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A Study on Different Surgical Treatment Modalities of Bimalleolar Fracture in Adults

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ABSTRACT
Functional outcome of surgery remained good to excellent and fair to poor result, were seen in those with associated syndesmotic injury and in patients with delayed union of medial malleolus and those with superficial or deep infections. To evaluate clinically and radiologically, the closed displaced bimalleolar ankle fractures in adults treated with open reduction and internal fixation. This is prospective interventions randomized study after obtaining the clearance from ethical committee of the college and consent from the patient with study duration from March 2023 to October 2023, age ranging from 18-60 years. There were 8 males (60%), 9 females (40%) in threaded screw group and male to female ratio was 1.5:1 while in tension band wiring with one third tubular plate group there were 9 males (53.3%), 8 female (46.7%)and male to female ratio was 1.14:1. The average age of patients in threaded screw with one third tubular plate group was 32.11 years (S.D±12.203) with range being 18-60 years and in tension band wiring with one third tubular plate group, average age of the patient was 36.30 years (S.D ±13.723) with the range being 18-60 years. There were 8 males (60%), 9 females (40%) in threaded screw group and male to female ratio was 1.5:1 while in tension band wiring with one third tubular plate group there were 9 males (53.3%), 8 females (46.7%) and male to female ratio was 1.14:1.

INTRODUCTION

Ankle fractures are one of the most common lower limb fractures[1], they account for 9% of all fractures[2], representing significant portion of the trauma workload[3]. The annual incidence of ankle fracture is between 107 and 184 per 100,000 persons[4,6] and around 2% of ankle fractures are open fractures[4]. Ankle fractures usually affect young men and older women[7], however, below the age of 50, ankle fractures are the commonest in men. After this age, females become predominant. Slippery surfaces and alcohol consumption are involved in nearly third of the cases[6]. The most common causes of ankle fractures are twisting injuries and falls, followed by sports injuries[4,5]. Diabetes mellitus and obesity are associated with fractures in middle aged and older adults[5], Most fractures are associated with ligament injuries and the magnitude and direction of the deforming force applied to the ankle joints directly correlate to the fracture pattern[8]. The ankle joint is hinge joint, the lower end of the tibia and its medial malleolus, together with the lateral malleolus of the fibula and the inferior transverse tibiofibular ligament form deep recess (mortise) to articulate with the body of the talus, the ankle joint has strong medial collateral (deltoid) ligament. The lateral ligament and the inferior tibiofibular ligament is usually considered syndesmosis. The ankle joint receives its blood supplied from the anterior and posterior tibial and fibular arteries. The joint is innervated by branches from deep fibular, saphenous, sural and tibila nerves[8].

Passive stability is mainly achieved by the medial and lateral ligament complexes, tibiofibular ligaments, tendons crossing the joint, bony contours and capsular attachments. Dynamic stability is usually conferred by gravity, muscle action and ground reaction forces. Stability requires the continuous action of soleus assisted by gastrocnemius, it increases on leaning forward and decreases on leaning backwards[8]. The posterior malleolus acts as restraint against posterior translation of the talus[9]. The first classification system for ankle fractures were developed by the Sir Percival Pott who described fractures in terms of the number of malleoli involved, thus dividing injuries into unimalleolar (70%), bimalleolar (23%) and trimalleolar (7%)[4]. There are two other commonly used classifications systems i.e..,Danis-Weber Classifiction which was introduced by Danis in 1949, modified by Weber in 1966 then adopted by the AO group and Lauge-Hansen Classification which was described in 1950 by Lauge Hansen as a result of both cadaveric dissections of experimentally produced fractures and clinical and radiological examinations[9]. The basis of this classification is on the position of the foot and the deforming force at the time of injury. The ankle injuries gained importance because body weight is transmitted through it and the locomotion depends upon the stability of this joint. It must be realized that ankle injuries are mixed ones, ligamentous and body failures due to deforming forces, thus the primary goal of treatment should be full restoration of anatomy. Though malleolar fractures are discussed extensively, the opinion in the treatment of these fractures varies widely because of differences in classification, reduction techniques and subjective symptoms at follow up studies. Many of these fractures were managed by manipulative reduction and conservative treatment and have yielded satisfactory results. Injuries like unstable syndesmotic distasis, tri or bimalleolar fractures required open reduction and fixation. Danis-Weber/AO Classification[10] Type A: Lateral malleolar fractures below the level of the ankle joint space. Type B: Oblique fractures of the lateral malleolus that start at level of joint space and then extend proximally. Type C: Distal shaft of the fibula proximal to the ankle joint Olerud-Molander Ankle Score. The scale is a functional rating scale and it consists of nine parameters, which are listed below[11,12]. Such as pain, then Running, then Stiffness, then Swelling, Stair climbing, Jumping, Squatting, Supports, daily living activities.

