Original Article

Adherence to Guideline of Venous Thromboembolism Prophylaxis in a Level 1 Trauma Center in Thailand

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Abstract

Objective: Venous thromboembolism (VTE) which includes deep vein thrombosis (DVT) and pulmonary embolism is a preventable complication in hospitalized trauma patients. Currently, the VTE guideline is the standard of care. However, underutilization of the guideline was reported. This study aimed to report the adherence to the VTE guideline in a Level 1 trauma center in Thailand. **Methods:** A retrospective review was performed on adult trauma patients admitted between January and December 2013. The inclusion criteria were Injury Severity Score ≥9 and admission in the hospital ≥7 days. The patients were classified into "very high risk of DVT," "high risk of DVT," and "high risk of bleeding" groups according to the hospital guideline. Adherence to the guideline, utility of the prophylaxis, and VTE occurrence were recorded. **Results:** During a 12-month period, 352 cases met the inclusion criteria. The overall adherence to the guideline was 28.9%, 5.2% in the "very high risk of DVT" group, 18.4% in the "high risk of DVT" group, and 57.9% in the "high risk of bleeding" group. VTE occurrence was 11 incidences in 10 patients (2.8%). The "high risk of bleeding" group had the highest in VTE occurrence (10 of 11 incidences). **Conclusions:** The adherence to the VTE prophylaxis guideline in Thailand was higher than previous studies. The pharmacological prophylaxis should be initiated as soon as possible.

Keywords: Prevention and control, venous thromboembolism, venous thrombosis

Introduction

Venous thromboembolism (VTE) which includes deep vein thrombosis (DVT) and pulmonary embolism (PE) is a preventable cause of death in hospitalized patients. Trauma patients are an at-risk population. A population-based research study reported that mechanism of trauma increased the odds of VTE by 12.6-fold.[1] The incidence of VTE in severe trauma identified by an Injury Severity Score (ISS) ≥9 without mechanical or pharmacological prophylaxis was 58% and was higher in patients with spinal injuries.[2] The incidence of DVT in the prophylaxis group was reported as 2%–44%.[3,4]

Since prophylaxis reduced the incidence of VTE in trauma, the DVT prophylaxis guideline became a standard of care. The commonly used guideline is from the American College of Chest Physicians (ACCP) which is now in the 9th edition. The guideline recommends pharmacological prophylaxis in major trauma patients and additional mechanical prophylaxis in acute spinal cord injury, traumatic brain injury, and spinal surgery for trauma. For patients who have contraindications for pharmacological prophylaxis, mechanical prophylaxis such as an intermittent compression pump is preferable over no prophylaxis.[5] Although the guideline has been available for decades, adherence to the guideline varies among countries. The ENDORSE study surveyed VTE prophylaxis worldwide and found that only 0.2% of at-risk surgical patients in Thailand received a proper prophylaxis according to the 2004 ACCP guideline.[6] Since the ENDORSE study, no data on the adherence to the DVT prophylaxis guideline in Thailand are available. This study aimed to investigate the adherence to the current DVT prophylaxis guideline in trauma patients at a Level 1 trauma center in Thailand.

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Methods

Study design

This is a retrospective review from a prospectively collected trauma registry of hospitalized trauma patients who were admitted in Songklanagarind Hospital that was a Level 1 trauma center in Thailand between January and December 2013.

Population

The study included only adult trauma patients defined as age ≥ 15 years old, major trauma patients identified as ISS ≥9, and all patients were hospitalized ≥7 days.

Outcomes and parameters

Adherence to the guideline was the primary outcome. The patients were categorized into three groups according to the hospital guideline that was adapted from the ACCP guideline that classified patients by the risk of DVT and bleeding risk. The guideline of DVT prophylaxis is illustrated in Figure 1.

The patients who had severe head injury with a Glasgow Coma Scale score ≤8, nonoperative management of solid organ injuries, renal failure, spinal column fracture with epidural hematoma, thrombocytopenia, and coagulopathy were classified in the "high risk of bleeding" group. The patients who had traumatic brain injury, spinal column injury, and acute spinal cord injury were classified in the "very high risk of DVT" group. Other patients were classified in "high risk of DVT" group. Adherence to the guideline was defined as patients who received a prophylaxis according to the guideline beginning at any time after admission. The date and type of prophylaxis and VTE were also collected. The VTE occurrences were only symptomatic cases who had radiographic confirmation or concomitant findings from computed tomography (CT) of the abdomen for follow-up of intra-abdominal injuries. Screening was not done routinely.

Statistical methods

Continuous data are expressed as mean and standard deviation or median and interquartile range. Categorical data are expressed as frequency and percentages. Kruskal–Wallis rank test was used to compare the means between the three groups, and the Chi-square test was used to compare proportions. $P < 0.05$ was considered as statistically significant different.

