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Epidemiological analysis of school-related injuries in emergency departments

 Mustafa Umit Can Dolek¹,  Murat Gol²,  Ummuhan Akbulut³¹Yalova University, Faculty of Medicine, Department of Emergency Medicine, Yalova, Türkiye²Malatya Training and Research Hospital, Department of Emergency Medicine, Malatya, Türkiye³Mustafa Kemal Paşa State Hospital, Emergency Department, Bursa, Türkiye

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Abstract

This study examines the epidemiological characteristics of children who presented to the emergency department due to school-related injuries at the state hospital in the Mustafakemalpaşa district of Bursa. This study was carried out retrospectively using case forms that included data on the patient's demographic information, location and time of injury, type of injury, as well as the diagnostic and treatment procedures. The research was conducted at Mustafa Kemal Paşa State Hospital, and 226 patients were examined. The study included 148 boys (65%) and 78 girls (35%). 72% of the patients had minor injuries, while 28% had moderate or severe injuries. One case required surgical intervention, and no fatal cases were observed. The highest incidence of injuries occurred in the middle school age group, particularly in the schoolyard and during recess hours. Falls were the most common mechanism of trauma (54.9%). No significant difference was found in the severity of injuries between genders and age groups ($p=0.31$), but there was a significant difference between the injured body regions ($p=0.021$). This study reveals that school injuries are generally minor, but there is a need to security across all age groups may be appropriate. Safety precautions in schoolyards and during recess should be increased, and future studies should conduct more detailed cause-and-effect analyses.

Keywords: School related injury, school accident, schoolyard safety, injury epidemiology

Introduction

School injuries are frequently observed among children and adolescents and can lead to significant health issues. Children spend a substantial part of their time in the school environment and participate in various physical activities during this period. Accidents that occur during these activities can cause both short-term and long-term health problems [1-3]. The frequency and severity of school accidents have a significant impact on the safety of the educational environment and on the physical and emotional development of children [2,4]. Therefore, understanding the causes, characteristics, and outcomes of school injuries is crucial for the prevention of such accidents and the development of effective interventions. Previous research indicates that school injuries are common and often occur during sports activities [5,6]. Some studies have shown that the most accident-prone areas in primary schools are uncontrolled areas such as playgrounds, stairs, and corridors [5]. In older school

children, the gymnasium and the schoolyard are the most frequent sites of injuries [7].

Understanding the frequency of accidents and identifying the environmental factors that increase this frequency can be of great importance for preventive measures. Limited data are available on emergency department visits due to school accidents. This study aims to analyze the patterns and characteristics of school injuries presented to a district emergency department and to create a general profile of these accidents.

Material and Methods

This study was conducted at Mustafa Kemal Paşa State Hospital, a secondary care hospital located approximately 70 km from the center of Bursa. Mustafakemalpaşa serves a population of approximately 110,000 and is the only hospital in the region, with an annual emergency department visit volume of 250,000-400,000 patients from both pediatric and adult age groups. Data collection

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Corresponding Author: Murat Gol, Malatya Training and Research Hospital, Department of Emergency Medicine, Malatya, Türkiye
Email: drmuratgol@gmail.com

was carried out over a four-month period from December 15, 2023, to June 10, 2024. All school-aged children presenting to the emergency department due to traumatic injuries occurring in the school building or schoolyard were included in the study. Patients whose legal guardians did not consent to participate in the study and those with incomplete or missing forms or hospital records were excluded from the study. The district has a total of 16,950 students enrolled in 23 primary and middle schools and 32 high schools. The school curriculum in all schools includes two hours of physical education classes per week. In the majority of schools, physical education classes are held either in the gymnasium or the schoolyard. Other classes, apart from physical education, are conducted either in classrooms or in the relevant subject laboratories. Data were recorded on the study case form by the medical doctor or emergency medicine specialist who attended to the patient. In the emergency department where the study was conducted, patients presenting with trauma within the last 24 hours are examined in the yellow zone of the emergency department. Patient management was performed in accordance with current guidelines, and no additional interventions were made due to the study. The case form included demographic data such as the patient's name, age, and gender; the location of the trauma (corridor, classroom, gymnasium, cafeteria, laboratory, yard), the time of the trauma (physical education class, non-physical education class, recess), whether the school was in the city center or not, the type of trauma (accident, violence, self-harm), the mechanism of trauma (fall, blunt trauma, penetrating injury), the location of the injury (head-neck, trunk, abdomen, upper extremity, lower extremity), the nature of the trauma (fracture, dislocation, contusion, sprain, open wound, closed head injury, open head wound, inhalation exposure, burn, organ system injury), the diagnostic test requested (X-ray, ultrasound, computed tomography), the treatment administered (dressing, suturing, splint, cast, invasive procedure under general anesthesia), and the outcome (admission, discharge). In the country where the study was conducted, the education system consists of 12 years of compulsory education: four years of primary school (grades 1, 2, 3, and 4), four years of middle school (grades 5, 6, 7, and 8), and four years of high school (grades 9, 10, 11, and 12). The ages of the patients were classified as preschool (1-5 years), primary school (6-9 years), middle school (10-13 years), and high school (14-18 years). Fall-related injuries were classified according to the National Database of Nursing Quality Indicators (NDNQI) as minor, moderate, and major injuries [8]. Mild traumas included injuries such as bruising and contusions, while moderate traumas included injuries requiring sutures, patients requiring splints or casts, and those requiring hospital admission. Severe cases included patients needing emergency surgical operations or intensive care. Additionally, in the writing of our study, OpenAI technology was utilized to correct language inconsistencies and to translate the text into English.

