Assessment of a self-administration protocol for extended subcutaneous thromboprophylaxis in lower limb arthroplasty

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The risk of venous thromboembolism in patients following arthroplasty may be reduced by continuing chemical thromboprophylaxis for up to 35 days post-operatively. This prospective cohort study investigated the compliance of 40 consecutive consenting patients undergoing lower limb arthroplasty with self-administration of a recommended subcutaneous chemotherapeutic agent for six weeks after surgery. Compliance was assessed by examination of the patient for signs of injection, number of syringes used, and a self-report diary at the end of the six-week period. A total of 40 patients, 15 men and 25 women, were recruited. One woman was excluded because immediate post-operative complications prevented her participation. Self-administration was considered feasible in 87% of patients (95% confidence interval (CI) 76 to 98) at the time of discharge. Among this group of 34 patients, 29 (85%) were compliant (95% CI 73 to 97). Patients can learn to self-administer subcutaneous injections of thromboprophylaxis, and compliance with extended prophylaxis to six weeks is good.

Venous thromboembolism remains the principal preventable cause of death following major elective orthopaedic surgery.\textsuperscript{1,2} Data for Scotland have shown that the rate of deep venous thrombosis (DVT) and pulmonary embolism remains at 2%\textsuperscript{3} with a mortality of 0.2% following hip arthroplasty,\textsuperscript{4} despite an increase in prescribing of thromboprophylaxis in hospital by orthopaedic surgeons.\textsuperscript{5,6} Most venous thrombotic events manifest clinically after discharge from hospital\textsuperscript{4,7} and are therefore seen by primary care physicians. There is evidence to show that continuing chemical thromboprophylaxis for four to six weeks after surgery can reduce the risk of asymptomatic venous thromboembolism\textsuperscript{8-13} and one study relating to total hip arthroplasty has demonstrated a significant reduction in symptomatic events.\textsuperscript{14} An increasing number of orthopaedic surgeons use extended prophylaxis.\textsuperscript{6} Currently, aspirin is most widely used because it is inexpensive and easy to administer, but there are concerns about its efficacy.\textsuperscript{15} There is a perception that although clinicians recognise the value of extended prophylaxis using either low molecular weight heparin, fondaparinux or adjusted-dose warfarin, they are concerned about the risk of haemorrhage and the cost. The resource implication for providers of primary care of district nurses attending each patient with a lower limb arthroplasty to administer daily injections of anticoagulant for five weeks following discharge, makes the proposal unattractive. We investigated whether patients were able to learn to self-administer a subcutaneous chemical thromboprophylactic agent and would comply with home administration.

Patients and Methods
The study was approved by the Local Ethics Committee.

We recruited 40 consecutive consenting adults admitted to a single elective orthopaedic unit following an explanation of the rationale and protocol. One woman was excluded because of cardiac complications in the immediate post-operative period requiring admission to an intensive care unit. Of the remaining 39 patients, 15 were men and 24 women; ten had a diagnosis of rheumatoid arthritis and 29 had osteoarthritis. All patients wore spectacles, but none was registered blind. We collected data on age, gender, the underlying diagnosis, any hand or ocular pathology that might compromise the use of a syringe, the patient’s opinion of their hand function (‘normal’, ‘impaired’, ‘severely disabled’), and the score from the Disability of the Arm, Shoulder and Hand (DASH) questionnaire.\textsuperscript{16} Patients were excluded from the trial if they had poor renal function or a history of gastrointestinal haemorrhage.
Patients underwent routine hip or knee arthroplasty. All operations were performed under regional anaesthesia. Following surgery all patients were graded compression stockings and used A-V impulse foot pumps (SCD, Kendall Healthcare Products, Mansfield, Massachusetts). The first dose of fondaparinux, a synthetic factor Xa inhibitor (2.5 mg subcutaneous injection; Glaxo-SmithKline, Middlesex, UK) was administered eight hours post-operatively. A second dose was given 24 hours later. These initial doses were administered by the ward nursing staff.

