Epidemiology of Pediatric Trauma and its Outcome Presenting to an Emergency Department of Tertiary Care Hospital in the Sultanate of Oman

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Abstract

Objectives: This study aimed to analyze pediatric trauma cases treated at Sultan Qaboos University Hospital in Oman, focusing on injury patterns, mechanisms and outcomes.

Methods: We conducted a retrospective chart review of pediatric patients aged 15 years and younger who presented to the emergency department (ED) over 12 months from January to December 2022. Data were collected on demographics, injury characteristics, clinical management, and outcomes, including pediatric intensive care unit (PICU) admissions and length of stay.

Results: A total of 1643 pediatric trauma cases were included in the study. Most injuries occurred in males (64.7%) and children aged 0-5 years (51.4%). The leading cause of injury was fall from height (50.8%), followed by collisions with fixed objects (12.2%) and sports injuries (8.2%). Injuries predominantly occurred at home (72.7%) and were most frequent during the evening and nighttime (71.5%). Lacerations (32.3%) and soft tissue injuries (19.3%) were the most common injury types, with the face (33%) and upper extremities (25.3%) being the most affected anatomical sites. Adolescents (11-15 years) were more prone to road traffic accidents and sports-related injuries, while younger children were more vulnerable to falls. Gender differences showed males were more susceptible to lacerations and fractures while females experienced higher rates of crush injuries and contusions. Most patients (89.3%) were treated and discharged from ED, while 6.7% were admitted to the hospital, and 2% had significant clinical outcomes. Patients admitted to the PICU had higher rates of motor vehicle collisions and polytrauma and required more intensive interventions.

Conclusions: The findings of this study revealed fall from height as the most common mechanism of injury, particularly among younger children. Males were more frequently affected, with lacerations and soft tissue injuries being the most common injury types. Adolescents were more prone to road traffic and sports-related injuries. The results emphasize the need for targeted preventive measures, especially at home, roadside and during recreational activities, to reduce pediatric trauma.

Keywords: Pediatric trauma; Emergency department; Outcome; Oman

Introduction

Trauma is an injury to the body caused by an external force. It can result from a variety of external factors, such as accidents, falls, violence, or disasters, and can lead to physical harm or psychological distress. Trauma can involve any part of the body and classification based on the severity of the injury.[1]

Pediatric trauma is a significant public health problem worldwide and the most common cause of morbidity and mortality. Each year approximately 950,000 children below 18 years die due to injury and violence.[2] Additionally, trauma accounts for over 20% of all deaths in the Gulf Cooperation Council (GCC).[3] Trauma especially falls, motor vehicle collisions, and burns, contributes significantly to pediatric emergency department (ED) visits and hospital admissions.[4] These injuries often lead to long-term disabilities, emphasizing the need for effective prevention and management approaches. In many cases, pediatric trauma is preventable, which underscores its importance as a public health concern.[2]

Despite the global burden, regional studies focusing on pediatric trauma remain limited, especially in Middle Eastern countries like Oman. Recent international studies suggest that falls and road traffic incidents are the primary mechanisms of injury in children under 15.[5-7] Boys are typically at higher risk than girls, with younger children more likely to be injured at home, while adolescents are more frequently involved in outdoor or sports-related injuries.[8] There is limited data available that focuses on the distinct features of trauma in the local younger population, which hampers to concentrate on targeted age-specific prevention strategies.[7]

Sultan Qaboos University Hospital (SQUH), located within the University Medical City campus, is a teaching hospital with a 600-bed capacity and an extensive catchment area. Its emergency department comprises 25 beds and serves both adult and pediatric patients. The ED handles approximately 60,000 visits annually of which 12,000 to 15,000 are pediatric cases. We have sought to analyze pediatric trauma cases at SQUH for over one year. The study's primary focus is to identify common injury sites, patterns of injuries, trauma mechanisms and their relationship to demographic factors like age and gender in children below 15 years old. This study aims to provide data to understand the burden of pediatric trauma in Oman and help to improve trauma care by highlighting the risks and understanding the most common mechanisms and outcomes of pediatric injuries.

Methods

A retrospective chart review of pediatric trauma cases was conducted from January to December 2022. The inclusion criteria included patients aged 15 years or younger who presented to the Emergency Department (ED) of Sultan Qaboos University Hospital (SQUH) with a history of trauma. Children with medical conditions associated with any form of trauma were excluded from the study. The study team designed a structured proforma to document necessary information. Patient data were obtained from the SQUH electronic medical record system. The collected data included patient demographics, time, day, and month of presentation, source of patients, site of injury, mechanisms of trauma, type of injury, anatomical location, ED assessment, management, and outcomes, including pediatric intensive care unit (PICU) admissions and length of stay.

