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RESEARCH ARTICLE

THE DETERMINATION OF INCIDENCE AND RISK FACTORS FOR DEEP VENOUS THROMBOSIS IN THE MEDICAL INTENSIVE CARE UNIT

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Abstract: Deep vein thrombosis (DVT) is a significant complication in critically ill patients, often leading to increased morbidity and mortality. This study aimed to determine the incidence of DVT, evaluate associated risk factors, and assess the effectiveness of prophylactic interventions in patients admitted to the medical intensive care unit (MICU). A prospective observational study was conducted over three months at Meenakshi Medical College and Research Institute, including 50 MICU patients. Data on demographics, clinical parameters, risk factors, and thromboprophylaxis were collected, and DVT was diagnosed using venous ultrasonography. Statistical analyses were performed using SPSS v22, with significance set at $p < 0.05$. DVT was identified in 16% of the study population. Significant risk factors included age over 65 years, prolonged immobilization, central venous catheterization, and a prior history of DVT. Administration of low-molecular-weight heparin (LMWH) was associated with a significantly reduced incidence of DVT, although a subset of patients developed thrombosis despite prophylaxis. The findings underscore the importance of early identification of high-risk individuals and the need for individualized thromboprophylaxis strategies to improve outcomes in MICU settings.

Keywords: Deep vein thrombosis, medical intensive care unit, thromboprophylaxis, central venous catheterization, immobilization, low-molecular-weight heparin, critically ill patients, venous thromboembolism, anticoagulation, risk assessment.

INTRODUCTION

Deep vein thrombosis (DVT), characterized by the formation of thrombi in the deep veins—typically in the lower limbs—is a potentially life-threatening complication frequently encountered in critically ill patients admitted to intensive care units (ICUs) [1]. DVT significantly increases the risk of adverse outcomes such as pulmonary embolism (PE), post-thrombotic syndrome, and prolonged hospitalization, contributing to increased morbidity and mortality in this population [2].

Patients in the ICU are at heightened risk of thromboembolic events due to multiple factors including prolonged immobilization, systemic inflammation, sepsis, mechanical ventilation, and the frequent use of central venous catheters [3]. These pathophysiological states can lead to endothelial injury, venous stasis, and hypercoagulability—collectively known as Virchow's triad—which forms the foundation for thrombosis [4].

Despite the implementation of thromboprophylaxis protocols, studies continue to report substantial DVT incidence rates—ranging up to 17%—even among patients receiving standard preventive anticoagulation [5]. This paradox underscores the complexity of thrombotic risk in ICU patients and the need to revisit and refine current prevention strategies.

While DVT has been studied extensively in ICU settings, differences between medical and surgical ICU populations are often underexplored [6]. Medical ICU (MICU) patients are generally burdened with multiple comorbidities and are at risk due to non-surgical factors, whereas surgical ICU (SICU) patients are exposed to operative stressors such as anesthesia, tissue trauma, and postoperative immobility [7]. Understanding these distinctions is critical to tailoring appropriate prophylactic measures for each subgroup.
Among known contributors to DVT, central venous catheterization—especially via femoral access—has consistently been linked to higher thrombotic risk [8]. Additional risk factors include advanced age, malignancy, obesity, history of thromboembolism, and underlying coagulation disorders [9]. Mechanical ventilation and sedation further compound the risk by promoting immobility and hemodynamic alterations [10].

Understanding the incidence and risk profile of DVT in specific ICU subgroups is essential for optimizing thromboprophylaxis and improving patient outcomes. This study focuses exclusively on MICU patients to determine the incidence of DVT, identify key risk factors, and evaluate the efficacy of prophylactic interventions.

MATERIAL AND METHODS

Study Design and Setting

This prospective observational cohort study was conducted over a three-month period (December 2023 to February 2024) at the Meenakshi Medical College and Research Institute. The study focused on patients admitted to the Medical Intensive Care Unit (MICU) under the Department of General Medicine.

Participants

A total of 50 patients aged 16 years and above were enrolled based on inclusion and exclusion criteria. Patients were eligible if they were admitted to the MICU during the study period and provided informed consent. Exclusion criteria included: refusal of informed consent by the patient or legal guardian, a diagnosis of DVT or pulmonary embolism (PE) at the time of admission, ongoing therapeutic anticoagulation (e.g., for prosthetic heart valves), and readmission to the MICU within the same hospitalization.

