Study of Pattern of Injuries in Cases of Fall from Height – A Cross Sectional Study

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ABSTRACT

Background: Falls from height (FFH) represent a major public health concern, particularly in developing countries like Bangladesh. FFH accounts for significant morbidity and mortality globally, with injury patterns and severity influenced by factors such as fall height, impact surface, and body orientation. **Aim:** This study aimed to analyze the correlation between fall height and injury severity, identify demographic and environmental risk factors, and assess medical responses and outcomes among FFH victims in Bangladesh. **Methods & Materials:** An observational cross-sectional study was conducted across major hospital in Dhaka over 18 months. Data were collected from 80 FFH victims through interviews, medical records, and clinical evaluations. **Results:** The study included participants aged 1–85 years (mean: 27.75 ± 18.49 years). FFH predominantly affected males (56.25%) and unemployed individuals (42.5%). Most falls occurred at home (37.5%) and from low to moderate heights (83% below 11 feet). Fractures (84%), scalp swellings (27.5%), and abrasions (41.3%) were the most common injuries. Severity was significantly associated with fall height ($p < 0.0001$). **Conclusion:** FFH remains a significant cause of injury in Bangladesh, with demographic and environmental factors influencing outcomes. Improved safety protocols, public awareness, and accessible emergency care are critical for mitigating the impact of FFH. Further research is warranted to explore long-term outcomes and tailored interventions for high-risk populations.

Keywords: *Fall from height, Pattern, Severity of Injuries.*

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INTRODUCTION

Falls from height (FFH) are a major cause of injury and death worldwide, particularly in developing countries like Bangladesh. FFH occurs when individuals fall from elevated locations such as rooftops, balconies, staircases, scaffolds, trees, and agricultural structures. The severity of injuries depends on factors including the height of the fall, body position during impact, the surface struck, and the biomechanical characteristics of affected body parts.[1]

In Bangladesh, FFH is a significant public health concern in both urban and rural areas. In cities, rapid construction growth has increased workplace accidents, especially among construction workers who often fall from scaffolds, ladders, and unfinished buildings. These incidents frequently result in serious injuries such as head trauma, limb fractures, and spinal cord damage, often due to inadequate safety measures, poor equipment maintenance, and insufficient worker training. [2]

In rural regions, FFH commonly occurs during agricultural activities, particularly when farmers climb palm or coconut trees for harvesting. Such falls often cause severe head and spinal injuries due to impact with hard ground surfaces. [3]

Vulnerable groups, including children and the elderly, are also at high risk. Children frequently fall from windows, balconies, or furniture during play, while elderly individuals face increased risk due to reduced balance, slower reflexes, and age-related physical decline. Despite increasing awareness, inadequate enforcement of safety regulations continues to contribute to high FFH-related injury and fatality rates in Bangladesh.[4]

Objectives

General Objective:

To determine the association between pattern of injury with fall from different level of height.

Specific Objectives:

1. To analyze the demographic distribution of falls from height (FFH) victims.
2. To determine the correlation between fall height and the severity of injuries sustained.
3. To identify any threshold heights at which the risk of specific injury types or severity levels increases significantly.
4. To assess the role of environmental factors and surface types in influencing injury patterns

METHODS & MATERIALS

This is Observational Cross-Sectional Study. This research was conducted in the Department of Forensic Medicine, Sir Salimullah Medical College, in collaboration with emergency department of Dhaka Medical College Hospital & Shaheed Suhrawardy Medical College, Sher-E-Bangla Nagar, Dhaka. In this study, the sampling technique was convenient sampling.

Study period: 18 months (From 1st January 2023 to 30th June 2024).

Materials

Questionnaire and checklist was used to collect data from victims of fall from height.

Measurement:

Height was measured by self-reporting.

Inclusion Criteria:

1. Individuals who have sustained injuries from falls from height.
2. Patients come at emergency department of the hospital due to fall from height.
3. Both male and female patients of all ages.
4. Incidents occurring in both urban and rural settings in Bangladesh.
5. Willingness to participate: Patients/their guardians must consent to participate in the study

Exclusion Criteria:

1. Victims of falls with incomplete medical records or unclear details of the fall incident.

2. Patients not willing to participate or whose guardians do not consent.
3. Falls that occur as a result of vehicular accidents or other traumatic events unrelated to height.

