



Epidemiology of Neurosurgical and Orthopedic Trauma in Children: A Study in the West of Iran

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Abstract

Background: Trauma can be categorized based on the characteristics of its cause into penetrating, blunt, thermal, or compressive trauma. Another type of classification is based on anatomical location, as trauma may occur at any anatomical site of the body.

Objectives: This study aimed to determine the epidemiology of neurosurgical and orthopedic trauma among children in the city of Ilam.

Methods: In this retrospective study, the health records of all patients aged 6 to 18 years with orthopedic and neurosurgical trauma who were referred to the hospital in Ilam were investigated. Since Imam Khomeini Hospital is the only public hospital for trauma patients in this city, only the records of patients who were referred to this hospital were reviewed.

Results: Results showed that in the neurosurgical trauma group, out of 145 reviewed cases, 96 (66.2%) patients were male and 49 (33.8%) were female. In relation to orthopedic traumas, out of 570 investigated cases, 386 (67.7%) were male and 184 (32.2%) were female. Additionally, results showed that 224 (39.3%) patients had fractures in the right hand, 255 (44.7%) had fractures in the left hand, and 91 (16%) had fractures in both hands. Furthermore, 21 (14.5%) patients had cervical spine injuries, 35 (24.1%) had thoracic spine injuries, 54 (37.2%) had lumbar spine injuries, and 35 (24.1%) had brain trauma.

Conclusions: In the present study, the epidemiology of neurosurgical and orthopedic trauma in children was investigated. Given the prevalence of these types of trauma in Ilam, it is necessary to provide essential training to prevent or reduce their occurrence in the future.

Keywords: Children, Adolescents, Trauma, Neurosurgery, Orthopedics

1. Background

Human health is threatened by various factors, including acute and chronic diseases as well as trauma. Trauma is the most common cause of mortality globally, with consequences such as loss of labor force leading to significant economic costs (1, 2). In Iran, trauma is one of the most common causes of death and is the leading cause of mortality among adolescents, resulting in disability and health-related economic damages (3, 4). In the pediatric group, trauma occurs due to various reasons such as falls (e.g., from stairs, heights), direct hits (blunt trauma), sports injuries, and different types

of accidents involving vehicles, pedestrians, motorcycles, and bicycles (5).

Trauma can be categorized based on the characteristics of its cause into penetrating, blunt, thermal, or compressive trauma. Another classification is based on anatomical location, as trauma can occur at any anatomical site of the body (6). For example, the prevalence of head trauma in children across five continents was reported by Dewan et al. in 30 peer-reviewed papers, with a prevalence ranging from 47 to 280 per 100,000 children (7). Additionally, a study by Eslami et al. found that the prevalence of blunt trauma was 57%, with 36.9% of injuries due to firearms and 34% due to accidents (8).

The hand is an organ with complex anatomy, used in everyday activities, communication, labor, relationships, and emotional expression (9). It is the primary organ in business, with many work-related injuries occurring in the hands or arms (10). The hand is essential for performing motor skills and activities of daily living, coordinating and controlling body movements, and interacting with the external environment (11-13).

Hand trauma involves injuries to the fingers, hand, and wrist, which can cause serious physical and psychological complications for a child. As children are considered the future labor force, traumatic injuries that reduce a child's performance can affect all aspects of their life, including mental, physical, and economic conditions. This imposes significant costs on society and hinders the economic progress of the country (14-16).

2. Objectives

Hand trauma is significant in all age groups, especially in children, as it can lead to various complications later in life. Therefore, this study aimed to determine the epidemiology of neurosurgical and orthopedic trauma among children in the city of Ilam.

3. Methods

In this retrospective study, the health records of all patients aged 6 to 18 years with orthopedic and neurosurgical trauma who were referred to the hospital in Ilam were investigated. Considering that Imam Khomeini Hospital is the only public hospital for trauma patients in this city, only the records of the patients referred to this hospital were reviewed.

The ethics code [IR.MEDILAM.REC.1402.022](#) was obtained for this study. Researchers assessed the health records of the patients, and those who met the inclusion criteria were enrolled in the study. The inclusion criteria were ages between 6 and 18 years and a definitive diagnosis of orthopedic trauma and neurosurgery based on anatomical conditions caused by injury. Patients with incomplete records and insufficient information were excluded from the study.

The study tools included a researcher-made checklist that collected data on the patient's age, living place (rural vs. urban), anatomical position of the injured hand, location of injury, medical imaging, product, season in which the injury occurred, presence or absence of fracture, whether the patient received emergency procedures, diagnosis, destination, and transfer mode of the patient. For neurosurgical trauma, factors such as the location of injury (cervical spine,

thoracic spine, lumbar spine, brain) and CT scan results including intracerebral contusion, epidural hematoma (EDH), intraventricular hemorrhage (IVH), traumatic subarachnoid hemorrhage (TSAH), and traumatic acute subdural hematoma (ASDH) were investigated. The checklist was completed by studying the patients' health records.

When reviewing the patients' records, principles of research ethics including trustworthiness and protecting the confidentiality of the information in health records were maintained. Additionally, only the general aspects of the data were reported, and the guidelines of the university on ethics in research were observed. The data was analyzed using SPSS software version 16.

