Deep Vein Thrombosis

Description/Etiology
Deep vein thrombosis (DVT) refers to the development of one or more blood clot (i.e., thrombus) in the deep veins of the pelvis or extremities. Although a lower extremity is usually involved, 10% of cases of DVT involve an upper extremity. The thrombus can inhibit circulation or can embolize (i.e., become dislodged and travel through the blood) and lodge in the brain, heart, or lung. DVT can lead to pulmonary embolism (PE), a potentially fatal condition if not treated promptly (for more information, see Quick Lesson About ... Pulmonary Embolism: an Overview ). Other potential complications include chronic venous insufficiency, post-thrombotic syndrome (PTS; i.e., a chronic condition characterized by pain, skin induration, leg edema, venous dilatation, and in severe cases, ulceration), and, rarely, phlegmasia cerulean dolens (i.e., a swollen, blue, painful leg).

Virchow’s triad of venous stasis, venous injury, and hypercoagulability of the blood describes three categories of factors that contribute to thrombosis. The causes of DVT are complex and multifactorial, and risk increases as the number of patient risk factors increases (see Risk Factors, below). Diagnosis of DVT is difficult because patients are often asymptomatic and, when symptomatic, often experience nonspecific symptoms. DVT is diagnosed based on clinical presentation, the presence of risk factors, blood tests, and imaging studies.

Treatment goals include clot removal, reduction in size and extension of the thrombotic occlusion, and prevention of PE. Anticoagulant therapy is given to reduce the thrombotic process and prevent new thrombus formation. Typical anticoagulant therapy involves unfractionated heparin (UFH) or low molecular weight heparin (LMWH) followed by long-term vitamin K antagonist (e.g., warfarin [Coumadin]) therapy; factor Xa inhibitors (e.g., rivaroxaban, fondaparinux) can also be used for long-term anticoagulant therapy. The International Society on Thrombosis and Hemostasis recommends 3 months of anticoagulant therapy for patients with unprovoked calf DVT and 3–6 months for patients with unprovoked DVT above the knee. Additional treatment options include thrombolytic therapy, inferior vena cava (IVC) filter placement, and endovascular procedures (e.g., catheter-directed thrombolysis [CDT], percutaneous mechanical thrombectomy [PMT]). Anticoagulant prophylaxis is considered appropriate in patients at high risk for DVT; those considered to be at lower risk can be candidates for mechanical prophylaxis (e.g., graduated compression stockings, intermittent pneumatic compression devices). (For more information on prevention of DVT, see Quick Lesson About...Deep Vein Thrombosis: Prevention --an Overview.)

Facts and Figures
The estimated incidence of DVT is 1–2:1,000 persons each year; approximately 5% of persons will develop DVT at some point during their lifetime. In the United States, there are approximately 600,000 hospitalizations for DVT each year, and as many as 300,000 deaths occur each year due to massive PE secondary to DVT. Lower extremity DVT is the source of 90% of acute PEs. PE is the underlying cause of up to 10% of in-hospital deaths. DVT usually develops in persons aged > 40 years and the incidence of DVT is increased 4-fold in older adults, compared with younger adults. The male-to-female ratio is 1.2:1. DVT is results in PTS in 25–38% of cases and venous ulceration in 10%.
**Risk Factors**
Risk factors for development of DVT include immobilization, age > 60 years, malignancy (especially pancreatic, liver, and ovarian; for more information, see *Quick Lesson About ... Thromboembolism, Venous, and Cancer*), cancer therapy, trauma, obesity (body mass index [BMI] > 30), recent major surgery, pregnancy and puerperium (for more information, see *Quick Lesson About ... Thromboembolism, Venous, in Pregnancy*), oral contraceptives, hormone therapy, heart or respiratory failure, smoking, central venous catheterization, previous DVT, hyperviscosity (e.g., sickle cell disease, polycythemia), acquired (e.g., antiphospholipid syndrome, hyperhomocysteinemia) and inherited thrombophilias (e.g., factor V Leiden, antithrombin deficiency), and certain other medical conditions (e.g., inflammatory bowel disease, systemic lupus erythematosus).

**Signs and Symptoms/Clinical Presentation**
Many cases of DVT are asymptomatic and are only diagnosed after PE develops. Symptoms of DVT include limb pain (which is less common in DVT of an upper extremity) that is generally throbbing in nature, tenderness, edema, skin warmth and erythema, and fever > 100.4 °F (38 °C). A positive Homans’ sign (i.e., pain on forced dorsiflexion of the foot) can be present, although this is not a consistent indicator of DVT. The lower extremities can become cyanotic and edematous in inferior vena cava DVT. Pain, tenderness, and edema can develop in the face, neck, back, and upper extremities if the superior vena cava is involved. Venous claudication (i.e., leg pain elicited by activity that increases the intravenous pressure), is a debilitating manifestation of PTS.

