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Original Research Article

Evaluation of prognostic predictors of mangled extremity severity scoring system on the outcome of traumatic extremities injuries at emergency department in Suez Canal University Hospitals

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ABSTRACT

Background: Severe traumatic lower limbs injuries have been associated with high incidence of multiple systems involved (integument, nerve, bone, and vascular structures). That's make difficulty and stress on surgeon's decision making either to amputate or preserve the injured limbs. The Mangled Extremity Severity Score (MESS) was developed in Seattle (Johansen et al), based on both retrospective and prospective analysis of admission data of patients with severe limb injuries. The objective of this study was to evaluation of the prognostic predicting factors of outcome of traumatic extremities patients using Mangled Severity Scoring System at Emergency Department in Suez Canal University Hospital in order to help surgeon to make decision either to preserve or to amputate.
Methods: This is a descriptive study (cross sectional), conducted on 60 patients with severe extremities injuries that met the criteria of the Mangled Extremity Severity Scoring attending to the Emergency Department (ED) at Suez Canal University Hospital.
Results: This study showed that 83.33% of the patients had associated fractures, 8.33% of them had pneumothorax, 5% of them had abdominal collection and 3.33% of them had brain injuries. This study showed that 75% of the studied patients had MESS less than 7 while 25% of them had MESS > or = 7. The Mangled scoring system was a good predictor of amputation among the studied patients with sensitivity of 71.4%, specificity of 100% and 90% accuracy.
Conclusions: Most of the patients had Mangled Extremity Severity Score less than 7. The MESS showed statistically significant difference between the amputated and the not amputated patients with 90% accuracy in prediction of amputation.

Keywords: ED, MESS

INTRODUCTION

Severe traumatic lower limbs injuries have been associated with high incidence of multiple systems involved

(Integument, nerve, bone, and vascular structures).[1] That's make difficulty and stress on surgeon's decision making either to amputate or preserve the injured limbs.[1]

Attempts to qualify the severity of the trauma and to establish numerical guidelines to whether amputate or salvage the limb have been proposed by several authors. The Mangled Extremity Severity Score (MESS) was developed in Seattle, based on both retrospective and prospective analysis of admission data of patients with severe limb injuries. Four variables deter-mine skeletal and soft-tissue injury, limb ischemia, surgical shock, and the age of the patient.[2,3] The aim of the work is to

evaluate the prognostic predictors of mangled extremity severity scoring system on the outcome of traumatic extremities patients attending emergency Department in Suez Canal University Hospitals.

METHODS

This is a descriptive cross sectional study that was conducted on 60 patients attending to the Emergency Department (ED) at Suez Canal University Hospital with severe extremities injuries. All patients met the criteria of the Mangled extremity severity scoring. Data was collected in pre-organized data sheet by the researcher from patients fulfilling inclusion and exclusion criteria. All patients were clinically assessed and man-aged using the ABCDE protocol. And by using the Mangled extremity severity score (MESS) (skeletal/soft tissue injury-limb ischemia- shock- age) to evaluate the prognostic predicting factors of outcome of traumatic extremities patients. The patients were followed up and recorded till one of the following outcomes is reached

- Amputated
- Had surgical reconstruction
- I.C.U admission
- Died at emergency room.

RESULTS

This descriptive study was conducted to evaluate the prognostic predictors of outcome of traumatic extremities injuries using Mangled extremity severity score (MESS) depending on four variables determining skeletal and soft-tissue injury, limb ischemia, surgical shock, and the age of the patient. This study was conducted on 60 poly-traumatized patients with severe extremities injuries met the criteria of the Mangled extremity severity scoring attending to the Emergency Department (ED) at Suez Canal University Hospital. In this study, the mean age was 30.8±12.2 year, 38.3% of them were in the age group between 25-34 years and 91.6% of the patients were males. Lower limb injuries (only) represented 71.67% of all injuries, upper limb injuries (only) as they represented 25% of all injuries, while injuries in both limbs represented 3.33%.

Table 1: Comparison between patients with and without amputation regarding age, initial clinical evaluation and mechanism of trauma.

