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Original Research Article

Risk factors associated with in-hospital mortality in critically ill elderly patients with venous thromboembolism

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ABSTRACT

Background: Venous thromboembolism (VTE) is a major cause of morbidity and mortality for patients admitted to the intensive care unit (ICU). The present study aims to investigate the risk factors for in-hospital mortality among critically ill elderly patients with VTE.
Methods: This was a retrospective cohort study utilizing data from the large medical information mart for intensive care IV (MIMIC-IV) database. All elderly patients diagnosed with VTE were included in the analysis. The analyses were conducted using SPSS version 26.0 software and MedCalc version 19.6. Univariable and multivariable logistic regression models were conducted to explore potential risk factors associated with in-hospital mortality.
Results: The study population had a median age of 75 years, with a range from 69.0 to 82.0 years, and males represented 50.4% of the cohort. Among critically ill VTE patients, the in-hospital mortality rate was 18.5% (237 out of 1282). Multivariable regression analysis revealed that longer ICU stays [OR: 1.034; 95% CI: 1.010-1.059, p=0.005], higher Charlson comorbidity index (CCI) scores [OR: 1.090; 95% CI: 1.001-1.187, p=0.046], elevated simplified acute physiology score II (SAPS II scores) [OR: 1.039; 95% CI: 1.023-1.056, p<0.001], increased red blood cell distribution width (RDW) levels [OR: 1.088; 95% CI: 1.006-1.178, p=0.035], lower mean arterial pressure (MAP) [OR: 0.975; 95% CI: 0.957-0.994, p=0.011], presence of severe liver disease [OR: 2.036; 95% CI: 1.051-3.941, p=0.035], and the necessity for renal replacement therapy (RRT) [OR: 2.478; 95% CI: 1.315-4.671, p=0.005] were significantly associated with an increased risk of in-hospital mortality among elderly ICU patients with VTE.
Conclusions: The study identifies numerous independent risk factors associated with in-hospital mortality among critically ill elderly patients with VT. These factors include prolonged length of ICU stay, elevated scores on the CCI and SAPS II, increased RDW, reduced MAP, the presence of severe liver disease, and the necessity for RRT.

Keywords: VTE, MIMIC-IV, In-hospital mortality, Risk factors

INTRODUCTION

Venous thromboembolism (VTE), including deep vein thrombosis (DVT) and pulmonary embolism (PE), is a significant contributor to morbidity and mortality among ICU patients.[1] Critically ill VTE patients experience a higher risk of VTE compared to the general population, primarily due to prolonged immobility, sedation, and the requirement of neuromuscular blockade to aid ventilation.[2] Despite the implementation of preventive measures like thrombosis prophylaxis, the incidence of VTE in critically ill patients ranges from 6% to 37%.[3,4] Previous studies have shown that several factors, such as older age, surgery, immobilization, and specific medical

conditions, can elevate the risk of VTE.[5] VTE imposes a substantial economic burden, with total costs related to VTE reaching $5,000 over 3 months, $10,000 over 6 months, and $33,000 over 1 year.[6] Consequently, the annual budget for VTE therapy surpasses $2 billion.[7] Moreover, as the population ages, the prevalence of PE increases, worsening the impact of VTE. The risk of developing VTE rises with age due to factors such as reduced mobility and chronic health conditions.[5] Cognitive impairment or communication issues in older individuals may hinder accurate reporting of symptoms. Identifying older individuals at high risk for VTE can facilitate early detection, diagnosis, and treatment.

Previous studies have revealed that risk factors contributing to mortality in patients with VTE include age, comorbidities, elevated D-dimer and troponin levels, decreased oxygen saturation, etc.[8,9] Furthermore, a prospective study by Faller et al also demonstrated that age, active cancer, systolic blood pressure <100 mm Hg, diabetes mellitus, low physical activity level, polypharmacy, anemia, high-sensitivity C-reactive protein, troponin, and elevated D-dimer were independent predictors of overall mortality in elderly patients with acute VTE.[10] Presence of multiple comorbidities in elderly patients can directly/indirectly increase risk of in-hospital mortality associated with VTE.[8,10] Although many investigations have explored risk factors for VTE-related mortality, few have focused on senior adults. Consequently, comprehensive understanding of risk factors contributing to in-hospital mortality in critically ill elderly patients with VTE is essential.

