



Research article

Surgeons' practices and perceptions regarding postoperative venous thromboprophylaxis for patients undergoing major orthopedic surgery at 108 military central hospital

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ABSTRACT

Patients undergoing major orthopedic surgery (MOS) are at the highest risk of developing postoperative venous thromboembolism (VTE) complications. Despite widespread recommendations for routine VTE prophylaxis, multiple publications have indicated that discrepancies between practice and guidelines persist. Therefore, it is crucial to identify the contributing factors to lay a solid foundation for future improvements. This study aimed to investigate the practices of VTE prophylaxis in MOS patients and the factors perceived to influence physicians' practices. This study employed a mixed methods approach in which medical records of 118 MOS patients were initially reviewed to measure adherence rates to guidelines. Subsequently, in-depth interviews were conducted with 15 surgeons based on the Theoretical Domain Framework to gain insights into the influencing factors of this practice. The research findings revealed the following compliance rates with VTE guidelines: indications (90.7%), anticoagulant choice (69.8%), dosage (91.9%), initiation time (100%), minimum duration of prevention (74.4%), and optimal prophylaxis duration (25.6%). Through in-depth interviews, we identified seven relevant theoretical domains influencing thromboprophylaxis practices. Main facilitators were adequate understanding of VTE prevention, consistent implementation, presence of hospital guideline, recognition of prevention benefits, and effective leadership. Frequently cited barriers included inadequate consideration of renal function, concerns about bleeding risks, impracticality of injectable treatments, absence of outpatient monitoring system, drugs' high cost, and patient financial constraints. In conclusion, the study pinpointed certain facets of VTE prevention that require enhancement in MOS patients. The identified factors that have an impact on this practice will be used as a foundation for designing suitable interventions to enhance it at the facility.

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INTRODUCTION

Venous thromboembolism (VTE), which encompasses deep vein thrombosis and pulmonary embolism, is a prevalent and serious medical complication that can increase hospital stays, treatment costs, and mortality rates [1]. Among all surgical specialties, major orthopedic surgery (MOS), including hip replacement and hip fracture surgeries, has the highest incidence of venous thromboembolism (VTE) [2]. The prevention of VTE in patients at risk presents the most significant opportunity to improve patient safety in hospitals among 79 patient safety practices due to its efficacy, cost-effectiveness, and benefit-risk ratio [3, 4]. MOS patients should receive routine VTE prophylaxis according to global evidence-based guidelines and the Vietnamese national guideline [2, 5, 6].

Despite long standing evidence and the existence of such guidelines, real world data reveals that current practice deviates from these standards [7, 8]. Hence, quality improvement initiatives are necessary to promote guideline adoption and reduce hospital-acquired VTE [9, 10]. To develop effective solutions, a comprehensive evaluation must identify VTE prevention areas with low compliance and examine factors that affect VTE recommendations [11].

A tertiary, special-class national hospital, the 108 Military Central Hospital, provides comprehensive and specialized medical care to patients nationwide. Orthopedics is an advanced specialty that draws many patients to the hospital for diagnosis and surgery. Optimizing anticoagulant use to prevent venous thromboembolism after major orthopedic surgery could improve patient outcomes, care quality, and satisfaction. To our knowledge, no mixed method studies have

been conducted to examine physicians' VTE preventive practices and perceptions in major orthopedic surgery patients with the aims of offering insights for future interventions. The research had two goals:

- (1) To investigate VTE prevention practice for major orthopedic surgery patients
- (2) To explore surgeons' perceptions regarding the practice of VTE prevention in patients undergoing major orthopedic surgery.

MATERIALS AND METHODS

STUDY DESIGN

This study employed a descriptive cross-sectional mixed methods research design that integrated quantitative and qualitative approaches. The research comprised two phases. Phase 1 involved a cross-sectional audit of medical records to assess adherence rates to thromboprophylaxis guidelines for patients undergoing major orthopedic surgery (MOS), thereby identifying prevention areas with low adherence. A qualitative phase of semi-structured interviews on surgeons was then deployed to explore the factors that affected MOS patients' VTE prevention efforts. The quantitative phase informed the types of surgeons for the qualitative phase and development of interview topic guide.