Patients were stratified and compared based on the site of injury, mechanisms of trauma and type of injury across three age groups: 0-5 years, 6-10 years and 11-15 years. The sources of patients were direct arrivals to the ED, those brought by emergency medical services (EMS), or those escorted from primary health centers. Mechanisms of injury include fall from height, impacts with fixed objects, sports injuries, motor vehicle collisions (MVC) and others. Injuries were categorized according to the involved body area: head, neck, face, chest, abdomen, pelvis, back and extremities. The operational definition of traumatic injuries was established using the International Classification of Diseases, Tenth Revision (ICD-10) codes. To quantify trauma severity, Injury Severity Score (ISS) is used with scores ranging from 1 to 75, where higher scores indicate more severe injuries. Injuries were categorized as minor (ISS <8), moderate (ISS 9–15), severe (ISS 16–24) and critical (ISS >24). Patient triage was conducted using the Canadian Triage and Acuity Scale (CTAS), a five-level system that prioritizes care based on condition severity, ranging from Level 1 (resuscitation) to Level 5 (non-urgent). Ethical approval for the study was obtained from the ethics committee of the SQU, College of Medicine and Health Sciences (REF. NO. SQU – EC/017/2023). Statistical analysis was conducted using STATA 15 software (Stata Corp LLC, College Station, TX). Data were presented as frequencies and

mean ± standard deviation (SD) where appropriate. Continuous variables were analyzed using the Student's t-test and categorical variables were analyzed using the Chi-square test. A p-value <0.05 was considered statistically significant.

OPERATIONAL DEFINITIONS

Soft tissue injury: Damage to muscles, ligaments, tendons or other connective tissues without bone involvement, often classified under categories for sprains or strains.

Contusion: Refers to a bruise resulting from blunt trauma that causes damage to small blood vessels under the skin without breaking the skin.

Laceration: Is a tear or split in the skin or soft tissue caused by trauma, often from sharp objects or high-impact forces.

Blunt injury: Results from an impact or force that does not penetrate the skin but may cause underlying tissue damage, such as contusions, fractures or organ damage.

Foreign body: Refers to an external object that enters the body through ingestion, inhalation, insertion or penetration causing harm or requiring medical intervention. Common examples include swallowed objects (coins or batteries), inhaled items (small toys or food particles) or embedded objects (splinters or shards).

Results

During the study period, a total of 1750 pediatric trauma cases meeting the inclusion criteria were registered. Following data screening, 107 cases with missing information were excluded resulting in 1643 patients included in the study. Of these, 845 (51.4%) were children aged 0-5 years, with a mean age of 6.25 ± 0.097 years, and 1064 (64.7%) were male.

More than two-thirds, 1174 (71.5%), of trauma patients visited the ED during the evening and night time [Figure 1]. In terms of days of the week, 1135 (69%) presented to the ED on weekdays (Sunday to Thursday), while the remaining 508 (31%) visited during the weekend. On average, 137 patients visited the ED monthly, with peaks in March and July, with 162 and 161 patients, respectively. [Figure 2]. Over the study duration, 1559 (95%) patients attended the emergency department directly, while 84 (5%) were brought in by EMS or primary health centers.

