RISK FACTORS FOR DEATH IN PATIENTS WITH SEVERE TRAUMA AND THE PREDICTIVE VALUE OF JMHW SCORE FOR 28D MORTALITY

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ABSTRACT

Objective*: To investigate the risk factors for death in patients with severe trauma, and the predictive value of the Japanese Ministry of Health and Welfare (JMHW) score for 28-day mortality.*

Methods: *Data for a total of 568 patients with severe trauma admitted to the emergency surgery department of our hospital from September 2018 to September 2019 were collected. Factors that might lead to the death of patients were selected, and the risk factors for the death of patients with severe trauma were analysed by univariate and multivariate logistic regression analysis. All patients were evaluated by the JMHW rating, Korean Society of Thrombosis and Haemostasis (KSTH) and International Society on Thrombosis and Haemostasis score (ISTH) to analyse the predictive value of JMHW score for 28-day mortality in patients with severe trauma.*

Results: *From September 2018 to September 2019, a total of 568 patients with severe trauma who met the inclusion criteria were admitted to our hospital. Of these 568 patients, 140 patients died, and the case fatality rate was 24.65%. There were 320 male patients, accounting for 56.34%. The most common types of injury were traffic injuries and blunt injuries. Univariate analysis showed that there was no statistically significant difference in the gender, trauma mechanism, injury, or treatment time between the two groups of patients (P>0.05). There were significant differences in age, ISS score, GCS score, and vital signs between the two groups of patients (P<0.05). Multivariate logistic regression analysis showed that age, hypotension at admission, an ISS score ≥16, and a GCS score were all influential factors for death in patients with severe trauma (P<0.05). The JMHW, KSTH, and ISTH scores in the survival group were significantly lower than those in the control group, and the differences were statistically significant (P<0.05). The ROC curve analysis showed that for the JMHW prediction for patients with severe trauma, the AUC was 0.862, the sensitivity was 89.23%, and the specificity was 85.02%; the KSTH predicted prognosis in severe trauma patients with an AUC of 0.795, a sensitivity of 81.26%, and a specificity of 83.25%; the AUC for predicting the prognosis of patients with severe trauma by ISTH was 0.746, the sensitivity was 76.50%, and the specificity was 77.22%.*

Conclusion: *Patient age, hypotension at admission, ISS score, and GCS score are all risk factors for death in patients with severe trauma. JMHW, KSTH, and ISTH scores have some value in predicting the prognosis of patients. Among them, JMHW scores have the highest diagnostic value and can be widely used in clinical practice.*

Keywords: *Patients with severe trauma, death, risk factors, JMHW score, 28-day mortality, predictive, value.*

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Introduction

Trauma is the destruction of human tissues or organs by mechanical factors[1]. It has a high incidence and a wide range of severity. Severe trauma can cause systemic reactions, localized pain, swelling, tenderness and other symptoms in the injured area. Deformation and dysfunction can occur during fracture and dislocation. There can also be fatal haemorrhages, shock, asphyxiation and disturbance of consciousness[2]. Trauma is the main factor causing disability or death among young and middle-aged people. With increased urbanization, the number of motor vehicles increases dramatically, and traumatic accidents occur frequently.

According to the statistics, trauma is the fifth leading cause of death among Chinese people[3]. Severe trauma can induce disseminated intravascular haemorrhage (DIC), and DIC can aggravate the patient's inflammatory response, cause the formation of microvascular thrombosis, lead to multiple organ dysfunction syndrome, and aggravate the patient's

condition[4]. Common clinical ways to evaluate DIC include JMHW rating, KSTH score, and ISTH score and so on.

However, there are few studies on the predictive value of different scores for death in severe patients[5]. This experiment was conducted to explore the risk factors for death in patients with severe trauma and the predictive value of DIC-related scores such as the JMHW score on 28-day mortality.

Materials and methods

General information

A total of 568 patients with severe trauma admitted to the emergency surgery department of our hospital from September 2018 to September 2019 were collected.

The inclusion criteria were:

• All patients were over 18 years old;

• The patient's injury severity score (ISS) was above 16;

• Complete patient case; the patient and their family members understood and signed the informed consent form.

The exclusion criteria were:

• Patients who had cardiac arrest due to drowning, trauma, and other factors; patients who lacked coagulation examination indexes within 1 h after admission;

• Patients who had a malignant tumour;

• Patients who had heart, liver, and kidney disorders;

• Patients who were pregnant;

• Patients who had used anticoagulants within the previous month.

This study was approved by the hospital ethics committee. All patients were divided into a survival group (n=438) and a death group (n=140) according to the prognosis.

