THE PATTERN OF INJURIES IN FALL FROM HEIGHT

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ABSTRACT

Deaths due to falls from height are common in urban locations. High incidence seen in age group 21-50 years and the height of fall varied from 0-140 feet, victims were males predominate female, ratio is being 9:6. Married urban people of low socioeconomic income group, low educated, and employed in construction works. High incidents take place at workplace while working at roofs of buildings, during 12pm-6pm working hours, in summer months. We revealed that in the majority of cases the site of primary impact. The pattern of injuries depends upon the site of primary impact. Most of the victims first struck the ground either by head or by the side of the body/trunk or limbs and buttock. Fissure fracture of the skull and fracture of cervical spine was noticed when the fall occurred on to concrete from height of 5 feet and on hard soil from the height of 10 feet. Multiple rib fractures, fractures of clavicle and laceration of liver was noticed when the fall was more than 20 feet on to hard surface. Fracture of upper limbs were seen in falls occurred on to concrete from height of 6 feet whereas the fracture of lower limb was found when the fall height was more than 15 feet on to hard surface. We observed that precipitating causes like epilepsy, natural diseases and use of drugs/alcohol, dizziness. Past history of hypertension and intake of anti-hypertension drugs was found. Reasons for fall, inappropriate fencing/barrier on terrace was the most common reason. 93.75% of fall from buildings were accidental whereas 6.25% suicidal in nature and no homicidal cases. Cranio-cerebral damage was most common cause of death. The medico legal autopsy focus on whether the death attributed purely to the height and helps to ruling out the various contributing factors like drugs, alcohol, and co-existing natural disease. The main objective of this study was to find out the pattern of injuries sustained fall from height, manner of falls, causes of falls, medico legal aspect and their preventive measures.

KEYWORDS

Surface of Fall, Height of Fall, Primary Site of Impact, Pattern of Injuries.


INTRODUCTION

Fall is dropping down from a height of relatively high position by the force of gravity. The pattern of injuries in cases of falls from height is dependent on the height, body weight, velocity, nature of surface impacted orientation of body at the movement of impact and the elasticity and viscosity of tissue of the contact body region, out of which height of fall is the major determining factor. Fall from height can be classified in several ways. Depending upon the height of fall which may vary from high rising building to ladder, chairs, tables, or staircases etc. into Lowfalls, highfall. Depending on condition affecting, into: Intrinsic [Where some events or condition affects postural control] and extrinsic [Where an environmental factor is the main contributing reason for the fall].

As a person falls from height, the Kinetic energy keeps on increasing due to acceleration during the fall and is maximum at the moment of impact. This amount of kinetic energy is transferred to the body of the person at the moment of impact causing injuries. Hence the severity of injuries is dependent on the height of fall. Victims of fall from height tend to sustain a unique pattern of injuries that depends on inertia of the body, moment of the body, rigidity of stationary objects and the nature of ground nature against which body falls.

The fall from height including fall from buildings, and tall trees these cases are pose problems for medico legal experts and investigators in arriving at conclusions regarding the manner of death as reliable eye witness evidence will not be available. Therefore it is essential for medico legal experts to analyze the nature and pattern of injuries sustained to the victim to form definite opinion as the nature of fall. The pattern of injuries varies depending upon the site of impact as well as height from which the victim had fallen.

 Determination of anatomical site which first impacts the ground [The primary site of impact] is useful in reconstruction of the event. The amount of kinetic energy acquired during the fall has to be fully expended by the time the body comes to rest so that, if only one impact occurs, it is likely to be more damaging than a series of lesser impacts, such as bouncing or rolling strike.

This retrospective study has been undertaken to determine the frequency, profile of victims, site of primary impact, cause and manner of death from pattern of injuries, factors responsible & to draw the attention towards the implementation of safety measures & building laws, for minimizing the incidences of fall from height.

AIMS AND OBJECTIVES

Analysis of cases of fall from height & demo graphic profile of victims. The pattern of injuries sustained to the victims in different types of impact. To correlate the pattern of injuries with the primary site of impact, factors responsible. To find out reasons for falls, manner of death and causes.
MATERIAL AND METHOD
Present study has been carried out in dept. of Forensic Medicine Mamata medical College and Hospital for a period of one year that is from Jan 2015 to Dec 2015, of all the cases of fall from height subjected. Regarding the demographic data, nature and pattern of injuries, nature of fall, site of primary impact, approximate height of fall, circumstances, location of fall, season, landing surface, cause of fall, cause of death in fall, period of survival, etc. were obtained from investigating officers. The height of fall has been determined by visiting the scene and taking measurements. History of fall from height cases data was collected in Proforma from victims, case sheets, accompanied and police reports, medico legal autopsy done for manner, cause of injuries in fall from height, concluded and compared with previous studies.

