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# Epidemiologies of Fatal Ground Level Falls in Autopsies Conducted in A Tertiary Care Hospital: A cross sectional Study

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## Abstract

**Background:** Falls are the second leading cause of unintentional injury deaths worldwide. Falls not only causes Mortality, but also Morbidity resulting in disabilities and loss of productivity. Death due to falls not only occurs in victims falling from a height but also in Ground level falls.

**Aim:** To study the age and sex distribution, place, surface, time, and outcome of fatal accidental Ground Level Falls.

**Methods:** The present study was carried out as a descriptive study in which medico legal autopsies of 115 victims of ground level fall victims were included. Lettule's method of en masse removal of viscera and dissection of organs was used for conducting medico legal autopsy. The Collected data was entered in MS excel and analysed.

**Conclusion:** The current study revealed that most victims of ground level falls were more than 50 years of age and indoor falls were more common than outdoor falls. 62% of the victims had suffered head injury. Effective fall prevention programmes should be framed to reduce the number of people who fall.

**Keywords:** Falls, Ground Level, Head Injury

## Introduction

According to World Health Organisation<sup>1</sup>, Falls are the second leading cause of unintentional injury deaths worldwide. Each year an estimated 6,84 ,000 individuals die from falls globally of which over 80% are in low- and middle-income countries. Adults older than 60 years of age suffer the greatest number of fatal falls.

A fall is defined as an event which results in a person coming to rest inadvertently on the ground or floor or other lower level.<sup>1</sup> Fall-related injuries may

be fatal or non-fatal, while all people who fall are at risk of injury. The age, gender and health of the individual can affect the type and severity of injury.

According to the Accident and suicide statistics of National Crime Records Bureau (NCRB) for the year 2019<sup>2</sup>, a total of 12048 cases of fall from height were registered in India. Out of this, 11997 cases were fatal with male: female ratio being 5.4:1. The burden was seen more in victims belonging to age group between 30-45 years of age. According to International Classification of Diseases- 11<sup>3</sup>, PA -60

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is the new code for Unintentional Falls on the same level or less than 1 metre.

Age is one of the key risk factors for falls. Older people have the highest risk of death or serious injury arising from a fall and the risk increases with age. Across all age groups and regions, both genders are at risk of falls. In some countries, it has been noted that males are more likely to die from a fall, while females suffer more non-fatal falls. Older women and younger children are especially prone to falls and increased injury severity. Occupations at elevated heights, comorbid conditions such as stroke, hypertension, vertigo, postural hypotension, visual disturbances in old age and unsafe environment related to buildings are other risk factors contributing to falls. Ground Level Falls are generally due to slips or trips. Injury results when the individual hits a walking or working surface or strikes some other object during the fall. Fall from short distance such as sofa, bed, chair or table less than 1.5 meter of heights are also included in Ground level falls.

Fatal ground level falls were due to accidental slipping and tripping owing to environmental factors like slimy and slippery floors indoor, spillage of water, insufficient lighting in rooms, rest rooms and lack of grab bars in balcony and staircases and congested pathways. Knight B. et al<sup>4</sup> study also states age, arthritis, postural instability, poor vision, dizziness as predisposing factors. Fatal ground level falls though can't be predicted are preventable with alteration of the above factors making room a safe environment.

### Materials and Methods

The present study has been conducted as a cross sectional study in Department of Forensic Medicine, Madurai Medical College & Government Rajaji Hospital during January 2016 to December 2016.

**Inclusion Criteria:** All cases of deaths due to Ground level falls (falls in bathrooms, beds, chairs, streets, and balcony) during the above said time period were included in the study. 115 cases of Ground level fall autopsies satisfied the inclusion criteria.

**Exclusion Criteria:** Falls from staircases in house, Decomposed case, Unknown cases, Cases

where history and details not available, Fall from moving vehicle (road traffic and train traffic accident), Fall from burning building, Fall into fire, Fall into water (with submersion or drowning) and Fall into machinery were excluded from the study. Lettule's method of en masse removal of viscera and dissection of organs was used for conducting medico legal autopsy. The study was done after obtaining approval from Institutional ethics committee.

