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## Minimally invasive technique of fixation of closed bimalleolar fractures

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### Abstract

**Introduction:** Among ankle fractures, bimalleolar and trimalleolar fractures constitute a majority of them. These are known to have significant complications in the postoperative period after open reduction and internal fixation, either due to soft tissue trauma or loss of reduction due to inadequate fixation or compliance by the patient. We decided to do retrospective study for analysis of results of our minimally invasive technique of fixation of malleolar fractures with single 4mm cannulated or partially threaded cancellous screw fixation for medial malleolus fracture and K wire for lateral malleolus fracture.

**Material and methods:** We conducted prospective follow up study in orthopaedic department at tertiary care hospital over a period of two years. Written informed consent was obtained from the patients and institutional ethical committee approval was also obtained.

**Results:** Wound complication occurred in 2 patients only (of 32 patients). Malunion or nonunion occurred among 3 patients in which lateral malleolus fracture was oblique or comminuted. Average time for union was 7.8 weeks. Closed reduction was achieved in 28 patients but in 2 cases mini open technique was required for medial malleolus fracture to remove interposing soft tissue.

**Discussion:** For these fractures, implants that could be preferred for minimally invasive surgery include K wires, cannulated cancellous screws. Another advantage is that we need to remove only one long K wire and one cannulated cancellous screw during implant removal making it a small surgery. Average time for union was 7.8 weeks in our study which was comparable to other studies.

**Conclusion:** Minimally invasive technique of fixation of ankle fractures with 2mm K wires for lateral malleolus and 4 mm cannulated cancellous screw fixation for medial malleolus gives good results with minimal complications and should be preferred in patients at high risk of soft tissue wound healing problems.

**Keywords:** Minimally, technique, fixation, bimalleolar, fractures

### Introduction

Incidence of ankle fractures is 1.79 per thousand population. Of this bimalleolar and trimalleolar fractures constitute a majority of them <sup>[1]</sup>. Anatomical reduction and stable fixation is absolutely necessary for good results postoperatively in majority of the patients <sup>[2]</sup>. There are many operative techniques employing k wires, stainless steel wires, screws and plates to achieve this goal in closed fractures <sup>[2]</sup>. These fractures are known to have significant complications in the postoperative period after open reduction and internal fixation, either due to soft tissue trauma or loss of reduction due to inadequate fixation or compliance by the patient. Wound complications with ORIF are seen in 18% of the patients. Hence there is increasing tendency to do minimally invasive techniques for fixation of those fractures, as they have proven benefits of minimising soft tissue damage related problems. Minimally invasive surgery is also preferable in patients with diabetes, regular tobacco use, chronic alcoholics, patients on steroids as they have high chances of wound dehiscence postoperatively <sup>[3]</sup>. At least iatrogenic soft tissue damage can be decreased with better cosmetic results <sup>[4]</sup>. There are many minimally invasive techniques employed for fixation of malleolar fractures with different results. We decided to do retrospective study for analysis of results of our minimally invasive technique of fixation of malleolar fractures with single 4mm cannulated or partially threaded cancellous screw fixation for medial malleolus fracture and K wire (2mm) for fibula (lateral malleolus) fracture <sup>[5]</sup>.

We did not use tension band wires, fully threaded headless cannulated compression screws or plates in minimally invasive surgery. We did not include trimalleolar or plafond fracture as they are rarely operated by minimally invasive technique due to most cartilage injury and risk of arthritis in the future [6].

### Material and Methods

32 patients with displaced bimalleolar ankle fractures who presented to emergency department of MIMER Medical college from Jan 2017 to December 2019 were included in the study.

Patients of both sexes and patients above 18 years were included in the study.

We excluded compound fractures, trimalleolar fractures, single malleolar fractures, pilon/ plafond fractures, patients not willing or unfit for surgery, fractures more than 1 week after trauma, patients with associated fractured tarsals. Bimalleolar fractures without displacement were also excluded as they could be managed conservatively.

Written informed consent was obtained from the patients and institutional ethical committee approval was also obtained. Patients were worked up for surgery.

Closed reduction was achieved by varus and dorsiflexion at ankle. Single long wire of 30cm and 2mm diameter was passed from tip of lateral malleolus percutaneously into medullary canal and after closed reduction of fracture under image intensifier into fibula. End of wire was left outside the skin after bending for removal later. Guide wire for 4mm cc screw was passed into medial malleolus across fracture of medial malleolus into distal tibia. Guide wire gained purchase into opposite cortex of tibia. Then with the help of cannulated drill bit the tract was drilled. Over the guide wire, 4mm cc screw of appropriate length was passed. Cc screw was preferred as it gave compression across the fracture. Reduction was checked in the image intensifier again. As far as possible open reduction was not done. However, in a couple of cases mini open technique was done for reduction of fracture of lateral malleolus only. Below knee slab was given post operatively for 3 weeks. Then partial weight bearing was allowed. Full weight bearing was allowed only if union was visible on follow-up X-rays at 6,12,18 weeks. Range of motion exercises were started after slab removal at 3 weeks.

