MORTALITY CHARACTERISTICS OF MULTIPLE TRAUMA PATIENTS AT MILITARY HOSPITAL 103

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Abstract

Objectives: To determine mortality characteristics of multiple trauma patients who were treated at Military Hospital 103. ***Methods:*** A prospective, descriptive study on 196 multiple trauma patients who were admitted and treated at the Surgical Intensive Care Unit (SICU), Military Hospital 103. Patients' clinical and subclinical data were collected at the time of admission, during treatment, and at the time of discharge from the SICU. The data were encoded and processed according to statistical methods. ***Results:*** The majority of multiple trauma patients were aged 20 - 40 (38.8%), mainly men (80.1%), and the main cause was traffic accidents (66.8%). The 30-day mortality rate of multiple trauma admitted to the SICU was 40.8%. The mortality rate within 24 and 48 hours after admission was 15.8% and 21.9%, respectively, then it gradually decreased over time. The main causes of death within the first 24 hours were traumatic shock (10.7%) and severe traumatic brain injury (5.1%), but the main cause of death after 24 hours was multiple organ failure (9.7%). Injury Severity Score (ISS) (HR 1.95; 95%CI: 1.05 - 3.64), brain trauma (HR 0.25; 95%CI: 0.09 - 0.70) and shock when arrival (HR 0.41; 95%CI: 0.22 - 0.75) were risk factors for survival over time in multiple trauma patients ($p < 0.05$). ***Conclusion:*** The mortality rate among multiple trauma patients was high. ISS, traumatic brain injury, and shock at the time of admission were risk factors for survival over time in patients with multiple traumas ($p < 0.05$). The main causes of death within the first 24 hours were traumatic shock and severe traumatic brain injury, but after 24 hours was multiple organ failure.

Keywords: Multiple trauma/polytrauma; Mortality.

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INTRODUCTION

Trauma is still a leading cause of death and has an enormous impact on patient's life and health systems. Trauma is a major cause of mortality, responsible for 9% of global deaths, and the primary reason for loss of life in young people [1]. Multiple trauma patients who have two or more severe injuries in different areas or organ systems, including at least one injury or a combination of life-threatening injuries. Despite progress in diagnosis and treatment, the mortality rate of patients with multiple traumas remains high [2, 3, 4]. There have been many studies on mortality in patients with multiple injuries, but in Vietnam, data on this issue is insufficient. Therefore, we conducted this study: *To determine mortality characteristics in multiple trauma patients who were admitted to the SICU, Military Hospital 103*.

MATERIALS AND METHODS

1. Subjects

196 multiple trauma patients treated at the SICU, Military Hospital 103 from 6/2020 - 6/2023.

* *Inclusion criteria:* Patients were diagnosed with multiple trauma (polytrauma), which is defined by the New Berlin Definition [5]; patients ≥ 18 years old.

* *Exclusion criteria:* Hospitalized > 24 hours after the accident; patients who have had surgery or treatment at previous level hospitals > 12 hours; pregnant woman; have chronic diseases such as cirrhosis, end-stage chronic kidney failure, congestive heart failure, and malignancy; patients had cardiac arrest before entering the hospital and was successfully resuscitated.

* *Criteria for removal from the study:* Transfer to another hospital before discharge; insufficient collection of research data.

2. Methods

* *Research design:* A prospective, descriptive study.

Vital signs, Glasgow score, and ISS were collected when patients entered the hospital. Blood samples were taken within 30 minutes of admission for biochemical, complete blood count, and blood gas tests. Patients' outcomes were assessed 30 days after admission.

The care of severely injured patients was performed in a structured way according to the A-B-C-D-E scheme and whole-body examination by the interdisciplinary team. Therapeutic decision-making took patients' physiological parameters into account, along with the overall severity of trauma and the complexity of the individual injuries [6, 7]. A patient was considered dead if the patient died in the hospital or was in serious condition and the family

requested to be discharged from the hospital. The above information was compiled in the research medical record.

