Original Research Article

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Relationship between initial fibrinogen level with coagulopathy and mortality in multiple trauma patients

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ABSTRACT

Background: In trauma induced coagulopathy (TIC), low fibrinogen value is often found and plasma fibrinogen reached low value earlier than other parameters of coagulation factors. Initial fibrinogen value is strongly correlated to the injury severity score (ISS) and be an independent predictor of mortality. This study was expected to see the relationship between initial fibrinogen level with coagulopathy and mortality, so it can predict early coagulopathy and can prevent bleeding complications that lead to mortality.

Methods: The study was conducted prospectively. The entire examination obtained from patients with multiple trauma. Fibrinogen levels and coagulopathy were taken from the blood laboratory tests in conjunction with other routine examination when patients were admitted to the ER of Hasan Sadikin General Hospital. Outcome parameters were the incidence of coagulopathy and mortality. Statistical analyses were performed to look at the significance of relationships.

Results: Of the 25 patients with multiple trauma obtained a majority of 80% were male patients and with the highest incidence mechanism was head trauma as many as 16 people (64%). There were 8 patients (32%) experienced coagulopathy and mortality occurred in 7 patients (28%). Chi square analysis found a significant association between fibrinogen and coagulopathy (p = 0.043), while the association between initial fibrinogen with mortality was not significant (p = 0.341).

Conclusions: Initial fibrinogen level is significantly associated with coagulopathy but it cannot predict mortality in patients with multiple trauma. Further study is needed in order to assess the benefit of these results on the management of multiple trauma patients.

Keywords: Coagulopathy, Fibrinogen, ISS, Multiple trauma, Mortality

INTRODUCTION

Coagulopathy which occurs in trauma is known as trauma induced coagulopathy (TIC). Reported by Brohi, that one in seven deaths caused by trauma and as much as 30% from all the trauma patients came to the hospital in conditions of TIC. TIC is a consequence of the slow hemodilution, acidosis, hypothermia and the loss of clotting factors through an active bleeding. Coagulopathy

caused by severe trauma can be life threatening and can be a predictor of morbidity and mortality. 1-8

In TIC state, low fibrinogen value is often encountered, and getting worse in the event of trauma with bleeding. Severe tissue injury may cause hypoperfusion that leads to a cascade of systemic anticoagulation and its subsequent hyperfibrinolysis, in which the value of fibrinogen in plasma tends to be low. Plasma fibrinogen

reached the lowest value at the earlier phase than other coagulation factor parameters and low fibrinogen value is one of the signs of deficiency of clotting factors primary in the case of trauma with major bleeding. Management of bleeding due to trauma requires the existence of a rapid identification TIC so that it can become the basis for replacement therapy.

The European Trauma Guidelines recommends that the threshold concentration of fibrinogen for patients with bleeding is 150 - 200 mg/dl as the basis for therapeutic fibrinogen substitute. Fibrinogen supplementation should be given when the value of fibrinogen is under 1 g/L, but some research proves that the value of fibrinogen under 2 g/L will give bad impact for the patients. ¹⁶⁻¹⁸

The most current scoring for trauma is using Injury Severity Score (ISS). ISS is a complex scoring system that summarizes patients data into one of numerical data. That value is used as the depiction of the degree of severity of patients clinically. A study reports in 2013 that mortality increases significantly in multiple trauma patients with ISS \geq 15 accompanied by low initial fibrinogen value. 9,19

This research was expected to reveal a relationship between the level of fibrinogen with the coagulopathy and to see the relationship between initial fibrinogen with occurrence of multiple trauma patient mortality.

The goal of these research was to see whether there is a relationship between the value of fibrinogen with coagulopathy and to see whether there is a relationship between the value of initial fibrinogen level with the occurrence of mortality in multiple trauma patients who admitted to our hospital.

METHODS

This study was conducted prospectively. The inclusion criteria were patients with multiple trauma with ISS ≥ 15 and age older than14 years. The exclusion criteria were patients on anticoagulant treatment, pregnancy, condition of hypothermia <34°C, patients with the condition of acidosis pH <7.1, patients with a history of diabetes, heart disease, liver cirrhosis or history of kidney failure and patients with peritonitis.

There were 25 patients eligible for the study, and this number was in accordance with the sample size calculation. Initial fibrinogen value was obtain from blood examination as soon as the patients were admitted, blood sampling performed in conjunction with the patient's routine blood tests in accordance with the procedures in the hospital ER. Clinical, laboratory and radiologic examinations were recorded. The ISS values were calculated and recorded.