STUDY SETTING

Department of General Orthopedics (B1A) and Department of Joint Surgery (B1C) in 108 Military Central Hospital, Vietnam.

PHASE 1:

Participants:

Inclusion criteria: Adult patients who were admitted to the Department B1A and B1C in November 2023 to undergo major orthopedic procedures, including knee replacement, hip replacement or hip fracture surgery.

Exclusion criteria: Patients with venous thromboembolism before surgery, those using anticoagulants for another condition, or those with inaccessible medical records.

Sample size: All patients who met the study criteria during the study period were included.

Data collection:

Data from eligible patients were collected from both electronic and paper medical records and entered into a paper data collection form. Patient data from admission to discharge were gathered, comprising demographic information, admission and discharge diagnoses, procedural details, features of provided VTE prevention methods, and discharge prescriptions. Based on the gathered information, the research team evaluated the adherence rate to the current treatment guidelines. For each patient, the assessed aspects included: (1) indication of VTE prevention methods, (2) the selection of anticoagulant agents, (3) anticoagulant dosing regimen, (4) timing of anticoagulant initiation, (5) minimum or optimal length of VTE prevention, and (6) overall adherence. Overall adherence was determined when all the individual aspects above were evaluated as adherent.

To investigate the level of compliance with VTE prevention guidelines among patients undergoing major orthopedic surgery, the research team compiled information from several guidelines and updated references, and then formulated specific criteria for evaluation [2, 5, 6, 12, 13]. These criteria were agreed upon within the research team before being applied to audit the medical record.

Data analysis: Data was analysed through descriptive statistics, using Microsoft Excel 2021.

PHASE 2:

Participants:

Inclusion criteria: Surgeons who performed

major orthopedic surgeries (MOS) and provided post-operative care for MOS patients.

Exclusion criteria: Surgeons who declined to participate or were not present during the interview period between May and June 2024.

Sample size: We applied a purposeful sampling technique, in which we intentionally invited two department leaders and several attending physicians with varying years of experience and professional qualifications to take part in the interview. This helped capture a diversity of relevant perspectives and beliefs. The sampling process was completed when analysis of the transcripts of three or more consecutive interviews showed data saturation (i.e. no new themes emerged). The research team expected that data saturation would be achieved with a sample size of 9 - 17 participants [14].

Data collection:

Data were collected using an interview topic guide with open-ended questions that was developed based on the findings of Phase 1 and the theoretical domain framework (TDF) [15]. The questions focused primarily on the aspects of VTE prevention that exhibited a suboptimal compliance rate (in Phase 1) to better understand the influencing factors.

The TDF framework is an established theoretical framework used in implementation studies to examine the factors that influence the behaviour of healthcare staff in following evidence-based recommendations [15-17]. The framework has 14 theoretical domains which include: Knowledge, Skills, Professional role, Beliefs about ability, Optimism, Beliefs about consequences, Reinforcement, Intention, Goal, Memory, Attention and decision process, Environmental context and resources, Social influence, Emotion, Behaviour regulation [16].

The interviews lasted 15 to 30 minutes. Prior to conducting the interview, informed consent was obtained from participants. The interviews were conducted and recorded in a private location in the hospital as arranged with the participants.

Data analysis:

Interviews were audio-recorded, transcribed verbatim, and made anonymous. Subsequently, a thematic analysis was performed using the Theoretical Domain Framework. Themes were categorized as facilitators or barriers to the VTE prevention practice.

Ethics approval

This research was reviewed and approved by the Ethics Committee of the 108 Military Central Hospital, under the approval number 3527/GCN-BV, 11/07/2023.

RESULTS AND DISCUSSION

RESULTS

Phase 1: Surgeons’ practices of VTE prevention for patients undergoing major orthopedic surgery at the Institute of Orthopedic Trauma, 108 Military Hospital 108

*** Patient characteristics and VTE prevention characteristics.**

Table 1 presents the characteristics of the patients and the details of VTE prevention. The mean age was 66.1 ± 17.8 years. 92.4% of patients were administered VTE prophylaxis. Upon discharge, 74 (62.7%) patients were prescribed anticoagulants. The median duration of VTE prophylaxis was 16 days.

