Utilization of Venous Thromboembolism Prophylaxis in a Medical-Surgical ICU

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**Study objective:** To assess the utilization of venous thromboembolism (VTE) prophylaxis in a medical-surgical ICU.

**Design:** Prospective cohort study.

**Setting:** A closed (mandatory critical care consult) medical-surgical ICU of a large community teaching hospital.

**Interventions:** The medical records of consecutive medical-surgical ICU admissions were evaluated by a single investigator during a 3-month period. Risk factors for VTE and the type and timing of VTE prophylaxis were recorded.

**Measurements and results:** Of 308 admissions evaluated, 209 were included in the study. VTE prophylaxis was administered within the first 24 h of ICU admission to 179 of the 209 study patients or 86%. Fifty-three percent \((n=111)\) were surgical patients and 47% \((n=98)\) were medical patients. The study patients had an average of 4.4 risk factors for VTE. Thirty study patients \((14\%)\) did not receive VTE prophylaxis.

**Conclusion:** Eighty-six percent of the medical-surgical patients included in this study received VTE prophylaxis. The utilization of VTE prophylaxis described in this study is higher compared to previously published data. The nature of physician coverage in our medical-surgical ICU (closed unit), consistent practice patterns of a designated ICU staff, and a continuing medical education program involving VTE prophylaxis are the factors believed to be responsible for these results.

(CHEST 1998; 113:162-64)

**Key words:** deep vein thrombosis; intensive care unit; pulmonary embolism; venous thromboembolism prophylaxis

**Abbreviation:** VTE=venous thromboembolism

Venous thromboembolism (VTE) is a major cause of morbidity and mortality in medical-surgical ICU patients. ICU patients are generally bedridden with multiple risk factors for VTE. Hirsch et al documented a 33% incidence of deep venous thrombosis among medical ICU patients admitted with an anticipated stay of \(\geq 48\) h. Autopsy series suggest that pulmonary emboli, the vast majority unsuspected, have been responsible for up to \(\geq 10\%\) deaths among inpatients and it is estimated that pulmonary emboli are the most common preventable cause of hospital mortality.2,3

Utilization of VTE prophylaxis in high-risk patients has been advocated by numerous authorities and multiple consensus committees for more than a decade.3-5 Nevertheless, a recent and frequently quoted study documented that only 33% of patients in the medical ICU of a major teaching hospital received standard VTE prophylaxis.6 The purpose of this study was to assess the utilization of VTE prophylaxis in a medical-surgical ICU staffed by critical care attending physicians with critical care subspecialty residents.

**Materials and Methods**

The medical-surgical ICU of St. John's Mercy Medical Center, a large community teaching hospital, was the setting for this
study. The medical-surgical ICU is closed (mandatory critical care consult) and staffed by critical care attending physicians and critical care subspecialty residents. The critical care attending staff encompasses five critical care attending physicians who rotate through the ICU to provide 24-h patient coverage and teaching for the house staff. The ICU teams caring for the patients were unaware of this study. The protocol was approved by the institution’s Human Research Committee.

The medical records of consecutive patients admitted to the ICU during the study period (August 9, 1995 through October 31, 1995) were reviewed by a single investigator (R.P.R.). The following data were extracted from the medical records: clinical diagnosis, risk factors for VTE, and methods and timing of the administration of VTE prophylaxis. Risk factors for VTE included age (older than 40 years counted as one risk factor, older than 70 years counted as two risk factors), obesity (>20% above ideal body weight), active malignant disease, nephrotic syndrome, estrogen therapy, pregnancy, postpartum state, recent myocardial infarction, left ventricular systolic dysfunction, prior thromboembolic disease, diagnosed hypercoagulable state, respiratory failure, acute or chronic paresis, pelvic or long-bone fractures, major trauma, and major surgery. The methods of VTE prophylaxis during the first 72 h were noted. The times of the following events were documented: time of the patient’s arrival in the ICU, time of implementation of VTE prophylaxis, time of discharge from the ICU, and times of documented mobilization out of bed.

Patients were excluded from the study for any one of the following reasons: prior entrance into this study during the same hospitalization; ICU admission diagnosis of deep vein thrombosis or pulmonary embolism; involvement of the investigator in the care of the patient before or during the study period; death within 24 h of ICU admission; and low risk for VTE related to ICU stay, specifically patients who had no risk factors other than bedrest, those who had one risk factor but were out of bed and out of the ICU within 48 h, and those with more than one risk factor but were out of bed and out of the ICU within 24 h.

**Results**

There were 308 admissions to the ICU during the study period. Ninety-nine admissions met exclusion criteria, resulting in 209 study patients. The reasons for the 99 exclusions were as follows: 10 admissions that represented patients already enrolled in the study earlier in the same hospitalization; 11 patients admitted to the ICU with the diagnosis of deep venous thrombosis or pulmonary embolism; 3 patients who had been cared for by the investigator; 7 patients who died within 24 h; 3 patients designated “comfort measures only” within 24 h; and 65 patients at low risk for VTE related to their ICU stay.

