Falls from heights in and around the city of Batman

Batman ve çevresinde yüksekten düşmeler

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BACKGROUND
We evaluated the demographic data, mortality rates, fall causes, and post-mortem findings of individuals who fell from heights.

METHODS
Five hundred thirty-eight patients who sustained injuries after an accidental fall from heights were entered into the study. Our cases were collected prospectively in Batman over a seven-month period.

RESULTS
The mean age was 12.4±3.22 years (3 months-98 years); 56.5% of patients were under 6 years old and 83.5% were under 20 years old. The mean fall height was 3.2±2.4 m. The mortality rate was 2.2%, and was highest among the patients who fell from flat-roofed houses. The most common injuries were to the head, and 100% of those who died had a head injury. Six patients were followed because of abdominal bleeding and 141 patients due to extremity fractures; 6.7% of patients were operated on and 83.8% of patients were treated in the emergency department.

CONCLUSION
The results of this study were at variance with literature data with respect to the following: falls from heights were most common in the 0-5 years of age group. Craniocerebral trauma is the most common injury in fatal falls. Males had a higher rate of falls from height than females.

Key Words: Balcony; Batman; falls; flat-roofed house; fracture; injury; mortality; stairs.

AMAÇ
Yüksekten düşenlerin demografik bilgileri, mortalite oranları, düşme nedenleri ve ölüm sonrası bulguları değerlendirildi.

GEREÇ VE YÖNTEM
Bu çalışmaya, kaza sonucu yüksekten düşmeye maruz kalan 538 hasta alındı. Olgular Batman'da yedi ay içerisinde prospektif olarak derlendi.

BULGULAR
Ortalama yaş 12,4±3,22 yıl (dağılım 3 ay-98 yıl) idi. Hastaların %56,5'i altı yaş altı, %83,5'i de 20 yaşından küçük idi. Ortalama düşme yüksekliği 3,2±2,4 m olarak saptandı. Mortalite oranı %2,2 bulundu. Mortalite oranı damdan düşenlerde en yüksek idi. En çok yaralanma kafada meydana gelmişti ve ölenlerin tamamında (%100) kafa yaralanması vardı. Altı hasta karın kanaması nedeniyle, 141 hasta da ekstremite kırıkları nedeni ile takip edildi. Hastaların %6,7'si ameliyat edildi; %83,8'i acil serviste tedavi edildi.

SONUÇ
Bu çalışmanın sonuçları literatür bilgileri arasında uyuşmazlık yoktu. Yüksekten düşmeler en fazla 0-5 yaş grubu olanlarda meydana gelmişti. Kranyoserebral travma ölümcül düşmelerin en yaygın yaralanması idi. Erkeklerde yüksekte düşme oranları kadınlara göre daha yüksek bulundu.

Anahtar Sözcükler: Balkon; Batman; düşmeler; ev damı; kırık; yaralanma; ölüm; merdiven.

Falls are a leading cause of injury in the United States, second only to motor vehicle crashes.[1] Falls from height are predominantly an urban phenomenon and represent an important form of blunt trauma.[2] The majority of falls were from balconies or rooftops due to the tendency of people to sit and sleep in these areas during the hotter months of the year.[3] High free falls are either the result of an accidental event or are a commonly used method of committing suicide; some cases of homicide are also known to occur.[4-9] Falls from flat-roofed houses are the second leading cause of death from accidental

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injury in the southeast region of Turkey after motor vehicle-related injuries, and accounted for more than 117 deaths (33.7% of 329 traumatic deaths) during 1997 among persons of all ages, 85 of whom were under 20 years. Among children under 10 years old, a fall was the most common reason for accidental death, accounting for 62 out of 96 such deaths in 1997.[10] Previous studies have shown that the most serious fall-related injuries occur in children and the elderly, although falls are also a common source of injury for younger adults.[11] Injuries that are most common include upper and lower extremity fractures, spinal fracture and head injuries.[1] The most common injury in falls from heights is to the head.[12] Victims had a complex of multiple injuries that required resuscitation and surgical management. Falls are the leading cause of non-fatal injury in the United States, accounting for several hundred thousand hospitalizations annually and for almost 9 million persons treated in emergency departments (EDs) who do not require hospitalization.[13] There are many published reports about injuries caused by falls from heights.[14-28] Falls from heights remain an important cause of morbidity and mortality, and our purpose herein was to describe our experience with such patients seen in our institution over a seven-month period. In this study, we evaluated the demographic data, mortality rates, fall causes, and post-mortem findings of individuals who fell from a range of heights.

