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A Study On Effect And Outcome Of Percutaneous Intramedullary Malleolar Screw Fixation Of Lateral Malleolus In Bimalleolar Ankle Fractures.

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ABSTRACT

Restoring the normal anatomy of the lateral malleolushas been recognized as the key to operative treatment of ankle fractures Yablon pointed out that the talus faithfully follows the lateral malleolus, and Harper showed that relatively minor lateral malleolus fractures allow for talar shaft and joint incongruity. To evaluate the treatment of bimalleolar fractures treated with the intramedullary malleolar screw fixation of lateral malleolus in non-communicated Weber A and Weber B ankle fractures. Twenty patients with Weber A and B lateral malleolus fractures were reviewed after they had done closed reduction and percutaneous internal fixation with an intramedullary malleolar screw with a length of the screw varies between 70 mm and 120 mm, 4.5 mm malleolar screw depending on the fracture location and pattern. All fractures united within an average time to union of 10 ± 1.64 weeks. There were no wound infections or complaints of painful hardware in one patient. At the latest follow-up, functional results were excellent in 13 patients (65%), good in 6 patients (30%), and fair in one patient (5%). If the reduction of the lateral malleolus can be obtained in a closed manner, then Percutaneous intramedullary screw fixation *is* a good easy technique in the management of lateral malleolar fracture that provides good clinical and radiological results as it is rapid, minimally invasive, and without prominent hardware

Keywords: Ankle Fracture; Lateral Malleolus; Intramedullary Screw

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INTRODUCTION

Ankle fractures are one of the most common fractures and in the lower limb are second in frequency only to proximal femoral fractures. Ankle fractures have a bimodal age distribution of young men and elderly women. There is a noticeable increase in ankle fractures among the elderly. Malleolar injuries are articular fractures. Treatment is aimed at restoring normal joint anatomy and providing sufficient stability for early movement. Anatomical restoration and stable fixation of the unstable, displaced fracture is a must. Restoring the normal anatomy of the lateral malleolus has been recognized as the key to the operative treatment of ankle fractures [1]. The treatment options for lateral malleolar fractures are either non-operative or operative including; cerclage wiring, lag screws, a plate and screws, a hook plate, tension band wiring, axial pins, and axial screws [1-3]. Recently, Acumed nails were introduced to fix the fibular fracture[4]. In 1963, the AO group introduced their well-known methods of fixation principles like buttress plates and screws and/or a lag screw, depending on the fracture pattern. These methods provide stable anatomic fixation and the results of numerous clinical studies are excellent [3,5,6]. The condition of the soft tissues is paramount. It has been criticized by several authors because of the small amount of overlying soft tissues laterally and patients' complaints of pain over prominent hardware and increased rate of infection [7-9]. Patient factors, such as age, diabetes, and osteoporosis, may alter the indications and fixation techniques for ankle fractures. Among the different methods of fixing lateral malleolus as intramedullary fixations using Steinmann pins [10] and Rush rods [11], however, apprehension about the hardware backing out has limited their usefulness. The purpose of this study is to evaluate the treatment in selective cases of bimalleolar fractures with the benefits of malleolar screw fixation of lateral malleolus in noncommunited Weber A and Weber B ankle fractures. Although fractures of the lateral malleolus without significant medial injury are common, the indications for open reduction of these fractures are still controversial. ORIF with plate fixation may lead to several complications especially in old age, patients with diabetic neuropathy, or patients with poor skin conditions. The incidence of complications may reach up to 30% as documented in certain studies. Plate fixation necessitates significant soft tissue dissection. Complaints regarding prominent hardware may reach up to 50% of the patients, wound problems are present in up to 26%, and implant failure may occur in 14% [12]. The main advantage is malleolar screw fixation is done through small incisions with little soft-tissue dissection, and need not wait for soft tissue swelling to subside in bimalleolar ankle fractures [13] In our study we adopt an internal fixation policy of simple Weber A and Weber B fibular fractures with a long intramedullary screw. It has been utilized because it is felt that this technique is simpler than buttress plating and with fewer hardware complications [14]. The long intramedullary screw allows better purchase within the fibular canal, therefore eliminating hardware migration [15]. The intramedullary screw provides stable fixation, thereby assuring that rehabilitation can be instituted early without the risk of loss of reduction [16] The Intramedullary position of the hardware reduces torque and bending moment on the device. Intramedullary fixation of weight-bearing long bone fractures has largely replaced compression plating because of these biomechanical advantages. The advantages are also evident in the treatment of non-comminuted lateral malleolus fractures, and the technique should be utilized in selective Cases [18].

METHODS

20 patients with selective cases of bimalleolar fractures in government Dharmapuri Medical and Hospital during the period between 2022 and 2023 were included in the study . Hospital and clinic records were reviewed for evidence of early or late complications relating to the wound, hardware, reduction, and union.

The surgeon's operation notes records were also evaluated for length of immobilization, time to full weight bearing, and total length of follow-up. Patients' subjective findings at the time of the last clinic visit were also documented. New patients were evaluated for anatomic healing and not for long term results related to degenerative arthritis.

