**Abstract**

**Aim:** The aim is to assess risk and evaluate the usage of pharmacological thromboprophylaxis adhering to the American College of Chest Physicians (ACCP) recommendations for prevention of venous thromboembolism (VTE) during early days of hospital stay in critically ill and surgery patients at a tertiary care teaching hospital. **Patients and Methods:** A prospective study was conducted over 1 year where all patients admitted in Intensive Care Unit (ICU), and surgery wards were enrolled in the study after an informed written consent. A structured pro forma was designed, and effective risk stratification for VTE was done. Patients were followed until discharge to record any pharmacological thromboprophylaxis according to the ACCP prevention of thrombosis recommendations. **Results:** A total of 210 patients included in this study as per the Caprini VTE Risk Assessment tool. Of 210, 150 (60%) patients were critically ill and 60 (40%) were surgical patients with an average age of 65.3 ± 11 and 55.4 ± 12 years, respectively. Of 150 critically ill patients, 21.3% of patients were classified having moderate VTE risk, 33.3% of patients having higher and 45.3% of patients having highest VTE risks. Of 60 postsurgical patients, 13.3% of patients were categorized having moderate VTE risk, 36.6% of patients having higher and 50% of patients having highest VTE risks. Pharmacological thromboprophylaxis was administered to 35.2% of patients, of which, 46.6% and 6.6% were ICU patients and postsurgical patients, respectively. This shows underutilization of pharmacological thromboprophylaxis. Adherence to guideline recommendations (choice of drug, dose, and duration) was observed in all postsurgical patients and 33% of critically ill patients. **Conclusions:** Pharmacological thromboprophylaxis to higher and highest VTE risk patients was too low, particularly in both the units and very low in surgery ward. Efforts required improving patient safety practice, particularly in higher and highest risk categories.

**Keywords:** American College of Chest Physicians recommendations, risk stratification, thromboprophylaxis, venous thromboembolism

**INTRODUCTION**

Venous thromboembolism (VTE) is major complication observed and reported in critically ill and postsurgical patients due to various risk factors one of which is longer hospital stay.[1-4] The condition is predisposed by transient and reversible clinical risk factors. VTE is the most common preventable cause of death in surgical patients, postsurgical orthopedic and critically ill patients.[5-8] Therapeutic objectives are essentially the prevention of thrombus in higher and highest risks for VTE in critically ill and postsurgical patients.

Thromboprophylaxis mainly mechanical methods and various anticoagulants (pharmacological) are practised to promote venous outflow from the legs and antithrombotic drugs, provides the most effective means of reducing morbidity.
and mortality in these patients. The American College of Chest Physicians (ACCP) recommends for evidence-based thromboprophylaxis guidelines for its use in various hospital settings.\textsuperscript{19} The rare occurrence of VTE is reported in Asia in literature but contrary to these studies has also reported the rising concern of VTE in Asian countries.\textsuperscript{2-4,6} Despite the evidence supporting thromboprophylaxis, it remains underused because surgeons, orthopedicians, and intensivists perceive that the risk of VTE is not high enough to justify the potential hemorrhagic complications of anticoagulant use.\textsuperscript{10,11}

This prospective study was conducted to evaluate the usage of pharmacological thromboprophylaxis as well as physician’s/ surgeon’s adherence to the ACCP recommended guidelines in Intensive Care Unit (ICU) and surgery wards in our tertiary care teaching hospital.

**Patients and Methods**

This prospective study was carried out in the ICU and surgery wards of a tertiary care teaching hospital in Pune, Maharashtra. Approval for this study was obtained before study initiation from the Institutional Ethics Committee.

All patients of either sex, admitted in the ICU and surgery wards were enrolled for risk stratification. A validated and standard model for the Caprini VTE Risk Assessment Model\textsuperscript{12} was used by a clinical pharmacist to identify risk factors and obtain risk score. Only the patients diagnosed with deep vein thrombosis (DVT)/VTE before admission in ICU and surgery wards and pregnant and pediatric population were excluded from the study.

A prospective chart review was performed for 1 year (August 2013–September 2014) for those patient case records that come under moderate, higher, and highest risk according to the Caprini VTE risk assessment model. The medication chart review was performed on a regular basis to assess any usage of pharmacological thromboprophylaxis. The prescribed pharmacological thromboprophylaxis was assessed for adherence with ACCP Evidence-based prevention of thrombosis guidelines.\textsuperscript{19} Information such as demographic details, risk factors contributing, and routine laboratory data were recorded in case report forms (CRFs). Factors such as patient’s characteristics, types of clinical presentation at onset, and prophylaxis strategy given during the hospitalization, clinical data, concomitant contraindications for the usage of anticoagulants, and comorbidity were majorly focused during the study. The pattern of utilization of pharmacological thromboprophylaxis included details such as drug name, dose, and duration were documented.

