

Deep Vein Thrombosis

by Patricia Emanuele, MSN, COHN-S

ABSTRACT

This article reviews the incidence, causes, risk factors, diagnosis, treatment, complications, and prevention of deep vein thrombosis (DVT). Various employees, including long-distance drivers or travelers, sedentary office workers, females taking estrogen, those who are obese, those who have cancer, and those who are hospitalized, may be at risk for developing this condition. Genetic testing can determine some inherited factors predisposing workers to clotting. Low-molecular weight heparins can be used to manage DVT on an outpatient basis.

Occupational health nurses frequently encounter employees who have been diagnosed with blood clots and deep vein thrombosis (DVT). Employees in various occupations, especially those in transportation, air travel, confined spaces, and sedentary office positions, are at high risk for DVT. The risk for DVT increases in employee populations with common factors (e.g., obesity, previous hospitalizations, cancer, older age, pregnancy, and use of oral contraceptives or hormone replacement therapy). This article disseminates current information about DVT in an effort to raise awareness of this condition, educate employees, promote health, and prevent disease, disability, and death.

INCIDENCE, ETIOLOGY, AND RISK FACTORS OF DVT

Blood clots can occur in any deep vein in the body, but most often form in the deep veins of the calf, causing DVT. According to the American Heart Association (2008), DVT occurs in 1 of every 1,000 Americans each year, affecting men and women alike. Whites and Blacks have a significantly higher incidence than Hispanics,

Asians, or Pacific Islanders. Nearly 600,000 Americans are hospitalized annually for DVT-related complications that kill up to 300,000. DVT is possibly the most common preventable cause of hospital death in the United States (Coalition to Prevent DVT, 2007). A clot in a deep vein can travel and occlude the blood flow to the lungs, causing a pulmonary embolism. A total occlusion results in death.

DVT may form for a variety of reasons, including trauma to a deep vein, abnormal blood clotting, and limited blood flow through a deep vein. In some cases, no cause is ever identified.

Any trauma injuring blood vessels can cause irritation and inflammation, raising the blood's clotting factors. However, DVT is most likely to occur after major trauma, especially fractures of the pelvis, hips, or legs, which is relevant to high-risk industries (i.e., construction).

Abnormal blood clotting and certain hypercoagulable states predispose the formation of clots (thrombophilia). Clot formation can be related to inherited tendencies or acquired factors predisposing clots, such as congenital deficiency of antithrombin, protein C or protein S deficiency, Factor V Leiden mutation, elevation of clotting Factor VIII, IX, or X, or possibly elevated homocysteine levels. According to the Centers for Disease Control and Prevention (CDC, 2008b), approximately 5% to 8% of

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Risk Factors for Deep Vein Thrombosis

Immobility
Older age
Individual or family history of deep vein thrombosis
Smoking
Dehydration
Cancer
Varicose veins
Surgery or other hospitalizations
Certain heart or respiratory conditions
Obesity
Pregnancy
Certain medications, especially those containing estrogen

the U.S. population has one of these clotting disorders, for which blood and genetic testing is now available. Testing is often recommended after an episode of DVT, and individuals with thrombophilia may be counseled to reduce other risk factors. Temporary prophylaxis during periods of high risk (i.e., major surgery) may be required.

Inactivity and prolonged immobility can cause blood to pool and clot. Occupational health nurses should be aware that the risk of DVT increases for long-distance drivers or travelers, sedentary office workers, and those who experience major injuries, immobilization, dehydration, or prolonged air travel (i.e., soldiers). DVT is often dubbed “Economy Class Syndrome” because during long flights, air travelers sit cramped in seats without moving and may be dehydrated due to decreased fluid intake or the use of alcohol during flight. The Mayo Clinic (Mayo-Clinic.com, 2007) recommends that passengers on flights lasting more than 4 hours stretch their calves at least once an hour. Flexing the feet several times promotes blood flow in the deep veins within the leg muscles.