Qualitative variables were presented as percentages. The Kolmogorov-Smirnov test was performed to check the normal distribution of the variables. Quantitative variables that are not normally distributed are presented as medians (interquartile range: Q1 - Q3). Test the difference between two quantitative variables that do not have a normal distribution using the Mann-Whitney test. Kaplan-Meier failure curve and log-rank test were fitted to explore the survival difference among groups. After the bivariable and multivariable Cox regression analysis, an adjusted hazard ratio with 95% Confidence Intervals (CI) was reported to declare the strength of association and statistical significance, respectively.

All analyses were performed using SPSS version 26.0.

RESULTS

Table 1. General characteristics of patients.

Characteristics		Quantity (n = 196)	Proportion (%)
Age	< 20	24	12.2
	20 - 40	76	38.8
	41 - 59	64	32.7
	≥ 60	32	16.3
Gender	Male	157	80.1
	Female	39	19.9
Causes	Traffic accidents	131	66.8
	Occupational accidents	32	16.3
	High fall	23	11.7
	Others	10	5.1
ISS	18 - 25	38	19.4
	26 - 40	98	50.0
	41 - 75	60	30.6
Outcome	Survival	116	59.2
	Death	80	40.8

Multiple trauma patients were mainly male (80.1%); the majority was in the working age (20 - 40 years old: 38.8%), with the main cause being traffic accidents (66.8%). 40.8% of patients dead.

Table 2. Main causes of death in multiple trauma patients.

Etiologies	Within 24 hours after admission	After 24 hours	Total
Traumatic shock	21 (10.7%)	14	35 (17.8%)
Severe traumatic brain injury	10 (5.1%)	16	26 (13.3%)
Multiple organ failure	0	19	19 (9.7%)
Total	31 (15.8%)	49 (25.0%)	80 (40.8%)

15.8% of multiple trauma patients died within 24 hours after admission. The main causes of death within the first 24 hours were traumatic shock (10.7%) and severe traumatic brain injury (5.1%).

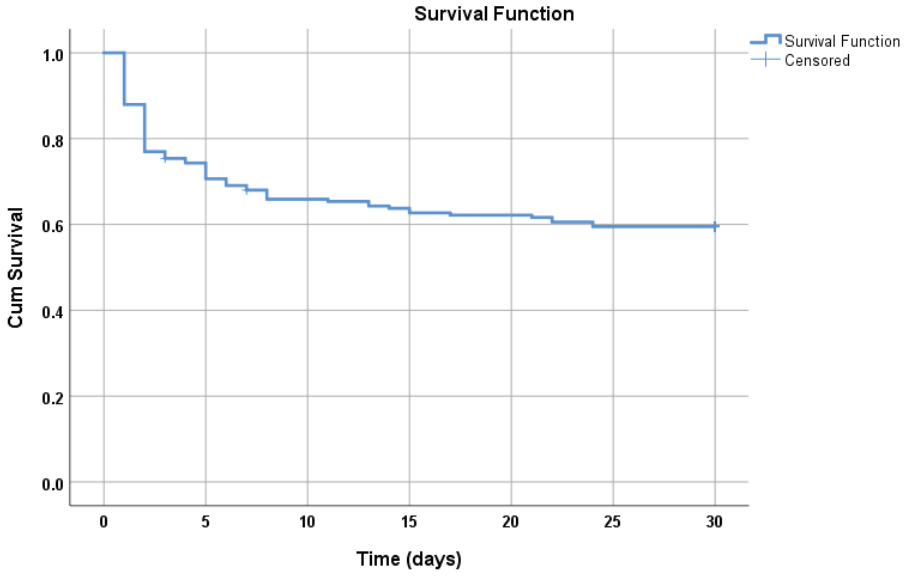

Figure 1. Kaplan-Meier total survival estimates.

21.9% of patients died within 48 hours after admission, then the mortality rate gradually decreased over time.