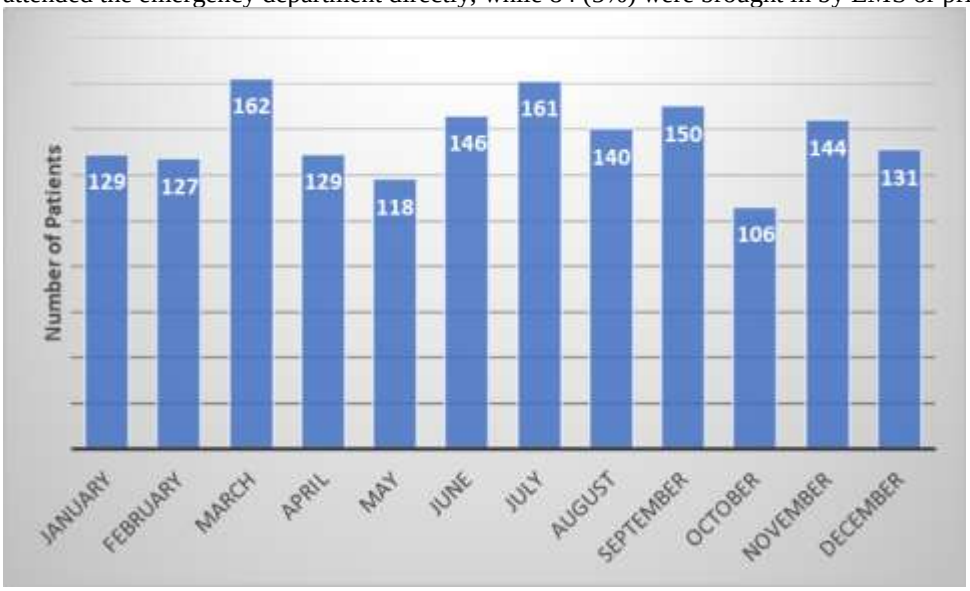

Figure 1: Distribution of pediatric trauma patients by months over study period.

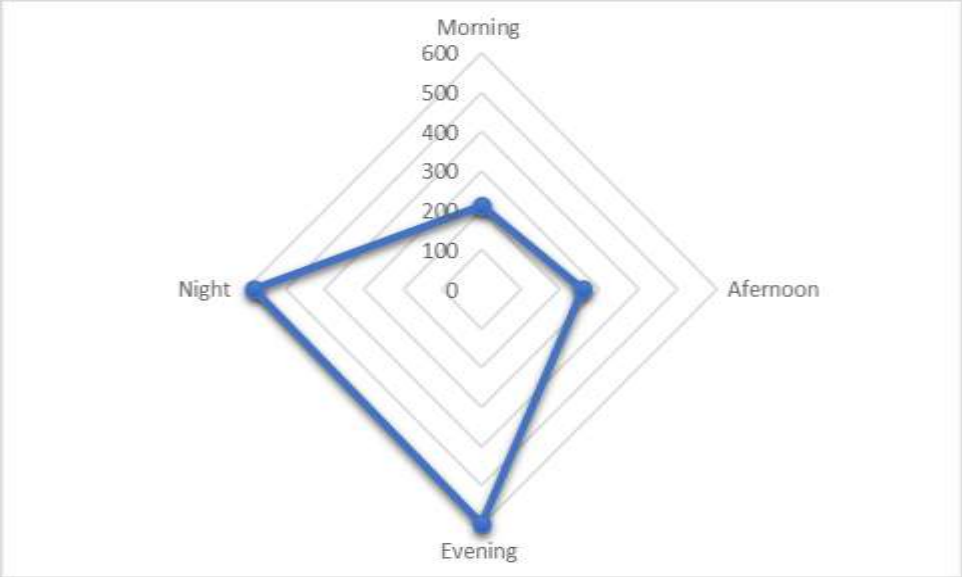

Figure 2: Radar chart of pediatric trauma patient's emergency department arrival time plotted over parts of the day.

Regarding the site of injury, the majority occurred at home, accounting for 1195 cases (72.7%), followed by 142 (8.6%) on the road and 134 (8.2%) at sports grounds. The leading mechanism of injury was fall from height, 835 cases (50.8%), proceeded by collisions with fixed objects, 200 cases (12.2%). Sports-related injuries, 134 cases (8.2%) were the third leading cause of trauma. The most prevalent types of injuries were lacerations (32.3%), followed by soft tissue injuries (19.3%) and fractures (16.6%). The face (33%) and upper extremities (25.3%) were the most frequently injured anatomical regions. [Table 1].

Table 1: Demographics, source of patients and injury characteristics among study population.

Variables	Total n = 1643	Frequency (%)
Age (Years) mean ± SD	6.25 ± .097	
Age categories		
0-5 years	845	(51.4)
6-10 years	496	(30.2)
11-15 years	302	(18.4)
Gender		
Male	1064	(64.7)
Female	579	(35.3)
Source of patients		
Direct arrival to ED	1559	(94.9)
Brought by EMS	47	(2.9)
Escorted from LHC	37	(2.2)
Site of injury		
Home	1195	(72.7)
Street	53	(3.3)
School	51	(3.1)
Road	142	(8.6)
Sports	134	(8.2)
Park/public place	68	(4.1)
Mechanisms of injury		
Fall from height	835	(50.8)
MVC – Pedestrian	47	(2.9)
MVC – Passenger	115	(7.0)