RESULTS AND DISCUSSION
Out of total 832 cases of medicolegal autopsy cases, fall from height constituted 32 cases amounting 3.84%.

<table>
<thead>
<tr>
<th>Height of Fall</th>
<th>He ad</th>
<th>Neck</th>
<th>Thorax</th>
<th>Abdomen /Pelvis</th>
<th>Upper/Lower Limb</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 Feet</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>21-40 Feet</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>41-60 Feet</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>61-80 Feet</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>81-100 Feet</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 1: Age and gender distribution

<table>
<thead>
<tr>
<th>Height of Fall</th>
<th>Hard Soil</th>
<th>Cement/Concrete</th>
<th>Stone</th>
<th>Tiles/Marbles</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 Feet</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>21-40 Feet</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>10</td>
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<tr>
<td>41-60 Feet</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>61-80 Feet</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>81-100 Feet</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>101-120 Feet</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>121-140 Feet</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>32</td>
</tr>
</tbody>
</table>

Table 6: According to nature of the ground, height fall and injuries sustained

<table>
<thead>
<tr>
<th>Fall from</th>
<th>Accident</th>
<th>Suicide</th>
<th>Homicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings</td>
<td>28 [87.50%]</td>
<td>2 [6.25%]</td>
<td>-</td>
</tr>
<tr>
<td>Trees</td>
<td>2 [6.25%]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>2</td>
<td>00</td>
</tr>
</tbody>
</table>

Table 7: Manner of fall

<table>
<thead>
<tr>
<th>Height of Fall</th>
<th>Head Injuries</th>
<th>CV</th>
<th>BP</th>
<th>Polytrauma</th>
<th>Sepsis</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 Feet</td>
<td>16</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>21-40 Feet</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>41-60 Feet</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 8: Cause of death in correlation with various heights
The incidence of fall from height is 3.84%. Similar to authors,3,4 injury due to fall from height remain a significant cause of morbidity and mortality.

We observed that the maximum number of fall from height 16 [50.00%] cases was seen in the age group 21-30 years followed by 8 [25.00%] cases of age group of 31-40 years and least 5 [15.62%] cases in age group of 41-50 years. Of the 2 cases were belonged to age group of 51-60 years. The least number of fall from height 2 cases occurred in age group of 60-70. The youngest age was 3 years and eldest was 70 years. The victim belong to the age group of 3 years while playing, accidentally fall from balcony. These are consistent with authors.

The incidence of fall from height common among household workers. (Table no.1) Male victims 29 [90.62%] were preponderated females 3 [9.37%], with male to female ratio is being 9:6. This result coincides with the findings by authors.1-4 Males are vulnerable people, earning members in our society.

Married people 30 [93.75%] outnumbered unmarried people 2 [6.25%]. These are similar to authors.2-4

Married group peoples were involving in household works for earning of daily income.

Urban population 24 [75.00%] constituted and rural population 8 [25.00%] constituted. These are consistent with authors.4,12,13 Many workers in household work in a variety of jobs could be at risk of falling from height remains one of the biggest cause of fatalities. (Fig. 1)

We observed that incidence of falls were more in low income group 24[75.00%], 6[18.75%] victims were belong to middle and least 2[6.25%] victims were belong to high socioeconomic group. These are consistent with authors.4,9 Low income factor as a one of the reason is that this group
population is prone to sustained injuries because their source of income is relating with their work. (Fig. 2)

In present study we noted that most of 20 [62.50%] victims were gained education up to primary level, followed by 6 [18.75%] secondary level and least 2 victims were up to graduation and 4 [12.50%] victims were illiterates. Same results are made by author.6-8 The education also plays an important role in victims daily earning, job opportunities and no work facilities. (Fig. 3)

Occupation wise, the highest incidence of falls occurred among construction workers 25 [87.50%] followed by day labourer/factory workers 4 [12.50%] and least 2 victims accidentally fall from tree. Only child accidentally fall from staircases while playing. These are consistent with authors.5-8 Most of the falls from buildings while working on it fall accidentally and succumb to the injuries sustained. This indicates the significance of highest number of victims as construction workers in maintenance in a variety of jobs could be at risk of falling from height, and those who under take one of jobs without proper training, planning or equipment. (Fig. 4)

Place of fall, most of 22 [78.12%] victims were sustained injuries at construction site in house hold and only 2 [6.25%] victims were fall from tree. Similar results were obtained by authors.5-7 The reason is might be lack of workman safety in building construction and house hold also implement safety regulations. Number of high rise buildings are being constructed in this area, where building safety codes are not properly followed. (Fig. 5)