Enoxaparin and dabigatran were administered to prevent venous thromboembolism (VTE) during the patients’ hospitalization, whilst dabigatran and rivaroxaban were prescribed for extended prophylaxis after discharge.

Table 1. Patient characteristics and VTE prophylactic characteristics

Characteristics	n (%) (N= 118)
Age (years), mean±SD	66.1±17.8
Male Gender, n (%)	56 (47.5)
Weight (kg), mean±SD	56.4±9.9
BMI (kg/m ²), mean±SD	21.6±2.8
Creatinin clearance < 30 mL/min, n (%)	7 (5.9)
Surgical indications, n (%)	
Elective total hip replacement surgery	32 (27.1)
Elective total knee replacement surgery	26 (22.0)
Hip fusion surgery for hip fractures	33 (28.0)
Hip replacement surgery for hip fractures	27 (22.9)
Patients with risk factors for severe bleeding, n (%)	9 (7.6)
Absolute contraindications to anticoagulation, n (%)	2 (1.7)
VTE prophylaxis methods, n (%)	109 (92.4)
Anticoagulant alone	71 (60.2)
Mechanical method alone	3 (2.5)
Combined anticoagulant and mechanical method	35 (29.7)
Anticoagulant prescription upon discharge, n (%)	74 (62.7)
Length of VTE prevention (days)*, mean±SD	16.2±7.3

* Calculated in 106 patients prescribed anticoagulant without contraindications to anticoagulants

*** Adherence rate to VTE prevention guidelines**

Figure 1 illustrates the adherence rates to VTE prevention guidelines. There was generally a high level of compliance with VTE prophylaxis indications, anticoagulant selection, anticoagulant dosage, initiation time, and minimum length of prophylaxis, with adherence rates of around 70% or higher. The aspect that had the lowest adherence was the optimal length of VTE prophylaxis, with a compliance rate of only 25.6%. The overall compliance rates for VTE prophylaxis, considering all aspects, including the minimal VTE prevention

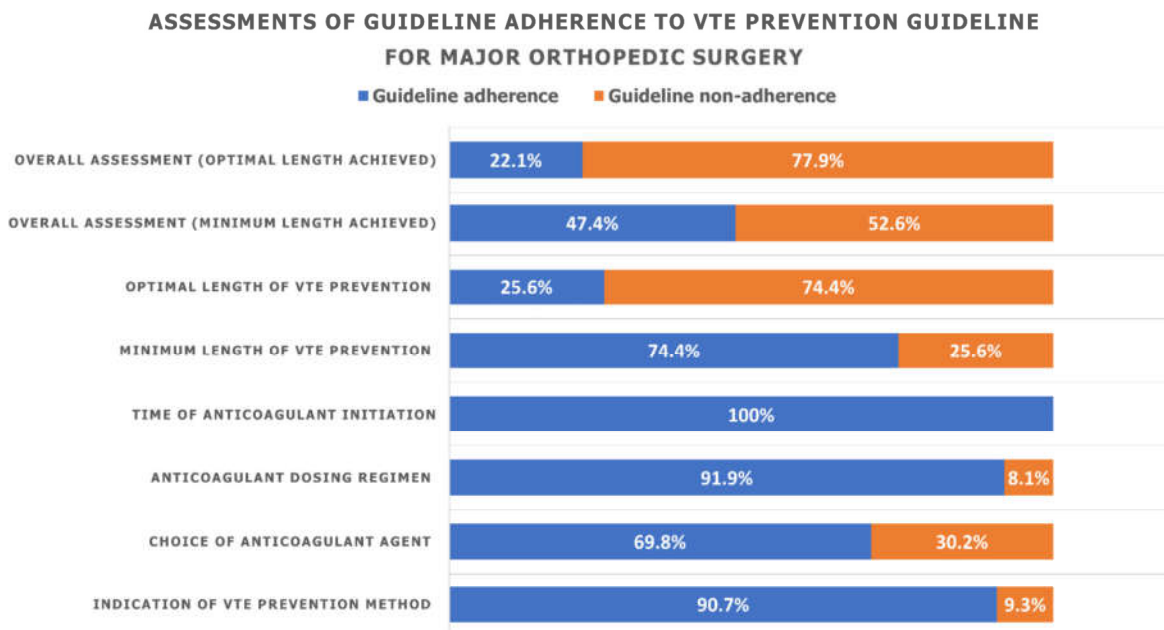


Figure 1. Adherence rate to VTE prevention guideline for major orthopaedic surgery

