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Original Article *Özgün Araştırma*

MANAGEMENT OF PEDIATRIC FALLS IN AN EMERGENCY DEPARTMENT: ANALYSIS OF 261 PEDIATRIC CASES

Acil Serviste Çocuklarda Düşme Olgularının Yönetimi: 261 Çocuk Olgunun Analizi

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ABSTRACT

Objective: Pediatric falls cause a significant burden for emergency departments and have negative patient outcomes such as prolonged length of stay and increased costs. The objective of this study was to evaluate results of the management of pediatric fall cases in an emergency department.

Material and Methods: Pediatric patients who presented to our emergency department due to falling injury were evaluated and analyzed according to the demographic data, including age and gender, Glasgow Coma Scale, Injury Severity Score time of presentation, site of injury, diagnosis, department of consultation, department of hospitalization, length of stay and cost. After the initial management in the emergency department, patients were consulted and referred to other departments, if deemed necessary.

Results: A total of 261 children were included in the study. Hospital admissions were most frequently made in summer, in August and on Saturdays. The children were most diagnosed by fractures followed by soft tissue trauma. The most injured body part was the head-neck region followed by extremities. The most frequently consulted departments included neurosurgery and orthopedics and traumatology. A total of 101 (38.7%) children were hospitalized. The median Injury Severity Score value of the patients was found as 3 and the median Glasgow Coma Scale value was found as 15 (8-15). The median treatment cost was found to be ₺278.8. The median length of stay was found as 31 (interquartile range, 21-63.5) (interquartile range için 2 sayısal değer verilmeli) hours. A strong positive correlation was found between length of stay and costs (r=0.629, p<0.001).

Conclusion: Pediatric age group fall injuries are common events that increase the workload of the emergency department and create a significant burden and cost for the health system and society. Our results show that, as expected, there is a very strong relationship between length of stay and treatment costs.

***Keywords**: Fall, children, emergency department, length of stay, cost*

ÖZ

Amaç: Çocuklarda düşme, acil servisler üzerinde önemli bir yük oluşturmakta ve hastanede kalış süresinde uzama ile artan maliyetler gibi olumsuz sonuçlara neden olabilmektedir. Bu çalışmanın amacı, bir acil serviste çocuklarda düşme olgularının yönetim sonuçlarının değerlendirilmesidir.

Gereç ve Yöntemler: Düşme kaynaklı yaralanma nedeniyle acil servisimize başvuran pediatrik hastalar; yaş ve cinsiyet gibi demografik veriler, Glasgow Koma Skalası, Injury Severity Score skorları, başvuru zamanları, yaralanma bölgesi, tanı, konsülte edilen bölüm, yatış verilen bölüm, hastanede kalış süresi ve maliyetler açısından değerlendirilmiş ve analiz edilmiştir. Acil servisteki ilk yönetim sonrasında gerekli görülen hastalar diğer bölümlerle konsülte edilerek sevk edilmiştir.

Bulgular: Çalışmaya 261 çocuk dahil edildi. Başvurular en sık yaz mevsiminde, Ağustos ayında ve Cumartesi günleri yapılmıştır. Çocuklarda en sık konulan tanılar kırık ve yumuşak doku hasarıdır. En sık yaralanan vücut bölgeleri baş-boyun bölgesi ve ekstremitelerdir. En sık konsültasyon yapılan bölümler beyin ve sinir cerrahisi ile ortopedi ve travmatolojidir. Toplam 101 çocuğa (%38.7) yatış verilmiştir. Hastaların medyan Injury Severity Score değeri 3 ve medyan Glasgow Koma Skalası değeri 15 (8-15) olarak bulunmuştur. Medyan tedavi maliyeti 278.8₺ olarak saptanmıştır. Medyan hastanede kalış süresi 31 (çeyrekler arası aralık, 21-63.5) (çeyrekler arası aralık için 2 sayısal değer verilmeli) saattir. Hastanede kalış süresi ile maliyetler arasında güçlü bir pozitif ilişki saptanmıştır (r=0.629, p<0.001).

Sonuç: Çocuk yaş grubu düşmeye bağlı yaralanmalar, acil servisin iş yükünü artıran, sağlık sistemi ve toplum için önemli bir yük oluşturan ve maliyeti artıran yaygın olaylardır. Elde ettiğimiz sonuçlar, beklendiği gibi kalış süresi ile tedavi maliyetleri arasında çok güçlü bir ilişki olduğunu göstermektedir.