Aims and Objective: To evaluate clinically and radiologically, the closed displaced bimalleolar ankle fractures in adults treated with open reduction and internal fixation.

MATERIAL AND METHODS

This is prospective interventions randomized study conducted in Department of Orthopaedics, I.Q city Medical College and hospital, Durgapur, West Bengal after obtaining the clearance from ethical committee of the college and consent from the patient. The purpose is to evaluate clinically and radiologically the displaced bimalleolar ankle fracture in adults above 18 yrs. of age treated with one third tubular/Recon/ Locking recon with tension bend wiring. The duration of study was 8 months including follow-up. The Total number of patients assessed and evaluated in this study was 30.

Inclusion Criteria:

- All displaced bi-malleolar ankle fractures in adults were included
- Age above 18 years and <60 years

Exclusion Criteria for Case:

- Un-displaced fractures and fractures treated by closed reduction
- Childhood and epiphyseal injuries around ankle were excluded from the study
- Ankle fractures with late presentation, with nonunion or mal-union were not included in the study

- Patient medically unfit or unwilling for surgery

Study duration: From March 2023 to October 2023 (8 months).

Operative procedures: Patients were subjected to open reduction and internal fixation and fixed with either partial threaded screw and one third tubular plate or tension band wiring with one third tubular/Recon/Locking recon. Operation was under spinal anaesthesia. Positioning Patient was kept in supine position and the affected limb was kept in extended and externally rotated on the operating table. A tourniquet was applied to the thigh as per requirement. Draping the skin over the ankle region with leg and foot was prepared by soap scrub and application of the povidine iodine (10%) solutions. The operative field was draped with sterile sheets and placing the towel clips so that they were not superimposed on the fracture on subsequent imaging. Fixation of the fibula with one third tubular plate Skin incision was given laterally extended above and below as required and in the entire cases fibula is fixed first. Incision started about 5 cm above the tip of malleolus and will extend downward and forwards 2.5 cm-3.5 cm below it. The incision was subjected to extend proximally when required

After exposing the fracture site, the hematoma and interposed soft tissue if any was removed and fracture surface was cleaned with a curette. The fracture was reduced and held in alignment with the help of bone holding forceps. One third tubular plate either 5,6 holes, depending upon the type of fracture was applied. The bone was drilled with a 2.8mm drill bit using a drill guide and will tap with a 3.5 mm cortical bone tap. 3.5 mm cortical screws were then is used to fix the fracture and fixation of medial malleolus with partially threaded screws. An anteromedial incision was made over the medial malleolus that begins approximately 2 cm proximal to the fracture line, extends distally and slightly posteriorly and ends approximately 2 cm distal to the tip of the medial malleolus. The skin with its underlying subcutaneous tissue was retracted anterior and posteriorly. The great saphenous vein and its accompanying nerve were retracted anteriorly. The fracture site was exposed and the fracture fragments were curetted to remove any loosed osseous or chondral fragments. With a bone-holding clamp or towel clip, the detached fragments were brought into normal position and internally fixed with two 1.5 mm smooth Kirschner wires drilled across the fracture site as temporary fixation devices. If the reduction was satisfactory, a 2.8 mm drill bit was drilled across the fracture fragments and a 4 mm partially threaded screw was inserted using a 4 mm screw driver and one of the Kirschner wires was removed. A second screw was then placed in a similar fashion and the second K-wire was removed. After fixation had been confirmed, the wound was irrigated and closed a traumatically, usually with interrupted non absorbable skin sutures. A posterior below knee plaster slab was applied after skin closure. Fixation of medial malleolus by tension band wiring. A similar incision was made on the medial malleolus to expose the medial malleolus and after reducing the fragment a towel clip was used to hold it in position and two k-wires was passed parallel to each other through the fragments. Then a through and through anterio-posterior drill hole was made on the tibia above 3 cm proximal to fracture and a length 20,22 gauge stain less steel was passed through the hole. The end was crossed over, with one end passing under the 2 k-wires and ends was tightened and twisted in a figure of eight fashion.

