Albumin and fibrinogen levels' relation with orthopedics traumatic patients' outcome after massive transfusion

Mohammadreza Bazavar,
Ali Tabrizi, Naghi Abedini[1],
Asghar Elmi

Departments of Orthopedics
Surgery, [1]Anesthesia, Shohada
Educational Hospital, Tabriz
University of Medical Sciences,
Tabriz, Iran

ABSTRACT

Background: Severe bleeding is common during limb trauma. It can lead to hemorrhagic shock required to massive blood transfusion. Coagulopathy is the major complication of massive transfusion-induced increased mortality rate. Aim of this study was evaluation of fibrinogen and albumin levels association with orthopedics traumatic patients' outcome who received massive transfusion. **Methods:** In a cross sectional study, 23 patients with severe limb injury admitted to orthopedic emergency department were studied. All the patients received massive transfusion, that is, >10 unit blood. Albumin and fibrinogen levels are measured at admission and 24 h later, and compared according to final outcome. **Results:** Twenty-three traumatic patients with severe limb injuries were studied, out of which ten (43.2%) died and 13 (56.8%) were alive. There was significant difference between patients outcome in fibrinogen level after 24 h, but no difference was observed in albumin levels. Based on regression model, fibrinogen after 24 h had a significant role in determining the final outcome in traumatic patients who received massive transfusion (odds ratio 0.48, 95% confidence interval 0.15–0.92, $P = 0.02$). **Conclusions:** According to our results, fibrinogen level is the most important factor in determination of orthopedics traumatic patients when received massive transfusion. However, serum albumin does not play any role in patients' outcome.

Key words: *Albumin, coagulopathy, fibrinogen, massive blood transfusion*

Address for correspondence:
Dr. Mohmmadreza Bazavar,
Golshahr Avenue, Shohada
Educational Hospital Orthopedics
Surgery Center of Tabriz University
of Medical Science, Tabriz, Iran.
E-mail: dr.bazavar@gmail.com

INTRODUCTION

Trauma is the most cause of death in young age.[1] Hemorrhagic shock and exsanguination are responsible for a large number of these deaths, accounting for more than 80% of deaths in the operating room and nearly 50% of deaths in the first 24 h after injury.[2,3] According to available reports less than 5% of civilian trauma patient admissions will require a massive transfusion.[1,2] Coagulation defects related to severe trauma is a major complication.[3,4] Factors can be related to coagulation including major blood loss with consumption of clotting factors and platelets and dilutional coagulopathy after administration of crystalloids and colloids to maintain blood pressure. Fibrinogen is also a positive acute-phase protein whose level reportedly increases in inflammatory disease, infection, or tissue damage.[4] The trauma coagulopathy is associated with patients mortality.[5] Also during severe trauma, the most typical changes included a depressed muscle protein synthesis, an increased synthesis of total liver proteins and positive acute-phase proteins, and decreased synthesis of negative acute-phase proteins like albumin.[6] Aim of this study was evaluation of fibrinogen and albumin levels and their association with orthopedics traumatic patients' outcome who received massive transfusion.

METHODS

A cross sectional study was conducted at Trauma Center of Northwestern Iran (Shohada Hospital affiliated to Tabriz University of Medical Sciences) from 2009 to 2012. In this study, 23 patients with severe crushed limb injury who referred to our trauma center were studied. Those meeting the inclusion criteria were invited to participate and provided informed consent. Inclusion criteria were younger patients (under 60 years), injury severity scores more than 15, patients

Access this article online	
Quick Response Code:	**Website:** www.saudija.org
	DOI: 10.4103/1658-354X.125915

needed to be taken at intensive care unit, and received massive blood transfusion (defined as ≥10 units of packed red blood cells). The excluded patients were head trauma or spinal cord injuries or trunk trauma, smoking positive, metabolic or systemic disease, and history of pervious blood transfusion.

In all patients, the initial resuscitation was performed as soon as admitted to the emergency room. Blood samples were obtained at admission and after 24 h. Part of the serum was frozen and stored at –70°C for determination of fibrinogen and albumin by an immunoturbidometric assay. Electrolytes, hemoglobin, and hematocrit levels were measured on admission. For early restoration, normal saline or ringer was used, clinical events were recorded thereafter until death or hospital discharge.

Statistical analysis

Descriptive statistical method (frequency, percentage), mean ± standard deviation, and Statistical Packages for Social Sciences (SPSS), version 17 for Windows software were used to statistically analyze the data. Comparison of variable changes between two patients' outcome was used by independent *t*-test. Regression model was used to determine the role of variables on patients' outcome. In this study, $P < 0.05$ was regarded meaningful.

RESULTS

Twenty-three traumatic patients with severe limb injuries, including two women and 21 men (between 20 and 60 year) with mean age of 36.3 years completed this study. All patients had received more than 10 units of blood. Out of 23, 10 traumatic patients (43.2%) died and 13 patients (56.8%) were alive. Laboratory findings are shown in Table 1. There was significant a difference between two groups of patients' outcome according to fibrinogen plasma levels after 24 h, but there was no difference in albumin levels. Based on regression model, fibrinogen after 24 h had a significant role in determining the final outcome in traumatic patients who received massive transfusion (odds ratio (OR) = 0.48, 95% confidence interval (CI) = 0.15–0.92, $P = 0.02$). The average time of death was 56.5 ± 10.8, 24 h after hospitalization. There was no difference in other laboratory parameters.

