CHAPTER **46**

VENOUS THROMBOTIC EVENT PROPHYLAXIS: What the Foot and Ankle Surgeon Should Know

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The utilization of anticoagulants for prevention of venous thrombotic events (VTEs; deep vein thrombosis [DVT] and pulmonary embolism) following foot and ankle surgery remains controversial at best. There continues to be published studies that conclude that perioperative prophylaxis for prevention of VTEs in foot and ankle surgery is not warranted. This is largely because these studies consistently report very low rates of thrombotic events (0.2-0.6%) (1), especially when compared to other major orthopedic procedures, i.e., total knee arthroplasty and total hip arthroplasty (40-60%) (2). Nonetheless, the reported low rates of occurrence do not preclude the seriousness and potentially life-threatening risks of development of DVT or pulmonary embolism by any cause. Because of the established high rates of occurrence following major orthopedic procedures, and the relatively preventable nature of VTE, there are established guidelines for VTE prophylaxis following these procedures. The guidelines and surgeon's strict adherence to them, has led to trending lower rates of VTE occurrence.

The author is of the opinion that the incidence of development of VTE associated with major foot and ankle surgical procedures may be much higher than the reported incidence. This is likely because all of the current literature is retrospective, and in most cases, all "podiatric procedures" are included, i.e., every procedure from hammertoe or bunion correction to major hindfoot and ankle fusions and trauma. If one were to only include major reconstructive surgery, trauma, and those nonoperative situations where immobilization is required, the incidence of development of VTE may be increased without prophylaxis. Current recommendations suggest that prophylaxis following any foot or ankle procedure is not warranted, but in questionable situations one must rely on retrospective data, expert consensus, or clinical judgement to decide whether or not to use prophylaxis (1).

In a recent editorial in *Chest*, the authors underscored the importance of balancing the risks and benefits of thromboprophylaxis in patients undergoing foot and ankle surgery (3). They highlighted an article in the same publication that listed the independent risk factors that put patients at higher risk for development of VTE when undergoing foot and ankle surgery. These specific risks were prior history of VTE (incidence 4.6%), use of hormone replacement therapy (HRT) or oral contraceptives (incidence, 0.55%), and obesity (incidence, 0.48) (1). These risk factors alone have higher incidence than any of the retrospective published studies regardless of procedure performed, and combining these risk factors with other known risk factors should obviously raise concern for possible development of VTE.

VTEs are an inevitable reality for anyone that performs reconstructive foot and ankle surgery. Although there are currently no established guidelines specific to this field, one should be keenly aware of potential risk factors, signs and symptoms of VTE, and prophylactic and treatment protocols should they be required. The purpose of this article is to give the reader a reasonable risk stratification model, highlight the suggested anticoagulant medications for prophylaxis and treatment of VTE, and offer a protocol based on orthopedic guidelines for prophylaxis.

RISK STRATIFICATION

As stated earlier, there are three independently specific risks associated with development of VTE following foot and ankle surgery: prior VTE, HRT or contraceptive use, and obesity. A combination of two or more of these risks, or one of these risks along with other risks increases the relative risk for development of VTE. The American College of Chest Physicians (ACCP) has recommended using "risk stratification tables" to quantify a given patient's risk. In these tables, risk factors are listed and assigned a number based on the relative risk. Higher numbers are associated with higher likelihood of development of VTE. All of the patient's risks are added and the sum places them into a defined risk level, e.g., low, moderate, high, highest. Once a risk level is defined, recommended prophylaxis is determined (Table 1). Use of such risk stratification models can prove quite beneficial in making an informed clinical decision of whether to use anticoagulants for VTE prophylaxis perioperatively.

Table 1

RISK FACTOR ASSESSMENT TOOL

5 points	3 points	2 points	1 point
TKA, THA	History of VTE	Age over 60 years	Age 41-60
Hip, Pelvis or leg fracture within 1 month	Family history of thrombosis or VTE	Malignancy or current chemo- or radiation therapy	Pregnancy or post partum within 1 month
Stroke within 1 month	Age over 75 years	Immobilizing cast for <1 month	Varicose veins
Multiple trauma within 1 month	History of MI, CHF, or COPD	Tourniquet time over 45 minutes	Obesity - BMI >29
Spinal Cord injury with paralysis	Congenital or acquired thrombophila	Major surgery lasting >45 minutes	Oral contraceptives, patch or hormone replacement therapy
			Minor Surgery

Caprini JA, Arcelus JI, Reyna JJ. Effective risk stratification of surgical and nonsurgical patients for venous thromboembolic disease. Semin Hematol 2001;2:12–19. TKA = total knee arthroplasty, THA= total hip arthroplasty, VTE = venous thrombotic event; MI = myocardial infarction; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; BMI= body mass index.

AVAILABLE PHARMACOLOGIC OPTIONS

Below are anticoagulant pharmacologic agents available for prophylaxis of VTE. The relative reduction rates (RR) reported are for total hip and total knee arthroplasty, however the effectiveness of the agents can easily be applied to foot and ankle surgery.

