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Pattern of Traumatic Injuries and Injury Severity Score in a Major Trauma Center in Shiraz, Southern Iran

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ABSTRACT

Objective: To record and classify mechanisms of injury and injury severity score (ISS) in trauma patients admitted to the largest trauma center in Southern Iran.
Methods: This was a prospective cross-sectional study including all the patients who were admitted to Nemazee hospital from 2009 to 2010. We recorded the trauma injury information of 1217 patients who were admitted to of emergency room of the Nemazee hospital during a 13-months period by means of a standard questionnaire. ISS was then obtained for every single patient.
Results: The mean age of patients was 26.6 ± 15.1 (range 1–95) years. The commonest type of trauma including 279 cases (22.9%) was car accident and the least resulted from shotgun injuries in 13 (1.1%) patients. The lowest ISS was due to assault multiple blunt traumas and the highest ISS resulted from shotgun injury. The mean ISS was about 6.3 ± 1.8 (range 1-66). Overall, 86 patients had scores above 17 (7.1%). A total of 69 male patients (7.5%) compared to 17 females (5.7%) had severe injury (ISS>17). Trauma injuries were significantly more severe in males compared to females ($p=0.014$). In the sunny and hot seasons total number of patient was higher. The mean ISS was highest in during spring ($p<0.001$).
Conclusion: In Shiraz, most of the trauma injuries are occurred during summer and hot weather. Men have greater number of injuries and higher ISS compared to women. The lowest ISS was due to assault multiple blunt trauma and the highest ISS was caused by shotgun injury, and car accident was the commonest cause of trauma with head and neck being the most frequent sites in our patients.

Keywords: Injury Severity Score (ISS); Prevention; Control; Epidemiology; Trauma.

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Introduction

Trauma injury is one of the main causes of mortality and morbidity worldwide [1]. In Iran, accidents alongside cardiovascular diseases are leading causes of death [2]. Today it is acknowledged that data collection, characterization and documentation of trauma injuries form a cornerstone in prevention and management of trauma. This would provide us with the clues, general overviews of types, grades, severity, incidence, prevalence and other characteristics of trauma injuries. Such information help expand initiative of trauma injury control and prevention in our area, build up new protocols of trauma management, facilitate functioning of our trauma centers and utilize our resources and materials more efficiently. It would also help to predict the process of the patient's in-hospital care

for prognosis of the treatment outcome or, even perhaps, cease the hospital care and stop wasting health care resources [3].

Injury Severity Score (ISS), first described by Baker and colleagues in 1974, is a validated and mostly used method for recording the anatomical region and severity of the trauma injury using a numerical grade scoring system [4]. Data recorded by ISS, are then easily revised retrospectively or prospectively in relation to the aforementioned processes. ISS is defined when one adds up the squares of three highest abbreviated injury severity scales (AIS), given to 6 general anatomical regions of the body in a trauma patient [5]. These anatomical sites include head and neck, face, thorax, abdomen, extremities and other sites .Description of scales are categorized as minor, moderate, serious, severe, critical, and maximal which is currently untreatable [5]. The highest value of ISS is 75, because if any of abbreviated injury scale (AIS) grades is 6, the ISS is considered as 75 and thus there was no need for calculating ISS [3]. In the past, the original form of AIS of 1974 model was used to consider both severity and the outcome of the injury since it had fatal codes from 6 to 9 to describe injuries in patients dying in the first 24 hours after injury, regardless of the injury severity. However, these so-called fatal codes were excluded from 1976 revision, thus making AIS scores in new model more meaningful. As previously demonstrated by Baker *et al.*, [6] ISS can be used not only in patients with injury to multiple areas of the body, but is also used to describe patients with single body region injuries [6]. The aim of this study was to evaluate the severity and prevalence of different injuries in patients referred to our level I trauma center in order to assist us in designing more efficient protocols in the management of trauma patients. Account is also taken of our requisites of resources and facilities for better future care. This provides helpful strategies to control and prevent such injuries, as far as possible. We would also be able to compare our data with other centers in our country or even with available international data to gain a more helpful outlook of our situation.

