

Pediatric trauma at a single center in the Qassim region of Saudi Arabia

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BACKGROUND: Trauma is one of the leading causes of pediatric mortality so the prevention of pediatric trauma is an important goal of any healthcare system. There are only a few studies on pediatric trauma in Saudi Arabia. The availability of data is vital for healthcare leaders in planning for healthcare services.

OBJECTIVE: Assess the epidemiology, patterns, and outcome of trauma in the pediatric population in the Qassim region in Saudi Arabia.

DESIGN: Descriptive medical records review.

SETTING: A single-center, academic specialized pediatric referral hospital.

PATIENTS AND METHODS: We reviewed all electronic and paper records for children (<14 years of age) admitted with a diagnosis of trauma to Maternity and Childrens Hospital (MCH) in Buraidah city in the two-year period between January 2017 and December 2018.

MAIN OUTCOME MEASURES: Type of injury, length of stay, and mortality.

SAMPLE SIZE: 133 children.

RESULT: In this cohort, 77 cases (58%) were admitted to the pediatric intensive care unit (PICU) and 56 (42%) to the pediatric surgery ward. The median (interquartile range) age was 5 (1.1-8) years, and 92 (69%) were boys. The most frequent trauma was road traffic accidents, accounting for 70 cases (52%), followed by fall from a height for 40 (30%) cases. Traumatic brain injury was the most frequent type of injury, accounting for 56 cases (42%), and blunt abdominal trauma was in 11 cases (8.3%). Neurosurgery was the primary subspecialty actively involved in 62 cases (47%). Of the injured children who were admitted to PICU, 36 (46%) needed mechanical ventilation support, while 7 (9%) of those admitted to PICU required the insertion of intra-costal drainage. The mortality in our study was 3.7% (5 cases); 4 of 5 deaths were secondary to road traffic accidents.

CONCLUSION: Pediatric trauma is a serious problem in our region with high mortality compared to international benchmarks. Road traffic accidents are the leading type of pediatric trauma, followed by falls from height. Further studies and perhaps national efforts are needed to identify ways to prevent road traffic accidents, and optimize the data registry and trauma services.

LIMITATION: There were many missing data and incomplete files that affect accuracy and preclude generalization.

CONFLICT OF INTEREST: None.

Trauma is one of the most common causes of death among children and adolescents and represents a serious public health problem worldwide.^{1,2} Children and adolescents are at risk of traumatic accidents due to physiological limitations, the process of growth, and behavioral characteristics (experience, need to test, exploration, adventure, and risky behaviors). In addition, the low level of environmental safety as well as lack of adult supervision, lead to more severe trauma.³

Road traffic accidents (RTAs) are the foremost cause of unnatural deaths in children globally and a major burden on the world's economy, causing a yearly loss of about \$518 billion (USD),⁴ which includes an annual loss of more than 260 000 lives in the 0-19 year age group.⁵ The World Health Organization recently reported that 1.24 million people were killed on the road, and up to 50 million people were injured worldwide. The number of road traffic deaths is expected to increase.^{6,7} Road injuries are the most serious cause of trauma in Saudi Arabia, with an accident-to-injury ratio of 8:6, compared with the international ratio of 8:1.8 The rate of RTA is the highest of all worldwide accidents.⁹ RTA in Saudi Arabia accounts for 4.7% of all mortality. In comparison, RTAs accounted for less than 1.7% of all mortality in Australia, the United Kingdom (UK), and in the United States of America (USA).¹⁰ Recently, road fatalities in Saudi Arabia have increased from 17.4 to 24 per 100 000 population compared with 10 per 100 000 in the USA, and 5 per 100 000 in the UK.¹¹ Saudi Arabia has the highest accident-to-death ratio in high income countries (32:1 versus 283:1 in the USA).¹² RTA has a substantial adverse effect on population health in Saudi Arabia and drains the country's resources.¹³

The Qassim Region has a population of about 1.6 million, of which about 24% are younger than 14 years of age.¹⁴ Given that the bulk of RTAs in Saudi Arabia occur in the Qassim region and few studies describe pediatric trauma in our region and the country, we were encouraged to explore RTAs in children in our region.^{13,15,16}

PATIENTS AND METHODS

This descriptive study was a review of medical records from Maternity and Childrens Hospital (MCH) in Buraidah city, a single referral center for pediatrics, for the two-year period between January 2017 to December 2018. MCH is a 500-bed academic hospital and the only regional referral pediatric hospital. Data were collected by means of a standard case report form. We screened the electronic files for all trauma cases that visited MCH during the study period. The

inclusion criteria were a pediatric patient (0 to 14 years of age) admitted with trauma injuries during the study period. Non-accidental pediatric injury and incomplete files were excluded from the analysis. The age group of 0 to 14 years is the Ministry of Health definition of the pediatric age group. The data was collected and analyzed statistically using IBM SPSS (Armonk, New York, United States: IBM Corp) version 20.

