

Martha M. Blondin  
Marita G. Titler

## Deep Vein Thrombosis and Pulmonary Embolism Prevention: What Role Do Nurses Play?

Nurses play a critical and essential role in patient management 24 hours a day. We are challenged to stay abreast of current research and trends in our areas of practice and to champion the change process when necessary. Deep venous thrombosis (DVT) and pulmonary embolism (PE) prevention should be a topic of concern for nurses in all specialties. It is a perplexing problem worthy of serious consideration by practitioners. The purpose of this article is to provide an overview of the nurses' role in DVT and PE prevention.

### Epidemiology

DVT and PE are associated with 300,000 to 600,000 hospitalizations and 50,000 deaths annually (U.S. Department of Health and Human Services [USDHHS], 1986). The work of Rudolph Virchow in the 1850s established the basis for what are believed to be the common causes of deep vein

thrombosis. These causes, commonly referred to as Virchow's Triad, include stasis (reduced blood flow velocity), hypercoagulable states (changes in blood elements), and endothelial damage (vein wall injury) (Goldhaber, 1993). Prevention is imperative. In 1986, the National Institutes of Health and the National Heart, Lung, and Blood Institute sponsored a conference to gain consensus on the phenomenon and prevention of DVT (USDHHS, 1986).

### Risk Factors

Risk factors for developing DVT and the subsequent potential of developing PE have been well established in surgical patients. Inherited as well as acquired risk factors appear to play a part in the disease process. Known inherited risk factors are deficiencies in the clotting cascade related to antithrombin III, protein C, protein S, fibrinogen, or plasminogen. Acquired risk factors include advancing age, cancer, stasis, estrogen therapy, immobilization, stroke, obesity, inflammatory bowel disease, prior thromboembolism, and previous history of surgery. Immobility, malignancy, cardiovascular disease, varicose veins, trauma, and length of surgery over 2 hours were also identified (USDHHS, 1986; Caprini, Arcelus, Hasty, Tamhane, & Fabrega, 1991). These risk factors are substantiated in the literature related to surgical patients, and to

a lesser extent for medical patients (Dalen & Hirsh, 1995; Goldhaber, 1993; Goldhaber et al., 1983; Lowe et al., 1992; Salzman & Hirsh, 1982; Shackford et al., 1990; Stenger, 1994). It is essential that risk factors be identified in order to institute preventative care.

### Assessment Tools

Several risk factor assessment tools have been presented in the literature and could prove beneficial if used as guidelines for prophylactic thromboembolism care. Dalen and Hirsh (1995) defined a patient's risk for developing DVT as low, moderate, high, or very high risk depending on the number of factors present. Low risk includes patients younger than age 40 subjected to minor surgery and having no other risk factors. Patients over 40 years of age undergoing major surgery but without other clinical risk factors are considered to be at moderate risk. A patient who is over 40 years old, undergoing major surgery, and has additional risk factors or history of myocardial infarction is considered at high risk; very high risk patients are defined as major surgery patients older than 40 years with a history of previous DVT, malignant disease, having orthopaedic surgery, or having sustained a hip fracture, stroke, or spinal cord injury.

Caprini et al. (1991) developed a worksheet, with options for care, to use while assessing patients for 27 risk factors. All fac-

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**Martha M. Blondin, BSN, RN**, is Clinical Nurse Specialist for Orthopaedic Nursing, Multispecialty Nursing Division, University of Iowa Hospitals and Clinics, Iowa City, IA.

**Marita G. Titler, PhD, RN, FAAN**, is Associate Director of Research, Department of Nursing and Senior Associate Director of Outcomes Research, Office of Outcomes Evaluation and Management, University of Iowa Hospitals and Clinics, Iowa City, IA.

tors are considered a single risk factor except for age, which is weighed heavier as age advances (age 61-70 = 2 risk factors; over age 70 = 3 risk factors). Low risk is defined as 0-1 factor, moderate risk 2-4 factors, and high risk greater than 4 factors. This particular tool has since been updated to include current recommendations proposed in the literature (see Figure 1) (Kendall Healthcare Products Company, 1995).

Experts at Brigham and Women's Hospital, Harvard Medical School, and the Harvard Community Health Plan designed a critical pathway for patients entering their emergency department with a suspected DVT (Pearson et al., 1995). The tool is primarily used as a guideline for diagnosing DVT rather than for assessment, yet assessment provides the deciding factor for its use. A method of ensuring appropriate prophylaxis against DVT should be incorporated into every patient's plan of care. Inclusion in the critical path is one means of achieving this goal; however, prophylaxis must always be individualized for each patient. A consistent method of determining risk factors and degree of risk must first be established. Using an assessment tool is advantageous for consistency.

### **Prophylaxis Recommendations**

The health professions are challenged to stay apprised of the changes in prophylactic methods while weighing the cost-benefit ratios in a cost-containing environment. Dalen and Hirsh (1995) provide practice guidelines from the American College of Chest Physicians Consensus Conference on Antithrombotic Therapy that are research and consensus based. These are summarized here.