All nurses involved in the study attended a half-hour training session on subcutaneous administration of fondaparinux using the pre-filled syringes. At the end of the study period, they were invited to complete a structured questionnaire to evaluate their experience of teaching patients: how difficult it was, whether it was a valuable use of their time, how easy the patients found it, and how long it took.

From the second post-operative day, the patients self-administered fondaparinux under the tutelage of the nursing staff once every 24 hours into the subcutaneous fat, 2 cm from the umbilicus, keeping the needle perpendicular to the skin. The prefilled syringes, when fully depressed, administer the full 2.5 mg dose and deploy a needle-guard that prevents subsequent needle-stick injury following removal of the needle from the skin.

The median hospital stay was five days (four to 14). No patient had a delayed discharge because of inclusion in the study.

All patients were assessed by a single observer (AW) prior to discharge. The safety of their technique of skin preparation, injection and needle disposal was assessed. The patients were asked to report their experiences of learning to self-inject using ten questions. If self-administration was deemed feasible the patient was discharged with the rest of their six-week supply of fondaparinux and a sharp-safe disposal box.

Patients were visited in their own home by a single observer (AW) who, with consent, examined the patient’s abdomen for evidence of recent injection. The used and unused syringes were collected for counting and the patients returned their administration diaries. They were again invited to complete a brief questionnaire to provide feedback about their experience of self-administration.

Results

Hand function. Twenty-seven patients reported normal hand function, ten impaired function, and two indicated that they were severely disabled because of their hand function. The proportion of patients reporting impaired or severely disabled function was significantly higher in those with rheumatoid arthritis (Table I) than in those with osteoarthritis. The patients with rheumatoid arthritis also had a higher mean DASH score (27 of 100) than the osteoarthritic group (16 of 100, Mann-Whitney U test = 54; p = 0.006). There was a strong correlation between self-reported hand function and the DASH score (Spearman’s ρ = 0.75; p < 0.001). No patient had had a significant previous hand injury or had a neurological deficit in the upper limb.

Feasibility. Of the 39 patients, 34 (87%; 95% CI 76 to 98) were able to self-administer the subcutaneous fondaparinux after a median of five days education. Of the five in whom it was not feasible, one had a minor upper gastrointestinal bleed, one developed a pseudoaneurysm in the knee related to his surgery, one with rheumatoid arthritis and a DASH score of 80 of 100 was unable to use the device because of problems in the hands, one withdrew because of a pre-existing needle-phobia, and one simply felt unable to cope (DASH score 17 of 100). There were no significant differences in feasibility between genders, underlying pathology or hand function, although there was a trend towards more problems in the rheumatoid group (Table II).

Compliance. Of the 34 patients (85%; 95% CI 73 to 97) who were deemed able to self-inject, 29 achieved greater than 90% compliance with extended prophylaxis for up to six weeks, based on the number of used syringes. Only one of these patients had no visible injection sites on examination at six weeks, and his compliance on the self-report diary was not greater than 90% (89%). A further five patients failed to complete their diary. There were no significant differences in compliance between gender, underlying pathology or hand function. At six weeks, all patients stated that the device was simple and the technique of injection easy.

Complications

Bleeding. One patient was taken off fondaparinux two days after surgery because of a minor haematemesis. She was started on an H2 antagonist and required no further treatment. Six of the 40 patients required a post-operative blood transfusion. This was within the range of the normal transfusion requirement for this unit. One patient developed a pseudoaneurysm following surgery, but this was not attributable to the use of fondaparinux.

<p>| Table I. Hand function by pathological diagnosis (chi-squared = 11.9, p = 0.003) |
|----------------------------------------|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Hand function</th>
<th>Normal</th>
<th>Impaired</th>
<th>Disabled</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Rheumatoid arthritis</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>24</td>
<td>5</td>
<td>29</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>10</td>
<td>2</td>
<td>39</td>
</tr>
</tbody>
</table>

<p>| Table II. Feasibility by pathological diagnosis (chi-squared = 3.6, p = 0.096) |
|----------------------------------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Feasible</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>10</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>2</td>
<td>27</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>34</td>
<td>39</td>
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Thrombosis. No patient had clinical evidence of thrombosis, either in hospital or up to six weeks post-operatively. Allergy. One patient developed oedema of the limbs and face two weeks after discharge from hospital. This resolved spontaneously on cessation of fondaparinux, indicating a temporal relationship, but no formal allergy testing was undertaken. The patient had no respiratory symptoms or rash.

