ORIGINAL ARTICLE

CHNR

Incidence of falls and fall-related characteristics in hospitalized children in South Korea: a descriptive study

Hyeyeong Park[1], Hyunju Kang[2]

[1]Graduate Student, Department of Nursing, Graduate School, Kangwon National University, Chuncheon, Korea
[2]Associate Professor, College of Nursing, Kangwon National University, Chuncheon, Korea

Corresponding author
Hyunju Kang
College of Nursing, Kangwon National University, 1 Kangwondaehak-gil, Chuncheon 24341, Korea
TEL: +82-33-250-8878
FAX: +82-33-259-5636
E-MAIL: hjkang@kangwon.ac.kr

Purpose: With the recent increase in interest in patient safety, prevention of falls in hospitalized children has become important. This study aimed to identify the incidence rate of falls among hospitalized children and explore fall-related characteristics. **Methods:** This retrospective descriptive study analyzed the medical information of 18,119 patients aged <18 years admitted to a general hospital in South Korea from electronic medical records and fall event reports between January 1, 2018, and September 30, 2023. The study variables included the general and clinical characteristics of the fall group and fall-related characteristics of the fall events. This study employed descriptive statistics and a chi-square test using IBM SPSS version 26.0. **Results:** Among the patients, 82 fall events were identified. Therefore, the fall incidence rate was 4.5 falls per 1,000 patients. Furthermore, a statistically significant difference was found concerning the type of injury sustained between children >1 year old and those <1 year old, and most cases had no damage or bruises. More cases were found in which falls occurred two days after hospitalization in winter and summer than on the day or the day after hospitalization, which was a statistically significant difference. In addition, fall prevalence was higher between 8 am and 4 pm, and when no caregiver was present. **Conclusion:** Based on the results of this study, education and interventions to prevent fall events in infants and toddlers should persist throughout hospitalization, and it is necessary to guide continuous management and observation of the caregivers.

Keywords: Accidental falls; Child, hospitalized; Incidence

INTRODUCTION

A fall is defined as an unintentional event that results in an individual descending to the bottom or a low level [1]. It is one of the most frequent patient safety issues in hospitals [2]. Fall-related injuries may be nonfatal, with mild clinical symptoms; however, some cases may be fatal, requiring long-term treatment or leading to death [1]. With the recent increase in emphasis on patient safety, hospitals have a responsibility to assess patients' fall risks during hospitaliza-tion and provide appropriate fall prevention interventions [3].

Although fall incidences are high in older adult patients with decreased physical and cognitive functions, hospitalized children are no exception [2]. Previous studies in the United States indicated that the fall incidence rate in hospitalized children was 0.84 to 2.19 falls per 1,000 patients per day [4,5]. In Japan, the fall incidence rate was 1.36 falls per 1,000 pediatric patients [6], and that among Saudi Arabia hospitalized pediatric patients in children's hospitals was 9.9

falls per 1,000 patients [7]. While the reported fall event incidences varied among hospitalized children, the number of falls reported in South Korea from 2008 to 2017 was 0.03% [2]. Another study reported 0.7% fall incidences among hospitalized children at a university hospital in Korea [8]. Dissimilar to adults, children undergo a continuous developmental process, and falls are common, depending on motor development. In other words, falls among children can be considered a natural part of the process of growth and development, but unintended falls in hospitalized children who admitted to hospitals for treatment can decrease quality of care and cause a serious health outcome [4]. If there is no damage, the event may not be recognized as an accident [6]. The reported incidence rate among hospitalized children may not be accurate owing to cases of no damage after a fall and mild cases may not be reported [9]. However, a previous study found that 58.5% of children who fell sustained injuries, and 17% required secondary treatment; therefore, emphasizing the importance of fall prevention, management, and monitoring of hospitalized children [10]. In South Korea, for patient safety, it is included the assessment the risk of falls and fall prevention activities for hospitalized patients, including children, in the medical institution's accreditation criteria [3]. Amid the emphasis on the importance of fall management for hospitalized children, some studies evaluated the fall risk assessment tools for pediatric patients [3,8,11] and studies on fall prevention education are insufficient [12]. Recently, warnings of pediatric falls occurring in medical institutions have been issued, further emphasizing the need for education and publicity on pediatric falls [13].

Several factors increase hospitalized children's risk of falls. Infants fall as they roll, crawl on the bed, or start walking, whereas young children fall as they learn to run or use the toilet. Adolescents may also fall without asking for help when changing clothes or going to the bathroom [7]. In addition to age, movement status after hospitalization, hospital environment, previous fall experiences, convulsion-related conditions, and use of dangerous medications are known to increase the fall risk [3,7]. In a total of 291 pediatric falls reported in the Korea patient safety reporting and learning system, the environmental factors of pediatric falls were related to the bed rails (36.1%), absence of carers (25.7%), pedestrian aids (6.9%), chairs (3.0%), and medical devices (1.2%) [13]. Accordingly, fall risk assessment tools that consider the characteristics of children's developmental age, sex, previous fall experience, medical diagnosis, hospitalized days, and paren-

tal cooperation have been developed. Many hospitals use these tools to assess fall risk and implement fall prevention interventions when children are admitted [8]. However, differences in evaluation items are evident among these tools; therefore, some studies analyzing the prediction of tools for the appropriate use of fall risk tools have been introduced [7,11,14]. However, given the number of variables that cannot be limited to specific factors, a multifaceted approach to situational factors related to falls in hospitalized children is required [4].