Table 2. Detailed reasons for inappropriate VTE prophylaxis for each aspect

Criteria	N	Rate of non-adherence	Reasons for Non-adherence	n (%)
VTE prevention indications	118	11 (9.3%)	Lack of anticoagulant indication for hip fracture patients	9 (81.8)
			Lack of anticoagulant indication for hip replacement patients	1 (9.1)
			Lack of mechanical method for hip fractures patients	1 (9.1)
Choice of anticoagulant	106	32 (30.2%)	Choice of DOAC for hip fracture patients	32 (100)
Anticoagulant dosing	74	6 (8.1%)	Dose not adjusted by Clcr	3 (50)
			Dose not adjusted by age	2 (33.3)
			Dose not adjusted by age and Clcr	1 (16.7)
Minimum length of VTE prevention	86	22 (25.6%)	Shorter than recommended in hip replacement patients	2 (10)
			Shorter than recommended in hip fracture patients	20 (90)
Optimal length of VTE prevention	86	64 (74.4%)	Shorter than recommended in hip replacement patients	26 (40.6)
			Shorter than recommended in knee replacement patients	2 (3.1)
			Shorter than recommended in hip fracture patients	36 (56.3)

duration, were 47.4%. However, when the criterion of optimal length of prophylaxis was included, the overall rate of adherence decreased to 22.1%.

*** Characteristics of non-adherent cases**

The specific justifications for inappropriate cases for each of the aforementioned aspects are presented in Table 2. Lack of prophylaxis indication for high risk VTE patients, failure to adjust the dose according to dosing correction

factors, and shorter-than-recommended use were the most common reasons for inappropriate prophylaxis prescriptions.

Phase 2: Surgeons' perceptions regarding the practice of VTE prevention in patients undergoing major orthopedic surgery at the Institute of Orthopedic Trauma, 108 Military Central Hospital.

*** Participants characteristics**

The characteristics of the participants are displayed in Table 3.

*** Barriers and facilitators to VTE prevention practices**

A total of 22 themes were identified within 7 out of 14 theoretical domains in the TDF. Specifically, seven domains related to the implementation of VTE prevention for MOS patients included: (1) Knowledge, (2) Skills, (3) Behaviour Regulation, (4) Environmental context and Resources, (5) Social Influences, (6) Beliefs in Consequences, (7) Goals.

Table 3. Characteristics of the participants

Participants characteristics	n (%) (N=15)
Number of doctors interviewed	15
Distribution by department, n (%)	
Department of General Orthopaedics (B1A)	8 (53.3)
Department of Joint Surgery (B1C)	7 (46.7)
Male gender, n (%)	15 (100)
Age (years), mean±SD	40.4±5.5
Education, n (%)	
Doctorate/Specialist Doctor level II	7 (46.6)
Master/Specialist Doctor level I	4 (26.7)
Bachelor	4 (26.7)
Leadership positions, n (%)	2 (13.3)
Years of experience at the hospital (years), n (%)	14.6±5.5
Interview duration (minutes)	
Mean±SD	15.9±4.6
Min - max	10 - 29

Table 4 lists 11 of 22 themes as VTE prevention facilitators. It was clear that VTE prevention measures were promoted by adequate understanding, regular practice,

Table 4. Facilitating factors to VTE prevention practice in each theoretical domain

TDF	11 themes classified as facilitators	n
Knowledge	Good understanding of thromboprophylaxis and consensus on regular prevention for MOS patients	15
	Doctors stay current with recommendations and practice consistently through training.	15
Skill	Regular practice of VTE risk assessment and prevention for high risk MOS patients by doctors	15
Behavior regulation	The need to implement auditing of practices followed by feedback and reminders to physicians	8
Environment context and resources	Availability of local VTE prevention guidelines	15
	The requirement for a CDSS to alert to contraindications and creatinine clearance-based dosing.	4
	The need for a brief guideline for clinicians to easily find	3
Social influences	Current close professional leadership from the department head and high consensus/agreement among doctors in the department	15
	The need for coordination among disciplines to ensure renal failure patients receive appropriate indications and dosages	3
Beliefs about consequences	High trust in the benefits of VTE preventive strategies for high-risk MOS patients	15
Goal	Preventive care is a priority for MOS patients.	15

