World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(CASE REPORT)

A rare case of bilateral closed Supratubercular bimalleolar ankle fractures in an adult: a surgical case report

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World Journal of Advanced Research and Reviews, 2026, 29(03), 829-836

Publication history: Received on 04 February 2026; revised on 10 March 2026; accepted on 13 March 2026

Article DOI: https://doi.org/10.30574/wjarr.2026.29.3.0624

Abstract

Introduction: Bilateral ankle fractures are rare injuries, particularly as closed supratubercular bimalleolar fractures. These unstable patterns involve a fibular fracture above the syndesmosis with medial malleolar injury and require precise anatomical reduction to restore ankle stability. Bilateral symmetrical involvement is exceptionally uncommon and may result from synchronized rotational forces applied to both ankles.

Case Presentation: A 35-year-old male with no prior medical history sustained bilateral ankle trauma after a low-energy fall. Examination showed bilateral swelling, deformity, and inability to bear weight, with intact skin and preserved distal neurovascular status. Radiographs revealed bilateral supratubercular lateral malleolar fractures associated with oblique medial malleolar fractures, confirming bilateral closed bimalleolar ankle fractures. The patient underwent single-stage bilateral open reduction and internal fixation using plate-and-screw constructs for the fibulae and cancellous screws for the medial malleoli, along with bilateral transsyndesmotic fixation. Postoperatively, immobilization was followed by progressive rehabilitation. Radiographic union was achieved at six weeks, and full, pain-free functional recovery was observed at three months.

Discussion: Bilateral ankle fractures are exceptional and may occur when similar rotational forces act simultaneously on both ankles. Supratubercular fibular fractures are often associated with syndesmotic disruption, making stabilization essential to restore ankle congruence and prevent long-term complications. Rigid internal fixation combined with syndesmotic stabilization allows early rehabilitation and favorable outcomes.

Conclusion: Bilateral closed supratubercular bimalleolar ankle fractures are an extremely rare injury pattern that can result from simultaneous rotational forces. Early diagnosis, anatomical reduction, stable fixation, and structured rehabilitation are key to achieving excellent functional outcomes.

Keywords: Bilateral ankle fracture; Bimalleolar fracture; Supratubercular fibular fracture; Rotational mechanism; Surgical fixation; Case report**.**

1. Introduction

Ankle fractures are among the most common injuries encountered in orthopedic trauma practice, typically resulting from low- to moderate-energy mechanisms. The majority are unilateral and follow well-established fracture patterns with standardized diagnostic and therapeutic approaches. In contrast, bilateral ankle fractures are distinctly rare and

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are most often associated with high-energy trauma, bone fragility, or unusual injury mechanisms involving simultaneous forces applied to both ankles.

Supratubercular bimalleolar ankle fractures, defined by a fibular fracture above the level of the syndesmosis associated with medial malleolar involvement, represent an unstable injury pattern commonly related to external rotational forces acting on a fixed foot. The occurrence of this fracture configuration in a bilateral closed form is exceptionally uncommon, with only a limited number of cases reported in the literature. Such bilateral injuries may result from synchronized rotational stresses applied concurrently to both lower limbs, even in the context of low- to moderate-energy trauma. Simultaneous involvement of both ankles poses significant challenges in diagnosis, surgical planning, postoperative management, and rehabilitation, with a major impact on patient mobility and functional recovery.

In this report, we present a rare case of bilateral closed supratubercular bimalleolar ankle fractures in an adult patient, successfully managed with surgical fixation followed by structured rehabilitation. The objectives of this case report are to describe the clinical and radiological features of this unusual injury pattern, to discuss the underlying injury mechanism, and to highlight the surgical management strategy and the role of early rehabilitation in achieving favorable functional outcomes.

2. Methods

This case report describes the clinical assessment, diagnostic approach, surgical management, and follow-up of an adult patient presenting with bilateral closed supratubercular bimalleolar ankle fractures. The patient was managed at a tertiary-level trauma and orthopedic center with specialized expertise in musculoskeletal injuries.

Initial evaluation included a comprehensive clinical examination of both ankles, focusing on swelling, deformity, pain, and functional impairment, as well as careful assessment of skin integrity and distal neurovascular status. Standard radiographic assessment was performed using anteroposterior, lateral, and mortise views of both ankles. The fracture patterns were identified as supratubercular fibular fractures associated with medial malleolar fractures and were classified according to the Lauge–Hansen classification system. Advanced imaging techniques, such as computed tomography, were not required due to the clear characterization of the fractures on plain radiographs.

Surgical treatment consisted of bilateral open reduction and internal fixation, performed under general anesthesia in a single operative session. Anatomical reduction was achieved and stabilized using plate-and-screw fixation for the fibular fractures and cancellous screws for the medial malleoli. Due to associated syndesmotic instability, bilateral transsyndesmotic fixation was performed using syndesmotic wires (syndesmotic pins) to stabilize the distal tibiofibular joints. Intraoperative fluoroscopy was used to confirm fracture reduction, implant positioning, restoration of fibular length, and ankle mortise stability.

