ORIGINAL ARTICLE

Efficacy of Caprini risk assessment model in predicting venous thromboembolism risks among Asian surgical patients

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ABSTRACT

Introduction: Caprini risk assessment model (RAM) has been validated in Caucasians but evidence of its suitability in Asian surgical patients is still unknown. This study aims to determine the efficacy of Caprini model in venous thromboembolism (VTE) risk assessment among Asian surgical patients.

Materials and Methods: Consecutive surgical patients with Asian ethnicities admitted to a tertiary public hospital between January 2013 and December 2014, were included. Their demographic details, VTE risk factors and scores based on Caprini RAM were recorded. Primary outcome of this study was symptomatic VTE within 90 days of hospitalisation. Fisher's exact test and Lasso regression were performed for statistical analysis.

Results: A total of 4206 patients were included in this study. Distribution of this study population by risk level was very low, 14.7%; low, 44.1%; moderate, 25.6% and high, 15.7%. The overall symptomatic VTE incidence within 90 days was 0.5%. The incidence of deep venous thrombosis (DVT), pulmonary embolism (PE) and both was 0.31%, 0.19% and 0.05% respectively. VTE incidence by risk category was very low, 0%; low, 0.16%; moderate, 0.37% and high, 2.12%. Obesity (BMI >25), history of prior major surgery, history of DVT/PE and high-risk category (scores ≥5) were significant VTE factors with odds ratio > 5.0. Following the Caprini RAM with ACCP preventive recommendations, an estimated 85% of surgical patients would need prophylaxis.

Conclusion: The overall VTE incidence among Asian surgical patients is low. Prophylaxis using Caprini RAM may subject a low incidence patient population to over utilisation of thromboprophylaxis and therefore not cost-effective when applied to Asian patients.

KEYWORDS:
Pulmonary embolism, venous thromboembolism

INTRODUCTION

Venous thromboembolism (VTE) incidence among Asians is increasing. In Singapore, deep venous thrombosis (DVT) prevalence among hospitalised patients has increased significantly within a decade from 0.079% (1989-1990) to 0.453% (2002-2003).[1] Annual incidence of VTE from a Korean Health Insurance Review and Assessment Service database has also climbed from 8.83 in 2004 to 13.8 per 100,000 individuals in 2008.[2] Similarly, the annual incidence of pulmonary embolism (PE) in China has quadrupled from 0.03% (1996) to 0.14% (2006).[3] In view of this escalating incidence of VTE, a group of medical and surgical clinicians from Asian countries have formulated the Asian VTE prophylaxis guidelines published in 2012 and updated them in 2017. This group of specialists devised the prophylaxis recommendations following systematic review of Asian literature on VTE. They recommended preventive measures among surgical patients according to three risk groups: low, moderate and high. What has been lacking in these guidelines is the sufficient clinical evidence on the use of an individual risk assessment model (RAM) such as Caprini score to objectively stratify VTE risks among hospitalised patients in Asia.[4,5] An individual RAM is an important tool in VTE prophylaxis implementation strategy. Thus far, the guideline has yet to endorse any RAM due to insufficient clinical validation in Asia on the use of a RAM, which is mainly based on data from Western countries where incidences of VTE are high.

Caprini et al., first published their VTE risk assessment model in 1991. They initially categorised patients into three risk levels – low, moderate and high as per Hull's proposal.[6] Subsequently in 2005, Caprini modified his model adopting low, moderate, high and highest risk categories based on the classification in the ACCP consensus.[7] Bahl et al[8] validated the Caprini RAM retrospectively in general, vascular and urologic surgical patients, based on hospital discharge from the University of Michigan Health System (UMHS) National Surgical Quality Improvement Program in 2010.[8] Panucci et al., then validated its use in a group of moderate and high-risk plastic and reconstructive surgery patients in the United States of America.[9] Subsequent validation studies were conducted mainly among Caucasians. These validations led to the inclusion of Caprini RAM in the 9th ACCP Prevention of Thrombosis guidelines for non-orthopaedic surgical patients. The ACCP guidelines using Caprini risk stratifications recommend the following prophylaxis: early ambulation for very low risk (score 0), mechanical method in low risk (score 1-2), either pharmacological or mechanical prevention in moderate risk (score 3-4) and combined pharmacological and mechanical prophylaxis in high risk group (score ≥5).[10] Although Caprini RAM has been endorsed by the ACCP guidelines, it is not widely used among Asian