Materials and Methods

Study population

This study was a cross-sectional study including trauma patients admitted during 7 to 9 random days of every month, and over a period of 13 month starting from 20 February 2009 to 20 March 2010. The patients had already been observed more for than 6 hours in the surgical Emergency Room (ER) of the Nemazee hospital, a tertiary healthcare center affiliated with Shiraz University of Medical Sciences. Namazee hospital is a level I trauma center with a heavy workload despite limited resources and facilities [7]. The study protocol was approved by institutional review board (IRB) and ethics committee of Shiraz University of Medical Sciences and all the patients gave their informed written consents before inclusion in the study.

Study protocol

ISS was calculated and recorded for the patients of the ER during 7 to 9 random days of every month by resident surgeons and attending physicians of the ER, and the data was collected by trained medical students. To calculate ISS for each injured person, the body was divided into six ISS body regions. These body regions were:

- Head or neck - including cervical spine
- Face - including the facial skeleton, nose, mouth, eyes and ears
- Chest - thoracic spine and diaphragm
- Abdomen or pelvic contents - abdominal organs and lumbar spine
- Extremities or pelvic girdle - pelvic skeleton
- External

To calculate the ISS, we considered the highest AIS severity code in each of the three most severely injured ISS body regions, square each AIS code and add the three squared numbers for an ISS (ISS = $A^2 + B^2 + C^2$ where A, B, C are the AIS scores of the three most injured ISS body regions) [4]. The ISS scores ranges from 1 to 75 (i.e. AIS scores of 5 for each category). If any of the three scores was a 6, the score was automatically set at 75. Since a score of 6 (unsurvivable) indicates the futility of further medical care in preserving life, this may mean a cessation of further care in triage for a patient with a score of 6 in any category [4]. Demographic data was recorded to enable us to compare the severity of injuries between men and women and also among different age groups. Also mechanisms of injuries were recorded. A standard data gathering form was used for recording the information.

Statistical analysis

The Statistical Package for Social Science, SPSS for Windows, version 15.0 (SPSS, Chicago, IL) was used for data analysis. Independent t-tests were used to compare results between the different gender and age groups; chi-square tests were used to compare proportions. Data are reported as means ± SD for 95% confidence interval (CI). A two-sided p-value less than <0.05 was considered statistically significant.

Results

Overall, 1217 injured patients admitted to Nemazee hospital ER met the inclusion criteria. Of these,

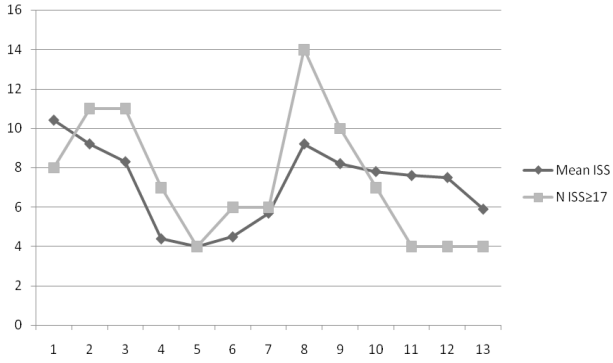

Fig. 1. Mean ISS and total number of severe injuries during months of the study from February 2009 and March 2012.

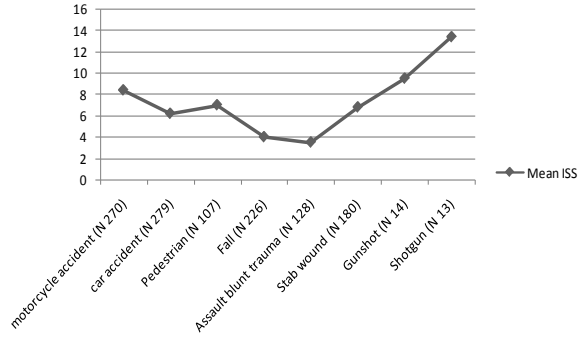

Fig. 2. Mean ISS regarding the cause of injury.

