

# Comparative Study of Injury Severity Score and New Injury Severity Score as Criteria for Admission of Trauma Patients in a Tertiary Care Centre

Pawan Sharma<sup>1</sup>, Abhishek Sharma<sup>2</sup>, Usha Kumari<sup>3</sup>

<sup>1</sup>Senior Advisor, (Surg) and Trauma Surgeon, Army College of Medical Sciences and Base Hospital, Delhi Cantt, New Delhi -110010, India, <sup>2</sup>III<sup>rd</sup> Year Resident, (Gen Surg), Base Hospital, Delhi Cantt, New Delhi - 110010, India, <sup>3</sup>UshaKumari, Internee Med Offr, Base Hospital, Delhi Cantt, New Delhi -110010, India

## Abstract

**Background:** Trauma has been a major cause of morbidity and mortality all across the globe. For the improvement of delivery of efficient care to these victims, various trauma severity indices have been devised which make it possible to plan emergency care and assess need for hospitalisation and optimise hospital resources. This study was carried out to compare and evaluate Injury Severity Score(ISS) and New Injury Severity Score(NISS) as criteria for admission of trauma patients.

**Methods:** It was a prospective observational study. The available data was analyzed to determine and compare ISS and NISS as the criteria for admission. The statistical software SPSS (version 20) was used for data analysis.

**Results:** A total of 102 patients were studied at Trauma Centre of our hospital. Out of the total patients, 59.8% patients had their NISS scores greater than ISS which showed that NISS is slightly more sensitive and accurate than ISS. It was observed that NISS was not better in predicting hospital stay as compared to ISS. The relationship between NISS and number of hospitalisation days was not statistically significant (p value= 0.112) whereas ISS was a better predictor of hospital stay (p value=0.042).

**Conclusion:** In this study, it was observed that majority of parameters have favored NISS whereas parameters like hospital stay have favored ISS. Hence, we concluded that NISS is a better score than ISS in many aspects and it can be preferred over ISS as one of the criteria for Hospital admission of trauma patients.

**Key words:** Admission criteriam, Injury severity score, Trauma

## INTRODUCTION

Injury continues to be a major cause of morbidity and mortality especially amongst the young population all across the globe and is already taking epidemic proportions.

According to WHO, accident is an event, which is independent of human will power, caused by an external force, acts rapidly, and results in physical or mental harm.

Today, violence and global advances in technology are contributing to the rising number of deaths and disabilities due to trauma. India and USA figure among the largest number of traffic related fatalities. Since early times, mankind has faced challenges of appropriately treating the trauma victims worldwide.

For the improvement of delivery of efficient and optimal outpatient or in patient care to these victims, various trauma severity indices have been devised. These indices, through uniform language, permit assessment the severity of anatomic injuries and probability of survival of such patients. These scoring systems make it possible to plan emergency care, assess need for hospitalisation, optimise hospital resources and document epidemiological characteristics. There are several severity indices that have been used in the results of research on trauma. These measures of scales have physiological, anatomical or mixed bases.

Access this article online



www.ijss-sn.com

Month of Submission : 02-2015  
Month of Peer Review : 03-2015  
Month of Acceptance : 03-2015  
Month of Publishing : 04-2015

**Corresponding Author:** Dr. Pawan Sharma, Department of Surgery, Trauma and Surgical Critical Care, Surgical Division, ACMS and Base Hospital, Delhi Cantt -110010, Mobile: +918860602390.

Among anatomical ones, ISS, that was created by Baker et al in 1974 has been considered the gold standard for over 40 years to classify trauma victims with blunt and penetrating injuries. Injury Severity Score is based on Abbreviated Injury Scale (AIS), a guideline of anatomical descriptors of wounds from trauma victims. It is made up of seven digits and each digit has its own significance.<sup>1</sup> The score, which in turn is based on the severity score of lesions established by AIS, tries to portray global severity of victims. The greater the score, greater is the severity of injury, and consequently greater mortality.<sup>2</sup>

Injury Severity Score, which is sum of the squares of highest AIS in three different body regions, considers only the most severe lesion in each body region, ignoring the second most severe lesion that many times, is in the same body segment as that of the first. New Injury Severity Score (NISS) considers the three most severe lesions in calculation, regardless of body regions.<sup>3</sup>

The ISS and the NISS were compared by Kulla M and colleagues in December 2005. The advantages, disadvantages and limitations in the use of these indices were brought forward.<sup>4</sup>

Moreover, till date, limited researches have been located in literature which compared ISS with NISS.