Warfarin (Coumadin)
Class: Vitamin K antagonist
RR and Complications: 55% risk reduction with increased bleeding, wound leakage, hematoma, hematuria, and hematemesis.
Pros: Oral, cheap, reversible with vitamin K (phytonadione).
Cons: Must monitor prothrombin time/INR and maintain between 2-3, must be stopped at least 3 days prior to surgery, causes an initial hypercoaguable state because of its initial inhibition of protein C, high risk of bleeding and bruising, must monitor patient's intake of green leafy vegetables, several drug-drug interactions.

Low Dose Unfractionated Heparin
Class: Antithromin III activator
RR and Complications: 58% risk reduction with a significant increase in major bleeding.
Pros: Can be used to bridge patients if warfarin is stopped prior to surgery, can be used up to 4 hours before surgery and not cause significant increase in bleeding, reversible with protomine sulfate, cheap.
Cons: Must be administered intravenously or subcutaneously, must be administered frequently or continuously because of its short half life, must measure partial thromboplastin time, risk of heparin induced thrombocytopenia.

Aspirin (acetlysalicylic acid)
Class: Irreversible cyclooxygenase inhibitor
RR and Complications: 28% risk reduction with a moderate increase in non-fatal major bleeding.
Pros: Cheap, oral, readily available.
Cons: High risk of gastrointestinal bleeding, relative drug-drug interaction.

Low Molecular Weight Heparins (e.g. Enoxaparin, Fondaparinux)
Class: Factor Xa inhibitor
RR and Complications: Consistently >50% with low risk of major bleeding.
Pros: No need to monitor, prevents fibrin clot formation, can be used in pregnancy.
Cons: Must be administered subcutaneously, only 60% reversible with protamine sulfate, potential heparin induced thrombocytopenia, potential injection site hematoma.

Rivaroxaban (Xarelto)
Class: Oral direct factor Xa inhibitor
RR and Complications: >50% risk reduction with a trend toward major bleeding.
Pros: Oral, potential for once per day dosing, no monitoring necessary.
Cons: New and therefore not as widely studied, expensive, no reversal.

Dabigatran (Pradaxa)
Class: Oral direct thrombin inhibitor
RR and Complications: Consistently >50% with low risk of major bleeding.
Pros: Oral, no need for monitoring.
Cons: Contraindicated in patients with renal impairment, new and therefore not widely studied, unknown drug-drug interactions, expensive.

PROPHYLACTIC PROTOCOL

The ACCP has established guidelines for prophylactic therapy for patients undergoing total knee and hip arthroplasty (4). Because there are no established guidelines for foot and ankle surgery, these guidelines at the very least offer a roadmap for the foot and ankle surgeon to follow should his or her clinical judgement and risk stratification indicate the need for prophylaxis. Table 2 outlines the risk level, rate of development of VTE, and suggested prophylactic measures. Based on all of the studies reviewed, low molecular weight heparins are recommended for use by the ACCP for VTE prophylaxis. Limitations of alternative agents include the possibility of increased bleeding, (which may occur with fondaparinux, rivaroxaban, and warfarin), possible decreased efficacy (low dose unfractionated heparin, warfarin, and aspirin,), and lack of long-term safety data (apixaban, dabigatran, and rivaroxaban). Furthermore, patients who place a high value on avoiding bleeding complications and a low value on its inconvenience are likely to choose an Intermittent Pneumatic Compression Device over the drug options. Although aspirin is not a new therapy for the prevention of DVT/VTE, previous ACCP guidelines recommended against using aspirin as the single agent for prophylaxis in any surgical population. In the current edition, the ACCP has revised this recommendation and indicates aspirin is an option—although not typically the agent of choice—for the prevention of DVT/VTE in major orthopedic surgery (4).

The ACCP also recommends that prophylaxis be continued for 10-14 days following the procedure and extended for up to 35 days for major orthopedic procedures. The author believes that for major reconstructive foot and ankle surgery, prophylaxis should continue for the duration of immobilization or non-weightbearing status (4).

CONCLUSION

Obviously more studies are needed as it pertains to VTE prophylaxis in foot and ankle surgery. The ACCP has outlined specific risks associated with foot and ankle surgery and a prophylactic protocol. Because of the relatively low risk of development of VTE, a prospective double blind study can be safely conducted without undue harm to patients not receiving prophylaxis. These studies should be carefully crafted to only include patients that are at a known elevated risk for development of VTE. This would allow one to determine, based on the type of procedure, whether VTE prophylaxis should be considered.

VTE events are largely preventable, especially following elective foot and ankle surgery. Although the risk is low, the fact that they do occur exists. The foot and ankle surgeon should be adequately equipped with knowledge of associated risk factors, prophylactic protocols, and treatment regimen should he or she encounter one.

Table 2

PROPHYLACTIC RECOMMENDATIONS BASED ON RISK STRATIFICATION

Score	Risk of VTE	Risk Level	Prophylacic Recommendations
0-1	<10%	Low	No specific recommendation, early ambulation
2	10-20%	Mod	IPCD, LMWH, or LDUH for 10-14 days, early ambulation
3-4	20-40%	High	IPCD, LMWH, or LDUH for 10-14 (or up to 35 days) days early ambulation
5+	40-80%	Highest	LMWH, Warfarin, or Fondaparinux alone or in combination with IPCD for 35 days or for length of immobilization

Geerts et al. Chest 2008;133;381-453. VTE = venous thrombotic event; IPCD = intermittent pneumatic compression device; LMWH = low molecular weight heparin; LDUH = low dose unfractionated heparin.

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