This research was approved by the Malatya Training and Research Hospital Education Planning Board on 08.08.2024 with the decision number 243856822. The study design was approved by the Yalova University Faculty of Medicine (approval number:

2025/270). Database management complies with legislation on privacy and this research is in accordance with the principles of the Declaration of Helsinki.

Statistical Analyses: IBM SPSS Statistics for Mac, Version 27.0 (Armonk, NY, IBM Corp) was used to perform the statistical analyses. The Kolmogorov-Smirnov test was applied to evaluate the conformity of the variables to a normal distribution. Categorical data were presented as case numbers and percentages. The Chi-Square test was used to compare quantitative and qualitative data between two groups. Ethical approval was obtained from the local clinical research ethics committee. Consent was obtained from the legal guardians of the patients before completing the study form.

Results

A total of 226 patients were included in the study. Of these patients, 148 were boys (65%) and 78 were girls (35%). 163 patients (72%) had minor injuries, while 63 patients (28%) had moderate or severe injuries. During the study period, there was one case requiring surgical intervention, and no fatal cases were observed. There was no statistically significant difference in injury severity between genders ($p=0.31$) (Table 1).

The median age of the patients included in the study was determined to be 11 years. The highest number of school injury-related visits occurred in the middle school group. There was no statistically significant difference in injury severity among the age groups. However, a statistically significant difference in injury severity was found between the injured body regions ($p=0.021$).

Of the students who presented with school injuries, 189 (83.6%) came with family members. Of the cases included in the study, 122 (53.9%) were injured in the schoolyard. A total of 147 patients (65%) were injured during recess. Among the students who presented, 179 (79.2%) were from schools in the district center, while 47 (20.8%) were from surrounding villages. Of the patients included in the study, 124 (54.9%) presented due to falls. A total of 206 patients (91.2%) sustained injuries due to accidents, while 11 patients (4.6%) were subjected to violence (Table 1).

Of the patients, 151 (66.8%) presented with contusions or sprains, while fractures or dislocations were identified in 36 patients (15.9%). The number of patients with closed head injuries was 22 (9.7%), and the number of patients with open wounds was 19 (8.4%). X-rays were taken for 186 patients (82.3%). Computed tomography was performed on 17 patients (7.5%), and 19 patients (8.4%) did not undergo any imaging studies. No treatment was administered to 104 patients (46%). Suturing was performed on 8 patients (3.5%), and 55 patients (24.3%) underwent immobilization with a splint or cast. A total of 223 patients (98.7%) were discharged from the emergency department, 2 patients (0.9%) were referred, and 1 patient (0.4%) was hospitalized (Table 2).

Table 1. Basic characteristics of the patients included in the study

	Frequency (N)	Percentage (%)	Minor	Moderately or severely	P value
Number of participants	226	100	163	63	
Age (Year)					
3-5	3	1.32	3	0	0.755
6-9	66	29.2	47	19	
10-13	111	49.11	80	31	
14-17	46	20.3	33	13	
Gender					0.31
Male	148	65	110	38	0.440
Female	78	35	53	25	
Companion					
Family	189	83.6	139	50	
Teacher	23	10.1	14	9	0.203
Other	14	6.4	10	4	
Trauma location					
Classroom	41	18.1	35	6	0.172
Corridor	20	8.8	17	3	
Staircase	26	11.5	21	5	
School yard	122	53.9	87	35	
Sports hall	7	3	3	4	0.257
Trauma time					
Physical education lesson	59	26.1	41	18	
Lesson	20	8.8	18	2	
Break	147	65	104	43	0.098
Environment					
District center	179	79.2	126	53	
Rural	47	20.7	37	10	
Trauma mechanism					0.799
Falling	124	54.8	94	30	
Blunt trauma	78	34.5	53	25	
Sharp object	6	2.6	2	4	
Other	18	7.9	14	4	0.021
Trauma type					
Accident	206	91.1	148	58	
Violence	11	4.8	9	2	
Self harm	2	0.8	1	1	0.021
Other	7	3	5	2	
Injured body part					
Head and neck	51	22.5	35	16	0.021
Torso	20	8.8	17	3	
Abdomen	26	11.5	21	5	
Upper extremity	122	53.9	87	35	
Lower extremity	7	3.	3	4	

