

Venous Thromboembolism Prophylaxis

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Venous thromboembolism (VTE) remains a burdensome source of morbidity and mortality despite many advances in diagnostic and treatment tools. VTE occurs in 10%-80% of hospitalized patients depending on the reason for hospitalization. Because few specific symptoms or findings may occur due to DVT or PE, clinical diagnosis is unreliable.¹ Routine screening of all patients is not practical. However, effective methods of prophylaxis are both cost-effective and safe.² Barriers to widespread application include the perception that the incidence of DVT/PE is low, that bleeding complications are frequent and that cost of prevention is high.

A recent supplement in *Chest*, reviewed this topic in detail and included over 600 references.³ Information is given on the quality of the studies reviewed as well as whether or not expert consensus exists for the recommendation given. What follows is a distillation of this comprehensive review.

Risk factors for the development of VTE include: increasing age; prolonged immobility, stroke or paralysis; previous VTE; cancer and therapeutic interventions; major surgery; trauma; obesity; varicose veins; cardiac dysfunction; central venous catheters; inflammatory bowel disease; nephrotic syndrome; and pregnancy or hormonal therapy use.⁴ Please keep in mind that patients may have several risk factors and that risk is additive. In addition patients may have predisposing thrombophilic disorders such as activated protein C resistance, antiphospholipid antibodies, deficiency of proteins (C, S, antithrombin), elevated homocysteine levels to name a few.⁵

There is general agreement that initiating mechanical preventive methods as soon as risk is identified has tremendous benefit. Elastic stockings (ES) and intermittent pneumatic compression (IPC) are most commonly used and at relatively low cost. Various anticoagulants are of additional benefit and are briefly reviewed. The most commonly used methods are low dose unfractionated heparin (LDUH) and low molecular weight heparin (LMWH). Oral anticoagulants remain in use, especially for orthopedic, medical, and stroke patients.

Surgical Conditions

General Surgery

The incidence of DVT in untreated patients undergoing general surgery is estimated at about 25% as assessed by the fibrinogen uptake test (FUT). Symptomatic PE was found in 1.6% of patients. LDUH and LMWH have been studied extensively and are the most effective agents at reducing the formation of DVT, as assessed by FUT.⁶ They appear to be equally efficacious with reductions of 50%-89% in fatal PE. Studies show an increased rate of bleeding and hematoma formation with LMWH used higher doses (>3400 anti-Xa units daily). Doses lower than this are equivalent to LDUH in prevention of VTE and can be given in close proximity to surgery.⁷ Combining ES with other agents provides additional protection. There is no significant benefit with the addition of aspirin or warfarin in general surgery patients.

For patients at low risk of complications (younger, without identifiable risk factors by history) and undergoing brief procedures, no prophylaxis is necessary. Those at moderate risk (over 40, undergoing major procedures but no additional risk factors) should receive LDUH every 8 to 12 hours or daily LMWH. Those at highest risk benefit from the addition of mechanical prophylaxis.^{3,9}

Gynecologic Surgery

The incidence of DVT is similar to that seen in general surgery. Likewise similar reductions of risk are seen with thromboprophylaxis, with the strongest evidence for use of LDUH. As mentioned above those at lowest risk (vaginal procedure, young without other risk factors) require no therapy save early mobilization. Those at moderate risk (over 40, abdominal procedure for benign disease) should receive LDUH twice daily, and those at highest risk (multiple risk factors, including malignancy) benefit from ES or IPC added to their regimen.^{3,8}

Urologic Surgery

Fewer data are available regarding the optimal preventive strategy for urologic procedures. However, LDUH and LMWH probably are as effective in this population as in general and gynecologic surgery.⁹ The stratified approach mentioned above is applicable.

Orthopedic Surgery

No less than 25 studies find the prevalence of DVT after total hip replacement (THR), total knee replacement (TKR), and hip fracture surgery to be about 50%-80%.^{3,10} The majority of these resolve

spontaneously, but our ability to predict those at high risk for developing clinical DVT/PE is limited. Therefore current wisdom is to provide primary prophylaxis to anyone undergoing a major lower extremity orthopedic procedure. Though regional anesthesia (spinal or epidural) has a somewhat lower risk, the risk is still substantial and should not change the approach to prophylactic therapy.

The optimal duration of thromboprophylaxis postoperatively remains unclear. At least 7 to 10 days is recommended, but some studies show substantial benefit with prolonged therapy.^{11,12} Routine surveillance for asymptomatic DVT at the time of hospital discharge is not recommended.

The occurrence of VTE is in isolated lower extremity fracture is poorly studied. More research is necessary in this area.

