

# Risk Factors for the Development of Deep Venous Thrombosis/Pulmonary Embolism

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## INTRODUCTION

We as podiatrists realize the importance of thoroughly addressing the potential complication of venous thromboembolic disease (VTED). This article will concentrate on the risk factors associated with the development of VTED to the extent that chemical prophylaxis would be warranted. In all instances, the benefits of chemical prophylaxis have to be carefully weighed against the complications they may cause (i.e., bleeding risks).

While the diagnosis and treatment of deep venous thrombosis (DVT) is to a degree straightforward, the decision to institute chemical DVT prophylaxis is more controversial (especially for foot and ankle surgery as compared to knee and hip replacement for example). There is an abundance of literature that supports the use of pharmacologic anti-coagulants in orthopedic procedures such as major joint replacement. Some studies show an incidence of thromboembolic events as high as 60% in these patients if not prophylaxed. Over time, standardized protocols have been developed for the use of anticoagulants in patients who are to undergo procedures such as a total hip or knee replacement, whereas there is much less standardization for foot and ankle surgery.

There are few controlled studies regarding the actual incidence of thromboembolic events following foot and ankle surgery. One of the larger studies evaluating thromboembolic events following foot and ankle surgery was published in 1998 (1). This publication is one of the most frequently cited references in articles discussing DVT prophylaxis after foot and ankle surgery. It is a prospective multi-center study among 15 major institutions across the country and included 2,733 patients. A surgeon from each of these institutions filled out a 1-page questionnaire on every patient having foot or ankle surgery during 1995. Patients with major trauma were excluded. A number of preoperative parameters were studied and included general demographic information, current medical disorders, history of DVT, and current medications. Intraoperative parameters included the type of surgery, use of tourniquet, and tourniquet site. Postoperative parameters evaluated the use of DVT prophylaxis, immobilization, and weight bearing status.

Among the 2,733 patients in the study there were 6 postoperative thromboembolic events (0.23%) including 4 non-fatal pulmonary emboli (PEs). No postoperative anticoagulation was given to 2,504 (92%) of the patients. In this group there were 4 postoperative detectable DVTs (0.16%). Of the patients that received postoperative prophylaxis, the incidence was 2 events in 218 patients (0.92%). One criticism that has been leveled against the study is the manner in which DVTs were documented. Neither venous ultrasounds nor venography were routinely performed to help document the presence of a DVT. Understandably, the cost of such testing would be very expensive, but there certainly could have been DVTs that were not diagnosed merely on the individual physician's clinical impression.

Furthermore, the authors did not find some of the parameters that are normally thought to be associated with DVT risk to actually increase the incidence of postoperative thromboembolic events. These included tourniquet use, major rearfoot or ankle surgery versus forefoot surgery, lack of DVT prophylaxis, even a history of previous DVT. Factors that were shown to increase the incidence of postoperative DVT were nonweight-bearing status and long-term cast immobilization. Even considering these 2 parameters, the incidence was increased only a small fraction of a percentage. Moreover, in the article's discussion the authors state that "Given the low incidence of deep vein thrombosis after foot ankle surgery and the costs and potential complications involved, the authors of this study think that the risks and costs of thromboembolic prophylaxis and screening are not justified for the small gain that may accrue"(1).

Over the last 15 years there have been a number of articles that address the issue of DVTs and PEs following foot and ankle surgery, with various disagreements regarding the circumstances that warrant chemical prophylaxis. In 2015, the American College of Foot and Ankle Surgeons published a "Clinical Consensus Statement" (CSS), which formulated recommendations for patient's warranting chemical prophylaxis based on the available literature. They are more aggressive as compared to some earlier recommendations, in part due to a greater consideration of postthrombotic syndrome, which received less attention in earlier studies.

## CONSIDERATIONS FOR CHEMICAL PROPHYLAXIS

First, it should be noted that the use of chemical prophylaxis is not “routinely” warranted after foot and ankle surgery (or in nonsurgical situations where immobilization is required). This is in contrast to hip and knee replacement surgery after which chemical prophylaxis is much more routine.

Regarding chemical prophylaxis for foot and ankle surgery there are 3 categories of risk factors to be considered: patient-specific factors, treatment-specific factors, and surgery/injury-specific factors. Each of these 3 categories is broken down into primary and secondary risk factors. Note: If one or more primary risk factors are present, strong consideration should be given to a multimodal prophylaxis, which may include pharmacologic agents. If only secondary risk factors are present, chemical prophylaxis is rarely warranted. However, the clinician is encouraged to consider the number and severity of the secondary risk factors, and in some instances chemical prophylaxis may be justified.

### Primary Patient-Specific Risk Factors

*Personal history of VTED.* A personal history of DVT/PE is the greatest risk factor as a predictor for the development of a future thrombotic event.

