

Accuracy of emergency transfusion score in prediction need for blood transfusion among multiple trauma patients: A cross-sectional study from Iran

Hossein Alimohammadi, Yalda Kianian¹, Farahnaz Bidari Zerepoosh, Hojjat Derakhshanfar, Mostafa Alavi-Moghadam, Hamid Reza Hatamabadi, Seyed-Mostafa Hosseini-Zijoud²



ABSTRACT

Objective: Prediction of blood transfusion requirement in trauma patients is a dilemma in most trauma centers. The aim of the current study was assessing the accuracy of emergency transfusion score (ETS) in detecting patients' need for blood transfusion in ED.

Methods: In this cross-sectional study, all multiple trauma patients referred to the emergency department (ED) of Imam Hossein Hospital, Tehran, Iran, from March to August 2014, were enrolled. ETS parameters including low blood pressure, free fluid on ultrasound, clinical instability of the pelvic ring, age, admission from the scene, and trauma mechanism were recorded for all patients. ETS was calculated for all patients and compared with patients who received blood transfusion to estimate the accuracy of ETS.

Results: Of the 793 patients included in the study, 54 (6%) received blood in the ED. The mean of ETS for all patients was 3.91 ± 0.93 . There was a significant correlation between ETS more than 3 and amount of blood transfusion ($P = 0.004$). The sensitivity, specificity, positive, and negative predictive value of ETS was 98.1%, 13.8%, 7.7%, and 99%, respectively.

Conclusion: ETS may be considered as a useful instrument for prioritizing multiple trauma patients' need for blood transfusion in Iran. Therefore, by implementing this score, it may be prevented from inappropriate requests for blood transfusion.

Key Words: Blood transfusion, emergency, multiple trauma, scoring system

Departments of Emergency Medicine and ¹Emergency Physician, Shahid Beheshti University of Medical Sciences, Varamin, ²Nephrology and Urology Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran

Address for correspondence:

Dr. Farahnaz Bidari Zerepoosh, Department of Emergency Medicine, Imam Hossein Hospital, Madani Street, Tehran, Iran.
E-mail: farahnazbidari@yahoo.com

INTRODUCTION

Nowadays, predicting blood transfusion requirement is a serious challenge in the management of trauma patients referring to the emergency department (ED). Despite improvements in saving trauma patients, half of them expire because of uncontrolled hemorrhagic shock within the first 48 hours after trauma.^[1-4] Indeed, one of the initial measurements for resuscitation of such patients is replacing the loss of blood volume with blood products and components. Correct identification of patients with high priority for blood transfusion and also estimation of blood volume for transfusion are conducting usually based on the symptoms and clinical examination. Besides,

providing each blood unit imposes some expenses on the health-care system, these products must be transfused in a limited time frame. Therefore, correct prediction and

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identification of patients' need for blood transfusion should be exactly considered in this regard.

Recently, several predictive systems are presented for prediction of blood transfusion requirement in severely injured patients including assessment of blood consumption (ABC) score, Trauma-Associated Severe Hemorrhage (TASH), Vandromme Score, Prince of Wales Hospital/Rainer Score, wade model, baker model, moore model, and predictive value of individual transfusion triggers.^[5-15]

Among these predictive instruments, emergency transfusion score (ETS), that introduced by Kuhne *et al.*, is considered as a safe and highly sensitive tool which can detect severely injured patients in need for blood products. The ETS includes the parameters low blood pressure, free fluid on ultrasound, clinical instability of the pelvic ring, age, admission from the scene, and trauma mechanism.^[7]

In Iran, there is no guideline or scoring system regarding blood transfusion requirement for trauma patients referred to ED. Therefore, inappropriate and excessive requests for blood products often lead to impose more expenses on the health-care system. Thus, the aim of current study was assessing the accuracy of ETS in identification of multiple trauma patients' need for blood transfusion in ED, in comparison to patients who received blood transfusion.

METHODS

Study design

This is a cross-sectional study and data are collected prospectively.

