

An innovative mechanism of tension band fixation of fracture Medial Malleolus with kirschner wires and Polyglycolic 1-0 sutures: Methods and outcomes (Butala's Polyglycolic Tension Band fixation Method)

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Abstract

Introduction: A prospective study was conducted from November 2014 to October 2016 to treat medial malleolus fractures using modified TB fixation method where instead of SS wire Polyglycolic 1-0 sutures were used and result were evaluated.

Materials & methods: All patients with fracture Medial Malleolus with or without lateral malleolus fracture were included in our study. Tension band suturing with 2 x 1.5 mm kirschner wire and Polyglycolic 1-0 suture was done by same surgeon and total 20 patients (20 ankles) were evaluated by AOFAS score and Baird and Jackson scoring system.

Results: Weber Type B was most common (11 cases) 55% with age group of 36-50yrs contributing to (12 cases) 60%. Mean age group was 44.5yrs and mean union period was 8 weeks. Fracture union time was same as compared to SS wire TBW figure of eight method and overall results were comparable to most studies. In our study, all 20 cases after brief follow up of 6 months showed complete union, no patient was infected and there wasn't any residual pain or discomfort.

Conclusion: Tension band suturing of fracture Medial Malleolus with kirschner wires and Polyglycolic 1-0 sutures is an innovative mechanism with additional benefits over conventional TBW with SS wire and Kirschner wires. Advantages were decreased hardware in situ; easier implant removal, less chances of implant exposure, infection and wound dehiscence. Simplicity of procedure with faster recovery and easier implant removal makes it one of many options to fix Medial Malleolus fractures.

Keywords: Medial Malleolus, TBW, Polyglycolic 1-0, SS wire, AOFAS score

Introduction

Ankle fractures are one of the most common lower limb fractures [1] and they account for 9% of all fractures [2], representing a significant portion of the trauma workload [3]. 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 [4]. Ankle fractures can be unimalleolar, Bimalleolar and trimalleolar. For moderate to large malleolar fragment both modalities of treatment are applicable like closed/ open reduction and internal fixation with two parallel cancellous screws [5] and tension band suturing [6]. The tension band suturing technique has got advantages over the screw fixation in the form of it resists the movement at the fracture site and it prevents non-union of the fracture as tension band suturing is four times stiffer than cancellous screws. As per AO trauma the medial malleolus is fixed with two partially threaded cancellous bone screws 4 mm. If the quality of the bone is not so good, or the fragment is small, a tension band suturing can be used. If the fragment is large and the fracture plane is vertical, as in some type A fractures, the fracture is fixed with a medial buttress plate [7]. Both malleolus are inherently conspicuous areas with limited skin coverage and poor blood

supply. All above mentioned methods utilizes heavy instrumentation especially if plate is used and CC screw fixation has been associated with pull through if mobilized earlier than recommended [8]. Similarly in TBW with Kirschner wires and SS wire there has been associated implant failure and discomfort among patients due to subcutaneous position of SS wire and cases have been reported where wire was exposed and warranted removal even before healing to prevent infection. Polyglycolic 1-0 sutures as a tensioning structure had been studied in comminuted fracture patella where it was used to encircle the fractured parts in patellar fracture [9]. In our study we modified the usual TBW method and have used Polyglycolic 1-0 sutures instead of SS wire and to reduce metal in body, instead we drilled through bones to pass Polyglycolic 1-0 sutures and Tension suturing was done via 2 Kirschner wires to overcome the issues encountered with SS wire.

Material & Method

This prospective study was conducted in department of Orthopaedics and Traumatology D.Y Patil Hospital, Navi Mumbai from Oct 2014 to Nov 2016. Total of 20 patients were included in study (20 ankles). All patients attending OPD or emergency with Bimalleolar or isolated malleolus fracture where counseled about different modalities of surgery and above mentioned procedure was performed after taking necessary consent.

Inclusion criteria:

1. Patient between 25 to 60 yrs of age
2. Patients having displaced malleolar fractures (Isolated

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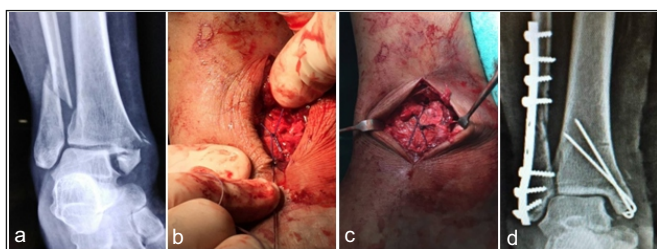


Figure 1: surgical procedure using Polyglycolic sutures and K wires
 -A X-ray showing Bimalleolar fracture
 -B Medial malleolus reduced and vicryl loop in figure of 8
 -C Suturing complete with stable and reduced fracture
 -D Post of X-ray with k wires and anatomically reduced fracture

	Grade A	Grade B	Grade C	Grade D	Grade E	Total
Pain	13	7	-	-	-	20
Stability	19	2	-	-	-	20
Walking	18	2	-	-	-	20
Running	8	12	-	-	-	20
Work	13	7	-	-	-	20
Motion	17	3	-	-	-	20
Radiography	19	1	-	-	-	20

Score based on subjective, objective and radiological criteria

medial malleolus or Bimalleolar fractures) for which conservative closed method is not indicated

3. Patients with Grade 1 compound injury.
4. Motivated patients who agreed to undergo regular physiotherapy.

Exclusion criteria:

1. Compound Grade 2/3 Gustillo Anderson (Open) ankle fracture/Plafond fractures
2. Old fracture more than 2 weeks old
3. A previous fracture of same or contra lateral ankle
4. Patient is unfit for surgery.

