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"Functional Outcome Of Open Reduction And Internalfixation In Bimalleolar Fractures Of Ankle"

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Abstract

Introduction: *One of the main causes of morbidity in both young people and the elderly has been shown to be ankle fractures. In this study, the functional outcome and the factors related to the functional outcome of patients who underwent ankle fracture surgery at our center will be evaluated.* ***Methodology:*** *A cross-sectional study of 30 patients undergoing fixation using screws or plates for the medial malleolus and fixation of the lateral malleolus with plates or pins will be conducted after receiving approval from the institutional ethical committee and the necessary authorities. The study was conducted in the R.L.Jalappa Hospital and Research Centre associated with theSri Devaraj Urs Medical College, Kolar. From September 2022 to December 2023. Results were evaluated usingBaird and Jackson score.*

Results: *Thirty patients were enrolled during the study period; their mean age was 40.77%. and their mean radiological union was 11.04%. In our patient sample, supination external rotation was the most often observed injury. 10% of patients had superficial skin infections after surgery, while 16.7% had swelling. As per the Baird and Jackson score, 63.3% of patients had an outstanding clinical functional outcome, 26.7% had a good outcome, 6.7% had a fair outcome, and 3.3% had a bad outcome.*

Conclusion:*Our research led us to the conclusion that, in skilled hands, open reduction and internal Fixation, using screws or plates for the medial malleolus and plating or pins for the lateral malleolus, is a very successful treatment option for bimalleolar fractures.*

Keywords: *Bimalleolar fractures, Supination external rotation, Baird and Jackson criteria.*

INTRODUCTION :

Ankle fractures occur in about 187 out of every 100,000 individuals annually. Only 2% of ankle fractures are open fractures, making them extremely uncommon. [1] Ankle injuries can involve both ligamentous and skeletal components. These days, Magnetic Resonance Imaging (MRI) is helpful in accurately identifying ligamentous damage; therefore, it's important to keep these parts in mind when treating these fractures.[2] Similar to other intraarticular fractures, bimalleolar ankle fractures require internal fixation and anatomical reduction by open techniques to prevent complications.LANE used a no-touch surgical approach and favoured screwing fracture fragments into place. Some clinicians are now using biodegradable implants to repair bimalleolar ankle fractures.[3] so, the present study focuses to evaluate the functional outcome of ankle fracture post plates/screws fixation for medial malleolus and pin/plates fixation for lateral malleolus over a six-month period using the Baird and Jackson scoring and to evaluate the fracture's radiological union following surgical treatment.

METHODOLOGY :

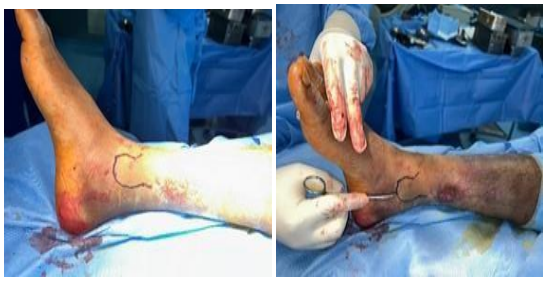
The present cross sectional study was conducted in the R.L.Jalappa Hospital and Research Centre associated with the Sri Devaraj
Urs Medical College, Kolar. From September 2022 to December 2023.
The sample size was derived from the following formula: the standard investigations: blood urea, serum creatinine, RBS, Hb%, HBsAg, ECG, and urine for sugar.

Sample size (n) = $\frac{z^2(P*Q)}{d^2}$

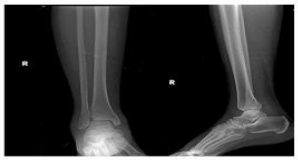
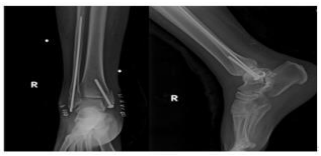
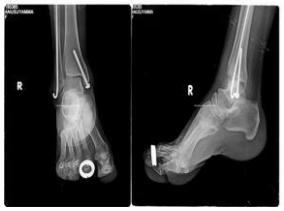
Where: Z is the critical value for 95% Confidence Interval, D is the absolute precision, P is the prevalence and q=1-p.= sample size 30
Inclusion Criteria are, patients with age group >18years, Diagnosed with a closed bimalleolar fractures of ankle joint, Open type 1 (Gustilo – Anderson). Exclusion Criteria are Open fracture type 2 ,3(Gustilo – Anderson), Patient having compound injuries or having tibial pilon or trimalleolar fracture, Minimally displaced mono malleolar fracture, Unwillingness to participate in the study.