Burn	17	(1.0)
Assault	05	(0.3)
Animal bite	14	(0.7)
Drowning	10	(0.6)
Electric shock	03	(0.2)
Falling of object on body part	62	(3.8)
Hit over fixed object	200	(12.2)
Needle prick/knife cut	33	(2.0)
Foreign body	87	(5.3)
Pulled elbow	36	(2.2)
Sports injury	134	(8.2)
Finger entrapped in door	45	(2.8)
Type of injury		
Laceration	531	(32.3)
Fracture / dislocation	273	(16.6)
Crush injury	18	(1.1)
Penetrating injury	27	(1.6)
Soft tissue injury	316	(19.3)
Burn	17	(1.0)
Contusion	206	(12.5)
Foreign body	87	(5.3)
Blunt injury	114	(7.0)
Drowning	10	(0.6)
Poly-trauma	44	(2.7)
Anatomic location of injury		
Head & neck	300	(18.3)
Face	543	(33.0)
Abdomen, pelvis & genitalia	45	(2.7)
Upper extremity	416	(25.3)
Lower extremity	254	(15.5)
Chest & back	41	(2.5)
Multiple injury	44	(2.7)

ED = Emergency department; EMS = Emergency medical services; LHC = Local health center; MVC = Motor vehicle collision.

Younger children (0-5 years) were more prone to injuries at home (88.3%) compared to those aged 6-10 years (63.5%) and 11-15 years (44.4%), whereas adolescents (11-15 years) were more frequently injured on the road (17.6% vs. 8.9% for 6-10 years and 5.3% for 0-5 years) and at sports grounds (26.5% vs. 9.9% for 6-10 years and 0.6% for 0-5 years). Those children sustaining injuries on the street had a higher proportion within 6-10 years (6.5%) than those aged 11-15 years (3.6%) and 0-5 years (1.2%). These differences were statistically significant.

The mechanism of injury varied by age. Younger patients (0-5 years) had higher rates of falls (57.5% vs. 49.5% for 6-10 years and 34.8% for 11-15 years) and foreign bodies (8.0% vs. 3.6% for 6-10 years and 0.3% for 11-15 years) but lower rates of assault (0% vs. 0.4% for 6-10 years and 1% for 11-15 years). Older children (11-15 years) had higher rates of sports-related injuries (26.5% vs. 9.9% for 6-10 years and 0.6% for 0-5 years) and MVC-passenger injuries (13.9% vs. 6.7% for 6-10 years and 4.7% for 0-5 years) compared to more minor children with $p < 0.001$. Lacerations and blunt injuries were more common in younger study population (0-5 years: 37.3% and 9.1%) compared to those aged 6-10 years (31.6% and 5.2%) and 11-15 years (19.6% and 3.6%). Conversely, fractures and soft tissue injuries were more prevalent in oldest age group (11-15 years: 27.8% and 25.8%) compared to children aged 6-10 years (21.7% and 18.8%) and 0-5 years (9.7% and 17.2%) [Table 2].

Table 2: Characteristics of pediatric trauma patients according to age categories.

Variables	Total n=1643 (%)	0-5 years 845 (51.4)	6-10 years 496 (30.2)	11-15 years 302 (18.4)	p-value
Site of injury					

