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"A PROSPECTIVE STUDY ON FUNCTIONAL OUTCOME OF OPEN REDUCTION AND INTERNAL FIXATION IN BIMALLEOLAR POTT'S FRACTURES OF ANKLE IN ADULTS"

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ABSTRACT

Background: Ankle injuries are importance because body weight is transmitted through it and locomotion depends upon the stability of this joint. To avoid complications, achieving anatomical reduction by open methods and internal fixation of bimalleolar Fracture of ankle are necessary.

Objectives: Objectives were to study the functional outcome and results of surgically managed bimalleolar fractures, to achieve stable fixation and early mobilization of the ankle.

Methods: We assessed the clinical, radiological and functional outcomes of 25 patients treated with various treatment modalities, including - tension band wiring (TBW), Kirschner (K)-wire, malleolar screw (MS) and cannulated cancellous screws (CCS) for medial malleolus fracture and one-third tubular plate, fibular locking plate for lateral malleolus fracture.

Results: In this prospective research, 25 cases of bimalleolar fractures of ankle were treated by various surgical methods. Majority 11(44%) patients had supination and external rotation injuries. 13 cases of lateral malleolar fracture, were fixed with anatomical plate and in 10 cases 1/3rd semitubular plate were used. Whereas for medial malleolar fractures, TBW was performed in 13 (52%) cases,4 mm cannulated cancellous screws in 8 cases(32%) and in 4(16%) cases malleolar screws were used. 22 of the 25 patients treated had overall good to excellent outcomes. The results were fair and poor in two patients and one patient respectively. In 5 patients we have noticed postoperative complications such as superficial skin infection, hypertrophic scar and delay union.

Conclusion: Anatomical reduction is important for all intra articular fractures, more so if a weight bearing joint like ankle is involved. Open reduction and internal fixation guarantee high standard of reduction besides eliminating chances of loss of reduction. For lateral stability of the ankle fibula length must be retained. In this study, after analysing our result, clinical and radiological results has been compared with other published result and found that TBW and fibular plate give excellent results. By stable surgical fixation of fracture, early mobilization can be done with good functional outcome

KEYWORDS : Bimalleolar fractures, ankle fractures, tension band wiring, malleolar screw, fibular plates and K wires

INTRODUCTION

One of the most common type of fractures treated by orthopedic surgeons is the ankle fracture. Both in young, active patients and the elderly people the prevalence of such fractures has increased over the last two decade[1,2]. Because the ankle transmits the entire body weight and the stability of ankle joint determines the locomotion these injuries are of utmost importance. Untreated or badly treated ankle fractures can result in significant impairments in the form of pain, instability and degenerative arthritis. Therefore, anatomical reduction is important to have good outcome.

The goals of treatment include achieving union of fracture and an ankle that moves and functions normally without pain.

According to Paul L Ramsey's experiments, about 1 mm lateral displacement in talus causes a about 42% reduction in tibiotalar contact area[2].

This clearly shows the need for perfect anatomical reduction, which could be better achieved by open reduction and internal fixation.

The operative method restores the anatomy and contact-loading characteristic of the ankle. Additional advantages include easier rehabilitation without a cast, early mobilization, and earlier weight bearing.[3]

The purpose of this study on closed bimalleolar fractures of ankle is to evaluate the functional outcome managed by open reduction and fixation.

AIM AND OBJECTIVES OF THE STUDY:

1. To study the functional outcome of surgically managed closed bimalleolar fractures of ankle in adults.
2. To assess the union of fractures after surgical management.
3. To achieve stable fixation and early mobilization of the ankle.
4. To evaluate the complications associated with the surgery.

METHODOLOGY

In this Prospective study we have studied 25 patients with fresh Bimalleolar fractures who attended Karnataka Institute of Medical Sciences, hubli, between December 2018 and October 2019. Approval from institution ethical committee was obtained. Inclusion criteria include Patients aged 19 years or older, Patients with fresh bimalleolar fractures of ankle and Patients who are fit for surgery. Exclusion criteria include Patients age 18 years or lesser and Patients unfit for surgery or anaesthesia.

As soon as the patients were brought to the casualty a complete survey was carried out to rule out significant injuries. Then the patients radiographs were taken, anteroposterior, lateral and mortise views of the ankle joints. On admission to the ward detailed history was taken relating to the age, sex, occupation, address, mode of injury, past and associated medical illness. Patients general condition was assessed and then they were put through a thorough clinical examination. In all these patients the following clinical signs were looked for. Swelling of the ankle, any deformity, skin condition, and neurovascular status were inspected.

Lower ends of tibia/fibula and the malleolar parts were palpated and looked for bony tenderness, displacements, any abnormal painful mobility, and crepitus. The interrelation of the malleoli was evaluated by palpation. Dorsalis pedis and posterior tibial arteries pulsations were checked. Distal neural status was also examined. Analgesics were given and patients were put on a below knee posterior POP slab to alleviate pain.

