



Research article

Venous thromboembolism prophylaxis usage among surgical patients in both private and public hospitals in Ethiopia

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ABSTRACT

Background: Venous thromboembolism (VTE) remains the commonest preventable cause of death in postoperative patients. VTE prophylaxis significantly reduces mortality risk, yet its utilization remains alarmingly low and variable (6–61 %) worldwide. This study aimed to compare VTE prophylaxis use among adult surgical patients in major hospitals in Addis Ababa, Ethiopia.

Materials and methods: A multicenter cross-sectional study was conducted in one private (Myungsung Christian Medical Center Comprehensive Specialized Hospital (MCM CSH)), and two public hospitals (Yekatit 12 Hospital Medical College and Menelik II Referral Hospital). Data was collected by chart review using standardized checklist. Caprini score was used for risk stratification, and associations was assessed using chi-square test with significance set at $p < 0.05$.

Results: From a total of 423 patients, 222 (52.3 %) patients were male. The mean age of the patients is 43.3(±14.7 SD) years. 414 (98 %) patients were at risk for VTE with 257(61 %) having moderate to high risk, but only 31(7.5 %) were on prophylaxis. Prophylaxis use was 12.5 % in MCM CSH, but it was 5.5 % and 5.1 % in Yekatit 12 and Menelik II Referral Hospitals respectively. VTE prophylaxis use was significantly less in public hospitals ($p < 0.05$).

Conclusions: Despite the majority of surgical patients being at risk of developing VTE, VTE prophylaxis remains significantly underutilized across major private and public hospitals in Ethiopia, particularly in public settings. The current study suggests standard risk assessment model implementation to address this significant and understudied risk to patients' lives.

1. Introduction

Venous thromboembolism (VTE) is a condition in which a blood clot (thrombus) forms in a vein. It encompasses two interrelated conditions that are part of the same spectrum, deep venous thrombosis (DVT) and pulmonary embolism (PE). VTE is a frequent complication in hospitalized patients, contributing significantly to prolonged hospital stays and preventable deaths [1]. While earlier study estimated more than 370,000 VTE-related deaths, with only 7 % were diagnosed ante mortem, 34 % were sudden fatal PE [2]. Although any patient can develop a blood clot, VTE disproportionately affects individuals undergoing surgery or recently hospitalized [2]. Besides that, compared to medical patients, surgical patients present with a more occult clinical picture and complained less often,

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but they are less likely to be receiving prophylaxis [3].

It has been well described that VTE prophylaxis for surgical patients significantly reduces the risk of death. However, the translation of this knowledge into consistent clinical practice remains suboptimal. The ENDORSE study, a large-scale evaluation of VTE risk and prophylaxis in 358 hospitals across 32 countries, revealed that while 64.4 % of surgical patients were deemed at risk for VTE, only 58.5 % received prophylaxis as per American College of Chest Physicians (ACCP) guidelines [2]. Recent reports still suggest only half of hospitalized surgical patients receive appropriate prevention measures [4,5]. Prophylaxis use widely varies from country to country (from 6 to 60.5 %) [6–13].

These starkly inconsistent results point towards multifaceted factors influencing VTE prophylaxis utilization. Studies have identified facility type, geographical disparities, the presence of dedicated VTE steering committees, robust quality control systems, and comprehensive training programs as key factors impacting implementation [2,8,13]. While single-institution studies may paint a rosier picture of prophylaxis use, multi-center comparative studies often reveal significantly lower rates [4–8]. Notably, the limited existing research on VTE prophylaxis among Ethiopian surgical patients is confined to single-institution settings, yielding inconsistent results [11,12].

Addressing the significant gaps in understanding VTE prophylaxis utilization among surgical patients in Ethiopia, the current study poses two crucial questions: 1) Does its use vary among adult patients admitted to major Addis Ababa hospitals (public and private)? and 2) Does this multi-institutional approach provide a more elaborate picture of the exact utilization status of VTE prophylaxis in the country? By shedding light on these critical issues, the study aims to advance our understanding of VTE prophylaxis underutilization, paving the way for targeted interventions and policy changes to optimize prevention strategies and safeguard patient health and well-being.

2. Methods

2.1. Sample selection

A cross-sectional study design was conducted from January to March 2022 at three hospitals, MCM CSH, Yekatit 12 Hospital Medical College, and Menelik II Generalized Hospital. MCM CSH is a leading private hospital with state of the art medical and surgical setup while the others are governmental hospitals with specialized surgical departments. The surgical patient flow of each of the hospitals was an average of 1500 cases per year. The three hospitals were selected due to their surgical patient flow, geographic representativeness of catchment population and availability of various sub-specialty level surgical procedures.

