International Journal Dental and Medical Sciences Research
Volume 4, Issue 6, Nov-Dec 2022 pp 320-324 www.ijdmsrjournal.com ISSN: 2582-6018

Evaluation of the Results of Antiglide plating of vertical shear fractures of medial malleolus due to supination adduction injury around ankle

Seeyan Mustafa Shah[1], Ajaz Ahmad Bhat[2], Irfan Andleeb Gul[3],
MS (Ortho), Department of Orthopaedics, Government Medical College, Srinagar, University of Kashmir, Jammu and Kashmir, India
MS (Ortho), Department of Orthopaedics, Government Medical College, Srinagar, University of Kashmir, Jammu and Kashmir, India
MS (Ortho), Department of Orthopaedics, Government Medical College, Srinagar, University of Kashmir, Jammu and Kashmir, India

Submitted: 05-11-2022 Accepted: 20-11-2022

ABSTRACT

Background: Vertical fractures of the medial ankle are fixed with cancellous screws placed perpendicular to the fracture site. It is important to support the fracture by placing a screw with a washer at the proximal apex of the fracture or using a small tubular plate or T-plate as support. Objective: To evaluate the radiological and functional results of open reduction and internal fixation with a T-shaped plate (anti-slip plate) in a vertical fracture of the medial ankle.

Patients and methods: This was a clinical study including 20 adult patients with vertical shear fracture of the medial ankle who were admitted to the Postgraduate Department of Orthopaedics, Govt Hospital for Bone And Joint Surgery, an associated hospital of Government Medical College, Srinagar, a Tertiary Care Referral Hospital between May 2019 and Feb 2022. They were treated with a T-shaped plate internal fixation (anti-slip plate). In this study, we used the Biard and Jackson ankle scores to evaluate the outcome.

Results: The healing time was 13.2±2.1 weeks in the range of 9-15 weeks, the majority of the observed group (54.1%) had a healing time in the range of 9-13 weeks. No complications and only two patients (10%) had a superficial infection without further complications. The Biard and Jackson score was 92.3 ± 3.7, ranging from 78 to 96. The majority of the study population (63.5%) had an excellent outcome, 28.2% of them had a good outcome, and 8.3% had a poor outcome.

Conclusions: The surgical solution of vertical excision of a medial ankle fracture provides excellent anatomic reduction and rigid fixation to restore joint congruity, helping to facilitate early mobilization and thereby achieve optimal ankle function.

Keywords: Medial ankle, Fracture fixation, Fractures.

I. INTRODUCTION

Vertical shear fractures of the medial ankle occur due to supination-adduction loading of the talus on the articular surface of the medial ankle [(1,2).] Vertical shear fractures of the medial malleolus are less common than transverse fractures. A wide variety of techniques are available for fixation of these fractures, including various cortical screws, cancellous screws, tension bands, and non-slip plates [3]. Fixation of these fractures must be sufficient to maintain a stable reduction of the articular surface of the ankle joint allowing early range of motion, maintaining congruence of the ankle joint, and reducing the risk of future post-traumatic arthritis in order to maximize functional outcome [4].

These fractures are often successfully treated with support or non-slip plates and screws with neutralizing plates [5]. The aim of this study was to evaluate the radiological and functional results of open reduction and internal fixation with a t-type (antiglide plate) in vertical shear fracture of the medial malleolus.

II. PATIENTS AND METHODS:

The prospective study was carried out in Postgraduate Department of Orthopaedics, Govt Hospital for Bone And Joint Surgery, an associated hospital of Government Medical College, Srinagar, a Tertiary Care Referral Hospital after institutional ethical clearance. Clinical data from 20 adult patients with vertical mid-ankle fracture admitted to the orthopedic department included 14 males (70%) and 6 females (30%). The mean age of patients in the current study was 45.7 ± 13.7 years,

International Journal Dental and Medical Sciences Research
Volume 4, Issue 6, Nov-Dec 2022 pp 320-324 www.ijdmsrjournal.com ISSN: 2582-6018

ranging from 23 to 64 years. Approximately half of the monitored group (44.7%) were aged between 50 and 65 years. Twelve (12) patients had an isolated vertical fracture of the medial malleolus that was fixed with a small T antiglide plate, another eight (8) patients had a vertical fracture of the medial malleolus associated with the lateral malleolus, which was fixed with a one-third semitubular plate and then fixation of the plate vertical fracture of the medial ankle with a small T anti-slip plate.

Inclusion criteria: Age over 18 years. Closed

Exclusion criteria: Type III open fracture. Patients medically unfit for surgery.