A total of 30 patients who were meeting inclusion criteria were selected formal consent form was also acquired from each patient. A thorough history was taken from the patient and/or any witnesses upon admission in order to determine the extent of the trauma and the mechanism of harm. A thorough examination was performed to exclude fractures at further locations. Examining the injured ankle locally and looking for any subsequent clinical symptoms.
Standard investigations were conducted. As soon as the patients' general condition stabilized, they were scheduled for surgery. The following were Preoperative Preparation of Patients:
Patients were prepared as per the anaesthetist's orders; tetanus toxoid injection and lignocaine test doses were given the day before surgery, and an adequate amount of blood was arranged according to requirements. A written and informed consent for surgery was obtained.

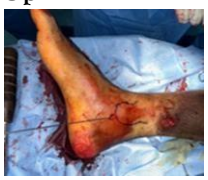
Operative Technique:
The patient was positioned in a supine position and given either spinal or epidural anaesthesia. In every instance, a pneumatic tourniquet was used. Because the treatment was carried out in a bloodless environment, it was easier to define the fracture pattern and allow anatomical reduction
Post – Operative Protocol:
Hospital practice dictated the administration of parenteral antibiotics for seven days during the post-operative period. The sutures were taken out after 14 days, and a below-the-knee slab was put in for 4 weeks. Beginning on the first or second postoperative day, a non-weight-bearing gait was implemented. Following the removal of the slab, partial weight bearing was initiated (when clinical and radiographic symptoms of union were visible). It was recommended to perform active ankle exercises.
For a minimum of six months, case follow-up was conducted at regular intervals of six weeks. Every patient was asked questions regarding pain, analgesic use, stiffness, oedema, activities of daily living, walking assistance use, return to work, and sports participation at each assessment. During the examination, the ankle's range of motion, oedema, and discomfort were assessed. Anteroposterior and lateral radiographs of the ankle were obtained during the examination. The study made use of the subjective, objective, and radiographic criteria found in Baird and Jackson's ankle grading system. After each patient received an evaluation, scores were assigned.

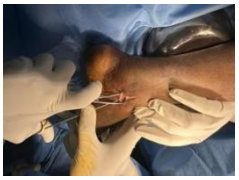
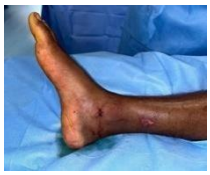
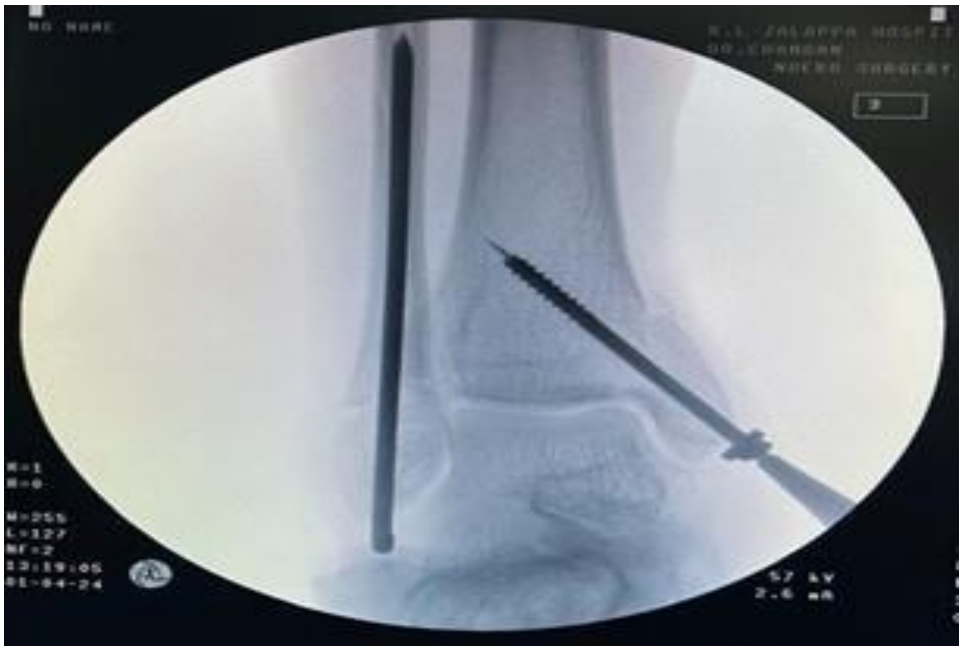