295(24.2%) were women, and 922 (75.8%) men. Total number of men with severe injury was 69 (7.5%) compared to that of women (n=17, 5.7%). Also trauma injuries were significantly more severe in men than in women (*p=0.014*). The Mean age was 26.6 ± 15.1 (range 1 to 95) years.

The mean ISS in this study was 6.3 ± 1.8 (range 1-66). We classified scores into 4 groups. 1 to 7, 8 to 16, 17 to 25, and greater than 25 and we considered scores equal to or greater than 17 as severe injury scores. Totally, 86 patients (7.1%) had scores above 17 (grades 3 and 4) (Table 1). Mean ISS of women was 4.9 ± 2.1, while that of men was 6.7 ± 1.6 (*p=0.031*). In the sunny and hot seasons, the total number of patient was higher, whereas it was lower in cold and rainy seasons. Although we had more patients with ISS>17 in autumn, but the mean ISS was significantly higher in spring than other seasons (*p<0.001*). The mean ISS was 9.2 ± 3.5 in spring, 4.3 ± 1.4 in summer, 7.7 ± 2.7 in autumn and 7.2 ± 4.1 in winter (Figure 1). Totally we had 203 patients in spring, 571 in summer, 186 in autumn and 257 in winter.

Table 1. Classification of patients in 4 subgroups, in terms of total number and percentage of injuries.

Injury Severity Score	Frequency	Valid Percent
1 (1-7)	802	65.9
2 (8-16)	329	27.0
3 (17-25)	43	3.5
4 (25<)	43	3.5
Total	1217	100.0

Of 1217 patients, 1057 (86.8%) had head and neck, 224 (18.4%) face, 295 (24.2%) chest, 248 (20.3%) abdomen and 498 (40.9%) extremity and external injuries (Table 2). Incidence of injury was higher in patients aged from 16 to 40 years, compared to that of the elderly, and injuries in higher age groups were not significantly more severe (Table 3). In respect of injuries, more than 50% of patients had low severity (1 to 16) injuries. Overall, the most common type or causes of trauma in this study was due to car accident with 279 patients (22.9%), and the least 13 (1.1%) resulted from gunshot. The lowest and highest ISS was due to assault multiple blunt trauma and gunshot respectively (Figure 2).

Discussion

Studies concerning the epidemiology of the trauma, its types and severity in an area and recording and classification of the corresponding data, as presented in this study, have been reported worldwide in recent decades. This will definitely provide us with a wide variety of choices in trauma care and management, and would enable us to evaluate the efficacy of the most preferred health care options, and finally leads us to decide better planning and more accurate trauma services, either for the trauma patients admitted in the future, or for making decisions about our environmental safety and providing facilities to prevent and/or reduce the rate and severity of trauma casualties in the area. For instance, knowing that motor vehicle crashes and fall were considered as the most frequent causes of injury and violent assaults were

Table 2. Total number of patients, injured with respect to anatomical sites, considering that any patient may have been injured in two or more regions.

Severity Grade	1 (1-7)	2 (8-16)	3 (17-25)	4 (25<)	Total
Head & Neck	682	289	43	43	1057
Face	94	80	21	29	224
Chest	125	103	30	37	295
Abdomen	137	60	21	30	248
Extremity & External	267	157	39	35	498

Table 3. ISS and total number of injuries according to age groups.

Age Groups	Trauma Frequency	Percentage of study population	Percentage of severe injury (Grades 3&4)
1 (1-16)	203	17.0%	2%
2 (16-40)	825	68.9%	7%
3 (40-60)	130	10.9%	11%
4 (60<)	39	3.3%	10%

rated as the highest grade of preventable injuries in some studies, would enable us to handle them more efficiently in the future [8]. Such data classification may also be useful to help us make comparisons among statistics from different trauma centers, or even international data [9].

Currently, multiple trauma severity scales are commonly used to obtain information about the patients. Injury classification based on its severity was taken into account first in 1950s by DeHaven to evaluate plane crash injuries [3]. It has since been changed and revised many times to evaluate injury severity in patients with different mechanisms of trauma-induced injuries [3].