The purpose of the present study was to assess the risk factors for in-hospital mortality among elderly patients in the ICU with VTE. Additionally, it aimed to determine the relationship between co-existing comorbidities and laboratory parameters routinely measured in clinical practice and in-hospital mortality.

METHODS

Data source

This retrospective cohort study was conducted by extracting data from critically ill patients from the MIMIC-IV database.[11] MIMIC-IV database comprises data on more than 50,000 patients admitted to the ICU at Beth Israel Deaconess medical center in Boston, MA, between 2008 and 2019. The first author, AP, gained access to database and extracted the relevant data (Certification No: 61239194) after completing the online course and signing a data use agreement. This study was conducted per the principles of declaration of Helsinki. Approval for use of MIMIC-IV database was obtained from review committee of the Massachusetts institute of technology and Beth Israel Deaconess medical center. As data is publicly available within the MIMIC-IV database, ethical approval and informed consent statements were not required for this study.

Selection of study population

All consecutive ICU patients diagnosed with VTE using the international classification of diseases (ICD)-9 and ICD-10 codes in MIMIC IV database were initially selected for present study. ICD-9 and 10 codes used for patient selection are shown in Table 1. Inclusion criteria were patients older than 65 years who stayed in ICU for more than 24 hours. Only data from patients with their 1st hospital and first ICU admission were included. Patients with an ICU stay of <24 h, those with multiple ICU admissions, and those under 18 years old were excluded.

Table 1: ICD codes for VTE.

ICD-9-CM codes	ICD-10-CM codes
45119, 4512, 45181, 45182, 45183, 45184, 45189, 4519, 4532, 4538, 45381, 45382, 45383, 45384, 45385, 45386, 45387, 45389, 4539, 4150, 41511, 41512, 41513, 41519, 45340, 45341, 45342, 4510, 452, 4530, 4531, 4533	I808, I809, I8290, I82890, I2699, I2692, I2690, I2602, I2609, I8000, I8001, I8002, I81, I820, I821

Data extraction

The extracted variables included basic characteristics (age, gender, length of hospital stay, and length of ICU stay), comorbidities (hypertension, diabetes, congestive heart failure, peripheral vascular disease, coronary artery disease, renal disease, severe liver disease, malignant cancer, cerebrovascular disease, and chronic obstructive pulmonary disease) and vital signs (heart rate, respiratory rate, pulse oximetry, and MAP). Data on laboratory tests of the first blood sample within the first day after admission were recorded, including hemoglobin, white blood cells (WBC), red blood cells (RBC), platelets, glucose, red blood cell distribution width (RDW), hematocrit, mean corpuscular hemoglobin concentration (MCHC), blood urea nitrogen (BUN), creatinine, bicarbonate, international normalized ratio (INR), prothrombin time (PT), and partial prothrombin time (PTT). We also extracted data on mechanical ventilation, diuretic use, RRT, hospital death sign, CCI, and SAPS II.

Statistical analysis

Continuous variables are described as medians and interquartile ranges (IQR), while categorical variables are presented as frequencies and percentages. We employed an independent sample t-test for continuous data and a Chi-square test for categorical data to compare the differences between survivor and non-survivor patients. Univariable and multivariable logistic regression models were utilized to explore potential risk factors associated with mortality. In this process, variables with a significance level of $p<0.1$ in the univariable analysis were included in the multivariable analysis. All analyses were performed using SPSS version 26.0 software and

MedCalc version 19.6. All statistical tests were 2-tailed, and a p<0.05 was considered statistically significant.