Nursing assessment. In their responses the nursing staff were ambivalent about how easy the patients found it to self inject, although they felt that on average they learned quickly. The nurses considered it safe for the patients to be self-administering fondaparinux at home. They enjoyed teaching patients to self-inject and thought it was a valuable use of their time. They reported that it took approximately 45 minutes to teach each patient (15-minute periods over three days), but felt that some would find self-administration unacceptable.

Discussion

There is good evidence that patients develop a relative thrombophilia following lower limb arthroplasty, and that this continues for up to three months post-operatively. A meta-analysis of the current literature reveals a 50% reduction in the odds of developing clinical venous thromboembolism following lower limb arthroplasty if chemical prophylaxis is extended to five or six weeks. The same analysis reported a similar reduction in venographic events, supporting the use of a venographic end-point as a good surrogate for clinical venous thromboembolism.

The most recent guidelines from the American College of Chest Physicians, published in 2004, recommend a minimum of ten days’ thromboprophylaxis with low molecular weight heparin (LMWH), fondaparinux, or adjusted-dose vitamin K antagonist after lower limb arthroplasty, and state that ideally this should be continued for up to 35 days. This builds on the recommendations from Kearon, who advises a tailored approach based on the risk factors for venous thromboembolism and that of major haemorrhage. It should be noted that these guidelines are based on trials adopting surrogate outcome measures of venous thromboembolism identified radiographically rather than clinically.

Indirect evidence suggests that fondaparinux may be more effective in preventing venous thromboembolism than LMWH, which is more effective than warfarin; however, its use may be associated with an increased risk of bleeding. The advantage of fondaparinux for self-administration is that it is given as a single daily dose. It is produced in prefilled syringes.

Our study demonstrates that patients can be taught to self-administer subcutaneous fondaparinux safely in the post-operative period, and that this does not delay discharge. This is particularly relevant in the primary care setting, where the alternative is for the district nurse to administer the medication. Most patients found the technique easy and the device simple to use. We could not identify a specific group of patients who were unable to self-administer. Of the three patients recruited to the study who declared a needle phobia, only one felt unable to continue with the trial. One patient with multiple sclerosis who was discharged with a feasible technique reported that he had recruited his wife to give the injections, as his illness relapsed following discharge.

The rate of compliance of 85% was encouraging and may reflect the importance both patients and nurses attached to the use of chemical thromboprophylaxis. This was confirmed by their responses to appropriate questioning during the study. Previous studies using LMWH have shown high levels of acceptance with self-administration for up to three weeks. Although it is relatively easy for patients to deceive investigators as to compliance, the use of three compliance tools in this study should minimise overestimation of the true level.

The sample size was too small to comment on the efficacy of extended fondaparinux use for the prevention of venous thromboembolism, but no patient in this study developed such problems. A double-blind multicentre trial in patients undergoing surgery for hip fractures showed a risk reduction of venous thromboembolism of 96% when fondaparinux administration was extended from a maximum of eight days to 31 days.

Self-administration of thromboprophylaxis reduces the overall cost if compliance is good and episodes of venous thromboembolism are prevented. Cost-effectiveness analysis using cost, rate of haemorrhage and efficacy of treatment data from the published literature reveals that extended prophylaxis for up to four weeks after discharge is safe and cost saving with LMWH, warfarin or aspirin. Another study has compared the cost-effectiveness of fondaparinux to that of LMWH, and concluded that by five years the use of fondaparinux confers a relative cost saving. Neither of these studies included the time taken to educate the patients in the injection technique. Clearly, the cost of dedicated nursing staff allocating an hour per patient for education would have to be taken into consideration. Our study design included the ward nursing staff training the patients, as in any unit this responsibility is likely to fall to them.

Patients were able to learn to self-administer chemical thromboprophylactic agents using ward nursing staff as trainers without delaying their discharge. Patient compliance with the regimen was good.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References