A study that analyzed fall characteristics in hospitalized children reported that falls occurred in 54% of patients during the day shift, 48% during the first five days after hospitalization, and 74% in the hospital room [7]. In another study, falls were most common on the 3rd day after hospitalization, with one-third occurring in the afternoon [5]. An analysis of the characteristics of hospitalized children who fell in Korea indicated that many boys aged 1–3 or 1–6 years old and those with respiratory diseases who sustained open wounds and bruises were the most common at 35.3% [2,3]. A previous study explored the fall occurrence time and place in hospitalized children in Korea [15]; however, limited to no identifying characteristics were identified from recent data reflecting the latest domestic clinical environment. Furthermore, although the cooperation of the parent was a major factor in pediatric falls, 84% of infants and 82% of all children experienced falls even in the presence of the parent [5,6]. In addition, hospitalized children's falls were accidental during breastfeeding, children fell while moving, or fell from beds or chairs [2,16]. And the unfamiliar environment of a hospital is a cause of falls [2]. Therefore, more detailed consideration and preparation for preventive monitoring are required to prevent falls among hospitalized children by exploring various aspects of the fall risk among the hospitalized children.

Hospitals have supervision and management systems that improve the quality of medical care through patient safety accident reports. However, falls in hospitalized children using these systems have been reported continuously. Therefore, this study aimed to retrospectively analyze the fall event report data of children under the age of 18 over the past five years to determine the actual incidence fall rate of hospitalized children. In addition, this study explored and identified differences in fall-related characteristics according to the age of the children and the time of fall. This study's hypothesis posited that the characteristics of fall events differ according to the age of the child and the day of the fall among hospital-

ized children. The hypothesis was established by considering the developmental age of children in which mobility through walking and by referring to previous studies in which pediatric falls were different depending on the hospitalization day [5,7].

The developmental age in which exercise ability through walking was considered, and a hypothesis was established by referring to the studies in which falls were different depending on the hospitalization date.

Through this study, it could provide evidence for developing more practical and effective intervention plans to prevent and reduce the risk of falls among pediatric inpatients.

METHODS

Ethical statements: This study was approved by the Institutional Review Board (IRB) of Kangwon National University Hospital (No. KNUH-2024-02-007). This study received a consent waiver.

1. Study Design

This retrospective descriptive study analyzed the medical information of all patients under the age of 18 years who were admitted to a general hospital in South Korea using electronic medical records and fall event reports. The reporting of this study was based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [17].

2. Sample

A total number of 18,119 children under the age of 18 were discharged from the hospital after being admitted to a general hospital located in K province between January 1, 2018, and September 30, 2023. Among them, a total of 82 patients reported fall events among the patient safety accidents and were classified as the fall group, and the remaining 18,037 patients were classified as the non-fall group.

3. Variables

1) General characteristics of hospitalized children

The general characteristics of the hospitalized children included the year and season of hospitalization, sex, age, hospitalized days, and diagnosis. Age was classified as <1 year,

1–3 years, 3–5 years, and >5 years. Hospital days were classified as 1–3 days, 3–7 days, and >7 days. Diagnoses were based on the Korean Standard Classification of Diseases (https://kcdcode.kr).

2) Clinical characteristics of fall group

Clinical characteristics of the fall group included previous hospitalization (yes/no), medical equipment, and initial fall risk scale scores. Intravenous lines, nasal cannulas, pulse oximeters, electrocardiogram monitors, and splints for medical equipment were considered duplicates.

3) Fall-related characteristics of fall events

The fall-related characteristics included the day of fall occurrence after hospitalization, time, location, related furniture/ equipment, patient bed side rail, caregiver presence (yes/no), the primary cause of the fall, and type of injury. Day of fall occurrence after hospitalization was classified as "on the day or the next day" and "after the second day." Time of fall was classified as "between midnight and 8 am," "between 8 am and 4 pm," and "between 4 pm and midnight." Locations were classified as "patient rooms," "corridors," "shower rooms/public bathrooms," "other hospital areas," or "outside hospital." Related furniture/equipment were classified as "patient bed," "other bed such as caregiver's or exam room's," "stroller/ wheelchair," or "not applicable." The side rail of the patient bed was classified as "raised," "lowered," "unknown," or "not applicable." The primary cause of fall events was classified as "child-related," "caregiver-related," or "environment-related." Child-related factors included "active behavior of child such as playing, running or standing," "child's immature motor developmental stage," and "child's physiologic condition." Caregiver-related factors included "temporary absence of the caregiver's gaze," "caregiver moving out of bed," and "lack of attention of caregiver such as sleeping." Type of fall-related injury was classified as "only bruise," "abrasion and bruise," hematoma," "laceration," or "no injury."

