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Evaluation of Outcome of Surgical Management of Ankle Fracture (Medial Malleolus) by Single Swiss Malleolar Screw

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ABSTRACT

Introduction: Ankle fractures are common orthopedic injury. These fractures involve medial and lateral malleolus with sometimes posterior malleolus. Ankle fracture may range from low energy injuries with little or no displacement to complex fractures with significant associated injuries. Stability of these injuries depends on a combination of boney and associated ligamentous injuries. **Objective:** To assess the evaluation of outcome of surgical management of ankle fracture (medial malleolus) by single swiss malleolar screw. **Methods:** This prospective study was conducted in Dept. of Orthopaedic and Trauma Surgery, Shaheed Monsur Ali Medical College and Hospital, Dhaka, Bangladesh from January to June-2022. Total 20 patients with malleolar ankle fractures were studied. All of these patients came to ER with acute injuries following RTA, fall from height etc. All of these patients were assessed pre and post operatively. All of these cases were classified according to Lauge-Hansen, Dennis-weber, AO classification. **Results:** In this series 20 patients with malleolar ankle fractures were studied. Of these, 3 in the operative and 1 in the conservative group were excluded as they were lost for follow up or refused treatment. Of the 20 cases included in this study 5 (25%) cases were treated conservatively and 15(75%) cases by operative methods. Age, sex distribution and side involved. The average age for the whole group was 56.45 years, (25-88 yrs). In this study right side was affected in 9 cases and left side in 11 cases. Maximum study patient were injured from RTA. All of them were treated by minimally invasive technique. Patients were kept on follow up at regular interval. All of the patient's plasters were removed at around after 28th POD. On consequent follow up patients could dorsiflex and planterflex ankle and walk after brief period of physiotherapy and active exercise. **Conclusion:** In our study internal fixation by minimally invasive procedure through single swiss malleolar screw for medial malleolus resulted in comparative positive outcome in five patients suffering from ankle fracture.

Key Words: Outcome, Ankle Fracture, Single Swiss Malleolar Screw.

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INTRODUCTION

Ankle fractures are common orthopedic injury. These fractures involve medial and lateral malleolus with sometimes posterior malleolus. Fractures involving the ankle mortise are one of the most common injuries in lower extremity. It has an incidence rate of 107 fractures per 1,00,000 person years [1]. Surgical management includes minimally invasive or traditional open method by swiss malleolar screw, k-wire, surgical wire, distal tibial locking plate and screw. The surgical management steps far superior in different aspects of outcome for the patient as the patient needs early mobilization. The ankle injuries gained importance because body weight is transmitted though it and the locomotion depends upon the stability of this joint. The ankle joint supports more weight per unit area than any other joint in the body [2]. The most congruous joint in the lower extremity is The Ankle joint which bears upto five times the body weight [3]. Ankle fracture may range from low energy injuries with little or no displacement to complex fractures with significant associated injuries. Stability of these injuries depends on a combination of boney and associated ligamentous injuries. Surgical management includes minimally invasive or traditional open method by swiss malleolar screw, k-wire, surgical wire, distal tibial locking plate and screw. The surgical management steps far superior in different aspects of outcome for the patient as the patient needs early mobilization. Despite there is a large variety of conservative and

surgical treatment techniques for these injuries, the number of poor outcomes reaches 7–38% [4–6], and in cases with severe pronation fractures it grows up to 40% [7]. In 60– 70% cases, injuries of this area occur in working-age people. In 60% cases, injuries of the ankle joint leads to development of arthrosis [8–10]. The occurrence rate depends on the fracture type: with malleolar fracture of the A-type (as defined by the International AO/ASIF Classification)-4%, with malleolar fracture of the Ctype-up to 33% [11]. They primarily involve the lateral or medial as well as the posterior malleolus. They are produced indirectly by shearing and tensile forces applied through the talus. These mechanisms of injury produce characteristic fracture patterns that are well described in the Lauge-Hansen classification [12]. This classification provides a good understanding of injury patterns as related to themechanism. However the AO classification [13] is more practical for clinical use and is, therefore, more often used. The management of malleolar fractures usually follow the guidelines of the AO Group, who recommend open reduction and internal fixation (ORIF) of all fracture dislocations. Operative fixation of these fractures yields predictably good outcomes.

