



## Original Research Article

# Evaluation of functional outcome in closed bimalleolar fracture treated with open reduction & internal fixation

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## Abstract

**Background:** Ankle fractures are among the common orthopedic injuries with an incidence of approximately 187/100,000 per year among different age groups and genders. Considering ankle injuries to be complex with lesser research done from other institutions on the outcome evaluation, we planned to do an evaluation of the functional outcome of bimalleolar fractures treated with open reduction and internal fixation at our institute.

**Objective:** To evaluate functional outcomes and post-operative complications in Closed Bimalleolar fracture treated with open reduction and internal fixation. **Materials and Methods:** Patients with closed bimalleolar fractures who underwent surgery at Himalayan Hospital between April 2022 to December 2023 were included. Patient's functional outcomes were evaluated using Olerud and Molander scores at 6 weeks and 12 weeks. Post-operative Complications were also evaluated at this time.

**Results:** Restriction of ankle dorsiflexion post-surgery was seen in all cases which Improved after 3 months follow-up. Postoperative complications like implant impingement were seen in 3 patients and skin necrosis was seen in 1 patient.

**Conclusion:** Functional outcome in bimalleolar surgery improved after 12 weeks of open reduction & internal fixation. Syndesmotic screw removal at 8-10 weeks is not necessary even after mobilization of the patient. A long follow-up of 6 months to 12 months is required to comment on the final functional outcome.

**Keywords:** Olerud & Molander scores, Bimalleolar fracture.

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## 1. Introduction

Ankle fractures are among the common orthopedic injuries with an incidence of approximately 187/100,000 per year among different age groups and genders.<sup>1-3</sup> It has been noted that ankle fractures are highest among young males and middle-to older-aged women.<sup>4</sup> With the aging population, the incidence is expected to increase substantially over the next several decades.<sup>5</sup> The ankle joint is highly vulnerable to injury due to its relative mobility and the amount of weight-bearing stress it endures. In fact, ankle joint supports relatively more amount of weight per unit area when compared to other joints in our body.<sup>6</sup> It is the most congruous joint in the lower extremity which bears up to five times our body weight.<sup>7</sup> Sir Robert Jones famously remarked that ankle is the most frequently injured joint in the body, yet

receives the least optimal treatment.<sup>8</sup> Ankle fractures are complex injuries, they have the potential to produce significant long-term disability and complications in the form of pain, instability, and early degenerative arthritis.<sup>9</sup> Outcomes in ankle fractures depends on many factors such as, the severity of the injury, anatomical reduction of the fracture, associated ligament injuries, post-operative rehabilitation and co-morbidities.<sup>10-12</sup> Considering ankle injuries to be complex with lesser research done from other institutions on the outcome evaluation and taking care of the above-mentioned factors we planned to do an evaluation of the functional outcome of bimalleolar fractures treated with open reduction and internal fixation at our institute.

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## 2. Materials and Methods

This observational study consisted of 40 cases, undergoing an Open Reduction Internal Fixation for Closed Bimalleolar fracture in Himalayan Hospital between April 2022 to December 2023. After the initial assessment patient was subjected to radiological evaluation using X-rays of ankle were taken in Anteroposterior, Lateral, and Mortise views. Danis Weber's classification was used to classify fracture patterns. In this study, all skeletally mature patients with closed bimalleolar fractures who gave consent for surgery were taken. Patients with open fractures, Trimalleolar, Isolated lateral malleolus, Isolated medial malleolus fractures, concomitant fracture, associated neuro-vascular injury in the involved lower limb, skeletally immature patients, and pathological fracture were excluded from this study.

Initially, the patient was given a below-knee slab and the limb was kept in the elevated position. Once the skin condition was appropriate for surgery, patients were planned for surgery. They were managed using plates, K-Wires, or screws for bimalleolar fractures. The fibula was fixed first with an appropriate implant followed by medial malleolus fixation. After the surgery, below-knee slab was applied. Sequential dressings done at post operated days 2nd, 4th, and 7th with suture removal on day 11th. Active ankle movements were started after 48 hours of surgery. After suture removal, a removable ankle splint was continued and the patients were allowed to walk with partial weight bearing with the help of walker support with removable splint in situ except for 5 patients requiring syndesmotic screws, in which delayed weight bearing was done at 6 weeks. Assessment was done at 6 and 12 weeks for functional assessment and complications using the Olerud and Molander score.<sup>14</sup>