Setting

This study was conducted at the ED of Imam Hossein Hospital, Tehran, Iran, from March to August 2014. Imam Hossein Hospital is a 570-bed educational, governmental, and general medical/surgical referral hospital with 59,000 m² area located in Tehran (Capital of Iran); it has been founded in March 1985. The ED of Imam Hossein Hospital is one of the most active and crowded wards which admit about 6000 cases per month. In this department, emergency medicine assistants (EMA) were trained for 3-year period and annually about 50 emergency specialists are graduated. It is worth noting that training of EMA is initiated in 2000 in Iran and this hospital is one of the pioneer hospitals.

Ethical consideration

The study followed the principles of the Declaration of Helsinki and was approved by the Medical Ethics Review Board of Shahid Beheshti University of Medical

Sciences. All information about the patients was fully kept confidential; also, all information will be released as a group without participants' name. Study participants did not incur any costs and the study protocol did not have any harm to participants. The written informed consent was obtained from volunteers, and details and purpose of the study were disclosed.

Subjects

In this study, all consecutive trauma patients (>20 years old) with suspected or definite severe injuries admitted to the ED between March and August 2014 were included. Admission to the ED because of multiple trauma followed predefined criteria including vital signs, injury pattern, and mechanism of accident such as falling from height and car or motorcycles crashes.^[16] Patients were excluded if they had not completed study and refused to participate.

Clinical examination and emergency transfusion score parameters

Every patient underwent a standardized diagnostic procedure of clinical, radiological, and laboratory tests. The patient's clinical examination followed advanced trauma life support recommendation. Based on these data, transfusion requirement may be ordered for patients, and finally, patients who received blood products were recorded in medical file.

For stabilization of blood pressure and maintenance of a baseline, hemoglobin at or >8 g dL⁻¹ for patients under 60 years of age and of 10 g dL⁻¹ or more for patients 60 years or older was aimed.

Then, ETS parameters including low blood pressure, free fluid on ultrasound, clinical instability of the pelvic ring, age, admission from the scene, and trauma mechanism were recorded for all patients. The ETS for each patient was calculated according to Table 1.

Finally, the association between ETS and receiving blood transfusion (which recorded in medical file) was calculated and presented as accuracy, sensitivity,

Table 1: Parameters of emergency transfusion score with possible predictive value on blood transfusion

Parameters	Score
Systolic blood pressure (mmHg)	
>90	1.5
<90	2.5
Car crashes, motorcycle crashes with car, car-pedestrian accidents, motorcycle-pedestrian accidents, overturning of cars, and motorcycles	2
Falling from heights more than 3 m	1
Free fluid in abdomen or pelvic	2
Fracture or instability of pelvic	1.5
Patient's transportation by ambulance	1
Age between 20 and 60 years	0.5
Age >60 years	1.5

specificity, positive predictive value, and negative predictive value in the cutoff equal to 3.

Statistical analysis

Statistical analyses were done by using the program SPSS version 20.0 (SPSS, Inc., Chicago, IL, USA) and Univariate analysis. Multiple logistic regression statistical model was also applied to assess the power of ETS in the prediction of patients' need for blood transfusion. $P < 0.05$ was considered statistically significant.

RESULTS

Seven hundred and ninety-three multiple trauma patients with the mean age of 36.77 ± 14.61 (20-91) years admitted between March and August 2014 were eligible for the study. A total of 547 (69%) patients were male. The mean of Glasgow Coma Scale was 11 ± 4 . Data are presented in Table 2.

For 280 patients, blood transfusion is ordered but 54 patients (6%) received blood transfusion in ED. Hemorrhagic shock was recorded in 26 (3.2%) patients.

The mean ETS score of patients was 3.91 ± 0.93 (0.5–8.5). There was a significant correlation between $ETS \geq 3$ and need blood transfusion ($P = 0.004$; 95% confidence interval: 0.001–0.012). The sensitivity, specificity, positive and negative predictive value, and negative likelihood ratio of ETS in cut point of 3 for prediction of need for blood transfusion were as 98.1%, 13.8%, 7.7%, 99%, and 9.2%, respectively. Figure 1 shows the ROC curve analysis. The area under the curve for ETS in cut point of 3 was 0.84 (95% confidence interval: 0.77–0.90), ($P = 0.0001$).