RESULTS

Of 203 cases admitted to the emergency department, we included 133 in the analysis. Seventy patients (34.5%) who arrived at our emergency department were not admitted for various reasons and were excluded from the study (52 were discharged home, 11 were discharged against medical advice, and 7 were referred to other hospitals). More than half of the patients (58%, n=77) required admission to the pediatric intensive care unit (PICU), while the remainder (42%, n=56) were admitted to the pediatric surgery ward (PSW) (**Table 1**). The majority of patients resided in Buraidah city (60%, n=80), with the remainder referred from nearby cities. Most of the cases were acute and arrived at MCH with a median time of presentation of 3 (interquartile range, 2-6) hours after the trauma.

Almost half of the patients (44%) (n=59) were referred to us via the Lifesaving Protocol (national protocol that allows small peripheral hospitals to transport their critically ill patients to secondary or tertiary hospitals), while 32% (n=43) were brought by their parents; 14% (n=19) by routine acceptance by referring hospital ambulance and 32 cases (24%) by the Red Crescent (**Table 1**).

The most frequent mode of trauma was RTAs followed by a fall from a height. Pedestrian trauma was also a significant trauma mode. Only 12 patients (9%) had known comorbidities; 8 in the 1-5 years age group.

The median age was 5 years (range 2 months to 13.2 years). The age group most often requiring PICU admission was 1-5 years (23.3%) (**Table 2, Figure 1**), while the greatest mortality was among the age group 5-10 years (2.2%). The most common type of trauma was RTA in all age groups. Forty-two percent (n=56) of trauma patients had isolated traumatic brain injury (TBI). The median time to a neurosurgery response was about 4 (interquartile 2-8.3, n=48) hours (from consultation time to physical presence at bedside). This relatively long delay in response is due to the lack of in-house neurosurgery in MCH, where all neurosurgery services are provided through consultation services from the nearby adult hospital. Of those with TBI, 17 patients had a subdural hemorrhage, 5 epidural hem-

orrhages, 5 subarachnoid hemorrhages, and 6 intracerebral hemorrhages; only 8 patients of TBI patients went to the surgery for hematoma evacuation. Blunt abdominal trauma accounted for only 8.3% (n=11), while polytrauma was reported in 30 % (n=40). For those patients, 6 had a liver injury, and 8 had a spleen injury; however, only 3 patients went to surgery (all splenic injuries). In our hospital, the pediatric surgeon is the main physician responsible for all trauma patients; however, neurosurgery is the primary subspecialty required in trauma patients. The pediatric surgeon was involved in the treatment of 47% (n=62) of all admitted patients. In contrast, ortho-

pedic surgery was involved in 13% (n=18) of admitted patients, while ophthalmology was only required in 8% (n=11) of admitted patients. Maxillofacial surgery was involved in 3% (n=4) and the same percentage for ENT as a subspecialty, while vascular surgery was needed in only one patient.

Blood transfusions were performed in about 19% (n=25) of admitted patients. In comparison, cross-sectional imaging studies were conducted in 72 % of all patients (52% as CT brain and 20 % as CT chest and abdomen); however, 22% of those images were part of the pan-CT protocol. Analysis For trauma patients admitted to PICU (n=77) showed that 47% (n=36) required mechanical ventilation, and 9% (n=7) required chest tube insertion for intracostal drainage. Only around 4% (n=3) had arterial line insertion, while 35% (n=27) required central venous line insertion. The median PICU length of stay for the trauma patients admitted to PICU was 3 (interquartile range, 1-7) days, while the median for total hospital stay was 4 (interquartile range (1-9, n=113) days. Overall, 57.1% (n=76) were discharged with improvement, and 10% (n=13) discharged with disabilities (types of disability were not clear from the records). Mortality in our cohort was 3.7% (n=5), and the commonest cause of death was RTAs (n=3). The median age was 8 years (compared with 5.2 days for patients who survived. Four of 5 (80%) who died were brought to the hospital by the Red Crescent (**Table 3**).