Coagulopathy was determined based on abnormal prothrombin time (PT) or abnormal partial

thromboplastin time (aPTT). Any rise in one of the coagulopathy indicators, is considered as coagulopathy, and entered into the respective coagulopathy group. Patients were followed until discharged from the hospital. In-hospital mortality was recorded when occurred. Data were analyzed by non-parametric statistical tests with chi square test. Statistical difference was set as significant at p < 0.05. This study was approved by the hospital's ethical committee.

RESULTS

There were 25 patients eligible for the study. The majority of patients were suffering from head trauma. Table 1 shows the patients' characteristics, causes of trauma, initial fibrinogen level, state of coagulopathy, and survivorships.

Table 1: Patients demography.

Characteristics	Subjects (n = 25)						
Gender							
Male	20 (80%)						
Female	5 (20%)						
Major trauma including							
Head trauma	16 (64%)						
Chest trauma	3 (12%)						
Abdominal trauma	3 (12%)						
Pelvic trauma	1 (4%)						
Extremity trauma	2 (8%)						
Coagulopathy							
Coagulopathy	8 (32%)						
Without coagulopathy	17 (68%)						
Fibrinogen							
High (≥ 200 mg/l)	18 (72%)						
Low (< 200 mg/l)	7 (28%)						
Mortality							
Not survive	7 (28%)						
Survive	18 (72%)						

Table 2 shows that there was a significant association between initial fibrinogen level with coagulopathy (p-value = 0.043).

Table 2: Association between initial fibrinogen level with coagulopathy

Coagulopathy						
Fibrinogen		Coagulopathy	Without Coagulopathy	Total		
High (≥ 200)	N	4	14	18		
	%	22.2	77.8	100		
Low (< 200)	N	4	3	7		
	%	57.1	42.9	100		
Total	N	8	17	25		
	%	32	68	100		

P-value = 0.043

Based on Table 3, we can see that there was no relationship between initial fibrinogen level with mortality (p-value = 0.341).

Table 3: Association between initial fibrinogen level with mortality.

		Mortality			
Fibrinogen		Survive	Not Survive	Total	
High (≥ 200)	N	12	6	18	
	%	66.7	33.3	100	
Low (< 200)	N	6	1	7	
	%	85.7	14.3	100	
Total	N	18	7	25	
	%	72	28	100	

P-value = 0.341

DISCUSSION

From the data we found that most of patients were male, and most of them were with head trauma. This is in accordance with various reports that trauma victims is the majority - with head trauma as the mechanism most commonly happens, either with intracranial hemorrhage or fracture of the skull bone.20 Table 2 shows that there was a significant association (p = 0.043) between initial fibrinogen level and coagulopathy in multiple trauma patients. This is in accordance with the theory of coagulopathy on trauma which stated that when trauma occurred, tissue damage and hypoperfusion increases the trombomodulin that finally activates fibrinolysis system in unison with the occurrence of acute traumatic coagulopathy (ATC).²¹ This confirms the hypothesis that there is a significant association between initial fibrinogen and coagulopathy in patients with multiple trauma. Another theory states that plasma fibrinogen reached the lowest value earlier than other coagulation factors, therefore it supports the use of initial fibrinogen as a marker for the occurrence of traumatic coagulopathy, in addition to the already commonly used of PT and aPTT.

Statistics has shown that there was no significant association between the values of fibrinogen with mortality. In this study, history of resuscitation therapy has not been taken into account either outside or inside the hospital, whereas in a study by Rourke said that the value of fibrinogen does not return to normal after resuscitation, so it is possible that patients that had been resuscitated and not resuscitated have the same fibrinogen level but patients are likely to have a different survival chance due to the presence or absence of resuscitation. Therefore, other variables may play a role that could affect the relationship between fibrinogen and mortality.⁹

There was no significant association between initial fibrinogen level with the occurrence of mortality in this study, it may be because the study subjects were mostly

patients with a diagnosis of head trauma, so although head trauma could be severe, tissue damage however were not so extensive and blood loss was not significant enough to provoke a substantial fibrinolysis. With these explanations, further research may be needed to focus on the role of fibrinogen in head trauma.

In conclusion, initial fibrinogen level is significantly associated with coagulopathy but it cannot predict mortality in patients with multiple trauma. Further study is needed in order to assess the benefit of these results on the management of multiple trauma patients.

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