RESULTS

Baseline characteristics of the study population

Utilizing inclusion and exclusion criteria, a total of 1282 patients with VTE selected for final cohort, comprising 1045 survivors and 237 non-survivors. Flow chart of patient selection process is shown in Figure 1. Median age of study population was 75 years, with an interquartile range of 69.0-82.0 years, and males accounted for 50.4%. In-hospital mortality rate for critically ill VTE patients was 18.5% (237/1282). Table 2 shows baseline characteristics of survivor and non-survivor groups. Compared to survivor group, patients in non-survival group were older (p<0.05), had significantly longer lengths of stay in ICU (p<0.001), and had higher CCI and SAPS II scores (p<0.001). Compared to patients in survival group, those in death group had significantly higher levels of WBC, glucose, RDW, BUN, PT, INR, PTT, and creatinine (all p<0.05), while they exhibited significantly lower levels of Hb, RBC, platelets, hematocrit, MCHC, bicarbonate (all p<0.05) (Table 2).

Regarding comorbidities, patients in survivor group had significantly higher proportion of HTN, renal disease, severe liver disease, and malignancy than non-survivor group (all p<0.05). Furthermore, patients in non-survival group were more likely to undergo mechanical ventilation and RRT compared to survival group (p<0.001).

Risk factors for in-hospital mortality among elderly VTE patients

Results of univariate and multivariate analysis are shown Table 3. After accounting for potential confounding variables through multivariable regression analysis, we found that longer length of stay in ICU (OR: 1.034; 95% CI: 1.010-1.059, p=0.005), higher CCI scores (OR: 1.090; 95% CI: 1.001-1.187, p=0.046), higher SAPS II scores (OR: 1.039; 95% CI: 1.023-1.056, p<0.001), elevated RDW levels (OR: 1.088; 95% CI: 1.006-1.178, p=0.035), lower MAP (OR: 0.975; 95% CI: 0.957-0.994, p=0.011), patients with severe liver disease (OR: 2.036; 95% CI: 1.051-3.941, p=0.035), and need for RRT (OR: 2.478; 95% CI: 1.315-4.671, p=0.005) were significantly associated with an increased risk of in-hospital mortality among elderly ICU patients with VTE (Table 3).

Table 2: Demographic and clinical characteristics of the study population in the elderly.

Characteristics	Survivors, (n=1045)	Non survivors, (n=237)	P value
Age (in year)	75.0 (69.0-82.0)	76.0 (71.0-82.0)	0.048
Gender (male)	526 (50.3)	120 (50.6)	0.934
LOS hospital, day	11.7 (7.0-19.3)	10.8 (5.3-18.9)	0.076
LOS ICU, day	2.9 (1.9-5.3)	4.9 (2.3-9.2)	0.000
CCI	6.0 (5.0-8.0)	8.0 (6.0-10.0)	0.000
SAPS II score	38.0 (31.0-47.0)	50.0 (42.0-61.0)	0.000
Hemoglobin, (g/dL)	10.6 (9.3-12.2)	10.0 (8.6-11.4)	0.000
WBC, (10^9/L)	11.0(8.3-14.4)	12.9 (8.7-18.3)	0.000
RBC, (10^9/L)	3.6 (3.1-4.1)	3.3 (2.9-3.9)	0.000
Platelets, (10^9/L)	190.7 (139.3-255)	169.0 (107.5-259.5)	0.014
Glucose, (mg/dL)	131 (112-160.5)	137 (111.5-169.5)	0.035
RDW, (%)	14.7 (13.7-16.3)	16.2 (14.7-17.8)	0.000
Hematocrit, (%)	32.1(28.2-36.9)	30.7(26.6-35.0)	0.003
MCHC	33.0 (32.0-34.0)	32.5(31.4-33.5)	0.000
BUN, (mg/dL)	20.5 (15.0-31.0)	29.0 (19.0-44.5)	0.000
Creatinine, (ng/dL)	1.0 (0.8-1.3)	1.3-0.9-2	0.040
Bicarbonate, (mEq/L)	23.0 (20.5-25.0)	21.5 (18.0-24.0)	0.000
INR	1.3 (1.2-1.5)	1.4 (1.2-1.8)	0.000
PT	14.2 (12.8-16.5)	15.7 (13.4-19.7)	0.000
PTT	35.6 (28.5-67.1)	40.4 (30.2-72.8)	0.032
Hypertension	527 (50.4)	100 (42.2)	0.022
Diabetes	294 (28.1)	76 (32.1)	0.228
Congestive heart failure	312 (29.9)	78 (32.9)	0.356
Peripheral vascular disease	116 (11.1)	37 (15.6)	0.053
Coronary artery disease	275 (26.3)	58 (24.5)	0.559
Renal disease	199 (19)	60 (25.3)	0.030
Severe liver disease	51 (4.9)	32 (13.5)	0.000
Malignant cancer	238 (22.8)	90 (38)	0.000
Cerebrovascular disease	169 (16.2)	42 (17.7)	0.561
COPD	298 (28.5)	73 (30.8)	0.484

