INTRODUCTION

Deep vein thrombosis (DVT) is a frequent complication after elective orthopedic surgery and can be a significant cause of morbidity and mortality. Although the incidence of DVT after foot and ankle surgery is low, a DVT leading to pulmonary embolism (PE) can be a cause of mortality. Commonly used DVT prophylaxis includes early mobilization, foot pumps, compression stockings, and chemical prophylaxis.1 Many of the recommendations for DVT prophylaxis after foot and ankle surgery have been extrapolated from the total joint arthroplasty literature. The incidence of DVT after hip and knee surgery can be more than 60%, with up to 13% subsequently having pulmonary emboli.2 Despite the benefits of chemical prophylaxis, chemical prophylaxis can be costly and cause wound healing complications.3 Risk factors should be taken into consideration when discussing potential chemical prophylaxis. Unfortunately, there are several risk factors that make preoperative screening for venous thromboembolism (VTE) more difficult. Some risk factors include family or personal history, older age, immobilization, stroke, cancer, lengthy surgical procedure, air travel, cigarette smoking, and oral contraceptives.4–11 The decision for DVT prophylaxis should be individualized for each patient after foot and ankle surgery.

VENOUS THROMBOEMBOLISM PROPHYLAXIS

The 2 main categories of VTE prophylaxis are mechanical and chemical. Mechanical prophylaxis includes compression stockings, ambulation, and intermittent pneumatic compression devices. Even if a patient is casted postoperatively, a weight-bearing cast may allow for muscle contraction and decrease the risk of DVT. Chemical prophylaxis includes aspirin, warfarin, low-molecular-weight heparins (LMWH, ie, Enoxaparin), and direct Xa inhibitors (ie, rivaroxaban). Although the use of direct Xa inhibitors is increasing in joint replacement patients, limited literature exists for the direct Xa inhibitors, especially in foot and ankle surgery.
Because the literature is poor regarding DVT prophylaxis in foot and ankle surgery, extrapolations have been used from joint replacement literature. Newer literature has suggested that aspirin is an appropriate agent for chemical DVT prophylaxis in total joint patients. In patients undergoing total joint arthroplasty, symptomatic thromboembolic events were lower in patients receiving 325 mg aspirin twice a day versus patients receiving warfarin. Pulmonary embolism rates were 0.14% in the aspirin group versus 1.07% in the warfarin group (P<.001). The aspirin group also had significantly fewer symptomatic DVTs, less wound related problems, and shorter related hospital stays.

Aspirin has also been studied in foot and ankle patients. However, the dosage and frequency of aspirin was much lower than what is recommended for a postoperative arthroplasty patient. In a study of VTE in foot and ankle surgery, placebo was compared with 75 mg of aspirin a day. The overall incidence of VTE was 0.42%, but there was no protective mechanism by this aspirin dose. The authors concluded that incidence of VTE is low, and chemical prophylaxis does not seem to be necessary if the patient is not high risk.

RISKS OF THROMBOPROPHYLAXIS

It is important to understand that mechanical and chemical DVT prophylaxis may decrease the incidence of VTE but does not make the risk zero. Risks of VTE prophylaxis, albeit low, sometimes outweigh the benefit of prophylaxis. In multiple studies, warfarin and LMWH have increased wound complications and superficial and deep infections. Warfarin has many food and drug interactions, requiring frequent monitoring and dose adjustments. In patients who do not adhere to a strict diet, international normalized ratio levels may fluctuate significantly.

Heparin-induced thrombocytopenia (HIT) is also a serious complication with absolute risk in orthopedic surgery of 0.2% for LMWH and 2.6% for unfractionated heparin. HIT often manifests 1 to 2 weeks after initiation of therapy but may occur as early as 1 to 2 days. It is identified by significant decrease in platelet count and positive HIT panel, and treatment involves cessation of heparin products and consultation with a specialist.

RISKS FOR VENOUS THROMBOEMBOLISM

Any factors increasing hypercoagulation, venous stasis, or endothelial vessel damage increase the risk for thrombosis. The preoperative evaluation of each patient should consist of an evaluation of postoperative VTE risk. Previous history of DVT, obesity, increasing age, cigarette use, oral contraceptive use, and tourniquet use have been reported as risk factors in differing articles. It is also important to ask if there is a family history of DVT and, if there is, whether there was ever a history of hypercoagulation workup.

TOURNIQUET

In foot and ankle surgery, tourniquets are helpful for maintaining a bloodless surgical field and increasing the ease of surgery. However, the literature is not conclusive about the correlation of DVT and tourniquet use in the foot and ankle. Maffulli and colleagues noted that thrombosis was more common with the use of a tourniquet in operatively treated ankle fractures compared with a control group, but the statistical significance of this increase was not calculated between the 2 groups. Conversely, in a prospective study, Simon and colleagues did not show an increased rate of thrombosis with the use of a thigh tourniquet in 117 patients undergoing forefoot surgery.

CHEST Guidelines

The American College of Chest Physicians produce recommendations on venous thromboprophylaxis in orthopedic surgery. Thirty-five days of chemical prophylaxis should be used in patients undergoing total hip or knee arthroplasty. Includes LMWH, fondaparinux, apixaban, dabigatran, rivaroxaban, unfractionated heparin, vitamin K antagonists, aspirin, or intermittent pneumatic compression device. Chemical prophylaxis should start 12 hours or more postoperatively. Recommend against Doppler ultrasound screening for asymptomatic patients. Inferior vena cava filter may be used for primary prevention in patients with increased bleeding risk or contraindications to chemical/mechanical thromboprophylaxis. No prophylaxis for isolated lower leg injury requiring immobilization.

