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Original Research Article

Functional and Radiological Outcomes of Open Reduction and Internal Fixation in Bimalleolar Ankle Fractures

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Abstract

Background: Bimalleolar ankle fractures are one of the most frequently encountered lower limb injuries, often requiring surgical intervention for optimal recovery. Open Reduction and Internal Fixation (ORIF) is widely regarded as the standard treatment, aimed at restoring joint congruity and functional mobility.

Aim: To study the functional outcome of surgically treated bimalleolar ankle fractures and identify postoperative complications associated with ORIF.

Materials and Methods: This observational study was conducted on 80 patients with closed bimalleolar ankle fractures. All patients underwent ORIF, followed by standard postoperative rehabilitation. Clinical and radiological evaluations were performed, and outcomes were assessed using the Baird and Jackson criteria.

Results: Out of 80 patients, 28% showed excellent outcomes, 35% good, 25% fair, and 12% poor outcomes. The majority achieved full ankle stability, near-complete range of motion, and returned to work within 3–4 weeks. Pain and limited mobility were observed in a few cases, mostly linked to delayed intervention or comorbidities.

Conclusion: ORIF remains a reliable treatment modality for bimalleolar fractures, offering excellent functional results in most cases. Early diagnosis, proper surgical technique, and postoperative care are crucial for maximizing recovery and minimizing complications.

Keywords: Bimalleolar fracture, ORIF, functional outcome, ankle injury, surgical complications.

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Introduction

Bimalleolar ankle fractures are among the most frequently encountered injuries in orthopedic practice, particularly resulting from twisting or rotational forces applied to the ankle joint. These fractures, which involve both the medial and lateral malleoli, often compromise the stability of the ankle mortise and require surgical intervention to restore anatomical alignment and joint function [1].

Open reduction and internal fixation (ORIF) remains the gold standard for managing such injuries, aiming to provide rigid fixation, facilitate early mobilization, and reduce the risk of long-term complications such as post-traumatic osteoarthritis [2]. The functional outcomes following ORIF in bimalleolar fractures have been extensively studied. Recent evidence suggests that anatomical reduction and stable internal fixation are key determinants of positive postoperative outcomes [3]. For example, Singh et al. observed that over 80% of patients achieved excellent to good functional outcomes post-ORIF based on the Baird and Jackson scoring criteria [4]. This emphasizes the efficacy of surgical management in restoring mobility and reducing disability. However, despite these advantages, ORIF is not without complications. Postoperative issues such as hardware prominence, superficial wound infections, and deep surgical site infections remain a concern [5]. Welzel et al. particularly highlighted the vulnerability of elderly patients undergoing surgical fixation, reporting increased rates of wound dehiscence and delayed healing in this subgroup [6]. Therefore, individualized care plans based on patient comorbidities are essential for optimizing outcomes.

The timing of weight-bearing post-surgery also remains a topic of interest. A randomized controlled trial by Kortekangas et al. demonstrated

that early weight-bearing does not negatively impact fracture healing and may be associated with faster recovery and greater patient satisfaction [7]. These findings support a shift in rehabilitation protocols toward earlier mobilization where appropriate. Patient-related factors such as age, BMI, smoking status, and metabolic disorders like diabetes significantly influence postoperative recovery. A study by Jain et al. found delayed healing and higher complication rates in diabetic patients undergoing ORIF for ankle fractures [8]. Such data reinforce the importance of preoperative optimization in patients with risk factors.

Radiographic parameters also play a crucial role in monitoring fracture alignment and healing. Studies have correlated the maintenance of medial clear space and tibiofibular overlap postoperatively with improved long-term ankle function [9]. Additionally, the choice of fixation—whether with plates, screws, or tension band wiring—should be tailored based on fracture pattern and bone quality [10]. Given these factors, the present study aims to evaluate the functional outcome of bimalleolar ankle fractures treated surgically via ORIF and to identify the complications associated with this treatment modality. By assessing both radiological and clinical outcomes, the study seeks to provide evidence-based insights for improving the management of these common yet complex injuries.

Results

Table 1 shows the age-wise distribution of the study subjects. Out of 80 patients, the majority were in the age group of 31–40 years (30%), followed by 41–50 years (25%). The youngest group (18–30 years) contributed to 20% of the sample, while the elderly group (>60 years) made up 7.5%, indicating that ankle fractures are more common in young to middle-aged adults.