Sample size was calculated using single population proportion formula assuming the rational use of thromboprophylaxis to be 50 % and Power of 80 %. Factoring in a non-response possibility, the total calculated sample size was 423. All hospitalized adult surgical patients who were admitted were included in the study. However, patients with a pre-existing VTE diagnosis or on anticoagulant therapy were excluded.

From the calculated sample size, proportionate allocation of samples was undertaken based on annual patient flow to the surgical department of each selected hospital. Within each hospital, patients were enrolled consecutively until the allocated sample size was achieved.

2.2. Data collection and management

A comprehensive checklist, developed based on reviewed studies, was used to gather data from patients' charts. This included details on clinical characteristics like diagnosis, comorbidities, and relevant laboratory findings such as platelet count and INR. The study also employed the Caprini score, a widely recognized risk stratification tool that helps identify surgical patients who may benefit most from pharmacological prophylaxis [12,14–16]. For general and abdominal-pelvic surgeries, the score uses four risk categories: Very Low (0 points), Low (1–2 points), Moderate (3–4 points), and High (5+ points). This approach is suggested to be used to assess individual patient risk and tailor prophylaxis recommendations accordingly.

The data was collected following a one-day training session on extracting key information from patients' charts. Pre-test was conducted on 5 % of the study population before full-scale data collection to ensure the checklist's clarity, simplicity, and understandability. Completeness and consistency checks were rigorously maintained throughout the data collection process.

2.3. Statistical analysis

Data were entered in to the SPSS software (version 25) for analysis. Descriptive statistics was used to summarize findings, numerical data expressed as mean \pm SD and the results were presented in tables and figures. To assess the difference in VTE prophylaxis practice among the hospitals, a Chi-square test was used with a p-value of <0.05 .

3. Results

3.1. Patient characteristics and VTE risk stratification

Table 1 summarizes the basic characteristics and surgery types of 423 surgical patients. The mean age of patients is 43.3 ± 14.7 years with those ≥ 60 years old encompassing 18.8 %. 222 (52.5 %) patients were male and 201 (47.5 %) were female. General surgery

(217, 51.3 %) was the leading surgical procedure done followed by Orthopedic surgery (75, 17.7 %) and Neurosurgery (51, 12.1 %). 68 (16 %) patients had associated comorbid illnesses other than the primary reason for their admission.

Fig. 1 shows VTE risk stratification of surgical patients based on Caprini risk assessment score. 156 (37 %) surgical patients were moderate risk and 101 (24 %) were high risk for the development of VTE.

3.1.1. VTE prophylaxis use

Fig. 2 shows overall VTE prophylaxis use in adult surgical patients. 414(98 %) patients were at risk to develop VTE. Only 31(7.5 %) of 414 at-risk patients received any form of prophylaxis while 383 (92.5 %) did not.

Table 2 shows prophylaxis use based on Caprini risk assessment score of adult surgical patients. The data shows only 19 (18.8 %) of high-risk, 9 (5.8 %) of moderate risk and 3 (1.9 %) of low-risk surgical patients received prophylaxis. This indicates that 81.2 %, 94.2 %, 98.1 % of patients in the high, moderate, and low-risk patients, respectively, were without prophylaxis. The results indicate that the chance of receiving VTE prophylaxis was significantly associated with the patients' risk stratification based on Caprini score, with high-risk patients having a greater chance of receiving prophylaxis, $X^2(3, N = 423) = 27.66, p < 0.001$.

With regards to type of prophylaxis used, all patients were managed using pharmacologic prophylaxis of which 24 (77.4 %) patients were given Unfractionated Heparin (UFH) and only 7 (22.6 %) were given Low Molecular Weight Heparin (LMWH).

Fig. 3 shows there was significant difference among the studied hospitals with regards to proportion of appropriate use of prophylaxis and types of prophylaxis medications used ($p < 0.05$). Prophylaxis use was 12.5 %, 5.5 % and 5.1 % in MCM CSH, Yekatit 12 Hospital Medical College and Menelik II Referral Hospital respectively. Only MMC CSH used LMWH as prophylactic medication for 7 patients. Prophylaxis use for the private hospital, MMC CSH, and public hospitals was 12.5 % and 5.1 % respectively. The odds of utilizing VTE Prophylaxis was twice more for private hospitals when compared to public hospitals in the current study, $X^2(1, N = 423) = 7.27, p < 0.01$.

