

EVALUATION OF FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT IN DISPLACED CLOSED BIMALLIOLAR FRACTURES IN ADULTS

Doried Shaheen*¹, Ghiyas Halloum², Ezzat Almohamed³

¹Department of Orthopedic, Tishreen University, Faculty of Medicine, Lattakia, Syria.

²Department of Orthopedic, Professor, Tishreen University, Faculty of Medicine, Lattakia, Syria.

³Department of Orthopedic, Professor, Tishreen University, Faculty of Medicine, Lattakia, Syria.

Received date: 08 November 2021

Revised date: 29 November 2021

Accepted date: 19 December 2021

*Corresponding Author: Doried Shaheen

Department of Orthopedic, Tishreen University, Faculty of Medicine, Lattakia, Syria.

ABSTRACT

Objective: The aim of this study is to evaluate the functional outcome of the different surgical treatments of displaced closed bimalleolar fractures. In addition to, detection complications resulting from the surgery.

Patients and Methods: Retrospective comparative study conducted for the period one year (May 2019 – May 2020) at Tishreen University Hospital in Lattakia-Syria. The study included two groups of patients were compared: group1 consisted of 30 patients (63.8%) who underwent fixation with tension wiring technique of the medial malleoli and with plate and screw of lateral malleoli, whereas group 2 consisted of 17 patients (36.2%) who underwent fixation by malleolar screw of medial malleoli and kirschner wires of the lateral malleoli. **Results:** The median age was 48 years, the most frequent age group was 51-65 year (44.7%), followed by the group 36-50 year (31.9%). Males represented 57.4 % of the patients, and right side was affected in 30 patients (63.8%). Low-energy injury was present in 40 patients (85.1%), and supination external rotation (SER) was the most frequent mechanism of injury (63.8%). Operative time was longer in group1 (70.96±5.9 vs 47.94±6.2, p:0.0001). According to Baird Jackson scoring during follow up period, improvement in functional outcome was more prominent in group1 compared to group2. Sex (Male), and the type SER were significantly associated with excellent and good functional outcomes. Superficial skin necrosis and Sudeck's disease were the most frequent complications in group1, whereas secondary displacement, nonunion and chronic swelling were more frequently in group2. **Conclusion:** Functional outcome was better after fixation fractures in the form plating and screw of the lateral malleoli and tension wiring technique of the medial malleoli

KEYWORDS: Bimalleolar fractures, functional outcomes, Baird Jackson scoring.

INTRODUCTION

Ankle joint is a complex hinge weight bearing joint with bones and ligaments playing an important role in the inherent stability.^[1] Ankle fractures are increasingly common injuries that necessitate a careful approach for proper management.^[1] The frequency of ankle fractures is approximately 187 in 100,000 person each year. Ankle fractures are becoming more common with advancing age, in which osteoporosis and increasing in fall risk are risk factors. The rates of fractures are similar between men and women, a higher rate in men as young adults, while women have higher rates in the age group 50 to 70 years.^[2,3]

Bimalleolar fractures account for more than 15 to 20 percent of all ankle fractures, which is defined as

fractures of both the lateral and medial malleoli and disrupt the medial and lateral stabilizing structures of ankle joint. The exact mechanisms of fractures are not well defined, and are believed to occur with a combination of supination and external rotation.^[4,5] Patients complain of marked pain, swelling, and tenderness associated with an inability to bear weight. Deformity may be present with displaced fractures.^[6]

Conservative treatment is considered only in undisplaced fractures. Surgical treatment of these fractures is usually recommended because they are unstable, in order to obtain an adequate reduction and a stable internal fixation, and to avoid ankle instability and early degenerative disease of the ankle.^[7,8] There are many operative methods that are used to treat bimalleolar

fractures with various functional results. Therefore, the aim of our study was: 1- to determine differences between the two techniques of fixation regarding the results of surgical correction of bimalleolar fractures 2- to determine functional outcomes of the two methods.

PATIENTS AND METHODS

This is a retrospective comparative study of a group of patients with displaced closed bimalleolar fractures attending department of orthopedic at Tishreen University Hospital in Lattakia-Syria during one-year period (May 2019- May 2020). The inclusion criteria were: patients of both sexes and aged 18 to 65 years. The exclusion criteria were: open fractures, Pilon fractures, concomitant lower extremity fractures, pathologic fractures, unimalleolar fractures (medial or lateral), and posterior malleolar fractures.

The following workup included: history and physical examination were performed. Patients assigned to group1 who undergone surgical treatment by fixation with tension wiring technique of the medial malleoli and with plate and screw of lateral malleoli, and group2 who undergone surgical treatment by malleolar screw of medial malleoli and kirschner wires of the lateral malleoli.

Patients were classified according to Lauge-Hansen classification, which uses mechanism of injury to define the fracture pattern.^[9]

Patients were followed up at regular intervals in the post-operative period by performing X-ray images of all patients' which taken in weight-bearing anteroposterior lateral, and mortise projections to assess for union status and to evaluate any complication if occurred. The Baird

and Jackson index was calculated at 3, and 6 months postoperatively.^[10]

Ethical consideration: All patients were provided a complete and clear informed consent after discussion about the study. This study was performed following the Declaration of Helsinki.

