

Venous Thromboembolism Risk and Prophylaxis in the Acute Hospital Care Settings in Oman: A National Multicenter Cross-sectional Study

Asma Al Jahwari¹ and Bader Al Rawahi^{1,2}

¹Hematopathology Residency Training Program, Oman Medical Specialty Board, Muscat, Oman

²Hematology Department, Sultan Qaboos University Hospital, Muscat, Oman

Received: 7 July 2023

Accepted: 28 December 2023

*Corresponding author: asma.j19@resident.omsb.org

DOI 10.5001/omj.2024.63

Abstract

Objectives: This study aims to evaluate the prevalence of venous thromboembolism (VTE) risk among inpatients in acute hospital care settings in Oman along with the proportion of at-risk patients who receive appropriate thromboprophylaxis. As secondary outcomes, we aim to evaluate the type and time of initiation of VTE prophylaxis.

Methods: This is a multicenter, cross-sectional study conducted in three tertiary hospitals in Oman. The study included acutely ill medical and surgical inpatients admitted from August to September 2022. VTE risk assessment and prophylaxis were assessed based on the American College of Chest Physicians- 2012 recommendations.

Results: A total of 384 patients were enrolled, 240 were medical patients and 144 were surgical patients. Based on the American College of Chest Physicians criteria, 179 (74.6%) and 92 (63.9%) of medical and surgical patients respectively are at risk of VTE and required prophylaxis. However, 142 (79.3%) and 70 (76.1%) of at-risk medical and surgical patients received appropriate prophylaxis respectively. In patients where pharmacological prophylaxis was contraindicated, mechanical prophylaxis was markedly underused. The median day of initiating VTE prophylaxis was day 1 of admission. In patients who underwent surgery, the median day of initiating VTE prophylaxis was day 1 postoperatively.

Conclusions: A large proportion of hospitalized patients in Oman are at risk of VTE. However, many patients do not receive appropriate prophylaxis. A national VTE risk assessment and guiding tool that also allows for monitoring of compliance is required. Alternative mechanical prophylaxis should be well- utilized when indicated.

Keywords: Venous, Thromboembolism, Risk, Prophylaxis, Inpatient.

Introduction

Venous thromboembolism (VTE) is the third most common vascular disease.¹ Data from Europe and the United States documenting the burden of VTE revealed that it is "responsible for more deaths each year than breast cancer, HIV disease, and motor vehicle crashes combined", and approximately 60% of VTE events are associated with a recent hospital stay".² Moreover, venous thromboembolism is the leading preventable cause of death among inpatients.³ Pulmonary embolism leads to round 5-10% of in-hospital deaths.⁴ Chronic thromboembolic hypertension and post-thrombotic syndrome are other long term complications of venous thromboembolism that lead to significant lifelong morbidity and increased cost of management.³ Appropriate prophylaxis can lead to substantial reduction in the incidence of VTE events and therefore less morbidity, mortality, in-hospital stay, and cost of management. Different

organizations- like American College of Chest Physicians (ACCP) and American Society of Hematology (ASH)- have established evidence based recommendations in order to guide health care professionals to the appropriate VTE prophylaxis based on patient's comorbidities and risk factors for both bleeding and thrombosis.^{1,5} However, despite that, many studies and audits have shown that the available guidelines and recommendations are markedly underused.⁶

ENDORSE Study, a multinational cross-sectional study that studied Venous thromboembolism risk & prophylaxis in the acute hospital care setting conducted in 32 countries including 3 Gulf countries, has concluded that -based on the 2004 ACCP evidence-based consensus guidelines- around 51.8% of patients who were admitted for surgical or medical causes were at risk of venous thromboembolism. Among surgical patients who required VTE prophylaxis, around 58.5% have received the recommended ACCP prophylaxis. On the other hand, only 39.5% of medical patients have received the recommended VTE prophylaxis.³

Sultanate of Oman was not involved in this study and there are no local published data that assess the compliance on standards and recommendations in VTE prophylaxis in the in-hospital settings. Recently, some tertiary care hospitals in Oman have adopted VTE risk assessment questionnaires that are filled by the admitting physicians for each newly admitted patient, but no local audits were done to assess compliance and practice. Besides that, these risk assessment charts are only electively filled and they do not give recommendations on type, period, and dose of the appropriate prophylactic regimen for the patient based on his medical history and risk factors. In order to design and implement a stricter local protocols and guiding system in our local hospitals, it is mandatory to initially assess the prevalence of patients at VTE risk in acute care hospital settings and to find the proportion of patients at VTE risk that currently receive the appropriate thromboprophylaxis.