***Anahtar Kelimeler**: Düşme, çocuklar, acil servis, hastanede kalma süresi, maliyet*

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INTRODUCTION

Unlike adults, physiologic, cognitive, and psychosocial differences affect child's perception and reactions to illness or injury. Children develop new skills and are often unaware of their limitations. Therefore, it can be said that all children are at some risk of falling. The World Health Organization (WHO) defined a fall as an event resulting in a person who comes to rest inadvertently on the ground or floor or other low levels (1). A fall is the most common cause of pediatric injuries requiring emergency medical attention (2). It is one of the most important risk factors leading to concussions in pediatric age group (3). Children aged between 1-4 years are more likely to be injured at home (such as falling off furniture, downstairs, or out of windows) than older children (4, 5). The risk factors for pediatric falls include risk taking behaviours from developmental process, age, gender, mental state, mobility, history of falls, playground conditions, perceptions of parents/caregivers, housing conditions, poverty, neighbourhood deprivation. (6). According to the data from the Center for Disease Control and Prevention, more than 2 million falls occur in a year from birth to 19 years old in the United States of America (USA) (7) (bu cümle ile beraber sonraki tüm referans numaralarında kayma var. 7. ve sonraki tüm referans numaralarının kontrol edilip düzeltilmesi gerekli). Most children fall many times in their lives without sustaining much more than a few cuts and bruises. However, some falls have more severe consequences, making them the fourth largest cause of unintentional injury death for children. On the other hand, pediatric falls cause a significant burden for emergency departments as well as overall hospitals and have the potential of negative patient outcomes such as prolonged length of stay and thus, increased costs. According to the WHO, falls are the most common type of pediatric injury presenting at emergency departments, and account for 20-25% of such visits (1). Pediatric falls are preventable accidents by taking the necessary measures. To develop preventive strategies, there is a need for studies to analyze the causes and outcomes of pediatric falls to add evidence on what is already known on this issue. Therefore, the objective of this study was to retrospectively evaluate the results of the management of pediatric fall cases in an emergency department.

MATERIALS AND METHODS

Study Design

A total of 261 children brought to the emergency department of our hospital due to fall injury, evaluated first in our department, consulted with other departments, hospitalized and treated in our hospital between January 01, 2016 and December 31, 2020 were included in this retrospective cohort study. Because of the retrospective design of the study, patient consent was waived. Patients older than 18 years, those who presented to the emergency department out of the study period and patients with missing data were excluded from the study. Data used in the study were obtained from the patient files and archives of the hospital. Data extraction was based on complaints of fall injury international classification of disease, 9th version, clinical modification (ICD-9 CM): unintentional fall-related external cause of injury codes (E-codes) (6). We used the fees corresponding to the SUT codes determined by the Ministry of Health of the Republic of Turkey for calculate the costs (8).

Study Population

Pediatric patients who presented to the emergency department of our hospital due to falling injury were evaluated and analyzed according to the demographic data, including age and gender, Glasgow Coma Scale (GCS), Injury Severity Score (ISS) scores, time of presentation (year, season, month, day of week, time), hour of presentation, site

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of injury, diagnosis, department of consultation, department of hospitalization, duration of hospitalization, cost, and mortality. Pediatric trauma care was initiated in the emergency department in all patients. After receiving medical history from the parents, GCS and ISS scores were calculated and a physical examination was performed. Biochemical analysis and imaging studies were performed, if deemed necessary. After the initial management in the emergency department, some patients were consulted and referred to other departments and the others were discharged.

Ethics Consideration

The study protocol was approved by the local ethics committee of our hospital (Düzce University Non-Interventional Health Research Ethics Committee, date: 15.03.2021, issue number: 2021/74). The study was conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

Data obtained in this study were statistically analyzed using SPSS version 23 (SPSS, Statistical Package for Social Sciences, IBM Inc., Armonk, NY, USA) package software. Normality of the continuous variables was evaluated with the Shapiro-Wilk test. Mann-Whitney U test was used for the comparison of the variables between two groups and Kruskal-Wallis test (Post-Hoc: Dunn-Bonferroni test) for the comparison of the variables between three groups. The correlation between two categorical variables was examined with the Pearson's Chi-square test or Fisher's Exact test. The correlation between two continuous variables was examined with Spearman's correlation analysis. The continuous variables were expressed as median (interquartile range [IQR]) and the categorical variables were given as frequency and percentage. $p<0.05$ values were considered statistically significant.