P<0.05 was considered significant

Table 2. Types of injuries, diagnostic and treatment methods, and patient outcomes

	N (%)
Nature	
Fracture/dislocated	36 (15.9)
Crush/sprain	151 (66.8)
Open wound	19 (8.4)
Closed head trauma	22 (9.7)
Organ system injury	1 (0.44)
Imaging test	
Ultrasound	3 (1.2)
Computerized tomog-raphy	17 (7.5)
X-ray	186 (82.3)
No examition	19 (8.4)
Treatment	
Dressing	59 (26.1)
Suturing	8 (3.5)
Splint/cast	55 (24.3)
No treatment	104 (46)
Outcome	
Discharge	223 (98.6)
Dispatch	2 (0.8)
Hospitalization	1 (0.4)

Discussion

The most significant finding of this study, which examined patients presenting to a district emergency department due to school injuries, is that the vast majority of school injuries are mild to moderate cases. In terms of injury severity, our study's findings are consistent with those of Leneway et al., Kamel et al. , Özdemir et al., Filser et al. [5,9-11]. In our study, 46% of the patients did not receive any treatment and 98.7% were discharged from the emergency department. This result indicates that the vast majority of school injuries are minor injuries that can be quickly assessed and discharged from the emergency department. Additionally, only 2 patients were referred for pediatric orthopedic intervention and 1 patient was hospitalized for follow-up purposes. These data support the notion that school injuries generally do not require serious interventions.

It was found that 65% of the patients included in the study were male. This result suggests that boys are more active, take more risks during physical activities, and are therefore more prone to injuries. In this respect, our study's results are consistent with the literature [10,12].

In our study, it was found that moderate or severe injuries in the lower extremities were statistically significant (p=0.021). Although this finding does not align well with the literature, it suggests that lower extremity injuries may lead to more serious traumas [4,13,14]. However, the limited number of patients

presenting to the emergency department due to lower extremity injuries in our study (n=7), with moderate or severe trauma detected in 4 of these patients, indicates that caution should be exercised regarding the generalizability of the results. This situation has the potential to introduce bias due to the small sample size. Therefore, larger patient group studies are needed to verify this finding and enhance its generalizability.

In our study, no statistically significant difference was found in injury severity among the age groups. However, contrary to the findings of Al-hajj et al. and Limbos et al., our study showed that middle school students had the highest number of injury visits [14,15]. Many other studies have yielded similar results to our study. In this respect, the results of our study are consistent with the literature [9,10,16]. This can be explained by the fact that middle school students in our country engage in more physical activities and are more active [17-19]. Injury rates and injury severity can vary significantly from school to school [16,20]. The higher incidence of trauma observed among middle school children in our study may be attributed to the increased frequency of physical education classes, sports competitions, and other physical activities during this period. Additionally, children in this age group are in the process of developing their physical and motor skills, which can lead to accidents due to balance and coordination deficiencies. Moreover, the increase in social interactions may encourage them to engage in more daring and risky behaviors within peer groups. Finally, their growing independence from their families and lack of supervision could further contribute to the occurrence of accidents.

Additionally, it was found that more serious injuries such as fractures or dislocations occurred at a rate of 15.9%. The rates of closed head trauma and open wounds were determined to be 9.7% and 8.4%, respectively. These data indicate that the severity of injuries occurring in the school environment is generally mild, but a certain proportion of more serious injuries also occur. It was found that the majority of injuries occurred during recess (65%) and in the schoolyard (53.9%). This finding is consistent with the results of Knobloch et al, who noted that gymnasiums and schoolyards are the most common locations for school injuries. Additionally, it was determined that school injuries were mostly seen in students from schools in the district center (79.2%) [7]. This can be attributed to the higher number of students in district center schools and the more widespread use of physical activity areas.

This study has certain limitations. First, data collection was conducted at only one state hospital in the Mustafakemalpaşa district. This may limit the generalizability of the results and may not provide comprehensive information about school injuries in different regions. The trauma severity scale used for the patients included in the study does not have any international validity. Additionally, the presence of only one case requiring surgical intervention and the absence of fatal cases during the study period may lead to a lack of data for assessing severe cases. The

inability to provide more detailed information on the causes and mechanisms of injuries may limit the development of prevention strategies.

Conclusion

The results of this study indicate that the majority of school injuries are minor, but a certain proportion of more serious injuries also occur. The absence of a statistically significant difference in injury severity between genders and age groups suggests that the risk of injury is similar for all students. Therefore, it is important to implement general preventive measures to enhance the safety of students across all age groups.

The high occurrence of injuries in schoolyards and during recess indicates that safety measures in these areas need to be increased. Future studies can contribute to the development of specific prevention strategies by examining the causes of school injuries in more detail.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical Approval

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