Timing of surgery: During the 1st week after the injury.

All patients were clinically and radiologically examined on admission to the hospital. Patients were operated on after 5 days of admission for edema and ecchymosis. Airway, breathing, circulation, vital signs and level of consciousness were assessed.

All patients had injured ankle pain and tenderness, limited motion around the injured ankle, non-weight bearing on the injured ankle, and edema of the injured ankle. For each case, 3 plain radiographs (antero-posterior - lateral - anteroposterior with the limb internally rotated 20 degrees "mortise view" on the ankle joint.

Figure 1 Pre op radiograph showing vertical malleolar fracture

Operating procedure:

The anterior portion of the fracture site was exposed, the periosteum was released from the edges of the medial ankle to the distal tibial joint surface, and the joint was inspected. the periosteum was removed posteriorly only enough to control the reduction.

All small, loose fragments that may impede anatomic reduction were removed and the periosteum was freed from the bone margins. In the presence of an impacted fragment of the medial horn, the main vertical plane of the fracture was gently opened by retraction of the medial ankle medially (book opening).

Plate application: Once the fracture is identified and freed of embedded periosteum in the usual manner, anatomic reduction is confirmed on anteroposterior and lateral fluoroscopy images, a small T plate is contoured to the center of the medial aspect of the medial ankle. Place the plate firmly by hand so that the proximal two holes lie on the main body of the tibia and the distal hole of the T plate on the medial malleolar fragment. The screw hole just proximal to the fracture site is first filled with 3.5 mm cortical screws to prevent further proximal displacement of the fracture, then the distal hole to the fracture site is filled with 4.0 mm cancellous screws After filling all plate holes with cortical and cancellous screws, confirm plate position and reduction with anteroposterior and lateral fluoroscopic views. It was essential to ensure that no screws violated the ankle joint.

Figure 2 Immediate Post-op radiograph AP view
Figure 3 Immediate Post-op radiograph Lat view

After irrigation of the surgical site with normal saline, the periosteal layer and the subcutaneous and dermal layers were closed with suture. In the case of the lateral malleolus, we start by closing the lateral incision and then closing the medial incision. A dressing and a 4 x 4 sterile gauze dressing are placed over the wound. A standard short leg plaster slab/cast is applied for immediate postoperative comfort.

Postoperative management:

Postoperatively, all patients received antibiotics consisting of cefotaxime and amikacin

International Journal Dental and Medical Sciences Research
Volume 4, Issue 6, Nov-Dec 2022 pp 320-324 www.ijdmsrjournal.com ISSN: 2582-6018

for 5 days. Analgesics and anti-inflammatory drugs were administered. Elevation of the affected limb was performed. Antero-posterior, lateral, and mortise radiographs were taken. Wounds were inspected on day 3 and sutures were removed on average on postoperative day 14. Plaster of Paris cast was applied below the knees. Discharged patients with instructions to walk without wearing crutches for 6 weeks and come for a check-up after 2 weeks.

Follow-Up:

Patients were followed up 2 weeks, 6 weeks and 3 months after surgery. After two weeks, remove the suture and replace the slab. At 6 weeks, both AP and lateral view ankle radiographs were taken and looked for signs of fracture healing, and then they were advised to bear partial weight for another 6 weeks with elevation of the limb at night. Regular follow-up was performed at 1, 2, 3 and 6 months after discharge until fracture union. Patients were allowed to bear full weight on the affected limb after three months.

Figure 5 Radiographs at follow up showing union

Statistical analysis:

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar and pie diagrams. Descriptive statistics: Means, standard deviations, medians, ranges and percentages were calculated. Significance test: chi-square test was used to compare the difference in frequency distribution between different groups. For continuous variables; An independent t-test analysis was performed to compare the means of dichotomous data. There was no specific sample size calculation. A significant p-value was considered when equal to or less than 0.05.

III. RESULTS

This study showed that 65% of the study population had no associated injury and 35% had a lateral ankle fracture as an associated injury (Table 1).

Table (1): Associated injuries in the study group

Associated injury	**NO(20)**	**%**
Absent	13	65%
Present Fracture of lateral malleolus	7	35%

This study showed that the mean time of union duration of the studied group was 13.2 ± 2.1 weeks ranged from 9 to 15 weeks. Most of the studied group (54.1%) had healing time ranged from 9 to 13 weeks (Table 2).