Graduated compression stockings (GCS), external pneumatic compression (EPC) sleeves, low-dose heparin therapy, or a combination of any or all of these mechanisms have been reported as successful, cost-effective approaches to prophylaxis in the moderate-to-high risk general surgery population. In very high risk general

surgery patients more aggressive treatment with warfarin therapy may be warranted.

Anticoagulation with low molecular weight heparin or warfarin is recommended for patients undergoing joint replacement in the hip or knee, or for repair of hip fracture. EPC and GCS are advocated as adjunctive therapy. Other general orthopaedic patients such as those undergoing spine surgery or other elective knee surgery should be treated according to risk factors.

Acute neurosurgical patients are candidates for GCS and EPC sleeves. There is a general hesitancy in this population to use pharmacologic prophylaxis until the hemorrhagic potential in the patient is stabilized (Hamilton, 1994). Acute spinal cord injury patients with paralysis should be treated with adjusted dose heparin or low molecular weight heparin in combination with GCS and/or EPC sleeves (Dalen & Hirsh, 1995).

Multiple trauma patients pose a significant challenge in the arena of DVT prophylaxis. Inferior vena cava filter placement may be an alternative in select very high risk patients when other prophylactic measures are contraindicated (Dalen & Hirsh, 1995). Venous plantar plexus compression (Impulse Technology) may also be beneficial for DVT prophylaxis when external pneumatic compression is undesirable or unable to be used due to lower-extremity fractures. These impulse devices were designed "to mimic the natural effects of walking and weight-bearing on the blood circulation in the feet and legs" (Kendall Healthcare Products Company, 1994). Rigid foot covers over the sole of the foot inflate to compress the venous plantar plexus of the foot, thus facilitating venous return.

### **Nurses' Role**

In this era of shortened acute care lengths of hospital stay and the American public demanding the most for its health care dollar, nurses play a significant role in patient preparedness, satisfaction, and outcomes. Nurses

should be involved in establishing protocols for DVT prophylaxis and in ensuring their implementation. DVT prevention should be incorporated into standards of care, care plans, and critical pathways. Risk surveillance reports are useful for trending problem patient populations and identifying opportunities to improve quality of care.

Perhaps the most important things nurses can do for their patients related to DVT are to be familiar with the risk factors related to its development and to recognize the importance of prevention. Consider prophylaxis preoperatively through discharge. Inquire about prophylaxis with the physician if there is no order or if the treatment plan does not match what is generally recommended for the risk factors the patient possesses. It is imperative that patients be educated preoperatively on the importance of DVT prophylaxis and their role in the strategy that is likely to be employed in their personal situation. This should include the review of basic leg exercises to improve venous return (ankle pumps) as well as the protocol for using mechanical devices and pharmacologic modalities. Provide patients with written and verbal instruction when possible.

If graduated compression stockings or external pneumatic compression sleeves will be used, measure your patient for the appropriate size. NEVER guess the size of a patient's extremity. Stockings or sleeves that are too large provide ineffective pressure for prophylaxis. Those that are too small are uncomfortable and potentially detrimental due to excessive constriction. Follow the manufacturer's instructions for proper fit and application and then educate your patient on the proper way to use these devices. Apply them preoperatively if possible. When GCS are ordered, they should be used at all times except while bathing and during skin assessment. If EPC sleeves are ordered with or without GCS, they should be worn at all times except while bathing, performing skin assessment, ambulating, or

Figure 1. Thrombosis Risk Factor Assessment for Surgical Patients

## Thrombosis Risk Factor Assessment For Surgical Patients

Due within 24 hours of admission.

Name \_\_\_\_\_ Age \_\_\_\_\_ Sex \_\_\_\_\_

Diagnosis \_\_\_\_\_ Admission: Elective or Emergency (circle one)

Type of surgery planned \_\_\_\_\_

Please check all pertinent factors (Each risk factor has value of 1 unless otherwise noted.)

