ORIGINAL ARTICLE

The importance of the injury severity scores and revised trauma scores for moderate traumas: A state hospital experience

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ABSTRACT

BACKGROUND: The degree of damage presents a pressing issue in determining trauma severity. Various trauma-scoring systems, such as the injury severity and revised trauma scores, are used worldwide. In this study, we aimed to evaluate the functionalities of these two trauma scoring systems, which are presently used frequently and have scientifically evolved at the state hospital level.

METHODS: Following approval from the ethics committee to conduct clinical studies with retrospective archive screening, data between January 1, 2012, and December 31, 2017, were retrospectively analysed for determining the factors affecting mortality in all patients diagnosed with traumatic injury in 29 Mayıs State Hospital. Incomplete or unclear data were excluded from this study. Mean and standard deviation were used for continuous variables; percentage and frequency values were used for binary variables. For evaluating continuous variables, Student's t-test or Mann–Whitney U-test was used in independent groups based on their distribution status. Dichotomous variables were evaluated using the chi-square test. The results and significant in univariate analyses were evaluated again by the linear and binary logistic regression model.

RESULTS: Mean age of all patients was 37.53±14.47 years [male (35.68±13.9) versus female (40.61±15.1) (p=0.116)]. Mean injury trauma score for the general population was 3.18±8.46. No dissimilarity was noted regarding gender for the injury severity score (ISS) [(3.93±10.49 versus 1.91±2.34) (p=0.727)]. Regarding age, for revised trauma score (RTS), no statistical significance was noted [(7.60±0.91 versus 7.81±0.16) (p=0.207)]. Regarding the injury mechanism, we detected a difference between the two trauma scores; both ISS and RTS also had statistical significance. The results were found for ISS [penetrant (6.56±6.47) versus blunt (2.45±8.68) (p=0.002)] and for RTS [penetrant (7.41±0.54) versus blunt (7.74±0.79) (p=0.001)]. After the final statistics with logistic linear regression, the respiratory rate was statistically significant for penetrant injury [AOR 0.22 (0.001, 0.47) (p≤0.05)]. In the detailed subanalysis for RTS score components, respiratory rate was also significant in moderate traumas [AOR 0.22 (0.001, 0.47) (p=0.004)].

CONCLUSION: Both ISS and RTS are nonsignificant in all moderate injury types. On the other hand, respiratory rate is an important marker, especially in penetrant moderate injuries.

Keywords: Injury severity score; moderate severe trauma; public hospital; revised trauma score.

INTRODUCTION

The trauma scoring system is a vital triage process for comparing different trauma injuries and care models for quality. [1] Approximately 60 years previously, a series of scales that evaluated the severity of the injury was established, and AIS was one of these. Since that day, the AIS scoring system has undergone changes and developed.[2] AIS-90 is a scoring system that includes the assessment of nine body regions (head, face, neck, thorax, abdomen, spine, upper extremities, lower extremities and external). Each injury site is given a score between 1 and 6, with a score of 1 corresponding to the slight-

Cite this article as: Yıldırım Aydın F, Dülger D. The importance of the injury severity scores and revised trauma scores for moderate traumas: A state hospital experience. Ulus Travma Acil Cerrahi Derg 2020;26:242-246.

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Ulus Travma Acil Cerrahi Derg 2020;26(2):242-246 DOI: 10.14744/tjtes.2020.06623 Submitted: 12.09.2019 Accepted: 11.02.2020 Online: 25.02.2020

est injury, and 6 indicating the most severe injury, which is equivalent to mortality. In patients with multiple injuries, the highest AIS score is known as the maximum AIS (MAIS). However, it has been shown that although MAIS can be used for defining overall severity, MAIS does not achieve a significant association with mortality in damage assessments.[3,4] Owing to all these disadvantages, an AIS-based injury severity score (ISS) was developed by Baker et al.,[5] where in the head or neck, face, chest and abdomen or pelvic contents were classified as extremities or pelvic girdle and outer surface. The ISS was then calculated as the sum of the squares of the highest AIS scores for the three most severely injured body regions. An important condition is present in this damage calculation system. If the damage in a single body area corresponds to the value of 6, the injury corresponds to the value of 75 in the ISS scoring system. In addition, another important issue is that if the severity of an injury cannot be determined, anAIS of 9 is assigned, and 99 points are awarded.[2] Because the ISS is an anatomically based score system, some doubts remain regarding the suitability of its use in trauma assessments.[6] In the calculation of the revised trauma score (RTS), which is a physiological score, the formula RTS=0.9368 GCS + 0.7326 SBP + 0.2908 RR is applied, where GCS is the Glasgow coma scale, SBP is the systolic blood pressure and RR is the respiratory rate.[6] Although the physiological origin trauma score systems had more predictors of in-hospital mortality, such as RTS than with anatomic-based with anatomic scoring systems, such as ISS in this perspective, this may have changed in moderate injuries. At this point, we aimed to clarify this vague question, especially concerning the type of injury.

