

# Evaluating the gap Between DVT Prophylaxis Guideline Recommendations and Common Medical Practice in Critically ill Patients: A Multi-Centre Study

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## ABSTRACT

**Background:** Although compliance with the guideline in venous thromboembolism prophylaxis have shown to improve outcomes, there is a wide gap between the guidelines and common medical practice. The aim of this study was to evaluate the gap between the deep venous thromboembolism (DVT) prophylaxis and Caprini score.

**Methods:** This observational cross sectional study carried out in two teaching hospital. Risk categories of patients and prophylaxis used were recorded. Appropriate adherence to the guidelines was analyzed.

**Results:** From 296 patients, prophylaxis of venous thrombosis was used in 228 patients (77.03%). Among them 58 (23.45%) received adequate whereas 152 (66.67%) and 18 (7.89%) received inadequate and extra prophylaxis respectively. Of all the patients, 78 (26.4%) had contraindications to receive thromboprophylaxis drugs, all of whom needed mechanical prophylaxis, while only 19 (28.3%) of them received it. Adherence to guidelines were low in relation to the use (39.19%) and to the type (25.44%) of prophylaxis.

**Conclusion:** Although prophylaxis of VTE is generally used in risk patients, but there was a high gap between DVT prophylaxis guideline recommendations and common medical practice in our intensive care units and appropriate adherence to guidelines is less frequent.

**Keywords:** Venous Thromboembolism, Caprini score, Intensive Care Unit, Guideline Adherence, thromboprophylaxis, appropriate prophylaxis

## Introduction

Despite the availability of effective and safe prophylactic measures and treatments, venous thromboembolism (VTE), which includes both deep vein thrombosis (DVT) and pulmonary embolism (PE) (1, 2), remains a serious health threat in hospitalized, particularly, ICU admitted patients due to having multiple risk factors for VTE including; prolonged immobilization, central venous catheterization, additional surgical procedures, sepsis, vasopressors and hemodialysis, and surgical complications such as postoperative infections (pneumonia, septicemia, ureteric infections) (3, 4). The Caprini score is one of the recommended score in guidelines to evaluate the risk of VTE occurrence based on the patient's characteristics. By calculating the total cumulative score, VTE risk levels are categorized and appropriate recommendations for VTE prevention are provided (5).

Patients were classified into four categories: "very low risk" (0 point), "low risk" (1-2 points),

"moderate risk" (3-4 points), and "high risk" ( $\geq 5$  points) in the Caprini score (6). However, appropriate adherence to guidelines is less frequent and gaps exist between recommendations and clinical practice as a result of some reasons such as the underestimation of thrombotic risk, lack of familiarity with recommendations, overestimation of bleeding risk, and logistical limitations of health care management systems (7, 8). So, thromboprophylaxis is still underutilized or inappropriately prescribed for many patients at risk of VTE. The aim of this study was to assess the diagnosis and management of VTE in critically ill patients admitted to our teaching hospitals and compare results with Caprini scoring system.

## Materials and Methods

In this descriptive cross-sectional study, we assessed patients who were admitted to the five ICUs (medical and surgical) of Nemazee and Shahid Rajaei hospitals affiliated to Shiraz

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**Table 1.** Caprini risk assessment model for venous thromboembolism.

| Caprini risk assessment model for venous thromboembolism       |                                      |   |                                       |
|--|--------------------------------------|---|---------------------------------------|
| 1 point per risk factor  | 2 point per risk factor              | 3 point per risk factor                                   | 4 point per risk factor               |
| ✓ Age 41–60 years  | ✓ Age 61–74 years                    | ✓ Age ≥75 years   | ✓ Stroke (<1 month)                   |
| ✓ Minor surgery  | ✓ Arthroscopic surgery               | ✓ History of VTE  | ✓ Elective arthroplasty               |
| ✓ BMI >25 kg/m <sup>2</sup>                                    | ✓ Major open surgery (>45 minutes)   | ✓ Family history of VTE                                   | ✓ Hip, pelvis or leg fracture         |
| ✓ Swollen legs   | ✓ Laparoscopic surgery (>45 minutes) | ✓ Factor V Leiden   | ✓ Acute spinal cord injury (<1 month) |
| ✓ Varicose veins Pregnancy or postpartum                       | ✓ Malignancy                         | ✓ Prothrombin 20210A                                      |                                       |
| ✓ History of unexplained or recurrent spontaneous abortion     | ✓ Confined to bed (>72 hours)        | ✓ Lupus anticoagulant                                     |                                       |
| ✓ Oral contraceptives or hormone replacement Sepsis (<1 month) | ✓ Immobilizing plaster cast          | ✓ Anticardiolipin antibodies                              |                                       |
| ✓ Serious lung disease, including pneumonia (<1 month)         | ✓ Central venous access              | ✓ Elevated serum homocysteine                             |                                       |
| ✓ Abnormal pulmonary function                                  |                                      | ✓ Heparin-induced thrombocytopenia                        |                                       |
| ✓ Acute myocardial infarction                                  |                                      | ✓ Other congenital or acquired thrombophilia If yes: Type |                                       |
| ✓ Congestive heart failure (< 1 month)                         |                                      |   |                                       |
| ✓ History of inflammatory bowel disease                        |                                      |   |                                       |
| ✓ Medical patient at bed rest                                  |                                      |   |                                       |
| ✓ Other risk factors:  |                                      |   |                                       |