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patients. The low incidence of VTE, coupled with fear of higher bleeding risk among Asian ethnicity than Caucasian counterpart, are possible reasons of its unpopular utilisation.

To date, a few validation studies in China, Vietnam and India on Caprini RAM among hospitalised patients have been conducted. Zhou et al., validated a modified Caprini RAM with a case-control study among Chinese patients with 347 VTE inpatients and 651 randomly selected non-VTE inpatients.[11] As it was a case-control study, it did not reflect the actual VTE incidence in their hospital.[11] A study by Hanh et al., in Vietnam based on hospital discharges of close to 2.8 million surgical patients demonstrated an overall low VTE incidence of 0.11%.[12] The symptomatic VTE rates by Caprini risk level: low to moderate, 0.04%; high, 0.11% and highest, 0.27% in Hanh's study were seven to ten times lower than the incidence reported in the United States of America (low to moderate, 0.7%; high, 0.97%; highest, 1.97%).[8,12] A prospective observational study on selected patients who underwent surgeries in India however, demonstrated a high overall VTE incidence of 7.3% but these were reported only in patients with Caprini score ≥5.13 These vast heterogeneous differences in the VTE incidence between two continents and among different ethnicities pose questions on the efficacy of Caprini model to stratify VTE risk among Asian surgical patients. The aim of this study was to evaluate the efficacy of using Caprini RAM in VTE prophylaxis among multi-ethnic Asian surgical patients.

MATERIALS AND METHODS

Study Design and Patients

All elective and emergency admissions to general surgical and vascular wards in a tertiary public hospital in Serdang (a suburban town of Kuala Lumpur), Malaysia from January 2013 to December 2014 were reviewed retrospectively. Of note, Serdang hospital utilises an electronic medical record (EMR) system that includes laboratory and imaging data. Kuala Lumpur is a cosmopolitan city and has a significant migrant population - largely refugees and migrant workers besides ethnically diverse Malaysian population. Therefore, all Asian patients regardless of their nationalities were included. Data were collected from EMR of this hospital. Ethical approval was obtained from the hospital institutional ethics committee.

Caprini Risk Assessment

The VTE risk factors using 2005 Caprini RAM were recorded for each patient. The patient was categorised into risk level based on the 9th ACCP guidelines recommendations - very low risk (score 0), low risk (score 1-2), moderate risk (score 3-4) and high risk (score ≥5). There was no mandated VTE prophylaxis protocol in this hospital at the time of this study. Decision on prophylaxis prescription was made preferentially by the attending consultant. Details of VTE prophylaxis, either pharmacological, mechanical or combined methods were documented. Pharmacological prophylaxis prescribed in this hospital comprised:

i. Subcutaneous (SC) heparin 5000units twice or thrice daily,
ii. SC enoxaparin 20/40/60 mg daily
iii. SC fondaparinux 2.5mg daily
iv. Direct oral anticoagulants (DOACs) such as rivaroxaban and dabigatran.

Other DOACs such as apixaban and edoxaban were not used in this hospital during the study period.

Mechanical methods used in this hospital during the study period were class 1 graduated compressive stockings (GCS) or sequential compressive device (SCD) or both. The diagnosis of VTE was confirmed by duplex ultrasonography and/or contrast enhanced computed tomography. VTE event was recorded when it occurred within 90 days of hospital admission. Mortality occurring during hospitalisation and within 90 days after discharge was also documented.

