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Epidemiology of Trauma in Children under 18 Years of Age

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ABSTRACT

Objectives: Given the increasing importance of pediatric injuries, their physical and psychological effects, and the economic burden they impose on healthcare system and regarding the substantial proportion of children and adolescents population, this study aimed to investigate the epidemiology of trauma patients, mechanisms and injuries in children under 18 years of age referred to a trauma center in west of Iran from 2015 to 2020.

Method: In this retrospective study, children aged under 18 years presented to our center from 2015 to 2020 were included Data including age, gender, time of admission to the hospital, mechanism of injury, anatomical location of injury, duration of hospitalization, and interventions performed were extracted from patient data file.Statistical analysis was conducted using STATA14 software.

Result: Of 42,527 cases included, 12,506 females and 30,021 males. Seventy percent of all cases were within the age range of 6 to 18 years. The duration of hospitalization was less than one day in 57.76% of cases, 1 to 5 days in 38.27%, and more than 5 days in 3.96%. The most common causes of injury were falls (18.58%) and road traffic accidents (32%). The upper extremities (50.14%), lower extremities (27.36%), and head and neck (15.32%) were the most commonly affected anatomical locations. Initial emergency interventions were provided to more than 94% of patients, while major surgical procedures, such as exploratory laparotomy and craniotomy, were performed in approximately 0.89% of cases. The incidence of trauma has been on a downward trend in recent years but has been on an upward trend again since 2019.

Conclusions: Based on our study findings, the majority of cases were males. Falls and road traffic accidents are the main contributing factors to pediatric injuries. The most common anatomical location affected in children was the upper extremities. Furthermore, most patients received initial interventions, and the hospitalization duration for most cases was less than five days.

Keywords: *Epidemiology, Trauma, Pediatrics*

1. INTRODUCTION

pediatric injury is a primary global public health concern, accounting for the approximately 950,000 children death annually. Of these 90% are due to unintentional injuries, while 10% result from violence and maltreatment [1]. Regarding the consequences of trauma including physiological, psychological, and economic impacts, evaluation of the epidemiology, treatment patterns, and mortality of pediatric trauma patients seems vital [2]. Despite recent technological advancements, trauma and its consequences have emerged as significant health concerns. Unlike common causes of mortality, such as cardiovascular diseases and cancer which predominantly affect older individuals, trauma disproportionately impacts the younger population [3]. Psychological stress resulting from trauma in childhood is often underestimated and therefore remains untreated [4]. Early life trauma is the strongest risk factor for emotional psychopathology for the rest of the life span [5].

According to the US National Center for Traumatic Injury Control, in 2003, there were approximately 14,110 trauma-related deaths in children under 18 years of age, of these 63% were due to motor vehicle accidents. According to the same report, falls were the leading cause of nonfatal injury in children [6].Trauma is a leading cause of death and disability in childhood

[7].Intracerebral injuries are the most common cause of pediatric trauma death, due to the adverse effects of traumatic coma on airway function, respiratory control, and cerebral blood flow [8].

This study aims to study the epidemiology of trauma in children under 18 years of age who were referred to our center during the years 2015 to 2020. Specifically, we investigated the prevalence of trauma based on age group, gender, time and date of admission to the hospital, anatomy of injury, length of hospital stays, causes of injury, and diagnostic and therapeutic interventions.

2. METHODS

This descriptive-analytical retrospective study was conducted at a trauma center to identify the relationships between the trauma of children and the variables under study with the aim of providing the necessary facilities in terms of equipment and manpower, and providing optimal health care to patients. Pediatric patients aged under 18 years, who were referred to our center from January 2015- December 2020 were included in the study. Children who had visited more than once for the same trauma were excluded. By referring to patients' clinical records, information based on demographic characteristics, injury mechanism, type of trauma, anatomy of injury, interventions and length of hospital stay were obtained and documented in a questionnaire by trained research assistant. The patients' charts were filled by pediatric emergency trained attending or fellow physician. This questionnaire was approved by the first executor of the project as an expert. In case of incomplete file, the patient was removed from the study. The data were initially imported into the statistical software SPSS for primary processing and subsequently entered into STATA14 software to achieve final results and evaluations. Descriptive analysis was conducted using STATA14 statistical software. P value < 0.05 was considered to be statistically significant.The design was approved by the Ethics Committee of University of Medical Sciences.