Sampling

A convenient sampling method was employed for the study.

Ethical approval:

Prior to the study conduct, the research protocol was sought approval from the Institutional review board (IRB) of Sir Salimullah Medical College. Ref no. 59.14.0000.131.000.18.0000.22.173. The study protocol, questionnaire and informed consent form as well as the methodology of the study was reviewed by Institutional review board(IRB).

Consent procedure:

Permission was taken from the Department of Forensic medicine. Every eligible participant was informed about the study and its objectives. Informed written consent was signed by all the participants.

Operational Definition

Fall from height: Injury sustained by a person after landing on the ground following a fall from an elevated place. Categorized into ranges:-

1. Low (1-3 meters)
2. Moderate (4-30 meters)
3. High (above 30 meters)

Severity of Injuries: it will be calculated by AIS, ISS & GCS.

Abbreviated injury scale: It is an anatomical based coding system to classify & describe the severity of injuries. It also represents the threat to life associated with the injury. It is range from 1 (minor)–6 **(**Un survivable).

RESULTS

The study results revealed the injury pattern of fall from height cases of 80 cases so that their injuries, locations and fatality can be revealed.

Age distribution of participants

A total of 80 participants were included in the study. The ages of participants ranged from 1 year to 85 years, with a mean age of 27.75 years (M=27.75) and a standard deviation of 18.49 years (SD=18.49). This indicates that there is a wide age variation among the participants, as evidenced by the range and standard deviation (*Table I***)**.

Table I
Distribution of participants according to age.

	N	Minimum age	Maximum age	Mean age	Std. Deviation
Age	80	1	85	27.75	18.49

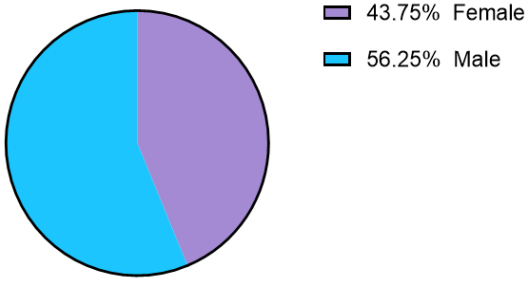

Figure 1 Gender Distribution

Analysis of Gender Distribution of the participants

Figure 1 illustrates the gender distribution of participants in the study as a pie chart. The majority of participants were male, comprising 56.25% of the sample. Female participants accounted for the remaining 43.75%. The chart visually represents the slightly higher proportion of male participants compared to females, highlighting a moderate gender imbalance in the sample.

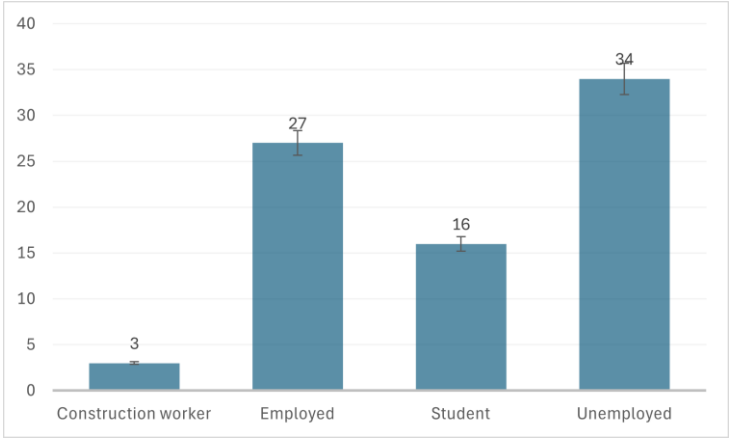

Figure 2 Participants Current profession to engage with in this study

Current profession of the participants

Figure 2 illustrates the distribution of participants across four occupational categories: Construction Worker, Employed, Student, and Unemployed. The Unemployed group was the largest, comprising 42.50% (34 participants), followed by the Employed group at 33.75% (27 participants). Students accounted for 20.00% (16 participants), while Construction Workers represented the smallest category at 3.75% (3 participants).