- |  |   |
|--|---|
| <input type="checkbox"/> Age 41 to 60 years (1 factor)   | <input type="checkbox"/> Pelvic surgery or total joint replacement                            |
| <input type="checkbox"/> Age 61 to 70 years (2 factors)  | <input type="checkbox"/> Confining travel, flight/auto<br>(>4 hours within week of admission) |
| <input type="checkbox"/> Age over 70 years (3 factors)   | <input type="checkbox"/> History of pelvic or long bone fracture                              |
| <input type="checkbox"/> Anticipated bed confinement > 72 hours  | <input type="checkbox"/> Leg edema, ulcers, stasis  |
| <input type="checkbox"/> History of DVT/PE (3 factors)   | <input type="checkbox"/> Malignancy   |
| <input type="checkbox"/> Varicose Veins  | <input type="checkbox"/> Pregnancy or postpartum (<1 month)                                   |
| <input type="checkbox"/> Obesity (>20% of ideal body weight)   | <input type="checkbox"/> Family history of DVT  |
| <input type="checkbox"/> History of previous major surgery   | <input type="checkbox"/> Inflammatory bowel disease   |
| <input type="checkbox"/> Previous immobilization (>72 hours)   | <input type="checkbox"/> Severe infection   |
| <input type="checkbox"/> MI  | <input type="checkbox"/> Hormone therapy<br>Name _____  |
| <input type="checkbox"/> CHF   | Dosage _____  |
| <input type="checkbox"/> Stroke  | <input type="checkbox"/> Hypercoagulable states<br>Congenital _____                           |
| <input type="checkbox"/> Crystalloid infusion (>5 liters/24 hrs.)  | Acquired _____  |
| <input type="checkbox"/> Severe COPD   | <input type="checkbox"/> Other _____  |
| <input type="checkbox"/> Trauma  |   |
| <input type="checkbox"/> Planned operation over 2 hours  |   |
| <input type="checkbox"/> Laparoscopic surgery with pneumoperitoneum<br>and reverse Trendelenburg (>1 hour) |   |

### TOTAL RISK FACTORS

Recommended modalities for each Risk Group

LOW RISK (1 Factor)	MODERATE RISK* (2-4 Factors)	HIGH RISK* (More than 4 Factors)
T.E.D. Stockings plus Early Ambulation	T.E.D. plus SCD or Anticoagulant	T.E.D. plus SCD plus Anticoagulant

\* T.E.D. plus A-V Impulse System could be used for the following patient conditions:

- Patients undergoing joint replacement surgery
- Patients with leg trauma, fractures or external fixation
- In the presence of Jones dressings, splints or casted limbs
- Patients with co-morbid risk of lower limb edema

Please check the modality(s) chosen from the list below and sign / date.

- |   |   |
|---|---|
| <input type="checkbox"/> T.E.D.® Stockings                                    | <input type="checkbox"/> Warfarin (Regimen: _____)        |
| <input type="checkbox"/> T.E.D.® Stockings plus SCD™ System                   | <input type="checkbox"/> Other                            |
| <input type="checkbox"/> T.E.D.® Stockings plus A-V Impulse System® Foot Pump | <input type="checkbox"/> No Prophylaxis                   |
| <input type="checkbox"/> Heparin (Regimen: _____)                             | <input type="checkbox"/> Suspect DVT, perform diagnostics |
| <input type="checkbox"/> Low Molecular Weight Heparin (Regimen: _____)        |   |

Contraindication to anticoagulants? YES or NO

If yes, explain. \_\_\_\_\_

Examining Physician's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

attending physical therapy. If your patient is up in a bedside chair or off the unit attending a lengthy test, pneumatic compression sleeves should be in place and plugged into the nearest electrical outlet. *A note of caution:* be sure to check the manufacturer's insert for the presence of latex in their product if your patient is sensitive or allergic to this material.

Physician preference varies in how long patients are required to wear mechanical modes of prophylaxis. The general consensus is that they should be worn until the patient is fully ambulatory (Caprini, Scurr, & Hasty, 1988; Clagett & Reisch, 1988; Hull, Raskob, & Hirsh, 1986). This definition, of course, must be agreed upon for your patient population. Orthopaedic patients, for example, are often still relatively immobile when they are discharged from the hospital so that GCS are appropriate after discharge for the majority of this patient group. A safe definition would be to consider discontinuing stockings when the patient is "up" more than "down." Hamilton, Hull, and Pineo (1994) suggested that "graduated stockings or intermittent pneumatic compression should be started preoperatively or as soon as a risk is identified, and continued until the patient is able to walk for more than 3-4 hours per day" (p. 285). Pneumatic compression sleeves are generally discontinued at discharge.

Maximizing patients' mobility plays a key role in DVT prophylaxis. Nurses can make a difference by motivating and assisting patients to perform range of motion exercises and ambulate as much as their medical condition will allow.

Keep patients adequately hydrated. If a patient is on a fluid restriction, make sure that the limit of the restriction is met. Appropriate hydration aids in blood flow, therefore helping limit venous stasis. Attention to intake and output as well as general nutrition are also important considerations.

## Summary

DVT and PE affect thousands

of patients and families annually. Prevention is critical to patients at risk for these disease developments. The challenge to nurses is to stay cognizant of the potential morbidity and mortality of these developments and to advocate for preventative measures for patients. The recommendations set forth are general recommendations. It is important to consider each patient individually with these guidelines in mind. ■

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## Nursing Pharmacology

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half to one-third of the usual starting dose for younger patients. Dose adjustments should be made in small increments and only after a reasonable period, usually bimonthly. When patients present with a near normal dose regimen of psychotropic agents, nurses should be highly suspicious about the possibility of overdosing. Finally, it is important to note that the rate of biological aging varies among the elderly; individual differences must be taken into account. ■

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