Surgical procedure and radiographic image

Pre Op **Post Op**



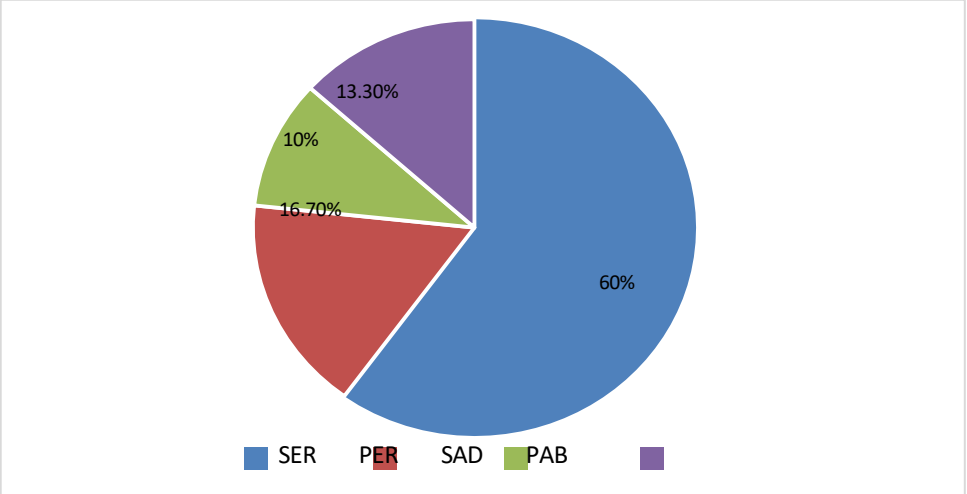
12 Weeks Radiographical evaluaton after surgery

RESULTS :

The present study has a diverse range of age groups ranging from 19 years to 70 years, of which the majority are between 19 and 30 years and 41 and 50 years, which is 30% each. Patients within the age range of 51–60 years are 20%, 31–40 years are 16.70%, and 61–70 years are 3.30%. the number of female and male patients is equally high, with 50% female patients and 50% male patients. There are a total of 30 patients, of which 15 are male and 15 are female.

In the present study, patients were categorized into SER, PER, SAD, and PAB according to the L-H classification. 18 patients are under SER, which is 60% of the total study population; 5 patients under PER, with 16.7% of the population; 3 patients under SAD, constituting 10%; and 4 patients under PAB, comprising 13.3% of the study population. In the present study, the maximum number of patients were under SER and the minimum under SAD.

Graph 1 : Percentage of different bimalleolar injuries according to L-H classification



According to side of injury, with 20 patients injured on the right side comprising 66.7%, whereas 33.3% of patients were injured on the left side. Out of 30 patients, 20 were injured by self- falls, which is 66.7%, whereas 10 were injured by RTA, which constitutes 33.3%.

The distribution of participants according to the Baird and Jackson scoring system for the present study population. 19 patients fall under the excellent category with 63.3%, 8 patients fall under the good category with 26.7%, 2 patients fall under the fair category with 6.7%, and 1 patient falls under the poor category, comprising a 3.3% population.

Table 1: distribution of study participants according to scoring system Of 30 patients, 22 have no complications, comprising 73.3%. 3 patients have infection, which is around 10%, and 5 patients have swelling, comprising 16.7%.

The mean age is 40.77, and the standard deviation is 12.5. Radiological union was found in a minimum of 8 weeks and a maximum of 16 weeks. The mean value of the radiological union is 11.40, and the standard deviation is 2.4.

Table 2: Showing mean of age and radiological union

Parameters	Minimum	Maximum	Mean	SD
Age (years)	19	63	40.77	12.5
Radiological union (Weeks)	8	16	11.40	2.4

Table 3 :Association between Age and outcome (Baired and Jackson score)

Baird and Jackson score	No. of patients	Percentages (%)
Excellent	19	63.3
Good	8	26.7
Fair	2	6.7
Poor	1	3.3

	Baired and Jackson score			

Age	Excelle nt	Good	Fair	Poor	Total (%)	Chi-squa re	P-valu e
19 – 30	8(26.7%)	1(3.3%)	0(0.0 %)	0(0.0 %)	9(30.0 %)	23.09	**0.02 7**
31 – 40	4(13.3%)	1(3.3%)	0(0.0 %)	0(0.0 %)	5(16.7 %)		
41 – 50	5(16.7%)	3(10.0 %)	0(0.0 %)	1(3.3 %)	9(30.0 %)		
51 – 60	2(6.7%)	3(10.0 %)	1(3.3 %)	0(0.0 %)	6(20%)		
61 – 70	0(0.0%)	0(0.0%)	1(3.3 %)	0(0.0 %)	1(3.3%)		
Tot al	19(63.3 %)	8(26.7 %)	2(6.7 %)	1(3.3 %)	30(100 %)		

A statistically significant (p>0.05) association is seen between age and surgical outcome.

