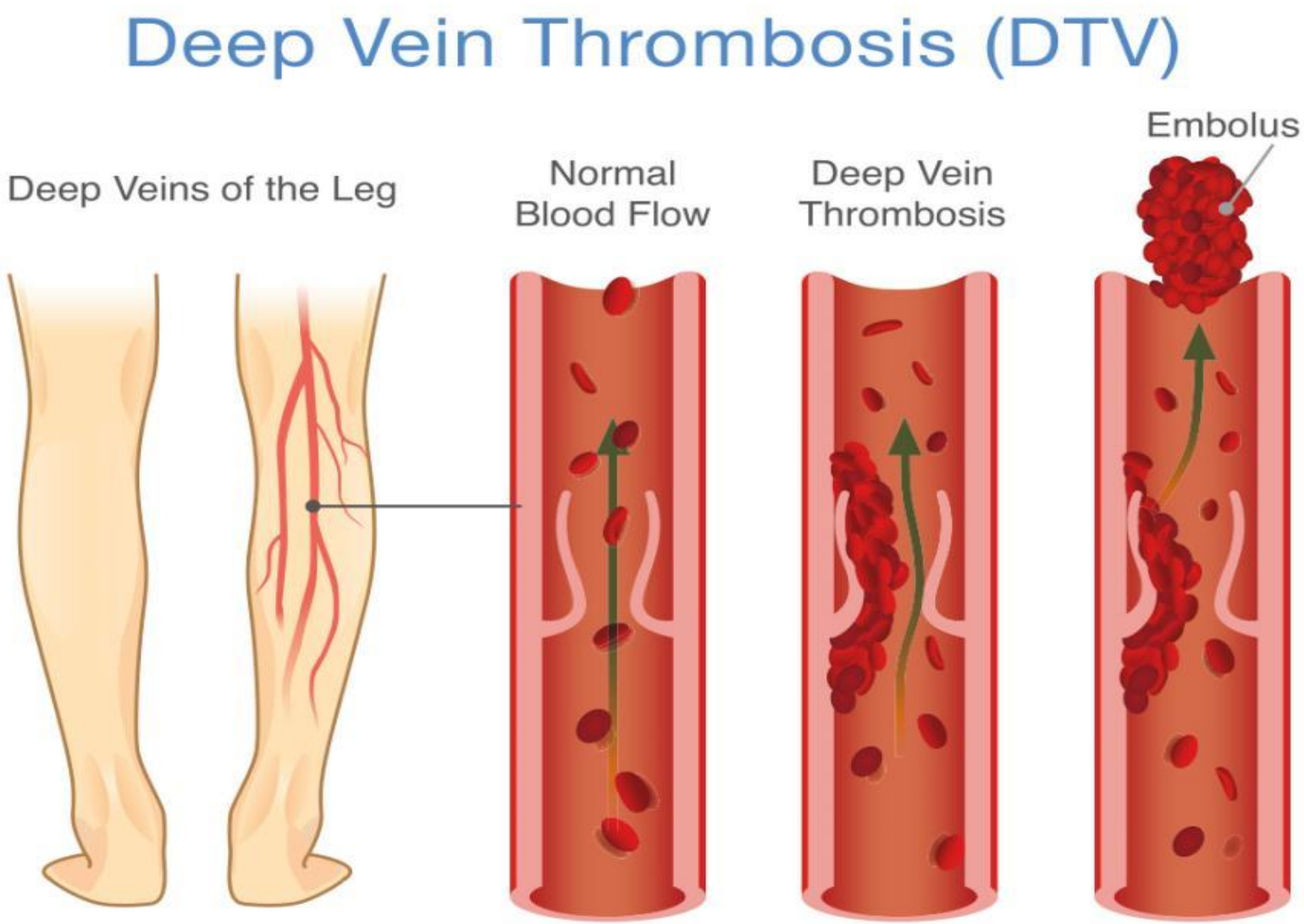
Thrombosis

- Formation of a blood clot or “thrombus”

