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ORIGINAL ARTICLE

# Pattern of Ankle Fractures Presenting in the Emergency Department of a Tertiary Care Center- A Descriptive Cross-sectional Study

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## ABSTRACT

**BACKGROUND**
This study aims to determine the prevalence of ankle fractures among patients presenting in the emergency department, as well as the injury patterns, demographic profiles, associated injuries, and modes of injury.

**METHODS**
This descriptive cross-sectional study was done at a tertiary care center involving patients presented with ankle fractures at the emergency department between January 1, 2022, and December 31, 2023. All patients diagnosed with ankle fractures were included in the study. Those with missing clinical records or radiographic images presented late (> 2 weeks of injury) and managed in other centers were excluded.

**RESULTS**
Out of 2256 patients, 168 (7.45%) had ankle fractures. Among 168 patients, 155 met the inclusion and exclusion criteria. There were 106 (68.39%) males and 49 (31.61%) females, with a mean age of 39.23±18.85 years (range, 6 to 83 years). RTA was seen in 100 (64.5 %) patients. Open fractures were seen in 16 (10.1%) cases. Associated injuries were seen in 53(34.2%) cases.

**CONCLUSION**
Ankle fracture commonly occurs in males in the fourth decade of life. RTA was the most common mechanism of injury. All findings observed were similar to what was reported in international studies.

**KEYWORDS**
Ankle fractures, Danis-Weber classification, Lauge-Hansen Classification

## INTRODUCTION

Ankle fracture is a common injury, with recent studies demonstrating an annual incidence of 120–150 fractures per 100,000 persons.[1] It is about 10% of all fractures and 36% of all lower extremity fractures.[2–4] The incidence is still increasing, particularly among elderly citizens, because of aging-associated increases in fragility fractures.[4] Sports injuries are a major cause of ankle fractures, but high-energy trauma is responsible for the most serious sequelae.[5] Lauge Hansen classified these fractures based on a cadaveric study into five groups: supination-adduction (SAD), supination-external rotation (SER), pronation-external rotation (PER), pronation-abduction (PAB), and pronation-dorsiflexion (PD).[6] The first term specifies the foot's position at injury, and the second indicates the direction of the force applied to the foot at injury.[6] It correlates the lines of ankle fractures with specific traumatic mechanisms. Another classification was the Danis-Weber classification, which was based on the location of the primary fibular fracture line.[6] The classification divided ankle fractures into three groups: type A (below the syndesmosis level), type B (at the syndesmosis), and type C (above the syndesmosis).[7] It is known from the literature that ankle fractures may cause functional disability for numerous activities and are often associated with pain, leading to significant negative effects on the quality of life.[8] Appropriate management of these injuries is essential to provide satisfactory functional outcomes.[8] Also, a proper understanding of fracture patterns and the mechanism of injury aids in treatment planning and execution.[9] There is scarce literature on ankle fractures evaluating injury mechanisms of fracture patterns. This study aims to find out the prevalence of ankle fractures in patients presenting to an emergency department. In addition, this study will explore demographic

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parameters, mechanisms of injury, and fracture classification.

## METHODS

A descriptive cross-sectional study was conducted at B&B Hospital, Gwarko, Lalitpur, Nepal, after getting formal approval from the institutional review committee (ref number: B&B IRC-23-26). The study included all patients presenting to the emergency department with ankle fractures between January 1, 2022, and December 31, 2023. Those patients with missing clinical records and radiographic images presented late (> 2 weeks of injury) and managed in other centers were excluded. A convenient sampling technique was used. The sample size was calculated using the following formula:

Sample size

Minimum required sample (N)

$= Z^2 \times p \times q / d^2 = 1.96^2 \times 0.1 \times (1-0.1) \div 0.05^2$

$= 138.29$

$= 139$

Where,

Z = 1.96, constant for a 95% Confidence interval

P = prevalence, 10% taken from previous study[2]

Q= 1-p

d = margin of error, 5%

The calculated sample size was 139. However, all eligible patients within the study period were included.

The following data were recorded using electronic pro forma: age, gender, side involved, mechanism of injury, injury type (open or close), fracture classification (Lauge Hansen and Danis-Weber)[6], and associated injuries. The diagnosis of ankle fracture was made after clinical and radiographic evaluation done in the emergency department by the principal investigator and verified by the senior author.