Place of fall of the participant

Table II presents the frequency and percentage distribution of falls reported by participants across different locations. Among the total of 80 respondents, 37.5% experienced falls at home, making it the most common location for falls. The workplace was the second most frequent location for falls, accounting for 36.3% of responses.

Table II
Frequency and percentage distribution of falls reported by participants.

Location of fall	n	Frequency	Percent
Home	80	30	37.5
Public area		21	26.3
Workplace		29	36.3
Total		80	100.0

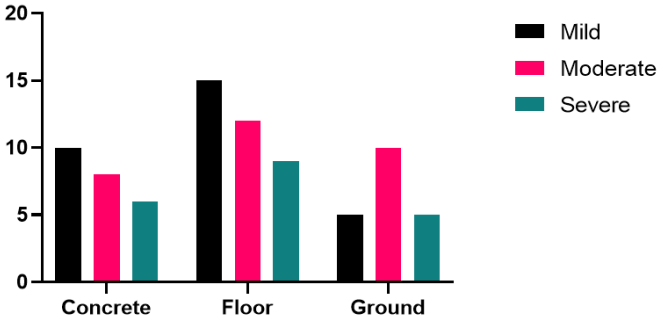

Figure 3 Frequencies of injuries across three surface types

For Concrete (8). Severe injuries, depicted in teal, were highest on the Floor (9), with Concrete and Ground both recording fewer cases (6 and 5, respectively). The Floor surface had the highest overall frequencies across all injury severities, while the Ground surface showed the fewest. This visualization suggests no clear association between surface type and injury severity, consistent with the chi-square test results (*Figure 3*).

Analysis of Injury Severity by Type of Incident

This table presents the distribution of injury severities (Mild, Moderate, Severe) across three types of incidents: Accidental, Homicidal, and Suicidal. These results highlight that the distribution of injury severity significantly differs for Accidental and Suicidal incidents, whereas no significant pattern is observed for Homicidal cases (Figurt *III*).

Table III
Types and Injury Severity and by Incident.

Type	Mild	Moderate	Severe	Chi-Square (df)	p-value
Accidental	50	20	4	27.04 (2)	< 0.0001
Homicidal	2	1	1	0.67 (2)	0.715
Suicidal	0	0	2	4.00 (1)	0.046

Distribution of various types of soft tissue injuries

Table IV illustrates the frequency distribution of various types of soft tissue injuries, including abrasions, incised wounds, lacerations, bruises, and penetrating wounds. Abrasions were the most frequently reported type of injury, with 34 occurrences, accounting for a significant proportion of the total cases. Lacerations and incised wounds were reported with comparable frequencies, 23 and 12 cases, respectively. Bruises were reported in 10 cases, while penetrating wounds were the least frequent, with only 1 reported instance. These data suggest that abrasions, lacerations, and incised wounds are the most prevalent types of injuries in the sample population, potentially indicating the dominance of blunt and sharp force trauma mechanisms. Multiple responses were allowed in questionnaire.

Table IV
The frequency distribution of various types of soft tissue injuries.

Type of Injury	Frequency	Percent (%)
Abrasion	34	42.5
Incised Wound	12	15.0
Laceration	23	28.8
Bruise	10	12.5
Penetrating Wound	1	1.3
Total	80	100

Distribution of head injuries of the participants

Table V summarizes the distribution of head injuries, including swelling of the scalp, skull fractures, and intracranial hemorrhages, based on frequency, percent, and valid percent. For **swelling of the scalp**, it was present in 27.5% of cases (n = 22), while 72.5% of cases (n = 58) showed no swelling. This indicates that swelling of the scalp is relatively common among the reported injuries. In contrast, **skull fractures** were much less frequent, with only 7.5% of cases (n = 6) exhibiting a fracture, while the majority (92.5%, n = 74) did not have a skull fracture. Similarly, **intracranial hemorrhages** were observed in 7.5% of cases (n = 6), with 92.5% of cases (n = 74) showing no hemorrhage. These findings are significant for understanding the prevalence of specific types of head injuries in the study population.

