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**ORIGINAL ARTICLE**

# Assessing the Predictive Value of Injury Severity Score (ISS) in Relation to Morbidity, Mortality, and Hospital Stay of Patients Following Road Traffic Accidents

MUHAMMAD NADEEM[1], SHAH ABBASS[2], HAIDER SHAH[3], SHAHZAD KHAN[4], ANWAR UL HAQ[5], SHAHID ALAM[6]
[1]*Associate Professor, General Surgery, Surgical B unit,Saidu Teaching Hospital, Swat*
[2]*Assistant Professor, General Surgery, Saidu Teaching Hospital, Swat*
[3]*Senior Registrar, General Surgery, Saidu Teaching Hospital, Swat*
[4]*Senior Registrar, Radiology, Saidu Teaching Hospital, Swat*
[5]*Professor, General Surgery, Saidu Teaching Hospital, Swat*
[6]*Assistant professor, General Surgery, Saidu Teaching Hospital, Swat*
*Correspondence to: Shah Abbass, Email: drshahabbas@yahoo.com*

## ABSTRACT

**Background:** Road traffic accidents (RTAs) remain one of the leading causes of death and disability worldwide. The Injury Severity Score (ISS) is a well-established tool used to assess trauma severity and predict outcomes in trauma patients. It is widely applied in evaluating the severity of injuries in patients following RTAs. This study aims to assess the predictive value of the ISS in relation to morbidity, mortality, and hospital stay in RTA patients at a major trauma center.

**Methodology:** This retrospective cohort study was conducted at a major trauma center over two years, from June 2023 to November 2023. A total of 92 patients involved in RTAs were included. Data were collected from the trauma registry, including demographic information, ISS scores, injury details (based on the Abbreviated Injury Scale - AIS), and clinical outcomes such as morbidity, mortality, and hospital length of stay. Statistical analysis was performed using SPSS, with Pearson's correlation and multivariate regression used to assess relationships between ISS and outcomes. A p-value of $<0.05$ was considered statistically significant.

**Results:** The study included 92 patients, with an average age of 42.1 years (range 19–89 years), and 68% of them were male. The mean ISS score was 17.8 ± 12.2. The mortality rate was 11%, with the highest mortality observed in patients with ISS scores greater than 25 (50% mortality). The morbidity rate was 27%, with a significant correlation between higher ISS scores and increased complications. The average hospital stay was 12.3 days, and longer stays were significantly associated with higher ISS scores ($p < 0.05$).

**Conclusion:** The ISS is a reliable predictor of morbidity, mortality, and hospital stay in patients following road traffic accidents. Higher ISS scores are associated with increased mortality, complications, and prolonged hospital stays. The findings support the use of ISS as a useful tool for triaging and managing trauma patients, enabling clinicians to make better-informed decisions regarding patient care and resource allocation.

**Keywords:** Injury Severity Score, Road Traffic Accidents, Morbidity, Mortality, Hospital Stay, Trauma, Predictive Value

## INTRODUCTION

Road traffic accidents (RTAs) are a leading cause of morbidity and mortality worldwide. With millions of lives lost and a significant number of individuals experiencing injuries of varying severity, it is essential to identify tools that can predict patient outcomes following trauma[1,2]. The Injury Severity Score (ISS) is one such tool, used to evaluate trauma patients based on the severity of injuries sustained. Developed in the 1970s, the ISS assigns scores based on injuries across different body regions, using the Abbreviated Injury Scale (AIS) to categorize the severity of each injury[3,4].

Previous studies have shown that the ISS is a strong predictor of various clinical outcomes, including morbidity, mortality, and the length of hospital stay[5]. Patients with higher ISS scores are more likely to experience complications[6], have prolonged hospitalizations[7], and face a higher risk of death[8]. Understanding the predictive value of the ISS for RTAs can assist clinicians in making early treatment decisions, improving outcomes, and managing resources effectively[9,10].

This study aims to explore the relationship between ISS and the following key outcomes in patients involved in road traffic accidents: morbidity, mortality, and hospital stay. The study will also assess how ISS can guide clinical decision-making and improve patient care in trauma settings.

## METHODOLOGY

This study employed a retrospective cohort design to assess the predictive value of the Injury Severity Score (ISS) in relation to morbidity, mortality, and hospital stay in patients following road traffic accidents (RTAs). The study was conducted at Surgical B Unit, Saidu Teaching Hospital Swat during from June 2023 to November 2023.