The fractures were classified based on the Lauge-Hansens and the AO classification in adults. Patients with unhealthy skin, those who were medically unfit for surgery were managed by closed reduction and were not included in the study.

Routine investigations were done. The patients were taken for surgery as early as possible once the general condition is stable and fit for surgery.

Operative Technique:
Under appropriate anaesthesia the patient was put in supine position on table with sand bag underneath the affected side buttock. Pneumatic tourniquet was applied to the proximal thigh after noting the time. Timing of surgery lasted around 1 to 1 ½ hours.

Exposure And Fixation Of Lateral Malleolus
The longitudinal lateral incision is the standard approach for most lateral malleolus fractures. The dissection plane is between the peroneus tertius anteriorly and the peroneus longus and brevis posteriorly. Handling the damaged soft tissue is crucial. Care was taken not to damage the superficial peroneal nerve, which lies very close anteriorly, especially in the proximal part.

Reduction of the fracture was done by traction and counter-traction in all fractures, after reduction hold both fragments with reduction holding forceps and fixed with semitubular plate or anatomical fibular plate. Drill hole were made and the plate was then fixed with the measured length of cortical or locking screws.

Exposure And Fixation Of Medial Malleolus :
The medial approach to the ankle was centered on the medial malleolus itself and was shifted either anteriorly for better access to the joint or posteriorly to expose the back of the tibia. The incision used was longitudinal or curvilinear, depending on the exposure needed.

Fracture fixation:
1. For intermediate-sized fragments, one wire and 2.0 or 2.5 mm drill bit was used to
prepare a hole for a 4.0 mm partially threaded cancellous screw or malleolar screw.
2. For larger fragments, two such drills are used for provisional fixation and replaced
One at a time with the 4 -mm partially threaded screws. To obtain a lag effect, their threads must cross the fracture and they should be oriented perpendicular to plane of the fracture.
3. When the medial malleolar fragment was too small for screws or if comminuted, K-Wires with a figure-of-eight tension band was used for fixation.

Syndesmosis Transfixation:
Talus must be reduced in the mortise. Any associated medial or lateral malleolar fractures were fixed. The reduction of the tibiofibular joint must be maintained during placement trans-syndesmotic fixation. The screw was inserted at the top of the fibular sulcus in the tibia, fixation is usually obtained by placing one or two screws from posterolaterally in the fibula to antero-medially in the tibia about 1.5 to 3.0 cm above the plafond.

Fixation of the syndesmosis was done with the ankle in full dorsiflexion to avoid over tightening of the mortise and loss of dorsiflexion postoperatively. Removal of the screw was done after at least 4 to 8 weeks, weight-bearing was delayed till screw removal.

Postoperatively, below knee posterior pop slab was given and the operated limb was kept elevated on a pillow and Patients were put on parenteral antibiotics for three days and changed to oral antibiotics. Non-weight bearing gait was started from first or the second postoperative day. Patients were advised strict non weight bearing for 6 weeks. Ankle mobilization exercise and partial weight bearing were started after 6 weeks and full weight bearing after 8 to 12 weeks depending upon signs of radiological union. In patients with syndesmotic screw fixation, weight bearing was delayed till screw removal. Follow up of cases was done at regular intervals of 6 weeks for minimum of 6 months. The ankle scoring system of subjective, objective, and radiographic criteria of Baird and Jackson was used for the study[4]. All the patients were evaluated and scores were given.Baird and Jackson Scoring system[4]:

Pain	**Points**
A. No pain	15
B. Mild pain with strenuous activity	12
C. Mild pain with activities of daily living	8
D. Pain with weight-bearing	4
E. Pain at rest	0
Stability Of Ankle	
A. No clinical instability	15
B. Instability with sports activities	05
C. Instability with activities of daily living- ability to walk	0
Able To Walk	
A. Able to walk desired distances without limp or pain	15
B. Able to walk desired distances with mild limp or pain	12
C. Moderately restricted in ability to walk	8
D. Able to walk short distances only	4
E. Unable to walk	0
Able To Run	
A. Able to run desired distances without pain	10
B. Able to run desired distances with slight pain	8
C. Moderate restriction in ability to run, with mild pain	6
D. Able to run short distances only	3
E. Unable to run	0
Ability To Work	
A. Able to perform usual occupation without restrictions	10
B. Able to perform usual occupation with restrictions in some strenuous activities	8
C. Able to perform usual occupation with substantial restriction	6
D. Partially disabled; selected jobs only	3
E. Unable to work	0
Motion Of The Ankle	
A. Within 10° of uninjured ankle	10
B. Within 15° of uninjured ankle	7
C. Within 20° of uninjured ankle	4
D. <50% of uninjured ankle, or dorsiflexion <5°	0
Radiographic Result	
A. Anatomical with intact mortise (normal medial clear space, normal superior 25 joint space, no talar tilt)	25
B. Same as A with mild reactive changes at the joint margins	15
C. Measurable narrowing of the superior joint space, with superior joint space 2 mm, or talar tilt >2 mm	10
D. Moderate narrowing of the superior joint space, with superior 5 joint space between 2 and 1mm	
E. Severe narrowing of the superior joint space, with superior joint space <1mm, widening of the medial clear space, severe reactive changes (sclerotic subchondral bone and osteophyte formation)	0
Maximum possible score	100