The risk for developing DVT increases with age, individual or family history of DVT, smoking, dehydration, cancer, varicose veins, surgery or other hospitalizations, certain heart or respiratory diseases, obesity, and pregnancy. The hormones found in birth control pills or hormone replacement therapy, especially estrogen, are assumed to increase the risk of clot formation by 3 to 4 times (James, Ortel, & Tapson, 2008). According to the American Heart Association (2008), the annual incidence of DVT among postpartum women was 3 times higher than pulmonary embolism, something to remember when employees return to the workplace. Also, employees who have had breast cancer and take tamoxifen should be monitored for DVT.

The risk of developing DVT increases with additional risk factors. For example, Factor V Leiden, present in 15% to 20% of those with DVT (James et al., 2008), com-

bined with birth control pills, increases the risk for DVT dramatically. The obese female employee taking tamoxifen and flying for 8 hours is at high risk. The Sidebar on this page lists risk factors for DVT.

SYMPTOMS OF DVT

DVT warning signs can evolve over several days or develop rapidly over a few hours. These may include warmth, tenderness, or redness or discoloration in the affected area—usually in one calf. The calf may feel tight, heavy, or pulled. Sometimes, only slight discomfort or severe pain increasing upon standing or walking is experienced. Also, it is possible to have no signs or symptoms. According to the U.S. Department of Health and Human Services (2008), only half of those with DVT report symptoms.

Occupational health nurses should refer employees for diagnosis and treatment before clots are dislodged and move to the lungs. DVT is commonly diagnosed using a noninvasive test called a Doppler ultrasound. Invasive testing requires ascending contrast venography (injecting dye into a foot vein) and is rarely used today. The D-dimer blood test measures a fragment of fibrin present in blood after the formation of a blood clot. The test is not always useful in determining DVT but excludes the diagnosis if the result is zero or very low.

TREATMENT

Immediate treatment for DVT includes medications and self-care measures. Depending on the severity of symptoms, hospitalization may be required or the employee may be sent home. Anticoagulants, or “blood thinners,” prevent new clots from forming and stop existing clots from extending. However, the body itself dissolves the existing clot. Heparin or a form of heparin is injected immediately, while an oral anticoagulant (warfarin) is often concurrently prescribed. Warfarin requires several days to take effect; once it does, the heparin is discontinued. Warfarin is often taken for 6 months and requires frequent laboratory evaluations to measure the body’s clotting ability and prevent over or under dosage. The Sidebar on the next page lists warfarin precautions. The International Normalized Ratio is the standard unit used to report the result of a prothrombin time. The higher the International Normalized Ratio, the longer it takes blood to clot. Individuals not taking anticoagulants typically have an International Normalized Ratio of approximately 1.0; the International Normalized Ratio range for those taking warfarin is ordinarily between 2.0 and 3.0. Currently, low-molecular weight heparins such as delteparin, enoxaparin, and tinzaparin can be self-administered subcutaneously into the abdomen once or twice a day with safety and efficacy and without the expense of hospitalization.

Sometimes, it is necessary to dissolve a clot when life or limb is threatened. Alteplase (tissue plasminogen activator) is an example of a medication used to dissolve clots. Individuals who are unable to take anticoagulants or achieve adequate anticoagulation require that a fine mesh filter be placed in the inferior vena cava to catch clots before they block blood flow to the lungs. Although

Warfarin Precautions

- Take warfarin at the same time each day.
- Observe safety measures because cuts may bleed longer and bumps or bruises can lead to serious internal bleeding.
- Wear Medic Alert identification.
- Use an electric razor.
- Use a soft toothbrush.
- Avoid aspirin and ibuprofen and check with a health care provider before taking other medications.
- Stop taking warfarin during pregnancy.
- Eat regular meals and foods. Warfarin antagonizes the action of vitamin K. Eating consistent amounts of foods containing vitamin K is recommended because warfarin doses will be adjusted based on the International Normalized Ratio. Foods containing vitamin K include broccoli, kale, spinach, cauliflower, garbanzo beans, collard or mustard greens, lentils, cabbage, lettuce, and liver.

rare, surgery may be needed to remove the clot and restore circulation.

Employees' activity levels after diagnosis depend on their level of pain, swelling, and clot size. Walking should feel comfortable. Frequent rest periods and elevation of the leg to reduce swelling and discomfort may be needed. The occupational health nurse should recommend that clients rest their leg on a pillow while reclining, the foot of the bed be raised, or a wedge be placed between the mattress and box spring to elevate the leg above hip level (without hyperextending the knee or applying pressure on the back of the knee). Applying warmth to the area may provide comfort.

