Abstract:
D Cawley, B Lenehan, A Devitt
Department of Orthopaedic Surgery, Merlin Park Hospital, Galway

Thromboembolic events are a post-operative complication of arthroplasty surgery for up to 3 months. The incidence however, is not fully known. Some form of prophylaxis should be provided to all arthroplasty patients. Clinicians are wary of side effects, compliance profile and the associated cost. The objective of this study is to investigate practice patterns and their relevance to 3 risk groups. Ninety questionnaires were sent to orthopaedic surgeons with 3 hypothetical clinical scenarios and 10 prophylaxis regimes for thromboembolism across different risk groups. The response rate was 81/90 (90%). The most popular options in all 3 cases were early mobilisation, thrombo-embolism deterrent (TED) stockings and low molecular weight heparin (LMWH) (51/81, 62% of all cases). An inconsistent relationship exists between preferred practice and relevant guidelines. Preferred practice does not correlate with each level of risk.

Introduction
Careful identification of pre-existing and peri-operative risk factors is important so that one can prescribe additional thromboprophylactic measures on a risk versus benefit basis. Total hip arthroplasty (THA), knee arthroplasty (TKA) and hip fracture surgery (HFS) patients are all high-risk for a thromboembolic event and all warrant similar mechanical and pharmacological thromboprophylaxis for an extended period at least. Risk stratification using accepted criteria such as those set out by Wells et al is necessary so that those at higher risk are treated appropriately. Alternatively, Murray et al suggested that the rate of pulmonary embolism (PE) after THA is far less than what is recorded- as low as $\frac{1}{2}-3$ per 1000. Recent conflicts between expert groups have made guidelines all the more difficult to follow. This study aims to determine risk stratification by orthopaedic surgeons for three hypothetical high-risk patients and the suitability of those choices as per the international guidelines. This study sets out to evaluate a clinicians preference for 3 hypothetical patient types.

Methods
Questionnaires were sent to 90 orthopaedic surgeons at 25 orthopaedic centres in the Republic of Ireland requesting what thromboprophylactic measures each consultant would routinely take in relation to patients of 3 different risk strategies. The clinical case scenarios consisted of 3 hypothetical patients. Patient A, is a 55 year old man, otherwise fit and healthy, for a routine primary total hip arthroplasty. Patient B, is a 75 year old woman, primary knee arthroplasty (TKA) and hip fracture surgery (HFS) patients are all high-risk for a thromboembolic event and all warrant similar mechanical and pharmacological thromboprophylaxis for an extended period at least. Risk stratification using accepted criteria such as those set out by Wells et al is necessary so that those at higher risk are treated appropriately. Alternatively, Murray et al suggested that the rate of pulmonary embolism (PE) after THA is far less than what is recorded- as low as $\frac{1}{2}-3$ per 1000. Recent conflicts between expert groups have made guidelines all the more difficult to follow. This study aims to determine risk stratification by orthopaedic surgeons for three hypothetical high-risk patients and the suitability of those choices as per the international guidelines. This study sets out to evaluate a clinicians preference for 3 hypothetical patient types.

Results
Total response rate was 81/90 (90%). The 3 most popular options for patients A, B and C were Early Mobilisation, TED stockings and LMWH - 151/243 (62%) of all cases.

Figure 1: Treatment options for A, B and C.
Peri-Operative
LMW Heparin was the most commonly used pharmacological agent for all risk groups. Early Mobilisation, TEDS and LMWH were the 3 most commonly prescribed choices of thromboprophylaxis. 185/243 (76%) prescribed both a mechanical and pharmacological thromboprophylaxis for each patient (Table 1). 9/243 (4%) was prescribed a single agent only. All but 5 respondents prescribed LMWH for at least 1 patient and 2 of these were using fondaparinux instead. 32/243 (13%) were prescribed neither TEDS nor Compression Devices as an inpatient. Some respondents felt that TEDS on swollen thighs may cause problems- i.e. acting as a tourniquet and increasing the predisposition to thrombosis or a PE when released. One further addition was a pre-operative Perfusion/Ventilation (V/Q) scan on patient B and a repeat scan prior to discharge.