DISCUSSION

Massive bleeding leads to loss, consumption, and dilution (by volume therapy) of coagulation factors.[7] The first factor critically decreased is fibrinogen.[8] The aim of any hemostatic therapy is to minimize blood loss and transfusion requirements. Increased transfusion need is known to

Table 1: Comparison of laboratory and clinical findings between two groups of traumatic patients (dead and alive)

	Dead patients (n=10)	Alive patients (n=13)	*P-value*
Age	38.4±11.5	37.6±10.7	0.6
ISS score	27.5±1.4	26.8±1.2	0.09
Hemoglobin (g/dl)	9.1±1.4	9.2±0.8	0.1
Fibrinogen at admission (mg/dl)	46.5±12.4	48.4±11.4	0.2
Fibrinogen after 24h (mg/dl)	124.5±18.9	85.6±14.5	<0.001
Albumin at admission (g/dl)	33.5±1.4	34.6±2.1	0.2
Albumin after 24h (g/dl)	31.7±2.1	32.4±1.8	0.2

ISS: Injury severity score

increase morbidity and mortality in traumatic patients.[8,9] In patients with similar injury severity scores (ISS), mortality is virtually quadrupled as a result of coagulopathy.[8] Massive bleeding or massive transfusion in multiple trauma patients is necessarily associated with impaired coagulation.[8,9] In the study by Stinger *et al.*,[10] fibrinogen levels was significantly increased in patients who received massive transfusion. Also, fibrinogen levels was correlated to mortality.[10] Georg *et al.*,[11] expressed that higher plasma fibrinogen might be associated with higher rates of survival.[11] According to recent studies, it has been shown that at a fibrinogen level of 150-200 mg/dl, there is already an increased tendency of peri- and postoperative bleeding.[11] A high fibrinogen count exerts a protective effect with regard to the amount of blood loss. In multiple trauma patients, priority must be given to early and effective correction of impaired fibrin polymerization by administering fibrinogen concentrate.[12] The critical threshold was suspected at a level below 100 mg/dl as shown by Hiippala *et al.*[13] Myburgh[14] showed that no evidence of any survival benefit associated with resuscitation with hyperoncotic albumin. In our study, like previous studies fibrinogen levels are important role in determining the final outcome for trauma patients. Although in medical literature, various factors such as severity of injury, age, and hemoglobin level has shown to be effective in patient mortality.[15] However, in our study, both patients groups were similar and provided high reliability. Unlike studies[6] that have been conducted in patients with head trauma, albumin concentration did not play a role for prediction in patients with limb injuries after receiving massive transfusion.

CONCLUSIONS

According to our results, fibrinogen level is the most important factor in determination of orthopedics traumatic patients when received massive transfusion. However, serum albumin does not any play role in patients' outcome.

REFERENCES

1. Nuneza TC, Cotton BA. Transfusion therapy in hemorrhagic shock. Curr Opin Crit Care 2009;15:536-41.
2. Sauaia A, Moore FA, Moore EE, Moser KS, Brennan R, Read RA, *et al*. Epidemiology of trauma deaths: A reassessment. J Trauma 1995;38:185-93.
3. Kauvar DS, Lefering R, Wade CE. Impact of hemorrhage on trauma outcome: An overview of epidemiology, clinical presentations, and therapeutic considerations. J Trauma 2006; 60(6 Suppl):S3-11.
4. Kushner I. The acute phase response: An overview. Methods Enzymol 1988;163:373-83.
5. Fries D, Martini WZ. Role of fibrinogen in trauma-induced coagulopathy. Br J Anaesth 2010;105:116-21.
6. Mansoor O, Cayol M, Gachon P, Boirie Y, Schoeffler P, Obled C, *et al*. Albumin and fibrinogen syntheses increase while muscle protein synthesis decreases in head-injured patients. Am J Physiol Endocrinol Metab 1997;273:E898-902.
7. Rangarajan K, Subramanian A, Pandey RM. Determinants of mortality in trauma patients following massive blood transfusion. J Emerg Trauma Shock 2011;4:58-63.
8. Brohi K, Singh J, Heron M, Coats T. Acute traumatic coagulopathy. J Trauma 2003;54:1127-30.
9. MacLeod JB, Lynn M, McKenney MG, Cohn SM, Murtha M. Early coagulopathy predicts mortality in trauma. J Trauma 2003;55:39-44.
10. Stinger HK, Spinella PC, Perkins JG, Grathwohl KW, Salinas J, Martini WZ, *et al*. The Ratio of Fibrinogen to Red Cells Transfused Affects Survival in Casualties Receiving Massive Transfusions at an Army Combat Support Hospital. J Trauma 2008;64:S79-85.
11. Weiss G, Lison S, Glaser M, Herberger S, Johanning K, Strasser T, *et al*. Observational study of fibrinogen concentrate in massive hemorrhage: Evaluation of a multicenter register. Blood Coagul Fibrinolysis 2011;22:727-34.
12. Meißnera A, Schlenkeb P. Massive Bleeding and Massive Transfusion. Transfus Med Hemother 2012;39:73-84.
13. Hiippala ST, Myllyla GJ, Vahtera EM. Hemostatic factors and replacement of major blood loss with plasma-poor red cell concentrates. Anesth Analg 1995;81:360-5.
14. Myburgh JA. The evidence for small-volume resuscitation with hyperoncotic albumin in critical illness. Crit Care 2008;12:143.
15. Maegelea M, Brockamp T, Nienaberc U, Probst C, Schoechl H, Gorlinger K, *et al*. Predictive models and algorithms for the need of transfusion including massive transfusion in severely injured patients. Transfus Med Hemother 2012; 39:85-97.