Fig. 4 shows there was statistically significant difference of utilization of VTE prophylaxis among departments, $X^2(6, N = 423) = 17.12, p < 0.01$. The highest proportion of prophylaxis use was in the vascular surgery where 2 out of the 5 patients (40 %) receiving prophylaxis followed by surgical oncology where 2 of the 14 patients (14.3 %) received prophylaxis. 9 of the 75 orthopedic surgery patients (12.7 %), 5 of the 51 neurosurgery patients (9.8 %) and 13 of 217 general surgical patients (5.9 %) received VTE prophylaxis. The lowest was in the urologic and cardiothoracic surgical departments where none of the patients were given prophylaxis.

4. Discussion

The main findings of this study were 1) 98 % of surgical patients were at risk of developing VTE, but only 7.5 % received any form of prophylaxis, indicating underutilization of VTE prophylaxis. 2) There is significant disparity of prophylaxis utilization among private and public hospitals, public hospitals having the minimum prophylaxis provision practice. 3) There was significant difference in provision prophylaxis among different surgical departments. Vascular surgery and surgical oncology utilized VTE prophylaxis better than the other departments.

The VTE prophylaxis use in this study was very low with only 7.5 % patients receiving any form of prophylaxis. This was significantly lower than reported rates in the multinational ENDORSE study and studies from the UK, Pakistan, China, Cameroon, and South Africa [2,5–10]. Only one nationwide Chinese interventional study found lower prophylaxis utilization of 5.9 % before implementation of physician educational intervention [17]. Two Ethiopian studies also found higher utilization of VTE prophylaxis [11,12]. The higher rate at Tikur Anbesa Specialized Hospital (TASH) could be attributed to presence of standard institutional guideline for VTE prophylaxis while the study conducted in Gondar Specialized Teaching Hospital, used different risk stratification score (Pauda risk assessment score). Additionally, no use of mechanical prophylaxis methods was reported in the current study, which is the preferred method of managing low risk patients according to the ACCP guidelines. This may contribute to the relatively lower prophylaxis utilization among low-risk patients in the current study.

The significantly low underutilization of thromboprophylaxis in this study can be attributed to several factors: lack of awareness of

Table 1

Characteristics of adult surgical patients admitted in three major hospitals in Addis Ababa, Ethiopia.

Variables	Category	Frequency	Percent
Age	<60 years old	344	81.2
	≥60 years old	79	18.8
Sex	Female	201	47.7
	Male	222	52.3
Comorbidities	Yes	68	16
	No	355	84
Surgery type	General surgery	217	51.3
	Orthopedic surgery	75	17.7
	Neurosurgery	51	12.1
	Uro-surgery	41	9.7
	Cardiothoracic surgery	20	4.7
	Surgical oncology	14	3.3
	Vascular surgery	5	1.2
	Total	423	100

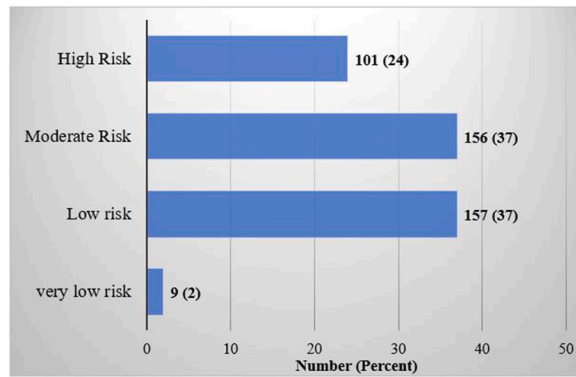


Fig. 1. Caprini risk assessment score of adult surgical patients admitted in three major hospitals in Addis Ababa, Ethiopia. 2022.

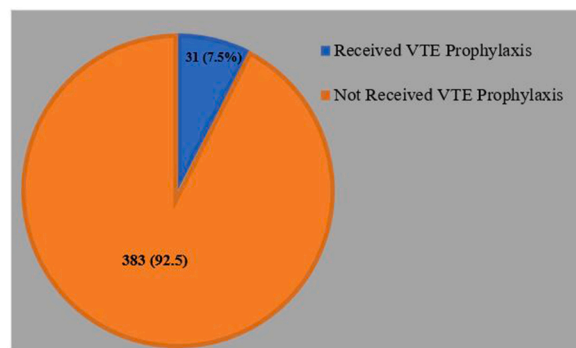


Fig. 2. Overall VTE prophylaxis use in adult surgical patients admitted in three major hospitals in Addis Ababa, Ethiopia. 2022.

Table 2

Prophylaxis use based on Caprini risk assessment score of adult surgical patients admitted in three major hospitals in Addis Ababa, Ethiopia.