Table 5. Barrier factors to VTE prevention practice in each theoretical domain

TDF	11 themes classified as barriers	n
Knowledge	Good postoperative mobility may lead to the prescription of shorter VTE prophylaxis than advised.	1
	VTE prophylaxis may be skipped in young, healthy hip fracture patients who undergo early surgery	1
Memory, attention, and decision-making processes	Prophylaxis indications may be missed due to lack of attention	5
	Lack of attention to the assessment of renal function and to consideration of renal function when prescribing anticoagulants may cause dosing issues and contraindications	12
Environment context and resources	The heavy workload may cause prescribing errors in VTE prevention.	2
	Anticoagulant cost and patient affordability of high-priced discharge prescriptions can lead to inadequate VTE prophylaxis duration.	4
	Lack of comprehensive system to manage the extended use of a high-risk drug for MOS patients after discharge could lead to suboptimal prevention duration	4
	Because the local guideline for MOS drugs was unclear for each MOS type, physicians may choose the wrong anticoagulant.	2
	Lack of tools to safeguard physicians against anticoagulant-related adverse events outside the hospital may lead to the suboptimal prophylaxis duration.	1
Beliefs about consequences	Concerns regarding bleeding and other uncontrollable issues after a long-term anticoagulant discharge prescription.	6
	Concerns about inconvenience, adverse drug reactions, and poor patient compliance if subcutaneous enoxaparin were prescribed for outpatients led to the inappropriate choice of a DOAC for hip fracture	6
	Physician views about the low prevalence of thrombotic events after discharge led to no anticoagulant prescription or shorter durations of anticoagulant use.	1

availability of local VTE prevention guidelines, prioritizing VTE prevention in MOS patient care, and professional leadership. Implementing regular audit on VTE prevention, producing support tools and summary guidelines, and offering interdisciplinary help were advised.

Table 5 lists 11 remaining themes as VTE prevention practice barriers. Failure to properly assess renal function and tailor regimens, concerns about bleeding risks with long term outpatient anticoagulants, the inconvenience of injectable medications, and the lack of a dedicated outpatient management system were common barriers. Drug prices and patient affordability were also obstacles.

DISCUSSION

Major orthopedic surgery (MOS) is a high-risk group for the development of venous thromboembolism (VTE) postoperatively, and it is widely recommended to indicate anticoagulant as a standard VTE prevention practice, unless contraindicated [5, 6]. Implementing effective prophylactic measures for this high-risk patient population can contribute significantly to the reduction of hospital-acquired thromboembolic events, morbidity, and mortality [9, 10]. The purpose of our study was to reveal gaps in the implementation of venous thromboprophylaxis for MOS patients, as well as the factors that might impact its implementation. We discussed in detail the key findings as follows:

VTE prophylaxis indication:

This study indicated 90.7% of patients had suitable VTE prevention indications. This rate is comparable to or greater than other Vietnamese and international research [7, 8]. We observed a minimal incidence of patients who did not receive any type of preventive measures, primarily among patients undergoing hip fracture surgery.

Analysis of clinicians' perspectives indicated that while they strongly agreed with recommendation of routinely prescribing prophylaxis for MOS patients, there were still existing barriers that led to underutilization of prophylaxis for these patients. The barriers included: (1) lack of attention to VTE prophylaxis, combined with high workload, leading to the omission of some patient groups; (2) some physicians' view that young, healthy hip fracture patients may not need prophylaxis. These views are inconsistent with current evidence-based guidelines and therefore need to be addressed to maximize appropriate VTE prophylaxis indications [6, 13, 18].