DISCUSSION :

Ankle fractures are intra-articular fractures. Therefore, the most appropriate treatment for displaced and unstable injuries is anatomical reduction and stable fixation, mostly through open reduction and internal fixation.[4]

Numerous factors influence the outcome of an ankle fracture, such as the degree of damage, the fracture's anatomical repair, any associated ligament and chondral injuries, post-operative rehabilitation plans, and co-morbid conditions. Even when surgical intervention is used to correct anatomical fractures, a significant percentage of patients do not demonstrate satisfactory results.

The management of ankle fractures has gradually changed as a result of advancements in biomechanics analysis, fixation methods, and the outcomes of research analysis. Anatomical repair of the damaged ankle and fracture union with painless, complete ankle motion are the objectives of treatment. A closed method of management is often inadequate forbimalleolar ankle fractures. Using the AO method and principles to treat malleolar fractures with precise ORIF resulted in increased percentages of excellent and good outcomes.[6]

The present study has a diverse range of age groups ranging from 19 years to 70 years, of whichthe majority are between 19 and 30 years and 41 and 50 years, which is 30% each. Patients within an age range of 51–60 years are 20%, 31–40 years are 16.70%, and 61–70 years are 3.30%, which brings a mean age of 40.77 years, which is in accordance with the study by Gaurav et al.,[7], where the mean age was 46.775 with a standard deviation of 15.432 and the mean age is in contrast to the study done by Gangadhran et al., where the youngest patient was 23years and the oldest was 70 years old and the average age was 53.5 years.[8]

In the present study, the number of female and male patients is equally high, with 50% female patients and 50% male patients. There are in total of 30 patients of which 15 patients are male and 15 patients are female where as a study by Gaurav et al.[39] noticed injury was more common in males 23 (57.5%) and females 17 (42.5%). In contrast to that, Gangadhran et al.,[8] found in their study that the majority of the patients were females, with 25 (56%) patients and males, with 20 (44%).

According to Singh G et al., males (58.33%) are m ore likely than females (41.66%) to be involved, a nd the right side (54.16%) is more likely than the l eftside(45.83%).These findings are consistent with our research and the findings of Motwani and Mar uthi, who found that 82.5% and 70% of their patie nts, respectively, were male.

The present study showed 20 patients were injured on the right side, comprising 66.7%, whereas 33.3%

were injured on the left side. In accordance
with our study, Gangadhran et al.,[8] noticed the right ankle was involved in 26 (58%) patients and in 19 (42%) patients, the left ankle was involved. In contrast to our study, a study by Gaurav et al.,[7] stated that the left side was more commonly implicated, accounting for 23 individuals (57.5%), while the right side included 17 patients (42.5%).

