

Anticoagulation Therapy Management

January 2007

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Unit I

Chapter 1

Normal Pathophysiology of the Coagulation System



Normal Physiology of the Coagulation System

- Objectives

- Describe the process of hemostasis, including the sequence of the three stages that prevent blood loss
- Briefly describe the series of events that occur in the extrinsic pathway, the intrinsic pathway, and the common pathway
- Describe the major functions of thrombin and fibrin



Normal Physiology of the Coagulation system

- Hemostasis – process by which bleeding is stopped. Three basic mechanisms operate to prevent blood loss:
 - Vascular spasm
 - Platelet plug formation – adherence of platelets to damaged endothelium
 - Generation of thrombin – tissue factor, phospholipids and collagen generate thrombin. This enzyme converts fibrinogen to fibrin.



Pathophysiology of the Coagulation System

- Coagulation pathways
 - Extrinsic pathway
 - Occurs rapidly, within seconds if trauma is severe
 - Requires the release of tissue thromboplastin (tissue factor)
 - Together, tissue thromboplastin, coagulation factor VII, and Ca^{++} ions activate factor X
 - Once factor X is activated, it reacts with the membrane phospholipids, prothrombin activator, prothrombin, thrombin, fibrinogen then fibrin



Pathophysiology of the Coagulation System

- Intrinsic Pathway
 - Occurs more slowly, usually requiring several minutes
 - Triggered when blood comes into contact with the underlying collagenous fibers of damaged blood vessels that activate factor XII
 - Activated factor XII activates factor XI which activates factor IX



Pathophysiology of the Coagulation System

- Intrinsic Pathway (con't)
 - Once factor IX is activated, it acts with factor VIII, Ca^{++} ions, and platelet phospholipids to activate factor X
 - Once factor X is activated, it reacts with phospholipids, then prothrombin activator, prothrombin, thrombin, fibrinogen and then fibrin



	Extrinsic Pathway	Intrinsic Pathway
	<i>Dominant pathway</i>	
	<i>Rapid initiation of clotting</i>	<i>Slower process</i>
Initiated by	Tissue Factor	Collagen
	Tissue factor + Factor VII + Ca ²⁺ ions → Activation of Factor X and Factor IX	Collagen + blood → Activation of Factor XII →
		↓ Factor XI
		↓ Factor IX
		↓ Factor VIII + CA ²⁺ ions + phospholipids →
Common Pathway	Activation of Factor X ↓ Factor X + phospholipids → Prothrombin activator	Activation of Factor X ↓
		Factor X + phospholipids → Prothrombin activator
	Prothrombin → Thrombin → Fibrinogen → Fibrin	Prothrombin → Thrombin → Fibrinogen → Fibrin



Pathophysiology of the Coagulation System

- The role of Vitamin K and clot formation
 - Vitamin K is not involved in actual clot formation, but is required for the synthesis of prothrombin (factor II) and factors, VII, IX, and X
 - Because it is fat-soluble, it can be absorbed through mucosa of the intestines and into the blood only if attached to fat



Chapter 1

Questions

1. Define hemostasis and discuss the 3 basic mechanisms that prevent blood loss
2. List the four vitamin K dependent clotting factors and briefly describe the role of Vitamin K in the clotting process
3. Briefly outline the coagulation cascade – extrinsic, intrinsic and common pathway



Unit 1

Chapter 2

Pathophysiology of the Coagulation System



Pathophysiology of the Coagulation System

- Objectives
 - Define the terms thrombosis and embolus
 - List the three contributing factors to the formation of an abnormal clot (Virchow's Triad)
 - List 3 protein deficiencies that can result in clinically significant thromboses



Pathophysiology of the Coagulation System

- Thrombosis – the formation, development, or existence of a blood clot within the vascular system
 - Virchow's Triad
 - Circulatory stasis
 - Endothelial injury
 - Hypercoagulable state



Pathophysiology of the Coagulation System

- Embolus – intravascular clot that floats within the blood
 - Pulmonary Embolus (PE)
 - Cerebral Embolus
 - Coronary Embolus
 - Peripheral Vascular Thrombi (systemic thrombi)



Pathophysiology of the Coagulation System

- Differences between a clot and a thrombus
 - A thrombus never forms outside a blood vessel, clots usually do
 - A thrombus develops from and maintains a point of attachment to a blood vessel's wall
 - Clots are formed as a less homogeneous mass, a thrombus yields a mass in which the blood components are highly organized



Disorders of clot formation - Inherited

- Activated Protein C Resistance – Factor V Leiden
- Protein S deficiency
- Protein C deficiency
- Antithrombin III Deficiency



Activated Protein C Resistance

- Most common hypercoagulable state
- Prevalence in patients with idiopathic DVT = 12-40%
- Enhances Factor Xa's conversion of prothrombin to thrombin and coagulation is not inhibited



Protein S Deficiency

- Similar to Protein C deficiency
- Autosomal dominant
- First incidence of DVT often occurring before age of 25 years



Protein C Deficiency

- Autosomal dominant
- 75% of major thrombotic events occur spontaneously
- In protein C deficiency, both intrinsic and extrinsic coagulation cascade can activate Factor X (needs vitamin K)
- Ultimately leads to excess thrombin formation and unrestricted clot formation



Antithrombin III Deficiency

- Multiple coagulation steps are unbalanced and the coagulation cascade may proceed unrestrained
- Patients may have DVTs that occur in their teen years



Unit I

Chapter 2 Questions

1. Define thrombosis and embolus
2. List the three contributing factors to clot formation
3. List 3 hypercoagulable states



