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**Original Article**

# Epidemiological and Pattern of Injuries due to Fall from Height: A Retrospective Study

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## ABSTRACT

**Background:** Fall from a height is one of the major causes of blunt-force trauma and it is also the most common type of accident in occupational settings. Builders, electricians, miners, painters, psychiatrists and pediatrics are particularly at risk. **Method:** A retrospective study was done in the Department of Forensic Medicine of BPS GMC (W), Khanpur Kalan, Sonipat, Haryana from 1 January 2017 to 31 December 2022. A comparative analysis of various factors such as gender, age groups, height of falls and injury patterns was done. **Results:** A total of 55 patients with fall-related injuries were identified during these 5 years of study. In all, 46 were male (83.6%) and 09 were female (16.4%). Head and neck (72.7%) and thorax (69.1%) are maximum affected region followed by the abdomen (45.5%), limbs (30.1%) and spines (9.1%). Majority of injured individuals (40%) belongs to working age group, that is, 21–30 years. **Conclusion:** It was observed that mortality from height is mainly accidental and thus preventable. Variations in the pattern of injuries by age, gender and height of fall provide important information for targeted preventive measures.

**Keywords:** Fall, Height, Injury pattern, Epidemiology, Suicidal, Accidental

## INTRODUCTION

One of the leading causes of blunt-force injuries is fall from height. Majority of falls are as a result of accident followed by suicide. The age of victim, height of fall, speed of fall, nature of impact surface, part of body that hit the ground first, duration of the mechanical effect, and how body reacts to this effect are all prognostic factors used to predict the severity of injury and the chances of survival [1]. Deaths due to falls from heights are commoner in urban settings. It is the commonest type of accident in occupational setting. Builders, electricians, miners, and painters are particularly at risk. It is one of the major causes of personal injuries in children and elderly [2].

According to the World Health Organization (WHO, 2020), falls are the second-leading cause of unintentional

injuries resulting in deaths, with an estimated death rate of 684,000 individuals globally. Approximately 37.3 million falls occur every year globally require medical attention. This leads to a loss of 17 million disability-adjusted life years (DALYs), that is, loss of potential years of life due to premature death [3].

The purpose of this study was to examine the relationship between fatal falls due to height and various factors including gender, age, cause of fall, location of fall, height of fall, injury site, and the cause of death. We compared our findings with other studies to find out any correlation.

## MATERIALS AND METHODS

This study started from 1 January 2017 to 31 December 2022 into mortuary of tertiary care hospital where we examined 55 autopsies with fall from height. The cases were reviewed in terms of the following variables such as gender, age, geographical distribution, manner of fall whether natural/unnatural, height of fall, place of fall, site of fall, place of death occurrence, site of injury, cause of death and associated fractures. Our study is based on the data provided by crime scene reports and photographs provided by police officials, medical records and autopsy reports.

### Inclusion Criteria

Deceased persons of all age groups who had a history of falling from a height were brought here for postmortem examination.

### Exclusion Criteria

1. Unknown dead bodies
2. Putrefied bodies
3. Transgender people
4. Burnt and mutilated dead bodies

### Observation

In our study out of 55 cases, 46 cases (83.6%) were male and 09 (16.4%) were female as shown in Table 1.

**Table 1: Gender distribution**

| Sex | Number | Percentage |
|---|---|---|
| Male | 46 | 83.6% |
| Female | 09 | 16.4% |

Maximum number (40%) cases reported from the age group 21–30 years followed by 41–50 years (23.6%) then by 51 years and above (21.8%) as shown in the Table 2.

**Table 2: Age-wise distribution**

| Age group (years) | Number | Percentage |
|---|---|---|
| 0–10 | 00 | 0% |
| 11–20 | 03 | 5.5% |
| 21–30 | 22 | 40% |
| 31–40 | 05 | 9.1% |
| 41–50 | 13 | 23.6% |
| 51 and above | 12 | 21.8% |

Majority of cases (81.8%) reported as accident and only 18.2% of cases reported as suicidal in nature. There are no cases of homicide injury as shown in the Table 3.

**Table 3: Manner of death-wise distribution**

| Manner of death | Number | Percentage |
|---|---|---|
| Accidental | 45 | 81.8% |
| Suicidal | 10 | 18.2% |
| Homicidal | 00 | 0% |

The Table 4 and Figure 1 show the relationship with place of fall where maximum number (65.5%) occurs in home, whereas 30.9% of cases reported from construction site and only 3.6% from hospital.

