FOOT AND ANKLE

Incidence of venous thromboembolism in elective foot and ankle surgery with and without aspirin prophylaxis

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The incidence of deep-vein thrombosis (DVT) and pulmonary embolism (PE) is thought to be low following foot and ankle surgery, but the routine use of chemoprophylaxis remains controversial. This retrospective study assessed the incidence of symptomatic venous thromboembolic (VTE) complications following a consecutive series of 2654 patients undergoing elective foot and ankle surgery. A total of 1078 patients received 75 mg aspirin as routine thromboprophylaxis between 2003 and 2006 and 1576 patients received no form of chemical thromboprophylaxis between 2007 and 2010. The overall incidence of VTE was 0.42% (DVT, 0.27%; PE, 0.15%) with 27 patients lost to follow-up. If these were included to create a worst case scenario, the overall VTE rate was 1.43%. There was no apparent protective effect against VTE by using aspirin.

We conclude that the incidence of VTE following foot and ankle surgery is very low and routine use of chemoprophylaxis does not appear necessary for patients who are not in the high risk group for VTE.

It has been suggested about 25 000 people in the United Kingdom die from a preventable hospital-acquired venous thromboembolism (VTE) each year. The risk of a thromboembolic event following hip and knee surgery has been well documented, with an incidence of asymptomatic deep-vein thrombosis (DVT) of between 40% and 60% without the use of mechanical or chemical thromboprophylaxis. It has been suggested that proximal DVTs have a higher embolic potential than distal DVTs. The incidence of a proximal DVT in hip and knee surgery has been reported to range between 20% and 40%, with a mortality rate of between 0.19% and 0.4%. Thromboprophylaxis has been shown to reduce the risk of DVT and fatal PE in these patients.

In the United Kingdom the National Institute of Clinical Excellence (NICE) has recommended that for patients undergoing elective hip and knee replacement, combined mechanical and pharmacological thromboprophylaxis should be offered based on an assessment of the patient’s risk factors. Although the implementation of these guidelines has been somewhat controversial, there is generally increasing pressure for all elective orthopaedic patients, including those undergoing foot and ankle surgery, to receive chemical thromboprophylaxis. The incidence of thromboembolic disease after foot and ankle surgery has been studied less than in other areas of orthopaedics but available data suggest that it is between 0.22% and 4%. It has therefore been suggested that chemical thromboprophylaxis is not warranted in elective foot and ankle surgery, regardless of the patient’s risk factors.

Antiplatelet therapy has been shown to reduce the incidence of thromboembolic disease and aspirin to reduce the risk of VTE in orthopaedic patients. The senior author (JDFC) had routinely used aspirin as chemoprophylaxis from 2003 to 2006 but stopped this because the incidence of thromboembolic disease was considered very low in elective foot and ankle surgery. The aim of this study was to determine the incidence of clinically significant thromboembolic events in patients undergoing elective foot and ankle surgery with and without the use of low dose aspirin as a form of chemical thromboprophylaxis.

Patients and Methods
A retrospective analysis was performed on all patients who underwent elective foot and ankle surgery under the care of the senior author (JDFC) between 2003 and 2010. Between 2003 and 2006 (inclusive) patients were given aspirin 75 mg once daily starting on the first post-operative day. In patients undergoing surgery to the forefoot, this was continued for two weeks; in those undergoing...
midfoot or hindfoot surgery it was continued for six weeks or until they were out of plaster. This decision was made based on the surgeon’s preference at that time. Between 2007 and 2010 no form of chemical thromboprophylaxis was used. All patients had pneumatic compression foot pumps placed on the non-operated limb in theatre and anti-embolism compression stockings on the ward.

The majority of patients were followed for a minimum of three months post-operatively. The remainder were contacted by telephone, or through their General Practitioner, at least three months post-operatively, to confirm whether or not a thromboembolic event had been diagnosed. Patients were not screened for clinically asymptomatic thromboembolic events.