Surgical technique:

All patients were operated under spinal anesthesia after regular fitness. Tourniquet was used to control bleeding and undue interference of surgical field. If associated Fibular fracture was present it was fixed first. For medial malleolus Anterior J approach was preferred. The fracture site was exposed and entrapped periosteum if any was cleared of fractured ends. Fracture reduction was done and temporarily held with secondary towel clip. Two 1.5 mm k-wires passed from the tip of malleolus obliquely and opposite cortex were engaged (Fig 1.D). 3cm to 3.5 cm proximal to the fracture site 2 drill hole were made with 2mm kirschner wire obliquely and grooves were

approximated and Polyglycolic 1-0 sutures was passed through one hole and taken out through other and loop in fashion of figure of eight pattern was done like done with SS wires (Fig 1.B & C). Same procedure was repeated as additional Polyglycolic 1-0 will enhance support and reduction. K-wires were retracted slightly bent and cut near the tip of malleolus and rotated inwards and hammered back. Proper wash given and suturing was done in layers. Entire surgery was done under C arm guidance and reduction was confirmed. Postoperatively the check x-ray was taken in all the patients to confirm the reduction and k-wires position. Slab was given immediately after post op. Ankle movements was started from day 7 after post op reduction in pain and edema, non-weight bearing walking started using walker after 21 days. Suture removal done on 14th day. Follow up done at 4 weeks, 8 weeks, 12 weeks and 24 weeks for clinical and radiological outcome.

Results

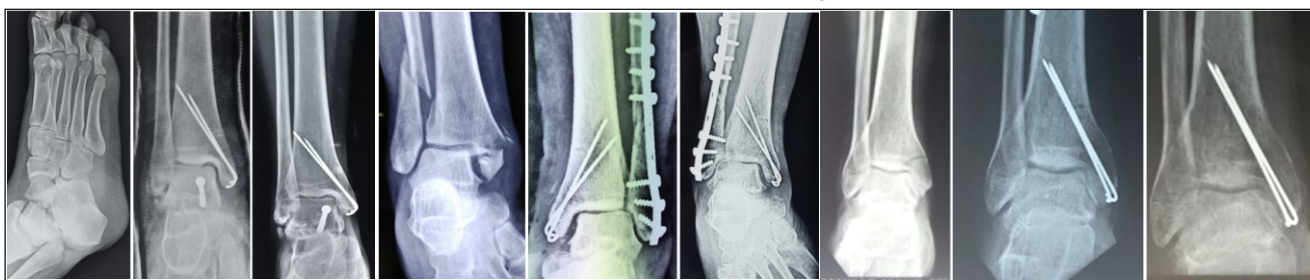
Patients were classified as per Weber-AO classification. Type A included 3 patients while type C had 6 patients. Maximum patients suffered type B accounting to 55%. Maximum patients were in age group of 36-50 years contributing to 60%. There were 14 male (70%) and 6 females (30%). Right ankle was affected in 14 cases (70%), whereas 6 had left sided fracture. The mode of injury was RTA in 13 cases (65%) and falls in 7 cases (35%). The scoring system of Baird and Jackson showed 76.4% of patients had excellent to good result, 24.28% achieved fair results and none had poor result. All cases achieved anatomical reduction of the medial malleolus radiologically. As per AOFAS scoring system 82% had score above 90 and remaining between 80-90.

Complications

Of total 20 patients none of the patient had difficulty of wound closure. None had painful hardware and only 1 of the patients with Diabetes developed suture site abscess which was debrided and after antibiotic coverage healed well. None of the patient suffered non union or malunion.

Discussion

The AO-ASIF group recommends tension-band suturing for small avulsion type fractures of the medial malleolus that are unacceptable for screw fixation as well as for



Case 1: 34 yr/male bimalleolar fracture- Treated with Kirschner wire and TBW with Polyglycolic 1-0 sutures. Left to right -fracture medial malleolus, immediate post op, follow up after 3 months.

Case 2: 44 yr female bimalleolar fracture- Treated with Kirschner wire and TBW with Polyglycolic 1-0 sutures. Left to right -fracture medial malleolus, immediate post op, follow up after 3 months.

Case 3: 54 yr/male medial malleolar fracture- Treated with Kirschner wire and TBW with Polyglycolic 1-0 sutures. Left to right -fracture medial malleolus, immediate post op, follow up after 3 month

osteoporotic bone. Tension band suturing is based on the principle of conversion of distractive forces into compressive forces at the fracture site (Pauwell) which is used in patella or olecranon fractures, whereas in Medial malleolus it is tension band fixation (Ostrum and Litsky) [10]. Advantages being rigid fixation and early ambulation in relation to other methods of internal fixation. In our study Weber Type B was most common (11 cases) 55% with age group of 36-50yrs contributing to (12 cases) 60%. Mean age group was 49.5yrs and mean union period was 8 weeks. Fracture union time was same as compared to SS wire TBW figure of eight method and overall results were comparable to most studies. Our method is innovative and reliable because Poly glycolic 1-0 sutures gets absorbed only after 21 days [11] and that much time is sufficient to form callus around fracture site and as Medial malleolus is a cancellous bone that much time is sufficient to initiate healing process and kirschner wire in

situ prevents displacement and holds the anatomical reduction. Implant removal is simple as only kirschner wire is to be removed. Overall surgical time is reduced and Kirschner wire removal can be done under local anesthesia with reduced stay in hospital especially in isolated Medial malleolus fractures.

Conclusions

Our procedure of TBW with Polyglycolic 1-0 sutures and K wires is simple yet cost effective, result oriented surgery and overall patient compliant in long run and can be considered in properly selected patients as one of the modality of treatment. It provides advantages of decreased hardware, less chances of implant exposure, infection and wound dehiscence and easier implant removal which can be done under Local anesthesia as only k wire withdrawal is required.

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