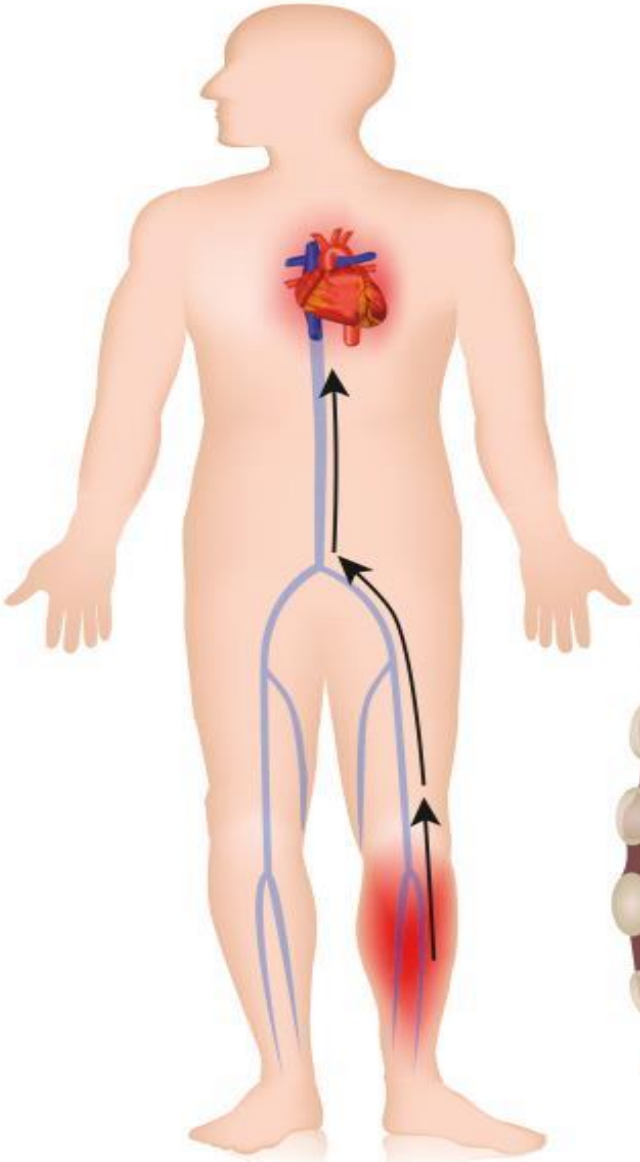
Thrombosis

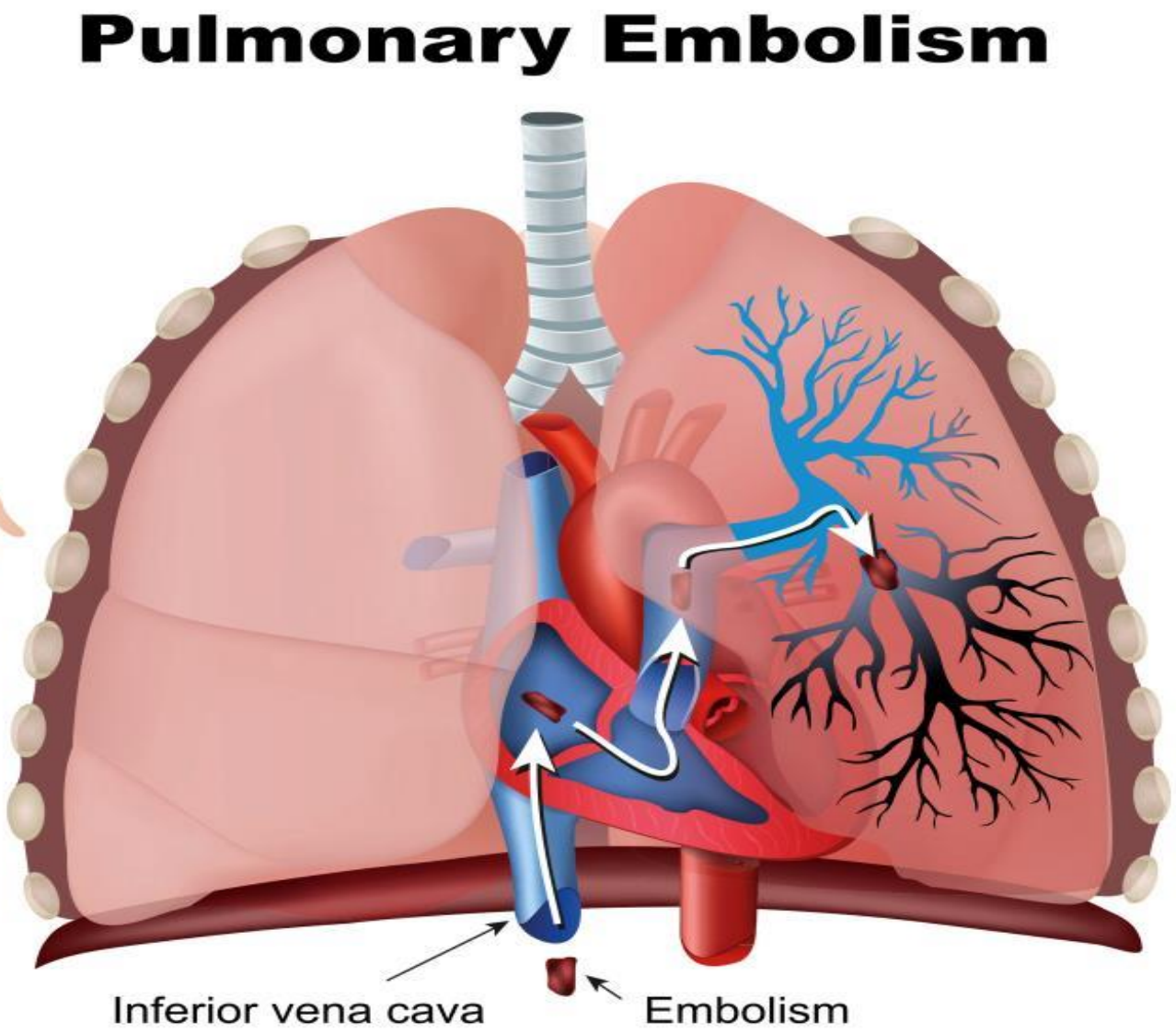
- Arterial thrombosis is caused by atherosclerosis and/or arrhythmias.
- Venous thrombosis is cause by decreased blood flow, injury to the vessel wall, and/or altered blood coagulation