**Table 2.** Guideline's assessment of risk

| Number of risk factor | VTE Risk Level | VTE prophylaxis recommended                   |
|-----------------------|----------------|---|
| 0                     | Very low       | Early ambulation                              |
| 1-2                   | Low            | Mechanical prophylaxis                        |
| 3-4                   | Moderate       | Pharmacological and/or Mechanical prophylaxis |
| ≥5                    | High           | Pharmacological and Mechanical prophylaxis    |

**Table 3.** Frequency and percentage of VTE prophylaxis according to number of risk factors in patients.

| Number of risk factor | Patients with prophylaxis n (%) | Patients without prophylaxis n (%) | Total n (%) |
|-----------------------|---------------------------------|------------------------------------|-------------|
| 0                     | 4 (50)                          | 4 (50)                             | 8           |
| 1-2                   | 15 (88.3)                       | 2 (11.8)                           | 17          |
| 3-4                   | 40 (78.4)                       | 11 (21.6)                          | 51          |
| ≥5                    | 169 (76.8)                      | 51 (23.2)                          | 220         |
| Total                 | 228                             | 68                                 | 296         |

University of Medical Sciences University of Medical Sciences. This study was approved by Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.REC.1395.70). All patients aged ≥18 years admitted to a medical or surgical ICUs for two or more days during 2016 March 20 to 2017 March 19 were included in this analysis. Patients from Maternity and Pediatric Area, and therefore children, obstetrical and gynecological patients were not included. In addition, patients who might require anticoagulant treatment for a medical reason (venous thromboembolic disease, peripheral arterial disease, coronary heart disease, and atrial fibrillation) were also excluded. Consent for participation was obtained from all patients who met inclusion criteria. Information about demographic characteristics, medical notes, patients' risk factors of deep vein thrombosis, contraindications of anticoagulant, type of prophylaxis used, the type of ICU where the patient was admitted, and adherence to the guideline's recommendations were recorded through a standardized process at each hospital by trained medical record abstractors. According to guideline recommendations (Table 1) patients were classified into four risk categories: very low, low, moderate and high, and the risk scoring was a part of guideline implementation. Recommendations of guidelines

were: a) early physical activity without other prophylaxis, such as heparins, in very low risk patients; b) prophylaxis with mechanical prophylaxis in low risk patient; c) prophylaxis with heparin/enoxaparin in moderate risk patients (or compression mechanical prophylaxis in patients with contraindications for the use of heparins); and d) heparins along with mechanical prophylaxis (Table 2). Administration of prophylaxis according to the guideline in each group defined as adequate group. The use of pharmacological prophylaxis in low risk patient, as well as pharmacological prophylaxis with mechanical device in patient with moderate risk defined as extra group. Administration of just pharmacological prophylaxis or mechanical device in high risk group defined as inadequate group. Appropriate adherence to the guidelines was assessed. The following indicators of adherence to guideline recommendations were analyzed:

- 1) The proportion of patients receiving appropriate prophylaxis according to patients' risk category (no prophylaxis in very low-risk patient and prophylaxis in low, moderate and high-risk patients);
- 2) The proportion of appropriate types of prophylaxis in low, moderate and high-risk patients (Table 3).