	Amputation		p-value
	No	Yes	
Age (years)[$]	29.28±12.47	33.71±11.45	0.2
SBP	110.77±8.7	102.38±9.95	0.003
DBP	71.54±7.45	62.38±8.89	0.003
HR	90.77±7.03	94.76±17.42	0.3
Trauma mechanism			
Motor car accident	31 (79.49%)	19 (90.48%)	0.3
Industrial injuries	8 (20.51%)	2 (9.52%)	

[$]= data are presented as mean±SD; *Statistical significance at p ≤ 0.05; SBP = Systolic blood pressure; DBP = diastolic blood pressure, HR = heart rate

The right side (only) was the most common side to be affected about 50% of all injuries. This study showed that the leg was the most common site to be injured in the lower limb (73.3%), while, the hand was the most site to be injured in the upper limb (35.2%). Regarding the mechanism of injury, road traffic accidents were responsible for 83.3% of injuries followed by industrial injuries which were responsible for 16.67%.

This study showed that 86.67% the patients had active bleeding with the venous injury represented 67.31% of the vascular injuries while the arterial injury represented 32.69% of all vascular injuries. Half (50%) of the patients had absent distal pulsation in the affected limb.

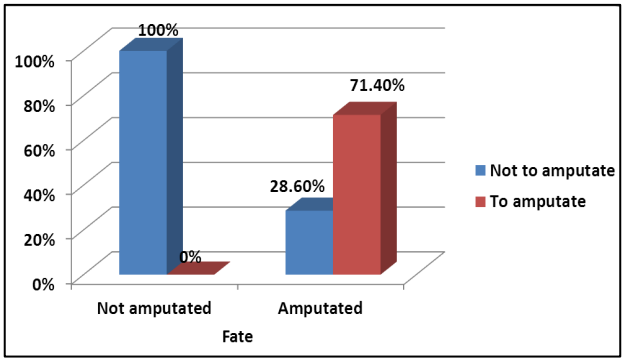

Figure 1: Decision of amputation according to Mangled score in relation to actual performed amputation.

Regarding the sensory function, 96.67% of the patients had hypothesia. Regarding the motor function, the entire patients had muscle weakness in the affected limb, 83.3% of the studied patients had associated fractures, 8.33% had pneumothorax injuries, 5% had abdominal collection and 3.33% had associated brain injuries. This study showed that Mangled score had statistically significant difference between the amputated and the not amputated patients as of the 21 patients who had amputations, 15 (71.4%) had Mangled score equal or more than 7 while 6 (28.6%) of them had Mangled score <7 and 39 patients avoided amputation and all of them had Mangled score <7 with good correlation between the Mangled score in relation to the actual performed amputation. Mangled score had sensitivity of 71.4%, specificity of 100% and 90% accuracy in prediction of amputation. This study revealed that 21 of the studied patients had amputation (35%) while 39 of them avoided amputation and had surgical reconstruction and repair (65%) (Figure 1).

Table 2: Comparison between patients with and without amputation regarding clinical evaluation of site of injury.

	Amputation		p-value
	No	Yes	
Active bleeding			
No	5 (12.82%)	3 (14.29%)	0.9
Yes	34 (87.18%)	18 (85.71%)	
Type of bleeding			
Venous	27 (79.41%)	8 (44.44%)	0.01*
Arterial	7 (20.59%)	10 (55.56%)	
Distal pulse			
Intact	30 (76.92%)	0	0.001*
No	9 (23.08%)	21 (100%)	
Sensory function			
Parethesia	0	2 (9.52%)	0.05*
Hypothesia	39 (100%)	19 (90.48%)	
Distal neurovascular			
Intact	2 (5.13%)	0	0.3
Injury	37 (94.87%)	21 (100%)	

*Statistical significance at $p \leq 0.05$.

Table 3: Comparison between patients with and without amputation regarding laboratory evaluation.

	Amputation		p-value
	No	Yes	
Hemoglobin (gm/dl)	10.6±1.3	10.2±1.2	0.2
TLC ($\times 10^3$)	11.2±1.58	11.1±1.5	0.8
Platelet ($\times 10^3$)	255.1±55.9	230±36.3	0.05

Data are presented as mean ± SD; *Statistical significance at $p \leq 0.05$

Table 4: Decision of amputation according to Mangled score in relation to actual performed amputation.

Decision of Mangled score	Performed amputate		p-value
	No	Yes	
Not to amputate (< 7)	39 (100%)	6 (28.6%)	0.001*
To amputate (> or = 7)	0	15 (71.4%)	

*Statistical significance at $p \leq 0.05$.

