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Anticoagulant Agents: Prophylactic Heparin

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After completion the learner should be able to:

1. Identify cause and risk factors for VTE.
2. Discuss VTE prophylaxis in hospital setting.
3. Correctly calculate dosage for heparin.

Venous Thrombosis and Embolism

Thrombosis is a result of dysfunctional hemostatic mechanisms that cause formation of a clot within a blood vessel. The type and severity of disease caused by thrombosis depends on the location of the clot, degree of blood flow obstruction, and whether the clot breaks off and travels to other body parts.

Venous thrombosis usually occurs where blood flow is slow, causing venous stasis. Accumulation of thrombin and coagulation substances initiates the clotting process, with formation of a clot and the resulting obstruction of blood flow. A venous thrombus can break off from the site of origin and travel to other parts of the body, becoming an embolus. Emboli traveling from the deep veins in the legs often lodge in the pulmonary arteries, resulting in pulmonary embolus (PE), a life-threatening condition. These two conditions are referred to as venous thromboembolism (VTE).

According to data from the Joint Commission, VTE affects an estimated 900,000 Americans annually, causing up to 100,000 deaths. Even though VTE affects up to 15% of hospitalized patients, the CDC states that fewer than half of patients at risk receive appropriate thromboprophylaxis while hospitalized.

The risk of VTE is significantly increased in people having reduced mobility, hospitalization, surgery, and cancer. For this reason, preventive measures to reduce the risk of VTE during hospitalization are important. A common preventive measure is the prophylactic administration of anticoagulant agents, such as unfractionated heparin and low-molecular weight heparin.

Heparin

Unfractionated heparin (UFH) is an anticoagulant that is used to prevent or inhibit the formation of clots, rather than dissolve formed clots. Heparin is a natural substance primarily found in the liver and was first used in 1938 to prevent clotting in blood transfusions. Indications for heparin include treatment of thromboembolic disorders, such as VTE and disseminated intravascular coagulation (DIC). Low dose therapy is used to prevent VTE for patients experiencing myocardial infarction, major abdominal or thoracic surgery, orthopedic procedures such as knee and hip arthroplasty, gynecologic surgery and conditions that cause prolonged immobility.

Low molecular weight heparin (LMWH) has been in use in the US since the FDA approval of enoxaparin (Lovenox) in 1993. Since that time, several other LMWHs have been approved by the FDA, and two are in current use, enoxaparin (Lovenox) and dalteparin (Fragmin). Like unfractionated heparin, LMWH prevents or inhibits the formation of clots, rather than dissolving formed clots. And, like heparin, LMWH is not absorbed via the GI tract, and so must be administered parenterally.

LMWH is a shortened form of the heparin molecule, resulting in a much smaller molecule. Its small size gives LMWH several advantages over UFH. LMWH does not bind to plasma proteins, macrophages, platelets, and endothelium as much as UFH does. This results in longer half-life, greater bioavailability, and possibly reduced bleeding, compared to UFH. LMWH produces very predictable plasma levels, allowing for a fixed dose 1—2 times daily, and eliminating the need for the frequent laboratory monitoring required by UFH. This predictable therapeutic response makes LMWH appropriate for use in the home setting.

Risk Factors for VTE

There are many risk factors for VTE, and they are cumulative. The more risk factors a patient has, the greater the risk for VTE. Hospitals use a variety of risk assessment models to identify patients who would benefit from thrombo-prophylaxis. These models typically assign points for various risk factors, to aid in determining if prophylaxis is warranted. For example, not all surgical patients require VTE prevention with anticoagulants, but it is indicated in certain types of surgery and in surgical patients with additional risk factors.

Risk factors for development of VTE include:

Trauma	Age over 40 yrs, highest risk over 75 yrs
Critical illness	Surgery, especially knee or hip arthoplasty
Immobility	Inflammatory bowel disease
Previous VTE	Respiratory disease
Family hx of VTE	Overweight or obese
Cancer	Heart failure, MI, or stroke
Spinal cord injury	Thrombophilic disorder
Dehydration	Sepsis
Hormone therapy	Pregnancy or postpartum

Types of Thromboprophylaxis

Measures to help prevent VTE in the hospital setting include pharmacologic and mechanical interventions. Pharmacologic options include the parenteral heparins UFH, enoxaparin, and dalteparin. Fondaparinux (Arixtra), an injectable factor Xa inhibitor, may be used for patients undergoing knee or hip arthroplasty or hip fracture surgery. The oral factor Xa inhibitors apixaban (Eliquis) and rivaroxaban (Xarelto) are approved for VTE prevention in patients having knee or hip arthroplasty. Argatroban (Acova), an injectable direct thrombin inhibitor, is approved for use in patients with a history of heparin-induced thrombocytopenia (HIT). It does not trigger production of the antibodies that reduce platelet count in HIT.