MATERIALS AND METHODS

Data on 538 patients in Batman who sustained injuries after falling accidentally from heights during the period March 2007 and September 2007 and were treated at Batman State Hospital ED were analyzed prospectively, and such patients were entered consecutively into the study. All the patients were seen in the ED. All were resuscitated according to Advanced Trauma Life Support Program (ATLS) principles and underwent diagnostic and therapeutic procedures according to existing protocols. Detailed information on the injuries (height of fall, collision surface, collision area of the body, reason for fall) was collected from the patients, paramedics and any witnesses. The patient's age, height of the fall, presence of injuries to the extremities, abdomen, chest and pelvis, and the mortality rate were recorded, as were the initial Glasgow Coma Scale (GCS), Injury Severity Score (ISS) and Pediatric Trauma Score (PTS).

An ISS of 15 or less for minor trauma and of 16 or more for major trauma were proposed as triage criteria.[29] PTS scores of less than or equal to 8 represented the more severely injured children and PTS scores of 9-12 the less severe cases.[19]

We conducted a prospective observational chart review at the regional level I trauma center in Batman. The hospital serves as a secondary care referral facility and level I trauma center for an estimated population of 800,000. Most patients with significant injuries would be expected to present or be referred to the center.

The climate is very hot (range: 39-47°C) in Batman, especially in summer months. It is difficult to stay and sleep indoors, so people prefer eating, drinking and sleeping atop flat-roofed houses. The flat-roofed house serves as the second residence of people in Batman from the end of March until the end of September, which explains the higher incidence of severe falls from flat-roofed houses in this area.

The patients were followed until discharge; data on the injuries, diagnostic and therapeutic interventions, hospital course and outcome were collected. Follow-up was by direct contact with the patient or family. The cause of death was obtained from the autopsy report or death certificate. When available, we corresponded with the hospital and physician caring for the patient at the time of death.

For the statistical analysis, SPSS 15.0 for Windows computer software was used. Student's t-test was used to compare the parameters and chi-square test was used to compare absolute numbers. The comparison between the variables was made using Pearson's correlation test. $p<0.05$ was considered as statistically significant.

In the present study, we separated the falls in four groups as follows: 1) from flat-roofed houses, 2) from balconies, 3) from stairs, and 4) from other/simple falls (chairs, donkeys/horses, elevator shafts, rock cliffs, bunk beds/berths, and cribs).

Patients who were dispatched to another trauma center, who died before admission to the ED, who had a doubtful history of fall from height, who were treated at another hospital due to fall from height before admission to our ED (there are 5 hospitals in Batman), who did not want to be observed in the ED after their first treatment, and who rejected the treatment were not included in the study.

RESULTS

Gender and age distribution

A total of 538 consecutive fall victims (178 females, 360 males) were entered into the study. All had suffered an apparently accidental fall from height (subsequently a small proportion of falls were attributed to suicidal intent; n=3); the majority of them (78.6%) had landed on concrete or pavement. The mean height of these accidental falls was 3.2±2.4 m (1-20 m). The mean age of the entire patient group was 12.4±3.22 years (range: 3 months-98 years); 56.5% were under 6 years old, 70.3% under 10 years old, 83.5% under 20 years old and 90.0% under 60 years old (Table 1). Fifty-four patients were older than 60 years. Males and children showed a greater tendency to fall from height. It was statistically significant for women (p=0.003) to fall from stairs and for patients under 10 years old (p=0.041) to fall from flat-roofed houses.

