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Original Research Article

Profile and Pattern of Deaths due to Fall from Height- A Prospective Study

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Key words
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Abstract

Introduction: Deaths due to fall from height are the second leading cause of injury-related deaths among the general population. The fatalities of the injuries depends on various factors such as the height of fall, the landing position and impact surface. Additionally, complexity of the patterns involved in these injuries & diversity of the injuries emphasizes the need for study in this area. **Material & Methods:** A prospective autopsy study of deaths due to fall from heights was carried out at the Department of Forensic Medicine & Toxicology attached to Government Kilpauk Medical College & Hospital, Chennai, Tamil Nadu for the year 2020 from 01-01-2020 to 31-12-2020. **Results:** Among the total 2719 cases autopsied during the study period, 69 cases (2.53 %) were deaths due to fall from height. Maximum deaths were seen in males (78.26%). Maximum number of fall from height cases were seen in the age group of 31-40 Years (42.02%). **Discussion:** Maximum case of fall from height was seen in those involved in painting as their profession (26.03%). Maximum cases of fall from height were seen in low socio economic status (76.81%). Maximum cases of death due to fall from height were married (69.56%). Maximum cases of fall from height were seen with a distance below 20 feet which constitutes 37.68%. With regards to the surface of impact following fall from height, maximum number was with fall over a hard surface (31.88%). The cause of death in maximum cases was attributed to Cranio-Spinal Injuries (37.68%). The most common manner of death was accidental in nature (82.60%). **Conclusion:** We concluded to employ certain vital strategies to prevent fall from heights as they carry a significant morbidity and mortality. These include creating awareness amongst workers, increasing parental supervision of toddlers during their play at heights and psychological counselling for students.

1. Introduction

Increasing urbanization and civilization has led to an increase in construction of high rise buildings especially to gratify human needs. Factors such as unsafe or uneven surfaces, slippery surfaces, poor lighting are prone towards increasing incidence of fall.

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The Human factors such as diminished eyesight, gait and balance problems amongst the elderly persons contribute immensely to greater incidence of fall from heights.[1] Globally, fall from height are a notable public jeopardy and are the leading causes of fatal injuries. It is the second leading cause of injury-related death worldwide. It is also a major cause of personal injuries disproportionally affecting the very young and the very old and causing a significant impact on victim's families and the society.[2]

A fatal fall from height can be accidental, suicidal or homicidal. In some cases, the manner of death becomes ambiguous, as multiple injuries sustained due to fall will mislead the autopsy surgeon to ascertain whether the injuries sustained were due to 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.[2]

Variety and the number of Trauma incurred due to fall from height poses a great burden on health services due to its severity. As most of these are preventable, it gains a lot of importance to deal with such cases.[3]

Extensive studies and adequate knowledge of the possible traumatic patterns incurred after a fall from height can improve the skills in the evaluation of such cases in the future. In this study we prospectively evaluated the demographic data, injury pattern of such cases and utilized this information for formulating the necessary preventive measures.

2. Aims & objectives

- To know the predominant sex, common age group, socio economic status, marital status & occupation involved in fall from height.
- To know about the fatal distance, most common cause of death, most common manner of death and type of landing surface increasing the fatality.

3. Materials and method

A prospective study of deaths due to fall from height for a period of one Year, from January 2020 to December 2020 was studied in the Department of Forensic Medicine& Toxicology of the tertiary care medical institution. Ethical Clearance taken. This study was conducted using a pre-tested structured proforma which fulfilled the inclusion and exclusion criteria, police inquest and perusal of hospital records.