Results from ENDORSE study in neighbor Gulf countries does not dispense the need for a local study as clinical practice varies widely between centers and countries. Additionally, ENDORSE study did not evaluate the time of initiation of VTE prophylaxis to exclude the delay in initiation of VTE prophylaxis for at risk patients. Based on that, a national multicenter study, on which, future practice improving plans can be build, is highly demanded.

The primary aim of this study is to evaluate the prevalence of patients at VTE risk in acute care hospital settings in three large hospitals in Oman from August to September 2022 and to find the proportion of patients at VTE risk that received appropriate thromboprophylaxis. Moreover, as a secondary objective, this study aims to identify the types of thromboprophylaxis used in acute hospital care setting and to estimate the time of initiation of VTE prophylaxis for at risk hospitalized patients.

Methods

This is a multicenter cross-sectional study conducted in three large hospitals in Oman: Sultan Qaboos University Hospital, (SQUH), Royal Hospital (RH) and Sohar Hospital (SH). It was conducted from August to September 2022.

Medical patients who are ≥ 35 years old, admitted under general acute medicine, medical subspecialties, hematology and oncology were included. Surgical patients who are ≥ 18 years old, admitted under general surgery, orthopedics and gynecology were included. Patients admitted in Intensive care units and obstetric wards, admitted solely for the treatment of VTE or on long term anticoagulation for any reason (e.g., atrial fibrillation or history of thrombosis), or admitted for elective procedure under local anesthesia were all excluded from the study.

Data about patient demographics, reason of admission, risk factors for both thrombosis and bleeding, type and time of the VTE prophylaxis was obtained from hospital information system. EpiData software was used to collect individual patient data. VTE risk assessment and prophylaxis based on American College of Chest Physicians (ACCP) recommendations- 2012. Well-trained physicians collected data in all the three centers.

Sample size was calculated based on the prevalence of VTE risk found in ENDORSE study around 50% with a desired confidence interval of 95%, power of 80% and alpha error of 5%. The sample size needed was 384. Convenient sampling method was used for sample selection.

Continuous variables were presented as mean, median, Interquartile range, and standard deviation. Categorical variables were presented as frequencies and percentages with 95% CI. IBM SPSS Statistics version 25.0 was used to analyze data.

No consent was taken from included patients. Ethical approval was obtained from the health studies and research approval committee at the Ministry of Health and the Medical Research Ethics Committee at SQUH.

Results

A total 384 patients were included of which 240(62.5%) are medical patients and 144 (37.5%) are surgical patients. The patients were almost equally distributed between the three included centers and between both genders. The median age was 61 years with Interquartile range (IQR) of 43-73 years. The median length of hospital stay on the day of data collection is 3 days with IQR of 1-5 days (Table 1).

Table 1: Characteristics of patients included in the study.

Characteristics		Median (IQR) or N (%)
Gender (female)		185 (48.2%)
Age (years)		61 (43-73)
Length of hospitalization up to survey date (Days)		3 (1-5)
No. of patients per hospital	Royal Hospital	133 (34.6%)
	Sultan Qaboos University Hospital	118 (30.7%)
	Sohar Hospital	133 (34.6%)
Specialty	Medical patients	240(62.5%)
	Surgical patients	144 (37.5%)

The most common causes of admission among medical patients are acute respiratory disease and non-respiratory infections. Most of the surgical patients were admitted for gastrointestinal, colorectal, hepatobiliary surgery, followed by orthopedic trauma (Table 2).

Table 2: Reasons for hospitalization of patients included in the study.

Reasons for hospitalization	N (%)
Medical Patients	
Acute heart failure	21 (8.6%)
Acute Respiratory disease (infectious and noninfectious)	55 (22.6%)
Non respiratory infection	40 (16.5%)
Ischemic stroke	9 (3.7%)
Hemorrhagic stroke	6 (2.5%)
Active malignancy	32 (13.2%)
Hematological disease	32 (13.2%)
Gastrointestinal/ hepatobiliary disease	15 (6.2%)
Other medical conditions	30 (12.5%)
Surgical patients	
Hip or knee replacement	4(2.8%)
Hip Fracture	3(2.1%)
Other orthopedic trauma	25(17.3%)
Gastrointestinal/colorectal /hepatobiliary surgery	52(36%)
Gynecological surgery	16 (11%)
Conservative management of acute surgical illness	14(9.7%)
Other surgery	30 (20%)

Both VTE and bleeding risk factors were evaluated for each included patient and the most common VTE risk factors were complete immobilization or Immobilization with bathroom privilege, long term immobility, obesity (BMI>30) and active cancer (Table 3).