3. RESULTS

Of 42,527 children included, 12506 (29.4%) were girls and 30021 (70.59%) were boys. among the age groups, the age group of 6-18 years had the highest frequency,Fig 1. Most of the female patients were in the age group under one year and the age group of 2 to 5 years. with increasing age, a higher percentage of boys visited the hospital table 1, Fig1.

Table 1: Examining the relationship between age groups and trauma

age	Male (%)	Female (%)	Total (%)
< 2 y	1945 (4.57)	1370(3.22)	3315(7.79)
2-5 y	5793 (13.62)	3648(8.58)	9441(22.2)
6-18 y	22283(52.4)	7488 (17.6)	29771 (70)
total	30021(70.59)	12506 (29.41)	42527(100)

The upper limbs, lower limbs, and head and neck were the most frequently affected organs respectively. Studying the relationship between the affected organs and gender showed that in both sexes, the upper limbs, followed by the lower limbs, were the most frequently organs affected table 2.

Table 2. Anatomical location of injury and its relationship to gender

Injured organ	male	Female	Total (%)
Head & Neck	4623 (10.87)	1850 (4.35)	6473 (15.22)
Upper limbs	15173 (35.67)	6079(14.29)	21252 (40.97)
trunk	1533 (3.60)	743 (1.74)	2276(5.35)
Lower limbs	8146 (19.15)	3479 (8.18)	11625 (27.33)
unspecified	546 (1.28)	355 (0.83)	901 (2.11)
Total (%)	30021 (70.59)	12506(29.41)	42527 (100)

In general, falls are the most common cause, followed by road accidents. Among boys, trauma from road accidents is the most common, while among girls, trauma from falls is the most common. Assaults account for a higher percentage of injuries

among boys than girls table3.

Table 3. Mechanism of injury and its relationship to gender

Mechanism of injury	Male (%)	Female (%)	Total (%)
Road accidents	8982 (21.12)	3578 (8.41)	12560 (29.53)
falling	13658 (32.11)	6795 (15.97)	20453 (48.09)
Penetrating trauma	2826 (6.64)	797 (1.87)	3623 (8.51)
Blunt trauma	1727 (4.06)	1015 (2.38)	2742 (6.44)
assault	1506 (3.54)	152 (0.35)	1658 (3.89)
suicide	30 (0.07)	15 (0.035)	45 (0.10)
Stings % bites	88 (0.20)	48 (0.11)	136 (0.31)
Other (burn, firearm, drowning, electrocution, etc.)	1186 (2.78)	99 (0.23)	1285 (3.02)
Total (%)	30021 (70.59)	12506 (29.41)	42527 (100)

In term of the length of hospital stay, hospitalization of less than one day had the most frequency, and girls account for a higher percentage of hospitalizations of less than one day table 4, Fig 2.

Table 4: Examining the relationship between gender and length of hospitalization

Length of hospital stay	Male (%)	Female (%)	Total (%)
< 1 day	16996 (39.96)	7569 (17.79)	24565 (57.76)
1-5 days	11777 (27.69)	4499 (10.57)	16276 (38.27)
>5 days	1248 (2.93)	438 (1.02)	1686 (3.96)
Total (%)	30021 (70.59)	12506 (29.41)	42527 (100)

Most interventions were related to primary interventions such as wound cleansing and dressing, suturing, splinting,etc, table 5.

Table 5: diagnostic and therapeutic interventions

intervention	male	female	Total (%)
Initial (wound cleansing, dressing, splinting, etc.)	24716 (93.89)	9988 (94.68)	34704 (94.12)
Emergent interventions (Craniotomy, laparotomy, splenectomy, etc.)	246 (0.93)	85 (0.80)	331 (0.89)
Urgent interventions (Nerve transplantation, amputation,etc.)	1361 (5.17)	476 (4.51)	1837 (5.07)
Total (%)	26323 (71.39)	10549 (28.60)	36872 (100)

Considering that we had information about the hours of about 10,000 cases, the highest number of referrals were in the three

time periods of 11-12, 17-18, and 21-23 and the lowest occurred in the time period of 6-7 am,Fig3.

The highest frequency was in the month of October 2019, with 1348 cases, and the lowest frequency was in December 2016, with 374 cases.

