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Epidemiology of Extraarticular Tibia Fractures, Shahid Mohammadi Hospital-Bandar Abbass-Iran 2002, 2003

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Abstract: Tibia fractures are among the most common long bone fractures and recognition of their epidemiology helps their better management and prevention. In this cross sectional prospective study, 250 patients with extraarticular tibia fracture, of all age groups, referred to Shahid Mohammadi Hospital, Bandar Abbass were studied. Information about age and sex and the fracture side, localization, open or closed fracture, comminution, associated injuries and the mechanism of the injury were registered. Tibia fractures constituted about 65% of all diaphyseal long bone fractures (the most common) and 70% of all open diaphyseal fractures (the most common). Most of the fractures occurred in young men (90%) and in the middle third of the bone (55%). In more than 75% of the cases injury was limited to the leg, more than 55% the fractures were closed and in more than 65% there was little comminution. About half of fractures occurred on either side and no statistically significant difference was found between the left and right limb with regard to open fracture occurrence and the severity of comminution (p = 0.291 and 0.713, respectively). The most common involved factor in occurrence of the fracture was motorcycle (65%), in contrast to findings of others where it constituted about 30% of the causes. Noting the results and that 58% of tibia fractures are caused by motorcycle accident with the reason being direct trauma to the shin of the driver in the majority of them, it is suggested that the use of a guard or shield get mandatory for protection of the shin of the motorcyclists.

Key words: Tibia, fracture, epidemiology, motorcycle

INTRODUCTION

Tibia fractures are the most common fractures among long bones (Whittle and Wood, 2003) and are the most common open ones too (Court-Brown *et al*., 1998). There has been considerable controversy regarding treatment of these fractures and several years ago it has been stated about them that any thing that is both common and controversial so is important too (Nicoll, 1974). This statement seems to be true nowadays also. Epidemiologic studies help us to better recognize the characteristics of a disease and so to treat it better. These studies deserve especial attention when dealing with tibia fractures, noting their high incidence and especially the difficulties that the orthopedic surgeons confront in their treatment. For this reason epidemiologic studies on the subject have been performed in different countries (Court-Brown and McBirnie, 1995; Bengner *et al*., 1990; Emami *et al*., 1996; Grutter *et al*., 2000; Grecco *et al*., 2002) and even attention has been paid to the epidemiology of fractures in different groups (Hill *et al*., 1989; Lenehan *et al*., 2003; Shaw *et al*., 1997) and different parts of this bone (Tytherleigh-Strong *et al*., 1997). In the present study we were to assess the epidemiology of extraarticular tibia fractures in a trauma center that was the only reference center in a state of our country (at the time of study conduction). It seemed to us that most of tibia fractures referred to this center result from motorcycle accidents and we could hardly find studies on the topic that what is the percentage of tibia fractures that result from this route. In fact most study on the topic deal with the fractures that the motorcyclists will sustain and do not answer the question. Up to the best of our knowledge Court-Brown *et al*. (1995) were the only writers that studied the mechanism of tibia fractures as related to motorcycle riding, but the figure that they provided was 30% which seemed to us to be low for the condition in our center.

MATERIALS AND METHODS

In this prospective cross sectional descriptive study all patients with extraarticular tibia fractures referred to Shahid Mohammadi Hospital, Bandar Abbass, Iran (the main center for Hormozgan state) between April 2002 and November 2003 were assessed carefully and the gathered

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Table 1: Gustillo-Anderson classification of open fractures

Type	Description
Type I	Minor clean wound less than 1 cm in size
Type II	Moderately contaminated wound 1 to 10 cm in size
Type IIIA	Severely contaminated wound, good bone coverage
Type IIIB	Severely contaminated wound, bone coverage necessary
Type IIIC	Severely contaminated wound, arterial damage with limb viability endangered

Table 2: Winquist-Hansen classification of fracture comminution

Grade	Comminution
I	No or minimal comminution
II	More than 50% contact between the two fragments, moderate comminution
III	Less than 50% contact between the two fragments, moderately severe comminution
IV	Severe comminution with no contact between the fragments, segmental fracture

data was documented. Extraarticular fracture was defined as fracture of the entire length except for the proximal and/or distal 5 cm of the bone (Court-Brown *et al*., 1995). In case the patient was discharged before detection of all injuries (personal consent, death), he or she was excluded from the study. All of the patients were followed up until discharge and most to complete recovery. The documented data were: Age, sex, side, location of the fracture (proximal, middle or distal third, segmental fracture), open or closed fracture and type of open fracture based on Gustillo-Anderson classification (Table 1) (Gustillo and Anderson, 1976), degree of comminution based on Winquist-Hansen classification (Table 2) (Winquist and Hansen, 1980), fracture in other bones or other injuries (abdomen, chest or head trauma) and finally the mechanism of injury. Mechanism of injury was divided to 6 groups after analyzing the data: (1) motorcycle accident, applied when the patient had been riding motorcycle accident, driver or associate (2) Motor vehicle accident except for motorcycle (3) Fall from height (4) Direct trauma like pedestrian or sport injuries (5) Torsion or indirect injury and (6) Pathological and/or stress fractures. In all parts of the study calculations are based upon the number of people with fractured tibia (uni or bilateral) rather than the number of fractures, except when specifically mentioned. It must be emphasized here that in the remainder of the text P/3 means proximal third, M/3 means middle third and D/3 means distal third. Statistical calculations were performed with SPSS 14.

