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Original Article

Surgery Section

Comparison of New Injury Severity Score and Revised Trauma Score in Predicting Outcome of Trauma Patients

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ABSTRACT

Introduction: Trauma is an important area of research, as it tends to take away a heavy toll of life regularly. To compare the severity and clinical outcome for the trauma patients, a number of injury severity scores have been designed as standardised tools. Although several systems exist, there is no consensus on, which is the best for predicting mortality.

Aim: To correlate various clinico-radiological parameters of the trauma patients and their trauma scores i.e., Revised Trauma Score (RTS) and New Injury Severity Score (NISS) and their outcome with respect to survival accordingly.

Materials and Methods: Sixty-one patients were randomly included in this study after taking informed written consent from the patients above 18 years of age and well oriented to time, place, and person or from such guardians if the patients were less than 18 years. Patients were then subjected to a fixed trauma protocol regularly followed at the study institute and trauma scoring was done for each one of them. The statistical analysis was done using statistical software SPSS for Windows (version 16), chi-square test was used for non parametric variable, Student's t-test was used for comparing two groups and one way ANOVA test was used for multiple groups' comparisons. p-value <0.05 was stated as statistically significant. ROC curve was used as a tool for diagnostic test evaluation.

Results: Out of 61 patients, RTS at presentation of survived patients were 7.2504±0.73178 and the patients who died were 6.09990±1.23611 with a p-value of 0.014 and sensitivity as 85%. NISS at presentation of survived patients was 17.39±6.614 and for the patients who died were 26.29±4.990 with a p-value being <0.001 and sensitivity being 100%.

Conclusion: New Injury Severity Score is a more sensitive scoring system and a better outcome predictor in comparison to RTS system.

Keywords: Abbreviated injury scale, Glasgow coma scale, Respiratory rate, Systolic blood pressure

INTRODUCTION

Trauma forms a major cause of death and disability worldwide. According to the Global burden of disease study, injuries are responsible for 5.1 million deaths and 15.2% of disability adjusted life years lost. It is estimated that by the year 2020, trauma will be the third most common cause of death in the world [1]. A trauma system is an organised, coordinated system for the provision of trauma care to all the injured patients in a defined geographic area [2]. This system starts with pre hospital care and involves central ambulance dispatch centres, paramedical services etc., [3] and on reaching the trauma centre, ATLS principles laid down by the American college of surgeons are then followed. Proper training and implementation of these principles in trauma centres, can improve outcomes of trauma patients [4].

Then comes the role of various injury severity scores, which are the standardised tools to compare the severity and the clinical outcomes as well as for triage of trauma patients. Several trauma scores are used and are classified into physiologic, anatomic and combined anatomic and physiologic scoring system [5].

The Injury Severity Score (ISS) and the NISS are the anatomic scores. Both depend upon Abbreviated Injury Scale (AIS), but differ in the calculation methods. Most studies have shown that NISS is superior to ISS for evaluating injured patients [2,6-9] although some showed that they have similar accuracy [5]. RTS is the best and the most universally used physiological trauma severity scoring system. RTS system can allow rapid characterisation of neurologic, circulatory and respiratory injuries. However, RTS has been criticised as a mere triage tool [10].

Thus, this study was taken up with the objective to correlate various clinico-radiological parameters of the trauma patients and their trauma scores i.e., RTS and NISS and their outcome with respect to survival accordingly.

MATERIALS AND METHODS

This comparative study was taken up at the Trauma centre, IMS, Banaras Hindu University after getting approval from the Institute's Ethical Committee (Dean/2015-16/EC/1552). Sixty-one patients that met the criteria for polytrauma and gave informed written consent were selected for this study. Inclusion criteria was, patient with polytrauma and exclusion criteria were, age less down 14 and greater than 65, pregnant women with polytrauma, patients with pre-existing co-morbidities and patient with polytrauma that was brought in dead.

