



Evaluation of functional outcome following ORIF of bimalleolar fractures of the ankle-A prospective study of 30 patients

Yeshwanth Subash*, Vishnu S, Damodharan

Department of Orthopaedics, Saveetha Medical College and Hospital, Thandalam, Chennai-602105, Tamil Nadu, India

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ABSTRACT

Bimalleolar fractures are common injuries, and stable fracture patterns can be treated conservatively, while complicated, unstable fractures would require surgical intervention. This study aimed to evaluate the functional outcome following ORIF (Open reduction and internal fixation) of these fractures. This was a study of 30 patients with bimalleolar fractures who presented between January 2013 to January 2016 treated with ORIF with a follow-up period of 3 years. Functional outcome was performed with the AOFAS (American Orthopaedic Foot and ankle society) score. The mean age of the patients was 41.6 years. There was a female preponderance seen in our study with the left side being more commonly affected. The mean time to fracture union was 12.13 weeks, and we had excellent outcomes in 18 patients, good in 10, while two patients had a fair result. We did not lose any of our patients to follow up. All of our patients were happy with the functional outcome achieved. No significant complications were seen in our study. ORIF in bimalleolar fractures enables restoration of the ankle mortise to an anatomical position and facilitates early mobilization of the ankle resulting in good functional outcomes.



*Corresponding Author

Name: Yeshwanth Subash
Phone: +91 9840092819
Email: djyesh99@gmail.com

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fall and sports injuries. They are often associated with ligamentous injuries which need to be addressed as well (Muller *et al.*, 1990; Makwana *et al.*, 2001). These fractures are classified according to the Lauge- Hansens classification and the most common type would be the SER (Supination external rotation) type in which the distal fibula fractures followed by the medial malleolus along with injury to the deltoid ligament. Intra-articular fractures require a good anatomical reduction with stable internal fixation to restore the syndesmosis of the joint (Lee *et al.*, 2005).

Failure to do so would alter the biomechanics of the joint leading to problems such as post-traumatic arthritis, ankle pain and stiffness resulting in decreased function of the joint (Pagliaro *et al.*, 2001; Burwell and Charnley, 1965). Stable and undisplaced fracture patterns can be managed conservatively with a below-knee cast for 8-10 weeks till fracture union while unstable and displaced fracture patterns would require surgical intervention (de Souza *et al.*, 1985). Surgical management

INTRODUCTION

Bimalleolar fractures are the most common lower limb fractures. They account for 10% of all fractures (Lauge-Hansen, 1950). The incidence of these fractures has been increasing over the past few decades, and they can be a cause of morbidity if not treated adequately. The most common modes of injury are road traffic accidents, slip and

would aim to achieve an excellent anatomic reduction, provide a rigid internal fixation followed by early mobilization of the ankle to give a good functional outcome to the patient (Cimino *et al.*, 1991). The management of these fractures has evolved due to an increased perception of ankle biomechanics and improvements in the techniques of fixation. This study aimed to evaluate the functional outcome following ORIF of bimalleolar fractures of the ankle.

MATERIALS AND METHODS

This was a prospective study of 30 patients with bimalleolar fractures of the ankle who presented between January 2013 to January 2016 treated with ORIF with a follow-up period of 3 years. The study was performed after obtaining approval from the ethical committee of our institution. All skeletally mature patients with bimalleolar fractures of the ankle willing for surgery and follow up were included in our study.

While skeletally immature patients, compound fractures, patients with neurovascular compromise and patients with active infection or inflammation in the affected limb were excluded. At the time of admission, the patients were evaluated clinically and radiologically. Radiographs of the affected ankle were taken in AP, lateral and oblique projections. CT scans were done in patients with intricate fracture patterns to assess the fracture geometry and to aid in planning for surgery. The ankle was stabilized with a below-knee slab, and the limb was kept elevated with pillows. The fractures were classified according to the Lauge-Hansens classification, and the fracture type was documented in the case records (Figure 1).

Routine blood investigations were done, and the patients were worked up for the surgical procedure. The procedures were performed under regional anaesthesia under i.v antibiotic cover. Injection Cefazolin 1gm was given at the time of induction of anaesthesia and was given for three days post-operatively. The surgeries were performed by the same Orthopaedic surgeon who was well versed with the procedure. The lateral malleolus was fixed first to gain length and restore the ankle mortise. A standard lateral approach was used, and the lateral malleolus was fixed with 1/3rd tubular or reconstruction plates while locking plates were used in elderly individuals with inadequate bone stock.

