

Clinical Research

Deep-Vein Thrombosis Prophylaxis in Foot and Ankle Surgery

What Is the Current State of Practice?

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Abstract: Background. When contemplating thromboprophylaxis for patients undergoing elective foot and ankle surgery the potential for complications secondary to venous thromboembolism (VTE) must be balanced against the cost, risk, and effectiveness of prophylactic treatment. The incidence of pulmonary embolism (PE) following foot and ankle surgery is considerably lower than after hip or knee surgery. The purpose of this study was to assess current trends in practice regarding VTE prophylaxis among expert orthopaedic foot and ankle surgeons. **Methods.** An e-mail-based survey of active AOFAS (American Orthopaedic Foot and Ankle Society) committee members was conducted ($n = 100$). Surgeons were questioned as to their use, type, and duration of thromboprophylaxis following elective ankle fusion surgery. Scenarios included the following: (1) A 50-year-old woman with no risk factors; (2) a 50-year-old woman with a history of PE; and (3) a 35-year-old woman actively using birth

control pills (BCPs). **Results.** The response rate for the survey was 80% (80/100). Replies regarding the use of thromboprophylaxis were as follows: (1) in the absence of risk factors, 57% of respondents (45/80) answered, "No prophylaxis required"; (2) for the scenario in which the patient had experienced a previous PE, 97.5% of respondents (78/80) answered, "Yes" to prophylaxis use; (3) for the scenario in which the patient was on BCP, 61.3% of respondents (49/80) stated that they would give some type of thromboprophylaxis. The most commonly recommended methods of prophylaxis were aspirin, 49% (24/49), and low-molecular-weight heparin, 47% (23/49). The recommended length of time for thromboprophylaxis varied widely, from 1 day to more than 6 weeks. **Conclusion.** There remains wide variation in the

practice of deep-vein thrombosis thromboprophylaxis within the foot and ankle community. Because risks for foot and ankle patients differ from those in the well-studied areas of hip and knee, specific guidelines are needed for foot and ankle surgery.

“However, clinicians and researchers continue to struggle to define, from a risk-benefit perspective, which subset of foot and ankle patients would benefit from VTE prophylaxis.”

Levels of Evidence: Level V: Expert Opinion

Keywords: thromboembolism; foot; ankle; prophylaxis; thromboprophylaxis; foot and ankle surgery; warfarin; heparin; aspirin; pulmonary embolism; deep-vein thrombosis (DVT)

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Table 1.

Responses to Survey Question Number 1, "Would You Routinely Provide Thromboprophylaxis?"^a.

Thromboprophylaxis	If No Risk Factors for DVT/ PE	If Previous PE	If 35-Year-Old Woman on BCP
Yes	35 (43%)	78 (97.5%)	49 (61.3%)
No	45 (56%)	2 (2.5%)	31 (38.7%)
Total (n)	80	80	80

Abbreviations: DVT, deep-vein thrombosis; PE, pulmonary embolism; BCP, birth control pill.

^aThe majority of respondents did not recommend chemical prophylaxis for patients with no risk factors. Nearly all respondents recommended thromboprophylaxis for patients with a history of PE, whereas thromboprophylaxis was recommended by 61% of respondents for patients on BCPs.

Introduction

Venous thromboembolism (VTE) causes substantial morbidity and mortality in orthopaedic surgery. VTE is well recognized as a potential complication of hip and knee arthroplasty; however, there is currently little scientific literature to guide best practice with regard to chemical thromboembolic prophylaxis in foot and ankle surgery. Some retrospective studies have found that the risk for symptomatic venous thrombosis is low and concluded that routine deep-vein thrombosis (DVT) prophylaxis is not indicated in most patients undergoing foot and ankle surgery.¹⁻⁶ However, clinicians and researchers continue to struggle to define, from a risk-benefit perspective, which subset of foot and ankle patients would benefit from VTE prophylaxis. The purpose of this study was to evaluate trends in the use of thromboembolic prophylaxis among a defined group of established orthopaedic foot and ankle surgeons.

Methods

A 1-page survey containing 3 clinical situations with 3 questions associated with each scenario (Tables 1 to 3) was e-mailed to all 100 active committee members of the AOFAS (American Orthopaedic Foot and Ankle Society). Ex-committee members and honorary or

non-committee members were excluded. Participation in the survey was voluntary. Responses were accepted if at least 1 part of each of the 3 clinical situations was answered. Responses were analyzed at 6 weeks. A custom-designed Microsoft Excel sheet was used to organize the data, which were analyzed using a Windows-based statistical software. Of the 100 clinicians surveyed, 80 responded, for a response rate of 80%.

The practice-pattern demographics of the study group were foot and ankle focused, with 75% (60/80) reporting that >90% of their practice was dedicated to foot and ankle problems. Only 2.5% (2/80) reported that foot and ankle surgery comprised less than half of their clinical practice.