4. Results

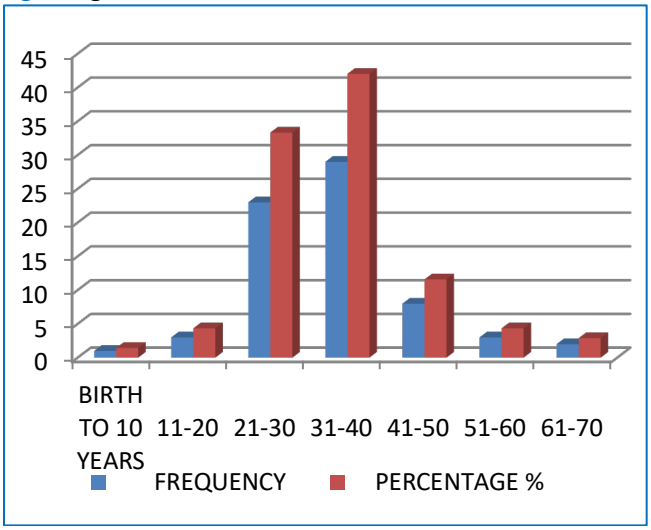
4.1 Gender wise distribution:

Maximum cases of fall from height were observed in males which contributed to (78.26%) of the total cases of fall from height.

4.2 Age wise distribution:

Maximum number of fall from height cases were seen in the age group of 31-40 Years (42.02%) followed by 21-30 Years (33.33%) (Refer to **Fig. no. 1**).

Fig. 1: Age Wise Distribution.



4.3 Occupation wise distribution:

Maximum case of fall from height was seen in those involved in painting as their profession (26.03%) followed by construction worker (21.73%) and factory worker (18.84%) (Refer to **Table no. 1**).

Table no. 1: Occupation wise distribution.

Occupation	Frequency	Percentage %
Painter	18	26.03
Construction worker	15	21.73
Factory worker	13	18.84
Daily wages	06	8.69
Professional	04	5.79
house wife	09	13.04
student	03	4.34
Toddler	01	1.44
total	69	100

4.4 Socio economic status wise distribution:

Maximum cases of fall from height was seen in low socio economic status (76.81%) followed by middle socio economic status (17.39%).

4.5 Marital status wise distribution:

Maximum cases of death due to fall from height were married (69.56%)

4.6 Approximate height of fall:

Maximum cases of fall from height were seen with a distance below 20 feet which constitutes

(37.68%) of the cases followed by 21-40 feet (27.53%) and 41-60 feet (20.28%) (Refer to **Table no. 2**).

Table no. 2: Approximate height of fall.

Approximate height of fall in feet	Frequency	Percentage %
1-20	26	37.68
21-40	19	27.53
41-60	14	20.28
61-80	07	10.14
>80	03	4.34
Total	69	100

4.7 Distribution of cases based on impact surface:

The impact surface was maximum with fall over a hard surface (31.88%) followed by fall over cement (23.18) and fall over sand (15.94%) (Refer to **Table no. 3**).

Table no. 3: Distribution of cases based on impact surface.

Impact surface	Frequency	Percentage %
Mud	08	11.59
Sand	11	15.94
Cement	16	23.18
Stone	09	13.04
Hard surface	22	31.88
Tiles / mosaic	03	4.34
Total	69	100

4.8 Cause of death:

The cause of death in maximum cases was attributed to Cranio-Spinal Injuries (37.68%) followed by head injury (23.18%) and blunt injury to the chest (13.04%) (Refer to **Table no. 4**).

Table no. 4: Cause of Death.

Cause of death	Frequency	Percentage %
Head injury	16	23.18
Cranio-spinal injuries	26	37.68
Blunt injury chest	09	13.04
Blunt injury abdomen	07	10.14
Shock and haemorrhage due to multiple injuries sustaned	08	11.59
Shock and haemorrhage due to injury to vital organs.	03	4.34
Total	69	100

4.9 Manner of death:

The most common manner of death was accidental in nature (82.60%) followed by suicidal (17.39%) and no cases of homicide was reported.

5. Discussion

Deaths due to fall from height is the second common cause of injuries related to death and are on rise. Maximum cases of fall from height were observed in males which contributed to (78.26%) of the total cases of fall from height. This is similar to the study conducted by Roopak SN et al[3], VT Venkatesh et al[4] & Bharath Kumar Guntheti et al[5]. This could be due to the fact that males being the breadwinner of the family and 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.

