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A CLINICAL AUDIT ON THE VENOUS THROMBOEMBOLISM PROPHYLAXIS IN THE MEDICAL-SURGICAL INTENSIVE CARE UNIT OF A TERTIARY REFERRAL HOSPITAL

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ABSTRACT

Delay in the initiation of venous thromboembolism (VTE) prophylaxis within the first 24 hours of intensive care unit (ICU) admission was associated with an increased risk of mortality. This study evaluated adherence towards VTE prophylaxis guidelines. A complete clinical audit cycle was performed in the medical-surgical ICU of a public tertiary state hospital. The standards were set as (1) all patients admitted to the ICU should receive pharmacological VTE prophylaxis within 24 hours of admission unless contraindicated and (2) all pharmacological VTE prophylaxis should be prescribed with the appropriate regimen. All adult ICU patients admitted in January 2023 were recruited in the phase one study, whereas all adult ICU patients admitted in January 2024 were recruited in the phase two study following an educational talk in August 2023. A total of 74 patients were recruited in the phase one study. Of these, only five (27.8%) indicated patients received pharmacological VTE prophylaxis within 24 hours of ICU admission. Two (40.0%) of them were underdosed with enoxaparin. Following educational intervention, 86 patients were recruited in the phase two study. Twelve (80.0%) indicated patients received pharmacological VTE prophylaxis within 24 hours of ICU admission. All of them received an appropriate dose of enoxaparin. The educational intervention improved the proportion of indicated patients receiving pharmacological VTE prophylaxis (p = 0.0083), and the proportion of patients receiving an appropriate enoxaparin regimen (p = 0.0735). A simple educational session was able to improve guideline adherence. A periodic educational session is warranted to ensure consistent adherence.

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INTRODUCTION

Venous thromboembolism (VTE) is a preventable medical condition which can manifest as deep vein thrombosis (DVT) or pulmonary embolism (PE). The prevalence of VTE among intensive care unit (ICU) patients was approximately 10.0% (Gao *et al*. 2022). Patients in ICU are predisposed to VTE due to the nature of interventions used such as pharmacological paralysis and sedation, indwelling catheters, central lines, mechanical ventilation and vasopressors (Zhang *et al*. 2019; Gao *et al*. 2022). Delay in the initiation of VTE prophylaxis within the first 24 hours of ICU admission was associated with an increased risk of mortality among adult ICU patients without VTE contraindication (Ho, Chavan and Pilcher 2011; Sahle *et al*. 2023). Patients who developed DVT had a longer duration of mechanical ventilation, length of ICU stay and length of hospital stay (Malato *et al*. 2015).

According to the Malaysian ICU Management Protocol 2019, all patients admitted to the ICU should receive pharmacological prophylaxis, either unfractionated heparin or low molecular heparin within 24 hours of admission unless contraindicated (Malaysian Society of Intensive Care 2019). Despite the availability of VTE prophylaxis guidelines, adherence to VTE prophylaxis was poor in developing countries (Abuowda *et al*. 2019). To date, limited studies have been exploring the practice of VTE prophylaxis in ICUs in Malaysia. This study aimed to evaluate the adherence towards VTE prophylaxis guidelines and to report the outcomes of an educational intervention on guideline adherence.

METHODS

This clinical audit was conducted at the ICU of Hospital Sultanah Bahiyah, a public tertiary referral hospital in the capital city of the state of Kedah, Malaysia. This clinical audit was conducted per the protocol stated in the Clinical Audit Handbook published by the Kedah State Health Department, Malaysia. The clinical audit protocol was registered with the National Medical Research Registry of Malaysia (NMRR ID-23-00903-J78). We evaluated the current practices, identified the gap between performance and standard, implemented a method of improvement and re-audited the performance. The Malaysian ICU Management Protocol 2019 was utilised as it provides standardised, evidence-based guidelines tailored to the Malaysian healthcare context for managing critically ill patients. There were two standards set for this clinical audit. First, all patients admitted to the ICU should receive pharmacological VTE prophylaxis within 24 hours of admission unless contraindicated. Second, all pharmacological VTE prophylaxis should be prescribed with the appropriate regimen.