Deep Vein Thrombosis

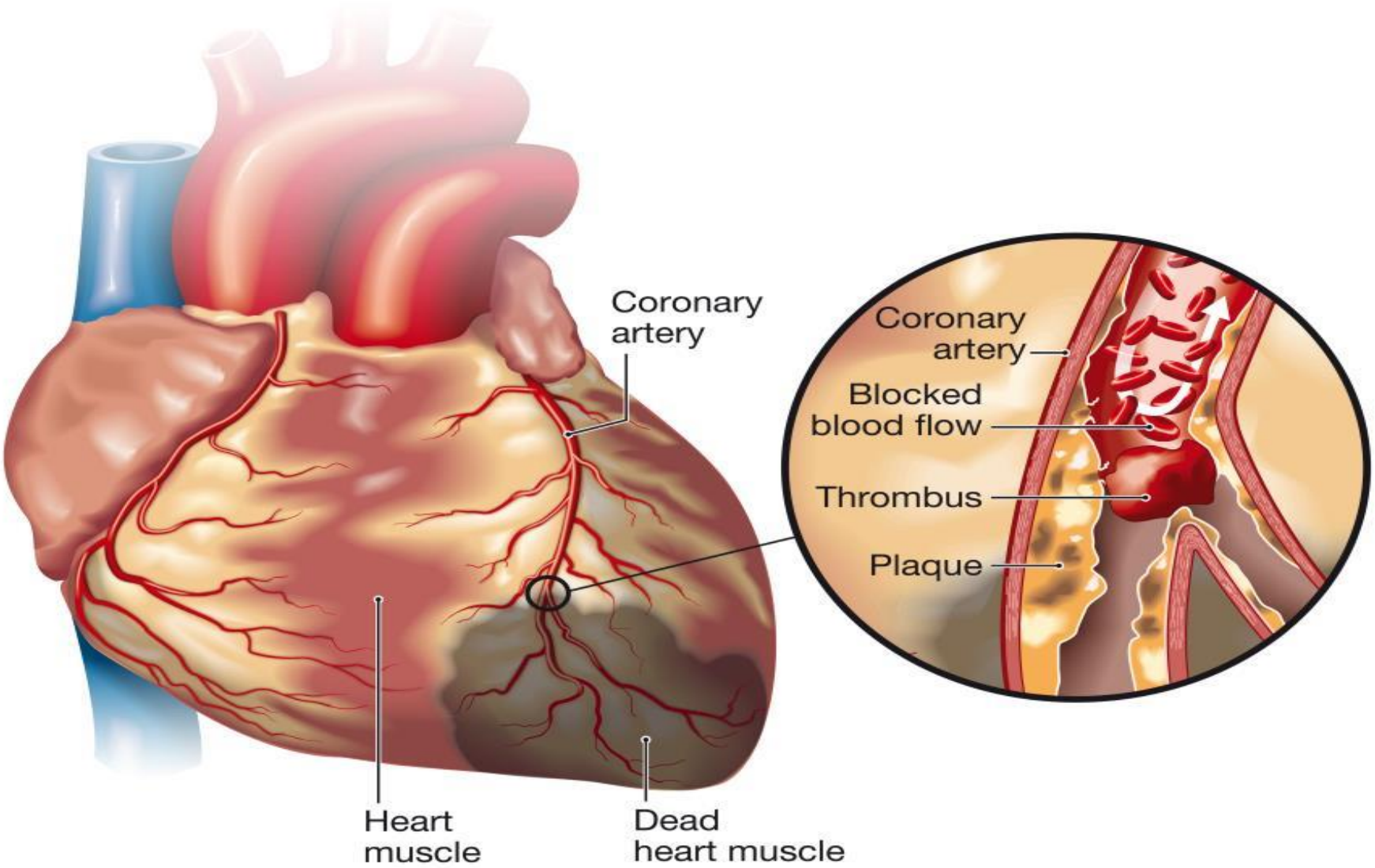


Pulmonary Embolism





Myocardial Infarction



Oral and Parenteral Anticoagulants

- Anticoagulants: prevent the formation and extension of a thrombus; used prophylactically in clients at risk for clot formation ("blood thinners")
  - Warfarin: oral and parenteral anticoagulant
  - Heparin sodium
  - Low-molecular-weight heparins (LMWHs) or fractionated heparins
    - Produce stable responses when administered at recommended dosages; bleeding less likely to occur
  - Direct-acting oral anticoagulants
    - Direct thrombin inhibitors
  - Factor X inhibitors

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Oral and Parenteral Anticoagulants—Actions

- All anticoagulants interfere with clotting mechanisms of the blood
- Warfarin: depletes prothrombin, VII, IX, and X
- Heparin:
  - Inhibits formation of fibrin clots
  - Must be taken parenterally
- LMWHs: inhibit the synthesis of factor X and the formation of thrombin (ex. Dalteparin, Enoxaparin)
- DAOCs: target specific portions of the coagulation cascade (inhibit thrombin or factor X)

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Oral and Parenteral Anticoagulants—Uses

- Used for:
  - Prevention formation & extension of a blood clot (Enoxaparin)
  - Prevention and treatment of DVT
  - Prevention and treatment of atrial fibrillation with embolization
  - Prevention and treatment of PE
  - Adjuvant treatment of MI
  - Prevention of thrombus formation after valve replacement surgery

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Parenteral Anticoagulants—Uses

- Parenteral anticoagulants are specifically used for:
  - Prevention of postoperative DVT and PE in certain clients undergoing surgical procedures
  - Prevention of clotting in arterial and heart surgery, in the equipment used for extracorporeal circulation, in blood transfusions, and in blood samples for the laboratory
  - Prevention of repeat cerebral thrombosis in some clients who have experience stroke
  - Treatment of coronary occlusion, acute MI, and peripheral arterial embolism
  - Diagnosis and treatment of DIC
  - Maintaining patency of IV catheters

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Oral and Parenteral Anticoagulants—Adverse Reactions #1

- Bleeding Reactions:
  - Mild to severe
  - Bruising or petechiae
  - Bleeding from bladder, bowel, stomach, uterus, or mucous membranes

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Oral and Parenteral Anticoagulants—Adverse Reactions #2

- Gastrointestinal System Reactions:
  - Nausea
  - Vomiting
  - Abdominal cramping
  - Diarrhea