Once swelling has subsided, below-the-knee graduated compression stockings with 30 to 40 mm Hg can improve blood circulation and prevent clotting. Regular support stockings will not work. Compression stockings should be fitted using precise measurements, worn for at least 1 to 2 years, and replaced every 3 to 6 months to maintain compression.

COMPLICATIONS

Early diagnosis and treatment of DVT are essential to avoid three complications: pulmonary embolism, recurrent DVT, and postthrombotic syndrome.

Pulmonary embolism occurs if a fragment of the clot breaks loose, travels through the heart, and migrates to the lungs, obstructing the pulmonary artery. Pulmonary embolism is a potentially fatal complication requiring immediate attention. Symptoms of pulmonary embolism include chest pain, sudden cough, rapid breathing, shortness of breath, rapid heart rate, low blood pressure, lightheaded-

IN SUMMARY

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- 1 Each year, deep vein thrombosis (DVT) occurs in 1 of every 1,000 Americans, hospitalizes nearly 600,000 for DVT-related complications, and kills up to 300,000. It is possibly the most common preventable cause of hospital deaths in the United States.
- 2 Occupations in transportation, air travel, confined spaces, and sedentary office positions pose risks for DVT. The risk of DVT increases with factors such as obesity, cancer, pregnancy, estrogen-containing medications, major surgery, and hospitalizations.
- 3 With an understanding of DVT, occupational health nurses are well positioned to promote DVT awareness and reduce the risk of complications for employees diagnosed with DVT.

ness, and a feeling of apprehension. In rare cases, the clot may be pumped toward the brain, causing cerebral venous thrombosis and stroke. DVT and pulmonary embolism are collectively referred to as venous thromboembolism.

The risk of recurrent DVT depends on the cause. Clots resulting from surgery or trauma are unlikely to recur. Individuals with spontaneous DVT without risk factors have a 30% risk of developing another clot within 10 years of the first episode (James et al., 2008). A combination of factors increases the risk of developing DVT.

Postthrombotic syndrome occurs when veins and valves are permanently damaged by the clot, causing persistent swelling, skin discoloration, leg ulcers, or pain. According to the CDC (2008a), as many as one third of individuals with DVT will develop postthrombotic syndrome. Occupational health nurses should encourage those diagnosed with DVT to adhere to their medication schedules, wear compression stockings, stay hydrated, and avoid risk factors.

PREVENTION OF DVT

Prevention of DVT is difficult because certain risk factors cannot be changed (i.e., age and family history). Occupational health nurses should advise employees to avoid prolonged sitting, bedrest, or lack of movement. If walking is impossible, wiggling the toes, moving the ankle in circles, and flexing the foot can help. On trips longer than 4 hours, travelers, in consultation with their health care provider, may need prophylactic anticoagulant medication and compression stockings to reduce leg swelling and encourage blood flow in the deep veins of the legs. The major reason inpatients are up walking as

soon as possible after surgery is to prevent DVT. DVT is common after hip and knee surgery and also in hospitalized patients on bedrest. Hospitals are developing DVT risk assessment tools and protocols to determine patient need for prophylactic mechanical devices, medication, or compression stockings upon hospital admission.

CONCLUSION

Employees can reduce the risk of DVT by staying active, wearing compression stockings, and avoiding smoking, obesity, and estrogen. The implications for occupational health nurses are significant. Employees diagnosed with DVT need education regarding medications, administration technique for low-molecular weight heparin, activity level, risk for and management of the disease, signs of complications, and when to seek immediate health care. Education about DVT risk factors, DVT prevention, and the benefit of early diagnosis can prevent life-threatening and chronic complications and enhance the quality of life for these workers.

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Deep Vein Thrombosis

This issue of the AAOHN JOURNAL contains a Continuing Nursing Education Module on "Deep Vein Thrombosis." 1.0 contact hour of continuing nursing education credit will be awarded by AAOHN upon successful completion of the posttest and evaluation.