During the first phase of the study, all data were collected retrospectively using the data recorded in the electronic hospital information system (eHIS). All patients admitted to the ICU between 1st January 2023 and 31st January 2023 were screened. Patients who were admitted due to COVID-19 infection, aged less than 18 years old, stayed less than 24 hours in the ICU, had VTE diagnosed before ICU admission, and had initiated VTE pharmacological prophylaxis before ICU admission were excluded from the audit. The auditors were clinical pharmacists. All discrepancies detected were discussed with the intensivist or anesthesiologist on duty.

The findings of the first phase clinical audit were presented to the intensivist in charge of the ICU on 14th August 2023. During the second phase, all data were collected prospectively due to changes in the reporting format of the eHIS which precluded proper documentation of medications served. All patients admitted to the ICU between 1st January 2024 and 31st January 2024 and fulfilled the inclusion criteria were analysed.

We have carried out a physical continuing medical education (CME) session between the two audit periods. This educational session was conducted in the ICU seminar room and lasted for an hour. The CME was delivered by a senior ICU pharmacist and attended by the intensivists on duty. Among the contents during the learning session were presentations related to our VTE audits including the objectives, methods, audit standards, audit tools and the results of the first cycle audit. Discussions and improvement strategies were achieved during the CME session.

Following the educational intervention, adherence to the VTE prophylaxis guidelines in the ICU was continuously monitored through a second cycle audit that was performed four months thereafter. Patients' outcomes including VTE events have been monitored.

The specific measure was taken to ensure data consistency across the auditors. All auditors who were working as clinical pharmacists received a brief description on the audit process including the methodology, patients' inclusion and exclusion criteria, the guidelines for VTE prophylaxis administration in the ICU setting and the appropriate documentation on the audit findings. As both auditors worked in the ICU setting, their expertise and knowledge were utilised to ensure data collection was tailored to the ICU environment. This allowed a specific and detailed assessment, while adhering to the standard protocol. Throughout this clinical audit period, ongoing communication was maintained among auditors. Issues encountered during data collection were promptly discussed by auditors to maintain the audit process uniformity.

Shifting from retrospective to prospective data collection methods has changed the quality of the data. Prospective data captures real-time information; thus, it reduces the reliance on previous data that may be incomplete or inconsistent. However, there is no doubt that there will be biases involving the auditors or external factors during the prospective data collection period. Realising this issue, we have improved the existing study protocol to ensure consistency of data collection between auditors. This standardisation helps to ensure accurate data, which is not always guaranteed in retrospective data since it is subject to the availability of the required data. Continuous monitoring also has been carried out. It involved a periodic cross-checking to ensure the data was uniform, accurate and in real-time. Communication between auditors helped to resolve problems that arise and subsequently reduced the inconsistent data.

The data was transcribed to Microsoft Excel 2019 (Microsoft, Washington). The data was then analysed by using the Statistical Package for the Social Sciences version 27 (International Business Machines, Armonk, New York). Categorical variables were reported as counts and percentages. Pearson's chi-square test or Fisher's exact test was used to evaluate the difference between the performance before and after intervention. A *p*-value of less than 0.05 was considered statistically significant.

RESULTS

During the first phase of the clinical audit, there were a total of 89 patients admitted to the ICU. Of these, 15 patients were excluded due to COVID-19 patients (*n* = 5), VTE prophylaxis initiated before the ICU admission (*n* = 4), ICU stay less than 24 hours (*n* = 4), and age less than 18 years old (*n* = 2). Of 74 patients recruited, the majority of them were Malays (*n* = 66, 89.2%) and half of them were male (*n* = 37, 50.0%) as shown in Table 1.

Table 1: Demographic data

Patient	Phase one	Phase two
Total number of patients	74	86
Gender		
Male	37 (50.0%)	55 (64.0%)
Female	37 (50.0%)	31 (36.0%)
Race		
Malay	66 (89.2%)	76 (88.4%)
Non-Malay	8 (10.8%)	10 (11.6%)

The majority of ICU patients (82.9%, *n* = 63) received some form of VTE prophylaxis within 24 hours of ICU admission. Among patients who were not indicated for pharmacological prophylaxis, 39 (69.6%) of them were given mechanical prophylaxis. Pharmacological prophylaxis was indicated for 18 (24.3%) patients. Of these, 13 (72.2%) patients were not prescribed any pharmacological prophylaxis. Out of 5 (27.8%) patients who were prescribed pharmacological prophylaxis, all of them received enoxaparin. However, 2 (40%) of them who were obese (BMI > 30 kgm^{-2}) did not receive adequate doses of enoxaparin.