After the both malleolus fixed syndesmosis is accessed by using hook test and fixed one or two screws from or outside plate (called syndesmosis screws) and removed at 12 weeks. After through irrigation the wound was closed in layers and below knee plaster of paris was applied. Post-operative management postoperatively, the ankle was immobilized in a posterior plaster splint with the ankle in neutral position and elevated. A cephalosporin antibiotic was administered prior to the operation and then 12 hourly for 24-48 hours after surgery and continued with oral antibiotics for another 5 days. Suture removal was done on the 10th day and then patients were discharged or the patients were discharged and called for suture removal on the 10th day after surgery in the OPD. Regular OPD checkup was done at monthly intervals up to 6 months and AP and lateral radiographs were obtained. Range-of-motion exercises were begun once the wound was healed. Weight bearing was restricted for 6 weeks, after which partial weight bearing was started when the fracture was healing well. Full weight bearing was allowed depending on radiographic evidence of fracture consolidation.

Statistical analysis: Data was checked for completeness and consistency. Data as age, sex and fracture side, mode of injury, age of fracture, operating time, weight bearing and time of union and functional outcomes were entered and analyzed by using SPSS V.21 for windows.

RESULTS AND DISCUSSIONS

The following variables of each patient record were analyzed: age, sex, distribution of fracture side, mode of injury, age of fracture, operating time, weight bearing, time of union, complications and functional outcomes. In our present study, the average age of patients in threaded screw with one third tubular plate

Fig. 1: surgical Approach Medial Malleolus

Fig. 2: Exposure and fixation technique

Fig. 3: surgical Approach lateral Malleolus

Fig. 4: Exposure showing fracture fixed with plate

Fig. 5: Bimalleolar ankle fracture treated with locking recon plate and tension band wiring (TBW) and syndesmosis screw

group was 32.11 years (S.D±12.203) with range being 18-60 years and in tension band wiring with one third tubular plate group, average age of the patient was 36.30 years (S.D±13.723) with the range being 18-60 years. There were 8 males (60%), 9 females (40%) in threaded screw group and male to female ratio was

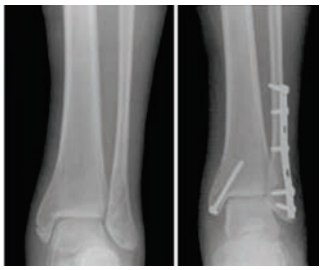

Fig. 6: Bimalleolar ankle fracture treated

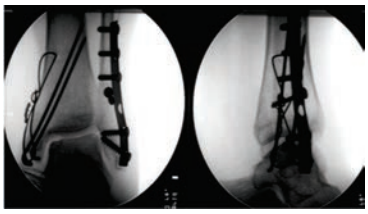

Fig. 7: Bimalleolar ankle fracture treated with TBW with one third tubular plate and screw