Table 1. Demographic and other characteristics of patients and incidents (n=133).

Gender	
Male	91 (68.9)
Female	41 (31.1)
Nationality	
Saudi	110 (83.3)
Non-Saudi	17 (12.9)
Missing data	5 (3.8)
Type of incident	
Road traffic accident	70 (53.0)
Pedestrian	22 (16.7)
Fall from height	40 (30.3)
Method of transfer to nearest hospital	
Family car	91 (68)
Red Crescent	32 (24)
Missing data	10 (8)
Acceptance to MCH	
Lifesaving protocol	59 (44.4)
Routine acceptance	19 (14.3)
Parents	43 (32.3)
Missing data	12(9)
Time of presentation to MCH after the accident (hours) (n=102)	3.0 (0-96)
Site of admission	
Pediatric intensive care unit	76 (57.6)
Pediatric surgical ward	56 (42.4)

Data are n (%) or median (range). MCH: Maternity and Childrens Hospital.

DISCUSSION

Children are especially vulnerable to sustained severe injuries, particularly head injuries, due to their

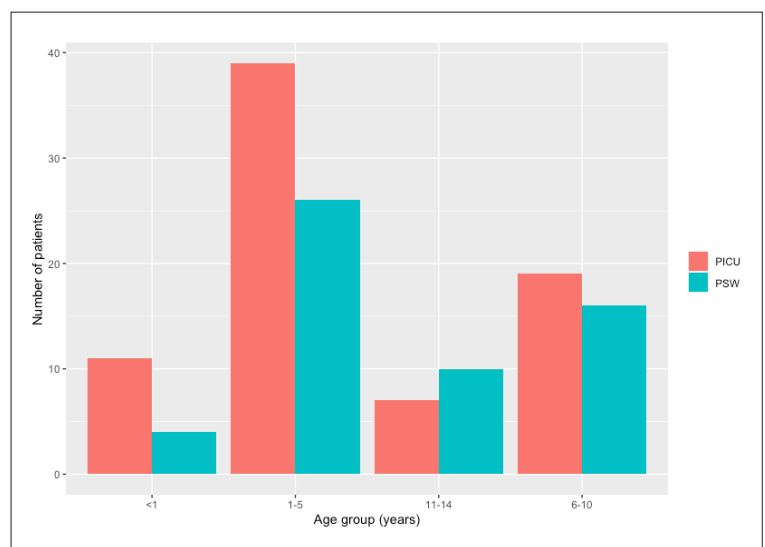


Figure 1. Unit of admission at Maternity and Childrens Hospital by age group.

Table 2. Characteristics and outcome of admitted patients stratified by age groups.

Age (years)	<1 (n=15)	1-5 (n=65)	6-10 (n=17)	11-14 (n=36)	All patients (n=133)
Type of incident					
Road traffic accident	9 (6.7)	29 (21.7)	19 (14.2)	13 (9.7)	70 (52.6)
Pedestrian	0	6 (4.5)	12 (9)	5 (3.7)	23 (17.3)
Fall from height	8 (6)	14 (10.5)	13 (9.7)	5 (3.7)	40 (30.1)
Site of admission at MCH					
PICU	12(9)	31(23.3)	23 (17.3)	11 (8.2)	77 (58)
PSW (pediatric surgery ward)	5 (3.7)	18 (13.5)	21 (15.7)	12 (9)	56 (42)
Diagnosis					
Isolated TBI	14 (10.5)	16 (12)	20 (15)	6 (4.5)	56 (42.1)
Mild TBI (GCS 13-15)	9 (6.7)	7 (5.2)	4 (3)	2 (1.5)	22 (16.5)
Moderate TBI (GCS 9-12)	4 (3)	5 (3.7)	9 (6.7)	1 (.7)	19 (14.2)
Severe TBI (GCS ≤8)	1 (.7)	4 (3)	7 (5.2)	3 (2.2)	15 (11.3)
Polytrauma	2 (1.5)	19 (14.2)	15 (11.2)	4 (3)	40 (30.1)
Blunt abdominal trauma	0	4 (3)	3 (2.2)	4 (3)	11 (8.3)
Chest trauma	0	3 (2.2)	2 (1.5)	3 (2.2)	8 (6)
Pelvic and extremities	0	4 (3)	0	1 (.7)	5 (3.8)
Unspecified	1 (.7)	3 (2.2)	4 (3)	5 (3.7)	13 (9.8)
Body part involved in the trauma					
Head	14 (10.5)	16 (12)	20 (15)	6 (4.5)	56 (41.8)
Chest	0	3 (2.2)	2 (1.5)	3 (2.2)	8 (6)
Abdominal organs	0	4 (3)	3 (2.2)	4 (3)	11 (8.2)
Extremities and pelvis	0	4 (3)	0	1 (.7)	5 (3.7)
More than two organs	0	18 (13.5)	15 (11.2)	5 (3.7)	38 (28.4)
Missing data	3 (2.2)	4 (3)	4 (3)	4 (3)	15 (11.2)
Outcome at hospital discharge					
Healthy	8 (6)	28 (21)	26 (19.5)	14 (10.5)	76 (57.1)
Possible sequelae	4 (3)	12 (58.9)	9 (6.7)	4 (3)	29 (21.8)
Died	1 (0.7)	1 (0.7)	3 (2.2)	0 (0)	5 (3.7)
Missing data	4 (3)	8 (6)	6 (4.5)	5 (3.7)	23 (17.3)