RESULTS

A total 261 of pediatric patients with fall-related injury were included in the study. The median age of the patients was 8 years (IQR,3-14) (interquartile range için 2 sayısal değer verilmeli) and 66.3% were boys. The most common presentation to the emergency department occurred in 2017 (n:109, 41.8%) and the least common presentation in 2019 (n:7, 2.7%). The presentations were most frequently in summer (n:105, 39.9%) and in August (n:46, 17.6%), while least in winter (n:34, 12.9%). Considering days of the week; the most common presentations occurred on Saturdays (n:44, 16.8%) and the least on Tuesdays (n:28, 10.7%) (Figure 1).

The children were most diagnosed by fractures (n:109, 41.8%) followed by soft tissue trauma (STT) (n:81; 31%). The most infrequent diagnoses were amputation (n:3, 1.1%), pneumothorax (n:5, 1.9%), pneumocephalus (n:8, 3.1%), cerebral contusion (n:1, 0.4%) and pulmonary contusion (n:4, 1.5%), and these diagnoses were not included in the analysis because of the small sample size. The most injured body part was the head-neck region (n:128, 49%), followed by extremities (n:81, 31%). Thirty-three (12.6%) patients had injury in more than one region.

In the study, a total of 181 patients were consulted to other departments. The most frequently consulted departments included neurosurgery (n:95, 53%), orthopedics and traumatology (n:86, 47.5%), and pediatric surgery (n: 74, 40.9%) departments, respectively. The least frequently consulted departments were thoracic surgery (n:2, 1.1%), and plastic, reconstructive and aesthetic surgery (n:3, 1.7%). These departments were not included in the analysis because of the small sample size.

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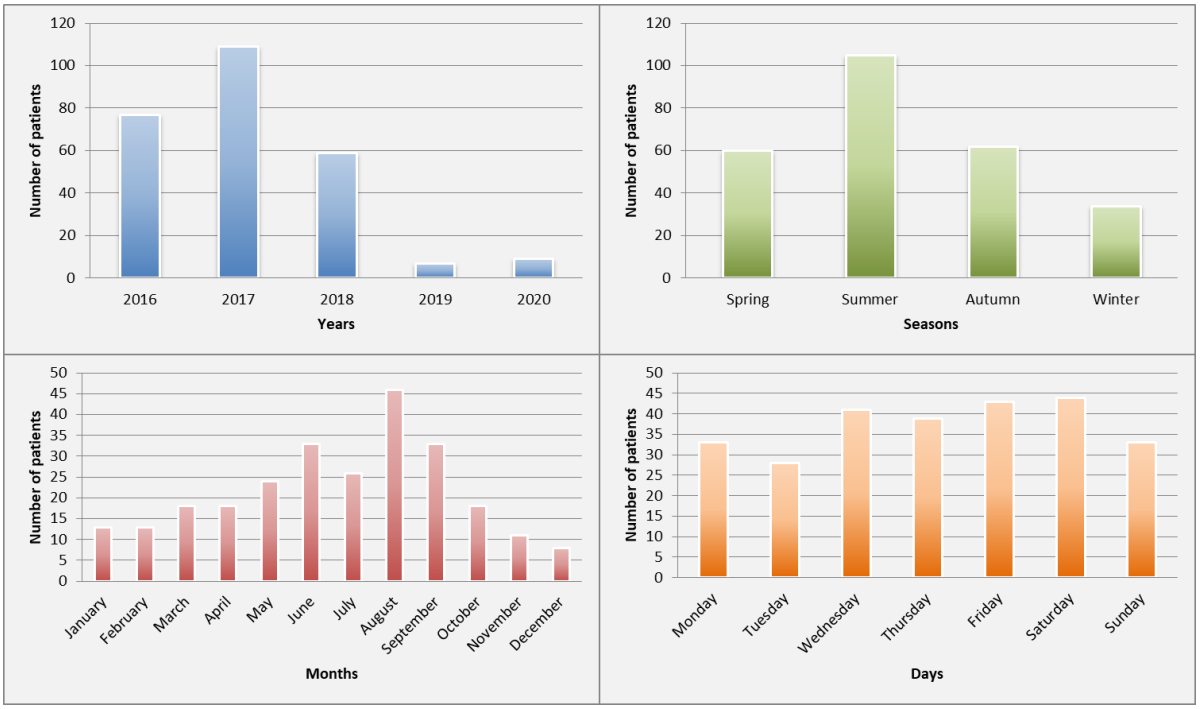

Figure 1: Distribution of the presentations due to fall-related injury by time periods

