

Forensic Medical Analysis of Fall From Height Cases Applied to Dicle University Medical Faculty Hospitals Between 2021-2022

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Özet

Objective: We evaluated the demographic data, trauma regions, bone fractures, hospitalization, first place to admission to hospital, fall places, fall heights, features of injuries according Turkish Penal Code of individuals who fell from heights.

Method: Six hundred twenty one individuals who have injuries after fall from heights were evaluated in the study. Our cases were received retrospectively in Diyarbakır over two years.

Results: The mean age was 20,29, %31,7 of patients were under 5 years old and %58,9 of patients were under 18 years, %5,3 of the cases occurred at the workplace, the most frequent month was august with %14,2, the most frequent season was summer with %38,7, %28,7 of the cases fall from distances below 5 m, the average height was 3,1 m, injuries from the cranium with %12,9, the mean bone fracture score was 1,58.

Conclusion: The results of this study in general were same with literature. Fall from heights were most frequently seen in children aged 2 years with %9,7 of cases, children under the age of 18 constitute %58,9 of the total cases and %5,3 of the cases are workplace accidents. Males had a higher rate of falls from height than females.

Anahtar Kelimeler: Diyarbakır, Falls from Heights, Injury, Fracture, Work Accidents

Introduction

In cases of injuries occurring as a result of forensic events, patients often apply to primary healthcare or emergency services, where general forensic examination reports are prepared by physicians. These reports typically include the patient's statement about how the trauma occurred, the area and type of lesions, and medical information such as internal organ injuries and bone fractures. In the conclusion section, legal articles related to the injuries are also documented ¹.

Falling from height ranks as the second most common cause of trauma after traffic accidents ². Injuries to the head, chest, abdomen, and extremities may occur in trauma cases due to falls from height. Depending on the severity of the injuries, outpatient treatment, observation, clinic admission, or surgery may be necessary.

Considering the traumas and injuries caused by falls from height, this issue represents a global public health problem due to its significant risk of disability and death. Many people are injured as a result of falls in workplaces or residential environments, particularly in high-rise buildings, due to carelessness and negligence. While treating these patients is essential, prioritizing preventive health services is of greater importance. Studies on falls from height provide crucial epidemiological information to inform both treatment strategies and preventive measures.

Efforts to prevent falls from height in our country include regulations on occupational health and safety, patient care plans for high-risk patients, and legal frameworks, as well as initiatives like the European Network for the Prevention of Falls in Europe (ProFaNE). These efforts aim to reduce the injury and mortality risks associated with falls.

In our study, the General Forensic Examination Reports of patients diagnosed with fall injuries who applied to Dicle University Faculty of Medicine Hospitals between 2021 and 2022 were analyzed. The objectives were to obtain data on the sociodemographic characteristics of the cases, the areas of injury, the clinical treatment processes, and the legal outcomes based on the relevant articles. Additionally, the study aimed to highlight key issues for forensic medicine and emergency experts and contribute to the literature on preventing falls from height due to their associated morbidity and mortality risks.

Materials and Methods

This study was conducted with the approval of the Dicle University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee. A total of 620 cases that applied to the Dicle University Faculty of Medicine Emergency Service between 2021 and 2022 and had General Forensic Examination Forms issued were evaluated. All patients were initially assessed by the emergency department.

Detailed data were collected from forensic examination forms and hospital records, including trauma area, presence and number of fractures, internal organ injuries, hospitalization details (e.g., intensive care unit admission, number of days hospitalized), surgeries performed, the first application center, legal articles mentioned in the Turkish Penal Code, place of injury, and the average fall height.

Additionally, demographic data (e.g., gender and age), specific injuries (e.g., types of thoracic injuries such as hemothorax, pneumothorax, and lung parenchymal injuries), vertebral fracture areas, and intracranial lesion types were evaluated.

The climate in Diyarbakır is extremely hot during the summer months, with temperatures ranging from 39°C to 47°C. Due to the discomfort of staying indoors, people in this region often prefer eating, drinking, and sleeping on flat-roofed houses, particularly between March and September. Consequently, falls from flat-roofed houses are a significant cause of serious injuries in Diyarbakır. Occupational accidents related to falls from height were specifically evaluated in our study. Individuals who were referred from another trauma center or left another center without permission and later applied to our center were included in the analysis. However, individuals who declined observation or refused treatment after the initial intervention were excluded.