A certificate will be awarded and the scored test will be returned when the following requirements are met by the participant: (1) The completed answer sheet is received at AAOHN on or before August 31, 2009; (2) A score of 70% (7 correct answers) is achieved by the participant; (3) The answer sheet is accompanied by a check or money order for \$15.00 (\$20.00 non-members), or purchase online for \$10.00 (\$15.00 non-members) at www.aaohn.org. Expect up to 4 weeks for delivery of the certificate.

Upon completion of this lesson, the occupational health nurse will be able to:

1. Discuss the incidence, causes, symptoms, risk factors, and complications of deep vein thrombosis (DVT).
2. Describe the importance of early diagnosis and prompt treatment for DVT.
3. Identify opportunities for DVT prevention.

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Contact hour credits received for successful completion of the posttest and evaluation may be used for relicensure, certification, or re-certification.

Directions: Circle the letter of the best answer on the answer sheet provided. (Note: You may submit a photocopy for processing.)

1. The American Heart Association (2008) reports that deep vein thrombosis (DVT) occurs in ____ of every 1,000 Americans each year.

- A. 1.
- B. 2.
- C. 3.
- D. 4.

2. Approximately how many Americans are hospitalized annually for DVT-related complications?

- A. 300,000.
- B. 400,000.
- C. 500,000.
- D. 600,000.

3. According to the Centers for Disease Control and Prevention (2008b), about _____ of the U.S. population has one clotting disorder predisposing the formation of clots.

- A. 1% to 4%.
- B. 5% to 8%.
- C. 9% to 12%.
- D. 13% to 16%.

4. To prevent "Economy Class Syndrome," the Mayo Clinic (2007) recommends that passengers on flights of more than ____ hours stretch their calves at least once per hour.

- A. 2.
- B. 3.
- C. 4.
- D. 5.

5. According to the U.S. Department of Health and Human Services (2008), only ____ of those with DVT report symptoms.

- A. 30%.
- B. 40%.
- C. 50%.
- D. 60%.

6. What is the usual International Normalized Ratio range for patients on warfarin?

- A. 1.0 to 2.0.
- B. 2.0 to 3.0.
- C. 3.0 to 4.0.
- D. 4.0 to 5.0.

7. All of the following foods are recommended for patients on warfarin except:

- A. Tomatoes.
- B. Broccoli.
- C. Cauliflower.
- D. Liver.

8. Below-the-knee graduated compression stockings with _____ mmHg can improve blood circulation and prevent clotting.

- A. 20 to 30.
- B. 30 to 40.
- C. 40 to 50.
- D. 50 to 60.

9. The occupational health nurse is alert that symptoms of pulmonary embolism include all of the following except:

- A. Sudden cough.
- B. Rapid heart rate.
- C. Lightheadedness.
- D. High blood pressure.

10. Individuals with spontaneous DVT without risk factors have a ____ risk of developing another clot within 10 years of the first episode.

- A. 20%.
- B. 30%.
- C. 40%.
- D. 50%.

Deep Vein Thrombosis

September 2008

(Goal: To gain ideas and strategies to enhance personal and professional growth in occupational health nursing.)

Mark one answer only!

(You may submit a photocopy of the answer sheet for processing.)

- | | |
|------------|-------------|
| 1. A B C D | 6. A B C D |
| 2. A B C D | 7. A B C D |
| 3. A B C D | 8. A B C D |
| 4. A B C D | 9. A B C D |
| 5. A B C D | 10. A B C D |

EVALUATION (must be completed to obtain credit)

Please use the scale below to evaluate this continuing education module.

	4 - To a great extent	3 - To some extent	2 - To little extent	1 - To no extent
1. As a result of completing this module, I am able to:				
A. Discuss the incidence, causes, symptoms, risk factors, and complications of deep vein thrombosis (DVT).	4	3	2	1
B. Describe the importance of early diagnosis and prompt treatment for DVT.	4	3	2	1
C. Identify opportunities for DVT prevention.	4	3	2	1
2. The objectives were relevant to the overall goal of this independent study module.	4	3	2	1
3. The teaching/learning resources were effective for the content.	4	3	2	1
4. How much time (in minutes) was required to read this module and take the test?	60	70	80	90

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