Unit 1

Chapter 3

Clinical Manifestations of Coagulation Disorders



Clinical Manifestations of Coagulation Disorders

- Objectives
 - Recognize the most frequent signs and symptoms of deep vein thrombosis (DVT), pulmonary embolism (PE), peripheral arterial ischemia/infarct
 - List the most frequent signs and symptoms of coronary artery disease (CAD), cardiac ischemia/infarct, atrial fibrillation (AFib) and heart failure
 - Recognize the most frequent signs and symptoms of cerebral vascular accident (CVA) and transient ischemic attack (TIA)



Clinical Manifestations of Coagulation Disorders

- Objectives (con't)
 - Identify the types of cardiac replacement valves commonly in use
 - List risk factors for stroke in patients with atrial fibrillation



Clinical Manifestations of the Coagulation System

- DVT
- Pulmonary Embolism
- Peripheral Artery Disease
- Peripheral Vascular Disease
- Atrial Fibrillation/Flutter
- Heart Failure
- CVA
- TIA
- AMI



Clinical Manifestations of Coagulation Disorders

- DVT
 - Symptoms – often very nonspecific and symptomatic; pain in a limb made worse by standing or walking and better with rest and elevation
 - Clinical findings – swelling of affected lower extremity above or below the knee; unilateral edema; positive Homan's sign (calf pain on dorsiflexion of the foot with knee slightly flexed); fever



Clinical Manifestations of Coagulation Disorders

- PE
 - Risk factors – surgery, especially orthopedic surgery; immobilization; cancer; CHF; pregnancy; hypercoagulable states
 - Symptoms – chest pain occurs in 80-90% of cases, classically described as pleuritic; dyspnea; hemoptysis; palpitations or feeling of apprehension
 - Clinical findings – tachypnea; tachycardia; normal lung exam or localized wheezing or possible pleural rub; atrial arrhythmias and other EKG changes; signs of DVT



Clinical Manifestations of Coagulation Disorders

- Peripheral Artery Disease (PAD)
 - Symptoms – intermittent claudication is the hallmark symptom, which produces cramping, pain, weakness or numbness in affected muscles; rest pain occurs in advanced disease; approximately 50% of patients with clinically evident lower extremity PAD are symptomatic



Clinical Manifestations of Coagulation Disorders

- PAD (con't)
 - Clinical findings – diminished or absent pulses; arterial bruits; arterial insufficiency; ischemic ulcers that are painful, dry, pale and often have a black necrotic crust; ulcers usually occur on the heels or toes; lower extremity pallor within one minute after leg elevation to 60 degrees and return of color delayed more than 15 seconds after lowering



Clinical Manifestations of Coagulation Disorders

- PVD

- Symptoms - sense of heaviness/fullness in the legs; burning sensation, especially around the ankles; aching of legs which is partially relieved by elevation of the extremity
- Clinical findings – edematous legs, feet and ankles; discoloration of legs with splotchy brown patches, especially around ankles; difficult to palpate distal pulses due to edema of feet and ankles; varicosities; wet, weeping ulcers, usually over the medial malleoli



Clinical Manifestations of Coagulation Disorders

- Atrial Fibrillation
 - Symptoms – palpitations; dizziness; dyspnea; other symptoms related to decrease in cardiac output from loss of atrial contractions
- Chronic Heart Failure
 - Symptoms – dyspnea on exertion; orthopnea; fatigue; edema; paroxysmal nocturnal dyspnea
 - Clinical findings – jugular vein distention; lung crackles; 3rd heart sound; hepatomegaly; cardiomegaly



Clinical Manifestations of Coagulation Disorders

- Acute Heart Failure
 - Symptoms – sudden, extreme dyspnea; pink, frothy sputum; diaphoresis
 - Clinical findings – patient appears cyanotic with cold clammy skin; acute onset of HTN or hypotension; new heart sounds (S3) or new murmur; pulmonary crackles



Clinical Manifestations of Coagulation Disorders

- CVA
 - Symptoms – aphasia; dysarthria; headache; coma; impaired level of consciousness
 - Clinical findings – carotid bruits; anatomic localization of neurologic deficits; retinal hemorrhage



Clinical Manifestations of Coagulation Disorders

- TIA
 - Symptoms – hemiparesis; aphasia; paresthesias; visual loss; diplopia
 - Clinical findings – most patients with TIA are neurologically intact by the time they come for medical attention; carotid bruit; retinal emboli; atrial fibrillation



Clinical Manifestations of Coagulation Disorders

- Myocardial Infarction
 - Symptoms – crushing chest pain often radiating to the jaw; substernal pain often radiating to the back; N/V; diaphoresis; diabetic patients may not experience any pain due to neuropathy; women often have only fatigue or burning in the throat as primary symptoms
 - Clinical findings – irregular heart rate; hyper or hypotension; tachycardia or bradycardia; dyspnea; EKG changes



Prosthetic Heart Valves

- Prosthetic Heart Valves
 - Mechanical valves – St. Jude's valve, need lifelong anticoagulation
 - Bioprosthetic valves – tissue valves, anticoagulation for at least 3 months



Unit 1

Chapter 3 Questions

1. Mrs. Martin, a 58 year-old female with a history of DVT presents to your clinic for management of her anticoagulant therapy. After completing an initial history, you discover that Mrs. Martin is unaware of common signs and symptoms of DVT. List 3 signs and symptoms of DVT that you would include in your teaching plan for this patient.



Unit 1

Chapter 3 Questions

2. Compare and contrast the signs of PAD and PVD?
3. List two clinical signs that may be associated with atrial fibrillation or atrial flutter?
4. List the two most commonly used prosthetic heart valves and the risk of thromboembolic events with each valve?



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