Comparison between "fibrinogen and base deficit level" and modified trauma bleeding severity score in predicting the need for massive blood transfusion in trauma patients

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Background
Severe trauma is a global public health issue. Approximately one in 10 mortalities is caused by traumatic injury, resulting in the annual global death of more than 5.8 million individuals. Massive hemorrhage is a major cause of death due to traumatic injury, and early administration of blood products with higher plasma and platelet ratio in trauma resuscitation is associated with decreased mortality. Fibrinogen (Fbg) and base-deficit (BD) levels might also be useful indicators for the need for massive transfusion. However, Modified Trauma-Bleeding Severity Score (TBSS) requires the assessment of several factors, such as vital signs, Focused Assessment with Sonography for Trauma, and pelvic and/or femoral fracture, making them slightly complicated. Thus, we aim to improve the outcome of trauma patients in need of massive blood transfusion at the emergency departments.

Patients and methods
This was a cross-sectional analytic study performed on two groups, with each group involving 35 patients. Fbg and BD levels were assessed in the first group, whereas the Modified TBSS of patients who attended to the Emergency Department of Suez Canal University Hospital was assessed in the second group.

Results
During clinical evaluation, respiratory rate was found to be statistically significant between Modified TBSS and Fbg (P=0.04). Modified TBSS (80%) was more sensitive than Fbg (71.5%) and BD (73.3%) ($P<0.05$). Furthermore, Modified TBSS (65%) was more specific than Fbg (60%) and BD (63%).

Conclusion
Focused Assessment with Sonography for Trauma and Modified TBSS are more sensitive and specific than BD and Fbg in predicting the need for massive transfusion.

Keywords:
base deficit, fibrinogen, massive transfusion, trauma care

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Introduction

Severe trauma is a global public health issue. Approximately one in 10 mortalities is caused by traumatic injury, resulting in the annual global death of more than 5.8 million individuals [1,2].

According to the WHO, an estimated 1.35 million children and young adults aged between 5 and 29 years die each year because of road-traffic crashes. Without action, road-traffic crashes are predicted to increase to become the eighth leading cause of death by 2030. Egypt loses ~12 000 lives because of road-traffic crashes every year [3].

Massive hemorrhage is a major cause of death due to traumatic injury [4,5]. Scoring systems predicting the need for massive transfusion (MT) are generally easy to use and inexpensive [6].

MT is defined as either of the following: when total blood volume is replaced within 24 h, when 50% of the total blood volume is replaced within 3 h, or when a rapid bleeding rate is documented or observed [7]. Rapid bleeding rate in adults can be defined as more than 4 U of red blood cells transfused within 4 h with active major bleeding or more than 150 ml/min of blood loss [8,9].

Traumatic Bleeding Severity Score (TBSS) accurately predicts the need for MT, although it takes time to determine because systolic blood pressure after a 1000-ml crystalloid infusion is used. Therefore, the Modified

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TBSS [age, sonography, pelvic fracture, serum lactate, and systolic blood pressure (SBP) on arrival] more accurately predicts the need for MT [10].

Fibrinogen (Fbg) and base-deficit (BD) levels might also be useful indicators for the need for MT. However, the Modified TBSS requires the assessment of several factors, such as vital signs, Focused Assessment with Sonography for Trauma (FAST), and pelvic fracture and/or femoral fracture, making them slightly complicated [11].

Thus, this study aims to compare Modified TBSS with Fbg and BD levels as a point-of-care test in the prediction of massive blood transfusion (MBT) to improve outcomes in trauma patients.

Patients and methods

This was a cross-sectional analytic study performed on two groups, with each group involving 35 patients. Fbg and BD levels were assessed in the first group, whereas the Modified TBSS of patients who attended to the Emergency Department at Suez Canal University Hospital, Ismailia, Egypt was assessed in the second group.

Inclusion criteria

(1) Age more than 18 years.
(2) Both sexes.
(3) All patients having injury-severity score (ISS) more than or equal to 16 trauma.

The patients who have any recent surgery due to trauma, undocumented blood transfusion transferred from outside of the hospital, and coagulopathy or Fbg deficiency were excluded from this study.

All participants were selected by convenience-sampling method, and then, each group was selected via simple random sampling: odd numbers for the Fbg and BD group and even numbers for the Modified TBSS group.

Comparison between the two groups was performed. The Fbg and BD levels were assessed in the first group, whereas the Modified TBSS was assessed in the other group.

The following are the objectives of the present study.