According to the international consensus on the term polytrauma- both anatomical and physiological parameters are included in its definition. It includes severely injured patients with associated injuries i.e., 2 or more severe injuries in at least two areas of the body and less often two or more severe injuries in a single body area. In this study, parameters studied included, demography of patients, mechanism of injury, Systolic Blood Pressure (SBP) Respiratory Rate (RR) and Glasgow Coma Scale (GCS). RTS and NISS were calculated for each patient at the time of arrival, at the time of intervention i.e. surgery and at the time of discharge. Finally, the patient outcome was compared on the basis of mortality and survival. ISS was calculated by giving each injury an AIS score. The highest AIS score in each body region was used. The AIS score of the three most severely injured body regions were then squared and added together to get ISS score (1-75). NISS was defined as the sum of the squares of AIS of the patient's three most severe injuries, regardless of the body region in which they occurred. RTS aimed at identifying severity based on the SBP, the GCS and the RR. RTS score (0-12) was calculated as GCS value×0.9368+SBP value×0.7326+RR value×0.2908. Patients were divided into two groups i.e., those who died and those who survived [11,12].

STATISTICAL ANALYSIS

The statistical analysis was done using statistical software SPSS for windows (version 16). Chi-square test was used for non parametric variable, Student's t-test was used for comparing two groups and one-way ANOVA test was used for multiple groups' comparisons. A p-value <0.05 was stated as statistically significant. ROC curve was used as a tool for diagnostic test evaluation. In the ROC curve, true positive rate (sensitivity) was plotted in the function of the false positive rate (100-specificity) for different cut-off points of a parameter.

RESULTS

In the present study, 61 patients were included and the mean age of presentation was 38.74±13.224 with male: female being 5.7:1. As per the outcome of the patients, 54 (88.5%) survived, while 7 (11.5%) died.

As is evident from the [Table/Fig-1], only ICU requirement showed a significant relation to mortality.

Findings in NCCT head could not establish a significant relation to the patient outcome according to this study [Table/Fig-2].

Out of all the patients with a positive finding in CECT abdomen, patients with both solid and hollow viscus injury had worse prognosis as compared to patients with either of them alone [Table/Fig-3].

	Survived	Died	p-value
Definitive airway	4	2	0.077
Intensive Care Unit (ICU) requirement	6	6	<0.001
Hemothorax	23	2	0.689
Pneumothorax	20	2	0.710
Tension pneumothorax	1	1	0.218
Flail chest	2	1	0.311
Lung contusion	9	0	0.580
Blood transfusion	34	6	0.40
Focused Assessment with Sonography in Trauma (FAST)	26	6	0.106
Shock	52	6	0.311

[Table/Fig-1]: Comparison of various parameters with outcome.

Finding	Survived	Died	Inference
No head injury	39	6	χ^2=0.624
Brain Contusions	14	1	p=0.706
Diffuse axonal injury	1	0	

[Table/Fig-2]: Non contrast CT head vs. outcome.

CECT abdomen	Total (n=61)	Survived	Died	Inference
No finding	29	28	1	χ^2=14.346[a]
Solid organ injury	17	14	3	p=0.081
Hollow viscus injury	12	10	2	
Both solid and hollow viscus injury	3	2	1	

[Table/Fig-3]: Contrast enhanced CT abdomen vs outcome.

Out of 61 patients, NISS at presentation of survived patients (17.39±6.614) and expired (26.29±4.990), with p-value <0.001 signifying that NISS value is a significant predictor of patients outcome [Table/Fig-4].

The [Table/Fig-5] shows the comparison of the mean scores in the survived patients at presentation and discharge. It shows the improvement in the NISS at the time of discharge while same is not true for RTS. Thus NISS is a better indicator of patient condition also.