Continued.

Characteristics	Survivors, (n=1045)	Non survivors, (n=237)	P value
Heart rate, (bpm)	86 (76-97)	91 (79-102)	0.002
MAP, (mmHg)	76 (70-84)	72 (68-79)	0.000
RR, (breaths/minutes)	19 (17-22)	21 (18-23)	0.001
SpO_2, (%)	97 (96-98)	97 (95-98)	0.653
Mechanical ventilation	343 (32.8)	117 (49.4)	0.000
Diuretic use	174 (16.7)	52 (21.9)	0.054
RRT	51 (4.9)	41 (17.3)	0.000

Values are expressed as the median (IQR) or n (%). CCI-Charlson comorbidity index; SAPS-The simplified acute physiology score; WBC-White blood cells; RBC-Red blood cell; MCHC-Mean corpuscular hemoglobin concentration; RDW-Red blood cell distribution width; BUN-Blood urea nitrogen; INR-International normalized ratio; PT-prothrombin time; PTT-partial thromboplastin time; RRT-Renal replacement therapy; MAP-Mean arterial pressure; RR-Respiratory rate; LOS-Length of stay; ICU-Intensive care unit.

Table 3: Univariate and multivariate analysis for factors associated with in-hospital mortality among critically ill patients with VTE.

Variables	Univariate analysis		Multivariate analysis	
	OR (95% CI)	P	OR (95% CI)	P
Age (in years)	1.018 (1.000-1.037)	0.050	1.016 (0.993-1.040)	0.184
Gender (male)	1.012 (0.763-1.342)	0.934		
LOS hospital	1.007 (0.999-1.014)	0.069	0.996 (0.988-1.005)	0.391
LOS ICU	1.044 (1.026-1.062)	<0.001	1.034 (1.010-1.059)	0.005
CCI	1.206 (1.147-1.267)	<0.001	1.090 (1.001-1.187)	0.046
SAPS II score	1.065 (1.054-1.077)	<0.001	1.039 (1.023-1.056)	<0.001
Hemoglobin	0.863 (0.803-0.929)	<0.001	1.096 (0.501-2.396)	0.819
WBC	1.010 (1.001-1.019)	0.030	1.002 (0.993-1.011)	0.670
RBC	0.693 (0.563-0.852)	0.001	0.610 (0.342-1.088)	0.094
Platelets	0.999 (0.998-1.001)	0.285		
Glucose	1.003 (1.001-1.005)	0.004	1.003 (1.000-1.005)	0.054
RDW	1.213 (1.148-1.282)	<0.001	1.088 (1.006-1.178)	0.035
Hematocrit	0.967 (0.944-0.990)	0.006	1.026 (0.798-1.318)	0.842
MCHC	0.809 (0.740-0.884)	<0.001	0.892 (0.681-1.169)	0.409
BUN	1.023 (1.016-1.030)	<0.001	1.007 (0.997-1.018)	0.188