Primary objective

To compare between Fbg and BD levels and Modified TBSS in predicting the need for MBT in trauma patients.

Secondary objective

To study the triggers for initiating MT in trauma patients.

Research question

Is there a difference between using the point-of-care test (Fbg and BD levels) and Modified TBSS in predicting the need for MBT in improving the outcomes of trauma patients?

Research hypothesis

Null hypothesis

There is no difference between using the point-of-care test (Fbg and BD levels) and Modified TBSS in predicting the need for MBT.

Alternative hypothesis

There is a difference between using the point-of-care test (Fbg and BD levels) and Modified TBSS in predicting the need for MBT.

Sample method

All participants were selected using the convenience-sampling method, and then, each group was selected by simple random sampling: odd numbers were added in the Fbg and BD group, and even numbers were added in the Modified TBSS group.

Sample size

The sample size was calculated on the basis of the following formula [11]:

$$n = \left[\frac{Z_{\alpha/2}+Z_{\beta}}{P_1-P_2}\right]^2 (p_1q_1+p_2q_2).$$

where

n=sample size.

$Z_{\alpha/2}$=1.96 (the critical value that divides the central 95% of the Z distribution from the 5% in the tail).

Z_{β}=0.84 (the critical value that separates the lower 20% of the Z distribution from the upper 80%).

$p1$=the percentage of patients who underwent MT, depending on Fbg level=96% [12].

$p2$=the percentage of patients who underwent MT, depending on Modified TBSS=7.1% [12].

q=1-P.

(1) The sample size will be 31 patients per group.

(2) The expected nonresponse rate is considered 10% based on similar studies. Each group comprises 35 patients.

Clinical methods

The following procedures were performed on each patient:

(1) Clinical history
Questionnaire: a thorough medical history was obtained from all patients and their relatives covering the patient's file number; patient's personal data, including age and sex; patient's trauma data, including time, mechanism of injury, anatomical site, associated injuries, clinical presentation, and event.
(2) Complete clinical examination includes vital signs: pulse; blood pressure; respiratory rate; initial assessment of the airway and cervical spine control, breathing, circulation, dysfunction of the central nervous system, and exposure; regional examination of the head and neck, chest, abdomen, extremities, and back; assessment of the condition of the patients as either stable or unstable, which determined the needed investigations and plan of management; assessment using FAST. MT is defined as follows:
  (a) Total blood volume is replaced within 24 h.
  (b) Fifty percent of the total blood volume is replaced within 3 h.
  (c) Rapid bleeding rate is documented or observed. Rapid bleeding rate in adults can be defined as more than 4 U of red blood cells transfused within 4 h with active major bleeding or more than 150 ml/min of blood loss.

The two groups were compared. The Fbg and BD levels were assessed in the first group, whereas the Modified TBSS was assessed in the other group.

The following are the parameters using the Modified TBSS:

(1) Age more than or equal to 60 years 6 points.
Less than 60 years 0 point.
(2) SBP on arrival more than or equal to 110 mmHg 0 point.
100–less than 110 mmHg 4 points.
90–less than 100 mmHg 8 points.
Less than 90 mmHg 12 points.
(3) FAST each region positive 3 points.
(4) Pelvic fracture type A 3 points.
Type B 6 points.
Type C 9 points.
(5) Lactate concentration on admission less than 2.5 mmol/l 0 points.
2.5– less than 5.0 mmol/l 4 points.
5– less than 7.5 mmol/l 8 points.
More than or equal to 7.5 mmol/l 12 points.
Cutoff point of this score is 14.
Data will be collected in a preorganized datasheet by the researcher from patients fulfilling the inclusion criteria.
Patients will be clinically assessed and managed as per the airway, breathing, and circulation protocol.
The following will be studied after stabilizing the patient.
(6) Investigations:
  (a) Laboratory investigations, such as complete blood count, blood typing and cross-matching, coagulation profile, serum electrolytes, and random blood sugar.
  (b) Normal values of serum lactate from 0.5 to 1 mmol/l, hyperlactemia (2–4 mmol/l), and lactic acidosis (typically <4–5 mmol/l) will be measured using the enzyme-linked immunosorbent assay technique.
  (c) Serum Fbg (normal range, 200–400 mg/dl) and BD (normal range, from −2 to +2) are measured using the enzyme-linked immunosorbent assay technique.
  (d) Radiographic investigations, including plain chest radiograph, pelvis radiograph, upper-extremity and lower-extremity radiograph, if needed, and FAST, computed tomography of the brain and pelvis, and others, if needed.
  (e) Outcomes at the emergency room: the patient was evaluated whether for admission to the ICU, to undergo surgical intervention, admission under observation, died at the emergency room, or transferred to a different institution.

