

Epidemiological Pattern of Foot Injuries in India: Preliminary Assessment of Data from a Tertiary Hospital

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ABSTRACT

Foot injuries are an often disabling, especially when the diagnosis is delayed and treatment is inappropriate; this becomes significant in polytrauma where diagnosis may be missed, and in young adults who are injured in the prime of life. No data on foot injury is available from India or any other developing country; we undertook a prospective 1 year study to evaluate incidence and epidemiology of foot injuries seen at our center. One hundred and thirty-four feet were injured in 1,765 patients, with 82% being males, and the average age being 30.8 years. Road accident was predominant cause (73.8%) in contrast to the published literature, with two-third being open injuries; 47% were polytrauma victims. The surgical delay averaged 3.14 days, reasons for which were multifactorial. This high incidence of foot injury (7.59%) in men in their most productive years assumes significance when residual disability occurs due to mismanagement. A high index of suspicion needs to be maintained in road accident victims and polytrauma cases, so that foot injury is not missed and treatment is not inordinately delayed.

Keywords: Foot injury, Epidemiology, Incidence, Fracture, Calcaneus, Polytrauma.

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INTRODUCTION

Despite being the principal weight bearing organ of the body, the amount of attention which the foot receives from the average orthopedic surgeon is often negligible. This is often accentuated in trauma situations, when a surgeon has to deal with polytrauma or life/limb-threatening situations, and foot injuries are often accorded a low priority. In modern times when the mortality after trauma has been significantly reduced, many such patients recover and go back into the mainstream of life. Inadequately treated foot injuries significantly affect the overall outcomes in these patients. This is well documented in international studies, as foot fractures are recorded to be the most commonly missed extremity fractures in polytrauma patients,¹ which may have important clinical and medicolegal implications.

A literature review reveals limited studies focussing on epidemiology of foot injuries; only one or two² are comprehensive and address the overall incidence, while others are limited to focussed demographic variables such

as specific types of foot injuries^{3,4} a single mechanism of trauma^{5,6} or a specific population of patients.^{7,8} At the present time there is no data on foot injury epidemiology in India, and this is an important lacuna in the prevailing orthopedic literature. A preliminary study was thus planned to evaluate the injury incidence and pattern of trauma encountered in our setting, and to see whether foot injuries get neglected in the Indian scenario. This study was undertaken prospectively over a 1 year period in a tertiary care center.

MATERIALS AND METHODS

All patients of foot injury, admitted in PGIMER Hospital Chandigarh, from April 2010 to March 2011 were included in the study. They were studied with respect to age, sex, mode of injury, injury type and pattern, radiological features and associated injuries; special note was made of the interval between injury and surgical/appropriate management. Details recorded included side of injury, the anatomical region (hind, mid and/or forefoot), the bones involved, the type of injury, whether being open or closed fracture and the actual number of injuries in that specific foot and leg. Special note was made of the injury severity and reasons for treatment delay. Patients with bilateral or segmental foot injuries and open foot fractures (with significant soft tissue laceration or traumatic partial amputations) were classified as 'severe foot injury'; the other patients constituted the 'simple foot injury' group. A foot injury was classified as segmental when more than one anatomical region of the foot was injured, or injury involved different levels within the same foot with skipped uninjured areas. Falls from 3 meters or more and road traffic collisions with high impact (high-speed collision, ejection from a vehicle, auto-pedestrian collision and motorcycle crashes with high speed or separation of the rider from the vehicle) were classified as high-energy injuries. The details and timing of all surgical interventions were recorded; since this was just a demographic study to determine the incidence and pattern of injury follow-up evaluation was not included as a part of this study.

OBSERVATIONS AND RESULTS

Over a 1 year period, 1,765 patients were admitted in PGIMER Chandigarh with significant traumatic injuries;

134 (7.59%) of these had a documented foot injury. There were 110 males (82.09%) and 24 females (17.91%) with involvement of 145 feet [44 (32.84%) left foot, 79 (58.96%) right and 11 (8.21%) bilateral]. The average age at presentation was 30.81 (range, 10-81) years. Roadside accident was the most common mode of injury, occurring in 99 (73.88%) cases followed by fall in 27 (20.15%) cases, fall of heavy object on foot in six (4.48%) cases and twisting and machine injury in one (0.75%) case each. Ninety-seven (72.39%) patients had open fractures, 31 (23.13%) patients had closed fractures and there were six (4.48%) patients with bilateral foot injury who had one side open and one side closed injury. Sixty-three (47.01%) patients had associated fractures (labeled as polytrauma), with lower extremity involvement being the most common (46 patients) followed by upper limb involvement in 13 patients, head and face involvement in seven patients, spine involvement in 6 patients (all with calcaneal fractures) and pelvic and abdominal involvement in three patients each. Only 71 patients (52.99%) had presented as isolated foot injuries.