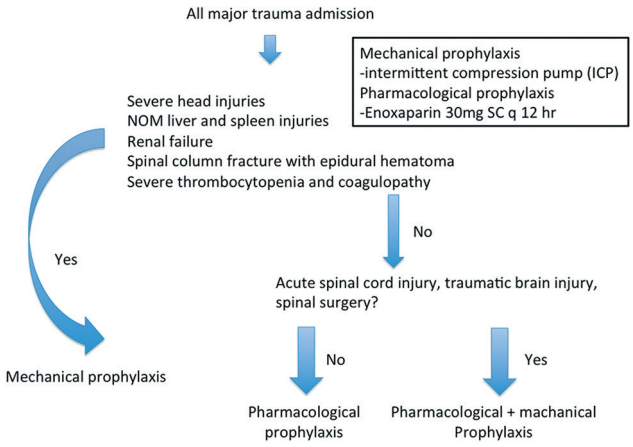

Figure 1: Venous thromboembolism prophylaxis guideline. NOM: Nonoperative management

Results

Between January and December 2013, 352 patients met the inclusion criteria. The median age was 36 years and the median ISS was 17. Motorcycle crash (38%) was the most common mechanism of trauma. There were 116 patients in the "very high risk of DVT" group, 103 patients in the "high risk of DVT" group, and 133 patients in the "high risk of bleeding" group. The demographic data are shown in Table 1.

The overall adherence to the guideline was 28.9%. Six (5.2%) of the 116 patients in the "very high risk of DVT" group had both pharmacological and mechanical prophylaxes according to the guideline. The median time to start the mechanical prophylaxis was on the admission day, and the median time to start pharmacological prophylaxis was on the 3rd day of admission. Nineteen (18.4%) of 103 patients in the "high risk of DVT" received a pharmacological prophylaxis which adhered to the guideline. The patients in this group received mechanical prophylaxis on the 1st day after admission and pharmacological prophylaxis on the 3rd day after admission. Seventy-seven (57.9%) of 133 patients (57.9%) in the "high risk of bleeding" group received mechanical prophylaxis during admission which adhered to the guideline, and the median time to start was on the day of admission. The patients in this group also received pharmacological prophylaxis, but it started later than the other groups; the median time to start was the 8th day after admission.

There were 11 VTE occurrences in 10 patients (2.8%). One of them had DVT and developed PE later. Among the ten patients, one patient was in the "high risk of DVT" group and nine patients were in the "high risk of bleeding" group. A summary of the results is shown in Table 2. Among those patients who had VTE, 5 of 10 had received blood transfusions >4 units before the VTE occurrence. One patient previously had femoral venous catheterization, and one patient was obese.

Most of the patients who had traumatic brain injury and solid organ injury did not receive any prophylaxis. The characteristics of the patients and the modality of prevention are shown in Table 3.

Discussion

The rate of VTE prophylaxis in this study was much higher than a previous study. The ENDORSE study reported that an international survey found that 0.2% of surgical patients in Thailand received a prophylaxis according to the ACCP guideline.[6] Wilasrusmee *et al*. conducted a cohort study from 2005 to 2006 to determine the incidence of DVT in critically ill surgical patients, but there was no DVT prophylaxis in their

Table 1: Demographic data of each group

	Very high risk of DVT group (*n*=116)	High risk of DVT group (*n*=103)	High risk of bleeding group (*n*=133)	*P*
Age (median, IQR)	37 (28.3)	34 (22.5)	38 (25)	0.02*
Gender (male:female)	84:32	89:14	105:28	0.04†
ISS (median, IQR)	17 (10.5)	12 (8)	22 (10)	<0.001*
Mechanism of injury, *n* (%)				
AVP	4 (3.4)	0 (0)	5 (3.8)	<0.001†
Assault	6 (5.2)	0 (0)	2 (1.5)	
Blast	4 (3.4)	10 (9.7)	13 (9.8)	
Burn	0 (0)	1 (1)	0 (0)	
Fall	20 (17.2)	7 (6.8)	17 (12.8)	
GSW	6 (5.2)	11 (10.7)	8 (6)	
MCC	51 (44)	30 (29.1)	53 (39.8)	
MVC	19 (16.4)	14 (13.6)	23 (17.3)	
Other	5 (4.3)	20 (19.4)	6 (4.5)	
SW	1 (0.9)	10 (9.7)	5 (3.8)	
Unknown	0 (0)	0 (0)	1 (0.8)	

*Kruskal-Wallis rank test, †Chi-square test. DVT: Deep vein thrombosis, IQR: Interquartile rank, ISS: Injury Severity Score, AVP: Auto vs pedestrian, GSW: Gunshot wound, MCC: Motor cycle crash, MVC: Motor vehicle crash, SW: Stab wound

Table 2: Adherence to the guideline and venous thromboembolism occurrences

	Very high risk of DVT group (*n*=116)	High risk of DVT group (*n*=103)	High risk of bleeding group (*n*=133)	*P*
Mechanical prophylaxis, *n* (%)	33 (28.4)	21 (20.4)	77 (57.9)	<0.001*
Start date (day, IQR)	0 (1)	1 (1)	0 (1)	0.48†
Pharmacological prophylaxis	13 (11.2)	19 (18.4)	35 (26.3)	0.01*
Start date (day, IQR)	3 (2)	3 (4)	8 (8.5)	0.02†
Adhere to the guideline	6 (5.2)	19 (18.4)	77 (57.9)	<0.001†
DVT, *n* (%)	0	1 (1)	7 (5.3)	0.01*
PE, *n* (%)	0	0	3 (2.3)	0.08*

*Chi-square test, †Kruskal-Wallis rank test. DVT: Deep vein thrombosis, IQR: Interquartile rank, PE: Pulmonary embolism

study and only 1% of the population was trauma patients.[7] Another cohort study was done in a surgical intensive care unit for the incidence of DVT, but no DVT prophylaxis was used.[8] The overall rate of adherence to the guideline was between 28.9% in our study which represented a big leap for DVT prophylaxis awareness in Thailand.