## Results and Discussion

### Age

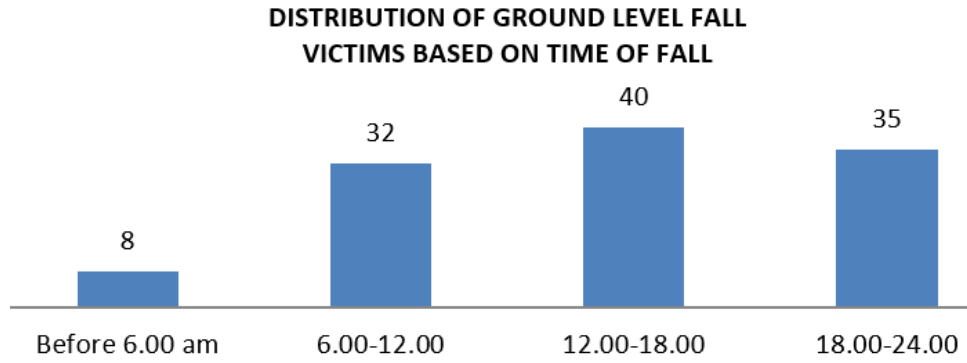
Age range starts from 4 years -85 years. The incidence peaked in the age group 61-70 years constituting 22.6 % (n=26) of the cases. 19.1% (n=22) of the victims belonged to the age group 51-60. Hence 39.1% of victims belonged to the age group of more than 60 years. Individuals <20 years were the least affected (4.3%, n=5). In the current study, it has been observed that the maximum number of ground level falls was observed in the age group 61-70 years. Elderly people in this age group are more susceptible to falls as they are more fragile and associated with co morbidities and age related changes like cataracts & refractive errors, dementia. The less incidence of ground level fall in younger age group (4.3%) is justified by the fact that they have a well-coordinated CNS and Motor system less vulnerable to falls. Karen M Chisholm et al<sup>5</sup> study done in Seattle - King medical Examiner's office in 2007 also supports the current study were 61% of the victims were >70 years of age.

### Sex Distributon

76.5% of the Victims were Males (n=88) and 23.5% of the victims were females. Sex Ratio was 3.3:1. Males were 3 times more affected than Females. The study revealed that males were 3 times more affected of ground level falls than females. In Karen M Chisholm et al<sup>5</sup> study again 69% were Males similar to the current study. Study by Bardale et al<sup>6</sup> shows more victims were males aged >65 years and incident occurred mainly Indoor similar to our study.

### Time of Fall

Most cases of ground level fall occurred between 12 noon - 6 p.m. i.e., during afternoon and evening (n=40, 34.8% cases). Least number of falls occurred during 12 midnight - early morning 6a.m. (n=8, 7% cases).



**Figure 1: Distribution of Ground level fall victims based on Time of fall**

**Place of Fall**

46% of the ground level fall deaths were due to fall in Indoor areas like bathrooms, beds/chairs and floor , while 36.5% of ground level falls were outdoor fall victims, like falls in streets and balcony . More falls, almost 35% of ground level falls had occurred in the time 12 noon – 6 pm. More of indoor falls can be owed to the slimy tiles inside the houses. Victims fall mainly in bathrooms, floors and mostly evening and night.

**Surface of Fall**

The surface of fall also plays a pivotal role in falls. Almost 58% of the ground level fall deaths were due to fall in tiles and marbles. The next most common surface of fall was hard soil (24.3%). Similar to our study, Karen M. Chisholm and Richard C. Harruff et al<sup>5</sup> also reported 79% of ground level falls on marbles and tiles.

**Survival Period**

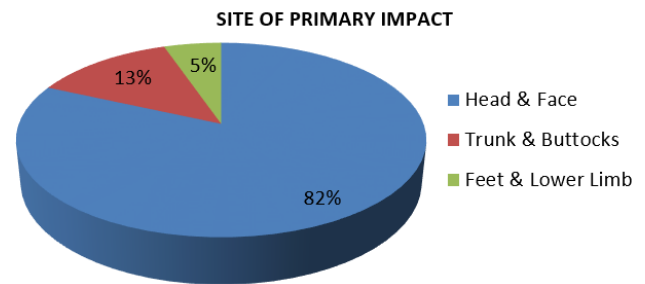
The survival period after a ground level fall was variable. 59% of the victims (n=68) survived for a period of 1-10 days. 24.3% of the victims were 1 day survivors. Only 1 victim survived for a month after the fall which was the longest survival period. Karen M Chisholm et al study<sup>5</sup> revealed similar survival period of 9-23 days in their study. In Annette Thierauf et al study<sup>7</sup>, about 77.9% of the ground-level falls were not immediately fatal, but present survival times from 3 hours to 349 days.

**Table 1: Distribution of Survival Period in Ground level fall victims.**

Survival period	No. of cases	Percentage
0 (Dead)	8	7%
1hour – 24 hours	18	24.3%
1 day – 10 days	68	59.1%
11 days – 30 days	10	8.7%
1 month	1	0.9%

**Primary Impact**

With regard to the site of primary impact, Head & Face was the most common site constituting 81.7% (n=94), the next common sites were trunk & buttocks constituting 13% (n=15). Feet/Lower limb constituting 5.3% (n=6) were the least common site of Primary impact. Head & Face was also the commonest primary site of impact in Vasudeva Murthy CR et al<sup>8</sup> study conducted in Davangere but the victims had fallen from a height contrastingly.