ISS, however, is one of the most helpful severity scales introduced and described ever. It is defined as the sum of the squares of three highest AIS, given to 6 general anatomical regions of the body in a trauma patient [5], with more complete definition provided in the introduction section. Although some other scales have been defined so far, studies have shown that they are not as useful as ISS [10]. New Injury Severity Score (NISS) for example, described by Osler *et al.* in 1997 is one such scale [11]. Definition is somehow like ISS but it is in fact different, as it does not consider the main body regions involved in the definition of ISS (a limitation of the ISS but not the NISS, as implied) [10]. As it was mentioned, NISS has to be equal or higher than ISS in any given patient. It may clearly overestimate the injury severity in trauma patients, and is therefore more sensitive but less specific than ISS in predicting mortality in trauma patients [10]. Also there are some other scales such as Trauma and Injury Severity Score (TRISS) [12] which have been revised [13] and also criticized [3]. However, we prefer not to discuss or compare these scales in details

As mentioned above, our goals in preparing this study were data documentation of our trauma patients and compare them with international data, so that we become capable of preventing and managing trauma patients more efficiently and design more useful protocols for our trauma center. It is also worthy of mention that in developing countries, it is crucial to know and predict how to use limited facilities like Intensive Care Unit (ICU) beds, insufficient in-hospital space or old imaging devices in order to benefit all the patients.

Revising international data on trauma epidemiology, McNicholl and Cooke in a prospective study conducted in 1995, described the epidemiology of major trauma in Northern Ireland between 1990 and 1991, and showed the incidence of major trauma as 23.2 per 100,000 per year. Road accidents and falls were 71% of all cases [11] comparing to car accident which was the commonest cause of trauma in our study. They also obtained data that could enable them to predict their needed facilities for the future. In another study in 2004, Potenza *et al.* brought forward the epidemiology of severe injuries in San Diego County over a period of 11 years [1]. In this study which consisted of 73.6% male and 26.4% female patients, mean age of trauma patients was 34.1 years including 33.1 in males and 36.9 in females compared to our patients' mean age (26.63 years) in our study. The mean ISS was 14.4 including14.8 in males and 13.2 in females compared to 6.29 in our study that showed motor vehicle accidents, assaults and falls as the major causes of trauma injuries in this population. In a review of the injury epidemiology in the UK and Europe in 2009 by Alexandrescu *et al.*, [14] injury incidence rate was 12900 per 100,000 in Greece, 11400 per 100,000 in Norway, and 7470 per 100,000 in Spain. The incidence of severe injury (ISS>15) was 52.2 per 100,000 in Italy. Overall, falls and road traffic crashes (RTC) were at the top of the list of trauma causes. In this study, higher ISSs were due to firearm traumas, RTC, and burns where in our study higher ISS related to gunshot injury. Approximately 50% of ISS>15 are in the young age group (16 to 25 years). In 1996, Farrell *et al.* as an interesting conclusion claimed that vehicle accident with moose is increasing in Northern New England [15] and most accidents occurred during the night. The majority (70%) of the victims had head and neck injuries. Mortality was 9% and mean ISS was 15.7 ± 9.0. Clearly, counting on the results of this study and considering safety of the vehicles, local authorities should look for efficient protocols to prevent such injuries.

By following the aforementioned goals, this study enabled us to gather information about trauma injuries in our area. Our results focused on the total number and severity of injuries in two genders, total number of injuries and injury severity scores in different seasons and months of the year, total number and severity of different mechanisms of

injury and comparison among different age groups.

In conclusion, in our area most of the trauma injuries occur in summer and hot weather and fewer injuries happen in cold weather. In total, male patients have higher number of injuries and ISS. The lowest ISS was due to assault multiple blunt traumas and the highest ISS was attributed to shotgun injury. The most common trauma was car accident injuries and head and neck suffered most frequent injuries in our patients. Total number of younger patients with injuries was higher than elderly patients, but this study did not show a statistically significant difference between severity of injuries in younger and elder patients.

Conflict of Interest: None declared.

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