

# Rise in Deaths Due to Fall from Height: A 3-Year Retrospective Study

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## Abstract

Deaths due to fall from height are the second leading cause of injury-related deaths. The fatalities of the injuries depend not only on the height of fall but also on the landing position and impact surface. Additionally, diversity of the injuries and the complexity of the patterns involved in these injuries, emphasizes the need for study in this area. A retrospective autopsy study of deaths due to fall from heights was carried out at the Department of Forensic Medicine, KIMS Hospital, Bangalore from January 2014 to December 2016. Among the total 1911 cases autopsied during the study period, 90 cases (4.07%) were deaths due to fall from height. Maximum number of cases was in the second decade of their lives (36.6%) and was followed by cases in third decade (21.1 %). male to female ratio was 6.5:1. About 41.1% of the cases were construction workers, followed by 15.5% students. Fatal height of fall was within 0-20 feet (48.8%) followed by 21-40 feet (44.4%).Amongst the fatal fall, 63.3% of cases succumbed to injuries without treatment. It was observed that in 41.1% the impact was on hard surface followed by fall on tiles in 35.5%.Head injury was the leading cause of death in 51.1% of the cases. We concluded that fall from heights carry a significant morbidity and mortality and to decrease the incidence of these deaths, it is important to employ certain vital strategies. These include creating awareness amongst workers, increasing parental supervision of toddlers during their play at heights and psychological counseling for students.

**Keywords:** Height of fall, Impact, Pattern of Injuries, Cranio-cerebral damage.

## Introduction

Increasing urbanization and civilization has led to an increase in construction of high rise buildings especially to gratify human needs. Additionally, factors like unsafe/uneven surfaces, poor lighting and slippery surfaces, diminished eyesight and problems with gait and balance among elderly contribute immensely to greater incidence of fall from heights.

Globally, fall from height are a substantial public jeopardy and are among the important leading causes of

serious and fatal injuries. It is the second leading cause of injury-related death worldwide. It is also a major cause of personal injuries disproportionately affecting the very young and the very old and causing a significant impact on victim's families and the society.

A fatal fall from height can result from accidents, suicides or homicides. In some cases, the manner of death becomes ambiguous. This is due to the fact that multiple injuries sustained due to fall pose a difficult task to autopsy surgeon to ascertain if the injuries were sustained due the fall or inflicted by other means before the fall. The severity of injury depends on many factors like the weight of the body and the manner in which the body impacts against the surface. Complexity of injuries increases with an increase in the height of the fall.

In this study, we retrospectively evaluated the

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demographic data, injury pattern of such cases and utilized this information for formulating the necessary preventive measures.

## Materials and Method

A Retrospective study of deaths due to fall from height for a period of 3 years, from January 2014 to December 2016 was studied in the Department of Forensic Medicine, Kempegowda Institute of Medical Sciences, Bangalore. This study was conducted using a pre-tested structured proforma which fulfilled the inclusion and exclusion criteria, police inquest and perusal of hospital records.

## Results

During this study period, total of 1911 cases were brought for post-mortem examination. Out of the 1911 cases, 90 (4.7%) cases were deaths due to fall from height.

**Gender distribution** - Of the 90 cases, 78 (86.6%) were male and 12(13.3%) were female fatalities. The males outnumbered the females in entirety and male to female ratio was 6.5:1. (Table-2)

**Age distribution** - The maximum number of victims 33 (36.6%) belonged to age group of 21-30 years followed by 19 (21.1%) belonging to 31 to 40 years age group. The least age was 1 year and uppermost age was 78 years. (Table-1)

**Occupation/livelihood/education distribution** - Predominance of deaths was seen among construction workers as seen in 37(41.1%) cases, followed by deaths among students as seen in 14(15.5%)cases, among factory workers as seen in 10(9%) cases and professionals as seen in 8(8.8%) cases. Least deaths were seen among toddlers as seen in 4(4.4%) cases and in senior citizens as seen in 3(3.3%) cases. (Table-3)

**Status of treatment** - Among the fatalities 57(63.3%) cases did not receive treatment and only 33(36.6%) cases received treatment. Among the ones who received treatment, the survival period of the injured was within 1-3 days in 28(84.8%) cases followed by 4-7 days in 4(12.1%) cases and in only 1 case survival was 7-14 days.

**Height of fall** – The height of descent among 44(48.8%) cases was 0-20 feet followed by 21-40 feet

among 40(44.4%) cases. The least of 61-80 feet and 81-100 feet was noticed in 1(1%) of cases. Evaluation of impacting surface of the body revealed that about 37(41.1%) cases fell on hard surface, followed by on tiles in 32(35.5%) cases and on cement surface in 9(10%) cases. (Table-4) & (Table-5)

**Pattern and location of injuries** - In about 74(82.2%) cases, external injuries were sustained in the cranial region. Internal categorization of injuries revealed that 69(76.6%) cases sustained intracerebral injury and 56(62.2%) cases sustained skull fractures.