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Oral and Parenteral Anticoagulants—Adverse Reactions #3

- Other Reactions:
  - Alopecia
  - Rash or urticaria
  - Hepatitis
  - Jaundice
  - Thrombocytopenia
  - Blood dyscrasias
  - Local irritation (heparin subcutaneous)
  - Hypersensitivity

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Oral and Parenteral Anticoagulants—Contraindications #1

- Contraindicated in clients with:
  - known hypersensitivity to the drugs
  - active bleeding
  - hemorrhagic disease
  - tuberculosis
  - leukemia
  - uncontrolled hypertension
  - GI ulcers
  - recent surgery of the eye or CNS

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Oral and Parenteral Anticoagulants—Contraindications #2

- Contraindicated in clients with:
  - aneurysms
  - severe renal or hepatic disease
  - lactation
  - pregnancy (oral and parenteral meds)
  - hypersensitivity to pork (LMWHs)
  - Jewish/Muslim culture (religious practices)

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Oral and Parenteral Anticoagulants—Precautions #1

- Used cautiously in clients with:
  - fever
  - heart failure or hypertension
  - diarrhea
  - diabetes
  - malignancy
  - renal or hepatic disease
  - psychoses or depression
  - a potential site for bleeding or hemorrhage
  - an epidural or spinal anesthesia

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Oral and Parenteral Anticoagulants—Precautions #2

- Used cautiously in clients with:
  - mechanical heart valves
  - genetic sensitivities to warfarin
  - antiepileptic or HIV antiretroviral treatment (warfarin is preferred)
  - apixaban (monitored by the Risk Evaluation and Mitigation Strategy Program due to greater chance of stroke when discontinued)
  - childbearing age women (use reliable contraceptives)

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Oral and Parenteral Anticoagulant—Interactions #1

Interacting Drug	Common Use	Effect of Interaction
Aspirin, acetaminophen, NSAIDs, and chloral hydrate	Pain relief and sedation	Increased risk of bleeding
Penicillin, aminoglycosides, isoniazid, tetracyclines, and cephalosporins	Anti-infective agents	Increased risk for bleeding
Beta-blockers and loop diuretics	Treatment of cardiac problems	Increased risk for bleeding

Oral and Parenteral Anticoagulant—Interactions #2

Interacting Drug/Food	Common Use	Effect of Interaction
Disulfiram and cimetidine	Management of GI distress	Increased risk of bleeding
Oral contraceptives, barbiturates, diuretics, and vitamin K	Birth control, sedation, treatment of cardiac problems, and treatment of bleeding disorders	Decreased effectiveness of the anticoagulant
Grapefruit juice	Part of diet	Increase serum levels of apixaban and rivaroxaban

Antiplatelet Drugs—Actions

- Antiplatelets prevent thrombus formation in the arterial system
- Actions: work by decreasing the platelets' ability to stick together (aggregate)
- Aspirin: prohibits aggregation for lifetime of platelets
- ADP blockers: alter the platelet cell membrane, preventing aggregation
- Glycoprotein receptor blockers: prevent enzyme production, inhibiting platelet aggregation

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Antiplatelet Drugs—Uses

- Used to treat clients at risk for:
  - Acute coronary syndrome
  - MI
  - Stroke
  - Intermittent claudation

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Antiplatelet Drugs—Adverse Reactions

- Common Adverse Reactions:
  - Heart palpitations
  - Bleeding
  - Dizziness and headache
  - Nausea, diarrhea, constipation and dyspepsia

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Antiplatelet Drugs—Contraindications

- Contraindicated in clients with:
  - known hypersensitivity to the drugs
  - congestive heart failure
  - active bleeding
  - pregnancy and lactation

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Antiplatelet Drugs—Precautions

- Used cautiously in:
  - Older adults
  - Pancytopenic clients (taking Cilostazol)
  - Renal or hepatic impairment
  - Pregnancy
- Discontinue use 1 week prior to surgery

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Antiplatelet Drugs—Interactions

Interacting Drug	Common Use	Effect of Interaction
Aspirin and NSAIDs	Pain relief	Increased risk of bleeding
Macrolide antibiotics	Anti-infective agents	Increased effectiveness of anti-infective
Digoxin	Management of cardiac problems	Decreased digoxin serum levels
Phenytoin	Control of seizure activity	Increased phenytoin serum levels