This research is aimed to make this comparison. We reviewed the pattern of admitting patients in a trauma centre of a tertiary care hospital during the period of study. We then compared ISS with NISS, as criteria for admission of trauma patients. This is one of the ways to objectively assess and define the admission criteria and minimise morbidity and mortality in trauma victims.

## MATERIAL AND METHODS

This was a prospective observational study. All Trauma patients brought to the trauma centre of our hospital and receiving treatment during the three months study period from 01 Jun to 30 Aug 2016 were included in the study.

All patients who were brought comatose, those brought in dead and those lacking the reliable history of trauma were excluded from the study.

A written informed consent was obtained from all those patients included in the study.

An institutional ethical committee clearance was not required as there were no drug administration or any interventions performed during the study.

A pre-designed format (Proforma) was used to record the observations. Daily visits to the trauma centre and surgical ward were undertaken to record the injuries of trauma patients. Follow up was done for three months. Scores were calculated with the help of AIS 2005 manual.

The statistical analysis was done by presenting the continuous data such as age etc. in mean  $\pm$  SD and the categorical data in frequencies with percentage. The appropriate charts i.e. pie/bar diagrams have been used for Qualitative data. The collected data at the end of the study period was analysed using statistical software SPSS (version 20).

Informed consent was sought from all the patients included in the study and ethical clearance was obtained from the institutional ethical committee.

## RESULTS

A total of 102 injured patients who reported or were brought to the trauma centre and qualified for the study after applying inclusion and exclusion criteria, were studied and analysed during the entire study period.

- i) The mean age of the patients was 39.75 $\pm$ 15.07 years. The age wise distribution of patients is given in Table 1. The maximum admissions were in 30-60 years age group followed by 10-30 years age group. There were only 8 admissions with age more than 60 years.

**Table 1: Age wise distribution**

Age (in years)	No. of patients	% patients
10-30 years	35	34.3
30-60 years	59	57.8
>60 years	8	7.8

- ii) The results showed high frequency of males (94.1%). The predominant mode of injury was blunt trauma (97.1%). The mechanism of injury follows the order-Road Traffic Accidents (57.84%), falls (35.29%) and Assaults (6.86%).
- iii) According to the ISS, patients scoring <10 were 36.3%, between 10 and 20, 46.1% and  $\geq$ 20, 17.6%. Scores above 38 points were not identified in any case. In total, 102 patient with various injuries were analysed, of which 17.6% victims presented with severe trauma, i.e. ISS  $\geq$ 20. The mean ISS was found to be 13.37, with standard deviation of 8.02 and median of 13.
- iv) On applying the NISS to the same group, 30.4% scored <10, 28.4% between 10 and 20 and 41.2%  $\geq$ 20. The range was 4 to 50. Considering 20 as severe trauma indicator, 41.2% patients had higher NISS scores. The mean NISS found was 17.19 with standard deviation of 9.80 and median of 17. Out of a total of 102 patients,

40.19% had equal scores on both scales and 59.81 % had higher NISS values than ISS.

- v) When relationship between ISS and patients admitted to ICU was established, results showed that there was significant ( $p$  value=0.00) relationship between them. (Figure 1) A total of 31 patients were admitted to ICU. Only 2.7% patients of the total patients of ISS<10 were admitted and similarly 34% with ISS between 10 and 20 were admitted whereas 77.8% with ISS>20 were admitted to ICU as shown in Figure 1.

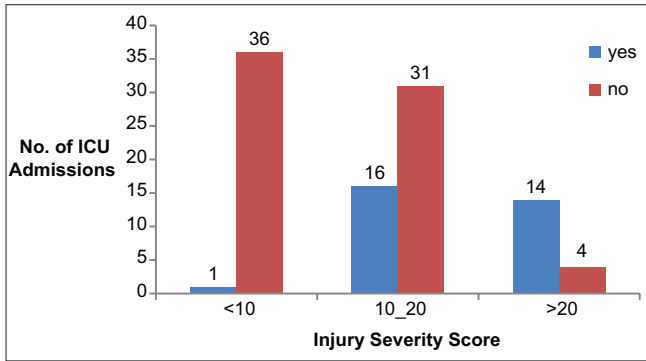


Figure 1: Number of ICU admissions based upon ISS

- vi) The relation of NISS and ISS was also significant. None of the patients with NISS <10 were admitted to ICU. 13.8% patients with NISS between 10 and 20 were admitted and 64.3% patients with NISS >20 were admitted to ICU (Figure 2).