In 66(73.3%) cases injuries were seen in thoracic region. Internally ribs fracture in 57(63.3%) cases and 41(45.5%) cases sustained lung injury. In 42(46.6%) cases, injuries were in abdomino-pelvic region. Internal categorization of injuries revealed that liver injury was highest among 25(27.7%) cases, followed by injury to kidney in 20(22.2%) cases. Long bones fracture was seen in 13(14.4%) cases and pelvis fracture in 10(11.1%) cases.

**Opinion** to the cause of death due to fall from height was head injury in 46(51.1%) cases followed by multiple injuries sustained in 43(47.7%) cases.

**Table 1 – Age distribution**

AGE DISTRIBUTION			
	2014	2015	2016
0-10	2	3	2
11-20	3	3	3
21-30	8	12	13
31-40	10	1	8
41-50	3	3	5
51-60	2	3	3
>60	0	1	2
<b>TOTAL</b>	28	26	36

**Table 2 – Gender distribution**

GENDER DISTRIBUTION		
	MALE	FEMALE
2014	22	6
2015	23	3
2016	33	3
<b>TOTAL</b>	78	12

**Table 3 – Occupation**

OCCUPATION			
	2014	2015	2016
Construction worker	11	10	16
Factory worker	3	3	4
Student	6	4	4
Agricultural worker	3	2	1
House wife	2	1	2
Professional	1	2	5
Toddler	1	1	2
Daily wage worker	1	2	0
Senior citizen	0	1	2
<b>TOTAL</b>	28	26	36

**Table 4- Height of fall**

HEIGHT OF FALL			
	2014	2015	2016
0-20	16	14	14
21-40	9	11	20
41-60	2	1	1
61-80	1	0	0
81-100	0	0	1
<b>TOTAL</b>	28	26	36

**Table 5- Impact surface**

IMPACT SURFACE			
	2014	2015	2016
Hard surface	12	8	17
Cement	4	2	3
Stone	1	2	0
Tiles	6	11	15
Mud	3	3	1
Sand	2	0	0
<b>TOTAL</b>	28	26	36

## Discussion

Deaths due to fall from height is the second leading cause of injury-related deaths and are on rise. These findings are similar to other studies.<sup>1-4, 8</sup>

Similar to studies done earlier,<sup>1-5, 7, 8</sup> our study showed that maximum number of cases was in the age group of 21-30 years and 31-40 years. However, this finding was in contrast to one of the studies.<sup>6</sup> Male predominance seen in our study was similar to few other studies<sup>1-8</sup>. This could be due to the fact that the young age groups are more vulnerable to falls validating their stressful and ambiguous lifestyles. The high incidence in males could be due to two reasons – males being the breadwinner of the family are more exposed to stress, strain and occupational hazards and a greater amount of zeal is involved in handling the work at heights compared to females.

Similar to some studies<sup>1, 2, 8</sup> majority of deaths occurred among construction workers. Lack of education, poor working skills, worker's qualities like careless attitude, misjudgment, and overconfidence in doing the unusual work, lack of safety measures employed could be the reasons causing fatal injuries. Chronic work pressure/burnout, poor sleep deprivation, work depression due to increased workloads, rigorous physical activities and working at heights for long intervals causing over exertion are few other predisposing factors for fatigue causing fatal injuries.

Among students, the reasons could be due to high amount of stress they are subjected to in their lives either due to personal affairs, poor academic performance, low self esteem and negative peers. The decreased incidence of falls among professionals can be due to secure employment and the awareness and the privileges of the rights to live. In toddlers, evolving developmental stage, innate curiosity of their surroundings, inadequate supervision, and improper safety measures employed could be the reason behind their death. In senior citizens, ageing leading to variations in physical, sensory and cognitive functions, prevailing health issues, loneliness, depression, family pressure, and general debility could be the reasons behind their deaths.

Among the impacting surfaces, the unyielding surfaces like hard surface and tiles offered resistance and energy during impact caused grave injuries. This was similar to one among studies.<sup>4</sup> During impact, despite resistance being offered by the victims as a protective mechanism, head is still the most vulnerable organ to injury. This could be the reason behind head injury being the most common injury. This is followed by thoracic and abdomino-pelvic injury. These findings was similar

to one among studies.<sup>1-8</sup>

### Conclusion

Deaths due to fall from height is on the rise. Most of the deaths due to fall from heights could be averted by using protective equipments, personal fall arrest systems, on-site precautionary measures, short safety training courses for the workers, adequate rest among workers, to employ ergonomics to derive a holistic approach to deal with risks involved from fall from height. Psychological counseling for students and elders and safety measures and strict supervision among toddlers would be few other mechanisms to avert fall from heights. This approach could reduce the morbidity and mortality of deaths due to fall from heights and decrease the burden on the health care system.

### Limitations

Our study has limitations associated with the community. Since it was a retrospective study, we relied only on the data reported and not all variables were documented. The variables that were documented were based on the reporting of the study cases.

**Conflicts of Interest:** None

**Funding:** None

**Ethical Approval:** Obtained

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