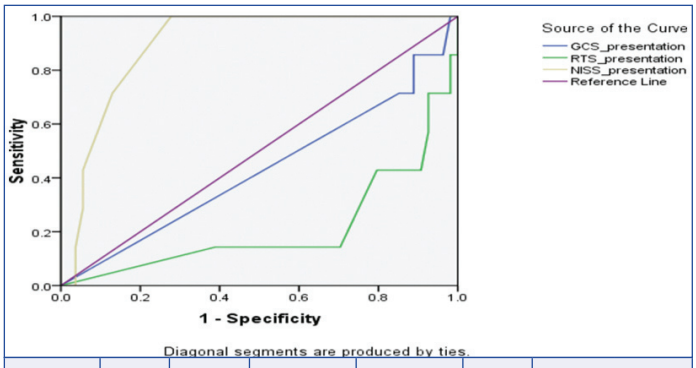
ROC shows that RTS was 85% sensitive and 100% specific with p-value being 0.014, while NISS was 100% sensitive and 73% specific with p-value being 0.001. Hence, NISS, carrying a significant p-value, was a more sensitive predictor for hospital stay, ICU requirement and mortality as compared to RTS, which in turn demonstrated a great specificity [Table/Fig-6].

Variables	Mean±SD		t-value	p-value
	Survived	Died		
Age	38.22±13.026	42.71±15.130	-0.844	0.402
Duration from injury	8.7833±6.18387	6.2857±2.37236	1.052	0.297
RR	29.33±7.919	30.29±12.175	-0.281	0.780
Pulse	107.93±16.271	108.57±26.063	-0.092	0.927
SBP	96.15±13.861	82.57±15.131	2.415	0.019
DBP	59.70±11.409	52.57±13.100	1.532	0.131
GCS presentation	14.19±2.075	13.43±2.820	0.871	0.387
GCS operation	14.30±1.929	11.57±3.359	3.201	0.002
GCS discharge	15.02±0.495	15.00±.00	0.037	0.971
SBP presentation	96.00±13.753	82.57±15.131	2.405	0.019
SBP operation	108.56±6.412	96.67±8.165	4.197	≤0.001
SBP discharge	112.91±14.957	116.00±.00	-0.205	0.838
RR presentation	29.46±7.630	30.29±12.175	-0.250	0.804
RR operation	25.04±3.273	33.00±6.197	-5.112	≤0.001
RR discharge	20.07±2.746	22.00±.00	-0.695	0.490
RTS presentation	7.2504±0.73178	6.0990±1.23611	3.593	0.331
NISS presentation	17.39±6.614	26.29±4.990	-3.424	0.001
Hospital stay	9.50±3.284	6.57±5.884	2.006	0.049

[Table/Fig-4]: Comparison of various parameters with outcome.

	At presentation (1)	At operation (2)	At discharge (3)	p-value (1 vs 2)	p-value (1 vs 3)
GCS	14.10±2.158	13.98±2.277	15.02±0.490	0.499	0.003
SBP	94.63±14.500	107.37±7.451	112.96±14.824	≤0.001	≤0.001
RR	29.92±7.709	25.83±4.322	20.11±2.733	≤0.001	≤0.001
RTS	7.1559±0.82933	7.5568±0.63020	7.8410±0.00001	≤0.001	≤0.001
NISS	18.23±6.944	18.33±6.896	17.59[a]±6.580	0.321	-

[Table/Fig-5]: Comparison of mean GCS, SBP, RR, RTS and NISS at presentation/ operation/surgery.



Diagonal segments are produced by ties.

Test result variable (s)	Area	Cut-off value	Sensitivity	Specificity	p-value	Asymptomatic 95% confidence interval	
						Lower bound	Upper bound
GCS	0.430	6.0	100%	100%	0.549	0.189	0.671
RTS	0.212	4.5	85%	100%	0.014	0.008	0.416
NISS	0.896	20	100%	73%	0.001	0.812	0.979

[Table/Fig-6]: Area under the ROC.