Home	1195 (72.7)	746 (88.3)	315 (63.5)	134 (44.4)	
Street	53 (3.2)	10 (1.2)	32 (6.5)	11 (3.6)	
School	51 (3.1)	12 (1.4)	26 (5.2)	13 (4.3)	0.001
Road	142 (8.6)	45 (5.3)	44 (8.9)	53 (17.6)	
Sports ground	134 (8.2)	05 (0.6)	49 (9.9)	80 (26.5)	
Park/public places	68 (4.2)	27 (3.2)	30 (6.0)	11 (3.6)	
Mechanisms of injury					
Fall from height	835 (50.8)	485 (57.5)	245 (49.5)	105 (34.8)	
MVC – Pedestrian	47 (2.9)	11 (1.3)	21 (4.2)	15 (5.0)	
MVC – Passenger	115 (7.0)	40 (4.7)	33 (6.7)	42 (13.9)	
Burn	17 (1.0)	09 (1.0)	03 (0.6)	05 (1.7)	
Assault	05 (0.3)	00 (0)	02 (0.4)	03 (1.0)	
Animal bite	14 (0.8)	05 (0.6)	06 (1.2)	03 (1.0)	
Drowning	10 (0.6)	08 (0.9)	01 (0.2)	01 (0.3)	0.001
Electric shock	03 (0.2)	01 (0.1)	02 (0.4)	00 (0)	
Falling of objects	62 (3.8)	30 (3.6)	19 (3.8)	13 (4.3)	
Hit over fixed object	200 (12.2)	105 (12.4)	68 (13.7)	27 (8.9)	
Needle prick	33 (2.0)	17 (2.0)	13 (2.6)	03 (1.0)	
Foreign body	87 (5.3)	68 (8.0)	18 (3.6)	01 (0.3)	
Pulled elbow	36 (2.2)	34 (4.0)	02 (0.4)	00 (0)	
Sport injury	134 (8.2)	05 (0.6)	49 (9.9)	80 (26.5)	
Finger entrapped in door	45 (2.7)	27 (3.3)	14 (2.8)	04 (1.3)	
Type of injury					
Laceration	531 (32.3)	315 (37.3)	157 (31.6)	59 (19.6)	
Fracture / dislocation	273 (16.6)	82 (9.7)	107 (21.7)	84 (27.8)	
Crush injury	18 (1.1)	11 (1.3)	07 (1.4)	00 (0)	
Penetrating injury	27 (1.7)	15 (1.8)	10 (2.0)	02 (0.7)	
Soft tissue injury	316 (19.2)	145 (17.2)	93 (18.8)	78 (25.8)	
Burn	17 (1.0)	10 (1.2)	02 (0.4)	05 (1.7)	0.001
Contusion	206 (12.5)	93 (11.0)	65 (13.1)	48 (15.9)	
Foreign body	87 (5.3)	68 (8.0)	18 (3.6)	01 (0.3)	
Blunt injury	114 (7.0)	77 (9.1)	26 (5.2)	11 (3.6)	
Drowning	10 (0.6)	08 (0.9)	01 (0.2)	01 (0.3)	
Poly – trauma	44 (2.7)	21 (2.5)	10 (2.0)	13 (4.3)	

Females were statistically significantly more prone to injuries at home (76% vs. 70.9%) but less prone at sports grounds (2.9% vs. 11%) compared to males. Females were more likely to sustain fall from height (52.9% vs. 49.7%), MVC-passenger injuries (10.2% vs. 5.3%), and pulled elbows (3.3% vs. 1.6%). In comparison, males were more inclined to experience MVC-pedestrian injuries (3.2% vs. 2.2%), assaults (0.5% vs. 0%), and collisions with fixed objects (13.2% vs. 10.2%), with p value <0.001. Regarding injury types, males were more predisposed to sustain lacerations (33.3% vs. 30.6%) and fractures (17.8% vs. 14.5%), although females showed a higher tendency to crush injuries (1.9% vs. 0.6%) and contusions (14.7% vs. 11.4%). However, the differences in injury types between genders were not statistically significant (p = 0.173) [Table 3].

Table 3: Characteristics of pediatric trauma patients according to gender.

Variables	**Total n=1643 (%)**	**Male 1064 (64.7)**	**Female 579 (35.3)**	**p-value**
Site of injury				
Home	1195 (72.7)	755 (70.9)	440 (76.0)	
Street	53 (3.2)	39 (3.8)	14 (2.4)	
School	51 (3.1)	35 (3.3)	16 (2.8)	0.001
Road	142 (8.6)	76 (7.1)	66 (11.4)	
Sports ground	134 (8.2)	117 (11.0)	17 (2.9)	
Park/public places	68 (4.2)	42 (3.9)	26 (4.5)	
Mechanisms of injury				

