

Current prevention practice for venous thromboembolism in Japanese intensive care units

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Abstract Venous thromboembolism (VTE) is a well-recognized life-threatening complication in the intensive care unit (ICU). However, no data have been reported regarding the prevalence and methods of prevention of VTE in Japanese ICUs. This study aimed to document the current practice of VTE prevention across a broad sample of medical-surgical ICU patients in Japan. In November 2010, we performed a point-prevalence survey of Japanese ICUs in training facilities for intensive care specialists. We recorded data from five consecutive ICU patients in each facility at any time on the day of the survey. A total of 470 patients were registered in this study. VTE prophylaxis was received by 85.3 % of participants. Of these, 69.8 % received mechanical prophylaxis and 12.5 % received pharmacological methods, with 17.7 % receiving both methods. Analyzing a comparison of the presence or absence of a hospital prevention protocol, the protocol group had higher rates of receiving prophylaxis (88.8 % vs. 80.0 %, $P < 0.01$) than the no-protocol group. In conclusion, VTE prophylaxis by mechanical methods was the

main method in a high number of medical-surgical ICU patients in Japan. The ICUs with a hospital VTE prevention protocol in place performed significantly higher rates of prophylaxis than those without a protocol.

Keywords Guideline adherence · Protocols · Prophylaxis · Venous thromboembolism

Venous thromboembolism (VTE), manifesting as either deep vein thrombosis or pulmonary embolism, is a well-recognized life-threatening complication in patients admitted to the intensive care unit (ICU) [1–3]. VTE has been shown to occur in 24–32 % of ICU patients who do not receive prophylaxis [1, 2, 4]. Pharmacological prophylaxis for critically ill patients is effective and is advocated by recent guidelines [5–7]. In cases with contraindications to pharmacological prophylaxis, mechanical devices such as intermittent pneumatic compression or elastic stocking are recommended [5, 6]. Despite the evidence, prophylaxis against VTE in hospitalized patients is significantly underutilized [8]. Few nationwide studies of VTE prevention practice for ICU patients exist [9, 10], and in Japan, there are no data on the prevalence and methods of prevention of VTE in ICUs. This study aimed to document the current practice of VTE prevention across a broad sample of mixed medical-surgical ICU patients in Japan.

The study was endorsed by the 38th Congress of the Japanese Society of Intensive Care Medicine. Japanese ICUs in training facilities for intensive care specialists were invited to participate. A point-prevalence survey was performed in November 2010, and we recorded data from five consecutive ICU patients in each facility at any time on the day of the survey. We excluded patients admitted to

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or discharged from the ICU on the study day, aged under 17 years, receiving treatment for VTE, and those who were ambulatory or under terminal care. We sent questionnaires to hospitals listed as training facilities for intensive care specialists in Japan. Demographic data included age, sex, height, weight, admission diagnosis categorized according to APACHE III, and risk factors for VTE [body mass index (BMI) >25, post operation (<7 days), mechanical ventilation, central venous catheter, malignancy, history of VTE, intravenous vasopressor, and intravenous sedation]. Information on VTE prophylaxis for the study day included pharmacological prophylaxis (type administered), mechanical prophylaxis (type), and the presence of contraindications to pharmacological VTE prophylaxis (prolonged prothrombin time, prolonged partial thromboplastin time, thrombocytopenia, active bleeding, or easily bleeding lesion). Therapeutic anticoagulation included pharmacological prophylaxis. Analyses were performed with PASW Statistics 18 software (IBM SPSS, Chicago, IL, USA). Continuous variables are expressed as mean \pm SD. Dichotomous variables are expressed as percentages. Statistical comparisons of dichotomous variables were performed using the chi square test or Fisher's exact test, as appropriate. All probability values were two tailed, and values less than 0.05 were considered statistically significant.

A total of 219 letters were sent to the hospitals, and 99 replies were received (response rate, 45.2 %). A total of 470 adult patients were in one of these ICUs at some time on the study day; their characteristics are summarized in Table 1. We identified two or more risk factors for VTE among 387 (82.3 %) patients. Patients had a median of three risk factors; 20 (4.3 %) patients had no perceived VTE risk factors.