Postoperative management included bilateral immobilization, strict non–weight-bearing, and standardized analgesic and thromboprophylaxis protocols. After an initial immobilization period, a structured and progressive physiotherapy program was initiated to restore ankle range of motion, strength, and functional capacity. Clinical and radiological follow-up assessments were conducted at regular intervals to evaluate fracture union, functional recovery, and the occurrence of any complications.

This case report was prepared in accordance with the SCARE 2023 guidelines, ensuring accuracy, transparency, and completeness of reporting (4).

3. Case Presentation

A 35-year-old male patient with no significant past medical history presented to the emergency department following a low-energy fall resulting in bilateral ankle trauma. The patient complained of severe pain in both ankles associated with complete inability to bear weight. On admission, he was hemodynamically stable, afebrile, and in good general condition.

3.1. Clinical Examination

Physical examination revealed **bilateral ankle swelling and deformity**, associated with marked tenderness on palpation and limited range of motion due to pain. Ecchymosis was noted around both ankles. The skin was intact with no open wounds. Distal neurovascular examination of both lower limbs was normal, with preserved peripheral pulses and intact sensory function **(Figure 1).**

Figure 1 Clinical presentation showing bilateral ankle deformities with visible swelling

3.1.1. Imaging Studies

Standard radiographic evaluation of both ankles, including anteroposterior, lateral, and mortise views, revealed bilateral bimalleolar ankle fractures associated with dislocation of the left ankle. On both sides, the lateral malleolus showed a supratubercular fracture located more than 6 cm above the tibiotalar joint line, with an oblique fracture pattern, while the medial malleolus also demonstrated an oblique fracture line.

According to the Lauge-Hansen classification, this injury pattern corresponds to a pronation–external rotation (PER) mechanism, stage III, characterized by a suprasyndesmotic fibular fracture resulting from external rotational forces applied to a pronated foot. These findings confirmed the diagnosis of bilateral closed supratubercular bimalleolar ankle fractures **(Figure 2) (Figure 3)**.

Figure 2 Radiographs of the right ankle showing a supratubercular bimalleolar fracture.

Figure 3 Radiographs of the left ankle demonstrating a supratubercular bimalleolar fracture associated with ankle dislocation.

3.1.2. Surgical Treatment

The patient underwent bilateral open reduction and internal fixation in a single operative session under general anesthesia.

- Right ankle: The lateral malleolar supratubercular fracture was stabilized using an 8-hole tubular plate, with six screws applied for fixation and an additional interfragmentary compression screw across the fracture site. The medial malleolar fracture was fixed using two cancellous screws. Syndesmotic instability was addressed by the insertion of a transsyndesmotic fixation wire (broche de syndesmose) to restore ankle mortise stability.

- Left ankle: The lateral malleolus was similarly stabilized with an 8-hole tubular plate using six screws. Fixation of the medial malleolus was achieved with a single cancellous screw. A transsyndesmotic fixation wire was also inserted to ensure adequate stabilization of the distal tibiofibular joint.

Intraoperative fluoroscopy confirmed satisfactory fracture reduction, proper implant positioning, and restoration of ankle alignment and stability. Postoperative radiographs demonstrated anatomical reduction and stable fixation of both ankles (Figures 4–6). The surgical procedure was uneventful.

Figure 4 Anteroposterior radiograph of both ankles showing plate-and-screw fixation of the lateral malleoli, cancellous screw fixation of the medial malleoli, and bilateral transsyndesmotic fixation wires.

Figure 5 Lateral radiograph of the right ankle showing plate-and-screw fixation of the lateral malleolus, cancellous screw fixation of the medial malleolus, and a transsyndesmotic fixation wire

Figure 6 Lateral radiograph of the left ankle showing plate-and-screw fixation of the lateral malleolus, fixation of the medial malleolus with a single cancellous screw, and a transsyndesmotic fixation wire

3.2. Postoperative Course and Outcome

Postoperatively, the patient was immobilized in bilateral plaster casts and maintained on strict non–weight-bearing. Plaster immobilization was continued for three weeks, after which a passive and progressive rehabilitation program was initiated to preserve ankle mobility. Radiographic assessment at six weeks demonstrated complete fracture union, allowing gradual progression to partial and then full weight-bearing.

At three months of follow-up, the patient had achieved full functional recovery, with normal range of motion in both ankles, absence of pain, and no residual functional limitations. He was able to return to his daily activities without restrictions.

4. Discussion

Bilateral closed ankle fractures are rare injuries, representing a small fraction of ankle fractures reported in the literature. The majority of ankle fractures are unilateral and result from isolated rotational mechanisms. Bilateral involvement is exceptional and usually associated with either high-energy trauma or the simultaneous application of similar mechanical forces to both ankles (8).