4. Data Analysis

First, fall incidence was calculated as the number of falls per 1,000 patients. Second, descriptive statistics were used to examine the clinical and fall-related characteristics of the fall group. Third, a chi-square test was performed to identify differences in proportions according to age and day of fall oc-

currence among the fall groups. The Fisher's exact test was performed if the expected frequency was <5. All statistical analyses were performed using IBM SPSS Statistics for Windows (version 26.0; IBM Corp.), with the significance level set at .05.

RESULTS

1. Fall Event Incidence Rate among Hospitalized Children

The fall incidence rates in hospitalized children are presented in Table 1. Among the patients (n=18,119), the number of fall events was 82. Therefore, the fall incidence rate was 4.5 falls per 1,000 patients. The incidence rate was high,

at 7.1, in 2021, and 6.4 in 2022, with significant differences by year (p=.022). Additionally, it was the highest, at 5.2, in spring and fall seasons, and 4.8 for boys, which was higher than 4.2 for girls; however, no significant difference was identified. The fall incidences among 1 to 3 years were very high at 11.4, and in the case of being hospitalized for more than seven days, it was high at 6.6; there were significant differences between age (p<.001) and hospitalization days (p=.008). Furthermore, fall incidences due to respiratory and mental diseases were high, at 11.2 and 13.9, respectively.

2. Clinical and Fall-Related Characteristics in Fall Group

Tables 2 and 3 present the clinical and fall-related charac-

Table 1. Incidence Rates of Falls in Hospitalized Children (*N*=18,119)

Categories		Fall	Non-fall	Total	Incidence rate[a]	*p*-value
		n	n	n		
Year of hospitalization	2018	18	3,551	3,569	5.0	.022
	2019	13	3,388	3,401	3.8	
	2020	6	2,262	2,268	2.6	
	2021	17	2,367	2,384	7.1	
	2022	22	3,417	3,439	6.4	
	2023	6	3,052	3,058	2.0	
Season of hospitalization	Spring (Mar–May)	24	4,632	4,656	5.2	.662
	Summer (Jun–Aug)	19	4,893	4,912	3.9	
	Autumn (Sep–Nev)	21	4,005	4,026	5.2	
	Winter (Dec–Feb)	18	4,507	4,525	4.0	
Sex	Male	47	9,664	9,711	4.8	.286
	Female	35	8,373	8,408	4.2	
Age (year)	<1	27	6,661	6,688	4.0	<.001
	1–3	45	3,911	3,956	11.4	
	3–5	3	1,833	1,836	1.6	
	>5	7	5,632	5,639	1.2	
HD (day)	1–3	23	8,129	8,152	2.8	.008
	3–7	46	7,965	8,011	5.7	
	>7	13	1,943	1,956	6.6	
Diagnosis	Respiratory/pulmonary	46	4,047	4,093	11.2	
	Gastrointestinal/digestive	7	1,836	1,843	3.8	
	Infectious disease	13	1,295	1,308	9.9	
	Renal/urinary	5	522	527	9.5	
	Neurologic/nervous system	3	363	366	8.2	
	Skin/musculoskeletal/orthopedic	1	347	348	2.9	
	Trauma/injury/poisonings	1	703	704	1.4	
	Psychological	3	213	216	13.9	
	Others	3	7,821	7,824	0.4	
	EENT/craniofacial	0	495	495	0	
	Endocrine/metabolic	0	262	262	0	
	Cardiac	0	77	77	0	
	Hematology/oncology	0	56	56	0	
Total		82	18,037	18,119	4.5	

[a]per 1,000 patients; HD, hospital days; EENT, eye ear nose throat.

Table 2. Clinical Characteristics of Fall Group in Hospitalized Children (*N*=82)

Categories		n (%)
Year of hospitalization	2018	18 (22.0)
	2019	13 (15.9)
	2020	6 (7.3)
	2021	17 (20.7)
	2022	22 (26.8)
	2023	6 (7.3)
Season of hospitalization	Spring (Mar–May)	24 (29.3)
	Summer (Jun–Aug)	19 (23.2)
	Autumn (Sep–Nev)	21 (25.6)
	Winter (Dec–Feb)	18 (22.0)
Sex	Male	47 (57.3)
	Female	35 (42.7)
Age (year)	< 1	27 (32.9)
	1–3	45 (54.9)
	3–5	3 (3.7)
	> 5	7 (8.5)
HD (days)	1–3	23 (28.0)
	3–7	46 (56.1)
	> 7	13 (15.9)
Diagnosis	Respiratory/pulmonary	46 (56.1)
	Gastrointestinal/digestive	7 (8.5)
	Infectious disease	13 (15.9)
	Renal/urinary	5 (6.1)
	Neurologic/nervous system	3 (3.7)
	Skin/musculoskeletal/ orthopedic	1 (1.2)
	Trauma/injury/poisonings	1 (1.2)
	Psych	3 (3.7)
	Others	3 (3.7)
Previous hospitalization experience	Yes	33 (40.2)
	No	49 (59.8)
Medical equipment (multiple response)	Intravenous line	75 (91.5)
	Nasal cannula	3 (3.7)
	Pulse oximeter	19 (23.2)
	EKG monitor	2 (2.4)
	Splint	1 (1.2)

HD, hospital days; EKG, electrocardiogram.