Methods and types of VTE prophylaxis used are shown in Fig. 1. VTE prophylaxis was administered to 85.3 % (401/470) of the participants. Of these, 69.8 % (280/401) received mechanical prophylaxis and 12.5 % (50/401) received pharmacological prophylaxis, with 17.7 % (71/401) receiving both methods. Of 69 patients (14.7 %) not receiving VTE prophylaxis, 53.6 % (37/69) had a reported contraindication to pharmacological prophylaxis. The most common form of mechanical prophylaxis was elastic stockings (66.1 %, 232/351), followed by intermittent pneumatic compression (IPC) devices (62.4 %, 219/351), with 28.5 % of the patients receiving mechanical prophylaxis (100/351) using both modalities. Among the 280 patients who received mechanical prophylaxis only, 108 (38.6 %) were reported to have a contraindication to pharmacological prophylaxis. Unfractionated heparin was the most common pharmacological agent used for VTE prophylaxis (79.3 %, 96/121). Warfarin and low molecular weight heparin were used in 22.3 % (27/121) and 5.0 %

Table 1 Patient demographic characteristics

Characteristic	<i>n</i> = 470
Age (years)	65 \pm 15
Gender, male	302 (66 %)
Height (cm)	160.0 \pm 9.3
Weight (kg)	57.7 \pm 13.4
BMI	22.5 \pm 4.3
Obesity (BMI > 25)	102 (22 %)
Postoperative (<7 days)	206 (44 %)
Mechanical ventilation	291 (62 %)
Central catheter use	313 (66 %)
Malignancy	96 (20 %)
History of VTE	8 (2 %)
Intravenous vasopressor	224 (48 %)
Intravenous sedation	253 (54 %)
Diagnostic categories	
Cardiovascular	141 (30 %)
Gastrointestinal	85 (18 %)
Neurological	59 (13 %)
Respiratory	57 (12 %)
Trauma	36 (8 %)
Sepsis	34 (7 %)
Contraindication to pharmacological prophylaxis	152 (32 %)

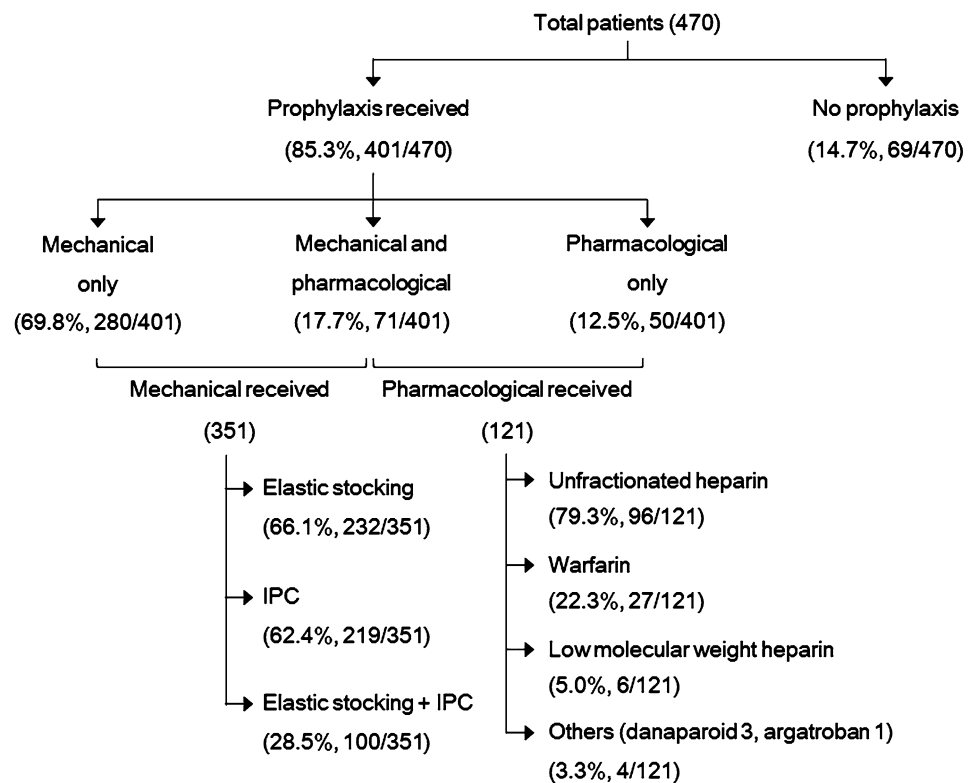
BMI body mass index, *VTE* venous thromboembolism

(6/121), respectively. Among 152 patients (32.3 %) with contraindications to pharmacological prophylaxis in the study, 115 (75.7 %) received prophylaxis; 113 received mechanical prophylaxis only, 2 received pharmacological prophylaxis, and 5 received both methods.

In a comparison between the surgical ICU patients and the medical ICU patients, the rate of VTE prophylaxis was similar (86.9 % vs. 84.1 %, respectively). However, the use of intermittent pneumatic compression devices was more frequent in the surgical ICU patients (53.9 % vs. 40.9 %, $P < 0.01$). In addition, the surgical ICU patients tended to have lower rates of pharmacological prophylaxis (21.8 % vs. 28.8 %, $P = 0.088$).

