Venous thromboembolism incidence in upper limb orthopedic surgery: do these procedures increase venous thromboembolism risk?

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Background: In 2005, the House of Commons (HoC) Health Committee stated deaths attributed to preventable, hospital-acquired venous thromboembolism (VTE) numbered upwards of 25,000 per annum. Nationwide prevention of VTE became the topic of a major health campaign. The HoC Health Committee stated there was an unstratified VTE risk of between 45% and 51% associated with orthopedic surgery. VTE research in orthopedic surgery has been concentrated on lower limb procedures. Experience suggests that this kind of relation does not hold true for upper limb orthopedic procedures. This project aimed to estimate the incidence of postoperative VTE in upper limb orthopedic surgery.

Methods: The incidence of postoperative VTE was assessed in 3357 consecutive upper limb orthopedic operations performed by 4 surgeons in Lancashire Teaching Hospitals National Health Service (NHS) Trust (LTHTR) between July 1, 2009, and July 31, 2012.

Results: Four pulmonary embolisms and 2 deep vein thromboses occurred. Incidence of postoperative VTE was 0.0018%, significantly lower than rates reported in the literature. Five of 6 patients who developed a VTE reported a personal or family history of VTE. Three patients would not have been identified as at risk under the current VTE screening guidelines. Three of these patients received appropriate anticoagulation according to present guidelines, yet VTE events still occurred.

Conclusion: These results indicate VTE risk in orthopedic upper limb surgery is much lower than reported in the literature. The necessity for screening for VTE in upper limb surgery is contested. The efficacy of VTE screening and current VTE prophylaxis is discussed, and an alternative and much simplified method of screening is suggested.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: DVT; PE; upper limb surgery; prophylaxis

Venous thromboembolism (VTE) is an umbrella term used to conflate 2 pathologies; typically, deep venous thrombosis (DVT) and its more serious and much rarer pathologic relation, pulmonary embolus (PE). The
unhelpful effect of this misnomer is regularly demonstrated throughout the professional literature and perhaps most seriously in the House of Commons (HoC) Health Care Committee report of 2005. The introduction of this document states that PE after DVT in hospitalized patients causes between 25,000 and 32,000 deaths each year in the United Kingdom. This figure defies credence because it exceeds the total of deaths from breast cancer, AIDS, and traffic accidents combined. It is more than 2.5 times greater than the 9554 annual deaths rightly or wrongly attributed to methicillin-resistant \textit{Staphylococcus aureus} and more than 5 times the total of all hospital-acquired infections.\textsuperscript{5}

The document goes further and states, “more alarming than the scale of the problem was the fact that VTE in hospitalised patients was largely preventable through the use thromboprophylaxis during the patient’s hospital stay and occasionally continuing after discharge.”\textsuperscript{15} Although it may be true that prophylaxis reduces DVT and, therefore VTE, it is less likely to be true for PE, and there is little evidence to support the extension of this assertion that thromboprophylaxis reduces death rates in trauma and orthopedic surgery.

The overwhelming majority of research into VTE rates and orthopedic surgery is in lower limb surgery, and it has long been known that lower limb surgery significantly increases the risk of DVT. On that basis, patient screening and the use of thromboprophylaxis is generally considered appropriate.\textsuperscript{7} Literature shows the rates vary but fall within the range of 25% to 67% after hip and knee surgery.\textsuperscript{2,13}

Some authors have shown that the use of thromboprophylaxis reduces the rates of DVT and PE after hip and knee surgery, and several types of thromboprophylaxis have been recommended for patients undergoing total hip or knee replacement,\textsuperscript{14,15} including antiplatelet drugs,\textsuperscript{8} intermittent pneumatic compression of the leg,\textsuperscript{6} oral anticoagulants,\textsuperscript{4,8} and low-molecular-weight heparin (LMWH).\textsuperscript{5} Because of the high risk of VTE events in this type of surgery and the relatively safe reduction of risk from providing anticoagulation, National Institute of Clinical Excellence (NICE) guidance encourages its use.\textsuperscript{11} There is, however, evidence to the contrary suggesting that there is little evidence that thromboprophylaxis prevents death and certainly none to support the HoC Health Committee’s implication that thousands of deaths could be prevented annually.\textsuperscript{10}