Statistical Analysis

STATA software version 18.0 (StataCorp, College Station, Texas, USA) was used for statistical analysis. Measured variables were reported as percentages for categorical data and means with standard deviation or medians with interquartile range (IQR; 25th to 75th quartile) for continuous data. Fisher's exact test was performed to determine the association between the risk factors and VTE incidence. In view of less than 10 outcome events per predictor variable, a penalised regression – Lasso regression analysis was used to calculate the odds ratio (OR) of the significantly associated risk factors for VTE incidence. Age and VTE prophylaxis were selected as potential confounding factors of VTE risk in the analysis. Variables with crude OR ≥2.0 and p-value <0.2 in the initial univariate analysis were included in the subsequent multivariate Lasso regression. OR of each Caprini risk level was also determined. Factors with p-value <0.05 (95% confidence interval, CI) were considered statistically significant.

RESULTS

A total of 4206 patients admitted to the surgical ward were included. The median age was 47 years old (IQR: 30-62). Majority of these patients, 2497/4206 (59.4%) were males. Malays were the dominant ethnic group in this study population, 2359/4206 (56.1%), followed by Chinese, 922/4206 (21.9%); Indians, 566/4206 (13.5%); Aborigines 52/4206 (1.2%) and other Asians comprised mainly immigrant workers, refugees and temporary visitors from Indonesia, Myanmar and South Asia, 307/4206 (7.3%). Median length of stay in the hospital was 2 days (IQR: 1 – 5). The overall symptomatic VTE incidence in this two-year study was 21/4206 (0.5%). Incidence of DVT, PE and both within 90 days of hospital admission was 12/4206 (0.28%), 7/4206 (0.17%) and 2/4206 (0.05%) respectively. Among the VTE cases, 18/21 patients did not undergo major surgery.

VTE prophylaxis was administered in 279/4206 (6.6%) patients during their hospital admissions. None had extended VTE prophylaxis upon discharge. A hundred and sixty-nine patients received pharmacological prophylaxis while 168 patients had mechanical measures. About 21%, 58/279 patients had combined pharmacological and mechanical therapy. Enoxaparin was the commonest pharmacological prophylaxis with 110/169 (65.1%) patients, followed by fondaparinux, 36/169 (21.3%) and low dose unfractionated heparin, 22/169 (13.0%). Only one patient had DOAC for prophylaxis. Of those who received mechanical prophylaxis, 153/168 (91.1%) patients had GCS alone, 8/168 (4.7%) SCD alone and 7/168 (4.2%) GCS and SCD. About 65% of patients who received VTE prophylaxis

had major surgery with one of them developed VTE. Despite prophylaxis, 10/279 patients developed VTE.

Overall mortality rate during hospitalisation and within 90 days after discharge was 184/4206 (4.4%). Two deceased had underlying pulmonary embolism, where causes of deaths were reported as metastatic malignancies and sepsis. Five deaths were unknown.

The following risk factors were not identified in this cohort of patients:
i. Positive factor V Leiden
ii. Elevated serum homocysteine
iii. Heparin-induced thrombocytopenia
iv. Elevated anti-cardiolipin
v. Family history of thrombosis
vi. Positive prothrombin 20210A

One patient with congenital thrombophilia developed VTE during hospitalisation. As this study comprised surgical patients only, primary thrombophilia was not routinely investigated unless there was relevant history of unprovoked thrombosis. Table I showed VTE incidence percentage and its association with each factor of the Caprini RAM.

Current swollen leg, varicose veins, obesity (BMI >25), serious lung disease including pneumonia (< 1 month), history of prior major surgery (<1 month) and history of DVT/ PE had crude OR ≥2.0 and p-value <0.2 in the initial univariate regression analysis. After adjusted multivariate regression analysis, obesity, history of prior major surgery and history of DVT/PE were statistically significant VTE predictors with OR ≥ 10.0 (p<0.05) Table II.