Data management and statistical analysis

Data were collected and coded then entered as spreadsheets using Microsoft Excel for Windows Office 2013 (SPSS Inc., Chicago, IL, USA). Data analysis using the statical Package for the social sciences software program (SPSS Inc., Chicago, IL, USA), version 10 for analysis. Data were presented as tables and graphs; t test was used to compare quantitative data and expressed as mean and SD. χ^2 test was used to compare qualitative data and expressed as number and percent. P value less than 0.05 was considered statistically significant.

Ethical approval

This study was approved by the appropriate Research Ethics Committee (approval no. 3174, date 19–7–1017). Informed consent was obtained from all patients.

Results

This study was performed on two groups, with each group comprising 35 patients. Fbg and BD levels were assessed in the first group, whereas Modified TBSS was assessed in the second group. The study showed that the age distribution of the studied population ranged from 18 to 60 years, with the majority between 18 and 29 years (47.1%) (mean age, 33.08±12.7 years). The majority of the studied population was male patients (61.40%).

The study found that motor car accidents (MCAs) were responsible for the majority of trauma mechanisms (65.70%), followed by falls (30%) and assaults (~4.30%).

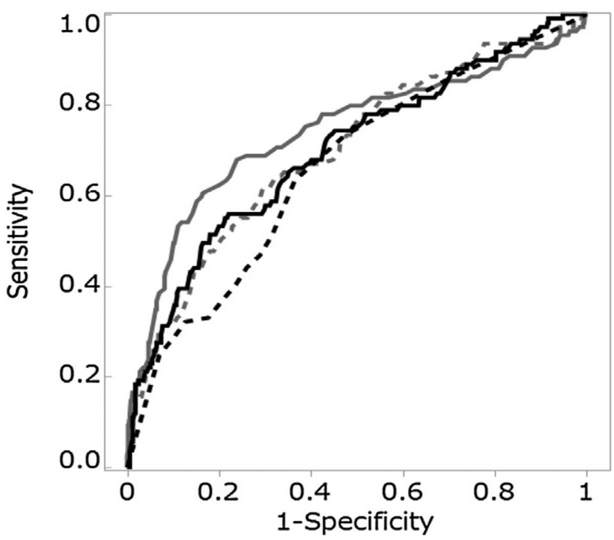
Additionally, the study revealed that the correlation between Modified TBSS and MBT was 71.4%, followed by Fbg (57.1%), although not statistically significant (P=0.1) (Table 1).

With respect to the predictors of MBT, this study showed that hemoglobin (HGB), ISS, Modified TBSS, and BD were statistically significant as predictors of MBT (P=0.003, P<0.05) compared with Fbg (P=0.03) (Table 2). Conversely, HGB, ISS, and BD were not statistically significant as predictors of MBT (P=0.3.2) (Table 3).

Figure 1 shows the receiver-operating curve (ROC) of sensitivity and specificity of ISS, Modified TBSS, BD, and Fbg.

Furthermore, this study shows that the ROC curve was statistically significant in Modified TBSS and BD

Figure 1



The receiver-operating curve of the sensitivity and specificity of injury-severity score, Modified Trauma-Bleeding Severity Score (TBSS), base deficit, and fibrinogen. Gray line >> ISS. Dotted gray line >> Modified TBSS. Black line >> base deficit. Dotted black line >> fibrinogen. ISS, injury-severity score.

Table 1 Comparison between Modified Trauma-Bleeding Severity Score and fibrinogen in relation to massive blood transfusion and nonmassive blood-transfusion groups

	Modified TBSS (*N*=35) [*n* (%)]	Fibrinogen (*N*=35) [*n* (%)]	*P* value
MBT (*N*=45)	25 (71.4)	20 (57.1)	0.1
Non-MBT (*N*=25)	10 (28.6)	15 (42.9)	

MBT, massive blood transfusion; Modified TBSS, Modified Trauma-Bleeding Severity Score; Non-MBT, nonmassive blood transfusion.

Table 2 Predictors of massive blood transfusion

	NMBT	MBT	*P* value
HGB	9.4±0.6	8.3±0.92	<0.05*
Fibrinogen	2.6±3.06	1.3±2	0.03*
ISS	18.8±2.5	22.5±3.11	<0.05*
Modified TBSS	4.7±6.07	12.4±11.6	0.003*
Base deficit	−5.8±2.6	−9.08±3.5	<0.05*

HGB, hemoglobin; ISS, injury-severity score; MBT, massive blood transfusion; NMBT, nonmassive blood transfusion; TBSS, Trauma-Bleeding Severity Score. **P* value was considered as significant when P<0.05.