Creatinine	1.267 (1.131-1.418)	<0.001	0.867 (0.710-1.059)	0.163
Bicarbonate	0.901 (0.870-0.934)	<0.001	0.990 (0.951-1.030)	0.626
INR	1.297 (1.106-1.522)	0.001	0.642 (0.154-2.680)	0.544
PT	1.029 (1.013-1.045)	0.001	1.048 (0.909-1.209)	0.515
PTT	1.004 (0.999-1.009)	0.131		
Hypertension (yes)	0.717 (0.540-0.954)	0.022	1.056 (0.709-1.573)	0.788
Diabetes (yes)	1.206 (0.889-1.635)	0.228		
Congestive heart failure (yes)	1.153 (0.852-1.558)	0.356		
Peripheral vascular disease (yes)	1.482 (0.993-2.211)	0.054	1.257 (0.766-2.060)	0.365
Coronary artery disease (yes)	0.907 (0.654-1.258)	0.559		
Renal disease (yes)	1.411 (1.035-2.007)	0.030	0.836 (0.485-1.444)	0.521
Severe liver disease (yes)	3.042 (1.907-4.853)	<0.001	2.036 (1.051-3.941)	0.035
Malignant cancer (yes)	2.076 (1.539-2.801)	<0.001	1.489 (0.959-2.313)	0.076
Cerebrovascular disease (yes)	1.116 (0.770-1.619)	0.562		
COPD (yes)	1.116 (0.821-1.516)	0.484		
Heart rate	1.013 (1.005-1.022)	0.003	1.002 (0.990-1.013)	0.767
MAP	0.959 (0.944-0.974)	<0.001	0.975 (0.957-0.994)	0.011
Respiratory rate	1.059 (1.022-1.098)	0.002	1.045 (0.996-1.095)	0.070
SpO_2	0.951 (0.894-1.012)	0.115		
Mechanical ventilation (yes)	1.995 (1.500-2.655)	<0.001	1.149 (0.768-1.718)	0.500
Diuretic use (yes)	1.407 (0.993-1.993)	0.054	1.271 (0.840-1.923)	0.256
RRT	4.077 (2.629-6.322)	<0.001	2.478 (1.315-4.671)	0.005

OR-Odds ratio; CI-Confidence interval; CCI-Charlson comorbidity index; SAPS-The simplified acute physiology score; WBC-White blood cells; RBC-Red blood cell; MCHC-Mean corpuscular hemoglobin concentration; RDW-Red blood cell distribution width; BUN-Blood urea nitrogen; INR-International normalized ratio; PT- Prothrombin time; PTT-Partial thromboplastin time; RRT-Renal replacement therapy; MAP-Mean arterial pressure; RR-Respiratory rate; LOS-Length of stay; ICU-Intensive care unit.

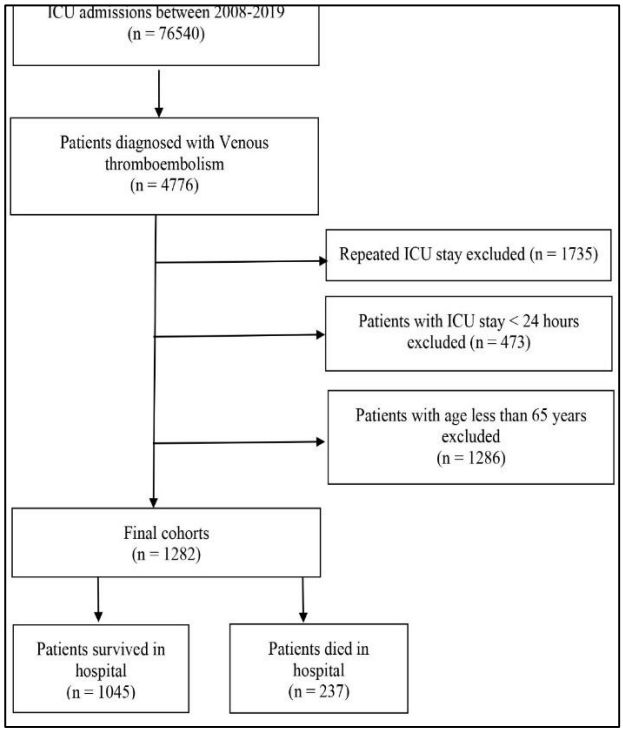

Figure 1: The exclusion and inclusion criteria of this study.