MATERIALS & METHODS

This prospective study was conducted in Dept. of Orthopaedic and Trauma Surgery, Shaheed Monsur Ali Medical College and Hospital, Dhaka, Bangladesh from January to June-2022. Total 20 patients with malleolar ankle fractures were studied. During this study we have operated on total of five patients with ankle fracture involving both medial and posterior malleolus and individually medial malleolus. All of these patients came to ER with acute injuries following RTA, fall from height etc. All of these patients were assessed pre and post operatively. All of these cases were classified according to Lauge-Hansen, Dennis-weber, AO classification.

Inclusion criteria:

a) Patients have any malleolar fracture of ankle joint.
b) Patients of any sex & in age groups of 20-65.
c) Patients who are fit for surgery.
d) Patients having malleolar fractures of ankle joint for which closed method is indicated.

Exclusion criteria:

a. Open ankle fracture,
b. A fracture and open epiphyses,
c. A previous fracture of either ankle,
d. Patient is unfit for surgery and or anesthesia.
e. Patient not giving written consent for surgery.

Cases were diagnosed on history, clinical examination and investigation. Statistical data included name, age, sex, ward, chief complaints, and history, general examination, investigations, treatment done, operative technique and type of implants used, post-operative complications of surgery and follow up results. Fractures of the ankle were evaluated using plain radiographs in anteroposterior, lateral and mortise views. The fractures were classified using the Lauge-Hansen [14], AO/OTA classification systems, and by the number of malleoli involved. Instability of the syndesmosis was identified on the basis of the mechanism of injury and the fracture pattern. Pain elicited with the squeeze test (manual medial-lateral compression across the syndesmosis) and the external-rotation stress test was considered as indicative of clinical syndesmotic instability. Radio logically tibiofibular clear space of less than five millimeters and widening of the medial clear space of more than four millimeters were considered as indications of syndesmotic instability. Intra-operatively, the fibula was manipulated to determine if there was excessive lateral displacement indicating syndesmotic injury. Patients with minimally displaced monomalleolar fractures, avulsion fractures and stable fractures. Patients with unhealthy skin, those who were medically unfit for surgery and those who would not cooperate for postoperative regimen were managed by closed reduction. Conservative management included the application short-leg cast for Stable or un-displaced ankle injuries, a long-leg cast for fractures that are unstable in rotation after obtaining closed reduction by reversing the mechanism of injury to the ankle, with radiographs taken immediately to ensure that there was no loss of reduction. Operative management was employed when lateral column was unstable and when talus shifted more than 2mm laterally. Medial malleolus was approached by medial approach and fixed with single malleolar screw, cancellous screw, k-wire or with tension band wiring with 2 screws or k-wires. In this study, operative fixation of the syndesmosis was done for fractures in which the disruption of the syndesmosis exceeded three millimeters, when medial stabilization could not otherwise be obtained and when of widening of the syndesmosis is made when there is a space of more than five millimeters between the distal aspects of the tibia and the fibula, as seen on the mortise radiograph. A 4.5millimeter screw was placed from the fibula medially into the tibia engaging three cortices. Removal of the screw was done at six weeks postoperatively for all cases. Posterior malleolus was fixed when fragment comprised more than 25 percent of the surface, according to estimates of the fracture size made from plain radiographs with use of a lag screw through a stab incision made over the tibia from the anterior direction, directed anteroposteriorly engaging the posterior fragment. Patients were put on below knee plaster at the time of discharge and advised non-weight bearing crutch walking. Partial weight bearing at six weeks, and full weight bearing when fracture had united, clinically and radio logically. Follow up of cases was done at regular intervals of 6 weeks for an average of 11 months with a range of 9 to 15 months. After 10 to 14 days the stitches were removed. At each assessment all patients were questioned with regard to pain, use of analgesics, stiffness, swelling, activities of daily living, use of walking aids, and return to work and participation in

sports. At examination, the gait; any thickening, swelling, or tenderness of the ankle; and the range of motion of the ankle were evaluated. Antero-posterior and lateral radiographs of the affected ankle and mortise radiographs of both ankles were made at the time of examination.

Assessment Criteria: The final result was graded as excellent, good, fair, or poor as using criteria as shown in annexure I.