Fall from height	835 (50.8)	529 (49.7)	306 (52.9)	
MVC – Pedestrian	47 (2.9)	34 (3.2)	13 (2.2)	
MVC – Passenger	115 (7.0)	56 (5.3)	59 (10.2)	
Burn	17 (1.0)	14 (1.3)	03 (0.5)	
Assault	05 (0.3)	05 (0.5)	00	
Animal bite	14 (0.8)	10 (0.9)	04 (0.7)	
Drowning	10 (0.6)	06 (0.6)	04 (0.7)	0.001
Electric shock	03 (0.2)	01 (0.1)	02 (0.3)	
Falling of objects	62 (3.8)	41 (3.8)	21 (3.6)	
Hit over fixed object	200 (12.2)	141 (13.2)	59 (10.2)	
Needle prick	33 (2.0)	19 (1.8)	14 (2.4)	
Foreign body	87 (5.3)	53 (5.0)	34 (5.9)	
Pulled elbow	36 (2.2)	17 (1.6)	19 (3.3)	
Sport injury	134 (8.2)	117 (11.0)	17 (2.9)	
Finger entrapped in door	45 (2.7)	21 (2.0)	24 (4.2)	
Type of injury				
Laceration	531 (32.3)	354 (33.3)	177 (30.6)	
Fracture / dislocation	273 (16.6)	189 (17.8)	84 (14.5)	
Crush injury	18 (1.1)	07 (0.6)	11 (1.9)	
Penetrating injury	27 (1.7)	16 (1.5)	11 (1.9)	
Soft tissue injury	316 (19.2)	204 (19.2)	112 (19.3)	0.173
Burn	17 (1.0)	13 (1.2)	04 (0.7)	
Contusion	206 (12.5)	121 (11.4)	85 (14.7)	
Foreign body	87 (5.3)	53 (4.9)	34 (5.9)	
Blunt injury	114 (7.0)	72 (6.8)	42 (7.3)	
Drowning	10 (0.6)	06 (0.6)	04 (0.7)	
Poly – trauma	44 (2.7)	29 (2.7)	15 (2.6)	

During the ED assessment, one patient (0.6%) was declared dead on arrival. Among the patients assessed, 58.7% received a CTAS yellow triage code indicating their conditions were urgent but stable enough to wait 30 minutes for treatment. The Injury Severity Score (ISS) revealed that the majority of injuries (65.7%) were classified as minor with scores below 8. Most patients (98.5%) had a normal Glasgow Coma Score (GCS). The trauma patients who had abnormal GCS and severe or critical ISS (≥16) were involved in an MVC, falling from height and struck an object on body parts.

Diagnostic imaging including X-ray, CT scan and Sonography for trauma was performed on 733 patients (44.6%), with 45% of these imaging studies revealing positive trauma-related findings. Emergency physicians treated 68% of the patients, while 32% required specialist care from trauma, orthopedic, neurosurgery, pediatric surgery, ENT, ophthalmology, and maxillofacial teams. Common intervention included a 4-6 hour observation period for minor injuries (29.8%). Systemic analgesia was administered (18.2%) of patients. Fracture management involved the application of back slabs for (14.3%) of patients and reduction under sedation for (4.6%). Wound care included treating lacerations with skin adhesive (13.4%), sutures (10.3%) and dressings (2.7%). The majority of patients, 1467 (89.3%), were treated and discharged from the ED while 111 (6.7%) required hospital admission and 64 (3.9%) were referred to specialized trauma centers. [Table 4].

Table 4: Emergency department assessment and management of study population.

Variables	Total n = 1643	Frequency (%)
ED triage code*		
Immediate (1 – Blue)	16	(1.0)
15 min (2 – Red)	106	(6.5)
30 min (3 – Yellow)	965	(58.7)
60 min (4 – Green)	556	(33.8)
GCS score		
15	1617	(98.5)
Less than 15	26	(1.5)

Injury Severity Score		
Minor (ISS <8)	1080	(65.7)
Moderate (ISS 9-15)	460	(28.0)
Severe (ISS 16-24)	68	(4.2)
Critical (ISS >24)	35	(2.1)
Imaging performed†		
Yes	733	(44.6)
No	910	(55.4)
Results of imaging‡ (n=733)		
Positive trauma related findings	403	(55.0)
Negative trauma related findings	330	(45.0)
Interventions		
Observation	490	(29.8)
Systemic analgesia	299	(18.2)
Wound management	434	(26.4)
Fracture management	311	(18.9)
Intubation	26	(1.7)
Others	82	(5.0)
Disposition and outcome		
Brought dead	01	(0.1)
Discharged from ED	1467	(89.3)
Admission	111	(6.7)
Referred to other hospital	64	(3.9)

*GCS = Glasgow Coma Scale; ED = Emergency department; *Canadian Triage and Acuity Scale (CTAS) Level 1 (Resuscitation, Blue): Immediate care required for life-threatening conditions. Level 2 (Emergent, Red): Urgent care within 15 minutes needed for potentially serious conditions. Level 3 (Urgent, Yellow): Assessment required within 30 minutes for serious conditions. Level 4 (Less Urgent, Green): Stable conditions requiring medical attention within 60 minutes. †Imaging studies; (X-ray, CT scan and Sonography for trauma); ‡Positive trauma-related findings include fractures, pneumothorax, intracranial hemorrhage and solid organ lacerations.*