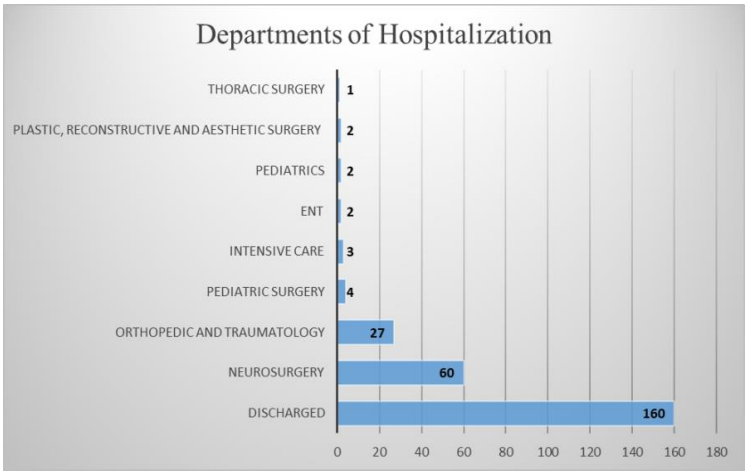

Figure 2: Distribution of the hospitalized departments

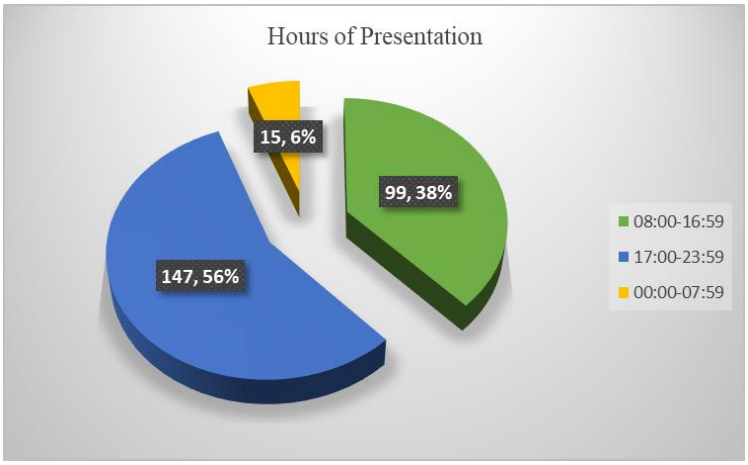

Figure 3: Distribution of the hour of presentation to the emergency department

Table 1: Analysis of the hour of presentation, ISS, GCS and treatment cost according to the clinical data

		Hour of Presentation									
	Total (n=261) n (%)	08:00-16:59 (n=99) n (%)	17:00-23:59 (n=147) n (%)	00:00-07:59 (n=15) n (%)	p	ISS Med (IQR)	p	GCS Med (Min-Max)	p	Cost, ₺ Med (IQR)	p
Diagnosis*											
SST	81 (31.0)	25 (25.3)	51 (34.7)	5 (33.3)	0.286	2 (2.5) / 6 (5)	<0.001	15 (12-15) / 15 (8-15	0.173	170.7 (377)/300.4 (499.9)	<0.001
Fracture	109 (41.8)	46 (46.5)	55 (37.4)	8 (53.3)	0.238	6 (5)/2 (2)	<0.001	15 (12-15)/15 (8-15)	0.003	489.5 (1328.5)/181 (249.2)	<0.001
Bleeding	17 (6.5)	4 (4)	12 (8.2)	1 (6.7)	0.438	27 (0)/3 (5)	<0.001	13 (8-15)/15 (10-15)	<0.001	765.4 (2852.6)/246.4 (397.1)	<0.001
Skin lesion	40 (15.3)	19 (19.2)	20 (13.6)	1 (6.7)	0.310	2 (5)/5 (4.5)	0.006	15 (8-15)/15 (12-15)	0.222	294.7 (463.4)/270.6 (434.9)	0.829
Head Trauma	69 (26.4)	24 (24.2)	42 (28.6)	3 (20)	0.635	2 (5)/6 (4)	<0.001	15 (10-15)/15 (8-15)	0.823	229.6 (191.4)/298.7 (557.9)	0.227
Amputation**	3 (1.1)	1 (1)	2 (1.4)	0 (0)	-	11 (-)/3 (5)	-	15 (15-15)/15 (8-15)	-	90.1 (-)/279.4 (432)	-
Pneumothorax**	5 (1.9)	1 (1)	4 (2.7)	0 (0)	-	24 (17)/3 (5)	-	14 (13-15)/15 (8-15)	-	1160.1 (7844.7)/268.9 (422.2)	-
Pneumocephalus **	8 (3.1)	3 (3)	5 (3.4)	0 (0)	-	18 (20)/3 (5)	-	12 (8-15)/15 (10-15)	-	1270.4 (10426.8)/267.1(385.9)	-
Pulmonary Contusion**	4 (1.5)	0 (0)	4 (2.7)	0 (0)	-	30 (8.3)/3 (5)	-	13 (13-14)/15 (8-15)	-	7080.3 (13578.9)/270.6 (411)	-
Site of Injury											
Head & Neck	128 (49.0)	51 (51.5)	71 (48.3)	6 (40)	0.071	3 (5)	0.004	15 (8-15)	<0.001	266.6 (305.5)	<0.001
Extremity	59 (22.6)	27 (27.3)	29 (19.7)	3 (20)		5 (5)		15 (15-15)		240.6 (602.9)	
Chest	6 (2.3)	5 (5.1)	1 (0.7)	0 (0)		6 (2.3)		15 (15-15)		243.7 (252.9)	
Abdomen	35 (13.4)	9 (9.1)	23 (15.6)	3 (20)		2 (1)		15 (10-15)		76.2 (378.4)	
Multiple traumas	33 (12.6)	7 (7.1)	23 (15.6)	3 (20)		6 (11)		15 (13-15)		571.3 (1086.9)	