The data was then stored in Microsoft Excel version 2019. Descriptive statistic was used. Continuous data was reported as mean ± standard deviation and categorical data was reported as number (percentage). The data analysis used the Statistical Package for Social Sciences (SPSS) version 26.0.

## RESULTS

Within the study period, 2256 patients presented to the emergency department with fractures. Out of 2256 patients, 168 (7.45%) had ankle fractures. Among 168 patients, 155 met the inclusion and exclusion criteria. There were 106 (68.39%) males and 49 (31.61%) females, with a mean age of 39.23±18.85 years (range, 6 to 83 years). The right side was involved in 93 (60%), the left side was involved in 58 (37.4%), and bilateral involvement was seen in 4 (2.6 %) cases. RTA was seen in 100 (64.5 %) patients, followed by falls from heights 27 (17.4%), twisting injuries 26 (16.8%), and others 2(1.3%). Open fractures were seen in 16 (10.1%) cases. Associated injuries were seen in 53(34.2%) cases. Out of 159 fractures, 129 (81.13%) could be classified using the Danis-Weber classification, and Type A was seen in 36 (27.9%), Type B was seen in 42 (32.55%), and Type C was seen in 51 (39.53%). [Table 1]

Table 1: Fracture patterns (n=159)

| Characteristics | Frequency, n (%) |
|---|---|
| **Anatomic classification** | |
| Uni-malleolus | 110 (69.18%) |
| Bi-malleolar | 39 (24.5%) |
| Tri-malleolar | 10 (6.28%) |
| **Lauge-Hansen Classification** | |
| SAD | 15 (9.43%) |
| SER | 54 (33.96%) |
| PER | 46 (28.93%) |
| PAB | 34 (21.39%) |
| PD | 10 (6.29%) |

## DISCUSSION

This study identified that the overall prevalence of ankle fractures was 7.45%. The finding was comparable to what was reported in the literature, which ranges from 6-10%.[2,10,11] In a study involving 2653 patients with various fractures, ankle fracture prevalence was 8.6%.[10] Similarly, in this study, male predominance was found at 68.39%. The finding was similar to what was reported in the literature, around 61-78%.[12,13] However, some studies have reported female predominance.[4,14] The reason behind that was the elderly population with low-energy injuries. This suggests that ankle fractures due to high-energy injuries are likely to occur among males, and low-energy injuries are common among elderly females. Furthermore, the mean age was 39.23 ±18.85 years. The finding was similar to what was reported in the literature, which ranges from 37-48 years.[12–14] This suggests that ankle fractures commonly occur in the fourth decade of life.

The commonest mechanism of injury was RTA, with 64.5%. The findings were similar to what was reported in the literature.[10,13] The frequency ranged from 67-80%.[10,13] In contrast, some studies have found low-energy falls as the predominant mechanism of injury.[3,12,15] However, they have included only elderly patients with fragility fractures. This suggests that ankle fracture also has bimodal distribution regarding the mechanism of injury. It occurs due to high-energy injuries among younger patients and low-energy injuries among the elderly.

This study also finds that uni malleolar fracture was the most common fracture type, with 69.18%. The finding was similar to what was reported in the literature, around 33-65%.[12,15,16] Similarly, according to the Danis-Weber classification, the commonest fracture type was type C, and according to the Lauge-Hansen classification, the commonest fracture type was SER type. The findings were also similar to what was reported in the literature.[10,13] This suggests that isolated lateral malleolus fractures are the most common fracture. Furthermore, open fracture was seen in 10.1% of cases. The finding was lower compared to what was reported in the literature, which was around 13-27%.[10,12,16] The exact reason behind the lower incidence of open fractures could not be identified. However, it can be assumed that most of the RTA in our patient population is motorbike accidents, and the ankle injury could be due to indirect injury rather than direct injury in previous studies,

resulting in a higher prevalence of open fractures.[10,12,16]
This study has several limitations. This was a single-center study, and convenient sampling was used, suggesting a risk of selection and reporting bias. Several other parameters, such as the presence of syndesmotic injuries, different patterns of associated injuries, hospital stay, and treatment commenced, which could influence the burden of disease, were not evaluated. This suggests that the findings of this study cannot be generalized. Hence, further study, including all epidemiological parameters, is required to strengthen the findings of this study further.

## CONCLUSION

Ankle fracture has a prevalence of 7.45%. They commonly occur in males in the fourth decade of life. RTA was the most common mechanism of injury. Unimalleolar fractures are the most common fracture type. All findings observed were similar to what was reported in international studies.

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