The remaining 209 admissions, referred to as the study group, represented a group of patients for whom VTE prophylaxis was indicated. Fifty-three percent (n=111) of the study group were surgical patients (underwent surgery or had trauma within 24 h of ICU admission) and 47% (n=98) were medical patients. Study patients had an average of 4.3 VTE risk factors, including immobilization. The form of VTE prophylaxis administered to study patients during the first 24 h is displayed in Table 1. Altogether, VTE prophylaxis was administered within 24 h to 179 of 209 patients, or 86% (Fig 1). No VTE prophylaxis was administered to the remaining 30 patients (14%). Three of these patients (1%) did not receive it because of clerical errors. There was no apparent reason for the lack of VTE prophylaxis in the remaining 27 patients (13%). In no cases could the lack of VTE prophylaxis be ascribed to contraindications to either pharmacologic methods or compression devices.

**DISCUSSION**

We found that 86% of the study group received VTE prophylaxis within the first 24 h in the ICU. This finding differs dramatically from the previously reported level of utilization in the ICU reported by Keane et al.6 What is the explanation for the dramatic difference in utilization of VTE prophylaxis between this study (86% within 24 h) and the prior study (33% after an average of 2 days)?

First, our study looked at a mixed population of medical and surgical patients, as opposed to a population of exclusively medical patients. Utilization of VTE

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**Table 1—Methods of VTE Prophylaxis**

<table>
<thead>
<tr>
<th>Method</th>
<th>No. of Patients</th>
<th>% of Study Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumatic compression stockings</td>
<td>120</td>
<td>57</td>
</tr>
<tr>
<td>Low-dose subcutaneous heparin</td>
<td>55</td>
<td>26</td>
</tr>
<tr>
<td>IV heparin</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Warfarin</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Dextran</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Inferior vena cava filter</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>None</td>
<td>30</td>
<td>14</td>
</tr>
</tbody>
</table>

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**Figure 1.** VTE prophylaxis administered during the first 24 h in the ICU.
prophylaxis has historically been stressed less for medical patients compared to surgical patients. Further analysis of our data revealed an 81% utilization of VTE prophylaxis among the medical (nonsurgical) subset of patients in our ICU. Thus, the mixed nature of our ICU accounts for only a small part of the difference.

Second, our study group did not include the population of patients transiently in the ICU or at low risk for VTE or with other extenuating circumstances. These patients constituted about 23% of our ICU admissions but a much smaller proportion of ICU patient-days. This population may have been included in the previous study.

The difference in the study population notwithstanding, it is clear that this study has found a higher rate of utilization of VTE prophylaxis. This improvement may be due in part to a general increasing awareness among physicians over time. However, we believe that much of the difference is due to the nature of physician coverage in our medical-surgical ICU (closed unit), consistent practice patterns of a designated ICU staff, and a continuing medical educational program directed toward recurrent day-to-day maintenance issues such as VTE prophylaxis and case-specific diseases.

In 1993 at our institution, there was an educational intervention directed at the critical care subspecialty residents and other house staff. The objective of this program was to evaluate and improve the utilization of VTE prophylaxis in medical-surgical ICU patients. The intervention consisted of an algorithm reflecting then-current VTE prophylaxis recommendations that was distributed and reviewed at the beginning of each month as new house staff began their ICU rotations. The percentage of patients receiving appropriate VTE prophylaxis rose from 73.4 to 87.0%. Further improvement to 96.5% utilization was achieved with a second intervention; a research nurse regularly reviewed the status of VTE prophylaxis for each patient, contacting the physician of any patient who was failing to receive appropriate measures. By 1995, when this study was performed, there had been complete turnover of critical care subspecialty residents and other house staff. The algorithm was no longer distributed, although structured education of house staff in VTE prophylaxis continued monthly. No independent reviewers have been assessing patients’ VTE prophylaxis status or contacting physicians regarding this issue. Utilization of VTE prophylaxis has persisted at a high level (86.0%) but not as high as during the period when the research nurse was reviewing charts and contacting physicians. Other studies have corroborated the positive impact of continuing educational efforts on physician practice patterns.

There remains room for improvement. Thirty patients (14%) in our study did not receive VTE prophylaxis during their first 24 h in the ICU. Based on the selection criteria used to determine the study group, VTE prophylaxis was certainly indicated in this group. In 3 patients (1%), the lack of VTE prophylaxis was apparently due to clerical error, but in the remaining 27 patients (13%), there was no apparent reason why either pharmacologic VTE prophylaxis or pneumatic compression stockings could not have been used. It appears that the physicians either forgot or did not see the importance of VTE prophylaxis. Another area of potential improvement is in the choice of method of VTE prophylaxis. In 29 patients (14%), subcutaneous heparin could have been substituted for pneumatic compression stockings. At our institution, there is roughly a 10-fold cost difference in favor of subcutaneous heparin.

**CONCLUSION**

This study in a medical-surgical ICU staffed by critical care attending physicians and critical care subspecialty residents documented that 86% of the patients received VTE prophylaxis during their first 24 h in the ICU. The utilization of VTE prophylaxis described in this study is much higher than previously reported. The nature of physician coverage in our medical-surgical ICU (closed unit), consistent practice patterns of a designated ICU staff, and a continuing medical education program involving VTE prophylaxis are the factors believed to be responsible for these results.

**REFERENCES**

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