Time and causes of falls

Patients most commonly (41.8%) fell from flat-roofed houses, followed by stairs (22.3%), simple falls (21.4%) and falls from balconies (14.5%). Most falls from height were due to the tendency of people to sit, sleep and eat on flat-roofed houses, balconies and stairs during the hotter months of the year. The causes of simple falls included chairs (8.7%), donkeys/horses (7.0%), elevator shafts (5.2%), rock cliffs (4.3%), bunk beds/berths (45.2%), and cribs (29.6%). 72.1% of patients had fallen between 06.00 a.m.-12.00 p.m., 19.2% between 12.00 p.m-24.00 p.m. and 8.7% between 24.00 p.m.-06.00 a.m. Even though most (75.1%) children (under 10 years old) fell in the early morning, the majority (68.5%) of older patients (older than 60 years) fell at midnight. Children began to wake up and get out of bed at 06.00 a.m., and began playing on the flat-roofs, balconies and stairs; thus, most of the victims fell in the early morning. Older patients, on the other hand, fell when they went to the toilet or woke up to drink water in the middle of the night. The mean time between falls from height and admission to the ED was 40 minutes (20 min-4 hours). Most of the patients (58%) had fallen in May-July (n=312); these months are the hottest in the Batman region (range: 39-47°C). The greater the temperature, the more people prefer sleeping on the flat-roofed houses, and on balconies and stairs in Batman. Falls tend to cluster then because people are more likely to sleep in these places when the temperature is high, and children are more likely to play there.

Injuries

The most common injuries overall were to the head (28.2%). The most frequent fracture in cranial bone was linear (n=114). Forty-five patients had a parietal linear fracture, followed by frontal (30 patients), occipital (24 patients) and temporal (15 patients) bones. In 17 patients, the fracture in cranial bones was a collapsing fracture. Furthermore, 4 patients had nasal fracture, 3 mandibular, 2 maxillary, and 2 orbital fracture (Table 2). Associated intracranial injuries were common, and mortality incidence was high in this group and was statistically significant. Intracranial injuries included epidural hematoma (n=31, p=0.000), subdural hematoma (n=5, p=0.000), intracerebral hematoma (n=2, p=0.831), cerebral contusion (n=8, p=0.000), cerebral edema (n=15, p=0.237), subarachnoid hemorrhage (n=9, p=0.000) and pneumocephali (n=5, p=0.007). In 2 patients, epidural hematoma occurred 24 hours after the fall from height. The proportion of intracranial events and mortality rate were higher among the patients who fell from flat-roofed houses and it was statistically significant (p=0.002).

Table 1. The distribution of gender, age, and mortality

	Rooftops n (%)	Balconies n (%)	Stairs n (%)	Simple falls n (%)	Total n (%)
Gender					
Female	66 (12.27)	22 (4.09)	53 (9.85)	37 (6.88)	178 (33.09)
Male	159 (29.55)	56 (10.41)	67 (12.45)	78 (14.49)	360 (66.91)
Age					
0-5	117 (21.75)	57 (10.59)	63 (11.71)	67 (12.45)	304 (56.50)
6-9	39 (7.24)	10 (1.86)	14 (2.60)	11 (2.04)	74 (13.75)
10-19	35 (6.51)	5 (0.93)	15 (2.79)	16 (2.97)	71 (13.20)
20-59	12 (2.23)	1 (0.19)	13 (2.41)	9 (1.67)	35 (6.50)
>60	22 (4.09)	5 (0.93)	15 (2.79)	12 (2.23)	54 (10.04)