The medial malleolus was then exposed via a posteromedial approach and fixed with either two 4 mm partially threaded cancellous screws or with a tension band wiring based on the fracture configuration. Fluoroscopic guidance was used during the

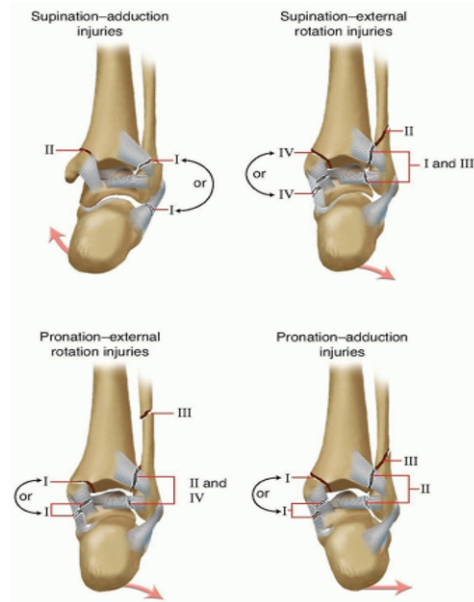


Figure 1: Lauge Hansen classification

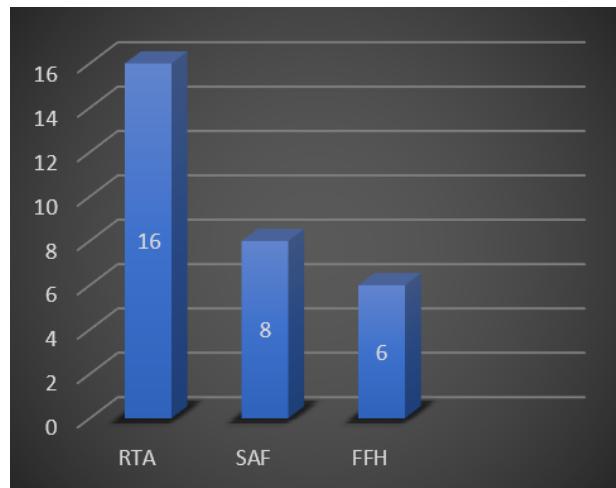


Figure 2: Mode of injury

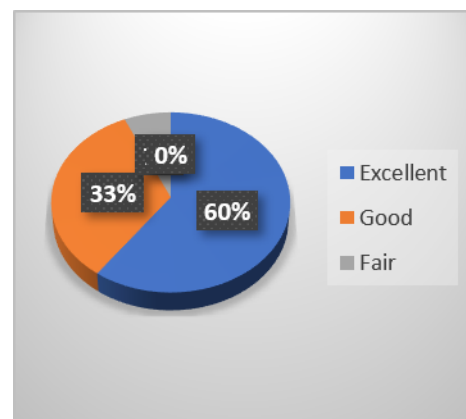


Figure 3: AOFAS Score

Table 1: Patient demographics and data

S.No	Age	Sex	Side	Mode of injury	Fracture type	Surgical time (mins)	Blood loss (ml)	Time to union (weeks)
1	45	M	L	RTA	PA	70	150	10
2	54	M	R	RTA	PA	60	175	12
3	60	F	L	SAF	PER	59	120	11
4	19	M	L	SAF	SER	74	100	11
5	28	F	R	RTA	SER	80	180	12
6	32	F	L	RTA	SER	76	210	10
7	41	M	L	FFH	SER	86	170	11
8	67	F	L	RTA	PER	84	180	13
9	54	M	L	FFH	SER	90	140	12
10	28	F	R	FFH	SER	58	185	12
11	31	F	R	SAF	PA	64	190	12
12	49	M	L	SAF	SER	74	185	13
13	33	F	R	RTA	SER	76	170	12
14	43	M	L	RTA	SER	70	176	14
15	54	M	L	RTA	PER	72	178	13
16	62	M	R	RTA	PER	84	170	11
17	40	M	R	RTA	SER	80	180	12
18	31	F	L	RTA	SER	79	174	12
19	28	M	R	RTA	SER	86	150	13
20	34	M	R	SAF	PA	90	170	14
21	30	F	L	SAF	SER	86	160	10
22	41	F	L	SAF	SER	84	148	11
23	54	F	R	FFH	SER	78	150	12
24	40	F	L	SAF	PA	77	170	11
25	56	F	L	RTA	SER	82	174	10
26	25	M	R	RTA	SER	84	180	11
27	28	F	L	RTA	SER	86	160	10
28	32	F	R	FFH	PA	84	175	11
29	44	M	R	SAF	SER	82	190	12
30	50	F	R	RTA	SER	90	160	13

procedure to aid in fracture reduction and fixation. A wound wash was given after ensuring haemostasis and closure was done in layers, and sterile dressing and compression bandage was applied. The patients were made to sit up in bed on the same evening of surgery, and the ankle and knee were actively mobilized. The patients were mobilized on the first postoperative day with non-weight bearing with walker support. Wound inspections were done on the 3rd and 5th postop days and sutures were removed on day 12. The patients were then discharged and asked to review at time frames of 1,3,6 months and yearly intervals after that where serial radiographs were taken to assess for signs of fracture union and functional assessment. All findings were documented in the case records. The fracture was deemed to have united radiologically when

there were cross trabeculations across the fracture site, and absence of tenderness at the fracture site and lack of pain on weight-bearing would indicate clinical union. The data collected were analyzed using IBM SPSS Version 22.0. Armonk, NY: IBM Corp. Chi-square test was used in the comparison of categorical variables. A P value of less than 0.05 was considered to be statistically significant. The patients were advised to do strict non-weight bearing waking until the fractures had united well clinically and radiologically.