MATERIALS AND METHODS

Following approval from the ethics committee for conducting clinical studies using retrospective archive screening, data between January 1, 2012, and December 31, 2017 were retrospectively analysed for determining the factors that affect mortality in all patients diagnosed with traumatic injury in 29 Mayıs State Hospital. Incomplete or unclear data were excluded from this study. Mean and standard deviation were used for the continuous variables, and percentage and frequency values were used for the binary variables. In the evaluation of the continuous variables, the Student's t-test or Mann-Whitney U test was used in the independent groups on the basis of their distribution status. Dichotomous variables were evaluated using the chi-square test. The final results were obtained using the logistic regression model. Data were analyzed using SPSS™ for Windows22 (SPSS, Chicago, IL).

RESULTS

For this study, between January 1, 2012, and December 31, 2017, a total of 680 patients were screened and a total of 91 patients concerning trauma injury clarification, who were admitted to the emergency department, were included in this investigation. Of these, 57 patients (60.0%) were male, and 35 (35.8%) were female. The mean age of all the patients was 37.53±14.7 years. The mean ages of males and females were 35.68±13.9 years and 40.62±15.1 years (p=0.12), respectively. When we look at the injury characteristics, both penetrant and blunt injuries were found in 13 males (81.3%) versus three females (11.8%) and 44 males (58.7%) versus 31 females (41.3%), respectively. Regarding trauma mechanism distribution, assault 27 (65.9%) versus 14 (34.1%), work accident 11 (61.1%) versus seven (38.9%), and traffic accident 19 (59.4%) versus 13 (40.6%) were found, respectively. The demographic characteristics of the patients are shown in Table 1.

DISCUSSION

ISS is an important tool for the prediction of mortality if its value is >16, which may result in mortality, and the treatment of these patients was suggested at trauma care centres.[7,8] Although the RTS is a physiological scoring system, RTS includes the GCS. Thus, if there is any head injury, this scoring system can be used for better assessment. However, if there is no significant head trauma, RTS prediction can be decreased for the prediction of survival.[9,10] In the late 1990s, Bickell[11,12]

Table 1. Demographic and trauma characteristics of the patients with moderate injury

Variables	Male [(n=57) (62.6%)]	Female [(n=34) (37.4%)]	p≤0.05	Total mean±SD
Age (year)	35.68±13.9	40.62±15.1	0.12	37.53±14.7
Injury characteristics, n (%)				
Penetrant (n=16)	13 (81.3)	3 (11.8)	0.09	
Blunt (n=75)	44 (58.7)	31 (41.3)		
Trauma mechanism, n (%)				
Assault (n=41)	27 (65.9)	14 (34.1)		
Work accident (n=18)	11 (61.1)	7 (38.9)		
Traffic accident (n=32)	19 (59.4)	13 (40.6)	0.84	
Total	57	34	91	

SD: Standard deviation.