Table 2. The distribution of injuries and mortality due to falls from heights

Injuries	Rooftops n (%)	Balconies n (%)	Stairs n (%)	Simple falls n (%)	Total n (%)
Head					
Linear f.	63 (11.71)	18 (3.35)	20 (3.71)	13 (2.41)	114 (21.18)
Collapsing f.	15 (2.79)	2 (0.37)	0	0	17 (3.16)
Epidural h.	19 (3.53)	5 (0.93)	5 (0.93)	2 (0.37)	31 (5.76)
Subdural h.	4 (0.74)	0	1 (0.19)	0	5 (0.92)
Subarachnoid h.	5 (0.92)	2 (0.37)	1 (0.19)	1 (0.19)	9 (1.67)
Cerebral contusion	4 (0.74)	3 (0.55)	0	1 (0.19)	8 (1.48)
Cerebral edema	6 (1.12)	2 (0.37)	5 (0.93)	2 (0.37)	15 (2.79)
Intracerebral h.	1 (0.19)	0	0	1 (0.19)	2 (0.37)
Pneumocephali	5 (0.93)	0	0	0	5 (0.93)
Maxillary f.	2 (0.37)	0	0	0	2 (0.37)
Mandibular f.	3 (0.56)	0	0	0	3 (0.56)
Nasal f.	4 (0.74)	0	0	0	4 (0.74)
Orbital f.	1 (0.19)	0	1 (0.19)	0	2 (0.37)
Thorax					
Hemothorax	1 (0.19)	0	2 (0.37)	0	3 (0.56)
Pneumothorax	2 (0.37)	0	2 (0.37)	0	4 (0.74)
Rib f.	3 (0.56)	0	2 (0.37)	1 (0.19)	6 (1.12)
Clavicula f.	1 (0.19)	0	1 (0.19)	3 (0.56)	5 (0.92)
Abdomen					
Splenic l.	2 (0.37)	0	0	0	2 (0.37)
Liver l.	3 (0.56)	0	0	0	3 (05.6)
Renal l.	1 (0.19)	0	0	0	1 (0.19)
Extremities					
Humerus f.	7 (1.30)	3 (0.56)	2 (0.37)	6 (1.12)	18 (3.35)
Radius f.	22 (4.09)	4 (0.74)	10 (1.86)	22 (4.09)	58 (10.78)
Ulna f.	10 (1.86)	2 (0.37)	4 (0.74)	6 (1.12)	22 (4.09)
Femur f.	8 (1.49)	2 (0.37)	1 (0.19)	4 (0.74)	15 (2.79)
Tibia f.	5 (0.92)	1 (0.19)	1 (0.19)	2 (0.37)	9 (1.67)
Fibula f.	1 (0.19)	1 (0.19)	2 (0.37)	0	4 (0.74)
Calcaneus	5 (0.9)	0	1 (0.2)	0	6 (1.1)
Metatarsal	3 (0.56)	0	1 (0.19)	2 (0.37)	5 (0.92)
Metacarpal	3 (0.56)	0	0	1 (0.19)	4 (0.74)
Pelvis f.	1 (0.19)	0	0	0	1 (0.19)
Spinal					
Cervical	4 (0.74)	0	1 (0.19)	0	5 (0.92)
Thoracal	1 (0.19)	0	0	0	1 (0.19)
Lumbar	3 (0.56)	0	2 (0.37)	0	5 (0.92)
Exitus	9 (1.67)	1 (0.19)	1 (0.19)	1 (0.19)	12 (2.23)
Operation	20 (3.72)	6 (1.12)	4 (0.74)	6 (1.12)	36 (6.69)

f.: Fractures; h.: Hematoma; l.: Laceration.

Thoracic injuries occurred in 15 patients (2.8%). The most common of these were rib fractures (6 patients). Three patients had hemopneumothorax, 1 had pneumothorax only and 5 had clavicular fracture; abdominal bleeding was ruled out by ultrasonography in these patients. Of patients who had thorax injuries, 4 patients had fallen from flat-roofed houses, 3 from balconies, 4 from stairs and 4 from simple height. Six (2%) had been followed because of abdominal bleeding. All these had fallen from 3.5 to 8 m. Blunt abdominal trauma was therefore an uncommon injury after falling from less than 4 m. Of 6 patients, 2 had a splenic laceration, 3 had a hepatic laceration and 1 had renal laceration (Table 2). Two patients with abdominal bleeding were operated and 2 patients died. However, the cause of death in patients with abdominal bleeding was not abdominal injury; these patients also had intracranial hematoma (epidural hematoma, subarachnoid hematoma).