Thrombolytic Drugs—Actions

- Thrombolytics, or fibrolytics, dissolve blood clots that have already formed within the walls of the blood vessel; reopen the blood vessel after they have already been occluded
- Actions: the action of each thrombolytic is slightly different but most break down fibrin clots by converting plasminogen to plasmin; plasmin is an enzyme that breaks down the fibrin in a blood clot

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Thrombolytic Drugs—Uses

- Used to treat:
  - Acute stroke or MI by lysis of blood clots in coronary artery
  - Blood clots causing pulmonary emboli and DVT
  - Suspected occlusions in central venous catheters

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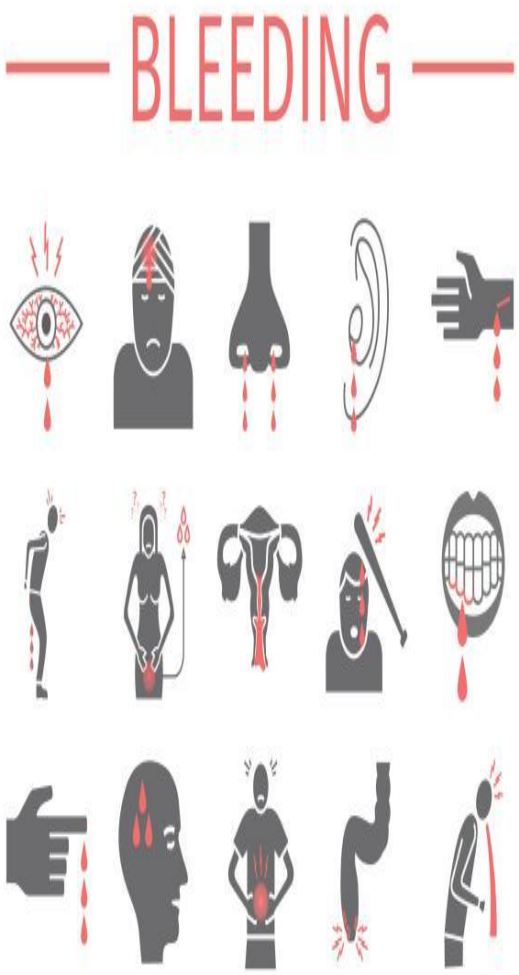
Thrombolytic Drugs—Adverse Reactions

- Bleeding Reactions:
  - Internal in GI or GU tract and brain
  - External or superficial at areas of broken skin, venipunctures, or recent surgical sites
- Allergic reactions can also occur



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Thrombolytic Drugs—Contraindications

- Contraindicated in clients with:
  - known hypersensitivity to the drugs
  - active bleeding
  - history of stroke
  - aneurysm
  - recent intracranial surgery

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Thrombolytic Drugs—Precautions

- Used cautiously in clients:
  - With recent major surgery (within 10 days)
  - status post coronary bypass grafting
  - who experienced stroke, trauma, vaginal or cesarean section, GI bleeding or trauma within the last 10 days
  - with hypertension, diabetic retinopathy, or any possible condition with bleeding
  - who are currently taking anticoagulants
  - who are pregnant

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Thrombolytic Drugs—Interactions

Interacting Drug	Common Use	Effect of Interaction
Aspirin	Pain relief	Increased risk for bleeding
Dipyridamole	Antiplatelet	Increased risk for bleeding
Anticoagulant	Prevent blood clots	Increased risk for bleeding

Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #1

- **Pre-administration Assessment**
- **Objective Data**
  - Vital signs
  - Inspect physical appearance, noting skin color, temperature and pain, differences bilaterally
  - Palpate for pedal pulses (note rate and strength)

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #2

- Pre-administration Assessment
- Objective Data
  - Test for a positive Homan sign (positive test suggests DVT)
  - Laboratory tests: baseline prothrombin time (PT), international normalized ratio (INR), and activated partial thromboplastin time (aPTT) if heparin is being administered (before 1st dose)
  - Thrombolytic agent use—CBC and radiologic testing such as CT scan

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Nursing Process—Client Receiving an Anticoagulant Antiplatelet, or Thrombolytic Drug #3