Inclusion Criteria

- Bimalleolar fractures with Weber type A and B
- Non-communited fractures
- Age between 18 and 65

Exclusion Criteria

- Lateral malleolus fractures with Syndesmotic disruption
- Communicated fractures
- Patient with metabolic disorders
- Osteoporotic patients with wide medullary canal
- Very narrow medullary canal

Spinal anesthesia was given to the patients. The use of a tourniquet was used only when we were fixing the medial malleolus. Image intensification was used to aid closed reduction by inverting the foot and then achieving and maintaining fracture reduction. A 1 cm incision was made just distal to the tip of the lateral malleolus. An entry hole was made in the tip of the lateral malleolus with a 2.5 mm k wire lateral malleolus tip center in anteroposterior and lateral view. Then entry point was widened with a 3.2mm drill bit. A 4.5 mm, Malleolar screw was passed across the fracture site and into the proximal fibular fragment. The screw was tightened until its head reached the bone. The screw length varies between 70 mm and 120 mm, according to the fracture location and pattern. Intraoperative imaging (AP, lateral, mortise) was always obtained to confirm the reduction of the fracture, the position of the screw. When a medial malleolus fracture is present, a separate incision is made for open reduction of this fracture after lateral malleolar fixation. Sutured was removed on the 14th postoperative day. A below-knee slab applied in a neutral position was applied for 2 weeks. Weight-bearing with below knee cast for another 4 weeks.

Non-weight-bearing and non-weight-bearing ambulation were varied according to the fracture pattern, and associated injuries, guided by the follow-up X-rays and patient pain tolerance.

RESULTS

Among 20 patients who participated in the study, 12 patients had their ankle fractured due to twisting injury of the ankle when falling, while 8 patients were due to road traffic accidents. The results were assessed both clinically and radiologically at the end of the 6 weeks, 10 weeks,3 months, and yearly follow-up period. Olerud and Molender for ankle scoring system were used to subjectively evaluate ankles by the patients. The mean of the olerud and molender score was 95 ± 7.717. The overall results were considered satisfactory in 19 patients (95%) and unsatisfactory in one patient (1%). All the cases were united with the union rate of 100%. Eighteen patients (90%) had a united fracture in 12 weeks or less and two patients (10%) had a united fracture in 8 weeks. The average time of union was 10 ± 1.64 weeks, ranging from 8 to 13 weeks. One patient had a broken drill bit inside the tibia encountered during medial malleoli fixation left inside. One patient (5%) had a painful prominent hardware where there was a medial placement of the screw. No patients had an infection, nonunion, or joint stiffness. Evaluation of immediate postoperative Xrays for adequacy of reduction a good reduction in 18 of 20 (90%) patients, a fair reduction in 2 of 20 (10%) patients, A functional rating scale was used to sub--jectively evaluate ankles in the patients Of these patients 13 patients (65%) had an excellent result and 6 (30%) were considered to have a good result. One patient (5%) who had a fair functional rating had frequent painful hardware.

Table 1: Radiographic criteria.

Good	Fibula out to the length <2 mm of posterior displacement <1 mm increase in medial clear space
Fair	Fibula shortened < 2 mm 2 - 4 mm of posterior displacement 1 - 3 mm increase in medial clear space
Poor	Fibula shortened > 2 mm >4 mm of posterior displacement > 3 mm increase in medial clear space

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Table 2: Reduction on X-ray.

Rating	Number of Patients	Percentage
Good	18	90%
Fair	2	10%
Poor	0	0%

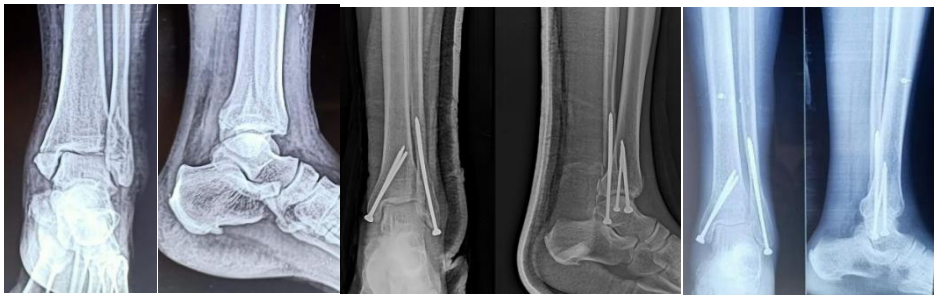
Table 3: Functional rating (compared with normal ankle).

Excellent	Normal range of motion without pain or stiffness and return to the previous activity level
Good	Normal range of motion without stiffness, return to previous activity level with only occasional pain following activity
Fair	Decreased range of motion, frequent pain following activity
Poor	Decreased range of motion, pain and stiffness at rest

Table 4: Functional results.