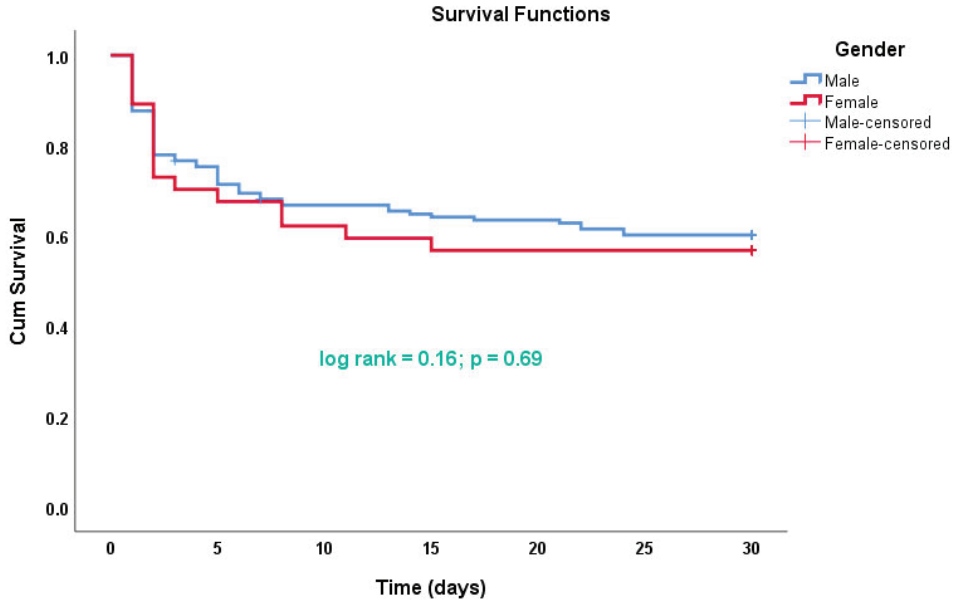

Figure 2. Kaplan-Meier survival estimates by gender.

The mean survival time of male and female patients was 20.2 days and 18.8 days, respectively. The difference was not statistically significant (p > 0,05).

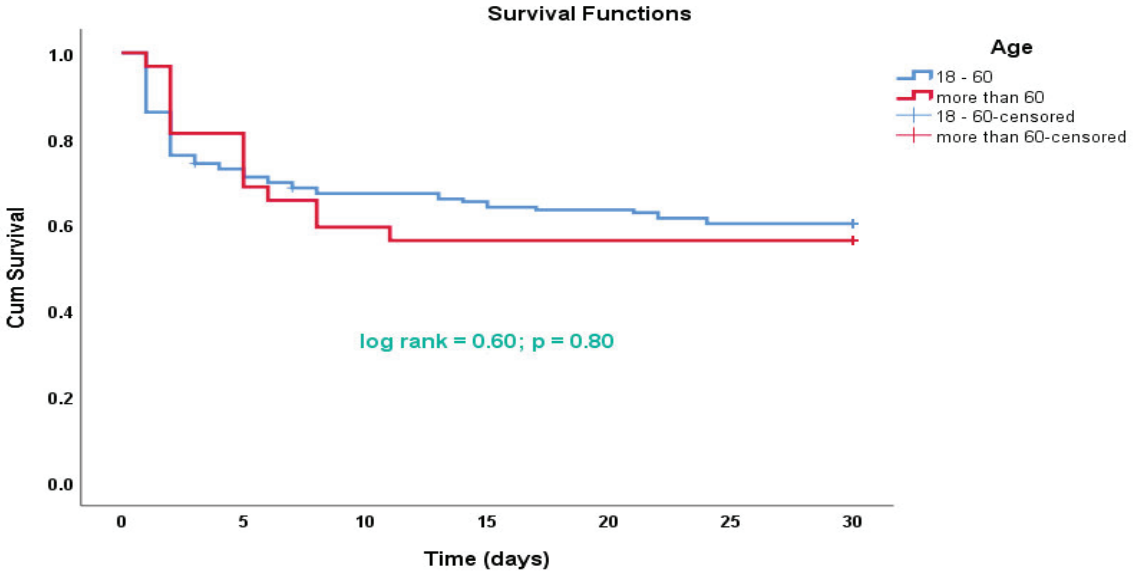

Figure 3. Kaplan-Meier survival estimates by age.