This high level of VTE risk has not yet been demonstrated in upper limb surgery, with most of the research from retrospective studies or case reports. Some authors have suggested that DVT rates after shoulder replacement are comparable to those after hip replacement.\textsuperscript{16} Alternatively, a recent comprehensive review of the literature suggested rates were as low as 0.26% to 0.64%, depending on the upper limb procedure performed.\textsuperscript{3}

The reason for this possible reduction in VTE rates may be that unlike lower limb operations, upper limb orthopedic surgery tends to be less associated with a significant reduction in mobility, one the features of Virchow’s triad. The procedures also tend to be shorter and less traumatic, with no surgical involvement of the lower limb deep veins.

Perhaps due to the lack of plausible evidence, NICE has shown considerable reluctance to give definitive guidance for VTE prophylaxis for upper limb procedures. NICE does not recommend routine thromboprophylaxis for patients undergoing upper limb surgery, but puts the onus back on clinicians, advising that patients considered at high risk of VTE be given mechanical prophylaxis on admission and prescribed chemical prophylaxis postoperatively, after discussion of the risks with the patient.\textsuperscript{11}

A proper large-scale analysis of the risk of VTE in elective upper limb surgery is long overdue. This study starts by determining the rate of postoperative VTE (stratified into PE and DVT) within all upper limb procedures performed at a large teaching hospital.

\textbf{Methods}

A complete data set of operations has been retained within the Orthopedic Department at Lancashire Teaching Hospitals NHS Trust using Bluespier (Worcestershire, UK). The period identified for study was between July 1, 2009, and July 31, 2012. For each of the 4 upper limb consultants, a search was performed using the codes for all upper limb procedures performed. Exclusions included operations coded as an emergency procedure, patients younger than 18 years, and procedures such as injections. Emergency procedures were excluded because part of the study design was to look at the utility of current VTE screening and prophylactic measures; moreover, these patients might experience several operations within a very short interval.

Each operation was considered a separate event, because several patients underwent more than 1 operation between July 2009 and July 2012. This generated a list of 3357 events to be included in the study. Patient records where then compared with the radiology database to determine if the patient had been
investigated for DVT or PE within the hospital. The Imaging Department provides 4 modalities of investigating and diagnosing a VTE: ultrasound with Doppler or venogram for a DVT, computed tomography scan of the thorax with contrast or a ventilation/perfusion scan for PE.

In keeping with most of the studies reviewed in the literature search, an empirical cutoff of 90 days was established for the diagnosis of PE or DVT related to the index surgical event. Once identified as having had a VTE, the patient’s notes were examined for possible risk factors, in keeping with those outlined in Venous Thromboembolism: Reducing the Risk.11

Results

Of the 3357 operation assessed, 1694 were performed on men and 1663 on women. A breakdown of the different procedures performed is presented in Figure 1. Patients were an average age of 54 years, and when categorized by sex, the average age was 53 years for men and 57 years for women.

Of the 3357 events included within the study, a postoperative VTE was identified in 6 patients, including 4 with PE and 2 with DVT, providing a 0.0018% incidence of VTE (6 of 3357). All PEs were diagnosed by CT imaging, 1 during the orthopedic admission and 3 subsequently on the medical assessment unit. Both DVTs were diagnosed by ultrasound Doppler imaging through the DVT clinic. These numbers were surprisingly small and did not lend themselves to anything other than the most straightforward analysis. The risk profiles for the patients who developed VTE events were determined from the case files and are summarized in Table I.