Table3: Most common VTE Risk Factors among Inpatients.

Risk factors	Frequency	Percentage
Obesity (BMI >30)	40	22%
Active cancer	68	17.7%
Long term immobility	107	27.9%
Acute hear failure or other respiratory disease	46	12%
Pulmonary infection	56	14%
Complete immobilization or immobilization with bathroom privilege	177	45%
Sepsis	57	15%
Acute neurological disease	29	7.5%
Mechanical ventilation	28	7.3%
ICU admission	13	3.8%

The most common bleeding risk factors among inpatients were significant renal impairment, thrombocytopenia, bleeding during admission and significant liver disease (Table 4).

Table 4: Bleeding risk factors among inpatients.

Risk factors	Frequency	Percentage
Deranged coagulation screen (Inherited or Acquired)	6	1.6%
Thrombocytopenia	12	3%
Platelet (50-100) x 10 ⁹ /L	7	1.8%
Platelet (25-49) x 10 ⁹ /L	5	1.3%
Platelet <25 x 10 ⁹ /L		
Bleeding during admission	16	4.2%
Intracranial hemorrhage	3	0.8%
Significant liver disease	13	3.4%
Active GI bleeding	8	2.1%
Significant renal impairment (GFR<30 ml/min/1.73m ²)	56	14%

Among all medical inpatients (n: 240), (179)75% were at risk of VTE and among those at risk, (142)79% received appropriate type of prophylaxis. Among all surgical patients (144), 92(64%) were at risk of VTE and among those at risk, 70(76%) received appropriate prophylaxis (Figure 1). Interestingly, both VTE risk prevalence and the rate of compliance on VTE prophylaxis for at risk patients is similar in all of the three included centers with overlapping 95% CI (table 5).

Figure 1: Prevalence of VTE risk and prophylaxis Use.

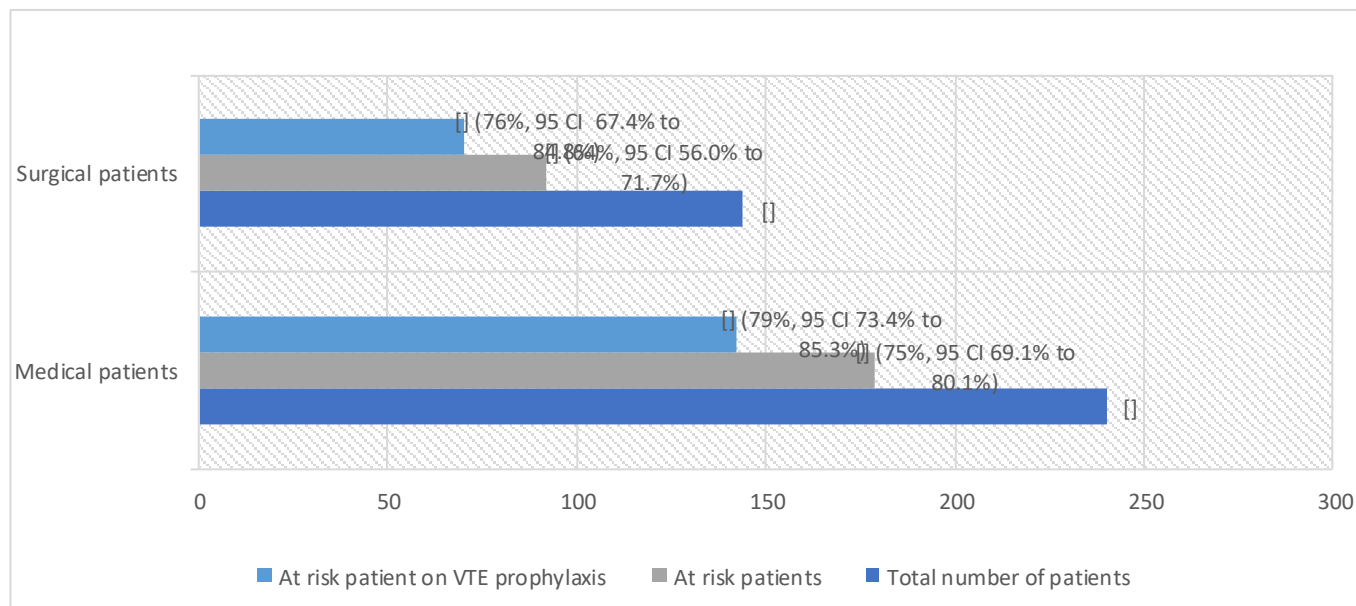


Table 5: Prevalence of VTE risk and prophylaxis use.