In the present study according to mode of injury,
20 patients were injured by self falls which is 66.7% whereas 10 patients were injure by RTA which constitutes 33.3%. Similar to our study Gangadhran et al., stated that the major cause of fracture was fall by either twisting, stumbling or slipping in 32cases (71%) and in 13 cases (29%), fracture was due to RTA whereas Gaurav et al., stated that the leading cause of injury is road traffic accidents (72.5%), followed by twisting injuries (20%) and falls from height (7.5%) which is opposing present study.[7,8]
In the present study patients were categorised into SER, PER, SAD,PAB according to Lauge- Hansen classification. 18 patients are under SER which is 60 % of total study population, 5 patients under PER with 16.7% of the population, 3 patients were under SAD constituting 10% and 4 patients under PAB comprising 13.3% of study population. In the present study, maximum number of patients were under SER and minimum under SAD. In par with the present study Gaurav et al., found in his investigation that the most common injury pattern was SER (50%), followed by supination adduction (32.5%), PER (15%), and pronation abduction (2.5%). SER was discovered to be the most common, with a p-value < 0.0001 and a Chi- Square value of 27.467.[7,8] The results are similar to a study by Gangadhran et al.
In the present study 63.3% patients showed excellent scoring, 26.7% with good scores, 6.7% with fair scores and 3.3% with poor scores with a chi square value of 23.09 and statistically significant p-value 0.027. The majority of patients in this study (83.33%) had an outstanding (43.75%) to good (39.58%) Braid and Jackson score at the end of six months, which is consistent with a study by Singh G et al. [9].
In research by Dwivedi R et al.[10] the average AOFAS ankle-hind foot score was 89.86 (±7.95) out of a maximum of 100, indicating good overall functional outcomes. The majority of patients reported no or occasional pain. Results for most of the patients ranged from excellent to good. Denis- Weber's classification suggests that less severe injuries produce better results. In Denis - Weber type A, every patient had outstanding results; in type B, 12 (85.71%) of 14 patients had excellent to good results; and in type C, 8 (80%) of 10 patients had excellent to good results.[10]
Ankle fractures usually result in surgery only in cases of unstable ankle injuries. The AOFAS score was used to assess 32 patients who had ORIF for bimalleolar fractures in research by Dhoju et al.[11] The AOFAS mean score of 90.56±10.92 was achieved by most patients, which was considered outstanding. The Denis-Weber classification showed that less severe injuries had better results
than severe injuries, although the difference was not statistically significant.
After surgery, 243 patients with ankle fractures were investigated by SM. Verhage et al., with a mean follow-up of 9.6 years. The AOFAS score indicated that the results were outstanding. The three main AO groups did not significantly differ from one another, with the total mean AOFAS score being 95. For the AO A, B, and C groups, the mean AOFAS scores were 95, 95, and 94, respectively.[12]
90% of the 232 patients with surgically treated unstable ankle fractures who had an AOFAS score of ≥90% had a functional recovery, according to a study by Egol et al. One year after surgery, most patients recovered well, with little or no discomfort and few limits on their ability to do daily tasks. Although conservative and surgical approaches yield similar functional results, a recent systematic review found that surgical treatment is helpful in achieving anatomical reduction and rigid surgical fixation, which may offer better protection against malunion, nonunion, and loss of reduction.[13]

54 patients with ankle fractures were evaluated 14 months and 3 years following surgery in research by Nilsson et al. The Olerud-Molander Ankle Score (OMAS), which has a median of 75 at 14 months and 85 at three years, was used for assessment. Forty percent of the patients complained of instability and difficulty climbing stairs, and over half reported discomfort, stiffness,and edema. They came to the

conclusion that the subjective outcomes were worse than anticipated after three years of surgical intervention for ankle fractures.[14]

Miller et al. identified risk variables for wound complications following ankle ORIF. Patients who encountered wound difficulties were more likely to develop diabetes, peripheral neuropathy, wound-compromising drugs, open fractures, and postoperative non-compliance. The study found no correlation between wound complications and surgical scheduling at cutoffs of 3, 5, 7, and 10 days from injury to ORIF.[15]

According to a recent study, patients who underwent surgery between eight hours and six days or beyond six days did not experience a longer postoperative stay than those who underwent surgery within eight hours of the injury.[16]

Five years following the fixation of an ankle fracture, Shah et al. reported functional outcomes. They disclosed that there was no discernible effect of the surgical date on the functional result as determined by the OMAS and Short Form.[17]

Schepers et al., found that patients who had surgery postponed by more than one day had a significant reduction in OMAS but no difference in the American Orthopaedic Foot and Ankle Society ankle-hindfoot score or Visual Analogue Scale.[18] Naumann et al., found that surgery postponed bymore than 6 days resulted in a lower functional outcome on the OMAS scale. Disparities in delayed surgical definitions and outcome assessment may explain the observed disparities.[16]

Koval et al. analyzed the Medicare database and found a minimal incidence of problems in older individuals two years following surgery.[19]

The present study represents the complications associated after fixtures of fracture. Of 30 patients, 22 patients have no complications, comprising 73.3%. 3 patients have infection, which is around 10%, 5 patients have swelling, comprising 16.7%, which represents that thereare very few complications in present study. A study by SooHoo NF et al., which found rates of pulmonary embolism (0.34%), mortality (1.07%), wound infection (1.44%), amputation (0.16%), revision open reduction and internal fixation (0.82%), and other short-term complications was in line with the current investigation.[20]

The present study describes the mean age and radiological union of the study population. The mean age is 40.77 and standard deviation being 12.5. Radiological reunion was found in minimum of 8 weeks and maximum of 16 weeks. The mean value of radiological union is 11.40, and standard deviation is 2.4.

Limitations: The present study has only 2 limitations, one of which is smaller sample size another is we would have assessed the functional reunion of fracture for more than 6 months.

Conclusion : Bimalleolar injuries according to Lauge-Hansen(L-H) classification incidence of SER, PER, SAD, PAB is in descending order in present study. Most of thepatients injured by self fall rather than RTA. Majority of patients have excellent scoring. Radiological union was found in minimum of 8 weeks and maximum of 16 weeks.

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