Discussion

The total incidence of postoperative VTE was 0.0018% for all procedures, significantly lower than rates reported in the literature. Three of the 6 patients who developed a VTE had undergone arthroscopic procedures of the shoulder. The results suggest that this puts an estimated incidence of VTE after an arthroscopic shoulder procedure in our study at 0.636% (n = 472), slightly higher than the rate of 0.038% found by Dattini et al3 in their literature review. The incidence of VTE after shoulder arthroplasty in our study was zero, as was the VTE incidence after any form of upper limb arthroplasty.

The relationship between shoulder arthroplasty and VTE is wildly varied throughout the literature. Willis et al16 prospectively assessed VTE incidence in patients who had undergone a shoulder arthroplasty by performing 4-limb Doppler ultrasound imaging on randomly selected patients at set intervals postoperatively. They reported the incidence of VTE was 13% (n = 100), which was comparable to the rates in hip and knee surgery in their institution.16 This level was not reflected in our study, because we assessed clinically significant VTE rather than assessing all patients in the absence of symptoms for “silent” or subclinical DVT/PE. Our findings fit better with those of Sperling et al12 and Lyman et al,9 who found VTE rates of 0.173% (n = 2885) and 0.734% (n = 13,759) respectively.

Our evidence suggests that patients are not at a greatly increased risk of VTE when undergoing upper limb orthopedic procedures. We therefore question the need for such complex screening tools as are currently in place. A VTE assessment risk was completed in the 6 patients who

<table>
<thead>
<tr>
<th>Table I</th>
<th>Risk profile for patients who developed venous thromboembolism events</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Patient A</td>
</tr>
<tr>
<td>Age, years</td>
<td>61</td>
</tr>
<tr>
<td>Sex</td>
<td>Female</td>
</tr>
<tr>
<td>Operation</td>
<td>Arthroscopic</td>
</tr>
<tr>
<td></td>
<td>subacromial decompression</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>40</td>
</tr>
<tr>
<td>Chemical prophylaxis</td>
<td>–</td>
</tr>
<tr>
<td>DVT or PE</td>
<td>Bilateral PE</td>
</tr>
<tr>
<td>History of VTE</td>
<td>–</td>
</tr>
<tr>
<td>Family history of VTE</td>
<td>Sister had spontaneous bilateral PE around same time</td>
</tr>
</tbody>
</table>

BMI, body mass index; DVT, deep venous thrombosis; MCPJ, metacarpophalangeal joint; ORIF, open reduction, internal fixation; PE, pulmonary embolism; VTE, venous thromboembolism.
developed a VTE, and 3 of these patients were deemed not to require prophylaxis. The other 3 were classified as requiring prophylaxis.

We considered the possibility that the screening tools in place are not effective in identifying those at potential risk of VTE in upper limb surgery and perhaps throughout surgery that the treatment suggested by this assessment in those shown to be at risk may not be suitable to prevent VTE.

The most striking common factor in the patients who sustained VTE events was the strong family or personal history of DVT or PE, with a positive history present in 5 of 6 patients (83%). Although this project was not designed to assess the effect of risk factors on VTE incidence, the high incidence of patients with a direct history or first-degree relative history of hypercoagulability cannot be ignored. Had thromboembolic risk been assessed using simple questions to elicit any positive family or personal history of VTE and patients treated aggressively with chemical prophylaxis, a PE might have been prevented in 3 of 4 patients.

Conclusions

In the light of this common feature, we suggest that a personal or family history of hypercoagulability may be a far more useful means of identifying at-risk patients. We consider such patients could be at critical risk of PE. An alert placed within patient records, similar to an allergy alert, or an alert bracelet demonstrating that the patient has experienced a previous VTE or has a family history of VTE, or both, might be more appropriate.

We are currently extending this study model to neighboring NHS Trusts to eliminate crossover errors. We are concerned that VTE assessment, as it is currently ordained and conducted in the NHS in upper limb surgery, is time-consuming, unfit for purpose, and should be discontinued. In its place we recommend an alert system that would take minutes, if not seconds, to assess. We encourage a similar analysis for lower limb procedures because we surmise patients at critical risk of PE may still not be adequately protected by current prophylaxis measures.

Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

References