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Epidemiology of Ankle Fracture in Mansoura University Emergency Hospital

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ABSTRACT

Background: Common injuries include ankle fractures, which can happen as a result of low-intensity trauma in young people or a high-intensity trauma in elderly, weak patients. Both the patient and the treating surgeon must overcome considerable obstacles while management of fractures of ankle in diabetic patients.

Objective: For determination of the epidemiology of ankle fractures regarding the overall incidence, incidence of each type, incidence of open fracture, incidence of diabetic patients and associated injuries.

Patients and Methods: In this analytical retrospective analysis, 255 cases of ankle fractures (malleolar fractures) of any kind and patients older than 18 years were included. The patients underwent radiographic exams, including an ankle X-ray, a duplex ultrasound on the lower limb, and, if necessary, a CT or MRI.

Results: The mean age was 37 years and male to female ratio was 55/45. Most of the studied cases were Closed Weber A1 (30%), followed by Closed Weber B2 (20%) and Closed Weber A2 (20%), then Open-Weber B3, Open-Weber B2 and Closed Weber B1, which represented 10% for each. diabetes mellitus and hypertension and smoking were recorded in 10%, 40% and 40% of cases respectively. Most of the studied cases (80%) were treated by operation, and only 20% of cases had cast management.

Conclusion: The majority of ankle fractures occur in middle-aged people, with a higher frequency of men. Ankle twisting (FTG) is the most frequent type of injury, followed by road traffic accident (RTA). In making decisions for the patients under study, smoking history is a crucial factor.

Keywords: Epidemiology, Ankle Fracture, Diabetic fractures, Weber classification.

INTRODUCTION

Common injuries include ankle fractures, which can happen as a result of low-intensity trauma in young people or a high-intensity trauma in elderly, weak patients. In order to lower the chance of developing post-traumatic ankle arthritis, treatment for these fractures tries to reestablish joint stability and alignment [1]. Open reduction and internal fixation are required for a double break of the ankle mortise ring with displacement and tibiofibular disruption. Whatever method is employed, it should secure the ankle joint mortise and provide perfect congruency, enabling early recuperation. Supine or type C supination-eversion fractures of the Lauge-Hansen classification have less displacement and fewer sequelae, but Weber ankle fractures and pilon fractures are linked to a lower result score [2].

Open fractures were typically more complex than closed fractures and occurred more frequently after high energy mechanisms. Patients with open fractures frequently had advanced ages, which most likely contributed to greater complication and secondary operation rates. Smaller disparities in the foot function index's and the brief musculoskeletal function assessment's activity functions were linked to higher morbidity following open ankle fractures. Open injuries were associated with older mean ages (51 vs 45 years, P 0.001), and fractures were more open as people aged [3].

At least three of the four major knee ligaments are typically torn after ankle fractures, and serious capsular, neurovascular, and tendinous injuries are common [4]. Diabetes patients with neuropathy or vasculopathy have greater complication rates than both diabetes patients without these comorbidities and non-diabetic patients. Open reduction and internal fixation using traditional techniques are advised for diabetic patients with unstable ankle fractures who do not have neuropathy or vasculopathy [5].

Both the patient and the treating surgeon must overcome considerable obstacles while management of ankle fractures in diabetic patients. The well-known risk factor for problems after ankle fracture repair is diabetes. Patients with diabetes who experience ankle fractures that need surgical fixation are more likely to experience complications [6]. DM patients' ankle fractures have long been acknowledged as a difficulty for working clinicians. In this patient population, malunion, delayed union, nonunion, infection, decreased wound healing, and Charcot arthropathy are common complications [7].

The aim of this study was to determine the epidemiology of ankle fractures regarding; the overall incidence, prevalence of each type, incidence of open fracture, incidence in diabetic patients and associated injuries in Mansoura University Emergency Hospital (MUEH).

PATIENTS AND METHODS

Patients who presented to the (MUEH), Mansoura, Egypt for one year (August 2022 to August 2023) with ankle fractures were included in this analytical retrospective study. The patients were analysed with regard to the mode of trauma, types of fractures, presence of diabetes mellitus, presence of vascular injury, and associated injuries. Any adult

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patient who had an ankle fracture (malleolar fractures) of any kind and was older than 18 years was included in the study. Paediatric patients younger than 18 years old with ankle fractures, patients with pilon fractures, and patients with tarsal fractures were excluded.