Table 3. Fall-related Characteristics of Fall Group in Hospitalized Children (*N*=82)

Categories		n (%)
Day of fall after hospitalization	On the day of hospitalization or the next day	36 (43.9)
	After two days	46 (56.1)
Time of fall	Between midnight and 8 am	20 (24.4)
	Between 8 am and 4 pm	33 (40.2)
	Between 4 pm and midnight	29 (35.4)
Location	Patient room	74 (90.3)
	Corridor	2 (2.4)
	Shower room/public bathroom	3 (3.7)
	Other hospital areas	2 (2.4)
	Outside hospital	1 (1.2)
Related furniture/ equipment	Patient bed	63 (76.8)
	Other bed	4 (4.9)
	Stroller/wheelchair	7 (8.5)
	Not applicable	8 (9.8)
Side rail of patient's bed	Raised	42 (51.2)
	Lowered	8 (9.8)
	Unknown	13 (15.9)
	Not applicable	19 (23.1)
Caregiver present	Yes	64 (78.0)
	No	18 (22.0)
Primary cause of fall	Child-related	
	Active behavior of child	25 (30.5)
	Child's immature motor developmental stage	3 (3.7)
	Child's physiological condition	5 (6.1)
	Caregiver-related	
	Temporary absence of the caregiver's gaze	24 (29.3)
	Caregiver moving out of bed	10 (12.2)
	Lack of attention of caregiver	6 (7.3)
	Environmental-related	9 (10.9)
Type of injury	Bruise	18 (22.1)
	Abrasion and bruise	9 (10.9)
	Hematoma	2 (2.4)
	Laceration	1 (1.2)
	No injury	52 (63.4)

teristics of the fall group. The number of falls was the highest in 2022 (26.8%) and in spring (29.3%). Boys accounted for 57.3% and those aged 1 to 3 years accounted for 54.9%. In addition, falls most frequently (56.1%) occurred between days 3 and 7 of hospitalization and accounted for the majority (56.1%) of respiratory diseases. Furthermore, 59.8% of patients had no previous hospitalization experience, 91.1% had venous lines.

A total of 56.1% of the falls occurred on the second day after hospitalization, and 40.2% occurred between 8 am and 4 pm. Most of these occurred in the hospital room, and 76.8% occurred in the patient's bed. At the time of the fall, 51.2%

had a raised side rail, and 78.0% had a caregiver present. Among the primary causes of falls, the active behavior of children was the highest at 30.5%, followed by the temporary absence of the caregiver's gaze (29.3%) and the caregiver's movement out of bed (12.2%). After the fall, 63.4% had no injury, while 22.1% had only bruises.

3. Characteristics of Fall Events According to Child's Age

Table 4 presents the differences between fall events under

Table 4. Characteristics of Fall Events According to Child's Age (*N*=82)

Categories		< 1 year n (%)	≥ 1 year n (%)	*p*-value
Season	Spring (Mar–May)	7 (25.9)	17 (30.9)	.453
	Summer (Jun–Aug)	9 (33.3)	10 (18.2)	
	Autumn (Sep–Nev)	5 (18.5)	16 (29.1)	
	Winter (Dec–Feb)	6 (22.2)	12 (21.8)	
Sex	Male	18 (66.7)	29 (52.7)	.168
	Female	9 (33.3)	26 (47.3)	
Previous hospitalization experience	Yes	10 (37.0)	23 (41.8)	.433
	No	17 (63.0)	32 (58.2)	
Day of fall after hospitalization	On the day of hospitalization or the next day	14 (51.9)	22 (40.0)	.350
	After two days	13 (48.1)	33 (60.0)	
Time of fall	Between midnight and 8 am	5 (18.5)	15 (27.3)	.726
	Between 8 am and 4 pm	12 (44.4)	21 (38.2)	
	Between 4 pm and midnight	10 (37.0)	19 (34.5)	
Location	Patient room	26 (96.3)	48 (87.3)	.718
	Corridor	0 (0.0)	2 (3.6)	
	Shower room/public bathroom	0 (0.0)	3 (5.5)	
	Other hospital areas	1 (3.7)	1 (1.8)	
	Outside hospital	0 (0.0)	1 (1.8)	
Related furniture/equipment	Patient bed	23 (85.2)	40 (72.7)	.127
	Other bed	2 (7.4)	2 (3.6)	
	Stroller/wheelchair	2 (7.4)	5 (9.1)	
	Not applicable	0 (0.0)	8 (14.5)	
Side rail of patient's bed	Raised	18 (66.7)	24 (43.6)	.262
	Lowered	2 (7.4)	6 (10.9)	
	Unknown	2 (7.4)	11 (20.0)	
	Not applicable	5 (18.5)	14 (25.5)	
Caregiver present	Yes	21 (77.8)	43 (78.2)	.588
	No	6 (22.2)	12 (21.8)	
Primary cause of fall	Child-related			.247
	Active behavior of child	6 (22.2)	19 (34.5)	
	Child's immature motor developmental stage	1 (3.7)	2 (3.6)	
	Child's physiological condition	0 (0.0)	5 (9.1)	
	Caregiver-related			
	Temporary absence of the caregiver's gaze	10 (37.0)	14 (25.5)	
	Caregiver's moving out of bed	6 (22.2)	4 (7.3)	
	Lack of attention of caregiver	2 (7.4)	4 (7.3)	
	Environmental-related	2 (7.4)	7 (12.7)	
Type of injury	Bruise	4 (14.8)	14 (25.5)	.027
	Abrasion and bruise	6 (22.2)	3 (5.5)	
	Hematoma	2 (7.4)	0 (0.0)	
	Laceration	0 (0.0)	1 (1.7)	
	No injury	15 (55.6)	37 (67.3)	