RESULTS

In the study period 392 diaphyseal long bone fractures were referred to our hospital from which 250 fractures were tibia fractures i.e., about 65%. Distribution of open fractures and severity of comminution with age is shown in Fig. 1 and 2. Ninety percent% of the patients

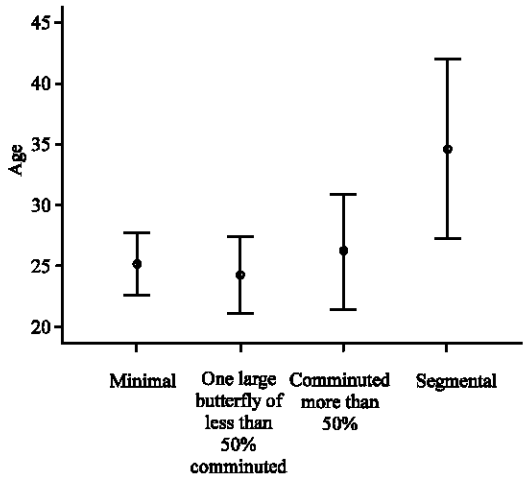

Fig. 1: Distribution of fracture comminution with age

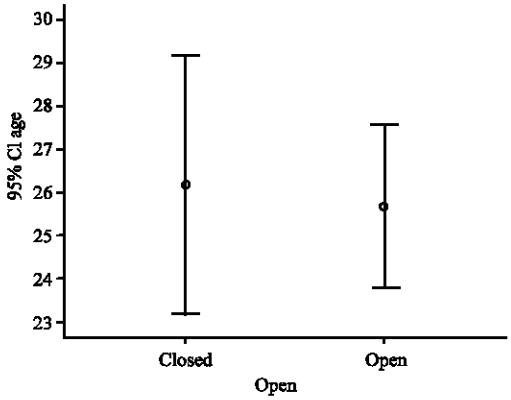

Fig. 2: Distribution of open fractures with age

(225) were male and 10% (25) female. Mean age of the patients was 25.79±14.89 years (2 to 80), 40.80±24.67 for women (3 to 80) and 24.12±12.29 (2 to 70) for men. Fifty two patients were younger than 16 years old (20.5%) (pediatric). One hundred and twenty six individuals had fractured their right tibia (50/4%), 121 their left tibia (48/4%) and 3 patients had bilateral fractures (1/2%). From all of the unilateral cases 136 fractures were located in the middle third (M/3) of the bone (55/1%), 60 in distal third (D/3) (24/3%) and 31 in proximal third (P/3) (12/6%). Twenty fractures (8/1%) were segmental i.e., in more than one place of the bone. In bilateral cases, in one patient both fractures were located in P/3, in the other the right sided fracture was in P/3 and the left one in M/3 and finally in the third one the right sided fracture was located in P/3 and the left side had sustained a segmental fracture. One hundred and forty eight of all of the diaphyseal long bone fractures referred to our hospital were open fractures, from which 106 were tibia fractures, that means about 70% of all of open diaphyseal fractures.

As mentioned 144 individuals had closed fractures (57/6%), including 41 less than 16 years old and all 3 patients with bilateral fractures. Of 106 patients with open fractures (42/4%), 51 individuals, including 8 less than 16 had sustained Type I open fracture (20/4%), 33 including 1 less than 16, type II (14/2%), 17 including 1 less than 16 Type III A (6/8%), 4 including 1 less than 16, Type III B (1/6%) and finally 1 Type IIIC (0.4%) (Fig. 2).

In 157 individuals (63/6%) including 42 less than 16 the severity of comminution was minimal (type I Winquist-Hansen classification) and in 38 (15/4%) including 6 less than 16 one large fragment and/or comminution less than 50% was present (type II). Type III comminution was present in 33 (13%) including 4 less than 16 and finally 20 patients (8/1%) had sustained segmental fractures.