Time of fall considering timing highest incidents took place between 12 pm - 6 pm during day time 20 [62.50%] cases, whereas during 6am-12 noon 10 [31.25%] cases, and during 6p.m-6am 2 [6.25%] cases occurred. These are similar to author.5-7 Most of the falls occurred during working hours, the reason is almost construction/buildings works are takes place in day time only. (Fig. 6)

Seasonal pattern, the majority of falls occurred in summer 30 [93.75%] and monsoon months 2 [6.25%]. These are consistent with authors.7-12 This is could be explained that the summer is the convenient season for construction/buildings works. The falls from greater heights tends to cluster in the summer months, presumably because household works are more likely takes place and more likely to be working on rooftop, terraces. (Fig. 7)

We observed that precipitating causes like epilepsy, natural diseases and use of drugs or alcohol, dizziness was the precipitating factor in 5 [15.62%] cases. 4 [12.50%] victims showed pre-existing illness. Same findings noted by authors.6-8 Factors contributing to falls from heights include faulty equipment, poor lighting, human factors, such as intoxication, inattention and host factors such as poor muscle tone, vision problems, and medication.

Presence of alcohol was confirmed in 2 cases. Similar findings were noted by authors.6-8 Drinking alcohol seems to be associated with a high risk of all types of fatal falls while at work time.

Past history of hypertension and intake of anti-hypertension drugs was found in 4 cases. Which are supported by authors.6-8 Physical weakness has been considered to be an important risk factor for falls in person’s with hypertension frequently history of giddiness and fall from heights.

According to survival period, in all 17 [53.12%] of victims dead in hospital admission within 12 24 hours followed by 4 [12.50%] victims dead in hospital in between 24 - 48 hours of fall and brought dead 2 [6.25%] cases were reported. In 2 [6.25%] cases the shortest survival periods 1-2 hours were observed for subjects falling from heights and 7 of individuals were discharged from hospital. The reason might be that most of our subjects fell from one level to the same level and did not die immediately. These are consistent with authors.7-11 Head injury, which would be expected to be the most common cause of death in all non-survivors, only occurred in 4 of patients who are survived their transport to hospital. (Fig. 8)

The present study revealed the pattern of primary impact site that cases fall from buildings. In the cases due to fall from height most of the victims first stuck the ground either by head or by the side of the body/trunk or limbs and buttock. The prime observation of study is that the pattern of injuries depends upon the site of primary impact.

According to primary impact, we revealed that in the majority of cases fall from buildings, the site of primary impact was the head 12 [37.50%]. Similar results were obtained by authors.9-11 Determination of primary site of impact was based on interpretation and evaluation of injuries. We revealed that serious injuries are sustained to the site of primary impact, but injuries of varying nature are seen on other parts of the body also. (Fig. 9)

According to injuries to thorax as primary trunk impact was seen in 8 [25.00%] cases of fall from buildings including front of body 3 [9.37%] cases, side of body 4 [12.37%] cases and 1 [3.12%] case back of body. These are consistent with other authors.8,10 Maximum number 13 [40.62%] of fracture ribs was noted in primary trunk impacts. Ribs usually affected were the 2nd to 10th Fractures were seen at three sites; front, back, and the posterior axillary lines. The inference drawn is that the ribs are fractured due to direct impact. The side of trunk impact can be found out from the sites of rib fracture. (Fig. 10)

Incidence of fracture of sternum 2 [6.25%] was seen in trunk impacts. Fracture of davicle and sternum were also seen associated with rib fracture. Sternal fractures were also associated with injuries to lungs 6 [18.75%] and heart in 1 cases. This could be due to compression of the organs between sternum and spine. Similar findings were made by authors.9-11

In leg primary impacts was seen in 12 [37.50%] cases of fall from buildings including feet/lower limb 7 [21.87%] cases, hand/upper limb b 3 [9.37%] cases and upper limb/lower limb 2 [6.25%] cases. Maximum number of fracture of femur was noted in primary leg impacts 4 [12.50%]. Similar observations are noted by authors.8-10 These findings are clearly indicative of primary leg impact; it could have been due to a direct impact. Fracture of calcaneum is an indication of feet impact. In leg impacts, cervical vertebrae were involved. This could be due to the transmission of forces through the vertebral column. (Table no. 2)