one year and those over one year. A statistically significant difference was found in the type of damage in children over 1 year old compared with children under 1 year old (*p* = .027), and more cases of no damage (67.3%) or only bruises (25.5%) were found. No significant differences were found between the two groups concerning the other categories.

4. Characteristics of Fall Events According to Day of Fall Occurrence

Table 5 presents the differences in the characteristics of the events according to the day of the fall occurrence. More cases were prevalent in which falls occurred two days after hospitalization in winter (32.6%) and summer (26.0%) than on the day or the day after hospitalization, with a statistically signif-

Table 5. Characteristics of Fall Events According to Day of Fall Occurrence (N=82)

Categories		On the day of hospitalization or the next day n (%)	After two hospital days n (%)	p-value
Season	Spring (Mar–May)	14 (38.9)	10 (21.7)	.022
	Summer (Jun–Aug)	7 (19.4)	12 (26.1)	
	Autumn (Sep–Nev)	12 (33.3)	9 (19.6)	
	Winter (Dec–Feb)	3 (8.3)	15 (32.6)	
Sex	Male	23 (63.9)	24 (52.2)	.201
	Female	13 (36.1)	22 (47.8)	
Previous hospitalization experience	Yes	14 (38.9)	19 (41.3)	.503
	No	22 (61.1)	27 (58.7)	
Age (year)	< 1	14 (38.9)	13 (28.3)	.218
	≥ 1	22 (61.1)	33 (71.7)	
Time of fall	Between midnight and 8 am	8 (22.2)	12 (26.1)	.039
	Between 8 am and 4 pm	10 (27.8)	23 (50.0)	
	Between 4 pm and midnight	18 (50.0)	11 (23.9)	
Location	Patient room	32 (88.9)	42 (91.3)	.941
	Corridor	1 (2.8)	1 (2.2)	
	Shower room/public bathroom	2 (5.6)	1 (2.2)	
	Other hospital areas	1 (2.8)	1 (2.2)	
	Outside hospital	0 (0.0)	1 (2.2)	
Related furniture/equipment	Patient bed	26 (72.2)	37 (80.4)	.166
	Other bed	3 (8.3)	1 (2.2)	
	Stroller/wheelchair	5 (13.9)	2 (4.3)	
	Not applicable	2 (5.6)	6 (13.0)	
Side rail of patient's bed	Raised	18 (50.0)	24 (52.2)	.862
	Lowered	3 (8.3)	5 (10.9)	
	Unknown	5 (13.9)	8 (17.4)	
	Not applicable	10 (27.8)	9 (19.6)	
Caregiver present	Yes	32 (88.9)	32 (69.6)	.032
	No	4 (11.1)	14 (30.4)	
Primary cause of fall	Child-related			.456
	Active behavior of child	9 (25.0)	16 (34.8)	
	Developmental state	2 (5.6)	1 (2.2)	
	Physiologic condition of child	2 (5.6)	3 (6.5)	
	Caregiver-related			
	Temporary absence of the caregiver's gaze	12 (33.3)	12 (26.1)	
	Caregiver's moving out of bed	2 (5.6)	8 (17.4)	
	Lack of attention of caregiver	4 (11.1)	2 (4.3)	
	Environmental-related	5 (13.9)	4 (8.7)	
Type of injury	Bruise	25 (69.4)	27 (58.7)	.606
	Abrasion and bruise	6 (16.7)	12 (26.1)	
	Hematoma	3 (8.3)	6 (13.0)	
	Laceration	1 (2.8)	1 (2.2)	
	No injury	1 (2.8)	0 (0.0)	

icant difference ($p=.022$). In addition, fall time was higher between 8 am and 4 am (50.0%) ($p=.039$), and the prevalence was higher when no caregiver was present (30.4%) ($p=.032$).

