

# Walnut tree falls as a cause of musculoskeletal injury - a study from a tertiary care center in Kashmir

Bir kas-iskelet yaralanması nedeni olarak ceviz ağacından düşmeler:  
Keşmirde üçüncü basamak tedavi merkezinden bir çalışma

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## BACKGROUND

Fall from height is one of the important causes of musculoskeletal injuries. Fall from walnut trees constitutes an important entity that leads to a significant mortality and morbidity amongst those engaged in fruit collection. The present study aimed to determine the prevalence of different musculoskeletal injuries in these victims and to highlight the importance of recognizing this incident as an occupational injury.

## METHODS

A retrospective study of all patients admitted to the Orthopedic Department of the Sher-i-Kashmir Institute of Medical Sciences (SKIMS) Medical College from January 2003 to December 2007 was conducted. The medical records were studied for the different types of bony injuries, associated injuries and delay in the referral of patients.

## RESULTS

94% of falls occurred from August to October. Of the 115 patients, 63 (54.7%) had associated non-orthopedic injuries. Head injury was the most common associated injury, presenting in 34 patients (29.5%). Thoracolumbar (16.5%), calcaneum (10.5%) and distal radius (8.7%) fractures constituted the common fractures encountered in the victims.

## CONCLUSION

Walnut tree injuries mostly involve young males who form the productive group of the population. Being a seasonal injury, it puts a considerable load on the health resources of the region over a small period of time.

**Key Words:** Fractures; Kashmir; occupational injury; walnut tree.

## AMAÇ

Yüksekten düşme, önemli kas-iskelet yaralanması nedenlerinden biridir. Ceviz ağaçlarından düşme, meyve toplama işi ile uğraşan insanlar arasında anlamlı mortalite ve morbiditeye yol açan önemli bir antiteyi oluşturmaktadır. Bu çalışma, bu kurbanlardaki farklı kas-iskelet yaralanması prevalansını belirlemeyi amaçlamakta ve bu yaralanmanın mesleki bir yaralanma şeklinde kabul edilmesinin önemini vurgulamaya çalışmaktadır.

## GEREÇ VE YÖNTEM

Ocak 2003 ile Aralık 2007 tarihleri arasında SKIMS Tıp Koleji Ortopedi Kliniği'ne kabul edilen bütün hastalarda geriye dönük bir çalışma yürütüldü. Tıbbi kayıtlar, değişik tipte kemik yaralanmaları, eşlik eden yaralanmalar ve hastaların nakledilmesindeki gecikmeye yönelik olarak çalışıldı.

## BULGULAR

Düşme olaylarının %94'ü, Ağustos ile Ekim ayları arasında oluşmuştur, 115 hastanın 63'ünde (%54,7) ortopedik olmayan yaralanmalar da eşlik etmiştir. 34 hastada (%29,5) bulunan kafa travması, en yaygın biçimde eşlik eden yaralanma olmuştur. Torakolomber (%16,5), kalkaneus (%10,5) ve distal radius (%8,7) kırıkları kurbanlarda karşılaşılan en yaygın kırıkları oluşturmıştır.

## SONUÇ

Ceviz ağacı yaralanmaları, çoğunlukla, toplumun üretken grubunu oluşturan genç erkekleri tutmaktadır. Mevsimsel bir yaralanma olması nedeniyle, ceviz ağacından düşme yaralanmaları, kısa bir zaman periyodu içinde bölgenin sağlık kaynakları üzerinde kayda değer bir yük oluşturmaktadır.

**Anahtar Sözcükler:** Kırıklar; Keşmir; mesleki yaralanma; ceviz ağacı.

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Fall from height is one of the leading causes of fatal and non-fatal injuries in adults, rivalled only by road traffic accident.<sup>[1]</sup> Falls can happen at any time and place, but falls in adults usually occur in an occupational setting.<sup>[2]</sup> The chances of a fall resulting in a serious injury depend upon the height of the fall, orientation of the fall, landing surface, and age of the patient.<sup>[3]</sup> Fall from trees in those whose profession involves climbing trees is a cause of concern primarily in agrarian societies. Musculoskeletal injuries form the bulk of injuries resulting from these accidents.<sup>[4]</sup> However, the bulk of the literature related to injuries associated with fall from trees is devoted to the spine and head injury associated with these falls.<sup>[5-7]</sup>

Walnut trees are economically important trees found in all parts of the Kashmir region, especially in the rural areas. The tree grows to a height of 40-75 feet and bears the nut that matures from August to October. The wood of the tree is also used widely. The method of collection of nuts practiced in the region is still primitive, which places the workers at a high risk of fall from the trees. With the ground beneath usually being hard, the probability of a serious injury is high.