There were 617/4206 (14.7%) patients categorised in very low, 1854/4206 (44.1%) low risk, 1076/4206 (25.6%) moderate risk and 659/4206 (15.7%) in high-risk groups. The high-risk category was further stratified as high risk with score 5 to 6, 435/4206 (10.3%); higher (7-8), 135/4206 (3.2%) and highest (≥9), 89/4206 (2.1%). VTE prophylaxis received in each risk level was as followed: very low, 0.5%; low, 1.6%; moderate, 7.2%; high, 20.5%; higher, 31.9% and highest, 40.4%. Incidence of VTE by risk level was very low, 0%; low, 3/1854 (0.16%); moderate, 4/1076 (0.37%); high, 10/435 (2.30%); higher, 3/135 (2.22%) and highest, 1/89 (1.12%) Figure 1.

Only high risk (≥ 5) category was identified as a statistically significant risk predictor of VTE (OR 5.18, p = 0.018). Patients with score 5-6, in particular, had statistically significant OR = 3.82 of VTE incidence (p=0.015) Table III.

DISCUSSION

Asia is a diverse continent with multi-ethnicities and different socioeconomic status. Many of the epidemiological VTE studies were conducted among East Asian population, mainly from developed countries such as Korea, Taiwan, Hong Kong and Singapore. They reported a population-wide annual VTE incidence of 8 to 20 per 100,000 persons, eight times lower than the incidence reported in Caucasians, 71 to 117 per 100,000 persons.[2,14-18] A recent meta-analysis of hospital registries in Asia demonstrated that the VTE incidence ranged between 11 and 88 cases per 10,000 admissions. These incidences were still low, only 20% of that recorded in the western countries.19 Epidemiological studies on VTE incidence is still lacking in developing countries such as Malaysia and its Southeast Asian counterparts. This study demonstrated an overall low incidence of symptomatic VTE among hospitalised surgical patients, 0.5%. The incidence reported in this study population was consistent with that reported among surgical patients in most Asian countries, 0.11 to 0.85%.[12,19] In a survey conducted in 2010 among Asian specialists, only half of the respondents practiced routine VTE prophylaxis. Most of them cited low VTE incidence in Asia as the commonest reason for not practicing VTE prophylaxis routinely. Other reasons included costs and bleeding risk.[20] However, there is still a contention in the actual incidence of VTE among hospitalised patients. It is arguable that the possible reasons for the low incidence of VTE are under-reporting with lack of awareness among clinicians, limited medical resources to make diagnosis and low post-mortem rates.[21]

The results of this study showed that obesity, past history of major surgery (less than a month) and history of DVT/PE were significant risk factors of VTE (OR >2.0). These results were similar to the literature in western countries. Anderson, Spencer and Bahl reported that major surgery, and previous DVT/PE were significant risk factors with odds ratio of more than two.[8,16,17] While obesity was a marginal risk factor in the Western population, it was a significant risk factor with OR >2.0 in our cohort and study by Zhou et al.[11,16] This could be explained by a higher VTE/obesity ratio, 2/47 (4.3%) in this study than the ratio, 33/2030 (1.63%) in the Bahl's study.[8,11] Although major surgery during hospitalisation was not significantly associated with VTE in this study, patients with history of major surgery (less than a month) were 14 times at risk of VTE. This could imply two possibilities: patients who developed complications requiring multiple surgeries and/ or patients discharged without extended VTE prophylaxis after major surgeries were at high risk of VTE.