DISCUSSION

This retrospective study aimed to identify incidence of falls among children admitted to a general hospital in South Korea over the recent five years and to explore fall-related characteristics in the fall event group. This study's results indicated that the incidence of falls in hospitalized children over the past five years was 4.5 per 1,000 patients, which exceeds the 0.03% reported in a previous study using data from the national hospital discharge in-depth injury survey [2]. Howev-

er, some studies have reported a different incidence than that reported in this study. Another study reported the incidence of falls in children aged under 13 years at a university hospital from July 2107 to January 2018 as 0.7% [8]. The fall incidences in a hospital in Saudi Arabia were reported to be 9.9% [7]. In this study, the hospital from which data was collected required a report about fall events regardless of whether injuries were sustained during hospitalization; since it may include all reported fall events, all actual falls could be calculated. In addition, it is meaningful to understand the average incidence rate of falls over the last five years compared to previous studies that investigated a short period. However, the number of children hospitalized in 2020 and 2021 owing to the COVID-19 pandemic and the inclusion of data only until September 2023 should be considered to determine a more accurate incidence rate. In this study, the fall incidence rate between the ages of 1 to 3 years was the highest, at 11.4. Even in the data reported at Miami children's hospital in the United States, the most falls were reported at 19 to 24 months [16], more falls were reported at 1 to 6 years old in South Korea than in those under the age of one or over the age of seven years [2], similar to the average age of 32.9 months in the fall group [8]. Children in the early childhood developmental stages may experience an increase in their level of activity according to their motor developmental status, which is not sophisticated. Therefore, considering that toddlers' risk of falling is higher than that of infants under the age of one year old, more careful preventive interventions are required when toddlers are admitted to a hospital. In this study, the fall incidences increased with the number of hospitalization days. Similarly, in Turkey, increased length of hospital stays for the children carried a higher risk for pediatric inpatient falls [18]. It should be considered that there were few children hospitalized for more than seven days compared to short-term hospitalization; however, the need to continue fall prevention interventions is raised by considering the condition and treatment of hospitalized children following long-term hospitalization. In this study, the diagnosis with the highest fall incidence rate was respiratory disease, followed by psychiatric disease. Respiratory diseases are the most frequent among hospitalized children; therefore, several children were diagnosed. The high fall incidence rates in psychiatric diseases are comparable to the results of a previous study showing that the risk of falls was the third highest in psychiatric diseases such as attention deficit hyperactivity disorder and impulse control disorders in Children's Memorial samples in the United States [16]. Special consideration of fall risk is required for hospitalized children with psychiatric diseases.

Regarding the fall-related characteristics of the 82 cases in the fall group, 56.1% occurred after two days of hospitalization, indicating that falls occur not only in unfamiliar hospitalization environments but also in familiar environments. In addition, fall events occurred at any time of the day but were mostly prevalent between 8 am and 4 pm, and most of them fell from their hospital beds. Unlike this study, Italian hospitals reported the highest rate of falls in bathrooms from early evening to night time [19]. Therefore, the time of fall occurrence needs to be considered together with the location of the fall and the situation at the time. One of the characteristics of the children's fall events was that they fell even though their beds' side rail was raised; therefore, even if the side rail was raised, the risk of falls may remain. There were fall events in strollers or wheelchairs, most of which were reportedly owed to not wearing seatbelts. Therefore, the emphasis on safety devices when using transportation should continue. Fall events were common even when caregivers were present; however, they were caused by the behavior of the children such as walking or running. Additionally, when caregivers temporarily averted their attention from their child, several instantaneous fall events occurred. Causes of falls in pediatric inpatients were loss of balance of child, lack of attention on behalf of parents, and stumbling [19]. Because most parent were present in fall events of child, parent presence is not protective against the falls of their children in hospital [20,21]. Actually, the parents' knowledge that children may fall during parental presence rated the lowest score in Australia [22]. This emphasizes the importance of evaluating whether parents have accurate knowledge and perception of child falls and educating them. On the other hand, parents or caregiver stress, anxiety, and fatigue affect their care for hospitalized children [18], therefore prior to fall preventive education, it is needed to assess their psycho emotional state. The careful monitoring and management of caregivers are required in consideration of the child's developmental age and parent's caring ability. Regarding fall injury type, 63.4% of the cases had no injury after the fall event, followed by bruises, accounting for 22.1%. However, in addition to the bruise, some have also been reported to occur damages such as fractures and cerebral hemorrhage [2]. In the case of a serious injury related to falls, and in these cases, more long-term treatment is required; therefore, the risk of fall injury should always be noted [10].

To identify the specific characteristics of fall events in toddler, this study compared the fall characteristics of those under 1 year old and those over 1 year old. When comparing fall characteristics according to age, a significant difference was observed concerning the type of injury in the fall group under and over the age of one year. The proportion of abrasions with bruises was higher among children under the age of one year than among those over the age of one year; therefore, it is necessary to examine the degree of injury in fall events in infants under the age of one year and to check for bruises or wounds on the skin or soft tissues.