Statistical Analysis

The data collected from the cases were entered into a Microsoft Office Excel file and digitally coded. Statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) version 21.0. Frequency tables were used for percentage values. Student's t-test was applied for parameter comparisons, and the chi-square test was used for absolute number comparisons. Pearson's correlation test was used to examine relationships between variables. A p-value of less than 0.05 was considered statistically significant..

Results

Among 620 cases, it was determined that 430 were male and 190 were female. The male-to-female ratio was calculated as 69.4% male and 30.6% female. The average age of the cases was 20.29 years, with the youngest being 1 year old and the oldest 89 years. The average age was found to be 16.25 years for females and 22.71 years for males, indicating a statistically significant difference between genders ($p=0.000$).

The average falling height for females was 3.01 meters, while for males, it was 3.15 meters. Men fell from a slightly greater height than women on average.

The highest number of cases was observed in 2-year-old children (9.7%, 60 cases), followed by 3-year-olds (9.5%, 59 cases). The proportion of cases involving children aged 5 and under was the highest, accounting for 31.7% (196 cases). The number of cases under the age of 18 constituted 58.9% (365 cases) of the total.

When categorized by the location of falls, workplace incidents accounted for 5.3% (33 cases). Seasonally, falls were most common in summer (38.7%, 240 cases), followed by spring (22.9%, 142 cases), winter (19.7%, 122 cases), and autumn (18.7%, 116 cases).

Regarding the initial point of medical care, 49.4% (306 cases) were first admitted to the University Hospital, 7.3% (45 cases) to the Provincial State Hospital, and 43.1% (267 cases) to the District State Hospital. Additionally, 2% of the cases were referred from abroad.

Falls below 5 meters were recorded in 28.7% (178 cases), while 4.7% (29 cases) involved falls above 5 meters. No information on the height of the fall was available for 413 cases.

Trauma and Injury Patterns

Trauma and injury patterns were classified based on the affected regions. Cranial trauma was observed in 28.9% of cases (179 cases), with an average falling height of 2.64 meters. Thoracic trauma occurred in 7.6% of cases (47 cases), with an average falling height of 3.52 meters. Abdominal, pelvic, and lumbar trauma were detected in 7.9% of cases (49 cases), with an average falling height of 2.94 meters. Lower and upper extremity trauma occurred in 12.6% of cases (78 cases), with an average falling height of 3.00 meters. Trauma affecting two regions was found in 21.5% of cases (133 cases), with an average falling height of 3.08 meters, while trauma affecting three regions occurred in 8.9% of cases (55 cases), with an average falling height of 4.44 meters. No statistically significant correlation was identified between the average falling height and the specific trauma region.

Fractures were observed in 41.9% of cases (260 cases), while 58.1% (360 cases) did not involve fractures. The average number of fractures was higher in females (0.93) compared to males (0.86); however, this difference was not statistically significant. Fractures were distributed across various body regions, with cranial fractures detected in 12.9% of cases (80 cases), thoracic fractures in 4.87% (30 cases), fractures in the abdominal, pelvic, and lumbar regions in 3.5% (22 cases), and fractures in the lower or upper extremities in 11.9% (74 cases). Fractures affecting two regions were found in 7.6% of cases (47 cases), and fractures in three regions were observed in 1.9% (12 cases).

Specific fracture types included linear skull fractures in 8.7% of cases (54 cases), skull collapse fractures in 1.8% (11 cases), cervical vertebra fractures in 0.3% (2 cases), and lumbar vertebra fractures in 5.6% (35 cases). The average falling height varied by fracture location, with cranial fractures occurring at an average height of 2.95 meters, thoracic fractures at 4.31 meters, fractures in the abdominal, pelvic, and lumbar regions at 3.57 meters, and fractures in the lower or upper extremities at 2.83 meters. Fractures affecting two regions were associated with an average falling

height of 4.43 meters, while fractures in three regions occurred at an average height of 3.00 meters. No statistically significant correlation was found between falling height and the fracture location. Other injuries were identified, including subarachnoid bleeding in 1.1% of cases (7 cases), epidural bleeding in 1.3% (8 cases), and subdural bleeding in 1.8% (11 cases). Thoracic injuries were noted in 12.1% of cases (75 cases), encompassing thoracic vertebra fractures in 4.7% (29 cases), rib fractures in 3.5% (22 cases), parenchymal lung damage in 1.6% (10 cases), contusion in 3.1% (19 cases), laceration in 0.3% (2 cases), pneumothorax in 3.5% (22 cases), and hemothorax in 1.6% (10 cases). Abdominal injuries were found in 1.1% of cases (7 cases), with liver injuries in 0.8% (5 cases) and spleen injuries in 0.3% (2 cases). No injuries to the kidneys, bladder, small intestine, or large intestine were detected.