The mean survival time of 18 - 60 and > 61-year-old patients were 20.1 and 18.8 days, respectively. The difference was not statistically significant (p > 0.05).

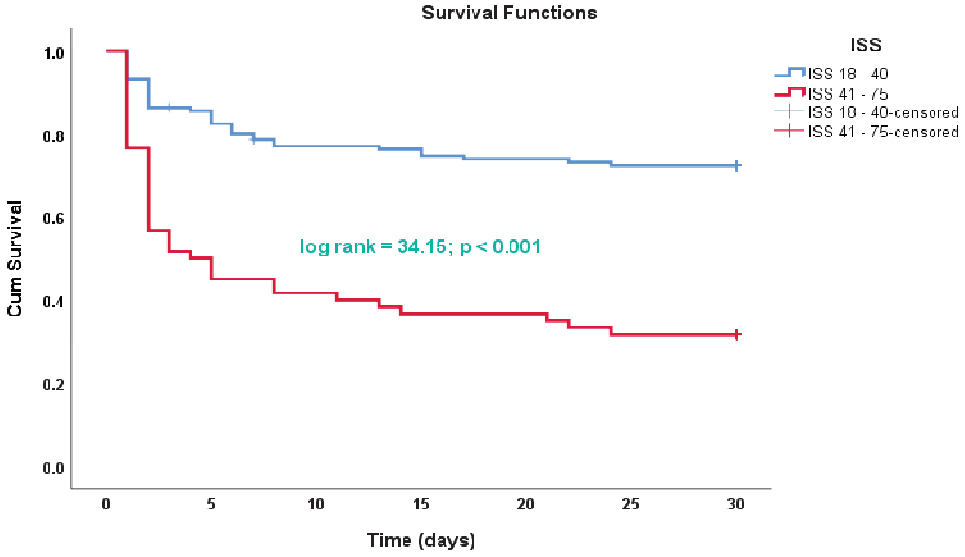

Figure 4. Kaplan-Meier survival estimates by ISS.

The median survival time of the ISS 41 - 75 group was 4.0 (0.7 - 7.3) days, lower than the ISS group, which was 18 - 41: 23.3 (21.3 - 25.2) days. The difference in the survival rate was statistically significant ($p < 0.05$).

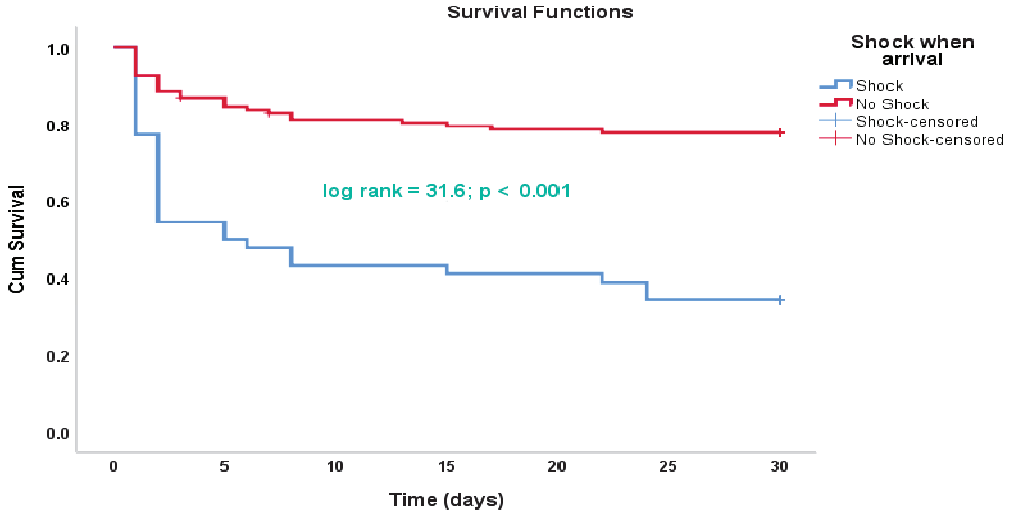

Figure 5. Kaplan-Meier survival estimates by shock when arrival.