Maximum number of fall from height cases were seen in the age group of 31-40 Years (42.02%) followed by 21-30 Years (33.33%).This result is similar to the studies conducted by J.V.Kiran Kumar et al[6], SR Jagannatha et al[7], VT Venkatesh et al[4]. However our study was in contrast with the study conducted by V.Prathapan and B.Umadethan.[8] This could be due to the fact that the young age groups are more vulnerable to falls validating their stressful and ambiguous lifestyles.

Maximum case of fall from height was seen in those involved in painting as their profession (26.03%) followed by construction worker (21.73%) and factory worker (18.84%). This is almost similar to the studies conducted by Naveen Kumar et al[2] and Roopak SN et al[3].This could be due to lack of education, poor working skills, worker's qualities like careless attitude, mis-judgement and over confidence in doing the unusual work, lack of safety measures employed could be the reason 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.

Maximum cases of fall from height was seen in low socio economic status (76.81%) followed by middle socio economic status (17.39%).This is similar to the studies conducted by the studies conducted by Lewis WS, Lee AB, Grantham SA and Mathis RD, Levine SH, Phifer.S.[9,10] This could be the reason that most of the people were daily wages and has to go to any type of work with risks involved for their livelihood.

Maximum cases of death due to fall from height were married (69.56%). This type of study based on marital status were not done however this was done in my study because there was a case of suicide by a men after marriage because of extramarital affairs and

he has chosen fall from height to commit suicide. In 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.

Maximum cases of fall from height were seen with a distance below 20 feet which constitutes (37.68%) of the cases followed by 21-40 feet (27.53%) and 41-60 feet (20.28%).This is similar to the studies conducted by Naveen Kumar T et al.[2] This indicates that most of the deaths due to fall from height were below 20 feet which can be prevented if proper safety measures were implemented during their profession. The impact surface was maximum with fall over a hard surface (31.88%) followed by fall over cement (23.18) and fall over sand (15.94%). This is similar to the study conducted by C.R Vasudeva Murthy, et al.[11] The impacting surfaces, the unyielding surfaces like hard surface and tiles offered resistance and energy during impact caused grave injuries during impact, despite resistance being offered by the victims as a protective mechanism, head is still the most vulnerable organ to injury.

The cause of death in maximum cases was attributed to Cranio-Spinal Injuries (37.68%) followed by head injury (23.18%) and blunt injury to the chest (13.04%).This is similar to the study conducted by Bharat Kumar Guntheti et al.[5] Head and spine is still the most vulnerable organ to injury due to presentation of these parts during a fall, this could be the reason behind head injury and cranio-spinal injury being the most common injuries followed by blunt injury to the chest and abdomen.

The most common manner of death was accidental in nature (82.60%) followed by suicidal (17.39%) and no cases of homicide was reported. This is similar to all studies conducted by Roopak SN, SR Jagannatha and Jagannatha SR, Pradeep Kumar MV, Naveen Kumar et al.[3,7] It is very difficult to differentiate a case of homicide in fall from height unless there are any transportation injuries, CCTV Footage which may give a clue on it.

6. Conclusion

Deaths due to fall from height is on the rise. The victim ranges from toddlers who fall accidentally to elders who attempt suicide in depression, but the statistics in the study shines light on the workplace deaths in relation to fall from height. Most of these 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.

Supervision by concerned authorities and stringent actions from government officials towards work place safety has to be mandated. If the established guidelines are followed properly, much of these accidental deaths can be prevented. Deaths due to cranio-cerebral injuries were the maximum in our study, which points out to ignorance of not using head guards or protective helmets at the workplace. Proper lighting at the workplace is also an essential need, which will help to reduce the workplace injuries.

Psychological counselling 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.

7. Recommendations

Stringent action should be taken by the government against the companies / work place areas where they are not following standard operating procedures pertained to life safety and organizations / companies which fail to provide proper protective covers during work.

An awareness demo can be given by an individual about the risk involved in the appropriate professions with do's and don'ts prior to commencement of work which can reduce accidental deaths of fall from height.

Climatic situation also plays a vital role like working during rainy seasons over a slippery area where there are higher chances of accidents can be prevented by using appropriate preventive measures at that material time.

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Ethical Clearance: Yes.
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