Pulmonary Embolism Severity Index and Simplified Pulmonary Embolism Severity Index Risk Scores Are Useful to Predict Mortality in Japanese Patients With Pulmonary Embolism

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Background: The Pulmonary Embolism Severity Index (PESI) and simplified PESI (sPESI) have not been fully evaluated in Japan, so the present study aimed to evaluate these risk stratification models in the prediction of mortality of affected patients in Japan.

Methods and Results: We retrospectively analysed 302 PE patients (63.9 ± 17.2 years of age; 42.4% male) from January 2011 to December 2012 using data from the Tokyo CCU Network. The areas under the receiver-operating characteristic curves were 0.92 (95% confidence interval (CI): 0.88–0.97) for the PESI and 0.88 (95% CI: 0.77–0.98) for the sPESI.

Conclusions: Both scores can be used to predict PE mortality in Japan. (*Circ J* 2015; **79**: 889–891)

Key Words: Length of stay; PESI score; Pulmonary embolism; Risk stratification

The pulmonary embolism severity index (PESI) and the simplified PESI (sPESI) are both well-validated and highly reliable clinical prognostic markers for patients with acute pulmonary embolism (PE).^{1–3} Although using these risk stratification models has been advocated in the guidelines of other countries, neither has been fully evaluated in Japan.⁴ Our aim in the present study was to evaluate their ability to predict 30-day mortality in Japanese PE patients.

Methods

The study was performed using data from the Tokyo CCU Network. This network is operated by 67 hospitals with the help of ambulance units through the control room of the Tokyo Fire Department. Institutions belonging to the Tokyo CCU Network routinely record and submit details on survey forms of all patients treated in their cardiovascular care units (CCUs).^{5–7} In this study, subjects comprised a continuous series of 485 PE cases treated at the institutions belonging to the Tokyo CCU Network between January 2011 and December 2012 (30-day mortality rate was 6.2%). Any subjects with missing data required to calculate either the PESI or sPESI score were excluded. The original PESI consists of 11 predictors: 2 demographic variables (age and male sex), 3 comorbid conditions

(cancer, heart failure and chronic lung disease), and 6 clinical factors (pulse rate ≥ 110 beats/min, systolic blood pressure < 100 mmHg, respiratory rate > 30 breaths/min, temperature $< 36^\circ\text{C}$, arterial oxygen saturation $< 90\%$ and altered mental status). The sPESI includes only 6 variables (age > 80 years, history of cancer, chronic cardiopulmonary disease, pulse rate ≥ 110 beats/min, systolic blood pressure < 100 mmHg and arterial oxyhemoglobin saturation $< 90\%$) of equal weight (1 point per variable).^{8,9}

Results

We retrospectively analysed 302 (62.3%) patients (age 63.9 ± 17.2 years; 42.4% male). PESI and sPESI risk classification distributions and mortality prediction are shown in **Table A**. The length of stay was not significantly different between each class (**Table B**). Receiver-operating characteristic (ROC) curves for mortality are shown in the **Figure**. The areas under the ROC curves were 0.92 (95% confidence interval [CI]: 0.88–0.97) for the original PESI score and 0.88 (95% CI: 0.77–0.98) for the sPESI score. There were no significant differences in prediction of mortality between the scores ($P=0.383$).

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Table. (A) Patient Variables for Calculating PESI and sPESI, (B) Risk Classification and Outcomes for the Original and sPESI Scores

(A) Variable	Total patients (n=302)	Included in sPESI		
Age	63.9±17.2			
Age >80 years (for sPESI only), n (%)	64 (21.2)	√		
Male sex, n (%)	127 (42.1)			
Cancer, n (%)	11 (3.6)	√		
Chronic heart failure, n (%)	10 (3.3)	√		
Chronic pulmonary disease, n (%)	9 (3.0)			
Pulse rate ≥110beats/min, n (%)	85 (28.1)			
Systolic blood pressure <100mmHg, n (%)	51 (16.9)	√		
Respiratory rate >30breaths/min, n (%)	37 (12.3)	√		
Temperature <36°C, n (%)	49 (16.2)			
Altered mental status, n (%)	30 (9.9)			
Arterial oxyhemoglobin saturation <90%, n (%)	57 (18.9)	√		
(B) Risk-class distribution	No. of patients, n (%)	Mortality, n (%)	Length of stay, days	
PESI				
Class I: ≤65 points	68 (22.5)	0 (0)	17.4±9.4	
Class II: 66–85 points	81 (26.8)	0 (0)	18.6±13.3	
Class III: 86–105 points	59 (19.5)	0 (0)	19.8±18.4	
Class IV: 106–125 points	27 (8.9)	0 (0)	25.7±24.3	
Class V: >125 points	67 (22.2)	7 (10.4)	22.2±17.1	
sPESI				
Low risk: 0 points	122 (40.4)	0 (0)	18.2±15.1	
High risk: ≥1 point(s)	180 (59.6)	7 (3.9)	21.1±16.3	

PESI, pulmonary embolism severity index; sPESI, simplified PESI.

Discussion

Our study has 2 important clinical implications. First, we can report the usefulness of risk models to predict mortality in Japanese PE patients, and that there were no significant differences between the 2 models. Either can be used to predict mortality. Second, the length of stay was the same for each class. A recent European Society of Cardiology guideline has advocated that low-risk patients could be considered for early discharge and home treatment. Our registry data showed that there were no significant differences in length of stay between each risk category. Recently, new oral anticoagulation drugs, without the necessity of titration, were approved in Japan. We might be able to consider early discharge of low-risk patients with these new drugs.^{10,11} Further investigations are needed to assess the appropriateness of these risk stratification models, which could be used to determine the length of stay in Japan.

Study Limitations

Our data showed a quite low mortality rate (2.5%), compared with previous studies. We could use only data from patients with the variables required to estimate the PESI score, which resulted in the selection of relatively lower-risk patients (total mortality rate was 6.2% for all consecutive PE patients from the Tokyo CCU Network database). Furthermore, the CCU Network database had a relatively low frequency of cancer/lung disease patients and a high frequency of low-oxygenation patients. These differences in patient characteristics might result in a relatively lower mortality rate. But we could successfully confirm that the scores were useful to predict the mortality of PE patients, especially in the low-risk population.

Further evaluation of more appropriate prediction models for Japanese PE patients and determining their length of stay are needed.

Conclusions

Both the PESI and sPESI risk scores could be used to predict 30-day mortality in Japanese patients with PE.

Disclosures

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