DISCUSSION

The present authors can finally infer from this study, that NISS which is an anatomical scoring system, is a better predictor of outcome in comparison to RTS, which takes into account the physiological parameters, in adult polytrauma patients.

Road traffic injuries are a leading cause of death in India [13]. Proper field triage along with a fixed trauma protocol for all the injured patients, tends to positively affect all the aspects of trauma care system [14]. A systematic approach was used for all the patients included in this study design i.e., preparation, triage, primary survey (according to protocols of ATLS), resuscitation, secondary survey (head to toe evaluation with history), continued post resuscitation monitoring and reevaluation and finally definitive care. Improved research is though, needed to assess the impact of such protocols for proper resource allocation, health care financing and funding and most importantly for patient outcomes.

Hueber Wegner S et al., found that Whole Body CT (WBCT) scan during trauma resuscitation is justified if performed quickly in a well structured environment and by a well organised team [15]. Moreover, given the low sensitivity, a negative FAST without confirmation by CT scan may result in missed intra abdominal injuries and thus should be reserved for haemodynamically unstable patients [16]. So, Contrast Enhanced CT chest and abdomen was done for all the study patients.

The task of incorporating various factors such as pre-existing morbidity, Age, Immunological differences and genetic predispositions into a scoring system, has made the prospectus of creating a universally acceptable and applicable trauma scoring system extremely arduous, if not impossible. Thus, the pre-existing comorbidities were kept in exclusion criteria of patients of this study.

On comparing the results of this study with the available literature, the present authors found that there have been some studies comparing two anatomical scoring systems [17,18] or two physiological scoring systems [19]. Fewer studies have been there comparing the two of them i.e., anatomical with physiological system [19-21]. There are hardly any studies, actually replicating the results of this study although, certain studies have given some conclusions which can be actually said to corroborate the results of this study. According to Jones JM et al., NISS was the strongest predictor of mortality out of all the variable that they tested for creating their own new trauma model i.e., NORMIT model [22]. Orhon R et al., determined that anatomical trauma scores predicted hospitalisation and ICU necessities better than the anatomo-physiological score i.e., TRISS model [23]. Dillon B et al., in their studies also concluded that on including a score, which takes into account body region locations of all injuries i.e., an anatomical scores gives better outcome prediction for trauma patients [24].

There were studies which also gave results contrary to the present study. Servia L et al., concluded that in trauma patients admitted to the ICU, the physiological models have some advances than the anatomical ones in terms of prediction of survival [20]. Soni KD et al., concluded that physiological based trauma scoring systems are much better predictor of in hospital mortality in comparison to anatomical based scoring systems for unintentional paediatric falls [21].

LIMITATION

The limitation of the present study is that it was conducted at a single centre and that too with a limited number of patients. To be able to generalise this finding, it would have to be tested in other groups of patients with a larger sample size.

CONCLUSION

According to this study, New Injury Severity Score (NISS) is a better predictor of outcome in comparison to Revised Trauma Score (RTS), in adult polytrauma patients, where the outcome is being measured by the survival rate. Hence, calculation of NISS should be included as a part of routine trauma protocol for all patients.