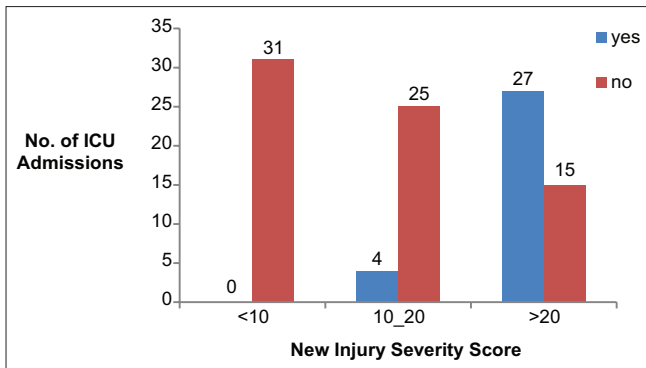


Figure 2: ICU admissions based upon NISS

Out of the total 31 patients admitted to ICU, 27 of them had NISS >20 whereas only 14 had ISS >20. It was evident from these results that NISS was more sensitive in predicting admissions to ICU than ISS.

- vii) The relationship of ISS with length of hospital stay was also significant ( $p$  value=0.042) but relationship of NISS and length of hospital stay was not significant ( $p$  value=0.112). It was observed that 1/3<sup>rd</sup> patients out of total, with ISS>20 were admitted for >30 days whereas almost only 1/5<sup>th</sup> Patient's with NISS of >20 were admitted to the hospital beyond 30 days.

Maximum patients with severe injury i.e. ISS and NISS >20 were admitted for a period of 10 to 30 days. In our results, it is seen that ISS predicts length of stay better than NISS.

Table 2: Morbidity

Score	ISS		NISS	
	Morbidity	No morbidity	Morbidity	No morbidity
<10	11	26	07	24
10-20	17	30	12	17
>20	13	05	22	20
Total	41	61	41	61

- viii) There was significant relation between morbidity and ISS ( $p$  value=0.008) and between morbidity and NISS as well ( $p$  value=0.037). (Table 2) Morbidity was defined as presence of one or more than one of the following features-length of hospital stay more than 30 days, presence of hospital acquired infections, mechanical ventilation for more than 7 days, two or more than two surgical procedures on the same patient and residual disability at the time of discharge. (Figure 3) Results showed that- total 41 patients had morbidity. Twenty two patients with NISS>20 had morbidity whereas only 13 patients with ISS >20 had morbidity as shown in Figure 3 and 4.