Clinical outcomes revealed that 10.6% of cases (66 cases) required hospitalization, with 1.3% (8 cases) requiring intensive care. Surgery was performed in 6.6% of cases (41 cases). One case resulted in death due to complications from the fall.

Workplace-related falls accounted for 5.3% (33 cases), with 32 involving males and one involving a female. Most workplace accidents occurred in summer (36.4%, 12 cases), followed by winter (27.3%, 9 cases), and spring and autumn (18.2%, 6 cases each). No statistically significant correlation was found between workplace accidents and seasons.

Discussion:

Traumas due to falls from height are in the second place in the etiology of blunt traumas, after traumas due to traffic accidents all over the world. It has an important place in forensic medicine practice due to the frequency of trauma and also its legal importance. While traffic accidents are the most common cause of trauma with a frequency of 60-66%, falls from height are around 20%, assault is around 8%, cutting and penetrating injuries are around 6-8%, and lastly, gunshot injuries are around 4%³.

Falls from height are frequently diagnosed in emergency department admissions due to traumatic reasons⁴. While it mostly occurs due to accidents in children; In adults, suicide may occur as a result of an accident or being pushed. The characteristics and severity of injuries are affected by the height from which one falls, the characteristics of the ground from which one falls, the part of the body where the impact occurs, body weight, and the age of the patient. Injury characteristics may differ in adults and pediatric age groups. In falls from the same distance, children under the age of three are less injured than those above. It is thought that the reason for this is that younger children have a skeleton rich in fat and cartilage tissue⁵.

Similar to other studies in our study, mostly minor injuries were observed in children falling from low distances (such as contusion, abrasion and laceration) ⁷.

In a study conducted according to injury types; It was found that the rate of chest, abdomen and brain injuries was low, and as the height increased, chest, abdomen and extremity injuries and head traumas increased ⁷. Similar findings were also described in the study of Gupta et al., in which 63 people fell. This study showed that fatal injuries increase with ⁸ our study, it was determined that the heights that could not be eliminated with simple medical intervention were 3.29 m, and the average heights that were life-threatening were 3.42 m. These findings are similar to the studies of Yağmur et al. and Al et al ^{7,8}.

One of the features affecting the body part affected by injuries occurring in falls from a height and the type of injury is the distance of the fall from a height. It has been observed that mortality rates are stated in reference books depending on the distance of falling from height. ¹⁰.

In a study, the average falling height distance was 4m ¹¹. In another study, the average falling distance was 7.2 m ¹². In our study, the average falling height distance was 3.1 m.

Of the 620 cases whose data series were examined in our study; It was determined that 430 of them were men and 190 were women; It was observed that women were followed proportionally by 30.6%, followed by men by 69.4%. While it was observed in Kingma's study that women were more affected than men ¹¹, in the majority of studies, it was observed that men were more affected than women ^{9, 14,15, 16}.

Studies have shown that the percentage of men over women is 60-70%. ^{3,5, 14,15, 16,17,18,19}. In our study, the male to female ratio was found to be close to many studies in the literature. Studies show that the proportion of men is high; It was thought to be due to the high physical activity intensity in the pediatric age population and the higher percentage of men working in relatively risky workplaces in the adult age group.

According to the findings obtained from the data series, the average age in our study was found to be 20.29. The minimum application age is 1 year and the highest application age is recorded as 89 years. In a study revealing the relationship between regional injuries and fall height distances, it was found to be 44.7 years ¹⁸. In a study examining the relationship between height and origin with specific skeletal fractures, it was found to be 55 years (13), and in another study on fatal falls from height and injury patterns, it was found to be 43.5 years ¹⁹.