## Statistical analysis

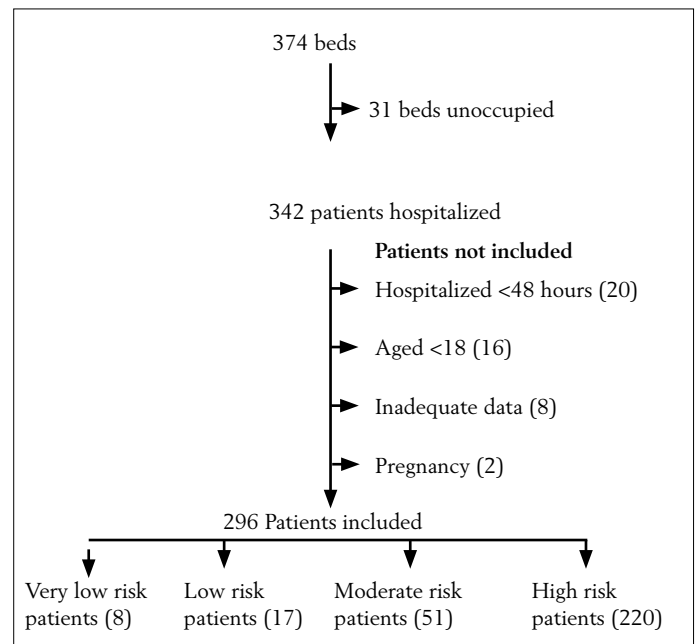
Analyses were performed using SPSS 19.0 (SPSS, Chicago, Ill). The Kolmogorov-Smirnov test was used to check the normality of the data. Chi-square test was used for dichotomized data. Independent t-test was used for continuous variables with normal distributions and Mann Whitney test was used for skewed data. To find the differences between the groups, we used ANOVA test.  $P < 0.05$  was considered significant.

## Results

Of 374 patients admitted to the hospital, 296 patients were included (Figure 1). The mean age (SD) of patients was 60 (17) years old and 209 patients (70.6%) were men. According to guideline's assessment of risk, 8 patients (2.7%) were classified as having very low risk, 17 (5.74%) as low risk, 51 patients as moderate (17.23) and 220 patients (74.32) as having high risk number. Of which 96(32.4%) were hospitalized in trauma ICU, 80 (27%) in medical ICU, 74 (25%) in neurosurgery ICU, 34 (11.5%) in surgical ICU and 12 (4.1%) in neurology ICU.

The higher the patients' number of risk factors, the more often prophylaxis was used. Prophylaxis was used in the majority of moderate and high-risk patients (78.43% and 76.82% respectively) (Table 3).

Table 4 shows characteristics of the patients and prophylaxis in different risk categories established in guidelines. Prophylaxis of venous thrombosis was used in 228 patients (77.03%). Among them 58 (23.45%) received adequate whereas 152 (66.67%) and 18 (7.89%) received inadequate and extra prophylaxis respectively. Pharmacological prophylaxis with low molecular-weight heparins (LMWH) was applied to 103 patients (45.17%) and with non-fractionated heparin (NFH) to 86 patients (37.72%). Non pharmacological prophylaxis with mechanical prophylaxis was utilized in 26 patients (11.40%). Of 68 patients without prophylaxis 54 (79.41%) had some contraindication concerning the use of prophylaxis and 14 (20.59%) patients had indication of prophylaxis administration.



**Figure 1.** Patients included in the study

Adherence to guideline recommendations only was observed in 58 patients. Adherence to DVT prophylaxis guidelines, was poor in relation to the use (39.19%) and (25.44%) to the type of prophylaxis. Characteristics of patients according to risk factors and use of prophylaxis of VTE in different ICUs have shown in Table 5. Appropriate prophylaxis use for moderate and high-risk patients were higher in surgical (37.5%) and medical (32.9%) ICUs than in trauma (17.20%) and neurosurgery (11.11%) ICUs. Adherence to guidelines with regard to medication dosage was not evaluated in this study.