Statistical analysis

A SPSS version 20 (SPSS Inc., Chicago, IL, USA) software was used for statistical comparison. $P < 0.05$ was considered statistically significant. The chi-square test was used for categorical data and the Mann Whitney U test was used for numerical data.

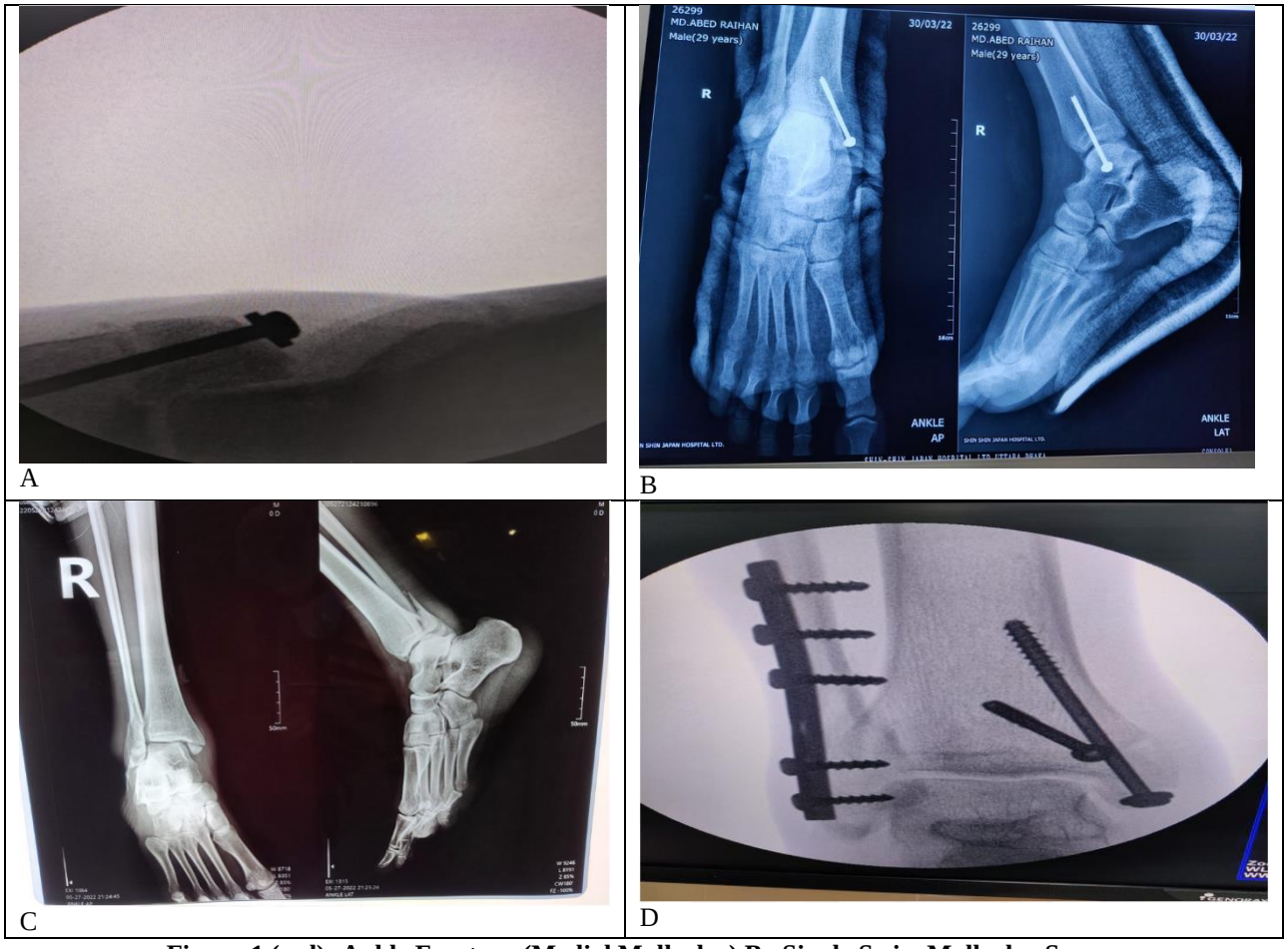

Figure-1 (a-d): Ankle Fracture (Medial Malleolus) By Single Swiss Malleolar Screw.