In our study, the number of applications in the first decade was 301 out of 620 cases, in the second decade 78, in the third decade 77, in the fourth decade 67, in the 5th decade 39, in the sixth decade 26, in the seventh decade 21, and in the eighth decade 10 cases. In the study conducted by Kingma,

covering the years 1990-1997, evaluating the applications made to the emergency departments of Gröningen University; It was determined that 64% of falls occurred between the ages of 10 and 59¹³. In a study conducted in Benin, the origins of death were investigated; It has been stated that accidents come first, and falls from construction due to work accidents come first among accidents^{8,10}.

In our study, the rate of workplace accidents was found to be 5.3%, and it was determined that there were 33 workplace accidents out of 620 cases. Considering that the pediatric population constituted approximately 58.9 percent of the cases in our study, the rate of workplace accidents was found to be lower than other studies.

While this difference between the studies can be interpreted as the origin being more related to work accidents, especially in provinces such as industry and shipyards, where occupational accidents due to falls from height are common, it should also be taken into consideration that most of the studies are postmortem autopsy studies. It should be taken into consideration that falls from roofs are common in the Southeastern Anatolia Region of our country or in geographies with similar climatic conditions, such as India, due to the habit of sleeping on roofs⁹.

In the biomechanics of falls from a height, the area affected by the trauma, the injuries that occur as a result of the spread of the force created by the traumatic effect, and the injury areas shape the vital importance and medical intervention of the injury that occurs in the person.

In Bruno's study of falls from height, which evaluated suicide-related deaths; The rib cage (92%), lungs (76%), heart (53%) and liver (58%) were stated as the most injured areas and organs. In our study, the areas exposed to trauma and the areas where the injury occurred categorized as head-neck, thorax, abdomen-pelvis-lumbar, upper or lower extremities, two separate areas, three or more than three injured areas.

In classification according to the region where the trauma is applied; the number of cases in which the cranium was exposed to traumatic impact was 179 with a percentage of 28.9%, the thorax was 46 cases with a percentage of 7.6%, the number of cases in the abdomen, pelvis and lumbar region was 49 cases with a percentage of 7.9%, the lower or upper extremity was 78 cases, the two regions were 21%. It was determined that there were 133 cases with a percentage of .5, and three regions had 55 cases with a percentage of 8.9%.

In Lapostolle's study in France; It was determined that the head, thorax and side areas were the first areas to contact the ground with a rate of 44%²¹.

In our study, 159 cases with a percentage of 25.6% were injured in the cranium, 45 cases with a percentage of 7.3% were injured in the thorax, 83 cases with a percentage of 5.3% were injured in the abdomen-pelvis-lumbar region, 80 cases with a percentage of 12.9% were injured in the lower or

upper extremities, % It was determined that 61 cases were injured in two regions, with a percentage of 9.8%, and 24 cases were injured in 3 regions, with a percentage of 3.9%.

According to Bruno's study, head trauma is the most common, followed by chest, abdomen and extremity trauma ²².

In a study conducted by Kingma at the University of Gröningen, 30% of the injuries were seen in the lower extremity and 30% in the upper extremity ¹³.

In a study conducted in Germany, the most common injuries were found to be in the thorax, followed by the extremities and then the cranium ²³.

In our study, the frequency of exposure to traumatic effects and the frequency of injury to the cranium, thorax, abdomen, pelvis, lumbar region, upper or lower extremities, two separate regions, three or more regions were affected by distance changes, and the frequency of injury increased as the distance increased. In Atanasijevic's study revealing the relationship between injury frequency and distance; the results were found to be compatible with the hypothesis, and it was determined that the frequency of head and thorax injuries increased with distance. The relationship between abdominal injuries and height has not been determined ²⁰.

In our study, no statistically significant difference was found between average height and bone fracture areas. In Petaros's study examining the relationship between height and fractures, it was revealed that there is a significant statistical relationship between many body fractures and height, except head and shoulder regions. In the study, it was stated that there was a positive correlation between height and extremity fractures, and in head traumas, head fractures occurred at lower heights. In our study, the regions where fractures occurred were; Among 620 cases, fractures were observed in the cranium in 80 cases with a percentage of 12.9%, in the thorax in 30 cases with a percentage of 4.87%, in the abdomen-pelvis-lumbar region with a percentage of 3.5% in 22 cases, and in the lower or upper extremities in 74 cases with a percentage of 11.9%. In Petaros's study, rib cage fractures were the most common at 73%, followed by spine fractures at 40%, lower extremity at 37%, upper extremity at 32% and pelvis fractures at 28%. In another study, rib fractures were found in 92%, sternum fractures in 46%, and clavicle fractures in 19% ²².