There were several differences in the reported VTE risk characteristics between this study population and the American study by Bahl et al.[8] Patients in this study were relatively younger with 73% of them aged ≤60 years, similar to a study in India (82%),[13] as compared to 59% in Bahl's study.[8] A large number of patients in Bahl's study underwent major surgery, 88.2% as opposed to 31.4% in this study.[8] Malignancy rate in this study population was 10.2%, three times lower than that among patients in Bahl's study (35%).8 There was no reported Factor V Leiden and positive prothrombin 20210A in this cohort of patients, a similar finding in the Chinese cohort by Zhou et al.[11] In contrast, there was a significant percentage of patients with these factors, 0.56% in the study by Bahl et al.[8] The rarity of Factor V Leiden and prothrombin 20210A among Asians in the literature with the exception of Indian population, supported this study finding. Prevalence of Factor V Leiden among young Indians with unprovoked DVT was reported at 9.1%.[22,23] The characteristic differences of these risk factors (elderly patients, obesity, major surgery, rate of trauma, malignancy and Factor V Leiden, prothrombin 20210A)

Table I: Distribution of VTE incidence in each risk factor and its association using Fisher's exact test.

Risk factors	VTE/N (%)	P
Age 41 – 60 (Y)	10/1316 (0.8)	0.058
Swollen Leg (Current)	3/57 (5.3)	<0.001*
Varicose Veins	2/32 (6.3)	0.012*
Obesity (BMI>25)	2/47 (4.3)	0.023*
minor Surgery Planned	1/730 (0.1)	0.156
Sepsis (<1 Month)	3/148 (2.0)	0.040*
Serious Lung Disease Including Pneumonia (< 1 Month)	3/79 (3.8)	0.008*
Oral Contraceptive Pills or Hormone Replacement Therapy	1/17 (5.8)	0.085
Pregnancy Or Postpartum (<1 Month)	1/33 (3.0)	0.159
History Of Unexplained Stillborn, Recurrent Spontaneous Abortion (≥3), Premature Birth with Toxaemia Or Growth-Restricted Infant	0/4 (0)	-
Acute Myocardial Infarction	0/27 (0)	-
Congestive Cardiac Failure (< 1 Month)	0/36 (0)	-
History Of Inflammatory Bowel Disease	0/9 (0)	-
History Of Prior Major Surgery (<1 Month)	1/21 (4.7)	0.023*
Chronic Obstructive Pulmonary Disease (COPD)	0/43 (0)	-
Age 61 To 74 Years	9/820 (1.1)	0.025*
Malignancy (Present/Previous)	7/429 (1.6)	0.005*
Laparoscopic Surgery (>45 Minutes)	0/174 (0)	-
Patient Confined to Bed (>72 Hours)	5/267 (1.9)	0.010*
immobilising Plaster Cast (<1 Month)	0/10 (0)	-
Central Venous Access	1/123 (0.8)	0.480
Major Surgery (>45 Minutes)	3/1320 (0.2)	0.250
Age ≥75 Years	0/323 (0)	-
History Of DVT/PE	7/17 (41.2)	<0.001*
Positive Lupus Anticoagulant	1/2 (50.0)	0.010*
Other Congenital/Acquired Thrombophilia	1/1 (100)	-
Stroke (<1 Month)	0/33 (0)	-
Elective Major Lower Extremity Arthroplasty	0/1 (0)	-
Hip, Pelvis or Leg Fracture	0/31 (0)	-
Acute Spinal Cord Injury or Paralysis (<1 Month)	0/7 (0)	-
Multiple Trauma (<1 Month)	1/97 (1.0)	0.402

BMI = Body mass index, n = Number of patients in each factor, *p<0.05

Table II: Caprini RAM risk factors with crude and adjusted odds ratio for VTE.