STATISTICAL ANALYSIS

Statistical analysis was performed by using IBM SPSS version20. Basic Descriptive statistics included means, standard deviations(SD), median, Frequency and percentages. To examine the relationships and comparisons between the two group, chi-square test was used. Independent t student test was used to compare 2 independent groups. All the tests were considered significant at a 5% type I error rate($p < 0.05$), β :20%, and power of the study:80%.

RESULTS

The baseline characteristics of the participants were as shown in (Table 1). Ages range from 18 years to 65 years (median 48 years). Patients were divided into three groups: 18-35(23.4%), 36-50(31.9%), and 51-65(44.7%). 57.4 % of the patients were males, and 42.6 % were females. Right side was affected in 30 patients (63.8%), and left side in 17 patients (36.2%). The fractures had occurred as a result of low-energy injury in 40 patients (85.1%) and high-energy injury in 7 patients (14.9%). Supination external rotation (SER) was the most frequent injury seen in our patient population in 30 patients (63.8%), followed by pronation external rotation (PER) in 12 patients (25.5%), and pronation abduction (PA) in 5 patients (10.6%).

Table 1: Demographic characteristics of the study population by comparison of the two groups.

Variable	Result
Sex	
Male	27(57.4 %)
Female	20(42.6%)
Age(year)	48 (Range 18-65)
Age group	
18-35	11(23.4%)
36-50	15(31.9%)
51-65	21(44.7%)
Affected side	
Right	30(63.8%)
Left	17(36.2%)
Cause of injury	
Low-energy injury (athletic activity, ground level twisting)	40(85.1%)
High-energy injury	
Falls from height	5(10.6%)
Road traffic accident	2(4.3%)
Mechanism of injury	
SER	30(63.8%)
PER	12(25.5%)
PA	5(10.6%)

In the group1, the operative time ranged between 60 minutes and 80 minutes with mean time 70.96±5.9, whereas in the group 2, the operative time was shorter and ranged between 40 minutes and 60 minutes with mean time 47.94±6.2. In the group1, the time to union ranged between 10 weeks and 12 weeks with an average time to union 10.80±1.1, whereas in the group 2, the union time was shorter and ranged between 9 weeks and 11 weeks with mean time 9.92±0.2, p:0.07

As per the Baird Jackson scoring system after 3 months, 20 (66.7%) cases had good to excellent results in group1, whereas in group2: 7(41.2%) cases had good to excellent results with significant difference, p: 0.03. After 6 months, group1 continued to show more improvement in functional outcome than group2, in which 23(76.6%) cases had good to excellent results in group1, whereas in group2: 11(64.7%) cases had good to excellent results with significant difference, p: 0.04.

Table 2: Operation characteristics and functional outcome of the study population by comparison of the two group.

Variable	Group 1 30(63.8%)	Group2 17(36.2%)	P value
Operation time (minute)	70.96±5.9(60-80)	47.94±6.2(40-60)	0.0001
Duration of union (week)	10.80±1.1(10-12)	9.92±0.2(9-11)	0.07
Baird and Jackson score (after 3 months)			
Excellent	9(30%)	4(23.5%)	0.03
Good	11(36.7%)	3(17.7%)	
Fair	9(30%)	9(52.9%)	
Poor	1(3.3%)	1(5.9%)	
Baird and Jackson score (after 6 months)			
Excellent	10(33.3%)	5(29.4%)	
Good	13(43.3%)	6(35.3%)	
Fair	6(20%)	5(29.4%)	
Poor	1(3.3%)	1(5.9%)	

According to the Baird and Jackson males were significantly associated with excellent and good functional outcomes as compared to females, p:0.02.

groups, but without significant differences, p: 0.08. In addition to that, SER was found to be associated significantly with excellent outcome compared to other types, p:0.0001.

Patients aged 36-50 years were associated with excellent and good function outcomes as compared to other

Table 3: Comparison of functional outcome according to demographic characteristics of patients and mechanism of injury of the study population.

Variable	Baird and Jackson			
	Excellent	Good	Fair	Poor
Sex				
Female	5(33.3%)	7(36.8%)	6(54.5%)	2(100%)
Male	10(66.7%)	12(63.2%)	5(45.5%)	0(0%)
Age group				
18-35	6(40%)	5(26.3%)	0(0%)	0(0%)
36-50	7(46.7%)	7(36.8%)	1(9.1%)	0(0%)
51-65	2(13.3%)	7(36.8%)	10(90.9%)	2(100%)
Mechanism of injury				
SER	10(66.7%)	13(68.4%)	7(63.6%)	0(0%)
PER	2(13.3%)	5(26.3%)	3(27.3%)	2(100%)
PA	3(20%)	1(5.3%)	1(9.1%)	0(0%)

There were early complications in 5 patients (16.7%) in group1, including superficial skin necrosis in 3 cases and infection in 2 cases, whereas in group2 early complications developed in 3 patients (17.7%), including secondary displacement in 2 cases and infection in one case, There were late complications in 7 patients (23.2%) in group1, and Sudeck's disease was the most frequent complication whereas in group2 complications

developed in 6 patients (35.4%), non-union and chronic swelling were the most frequent complications.