Among 1643 participants, 33 (2%) of patients had significant clinical outcomes. No statistically significant differences in age or gender were noted between the groups. PICU admissions were more frequent for children involved in motor vehicle collisions (45.5% vs 10.3%), struck by falling objects (6% vs 5.1%) and with polytrauma (54.5% vs 12.8%), compared to those in ward or high dependency units. Critical triage codes (Blue 42.4% vs 1.2%, Red 45.4% vs 36%) and severe (48.5% vs 5.1%) or critical (33.3% vs 1.3%) injury severity scores correlated with more severe outcomes ($p < 0.001$). These patients often required intubation, laparotomy and craniotomy with more extended hospital stays (10.96 vs 2.16 days, $p < 0.001$) [Table 5].

Table 5: Characteristics of pediatric trauma patients upon admission.

Variables	**Total n=111 (%)**	**Ward / HD n=78 (70)**	**PICU n=33 (30)**	**p-value**
Age (Years) mean ± SD		5.92 ± 0.45	5.94 ± 0.77	
Gender				
Male	71 (64)	48 (61.5)	23 (70)	0.701
Female	40 (36)	30 (38.5)	10 (30)	
Mechanisms of injury				
Fall from height	43 (38.8)	35 (44.8)	08 (24.3)	
Hit over fixed object	06 (5.4)	04 (5.1)	02 (6.0)	
MVC -passenger	23 (20.7)	08 (10.3)	15 (45.5)	0.001
Falling of object	06 (5.4)	04 (5.1)	02 (6.0)	
MVC-pedestrian	15 (13.5)	11 (14.1)	04 (12.2)	
Drowning	04 (3.6)	02 (2.6)	02 (6.0)	
Others	14 (12.6)	14 (18.0)	00	
Type of injury				
Laceration	20 (18.0)	15 (19.2)	05 (15.1)	

Fracture	21 (19.0)	20 (25.7)	01 (3.1)	
Contusion	06 (5.4)	05 (6.4)	01 (3.1)	
Blunt injury	13 (11.7)	10 (12.8)	03 (9.0)	0.001
Poly-trauma	28 (25.2)	10 (12.8)	18 (54.5)	
Penetrating injury	04 (3.6)	01 (1.3)	03 (9.1)	
Drowning	04 (3.6)	02 (2.6)	02 (6.1)	
Others	15 (13.5)	15 (19.2)	00	
ED triage code				
Immediate (1 - Blue)	15 (13.6)	01 (1.2)	14 (42.4)	
15 min (2 - Red)	43 (38.7)	28 (36.0)	15 (45.4)	0.001
30 min (3 - Yellow)	43 (38.7)	39 (50.0)	04 (12.2)	
60 min (4-Green)	10 (9.0)	10 (12.8)	00	
Injury severity score†				
Minor (ISS <8)	29 (26.2)	29 (37.2)	00	
Moderate (ISS 9-15)	50 (45.0)	44 (56.4)	06 (18.2)	0.001
Severe (ISS 16-24)	20 (18.0)	04 (5.1)	16 (48.5)	
Critical (ISS >24)	12 (10.8)	01 (1.3)	11 (33.3)	
Interventions*				
Observation	38 (34.3)	35 (44.9)	03 (9.1)	
Intubation	26 (23.4)	00	26 (78.8)	
Chest tube	01 (0.9)	00	01 (3.1)	
Exploratory laparotomy	04 (3.6)	01 (1.2)	03 (9.1)	
Fracture management	27 (24.3)	21 (27.0)	06 (18.2)	
Craniotomy	06 (5.4)	00	06 (18.2)	
Others	22 (19.8)	21 (27.0)	01 (3.1)	
Length of hospital stay (Days)		2.16 ± 0.23	10.96 ± 2.2	0.001

*MVC = Motor vehicle collision, HDU = High dependency unit, PICU= Pediatric intensive care unit, ISS = †Injury severity score; Minor Injuries (ISS <8): Includes injuries that are not life-threatening and require minimal medical intervention. Moderate Injuries (ISS 9-15): Represents injuries that may require significant medical attention but are not immediately life-threatening. Severe Injuries (ISS 16-24): Includes injuries that are life-threatening and may require intensive care or surgical intervention. Critical Injuries (ISS >24): Denotes injuries that are life-threatening or unsurvivable often associated with multi-system trauma. *11 Patient had multiple procedures.*

Discussion

This study presents valuable insights into pediatric trauma patterns at Sultan Qaboos University Hospital (SQUH). It highlights key injury mechanisms, types and demographic correlations while contributing to the regional body of knowledge on pediatric trauma.