The survey presented the following hypothetical clinical case scenarios:

1. A 50-year-old woman undergoing an ankle fusion with no history of DVT or pulmonary embolism (PE)
2. A 50-year-old woman undergoing ankle fusion, with a history of PE
3. A 35-year-old woman nonsmoker scheduled to undergo an ankle fusion, who is on birth control pills (BCPs)

Respondents were then asked the following questions regarding each scenario:

1. Would you routinely recommend thromboprophylaxis?
2. What type of prophylaxis would you recommend?
3. How long should prophylaxis be continued?

Results

Scenario 1

The majority of respondents—56% (45/80)—did not recommend chemical prophylaxis for a 50-year-old patient with no risk factors (Table 1). For those who did recommend prophylaxis, the primary method of choice was aspirin, at 66% (23/35); only 12 out of 80 would recommend low-molecular-weight heparin (LMWH) or warfarin in this scenario (Table 2).

Scenario 2

Nearly all respondents—97.5% (78/80)—recommended thromboprophylaxis for a 50-year-old with a history of PE, undergoing an ankle fusion and requiring a non-weight-bearing cast for 6 weeks postoperatively (Table 1). The most commonly recommended methods of prophylaxis (Table 2) were LMWH (76.3% [58/77]) and warfarin (18.4% [14]).

Scenario 3

Thromboprophylaxis was recommended by 61% of respondents (49/80) for a 35-year-old on the BCP (Table 1). The most commonly recommended methods of prophylaxis (Table 2) were aspirin (49% [24/49]) and LMWH (47% [23/49]). The recommended length of time for prophylaxis varied widely, from 1 day to 6 or more weeks (Table 3).

Discussion

The risk factors for VTE in foot and ankle surgery cited include, but may not be limited to, prior thromboembolic disease,^{7,8} family history of VTE,⁹ hypercoagulable state,¹⁰ use of oral contraceptive, prolonged

Table 2.

Responses to Survey Question Number 2, "If Yes, How Would You Provide Thromboprophylaxis?"^a.

Prophylactic Modality	If No Risk Factors for DVT/PE	If Previous PE	If 35-Year-Old Woman on BCP
Aspirin	23 (65%)	2 (2.6%)	24 (49%)
LMWH	10 (29.4%)	60 (77%)	23 (47%)
Warfarin	1 (2.8%)	14 (18.4%)	0
IVC filter	0	1 (1.3%)	0
Obtain vascular opinion	0	1 (1.3%)	0
Boots	1 (2.8%)	0	1 (2%)
Discontinue BCP	0	0	1 (2%)
Total (n)	35	78	49

Abbreviations: LMWH, low-molecular-weight heparin; DVT, deep-vein thrombosis; PE, pulmonary embolism; BCP, birth control pills; IVC, inferior vena cava.

^aFor those who did recommend prophylaxis in the absence of risk factors for DVT/PE, the primary method of choice was aspirin. For patients with a history of PE, the most commonly recommended methods of prophylaxis were LMWH (76.3%) and warfarin (18.4%). For patients on BCP, the most commonly recommended methods of prophylaxis were aspirin (49%) and LMWH (47%).

immobilization,¹¹ smoking,¹² obesity,¹³ malignancy,¹⁴ and so on.

Current available evidence, albeit limited, would suggest that VTE is relatively uncommon in foot and ankle surgery.¹⁻⁶ This is particularly true when compared with rates of VTE in hip and knee surgery.¹⁵⁻¹⁹ The primary purpose of the current study was to review the pooled expertise of orthopaedic foot and ankle surgeons and enhance our understanding of the current state of practice in this area. Several unanswered questions remain, including which patients should receive VTE prophylaxis; what type of prophylaxis should be used; and what duration of prophylaxis should be recommended.

There was widespread agreement (97.5%) in our response group that a patient with a history of VTE should receive thromboprophylaxis during the postoperative period (Table 1). Indeed, a history of thromboembolism has long been acknowledged as a predictor of subsequent DVT in the postoperative patient.^{20,21} One of the implications of this study is to emphasize the critical importance of ensuring that every patient is actually asked whether he or she has a history of previous VTE.

For patients with a history of VTE, there was also a consensus that prophylactic treatment with LMWH or warfarin was preferable to treatment with aspirin (Table 2). However, there was no clear consensus with regard to prophylaxis with LMWH versus warfarin: 77% (60/80) of respondents recommended LMWH, whereas 18% (14/80) recommended warfarin, and 6% (4/80) recommended other prophylaxes (eg, aspirin and IVC filters). Perhaps some of the confusion relates to a lack of awareness of the risk factors for VTE in foot and ankle surgery on the part of consulting physicians, for whom it may represent only a small part of their practice. Hence, there is a need to educate surgeons regarding the fact that foot and ankle surgery carries risk factors that are different from those in other types of surgery. Similarly, consulting physicians (eg, hematologists and chest physicians) and physicians involved in

Table 3.