Lastly, in order to explore how the characteristics of each time the falls occurred are different, it was compared the fall-related characteristics on the date of the fall. A significant difference was observed in the season of occurrence, the time of occurrence, and the presence of a caregiver between the group that experienced a fall on the day of hospitalization or the next day and the group that experienced a fall two days after hospitalization. The group that experienced falls on the day of hospitalization or the next day was common in spring and autumn and between 4 pm and midnight. Conversely, the number of cases that occurred two days after hospitalization was higher in summer and winter, and between 8 am and 4 pm. Even though seasonal difference should be considered together in various aspects, such as the occurrence of acute diseases and increase of children's activity, our result suggests that it has to be noticed the risk of falls considered seasons and hospital days together. The hospitalization day was a related factor influencing falls in hospitalized children [4], fall events time was more in day shift [7]. Depending on our findings, so, it should be taken in to account that the longer hospitalization days, the risk of falls occurring even during the morning and afternoon, when there is more active time. Therefore, intensive observation is required when the risk of fall events is high, depending on hospitalization days. In addition, more cases were found where fall events occurred two days after hospitalization and no caregiver was present. This result suggests that if hospitalization continues, the caregiver is more likely to leave the child's bedside for a while, increasing the number of fall events. This suggests that there is a possibility that falls may occur as the hospitalization date passes, along with the consequences of falling even though the caregiver resides. This can be attributed to the caregivers' complacency according to the familiarity of the hospital environment and lack of awareness of the risk of falls [22,23]. Therefore, fall prevention education for hospitalized children should not be limited to the early stages of hospitalization but should continue throughout hospitalization, and continuous education and observation are required to ensure the awareness and attention of caregivers concerning fall events [12]. Pediatric nurses play an important role in patient safety by observing children and communicating with parents. The fall risk assessment of nurses should be done well [24], and training for preventive education is required [25]. But various methods of promotion and guidance are also needed so that parents continue to recognize and pay attention to the risk of falls for their child.

This study had several limitations. First, this study analyzed data from one general hospital; therefore, the results may not be generalizable to hospitalized children in South Korea. Second, this study did not include all the various clinical characteristics of the children and caregivers; therefore, attention should be paid to the interpretation of the results. Third, this study included changes of inpatients due to restrictions on pediatric wards during the COVID-19 pandemic; therefore, the consideration of these special period is needed.

CONCLUSION

This study was conducted to identify the incidence rate of falls in hospitalized children in South Korea and to explore the differences in fall-related characteristics according to the age of the children and the date of fall occurrence after hospitalization. The results indicated that the incidence rate of falls in hospitalized children was 4.5 per 1,000 patients, and a significant difference was observed concerning the type of injury in children over the age of one compared with those under the age of one. Additionally, more cases were identified in which no caregiver was present during fall events after the second day of hospitalization than during fall events on the first or second day of hospitalization. Based on the results of this study, education and intervention to prevent falls in infants and toddlers should be conducted throughout hospitalization, and it is necessary to guide the continuous management and observation of caregivers.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors; Data collection: Hyeyeong

CHNR

ORCID and ResearcherID

Hyeyeong Park   https://orcid.org/0009-0001-0154-2915
                      https://researcherid.com/rid/KWT-6284-2024
Hyunju Kang   https://orcid.org/0000-0002-2129-1658
                      https://researcherid.com/rid/KVZ-3932-2024

REFERENCES

1. World Health Organization. Falls [Internet]. 2021 [cited 2024 March 20]. Available from: https://www.who.int/news-room/factsheets/detail/falls

2. Lee JW. Factors affecting hospitalized children's falls - using data in the national hospital discharge in-depth injury survey. Journal of the Korea Academia-Industrial cooperation Society. 2020;21(7):510-516. https://doi.org/10.5762/KAIS.2020.21.7.510

3. Shin HJ, Kim YN, Kim JH, Son IS, Bang KS. A pediatric fall-risk assessment tool for hospitalized children. Child Health Nursing Research. 2014;20(3):215-224. https://doi.org/10.4094/chnr.2014.20.3.215

4. Harvey K, Kramlich D, Chapman J, Parker J, Blades E. Exploring and evaluating five paediatric falls assessment instruments and injury risk indicators: an ambispective study in a tertiary care setting. Journal of Nursing Management. 2010;18(5):531-541. https://doi.org/10.1111/j.1365-2834.2010.01095.x

5. Jamerson PA, Graf E, Messmer PR, Fields HW, Barton S, Berger A, et al. Inpatient falls in freestanding children's hospitals. Pediatric Nursing. 2014;40(3):127-135.