The following indicators of adherence to guideline recommendations were analyzed:

1. The proportion of patients receiving appropriate pharmacological thromboprophylaxis according to patient’s risk category (moderate, higher, and highest-risk)

2. The proportion of appropriate dose, frequency, and duration of pharmacological thromboprophylaxis in the patients.

Appropriate pharmacological thromboprophylaxis for VTE was defined as the selection of appropriate drug, dose, frequency, and duration as recommended in the ACCP guideline for the diagnosed clinical condition. The data were captured and analyzed at the end of 12 months of the study period. The results were disseminated by the clinical pharmacy to all the physicians and surgeons of the units.

The numerical variable like age was expressed as the average ± standard deviation (SD). The deviations from the guidelines in prescribing VTE prophylaxis were expressed in terms of percentages. Data were analyzed with Microsoft Excel spread sheet. Statistical analysis was performed using Pearson’s Chi-square test or test for trends to compare proportions and ANOVA to compare means. A 5% level of significance was accepted for all statistical tests.

**Results**

A total of 210 patients included in this study as per the Caprini VTE Risk Assessment tool. Of 210, 150 (60%) patients were critically ill and 60 (40%) were surgical patients with an average age of 65.3 ± 11 and 55.4 ± 12 years, respectively. The mean duration of length of stay for all patients was observed to be 9.8 days ±8. The mean length of stay of patients admitted to ICU and surgery was found to be 6.8 days ± 8 and 9.9 days ± 4, respectively. Table 1 shows overall risk categories of inpatients of ICU and Surgery units where 98 (46.6%) and 72 (34.3%) were having highest and higher risk for VTE.

According to the Caprini VTE Risk Assessment, of 150 critically ill patients, 32 (21.3%) patients were classified having moderate VTE risk, 50 (33.3%) patients having higher and 68 (45.3%) patients having highest VTE risks. The overall mean number of risk factors (SD) in critically ill patients was found to be 2.9 (0.49). Of 60 postsurgical patients, 8 (13.3%) patients were categorized having moderate VTE risk, 22 (36.6%) patients having higher and 30 (50%) patients having highest VTE risks. The overall mean number of risk factors (SD) in postsurgical patients was found to be 3.2 (0.75).

Of 210 consecutive admissions who were eligible as per predefined criteria, pharmacological thromboprophylaxis was administered to 74 (35.2%) patients, in which, 70 of 150 (46.6%) and 4 of 60 (6.6%) were ICU patients and postsurgical patients, respectively. Of remaining 136 patients, 104 (76.4%) were eligible for thromboprophylaxis without any contraindications despite being in risk categories for development of VTE [Table 2].

Patients with pharmacological thromboprophylaxis had a slight high mean number (SD) of risk factors than patients without VTE prophylaxis (3.1 [0.7] vs. 2.8 [0.8]; \textit{P} = 0.010). Only 42 (24.7%) of 170 higher and highest risk category patients in
both the units pharmacological thromboprophylaxis was used. 96 (56.4%) of higher and highest risk patients did not receive any thromboprophylaxis. Of 170 higher and highest risk patients who did not receive prophylaxis were only 32 (19%) due to absolute or relative contraindication for pharmacological thromboprophylaxis like 7 active bleeding, 6 that may lead to bleeding such as active peptic ulcer or hepatic injury, 4 hemorrhagic stroke, congenital bleeding disorder in 3 and 10 were having low platelet count, and 2 came up with bleeding during hospital admission. Table 3 shows characteristics of patients according to risk factors and use of VTE prophylaxis in different wards which varied widely between ICU and surgery where only 74 (35.2%) inpatients were prescribed with prophylaxis for VTE having an average risk factor of 3.1. Remaining 136 (64.7%) besides having average risk factor of 2.8 were not on any kind of prophylaxis for VTE.

Adherence to guidelines was low in relation to usage (74 of 210 patients, 35.2%). Adherence to guideline recommendations (choice of drug, dose, and duration) was observed in all postsurgical patients 4 (100%) and 47 (33%) of critically ill patients. Type, frequency, and dose of pharmacological thromboprophylaxis were completely adhered to ACCP recommendation (in all 74 patients, 100%). The duration of pharmacological thromboprophylaxis prescribed to the ICU patients was nonadherent (14 of 70, 20%).

Out of 74 patients, low molecular weight heparin (LMWH) was prescribed to 53 (71.6%) and unfractionated heparin (UFH) in 21 (28.3%). The majority (49 of 150, 32.6%) of suitable pharmacological thromboprophylaxis was Enoxaparin (preferred LMWH) for twice daily for a mean duration of 5 days (range 2–10 days). In ICU patients, UFH (28.3%) was prescribed for twice daily for a mean duration of 6 days (range 1–11 days), whereas in postsurgical patients, the preferred pharmacological thromboprophylactic agent was Enoxaparin (twice daily) for a mean duration of 7 days (range 5–15 days).