## 3. Results

The table presents the recovery outcomes of three types of injuries (Type A, Type B, and Type C) over two durations (6 weeks and 12 weeks). In Type A, only one case showed a fair outcome (31-60) at both 6 and 12 weeks, with no cases in the excellent or poor categories. Type B showed better recovery with time, as 3 cases improved to a good outcome (61-90) at 6 weeks, increasing to 16 cases at 12 weeks, while the number of fair outcomes decreased from 14 to 8. However, 8 cases remained in the poor category at 6 weeks, with none at 12 weeks. Type C had one case achieving an excellent outcome (>90) at 12 weeks, while the number of good recoveries improved from 0 at 6 weeks to 8 at 12 weeks. Fair outcomes in Type C slightly decreased from 7 at 6 weeks to 6 at 12 weeks, while 7 cases remained in the poor category at 6 weeks, with none in that category at 12 weeks. Overall, longer recovery duration improved outcomes, particularly for Type B and C injuries as shown in (Figure 1).



**Figure 1:** Shows recovery outcomes of three types of injuries (Type A, Type B, and Type C) over two durations (3 months)

**Table 1:** Comparison of Olerud and Molander scores at 6 weeks and 3 months interval

Type of injury	Type A		Type B		Type C	
	6 weeks	12 weeks	6 weeks	12 weeks	6 weeks	12 weeks
Excellent (>90)				1		
Good (61-90)			3	16		8
Fair (31-60)	1	1	14	8	7	6
Poor (<30)			8		7	

The **Table 2** presents postoperative complications observed in a total of 40 patients. Skin necrosis occurred in 1 patient, accounting for 2.5% of cases, while no cases of infection were reported (0%). Impingement was the most common complication, affecting 3 patients (7.5%). Overall, the majority of patients did not experience these specific complications, indicating a relatively low incidence of postoperative issues in the study population as shown in (**Figure 2**).



**Figure 2:** Shows a patient's lower extremities, likely after a medical procedure, demonstrating "Functional ROM at 3 months," which suggests "Functional Range of Motion" at three months post-operation or injury. The three panels show different views of the legs and feet, with the top panel showing the legs straight and aligned, the middle panel showing the feet and ankles in a neutral position, and the bottom panel showing the feet and ankles bent upward, demonstrating dorsiflexion. This visual documentation indicates successful recovery and restored functionality of the ankle joint at three months

**Table 2:** Clinical complications in patients with bimalleolar fractures

Postoperative period	Frequency (n)	Percentage (%)
Skin necrosis	1	2.5
Infection	0	0
Impingement	3	7.5
<b>Total</b>	40	100

The **Table 3** presents radiological complications observed in a total of 40 patients. Screw or K-wire back out was reported in 2 cases, accounting for 5% of the total, while no instances of implant failure were observed (0%). Overall, radiological complications were minimal, suggesting a stable outcome for most patients in the study.

**Table 3:** Radiological complications

Radiological complications	Frequency (n)	Percentage (%)
Screw/k-wire back out	2	5
Implant failure	0	0
<b>Total</b>	40	100

#### 4. Discussion

Our findings reveal a distinct distribution among the various types of fractures as delineated by the Danis-Weber classification. In our study, a total of 40 cases were taken. Notably, Type B fractures emerged as the most common category, accounting for 25 cases. This represents a significant majority, 62.5%, of the total fractures analysed, highlighting the prevalent nature of Type B fractures in bimalleolar injuries. Following Type B, Type C fractures constituted a substantial portion of the cases studied and identified 14 cases of Type C fractures, which translates to 35% of the overall cases, underscoring the significant yet slightly less common occurrence of this fracture type compared to Type B. In stark contrast, Type A fractures were exceedingly rare within our research findings. Only 1 case of a Type A fracture was identified, making up a mere 2.5% of the total cases. This rarity underscores the relatively uncommon nature of Type A fractures in the context of bimalleolar injuries. The results of our meticulous investigation align closely with the findings from other

distinguished studies in the field, such as those of Makwana et al.<sup>20</sup> They also identified similar patterns in the distribution of bimalleolar fracture types according to the Danis-Weber classification.

Out of the total cases reviewed, an overwhelming majority for fibula (lateral malleolus) fractures, amounting to 38 patients, underwent plate fixation. The predominance of plate fixation in our study remains the primary choice among healthcare providers for managing these types of injuries, reflecting its reliability and effectiveness in promoting bone healing and restoration of function. In contrast to the widespread application of plate fixation, alternative methods of fixation were notably less common among our patient population. K-wire (Kirschner wire) and screw fixation was employed in only 2 cases, due to poor skin conditions, which accounts for 2.5% of the total cases respectively. Union was noted in these case also, which showed that when the skin conditions are not suitable, minimal invasive techniques can also help us to achieve union. Our study's findings are in alignment with the results from similar research by Thangajarah and Makwana et al.<sup>20,21</sup>

Medial malleolus fixation was primarily done with screw, 39 patients went for screw fixation (97.5%) and 1 patient (2.5%) had TBW fixation due to small fragment involvement. Overall union was 100% at 3 months.