This study aimed to determine the pattern of different musculoskeletal injuries encountered in patients presenting with fall from walnut trees. We further highlight the need for recognizing this injury as an occupational one and suggest measures to decrease the occurrence of this injury.

## MATERIALS AND METHODS

A retrospective hospital-based study of patients presenting to the Orthopedic Department of Sher-i-Kashmir Institute of Medical Sciences (SKIMS) Medical College Hospital with a history of fall from walnut trees was conducted. The study included all such patients who reported to the hospital between January 2003 and December 2007. Clearance for the study was obtained from the SKIMS Ethical Review Board. The hospital records of all such patients who were admitted to the hospital were studied in detail with regard to patient profile, types of bony injuries, associated injuries, delay in referral, and the mechanism of the fall.

Our Institution receives patients from all areas of the region as it is located on the main highway connecting the entire region. The Orthopedic Department also receives patients from the Institute of Medical Sciences, which is the only center in the region having the surgical super-specialities of neurosurgery, urological surgery and cardiovascular surgery, but without an orthopedic department of its own.

## RESULTS

During the five year period (2003-2007), 1932 patients with fractures were admitted in the Orthopedic Department (excluding the patients admitted in the aftermath of the 2005 earthquake). Road traffic accident was the major mode of injury in these patients, accounting for 1135 (58.8%) of all patients. Walnut tree falls were responsible in 119 patients (6.16%). Four patients died in the Emergency Department of the hospital before a thorough workup of the patient could be done. These patients were excluded, and the final result is based on 115 patients. Fifty-two patients admitted to the hospital did not have any significant non-orthopedic injury. The remainder of the 63 patients were referred to the hospital for treatment of musculoskeletal injuries after management of other surgical injuries. Head injury was the most common injury, present in 34 patients. Twelve patients had cervical spine injuries, which were managed by neurosurgeons before patients were referred for orthopedic injury management. Ten patients had chest injuries, eight had abdominal injuries, and six patients were managed for genitourinary injuries.

The number of patients admitted in the Orthopedic Department each year due to walnut tree falls has remained more or less similar over the last five years (Table 1). One hundred and eight patients had injuries during the period of August to October, with September having the highest number of admissions. Walnut injuries accounted for 53.2% of all the fracture patients admitted between August and October. Walnut is a seasonal fruit that matures from the second half of August to early October; thus, the incidence of injuries is also observed more in these months. Seven patients fell from the tree over the remaining months of the year.

**Table 1.** Distribution of musculoskeletal injuries over the five-year period

Month	Year					Total no. of patients
	2003	2004	2005	2006	2007	
August	7	8	6	9	6	36
September	11	13	14	9	12	59
October	2	3	2	4	2	13
Rest of year	3	2	0	1	1	7
Total	23	26	22	23	21	115



**Fig. 1.** (a) Radiograph of burst compression of L1 fracture. (b) CT scan showing the burst compression fracture with compromise of the spinal canal by the bone fragments. (c) Radiograph following the fracture fixation with pedicle screws.

The patients were exclusively male, in the age group of 18 to 52 years. The average age of the patients was 37.8 years. The delay between injury and arrival at the tertiary centers (Medical College or Institute) varied from 2-28 hours, with an average delay of 7.2 hours. Thirty-four patients were brought directly to the tertiary centers by their attendants. The rest of the patients were initially managed at nearby health centers before being referred to higher centers. All the patients referred from the peripheral centers had intravenous access but the spine was not stabilized in any patient. The limb fractures were splinted in all patients but the splintage was proper in only 36% of them. In the remaining patients, the splint was not adequate to immobilize the fractures.

Spine fractures constituted an important cause of morbidity in the fall victims. Fifty-two patients (45.2%) had fractures of the spine. Thoracolumbar fractures were seen in 19 patients, cervical spine fractures in 16 patients, lumbar fractures in seven patients, thoracic fractures in six, and sacral fracture in one patient. Three patients had multiple spine fractures at non-continuous levels. Twelve patients had neuro-deficit on arrival. Three patients had quadriplegia, seven had paraplegia and two patients had monoplegia. The indications for surgery in patients were:

- All patients with neuro-deficit and with progressive neuro-deficit.
- Burst fractures with angulation >20%; loss of height >50% and canal compromise >50%.
- Compression fractures with loss of height >50% and angulation >20%.
- Flexion-distraction injuries.