Table 4: Comparison of postoperative complications of the study population.

Complication	Group 1	Group 2
Early complications		
Superficial skin necrosis	3(10%)	0(0%)
Secondary displacement	0(0%)	2(11.8%)
Infection	2(6.7%)	1(5.9%)
Pressure ulcer	0(0%)	0(0%)
Late complications		
Joint stiffness	1(3.3%)	0(0%)
Impaired union	1(3.3%)	1(5.9%)
Non-union	0(0%)	2(11.8%)
Sudeck's disease	3(10%)	1(5.9%)
Chronic swelling	1(3.3%)	2(11.8%)
Degenerative arthritis	1(3.3%)	0(0%)

DISCUSSION

Bimalliolar fractures lead to significantly worse functional results than isolated fibula fractures. Accurate diagnosis and appropriate treatment can improve the prognosis.

This study showed the main findings. First, fractures were more frequently in males, and there were plenty of fracture cases being peak well into middle age and elderly. Second, low-energy injury was the main cause of fractures, and supination external rotation represented the frequent mechanism of injury. Surgical procedure duration was significantly longer in group1, and the mean time for union was also longer but without significant difference. Third, during follow up periods the functional outcome was favorable in group1 compared to group 2, and males, age group 36-50 year, and SER type were associated with excellent results. Majority of complications in group1 were superficial skin necrosis and Sudeck's disease, whereas in group2 secondary displacement, chronic swelling, and non-union were the most frequent complications.

These findings may be explained as follow: comorbidities and bone and soft tissue fragility are the main ones explaining this high risk situation of elderly. The difference of operation time between the two method is due to surgical technique that used in every method.

These findings are comparable with study conducted by Singh *et al.*,(2019) in 22 patients with bimalliolar fractures who underwent fixation with tension band technique for medial malleolus fracture and plating for lateral malleolus fracture. Fractures were more frequently in males with mean age 37.3 year. Right side was more affected (63.6%), road traffic accident was the frequent cause of injury (40.9%), and the frequent cause of injury was SER. An average time for union was 17 weeks.^[11]

Borkar *et al.*, (2020) conducted a study in 32 patients with bimalliolar fractures who underwent screw fixation

for medial malleolus fracture and kirschner wire for lateral malleolus fracture. Fractures were more frequently in males with mean age 46.2 year. An average time for operation was 47.5 minute and for union was 7.8 weeks. Infection and malunion were the most frequent observed complications.^[12]

In summary, fixation with tension band technique for medial malleolus fracture and plating for lateral displaced malleolus fracture demonstrated favorable results in obtaining adequate reduction. In addition to that, we emphasis the importance of regular follow up and prophylaxis of infection.

REFERENCES

1. Arastu M, Demcoe R, Buckley R. Current concepts review: ankle fractures. *Acta Chir Orthop Traumatol Cech*, 2012; 79: 473-83.
2. Elsoe F, Larsen P, Ostgaard S. Population -based epidemiology of 9767 ankle fractures. *Foot and Ankle Surgery*, 24: 34-9.
3. Court C, Caesar B. Epidemiology of adult fractures: a review. *Injury*, 2006; 37: 691-7.
4. Fisher N, Atanda A, Egol K. Repair of biomalleolar ankle fracture. *Journal of orthopaedic trauma*, 2017; 3: S14-S15.
5. Goost H, Kabir K, Burger C. Fractures of the ankle joint investigation and treatment options. *Dtsch Arztebi Int*, 2014; 111: 377-388.
6. Lash N, Horne G, Devane P. Ankle fractures: functional and lifestyle outcomes at 2 years. *ANZ j Surg*, 2002; 72: 724-730.
7. Donken C, Van L, Verhofstad M. Surgical versus conservative interventions for treating ankle fractures in adults. *Cochrane Database Syst Rev.*, 2012. CD 008470.
8. Singh R, Maoharan G, Theobald P. Ankle fractures: A Literature review of current treatment methods. *Open Journal of Orthopedics*, 2014; 4: 292-303.
9. Shariff S, Nathwani D. Lauge-Hansen classification -a literature review. *Injury*, 2006; 37: 888-90.
10. Bird R, Jackson F. Fractures of the distal part of the fibula with associated disruption of deltoid ligament. Treatment without repair of the deltoid ligament. *J Bone Joint Surg Am.*, 1987; 69: 1346.
11. Singh R, Sharma G. Functional results of bimalleolar ankle fractures treated by plating and tension band wiring technique: a prospective study. *International Journal of Orthopedic science*, 2019; 5: 379-382.
12. Borker S, Godbole S, Pawar A. Minimally invasive technique of fixation of closed bimalleolar fractures. *International Journal of Orthopedic science*, 2020; 6: 90-92.