Hospital	Number of patients	At risk patients		At risk patients on recommended prophylaxis	
		N	Percentage (95% CI)	N	Percentage (95% CI)
Royal Hospital	133	87	65.4 (57.3 - 73.5)	68	78.1 (69.5 - 86.8)
SQU Hospital	118	83	70.3 (62.1 - 78.6)	66	79.5 (70.8 - 88.2)
Sohar Hospital	133	101	75.9 (68.7 - 83.2)	78	77.2 (69.1 - 85.4)
Total	384	271	70.6 (65.7 - 75.1)	212	78.3 (72.8 - 82.9)

The group of high-risk patients who didn't receive appropriate prophylaxis were separately evaluated for bleeding risk that could have prevented keeping them on pharmacological prophylaxis. Around 49.1% of this group of patients had a bleeding risk factor (Table 6).

Table 6: Bleeding risk factors among at risk patients not receiving prophylaxis (59 patients)

Rick factors		Frequency	Percentage	
Bleeding risk	Bleeding During Admission	13	22%	49.1%
	Thrombocytopenia (platelet <100)	8	13.6%	
	Significant Liver Disease	5	8.5%	
	Deranged coagulation screen (Inherited or Acquired)	3	5%	
Significant renal impairment		11		18.6%
Family refused anticoagulation		1		1.6%
No bleeding risk found		18		30.5%

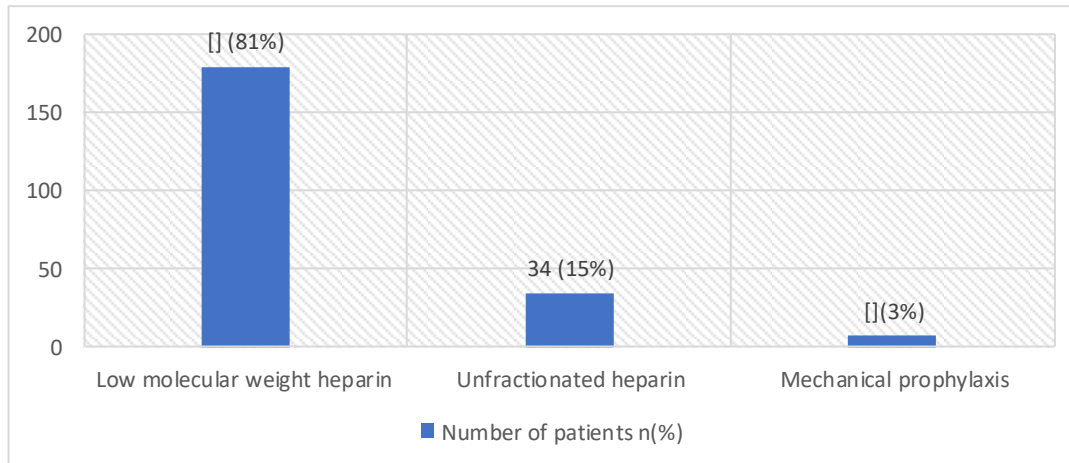


Figure 2: Types of prophylaxis used for at risk patients.

Mechanical prophylaxis is infrequently used on the 3 included institutions as figure 2 shows. The day of Initiating VTE prophylaxis was evaluated to assess for any delay. The median day of initiating VTE prophylaxis was the first day of admission in all patients with IQR of day.^{1,2} In patients who underwent surgery, the median day of initiating VTE prophylaxis was day 1 postoperatively with IQR of day (0-1).

Discussion

This is the first study in Oman that evaluates VTE prevalence and the practice of prophylaxis. It showed that the majority of acutely ill inpatients in Oman are at significant risk of VTE and require prophylaxis. However, despite all national efforts, around one fifth of those patients did not receive the appropriate prophylaxis. The study has also showed that the prevalence of VTE risk and the rate of compliance on VTE prophylaxis recommendation is comparable between the three included centers.