Responses to Survey Question Number 3, "If Yes, Duration Of Prophylaxis?"^a.

Duration	If No Risk Factors for DVT/PE	If Previous PE	If 35-Year-Old Woman on BCP
1 day	1 (3%)	0	0
10 days	1 (3%)	1 (1.3%)	2 (4%)
2 weeks	4 (12%)	17 (23.2%)	9 (18%)
3 weeks	1 (3%)	0	0
4 weeks	5 (15%)	8 (9.5%)	4 (8%)
6 weeks	13 (38%)	25 (45%)	16 (33%)
12 weeks	0	8 (9.5%)	2 (4%)
Until cast off/FWB	10 (30%)	15 (17.4%)	11 (22%)
Skipped question	0	4 (5.4%)	5 (10%)
Total (n)	35	78	49

Abbreviations: DVT, deep-vein thrombosis; PE, pulmonary embolism; BCP, birth control pills; FWB, full weight bearing.

^aThe recommended length of time for prophylaxis varied widely, from 1 day to 6 or more weeks.

formulating policy may lack sufficient knowledge of the risk factors for VTE in foot and ankle surgery, resulting in varying and confusing guidelines and advice.

Our survey suggests that the majority of foot and ankle experts (56%) do not recommend routine VTE prophylaxis following major hindfoot surgery (eg, ankle fusion) in patients who have no risk factors (Table 1). Presumably the rationale for this is based on weighing the relatively low risk of VTE after foot and ankle surgery against the known complications of thromboprophylaxis, such as wound hematoma, heparin-induced thrombocytopenia (HIT), and poor wound healing. Evidence from the current literature would suggest that the incidence of VTE in the elective postsurgical foot and ankle patient is between 1% and 4%, which is markedly lower than the rate for comparable hip or knee procedures.¹⁻⁴ Furthermore, the vast majority of these VTE events appear to be blood clots in the small veins below the knee and are therefore far less likely to be clinically significant. The reported frequency of severe (major) wounds or systemic hemorrhagic complications in postoperative orthopaedic patients who have received chemoprophylaxis ranges from 1.5% to 5.1%.^{9,15} Moreover, many of these studies have excluded the highest-risk patients (elderly patients or those with a history of gastrointestinal bleeding) and therefore have likely underestimated the true risk of bleeding. Girolami and Girolami²² reported a 6.5% incidence of HIT in patients who were treated with unfractionated heparin after orthopaedic surgery. In up to 50% of patients, HIT has been reported to lead to DVT, PE, myocardial infarction, stroke, hemorrhage, amputation, or death.^{23,24}

Our study assessed how foot and ankle experts perceived the active use of BCPs as a potential risk factor for VTE. The results suggest that patients on BCP are considered to be at higher risk for VTE than patients with no risk factors. For several decades, the published literature has suggested an association between the use of BCP and an increased risk of

thromboembolism, both arterial and venous.²⁵ It is postulated that BCPs contribute to risk via increasing prothrombotic factors and inducing activated protein C resistance.²⁶ Although the link between the use of BCP and thromboembolism has been well established, only a handful of recent nonrandomized studies have investigated the effect of BCPs in postoperative patients.^{27,28} In 2 case-control series, Vessey et al²⁹ and Greene and Sartwell³⁰ suggested that the use of BCPs was significantly higher in those who experienced postoperative VTE. The results in 4 subsequent cohort studies have been mixed, however.³¹⁻³⁴ Therefore, until further appropriately designed studies with objective diagnostic end points are performed, there still remains conflicting evidence in the current literature to implicate the use of BCPs as a significant risk factor for VTE in the surgical patient.

A review of the literature suggests a variety of proposed risk factors for postoperative VTE. However, studies of these risk factors are confused by evidence from medical and population settings. Risk factors found to be significant for medical DVT may differ from those in a surgical context. In addition, patient groups undergoing different types of surgery (eg, orthopaedic vs general surgery) may not be comparable. Finally, the emphasis on a confirmed, objective diagnosis of DVT and PE (vs the inaccurate nature of a clinical diagnosis in screening for thromboembolism) is a crucial yet underestimated criterion for a trial's validity. Nevertheless, the most commonly cited factors for increased risk of VTE are a history of DVT or PE,^{7,8} positive family history,⁹ obesity,¹³ malignancy,¹⁴ immobilization,¹¹ hereditary thrombophilias,¹⁰ airline travel,³⁵ and smoking.¹²