DISCUSSION

The current study demonstrated that ETS in ED has a high sensitivity in identification of patients' need for blood transfusion in Iran, which is similar to previous study conducted by Kuhne *et al.*^[7] The findings of a study by Ruchholtz *et al.* on 1103 trauma patients revealed a direct correlation between ETS and blood transfusion requirement.^[12] In another study conducted by Clarke *et al.*, 378 trauma patients (105 received blood transfusion) were assessed regarding blood transfusion requirement in terms of shock criteria including hematocrit $< 30\%$, blood loss more than 0.5 liter, gastrointestinal bleeding, or emergency surgery. Based on these criteria, 55% of patients did not require blood transfusion.^[17] In a study by Cotton *et al.*, ABC score was evaluated for detecting need blood transfusion in 3 trauma centers. In this score, trauma mechanism, low blood pressure, heart rate over 120 beats/min, and free fluid on ultrasound were considered as risk factors for blood transfusion requirement. Findings showed that

Table 2: Univariate analysis of 793 multiple trauma patients

Parameters	Emergency transfusion score		P
	<3 (%)	≥ 3 (%)	
Age (year)			
> 60	98 (13.7)	619 (86.3)	0.031
≤ 60	5 (6.6)	71 (93.4)	
Falling (meter)			
< 3	94 (12.7)	649 (87.3)	0.188
≥ 3	9 (18)	41 (82)	
Traffic accident			
Yes	96 (12.4)	676 (87.6)	0.013
No	7 (33.3)	14 (66.7)	
Systolic blood pressure (mmHg)			
< 90	0	14 (100)	0.140
90-120	103 (13.2)	676 (86.8)	
Free fluid			
No	103 (13.5)	659 (86.5)	0.012
Yes	0	31 (100)	
Pelvic ring			
Stable	103 (13.2)	678 (86.8)	0.186
Unstable	0	12 (100)	

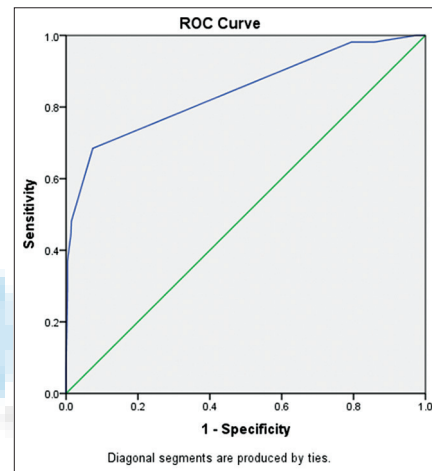


Figure 1: Receiver operating characteristic plot for emergency transfusion score

ABC score has sensitivity about 75%–90% and specificity 67%–88%.^[18]

In another investigation, blood transfusion requirement in trauma patients was assessed according to some predictive factors such as lactate more than 5 mM, heart rate over 105 beats/min, international normalized ratio (INR) more than 1.5, hemoglobin ≤ 11 g/dl, and systolic blood pressure < 110 mmHg. Findings showed that sensitivity and specificity of this method in prediction of patients' need for blood transfusion were 53% and 98%, respectively^[13] which are higher than findings of the present study. In Chico-Fernández *et al.*'s study, a comparison was performed among some predictive instruments of blood transfusion requirement including TASH, ABC, and ETS. It was demonstrated that ETS has more sensitivity than other scales.^[6]

Regarding the current finding and previous investigations, it can be stated that ETS is a sensitive and reliable instrument for prediction of patients' need for blood transfusion in ED.

Lack of cooperation from patients to participate in current investigation was the major limitation of this study. Furthermore, in the current study, we were not accessible to the INR/PT/PTT findings. The lack of large sample size of population could be mentioned as another potential limitation.

CONCLUSION

Based on the present findings, ETS can be considered as a useful instrument for prioritizing multiple trauma patients' need for blood transfusion. Therefore, by implementing this score, it may be prevented from inappropriate requests for blood transfusion and avoided high costs imposed on health-care system.

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Conflicts of interest

There are no conflicts of interest.

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