Observation indicators

Age, gender, trauma mechanism, professional first aid, on-site assessment of coma, time elapsed between trauma and treatment, vital signs on admission, ISS score on admission, serum examination indicators after admission, emergency room wait time, emergency surgery, mechanical ventilation, and central venous pressure measurement were collected for all patients, and 28-day mortality was recorded.

The JMHW, KSTH, and ISTH scores were calculated according to the data at the time of admission. See Table 1.

Clinical index	Score	JMHW	KSTH	ISTH
Blood platelet ($\times 10^9$/L)	0	> 120	> 100	> 100
	1	80 < and ≤ 120	≤ 100	≤ 100
	2	50 < and ≤ 80		< 50
	3	≤ 50		
PT (s)	0	< 1.25	< 3	< 3
	1	1.25 ≤ and < 1.67	≥ 3	3 ≤ and < 6
	2	≥ 1.67		≥ 6
Fibrinogen related markers (mg/L)	0	FDP < 10	D-D < 1.0	D-D < 1.0
	1	10 ≤ FDP < 20	D-D ≥ 1.0	
	2	20 ≤ FDP < 40		1.0 ≤ D-D < 5.0
	3	40 ≤ FDP		D-D ≥ 5.0
Fibrinogen (g/L)	0	> 1.5	> 1.5	> 1.0
	1	1.0 < and ≤ 1.5	≤ 1.5	< 1.0
	2	< 1.0		
Underlying disease	1	Exists		
Bleeding	1	Exists		
Organ failure	1	Exists		
Dominance DIC		≥ 7	≥ 3	≥ 5

Table 1: Three kinds of DIC scoring criteria.

Statistical methods

Data in this study were analysed using the SPSS 20.0 software package. All measurement data were expressed as ($\bar{x}\pm s$), and a t-test was used for inter-group comparison. The counting data were expressed as percentages, and a χ^2 test was used for comparison between groups. Grade data were compared using a ridit test. Univariate and multivariate logistic regressions were used to analyse the influencing factors of death in patients with severe trauma, and a receiver operating characteristic (ROC) curve was used to analyse the predictive value of the JMHW score on 28-day mortality. A $P<0.05$ was considered statistically significant.

Results

Clinical data analysis of all patients

From September 2018 to September 2019, a total of 568 patients with severe trauma who met the inclusion criteria were admitted to our hospital. Of the total, 140 patients died, and the case fatality rate was 24.65%. There were 320 male patients, which accounted for 56.34%. The most common types of injury were traffic injuries and blunt injuries.

Univariate analysis showed that there was no statistically significant difference in the gender, trauma mechanism, injury, or treatment time between

the two groups of patients (P>0.05). There were significant differences in age, ISS score, Glasgow Coma Scale (GCS) score, and vital signs between the two groups of patients (P<0.05). See Table 2.

Data		Total quantity (*n*=568)	Survival group (*n*=438)	Death group (*n*=140)	*P*
Gender	Male	320	234	86	0.936
	Female	248	194	54	
Age		45.12±20.33	36.26±10.48	53.48±8.12	< 0.001
Trauma mechanism	Traffic injury	241	181	60	0.073
	Blunt injury	203	163	40	
	Sharp injury	76	53	23	
	Burns	48	31	17	
Injury to treatment time		145.26±89.55	144.58±75.26	147.26±112.33	0.748
ISS Score	< 16	396	328	88	0.009
	≥ 16	172	110	52	
GCS Score		13.25±2.56	14.56±1.86	6.58±4.12	< 0.001
Vital signs	Heart rate	85.00±18.00	83.00±12.00	90.00±19.00	< 0.001
	Temperature	37.12±3.45	36.45±2.45	35.58±3.30	0.004
	Low blood pressure on admission	118.23±46.12	125.43±20.15	54.16±5.26	< 0.001
	Breath	22.50±5.50	20.50±4.50	25.50±5.00	< 0.001

Table 2: Clinical data analysis of all patients ($\bar{x}\pm s$).

Analysis of independent risk factors affecting the prognosis of trauma patients

Multivariate logistic regression analysis showed that age, hypotension at admission, ISS score ≥16, and GCS score were all influencing factors for the death of patients with severe trauma (P<0.05). See Table 3.

Variables	OR Value	95% *CI*	*P* Value
Age	0.621	0.415-0.912	0.012
Hypotension at admission	0.547	0.385-0.785	0.002
ISS score ≥ 16	0.615	0.518-0.895	0.001
GCS score	0.532	0.416-0.852	0.001

Table 3: Analysis of independent risk factors affecting the prognosis of trauma patients.

Comparison of three DIC scores between the two groups

The JMHW, KSTH, and ISTH scores in the survival group were significantly lower than those in the death group, with statistically significant differences (P<0.05). See Table 4.