Table 3 Predictors of massive blood transfusion in relation to Modified Trauma-Bleeding Severity Score and fibrinogen

	Modified TBSS	Fibrinogen	*P* value
HGB	8.6±0.81	8.8±1.15	0.3
Fibrinogen	–	3.6±2.4	<0.05*
ISS	20.7±2.9	21.6±3.7	0.2
Modified TBSS	19.3±6.1	–	<0.05*
Base deficit	−7.4±3.6	−8.4±3.4	0.2

HGB, hemoglobin; ISS, injury-severity score; TBSS, Trauma-Bleeding Severity Score.

Table 4 Receiver-operating curve of the sensitivity and specificity in the studied population

	Area under the curve	Cutoff point	Sensitivity (%)	Specificity (%)	*P* value	95% confidence interval
Fibrinogen	0.758	1.05	71.5	60	<0.05*	0.235–0.521
ISS	0.833	17	91.1	72	0.009	0.717–.928
Modified TBSS	0.819	13	80	65	<0.05*	0.566–0.811
Base deficit	0.772	−8	73.3	63	<0.05*	0.114–0.327

ISS, injury-severity score; TBSS, Trauma-Bleeding Severity Score. **P* value was considered as significant when $P<0.05$.

($P<0.05$), with Modified TBSS being more sensitive (80%) than Fbg (71.5%) and BD (73.3%). Additionally, Modified TBSS was more specific (65%) than Fbg (60%) and BD (63%) (Table 4).

With respect to the outcomes of the studied population in the MBT and nonmassive blood-transfusion groups, our study revealed that the majority of the studied population in the MBT group underwent surgical intervention (42.2%), followed by ICU admission (28.9%), whereas the majority of the studied patients in the nonmassive blood-transfusion group had been admitted under observation (84%), followed by ICU admission (12%) (Table 5). Conversely, the majority of the studied population in the Modified TBSS group was admitted under observation (34.3%), followed by undergoing surgical intervention (31.4%), whereas the majority of the studied population in the Fbg group was admitted under observation (40%), followed by undergoing surgical intervention (25.7%) (Table 6).

Table 5 Outcome of the studied population in the massive blood-transfusion and nonmassive blood-transfusion groups

	MBT [*n* (%)]	Non-MBT [*n* (%)]	*P* value
Inpatient	5 (11)	21 (84)	<0.05*
ICU	13 (28.9)	3 (12)	
Surgery	19 (42.2)	1 (4)	
Died	8 (17.8)	0	

MBT, massive blood transfusion; Non-MBT, nonmassive blood transfusion. **P* value was considered as significant when $P<0.05$.

Table 6 Outcome of the studied population in the modified Trauma-Bleeding Severity Score and fibrinogen groups

	Modified TBSS [*n* (%)]	Fibrinogen [*n* (%)]	*P* value
Inpatient	12 (34.3)	14 (40)	0.6
ICU	8 (22.9)	8 (22.9)	
Surgery	11 (31.4)	9 (25.7)	
Died	4 (11.4)	4 (11.4)	

TBSS, Trauma-Bleeding Severity Score.

Discussion

Convenient, prompt, and accurate determination of the need for MT is essential for the early activation of an MT protocol, and several appropriate triggers for MT protocol initiation have been developed, such as scoring systems [8] and rotational thromboelastography [9].

A cross-sectional analytic study was performed on two groups of patients fulfilling the inclusion and exclusion criteria, each group included 35 patients, one group to assess the Modified TBSS and the other to assess the Fbg and BD levels for the prediction of MBT.

Thus, this study aims to test the accuracy of Modified TBSS by comparing the Fbg and BD levels as the point-of-care test in predicting for MBT to improve the outcomes in trauma patients.

This study showed that the age distribution among the studied population ranged from 18 to 60 years, with the majority between 18 and 29 years (47.1%) (mean age, 33.08±12.7 years).

The results of this study were consistent with that of the study by Peng and colleagues in which age distribution among the studied patients ranged from 18 to 65 years, with a mean age of 40.5 years, of which the majority was between 18 and 34 years (33%).