Table V
Distribution of Head Injuries.

Type of Injury	Response	Frequency (n)	Percent (%)
Swelling of Scalp	No	58	72.5
	Yes	22	27.5
Skull Fracture	No	74	92.5
	Yes	6	7.5
Intracranial Hemorrhage	No	74	92.5
	Yes	6	7.5
Total		80	100.0

DISCUSSION

The present study examined 80 participants aged between 1 and 85 years, with a mean age of 27.75 ± 18.49 years, demonstrating substantial age diversity. This broad age range provided insight into perspectives across multiple life stages and allowed for a more inclusive understanding of medicolegal and fall-related issues. Compared with previous studies that focused on narrower age ranges, the current study offers improved generalizability. However, the wide variation also limits the ability to identify age-specific trends, indicating that future research should categorize participants into defined age groups for more precise analysis. [5]

The age distribution showed uneven representation across age groups, with the highest proportion of participants in the 26–30 years group, followed by the 0–5 and 36–40 years categories. The least represented groups were older adults, particularly those aged 61–65 and above 70 years, while some age groups had no participants. This suggests greater participation of younger individuals, possibly reflecting early-career professionals or dependents frequently exposed to clinical or domestic environments. Similar patterns have been observed in previous studies, although many had more consistent age representation, likely due to differences in sampling methods and study designs. [6]

Gender distribution revealed a moderate male predominance, with males accounting for 56.25% of participants compared to 43.75% females. This aligns with existing literature indicating that males are more frequently involved in falls from height, possibly due to occupational exposure, involvement in high-risk physical activities, and sociocultural factors that increase risk-taking behavior. [7]

The occupational distribution showed significant variation, with the largest proportion of participants being unemployed, followed by employed individuals and students, while construction workers formed a small percentage. Statistical analysis confirmed significant differences in distribution, suggesting that falls from height are not restricted to high-risk occupations such as construction. Instead, they frequently occur in domestic and general workplace settings. The lower representation of construction workers contrasts with traditional assumptions and may reflect regional occupational trends or improved safety regulations in high-risk industries. [8]

Analysis of fall locations revealed that most incidents occurred at home, closely followed by workplaces, while public areas accounted for fewer cases. These findings emphasize that both domestic and occupational environments are critical areas for fall prevention strategies. Household falls may result from unsafe environmental conditions or age-related vulnerability, while workplace falls often arise from occupational hazards and inadequate safety compliance. [9]

Regarding fall height, most incidents occurred from lower heights, particularly between 1 and 7 feet, indicating that falls during routine daily activities are most common. Although falls from higher heights were less frequent, they are often associated with more severe injuries. This highlights the importance of implementing safety measures in everyday environments to reduce fall incidence. [10]

Injury pattern analysis demonstrated a significant association between injury type and occurrence. Fractures were the most common injuries, followed by head and spinal injuries. The predominance of abrasions and lacerations highlights the need for preventive strategies targeting blunt trauma. Preventive measures such as non-slip flooring, protective equipment, improved safety protocols, and increased awareness can help reduce injury risk. Overall, the study underscores the multifactorial nature of falls from height and emphasizes the need for targeted, location-specific, and demographic-based fall prevention strategies. [11]

CONCLUSION

This study highlights the significant public health burden of falls from height (FFH) in Bangladesh, emphasizing their occurrence across diverse settings, from homes to workplaces. It established a clear correlation between fall height and injury severity, revealing that even low-height falls can result in significant injuries, including fractures, head trauma, and spinal injuries. These findings underscore the necessity for targeted preventive measures, including safety protocols, public education, and policy reforms.

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ETHICAL CONSIDERATION

Ethical issues (including plagiarism, data fabrication, double publication) were completely obliged by the authors.

CONFLICT OF INTEREST

There is no conflict of interest.

AUTHORS CONTRIBUTION

All the authors contributed equally to the study.

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