According to primary buttock impact, falls from trees were primary buttock impact which constituted 6.25%. Whereas in fall from buildings there was 1 case of buttock impact. These are consistent with other authors.8-9-11 Pelvic fractures were seen in 3 [9.37%] cases in buttock impacts. This is a very significant finding and the inference drawn is that fracture pelvis is a clear indication of buttock impact. (Table 3)

Pattern of injuries, wide range of injuries varying from soft tissue injuries to fracture of vault, base of skull along with intra cranial haemorrhages was found in majority of cases. Different
types of external injuries were noted in all types of primary impact. Head injury in primary impacts could have been due to secondary impact has been noted in 21 [65.62%] cases. Brain injury was noted in all cases associated with intracranial bleeding. The present study showed intra cranial haemorrhages in 21 [65.62%] cases. Subarachnoid haemorrhage was the commonest found in 18 [56.25%] cases. Subdural, and extradural haemorrhage was seen in 3 cases along with subdural, subarachnoid haemorrhages. These are consistent with authors.8-10

Among skull fractures, fissured fracture was more frequently found 18 [56.25%] followed by comminuted fracture 3 [9.37%]. This indicates the predominance of different fractures, where the victims of fall from height are thrown with great impact. Fissure fracture of the skull was noticed when the fall occurred on to concrete from minimum height of 3 feet and onto hard soil from the height of the 10 feet. Similar observations were made by authors.9-11

Fracture of spine, fracture spine was noted in primary impacts 7 [21.87%]. The region most affected was the cervical spine 5 [15.62%]. The cervical and upper thoracic spines were involved in primary head impacts; while lower thoracic and lumbar vertebrae were involved in primary trunk impacts. These are consistent with authors.8-10 (Table no. 5)

Fracture of humerus, ulna and radius were also seen in 7 [21.87%] cases. There was no correlation with the primary site of impact; however the incidence was more in primary trunk impacts. Same findings were made by authors.10,12

Femur of fracture was commonly seen in 4 cases with primary side impact while fractures of leg bones were seen in cases with primary impact. Same findings noted by authors.10,12 Fracture of facial bones [nasal, maxilla and mandible] was seen in 2 [6.25%] cases. Fracture and dislocation of teeth was observed in 2 [6.25%] cases. Similar results obtained by other studies.9,10

Associated external injuries to other systems were found in 9 [28.12%] cases. These included head injuries, both limbs and chest injuries with rib fractures. These are consistent with authors.9,12

According to abdomen and pelvis injuries, visceral injuries were seen in 19 [54.37%] cases. Irrespective of the nature of primary impact, various injuries to internal organs like lungs, heart, liver, spleen, intestines and urinary bladder are sustained only in cases of primary impact cases. Similar results were established by authors.9,11,13 Abdominal injuries such as intestine and mesentery injury seen in two cases. (Fig. 11)

Liver the organ which was most commonly involved in 7 [21.87%] cases and in 1 case the overlying ribs were fractured, laceration of liver was present on its under surface. These are similar to authors.9,11,13

Spleen showed multiple lacerations in 3 [9.37%] cases but fracture of the overlying ribs was not seen in these cases were damaged when height of fall was more than 20 feet onto hard surface. Similar findings are noted by authors.9-11 This finding indicative that damage to these internal organs was due to deceleration. Hence spleen was the most common organ involved by deceleration.

Maximum number 6 [18.75%] of lung injuries was in the group of trunk impacts. Same finding made by authors.10,12

Rupture of heart and diaphragm were seen in 1 [3.12%] case of fall from a height more than 60 feet. Deceleration injuries of heart and aorta were seen in primary and buttock impacts. These are consistent with authors.10-13

Injury to kidney was seen in one victim of buttock impact, it was associated with fracture of ribs. This finding indicate the injury to the kidney was a result of direct impact. Similar findings were noted by authors.11-13

Fracture of upper limbs were seen in 7 [21.87%] falls occurred on to concrete from height of 60 feet whereas the fracture of lower limb was found in 5 cases when the fall height was more than 15 feet on to hard surface. Similar observations were made by authors.10,13

In present study, we observed that the maximum numbers of falls 16 [50.00%] were from a height of 0-20feet. In 10 [31.25%] cases, the height of fall was 21-40 feet. The height of fall was below 41-60 feet in 3 [9.37%] cases. In the 61-80 feet range, there was only 1 case, which was head impact. No case was observed in the range of 51-60 feet height. One case was found in the range of 61-70 feet height. Height of fall varied from 20-70 feet. One fall from tree case was found in the range of 121-140 feet height. Height of fall varied from 20-70 feet. These are consistent with authors.9,10,15 Majority of cases of falls with primary impact were those which occurred from greater heights and also head injury and intracranial haemorrhages and brain parenchymal occurred in significant number of cases of side impact. The severity of injuries is dependent on the height of fall. The height of falls is a material factor in causing extensive injuries to head. This is evidenced by the presence of multiple severe injuries if the height of fall is more. (Table no.9.)