In our study, it was found that the number of linear skull fractures was 8.7% with 54 cases, collapse fractures were seen in 11 cases with a rate of 1.8%, and cervical vertebra fractures were seen in 2 cases with a percentage of 0.3%. It was determined that there was subarachnoid bleeding in 7 of the cases (1.1%), epidural bleeding in 8 cases (1.3%), and subdural bleeding in 11 cases (1.8%). In a study, it was recorded that 70% of all skull fractures occurring below 10 meters were linear fractures, 28% were temporal fractures, and 27% were parietal fractures ¹⁵.

In a study, logistic regression analyzes were conducted between height and body parts; It has been shown that there is a significant relationship between height and fracture in many body regions¹⁵. In our study, no statistically significant difference was found between average height and bone fracture areas. However, a correlation was found between average height and number of days of hospitalization.

In a study, fractures and the number of regions where they are located were classified; fractures were found in 36 cases in 1 region, 53 cases in 2 regions, 40 cases in 3 regions, 35 cases in 4 regions, 13 cases in 5 regions, and 1 case in 7 regions¹³. In our study, it was determined that 1 fracture occurred in 144 cases, with the highest percentage of 23.1%.

Liver is the most commonly injured solid abdominal organ in all blunt injuries^{22,24}. Injuries to the stomach and intestines are less common due to their ability to move within the abdomen. It is thought that the presence of kidney injuries in the retroperitoneal area and the presence of a thick fatty capsular structure have a protective cushion effect²³. In our study, the most frequently injured organ was the lung in 63 cases with a percentage of 10.1%, followed by the liver in 5 cases, which is the most frequently injured internal organ with a percentage of 0.8%, and the spleen in 2 cases with a percentage of 0.3%. No kidney, bladder, small intestine, large intestine injuries were detected. In a study, it was recorded that the lung (76%) was the most frequently injured organ, while the liver (58%), spleen (36%), and kidney (28%) were injured²⁴. In the studies, the most frequently injured organ was the lung, the most frequently injured organ. It was determined that the most frequently injured internal organ is the liver, and the same results were obtained in our study.

Conclusion

Falls from heights are an important global public health problem in terms of preventable trauma due to lack of attention and negligent behavior. Of the 620 cases, 430 were male and 190 were female, and the average age at presentation was 20.29. It is most frequently seen in children aged 2 years with 9.7% of 60 cases, children under the age of 18 constitute 58.9% of the total cases, and 5.3% of the cases are workplace accidents. 413 cases fell distance Information was not recorded. 28.7% of the cases fell from a distance of less than 5 meters. The most commonly injured organ is the lung. Hospitalization was required in 10.6% of the cases. Surgery was performed on 6.6%. It has been determined that the overwhelming majority of workplace accident victims are men, in 32 out of 33 accidents the victims are men, and workplace accidents occur most frequently in the summer season.