RESULTS AND DISCUSSION

The mean age of the patients was 41.6 years ranging from 19 to 67 years. There was a female preponderance seen in our study with the left ankle

being more commonly affected. The most common mode of injury was road traffic accidents followed by slip and fall and fall from height (Figure 2). SER was the most common fracture type seen followed by PA according to the Lauge-Hansen classification. The average surgical time was 78.16 minutes ranging from 58 to 90 minutes, and the average blood loss was 161.36 ml ranging from 100 to 210 ml. The mean time from injury to presentation to the hospital was eight days, ranging from 1 to 21 days, while the meantime from presentation to the surgical procedure was three days ranging from 2 to 6 days. The average time to fracture union was 12.13 weeks ranging from 10 to 14 weeks (Table 1). According to the AOFAS score, we had excellent results in 18 patients, good in 10 and fair results in 2 patients (Figure 3).

We were able to achieve a 100% union rate with all fractures uniting at the end of 6 months. We had minor complications such as superficial skin tract infections in 3 patients and ankle stiffness in 1 patient. We had no significant complications such as nonunion, malunion, deep infection, implant failure or migration seen in our study. None of our patients was lost to follow up.

Bimalleolar fractures of the ankle are common lower limb injuries, and their incidence has been increasing over the past few decades. Since they involve a weight-bearing joint, they are quite challenging to treat and are associated with a high rate of complications. Conservative management can be done in patients with undisplaced and stable fracture patterns while it would not be feasible in displaced and unstable fracture patterns where it would result in a poor functional outcome (Beris *et al.*, 1997; Schepers *et al.*, 2013).

Surgical management would aim to follow the AO principles by achieving an excellent anatomic reduction, provide rigid internal fixation, preservation of blood supply to the bone by proper soft tissue handling followed by early mobilization of the ankle to give a good functional outcome to the patient (Schepers *et al.*, 2011). While dealing with surgical management of these fractures, it would be ideal to fix the lateral malleolus first to regain length, and it facilitates anatomical repositioning of the talus in the ankle mortise (Appleton *et al.*, 2006; Büchler *et al.*, 2009); The reason behind this is that the displacement of the talus follows that of the lateral malleolus. The lateral malleolus can be fixed with 1/3rd tubular or reconstruction plates while locking plates can be used in elderly individuals with inadequate bone stock. The medial malleolus was exposed via a posteromedial approach and

fixed with either two 4 mm partially threaded cancellous screws or with a tension band wiring based on the fracture configuration. Cannulated cancellous screws can be used in stable fracture patterns with good bone stock.

At the same time, tension band wiring is preferred in intricate fracture patterns where the cancellous screws might not have a good purchase as well as to provide compression at the fracture site using the tension band principle (Obremskey *et al.*, 2002; Stufkens *et al.*, 2009). We found that the functional outcomes were satisfactory using both implant options. In 3 of our patients, we encountered a syndesmotic injury which was assessed intraoperatively after internal fixation of both the malleoli by using a bone hook to lever the fibula laterally to check for instability. A long 3.5mm cortical screw was passed through the fibular plate from a posterolateral to an anteromedial direction to engage three cortices, and the screws were removed after six weeks.

We mobilized the ankles quite early and actively in all patients, and we were able to get a good range of movement in all except one patient who was non-cooperative and did not mobilize adequately as per our instructions. We did not advise partial weight-bearing walking for any of our patients, and they were permitted weight-bearing walking only after the clinical and radiological union of the fracture. Donken *et al.* studied 276 patients with bimalleolar fractures and observed that the SER was the most common fracture type seen.

They reported excellent outcomes in 92% of patients with minimal complications (Donken *et al.*, 2012). Shivarathre *et al.* studied 92 patients with nine months follow up and reported reasonable rates of a union in their series. They had complications such as superficial skin infections in 6 patients and deep infection in 4 patients with no complications such as nonunion or malunion seen in their series (Shivarathre *et al.*, 2011). In Macera *et al.* study of 378 patients, they reported minor complications such as superficial infection in 1 patient and also reported significant complications such as post-traumatic arthritis, malunion as well as arthrofibrosis (Macera *et al.*, 2018).

In our series of 30 patients we were able to achieve a 100% union rate with the meantime to fracture union being 12.3 weeks. According to the AOFAS score, we had excellent results in 18, good in 10, and fair outcome in 2 patients. We had minor complications such as superficial skin infections and ankle stiffness while there were no major complications encountered. None of our patients was lost to follow

up. All patients were satisfied with the functional outcome achieved.

CONCLUSION

ORIF in the management of bimalleolar fractures facilitated a good reduction of the articular surface with the restoration of the ankle mortise to an anatomical position. Early and active mobilization of the ankle is a key factor in achieving an excellent functional outcome along with protracted weight bearing till radiological and clinical signs of fracture union are seen.

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Conflict of interest

The authors declare that they have no conflict of interest for this study.

Ethical approval

Approval taken from the ethical committee.

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