Postoperative complications were minimal, with most patients experiencing no complications, though 1 case of skin necrosis and 3 cases of impingement were reported. The K-wire was removed at 6 weeks postoperatively for patients having impingement and the case with skin necrosis underwent split-thickness skin graft (SSG) coverage. Radiologically, all patients showed union of fractures without any instances of non-union. Radiological complications are rare, with only 2 cases of screw backout and no implant failures reported. This study highlights effective management and positive outcomes in patients with bimalleolar fractures. Results of our study reveal several comparisons and contrasts with findings from other notable studies in the field of bimalleolar fracture treatment and outcomes.

Functionally, patients showed improvement over time. At 6 weeks follow-up, patient with Type A injury showed fair outcome which remained the same even after 12 weeks follow up. With Type B injuries, at 6 weeks follow-up, 32% cases had poor outcome, 56% with fair outcome and 12% with good outcome which improved to 32% with fair, 64% with good and 4% with excellent outcomes. Among the Type C injuries 50% had poor outcome and 50% had fair outcome at 6 weeks which further improved to 43% having fair and 57% having good outcome at 12 weeks follow-up. Overall the majority (55%) demonstrated fair outcome at 6 weeks and further improved to good outcome (60%) by 3 months as per the Olerud and Molander score.

In cases requiring syndesmotic screws, this study evaluated the frequency and outcomes based on the type of injury and duration of follow-up. Among the 40 cases analysed, Type C injuries were associated with a majority of cases, 4 (28.6%) out of 14 cases were noted with syndesmotic injury. For Type B injuries, 1(4%) case was recorded out of 25 instances and no case with Type A was seen. 4 cortex fixation was done with syndesmotic screws. We could not find any relevant comparable study with respect to the above findings. All patients who did not require syndesmotic screws were allowed partial weight bearing after suture removal, however, the cases requiring syndesmotic screws were allowed partial weight bearing at 6 weeks. After evaluating the functional outcomes after 12 weeks, it was noticed that the case of Type B injury showed good outcome score and cases of Type C showed fair outcome scores. No syndesmotic screws were removed at 8-10weeks and no breakage of the screw was seen after the patients were allowed full weight bearing, this was relatable to a study done by Khurana et al. showing that removal of syndesmotic screw does not affect functional outcome score. The study highlighted the variations in outcomes, with some cases demonstrating favourable results, particularly in the good and fair categories, suggesting the importance of careful consideration of injury type and follow-up duration in treatment planning.

In terms of functional outcomes assessed by the Olerud and Molander score, the present study showed an improvement over time, which aligns with the findings of Low CK et al. Both studies observed good outcomes across different fracture types, indicating effective treatment and rehabilitation strategies.<sup>13,14</sup> Contrasting with the findings of Lash N et al., the present study demonstrated effective surgical outcomes. They noted better functional outcomes in cases treated after casting when compared to surgery, which suggests different patient or treatment variables could influence these outcomes.<sup>15,16</sup>

The influence of age on functional outcomes, highlighted by Shah NH et al. suggests an area for further analysis in the present study.<sup>17</sup> While Shah's study emphasized age as a significant factor, the present study did not directly correlate age with functional outcomes, presenting an opportunity for future research. The preference for plate and screw fixation in our study correlates with the recommendations of Kho DH et al. Both studies support the use of ORIF, especially in young, active patients, indicating a trend toward these fixation methods in current surgical practices.<sup>18,19</sup>

## 5. Conclusion

1. Functional outcomes, assessed using the Olerud and Molander score, showed improvement in scores at 12 weeks. Hence a minimum of 12 weeks is required to comment on the functional outcome scores.

2. Patients with syndesmotic screws fixation showed no breakage of screws after mobilization post surgery, at 12 weeks follow-up. Therefore, it is not necessary to remove syndesmotic screws at 8-10 weeks.
3. A significant improvement in functional outcome was noted from 6 weeks to 12 weeks. But, however full ankle dorsiflexion could not be achieved, this when compared to literature showed that a minimum of 6 months to 1 year time is required to regain full ankle ROM.
4. The major drawback in our study was the short duration of follow-up. So, a longer follow-up of 6 months to 12 months is required to comment on the final functional outcome.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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