RESULTS

Total20 patients with malleolar ankle fractures were studied. Of these, 3 in the operative and 1 in the conservative group were excluded as they were lost for follow up or refused treatment. Of the 20 cases included in this study 5 (25%) cases were treated conservatively and 15(75%) cases by operative methods. Age, sex distribution and side involved. The average age for the whole group was 56.45 years, (25-88 yrs) Male to female ratio for the whole series was 1.44:1. In this study right side was affected in 9 cases and left side in 11 cases.

Mechanism of injury:

8 cases (most of them in older age group) affected were due to twisting injury (fall from same level), 7 cases due to road traffic accident, 4 cases were due to fall from height and 1 cases were due to sports injuries.

Associated Injuries:

There were 3 cases (15%) with associated fractures. All were in operative group and had, humerus, femoral shaft, trochanteric, clavicle, and stable compression vertebral fractures. 1 patient in the conservative group had concussion head injury.3 patients had lacerated wounds.

Treatment of individual fractures:

Medial malleolus was fixed with tension band wiring (8 cases,), malleolar screw (3 cases), K wire fixation (2 cases) and cancellous screw in one case. Lateral malleolus was fixed with lateral plate (6 cases), lateral plate with interfragmentary fixation (4 cases), K wires (1 cases). Posterior malleolar fixation was done in two cases while syndesmotic screw fixation was done in one case.

Functional end results

20 fractures united at an average of 13 weeks, with range of 6-16weeks. Two fractures ended in non-union. Patients were followed at regular intervals for an average of 11 months with a range of 9 to 15 months.

Table-1: Functional outcome (N=20)

Treatment groups	Excellent	Good	Fair	Poor
Conservative	1	2	1	1
Operative	4	5	4	2

Table-2: Functional end results and fracture types based on malleolarity (N=20)

Malleolar types	Method of treatment	Results				Total
		Excellent	Good	Fair	Poor	
MM	Conservative	1	2	1	0	4
	Operative	1	1	1	0	3
LM	Conservative	0	0	1	1	2
	Operative	1	0	0	0	1
BM	Conservative	0	0	0	0	0
	Operative	2	3	2	1	8
TM	Conservative	0	0	0	0	0
	Operative	0	1	0	1	2

Table-3: Functional end results and fracture types based on Lange and Hasan types (N=20)

Lange and Hasan	Method of treatment	Results				Total
		Excellent	Good	Fair	Poor	
I(SER)	Conservative	1	1	1	0	3
	Operative	1	1	1	0	3
II(SA)	Conservative	0	1	0	0	1
	Operative	2	1	1	1	5
II(PER)	Conservative	0	0	0	0	0
	Operative	0	1	0	1	2
IV(PA)	Conservative	0	0	1	0	1
	Operative	1	2	1	1	5

Table-4: Functional end results and fracture types based on AO type (N=20)

AO/OTA	Method of treatment	Results				Total
		Excellent	Good	Fair	Poor	
A	Conservative	1	2	1	0	4
	Operative	1	1	0	0	2
B	Conservative	0	0	1	0	1
	Operative	3	2	2	1	7
C	Conservative	0	0	0	0	0
	Operative	1	2	2	1	6

While 18 of the 20 patients had a satisfactory result, the ankles were by no means entirely normal. Most of these patients were totally free of pain, but about half had what might be termed a sensitive ankle. One had an occasional twinge of discomfort that did not require any form of medication or any modification of activity.

Complications:

In the ORIF group one patient had a surgical wound that could not be closed over the medial malleolus. This was allowed to heal by secondary intention, without problem. Poor bone quality was noted in five patients, but satisfactory stable fixation was always achieved. In the closed treatment group no loss of reduction was seen immediately after the application of a molded below-knee cast. One superficial infection occurred in the ORIF group, and was successfully treated with antibiotics. There were no cases of infection in the closed group, but one patient developed a superficial skin

ulcer over the medial malleolus, which healed satisfactorily. Two patients complained of tenderness of the scar. Mal-union of the fracture was seen in two patients in the closed group. One had mal-union of a fracture of the lateral malleolus and complained of persistent pain in the ankle, which limited her mobility. One had a mal-union of fractures of the medial malleolus but had no pain or functional disability. Two patients had non-union of the medial malleolus, but neither had symptoms or functional disability.