Methods

Primary and secondary surveys were used as part of the initial evaluation and management process in a linear progression of steps. It required life-threatening injury to be evaluated and treated when it was determined to be so in a synchronised, non-dissociated manner.

The core survey covered maintaining the airway while protecting the cervical spine, assessing breathing and ventilation, controlling bleeding, assessing impairment and neurological conditions, and assessing exposure while controlling the environment. All unstable polytrauma patients were exposed to FAST, portable chest, and pelvis X-rays in the resuscitation room to complete the initial survey.

Age, sex, occupation, mechanism of trauma, time of trauma, arrival, and resuscitation were all recorded in the secondary survey, along with the AMPLE history (A = Allergies, M = Medication used, P = Past Illnesses, L = Last Meal, and E = Events/Environment connected to injury). The clinical assessment of the patients in the trauma room included vital signs, a GCS, and a comprehensive general examination from head to toe with a log-roll to find any injuries that might be life-threatening or occult. The vascular system was examined while the lower extremities were being examined, and both strong indicators (like active bleeding, pulsatile hemorrhage, or expanding hematomas) and soft symptoms (like weak pulses, hypotension, or considerable on-scene blood loss) were looked for. Assessment of the peripheral nerves was done for common peroneal nerve injury, deep peroneal (Fibular) nerve injury, and superficial peroneal (Fibular) nerve injury (motor and sensory testing).

Investigations:

Laboratory investigations included complete blood count, liver function tests, kidney function tests and international normalized ratio. While radiological examinations included X-ray antero-posterior, lateral and mortise view on ankle, duplex ultrasound on lower limb and CT or MRI if required.

Ethical approval:

This study was approved by the Mansoura Medical Ethics Committee of the Mansoura Faculty of Medicine. All participants gave written consent after receiving all information. The Helsinki Declaration was followed throughout the study's conduct.

Statistical analysis

SPSS software, version 25 (SPSS Inc., Chicago, USA), was used to analyse the data. Number and percentage were used to describe qualitative data. Mean, standard deviation (SD), median, and range were used to describe quantitative data. The acquired results' significance was assessed at the (0.05) level. When necessary, the Chi-Square test was performed for comparing qualitative data between groups. For properly distributed quantitative data, the student t-test was employed to compare two independent groups.

RESULTS

255 patients with ankle fractures were included in this analytical retrospective study. Table 1 lists the analyzed cases' demographic features. The analysed cases had a mean age of 37. The ratio of men to women (M/F) was 55/45. Ankle twist (FTG), was the most frequent form of trauma. Closed Weber A1 accounted for roughly 30 percent of the examined cases. Only 20% of the patients in the study had open fractures, whereas 80 percent of the cases involved closed fractures. In 50% of the cases there were no associated injuries. In 50 percent of the instances there were no related fractures. 10 percent and 40 percent of cases, respectively, had DM and HTN. Additionally, smoking was noted in 40 percent of the cases. 100 percent of the cases were edematous. The majority of the examined cases (80 percent) were operated on, while just 20 percent were cast-managed.

Table (1): Demographic characteristics, mode of trauma, fracture classification, oedema, associated injuries, fractures and diseases and treatment decision of the studied cases

	N=255	**%**
Age/ years: **Median (range)**	35.5(15.0-61.0)	
Sex		
Male	140	54.9
Female	115	45.1
Mode of trauma		
RTA	76	29.8
FTG (Ankle twist)	153	60.0
FFH	26	10.2
Classification		
Open -Weber B3	26	10.2
Open -Weber B2	26	10.2
Closed Weber B2	51	20.0
Closed Weber B1	26	10.2
Closed Weber A2	51	20.0
Closed Weber A1	75	29.4
Open	52	20.4
Closed	203	79.6
Associated injury		
NO	127	49.8
Monophasic ATA-PTA	26	10.2
Cut wound only on foot	26	10.2
Biphasic ATA-PTA	51	20.0
Anterior tibiofibular ligament Injury	25	9.8
Associated Fracture		
No	127	49.8
Surgical neck humerus	26	10.2
Fracture LL BB	25	9.8
Fracture Neck of femur	26	10.2
Fracture L2-3	25	9.8
Fracture Calcaneus	26	10.2
Disease		
No	127	49.8
HTN	102	40.0
DM	26	10.2
Smoking history		
Nonsmoker	153	60.0
Smoker	102	40.0
Oedema	255	100.0
Treatment Decision		
Operation	204	80.0
Cast	51	20.0