All patients undergoing elective foot and ankle surgery under the care of the senior author (JDFC) were included in the study, except those who were receiving anticoagulation therapy for a pre-existing medical condition. Patients receiving low-dose aspirin for a pre-existing medical condition between 2007 and 2010 were also excluded. Those patients considered to be at high risk of DVT (previous VTE, obesity, the presence of a pro-coagulant condition such as protein C deficiency, a history of cancer or patients taking the combined oral contraceptive pill) received low-molecular-weight heparin (LMWH), and were also excluded. Of the 2704 patients considered, a total of 50 patients were excluded from the study, of whom 20 (0.74%) had a previous history of a thromboembolic event and 22 (0.81%) were either obese, had a history of cancer or were taking the contraceptive pill. One patient (0.04%) suffered from haemophilia A (factor VIII deficiency) and one patient (0.04%) had a previous history of splenectomy. A further six patients (0.22%) were given post-operative LMWH as part of a departmental policy and were also excluded from the study.

A consecutive series of 2654 patients were, therefore, included in the study (1427 males and 1227 females), of which 1078 received aspirin post-operatively and 1576 received no form of chemical thromboprophylaxis. During the study 27 patients were not contactable (10 males and 17 females) and were therefore lost to follow-up, ten of whom were in the aspirin group and 17 in the no aspirin group.

**Statistical analysis.** This was performed using MedCalc for Windows, version 9.6.4 (MedCalc, Mariakerke, Belgium). The chi-squared test and the Mann-Whitney U test were used to compare the two groups. Statistical significance was accepted if \( p < 0.05 \).

**Results**

Excluding the 27 patients lost to follow-up, 11 patients (0.42%) of the remaining 2627 patients had a symptomatic thromboembolic event post-operatively. There were seven DVTs and four non-fatal PEs. The overall incidence of a DVT and PE was 0.27% and 0.15% respectively (Table I).

The incidence of symptomatic thromboembolism was higher in the aspirin group than the no thromboprophylaxis group (0.47% and 0.39% respectively) (Table II). There was, however, no statistical difference in the rate of thromboembolic events between the two groups (\( p = 0.985 \), chi-squared test). Interestingly, in the aspirin group, DVT was more common than PE. In the no chemical thromboprophylaxis group, the incidence of DVT and PE was equal (Table I). There was, however, no statistical difference in the rate of PE or DVT between those who received aspirin and those who did not (\( p = 0.9 \) and \( p = 0.615 \), respectively, chi-squared test).

### Table I. The incidence of a venous thromboembolic event (VTE; either deep-vein thrombosis (DVT) or pulmonary embolism (PE)) in the aspirin, no thromboprophylaxis and combined study groups, excluding the patients lost to follow-up

<table>
<thead>
<tr>
<th></th>
<th>Number of patients</th>
<th>Number</th>
<th>Incidence (%)</th>
<th>Number</th>
<th>Incidence (%)</th>
<th>Total number of VTEs</th>
<th>Overall incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin</td>
<td>1068</td>
<td>4</td>
<td>0.37</td>
<td>1</td>
<td>0.09</td>
<td>5</td>
<td>0.47</td>
</tr>
<tr>
<td>No thromboprophylaxis</td>
<td>1559</td>
<td>3</td>
<td>0.19</td>
<td>3</td>
<td>0.19</td>
<td>6</td>
<td>0.39</td>
</tr>
<tr>
<td>Combined</td>
<td>2627</td>
<td>7</td>
<td>0.27</td>
<td>4</td>
<td>0.15</td>
<td>11</td>
<td>0.42</td>
</tr>
</tbody>
</table>

### Table II. The incidence of a venous thromboembolic event (VTE; either a deep-vein thrombosis (DVT) or pulmonary embolism (PE)) in males and females, excluding those lost to follow-up

<table>
<thead>
<tr>
<th></th>
<th>Number of patients</th>
<th>Number</th>
<th>Incidence (%)</th>
<th>Number</th>
<th>Incidence (%)</th>
<th>Total number of VTEs</th>
<th>Overall incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>1417</td>
<td>1</td>
<td>0.07</td>
<td>4</td>
<td>0.3</td>
<td>5</td>
<td>0.35</td>
</tr>
<tr>
<td>Females</td>
<td>1210</td>
<td>6</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0.5</td>
</tr>
</tbody>
</table>
group. This was not statistically significant (Mann-Whitney test, p = 0.082). In this study females had an increased incidence of thromboembolic events compared with males (Table II). In particular females had more DVTs as all thromboembolic events diagnosed in the female group were DVTs, there were no PEs. In contrast males had a higher incidence of PE compared with DVT (Table II). There was no significant difference between the incidence of thromboembolic events as a whole (p = 0.795) or in terms of PE (p = 0.179) or DVT (p = 0.085, all chi-squared test) between males and females.