4. Results

[Table 1](#) shows the demographic characteristics of the patients. According to the findings, in the neurosurgical trauma group, out of 145 reviewed cases, 96 (66.2%) of the patients were male and 49 (33.8%) were female. Regarding orthopedic traumas, out of 570 investigated cases, 386 (67.7%) were male and 184 (32.2%) were female ([Table 1](#)).

The results in [Table 2](#) showed that 224 (39.3%) patients had fractures in the right hand, 255 (44.7%) had fractures in the left hand, and 91 (16%) had fractures in both hands.

The results in [Table 3](#) showed that 21 (14.5%) patients had cervical spine injuries, 35 (24.1%) had thoracic spine injuries, 54 (37.2%) had lumbar spine injuries, and 35 (24.1%) had brain trauma.

5. Discussion

Trauma injuries are among the most significant challenges for healthcare systems worldwide and are a major factor in reducing patients' quality of life. Trauma is also considered one of the leading causes of death and social health problems (17). In childhood, injuries account for about 10% of all illnesses globally, with 84% being unintentional. The most prevalent type of injury in children is brain-associated injuries (18, 19).

In a retrospective study conducted by Nikdel et al. in the city of Urmia, trauma patients with an average age of 30 years were examined over a 6-month period. The prevalence of trauma in upper and lower extremities was 28.7% (5097 people), multiple injuries accounted for 27.3% (4863), spine injuries 21.2% (3778), head, face, and soft tissue of the neck injuries 13.8% (2451), and abdomen and pelvis injuries 9% (1602) (20).

Table 1. Demographic Characteristics of the Research Patients^a

Variables	Orthopedic Fractures			Neuroscience Fractures		
	Boy	Girls	Total	Boy	Girls	Total
Location						
City	290 (75.1)	102 (55.4)	386 (67.6)	57 (59.4)	31 (63.3)	88 (60.7)
Village	96 (24.9)	82 (44.6)	184 (31.2)	39 (40.6)	18 (36.7)	57 (39.3)
Location						
Sports	167 (43.3)	46 (25)	213 (37.4)	37 (38.5)	24 (49)	61 (42.1)
Home	61 (15.8)	33 (17.9)	94 (16.5)	14 (14.6)	1 (2)	15 (10.3)
School	96 (24.9)	56 (30.4)	152 (26.7)	12 (12.5)	3 (6.1)	15 (10.3)
Street or highway	55 (14.2)	36 (19.6)	91 (16)	31 (32.3)	21 (42.9)	52 (35.9)
Other public property	7 (1.8)	13 (7.1)	20 (3.5)	2 (2.1)	0 (0)	2 (1.4)
Medical imaging						
X-ray	253 (65.5)	170 (92.4)	423 (74.2)	1 (1)	2 (4.1)	3 (2.1)
Computed tomography	114 (29.5)	7 (3.8)	121 (21.2)	80 (83.3)	41 (83.7)	121 (83.4)
Both	19 (4.9)	7 (3.8)	26 (4.6)	15 (15.6)	6 (12.2)	21 (14.5)
Product						
Bicycles	168 (43.5)	31 (16.8)	199 (34.9)	22 (22.9)	6 (12.2)	28 (19.3)
Sport injuries	60 (15.5)	78 (42.4)	138 (24.2)	25 (26)	16 (32.7)	41 (28.3)
Stairs	81 (21)	44 (23.9)	125 (21.9)	34 (35.4)	15 (30.6)	49 (33.8)
Driving accidents	59 (15.3)	29 (15.8)	88 (15.4)	12 (12.5)	11 (22.4)	23 (15.9)
other	18 (4.7)	2 (1.1)	20 (3.5)	3 (3.1)	1 (2)	4 (2.8)
Age (y)						
5 - 7	97 (25.1)	56 (30.4)	153 (26.8)	20 (20.8)	12 (24.5)	32 (22.1)
7 - 12	183 (47.4)	82 (44.6)	265 (46.5)	24 (25)	19 (38.8)	43 (29.7)
12 - 18	106 (27.5)	46 (25)	152 (26.7)	52 (54.2)	18 (36.7)	70 (48.3)
Season						
Spring	74 (19.2)	9 (4.9)	83 (14.6)	31 (32.3)	13 (26.5)	44 (30.3)
Summer	160 (41.5)	74 (40.2)	234 (41.1)	17 (17.7)	13 (26.5)	30 (20.7)
Autumn	123 (31.9)	74 (40.2)	197 (34.6)	27 (28.1)	18 (36.7)	45 (31)
Winter	29 (7.5)	27 (14.7)	56 (9.8)	21 (21.9)	5 (10.2)	26 (17.9)
Follow-up treatment post discharge						
Yes	132 (34.2)	64 (34.8)	196 (34.4)	65 (67.7)	25 (51)	90 (62.1)
No	254 (65.8)	120 (65.2)	374 (65.6)	31 (32.3)	24 (49)	55 (37.9)
Destination						
Discharge by personal consent	253 (65.5)	121 (65.8)	374 (65.6)	43 (44.8)	28 (57.1)	71 (49)
Dispatch to other centers	68 (17.6)	36 (19.6)	104 (18.2)	36 (37.5)	13 (26.5)	49 (33.8)
Hospitalization	65 (16.8)	27 (14.7)	92 (16.1)	17 (17.7)	8 (16.3)	25 (17.2)
How to transfer the patient						
Ambulance (land or air)	45 (11.7)	31 (16.8)	76 (13.3)	84 (87.5)		125 (86.2)
Non-ambulance	330 (85.5)	153 (83.2)	483 (84.7)	0 (0)	0 (0)	0 (0)
Unknown	11 (2.8)	0 (0)	11 (1.9)	0 (0)	0 (0)	0 (0)