- Pre-administration Assessment
- Subjective Data
  - History and reason for clotting experience
  - Pain assessment if experiencing pain
  - Medical/family history
  - Current list of all drugs and supplements

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #4

- **Ongoing Assessment**
  - Close assessment and careful monitoring for:
    - Signs of bleeding or hemorrhage; assess gums, nose, stools, urine, or NG drainage
    - Level of consciousness (intracranial bleeding)
  - Warfarin:
    - Daily PT/INR measurements until the levels stabilized; then monitored every 4 to 6 weeks
  - Heparin:
    - Daily aPTT monitoring
  - Periodically monitor platelet counts, hematocrit, and occult blood in stool
  - Monitor for signs of hypersensitivity reaction

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #5

- Nursing Diagnosis
  - Injury Risk related to excessive bleeding due to drug therapy
  - Altered Health Seeking Behavior related to preparing to communicate drug use if incapacitated
  - Anxiety related to fear of atypical bleeding during thrombolytic drug therapy

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #6

- Planning
  - Expected client outcomes depend on the reason for administration of the drug but include
    - Optimal response to therapy
    - Management of adverse drug reactions
    - Confidence in an understanding of the prescribed medication regimen

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Nursing Process—Client Receiving an Anticoagulant Antiplatelet, or Thrombolytic Drug #7

- Implementation
  - *Promoting Optimal Response to Therapy—Oral Administration of Anticoagulants*
    - DAOCs have a fixed dose; do not require blood monitoring
    - Warfarin: loading dose may be prescribed for 2 to 4 days followed by a maintenance dose; adjusted based on PT/INR; give dose in evening at specified time
    - Optimal therapeutic results—PT is 1.2 to 1.5 times the control value
    - Encourage client to maintain a stable
      - level of vitamin K in diet

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #8

- Implementation
  - Promoting Optimal Response to Therapy—Parenteral Administration of Anticoagulants
    - Administration of heparin: intermittent IV, continuous IV infusion, or subcutaneous route
    - Inspect needle site for signs of inflammation, pain, and tenderness along pathway of vein
    - Choose the strength of the heparin vial closest to the prescribed dose (e.g., 1000 units per mL; 5000 units per mL)
    - To prevent medication errors, read heparin vials carefully and prevent distractions while preparing drug

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Nursing Process—Client Receiving an Anticoagulant Antiplatelet, or Thrombolytic Drug #9

- Implementation
  - Promoting Optimal Response to Therapy—Parenteral Administration of Anticoagulants
    - Continuous IV heparin must be administered via IV pump; check infusion pump every 1 to 2 hours
    - Subcutaneous heparin administration: rotate injection sites
    - Apply firm pressure after subcutaneous administration of heparin to avoid hematoma formation
    - Inspect injection sites for sign of inflammation and hematoma formation

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #10

- **Implementation**
  - ***Promoting Optimal Response to Therapy—Parenteral Administration of Anticoagulants***
  - **Monitor coagulation laboratory tests before, during, and after heparin therapy as indicated (perform blood tests q4hrs)**
    - **Drugs for DVT prevention come in prefilled syringes; do not expel air bubble; administer in deep subcutaneous tissue; do not aspirate**
    - **Withhold the drug and notify the provider if:**
      - **The PT exceeds 1.5 times the control value**
      - **There is evidence of bleeding**
      - **The INR is greater than 3**

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #11

- Implementation
  - Promoting Optimal Response to Therapy—Administration of Thrombolytics
    - Administer the thrombolytic drug as soon as possible after the formation of a thrombus (within 4 to 6 hours)
    - Assess client for bleeding until therapy is completed; vital signs
    - Administer opioid analgesic for pain management

Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #12

- Implementation
  - Monitoring and Managing Client Needs
    - Injury Risk
      - Notify all healthcare providers that client is on an anticoagulant
      - Check for signs of bleeding:
        - Drop in blood pressure, rise in pulse rate
        - Inspect skin and mucous membranes for bruising; nose bleeds, cuts, scratches, bleeding after injections
        - Inspect urine stool, urine, emesis, NG contents for blood
        - Check toothbrush and gums for blood after oral care