This study showed that no statistically significant difference was observed (P=0.3) in terms of age between the MT and non-MT groups, with a mean age of 32.06±12.5 and 34.9±13.3 years, respectively.

The results of our study were similar to the results of a study conducted by Krumrei *et al.* [13], in which the median age of the MT group was 28 years, whereas that of the non-MT group was 38 years; no statistically significant difference between both groups in terms of age was observed (P=0.34).

This study showed that no statistically significant difference was noted in terms of age between the Modified TBSS and Fbg groups, with a mean age of 34.5±13.4 and 31.6±12.07 years, respectively.

In this study, the majority of the studied population was male patients (61.40%).

This result was consistent with the results of a study by Rau *et al.* [14], in which the majority of the polytrauma patients were male patients (69.1%).

This study showed that the majority of the patients in the non-MT group was male patients (56%), with female patients comprising 44% of the total number, whereas the majority of the patients in the MT group was male patients (64.4%), with female patients comprising ~35.60%, with no statistically significant difference (P=0.3).

These results were consistent with that of a study by Malone *et al.* [15], in which the majority of the patients in the non-MT and MT groups were male patients (69 and 71%, respectively), with no statistically significant difference between both groups regarding sex (P=0.245).

This study showed that the majority of patients in the Fbg group was male patients (65.70%), with 34.30% female patients, whereas the majority of the Modified TBSS group was male patients (57.10%), with ~42.90% female patients, showing no statistically significant difference (P=0.3).

With respect to the mechanism of trauma, this study showed that MCAs were responsible for the majority of trauma in the studied-patient population (65.70%), followed by falls (30%) and assaults (~4.30%).

These results were consistent with the results of a study by Domingues *et al.* [16], in which MCAs were responsible for 44.1% of patients with trauma, followed by falls (30.3%) and assaults (18.0%).

This study showed that the majority of the patients in the MT and non-MT groups had MCAs (62.2 and 72%, respectively), with no statistically significant difference (P=0.7).

This study showed that the clinical evaluation of the patients in the MT group was found to be statistically significant (P<0.05) compared with the non-MT group in terms of airway (Glasgow coma scale <8 was 44.4 vs. 8%), breathing (assisted ventilation 77.8 vs. 44%), circulation [SBP <90 mmHg was 64.4 vs. 16% and heart rate (HR) >100/min was 95.6 vs. 72%], active bleeding was 31.1 versus 0%, and positive FAST was 91.1 versus 68%, although it was not statistically significant in terms of respiratory rate, and pelvis and/or femoral fracture.

These results were consistent with the results of a study by Takehiro *et al.* [12], in which the median SBP in the non-MT and MT groups was 130 and 109 mmHg, respectively. Additionally, the median HR in the non-MT and MT groups was 84 and 103 beats per minute, respectively; positive FAST was 12.3 and 33.3% in the non-MT and MT groups, respectively.

Additionally, these results were consistent with the results of another study by Nakamura *et al.* [17], in which the median SBP was 137 (114–160) and 109 (81–136) mmHg in the non-MT and MT groups, respectively. Additionally, the median HR was 84 (72–95) and 108 (89–122) beats per minute in the non-MT and MT groups, respectively; the median Glasgow coma scale was 14 (9–15) and 11 (4–14) in the non-MT and MT groups, respectively.

This study showed that the correlation between Modified TBSS and MBT was 71.4%, followed by Fbg with 57.1%, with no statistically significant difference between them in terms of MBT.

No available studies were noted comparing Modified TBSS and Fbg in terms of MBT.

This study showed that HGB, ISS, Modified TBSS, and BD were statistically significant as predictors of MBT (P<0.05, P<0.05, P=0.003, and P<0.05, respectively) compared with Fbg (P=0.03).

These results were consistent with the results of a study conducted by Takehiro *et al.* [12], in which HGB, ISS, Fbg, and BD were good predictors of blood transfusion. Specifically, in the non-MT group, HGB, ISS, Fbg, and BD was 13.4 g/dl, 22, 241, and 0.1, respectively, compared with 11.3 g/dl, 27, 167, and −3.8 in the MT group, respectively, all of them were found to be statistically significant as predictors of MBT.

Furthermore, these results were consistent with the results of a study conducted by Ogura *et al.* [10], in which Modified TBSS was 19.5 and 6.0 in the MT and non-MT groups, respectively, and was statistically significant as a predictor of MBT.

With respect to the outcome of the studied patients in our study, it showed that the majority was admitted for observation (37.10%), followed by 28.60% who underwent surgical intervention and 22.90% for ICU admission, with an ~11.40% mortality rate.