Data are n (%). TBI: traumatic brain injury, GCS: Glasgow Coma Scale.

Table 3. Characteristics of trauma patients who died (n=5).

Gender	
Male	4
Female	1
Nationality	
Saudi	5
Non-Saudi	0
Type of incidence	
RTA	3
Pedestrian	1
Fall	1
Method of transfer to hospital from the site of the accident to nearest hospital	
Family car	1
Red crescent	4

physical dimensions (larger head to body ratio). Injury-related neurological sequelae result in longer periods of morbidity compared to similar injuries in adults. Unfortunately, we have the highest rate of RTAs in Saudi Arabia compared with other countries, and the most severe forms of trauma.^{8-12,15} The results of our study are alarming in terms of magnitude and direction with an increased rate of pediatric trauma as well as an increase in mortality compared with international data. The mortality of 3.7% in our cohort compares with only 0.4% in a large epidemiology study in the UK.¹⁷ Locally, two studies reported a lower mortality rate in pediatric trauma compared with our study: Alghnam et al reported 2.3% and Alnasser et al 2.8%; however, these results are still significantly high compared to international reports.¹⁶⁻¹⁸ We have insufficient data to explain this huge increase in mortality rate compared to the international benchmark. We hypothesize a multifactorial process that includes lack of strict adherence to safety measures like

designated car seats for children, helmet-wearing during active outdoor activity, and child-friendly environments in parks and public areas.

RTA was the leading cause of trauma in our cohort (52%), which is consistent with other local reports.^{15,16,19} Unfortunately, we have insufficient data on safety measures like seat-belt and designated car seats for children involved in RTAs, which needs to be addressed in future research. Falls from a height are the second leading cause of pediatric trauma in our cohort, which also points to another concern about environmental safety for children; however, we are missing data pertinent to circumstances of falls like helmet-wearing, risky behavior, and the presence/absence of a child-friendly environment, which precludes any judgment about the nature of falls, which is another area for future research.

The recent introduction of a nation-wide, camera-based ticketing system (Saher Camera) was a significant step toward primary prevention of RTAs in our country. The camera system effectively decreases the severity of injuries and the numbers of deaths. In one large single-center retrospective comparative study that compared RTA severity and mortality pre- and post-implementation of camera-based ticketing system, they found a 5% absolute risk reduction in overall mortality (from 13.2% to 8.2%) along with a decrease of injury severity score (ISS) from 16 to 13.5 with significant *P* value.¹⁸ However, we are still far from meeting international figures, and we are in need of active programs in the primary prevention of RTA and falls focused on the pediatric population. Given the study's nature (retrospective), missing data and incomplete files might affect the accuracy of the results and preclude generalization.

In conclusion, pediatric trauma is common in the pediatric population and mainly due to RTAs and falls from a height. The rate of mortality is high compared with international figures. There is room for improvement in making our streets safe for children as well as educating the public about safety and precaution to prevent head injuries in children. We believe that our region and perhaps our country needs a comprehensive program for trauma prevention in the pediatric population.

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