### Results

Average age of patients was about 46.2 years. Male were more as compared to females (18 males and 14 females) Average operative time was 47.5min (44-60 min). Wound complication occurred in 2 patients only (2 out of 32 patients). Complications-Malunion or nonunion occurred in 3 patients (3 patients in which lateral malleolus fracture was oblique or comminuted). In two patients plating for fibula had to done. Average time for union was 7.8 weeks. Duration of hospital stay was 7.1(+/-1.9) days. Closed reduction was achieved in 28 patients but in 2 cases mini open technique was required for medial malleolus fracture to remove interposing soft tissue. Average image intensifier time required was 4.9mins (294 seconds).

### Discussion

Open reduction and internal fixation of bimalleolar fracture is standard technique of fixation in management of such fractures whenever conservative treatment is not possible [7]. However due to considerable soft tissue problems such as

wound dehiscence and infection with open technique in already traumatized soft tissues, minimally invasive techniques are becoming popular. Also large scars of surgery are not preferable for cosmetic effect particularly in young females [8]. Classical implants used for fixation of bimalleolar fractures include plates and screws for fibula and either tension band wiring with K wires or cannulated cancellous screws for medial malleolus [9]. For these fractures, implants that could be preferred for minimally invasive surgery include K wires, cannulated cancellous screws. Many authors have described 2 to 3 k wires for lateral malleolus or trans-articular external fixation [10, 11].

We preferred single 2mm K wire into tip of lateral malleolus only as it decreases soft tissue trauma further and gives good stable fixation compared to smaller K wires [12]. Similarly, we preferred single cannulated cancellous screw for medial malleolus as it decreases radiation exposure and avoids multiple holes in medial malleolus making it prone to fractures during insertion [13, 14]. We did not encounter significant syndesmosis injury after fixation of bimalleolar ankle fractures in most cases and had to put syndesmosis screw in only 5 cases out of 32, which also was done percutaneously. In only 4 cases mini open technique through 1.5 to 2cm incision was required as reduction after closed reduction was not satisfactory or there was soft tissue interposition.

Another advantage of our technique is that we need to remove only one long K wire and one cannulated cancellous screw during implant removal making it a small surgery. K wire was left out of the skin and could be removed in outpatient department after 6-12 weeks. Another technique of minimally invasive ankle fixation described in literature is percutaneous locking plates but is described for pilon fractures and lateral malleolar fractures only [15].

In our study average operative time was 47.5 min which was comparable to other studies in literature employing open reduction and internal fixation. Wound complication occurred in only two patients out of 32 i.e. 6.25% of cases. This was comparable to study by Robinson Esteves Santos Pires *et al.* who had wound complication rate of 5% with MIPPO and Sherif Mohamad Abddgaid *et al.* who noted wound complication rate of only 0.5% with MIPPO. Thus complication rate was significantly less than wound problems in 18% for open reduction and internal fixation technique [16, 17].

In our study closed reduction was achieved in 28 out of 32 cases. Thus 12.5% cases required open reduction (in our case mini open technique). This was comparable to study by Sherif Mohamad Abddgaid *et al.* in which 10.6% of patients required open reduction and internal fixation [17].

Average time for union was 7.8weeks in our study which was comparable to other studies in literature like the study by Khaled M Emara in which time for union was 6.92 weeks and study by Robinson Esteves Santos Pires *et al.* in which all fractures healed by 8 weeks [14, 16].

Average duration of hospital stay was 7.1 days in our study which was also comparable to other studies in which minimally invasive techniques were employed [15].

Average complication rate in our study was 9.4% excluding infection which was comparable to study by Khaled M Emara *et al.* in which it was 11.5% and Sherif Mohamad Abddgaid *et al.* in which it was 10.6%. However, in open technique complication rates can be as high as 36% [14, 17].

Average image intensifier time was 294 seconds which was 6 times as compared to open technique (45.25 seconds) [18].

### Conclusion

Minimally invasive technique of fixation of ankle fractures with 2mm K wires for lateral malleolus and 4 mm cannulated cancellous screw fixation for medial malleolus gives good results with minimal complications and should be preferred in patients at high risk of soft tissue wound healing problems.

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