Including the 27 patients lost to follow-up, and assuming they all developed a symptomatic thromboembolic event as a worst case scenario, the incidence of symptomatic thromboembolism would rise to 1.43% (38 of 2634 patients) (Table III). Here the incidence of a thromboembolic event on aspirin would be 1.39% (15 of 1078) and that with no chemical thromboprophylaxis would be 1.46% (23 of 1576) (Table III).

Post-hoc power analysis revealed with 1078 patients in the aspirin group and 1576 patients in the no chemical thromboprophylaxis group, this study had a 79% chance of detecting a significant difference at a one-sided 0.05 significance level. This assumes that the response rate of aspirin is 0.005 and that of no chemical thromboprophylaxis is 0.015. In other words we have a 79% power to detect a threefold increase in the rate of symptomatic DVT or PE from 0.5% (0.005) in the aspirin group to 1.5% (0.015) in the no chemical thromboprophylaxis group.

### Discussion

We found an overall incidence of symptomatic thromboembolism of 0.42%. In a previous multicentre study, Mizel et al reported a 0.22% incidence of DVT and a 0.15% incidence of a non-fatal PE in 2733 patients following foot and ankle surgery. Since then several studies have investigated the incidence of thromboembolic disease in this patient group. Solis and Saxby reported an incidence of radiologically identifiable below-knee DVTs of 3.5% in a prospective study involving 201 patients undergoing foot and ankle surgery. There was no radiological evidence of DVT progression proximal to the calf. Similarly, Radl et al reported an incidence of 4% of radiologically identifiable distal DVTs in 100 patients following hallux valgus surgery. In both studies all DVTs were asymptomatic. Hanslow et al retrospectively reviewed 602 patients undergoing foot and ankle surgery and reported a 4% incidence of DVT and a 1.3% incidence of PE. However, more recently in a larger retrospective review of 1000 patients undergoing foot and ankle surgery the incidence of DVT and PE was 0.4% and 0.3% respectively.¹⁷

One possible explanation for the difference in the incidence of thromboembolic disease in these studies is size of the population. Following the study by Mizel et al, the subsequent investigations consisted of relatively small numbers of patients. In terms of sample size, our study is comparable to that of Mizel et al. Indeed, excluding those lost to follow-up, our study suggests a similar incidence of postoperative thromboembolic events, with the incidence of DVT and PE being 0.27% and 0.15% respectively. Even considering the lost to follow-up group, our results suggest an incidence of a symptomatic thromboembolic event to be far less than that suggested by Solis and Saxby. Radl et al and Hanslow et al. In support of this, studies have indicated similarly low VTE rates in podiatric surgery. One such study retrospectively reviewed 7264 patients undergoing podiatric surgery over a five year period and identified the incidence of symptomatic VTE to be 0.3%.

Interestingly a recent review of a national database reported the incidence of thromboembolic events to be much lower in elective foot and ankle surgery. The incidence of DVT and PE ranged between 0.01% and 0.03% and 0.02% and 0.17%, respectively, in 42 292 patients. Although a database survey carries all the inherent problems of data entry, data retrieval and acknowledgment of complications, it is interesting to see a demonstrable increase in the incidence of DVT and PE following ankle fracture surgery (0.12% and 0.17% respectively). A significantly higher incidence of thromboembolic events have also been reported in patients with a rupture of the tendo Achillis.²⁰,²¹ A previous prospective study has suggested the incidence of thromboembolic events to be as high as 34% in patients with a rupture of the tendo Achillis. Here the incidence of asymptomatic and symptomatic VTE was 23% and 11% respectively, with no significant difference in rates of VTE in patients treated conservatively or operatively. A similarly high incidence of VTE (6.3%) was recently reported in patients treated for rupture of the tendo Achillis with prolonged cast immobilisation.