During the phase two clinical audit (re-audit), there were a total of 109 patients admitted to the ICU. Of these, 23 patients were excluded due to ICU stay less than 24 hours (*n* = 12), less than 18 years old (*n* = 4), VTE prophylaxis initiated before ICU admission (*n* = 4), and ICU admission due to COVID-19 (*n* = 3). Of 86 patients recruited, the majority of them were Malays (*n* = 76, 88.4%) and male (*n* = 55, 64.0%), as shown in Table 1.

The majority of ICU patients (*n* = 83, 96.5%) received VTE prophylaxis within 24 hours of ICU admission. Among patients who were not indicated for pharmacological prophylaxis, 42 (59.2%) of them received mechanical prophylaxis. Pharmacological prophylaxis was indicated for 15 (17.4%) patients. Of these, 3 (20.0%) patients were not prescribed with any pharmacological prophylaxis. All patients (*n* = 12) who received pharmacological prophylaxis were prescribed enoxaparin with an appropriate dose.

The percentage of patients who were appropriately started on pharmacological VTE prophylaxis increased significantly from 27.8% in the phase one clinical audit to 80.0% in the phase two clinical audit (re-audit) with a 95% confidence interval of 0.0243 to 0.5349 and a *p*-value of 0.0083. The proportion of appropriate pharmacological VTE prophylaxis regimens prescribed also increased from 60.0% to 100% (95% confidence interval: 0.0022–1.4581; *p* = 0.0735) as shown in Table 2.

Table 2: Clinical audit standards and performance

No.	Standards	Target (%)	Phase of audit		95% CI	*p*-value
			One, *n* (%)	Two, *n* (%)		
1	All patients admitted to the ICU should receive pharmacological VTE prophylaxis within 24 hours of ICU admission unless contraindicated.	100	5/18 (27.8)	12/15 (80.0)	0.0243–0.5349	0.0083[a]
2	All patients initiated with pharmacological VTE prophylaxis should be prescribed an appropriate regimen.	100	3/5 (60.0)	12/12 (100)	0.0022–1.4581	0.0735[b]

Note: [a] = Pearson's chi-square test; [b] = Fisher's exact test; CI = confidence interval; ICU = intensive care unit; VTE = venous thromboembolism.

DISCUSSION

To the best of the investigators' knowledge, this is the first clinical audit on the use of VTE prophylaxis among ICU patients in the state of Kedah, Malaysia. The educational intervention significantly improved the proportion of patients receiving pharmacological VTE prophylaxis and all patients received an appropriate regimen. Adherence to VTE prophylaxis protocol in the ICU setting could inexplicably reduce the risk of VTE, which could prolong the recovery phase or increase mortality. Effective prophylaxis measures in turn helps to avoid extended hospital stay and cut down healthcare costs.

A study done in Saudi Arabia reported that 13.6% of the patients received a suboptimal dose of VTE prophylaxis (Noor *et al*. 2020). Similarly, 2 out of 5 (40%) of our patients received suboptimal doses of enoxaparin, and both were obese. This might be due to fear of bleeding, as pharmacokinetics of enoxaparin are altered in obesity and may call for individualised dosing. This is especially true when complicated with underlying renal insufficiency, raising concerns on accumulation of doses when given for a prolonged period. However, due to lack of regular tests for therapeutic monitoring, clinicians tend to err on the side of caution.

Nonetheless, following an educational session, the proportion of patients receiving pharmacological VTE prophylaxis significantly improved and received an appropriate dose of enoxaparin. This concord with the findings by a study in Pakistan which concluded that educational intervention significantly improved adherence towards VTE prophylaxis guidelines (Shah *et al*. 2022).

Despite an increase in the proportion of appropriate pharmacological VTE prophylaxis regimens prescribed from 60.0% in the initial audit to 100% in the re-audit, the improvement did not reach statistical significance (95% confidence interval: 0.0022–1.4581; $p = 0.0735$). This may be due to small sample size as our clinical audit was not powered to detect a significant effect. Nonetheless, the absolute improvement to full compliance is noteworthy and may reflect a positive impact of our educational session. Ongoing evaluation and reinforcement of prescribing practices are warranted to assess the sustainability of this improvement and to ensure continued improvement in patient care.