*Hypercoagulability.* Patients can be hypercoagulable due to inherited genetic disorders (e.g., deficiencies in Protein C, S, or antithrombin III, or mutations in factor V Leiden) or the hypercoagulability may be an acquired condition (e.g., myeloproliferative disorders and hyperviscosity syndromes). According to the literature, factor V Leiden mutation is the most pertinent of hypercoagulation disorders. If a patient is heterozygous for this genetic mutation the risk for a VTED event is increased by a factor of 7, whereas homozygous individuals have an increased risk of nearly 80. It is also estimated that factor V Leiden mutations are at least partially implicated in close to 20% of all VTED events. It is important to note that routine screening is not indicated.

*Active/recent cancer.* Cancer is considered a risk factor because of the observation that tumor cells can activate the blood clotting system. However, patients that have been in remission for 6 or more months are not considered at increased risk related to the cancer history.

### Secondary Patient-Related Risk Factors

*Obesity (body mass index >30).* There is no uniform agreement as to what constitutes obesity as it relates to VTED risk. However, the CSS panel defined obesity as a body mass index >30 (2).

*Advanced age (>60 years).* Age as a risk factor is a continuum, however, patients age 60 years and older should be considered at increased risk with regards to consideration for chemical prophylaxis.

*Family history of VTED.* This primarily is an issue because of the heritability of genetic blood disorders.

*Oral contraceptives/hormone replacement therapy.* While this is most often an issue with female patients, males on hormone therapy (generally estrogen) for prostate cancer are also included in this category.

*Varicose veins.* Varicosities are associated with increased risk for DVT because of their relationship to valvular incompetency and venous stasis.

*Higher injury severity scores.* Severe foot and ankle injuries are defined as those with a fracture, dislocation, or complete tendon rupture. The link between injury and development of VTED is the likely damage to the local venous and lymphatic systems.

*Diabetes/presence of more than 1 comorbidity.* The CSS panel did not define what the comorbid conditions were, but did point out the specific risk posed by the presence of diabetes. Interestingly the current literature has not established a link between VTED and the following conditions: smoking, pregnancy, ethnicity, sex, and the presence of cardiovascular disease.

### Primary Treatment-Specific Risk Factors

*Prolonged immobilization.* Prolonged immobilization is defined as period of time greater than 4 weeks. Immobilization itself includes the following: casts, cam walker boots, splints, external fixation, arthrodesis, or any other state that interferes with normal motion across the ankle joint. However, the CSS panel makes the following point, “Despite the strong association between limb immobilization and heightened VTED risk, limb immobilization by itself is rarely enough to warrant the use of chemical prophylaxis. The panel agreed that the greatest concern is when immobilization is prolonged (>4 weeks), rigid, or coupled with other known risk factors”(2).

### Secondary Treatment-Specific Risk Factors

*Non-weightbearing.* Non-weightbearing has been identified as a risk factor in the conservative as well as surgical management of foot and ankle conditions.

*Hospitalization.* The panel considered patients hospitalized longer than 24 hours to be at increased risk for the development of VTED until discharged. Whereas, those patients hospitalized longer than 72 hours to be at increased risk subsequent to discharge.

*Bed rest.* This status applies to hospitalized patients, those in long-term care facilities and also those convalescing at home.

### Primary Risk Factors Related to Surgery, Anesthesia, or Injury Type

There are no primary risk factors related to surgery, anesthesia, or injury type.

### **Secondary Risk Factors Related to Surgery, Anesthesia, or Injury Type**

*General anesthesia.* It is reported that general anesthesia increases the risk of VTED by a factor of 3 as compared to regional anesthesia. General anesthesia causes vasodilation, which increases venous stasis.

*Hindfoot/ankle surgery.* This risk factor relates to the trauma of the surgery itself in addition to the prolonged immobilization that is often required during the postoperative period.

*Achilles rupture.* This includes the conservative management of Achilles ruptures, and is related to loss of the calf muscle pump, which increases stasis.

### **CONCLUSION**

It is well understood that the chemical prophylaxis of DVT is controversial and studies do not always agree on the recommendations. In any event, it is important for clinicians to have some reasonable guidelines that we are familiar with

and can discuss with the patient. It is important to have the discussion of whether or not chemical prophylaxis is warranted before a problem occurs. In the case of a surgery patient, the discussion is generally a part of the preoperative consultation, whereas in the conservatively treated patient it is generally in the context of an injury or condition that requires us to immobilize the patient. The decision to institute chemical prophylaxis should be communicated to the internist, who can help recommend appropriate therapy and perform pertinent monitoring if indicated.

### **REFERENCES**

1. Mizel MS, Temple HT, et al. Thromboembolism after foot and ankle surgery. *Clin Orthop* 1998;348:180-5.
2. Fleischer AE, Abicht BP, et al. American College of Foot and Ankle Surgeons' Clinical Consensus Statement: risk, prevention, and diagnosis venous thromboembolism disease in foot and ankle surgery and injuries requiring immobilization. *J Foot Ankle Surg* 2015;54:497-507.