Fractures of the extremities occurred in 21.2% of patients; 19% of all patients suffered from fractures of the upper limbs. Some patients had more than one extremities fracture. The incidence of extremity fractures was greater in falls from more than 3.5 m in adults and more than 5 m in children. The most common was radius fracture (58 patients, 10.8%), followed by fracture of the ulna (22), femur (18), humerus (18), tibia (9), calcaneus (6), fibula (4), metatarsal (5), and metacarpal (4). Patients with extremity fractures had most commonly fallen from flat-roofed houses (n=46). Multiple fractures were common, especially in falls from greater heights. 2.1% of all patients with extremity fractures were operated, the remainder were treated conservatively. Only one patient with extremity fracture (femur) died, but the cause of death obtained from the autopsy report was subarachnoid hematoma.

Approximately 2.1% of the patients (n=11) had spinal injuries: cervical (5 patients), thoracal (1 patient) and lumbar (5 patients). The majority of cervical and lumbar traumas were atlanto-occipital dislocation/fracture (n=3), thoracolumbar junction (L1 compression fracture) dislocation/fracture (n=3) and lumbosacral junction fracture (n=2). Two patients had C5 fracture. The neurological complications of injuries to the spine were correlated with increasing height of fall (p=0.022). Only 1 patient had pelvic injury, type 1. Mortality incidence was high in patients with cervical fractures (p=0.000). Five of the patients with spinal injuries (4 cervical, 1 thoracal) died; 1 patient was operated. Of patients with spinal injuries, most had fallen from flat-roofed houses (n=4), but statistically it was not significant (p=0.711).

Mortality and height

The mortality rate was 2.2% (12 patients: 6 females, 6 males). The mean fall height was 3.2±2.4 m (1-20 m). The mean fall height in children under the age of 10 years who died was 4 m; in this group, the mortality rate was 1.56%. In deaths among the patients over the age of 60, the mean fall height was 3.6 m and mortality rate was 9.25%. Five patients died in the ED within the first six hours of the event.

The most common reason for death was head injury; 100% of those (n=12) who died had head injuries. The cause of all deaths was head injuries according to the autopsy reports. Fatalities were more common when children fell from great heights (over 4 m), or when the child's head hit a hard surface, such as concrete. The mortality rate was higher among the patients who fell from flat-roofed houses (n=9, p=0.018). Eighteen patients were unconscious at admission, and the GCS was under 10 in 12 of them. In the group, overall median ISS was 17 and the median GCS was 14.6±3.4. In the patients who died, the median ISS and GCS were 73 and 7, respectively. The mortality and morbidity of injuries were statistically correlated with a decrease in the GCS (<10) (p=0.000). The mortality incidence was high in patients who were older than 60 years (p=0.000) and who were unconscious (p=0.000) at admission. Two hundred and seventy-four patients were observed for 12 hours and 177 for 24 hours in the ED; they were then discharged with good recovery. Eighty-two patients were hospitalized, and 44% of them (n=36) were operated.

DISCUSSION

Falls from a height present a great challenge to trauma services.[12,30] In children, they are most commonly due to accidents, while in adults, they are attributed to suicide, accident or crime. The nature and magnitude of the injuries occurring due to falls depend on the height of the fall, the nature of the contact surface, body orientation on impact, body mass, the victim's ability to distribute the impact forces efficiently, and the victim's age.[30] The nature of injuries associated with falls from height in children is considerably different from that in adults. Children younger than three years are much less likely to have serious injuries than older children who fall the same distance. It is thought that because younger children have more fat and cartilage and less muscle mass than older children, they better dissipate the energy transferred by the fall.[31]