4. DISCUSSION

In a study conducted by Javid et al. in Tehran in 2006, out of a total of 318 children referred to the emergency department of three pediatric trauma centers due to accidents, 151 patients had musculoskeletal injuries and 31 patients had no obvious physical injuries. 33.6% of patients also had multiple traumas. 52.8% of accidents occurred in spring and summer, 21.7% in autumn, and 25.5% in winter. The mechanism of trauma was a motorcycle-pedestrian collision in 33.7% of cases and a car-pedestrian collision in 31.9%. The most common bone injuries were fractures of the tibia and fibula (62 cases), femur (25 cases), forearm (18 cases), and humerus (11 cases). 24% of patients were transported to the hospital by ambulance, and the rest were transported by the public or family [9].

In a study conducted by Memarzadeh et al. in Isfahan in 2008, all traumatized children referred to the emergency department, which included 2300 people, were examined, of which 66.7% were boys and 33.3% were girls. Most traumas occurred at home and school. The most common type of accident was falls (32%) followed by traffic accidents (31.1%) which was similar to our results. Based on anatomical location, the head (38.5%), multiple trauma (34.3%) and limbs (18.9%) were the most common anatomical locations [10].

In a study conducted in Tehran in 2015 by Dowlatabadi et al., the records of children referred to the trauma unit of the emergency department, in 2011 and 2012 were reviewed. Information from the clinical records of 540 children was collected and reviewed using a census method (69.3% boys). 169 (30.9%) cases had been referred in the summer season and 322 (58.9%) cases had been referred between 4 pm and midnight. Traffic accidents were the most common mechanism with 286 (52.3%) cases and the head and neck was the most common injury location [11].

In a study conducted in Queensland, Australia in 2019, Mark et al. collected and analyzed data recorded in the Queensland Children's Trauma Health Service Registration Form from 2008 to 2015. Demographic information and clinical characteristics of trauma cases in children under 16 years of age were described and their association with age and mortality was analyzed. 542 trauma cases were included of which 66.4% were male. The overall mortality rate in January 2012 was 11.1%. The median injury severity score (ISS) was 11 (IQR=9-22). 48.2% (n=261) had an ISS greater than 12 and 41.7% (n=226) had an ISS greater than 15. The most common injury pattern was limited to head injuries (29.7%, n=161) and multitrauma (31.2%, n=169). Surgery was required in 28.4% of cases (n=154). The most common location of trauma was home (37.6%, n=204). The highest mortality rates related to injury severity were related to abdominal, spine, chest and inflicted injuries/drowning and hanging [12].

The results of these studies are similar to our study in term of demographic characteristics and differences in frequency of mechanisms and type of injury may be related to cultural characteristics and differences in study population due to our hospital as a referral trauma center.

5. CONCLUSION

In our study, boys accounted for a higher percentage of injury cases (about 70.87%).in the age range under one year, the difference in frequency between girls and boys was less, which is probably due to the lack of differences in the specific characteristics and roles of girls and boys and the smaller difference in psychological characteristics in this age range. With increasing age, the difference in frequency between boys and girls patients was increased which is probably because more boys are employed in jobs that do not require an academic degree moreover boys around the age of 18 spend more time away from home. The most common anatomical site of injury was the upper limb (50.14%), followed by the lower limb (27.36%) and the head and neck (15.32%). Falls were the most common cause of injury, with about 50.33% of cases followed by accidents. The notable point is related to the fight and firearms. 3.24% of cases were related to conflict and assaults, with 90.45% occurring in boys and 9.54% in girls.o.95% of the causes of injury were firearm-related, with 84.72% in boys and 15.28% in girls.

Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Fig 1. Comparison of the patients age in both sexes