According to type of surface the body striking the ground, we observed that majority of the 29 [90.62%] cases falls were onto hard surface like cement/concrete, stone, hard soil and marble followed by 3 [9.37%] falls onto soft surface like sand and mud. These are consistent with authors.9,11,16 On a relatively yielding surface, the energy is given up slowly, but on a relatively unyielding surface such as hard soil, concrete, time deceleration is shorter and hence the forces on the body are much great. The nature of the surface onto which the victim falls and the degree to which the fall is broken on the way down modify the pattern and severity of injuries. (Table no. 6)

Multi organ involvement was noticed where the nature of ground was hard surface and isolated fatal injuries were hall mark of falls over the soft surface. Same observations were noted by authors.9,11,16

Fatalities occur primarily when a person fall from greater than 20 feet or when the head of victim hits a hard surface such as concrete, this includes falls from roofs, and terraces. These are consistent with authors.12,14,17

Multiple rib fractures, fracture of clavicle, and laceration of liver was noticed when the fall height was 60 feet on to concrete. Similar results were made by authors.9-11

According to base of building, in most of the cases the victims fell close to the building 30 [93.75%] within 1 meter from the base of the building. 2 cases were fall from tree with various distance from the main stem of the tree. Similar results were noted by authors.10,11,16 An attempt was also made to find out relation between the height of fall and horizontal distance but no definite link was seen.

Reasons for fall, inappropriate fencing/barrier on terrace was the most common reason behind accidental falls 22 [68.75%]. These are consistent with authors.17-19 Alcoholic intoxication, chronic illness with long term treatment,
psychiatric disorder, and dizziness, faulty equipment, intoxicating agents are other reasons. Lack of parental supervision of children while playing. The common risk factors and aetiology observed were lack of safety measures at work place/residence. (Fig.12)

As per manner of fall, most of 30 [93.75%] cases of fall from height including fall from buildings 28 [87.50%] and fall from tree 2 [6.25%] were accidental whereas 2 [6.25%] cases fall from buildings was suicidal in nature. Homicidal falls were not reported. The findings were same with authors. [19-21] Falls from a considerable height, usually from a building rooftop/terrace are common in suicide and in accidents, especially to children; deaths from a fall may be homicidal. (Table no.7)

As to the cause of death, cranio-cerebral damage was most common occurring in 21 [65.62%] cases. It is also observed that persons who died due to fall from lesser heights usually from 10-12 feet, head was commonly the site of primary impact and cranio-cerebral damage was the cause of death. Haemorrhagic shock was the cause of death in 10[31.25%] cases of primary impacts including feet, trunk, leg and buttock impacts. These were consistent with authors. [7,11,12] Our study had demonstrated that yet head trauma was the most common cause of death, the circumstance of fatal falls and the height of fall could be detected. (Table no.8)

RECOMMENDATIONS
Safety measures of residence like high parapet wall for the roof/building fenced with vertical bars and at the construction work place self-retracting life lines, locking snap hooks, head gear, rope grab, life line anchor, lanyard and shock absorber

CONCLUSION
Incidence of fall from height is 3.68%. The vulnerable age group is 21-50 years. Most of falls from buildings, victim married males, and male to female ratio is being 9:6. Majority of the victims were Hindu faith followers from urban area, gained primary education, belonged to low socioeconomic group. Maximum number of incidents takes place during afternoon, in summer months, at work place, among construction workers. In 48.07% cases the height of fall was 0-20 feet followed by 21-40 feet.

Primary head impact is the commonest type. Head was seen as the site of primary impact in most of the cases of falls from lesser heights 0-20 feet. Side of the body was seen as the site of primary impact in falls from greater heights 60-70 feet.

Abdominal and thoracic injuries were common when the fall was 21-40 feet with increasing in height, the limb injuries were noticed.

Multi-organ trauma was seen when fall was on to hard surface. Deceleration injuries involving the spleen, liver occurred with primary impact. Femur was involved with primary side impact cases. The common risk factors and aetiology observed. Most of falls were accidental, head injury is the most common cause of death. Both autopsy findings and medical, past history, the findings at the scene of fall and toxicology results have to be considered the circumstance.

Reasons for falls, lack of safety measures at work place, alcoholic intoxication, chronic illness with long term treatment, and dizziness. These injuries are potentially preventable by simple legislative measures and public awareness.

REFERENCES