Twenty-one patients underwent fixation of the fractures. The remainder of the patients were managed conservatively (Fig. 1a-c).

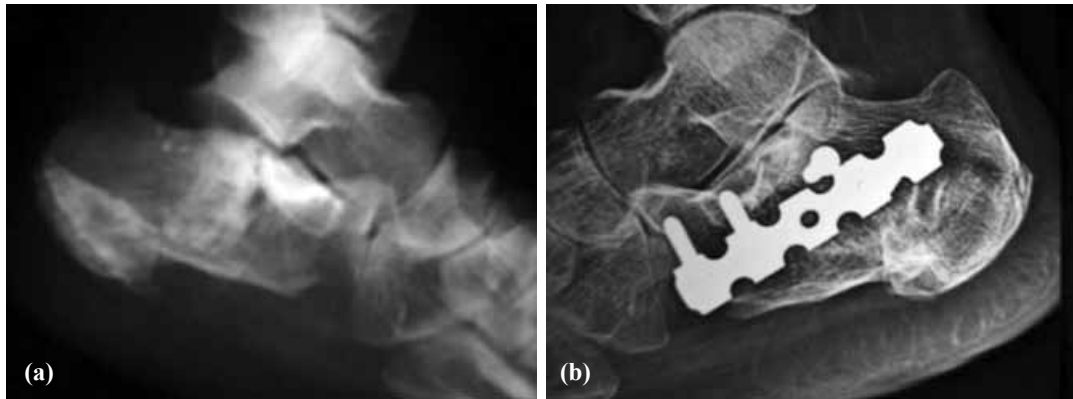
Lower limb fractures were seen in 58 patients (Table 2). Of these, 11 patients had associated spine fractures and nine patients had fractures of an upper

limb. Pelvic fractures were relatively common. All three patients with hip dislocation had posterior dislocation, one patient having an associated sciatic nerve injury that improved following reduction. Being a high energy injury involving fall from a height, calcaneal fractures were the most common fractures in the patients. Pelvic and tibial fractures were also common. The different fractures were managed according to the routine orthopedic principles of fracture management. All the compound fractures were treated by debridement and external fixation since the injuries were all regarded as occurring in a potentially contaminated environment (Fig. 2a, b).

Thirty-three patients had injuries involving the upper limb (Table 3). Since the patients fell on outstretched hands, the fractures of the distal radius were the most common injuries involving the upper limb. All these fractures were comminuted and as such were managed with ligamentotaxis and external/internal fixation. Humeral fractures were also common. Inferior dislocation of the humeral head and lunate dislocation were seen in one patient each. Two patients also had

**Table 2.** Pattern of injuries in the lower limb

Type of fracture	Closed	Compound	Total
Pelvic fractures	7	–	7
Acetabular fractures	3	–	3
Hip dislocations	3	–	3
Proximal femur	5	1	6
Shaft of femur	6	1	7
Distal femur	3	1	4
Patella	1	–	1
Proximal tibia	3	–	3
Tibia ± fibula	7	3	10
Distal tibia (Pilon)	2	–	2
Ankle fractures	3	1	4
Calcaneal fractures	11	1	12
Metatarsal and other foot fractures	3	2	5



**Fig. 2.** (a) Calcaneal fracture sustained following fall. (b) Radiograph at six months following open reduction demonstrating union of fracture and good reconstruction.

brachial plexus injuries. The brachial plexus injuries in both these patients were managed conservatively.

### DISCUSSION

Falls from trees constitute an important sub-group of injuries resulting from falls from height. This is all the more relevant in countries like India with a large population residing in rural areas and having to depend on trees for their livelihood. Fall from palm and kola nut trees is the second most common cause of spinal injury in Nigeria, accounting for 42.9% of cases.<sup>[5]</sup> Bajracharya,<sup>[6]</sup> in a series of 896 Nepalese patients with spinal injury from a predominantly rural background, reported fall as the cause of injury in 188 patients (21%). Mulford<sup>[8]</sup> reported 85 patients with a history of fall from palm trees among the 104 patients with palm tree-related injuries; 60.1% of patients had fractures and 16.3% had spinal injuries, with the most common fractures being those of the skull and long bones.

Fall from a height of more than 15 meters (m) is associated with severe injuries.<sup>[3]</sup> The walnut tree, which grows to a height of 15-40 m, may thus be regarded as a source of severe injury to the victims. The walnut tree found in Kashmir (Persian walnut - *Juglans*

*regia*) is famed for its nut and wood. There are approximately 500,000 walnut trees in the region and approximately 7000 hectares are under cultivation. The walnut industry contributes 2 billion rupees annually to the economy of the region. The injuries and their fallout have a severe socioeconomic impact. The population engaged in walnut cultivation is composed of the young and robust males. Injuries in this economically productive group in terms of loss of manpower and cost of managing these patients have a profound effect. In addition, the injury, being seasonal, puts a tremendous extra load on the already burdened hospitals of Kashmir.