## Discussion

This study was designed to explore the gap between current medical practice and Caprini scoring recommendations in patients admitted to intensive care units of 2 teaching hospitals. In this regard,

**Table 4.** Characteristics of the patients and prophylaxis in different risk categories established in guidelines

| Number of risk factor | Inadequate prophylaxis n (%) | Adequate prophylaxis n (%) | Extra prophylaxis n (%) | Total n (%) |
|-----------------------|------------------------------|----------------------------|-------------------------|-------------|
| 0                     | -                            | -                          | 4(100)                  | 4           |
| 1-2                   | -                            | 2(13.3)                    | 13(86.7)                | 15          |
| 3-4                   | -                            | 39(97.5)                   | 1(2.5)                  | 40          |
| ≥5                    | 152(89.94)                   | 17(10.06)                  | -                       | 169         |
| Total                 | 152(66.67)                   | 58(25.44)                  | 18(7.89)                | 228         |

**Table 5.** Characteristic of patients in different ICUs.

| ICUs                                 | Medical   | Trauma    | Neurosurgery | Surgical  | Neurology | Total n (%) |
|--------------------------------------|-----------|-----------|--------------|-----------|-----------|-------------|
| Admitted patient, n                  | 80        | 96        | 74           | 34        | 12        | 296         |
| Moderate and high risk patient n (%) | 70(25.83) | 93(34.32) | 72(26.57)    | 24(8.86)  | 12(4.43)  | 271         |
| Adequate prophylaxis n (%)           | 23(32.9)  | 16(17.20) | 8(11.11)     | 9(37.5)   | -         | 56          |
| Inadequate prophylaxis n (%)         | 34(48.57) | 62(66.67) | 33(45.83)    | 11(45.83) | 12(100)   | 152         |
| Extra prophylaxis n (%)              | -         | 1(1)      | -            | -         | -         | 1           |
| No prophylaxis n (%)                 | 13(18.57) | 14(15.05) | 31(41.89)    | 4(11.76)  | -         | 62          |

adequately prophylaxis administered patients, as well as patients who had contraindication and did not received prophylaxis, and the correct administration of mechanical prophylaxis, anticoagulants or both of them according to risk category, were evaluated and showed a low adherence to guideline in relation to the use (39.19%) and to the type (25.44%) of prophylaxis. Studies in this area have expressed different results. Similarly, the study which was evaluated adherence to the ACCP guidelines showed that only 12.7% of medical and 16.4% of surgical patients were received appropriate type, dose, and duration of VTE prophylaxis according to seventh ACCP guidelines (9). Vallano et al. reported that comprehensive attention to the guideline was 42% in their study population (10). In another study by Arcelus et al., in which 2162 patients who underwent orthopedic major surgery were reviewed, revealed that the accordance of administration of prophylaxis with the ACCP guideline during the admission and after discharge was 85.7% and 63.6% respectively (11). In our study findings, it was shown that just 11.76% of patients in low-risk and 7.73% of patients in high-risk groups had received adequate treatment (mechanical prophylaxis and mechanical prophylaxis with anticoagulants respectively). Totally, 78 (26.4%) patients who had contraindications for anticoagulant therapy should be used mechanical prophylaxis, while in 19 (28.3%) of 78 patients mechanical prophylaxis were used.

Therefore, it should be noted that the use of mechanical prophylaxis is much less than that of recommended in accordance with other studies. Lack of awareness of guidelines and negative attitudes to guidelines are the main physician-related and lack of resources and equipment, inappropriate skill and lack of staff (7, 8, 12), are some of the environmental barriers to implementation of antithrombotic management guidelines in our study. Educational programs have been suggested to improve prophylaxis rates (13, 14). In this regard Boddi and colleagues have shown, training doctors in ICU over one year has significantly reduced the incidence of DVT (from 11.9% to 4.5%) (15).

Our study had some limitations among them unavailability of proper devices and unfamiliarity with guidelines were the main affecting factors that created the gap between current practice and guideline recommendations.

## Conclusion

There was a high gap between DVT prophylaxis guideline recommendations and common medical practice in intensive care units. Medical specialty of ICUs has also great impact on this gap.

### AUTHOR CONTRIBUTIONS:

**Concept:** MM, GS; **Design:** RC, MM; **Supervision:** MM; **Fundings:** MM; **Materials:** GS; **Data Collection and/or Processing:** RC, ZE; **Analysis and/or Interpretation:** ZE, VN, RC; **Literature Search:** ZE, RC; **Writing Manuscript:** ZE, VN, MM; **Critical Review:** GS, VN.

**Ethics Committee Approval:** This study was approved by Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.REC.1395.70).

**Informed Consent:** Patients who met inclusion criteria and agreed to participate were asked to provide informed consent

**Peer-review:** Externally peer-reviewed.

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