**Discussion**

The Caprini VTE Risk Assessment Tool was used in the institution for the first time by a clinical pharmacist to identify and categorize the percentage of patients vulnerable to moderate, higher and highest risks of VTE in ICU and surgery wards. A significant percentage of inpatients in both the units was found to have moderate, higher, and highest risk for VTE. However, there was overall underutilization of pharmacological thromboprophylaxis for VTE, but the pharmacological thromboprophylaxis prescribed was adhering to the ACCP recommendations except in few. The current study reveals that there is a significant wide variation in practice existing between ICU and surgery ward. To the surprise, we found an overall mean number of risk factors for VTE to be extremely significant ($P = 0.0008$) in surgery patients having no contraindications for pharmacological thromboprophylaxis. The prescribing for any VTE prophylaxis in at-risk postsurgical patients by surgeons was too low compared to intensivist and physicians in ICU. This was also reported in several studies except few where thromboprophylaxis was in the range of 38%–94% according to the type of illness or procedure.[13,14] The low rate of prophylaxis in our hospital can be attributed to several factors. First, the belief of low incidence of VTE in postsurgical and critically/medically ill patients, which has been contradicted by several western and Indian incidence studies.[15–18] Whereas, several studies have demonstrated that Asians and Indians have significant risk factors for the development of VTE and incidences are rising with a change in global scenario.[3–5,19] Second, the benefit of thromboprophylaxis to the patient is less perceived by surgeons comparing physicians in developing countries.[6,11,19,20] Third, the risk of bleeding is considered to be more critical while practising pharmacological thromboprophylaxis.[21]

Pharmacological thromboprophylaxis to higher and highest VTE risk patients was too low (24.7%). However, a more than two fourth (56.4%) were eligible as per the ACCP.
recommendations. The results of Vallès et al.\textsuperscript{[21]} had shown the underutilization of DVT prophylaxis in medical ill patients even though they were at significant risk of DVT. Similarly, the results of Todi et al.\textsuperscript{[23]} have also shown less utilization of DVT prophylaxis in medically ill and surgical patients. The same underutilization of thromboprophylaxis has been cited by ENDORSE study.\textsuperscript{[24]} On the contrary, an Indian study found good adherence to the ACCP guidelines for the thromboprophylaxis for DVT but with underutilization in higher risk category postsurgical patients.\textsuperscript{[25]}

Overall adherence to the ACCP recommendatinons for pharmacological thromboprophylaxis was appreciable compared to Indian studies.\textsuperscript{[22-24]} This finding suggests that the physicians and surgeons are aware of the guideline. The selection of thromboprophylaxis, i.e., drug, dose, duration was appropriate according to clinical condition. Several studies have cited inappropriate prescribing in at-risk patients in relation to choice, dose, and duration of pharmacological thromboprophylaxis.\textsuperscript{[16-18]} Even a study revealed thromboprophylaxis (25.6%) to no risk patients (25.6%).\textsuperscript{[13]}

LMWH was by far the most often used type of pharmacological thromboprophylaxis in at-risk hospitalized patients as revealed in other studies. In the study, enoxaparin (60 mg) was the preferred LMWH twice daily. The choice of this agent was based on safety and efficacy as a thromboprophylactic. There were few cases in which duration was nonadhered as stated in the ACCP recommendation, which can be corrected in future by a proper communication to the practitioners in ICU.\textsuperscript{[16-18]}

The reason for underutilization has been cited by several literatures, where, the administrative barrier was one of them.\textsuperscript{[15-18]} The strategy must be developed to address the administrative barrier to improve any VTE prophylaxis during hospital stay like frequent conduct of educational forums, intermittent academic detailing, implementation of Caprini VTE Risk Score in the case sheets for physician’s reference, etc.

Wide differences in the everyday practice of VTE prophylaxis in patients of both the hospital units deemed as being at risk suggest that despite the availability of ACCP evidence-based consensus guideline, the awareness and perceiving of the risk of VTE in hospitalized patients is still insufficient. Efforts should be made to increase awareness through vigorous education actions. Development of short and easy to review the ACCP guideline, cards, handbook for ready access has been shown to be beneficial in improving VTE prophylaxis, thereby reducing the rate of VTE episodes.\textsuperscript{[7,19,25]}

This study highlights immediate attention on the implementation of standardized methods (Caprini VTE risk assessment tool) for identifying and labeling of at-risk patients to ensure appropriate pharmacological thromboprophylaxis. Incorporation of this tool by a clinical pharmacist in ICU and surgery ward as a part of initial management is carried out in our study could be a simple and cost-effective strategy to promote VTE prophylaxis in developing countries.

**Conclusions**

Pharmacological thromboprophylaxis to higher and highest VTE risk patients were too particularly in both the units and very low in surgery ward. Overall adherence to ACCP recommendations for pharmacological thromboprophylaxis was appreciable. Enoxaparin was the preferred LMWH for thromboprophylaxis. Efforts with an intervention should be made to implement the recommended guideline to improve patient safety practice, particularly in higher and highest risk categories.

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**Conflicts of interest**

There are no conflicts of interest.

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