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**Sample Size Calculation:** The sample size was calculated based on an expected incidence of mortality of 10%, a confidence level of 95%, and a margin of error of 5%. Using an online sample size calculator, the required sample size was estimated to be 92 patients, considering the estimated population size for the trauma center during the study period.

**Inclusion Criteria:**

- Patients aged 18 years or older.
- Patients who sustained injuries as a result of road traffic accidents (RTAs).
- Complete medical records with ISS scores and injury details available.
- Patients admitted to the trauma center within 24 hours of the accident.

**Exclusion Criteria:**

- Patients with incomplete medical records or missing ISS scores.
- Patients who were transferred to other hospitals within 24 hours of admission.
- Patients with isolated injuries (e.g., minor fractures without significant trauma).
- Pediatric patients under 18 years of age.

**Data Collection:** The data was obtained from the hospital's trauma registry, which included demographic information, ISS scores, details of injuries (classified according to the Abbreviated Injury Scale - AIS), outcomes (morbidity, mortality, hospital length of stay), and complications. Morbidity was defined as any complication (e.g., organ failure, infections) that occurred during the hospital stay.

**Statistical Analysis:** The data were analyzed using SPSS Version 23.0. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. The relationship between ISS and the outcomes (morbidity, mortality, hospital stay) was assessed using Pearson's correlation and multivariate regression analysis. A p-value < 0.05 was considered statistically significant.

## RESULTS

A total of 92 patients were included in the study, with an average age of 42.1 years (range 19–89 years). The majority of patients (68%) were male, with the following demographic and clinical characteristics. (Table 1)

Table 1: Demographic Details of Included Patients

| Variable | N = 92 | Percentage/Mean |
|---|---|---|
| Gender (Male) | 62 | 67.4% |
| Gender (Female) | 30 | 32.6% |
| Mean Age (years) | 42.1 ± 12.2 | |
| Age Group (18-30 years) | 22 | 23.9% |
| Age Group (31-50 years) | 38 | 41.3% |
| Age Group (51-70 years) | 24 | 26.1% |
| Age Group (71+ years) | 8 | 8.7% |

The Injury Severity Score (ISS) was calculated based on the Abbreviated Injury Scale (AIS) for each patient. The mean ISS score for the cohort was 17.8 ± 12.2, with the following distribution: (Table 2)

Table 2: Injury Severity Score (ISS)

| ISS Range | Number of Patients | Percentage (%) |
|---|---|---|
| ISS 1-8 | 28 | 30.4% |
| ISS 9-15 | 32 | 34.8% |
| ISS 16-25 | 18 | 19.6% |
| ISS > 25 | 14 | 15.2% |

The mortality rate for the entire cohort was 11% (10 out of 92 patients). Mortality was significantly associated with higher ISS scores. A breakdown of mortality by ISS range is shown below: Table 3

Table 3: Mortality according to the ISS

| ISS Range | Mortality (N) | Mortality Rate (%) |
|---|---|---|
| ISS 1-8 | 0 | 0% |
| ISS 9-15 | 3 | 9.4% |
| ISS 16-25 | 4 | 22.2% |
| ISS > 25 | 3 | 21.4% |

Morbidity, defined as complications arising during the hospital stay, was observed in 27% of patients (25 out of 92). The most common complications included infections, organ failure, and neurological impairments. The morbidity rate was highest among patients with higher ISS scores. Table 4

Table 4: Morbidity according to the ISS

| ISS Range | Morbidity (N) | Morbidity Rate (%) |
|---|---|---|
| ISS 1-8 | 4 | 14.3% |
| ISS 9-15 | 8 | 25.0% |
| ISS 16-25 | 8 | 44.4% |
| ISS > 25 | 5 | 35.7% |

The mean hospital stay for the entire cohort was 12.3 ± 8.5 days. Longer hospital stays were significantly associated with higher ISS scores. Patients with ISS > 25 had an average hospital stay of 20 days, while those with lower ISS scores had an average stay of 7-8 days. Table 5

Table 5: Hospital Stay

| ISS Range | Mean Hospital Stay (Days) |
|---|---|
| ISS 1-8 | 7.3 ± 3.2 |
| ISS 9-15 | 10.5 ± 5.1 |
| ISS 16-25 | 14.2 ± 7.8 |
| ISS > 25 | 20.1 ± 10.3 |

**Logistic Regression Analysis:** To assess the predictive value of ISS for mortality and morbidity, a logistic regression analysis was conducted. The model included ISS scores, age, and gender as predictor variables for both mortality and morbidity.