Another notable observation was during both phase one and phase two of the study, the majority of patients who were not candidates for pharmacological prophylaxis, received mechanical prophylaxis instead. This aligned with the current clinical recommendation, which advocates for mechanical prophylaxis when pharmacological prophylaxis is contraindicated. However, it is important to note that not all patients received any form of VTE prophylaxis. This may be attributed to specific clinical contraindications or incomplete documentation in the medical records.

There were several limitations in our clinical audit. First, our phase one data was collected retrospectively. This may lead to incomplete or inaccurate data. Second, we did not explore the incidence of VTE development nor its correlation with the enoxaparin regimen. This hindered us from concluding that an appropriate enoxaparin regimen can prevent the development of VTE. Third, this study was not adequately powered to identify the significant difference between the pre- and post-intervention phases. As such, while observed improvement suggests a potential positive impact, definitive conclusions cannot be conclusively determined. Future studies should employ prospective designs, incorporate larger cohorts, and evaluate the VTE incidence in relation to enoxaparin regimens to provide more robust evidence on effectiveness of prophylactic intervention.

CONCLUSION

This study highlighted that only one-fourth of eligible patients started on pharmacological VTE prophylaxis within 24 hours of ICU admissions and almost half of them were under dosed. A simple educational intervention significantly improved compliance towards VTE prophylaxis guidelines in terms of timely pharmacological VTE prophylaxis initiation and enoxaparin regimen. A periodic educational session is warranted to ensure consistent compliance with the ICU VTE prophylaxis guidelines. Future studies should therefore be prospective in design and further explore the incidence of VTE development. Educational sessions on VTE prophylaxis should be scheduled periodically to ensure consistent compliance.

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CONFLICT OF INTEREST

This study has no conflict of interest.

REFERENCES

ABUOWDA, Y., ALSWERKI, M., AHMAD, A. A. *et al.* (2019) Pharmacological prophylaxis of venous thromboembolism in adult medical and surgical wards in the Gaza Strip: A multi-centre clinical audit, *The Lancet*, 393: S1. https://doi.org/10.1016/S0140-6736(19)30587-2

GAO, X., ZENG, L., WANG, H. *et al.* (2022) Prevalence of venous thromboembolism in intensive care units: A meta-analysis, *Journal of Clinical Medicine*, 11(22): 6691. https://doi.org/10.3390/jcm11226691

HO, K. M., CHAVAN, S. & PILCHER, D. (2011) Omission of early thromboprophylaxis and mortality in critically ill patients: A multicenter registry study. *Chest*, 140(6): 1436–1446. https://doi.org/10.1378/chest.11-1444

MALATO, A., DENTALI, F., SIRAGUSA, S. *et al.* (2015) The impact of deep vein thrombosis in critically ill patients: A meta-analysis of major clinical outcomes, *Blood Transfusion*, 13(4): 559–568. https://doi.org/10.2450/2015.0277-14

MALAYSIAN SOCIETY OF INTENSIVE CARE. (2019) *ICU Management Protocols*, 2nd edition, pp. 57 (Malaysia: Malaysian Society of Intensive Care).

NOOR, A. S. M., BUNING, J. A., STEPHEN, T. J. *et al.* (2020) Venous thromboembolism risk assessment and prophylaxis in intensive care unit; clinical audit and performance improvement project, *International Journal of Health Sciences and Research*, 10(10): 54–61.

SAHLE, B. W., PILCHER, D., PETER, K. *et al*. (2023) Mortality data from omission of early thromboprophylaxis in critically ill patients highlights the importance of an individualised diagnosis-related approach, *Thrombosis Journal*, 21(59): 1–9. https://doi.org/10.1186/s12959-023-00499-y

SHAH, M. H., KHAN, M. S., AHMAD, S. *et al*. (2022) Risk assessment and prophylaxis of venous thromboembolism in patients of medical ward of Northwest General Hospital and Research Center, Peshawar, Pakistan: A quality improvement project, *Cureus*, 14(12): e32811. https://doi.org/10.7759/cureus.32811

ZHANG, C., ZHANG, Z., MI, J. *et al.* (2019) The cumulative venous thromboembolism incidence and risk factors in intensive care patients receiving the guideline-recommended thromboprophylaxis, *Medicine*, 98(23): e15833. https://doi.org/10.1097/MD.0000000000015833