Rating	Number of Patients	Percentage
Excellent	13	65%
Good	6	30%
Fair	1	5%
Poor	0	0%

CASE 1



(a) **(b)** **(c)**

CASE 2

(d) **(e)** **(f)**

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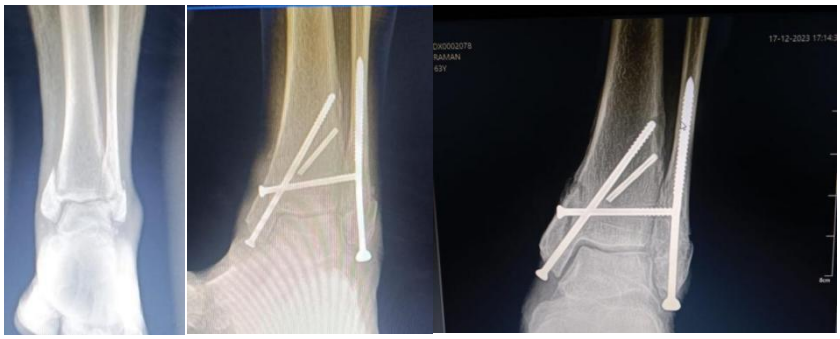
CASE 3

(g) **(h)** **(i)**

CASE 4



(j) **(k)** **(l)**

Figure 1: (a,d,g,j Pre-operative xrays), (b,e,h,k immediate post-operative xrays), (c,f,i,k Follow up xrays)

DISCUSSION

Stable anatomic fixation of the lateral malleolus fragment is highly appreciated to achieve satisfactory results in ankle fractures Most commonly buttress plating and a lag screw. This provides reliable fixation and maintains the length and rotation of the lateral malleolus. It is preferred in comminuted fractures, as length could not be reliably maintained with an intramedullary screw. The reduction of the fracture may be done in a closed or open manner. The complications of plate fixation of the lateral malleoli are wound problems; especially in swollen ankles and pain due to prominent hardware often develops late. Advantages of closed reduction include minimal soft-tissue dissection, short operative time, no need for tourniquet if isolated lateral malleolus fractures, improved healing and shortened rehabilitation time, Because the fracture hematoma is not violated, and increased union rate. The long intramedullary malleolar screw allows it to get purchased within the fibular canal, therefore eliminating hardware migration. The intramedullary position allows for dynamic compression at the fracture site with weight bearing, thus facilitating fracture healing. The slight flexibility of the axial screw allows it to easily accommodate the distal fibular bow, resulting in a three-point fixation of the fracture, as the lateral malleolus is normally in 10 to 15 degrees of valgus concerning the fibular shaft [19]. The fractures were fixed with one of the two above fixation methods and then placed under a torsional load to failure. It was found that the intramedullary screw provided 68.4% of the strength of native bone compared to the lateral buttress plate provided 60.5%. This was not statistically significant, but it did prove that an intramedullary screw provides stable fixation. So, rehabilitation can be started early without the risk of loss or reduction. This study includes the postoperative evaluation of closed reduction and percutaneous internal fixation of unstable lateral malleolus fractures Weber types A or B with an intramedullary, 4.5 mm malleolar screw. The length of the screw varies between 70mm to 120 mm, depending on the fracture location and pattern. The results of this study are comparable with the results of Bankston, *et al*. [16] they found the Intramedullary screw provided 66.5% of the strength of native bone compared to the lateral buttress plate provided 61.5%. This was not statistically significant, but it did prove that an Intramedullary screw provides stable fixation, thereby assuring that rehabilitation can be instituted early without the risk of loss of reduction. Chaffer and Manoli [10] realized that lateral hardware could lead to wound problems and they evaluated the technique described by Weber in which a buttress plate is placed posteriorly on the lateral malleolus. They described this as the “anti-glide” technique. They performed biomechanical studies and demonstrated that this method of fixation was more stable than a laterally placed plate and lag screw.

However, this technique is more demanding in that the surgical dissection posteriorly is difficult. Also, the hardware is left in contact with the peroneal tendons, which could cause irritation and pain. Ray TD et al [17] study included 24 patients treated with closed reduction and percutaneous internal fixation with an intramedullary, fully threaded, self-tapping screw. At the final follow-up, 42.1% had excellent results, 42.1% had good results, 5.3% had fair results and 10.5% had poor results. Tamara D. Ray, , used intramedullary screw fixation for lateral malleolus fracture in 24 patients and they have good results Latif G et al [19] study which included 46 patients with Weber A and low Weber B displaced lateral malleolus fractures who underwent closed reduction and percutaneous internal fixation with an intramedullary, 3.5 mm, fully threaded, self-tapping bone screw were retrospectively reviewed.

CONCLUSION

This study includes the postoperative evaluation of closed reduction and percutaneous internal fixation of lateral malleolus fractures Weber types A or B with an intramedullary 4.5 mm malleolar screw. All the cases were united with a union rate of 100%. The use of intramedullary screw fixation is an efficient and safe alternative to the classic ORIF methods using neutralization plates in unstable low malleolar fractures. This closed technique also eliminates screw penetration of the ankle joint and damage to the peroneal tendons, which can be a risk when a plate or lag screws are employed as internal fixation. Surgical time is also reduced and tourniquet use is optional. If an acceptable reduction cannot be obtained using this technique, open reduction and internal fixation with the plate should be performed.

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