**Logistic Regression for Mortality:** A logistic regression model was fitted to predict mortality using ISS, age, and gender as independent variables. The dependent variable was mortality (coded as 1 = deceased, 0 = alive).

Table 6: The regression analysis results are presented below

| Variable | Odds Ratio (OR) | 95% CI for OR | p-value |
|---|---|---|---|
| ISS (per point) | 1.07 | 1.02 - 1.13 | 0.005 |
| Age (per year) | 1.02 | 1.00 - 1.04 | 0.025 |
| Male (vs. Female) | 1.68 | 0.61 - 4.58 | 0.31 |

**Interpretation:**

- ISS: For every 1-point increase in ISS, the odds of mortality increased by 7% (OR = 1.07, p = 0.005), suggesting a significant relationship between ISS and the likelihood of death.
- Age: For every additional year of age, the odds of mortality increased by 2% (OR = 1.02, p = 0.025), indicating that older patients have a slightly higher risk of death following trauma.
- Gender: Male gender did not significantly influence mortality in this study (p = 0.31), though it showed a slight increase in the odds of mortality.

**Logistic Regression for Morbidity:** A similar logistic regression model was used to predict morbidity (coded as 1 = complication, 0 = no complication) based on ISS, age, and gender.

Table 7: The regression analysis results are presented below

| Variable | Odds Ratio (OR) | 95% CI for OR | p-value |
|---|---|---|---|
| ISS (per point) | 1.06 | 1.03 - 1.09 | 0.001 |
| Age (per year) | 1.03 | 1.01 - 1.06 | 0.015 |
| Male (vs. Female) | 1.48 | 0.84 - 2.61 | 0.17 |

**Interpretation:**

- ISS: For every 1-point increase in ISS, the odds of morbidity increased by 6% (OR = 1.06, p = 0.001), confirming that higher ISS is strongly associated with an increased risk of complications.
- Age: For every additional year of age, the odds of morbidity increased by 3% (OR = 1.03, p = 0.015), indicating that older patients are more likely to experience complications.
- Gender: Similar to mortality, male gender did not significantly affect morbidity in this study (p = 0.17).

## DISCUSSION

This study aimed to assess the predictive value of the Injury Severity Score (ISS) in relation to morbidity, mortality, and hospital stay in patients involved in road traffic accidents (RTAs). The results strongly support the ISS as a reliable and valuable tool in predicting patient outcomes. Higher ISS scores were consistently associated with increased morbidity, mortality, and prolonged hospital stays. These findings are consistent with those of previous studies, which have demonstrated that ISS is a key determinant of trauma outcomes, and our study further reinforces its clinical relevance in trauma care.

The relationship between the ISS and morbidity in trauma patients is well-established. This study found that higher ISS scores were significantly associated with an increased risk of complications, including organ failure, infections, and neurological impairments. In patients with an ISS of 16-25, nearly 44.4% developed complications, and in those with ISS scores greater than 25, 35.7% experienced complications. This aligns with previous studies that have shown that more severe injuries, as indicated by higher ISS scores, tend to lead to more significant complications[1,4].

The increased risk of morbidity in patients with higher ISS scores is likely due to the involvement of multiple body regions, which can result in more complex clinical management. These patients are at higher risk of experiencing multi-organ failure, prolonged recovery times, and the need for multiple surgical interventions. Additionally, such patients often require more intensive monitoring in the ICU, further increasing the likelihood of complications and longer hospital stays[5,7]. The ISS is a tool that helps clinicians anticipate these challenges, allowing them to provide more targeted and proactive care.

One of the most critical outcomes in trauma care is mortality, and ISS has consistently proven to be a reliable predictor of survival in trauma patients. In this study, we observed a significant increase in mortality rates with higher ISS scores. The overall mortality rate for the cohort was 11%, but for those with ISS scores greater than 25, the mortality rate increased to 21.4%. This finding is consistent with research by Maier et al. (2006) and Dijkman et al. (2013), who demonstrated that high ISS scores are correlated with increased mortality in trauma patients, especially those with severe polytrauma[6,7].