Anticoagulant agent selection:

The rate of adherence to recommendation on anticoagulant selection was relatively high, at 69.8%. The primary reason for nonadherence was the selection of DOACs for hip fracture surgery, although LMWH, heparin, or vitamin K antagonists are the recommended options. The lack of data from major clinical trials and the absence of recognized indications on the product label are the reasons why DOACs are not advised for preventing VTE in patients undergoing hip fracture surgery [19, 20]. According to current established international guidelines to date, it is not advised to use DOACs for these patients [21].

Interviews showed that the main obstacle was that the hospital guideline did not specify which anticoagulant to use for MOS procedures. Due to the ease of DOACs administration, doctors prescribed oral DOACs, especially for outpatients. This implies that the hospital's VTE prevention guidelines should be updated and revised. LMWH should be prescribed to hip fracture patients after discharge instead of DOACs until efficacy and safety are proven. However, failure to comply with prescribed treatment for injectable drugs after discharge can reduce the efficiency of preventative measures, increasing the risk of thrombosis and bleeding [22]. This means that patient education on injectable medication administration is needed to ensure adherence and optimize anticoagulation safety and efficacy [23].

Drug dosage:

91.9% of patients received the correct anticoagulant dose, whereas 9.1% did not. The main issue was the lack of renal function-based drug dosage evaluation and adjustment. Surgeons suggested adding renal function-based alerts and dose recommendations to the physician's computerized drug ordering interface to prevent dosing errors for renal failure patients. The research team considers this solution practical because the hospital piloted it successfully with antibiotics.

VTE prevention length:

While 74.4% of patients were prescribed the minimum recommended duration, only around one fourth of patients were prescribed optimal duration. This figure is much lower than in other studies [7, 24]. Several key barriers to this suboptimal practice were then identified by the doctors. Clinicians expressed their concern about the risk of bleeding and

their inability to manage the problems arising from long term anticoagulation. The absence of consistency and synchronization in our patient management system further emphasises these concerns. Most surgical patients at Vietnam's tertiary hospitals, including 108 Military Central Hospital, are referred from lower-level hospitals or service patients. These patients are not typically under the routine and long-term care of 108 Hospital. Thus, prescribing a high-risk drug for an extended period without monitoring makes practitioners even more cautious. Furthermore, over 25% of doctors said that prescribing anticoagulants for the optimal duration could exceed the hospital's maximum prescription value due to the high cost of anticoagulants and other frequently co-prescribed medications for MOS patients. Thus, clinicians may prescribe an insufficient number of days for venous thromboembolism prevention. To ensure optimal prophylaxis for MOS patients, a program or stewardship should be established [10].

In summary, our study has highlighted the overall status of VTE prevention practices and then provided a comprehensive view of the barriers and facilitators affecting this practice for MOS patients. Quantitative analysis identified several areas for improvement, including 1) Guaranteeing that all femoral fracture patients receive VTE prophylaxis, 2) Ensuring that discharged femoral fracture patients receive LMWH instead of DOACs, 3) Prescribing appropriate individualized anticoagulant dosing, and 4) Prescribing minimal and optimal VTE prophylaxis duration. The qualitative results revealed the simultaneous and complex

existence of numerous contributing factors. Consequently, implementing comprehensive multifaceted interventions, preferably withing an anticoagulant stewardship program framework, is the most appropriate approach to address these intricate practice problems [10, 25-29]. Considering the issues identified from quantitative data, the barriers and facilitators revealed from qualitative analysis, and literature review, the evidence-based strategies that may be integrated into the multifaceted interventions for improving VTE prevention practices include guideline revision [26], clinical decision support systems [28, 30], audit and feedback activities [10, 11, 25], improved training and education [31-33], and multidisciplinary collaboration involving clinical pharmacists [34-36].

CONCLUSION

Despite the hospital's implementation of local VTE prevention guidelines and doctors' regular practice of VTE prevention, our analysis found gaps in adherence to standard recommendations, particularly regarding prevention length. The application of the Theoretical Domain Framework has revealed the facilitators and barriers that influenced VTE preventative practice. This study provides a crucial basis to suggest practical approaches to improve VTE prevention strategies for major orthopedic surgery patients. A multi-component intervention package is needed to maximize VTE preventive measures for major orthopedic surgery patients.

CONFLICTS OF INTEREST

None.

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