REFERENCES

[1] Krug EG. Injury surveillance is key to preventing injuries. Lancet. 2004;364(9445):1563-66.
[2] Kortbeek JB. Buckley R. Trauma-care systems in Canada. Injury. 2003;34:658-63.
[3] Bulger EM. Maier RV. Prehospital care of the injured: what's new. Surgical Clinics of North America. 2007;87:37-53.
[4] Gerardo CJ, Glickman SW, Vaslef SN, Chandra A, Pietrobon R, Cairns CB. The rapid impact on mortality rates of a dedicated care team including trauma and emergency physicians at an academic medical centre. J Emerg Med. 2011;8:586-91.
[5] Chawda MN, Hildebrand F, Pape HC, Giannoudis PV. Predicting outcome after multiple trauma: which scoring system? Injury. 2004;35:347-58.
[6] Huber-Wagner S, Lefering R, Quick LM, Korner M, Kay MV, Pfeifer KJ. Effect of whole body CT during trauma resuscitation on survival: a retrospective, multicentre study. Lancet. 2009;373:1455-61
[7] Mitchell RJ, Chong S. Comparison of injury related hospitalized moerbidity and mortality in urban and rural areas in Australia. Rural Remote Heath. 2010;10:1326.
[8] Moffatt SE. Hypothermia in trauma. Emerg Med J. 2013;30:989-96.
[9] Nolan JP, Soar J, Zideman DA, Biarent D, Bossaert LL, Deakin C, et al. European Resuscitattion council guidelinesfor resuscitation 2010. Section 1. Executive Summary. Resuscitation. 2010;81:1219-76.
[10] Jeong JH, Park YJ, Kim DH, Kim TY , Kang C, Lee SH, et al. The new trauma score (NTS): a modification of the Revised Trauma Score for the better trauma mortality prediction. BMC Surg. 2017;17:77.
[11] Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A revision of the trauma score. J Trauma. 1989;29:623-29.
[12] Osler T, Baker SP, Long W. A Modification of the injury severity score that both improves accuracy and simplifies scoring. J Trauma. 1997;43:922-25.
[13] Gururaj G. Road traffic deaths, injuries and disabilities in India: Current scenario. Natl Med J India. 2008;21(1):14-20.
[14] Sasser SM, Hunt RC, Faul M, Sugerman D, Kim TY, Kang C, et al. Guidelines for field triage of injured patients: recommendations of the National Expert Panel on Field Triage. MMWR Recomm Rep. 2011;61:01-20.
[15] Huber-Wagner S, Biberthaler P, Häberle S, Wierer M, Dobritz M, Rummeny E, et al. Whole-body CT in haemodynamically unstable severely injured patients-A retrospective, multicentre study. PLoS One. 2013;8(7):e68880.
[16] Natarajan B, Gupta PK, Cemaj S, Sorensen M, Hatzoudis GI, Forse RA. FAST scan: Is it worth doing in hemodynamically stable blunt trauma patients? Surgery. 2010;148:695-701.
[17] Koksal O, Ozdemir F, Bulut M, Aydin S, Almacioglu ML, Ozguc H. Comparison of trauma scoring systems for predicting mortality in firearm injuries. Turk J Trauma. 2009;15(6):559-64.
[18] Zhao XG, Ma YF, Zhang M, Gan JX, Xu SW, Jiang GY. Comparison of the new injury severity score and the injury severity score in multiple trauma patients. Chin J Traumatol. 2008;11:368-71.
[19] Roy N, Gerdin M, Schneider E, Kizhakke Veetil DK, Khajanchi M, Kumar V, el al. Validation of international trauma scoring systems in urban trauma centres in India. Injury. 2016;47:2459-64.
[20] Servia L, Badia M, Montserrat N. Severity scores in trauma patients admitted to ICU. Physiological and anatomical models. Med Intensiva. 2017;43:26-34.
[21] Soni KD, Mahindreakar S, Gupta A, Kumar S, Sagar S, Jhakal A. Comparision of ISS, NISS and RTS score as a predictor of mortality in paediatric fall. Burns and Trauma.2017;5:25-31.
[22] Jones JM, Skaga NO, Sovik S, Lossius HM, Eken T. Norwegian survival prediction model in trauma: modelling effects of anatomic injury, acute physiology, age, and co- morbidity. Acta Anaesthesiol Scand. 2014;58(3):303-15.
[23] Orhon R, Eren SH, Karadevi S, Korkmaz L, Coskun A, Eren M, et al. comparision of trauma scores for predicting mortality and morbidity on trauma patients. Turk J Trauma.2014;20:258-64.
[24] Dillon B, Wang W, Bouarmra O. A comparision study of the Injury Score Model. Eur J Trauma. 2016;32:538-47.

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