The relationship between sociodemographic traits and the choices made for the sample under study is shown in Table 2. While there was no statistically significant association found between age and the choice made, there was a highly statistically significant correlation between sex and the choice made. Between the type of trauma and the choice made (surgery or cast), there was a highly statistically significant connection.

Table (2): Relation between demographic characteristics, mode of trauma and decision taken for studied sample

	Cast (No=51%)	Operation (No=204%)	Test of significance
Age/years (Mean ±SD)	34.0±2.09	38.13±18.94	P=0.122
Sex			
Male	51(100)	89 (43.6)	P<0.001*
Female	0	115 (56.4)	
Mode of trauma			
RTA	25(49)	51(25)	P<0.001*
FTG (Ankle twist)	0	153(75)	
FFH	26(51)	0	

*Statistically significant

Table (3) shows the relationship between fracture categorization and the choice made for the sample under study. The classification of the fracture and the choice made were statistically significantly correlated. The relationship between related injury, associated fracture, and decision made for the analyzed sample is shown in Table (4). The choice made was significantly correlated with the resulting fracture and damage.

Table (3): Relation between fracture classification and decision taken for studied sample

	Cast (N=51%)	Operation (N=204%)	Test of significance
Classification			
Open -Weber B3	0	26(12.7)	P<0.001*
Open -Weber B2	0	26(12.7)	
Closed Weber B2	0	51(26)	
Closed Weber B1	0	26(12.7)	
Closed Weber A2	26(51)	25(12.3)	
Closed Weber A1	25(49)	50(24.5)	

*Statistically significant

Table (4): Relation between associated injury, associated fracture and decision taken for studied sample

	Cast (N=51%)	Operation (N=204%)	Test of significance
Associated injury			
NO	0	127(62.2)	
Monophasic ATA-PTA	0	26(12.7)	P<0.001*
Cut wound only in foot	26(51)	0	
Biphasic ATA-PTA	0	51(25.0)	
Anterior tibiofibular ligament injury	25(49)	0	
Associated fracture			
No	0	127(62.2)	
Surgical neck humerus	0	26(12.7)	P<0.001*
Fracture LL BB	25(49.0)	0	
Fracture NOF	0	26(12.7)	
Fracture L2-3	0	25(12.2)	
Fracture Calcaneus	26(51.0)	0	

*Statistically significant

The relationship between the related disease and the choice made for the sample under study is shown in table (5). Between the linked disease and the choice made (surgery or cast), there was no statistically significant connection. Smoking history and the choice made (surgery or cast) were statistically significantly correlated (p<0.001).

Table (5): Relation between associated disease, smoking history and decision taken for studied sample

	Cast (N=51%)	Operation (N=204%)	Test of significance
Disease			
No	32(62.9)	95(46.6)	P=0.392
HTN	9(17.6)	93(45.6)	
DM	10(19.6)	16 (7.8)	
Smoking History			
Non-smoker	0	153(75)	P<0.001*
Smoker	51(100)	51(25)	

*Statistically significant

DISCUSSION

Despite the prevalence of ankle fractures, not much has been written recently about epidemiology. Ankle fracture incidence from a non-selected patient group is reported to be 168.7/100,000/year in one study [8]. The current study provided evidence about demographic parameters, showing that the mean age of the cases under study was 37 years. The ratio of men to women (M/F) was 55/45. Different types of traumas, such as twisting, impact, and crush injuries, can result in ankle fractures. Twisting forces may be transmitted through the ankle during sports, falls, trips, or other activities. Impact injuries can happen when someone falls from a height and hits their talus with their distal tibia and fibula. An ankle crush injury may result from a car collision or by being crushed beneath a large object [9].