Mechanical interventions include devices to promote circulation in the legs, such as intermittent pneumatic compression devices and graduated compression stockings. These non-pharmacologic measures may be used for patients at lower risk for VTE. They are also used for patients at higher risk who are also at high risk for bleeding, and for whom anticoagulant use is not recommended. This may include patients with bleeding disorders, active bleeding, lumbar puncture, spinal/epidural anesthesia, neurosurgical procedures, severe liver disease, severe thrombocytopenia, or renal impairment with creatinine clearance <30 ml/min. Concurrent use of other anticoagulant, antiplatelet or thrombolytic agents also increases the risk of bleeding.

VTE Prophylaxis and Nursing Implications

All patients should be assessed for risk of VTE within 24 hours of admission, using the facility's models and guidelines. Patients categorized as low risk may be managed with early ambulation and/or use of pneumatic compression devices or graduated compression stockings.

When pharmacologic therapy is indicated, heparin or LMWH are commonly used. A standard dose of heparin for VTE prophylaxis is 5000 units every 8-12 hours by deep subcutaneous injection. LMWH can be administered less frequently, due to its longer half-life. Enoxaparin is commonly administered at a dose of 40 mg once daily or 30 mg every 12 hours subcutaneously. Patients with obesity may require higher doses, while those with renal impairment may need lower doses. Heparin and LMWH are usually administered for up to 7-14 days, or until the patient is fully ambulatory. In some cases, therapy is continued for 30 days or longer.

Because VTE prophylaxis involves low-dose therapy, most patients do not require ongoing laboratory monitoring. If monitoring is done, common testing includes periodic platelet counts to watch for HIT, hematocrit to monitor for bleeding, and coagulation tests— aPTT for UFH, and anti-factor Xa levels for LMWH.

UFH and LMWH should be injected into the fatty layer of the abdomen, avoiding the area 2 inches around the umbilicus. Injection sites should be rotated, with documentation of the site used. A fine-gauge needle, 25-27g, should be used. The air bubble in the prefilled syringes should not be expelled, as it allows complete delivery of the dose and prevents leaking of the drug up through the injection tract. To minimize trauma and bruising, do not aspirate before injecting or massage the site after. The injections may result in pain, bruising, induration or hematoma formation. Measures that may help to reduce these include applying a cold pack before and after the injection, injecting slowly over 10-30 seconds, leaving the needle in for 10 seconds, withdrawing the needle slowly, and applying pressure to the site for 30 seconds after needle removal.

The patient should be monitored for signs of VTE, including edema, redness, pain or local tenderness in the leg, and new shortness of breath, chest pain, cough, or hemoptysis. Monitoring for signs of bleeding is also important, since bleeding can occur even with low-dose therapy. Notify the physician promptly if the patient begins to bruise easily or develops petechiae, nosebleeds, blood in urine or stool, dark or tarry stools, or vomiting or coughing up blood.

Through careful assessment, monitoring, and administration of anticoagulant agents, the nurse can promote safe and effective thromboprophylaxis.

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Competency Assessment Tool

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PEAK DEVELOPMENT RESOURCES LLC

Anticoagulant Agents: Prophylactic Heparin

NAME:_____ DATE: _____ UNIT:_____

Directions: Place the letter of the one best answer in the space provided.

_____1. The type and severity of disease caused by thrombosis depends on:
A. the degree of blood flow obstruction
B. whether the clot travels to another area
C. the location of the clot
D. all of the above

_____2. Emboli breaking off from the deep veins in the legs commonly lodge in the:
A. ascending aorta
B. right atrium
C. pulmonary arteries
D. pulmonary veins

_____3. According to the CDC, fewer than half of hospitalized patients at risk for venous thromboembolism (VTE) receive appropriate thromboprophylaxis.
A. True
B. False

_____4. Compared to unfractionated heparin, low-molecular weight heparin (LMWH) has which of the following benefits:
A. shorter half-life
B. decreased bioavailability
C. predictable plasma levels
D. readily absorbed through the GI tract

_____5. A major advantage of LMWH over unfractionated heparin is that LMWH can be used to dissolve clots, such as with MI or deep vein thrombosis.
A. True
B. False

_____6. All surgical patients are at risk for VTE and should receive thromboprophylaxis with anticoagulant drugs.
A. True
B. False

_____7. Oral factor Xa inhibitors, such as apixaban (Eliquis) are approved for VTE prevention in patients having:
A. thrombophilic disorders
B. knee or hip arthoplasty
C. inflammatory bowel disease
D. obesity

_____8. Which of the following anticoagulant agents is least likely to cause heparin-induced thrombocytopenia:
A. dalteparin (Fragmin)
B. unfractionated heparin
C. enoxaparin (Lovenox)
D. argatroban (Acova)

_____9. Measures to help prevent bruising with subcutaneous heparin injections include all of the following EXCEPT:
A. using a fine-gauge needle, 25-27g
B. injecting slowly, over 10-30 seconds
C. removing the needle quickly
D. applying pressure after the injection

_____10. Drug Order: Enoxaparin 40 mg subcutaneously once daily
Drug Label: Enoxaparin injection 300 mg per 3 ml
Give:
A. 0.4 ml
B. 0.8 ml
C. 1.2 ml
D. 2.5 ml

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Employee Name	Unit	Test Date	Score