Mangled score had the ability to predict amputation in relation to the actual performed amputation among the studied patients (Figure 1). Regarding the initial clinical evaluation of the patients, the mean of SBP in the amputated group and the not amputated group of the studied patients was 102.38±9.95 and 110.77±8.7 mmHg respectively and the mean of DBP in the amputated group and the not amputated group of the studied patients was 62.38±8.89 and 71.54±7.45 mmHg respectively which showed statistically significant difference between both groups regarding the decision of amputation. This concludes that SBP and DBP were the vital signs that

showed statistically significant difference between the amputated and not amputated patients (Table 1).

The mean of the age of the amputated group and the non-amputated group was 33.71±11.45 and 29.28±12.47, mechanism of trauma and HR had no statistically significant difference between both groups regarding the decision of amputation (Table 1). Regarding the initial clinical evaluation of the affected limb, the type of bleeding and presence or absence of distal pulsation showed statistically significant difference be-tween the amputated and not amputated patients with p-value of 0.01 and 0.001 respectively (Table 2). The mean of the HB level between the patients with and without amputation was 10.2±1.2 and 10.6±1.3 g% respectively which had no statistically significant difference. Moreover, complete blood count (CBC) parameters were not different between the amputated and not amputated patients (Table 3).

Regarding the clinical evaluation of the site of injury, this study found that the absence of distal pulsation in the injured limb and the arterial bleeding had statistically significant difference between patients with and without amputation. Amputation was done among 21 patients among whom 15 patients (71.4%) has Mangled score with preference of amputation. All patients who had no amputation has Mangled score with preference of not to amputate. Mangled score had statistically significant difference regarding the prediction of the limb amputation or salvation among the studied patients (Table 4).

DISCUSSION

Trauma is a serious global health problem, accounting for about one in 10 deaths worldwide, and five million deaths per year, of which 1 million are in Europe.[4-6] Severe traumatic lower limbs injuries have been associated with high incidence of multiple systems involved (integument, nerve, bone, and vascular structures.[4] Several limb salvage scoring systems have been devised to aid clinicians to take their decision of when to salvage or to amputate. The developers of these scoring systems attempted to validate them by demonstrating high rates of specificity and sensitivity in predicting limb salvage.[6,7]

The Mangled extremity severity score (MESS) was developed in Johansen S et al, based on both retrospective and prospective analysis of admission data of patients with severe limb injuries.[13] Four variables are used in the score which are: skeletal and soft-tissue injury, limb ischemia, shock, and the age of the patients.[2,3]

This is descriptive study conducted in the Emergency Department in Suez Canal University Hospital to evaluate the prognostic predictors of Mangled extremity severity scoring system on the outcome of traumatic extremities patients. Almost 50% of injury-related mortality is in young people between the ages of 15 and 44 years.[6] In this study, the mean age was 30.83±12.21 year, 38.33% of them were in the age group between 25-34 years and 91.6% of the patients were males. These results match the results of another study conducted by Kumar et al, in which the mean age of the patients was 34.5 years and most of them were males 84.6%.[4]

Also these results match the results of another study performed by David S et al, in which the mean age of the patients was 30.6 years and males accounted for 85.4% of the patients.[5] Another study by Karami et al, matches the results of this study in which the mean age of the patients was 28 years and 90% of the patients were males.[6] In this study, lower limb injuries (only) represented 71.67% of all injuries and they were more frequent than upper limb injuries (only) as they represented 25% of all injuries while 3.33% due to injuries in both limbs. These results match the results of another study performed in which of the severely damaged limbs, 30% upper and 70% lower extremitie.[6] This study showed that the right side (only) was the most common side to be affected about 50% of all injuries as these results match the results of a previous study, in which the right side was commonly injured about 57%.[4] This study showed that the leg was the most common site to be injured in the lower limb 73.33% and this matches the results of a study performed by Kumar et al, in which crush injury of leg was observed in 80% of injured limbs.[4] Also this study showed that the hand was the most site to be injured in the upper limb 35.29%.

Regarding the mechanism of injury, this study showed that road traffic accidents were responsible for 83.33% of injuries followed by industrial injuries which were responsible for 16.67%. These results agree with the results of another study performed by Al-Salman M et al, in which the majority of vascular injuries were caused by blunt trauma and 91% of those were caused by road traffic collisions.[8] This study showed that 86.67% the patients had active bleeding with the venous injury represented 67.31% of the vascular injuries while the arterial injury represented 32.69% of all vascular injuries which does not match with the results performed by Kauvar et al, in which venous injury was present in 26.6% of injuries while arterial injury was 73.4%.[5]