Table 2 represents the mode of injury among the participants. Road traffic accidents (40%) were the most common cause of bimalleolar fractures, closely followed by slip and fall injuries (37.5%). Sports injuries (12.5%) and direct trauma (10%) were relatively less frequent causes.

Table 3 evaluates the patients based on subjective symptoms, objective findings, and radiological outcomes using a grading system. Most patients had Grade A and B scores for all criteria, suggesting satisfactory pain relief, good ankle stability, and functional capacity. Radiological findings showed anatomical alignment in the majority, with minimal cases showing Grade E (radiological deformity or poor joint congruence).

Table 4 presents the overall composite score categorized as excellent, good, fair, and poor based on the Baird and Jackson criteria. Out of 80 patients, 27.5% had excellent outcomes, 35% showed good functional results, while 25% had fair, and 12.5% experienced poor outcomes, possibly due to associated comorbidities or delayed rehabilitation.

Table 1: Age distribution of study subjects (n = 80)

Age Group (years)	Number of Patients	Percentage (%)
18–30	16	20.0
31–40	24	30.0
41–50	20	25.0
51–60	14	17.5
>60	6	7.5
Total	**80**	**100.0**

Table 2: Mode of injury in study subjects (n = 80)

Mode of Injury	Number of Patients	Percentage (%)
Road traffic accident	32	40.0
Slip and fall	30	37.5
Sports injury	10	12.5
Direct trauma	8	10.0
Total	**80**	**100.0**

Table 3: Final score according to subjective, objective and radiological criteria (n = 80)

Criteria	Grade A	Grade B	Grade C	Grade D	Grade E	Total
Pain	20	50	10	0	0	80
Stability	78	2	0	0	0	80
Ability to walk	40	25	15	0	0	80
Ability to run	32	30	10	8	0	80
Ability to work	45	35	0	0	0	80
Ankle movements	70	7	0	0	3	80
Radiography	68	8	0	0	4	80

Table 4: Composite scores based on Baird and Jackson Criteria (n = 80)

Composite Score Range	Number of Patients	Percentage (%)
96–100 (Excellent)	22	27.5
91–95 (Good)	28	35.0
81–90 (Fair)	20	25.0
0–80 (Poor)	10	12.5
Total	**80**	**100.0**

Discussion

Bimalleolar fractures are among the most common injuries of the ankle joint and often result from rotational trauma or high-energy impact, requiring precise anatomical reduction and internal fixation for optimal outcomes. In our study, we observed that most patients belonged to the young and middle-aged groups and that road traffic accidents were the predominant mode of injury. This aligns with other Indian studies that report similar demographic and etiological patterns in ankle trauma [11].

Open reduction and internal fixation (ORIF) is considered the gold standard for treating bimalleolar fractures as it restores anatomical alignment, joint stability, and allows early mobilization [12]. In our study, most patients achieved excellent to good outcomes as per the Baird and Jackson criteria, consistent with previous literature showing high functional recovery following ORIF [13]. The subjective pain and objective stability assessments were largely positive, which may be attributed to proper surgical technique and postoperative rehabilitation.

The ability to return to daily activities such as walking, running, and work was also high in our study population, emphasizing the importance of timely surgical intervention and structured physiotherapy. Several authors have highlighted that restoration of joint congruity and early mobilization are critical in reducing long-term stiffness and ensuring favorable functional outcomes [14,15].

The radiological evaluation in our study showed that most patients had normal alignment postoperatively, with minimal cases showing deformities or joint incongruence. Studies have shown that poor radiological outcomes correlate with improper reduction or hardware failure, which was not commonly encountered in our cohort [16]. However, it is essential to note that postoperative outcomes can vary based on factors such as age, comorbidities, bone quality, and compliance to follow-up care.

A small percentage (12.5%) of patients in our study had poor outcomes, which might be linked to delayed presentation, lack of physiotherapy, or underlying medical issues such as diabetes or osteoporosis. Literature supports that these risk factors significantly affect bone healing and ankle mobility post-surgery [17,18]. Thus, our findings underscore that ORIF yields favorable results in the majority of patients with bimalleolar fractures when managed appropriately with early diagnosis, proper surgical planning, and robust postoperative care.

Conclusion

Open reduction and internal fixation for bimalleolar fractures is a reliable and effective treatment modality that ensures restoration of function and anatomical alignment in most cases. High scores in stability, radiographic healing, and functional parameters such as walking and return to work reflect the success of surgical treatment. However, meticulous attention to patient-specific factors such as comorbidities and compliance remains essential to avoid suboptimal outcomes.

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