Table (2): Time of union among the studied group

Variable	**The studied group (20)**	
NO (20)	**%**	
Time of union		
9-12 weeks	12	59.1%
13-16 weeks	8	40.9%

This study showed that at the end of follow-up, 14 patients (68.2%) had no pain and 6 patients (31.8%) had mild pain with strenuous activity. At the end of follow-up, 18 patients (90 %) were able to walk the required distance without limping or pain, while 2 patients (10%) were able to walk the required distance with mild limping or pain. Moreover, at the end of follow-up, 17 patients (85%) were able to run the required distance without pain, 2 patients (10%) were able to run the required distance with mild pain, while only one patient (5%) had moderate limitation ability to run with mild pain. Additionally, at the end of follow-up, 18 patients (90 %) had clinical ankle stability and only two patients (10%) had instability during sports activities. Finally, at the end of follow-up, 14 patients (70%) had ankle motion within 10° of the uninjured ankle, four patients (20%) had ankle motion within 15° of the uninjured ankle, and two

International Journal Dental and Medical Sciences Research
Volume 4, Issue 6, Nov-Dec 2022 pp 320-324 www.ijdmsrjournal.com ISSN: 2582-6018

patients (10%) had ankle within 20° of the uninjured ankle (table 3).

Table (3): Among the studied group

Variable	The studied group (20)	
NO (20)	**%**	
Pain intensity		
Mild pain with strenuous activity	14	68.2%
No pain	6	31.8%
Ability to walk		
Able to walk desired distances without limp or pain	18	90 %
Able to walk desired distances with mild limp or pain	2	10%
Ability to run		
Able to run desired distances without pain	17	85 %
Able to run desired distances with slight pain	2	10 %
Moderate restriction in ability to run, with mild pain	1	5%
Stability of ankle		
No clinical instability	18	90%
Instability with sports activities	2	10%
Motion of the ankle		
Within 10° of uninjured ankle	14	70%
Within 15° of uninjured ankle	4	20%
Within 20° of uninjured ankle	2	10%

Regarding pain intensity, this study showed that the pain intensity among the studied group had average of 13.2 ± 1.4 that ranged from 12 to 15. The stability range in the study group averaged 13.9 ± 0.2, ranging from 13 to 15. The walking range averaged 14.2 ± 1.6, which ranged from 8 to 15. The running range averaged 9.2 ± 1, 2, which ranged from 6. Range of work averaged 9.3 ± 1.1, which ranged from 6 to 10. Ankle range of motion averaged 9.4 ± 1.7, which ranged from 4 to 10. Finally, range The X-ray had a mean of 22.4 ± 0.4, ranging from 24 to 25. The Baird and Jackson scoring system was 95.3 ± 4.9, ranging from 76 to 98. The majority of the study group, 68.2%, had excellent result, 22.7% of them had a good result and 9.0% had a poor result (Table 4).

Table (4): Baird and Jackson's Scoring System among the studied group

Variable	Variables	The studied group(20) Mean ± SD
Baird and Jackson's Scoring System	**Pain intensity**	13.2 ± 1.4
	Stability	13.9 ± 0.2
	Walk	14.2±1.6
	Run	9.2±1.2
	Work	9.3 ±1.1
	Motion ankle	9.4± 1.7
	X-ray	22.4 ± 0.4

Table (5) showed that most of the studied group (90.9%) did not have any complications and only two patients (9.1%) had superficial infection, which was controlled by antibiotic and dressing.

Table (5): Complications distribution among the studied group

Complications	NO (20)	%
No	18	90 %
Superficial infection	2	10%

IV. DISCUSSION

In terms of injuries, 63.6% of patients in our study with only medial ankle injuries and 36.4% had combined medial and lateral ankle injuries. Patients with combined medial and lateral malleolus injuries were treated with a medial ankle splint and a lateral ankle semitubular splint, whereas patients with only medial ankle injuries were treated with a nonslip splint. This is in agreement with Palmanovich et al. (6) who reported that most ankle fractures commonly occur in association with lateral or medial malleolar fractures.

Regarding bone union after antiglade plate in our study, the duration of union was 13.2 ± 2.1 weeks, ranging from 9 to 15 weeks. The majority of the monitored group (54.1%) had a healing time between 9 and 13 weeks. this is the same as Ahn et al. (7) in their study, which included 70 patients who were followed for a minimum of 12 (mean 55, range 12 to 109) months. Union occurred after an average of 57 (range 37 to 81) days (almost 14 weeks) in all cases. In addition, Sukur et al. (8) in their study found that follow-up evaluation at 12 postoperative weeks showed healing in all patients, where the presence of bridging callus in at least 3

cortices or the disappearance of the fracture line was accepted as radiological healing.