In our series, 225 (41.8%) of the 538 patients had fallen from flat-roofed houses, followed by falls from stairs, simple falls and falls from balconies. The majority (67%) of patients were men. The age ranges of these four groups were similar. The age groups with the highest rates of death in association with accidental falls were 0-5 years (n=5) and over 60 years (n=5). In our study, young children who fell from less than 3 m sustained only minor injuries, such as contusions, abrasions and lacerations; fractures were the most common of their serious injuries and the radius, ulna and femur were the most frequent sites. Multiple fractures were common in falls from greater heights. Craniocerebral injuries were the most common in fatal falls. Falls accounted for 60% of traumatic brain injuries in a study by Carol et al.[32]: abdominal and chest injuries were relatively uncommon in falls from less than 4 m; mortality increased in falls from 4.5 m or more; and in children under the age of 10 years, the median height of fatal falls was 5 m. These findings are similar to those of Yagmur et al.[12] In contrast to our study, previous studies[16,17] have shown a higher mortality for falls from five or more stories, assuming a distance of 10 feet per storey. Mathis et al.[16] described 33 fall injuries in adults occurring under purely non-intentional circumstances at a popular college 'spring break' resort; among the 33 falls from balconies, five patients died and these deaths occurred due to falls from the third storey and higher.

The types of injuries we encountered were similar to those described in other studies of falls from height.[1,4,6,18,33-38] Of the 538 people who fell from heights, the head was the most frequently injured region. Chest, abdominal, extremity and neck injuries occurred in decreasing order of frequency. As the height increased, the incidence of chest, abdominal and extremity injuries rose along with head injuries. Similar findings have been reported by Gupta et al.,[4] who described 63 persons who fell from heights. It was demonstrated that lethal injuries involving multiple organs rose in number as the height increased.[39]

In general, increased age is associated with lower physical condition. The increasing fragility of bones in the elderly and the liability of elderly patients to succumb to fractures contribute to the higher rates of morbidity and mortality in older age groups following falls. For example, Berghaus[40] reported that more than 40% of his subject population were over 50 years of age, and due to this there were significantly more deaths for falls from less than 5 m. The rate of victims over 50 years of age was 20.7%, and 94% of these had fallen from heights of less than 5 m. In our study, the rate of victims over 60 years of age was 10.1%, and 100% of them had fallen from 3 m to 8 m.

Almost all our patients had fallen accidentally; three ultimately appeared to have fallen due to suici-

dal intent. There were head injuries in 100%, extremity injuries in 16.6%, abdominal injuries in 16.6%, and thorax injuries in 16.6% of deaths. Most of the patients had fallen from 3.5 to 5 m (n=501) and 11 (2.1%) of these had died; 5 patients had fallen 5-9 m and none had died; and 2 patients had fallen 15-20 m and 1 (50.0%) had died. The remainder of the patients (n=30) had fallen from 1.3 m to 2.8 m. Deaths occurred primarily as a result of head injuries and were a direct result of the distance fell.

Many falls from heights occur during summer, primarily because residents sleep outdoors when temperatures are high. The houses are often very simple, and have no barrier around the roof. The victims' families are more likely than the general population to experience social and demographic factors such as poverty, single-parent households and inadequate childcare. In our study, 76.3% of patients were less than 10 years old and 83.5% were under 20 years old, showing that most of these who fall from height are young. In the literature, far less child deaths associated with falls from heights are reported.[41] In our study, in terms of the distribution of accidents according to season, deaths associated with falls from height were higher in May-July (58%) when the weather is hot. The habit of sleeping on the stairs, balconies and flat-roofed houses on hot nights plays a significant role in this increase. We think it is important for stairs, balconies and rooftops to be surrounded by barriers to prevent accidental falls. These findings are similar to those of Yagmur et al. and Subası et al.[3,12]

The management of accidental injuries due to falls from height is much the same as for any other trauma. Targeted rapid multidisciplinary assessment of patients attending the ED because of a fall might reduce the number of hospital admissions. Stabilization, with particular attention to airway maintenance and hemodynamic resuscitation, is the initial concern.[22] The high incidence of head injuries among our victims of accidental falls underscores the need for early evaluation for intra-abdominal trauma followed by cranial computerized tomography scanning and subsequent management of lesser injuries in this subset of patients.