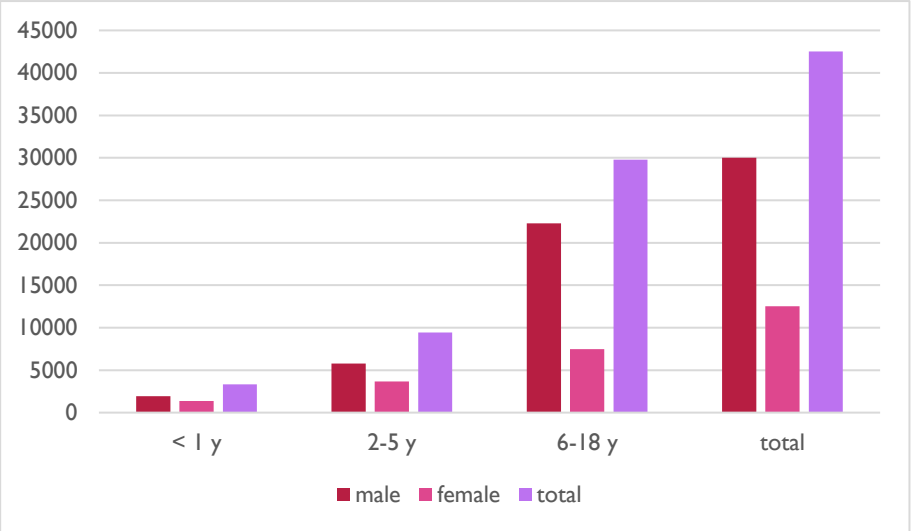


Fig 2. Comparison of the length of hospitalization in both sexes

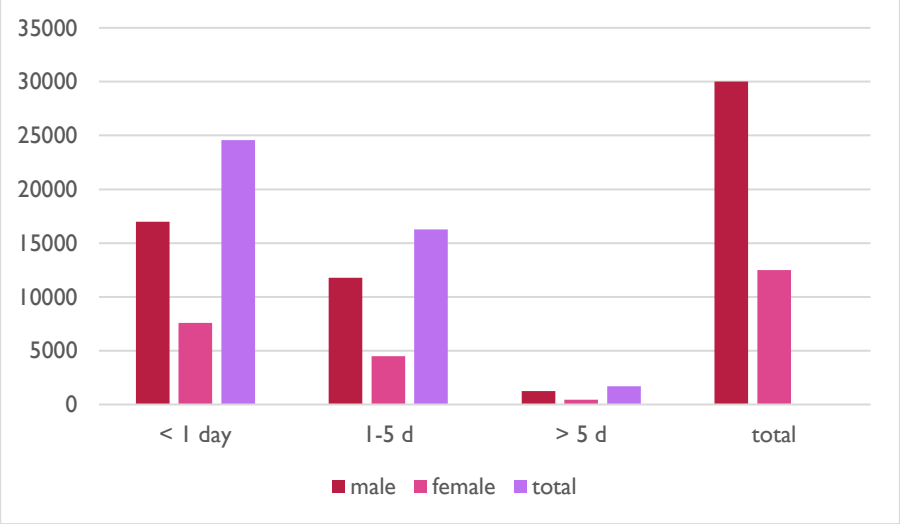
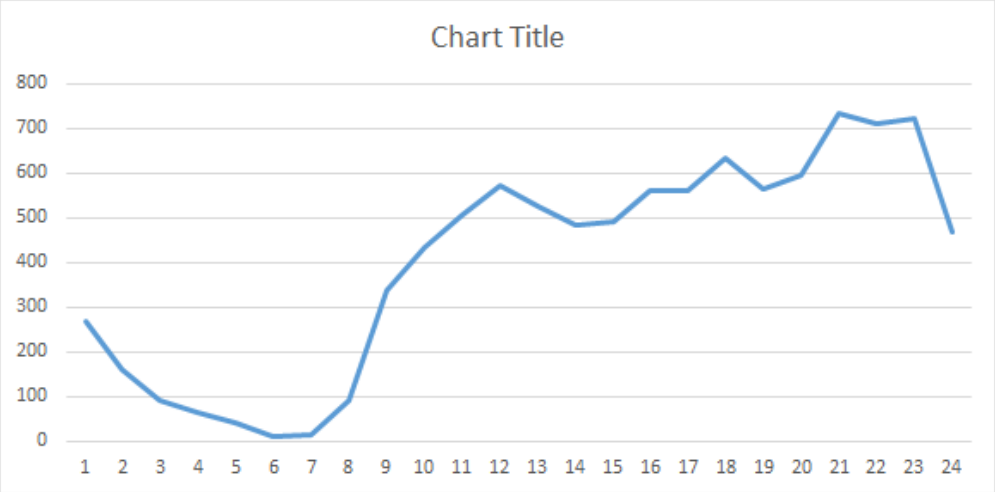


Fig 3. Total frequency by referral hour



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