Seventy two patients (29/1%) had sustained no other associated injuries and in 121 (49%) the only other injury was a fibula fracture. This means that 78/1% of the patients had injured only their leg and the fibula was fractured in 67/9% of the patients (the most common associated fracture). In 45 patients (18/9%), in addition to fibula some other bone(s) was (were) fractured too or some other injury was present. In 10 individuals the fibula was intact, but injury or fracture was present in some other part of the body. Associated injuries consisted of 4 upper limb fractures, 3 femur fractures, 1 pelvic fracture, 5 cases of head injury and noticeably 2 cases of compartment syndrome (0/8%), both of which occurred in patients with noncomminuted fracture in M/3 of the bone. In the period we could not detect any cases of abdomen or chest trauma associated with tibia fracture. In all of the 3 patients with bilateral tibia fractures, the fibula was fractured bilaterally, one of them had sustained femur fracture also and the other had multiple fractures.

Mechanism of the fracture in 145 cases was motorcycle accident (58%). Direct trauma was involved in 54 cases (6/21%) 26 cases (4/10%) were due to motor vehicle to pedestrian accident except for motorcycles, 15 had occurred during sport activities (6%) and 13 (2/5%) were the result of motorcycle to pedestrian accident. Twenty nine fractures had occurred after a fall from height (6/11%) and 11 resulted from motor vehicle accidents except for motorcycles (4/4%). Toddler fracture (torsion mechanism) was seen in 4 patients (3/6%) and the 2 pathologic fractures of our series occurred in patients with nonossifying fibroma (a benign process). No cases of stress or malignant pathologic fracture were observed.

No statistically significant relation was found between the side of the fractured limb and open fracture occurrence and the severity of comminution ($p = 0.291$ and 0.713, respectively).

DISCUSSION

In this study we examined the epidemiology of extraarticular tibia fractures in a trauma referral center of our country. According to creditable references these fracture occur in younger individuals (average age 37, 31 for men and 54 for women) and are 3 times more common in men than women (incidence 41/100000 for men and 12/100000 for women) (Court-Brown, 2001), though the incidence has been claimed to be 2 times more common in women too (Court-Brown and Birnie, 1995). In our series tibia fractures were the most common long bone fracture encountered by orthopedic surgeons and this has been the experience of others too (1). Again most tibia fractures in the present study occurred in young men. Considering that most (90%) of our patients were men and that the most common cause was motorcycle accident (58%), it can be assumed that the fact that women use motorcycle less often in our country due to cultural customs, has protected their tibias from fracture. On the other hand the higher mean age of women in the present study compares to other studies that have found osteoporosis as a causative factor in this fracture (Emami *et al*., 1996).

The high incidence of open fractures in our series is interesting. Although in experience of others tibia fractures have been the most common open diaphyseal long bone fractures (Court-Brown *et al*., 1998) and in the present study too they comprised about 70% of open long bone fractures, in other studies 25% of tibia fractures have been open (Court-Brown *et al*., 1995) in comparison to more than 40% in our series. Despite this, severe trauma is comparatively low in the present study, as with increasing the degree (type) of open fracture, the number of cases in that category decreases, so that open Type IIIC fracture occurred only in one patient (0.9% of all open fractures), whereas in Court-Brown series 60% of open fractures were of Type III and 8/2% of all open fractures were of Type IIIC. Present study found low (60%) intraobserver reliability for Gustillo-Anderson classification of open fractures (Brumback and Jones, 1994). This can explain to some extent the difference, although by no means exactly. By the same way, in the present study the number of cases decreases with increasing the severity of comminution. Both of these findings may reflect the culture of the region and the streets that neither of them allows the motorcyclists to take part in high velocity races or journeys (most if not all of the fractures in our patients riding motorcycles had occurred in the town and not the roads).

Again the finding that there was no statistically significant difference between the left and right limb with regard to open fracture occurrence and the severity of comminution is in contrast to the finding of others (Imran and Vishvanathan, 2004).

Finally is the answer to the main question of the study and the important finding of involvement of motorcycle in 65% of all of tibia fractures, which probably reflects the excessive use and unfortunately improper use of motor vehicles in the country and has been the experience of others in developing countries too (Lateef, 2002). Though many studies have been performed on the types of trauma to motorcyclists including tibia fractures (Oluwadiya *et al*., 2004; Zettas, 1979), up to the best of our knowledge very few studies have noted the relation between tibia fractures and motorcycling. So it can be easily determined from the literature that tibia fracture is the most common fracture in motorcyclists, but seldom it can be understood that what is the percent of tibia fractures that are created via motorcycle accident. In fact in the studies that we could retrieve, Road Traffic Accident has been referred to as a mechanism of fracture and motorcyclists have been considered a group only in one study (Court-Brown McBirnie, 1995), in which 30% of the fractures had been caused by this route.

It is possible that despite the best efforts some patients may have been missed in our study, for different reasons such as lack of our knowledge, despite the best preparations, of entrance of a patient with long bone fracture to the hospital. In the same way the finding of no patient with chest or abdomen trauma is strange and most likely because of missing of them.

CONCLUSIONS

Since well 58% of tibia fractures in our series have been produced by motorcycle, it seems that treating the motorcyclists and motor vehicle drivers harder and providing the motorcyclists with some form of shin guard is necessary.

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