Caprini risk assessment score	Thromboprophylaxis Given	
	Yes	No
Low risk	3 (1.9 %)	154 (98.1 %)
Moderate risk	9 (5.8 %)	147 (94.2 %)
High risk	19 (18.8 %)	82 (81.2 %)
Total	31 (7.5 %)	383 (92.5 %)

$\chi^2 (3, N = 423) = 27.66, p < 0.001$

DVT and PE incidence, failure to identify patients at risk, and the absence of standardized risk stratification models incorporated into patient care. While broader use of drugs like UFH may be perceived as beneficial, concerns about anticoagulation-related complications, particularly bleeding in postoperative surgical patients, may discourage physicians from prescribing VTE prophylaxis. Additionally, the cost of recommended prophylactic medications like Enoxaparin and LMWH, coupled with the need for continuous laboratory monitoring, especially for UFH, can hinder clinician adoption of appropriate prophylaxis regimens. It is well-established that, in developing countries, inadequate prophylaxis predisposes surgical patients to DVT and its cascade of complications, including post-thrombotic syndrome, chronic thromboembolic pulmonary hypertension, PTE, and even sudden death [1,5]. While such VTE prophylaxis (UFH and LMWH) is generally used in various cardiac surgeries, but the current results demonstrated that none of these patients received these drugs. This might be due to lack of clear and established protocols for VTE prophylaxis following cardiac surgery leading to confusion or inconsistency in how doctors approach prophylaxis for individual patients. Further compounding the issue, the lack of reliable diagnostic capabilities for DVT and PTE, along with limited therapeutic options available in Ethiopia, make the underutilization of thromboprophylaxis an unprecedented threat to the clinical care of surgical patients.

The current study also found that there is significant difference in VTE prophylaxis utilization between private and public hospitals, which was not assessed in previous studies in Ethiopia. The ENDORSE study and nationwide hospital survey conducted in China found similar disparity in VTE prophylaxis utilization, which was related to facility type, geographical disparities, presence of VTE steering committee, constant quality control, and training on VTE to be significant factors [2,8,18]. Another study also showed prophylaxis

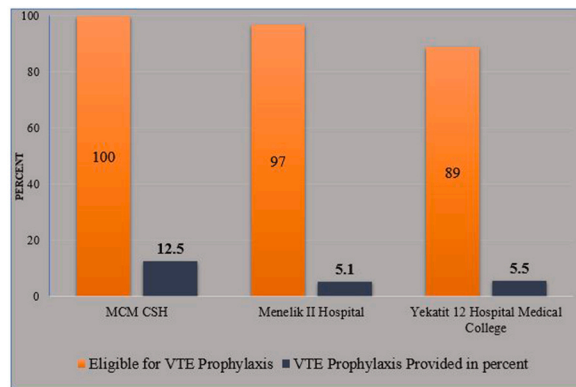


Fig. 3. Difference among the studied hospitals with regards to proportion of Overall VTE prophylaxis use in adult surgical patients admitted in three major hospitals in Addis Ababa, Ethiopia, 2022. $\chi^2 (1, N = 423) = 7.27, p < 0.01$.

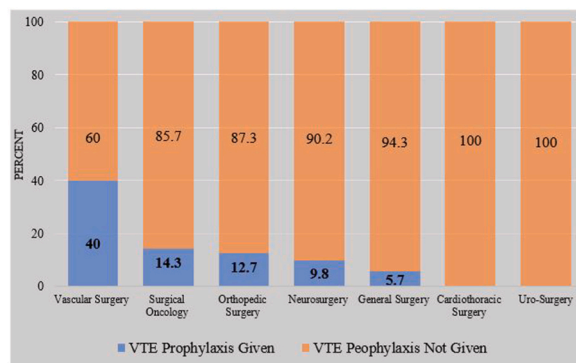


Fig. 4. Overall proportion of VTE prophylaxis use among departments in adult surgical patients admitted in three major hospitals in Addis Ababa, Ethiopia, 2022. $\chi^2 (6, N = 423) = 17.12, p < 0.01$.

utilization difference in a single institution before and after physician educational intervention showing the importance of training physicians to improve utilization [18]. Factors for difference among institutions was also evidenced in before-after interventional studies which demonstrated the difference in VTE prophylaxis utilization and rate of VTE by applying computer based mandatory individualized VTE risk stratification [19–22].