noted that modest volume therapy with rapid fluid replacement, which is accepting hypotension within acceptable limits, was beneficial for patients with penetrating trauma. Also, the view that it is increasingly useful for cases of blunt trauma and haemorrhagic shock trauma concerning limited volume fluid replacement is gaining popularity.[13–17] In a recent study conducted in the US, Haut et al.[18] showed that intensive volume treatment was associated with worsened outcomes. The authors concluded that pre-hospital volume therapy is no longer useful. The advocates of large-volume replacement, however, justify its use by focusing on the importance of increasing mean arterial blood pressure and maintaining adequate organ perfusion.[19] However, its disadvantage is that it is more difficult to confirm the permissible hypotension in patients with concurrent severe traumatic brain injury. It should be well-established and, as stated in recent literature, normotension should be targeted for maintaining adequate cerebral perfusion pressure, and excessive volume replacement should be avoided.[20] At this point, we can see that parallel to the results, when normal cerebral perfusion is present, GCS is not very effective in evaluating trauma scoring if there is no severe head trauma, which may cause GCS to lose its effectiveness in predictability, especially in moderate- and low-grade traumas. Singh et al.,[21] in their study, reported that the post-traumatic mortality risk ratio of those with lower than 90 mmHg SBP increased by 2.6 times. In another study conducted in 2019, Albuz stated that the risk of mortality was 4.6 in patients with 90 mmHg below SBP and serious penetrating injuries.[22] As mentioned previously, if the systolic pressure is not less than 90 mmHg, especially in trauma patients, the damage prediction value decreases. Because the SBP was above 90 mmHg in most of our cases, at this point, we can see that it is parallel to the results, when normal cerebral perfusion is present, GCS is not very effective in trauma scoring, which may cause GCS to lose its effectiveness, especially in moderate- and low-grade trauma. In addition, the predictive value of SBP in moderate-degree traumas was not significant as well, similar to GCS for both blunt and penetrant traumas. Regarding SBP and GCS as the subcomponents of RTS, we believe that the decreased predictive ability of the effectiveness of RTS depends on the inability of these two variables in the moderate traumas. Simply, we can say that for these two trauma scores, the higher the ISS, the higher the mortality risk, and the higher the RTS score, the lower the mortality risk. We, too, detected a negative correlation [(−0.423) (p≤0.05)] between the ISS and RTS scores, and this was significant (Table 2). Among our cases, one patient with severe blunt trauma resulted in mortality. The RTS score was also detected to be significantly higher in blunt than in penetrant traumas in univariate analysis, indicating the RTS could be better for blunt trauma victims regarding life chance. However, its statistical significance was lost after multiple linear regression. Even if SBP less than 90 mmHg was important for trauma mortality, in our study, systolic pressure was not predictive for mortality. We believe that this result depends on both patients with higher SBP and higher GCS values, on the basis of our trauma cases. However, because an anatomical scoring system, such as the ISS, is based on anatomy evaluation, we found that the score in penetrating injuries was significantly higher than the RTS value. However, ISS lost its significance with multiple linear regression similar to RTS (Table 3). Circulatory failure may affect respiratory physiology by altering both ventilation control and pulmonary perfusion. An increase in the left ventricular filling pressure (and therefore the pulmonary capillary pressure)—among others—affects pulmonary compliance and alveolocapillary membrane conductivity. These changes increase the respiratory rate.[23] In

Table 2. Results of Spearman's correlation

	Correlations	ISS	RTS
Spearman's rho			
ISS	Correlation coefficient	1.000	−0.427*
	Sig. (2-tailed)	–	0.000
	N	91	91
RTS	Correlation coefficient	−0.427*	1.000
	Sig. (2-tailed)	0.000	–
	N	91	91

*Correlation is significant at the 0.01 level (2-tailed). ISS: Injury severity score; RTS: Revised trauma score.

Table 3. The results of the univariate and multivariate analyses with multiple logistic regression

	Blunt (+)	Penetrant (–)	p≤0.05	AOR [Exp(B)] (95% CI)	p≤0.05
ISS	2.45±8.68	6.56±6.47	0.002*	0.26 (−018, 0.42)	0.432
RTS	7.74±0.79	7.4±0.54	0.001*	0.24 (−0.267, 0.509)	0.537
SBP	119±17.14	106.4±16.12	0.002	−0.29 (−0.0012, −0.001)	0.03
RR	16.5±3.54	18.1±3.06	0.095	0.22 (0.001, 0.47)	0.04*
GCS	13.58±1.31	13±1.21	0.023	−015 (−0.163, 0154)	0.96

ISS: Injury severity score; RTS: Revised trauma score; SBP: Systolic blood pressure; RR: Respiratory rate; GCS: Glasgow coma scale; CI: Confidence interval.
The Mann-Whitney U test results for ISS, RTS, and sub-compounds of RTS trauma scores (SBP, respiratory rates, and GCS), concerning injury characteristics. The results of blunt and penetrant injuries in terms of age with Student's t-test for independent groups. *Significant final statistical results.

addition, in a recent study, Barthel et al.[23] stated that the predictive feature of respiratory rate in mortality remains important even in this period when prognostic alternatives increase. Furthermore, Frank has proven pulmonary oedema to be a poor prognostic marker in acute MI.[24] In our study, too, the respiratory rate was significantly higher in penetrant traumas in linear regression results [AOR 0.22 (0.001, 0.47) (p≤0.05)].

Conclusion

In summary, the main points include the following: haemothorax, pneumothorax, sail chest, superficial breathing owing to pain, and even back injuries (especially for pneumothorax) should not be overlooked. We believe that both RTS, which is a physiological scoring system, and ISS, which is based on the anatomic scoring systems, cannot predict with higher accuracy for moderate traumatic injuries, especially that traumatic flail chest is a rare consequence of blunt trauma. It usually occurs in the setting of a high-velocity motor vehicle accident, which usually leads to high morbidity and mortality. Any trauma should not be isolated. For example, whenever there is any penetrant chest trauma, we should keep in mind that the flail chest may occur owing to possible blunt trauma. Therefore, only respiratory rates are significant, especially for moderately penetrant injuries. In our next study, we have planned our time table for evaluating the effectivity of both respiratory rates and oxygen saturation in moderate injuries by multicentre prospective studies with the status of the state hospital.