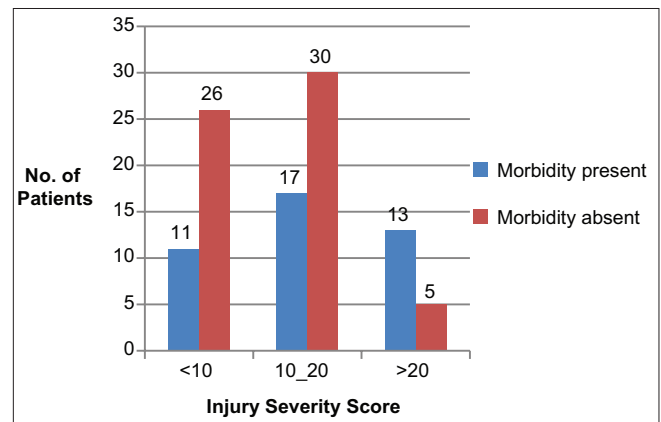


Figure 3: ISS based morbidity and mortality

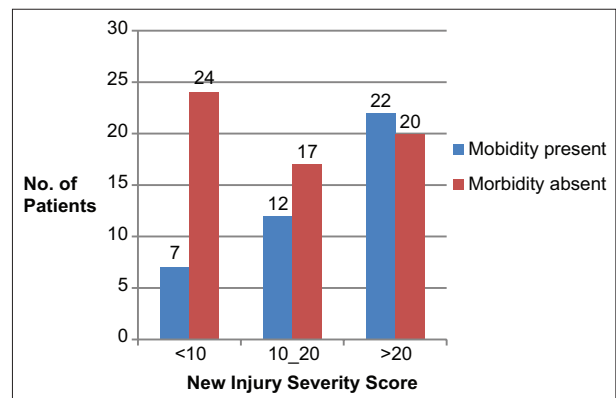


Figure 4: NISS based morbidity and mortality

Similarly, 7 patients with NISS<10 presented with morbidity whereas 11 patients with ISS <10 showed morbidity. This shows that, NISS is a better predictor of morbidity. (Figure 4)

## DISCUSSION

Various studies have been done in the past to analyse the utility of trauma scoring systems. The evaluation of the severity of injuries has been a major concern for the investigators over a period of years. The modern scientific era of measurement of injury began in 1952, when De Haven proposed a rudimentary classification of human injury to facilitate his light plane crashes study.<sup>5</sup>

In 1971, AIS was published by the committee on automotive safety.<sup>1</sup> Encouraging results following utility of AIS paved the way for introduction of two of the most popular scores- Injury Severity score (ISS) and New Injury Severity Score (NISS) that are most widely used scores these days. The Injury Severity Score was first published in 1974.<sup>2</sup> ISS is based on AIS which was updated in 1976 which automatically updated ISS. Twenty years later, in 1997 Baker et al<sup>3</sup> modified ISS to NISS. Subsequently, comparison between these 2 scores came into picture.

A prospective study in 2015 at Al-Ain Hospital over 3 years showed that 82.2% patients suffered blunt trauma with mean age of 32 years. Among them 87% were males. Main mechanisms of injury were road traffic accidents (32.8%) and falling from height (22.4%). Mortality was 2.4% which was significantly increased by low GCS ( $p<0.0001$ ), high NISS ( $p<0.0001$ ), and low systolic blood pressure at hospital arrival.<sup>11</sup> Another study comparing ISS and NISS for mortality and complications was conducted by Smith BP et al consisted of a total of 256 severely injured patients. Only 195 patients survived until discharge. The mortality area under curve for NISS was greater than the area under curve for ISS. The NISS outperformed ISS as a predictor of mortality and complications in penetrating trauma patients.<sup>7</sup>

Our study was conducted in the Trauma centre of a tertiary care service hospital.

It was seen that the maximum patients were from age group of 30-60 years, followed by 10-30 years. A similar trend was observed in a study conducted by Tamim H et al in 2015 where the admissions are maximum in adult age group.<sup>11</sup>

In our study, ISS and NISS were compared with each other in terms of various parameters. Out of the total patients, 59.8% patients had their NISS scores greater than ISS (mean ISS and NISS being 13.4 and 17.19 respectively)

which showed that NISS is slightly more sensitive and accurate than ISS. Similar results were seen in their work published by Baker et al in 1997.<sup>3</sup> Another study conducted by Tay SY et al in 2004 showed that ISS and NISS share similar accuracy.<sup>10</sup>

The comparison of the scores with regards to ICU admissions has shown that 27 ICU admitted patients had NISS >20 whereas 14 had an ISS>20. Hence, NISS is more sensitive in predicting admissions to ICU than ISS. Similar trends have been reflected in the study published by Balogh ZI et al in 2003.<sup>9</sup> There are few studies which differ in their results. One of them is conducted by Tay SY et al which showed that ISS and NISS had equal accuracy.<sup>10</sup> On the other hand, another study highlights ISS as a better parameter than NISS in predicting admissions to ICU.<sup>11</sup>

In our study, it was observed that NISS was not better in predicting hospital stay as compared to ISS. The relationship between NISS and number of hospitalisation days was not statistically significant ( $p$  value = 0.112) whereas ISS was a better predictor of hospital stay ( $p$  value=0.042). Similar results were observed by Tamim H et al in their study published in 2008.<sup>11</sup> Other studies showed opposite results.<sup>8</sup>

Our study has favoured NISS as a better prediction of morbidity as compared to ISS. It was seen that higher the severity of injury, more it becomes a better predictor of morbidity. Similar trends were observed in other studies also in the literature.<sup>2</sup>