Table 1 (contined)

Consulted departments*											
Pediatric Surgery	74/181 (40.9)	24 (35.8)	41 (41.4)	9 (60)	0.224	6 (15)/6 (3)	0.001	15 (8-15)/15 (12-15)	0.001	512.8 (1185.6)/242.2 (458.5)	<0.001
Neurosurgery	96/181 (53.0)	31 (46.3)	56 (56.6)	9 (60)	0.364	6 (11)/5 (4)	<0.001	15 (8-15)/15 (13-15)	<0.001	476.7 (944.8)/177 (411.6)	<0.001
ENT	15/181 (8.3)	7 (10.4)	6 (6.1)	2 (13.3)	0.458	6 (4)/6 (8)	0.546	15 (13-15)/15 (8-15)	0.430	318 (324.1)/338.1 (691.5)	0.730
Orthopedics	86/181 (47.5)	36 (53.7)	44 (44.4)	6 (40)	0.416	6 (8)/3 (4)	<0.001	15 (8-15)/15 (12-15)	0.166	662.9 (1552.5)/222.3 (293)	<0.001
Forensic Medicine	22/181 (12.2)	5 (7.5)	15 (15.2)	2 (13.3)	0.327	2.5 (1)/6 (7)	<0.001	15 (12-15)/15 (8-15)	0.060	35.6 (60.2)/375 (744.9)	<0.001
Ophthalmology	11/181 (6.1)	4 (6)	7 (7.1)	0 (0)	0.897	6 (11)/6 (8)	0.690	14 (12-15)/15 (8-15)	0.008	734 (1485.6)/329.5 (520)	0.084
Thoracic Surgery**	2/181 (1.1)	1 (1.5)	1 (1)	0 (0)	-	16.5 (0)/6 (8)	-	14 (15-15)/15 (8-15)	-	2669.8 (-)/335.2 (577.1)	-
PRAS **	3/181 (1.7)	2 (3)	0 (0)	1 (6.7)	-	6 (-)/6 (8)	-	15 (15-15)/15 (8-15)	-	752.5 (-)/332.6 (595.2)	-
Hospitalization*	101 (38.7)	34 (34.3)	56 (38.1)	11 (73.3)	0.015	6 (12)/3 (5)	<0.001	15 (8-15)/15 (14-15)	<0.001	675 (1525.5)/156.9 (198.8)	<0.001
Department** Pediatric Surgery	4 (1.5)	2 (2)	2 (1.4)	0 (0)	-	12.5 (17.3)	-	14 (14-15)	-	2392.6 (3142.6)	-
Neurosurgery	60 (23.0)	15 (15.2)	38 (25.9)	7 (46.7)		6 (19.5)		15 (8-15)		534 (1115.5)	
Orthopedics	27 (10.3)	13 (13.1)	10 (6.8)	4 (26.7)		6 (5)		15 (15-15)		1170.6 (1602.3)	
ENT	2 (0.8)	2 (2)	0 (0)	0 (0)		4.5 (-)		15 (15-15)		440.2 (-)	
Pediatrics	2 (0.8)	0 (0)	2 (1.4)	0 (0)		23.5 (-)		12.5 (10-15)		2112.4 (-)	
ICU	3 (1.1)	0 (0)	3 (2)	0 (0)		18 (0)		13 (12-14)		734 (-)	
Thoracic Surgery	1 (0.4)	0 (0)	1 (0.7)	0 (0)		27		13 (-)		571.3 (-)	
PRAS	2 (0.8)	2 (2)	0 (0)	0 (0)		12 (0)		15 (15-15)		4079.3 (-)	