Ethics Committee Approval: Approved by the local ethics committee.

Peer-review: Internally peer-reviewed.

Authorship Contributions: Concept: F.Y.A.; Design: F.Y.A.; Supervision: D.D.; Materials: F.Y.A.; Data: F.Y.A.; Analysis: F.Y.A.; Literature search: D.D.; Writing: D.D.; Critical revision: F.Y.A.

Conflict of Interest: None declared.

Financial Disclosure: The autors declared that this study has received no financial support.

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ORİJİNAL ÇALIŞMA - *ÖZET*

Yaralanma ciddiyeti skorları ve revize edilmiş travma skorlarının orta dereceli travmalar için önemi: Bir devlet hastanesi tecrübesi

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AMAÇ: Hasarın derecesi, travmanın ciddiyetinin belirlenmesinde halen güncel ve önemli bir konudur. Bu amaçla dünyada çeşitli travma skorlama sistemleri kullanılmaktadır. Yaralanma şiddeti skoru ve revize travma skorları bunlardan biridir. Bu yazıda, şu anda sıklıkla kullanılan ve bilim tarafından büyük ölçüde olgunlaşan bu iki travma puanlama sisteminin işlevlerini devlet hastanesi düzeyinde değerlendirmeyi amaçladık.

GEREÇ VE YÖNTEM: Geriye dönük arşiv taraması ile klinik çalışmalar yürütmek üzere etik kurul onayını takiben; 1 Ocak 2012 ve 31 Aralık 2017 tarihleri arasındaki veriler, 29 Mayıs Devlet Hastanesi'nde travmatik yaralanma tanısı alan tüm hastalarda mortaliteyi etkileyen faktörleri belirlemek amacıyla geriye dönük olarak incelendi. Eksik veya net olmayan veriler çalışmaya alınmadı. Sürekli değişkenler için basit ve standart sapma, ikili değişkenler için yüzde ve frekans değerleri kullanıldı. Sürekli değişkenlerin değerlendirilmesinde, bağımsız gruplarda dağılım durumuna göre Student t-testi veya Mann-Whitney U-testi kullanıldı. İkili değişkenler ki-kare testi ile değerlendirildi. Tek değişkenli analizlerde anlamlı olduğu tespit edilen değişkenler lineer ve ikili lojistik regresyon (LR) modeli ile tekrar değerlendirildi.

BULGULAR: Tüm hastaların yaş ortalaması 37.53±14.47 yıldı [erkek (35.68±13.9) – kadın (40.61±15.1) – (p=0.116)]. Genel popülasyon için ortalama yaralanma travma skoru 3.18±8.46 idi. Yaralanma şiddeti skoru (ISS) cinsiyeti ile ilgili farklılık görülmemiştir [(3.93±10.49 ve 1.91±2.34) (p=0.727)]. Yaş ile ilgili olarak, gözden geçirilmiş travma skoru (RTS) için istatistiksel anlamlılık kaydedilmedi [(7.60±0.91'e karşılık 7.81±0.16) (p=0.207)]. Yaralanma mekanizması ile ilgili olarak, iki travma skoru arasında bir fark saptandı; hem ISS hem de RTS'nin istatistiksel önemi vardı. Sonuçlar ISS [penetrant (6.56±6.47) ile künt (2.45±8.68) (p=0.002)] ve RTS [penetrant (7.41±0.54) ile künt (7.74±0.79) (p=0.001)] için bulundu. Lojistik lineer regresyon ile son istatistiklerden sonra, penetran yaralanma için solunum hızı istatistiksel olarak anlamlı idi [AOR 0.22 (0.001, 0.47) (p<0.05)]. RTS skoru bileşenleri için ayrıntılı subanalizde orta dereceli travmalarda solunum hızı da anlamlıydı [AOR 0.22 (0.001, 0.47) (p=0.004)].

TARTIŞMA: Her iki ISS ve RTS de orta dereceli yaralanma tiplerinin hepsinde önemsizdir. Diğer yandan solunum hızı özellikle penetran ve orta dereceli yaralanmalarda önemli bir belirteçtir.

Anahtar sözcükler: Devlet hastanesi; orta şiddetli travma; revize travma skoru; yaralanma şiddeti skoru.

Ulus Travma Acil Cerrahi Derg 2020;26(2):242-246 doi: 10.14744/tjtes.2020.06623