

# Practice Points: Thromboembolic Disease

Thromboembolic disease or venous thromboembolism (VTE) includes **deep vein thrombosis (DVT)** and **pulmonary embolism (PE)**. DVT is defined as the formation of a blood clot (thrombus) in a deep vein of the extremity. PE occurs when a clot becomes detached, travels through the blood stream and blocks or occludes a blood vessel. VTE is responsible for 600,000 hospitalizations per year and up to 200,000 deaths in the United States.<sup>1</sup>

## VTE Formation

Thromboembolic disease is a disease process with multiple causes. Virchow identified three factors which contribute to VTE formation.<sup>2</sup>

- 1. Venous stasis** – sluggish circulation can be caused by immobility, paralysis, stroke, valvular insufficiency and tourniquet use in the operating room.
- 2. Blood coagulability** – changes in blood coagulability can be due to inherited disorders (Factor V Leiden, protein C or S deficiency), cancer, estrogen therapies such as oral contraceptives or hormone replacement therapy and major surgery.
- 3. Vessel wall damage** – vessel walls can be damaged by kinking of the major vessels (hip dislocation), trauma, indwelling catheters or scarring of vessels by previous VTE.

## What Interventions are Effective in Identifying and Reducing the Risk of Thromboembolic Events?

### Recommended for Practice

Guidelines from the American Academy of Orthopaedic Surgeons (AAOS)<sup>3</sup> and the American College of Chest Physicians (ACCP)<sup>4</sup> advocate risk identification followed by implementation of prophylaxis protocols as the cornerstones for prevention of thromboembolic events.

#### Risk Identification

It is essential that patients are assessed for VTE risk and prophylaxis regimes are instituted as appropriate. This can be accomplished in a variety of ways beginning with identification of patients at risk on admission to the hospital and instituting appropriate prophylactic interventions. Incorporating a risk assessment in electronic records to alert physicians of patients at risk for VTE/PE on admission has been found to increase use of mechanical and chemical prophylaxis and decrease the incidence of VTE.<sup>3</sup> Many orthopaedic patients fall into the high-risk target groups based on the type of surgery they are undergoing (i.e., hip or knee arthroplasty [THA, TKA], hip fracture surgery [HFS], spinal procedures). ACCP recommends implementation of group-specific prophylaxis routinely for all patients who belong to a major target group.

#### Risk Factors for VTE:

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Surgery	Trauma (major or lower extremity)
Immobility, paresis	Malignancy
Cancer therapy	Previous VTE
Increasing age	Pregnancy/postpartum period
Oral contraceptive	Hormone Replacement Therapy
Selective estrogen receptor modulators	Inherited/acquired thrombophilia
Acute medical illness	Inflammatory bowel disease
Heart/respiratory failure	Nephrotic syndrome
Obesity	Smoking
Myeloproliferative disorders	Varicose veins
Paroxysmal nocturnal hemoglobin	Central venous catheter

#### Physical Exam

Clinical diagnosis is reported to be unreliable. The physical presentation of VTE is affected by the size and location of the thrombus. If a vein is partially obstructed, physical findings may be absent. Homan's sign (pain in the calf with forced dorsiflexion of the foot) is positive in less than half of symptomatic VTEs.<sup>5</sup>

## Recommended for Practice (continued)

### Signs/symptoms of DVT

Pain or tenderness over area of clot	Positive Homan's sign
Swelling or tightness of calf	Discoloration of skin

### Signs/symptoms of PE

Dyspnea	Increased respirations
Lower systemic arterial pressure	Syncope
Cough, hemoptysis	Tachycardia
Anxiety, restlessness	Diaphoresis, fever
Chest pain	

### Prophylaxis Regimes

Combined modalities are recommended in an effort to prevent VTE. Multi-modal regimes may combine regional anesthesia, early mobilization, as well as chemical and mechanical prophylaxis.

### Regional Anesthesia

In consultation with the anesthesia care provider, patients should be considered for regional anesthesia.<sup>3</sup> Thrombosis begins in the operating room.<sup>6</sup> The use of spinal or epidural anesthesia reduces the risk of venous thrombus. Studies have demonstrated that epidural and spinal anesthesia reduce the risk of postoperative venous thrombosis by approximately 40-50%.<sup>7</sup>

Epidural anesthesia recommendations include: (1) If using low molecular weight heparin (LMWH), administer the first dose no earlier than 24hrs postoperatively after establishment of adequate homeostasis, (2) First dose of LMWH is initiated at least 2hrs after the continuous epidural anesthesia catheter is removed.<sup>5</sup>

### Chemical Prophylaxis

**Elective hip or knee arthroplasty, hip fracture surgery:** Use of one of the following: LMWH, fondaparinux, adjusted dose vitamin K antagonist.<sup>4</sup>

**Arthroscopic knee surgery:** patients who are at a higher than usual risk, based on preexisting VTE risk factors or following a prolonged or complicated procedure, thromboprophylaxis with LMWH is recommended.<sup>4</sup>

**Elective spine surgery:** patients who have high risk factors, such as advanced age, known malignancy, presence of a neurologic deficit, previous VTE, or an anterior surgical approach should have chemical prophylaxis (LDUH or LMWH), mechanical prophylaxis, or a combination of methods.<sup>4</sup>

### Duration of Chemical Prophylaxis

Patients undergoing THA, TKA, and HFS should receive thromboprophylaxis for a minimum of 10 days. Extended prophylaxis should be considered in patients with THA or HFS.<sup>4,3</sup>

**1. Unfractionated heparin (UH)** binds to antithrombin III. With the introduction of LMWH's UH isn't utilized often. Recommended dosage 5000u sq q 8-12hr. PTT must be monitored.