FUNCTIONAL GRADING	**SCORE**
Excellent	96 to 100 points,
Good	91 to 95 points,
Fair	81 to 90 points,
Poor	0 to 80 points

Fig 1. Intraoperative Image Of Fibula Fixation With Anatomical Plate Screws A) Exposing Fracture Site After Skin Incision B) Fixation Of Lateral Malleolus With Fibular Locking Plate.

Fig 2. Intraoperative Image Of Medial Malleolus Fixed With Tbw A)

Exposure Of Fracture Medial Malleolus After Skin Incision. B) Fracture Reduced And Fixed With Kwire. C) Tension Band Wiring Done Of Medial Malleolus

RESULT

In this prospective study, 25 cases of bimalleolar fractures of ankle were treated by surgical methods. The youngest patient was 21 years old and oldest was 66 years of age. The mean age in our study was 42 years. In this study, males were most frequently involved.

The major cause of fracture in our study was road traffic accidents in 14 (56%) followed by 9 (36%) patients fracture due to slip and fall. The rest 2 (8%)patients had fractures due to fall from height. The Right ankle (68%) was more frequently involved than left ankle (32%) in our study.

In the present series 11(44%) patients had supination and external rotation injuries which is the majority, followed by 7(28%) patients having pronation external rotation and 7(28%) patients had pronation abduction and supination adduction injuries totally.

Most of the patients were operated between 2 and 5 days. Average duration between trauma and surgery was 4 days in our series. All the patients were given spinal anesthesia.

For lateral malleolar fracture, 13 were fixed with anatomical plate and 1/3rd semitubular plate in 10 cases . Whereas for medial malleolar fractures, tension band wiring was done in 13 (52%) cases, 4 mm cannulated cancellous screws in 8 cases(32%) and in 4(16%) cases malleolar screws were used.

In our study, the average time taken for union was 10 weeks. Most of the cases (80%) showed union between 8 – 12 weeks. 5 patients(20 %) had complications.3 patients(12%) had superficial infection, one patient(4%) had delayed union medial malleolus and one patient(4%) developed hypertrophic scar. In the present study of 25 patients with Bimalleolar ankle fractures treated by open reduction and internal fixation, Excellent results were achieved in 17(68%)patients, good in 5 (20%) Fair in 2 (8%) and Poor in 1 patient (4%). The patient with poor result had mild pain with activities of daily living, diminution in the abilities to run and to do work, reduced motion of ankle and narrowing of joint space

Fig.3a) Preoperative X-ray of left ankle's anteroposterior amd mortise (a) and lateral (b) views showing Pott's fracture of ankle with supination and external rotation injury.

Fig. 3c Immediate Post-op Xray

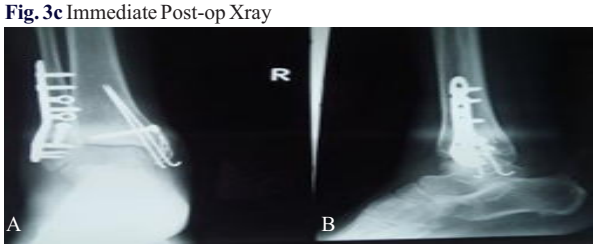

Fig 4 : Postoperative X-ray of right ankle's anteroposterior (a) and lateral (b) views showing Pott's fracture of ankle with supination external rotation injury fix with TBW of medial malleolus and fibula locking plate of lateral malleolus.

Fig 5. Preoperative X-ray of right ankle's anteroposterior (a) and lateral (b) views showing Pott's fracture of ankle with pronation external rotation injury.