Examination of the mechanisms of these accidents suggests that teaching young children how to avoid hazardous situations could play some part in prevention, together with parental information and education. The circumstances in which the accidents occur lead to the conclusion that active prevention could be by passive protection, ensured by the creation of a safer environment (compulsory building of pitch-roofed houses or of a barrier around flat roofs, balconies and stairs). Several strategies, some of which have documented effectiveness, have been suggested to prevent children from falling from heights. Parent counseling has been effective in preventing infant falls and other injuries, and should be part of any prevention program.[21,42] A pilot program combining education with the provision of a safe roof, balcony and stairs would reduce the incidence of falls and deaths.

In conclusion, high-fall heights are a common cause of death and disability in Batman in the southeast region of Turkey. Our findings suggest that craniocerebral trauma is the most common feature of fatal falls and that blunt abdominal trauma is an uncommon injury after falling from less than 4 m. Children under 10 years old accounted for the highest risk group. The habit of sleeping on the stairs, balconies and flat-roofed houses on hot nights plays a significant role in falls from heights. To prevent accidental falls, these places have to be secured with the construction of barriers.

REFERENCES

1. Pipas L, Schaefer N, Brown LH. Falls from rooftops after heavy snowfalls: the risks of snow clearing activities. Am J Emerg Med 2002;20:635-7.
2. Risser D, Bönsch A, Schneider B, Bauer G. Risk of dying after a free fall from height. Forensic Sci Int 1996;78:187-91.
3. Goren S, Subasi M, Tırasci Y, Gurkan F. Fatal falls from heights in and around Diyarbakir, Turkey. Forensic Sci Int 2003;137:37-40.
4. Gupta SM, Chandra J, Dogra TD. Blunt force lesions related to the heights of a fall. Am J Forensic Med Pathol 1982;3:35-43.
5. Lewis WS, Lee AB Jr, Grantham SA. "Jumpers syndrome". The trauma of high free fall as seen at Harlem Hospital. J Trauma 1965;5:812-8.
6. Li L, Smialek JE. The investigation of fatal falls and jumps from heights in Maryland (1987-1992). Am J Forensic Med Pathol 1994;15:295-9.
7. Smerling M. Forensic medicine and crime aspects concerning plunges from heights. Report on extensive data (125 cases). Arch Kriminol 1977;160:39-50. [Abstract]
8. Smerling M. Legal and forensic medical aspects of falls from a height (II). Report on an extensive experience (125 cases). Arch Kriminol 1977t;160:65-77. [Abstract]
9. Smerling M. Forensic-medicine and criminal aspects involving falls from high altitudes. Report on extensive data (125 cases). Arch Kriminol 1977;160:176-87. [Abstract]
10. Yagmur Y, Kiraz M, Kara IH. Looking at trauma and deaths: Diyarbakir city in Turkey. Injury 1999;30:111-4.