As reflected by our survey, the optimal choice and duration of thromboprophylaxis unfortunately remains a dilemma. Currently, there exist a number of different guidelines for the prevention of VTE in orthopaedic surgery. The majority of international

guidelines unanimously agree that heparin can be used for thromboprophylaxis in hip and knee replacements.³⁶ Fondaparinux is regarded as an equivalent alternative to LMWH by most guidelines developed after 2006.³⁶

There is, however, a lack of consensus regarding the role of warfarin and aspirin and the sole use of mechanical devices. With regard to aspirin, the main issue leading to conflicting recommendations has been whether there exists a causal relationship between asymptomatic DVT detected by venography or ultrasound, and clinically important VTE (symptomatic DVT and PE). This hypothesis has been supported by the ACCP (American College of Chest Physicians),³⁷ for example, but not by the AAOS (American Academy of Orthopaedic Surgeons).^{38,39} The AAOS has placed greater emphasis on the risk of bleeding from surgical wounds than has the ACCP, which has been reflected in the recommendations set forth by each organization. Previously, if only the results of high-quality RCTs were considered, there was insufficient evidence for the use of aspirin.^{16-18,40} If these trials were disregarded, only a grade B recommendation remained in favor of aspirin.

However, recent changes to both the ACCP and AAOS guidelines are in agreement regarding the use of aspirin as a valid choice for chemoprophylaxis of VTE.⁴¹ In addition, in a recent review of the literature of aspirin alone or in combination with pneumatic compression therapy, Stewart and Freshour⁴¹ concluded that the evidence supports the efficacy of aspirin as an option for VTE prophylaxis in patients undergoing total knee arthroplasty, total hip arthroplasty, or hip fracture surgery. These results have also led the Surgical Care Improvement Project to alter their process measures for thromboprophylaxis to include aspirin, effective in 2014.⁴²

In another recent analysis, Raphael et al⁴³ studied patients undergoing total joint arthroplasty and found that the overall rate of symptomatic PE was lower

in patients receiving aspirin (0.14%) than in patients receiving warfarin (1.07%; $P < .001$). The aspirin group also had significantly fewer symptomatic DVTs and wound-related problems and shorter hospital stays. Based on these findings from a large institutional database, the authors concluded that aspirin offers suitable prophylaxis against symptomatic PE in selected patients.

When effective prophylactic measures exist, appropriate guidelines and protocols are frequently not consistently applied. Correctly categorizing patients into appropriate risk groups is subject to error. Recently, the concept of quantitative risk assessment for VTE with risk scoring has emerged. Gearhart et al⁴⁴ devised a risk-assessment profile (RAP) score in patients with assorted trauma and validated the score in 184 individuals. Significant differences were noted in 5 of the 15 RAP factors between the high-risk and low-risk groups: obesity, transfusion >4 units, surgery of more than 2 hours' duration, severe head injury, and complex fractures of a lower extremity. The authors concluded that patients with a RAP score >5 were 3 times more likely to develop VTE than those with lower scores.

Knudson et al⁴⁵ developed a risk assessment model based on 1602 episodes of symptomatic VTE identified from a review of 450 375 patients within the American College of Surgeon's National Trauma Data Bank. Six factors were identified by multivariate logistic regression to be independently significant for VTE: age >40 years (odds ratio [OR] = 2.01), lower-extremity fracture (OR = 1.92), head injury (OR = 1.24), ventilator days >3 (OR = 8.08), venous injury (OR = 3.56), and a major operative procedure (OR = 1.53).

The Caprini Risk Assessment Model⁷ is a similar prognostic scoring system that is intended to guide the clinician on the use of prophylactic regimens for 4 risk-stratified groups of patients. However, it has neither been validated in the setting of orthopaedic surgery in general, nor foot and ankle surgery in particular. Currently, individualized prescription of thromboprophylaxis

based on formal risk assessment models is not routinely used by most orthopaedic foot and ankle surgeons because validated risk models specific to foot and ankle surgery have yet to be devised for our practice.

Conclusion

This study presents the current state of practice with respect to VTE prophylaxis among a group of established orthopaedic foot and ankle surgeons. The majority of surgeons surveyed did not recommend routine VTE prophylaxis in elective ankle fusion surgery in the absence of clear VTE risk factors. Presumably, this was a result of the low incidence of DVT following elective foot and ankle surgery as well as the known burden of potential complications associated with thromboprophylaxis. Conversely, all foot and ankle patients should be screened for a history of VTE and other clearly established risk factors, as outlined above. For those patients found to be at high risk, the consensus is that some type of prophylaxis is warranted. Given the lack of conclusive, evidence-based guidelines, there remain large variations in the method and duration of DVT prophylaxis used by foot and ankle surgeons. A validated, foot-and-ankle-specific treatment algorithm that will guide the choice and duration of VTE prophylaxis, possibly in conjunction with a validated foot-and-ankle-specific risk assessment model is warranted.

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