The results of the current study showed that ankle twist (FTG) was the most frequent type of trauma, followed by RTA (30 percent) and FFH (10 percent). Likewise, **Xu and his coworkers**[10] have identified six mechanisms of harm, including 9 patients with crush injuries, 90 with twisting injuries, 80 with falls from a standing height or below, 17 with sports injuries, 4 with height-related falls, and 35 with traffic accidents. Twisting injuries (38.5 percent) and falls from a height of standing or less (34.2 percent) were the most frequent mechanisms.

Similar to this, **Mizusaki and his colleagues**[11] have demonstrated that the most common mechanism of injury was a fall from standing height (dancing, dancing, sports, strolling, stepping out of a car), which occurred in 51.42 percent of the patients, with half of them being women and a mean age of 46.22 years. 20% of the patients who experienced the second most frequent mechanism—falling down stairs had a mean age of 48.35 years and were 85.71 percent female. The third most prevalent mechanism, which affected 10% of the patients (all of whom were men with a mean age of 41.42), was being run over by a car. The next most common condition was car accidents, which affected 7.15 percent of the patients and were all men with a mean age of 30.8 years. The second most frequent mechanism was direct trauma to the fibula, which occurred in 4.28 percent of the patients, all of whom were men with a mean age of 32.33. 7.15 percent of the patients, who had a mean age of 43.8 years and were all male, experienced falls from heights.

Elsoe and his associates[8] have shown that falls (61%) and sports (22%) were the two most common ways of injury. Accordingly, **Court-Brown and Caesar**[12] have shown that falls from standing height account for around 80% of all fractures and are the most common mechanism of damage. The researchers also discovered that sports-related injuries accounted for 20.8% of all type C fractures, with patients' average ages being 32.5 years old and being exclusively male.

An increase in ankle fractures has been noted in several research over the past few decades. The increase in sports participation and the shift in the population's age composition are the main factors believed to be responsible for this. For many distinct fracture types, it is common to report changes in incidence, fracture pattern, and demography over time [12,13].

The most frequent cause of injury, according to **Scheer and his colleagues**[1] research, was falling (54.83 percent), followed by sports (20.76 percent), exercise (16.84 percent), jumping (4.42 percent), trauma (2.84 percent), and others (0.30 percent)**.** According to a study by **Sakaki and his colleagues**[14], torsional trauma, which occurred in 34 cases, was the most common type of injury, followed by car accidents (20 cases) and motorcycle accidents (19 cases).

The current study's findings regarding fracture classification showed that the majority of the analyzed cases were classified as Closed Weber A1 (30 percent), Closed Weber B2 (20 percent), and Closed Weber A2 (20 percent), before Open-Weber B3, Open-Weber B2, and Closed Weber B1 (10%) each. Eighty percent of the cases investigated were closed fractures, while only twenty percent involved open fractures. Similar findings have been made by **Mizusaki and his colleagues**[11], who found that 20 patients (13.34 percent) had open fractures while 20 patients (86.66 percent) had closed fractures. Additionally, 70 patients (46.66 percent) had Weber type B fractures, followed by 32 percent for type A and 21.34 percent for type C fractures.

Stéfani et al.[15] have shown that this approach exhibits significant interobserver reliability, with 38 percent having type A, 52 percent having type B, and 10 percent having type C. Accordingly, **Sakaki and his associates**[14] have shown that the B type was the most prevalent, with 41 cases, followed by the C type with 27 cases and the A type with 5. The most prevalent subtype, B2, had 21 occurrences, or 28 percent of the treated patients. According to the **Gustilo and Anderson**[16] classification, twenty-one fractures (28 percent) were compound fractures, eight of which were type I, four type II, four type IIIA, and five type IIIB.

The fracture distribution according to the orthopaedic trauma association (OTA) classification **Marsh *et al.*** [17] was reported as 24.1 percent type A, 65.8 percent type B, and 10.1% type C [12], as shown by **Marsh and his colleagues**[17]. Bimalleolar fractures account for 20 percent of fractures, unimalleolar fractures for 70% of fractures, and trimalleolar fractures for 10 percent of fractures [9,18, 19].