In our study it was seen that the most predominant mode of injury was blunt trauma (97.1%). All patients who died had a history of blunt trauma. We simply observed the mean ISS and NISS of patients who died of blunt trauma, which were 24.75 and 31.5 respectively. This showed that NISS is a better predictor of mortality in patients with blunt trauma. Similar results have been observed in other studies as well.<sup>6,12</sup> One study which differs in this regard was conducted at American University of Beirut in 2008 which brought out that ISS and NISS were at par in predicting survival.<sup>11</sup>

So, as far as scores are concerned, NISS was observed to be better in all parameters except in predicting the length of the hospital stay. Although, studies with sample size less than 1000 have shown comparable results for ISS and NISS but our study has favoured NISS.

## CONCLUSION

The study concludes that NISS is a better predictor for majority of the parameters like ICU admissions, mortality and morbidity in injured patients and hence, is a better tool

of the two in deciding hospital admission. A threshold of NISS of 20 is strongly suggested beyond which all trauma victims should be hospitalised irrespective of the clinical condition on arrival, mechanism of injury, age or the presence or absence of comorbid conditions. However, in view of the small sample size and short study period, more elaborate and multicenteric studies with larger sample size and more variables are suggested to substantiate the present observations and the conclusions.

## REFERENCES

1. Association for the Advancement of Automotive Medicine – AAAM. Abbreviated Injury Scale (AIS): 2015 revised update.
2. Baker SP, O’neill B, Haddon W, Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. *J Trauma*. 1974 Mar; 14(3):187–196.
3. Osler T, Baker SP, Long W. A modification of the injury severity score that both improves accuracy and simplifies scoring. *J Trauma*. 1997 Dec; 43(6):922–925.
4. Kulla M, Fischer S, Helm M, Lampl L. [How to assess the severity of the multi-system trauma in the emergency-room — a critical review] *Traumascorésfür den Schockraum — einekritischeÜbersicht. AnesthesiolIntensivmedNotfallmedSchmerzther*. 2005 Dec; 40(12):726–736.
5. Campos M A. O Injury Severity Score e a sua nova propostaemvítimas de trauma crânio-encefálico: diferençasemresultados e efetividade de valor preditivo. [dissertação]. São Paulo (SP): Escola de Enfermagem/USP; 2001.
6. Jamulitrat S, Sangkerd P, Thongpiyapoom S, Na Narong M. A comparison of mortality predictive abilities between NISS and ISS in trauma patients. *J Med Assoc Thai*. 2001 Oct; 84(10):1416–1421.
7. Eid HO, Abu Zidan FM. New Injury Severity Score is a better predictor for blunt trauma patients than the ISS. *World J Surg*. 2015 Jan;39(1):165-171.
8. Lavoie A, Moore L, LeSage N, Liberman M, Sampalis JS. The Injury Severity Score or the New Injury Severity Score for predicting intensive care unit admission and hospital length of stay. *Injury*. 2005 Apr; 36(4):477–483.
9. Balogh ZJ, Varga E, Tomka J, Süveges G, Tóth L, Simonka JA. The new injury severity score is a better predictor of extended hospitalization and intensive care unit admission than the injury severity score in patients with multiple orthopaedic injuries. *J Ortho Trauma*. 2003 Aug; 17(7):508–512.
10. Tay SY, Sloan EP, Zun L, Zaret P. Comparison of the New Injury Severity Score and the Injury Severity Score. *J Trauma*. 2004 Jan; 56(1):162–164.
11. Tamim H et al. The statistical performance of Injury Severity Score and New Injury Severity Score in predicting mortality, admission to intensive care unit and length of hospital stay. *J Injury*. 2008 Jan;39(1):115-120.
12. Deng Q, Tang B, Xue C, Liu Y, Liu X, Lv Y, Zhang L. Comparison of the ability to predict mortality between the Injury Severity Score and the New Injury Severity Score-A Meta Analysis. *Int J Environ Res Public Health*. 2016 Aug; 16:13(8). Epub Aug16.

**How to cite this article:** Sharma P, Sharma A, Kumari U. Comparative Study of Injury Severity Score and New Injury Severity Score as Criteria for Admission of Trauma Patients in a Tertiary Care Centre. *Int J Sci Stud* 2015;3(1):183-187.

**Source of Support:** Nil, **Conflicts of Interest:** None declared.