GCS: Glasgow Coma Scale, ISS: Injury Severity Score, IQR: interquartile range, STT: soft tissue trauma, ENT: ear, nose and throat, ICU: intensive care unit, PRAS: Plastic, Reconstructive and Aesthetic Surgery *ISS, GCS and cost are given according to Yes/No rank** Only frequency analysis due to small sample size

A total of 101 (38.7%) children were hospitalized. Distribution of the hospitalized departments is given in Figure 2. No mortality occurred in any patient. An analysis was performed to determine the relationship between hour of presentation, ISS, GCS and treatment cost. The results obtained from analysis of the hour of presentation, ISS, GCS and treatment cost according to the clinical data is given in Table 1.

Hours of Presentation

Hours of presentation to the emergency department are given in Figure 3. Hospitalization status was examined according to the hour of presentation. Accordingly, the rate of hospitalization was statistically significantly higher among the patients who presented between 00:00-07:59 (n:11, 73.3%) compared to the patients who presented between 08:00-16:59 (n:34, 34.3%) and between 17:00-23:59 (n:56, 38.1%) (p=0.015).

ISS

The median ISS value of the patients was found as 3 (IQR,1-6) (interquartile range için 2 sayısal değer verilmeli). The ISS scores were significantly lower in the patients diagnosed with STT (Y/N: 2 [2.5)/6 [5]), skin lesion (Y/N: 2 [5)/5 [4.5]) and head trauma (Y/N: 2 [5]/6 [4]) (p<0.001, p=0.006, p<0.001; respectively). ISS scores were statistically significantly higher in the patients diagnosed with fracture (Y/N: 6 [5]/2 [2]) and bleeding (Y/N: 27 [0]/3 [5]) (for both p<0.01). ISS scores were significantly higher in the patients with multiple traumas compared to the patients with head & neck, extremity and abdominal injury (Kruskal Wallis: p<0.001, Post-Hoc: p=0.007, p=0.031, p=0.015; respectively).

ISS scores were statistically significantly higher in the patients consulted with neurosurgery (Y/N: 6 [11]/5 [4]), pediatric surgery (Y/N: 6 [15]/6 [3]), and orthopedic and traumatology (Y/N: 6 [8]/3 [4]) departments (p=0.001, p<0.001, p<0.001; respectively). The median ISS score was significantly lower in the patients consulted with the forensic department (2.5 [1]) than the patients who did not receive consultation from this department (6 [7]) (p<0.001). The median ISS score was significantly higher in the hospitalized patients (6 [12]) compared to the discharged patients (3 [5]) (p<0.001).

GCS

The median GCS value was found as 15 (8-15). The median GCS value was significantly higher in the patients diagnosed with fracture (15 [12-15]) compared to the patients who were not diagnosed with fracture (15 [8-15]) (p=0.003). The median GCS value was significantly lower in the patients diagnosed with bleeding (13 [8-15]) compared to the patients who were not diagnosed with bleeding (15 [10-15]) (p<0.001). The median GCS value was significantly lower in the patients with head & neck injury compared to the other injury sites (Kruskal Wallis: p<0.001, Post-Hoc: p=0.001). GCS values were significantly lower in the patients consulted with neurosurgery (Y/N: 15 [8-15]/15 [13-15]), pediatric surgery (Y/N: 15 [8-15]/15 [12-15]) and ophthalmology (Y/N: 6 [8]/3 [4]) departments (p=0.001, p<0.001, p=0.008; respectively). The median ISS score was significantly lower in the hospitalized patients (15 [8-15]) compared to the discharged patients (15 [14-15]) (p<0.001).