DISCUSSION

The present study reveals that critically ill elderly patients with VTE have an in-hospital mortality rate of 18.5%. Furthermore, our study demonstrated that several factors, including prolonged ICU stays, elevated CCI scores, increased SAPS II scores, elevated RDW levels, decreased MAP, severe liver disease, and the necessity for RRT, were independently associated with increased in-hospital mortality rates.

The mortality rate of VTE patients during hospitalization is influenced by several factors, including age, underlying health conditions, the severity of the illness, treatment methods, and the effectiveness of timely management. The study by Cohen et al revealed a mortality rate of 26.1% among large populations of hospitalized COVID-19 patients, which is slightly higher than the 18.5% observed in the present study. Another study reported an all-cause mortality rate of 8% among patients with VTE over a three-month period.[12,13] The wide variability in mortality rates observed across these studies can be attributed to factors such as the age demographics of the population, the distribution of risk factors, responses within the healthcare system, and differences in treatment protocols. Extended stays in the ICU can have negative effects on health, raising the likelihood of infections, complications, and mortality.[14,15] Moitra et al conducted a study examining the relationship between ICU duration and one-year mortality in elderly patients.[16] Their findings showed a one-year mortality rate of 26.6%, ranging from 19.4% for patients with a single-day ICU stay to 57.8% for those staying beyond 21 days. In the present study, we also observed that an extended stay in the ICU is linked with an increased risk of in-hospital mortality among elderly VTE patients. For each incremental increase in the duration of ICU stay, there is a 3.4% greater likelihood of in-hospital mortality occurring. Extended periods in the ICU can lead to immobility, heightening the risk of DVT or worsening existing VTE. Prolonged immobility significantly raises the chances of clot formation, contributing to increased morbidity and mortality rates.[15] Moreover, patients with VTE often receive anticoagulation therapy to prevent clot recurrence and expansion. Lengthy stays in ICUs may extend the duration of anticoagulant treatment, potentially increasing the likelihood of bleeding complications.[14,15] The CCI is a reliable and simple tool for risk stratification based on comorbid diseases.[17] It is widely used as an indicator of prognosis and mortality. Numerous studies have explored the relationship between the CCI and mortality among individuals with VTE.[18,19] Generally, these studies have concluded that a higher CCI score correlates with elevated mortality rates in VTE patients. Consistent with findings from previous studies, our study also demonstrated that the CCI score is an independent predictor for in-hospital mortality in elderly VTE patients.[18,19] Yang et al demonstrated this in patients with sepsis, and another study found a similar association with long-term mortality in heart failure patients with increasing CCI scores.[20,21]

The SAPS II score is utilized to assess disease severity and predict mortality risk for critically ill patients admitted to ICUs.[22,23] It encompasses various physiological parameters, including age and the presence of specific comorbidities, along with vital signs such as heart rate and respiration rate. Several studies have consistently shown a strong correlation between higher SAPS II scores and increased mortality rates.[22–25] Patients with higher scores typically experience a more severe clinical course, thereby facing a heightened risk of mortality. SAPS II score serves as a valuable tool for guiding treatment decisions and allocating resources within the ICU setting. Shen et al conducted a study using data from ICUs to develop a prognostic nomogram for predicting 30-day mortality in critically ill patients diagnosed with DVT.[26] Their findings indicated that the SAPS II score exhibited good predictive ability for this outcome, with an area under the curve (AUC) of 0.781 (95% CI: 0.732-0.831). The present study also revealed a significant association between increased SAPS II scores and in-hospital mortality among VTE patients in the ICU.