Post-Discharge
15/81 (18%) prescribed patient A anti-coagulation after discharge. 34/81 (42%) prescribed patient B anti-coagulation after discharge. 17/81 (21%) prescribed C anti-coagulation after discharge. 43/243 (18%) of all patients were prescribed Aspirin. 28/43 were on Aspirin for 6 weeks post-operatively. 49/243 (19%) of all patients were prescribed Warfarin (low dose and regular) post-operatively. 7/12 (58%) patients recommended for a Greenfield filter were not discharged on any thromboprophylaxis. Additional relevant results offered by respondents included post-operative LMWH or fondaparinux for 4-6 weeks for A, B and C, direct thrombin inhibitor, eg. rivaroxaban, dabigatran, therapeutic dose LMWH post-operatively in hospital for B, Warfarin post-operatively for 2 weeks for B, commencing Warfarin the evening before the operation and leg elevation.

Risk Stratification
With regard to risk stratification, options were analysed to find out if each choice was prescribed to one or two risk groups (Did differentiate) or across all risk groups (Did not differentiate) (Figure 2). Low-dose Warfarin was never prescribed across all risks- selected cases only and so had a 100% differentiation rate. Only one respondent picked Nothing as an option, and all respondents picked Greenfield Filter for B only.

Figure 2: Risk Differentiation for each treatment option.

Intra Centre Agreement
All options both selected and unselected were evaluated for the top 6 orthopaedic centres who responded. Agreement on an option was only obtained if all respondents agreed to select or not select that option. Agreement varied from 900/2430 (37%) in a unit with 7 respondents to 1700/2430 (70%) agreement from a unit with 4 respondents.

Discussion
The high rate of reply for this study indicates an enthusiasm for persevering to address the thromboprophylaxis debate. In general, clinicians would rather avoid extended outpatient prophylaxis for all patients, preferring to focus on those most at risk. However, the medicolegal environment would coerce clinicians to be inclined to over-treat. Hip fractures in particular are very expensive to treat and measures warrant cost justification al pointed out that if prophylactic treatment results in increased death rate from complications of 0.05% or more the use of prophylaxis may actually be harmful. The American Academy of Orthopedic Surgeons (AAOS) recommend that patients at standard risk of both PE and major bleeding should be considered for aspirin, LMWH, synthetic pentasaccharides, or warfarin with an INR goal of d2.0. Patients at elevated risk of PE and at standard risk of major bleeding should be considered for LMWH, synthetic pentasaccharides, or warfarin with an INR goal of d2.0. Patients at standard risk of PE and at elevated risk of major bleeding should be considered for aspirin, warfarin with an INR goal of d2.0, or none. Patients at elevated risk of both PE and major bleeding should be considered for aspirin, warfarin with an INR goal of d2.0, or none.

The American College of Chest Physicians (ACCP) recommend that every hospital should develop a fomal strategy that addresses the prevention of venous thromboembolism (VTE) (Grade 1A evidence) 7. Murray et al pointed out that if prophylactic treatment results in increased death rate from complications of 0.05% or more the use of prophylaxis may actually be harmful. The American Academy of Orthopedic Surgeons (AAOS) recommend that patients at standard risk of both PE and major bleeding should be considered for aspirin, LMWH, synthetic pentasaccharides, or warfarin with an INR goal of d2.0. Patients at elevated risk of PE and at standard risk of major bleeding should be considered for LMWH, synthetic pentasaccharides, or warfarin with an INR goal of d2.0. Patients at standard risk of PE and at elevated risk of major bleeding should be considered for aspirin, warfarin with an INR goal of d2.0, or none. Patients at elevated risk of both PE and major bleeding should be considered for aspirin, warfarin with an INR goal of d2.0, or none.