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #13

- Implementation
  - Monitoring and Managing Client Needs
    - Altered Health Seeking Behavior
      - Educate about food and drug interactions
      - Instruct client to wear medical identification to indicate receiving anticoagulant or antiplatelet therapy and report anticoagulant therapy to all healthcare providers
      - Teach client the reason for prolonged pressure on venipuncture sites

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #14

- Implementation
  - Monitoring and Managing Client Needs
    - Anxiety
      - Reassure client and communicate with family member
      - Assess for signs of internal and external bleeding and hemorrhage
      - If uncontrolled bleeding is noted or if there are signs of internal bleeding, stop the drug immediately and notify the healthcare provider
      - Monitor vital signs and for signs of allergic reactions

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #15

- Implementation
  - Managing Anticoagulant Overdosage
    - Oral Anticoagulants
      - Monitor for symptoms of warfarin overdosage:
        - Blood in stool; petechiae
        - Oozing from superficial injuries
        - Excessive menstrual bleeding
      - Provider typically withholds oral anticoagulant for a few days or orders the administration of vitamin K; idarucizumab reverses the direct thrombin inhibitor—dabigatran
      - Phytoniadone is used to reverse the effect of Warfarin overdosage.
      - Administration of whole blood or plasma may be necessary if severe bleeding occurs

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #16

- Implementation
  - Managing Anticoagulant Overdosage
    - Parenteral Anticoagulants
      - Discontinue drug if there are signs of overdosage; effects are usually immediate
      - Provider may order PROTAMINE-specific heparin antagonists/antidote and also effective with LMWH overdose
      - Monitor blood pressure and pulse rate after administration of antidote
      - Observe new evidence of bleeding until blood coagulation tests are within normal limits
      - Blood transfusions or fresh frozen plasma may be ordered

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #17

- **Implementation—Educating the Client and Family**
  - Notify pharmacist that client requires education on anticoagulant therapy; reinforce teaching
  - Emphasize the importance of drug therapy and following the therapeutic drug regimen
  - Educate the client about the adverse reactions and to contact the primary healthcare provider if adverse reactions occur

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #18

- **Implementation—Educating the Client and Family**
  - Teach the client:
    - that PT and INR will be drawn and monitored
    - to inform all healthcare providers of anticoagulant use
    - to avoid alcohol
    - to be aware of foods high in vitamin K and try to keep a consistent level of vitamin K in diet (green leafy vegetables)
    - to monitor and report signs of bleeding

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #19

- **Implementation—Educating the Client and Family**
  - Teach the client to:
    - use a soft toothbrush and consult dentist regarding oral hygiene routine
    - avoid the use of an electric razor
    - use reliable contraception (if woman of childbearing age)
    - wear or carry medical identification notifying others of anticoagulant therapy

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Nursing Process—Client Receiving an Anticoagulant, Antiplatelet, or Thrombolytic Drug #20

- **Evaluation**
  - Was the therapeutic effect achieved and blood coagulation controlled?
  - Were adverse reactions: identified, reported, and managed?
    - No injury is evident
    - Client enhances health behavior effectively
    - Anxiety is managed successfully
  - Did client and family express confidence and demonstrate understanding of drug regimen?

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Pharmacology in Practice Exercise #1

- A nurse will initiate anticoagulant therapy with a client. In which of the following client conditions is an anticoagulant contraindicated? Select all that apply.

a) Diabetic retinopathy

b) Tuberculosis

c) GI bleeding

d) Leukemia

e) Hemorrhagic disease

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Pharmacology in Practice Exercise#2

- A client is being seen at an urgent care facility for the treatment of severe acute angina. A nurse is administering sublingual nitroglycerin to the client every 5 minutes. What is the maximum number of doses of nitroglycerin the nurse should administer before reporting no improvement to the primary health care provider?

a) 3 doses in a 15-minute period

b) 5 doses in a 30-minute period

c) 7 doses in a 30-minute period

d) 9 doses in a 60-minute period

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Pharmacology in Practice Exercise #3

- A nurse is caring for a client who has been administered heparin following the administration of a thrombolytic drug to prevent another thrombus from forming. What should the nurse monitor for in the client after the administration of heparin?

a) Internal bleeding

b) Difficulty in breathing

c) Excessive perspiration

d) Skin rash

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