Fig 6. Postoperative X-ray of right ankle's lateral (a) and anteroposterior (b) views showing Pott's fracture of ankle with pronation external rotation injury fixed with CC screw medial malleolus and one-third tubular plate lateral malleolus immediate post op and follow up Xrays at 9 weeks Post-op(d)

DISCUSSION

In our study, fractures were commoner in the 51-60 yrs age group, with mean age being 42 yrs. This finding was similar to observation of Baird and Jackson[4], Roberts RS[5], Beris et al and Lee et al[6].Almost equal male(52%) and female(48%) ratio observed in our series of studies, which is comparable to the study of Lee et al[6]

Road traffic accidents constituted majority of cases in our current study, which was in accordance with study by Lee et al.[6]In the present study, right ankle was more commonly affected, in accordance with Roberts RS[7], Beris et al.[8] In the present study Lauge Hansens classification system was used for operative evaluation. The most common type of injury was supination external rotation (44%) followed by pronation and external rotation (28%) and least common was pronation adduction. This finding was in accordance to observation of Roberts RS[7] and Baird and Jackson[3]The results in this study were compared with that of Burnwell and Charnley[9], Colton[10], DeSouza et al[11], Beris et al[8]. In Colton[10] series he found that eighteen

(70%) of patients had good to excellent results. Burnwell and Charnley[9] in their series of 132 patients, 102 (77.3%) had good results, 16% had fair results and 6% patients were found to have a poor score. In the study conducted by DeSouza, et al[11] on 150 fractures of ankle treated by open reduction and stable internal fixation using AO ASIF method obtained 90% good results. In a study conducted by Beris et al[8] of 144 patients with ankle fracture there were good to excellent results in 74.3% patients, fair results in 14.6% and poor result in 11.1%. All these were comparable to this study where 68% patients with ankle fractures had excellent results, 20% good, 8% fair and poor results in 4% patients.

Table 1. Functional Results As Seen In Various Studies

STUDY	GOOD TO EXCELLENT RESULTS	FAIR RESULTS	POOR RESULTS
Colton[10]	18 (70%)	4 (15%)	4 (15%)
De souza[11]	135(90%)	9(6%)	6(4%)
Beris et al[8]	105(74.3%)	21(14.6%)	16(11.1%)
Burnwell & Charnley[9]	102 (77%)	22 (17%)	8 (6%)
Our study	22(88%)	2(8%)	1(4%)

Observation in this study support the contention of Yablon et al[9] that lateral malleolus is the key to the anatomical reduction of bimalleolar fractures, because the displacement of the talus faithfully followed that of the lateral malleolus. Poor reduction of the lateral malleolus fracture would result in persistent lateral displacement or residual shortening. This does not necessarily lessen the importance of medial malleolus, but it does serve to emphasize that the lateral malleolus should no longer be ignored.

Lateral malleolus can be fixed by various methods. Lateral plate, as advocated by AO group has become widely accepted for treatment of fibular fracture. Hughes et al recommended that lateral malleolus should be fixed first. The medial malleolus is then inspected for stability and fixed if necessary. This allows minimal postoperative immobilization and rapid recovery of function.

In the current study, the functional outcome was better in patients who underwent stable internal fixation of the medial malleolus by tension band wiring. In many fractured ankles, syndesmosis is stable after reduction and internal fixation of fibula fracture and medial malleolar fracture. Yablon et al[12] stated that anatomical reduction of the fibula is the key factor in achieving good outcome of the treatment of ankle fractures with syndesmotic disruption. In the current series, 1 patient underwent trans-syndesmotic screw fixation. In our 25 patients there was no instability of ankle or subtalar joints, because we allowed sufficient time for the soft tissues around the ankle to heal. We preferred postoperative immobilization rather than allowing active ankle exercise as there was no difference in the results after 6 months of follow up.

Although early mobilization was advocated by AO immobilization also has been supported. Others have found no significant difference in the results produced after early motion or immediate plaster splintage. In this series immobilization in a plaster for 6 weeks followed by mobilization and partial weight bearing was used successfully.

The range of motion was reduced initially but after the cast removal the ankle movement rapidly improved. A number of different treatment regimens have been suggested.

Burwell and Charnley[9] advocated postoperative joint mobility exercises in bed until motion was restored followed by full weight bearing in a cast.

A broad understanding of all aspects of mechanism of injury, pathoanatomy and treatment options coupled with training experience is required before any attempt should be made to treat these injuries with thorough understanding of injury patterns repair of the damaged ankle joint can lead to rewarding outcomes for the patient and physician.

Majority of the patients (82.5%) showed good to excellent results in the current study, similar to what was observed in other series such as those by Burnwell and Charnley,[9] Colton[10] and Beris et al.[8] The treatment of bimalleolar fractures with accurate open reduction and stable internal fixation using AO method and principles was found to give a high percentage of excellent and good results. This study supports these conclusions and was comparable with those in other studies.

CONCLUSION

In the present study of 25 patients, majority of the medial malleoli fractures were treated with TBW and lateral malleoli fractures with plating showed congruence articular surface with anatomical reduction. This will give excellent to good result. After analysing our results (clinical and radiological) and on comparing with other published series, tension band wiring and fibular plating gave excellent to good results.

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