DISCUSSION

The primary risk associated with closed treatment is inadequate restoration of the biomechanics of the ankle, which can lead to a poor outcome. Conversely, while open reduction and internal fixation is an excellent method for the restoration of the normal anatomy of the joint, it is accompanied by the costs and risks of an operation. The most common intra-articular fracture of a weight-bearing joint occurs in the ankle. Total 20 patients with malleolar ankle fractures were studied. Of these, 3 in the operative and 1 in the conservative group were excluded as they were lost for follow up or refused treatment. Of the 20 cases included in this study 5 (25%) cases were treated conservatively and 15(75%) cases by operative methods. Age, sex distribution and side involved. Two methods of restoring function and preventing arthritis have been used: closed treatment, including manipulative reduction and immobilization in a plaster cast, and open reduction and internal fixation. Burwell and Charnley [15] showed that anatomical reduction and satisfactory fixation led to a rapid return of function. The treatment of ankle fractures involves both a risk-benefit and a cost-benefit analysis. Current opinion has increasingly favored primary operative intervention [16] for a displaced or unstable fracture of the ankle, with the greatest emphasis on anatomical reduction and rigid fixation of the lateral malleolus, and fractures of the medial malleolus and those of the posterior malleolus have also been fixed whenever indicated [15,16,17,18,19,20]. In the present series had used both operative and conservative methods for the management of ankle injuries. We had 20 cases in our series of which 16 were operated and 4 treated conservatively with follow up of an average of 11 months with a range of 9 to 15 months. The population of ankle fractures in this study was similar to the populations studied by other authors. The mean age of our patients was also similar to that in most reported series [21,22,23]. Ankle injuries occur more in males in third decade. It reflects more physical activities of middleaged workingman. In this study it was found that ankle injuries were more due to fall at same level (40%) which were comparable to Kristensen [24] series (58.9%), Van Laarhoven [23] (58%), Bauer et al [21] (60%). Vehicular accidents were the second common cause. Two wheeler accidents have increased in frequency in last few decades due to increase in their density. Another cause is inorderly traffic on the road. The high incidence of supination-external rotation injuries is common in present series as in series of Van Laarhoven [23] Egol [25]. Generally, these fractures account for about 60 percent of all ankle fracture. AO type B fractures were common in present series as in Makwaana et al [11], Van Laarhoven et al [23] series. Most authors have stated that anatomical reduction of the displaced medial malleolus ensures correction of talar displacement and is of paramount importance in treating unstable fractures [4,5]. However, more recent studies have indicated that the talus is more accurately repositioned in the mortise by anatomical reduction of the lateral malleolus [12,16]. While a number of methods (cerclage wires, single or multiple lag screws, an intramedullary Rush rod, or a single malleolar screw) are available, the lateral plate, as advocated by the AO Group, has become widely accepted for the treatment of the fibular fracture of the two fractures of the posterior malleolus with residual displacement, one had articular involvement of less than 25 percent. McDaniel and Wilson [27] showed that closed reduction of fractures involving less than 25 percent of the posterior tibial surface led to a good or excellent result in eighteen of twenty-eight patients, even in the presence of residual displacement of more than two millimeters. If the fragment comprises more than 25 percent of the surface, according to estimates of the fracture size made from plain radiographs, a good or excellent result can be expected in operated cases. In many fractured ankles, the syndesmosis is stable after reduction and internal fixation of the fibular fracture and any associated medial malleolar fracture. Yablon et al [26] stated that anatomical reduction of the fibula is the key factor in achieving a good outcome of treatment of ankle fractures that have accompanying syndesmotic disruption. We had 60% excellent and good results which were same in conservatively treated and operated group however results cannot be compared as the indications were different that is conservatively treated group was having simpler (monomalleolar, undisplaced, stable) fractures.

CONCLUSION

In our study internal fixation by minimally invasive procedure through single swiss malleolar screw for medial malleolus resulted in comparative positive outcome in five patients suffering from ankle fracture.

Conflict of Interest: None.
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