**Table 4: Place of fall**

| Place of fall | Number | Percentage |
|---|---|---|
| Home | 36 | 65.5% |
| Construction site | 17 | 30.9% |
| Hospital building | 02 | 3.6% |

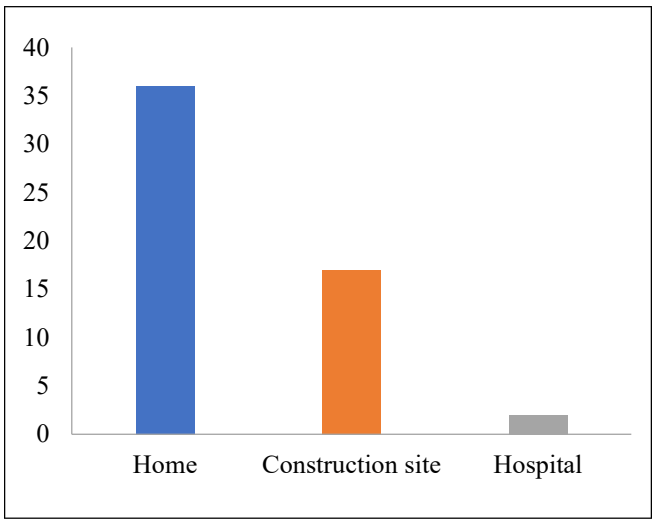


**Figure 1: Place of fall**

The Table 5 shows rooftop (87.3%) cases is commonest site of fall followed by window (10.9% cases) then from a construction machine (1.8% cases). All the cases reported from fall from window are suicidal in nature.

**Table 5: Site of fall**

| Site of fall | Number | Percentage |
|---|---|---|
| Rooftop | 48 | 87.3% |
| Window | 6 | 10.9% |
| Machine | 01 | 1.8% |

The Table 6 and Figure 2 show that head and neck are the common region involved in injuries (72.7% cases) followed by thorax (69.1%) then limbs (45.5%), abdomen (30.1%) and spine (9.1%).

**Table 6: Anatomical regions of injuries**

| Injury region | Number | Percentage |
|---|---|---|
| Head and neck | 40 | 72.7% |
| Thorax | 38 | 69.1% |
| Abdomen | 17 | 30.1% |
| Limbs | 25 | 45.5% |
| Spine | 5 | 9.1% |

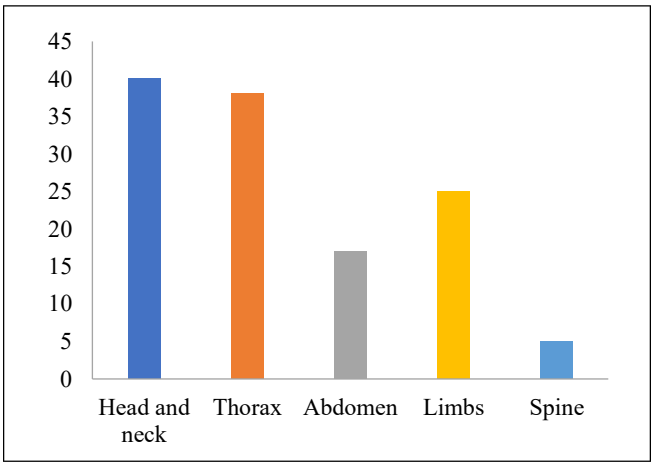


**Figure 2: Anatomical regions of injuries**

In our study, 67.2% of cases suffered from intracranial hemorrhages followed by injuries to cranial vault (54.5%) and base of skull (45.5%) as shown in the Table 7.

**Table 7: Distribution of fatal head injury**

| Injury location | Number | Percentage |
|---|---|---|
| Cranial vault | 30 | 54.5% |
| Base of skull | 25 | 45.5% |
| Subdural Subarachnoid Hemorrhage | 37 | 67.2% |

In our study, maximum number of cases (63.7%) died due to head injury followed by polytrauma (14.5%). Hemorrhage and shock and spinal shock are other cause of death in 12.7% and 9.1%, respectively, as shown in the Table 8.

In terms of the height of fall, it was determined that 20 cases (36.4%) had fallen from high heights (>5 m) and 36 cases (63.6%) from low heights (<5 m). This study

**Table 8: Cause of death**

| COD | Number | Percentage |
|---|---|---|
| Head injury | 35 | 63.7% |
| Polytrauma | 08 | 14.5% |
| Spinal shock | 05 | 9.1% |
| Hemorrhage and shock | 07 | 12.7% |

**Table 9: Fall height and relation with injuries**

| Injury | <5 m (35 cases) | Percentage | >5 m (20 cases) | Percentage |
|---|---|---|---|---|
| Head & neck | 24 | 68.6% | 16 | 80% |
| Thorax | 28 | 80% | 10 | 50% |
| Abdomen | 07 | 20% | 10 | 50% |
| Limbs | 13 | 37.1% | 12 | 60% |
| Spine | 00 | 0% | 05 | 25% |