Fig.8: Bimalleolar ankle fracture treated with recon plate and screw

1.5:1 while in tension band wiring with one third tubular plate group there were 9 males (53.3%), 8 females (46.7%)and male to female ratio was 1.14:1. In our study, slipping/stumbling was the most common mode of injury seen in 5 cases (37%), followed by fall from steps in 5 cases (25.6%) and sports injuries in 4 cases (22 %) and 3 cases (20 %). RTA in threaded screw with one third tubular plate group. In tension band wiring with one third tubular plate group, slipping/stumbling was the cause of fracture in 6 cases (40%) followed by RTA in 4 cases (26.7%), fall from steps in 3 cases (20 %) and sport injuries in 2 cases (13.3 %). The mean age of fracture in threaded screw with one third tubular plate group was 5.13 (±1.959) days ranging from 3-10 days. In the fully threaded screw group the average hospital stay was 8.40 (± 2.501) days, ranging from 5-12 days and in partially threaded screw group the average stay was 8.07 (± 2.187) days ranging from 6-12 days. Clinically, the mean time for union in threaded screw with one third tubular plate group was 7.47 weeks (range 5-10 weeks).

The range of motion in threaded screw with one third tubular plate group was 100% in 0-20° dorsiflexion, 92.4% in 0-50° planter flexion, 78% in 0-20° pronation and 84.2% in 0-40° supination while in tension band wiring with one third tubular plate group was 100% in 0-20° dorsiflexion, 85.4% in 0-50° planter flexion, 82% in 0-20° pronation and 85.6% in 0-40° supination. Ramana et al. did a study on internal fixation of 48 cases bimalleolar fractures from Vijayawada. They concluded that pronation-abduction type of mechanism was common and then followed by supination and external rotation mode of injury. The most common cause was slip and fall[13]. Vivian et al. conducted a study on functional outcome of operated cases of 45 ankle fractures from Mangalore. Olreud and Molander scoring system was used in this study. They observed fractures with internal fixation yield good outcomes. They concluded early treatment of fractures of ankle without delay, provides better anatomical reduction and fixation in 16 cases. Better post-operative mobilization and rehabilitation helps in improving outcome in operated ankle fractures. Alamgir *et al*.[14] dis a study on tension band wiring for displaced lateral malleoli fractures and for bimalleolar fractures plating was done in 20 patients. They concluded displaced lateral malleolus fractures demands surgical management accompanied with tension band wiring with the use of 2 k-wires which gives a stable fixation and helps in union of fracture[15]. Ayyoub A. Mohammed *et al*. performed a study to compare tension band wiring and screw fixation for medial malleoli fractures among 20 patients. The outcome was good in four fifth of patients of malleolar screw fixation and 90% of tension band wiring cases[16]. Dhoom Singh Jhatoh did a study to evaluate the outcomes in 27 patients who underwent internal fixation. Baird and Jackson scoring system is used. It was observed that 83.2% as Good, 8.3% as Fair and 8.3% as poor outcome[17]. Vijay *et al*. performed a prospective study in assessing surgical management of 36 cases of malleolar fractures from Pune. The outcome were based on Baird and Jackson scoring system and they observed excellent results in 30.6% patients, 55.6% had good results, 8.3% patients had fair results and results were poor in 5.5%[18]. Mohan et al. did a study to assess the clinical outcome of 45 cases of ankle fractures from a period of June 2015-February 2016 in Mangalore. They observed improvement in pain and also in activity levels[19]. Ostrum et al. did a study on open reduction internal fixation of bimalleolar fracture of ankle along with syndesmotic injury and stated that failure to sufficiently recognize and treat injuries to tsyndesmosis may outcome in continued ankle instability and poor patient outcomes[20]. K. Ramkumar Reddy et al. Did A study in which he did tension band wiring for fractures of medial malleolus and assessed their outcome in 30 patients who are in Warangal. They concluded understanding the mechanism of fracture preoperatively is significant for reduction and fixation procedure, in terms of better outcome of procedures[21]. Dhoju D performed study on Outcome of 32 cases of Bimalleolar Fractures in Nepal. Excellent results were found in surgically treated cases. They concluded syndesmotic screw was not significant association in comparing outcome[22].

CONCLUSION

In this interventional study, we studied the results of threaded screw with one third tubular plate fixation and tension band wiring with one third tubular plate fixation were insignificant in term fracture union, range of motion, weight bearing and functional outcome but there were definite advantages in threaded screw with one third tubular plate fixation. In our study the overall functional outcome was 93 % excellent to good results in threaded screw with one third tubular plate fixation.

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