The "very high risk of DVT" group had the lowest adherence rate to the guideline since this group needed dual prophylaxes to complete the guideline. This group also had fewer patients who received a pharmacological prophylaxis. The explanation was the patients in this group were more severe which was indicated by the high ISS that possibly caused reluctance of the physicians to start a pharmacological prophylaxis. The "high risk of bleeding" group had the highest ISS, but the guideline required only a mechanical prophylaxis which caused this group to have the highest adherence.

Only few studies reported the incidence of VTE in trauma in Asian population. A study by Wong *et al*. in Singapore reported the incidence of VTE in trauma patients. The study reported VTE incidences of 0.39% and 0.15% of PE during a 10-year period.[9] The incidence of VTE in our study was 2.84%, which was almost ten times higher. These two studies reported only symptomatic VTE in major trauma patients. The explanation of the huge difference may be that our patients underwent follow-up CT scan. The study from Wong *et al.* collected data from 1998 to 2007 while this study was in 2013. Another study from Prichayudh *et al*. performed DVT screening in a surgical intensive care unit in which 12% of the population was trauma patients; the study reported the incidence of DVT at 3.6% which was close to our study.

Most of the VTE occurrences were in the "high risk of bleeding" group. Since this group initially had contraindications for the pharmacological prophylaxis, it was started only after no contraindications were observed. Therefore, pharmacological prophylaxis was initiated on the 8th day after admission. This confirms the importance of timing to initiate a pharmacological prophylaxis which should be as soon as possible.

Conclusion

The interesting finding in this study was 50% of the patients who had VTE and had a history of blood transfusions >4 units. Blood transfusion was reported as a risk factor of VTE in a

Table 3: Modality of the prophylaxis

	None (*n*=192), *n* (%)	Pharmacological prophylaxis (*n*=29), *n* (%)	Mechanical prophylaxis (*n*=93), *n* (%)	Both (*n*=38), *n* (%)	*P*
Sex					
Male	157 (81.8)	18 (62.1)	71 (76.3)	32 (84.2)	0.075*
Female	35 (18.2)	11 (37.9)	22 (23.7)	6 (15.8)	
Age					
Median (IQR)	37.5 (24.5)	44 (36)	35 (25)	30.5 (25)	0.662†
Acute spinal cord injury					
No	189 (99.5)	28 (96.6)	87 (93.5)	32 (84.2)	<0.001*
Yes	1 (0.5)	1 (3.4)	6 (6.5)	6 (15.8)	
Traumatic brain injury					
No	117 (61)	21 (72.4)	40 (43)	31 (81.6)	<0.001*
Yes	75 (39)	8 (27.6)	53 (57)	7 (18.4)	
Pelvic fracture					
No	184 (95.8)	20 (69)	90 (96.8)	32 (84.2)	<0.001*
Yes	8 (4.2)	9 (31)	3 (3.2)	6 (15.8)	
Spinal column fracture					
No	170 (88.5)	22 (75.9)	66 (71)	27 (71.1)	0.002*
Yes	22 (11.5)	7 (24.1)	27 (29)	11 (28.9)	
NOM of solid organ injury					
No	177 (92.2)	26 (89.7)	84 (90.3)	35 (92.1)	0.935*
Yes	15 (7.8)	3 (10.3)	9 (9.7)	3 (7.9)	
ISS					
Median (IQR)	14 (8.5)	17 (12)	19 (15)	24.5 (17)	<0.001†

*Chi-square test, †Kruskal-Wallis rank test. DVT: Deep vein thrombosis, IQR: Interquartile rank, ISS: Injury Severity Score, NOM: Nonoperative management

postoperative setting,[10,11] but it was inconclusive in trauma setting. However, the VTE occurrence in this study was too low to make a conclusion that a blood transfusion >4 units was a risk factor for VTE in trauma.

The limitation of this study is the exclusion of patients who were hospitalized <7 days which caused a loss of cases who were discharged early or died within a week. However, the cases who were discharged within a week after admission were mostly minor trauma patients who possibly did not need a prophylaxis. The strength of the study is that the data were collected from a trauma registry which routinely collected prospective data. This study also reported the incidence of VTE in trauma in an Asian population which was rarely reported in the current evidence. In conclusion, compliance to DVT prophylaxis treatment in Thailand has improved over time.

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Conflicts of interest

There are no conflicts of interest.

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