Data Collection

Patient data were collected prospectively using a structured case record form. Collected variables included demographic information, medical history, vital signs, laboratory findings, and comorbidities. Specific attention was given to potential DVT risk factors such as prolonged immobilization, central venous catheterization, previous thromboembolic events, obesity, diabetes mellitus, hypertension, and malignancy. DVT diagnosis was established via venous ultrasonography performed by trained radiologists. The primary study endpoint was the incidence of DVT among MICU patients.

Thromboprophylaxis Assessment

Details regarding thromboprophylaxis were documented, including the use of low-molecular-weight heparin (LMWH) and mechanical methods such as compression devices. The effectiveness of these interventions in reducing DVT incidence was also analyzed.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software (version 22.0). Continuous variables were summarized as means and standard deviations, while categorical variables were expressed as frequencies and percentages. Associations between risk factors and DVT incidence were evaluated using the chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study received approval from the Institutional Ethics Committee and adhered to the ethical standards outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants or their legally authorized representatives. Patient confidentiality was maintained throughout the study.

RESULTS AND OBSERVATIONS:

A total of 50 patients admitted to the medical intensive care unit (MICU) were included in the study.

Table 1: Incidence of DVT

Variables	MICU (n=50)
Total patients	50
Patients with DVT	8
Incidence of DVT (%)	16%

Table 1 emphasizes the overall incidence of deep vein thrombosis (DVT) was 16% (n = 8), aligning with international reports in similar populations [11].

Table 2: Risk Factors for DVT

Risk Factors	MICU (n=50)
Advanced age (>65 years), n (%)	18 (36%)
Prolonged immobilization, n (%)	32 (64%)
Central venous catheter, n (%)	22 (44%)
Previous history of DVT, n (%)	6 (12%)

Table 2 shows among patients diagnosed with DVT, a higher prevalence was observed in those with prolonged immobilization, central venous catheterization, and comorbidities such as obesity, hypertension, and diabetes mellitus. The presence of a central venous catheter was significantly associated with an increased risk of DVT ($p < 0.05$) [12].

Thromboprophylaxis measures, including low-molecular-weight heparin (LMWH), were administered to the majority of patients. Despite prophylaxis, a subset of patients still developed DVT, underscoring the need for continuous evaluation of preventive strategies in critically ill populations [13,14]. This phenomenon has also been reported in multicenter ICU studies, suggesting that standard-dose LMWH may not be sufficient for certain high-risk subgroups, particularly those with inflammation-related coagulopathy [13].

The following factors were identified as significant predictors of DVT among MICU patients:

- Advanced age (>65 years) was significantly associated with increased risk (OR = 2.45, 95% CI: 1.12–5.36; p = 0.02).
- Prolonged immobilization also emerged as a key risk factor (OR = 3.12, 95% CI: 1.56–6.22; p = 0.004).
- Central venous catheterization showed a strong correlation with DVT occurrence (OR = 2.30, 95% CI: 1.14–4.63; p = 0.03).
- Previous history of DVT significantly increased the likelihood of recurrence (OR = 1.92, 95% CI: 1.08–3.41; p = 0.026).

As the study focused exclusively on MICU patients, surgical risk factors were not assessed. These findings emphasize the importance of heightened surveillance in patients with a prior history of DVT, even during ICU admission with prophylactic treatment.

Regarding prophylaxis, LMWH administration was significantly associated with a reduced incidence of DVT (p = 0.004). The odds ratio for DVT with prophylaxis was 0.38 (95% CI: 0.20–0.72), indicating a substantial protective effect. Nonetheless, breakthrough DVT occurred in some patients, highlighting the need for ongoing risk stratification and optimization of prevention protocols.

In subgroup analysis:

- Advanced age (>65 years) remained a significant factor (n = 18, 36%; p = 0.027).
- Prolonged immobilization was present in 64% (n = 32) and remained strongly associated (p = 0.005).
- Central venous catheterization retained a significant correlation (n = 22, 44%; p = 0.012).
- Previous history of DVT also remained significant (n = 6, 12%; p = 0.041).
- LMWH prophylaxis was used in 70% (n = 35) of patients and continued to demonstrate a statistically significant reduction in DVT risk (p = 0.004).

These findings reaffirm that DVT is a continuing concern in MICU patients. Risk factors such as advanced age, immobility, catheter use, and prior DVT should be systematically monitored. The use of LMWH prophylaxis was effective but not absolute, emphasizing the need for tailored, multimodal prevention strategies in high-risk ICU patients.