The median survival time of shock when arrival was 5.0 (1.9 - 8.0) days, lower than patients with no shock: 24.5 (22.5 - 27.4). The difference in the survival rate was statistically significant ($p < 0.05$).

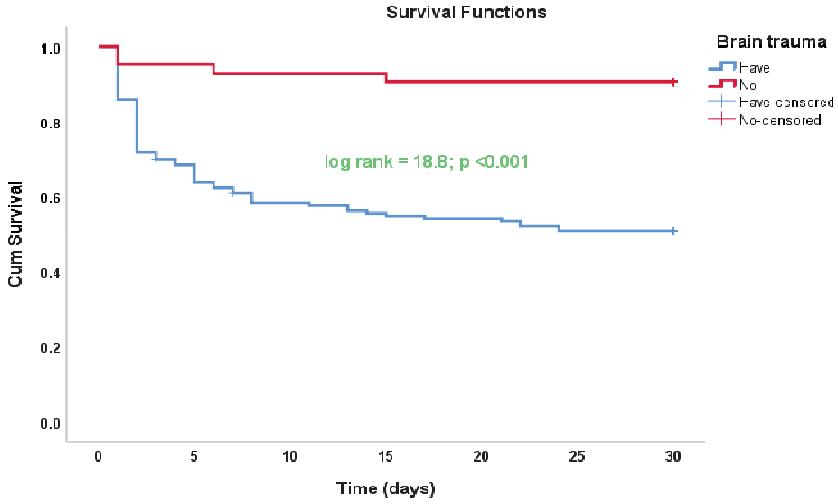

Figure 6. Kaplan-Meier survival estimates by brain trauma when arrival.

The mean survival time of patients who had brain trauma was 17.7, lower than patients with no brain trauma: 27.6 days. The difference in the survival rate was statistically significant ($p < 0.05$).

Table 3. Cox regression analysis on some factors affects the rate of survival in patients.

Characteristics	Unadjusted model		Adjusted model	
	Hazard ratio (95%CI)	p	Hazard ratio (95%CI)	p
ISS (41 - 75 vs. 18 - 40)	3.38 (2.15 - 5.31)	< 0.001	1.95 (1.05 - 3.64)	0.036
Brain trauma	0.16 (0.06 - 0.42)	< 0.001	0.25 (0.09- 0.70)	0.008
Glucose (mmol/L) (≥ 10 vs. < 10)	2.04 (1.27 - 3.28)	0.003	1.67 (0.93 - 3.00)	0.084
Lactate (mmol/L) (≥ 3 vs. < 3)	1.74 (0.99 - 3.05)	0.056	1.13 (0.55 - 2.33)	0.746
Shock at admission time	0.26 (0.15 - 0.44)	< 0.001	0.41 (0.22 - 0.75)	0.004

ISS, brain trauma, and shock when arrival were risk factors for survival over time in patients with multiple trauma ($p < 0.05$). The hazard of death among

patients with ISS 41 - 70 was 1.95 times higher than those who had ISS 18 - 40. The hazard of death among patients without brain trauma and shock at admission was 0.25 and 0.41 times lower as compared to those who have brain trauma or shock, respectively.

DISCUSSION

Multiple trauma patients were mainly male (80.1%) and working age (20 - 40 years old: 38.8%), with traffic accidents (66.8%) as the main cause (*Table 1*). Similarly, Nguyen Truong Giang (2007) also found that 77.3% of multiple trauma patients were male, young age 35 ± 15, with 81.3% due to traffic accidents [8].