Total Hip Replacement (THR)

Multiple well-designed studies have investigated this area. Geerts in his review cites 18 references.³ Adjusted-dose warfarin begun the evening before surgery with a target INR of 2.0-3.0 is safe and effective and is widely used. LMWH therapy is also quite effective. This can be initiated 12 h before surgery, 12-24 h after surgery or 4-6 h after surgery at half the usual dose and increased to the usual dose the next day.³ The risk of postoperative bleeding is slightly higher with LMWH.² ES or IPC may be helpful adjuvant therapy. Aspirin does not reduce risk, nor does LDUH and neither is recommended.

Total Knee Replacement (TKR)

The rate of DVT is higher for TKR than for THR. Regimens with good efficacy in THR are not as successful and the concerns about bleeding are greater. LMWH and adjusted dose warfarin appear to be equally efficacious.¹¹ IPC if applied intraoperatively or immediately postoperatively has been shown to be effective in several small studies.³ Once again LDUH and aspirin are not useful.

Hip Fracture Surgery

Although the rates of DVT after hip fracture are similar to the rates in arthroplasty patients, the rate of fatal PE is higher.¹³ Either LMWH or oral anticoagulation is recommended and instituted as soon as feasible, either preoperatively if surgery will be delayed, or postoperatively as soon hemostasis is attained. Data on LDUH is limited and aspirin is ineffective.

Neurosurgery

The incidence of DVT is about 22% in patients undergoing a neurosurgical procedure. Risk factors include intracranial rather than spinal surgery, malignancy, duration of surgery, leg weakness, and increased age.¹⁴ IPC with or without ES can be recommended without reservation. Some studies have found LMWH and LDUH efficacious, but concern remains over the risk of hemorrhage.¹⁵ Combination therapy should be considered for those at highest risk.

Trauma

Patients with multisystem or major trauma receiving no prophylaxis have a greater than 50% chance of developing VTE. Fatal PE occurs in up to 2%.¹⁶ Risk is highest for those with lower extremity or pelvic fractures, spine fractures and head injury. Though some data is available, the heterogeneity of the trauma population makes generalizing difficult. Many factors have limited the research in this area. Mechanical prophylaxis should be started as soon as possible. Little data is available, but it is safe for those patients who have an immediate contraindication to pharmacologic methods. LDUH is commonly utilized, but is not particularly effective. LMWH in the absence of intracranial hemorrhage is safe and effective and is recommended once primary hemostasis has been obtained.¹⁷

IVC placement is indicated in those patients who have absolute contraindications to anticoagulation and have demonstrated proximal DVT or those undergoing major surgery in the near future.¹⁸

Acute Spinal Cord Injury

Of all patients admitted to the hospital those with acute spinal cord (SCI) injury have the highest risk of VTE. Factors increasing risk are complete injury, paraplegia and short duration (less than 3 months since injury).¹⁹ LMWH is superior to LDUH for prevention of VTE.¹⁹ LDUH, ES and IPC are not nearly as effective and should be utilized only if there is a contraindication to anticoagulation (such as a spinal hematoma in incomplete cord injury). Acute SCI patients should continue DVT prophylaxis for a minimum of 3 months and can be switched over to oral anticoagulants.²⁰

Medical Conditions

Myocardial Infarction

While the incidence of VTE is high (about 25%) the aggressive therapy of MI with thrombolytics, unfractionated heparin, LMWH, and antiplatelet

medications has superseded prevention of DVT as a primary endpoint for therapy.³

Ischemic Stroke

The incidence of DVT in the patient with a stroke is 55%, and 5% of early deaths are due to PE. Many randomized trials have proven the efficacy of LDUH and LMWH with equivalent results.³ Duration of therapy should be based on the presence of ongoing risk factors such as immobility, atrial fibrillation, CHF and paresis. Patients with hemorrhagic stroke are treated with IPC or ES initially.

Other Medical Conditions

Patients admitted to medical services have a DVT incidence of 16% with a risk of fatal PE of 2.5%. As with other groups risk increases with age, severity of illness, bedrest, cardiac disorders (CHF, atrial fibrillation, cardiomyopathy). Some of those at highest risk are those with a diagnosis of cancer, particularly adenocarcinoma. Hypercoagulability, treatment (especially with antiestrogens), and debility caused by the underlying disorder or side effects of treatment, and indwelling venous catheters all increase the risk of VTE.

Multiple trials have demonstrated the efficacy of both LDUH and LMWH, with LMWH either equal to or superior to LDUH.³ In patients at high risk for bleeding, such as those in the ICU setting requiring procedures, mechanical measures are suggested.

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