References

1. **Ersoy S, Sonmez BM, Yilmaz F, Kavalci C, Ozturk D, Altinbilek E, et al.** Analysis and injury patterns of walnut tree falls in central anatolia of turkey. *World J Emerg Surg.* 2014;1-5
2. **Saukko P, Knight B.** The Pathology of Wounds. (Saukko P, Knight B. Ed.) *Knight's Forensic Pathology*, 2016; 133-166.
3. **Yavuz YO, Yıldırım H.** Acil serviste hikaye ve fizik muayene: travma hastasına yaklaşım. *Türkiye Klinikleri J. Orthop and Traumatol-Special Topics* 2010; 3:10- 15.
4. **Sever M.** Evaluation of patient characteristics and outcome in fall from height. *Akademik Acil Tıp Dergisi* 2009; 8:25-30.
5. **Beale JP, Wyatt JP, Beard D, Busuttil A, Graham CA.** A five year study of high falls in Edinburgh. *Injury* 2000; 8:31
6. **Meller JL, Shermeta DW.** Falls in urban children. A problem revisited. *Am J Dis Child* 1987; 141:1271.
7. **Al B, Yıldırım C, Çoban S.** Falls from heights in and around the city of Batman. *Ulus Travma Acil Cerrahisi Dergisi* 2009;15:141-147.
8. **Gupta SM, Chandra J, Dogra TD.** Blunt force lesions related to the heights of a fall. *Am J Forensic Med Pathology* 1982; 3: 35-43.
9. **Yağmur Y, Gülloğlu C, Aldemir M, Orak M.** Falls from flat roofed houses: a surgical experience of 1643 patients. *İnjury* 2004; 35: 425-428.
10. **Buckman RF, Buckman PD.** Vertical deceleration trauma: principles of management. *Surg Clin N Am.* 1991; 71: 331:44.
11. **Aufmkolk M, Voggenreiter G, Majetschak M, Neudeck F, Schmit-Neuerburg KP, Obertacke U.** Injuries due to falls from a great height. A comparative analysis of injuries and their outcome following suicide-related and accidental falls. *Unfallchirurg.*1999; 102-525.
12. **Richter D, Hahn MP, Ostermann PA, Muhr G.** Injury pattern after fall from great height. An analysis of 101 cases. *Unfallchirurg.* 1995; 13: 609.
13. **Kingma J, Ten Duis HJ.** Severity of injuries due to accidental fall across the life span: a retrospective hospital-based study. *Percept Mot Skills.* 2000; 62-72.
14. **İçer M, Güloğlu C, Orak M, Üstündağ M.** Factors affecting mortality caused by falls from height *Ulus Travma Acil Cerr Derg*, November 2013; 529-535.
15. **Petaros A, Slaus M, Coklo M, Sosa I, Cengija M, Bosnar A.** Retrospective analysis of free-fall fractures with regard to height and cause of fall. *Forensic Science International*, 2013; 290-295.
16. **Gören S, Subaşı M, Tıraşçı Y, Gürkan F.** Fatal falls from heights in and around Diyarbakir, Turkey. *Forensic Science International* 2003, 37–40.
17. **Magdalena E. Kusior, Katarzyna Pejka, Michał Knapik, Nadja Sajuk, Szymon Kłaptocz, Tomasz Konopka.** Analysis of the nature of injuries in victims of fall from height. *Archives of Forensic Medicine and Criminology*, 2017; 106-124.
18. **Guzel A, Karasalihoğlu S, Kucukuğurluoğlu Y.** Çocuk acil unitemize düşme nedeniyle başvuran travma olgularının değerlendirilmesi. *Ulus Travma Acil Cerrahi Derg* 2007; 211-216.
19. **Obeid NR et al.** Fatal Falls in New York City An Autopsy Analysis of Injury Patterns. *Am J Forensic Med Pathol* 2016; 80-85.
20. **Atanasijevic TC, Savic SN, Nikolic SD, Djoki VM.** Frequency and severity of injuries in correlation with the height of fall. *J Forensic Sci.* 2005, 608.

- 21. Lapostolle, Frédéric MD; Gere, Christophe MD; Borron, Stephen W. MD; Petrovic, Tomislav MD; Dallemagne, Frédéric MD; Beruben, Arielle MD; Lapandry, Claude MD; Adnet, Frédéric MD, PhD.** Prognostic factors in victims of falls from height. *Critical Care Medicine*, 2005; 1239-1242.
- 22. Bruno CM et al.** The Injury Pattern in Fatal Suicidal Falls From A Height: An Examination of 307 Cases. *Forensic Science International* 2014; 57-62.
- 23. Thierauf A, PreuB J, Lignitz E, Madea B.** Retrospective analysis of fatal falls. *Forensic Science International* 2010; 92-96.
- 24. Simonsen J.** Injuries Sustained from High-Velocity impact with Water After Jumps From High Bridges: a Preliminary Report of 10 Cases. *Am. J. Forensic Med. Pathol.* 1983; 139-142.
- 25. Gennarelli TA, Wodzin E.** AIS 2005: A contemporary injury scale. *Injury, Int. J. Care Injured* 2006; 1083–1091.
- 26. E.E. Turk, M. Tsokos,** Pathologic features of fatal falls from height, *Am. J. Forensic Med. Pathol.* 2004; 194–199.