Foot and Ankle Surgery

Studies evaluating heterogeneous populations after foot and ankle surgery concluded that the risk is low for a thromboembolic event. Each study identified its own risk factors (Table 1). Surveys of Practice

Two surveys evaluating the use of DVT prophylaxis after foot and ankle surgery found that most
orthopedic surgeons did not routinely use chemical prophylaxis (Table 2).1,21

TRAUMA

Trauma patients are a cohort of foot and ankle patients that may be at higher risk for VTE. However, the incidence of DVT and PE in foot and ankle trauma patients in a national trauma databank was low. Of 160 patients with isolated foot and ankle trauma, the incidence of DVT and PE was 0.28 and 0.21, respectively.10 This low rate of VTE is in agreement with the recommendations of the American College of Chest Physicians that no prophylaxis is necessary for isolated lower leg injury requiring immobilization.19

<table>
<thead>
<tr>
<th>Study</th>
<th>Routine Usage (%)</th>
<th>Prophylaxis Methods</th>
<th>Surgeons’ Viewpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wolf &amp; DiGiovanni,21 2004</td>
<td>44</td>
<td>Most commonly used sequential compression device and LMWH.</td>
<td>&lt;50% used prophylaxis, but 70% believed it was sometimes necessary</td>
</tr>
<tr>
<td>Gadgil &amp; Thomas,1 2007</td>
<td>19</td>
<td>Wide variety in thromboembolic prophylaxis</td>
<td>Lack of published evidence and low rate of VTE were most common reasons for not using prophylaxis</td>
</tr>
</tbody>
</table>

ANKLE FRACTURES

Ankle fractures are some of the most common injuries treated by orthopedic surgeons. Despite this, there are few studies investigating VTE and ankle fractures. In a prospective cohort, Selby and colleagues evaluated symptomatic VTE in patients with a tibial, fibular, or ankle fracture (treated nonoperatively) or a patellar or foot fracture (treated operatively or conservatively). There was no chemical DVT prophylaxis, and only 7 of the 1179 patients (0.7%) had a thromboembolic event. The authors concluded that symptomatic VTE is an infrequent complication in lower limb fractures, and these fractures can be managed without thromboprophylaxis.

In a larger retrospective review, the incidence of thromboembolic event was 3% in 1540 patients who underwent ankle open reduction and internal fixation (ORIF). The authors noted that the VTE rate was not affected by the use of chemical prophylaxis.

METATARSAL FRACTURES

Most patients with nonoperative metatarsal fractures are allowed to weight bear in a protective device. The spectrum of metatarsal fractures requiring operative intervention is wide, and the number of patients required to have an appropriately powered study would be difficult. There was only one study investigating PE and surgical fixation of a metatarsal fracture. In this retrospective review of 1477 patients, there were 4 patients (0.27%) who were diagnosed with a symptomatic PE within 90 days of the initial procedure. Because of this low rate in this heterogenous population, the authors concluded routine thromboprophylaxis may not be necessary for isolated metatarsal fractures.

HALUX VALGUS

In the elective setting, there are even fewer articles about VTE. There was only one study identified regarding hallux valgus. This was a prospective study in which patients were screened for venous thrombosis after chevron bunionectomy, even in the absence of symptoms. None of the 100 patients received chemical prophylaxis, and only 4 patients had a venous thrombosis. The average age of the DVT group was significantly higher than the non-DVT group. Because of these results, the authors concluded that patients are at low risk for venous thrombosis after surgical treatment for hallux valgus, but routine prophylaxis may be justified for patients older than 60 years.

Achilles Tendon Rupture

Achilles tendon ruptures are also a common injury that is treated by all orthopedic surgeons. The literature on Achilles tendon VTE is more comprehensive than other foot and ankle conditions but still does not compare in thoroughness to joint replacement data. Lapidus and colleagues prospectively evaluated 91 patients surgically treated for Achilles tendon ruptures. The patients were randomly divided into 2 groups (dalteparin vs placebo) and were evaluated at 3 and 6 weeks after surgery for DVT regardless of symptoms. Both groups showed a high rate of DVT (34% in dalteparin group and 36% in placebo group), and no significant difference existed between the 2 groups.

Patel and colleagues reached a similar conclusion on their retrospectively study of 1172 patients who had an Achilles tendon rupture diagnosed. The rates for symptomatic DVT and PE after an Achilles tendon rupture were 5 of 1172 (0.43%) and 4 of 1172 (0.34%), respectively. The investigators noted that body mass index, age, and surgical repair did not significantly influence the rates of thrombosis.

It is common practice to temporarily immobilize the limb after an acute Achilles injury. Even with aggressive functional rehabilitation, a period of 1 to 2 weeks of immobilization is common. Healy and colleagues retrospectively evaluated 208 patients with an Achilles tendon injury that was treated with cast immobilization for at least 1 week. They reported a 6.3% rate of symptomatic DVT and 1.4% rate of PE. Despite this higher incidence of VTE, it is difficult to conclude that the cast immobilization was the cause of the VTE, as proximal retraction of the rupture has been theorized to increase pressures on the deep calf veins.

SUMMARY/DISCUSSION

The approach to chemical DVT prophylaxis should be individualized in each patient. The literature is not conclusive with strong recommendations for or against DVT prophylaxis. More high-quality studies must be done before strong recommendations can be made. The presence of risk factors should be strongly considered when making the determination of whether to place patients on chemical prophylaxis. The discussion of DVT prophylaxis as well as nonoperative treatment of
Achilles tendon ruptures should be made with each patient before any surgical treatment.

REFERENCES