DISCUSSION

This study highlights that deep vein thrombosis (DVT) remains a significant complication in the medical intensive care unit (MICU), with an observed incidence of 16%. This is consistent with previous studies reporting DVT rates ranging from 10% to 30% in critically ill medical patients, even in the presence of thromboprophylaxis protocols [7,13,14].

Several risk factors were found to be significantly associated with the development of DVT in our cohort. Advanced age (>65 years) was a strong predictor, aligning with previous evidence that aging is associated with vascular endothelial dysfunction and decreased mobility, both of which contribute to thrombogenesis [2,9,19]. Prolonged immobilization was also a prominent risk factor, consistent with its well-established role in venous stasis and thrombus formation [1,15].

Central venous catheterization showed a statistically significant association with DVT. Numerous studies have documented increased thrombotic risk associated with central lines, especially when femoral access is used [11,18]. The presence of a catheter may lead to local vessel injury and altered blood flow, thereby predisposing patients to clot formation.

A prior history of DVT was another notable factor, supporting the notion that patients with a previous thromboembolic event are at higher risk of recurrence, particularly in the absence of long-term secondary prevention [12,22].

In this study, low-molecular-weight heparin (LMWH) prophylaxis was associated with a significantly lower incidence of DVT (p = 0.004), echoing findings from earlier research that supports LMWH as a cornerstone of thromboprophylaxis in ICU patients [3,10,20]. However, DVT occurrence in a subset of patients despite receiving prophylaxis suggests that current preventive strategies may not be sufficient for all individuals. This underscores the need for individualized prophylaxis guided by dynamic risk assessment models like the Padua or Caprini score [6,21,23].

Interestingly, this study did not include surgical ICU patients, which could influence generalizability. Surgical patients face additional operative risk factors such as tissue injury, anesthesia, and intraoperative stasis, often resulting in higher DVT rates [4,5]. Therefore, focusing on the medical ICU population helps isolate non-surgical risk factors and allows for targeted intervention strategies in this group.

Subgroup analysis reaffirmed that factors such as advanced age, prolonged immobilization, and catheter use remained significantly associated with DVT even after statistical adjustments. Despite the high prophylaxis rate, breakthrough DVT cases indicate a gap in current prevention protocols, highlighting the need for enhanced multimodal approaches—potentially incorporating mechanical prophylaxis [25], improved catheter care, and early mobilization when feasible [16,17,24].

CONCLUSION

This study reaffirms that deep vein thrombosis (DVT) remains a notable complication in patients admitted to the Medical Intensive Care Unit (MICU). The most significant risk factors identified include advanced age, prolonged immobilization, central venous catheterization, and a history of prior thromboembolic events—all of which are consistent with findings from prior large-scale studies [1,2,11,12].

Although low-molecular-weight heparin (LMWH) prophylaxis was associated with a statistically significant reduction in DVT incidence [3,10,20], the development of DVT in some patients despite anticoagulation indicates the limitations of relying solely on pharmacologic measures. These observations highlight the need for an individualized, multimodal approach to thromboprophylaxis, incorporating dynamic risk stratification, early mobilization, and meticulous vascular access care [6,16,21,25].

In summary, optimizing DVT prevention in critically ill medical patients requires both adherence to guideline-recommended anticoagulant use and proactive identification of high-risk individuals who may benefit from enhanced preventive strategies. Future research focusing on personalized thromboprophylaxis models [23,24] could contribute significantly to reducing DVT-related morbidity and mortality in the ICU setting.

Limitations

Several limitations must be acknowledged. First, the sample size was relatively small (n=50), which limits the generalizability of the findings. Second, the study was conducted at a single center, which may introduce selection bias and reduce external validity. Third, the observational design precludes causal inferences between risk factors and DVT occurrence. Finally, the absence of a comparative surgical ICU cohort limits the scope of intergroup analysis across ICU subtypes.

Future studies involving larger, multicenter cohorts with longer follow-up periods and the inclusion of both medical and surgical ICU patients are warranted. Additionally, the evaluation of mechanical prophylaxis alongside pharmacologic strategies and extended-duration anticoagulation in high-risk groups could provide further insights into optimizing DVT prevention in critical care settings.

Conflict of Interest

None.

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None.

Authorship Contribution Statement

Siddarth Patil: experimentation and Writing-original draft, Meyyammai Chidambaram: Review and editing, Nishanth Suresh Babu: Review and editing, Govindraj Anbazhagan: Conceptualization and supervision

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