11. 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;90:62-72.
12. Yagmur Y, Güloglu C, Aldemir M, Orak M. Falls from flat-roofed houses: a surgical experience of 1643 patients. Injury 2004;35:425-8.
13. National SAFE KIDS Campaign. Falls Fact Sheet. Washington (DC): National SAFE KIDS Campaign; 1998.
14. Klockgether-Radke A, Sydow M, Zielmann S, Burchardi H, Kettler D. Polytrauma following a fall from a great height. The injury pattern and the intensive medicine aspects. Anasthesiol Intensivmed Notfallmed Schmerzther 1992;27:37-41.
15. Lowenstein SR, Yaron M, Carrero R, Devereux D, Jacobs LM. Vertical trauma: injuries to patients who fall and land on their feet. Ann Emerg Med 1989;18:161-5.
16. Mathis RD, Levine SH, Phifer S. An analysis of accidental free falls from a height: the 'spring break' syndrome. J Trauma 1993;34:123-6.
17. McSwain NE, Shaftan GW. Blunt trauma after vertical deceleration. Postgrad Surg 1990;2:140-5.
18. Steedman DJ. Severity of free-fall injury. Injury 1989;20:259-61.
19. Tan YH, Chin TW, Mitra AK, Tan SK. Tarsometatarsal (Lisfranc's) injuries-results of open reduction and internal fixation. Ann Acad Med Singapore 1995;24:816-9.
20. Weisskopf M, Hoffmann R, Südkamp NP, Haas NP. Dens fracture and multiple fracture of the thoracic spine after fall from great height. Diagnostic standard. Unfallchirurg 1996;99:520-4. [Abstract]
21. Williams RA. Injuries in infants and small children resulting from witnessed and corroborated free falls. J Trauma 1991;31:1350-2.
22. Yagmur Y, Guloglu C, Kara IH. The pattern of injury and mortality rates in patients who had fallen from flat-roofed buildings. Eur J Trauma Emerg Surg 1999;22:7-10.
23. Derr J, Forst L, Chen HY, Conroy L. Fatal falls in the US construction industry, 1990 to 1999. J Occup Environ Med 2001;43:853-60.
24. Stern FB, Ruder AM, Chen G. Proportionate mortality among unionized roofers and waterproofers. Am J Ind Med 2000;37:478-92.
25. Janicak CA. Fall-related deaths in the construction industry. Journal of Safety Research 1998;29:35-42.
26. Chen G-X, Fosbroke D. Work-related fatal injury risk of construction worker by occupation and cause of death. Human and Ecological Risk Assesment 1998;4:1371-90.
27. Ringen K, Seegal J, Englund A. Safety and health in the construction industry. Annu Rev Public Health 1995;16:165-88.
28. Robinson CF, Halperin WE, Alterman T, Braddee RW, Burnett CA, Fosbroke DE, et al. Mortality patterns among construction workers in the United States. Occup Med 1995;10:269-83.
29. Weisskopf M, Hoffmann R, Südkamp NP, Haas NP. Dens fracture and multiple fracture of the thoracic spine after fall from great height. Diagnostic standard. Unfallchirurg 1996;99:520-4. [Abstract]
30. Beale JP, Wyatt JP, Beard D, Busuttil A, Graham CA. A five year study of high falls in Edinburgh. Injury 2000;31:503-8.
31. Meller JL, Shermeta DW. Falls in urban children. A problem revisited. Am J Dis Child 1987;141:1271-5.
32. Hawley CA, Ward AB, Long J, Owen DW, Magnay AR. Prevalence of traumatic brain injury amongst children admitted to hospital in one health district: a population-based study. Injury 2003;34:256-60.
33. Barlow B, Niemirska M, Gandhi RP, Leblanc W. Ten years of experience with falls from a height in children. J Pediatr Surg 1983;18:509-11.
34. Warner KG, Demling RH. The pathophysiology of free-fall injury. Ann Emerg Med 1986;15:1088-93.
35. Reynolds BM, Balsano NA, Reynolds FX. Falls from heights: a surgical experience of 200 consecutive cases. Ann Surg 1971;174:304-8.
36. Roshkow JE, Haller JO, Hotson GC, Sclafani SJ, Mezzacappa PM, Rachlin S. Imaging evaluation of children after falls from a height: review of 45 cases. Radiology 1990;175:359-63.
37. Lukas GM, Hutton JE Jr, Lim RC, Mathewson C Jr. Injuries sustained from high velocity impact with water: an experience from the Golden Gate Bridge. J Trauma 1981;21:612-8.
38. Agalar F, Cakmakci M, Sayek I. Factors effecting mortality in urban vertical free falls: evaluation of 180 cases. Int Surg 1999;84:271-4.
39. Hall JR, Reyes HM, Horvat M, Meller JL, Stein R. The mortality of childhood falls. J Trauma 1989;29:1273-5.
40. Berghaus G. Mathematic-statistical discrimination between suicide and accident in falls from height (author's transl). Z Rechtsmed 1978;80:273-86. [Abstract]
41. Gill JR. Fatal descent from height in New York City. J Forensic Sci 2001;46:1132-7.
42. Bass JL, Christoffel KK, Widome M, Boyle W, Scheidt P, Stanwick R, et al. Childhood injury prevention counseling in primary care settings: a critical review of the literature. Pediatrics 1993;92:544-50.