Cost

The median treatment cost was found as ₺278.8 (435.2). The median cost was statistically significantly lower in the patients diagnosed with STT (Y/N: 170.7 [377]/300.4 [499.9]) (p<0.001). Treatment costs were significantly higher in the patients diagnosed with fracture (Y/N: 489.5 [1328.5]/181 [249.2]) and bleeding (Y/N: 765.4 [2852.6]/246.4 [397.1]) (p<0.001). The median cost was statistically significantly higher in the patients with multiple traumas (571.3 [1086.9]) compared to

those with head-neck injury (266.6 [305.5]), extremity injury (240.6 [602.9]) and abdominal injury (76.2 [378.4]) (Kruskal Wallis: p<0.001, Post-Hoc: p=0.006, p=0.004, p<0.001; respectively). In addition, the median cost was significantly lower in the patients with abdominal injury compared to those with head-neck and extremity injuries (Post-Hoc: p=0.002, p=0.044; respectively).

Treatment costs were significantly higher in the patients consulted with neurosurgery (Y/N: 476.7 [944.8]/177 [411.6]), pediatric surgery (Y/N: 512.8 [1185.6]/242.2 [458.5]) and orthopedics and traumatology (Y/N: 662.9 [1552.5]/222.3 [293]) (for all p<0.001). The median cost was significantly lower in the patients consulted with the forensic department (35.6 [60.2]) than the patients who did not receive consultation from this department (375 [744.9]) (p<0.001). The median cost was significantly higher in the hospitalized patients (675 [1525.5]) compared to the discharged patients (156.9 [198.8]) (p<0.001).

Length of Stay (LOS)

The median LOS was found as 31 (IQR,21-63.5) hours in the 101 hospitalized patients. Results of the hospitalization according to the sites of injury are shown in Table 2. Although no significant difference was found between the sites of injury in terms of hospitalization, the shortest LOS was found in the patients with head-neck injury (p=0.321).

Correlations

Linear correlations examined between ISS, GCS, LOS and cost data of the patients are given in Table 3. Accordingly, a moderate negative correlation was found between ISS and GCS (r=-0.534, p<0.001). A moderate positive correlation was found between ISS and costs (r=0.542, p<0.001). There was a very weak negative correlation between GCS and LOS (r=-0.215, p=0.031). There was a weak negative correlation between GCS and costs (r=-0.390, p<0.001). Finally, a strong positive correlation was found between LOS and costs (r=0.629, p<0.001).

Table 2: Length of stay according to the site of injury

	Hospitalization (n=101) n (%)	**LOS, h Med (IQR)**	**p**
Site of injury			
Head & Neck	58 (57.4)	24.5 (24)	
Extremity	18 (17.8)	39.5 (43.5)	
Chest	0 (0)	-	0.321
Abdomen	7 (6.9)	51 (60)	
Multiple traumas	18 (17.8)	38.5 (74.5)	

LOS: Length of stay

Table 3: Correlation analysis

	n		**ISS**	**GCS**	**LOS**	**Cost**
ISS	261	r	1.000	-0.534	0.189	0.542
		p	-	<0.001	0.059	<0.001
GCS	261	r	-0.534	1.000	-0.215	-0.390
		p	<0.001	-	0.031	<0.001
LOS, hour	101	r	0.189	-0.215	1.000	0.629
		p	0.059	0.031	-	<0.001
Cost, ₺	261	r	0.542	-0.390	0.629	1.000
		p	<0.001	<0.001	<0.001	-

GCS: Glasgow Coma Scale, ISS: Injury Severity Score, LOS: Length of stay

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DISCUSSION

It is important to evaluate and analyze pediatric fall-related injury cases to develop strategies to prevent these accidents because of the increased workload on the emergency departments, prolonged length of stay and thus, increased treatment cost caused by these injuries. In the present study, we analyzed the relationship of ISS, GCS, length of stay (LOS), hospitalization status and treatment cost with clinical features, including demographics, time periods of presentations due to the chief complaint of fall-related injury, site of injury, consulted and hospitalized departments. Many studies have been conducted in the literature about the mechanisms and results of pediatric injuries managed first in emergency departments (9-11).

Male children are more likely to sustain a fall-related injury. This may be attributable to cultural influence that encourages boys to engage in aggressive play that carries a higher risk for falling (2). According to the "Children and Falls" 2007 report by the WHO, the rate of boys suffering fall is higher than girls worldwide (1). Husayin et al. reported the rate of boys suffering from a fall as 56% (12). Schaffer et al. reported that 58.5% of children presenting to the hospital were boys (9). Also, in our study most of the patients were boys by 66.3%.

Studies have reported different results about time periods of presentation due to pediatric injuries. It was reported in a study by Akpinar that pediatric injury cases were encountered most in summer and in July followed by April, on Wednesdays and between 16:00-23:59 (11). In another study by Segal et al., the majority of pediatric fall incidents occurred in summer, between July and August and on Saturdays (13). Similarly, in the present study most of the presentations to the emergency department due to pediatric fall injuries occurred in summer, in August, on Saturdays and between 17:00-23.59. This result may be attributed to the fact that children engage in more activities in summers.