Risk factors	Univariate analysis		Multivariate analysis	
	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p
Swollen leg (current)	8.69 (2.34-32.32)	0.001	4.05 (0.76-21.49)	0.101
Varicose veins	5.88 (1.33-26.00)	0.020	5.71 (0.86-37.71)	0.071
Obesity (BMI >25)	12.02 (2.68-53.93)	0.001	12.68 (2.35-68.33)	0.003
Sepsis (<1 month)	1.86 (0.45-7.76)	0.392	-	-
Serious lung disease including pneumonia (<1 month)	3.44 (0.99-11.88)	0.051	2.47 (0.53-1.37)	0.247
History of prior major surgery (<1 month)	7.62 (1.06-54.72)	0.043	13.94 (1.67-116.29)	0.015
Age 61-74 years	1.71 (0.70-4.18)	0.240	-	-
Malignancy (present/previous)	1.68 (0.51-5.55)	0.393	-	-
Patient confined to bed (>72 hours)	1.47 (0.39-5.52)	0.567	-	-
History of DVT/PE	167.23 (48.73-573.81)	<0.001	188.27 (52.12-680.09)	<0.001
OR = Odds ratio				

possibly accounted for a low incidence of VTE in this study cohort.

Comparing VTE incidence by risk score, Bahl reported 0.7% VTE incidence in patients with score ≤2, which was seven times higher compared to 3/2471 (0.1%) incidence in this study population.[8] VTE incidence in moderate risk (score 3-4) of this study population was 4/1076 (0.4%) half of that in the Bahl's study of similar score. This study demonstrated a high VTE incidence rate, 14/659 (2.1%) and a statistically significant OR of 5.18 in patients with score ≥ 5. However, when we further categorised the score of ≥5 into three different levels: 5-6, 7-8 and ≥9, the VTE incidence showed a downtrend as the score increased in this study. This result was contradictory to most studies, in which the incidence of VTE was significantly higher at score ≥7.13,[24] This could be explained by the relatively higher VTE prophylaxis rate, 32 to 40% in patients of this study with score ≥7 than those with score 5-6 (21%), resulting in a decreased VTE incidence.

More than half, 11/21 patients of this study who developed VTE within 90 days of hospitalisation did not received prophylaxis. In spite of prophylaxis, VTE occurred substantially in 10/279 (3.6%) patients implying suboptimal or ineffective preventive measures. About 85% (18/21) of the

Table III: Caprini RAM risk levels with adjusted odds ratio for VTE.

Risks	Adjusted OR (95% CI)	p
Low (1-2)	0.44 (0.11-1.73)	0.241
Moderate (3-4)	0.54 (0.18-1.69)	0.293
High (≥5)	5.18 (1.33-20.19)	0.018
5 to 6	3.82 (1.30-11.28)	0.015
7 to 8	1.67 (0.41-6.82)	0.478
>8	0.50 (0.06-4.10)	0.518

VTE cases occurred in patients who did not undergo major surgery. While it is a routine practice of VTE prophylaxis prescription in patients undergoing major surgeries, the remaining surgical patients are often not assessed of their VTE risks. Many factors such as varicose veins, obesity, sepsis, serious lung disease, malignancy, immobility and history of DVT/PE are commonly neglected as risk of VTE during hospitalisation. This supports the important role of individual risk assessment to identify high VTE risk hospitalised patients even if they do not undergo surgical procedures. This, in turn, would ensure optimal VTE prophylaxis to reduce its risk among hospitalised surgical patients.

There are two aspects of Caprini RAM: the score for each risk level and its recommended prophylaxis according to ACCP guidelines. Most studies demonstrated that the risk of VTE was higher with increasing score.[8,11-13] VTE incidence in this study of low and moderate risk levels were much lower than the incidence in the equivalent risk levels in Caucasian studies.8 In addition, VTE incidence was only found in those patients with score ≥ 5 in prospective studies by Song et al., and Bilgi et al.[13,24] About 85% of patients in this study with score ≥1 would need VTE prophylaxis when adhering to the prophylactic recommendations by the Caprini RAM. Therefore, it is not effective to apply Caprini RAM recommendation to start prophylaxis at score ≥1 in this study population when VTE incidence is low.[10]

Despite institutional prophylactic strategy using Caprini RAM in 2005 at the University of Michigan, they could only achieve 25 to 27% VTE prophylaxis rate among those patients at score ≥5.8 They were able to achieve 95 to 97% compliance rate only after a decade of Caprini RAM implementation with various measures, including EMR and a system hard stop at the University of Michigan.[25] Implementation of Caprini RAM as VTE risk stratification will be a challenge in Asia because most hospitals, particularly in South and South East Asian countries, have no EMR facility. VTE risk assessment using Caprini model with 39 factors for each patient in this continent will eventually lead to non-compliance as it is tedious and time-consuming using paper record.