Out of 134 patients with foot injury, there were 177 injuries of different regions of foot (Table 1); 60 were hindfoot injuries, 23 midfoot injuries and 94 forefoot injuries. These injuries included 11 cases (8.21%) with multiple injuries involving different three regions of foot. Specific diagnostic labeling revealed 45 calcaneal injuries, eight talar injuries, three subtalar joint fracture dislocations and four heel pad avulsions in the hindfoot. In the midfoot there were 12 Lisfranc injuries, five Chopart's dislocations, three navicular injuries, one cuboid fracture and two medial cuneiform injuries. Forefoot injuries were the commonest, with 66 cases of metatarsals injuries, 20 phalangeal injuries and eight combined metacarpal and phalangeal injuries.

Fifty-six out of 134 patients (41.79%) were classified as severe foot injuries; further evaluation revealed bilateral foot involvement in three of these cases, combined bilateral

and segmental foot involvement in two cases, and segmental foot involvement in 12 cases. Moderate soft tissue injury was noted in three segmental foot injuries, while 23 cases had significant soft tissue loss, with associated crushing/traumatic foot amputation in 13 cases. Seventy-eight cases had simple foot injuries.

The mean interval between foot injury and surgical intervention was 5.01 days in hindfoot injuries, 4.55 days in mixed foot injury, 1.76 days in forefoot and 1.5 days in midfoot injuries respectively; the overall mean delay for treatment was 3.14 days in foot injuries. This did not include those feet where surgery was not done, like calcaneal fractures (21 of 45 fractures) and minor fractures of the forefoot.

DISCUSSION

Despite the fact that foot trauma is a significant cause of morbidity, a literature search conducted in May 2011 did not reveal many publications, with none being found from India or Southeast Asian countries, where barefoot walking is still routine, and foot-related deformity assume even more significance. Out of 670 results encountered with the keywords 'foot injury epidemiology' less than 10 were relevant, and only the study by Ayman et al² was found to be comprehensive. This particular study was an evaluation done in a high income developing country (UAE); other epidemiological studies focus on specific groups like motorcyclists or the elderly.⁵⁻⁷

Our prospective evaluation brought to light some facts that need to be highlighted; it was no surprise that the predominant sex with foot injury was male (ratio >4:1), and reflects the fact that men are more involved in road traffic accidents (RTA) and industrial accidents. The mean age of patients with injured feet was 30.81 years, and brings to the forefront the fact that the most productive age group of the population is at risk, and any disability would significantly affect the work force as well as the dependent families.

Table 1: Region-wise foot fracture (n = 177) distribution

Region	Specific fracture	No. of cases	Region (%)	Foot injuries (%)
Forefoot		94	—	(53.1)
	Metatarsals	66	70.21	27.29
	Phalanges	20	21.8	11.3
	Combined	8	8.51	4.52
Hindfoot		60	—	(33.9)
	Calcaneus	45	75	25.42
	Talus	8	13.33	4.52
	Subtalar # dislocation	3	5	1.69
	Heel pad avulsion	4	6.67	2.26
Midfoot		23	—	(13)
	Lisfranc injury	12	52.17	6.78
	Chopart injury	5	21.74	2.82
	Navicular #	3	13.04	1.69
	Cuneiform #	2	8.70	1.13

A deviation from previous studies like the UAE study² and a German study⁹ was the fact that roadside accidents (73.88%) were the most common mode of injury noted by us; fall from height (52%) was the most common mode of foot trauma found by Ayman et al² (due to more involvement of people in construction of high rise buildings in UAE) and by Probst et al⁹ (due to suicide attempts, etc). This difference further highlights the bad traffic conditions and inadequate road sense in the average Indian; this is often compounded by the fact that the initial examination may miss closed foot injuries, further delaying appropriate treatment and worsening outcomes.