**Assessment**

» **Laboratory Tests**
  - Platelet count, bleeding time, and clotting assays (e.g., PT/international normalized ratio [INR], and activated partial thromboplastin time [aPTT]) can be ordered to determine coagulation status
  - D-dimer (i.e., a fibrin split product) assay can be ordered; negative D-dimer assay excludes DVT, while positive result warrants further testing
  - Tests to assess for hypercoagulable conditions that increase DVT risk can be ordered

» **Other Diagnostic Tests/Studies**
  - Compression ultrasonography is the preferred method of testing for proximal DVT; venous ultrasonography has a mean sensitivity of 97% and specificity of 94% for diagnosis of DVT
  - Contrast venography, although still considered the gold standard, is currently being replaced by ultrasonography as an initial screening tool for diagnosing DVT
  - MRI can also be used to noninvasively diagnose DVT
  - A validated risk DVT risk assessment tool, such as the Wells score, can be used to assess pre-test probability of DVT

**Treatment Goals**

» **Promote Optimum Physiologic Function and Reduce Risk of Complications**
  - Closely monitor the DVT site and vital signs; assess all physiologic systems; monitor laboratory/diagnostic study results; immediately report abnormalities and treat, as ordered
  - Administer prescribed anticoagulants; monitor for treatment efficacy and adverse effects
    - Initial therapy generally involves UFH or LMWH (e.g., enoxaparin [Lovenox]); warfarin, which is appropriate for long-term but not initial therapy, is started concurrently with heparin
    - Monitor for complications of anticoagulant therapy, including bleeding and heparin-induced thrombocytopenia (HIT; i.e., an uncommon but serious complication of heparin therapy); to evaluate for HIT, measure platelet count when starting heparin therapy and recheck every 3–5 days
    - Monitor INR in patients on warfarin (see *Red Flags*, below)
  - Follow facility pre- and postsurgical/procedure protocols if patient becomes a candidate for a procedure (e.g., CDT, PMT, IFC filter placement)
    - Reinforce pre- and postsurgical/procedure education and verify completion of facility informed consent documents
  - Apply anti-embolism stockings or intermittent pneumatic compression, as ordered
  - Carefully reposition the patient at regular intervals and mobilize as ordered
  - Use support pads, bed cradles, mattresses, and therapeutic beds as needed and prescribed
Support Emotional Well-Being and Educate

- Assess patient’s anxiety level and coping ability; educate and encourage discussion about DVT etiology, potential complications, prevention, treatment risks and benefits, participation in rehabilitation, and the challenge of recovering from a disabling condition

Food for Thought

- DVT and PE are manifestations of the same disease, termed venous thromboembolism (VTE; for more information, see *Quick Lesson About ... Thromboembolism, Venous*)
- Thrombolytic agents (e.g., streptokinase, urokinase) are rarely used in DVT, but can be ordered in rare cases of extensive iliofemoral venous thrombosis if the patient is at low risk for bleeding
- Age-associated increase in D-dimer level results in decline in the specificity of D-dimer testing in older adults. Other conditions associated with elevated D-dimer levels include malignancy, infection, pregnancy, surgery, inflammation, disseminated intravascular coagulopathy, and renal dysfunction
  - An age-adjusted D-dimer cutoff value obtained by multiplying 10 μg/L by the patient’s age is often used instead of the conventional cutoff of 500 μg/L. Researchers in a study of 138 patients with a mean age of 71.6 years determined that, in patients at low DVT risk based on Wells score, the cutoff value can be raised to 25 μg/L x age, while maintaining a sensitivity of 100% (Gómez-Jabalera et al., 2018)

Red Flags

- **Contraindications** to warfarin therapy include pregnancy (but not breastfeeding), hypersensitivity, active bleeding, recent surgery, lumbar puncture, and advanced liver disease
- Verify that patients receiving warfarin have an INR in the range of 2.0–3.0 to prevent bleeding or clotting; the risk for recurrent VTE increases when the INR drops below 2.0, and the risk for bleeding is higher when the INR is over 3.0
- **Monitor closely for signs and symptoms of PE** (e.g., tachycardia, hypotension, transient pleural friction rub, crackles, low oxygen saturation, cyanosis, syncope, and distended neck veins)

What Do I Need to Tell the Patient/Patient’s Family?

- Instruct the patient to eliminate modifiable risk factors associated with DVT, including oral contraceptive use, hormone replacement therapy, smoking, sedentary lifestyle, and obesity
- Advise the patient to avoid prolonged sitting or standing in one position, and to flex knees and rotate ankles on automobile or airplane trips longer than 4 hours
- Educate about the signs and symptoms of PE (e.g., sudden-onset dyspnea, tachypnea, pleuritic chest pain) and the importance of seeking immediate medical attention should they occur
- Educate about the importance of strict adherence to the anticoagulation regimen (e.g., taking the medication at the same time daily), testing clotting time regularly, avoiding activities that can cause bleeding or bruising, and wearing a medical alert bracelet
- Emphasize the importance of regular movement and exercise, even in patients with PTS, because they improve flexibility without increasing symptoms

References