Regarding the outcome after the follow-up period, the total final Biard and Jackson (9) score was 95.3 ± 4.9, ranging from 76 to 98. The majority of the follow-up group (68.2%) had an excellent outcome, 22.7% of them it had a good result. result and 9.0% had a wrong result. This is consistent with the results of most studies such as Velez et al.(10) with 4.5% of cases with poor functional outcomes. Additionally, in a study by Singh et al. (11), reported that 5.4% had poor results. In addition, the clinical outcome of plate fixation of displaced fractures is satisfactory, and poor outcomes are uncommon [7]. Moreover, the overall result of the current study is consistent with Jones et al. (12) who concluded that the slip plating technique with lag-screw placement is biomechanically superior to the other 2 commonly used constructs. However, the result of the current study is close to Kilian et al. (13) where the final total score was 94.5 ± 6.0 (range 85–100) points, but reported no dissatisfied patients.

Regarding the complications in our current study, the majority of the study group (90 %) had no complications and only two patients (10%) had a superficial infection without further complications. This is in contrast to Kilian et al. (13) where complications were observed in 3 (15%) non-slip plate patients (2 hardware irritations and 1 skin reaction without infection).

V. CONCLUSION

The surgical solution of the vertical excision of the medial ankle fracture provided excellent anatomic reduction and rigid fixation to restore joint congruity, helping to facilitate early mobilization and thereby achieving optimal ankle function. Osteosynthesis using a small T-plate in vertical shear of the medial ankle fracture provided a good option for rigid fixation. Non-slip plate fixation is readily available and costs significantly less than a pre-assembled, anatomically specific type of fixation.

REFERENCES

[1]. **Wegner A, Wolinsky P, Robbins M et al. (2016):** Antiglide plating of vertical medial malleolus fractures provides stiffer initial fixation than bicortical or unicortical screw fixation. Clin Biomech., 31: 29–32 .

[2]. **Heckman J, Bucholz R, Tornetta P et al. (2015):** Rockwood and green's fractures in adults. Philadelphia: Lippincott Williams & Wilkins, Pp: 2400.

[3]. **Blake S, Yakubek G, Shaer J (2015):**Use of a Locked Fibular Plate for Fixation of a Vertical Shear Medial Malleolus Fracture: A Case Report. J Foot Ankle Surg., 54 (6):1202-5.

[4]. **Simanski C, Maegele M, Lefering R et al. (2006):** Functional treatment and early weightbearing after an ankle fracture: a prospective study. J Orthop Trauma, 20: 108–114 .

[5]. **Dumigan R, Bronson D, Early J (2006):** Analysis of fixation methods for vertical shear fractures of the medial malleolus. J Orthop Trauma, 20: 687–691 .

[6]. **Palmanovich E, Ohana N, Yaacobi E et al. (2020):** Preoperative planning and surgical technique for optimizing internal fixation of posterior malleolar fractures: CT versus standard radiographs. J Orthop Surg Res., 15: 1–9 .

[7]. **Ahn J, Kim S, Lee J et al. (2016):** Incidence of peroneal tendinopathy after application of a posterior antiglide plate for repair of supination external rotation lateral malleolar fractures. J. Foot Ankle Surg., 55: 90–93 .

[8]. **Sukur E, Akmanb Y, Gokcenc H et al. (2017):** Open reduction in pilon variant posterior malleolar fractures: radiological and clinical evaluation. Orthop Traumatol Surg Res., 103: 703–707 .

[9]. **Baird R, Jackson S (1987):** Fracture of the distal part of fibula with associated disruption of the deltoid ligament. J Bone Joint Surg., 69: 1346-52.

[10]. **Velez N, Moreno A, Martínez O et al. (2004):** Posterior antiglide plate vs lateral plate to treat Weber type B ankle fractures. Acta Ortopédica Mex., **18**: 39–44 .

[11]. **Singh R, Kamal T, Roulohamin N et al. (2014):** Ankle fractures: a literature review of current treatment methods. Open J. Orthop., **4**: 292–303 .

[12]. **Jones D, Cannada L, Bledsoe J (2016):** Are hook plates advantageous compared to antiglide plates for vertical shear malleolar fractures. Am J Orthop., 45: 98–102.

[13]. **Kilian M, Csörgö P, Vajczikova S et al. (2017):** Antiglide versus lateral plate fixation for Danis-Weber type B malleolar fractures caused by supination-external rotation injury. J Clin Orthop Trauma, 8: 327–331 .