Aspirin should not be used alone as

Thromboembolism Prophylaxis Practices in Orthopaedic Arthroplasty Patients 2
Thromboembolism prophylaxis for any patient group (1A), mechanical methods of thromboprophylaxis for patients should be used for patients at high bleeding risk (1A) or possibly as an adjunct to anticoagulant thromboprophylaxis (2A). For patients undergoing THA or TKA, one of the following three anticoagulant agents should be used: LMWH, fondaparinux, or warfarin, INR target, 2.5; range, 2.0 to 3.0 (each 1A). For patients undergoing hip fracture surgery (HFS), they advocated the routine use of fondaparinux (1A), LMWH (1B), warfarin (target INR, 2.5; range, 2.0 to 3.0) (1B), or low density unfractionnated heparin (LDUH) (1B). Patients undergoing TKA, THA or HFS were recommended thromboprophylaxis for a minimum of 10 days (1A); for THA and HFS, continuing thromboprophylaxis > 10 days and up to 35 days (1A). The National Institute of Clinical Excellence (NICE) group advocate mechanical prophylaxis and either LMWH or fondaparinux for all HFS, THA or TKA patients with one or more additional risk factors, for 4 weeks after surgery. They also give an in-depth description of the application of compression stockings, compression devices and other thromboprophylactic measures.

Timing of thromboprophylaxis was not a focal point in this study. The various treatment options were presented without reference to whether they were started pre- or post-operatively. The NICE guidelines consider optimal timing of starting thromboprophylaxis as inconclusive. AAOS guidelines recommend starting aspirin, LMWH, fondaparinux or Warfarin post-operatively or additionally starting Warfarin the evening before surgery. Finally, the ACCP, for THA, give equal merit to starting LMWH or Warfarin pre- or post-operatively and fondaparinux post-operatively. If a delay is anticipated, HFS patients should be started on LMWH pre-operatively. Administration before or after surgery would be justifiable in each case. The 3 hypothetical patients are representative of 3 risk groups yet all are considered high risk for a thromboembolic event. Furthermore, the 10 choices reflect pre-, peri-operative and post-discharge treatments allowing ample choice for each risk group. A 37-70% intra-centre agreement rate signifies a divergence of opinion in a country where orthopaedic surgeons meet regularly on an academic basis. Regional agreement on a regimen may yield a more structured approach to risk assessment and prevention. This especially has implications for junior medical and nursing staff as an agreed standard is easier to follow and more reproducible.

The guidelines also indicate a form of pharmacological prophylaxis for all hip/knee arthroplasty patients. Despite this 19/51 (37%) of respondents differentiated between risk groups for LMWH. Of the 12% of patients that were prescribed Warfarin, 4/26 (74%) of these differentiated between risk groups, however there are relative indications for Warfarising all 3 risk groups. Frequently clinicians use a multimodal approach over a single agent approach and many patterns of thromboprophylaxis exist. The multimodal approach involves more disciplines in the patient care and raises VTE awareness as a result. Discharge thromboprophylaxis regimes are indicated by the guidelines for all of these patients. 18%, 42% and 21% of patients A, B and C were discharged on a thromboprophylactic regime respectively. This may reflect a wariness of post-discharge complications including haemorrhage (both at the surgical site and elsewhere), proper compliance (self-administering sub-cutaneous heparin, compression devices), proper dosing (Warfarin) and repeat coagulation tests (costly).

The treatment choices in this study reflected a willingness to use several simultaneous thromboprophylactic agents during the peri-operative period. Despite a literature focus on individual thromboprophylactic agents, multimodal prevention remains central to our approach, as outlined in the aforementioned guidelines. A limitation of our study however, is that it does not clarify duration of treatment, especially as between two thirds and three quarters of symptomatic VTE events occur after the usual date of hospital discharge. Potential hip/knee arthroplasty or hip fracture patients are under-treated according to their risk status and for an inadequate amount of time. A regional or national consensus is recommended to identify what measures are needed for all hip and knee arthroplasty and hip-fracture patients, and how assessment will identify those at a higher risk. Furthermore, internationally accepted guidelines should remain the mainstay of one's approach to thromboprophylaxis in these patients.

Correspondence: D Cawley
Department of Orthopaedic Surgery, Merlin Park Hospital, Galway
Email: derekcawley@hotmail.com

References
6. NICE Clinical Guideline 92 Venous thromboembolism:reducing the risk. Developed by the National Collaborating Centre for Acute and Chronic Conditions. Jan 2010