About 30,000-40,000 people are engaged in climbing the walnut trees, and are thus at risk of a fall from trees. The 115 patients reporting to our hospital are only a fraction of the injuries sustained. A number of patients with minimal injuries may not reach the tertiary centers. Furthermore, a significant number of injuries result in on-site deaths. The total number of patients with walnut tree injuries is difficult to determine in the absence of any comprehensive data. To date, only one study has been reported from the region on the injury pattern of victims. Tabish et al.<sup>[9]</sup> studied 87 patients in our region over a three-year period and reported a mortality of 24.13%. Cervical spine injury was the most common injury, followed by brain contusion. Head injury was the major cause of mortality. Our study, although from the same region, had a very low mortality since our center does not have a neurosurgical department and most patients with head injury and cervical injuries are referred to SKIMS, where such facilities are available.

Head injury, spinal fractures and extremity injuries comprise the bulk of injuries in persons who fall from trees. Abdominal and chest trauma are also seen quite frequently. Metz et al.<sup>[10]</sup> noted spine fractures in 51% of patients with a history of fall from tree stands. Over a five-year period, 51 patients sustained a fall from tree stands, with 41% having extremity injuries

**Table 3.** Pattern of injuries in the upper limb

Type of fracture	Closed	Compound	Total
Clavicle	3	—	3
Shoulder dislocation	2	—	2
Proximal humerus	3	—	3
Shaft of humerus	4	2	6
Distal humerus	3	—	3
Elbow dislocation	1	—	1
Olecranon	1	—	1
Forearm bones	4	1	5
Distal radius	9	1	10
Carpal bones and metacarpals	3	—	3

and 24% closed head injuries. Spine fractures, especially burst and compression wedge fractures, are the leading cause of long-term morbidity in these patients. Crites et al.<sup>[7]</sup> found a significant neurological injury in 12 of the 47 patients with spine fractures who fell from hunting tree stands. Urquhart et al.<sup>[11]</sup> studied deer stand fall victims from 1982-89, and six of the 18 patients with neuro-deficit remained permanently paralyzed. The prevalence of cervical spine injuries is comparatively less in our study due to the fact that a number of cervical spine fractures were managed by neurosurgeons at the Institute because of better intensive care unit (ICU) facilities. Calcaneal and distal radius fractures are the more common types of extremity fractures because of the peculiar nature of the fall on the feet, with the victim stretching out their hand(s).

The major reason for falls from trees is the primitive method of nut collection employed by the laborers. The workers collect nuts by standing on the branches of the tree and using a stick to drop the nut. During this process, the victims lose their balance and fall. The slippery nature of the bark adds to the probability of fall. The second pattern of fall is the branch giving way while the worker is perched on the branch. No patient in our study was under the influence of alcohol. This is attributed to religious factors and absence of alcohol vendors in the rural areas. This is in contrast to the other parts of the world where alcohol intake is a significant factor in falls. Most of the studies have reported alcohol intake at the time of fall in 10-20% of patients.<sup>[8,11]</sup>

A heartening aspect of the study is the average delay of only 7.2 hours between the injury and arrival at a tertiary center. This is unlike other parts of India where there is a significant delay before victims reach the trauma centers. Jayaswal et al.<sup>[12]</sup> in a study on spinal trauma injuries found that more than 40% of patients arrived in hospital after more than 48 hours. This delay has an effect on the final outcome of the patients. The less transfer time in our case is due to the lack of adequate facilities in the periphery (which prompts people to bring victims directly to tertiary centers) and the small area of the region (the most distant parts being only some 100 km from Srinagar city). However, the fact that none of the victims was referred from peripheral health centers with neck immobilization is a cause of concern for health administrators. This highlights the need of creating awareness about

the management of trauma victims among the doctors working in the periphery.

The importance of educating the workers to prevent the occurrence of these injuries cannot be over-emphasized. The use of tree stands will help decrease the injury to a large extent. Use of anti-slip boots, helmets, and chest and abdominal gear will all go a long way in reducing the mortality and morbidity associated with the injury.

Falls from walnut trees are an important cause of morbidity in the workers engaged in the walnut industry. There is a need to recognize this injury as an occupational injury in the medical literature.

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