The relationship between ISS and mortality can be attributed to several factors. Higher ISS values often reflect severe injuries to vital organs or systems, such as the brain, chest, or abdomen, where life-threatening conditions such as traumatic brain injury, hemorrhagic shock, and multi-organ failure are more likely to occur. These severe injuries require intensive care and are more likely to result in death, particularly if not managed effectively. The ISS helps clinicians to identify patients at higher risk of death, allowing for prioritization of aggressive treatments, early intervention, and better resource allocation in trauma centers[8].

As expected, the length of hospital stay was significantly longer for patients with higher ISS scores. Patients with an ISS of 25 or higher had a mean hospital stay of 20 days, while patients with lower ISS scores[1-8] had a mean stay of 7.3 days. This correlation between higher ISS and longer hospital stays is consistent with prior studies that have shown that patients with more severe injuries tend to require longer hospitalization due to the need for surgical interventions, intensive care, and rehabilitation[5,7]. Longer stays may also be due to complications arising from severe trauma, including infections, organ failure, and the need for prolonged mechanical ventilation or dialysis.

One important factor contributing to longer hospital stays is the increased requirement for rehabilitation in patients with higher ISS scores. Severe trauma often leads to disabilities that necessitate physical therapy and long-term rehabilitation. This aspect of recovery is often overlooked in studies that focus solely on mortality, but it is an important determinant of the overall length of hospital stay and the quality of life after trauma[9]. The ISS, therefore, provides valuable insight into the expected length of hospitalization and the need for post-trauma rehabilitation.

In this study, age was also found to be a predictor of morbidity and mortality. Older patients had a slightly higher risk of both complications and death following an RTA. This is in line with studies that have shown that aging is associated with poorer trauma outcomes, likely due to the increased prevalence of comorbidities, reduced physiological reserve, and slower recovery times[10]. For instance, older adults are more likely to experience complications such as pneumonia, deep vein thrombosis, and delirium during hospitalization. Additionally, their injuries may take longer to heal, leading to extended hospital stays and greater long-term disability[11]. Therefore, while ISS is a key predictor, it is important to consider age as an additional factor when assessing trauma patients, as it may further influence outcomes.

Interestingly, gender was not a significant predictor of either mortality or morbidity in this cohort. Although male patients comprised 67.4% of the sample, gender did not show a statistically significant difference in mortality or morbidity, in contrast to other studies that have found that males often have a higher incidence of fatal injuries[12]. This might be due to the specific nature of our cohort or the relatively small sample size. It is important to note that while gender might not have been significant in this particular study, other factors such as socioeconomic status, comorbidities, and specific injury types could also influence the outcomes and may be considered in future studies.

The results of this study emphasize the importance of utilizing the ISS not only to assess the severity of injuries but also to predict the likelihood of adverse outcomes, including morbidity, mortality, and prolonged hospital stays. Clinicians can use the ISS to inform triage decisions, prioritize high-risk patients for intensive care, and allocate resources effectively. Additionally, the predictive value of ISS can guide treatment plans, including the need for surgical intervention, intensive monitoring, and rehabilitation services. The ISS also serves as a valuable communication tool among healthcare providers, helping them to assess and manage trauma patients with greater precision and efficacy[13].

**Limitations:** This study has several limitations. First, it is a retrospective study, which inherently carries the risk of selection bias and incomplete data. Some patients may have been excluded due to incomplete records, and this may have influenced the generalizability of the findings. Second, the study was conducted at a single trauma center, and the results may not be representative of other settings with different patient populations. Third, the analysis was based on ISS as the primary predictor, without considering other scoring systems or biomarkers that may provide a more comprehensive risk assessment. Finally, while ISS is a strong predictor of injury severity, it does not account for factors such as pre-existing comorbidities, which can significantly impact outcomes.

## CONCLUSION

The Injury Severity Score (ISS) is a valuable and reliable predictor of patient outcomes following road traffic accidents (RTAs). This study demonstrates that higher ISS scores are strongly associated with increased morbidity, mortality, and prolonged hospital stays. Specifically, for every increase in ISS, the odds of mortality and complications significantly rise, particularly in patients with ISS scores greater than 25. Age also contributes to worse outcomes, with older patients showing a slightly higher risk for both mortality and morbidity. Gender, however, did not significantly impact the results in this cohort. These findings support the use of the ISS as a key triage tool in trauma care, helping clinicians to make informed decisions regarding the management, resource allocation, and prioritization of care for trauma patients.

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