In Oman, 70.6% of hospitalized patients are at risk of VTE. This is relatively corresponding to the prevalence of VTE risk among hospitalized patients in other gulf countries which was 62%.⁶ Although this study came after more than one decade from the ENDORSE study which can make it an unfair comparison, the rate of compliance on VTE prophylaxis recommendations in Oman is relatively better than the majority of countries involved in the ENDORSE study.³ A more recent study conducted in a tertiary hospital in South Africa in 2019 - that evaluated VTE risk among surgical patients and the rate of compliance on recommended VTE prophylaxis according to ACCP guidelines and Carpini risk assessment model- have showed that 77% of patients were at risk of VTE, however, only 26% of those patients have received the appropriate prophylaxis.⁷

While around 50% of at-risk patients who were not kept on appropriate prophylaxis had significant risk of bleeding that justifies omitting pharmacological prophylaxis, those patients were not kept on the recommended prophylaxis in such cases which is the mechanical prophylaxis. Moreover, mechanical prophylaxis is only used in 3% of all at-risk patients. In gulf countries, mechanical prophylaxis was used in 8% of high-risk patients highlighting the underutilization of other forms of VTE prophylaxis when anticoagulation is contraindicated.⁶ The shortage of mechanical prophylaxis devices was discussed in another study conducted in South Africa as a possible contributing factor to the poor compliance on VTE prophylaxis is this group of patients with high risk of bleeding.⁷ Undoubtedly, mechanical prophylaxis is likely under-documented in the locally used Hospital Information Systems (HIS) which can lead to underestimation of its actual use. Apart from this, the causes of inappropriate utilization of mechanical prophylaxis can be due to awareness issues among clinicians, or unavailability of an adequate number of these devices in order to meet the needs in the included centers.

This study has also evaluated an important factor that was not assessed in the ENDORSE study which is the time of initiating VTE prophylaxis as indicated by more evolving evidence. According to the NICE guidelines, and quality standards, VTE prophylaxis should be initiated within 14 hours of admission.⁸ In a study that was conducted by a group from the University of Michigan, early initiation of VTE prophylaxis within 24 hours of hospital presentation in stable trauma patients was associated with significantly lower rates of VTE.⁹ Another recently published study has found that delayed initiation of VTE prophylaxis after 24 hours of admission in critically ill patients with low bleeding risk is independently associated with higher mortality.¹⁰ Our current study has showed that VTE prophylaxis is mostly initiated early within 1 day of admission and post operatively which reflects good compliance and awareness of the importance of early VTE prophylaxis among both surgical and medical patients. It should be noted that the time was reported in days from admission not in hours which could have allowed for more detailed assessment of compliance on international recommendations.

The cross-sectional design of this study is one of its limitations due to the chance of collecting un-updated patient data from the hospital information system rather than through meeting the patient to take detailed updated history. Furthermore, the median day of admission on which the survey was conducted was day 3 which means that the study was unable to ensure that all patients were kept on prophylaxis as long as they are fulfilling the criteria for VTE prophylaxis. This can overestimate the rate of compliance on recommendations. An additional limitation is that few trauma patients with contraindication to both pharmacological and mechanical prophylaxis might be falsely counted as high-risk group that didn't receive appropriate prophylaxis. Finally, as mentioned earlier, mechanical prophylaxis is not well documented in our hospital information systems and the data was only extracted from the clinical notes. This carries a high risk of underestimating its actual use.

In spite of the relatively good local compliance on VTE prophylaxis recommendation when compared to other international studies, for a such feasibly preventable leading cause of mortality among inpatients, our target rate of compliance should be much higher and approaching 100%. A stricter tool that provides a recommendation according to the personalized patient risk score should be established. This tool should also allow for easy monitoring of compliance. More objective VTE risk assessment models and scores like Padua score for medical inpatients,¹¹ Carpini and Rogers scores for non-orthopedic surgical patients¹² should be utilized to build risk assessment tools for better guidance of clinicians on the appropriate VTE prophylactic measures for each patient. Assessment of the duration of VTE prophylaxis during and after hospital admission for orthopedic surgery patients is required to ensure that patients are kept on the appropriate prophylaxis for the whole recommended period as per the ACCP guidelines.¹³ Awareness on the importance of the mechanical prophylaxis should be increased and adequate number of devices must be made available in all local health care institutions to encourage and maximize the best practice of VTE prophylaxis in our initiations.

Conclusion

VTE is a preventable complication that can lead to mortality, morbidity and increase cost of management among hospitalized medical and surgical patients. This study has showed that a large proportion of hospitalized patients in Oman are at risk of VTE. However, despite the efforts, many patients do not receive appropriate prophylaxis. A national VTE risk assessment and guiding tool that allows for monitoring compliance is required. The use of alternative mechanical prophylaxis should be warranted when indicated.

Acknowledgements

Sathiya Murthi Panchatcharam, Statistics Specialist, Research & Studies Section, Medical Simulation and Innovation Center, Oman Medical Specialty Board, Muscat, Sultanate of Oman

Disclosure

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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