The diagnosis made due to fall-related injuries largely depends on the mechanism and severity of fall. Studies in the literature reporting distribution of the diagnoses made due to fall-related pediatric injury are scarce. However, there were studies reporting diagnosis due to other type of pediatric injuries. In a study by Akpinar investigating pediatric violence cases presented to the emergency department, 77% of the patients were diagnosed with STT, 7.5% with fracture and 3.33% with incision. Multiple traumas were found in one child (0.83%) (11). In another study by the same author investigating pediatric injuries due to road traffic accidents, 92% of the patients were diagnosed with STT, 97.8% with Pneumocephalus, 92.7% with pneumothorax and 99.3% with pulmonary contusion (14). In a study by Migneault investigating injuries of children who fell from monkey bars, 37.3% of the children were diagnosed with fracture, 20.1% with STT, and 15.8% with minor head injury (15). In our study, the most common diagnosis was fracture in 41.8% and followed by STT in 31% of the patients. There are some differences among the studies regarding diagnoses made for fall-related injury in children. These are attributable to different types of injuries, different types of falls and cultural differences among the study populations.

Young children are more likely to sustain head injury due to fall because of their larger cephalic mass compared to the rest of the body (16). As a child grows, their head circumference gets smaller and in case of fall, they become able to brace their falls with their upper extremities (17). Therefore, two most common sites of injury during a fall are head and extremities. Likewise, in our study the most common site of injury was head-neck region at 49% followed by extremities at 31%.

In general practice, after first assessment of children presenting to the emergency department due to fall-related injury is made, treatment is initiated here and then the patients are consulted with and referred to the relevant departments for further evaluations. In our study, the most frequently consulted departments included neurosurgery by 53%, orthopedics by 47.5% and pediatric surgery by 40.9%. This resulted from the fact that most common site of injury were head and extremities. In a study by Akpinar, the most consulted departments were ENT by 41.7% and orthopedics by 20.8% (11). In the other study of the author, the most commonly consulted departments were neurosurgery by 76.6%, orthopedics by 70.1% and pediatric surgery by 70.1% (14). Relatively lower consultation rates in our study were attributed to different types of injury investigated among the studies.

Unlike the previous studies, we investigated the relationships between ISS, GCS, treatment cost and length of stay, and the clinical data. In a study by Bulut et al. investigating characteristics of childhood falls, the median ISI score was reported as 13 and the median GCS score as 14 (18). Our results are within the range reported in the literature.

Childhood fall-related injuries may result in hospitalization. Length of stay in hospital is a factor directly affecting treatment costs. Length of stay is determined by the mechanism and type of falls, severity of the injury and treatment administered. In the present study, the median length of stay in the hospital was 31 hours in the hospitalized patients. In the study by Bulut et al. the mean length of stay was found as 5.6 days (18). In the study by Akpinar, the median length of stay was reported as 51 hours (14).

In our study, the median treatment cost was found as ₺278.8. Treatment costs were significantly higher in patients with fracture and multiple traumas. Since there is no study specifically analysing treatment cost in patients with fall-related injury, we could not compare our costs.

Retrospective nature of the study is the main limitation. In addition, only data existing within the study period could be analysed. However, to our knowledge, this study is the first to investigate the relationship of clinical data with ISS, GCS scores, length of stay in hospital and cost in pediatric patients presenting to the emergency department with fall-related injuries.

Pediatric fall-related injuries are common incidents, increasing the workload of the emergency department and furthermore significant burden and cost to both the health system and society. This study provided insight into the potential cost savings that can be achieved if injury prevention programs and strategies are successfully implemented. Because these incidents increase treatment costs by prolonging hospitalization. Our results indicate a very strong correlation between length of stay and treatment costs as expected. It is necessary to develop strategies to prevent falls in children and this data on the costs of child falls can be used to conduct cost-effectiveness analyses of injury prevention programs or strategies that can help plan and prioritize injury prevention activities. Further comprehensive multi-centre cohort studies are needed to develop strategies for prevention and reduction of pediatric falls.

Conflict of Interest: The authors declare that they have no conflict of interest.

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authors have read the article and confirmed.*Ethical Committee Approval:* Düzce University Non-Interventional Health Research Ethics Committee, date: 15.03.2021, issue number: 2021/74.

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