Private hospitals like MMC CSH had several advantages contributing to higher prophylaxis utilization: better technical resources, lower patient load, established protocols, and strong control mechanisms. However, physicians in public hospitals have great number of patients and time constraints that they tend to focus on direct therapeutic approaches, prioritize treating acute illnesses and emergencies and thus, give little to none focus when it comes to preventive therapies like VTE prophylaxis. Coupled with a relatively strict control of government bodies, private hospitals are in a better position to include preventive care packages like VTE prophylaxis to their patients according to international, nationally, or institutionally adopted standards. This might be one of the reasons for the immense underutilization of VTE prophylaxis in the public hospitals as compared to private ones.

The choice of type of pharmacologic prophylaxis was significantly associated with the facility type and with VTE prophylaxis utilization rate. Only MMC CSH provided LMWH as prophylaxis while the public hospitals gave only UFH. No use of newer agents like Enoxaparin was seen in the current study. This result also aligns with the study done at TASH which showed parenteral UFH twice or three times per day was the most widely used thromboprophylaxis regimen [12]. The major factor behind the choice of which agent of prophylaxis to use, in Ethiopia's setting, is the cost of the medications which is the biggest consideration in government hospitals. Consideration of cost limits the tendency to prescribe appropriate prophylaxis to patients especially the ones not deemed to have high risk based on risk stratification score.

Practice difference between individual surgical departments was also significant in the current study. Those having the least use were the neurosurgery, cardiothoracic surgery, and urology departments. Majority of the patients in the general and orthopedic surgical departments which required prophylaxis also didn't receive it. This is similar to results seen in multi-facility researches done in United States and China where there were disparities of prophylaxis utilization among departments and sections of hospitals with specific quality measures [1,3,8]. This shows the practice disparity between different physicians is a major contributing factor towards appropriate prophylaxis practice and that this can be corrected by applying a standardized Risk Assessment Models (RAM), such as the Caprini score, into patient care hence eliminating the individual component of the problem that exists.

The limitation of the current study was, first, lack of data to determine the timing of the start of prophylaxis medication and the total duration of prophylaxis use which were found to be significant determinant for appropriate prophylaxis use in other studies. Secondly, this was a cross-sectional study and didn't assess the number of patients who actually developed VTE and its complications from the patients who were deemed to be at risk from the study. Thirdly, the current study assessed prophylaxis use based on prescribed thromboprophylaxis and not on adherence which is a great factor as well. Further studies should be done with regards to this aspect, in order to improve on the findings.

5. Conclusion and recommendations

Despite the high risk of VTE among surgical patients in Ethiopia, our study reveals a significant underutilization of prophylaxis, particularly in public hospitals. To address this, we recommend implementing continuous education programs and disseminating clear guidelines on VTE prophylaxis for healthcare providers, establishing regular audits and feedback systems to monitor and improve adherence to prophylaxis guidelines, utilizing computer-based alerts in hospitals with electronic health record systems to prompt timely prophylaxis, and adopting standardized risk assessment models like the Caprini score to ensure consistent and accurate identification of at-risk patients. These recommendations aim to enhance the implementation of VTE prophylaxis and ultimately improve patient outcomes in Ethiopian healthcare settings. Further research is essential to explore the barriers to effective prophylaxis and develop tailored strategies for different hospital environments.

Ethical approval and informed consent

Ethical clearance was obtained from the Ethical Review Board of the Myungsung Medical College/Myungsung Comprehensive Medical Center, Addis Ababa, Ethiopia (Protocol No. PRO-110720) and then permission was obtained from the hospitals to conduct the study. Information obtained from the data collected during the study was only handled by the research team. Informed consent was waived as the study was conducted retrospectively and also we did not encounter the study Patients directly. The current study was conducted in accordance with the Declaration of Helsinki.

Data sharing statement

Data associated with this study has not been deposited into a publicly available repository. All data used and/or analyzed are included in this article and are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Emmanuel Girma: Writing – review & editing, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ashenafi Zelalem:** Writing – original draft, Visualization, Supervision, Software, Methodology, Formal analysis. **Anania Admasu:** Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Hermela Tesfaye:** Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Wondmagegn Demiss:** Writing – review & editing, Supervision, Methodology. **Israel H. Giorgis:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Song-Jung Kim:** Writing – review & editing, Validation, Supervision, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Abbreviations

ACCP	American College of Chest Physicians
ASH	American Society of Hematology
DVT	deep vein thrombosis
DOACs	direct oral anticoagulants
LMWH	Low molecular Weight Heparin
MMC/MCM	Myungsung Medical College/Myungsung Comprehensive Medical Center
PE	pulmonary embolism
RAM	risk assessment model
SPSS	Statistical Package for Social Sciences
TASH	Tikur Anbessa Specialized Hospital

UFH unfractionated heparin
 VTE venous thromboembolism

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