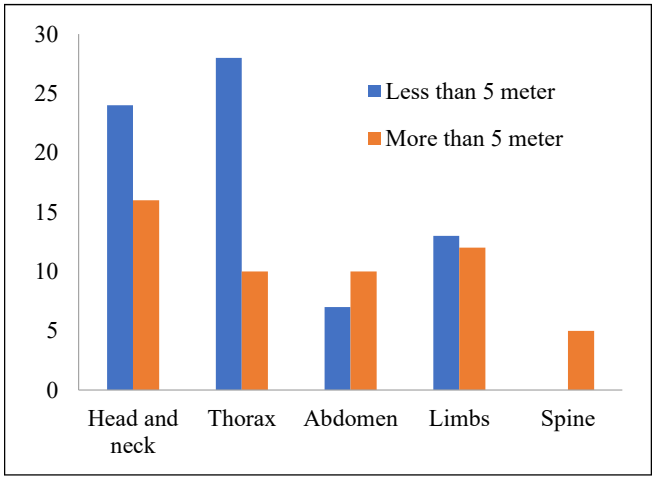


**Figure 3: Fall height and relation with injuries**

revealed that cases with head, neck, abdomen and spine injuries occurred more frequently in falls from high heights, whereas cases with fatal injuries to a smaller area occurred more frequently in falls from low heights (Table 9; Figure 3). In all, 69.1% of the cases had fractures of the ribs, and 45.5% had extremity fractures. It was understood that the greater the height of the fall, the more frequent occurrences of cranial vault and spine injuries. Injuries to the major arteries (the inferior vena cava was seen in Case 01). The height of fall was found to be significantly higher in suicide cases than in accidental falls. It was noted that out of 10 suicide cases, 04 cases had a history of organic illness.

## DISCUSSION

In the present study, higher victims were found among males (46 cases, 83.6%) than females (09 cases, 16.4%). This is due to the predominance of male employment in occupational settings in our society. Our study coincides with studies done by other researchers in which males were predominant over females [1,3,4].

When the cases were evaluated by age group, it was seen that the 21–30-year-age group (40%) was affected most, followed by the 41–50-year-age group (23.6%) then above the 51-year-age group (21.8%), similar to the study by Mekkodathil *et al*. in which the most affected age group was 20–29 years (26.1%) [3]. Among senior citizens, there is still a high risk of mortality, even in low-height falls, due to preexisting illnesses and physical frailties [1] .

It was found that 81.8% of the cases were categorized as accidental deaths, whereas 18.2% were suicides, which is similar to other studies in which accidental deaths were more prevalent than suicidal deaths [1,4,5].

In the present study, most of the people fall at home (65.5%) followed from construction site (17%) followed from hospital building (3.6%), which is similar in other studies in which maximum cases were noticed from home [1,6].

In our study, 60% of cases were suicidal and belonged to the age group above 45 years. Suicidal tendency people generally prefer high altitudes because at a higher altitude, the chances of survival are much lower [7-9]. Four suicidal victims in this study had chronic illnesses, and they preferred to jump through windows at night. Suicides generally happen at night, and at crime scenes, the presence of an open window indicates suicidal tendencies [7,8]. Risk factors for suicide among senior citizens include retirement, losing a loved one, loneliness, disability and accompanying chronic illnesses [10].

In the present study, injuries over the head and neck, and thorax were predominantly seen in 72.7% and 69.1% of the cases, respectively, which was similar to other studies in which head injuries and rib fractures were present in most of the cases [7-9,11].

When reviewing fall heights, Goren and Wang split their cases into two groups: high (>5 m) and low (<5 m) [4,12,13]. The fall height for the cases was similarly divided in our study, in which 63.6% of cases fell from <5 m, whereas 36.4% of cases fell from >5 m. We also observed that as the fall height increased, the severity of the head injury increased (16 cases, 80%), which was similar to the previous study done by Gill [7]. Multiple injuries over the body were predominantly seen as the fall height increased >5 m, which was observed by Lau *et al.* [14]. We also observed that injury to the spine is also associated with a high-height fall. All of the 05 cases who had injury to the spine were jumped from >5m height. Colon rupture was seen in 1 case out of 20 cases who jump from high (>5m) height, a similar was observed in previous studies as the height increase chances of intestinal rupture increased [8].

## CONCLUSION

It was observed that fatalities from height are mainly the result of accidents and thus preventable. Mortality is common in younger and older age groups, so protective measures should be taken specifically for these groups such as appropriate planning, education, and counseling of chronically ill patients.

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