This study identified specific injury types based on age and gender, revealing that a significant number (51.4%) of younger children (0-5 years) were more prone to injuries, with males being injured at twice the rate of females (2:1 ratio). However, the overall pattern of injury types across genders did not show statistically significant differences, which may suggest that gender-based differences are more activity-related than physiological.[9] These results are consistent with other epidemiological studies on pediatric trauma conducted in the GCC and sub-Saharan Africa regions.[10-12] In this study, the primary sites of trauma for both sexes were at home (72.7%) and on-road (8.6%); however, a higher percentage of adolescent males (11-15 years) were injured on sports grounds, this is in line with literature that associates this age group with increased participation in organized sports and outdoor activities, leading to more injuries.[13,14] Road traffic accidents, though less frequent in this study, remain a notable cause of trauma in adolescents, which corresponds to findings from other regions where traffic injuries are a common concern in this age group.[15] Our findings align with previous studies that have identified falls as the leading cause of pediatric trauma, accounting for 50.8% of cases in this study. This is consistent with global reports, where falls constitute a significant proportion of pediatric injuries, particularly in younger children.[2,16-18] Smaller children are vulnerable to falls due to their developmental stage, lack of coordination and natural tendency to explore their surroundings. This highlights the need for focused preventive measures within homes, including child-friendly environments, to reduce fall risks.

Lacerations (32.3%) and soft tissue injuries (19.3%) were the most frequent injury types, with the face (33%) and upper extremities (25.3%) being the most commonly affected anatomical regions. These results are consistent with other studies, which have identified lacerations and soft tissue injuries as the leading types of trauma in pediatric populations.[19,20] The predominance of these injury types showed the relatively minor nature of most pediatric trauma cases, many of which were caused by low-energy mechanisms. The high number of facial and upper extremity injuries likely reflects the vulnerability of these regions in common mechanisms of injury such as falls and sports-related trauma.[21,22] Interestingly, long bone fractures were more common in adolescents than in younger children. One possible explanation for this difference is that older children are more likely to engage in vigorous activities, such as sports or road traffic accidents, leading to more severe injuries like fractures. Additionally, younger children's bones are more flexible and less likely to break than those of adolescents.[23] According to the study, most patients (89.3%) were treated and discharged from the emergency department, indicating a pattern of non-severe injuries that could be managed with conservative treatments, such as wound closure using Dermabond or suturing and fracture management using back slabs or reduction under sedation. This matches with other studies, showing that most pediatric trauma cases involve minor injuries that do not require surgical intervention.[24,25] However, a small proportion of patients (6.7%) required hospital admission, and 2% experienced significant clinical outcomes, such as admission to the pediatric intensive care unit (PICU). Patients admitted to the PICU were associated with severe trauma mechanisms, including motor vehicle collisions and polytrauma, emphasizing the importance of traffic safety measures for children.[9] Preventive measures, such as enforcing child seatbelt use, promoting pedestrian safety, and implementing sport safety protocols, likely reduced injury severity.[26] Overall, the results of this study are consistent with global trends in pediatric trauma, underscoring the need for targeted preventive strategies to reduce the incidence and severity of injuries in children.[27]

To our knowledge, this is the first study with a thorough understanding of pediatric trauma. There were limitations in this study. The first limitation was its retrospective nature and reliance on previously recorded medical charts and electronic data. This can lead to incomplete or inaccurate information due to missing data or variability in clinical documentation. Second, the study overlooked parental supervision, or environmental factors, which can significantly influence the incidence and type of injuries among children. Third, follow-ups of patients with severe traumatic injuries were missing. Lastly, the study was conducted at a single tertiary care hospital. Therefore, the results may not generalize to other regions or healthcare settings across Oman or the Middle East.

Conclusion

This study gives valuable information about the patterns of pediatric trauma and identifies falls from height as the most common mechanism of injury, particularly among younger children. Males were more frequently affected with lacerations and soft tissue injuries being the most common injury types. Adolescents were more prone to road traffic and sports-related injuries. The results also highlight the importance of focused safety measures especially at home, on the road and during recreational activities to prevent injuries in children. Future research should focus on intervention strategies and long-term outcomes and include other healthcare settings to understand pediatric trauma and prevention methods better.

Disclosure

The authors declare no conflict of interest and no funding received for this study.

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