^a Values are expressed as No. (%).

Various studies have been conducted on trauma in patients aged 0 to 18 years in Iran. In a meta-analysis by Shokri et al., the prevalence of trauma at birth in Iran was 2.7% (95% CI [1.3 - 5.3]) (21). Other studies have focused on different age groups. For instance, Sadeghi and Mohammadi reported a prevalence of trauma at 26.2% (95% CI [14.4 - 29.2]) (22), and a meta-analysis by Maleki et

al. in Iran found the prevalence of traumatic spinal cord injury (TSCI) to be 3 per 10,000 people, with a mean mortality rate of 3.9% (23).

In the study by Sharma et al., the prevalence of orthopedic trauma was 37.8% (299), head trauma 24.7% (192), burn-related trauma 15.17% (120), abdomen trauma

Table 2. Prevalence of Orthopedic Traumas in Children According to Trauma Characteristics ^a

Variables	Boy	Girls	Total
Injured hand			
Right	129 (33.4)	95 (51.6)	224 (39.3)
Left	197 (51)	58 (31.5)	255 (44.7)
Both	60 (15.5)	31 (16.8)	91 (16)
Diagnosis			
Metacarpal fracture	40 (10.4)	33 (17.9)	73 (12.8)
Long finger fracture	65 (16.8)	32 (17.4)	97 (17)
Hand contusion	93 (24.1)	35 (19)	128 (22.5)
Finger contusion	82 (21.2)	37 (20.1)	119 (20.9)
Wrist sprain	88 (22.8)	25 (13.6)	113 (19.8)
Wrist contusion	14 (3.6)	11 (6)	25 (4.4)
Finger sprain	4 (1)	8 (4.3)	12 (2.1)
Other diagnosis	0 (0)	3 (1.6)	3 (0.5)

^a Values are expressed as No. (%).

Table 3. Prevalence of Types of Neurosurgical Traumas in Children According to Trauma Characteristics ^a

Variables	Boy	Girls	Total
Level of the injury			
Cervical spine	12 (12.5)	9 (18.4)	21 (14.5)
Thoracic spine	20 (20.8)	15 (30.6)	35 (24.1)
Lumbar spine	37 (38.5)	17 (34.7)	54 (37.2)
Brain	27 (28.1)	8 (16.3)	35 (24.1)
CT findings for brain injury			
Intracerebral contusion	9 (33.3)	2 (25)	11 (31.4)
EDH epidural hematoma	5 (18.5)	1 (12.5)	6 (17.1)
IVH Intraventricular hemorrhage OR tSAH Traumatic subarachnoid hemorrhage	5 (18.5)	0 (0)	5 (14.3)
ASDH acute subdural hematoma	8 (29.6)	5 (62.5)	13 (37.1)

^a Values are expressed as No. (%).

7.83% (62), and chest trauma 2.78% (22) (24). In the study by Singh et al., the prevalence of upper extremity injuries in the age group of 0 to 5 years was 50.9%, and in the age group of 6 to 15 years, it was 47.42%. The most common types of injuries in this study included pelvic and lower limb injuries. Complete spinal cord injuries were reported in a very small number of cases, with a rate of 2.9% for the age group of 0 to 5 years and 4.8% for the age group of 6 to 15 years (25).

5.1. Conclusions

In the present study, the epidemiology of neurosurgical and orthopedic trauma in children was investigated. Given the prevalence of these types of trauma in Ilam, it is necessary to provide essential

training to prevent or reduce their occurrence in the future.

Footnotes

Authors' Contribution: Study concept and design: S.S., A.R., H.K., and H.M.; acquisition of data: S.S., A.R., M.H., and H.M.; analysis and interpretation of data: S.S., A.R., H.K., and H.M.; drafting of the manuscript: S.S., A.R., M.H., and H.K.; critical revision of the manuscript for important intellectual content: S.S., A.R., H.K., and H.M.; statistical analysis: S.S., A.R., M.H., and H.K.; administrative, technical, and material support: S.S., A.R., M.H., and H.M.; study supervision: S.S., A.R., H.K., and H.M.

Conflict of Interests Statement: The authors declare no potential conflicts of interest.

Data Availability: The dataset presented in the study is available on request from the corresponding author during submission or after publication.

Ethical Approval: The current study was conducted after approval by the Ethics Committee (IR.MEDILAM.REC.1402.022).

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