The use of aspirin as a form of chemical thromboprophylaxis in orthopaedic patients remains controversial. It has previously been indicated that there is a reduction in the incidence of thromboembolic disease through the use of antiplatelet therapy. The American Academy of Orthopaedic Surgeons has recommended aspirin as a form of chemical thromboprophylaxis in patients undergoing elective hip and knee surgery. Furthermore the Pulmonary Embolism Prevention trial (PEP trial) suggested aspirin to reduce the risk of DVT and PE by at least one third in patients during a period of increased risk. Surprisingly,
excluding the lost to follow-up group, there were more thromboembolic events in those taking aspirin as a form of thromboprophylaxis, though this was not statistically significant. The increased incidence was related to an increased incidence of DVT (0.37% compared with 0.19%) as the incidence of PE was less in the aspirin group compared with the non-aspirin group (0.09% compared with 0.19%). This might be an incidental finding but possibly suggests that aspirin has little effect on DVT propagation but confers some protection towards the development of proximal emboli. Hanslow et al. found a similar result whereby thromboprophylaxis with 40 mg of subcutaneous LMWH increased the risk of thromboembolic complications. In our study, aspirin also appeared to delay the development or diagnosis of a thromboembolic event by about 4.5 weeks although this was not statistically significant. It would be interesting to see the effect of aspirin on the incidence of a thromboembolic event in this patient group, if it was continued for a longer period of time post-operatively.

A topical current debate is the use of other forms of chemical thromboprophylaxis in foot and ankle surgery, besides aspirin. We have noted that the overall incidence of a symptomatic thromboembolic event was as low as 0.42% to 1.5%. This therefore raises the question of whether this low incidence merits the routine use of any form of chemical thromboprophylaxis. Other than the antiplatelet agents, the pharmacological agents currently recommended for thromboprophylaxis are anticoagulants. These include the antithrombin inhibitors such as unfractionated heparin and LMWH, the factor Xa inhibitors and the vitamin K antagonists such as warfarin. Whereas all these have been shown to reduce the risk of VTE in orthopaedic patients, the increased risk of bleeding, wound problems, heparin-induced thrombocytopenia (HIT), factor Xa inhibitor-induced thrombocytopenia and spinal haematoma (following epidural anaesthesia) associated with anticoagulant therapy have been well documented. Indeed, it has been suggested that the incidence of major or minor bleeding in patients receiving heparin therapy is 2%, twice that of patients not receiving heparin therapy. Furthermore it is estimated that the incidence of the potentially fatal type II HIT is 1%. It is interesting therefore that with an overall incidence of a thromboembolic event of 0.42% as in this study, the risk of chemical thromboprophylaxis may very well serve to outweigh its benefits in elective foot and ankle surgery.

One limitation to our study is the fact that patients only underwent radiological screening for thromboembolic disease if clinical suspicion was raised. Clinical assessment is an inaccurate means of detecting thromboembolic events, as many are clinically silent. Patients with untreated symptomatic proximal DVTs have a 30% to 40% incidence of PE. The aim of this study was therefore to determine the incidence of symptomatic thromboembolic events in elective foot and ankle surgery. Our results are compatible with previous studies and demonstrate a low incidence of a thromboembolism in these patients. Although the follow-up period employed in this study was three months and it is possible that patients developed a thromboembolic event later, previous population based studies have indicated that patients are at an increased risk of a thromboembolic event for up to three months following elective hip and knee replacement. Therefore we feel that three months is an adequate follow-up period to assess the incidence of VTE in elective foot and ankle surgery but acknowledge that a longer follow-up would establish whether this definitely applies to this group of patients.

We conclude that the reported risks of routine chemical thromboprophylaxis appear to outweigh any potential benefits and the use of aspirin does not appear to confer significant protection against symptomatic VTE. An alternative form of thromboprophylaxis should be considered in high risk patients such as those who are obese, continue with the combined oral contraceptive pill or have a previous history of VTE or a pro-coagulant condition.

### Supplementary material

A table detailing all cases of post-operative thromboembolic disease (deep-vein thrombosis or pulmonary embolus) with the operation performed, type of event, time from surgery and type of thromboprophylaxis received, is available with the electronic version of this article on our website www.ibjs.org.uk

### References