Women 60 years of age and older with bi- and trimalleolar fractures had the highest frequency of open ankle fractures, which are difficult to handle in terms of soft tissue. The category of open fractures made approximately 3% of all fractures. The length of

hospitalization was longer than it was for closed fractures because of the severity of the injury, however it did shorten during the study period. As anticipated, open fractures were more common than closed fractures to be involved in transport incidents. Contrary to recent data (for 1998–2008), which shows a usually moderate increase in fractures in arms and legs, transport accidents as the mechanism of injury declined slightly during the research period [20].

The current study showed that 50 percent of the analyzed cases had no linked injuries in terms of the distribution of the presence of associated fractures, diseases, and injuries. The percentages of monophasic anterior and posterior tibial arteries (ATA-PTA), cut wounds in the foot, biphasic ATA-PTA, and anterior tibiofibular ligament injury were around 50, 10, 20, 10, and 10 respectively. In 50 percent of the instances that were evaluated, there were no related fractures. For each type of fracture, there were roughly 10% of surgical neck humerus fractures, LL BB and NOF fractures (both of which involved the lower limbs), L2-3 fractures, and calcaneus fractures. In 50 percent of the instances that were evaluated, there were no underlying illnesses.

Sakaki and his associates[14] have shown that 16 cases involved individuals had multiple traumas. Additionally, 22 patients with a total of 34 related musculoskeletal injuries were identified. According to research by **Mizusaki and his colleagues**[11], 42 patients (28 percent) had a concurrent skin lesion, while 116 patients (77.33 percent) did not receive any medicine.

The current study's findings on treatment choices showed that the majority of the investigated cases (80 percent) were operated upon, with just 20% underwent cast care and follow-up at an outpatient clinic. The majority of ankle fractures in **Thur and colleagues**[20] investigation were surgically repaired, as would be expected; given that they only looked at inpatients**.** As a result, they underwent more surgeries than had previously been recorded. With open fractures than with closed fractures, external fixation was more frequently employed. This is not unusual because open fractures require initial damage control more frequently [20].

While most ankle fracture patients used plaster casts as temporary immobilization devices prior to final fixing, **Sakaki and his colleagues**[14] found that six (8.2 percent) had definite osteosynthesis performed on the same day of admission and that 18 (24.7 percent) required reduction of the associated dislocation and installation of a trans-articular external fixation**.** The proportions of conservative, external fixation, surgical with screw, and surgical with screw + plates, according to **Mizusaki and colleagues**[11] investigation, were, respectively, 25.34 percent, 6.67 percent, 10.66 percent, and 57.33 percent.

According to the results of the current study, smoking history and the choice between having surgery or wearing a cast had a very statistically significant link ($P<0.001$). Smoking prevents or delays the ankle fracture from healing, which may necessitate surgery for the cast-wearing patient. Smokers were likely among the patients who underwent surgery. In a similar vein, **Audet and her colleagues**[21] have shown that current smokers are more likely than former smokers and non-smokers to use prescription painkillers several months after injury and have worse patient-reported functional outcome scores following surgical treatment of torsional ankle fractures.

While **Dean and his colleagues**[22] showed no correlation between smoking and physical function (PF) and pain interference (PI) PROMIS scores after at least two years, **Bhandari and his colleagues**[23] reported that smoking was linked to worse SF-36 scores three months after an ankle fracture.

Also, active smoking is a substantial modifiable risk factor, and it should be stopped before foot and ankle surgery whenever it is possible, according to research by **Beahrs and his colleagues**[24]. Orthopaedic surgeons are crucial in informing patients about the negative effects of smoking and allowing access to services for quitting.

Smoking has been connected to higher incidence of general complications and wound complications, second only after the complications of the spine, knee, hip, tibia, and total hip arthroplasty. Furthermore, smoking has been associated with a rise in non-unions following fractures of the tibia, hip, cervical spine, and lumbar spine [25].

CONCLUSION

The majority of ankle fractures occur in middle-aged people, with a higher frequency of men. Ankle twisting (FTG) is the most frequent type of injury, followed by RTA. Weber A and B showed comparable incidence (each at 50 percent). In making decisions for the patients under study, smoking history is a crucial factor.

RECOMMENDATIONS

Further studies have to be conducted on large number of cases and on different population to confirm our results. Smoking cessions should be performed to decrease the possibility of ankle fracture. Keep observation of diabetic patients with ankle fracture to prevent fracture complications.

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