RDW provides a simple and cost-effective means of assessing the variation in red blood cell size (anisocytosis). While traditionally utilized for diagnosing anemia, mounting evidence indicates a correlation between elevated RDW levels and poorer outcomes across various diseases.[27-29] Additionally, research has demonstrated that RDW as a reliable predictor of overall mortality in critically ill patients.[30] A study conducted by

Ellingsen et al examined the utility of RDW as a predictor of mortality in patients with VTE.[31] The research revealed that patients with an RDW of 13.3% or higher at baseline exhibited a 30% increased risk of all-cause mortality following the initial VTE event, compared to individuals with an RDW below 13.3%. These results imply that RDW could serve as a valuable marker for identifying VTE patients at elevated risk of mortality. Another study conducted by Fujita et al revealed that patients with RDW levels ≥16.1% experienced a significantly increased risk of mortality compared to those with levels below 16.1%.[30] Furthermore, in the high-RDW group (RDW ≥16.1%), ICU mortality rates were notably higher at 37.9% compared to 19.2% for the low RDW group (p<0.001). Similarly, the risk of long-term mortality remained significantly elevated in the high-RDW group, indicating that RDW serves as a robust predictor for both ICU and long-term mortality in patients hospitalized in a medical ICU. Consistent with the findings of prior research.[30,31] Our study also identified RDW as an independent predictor of in-hospital mortality among critically ill elderly patients with VTE.

Grainger et al investigated the long-term prognosis of patients with PE requiring ICU admission.[32] Their study identified active malignancy as the most significant independent risk factor for mortality. Additionally, chronic liver disease, renal dysfunction, and pre-existing respiratory diseases were found to be independent predictors of increased mortality. However, in the present study, only severe liver disease was associated with of in-hospital mortality among elderly VTE patients. Prior studies have established a clear link between severe liver impairment and heightened mortality rates among patients with VTE.[33,34] This increased risk arises from observed changes in the coagulation system commonly present in severe liver disease, leading to a prothrombotic state. Moreover, compromised liver function can hinder the synthesis of crucial clotting factors and platelets, exacerbating the predisposition to thrombotic events and adverse consequences.[33] Additionally, underlying liver conditions may weaken the immune system, rendering patients more vulnerable to complications associated with VTE.

Patients admitted to ICU are experiencing an increasing prevalence of acute kidney injury (AKI).[35] AKI has been recognized as a serious event consistently associated with adverse outcomes including prolonged hospital or ICU stays, development of end-stage and chronic kidney disease, and the need for RRT.[35,36] Studies have suggested that AKI could significantly worsen the prognosis for individuals with VTE, increasing their risk of mortality and other complications.[36-38] A study by Elseviers et al found that patients with AKI who underwent RRT had a higher mortality rate (58% vs. 43%) and longer hospital stays compared to those managed conservatively.[39] Even after adjusting for disease severity, the risk of death remained significantly elevated in the RRT group (relative risk=1.75, 95% CI: 1.4 to 2.3). This observation persisted across various subgroups and after accounting for potential confounders, indicating that factors beyond disease severity contribute to the heightened mortality observed in AKI patients undergoing RRT. In the present study, even after accounting for potential confounders, we also demonstrated that the need for RRT (OR: 2.478; 95% CI: 1.315-4.671, p=0.005) was significantly associated with an increased risk of in-hospital mortality among elderly ICU patients with VTE. This study has several limitations. Firstly, it employs a retrospective design utilizing samples from a public database, which might introduce selection bias, potentially impacting the results. Secondly, data collection was limited to the first day of admission, lacking real-time dynamic information. Additionally, being a single-center study, the findings may not be generalizable.

CONCLUSION

The present study provides new insights into the risk factors associated with increased in-hospital mortality among elderly ICU patients with VTE. Notably, this study reveals that factors such as a longer length of stay in the ICU, higher CCI and SAPS II scores, elevated RDW levels, lower MAP, presence of severe liver disease, and the need for RRT are predictors of in-hospital mortality. By understanding these factors, healthcare professionals can potentially develop better strategies for managing this patient population and improve their chances of survival.

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