**2. Low molecular weight heparins (LMWH)** are utilized with great success. LMWH possess anti Xa and anti IIa activity. They have a predictable dose response and do not require serum monitoring. Because medications are manufactured differently, LMWH cannot be interchanged.

Lovenox®	Dose	½ Life
Hip/Knee Arthroplasty	30mg q 12 hr sq	3-6
Hip Fracture	40mg daily sq may be considered with THA *begin 12-24 hrs after surgery	
Fragmin®		
Hip Fracture or Arthroplasty	2500 IU sq 4-8 hrs after OR 5000 IU sq daily *begin 4-8 hrs after surgery	3-5hrs

\*manufacturer's recommendations

## Recommended for Practice (continued)

In patients with severe renal impairment (creatinine clearance < 30ml/min) dosage should be adjusted.

**3. Arixtra® (Fondaparinux sodium)** Arixtra® is a synthetic selective factor Xa inhibitor

Arixtra®	Dose	½ Life
Hip/Knee Arthroplasty	2.5mg sq daily	17-21 hrs
Hip Fracture	2.5mg sq daily	
	*begin 6-8hrs after surgery	

\*manufacturer's recommendations

**4. Coumadin®** is a vitamin K antagonist. It is adjusted dosing to achieve a desired International Normalized Ratio (INR), so therapy requires blood monitoring. It has a 48-72hr half-life; onset of action is delayed.

Coumadin® may be initiated the evening before operation.

Target INR 2.5 (range 2-3)<sup>4</sup>

Target INR ≤2.0<sup>3</sup>

**5. Aspirin** has an antiplatelet effect. It is most often used in orthopaedics as part of multi-modal regime.

### Mechanical Prophylaxis

The use of mechanical prophylaxis assists with the venous return in patients.

The mechanical devices produce flow of blood through the vessels similar to what is produced by the plexus of veins in the foot and the calf muscle.<sup>11</sup> The flow creates turbulence in the valve pockets which can be a site of thrombosis formation. In addition, intermittent pneumatic compression may further inhibit platelet aggregation by stimulating the release of fibrinolytics.<sup>14</sup>

Options for mechanical devices include graduated compression stockings (GCS), intermittent pneumatic compression stockings (IPC), and venous foot pump (VFP).<sup>9,10</sup> It is important that the stockings are graduated compression and a proper fit is essential.

Early mobilization of patients also assist with decreasing venous stasis by utilizing the muscles of the lower extremity for venous return.

Patients should be considered for intra-operative and/or immediate post-operative mechanical prophylaxis and continued mechanical prophylaxis until discharge to home.

Mechanical prophylaxis alone is recommended as an alternative in TKA and HFS when anticoagulants are contraindicated due to high bleeding risk.

## Likely To Be Effective

### Mobility

Patients should be encouraged to progressively increase mobility after discharge.

### Teaching

Patients should be taught to actively dorsiflex and plantar flex the ankle and toes. This exercise should be performed in sets of 10-20 every half hour when the patient is awake. Patients should be educated about the common symptoms of VTE and PE.

## Benefits Balanced with Harms

Commencement of prophylaxis: the timing of initiation of pharmacologic prophylaxis should be based on the efficacy-to-bleeding tradeoffs for that agent. LMWH may be started preoperatively or postoperative as small differences are present and both options are acceptable.<sup>4</sup>

## Not Recommended For Practice

**The use of a single modality after some procedures is not recommended.** Aspirin should not be used alone after THA, TKA, and HFS.<sup>4</sup> It is most often used in orthopedics as part of multi-modal regime.

Dextran, LDUH, IPC or VFP should not be used as the only method of prophylaxis for THA. LDUH or VFP are not effective as sole methods of thromboprophylaxis for TKA.<sup>4</sup>

**It is a medical decision for utilizing thromboprophylaxis for the following (unless the patient is at higher than usual risk): knee arthroscopy, posterior approach elective spine surgery, and isolated lower extremity injury.**

**Routine screening of asymptomatic patients following major orthopaedic surgery is not suggested.**<sup>4</sup>

## Abbreviations

DVT:	Deep vein thrombosis	PE:	Pulmonary embolism
GCS:	Graduated compression stockings	THA:	Total hip arthroplasty/replacement
HFS:	Hip fracture surgery/repair	TKA:	Total knee arthroplasty/replacement
IPC:	Intermittent pneumatic compression device	UH:	Unfractionated heparin
LDUH:	Low dose unfractionated heparin	VFP:	Venous foot pump
LMWH:	Low molecular weight heparin	INR:	International Normalized Ratio

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**Author:** Nancy Hiltz, MS, RN, ONC  
Orthopaedic Clinical Specialist  
Kaplan Center for Joint Reconstruction Surgery,  
Newton Wellesley Hospital, Boston, MA

**Reviewer:** Beverly A. Morris, RN, CNP, MBA  
Nurse Educator, Researcher  
University of California Medical Center, San Diego, CA

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National Association of Orthopaedic Nurses  
401 N. Michigan Ave. Suite 2200, Chicago, IL 60611  
800.289.6266  
[www.orthonurse.org](http://www.orthonurse.org)