The fracture pattern observed in this case consisted of bilateral bimalleolar ankle fractures, with a supratubercular fracture of the lateral malleolus associated with an oblique fracture of the medial malleolus. This configuration reflects a rotational injury mechanism acting at the ankle joint. According to biomechanical principles, such fractures typically result from external rotation forces applied to a weight-bearing foot, leading to sequential failure of the osseous structures of the ankle (2,9). The supratubercular location of the fibular fracture suggests a high rotational moment transmitted proximally along the fibula, while the oblique fracture of the medial malleolus reflects tensile stress on the medial aspect of the ankle.

The occurrence of bilateral symmetrical fracture patterns can be explained by the injury mechanism. During low-energy falls, simultaneous twisting of both ankles may occur when both feet are planted and the body undergoes sudden rotation, such as during a slip or misstep. This can generate comparable rotational forces on both ankles, resulting in mirror-image injuries. Similar cases of bilateral ankle fractures following minor trauma have been reported, supporting the hypothesis that synchronized rotational loading rather than impact severity plays a key role in bilateral injuries (8).

According to the Lauge-Hansen classification, this injury pattern corresponds to a **pronation–external rotation (PER) mechanism, stage III**, characterized by a suprasyndesmotic fibular fracture resulting from external rotational forces applied to a pronated foot (11). These findings confirm the diagnosis of bilateral closed supratubercular bimalleolar ankle fractures. The correlation between this biomechanical model and the radiographic features strengthens the hypothesis of synchronized rotational forces acting on both ankles. Recognition of this mechanism is clinically important, as it guides systematic assessment of distal tibiofibular syndesmotic stability and supports the indication for transsyndesmotic fixation performed in this case (12).

Supratubercular fibular fractures are frequently associated with disruption of the distal tibiofibular syndesmosis due to the transmission of rotational forces beyond the ankle mortise. Inadequate management of syndesmotic instability may compromise ankle congruence and lead to chronic pain, instability, and early post-traumatic osteoarthritis. In the present case, systematic syndesmotic stabilization using transsyndesmotic fixation wires in both ankles was performed to restore the anatomical relationship between the tibia and fibula and ensure rotational stability of the ankle mortise. This strategy is supported by clinical and biomechanical studies emphasizing the importance of addressing the syndesmosis in fractures extending above the ankle joint (1,6).

The use of transsyndesmotic fixation remains a widely accepted technique in the management of ankle fractures with syndesmotic involvement, and several studies have reported satisfactory functional outcomes regardless of whether the fixation is retained or removed after fracture healing (7).

Rigid internal fixation remains the cornerstone of treatment for unstable bimalleolar ankle fractures. Plate fixation of the lateral malleolus allows restoration of fibular length and alignment, while screw fixation of the medial malleolus ensures medial column stability (3,5). When combined with syndesmotic stabilization, this construct provides sufficient rigidity to allow early functional rehabilitation.

Even minimal malalignment of the ankle mortise following malleolar fractures can significantly alter tibiotalar contact pressures, predisposing to early post-traumatic osteoarthritis. This underscores the critical importance of achieving anatomical reduction and stable fixation in ankle fractures (10).

Rehabilitation is particularly challenging in bilateral ankle fractures due to prolonged non-weight-bearing and the risk of joint stiffness and muscle atrophy. Early initiation of controlled rehabilitation following a short period of immobilization has been shown to improve range of motion and functional outcomes (8). In the present case, progressive rehabilitation resulted in complete restoration of ankle mobility and function within three months.

Compared with open ankle fractures, closed fractures generally demonstrate a more favorable prognosis with fewer soft-tissue complications such as infection and delayed union (9). However, bilateral involvement requires meticulous surgical planning and coordinated rehabilitation to achieve symmetrical functional recovery. The excellent outcome observed in this patient highlights the effectiveness of prompt diagnosis, appropriate surgical fixation, syndesmotic stabilization, and structured rehabilitation.

5. Conclusion

Bilateral closed bimalleolar ankle fractures with supratubercular involvement of the lateral malleolus represent an exceptionally rare clinical entity. Their occurrence can be explained by synchronized rotational forces applied to both ankles, even in the context of low-energy trauma.

This case demonstrates that accurate diagnosis, meticulous anatomical reduction, rigid internal fixation, and systematic syndesmotic stabilization, followed by structured rehabilitation, can result in excellent functional outcomes. Complete fracture union, absence of pain, and full restoration of ankle mobility were achieved within three months.

This report contributes to the limited literature on bilateral closed ankle fractures and emphasizes the importance of understanding injury mechanisms, restoring ankle biomechanics, and implementing evidence-based postoperative care. Further studies are required to establish standardized management strategies for this rare but impactful injury pattern.

Compliance with ethical standards

Acknowledgments

The authors would like to thank the medical and nursing staff involved in the patient's care.

Disclosure of conflict of interest

The authors declare that they have no competing interests.

Statement of ethical approval

This case report is exempt from ethical approval at our institution.

Statement of informed consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Provenance and peer review

Not commissioned, externally peer reviewed.

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