These results were not consistent with the results of a study performed by Domingues *et al.* [16], in which 39% of the patients were admitted to the ICU, 29.3% were admitted for conservative management, and 25.8% underwent surgical intervention, with a 5.9% mortality rate. This may be due to the large sample size of the said study (10 588 patients) compared with our study (n=70 patients).

This study showed that the majority of the studied population in the MT group underwent surgical intervention (42.2%), followed by ICU admission (28.9%), whereas the majority of the studied patients in the non-MT group had been admitted under observation (84%), followed by ICU admission (12%).

These results were consistent with the results of a study conducted by Takehiro *et al.* [12], in which 79.5% of the patients in the MT group had surgical intervention, with a 38.5% mortality rate, whereas 31.6% of the patients in the non-MT group underwent surgical intervention, with a 5.3% mortality rate, with a statistically significant difference between the outcome of both groups.

Moreover, these results were consistent with the results of another study by Malone *et al.* [15], in which the blood-transfusion group demonstrated a significant increase in both mortality (11.4 vs. 0.8%) compared with the no-blood-transfusion group (P<0.001) and ICU admission (59.6 vs. 18.0%) (P<0.001).

This study showed that the majority of the studied population in the Modified TBSS group were admitted inpatient (34.3%), followed by surgical intervention (31.4%), whereas the majority of the patients in the Fbg group were admitted inpatient (40%), followed by surgical intervention (25.7%), with no statistically significant difference between the outcomes of both groups (P=0.6).

No studies comparing both Modified TBSS and Fbg in terms of patient outcomes were noted.

This study showed the ROC analysis and the area under the curve (AUC) to clarify which factor was the most useful predictor for MT as the highest AUC was achieved for ISS (0.823), followed by Modified TBSS (0.819), BD (0.772), and Fbg (0.758).

Furthermore, this study showed that the optimal cutoff-point value for Modified TBSS was 13, with 80% sensitivity and 65% specificity, whereas the optimal cutoff-point value for BD was −8, with 73.3% sensitivity and 63% specificity, followed by Fbg with a cutoff value of 1.05 μg/l, with 71.5% sensitivity and 60% specificity.

These results were close to the results of a study by Ogura *et al.* [10], in which Modified TBSS had an AUC of 0.915, with 80% sensitivity and 91.1% specificity. This may be due to the similarity in the cutoff value, since in the said study, the cutoff value was 14, whereas in our study, it was 13.

Additionally, these results were consistent with the results of a study by Takehiro *et al.* [12], in which the AUC for BD was higher than that of Fbg (0.845 vs. 0.765), and the sensitivity and specificity of BD were higher than Fbg (80 vs. 78%, 67 vs. 65%, respectively).

This study evaluated the predictors of MT using a univariate correlation model, which revealed that Modified TBSS, BD, ISS, HGB, FAST, and Fbg were good predictors for MBT with the following P values: 0.005, 0.001, <0.05, <0.05, 0.02, and 0.03, respectively, whereas sex, trauma mechanism, and femoral fracture were not useful for the prediction of MBT.

These results were similar to the results of a study conducted by Takehiro *et al.* [12], in which they used a univariate logistic regression model that revealed HGB, BD, and Fbg levels as well as FAST positivity were useful predictors for MBT, with the following P values: <0.0001, <0.0001, <0.0001, and 0.01, respectively.

Our study had some limitations. Although calculation was used to reach this sample size, it was still relatively small. This is a single-center study, whose results could not be efficiently generalized. Larger, multicentric studies are suggested to furthermore accurately assess the efficacy of the score. The study was not blinded, which might have introduced some bias into the results.

Conclusion

This study showed the predictors of MT using a univariate correlation model, which revealed that Modified TBSS, BD, ISS, HGB, FAST, and Fbg were good predictors for MBT. The multifactorial correlation of the studied population shows that FAST, ISS, and Modified TBSS were more statistically significant than HGB, whereas BD and Fbg were not statistically significant. FAST, ISS, HGB, and Modified TBSS were more sensitive and specific than BD and Fbg in the prediction of the need for MT.

Recommendation of the study: all centers that take care of critically ill patients of all varieties should evaluate them and develop their own protocol to help trained providers promptly recognize the early initiation of MT and determine the endpoints to limit over transfusion.

Further study is needed with a large sample size with more specific matching regarding the severity of trauma for a sound comparison for the need of massive BT to be more realistic.

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Conflicts of interest
There are no conflicts of interest.

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