A hospital VTE prevention protocol was in place in 57.6 % of the study hospitals. In an analysis of a comparison of the presence or absence of a hospital prevention protocol, there were no significant differences in patient demographic characteristics between the two groups. The protocol group had higher rates of receiving prophylaxis (88.8 % vs. 80.0 %, $P < 0.01$) than the no-protocol group. The difference in the use of prophylaxis between the groups was driven mainly by an increased combined use of elastic stocking and intermittent pneumatic compression (25.6 % vs. 14.6 %, $P < 0.01$), and elastic stocking alone (53.7 % vs. 42.7 %, $P < 0.05$). The protocol group also

Fig. 1 Methods and types of venous thromboembolism prophylaxis used. *IPC* intermittent pneumatic compression



tended to have higher rates of pharmacological prophylaxis (28.8 % vs. 21.1 %, $P = 0.062$).

We found that VTE prophylaxis was administered to 85.3 % of medical-surgical ICU patients in Japan. Mechanical prophylaxis was the most commonly used form of VTE prophylaxis. The patients in hospitals with a VTE prevention protocol in place had significantly higher rates of receiving prophylaxis than patients in hospitals with no protocol.

To our knowledge, this is the first survey to investigate the current practice of VTE prevention in Japanese ICUs. VTE prophylaxis was received by 85.3 % of patients in our study, which is comparable to previous international studies: 86 % in Australian and New Zealand ICUs [10] and 85.4 % in French and Canadian ICUs [9]. However, pharmacological prophylaxis was extremely less frequent in Japanese ICUs (25.7 %) compared with Australian and New Zealand ICUs (64 %) [10] and French and Canadian ICUs (63.9 %) [9]. Pharmacological methods to prevent VTE are safe, effective, cost-effective, and advocated by recent guidelines [5, 6]. The reasons for underuse of pharmacological prophylaxis in Japan might be that approved use of low molecular weight heparin or synthetic inhibitors of coagulation factor Xa is limited to high-risk post-abdominal or post-orthopedic surgery patients only. Multiple reasons have been given to explain this underuse, including a lack of physician familiarity or agreement with recent guidelines, underestimation of VTE risk, concern

over risk of bleeding, and the perception that the guidelines are resource intensive or impractical.

Our study shows that mechanical prophylaxis is the most commonly used form of VTE prophylaxis in Japanese ICUs. Little is known regarding the effectiveness of mechanical prophylaxis in ICU patients [11]; some evidence shows that elastic stockings may be less effective than pharmacological prophylaxis [12]. Recent guidelines [5, 6] suggest that mechanical prophylaxis should be confined primarily to patients at high risk of bleeding or possibly as an adjunct to pharmacological measures, and that careful attention should be directed toward their proper use to prevent complications. It is especially important to use mechanical prophylaxis for patients with contraindications to pharmacological methods.

Our study shows that local hospital VTE prevention protocols contribute to active administration of prophylaxis for medical-surgical ICU patients. Patients from hospitals with a prevention protocol had significantly higher rates of receiving prophylaxis than patients from hospitals with no protocol and tended to have higher rates of receiving pharmacological prophylaxis. The local hospital protocol was in place in 57.6 % of the study hospitals. The annual study of the Japanese Society of Anesthesiologists, Committee on Patient Safety and Risk Management, Perioperative Pulmonary Thromboembolism Working Group reported that individual guidelines for the prevention of perioperative VTE were adopted in 55.4 % of the training

institutions [13]. Evidence-based clinical practice guidelines [14] recommend that the local thromboprophylaxis strategy be in the form of a written, institution-wide policy. In the subanalysis of the Epidemiologic International Day for the Evaluation of Patients at Risk for VTE the Acute Hospital Care Setting (ENDORSE) study, one of the factors significantly associated with higher prophylaxis use included adoption of hospital-wide VTE prophylaxis protocols [15].

The strengths of our study were the relatively large number of participating ICUs in Japan and the varied population of critically ill medical and surgical patients, including cardiovascular, gastrointestinal, and neurosurgical subgroups. The study limitations include the point-prevalence design with practice documented only on a specific audit day, which may not reflect overall practice and cannot provide data regarding the incidence of VTE. Second, because participating ICUs represent only approximately half the training facilities for intensive care specialists in Japan, the results may not represent practice in other Japanese ICUs. Finally, the cross-sectional design does not provide longitudinal data about delays in commencement, temporary interruption, or cessation or change of VTE prophylaxis.

In conclusion, in this point-prevalence survey, we found that VTE prophylaxis was received by 85.3 % of medical-surgical ICU patients in Japan. Mechanical prophylaxis was the most commonly used form of VTE prophylaxis, and pharmacological prophylaxis was less frequently used. The ICUs with a hospital VTE prevention protocol in place performed significantly higher rates of prophylaxis than did ICUs without a protocol and tended to have higher rates of implementing pharmacological methods.

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