With a low incidence of VTE in this cohort of surgical patients and different risk characteristics, the use of Caprini RAM may lead to over-prescription of VTE prophylaxis. In addition, the issue of bleeding risk has not been adequately addressed. There have been reports in the past of high bleeding risk after pharmacological prophylaxis, 7.3 to 13.6% among Asians.[26-29] Japanese studies demonstrate equal efficacy of a lower enoxaparin dose in VTE prophylaxis and advocate use of pharmacological measure strictly in higher risk groups.[28,29]

Based on these two factors: low VTE incidence and different bleeding profile, we need to modify Caprini RAM based on local risk factors and VTE incidence to improve its efficacy and acceptability in this community. We propose modification of Caprini RAM into three risk categories according to the Asian VTE guidelines prophylactic recommendation: low (≤2; early ambulation), moderate (3-4; mechanical or pharmacological therapy) and high (≥5; combined therapy).[4]

There are many criteria and weightage used in RAM. Some of these risks are neither inherent nor common in Asian patients, such as Factor V Leiden and positive prothrombin 20210A. Having many criteria based on types of surgery and procedures are also cumbersome in individual risk assessment. An elaborate risk score is no doubt more specific in estimating the risk but in a busy clinical setting, it becomes a daunting task for the health care worker who does the risk assessment. To simplify RAM, we recommend reduction in the number of risks: remove medical patient currently at bed rest, incorporate laparoscopic and arthroscopic surgery into single factor - major surgery, group Factor V Leiden, elevated serum homocysteine, positive prothrombin 20210A, positive lupus anticoagulant, elevated anticardiolipin antibodies and other congenital or acquired thrombophilia as single factor - thrombophilia, and distribute age into two group (age 41-60 and age >60). Using this modified RAM that caters to our population, we would be able to pragmatically implement VTE prophylaxis among Asian patients.

There were several limitations in this study. Risk factors were reported based on documentation in the medical notes, thus, substantial number of factors could be missing in the records. Panunucci et al., demonstrated that face-to-face interaction provided better accuracy in VTE risk stratification than EMR review.30 As this was a retrospective study, the incidence of VTE could be underreported. Additionally, we only captured the symptomatic VTE based on symptoms recorded in the EMR and imaging evidence. The incidence could have been higher if routine screening for VTE was done, as part of a prospective study. Lack of post-mortem for sudden deaths due to a local culture of autopsy avoidance in order to allow early release of the deceased for rituals and burial, unless there was medico-legality involvement, could contribute to the low VTE incidence. A proportion of deaths due to VTE might be missed, evidenced by a substantial percentage of deaths in this study with unknown causes after hospital discharge. Another possibility of unrecorded VTE incidence in this study was that some discharged patients could have sought treatment elsewhere.

Nevertheless, this study provides a retrospective VTE risk evaluation in Asian surgical patients as reference for future prospective validation studies of VTE RAM in this continent.

CONCLUSIONS

Venous thromboembolism (VTE) incidence among Asian surgical patients is low. Only groups with risk scores ≥ 5 significantly predicts VTE risk. Using Caprini risk assessment model (RAM) and its ACCP recommended preventive measures may be an overutilisation of VTE prophylaxis in this low-risk population and may not be cost-effective. Therefore, a modified individual RAM that caters to Asian population is needed as an important tool for implementation of an effective VTE prophylactic strategy.

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