The injury pattern seen by us was also somewhat different. As expected, we found the metatarsals (27.29%) and calcaneum (25.42%) to be the most commonly injured bones in our study; however, a finding of note was the high incidence of open calcaneal fractures (46.67%) compared to around 7.7 to 17% reported in the literature. This may be due to the complex trauma encountered in serious road accidents in our study, and the foot was often grossly twisted or crushed. On the other hand only 2% calcaneal fractures were open in Ayman's study,² as the predominant injury modality encountered by them was a fall. Again only 4.48% of the calcaneal fractures seen by us had an associated spine fracture (as compared to >10% reported in literature;^{2,9} this is again a reflection of the different trauma mechanisms encountered for these foot injuries in our country (road accidents rather than falls).

Another finding of note in our series was the relatively higher incidence of midfoot injuries compared to the UAE study,² with Lisfranc injuries being the most common such injury seen by us. This further highlights the importance of an accurate clinical examination in all swollen or painful feet, especially in road accidents or polytrauma cases, as these Lisfrancs injuries are the most commonly overlooked foot trauma despite adequate radiographs. The disability after inadequate treatment of midfoot injuries is very significant,¹¹ and can affect the earning capacity of these patients.

Delay in foot injury treatment is fairly common in the acute setting even in the western world where diagnostics are more advanced and index of suspicion maybe higher. Although delayed diagnosis maybe multifactorial, the effect on the outcome remains significant, as many polytrauma patients now survive and are left with foot-related disabilities, if management is not appropriate at the initial phase. The average delay at our center between injury and surgical treatment was 3.14 days (range, 0-24 days), with maximum delay averaging 5.1 days in hindfoot injuries. This delay was attributed to priority given to other life or limb-threatening injuries (occurring in 47.01% of our cases), delayed referral and restricted operating time in the referral

center where other injuries took priority. However, many hindfoot trauma delays were intentional, as operative management of closed calcaneus fractures was usually deferred due to swelling of the heel.

Severity of foot injury seen by us was considerable, with 41.79% of the cases having significant foot injury, with or without soft tissue involvement. If treatment is inadequate or delayed in this group the prognosis of becomes worse, and will long-term functional disability would be an issue in this productive age group. This is supported by other studies;^{8,10,11} the consensus is that more attention with aggressive management in complex foot injuries is imperative to improve the outcome, more so in multiply injured patients who survive and have to walk on a painful or deformed foot.

Our study highlights some major issues which have importance in the Indian context. This brings into focus the fact that the foot injuries in road accidents are often severe in nature, as shown by the high incidence of segmental, bilateral and open fractures (Tables 2 and 3). RTAs are the predominant mode of injury, and delays in surgical intervention are significant even at tertiary referral centers. Most times the attention is focussed on the more serious injuries, but the index of suspicion is also often low, and this needs to be addressed. One point of note is the fact that the current data maybe somewhat skewed; what we report are foot injuries referred to a tertiary care center which are usually severe and associated with polytrauma, and often present late in the initial stages. Nevertheless, an incidence of 7.59% foot injuries in all trauma cases brings to focus the large number of such cases. Add to that the fact that many more polytrauma cases are now surviving due to better medical interventions, and we could potentially be looking at a large population group who has significant residual disability due to inadequate diagnosis and inappropriate.

Table 2: Distribution of associated injuries

Region involved	No. of cases (%)
Lower limb (excluding foot)	46 (34.33)
Upper limb	13 (9.7)
Head and face	7 (5.22)
Spine	6 (4.48)
Abdomen	3 (2.24)

Table 3: Distribution of severe foot injuries (n = 56)

Injury type	No. of cases
Bilateral	3
Bilateral and segmental	2
Segmental	12
Segmental with soft tissue loss	3
Significant soft tissue loss	23
Crushing/traumatic amputation	13

CONCLUSION

Our study has shown that foot injuries are seen in 7.4% cases presenting with trauma, and constitute a significant group in polytrauma cases. These are often severe, many times open injuries, and treatment delays could have potentially disabling effects on the outcome. A high index of suspicion needs to be maintained in all cases presenting to a trauma center in order to accurately diagnose and appropriately manage these injuries.

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