6. Fujita Y, Fujita M, Fujiwara C. Pediatric falls: effect of prevention measures and characteristics of pediatric wards. Japan Journal of Nursing Science. 2013;10(2):223-231. https://doi.org/10.1111/jjns.12004

7. AlSowailmi BA, AlAkeely MH, AlJutaily HI, Alhasoon MA, Omair A, AlKhalaf HA. Prevalence of fall injuries and risk factors for fall among hospitalized children in a specialized children's hospital in Saudi Arabia. Annals of Saudi Medicine. 2018;38(3):225-229. https://doi.org/10.5144/0256-4947.2018.225

8. Cho YH, Kim YJ. Evaluation of the Humpty Dumpty Falls Scale: an analysis of electronic medical records. Journal of Korean Clinical Nursing Research. 2019;25(2):142-150. https://doi.org/10.22650/JKCNR.2019.25.2.142

9. Gordon MD, Walden M, Braun C, Hagan J, Lovenstein A. Parents' perception of fall risk and incidence of falls in the pediatric ambulatory environment. Journal of Pediatric Nursing. 2021;61:424-432. https://doi.org/10.1016/j.pedn.2021.09.028

10. Schaffer PL, Daraiseh NM, Daum L, Mendez E, Lin L, Huth MM. Pediatric inpatient falls and injuries: a descriptive analysis of risk factors. Journal for Specialists in Pediatric Nursing. 2012;17(1):10-18. https://doi.org/10.1111/j.1744-6155.2011.00315.x

11. Kim HY, Chung YC, Lim EY, Kim SH. Evidence-based nursing case for optimal pediatric fall risk assessment tools. Evidence and Nursing. 2021;9(1):22-26. https://doi.org/10.54003/kebn.2021.9.1.22

12. Park SY, Ju HO. The effect of pediatric inpatient fall prevention education on caregivers' fall-related knowledge and preventive behaviors. The Journal of Korean Academic Society of Nursing Education. 2017;23(4):398-408. https://doi.org/10.5977/jkasne.2017.23.4.398

13. Korea Patient Reporting and Learning System [Internet]. 2020 [cited 2024 May 8]. Available from: https://www.kops.or.kr/portal/board/news/boardDetail.do?bbsId=news&nttNo=20000000000510

14. Sackinger D, Carlin K, Zierler B. GRAF-PIF fall risk assessment tool: predictive accuracy in a children's hospital. Pediatric Nursing. 2021;47(4):189.

15. Sung YH, Kwon IG, Kim KH, Kim JS. A study on fall experience in inpatients of children. The Chung-Ang Journal of Nursing. 2006;10(1):55-61.

16. Graf E. Magnet children's hospitals: leading knowledge development and quality standards for inpatient pediatric fall prevention programs. Journal of Pediatric Nursing. 2011;26(2):122-127. https://doi.org/10.1016/j.pedn.2010.12.007

17. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vanden-

broucke JP; STROBE Initiative. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. BMJ. 2007;335(7624):806-808. https://doi.org/10.1136/bmj.39335.541782.AD

18. Almis H, Bucak IH, Konca C, Turgut M. Risk factors related to caregivers in hospitalized children's falls. Journal of Pediatric Nursing. 2017;32:3-7. https://doi.org/10.1016/j.pedn.2016.10.006

19. Da Rin Della Mora R, Calza S, Urbano A, Esibiti F, Sperlinga ML, Bagnasco A, et al. Falls among children in an Italian hospital: a prospective study. Nursing Children and Young People. 2012;24(10): 22-26. https://doi.org/10.7748/ncyp2012.12.24.10.22.c9463

20. Parker C, Kellaway J, Stockton K. Analysis of falls within paediatric hospital and community healthcare settings. Journal of Pediatric Nursing. 2020;50:31-36. https://doi.org/10.1016/j.pedn.2019.09.026

21. Sackinger D, Carlin K, Zierler B. Association of parent demographic and psychophysical characteristics and pediatric hospital falls: a pilot and feasibility study. Journal of Pediatric Nursing. 2022;63:28-38.

https://doi.org/10.1016/j.pedn.2021.12.013

22. Sheppard-Law S, Brogan F, Usherwood F, Hunstead P, Shala DR. Predictors of parent's knowledge of hospital-based pediatric falls. Journal for Specialists in Pediatric Nursing. 2022;27(2):e12368. https://doi.org/10.1111/jspn.12368

23. Shala DR, Brogan F, Cruickshank M, Kornman K, Sheppard-Law S. Exploring Australian parents' knowledge and awareness of pediatric inpatient falls: a qualitative study. Journal for Specialists in Pediatric Nursing. 2019;24(4):e12268. https://doi.org/10.1111/jspn.12268

24. Labrague LJ. Nurses' adherence to patient safety protocols and its relationship with adverse patient events. Journal of Nursing Scholarship. 2024;56(2):282-290. https://doi.org/10.1111/jnu.12942

25. Rogers C, Irving A. Nurses' perspectives on inpatient falls in a large academic hospital in South Africa. Curationis. 2023;46(1):a2479. https://doi.org/10.4102/curationis.v46i1.2479