This study showed that 50% of the patients had absent distal pulsation in the affected limb which matches the results of study, in which pulse deficit was documented in 50.7% of the patients on arrival to the emergency room.[9] These results do not match the results of another study conducted by Bosse et al, in which absence of distal pulsation presented in 24.6% of the patients and this may be due to the large sample size (n = 545) while the present study had only 60 patients in the sample size.[10] Regarding the sensory function, this study showed that 96.67% of the patients had hypothesia which doesn't match the results of another study performed by Bosse et al, in which 20% of the patients had sensory deficits on presenting to the emergency room and this may be due

the large sample size (n = 545) while the present study had only 60 patients in the sample size.[10] Regarding the motor function, this study found that all the patient had muscle weakness in the affected limb. These results match the results of another study, in which 81.5% of the patients.[9] This study showed that 83.33% of the studied patients had associated fractures, 8.33% of them had pneumothorax injuries, 5% of them had abdominal collection and 3.33% had associated brain injuries. These results match the results of Karami et al, in which all patients had fractures.[6] These results match also the results of another study, in which 3.17% of the patient had concomitant chest injuries.[11]

This study showed that Mangled score had statistically significant difference between the amputated and the not amputated patients as of the 21 patients who had amputations, 15 (71.4%) had Mangled score equal or more than 7 while 6 (28.6%) of them had Mangled score <7 and it was found that 39 patients avoided amputation and all of them had Mangled score <7 with good correlation between the Mangled score in relation to the actual performed amputation. These results match the results of another study performed by Feritas et al, in which 8 patients exposed to amputation, 6 of them (75%) had Mangled score equal or more than 7 while only 2 (25%) had Mangled score less than 7 and it was found that 12 patients avoided amputation and all of them had Mangled score less than 7.[12]

This study showed that Mangled score had sensitivity of 71.4%, specificity of 100% and 90% accuracy in prediction of amputation. These results match the results of another study, in which the Mangled score had a high specificity (98%) and a high sensitivity (91%), also these results match the results of another study conducted by Karami et al, in which the Mangled score demonstrated a high specificity 80% and high sensitivity 87% for all of injured limb analysis.[4,6] This study revealed that 21 of the studied patients had amputation (35%) while 39 of them avoided amputation and had surgical reconstruction and repair (65%). These results match the results of another study, in which 40% of the patients had amputation while 60% of them had limb salvation, also they match the results of Karami et al, in which 25% of the patients had amputation and 75% of them had avoided the amputation.[6,12] Regarding the initial clinical evaluation of the patients, this study found that the mean of SBP in the amputated group and the not amputated group of the studied patients was 102.3±9.9 and 110.7±8.7 mmHg respectively and the mean of DBP in the amputated group and the not amputated group of the studied patients was 62.3±8.8 and 71.5±7.4 mmHg respectively which showed statistically significant difference between both groups regarding the decision of amputation.

In contrast, Feritas et al, reported that the mean of SBP in the amputated group and the salvaged group was 107 and 130 mmHg respectively which showed no statistically significant difference.[12] This study showed that the mean of the age of the amputated group and the not amputated group was 33.71±11.45 and 29.28±12.47, mechanism of trauma and HR had no statistically significant difference between both groups regarding the decision of amputation. These results match the results of a study performed by Feritas et al, in which the mean age of the amputated group and the not amputated group was 40.5 and 30 respectively which showed no statistically significant difference.[12] Regarding the clinical evaluation of the site of injury, this study found that absence of distal pulsation in the injured limb and the arterial bleeding had statistically significant difference between patients with and without amputation.

These results match the results of Bosse et al, in which absence of distal pulsation at time of examination and associated arterial injuries were more indicative of poor outcome and amputation.[10] This study found that the mean of the HB level between the patients with and without amputation was 10.2±1.2 and 10.6±1.3 g% respectively which had no statistically significant difference.

CONCLUSION

The MESS had statistically significant difference between the amputated and the not amputated patients with 90% accuracy in prediction of amputation. The MESS had sensitivity of 71.4%, specificity of 100% among the studied patients. SBP and DBP were the only vital signs that showed statistically significant difference between the amputated and not amputated patients regarding decision of amputation. Absence of distal pulsation of the injured extremities and the type of bleeding had statistically significant difference between the amputated and not amputated patients regarding decision of amputation.

Also it was found that age, HR, mechanism of injury, the presence of active bleeding and the presence of sensory/motor dysfunction had no statistically significant difference between the amputated and not amputated patients regarding decision of amputation.

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