Score	Survival group	Death group	*t*	*P*
JMHW	2.50±1.00	3.00±1.00	5.15	< 0.001
KSTH	1.50±0.50	2.00±1.50	6.0168	< 0.001
ISTH	2.50±1.50	3.50±1.00	7.379	< 0.001

Table 4: Comparison of three DIC scores between the two groups.

Value analysis of 28-day mortality in patients with three DIC scores

The ROC curve analysis showed that the area under the curve (AUC), sensitivity, and specificity of the JMHW score in predicting the prognosis of patients with severe trauma were 0.862, 89.23%, and 85.02%, respectively. The AUC of the KSTH score was 0.795, the sensitivity was 81.26%, and the specificity was 83.25%. The ISTH score predicted the prognosis of patients with severe trauma with an AUC of 0.746, a sensitivity of 76.50%, and a specificity of 77.22%, as shown in Table 5.

Score	AUC	95% CI	Sensitivity	Specificity
JMHW	0.862	0.816-0.911	89.23%	85.02%
KSTH	0.795	0.742-0.832	81.26%	83.25%
ISTH	0.746	0.686-0.792	76.50%	77.22%

Table 5: Value analysis of evaluating 28-day mortality of patients with three DIC scores.

Discussion

Trauma is one of the major causes of human death in the world, among which traffic injuries, fall injuries, mechanical injuries, sharp injuries, falls, and burns are the most common[6]. Severe trauma occurs rapidly and has a high fatality rate, and poses a great threat to the life of patients. Therefore, finding risk factors for death in patients with severe trauma, and finding methods to evaluate patient prognosis is important.

Our hospital selected 568 patients with severe trauma for the purpose of studying the risk factors of death in patients with severe trauma. Of the total, 140 patients died, giving a case fatality rate of 24.65%. There were 320 male patients, accounting for 56.34%. Traffic injuries and blunt injuries were the main causes of death, and the fatality rate was as high as 71.43%. Univariate analysis showed statistical differences in age, ISS score, GCS score, and vital signs between the two groups (P<0.05). Shock is one of the most common conditions in patients

with severe trauma. It can induce complications and even concurrent MODS, which seriously endangers the lives of patients. Early assessment of patients with shock is of great significance to improving the prognosis of patients[7]. Clinically, a systolic blood pressure below 90 mmHg is used as a test standard to evaluate the occurrence of shock in patients[8]. Previous studies have shown that age has a certain effect on the mortality of patients with severe trauma[9]. The GCS score is a score that reflects the patient's neurological function and is an important predictor of death[10]. The ISS score reflects the severity of the patient's injury and has certain significance in evaluating the prognosis of the patient[11]. Multivariate logistic regression analysis in this experiment confirmed that age, low blood pressure at admission, ISS score ≥16, and GCS score were all influencing factors for death in patients with severe trauma ($P<0.05$), similar to the results of Lin et al.[12].

DIC is a clinical syndrome mainly characterized by haemorrhage, thrombosis, and microcirculation dysfunction, and it is a disease that needs to be diagnosed and treated in a timely manner[13]. Previous studies have found that severe trauma patients are very likely to suffer the complications of DIC, with massive bleeding, decreased vital signs, multiple organ failure, abnormal consciousness, and even shock, which seriously endangers the life and health of patients with severe trauma[14]. The JMHW score was proposed in 1987, and has many reference items, including details of basic diseases, bleeding symptoms, and organ failure, which are relatively comprehensive. Compared with the KSTH and ISTH scores, the JMHW greatly reduces the rate of missed diagnosis of DIC, and it is now widely used in the clinical diagnosis of DIC[15]. In this study, the JMHW, KSTH, and ISTH scores of patients in the survival group were significantly lower than those in the death group, and the differences were statistically significant ($P<0.05$). It was suggested that the changes in the three DIC scores have a certain relationship with the prognosis of patients.

For further exploration, the ROC curve analysis found that the AUC for the JMHW score predicting the prognosis of patients with severe trauma is 0.862, the sensitivity is 89.23%, and the specificity is 85.02%; the AUC of the KSTH score predicting the prognosis of patients with severe trauma was 0.795, the sensitivity was 81.26%, and the specificity was 83.25%; the AUC for predicting prognosis in patients with severe trauma was 0.746, the sensitivity was 76.50%, and the specificity was 77.22%. It was suggested that the three DIC scores have some value for predicting 28-day mortality in patients with severe trauma, of which JMHW has the highest predictive value.

In summary, patient age, hypotension at admission, ISS score, and GCS score are all risk factors for death in patients with severe trauma, and these factors should be adjusted in time to improve patient prognosis. JMHW, KSTH, and ISTH scores have some value for predicting the prognosis of patients. Among them, JMHW scores have the highest diagnostic value and can be widely used in clinical practice.

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