In our study, 15.8% of multiple trauma patients died within 24 hours, and 21.9% of patients died within 48 hours after admission. Kisat MT (2016) demonstrated that the mortality appeared to be highest during patients' first day in the ICU. After surviving for 24 hours, however, trauma patients' proportional mortality more than halved, falling from 9.9% to 3.8% [9]. In our study, the main causes of death within the first 24 hours were traumatic shock and severe traumatic brain injury, and the main cause of death after 24 hours was multiple organ failure (9.7%) (*Table 2 and Figure 1*). This result is similar to research by A Sauaia (1995) that central nervous system injuries and exsanguination were the most frequent cause of death in acute and early phases (within 48 hours and from 3 to 7 days after admission, respectively), and organ failure (7%) was the most common cause of late death (after 7 days) [10]. Nguyen Truong Giang (2006) demonstrated that 23.0% of multiple trauma patients died (72.9% total death) within 24 hours after admission, and the main cause was traumatic brain injury combined with shock or respiratory failure [8]. A study in Dutch by El Mestoui Z (2016) showed that almost 92% of the total population died because of the effects of the accidents (primary trauma). Most patients died because of the effects of severe head injury (63.4%), followed by exsanguination (17.6%) [11]. In 2019, Brohi et al. set a challenge to trauma surgeons, clinicians, and scientists to explain why up to 25% of trauma patients, often admitted to hospitals with normalized perfusion and coagulation status, were still dead despite receiving the best medical care. The first group of early deaths occur 3 - 6 to 24 hours after injury and appear to be associated with profound cardiac and vascular failure. The second group of late deaths occur at 1 to 7 days and appear to be associated with an indolent form of multiple organ failure, immunosuppression, and sepsis,

referred to as persistent inflammation, immunosuppression, and catabolism syndrome (PIICS) [4].

Our research showed that there was no difference in mortality by gender (*Figure 2*) and between two age groups > 60 and < 60 years old (*Figure 3).* In addition, the hospitalized group with ISS scores (41 - 75) had a statistically significant higher mortality rate than the group with ISS scores 18 - 40 (*Figure 4*). Moreover, patients with multiple injuries admitted to the hospital in a state of shock or with traumatic brain injury had a higher mortality rate than the group without shock or without traumatic brain injury, with statistical significance ($p < 0.05$) (*Figures 5 and 6*). Similarly, Kisat MT (2016) found that among patients with an intensive care unit length of stay < 41 days, higher ISS and lower Glasgow score independently predicted mortality [9].

In our study, ISS (HR 1.95; 95%CI: 1.05 - 3.64), brain trauma (HR 0.25; 95%CI: 0.09 - 0.70), and shock when arrival (HR 0.41; 95%CI: 0.22 - 0.75) were independent risk factors for survival over time in patients ($p < 0.05$). The hazard of death among patients with an ISS 41 - 75 was 1.95 times higher than those who had an ISS of 18 - 40. The hazard of death among patients without brain trauma and shock at admission was 0.25 and 0.41 times lower than that of those who had brain trauma or shock, respectively (*Table 3*). Messelu MA et al. (2023) found that the hazard of death among patients with a Glasgow score < 9 was 3.9 times higher than those who had a Glasgow score of 13 - 15 [3]. A study by Jelodar S (2014) showed that Glasgow ≤ 8 (OR 16.5; 95%CI 5.9 - 40.8), head fracture (OR 5.8; 95%CI 3.1 - 9.5) were independent predictors of death in studied patients [12]. Luiz Costa (2017) studied 200 polytrauma patients demonstrated that lactate level (OR 1.06; 95%CI: 1.03 - 1.09; $p < 0.001$), Glasgow Coma Scale score (OR 0.98; 95%CI: 0.97 - 0.99; $p < 0.001$), and presence of traumatic brain injury (OR 6.09; 95%CI: 2.45 - 15.14; $p < 0.001$) were independent early predictors of mortality [13].

CONCLUSION

The overall mortality rate among multiple trauma patients admitted to the SICU was high (40.8%). The main causes of death within the first 24 hours were traumatic shock (10.7%) and severe traumatic brain injury (5.1%), and the main cause of death after 24 hours was multiple organ failure (9.7%). We identified ISS (HR 1.95; 95%CI: 1.05 - 3.64), brain trauma (HR 0.25; 95%CI: 0.09 - 0.70), and shock when arrival (HR 0.41; 95%CI: 0.22 - 0.75) were risk factors for survival over time in multiple trauma patients ($p < 0.05$).

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