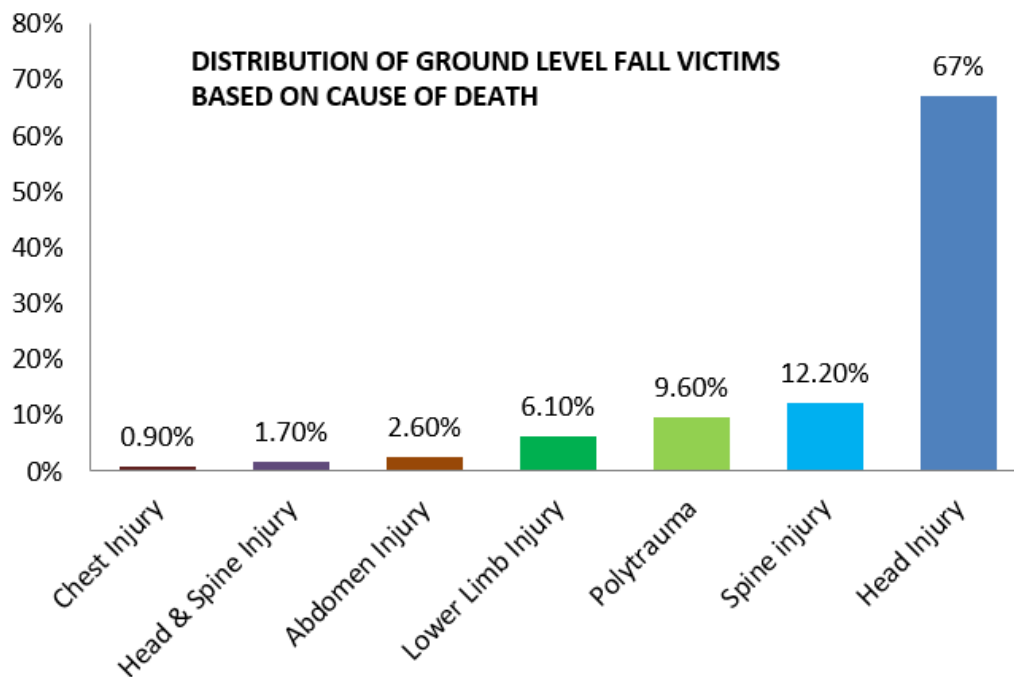
**Figure 2: Distribution of Site of Primary Impact in Ground level fall victims.**

**Injury Pattern**

The injury pattern in Ground level fall victims in the current study as Polymorphic, meaning the victims had multiple injuries all over the body. Preuß

et al<sup>9</sup> study done in Germany also supports the current study in which the injuries were Polymorphic – skull & brain injuries, loss of blood, cervical spine injuries were seen in the victims. 50 victims had died due to injury in multiple regions. In the current study, 89 victims had Head injury which being the

commonest, 17 had sustained spine injury, and 11 had injuries of major bones. Abdominal injuries were the least. And only 7 of the victims had abdominal injuries. Similarly only 9 had abdominal injuries in the study conducted by Peru et al<sup>9</sup> in Germany.



**Figure 3: Distribution of Ground level fall victims based on cause of Death.**

### Head Injury

Subdural Haemorrhage (62%) and subarachnoid haemorrhage (61%) were the commonest pattern of head injury in victims of Ground level fall. Parlak et al<sup>10</sup>, Ankara Turkey, CT findings of Ground level fall victims supported that Head injury victims had Traumatic Intra cranial Haemorrhage.

### Spine Injury

In the present study, victims had sustained spine injuries too, 14 had sustained Cervical Spine injury and 3 had sustained Lumbosacral spine injury. Parlak et al<sup>10</sup> study done in Ankara Turkey, CT findings of Ground level fall victims documented that 52 out of 489 victims had spine injuries.

### Conclusion

The current study revealed that most victims of ground level falls were more than 50 years of age and indoor falls were more common than outdoor falls. Effective fall prevention programmes should

be framed to reduce the number of people who fall, the rate of falls and the severity of injury should a fall occur. Provision of safety devices such as grab handles high friction floors and footwear, as well as low power lighting at night. Home assessment and environmental modification for those with known risk factors or a history of falling. Community-based group programmes which may incorporate fall prevention education.

**Conflict of Interest:** Nil

**Source of Funding:** Nil

**Ethical Clearance:** Obtained from Institutional Ethics Committee, Madurai Medical College, Madurai, Tamil Nadu

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