Section: Orthopaedics

Original Research Article

FUNCTIONAL OUTCOME OF DISTAL TIBIOFIBULAR SYNDESMOTIC INJURIES ASSOCIATED WITH ANKLE FRACTURES TREATED BY OPEN REDUCTION AND INTERNAL FIXATION AND SYNDESMOTIC SCREWS- A PROSPECTIVE STUDY

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ABSTRACT

Background: Ankle fractures are the second most common fractures in the lower limb, following hip fractures. They account for approximately 10% of all fractures, with an incidence rate of 137 per 100,000 individuals per year our aim is to analyse the radiological and functional outcome of distal tibiofibular syndesmotic injuries associated with ankle injuries treated by open reduction and internal fixation and syndesmotic screws.

Materials and Methods: The present study was conducted at Andhra Medical College, Visakhapatnam, Andhra Pradesh, India. In our study, 30 cases of bi malleolar ankle fractures were analysed. Classification used was Lauge-Hansen and Denis Weber classification. Self-fall and twisting injury are the most common mode of injury followed by road traffic accident. Average injury surgery interval was 7 days. Malleolar screw for medial malleolus and plate (one third tubular plate / reconstruction plate) for fibula and trans syndesmotic screws were common mode of fixation.

Results: Results were analysed using AOFAS (American Orthopaedic Foot and Ankle Scoring). The scoring was excellent and good in 90% of cases and poor in 10 % of cases.

Conclusion: Accurate anatomical reduction and fixation of syndesmotic disruption associated with ankle fractures results in good functional outcome.

Keywords: Bimalleolar ankle fractures, Syndesmotic injuries. Lauge – Hansen, Denis Weber, American Orthopaedic Foot and Ankle scoring.

INTRODUCTION

The ankle is an intricate hinge joint that consists of the tibiotalar, subtalar, and inferior tibiofibular joints. The ankle joint consists of the distal fibula, distal tibia, and talus dome. The stability of the distal tibiofibular joint is maintained by the structural characteristics of the bones and the reinforcing syndesmotic ligaments. The fundamental purpose of the ligament complex is to preserve the structural stability of the tibia and fibula, while also providing resistance against axial, rotational, and translational pressures. The Syndesmotic ligament plays a crucial role in maintaining ankle stability. The ankle syndesmosis is composed of the anterior inferior tibiofibular ligament, posterior inferior tibiofibular ligament (PITFL), transverse tibiofibular ligament, and interosseous ligament, which is a continuation of the interosseous membrane and extends distally.[1]

Ankle fractures are the second most common fractures in the lower limb, following hip fractures. They account for approximately 10% of all fractures, with an incidence rate of 137 per 100,000 individuals per year.[2]

The occurrence of these injuries follows a bimodal distribution, with the highest frequency observed in younger males and older females. There is a 50-year gap between the two peaks.[3] These injuries are

usually caused by low levels of energy, with the majority resulting from self-falls (twisting injuries), followed by sports injuries and road traffic accidents. The distal tibiofibular syndesmotic injuries include around 30% of all ankle injuries and around 20% of undetected syndesmotic injuries. These injuries can result in chronic ankle pain and early post-traumatic arthritis. The user's text is enclosed in tags. Ankle joint injuries result in damage to both the bony structure and the ligaments and soft tissues. For ankle fractures, only minor deviation from the usual condition is acceptable for maintaining optimal joint function.[4]

Failure to diagnose syndesmotic injuries can lead to recurrent instances of ankle instability, increasing the likelihood of developing degenerative arthritis at an early stage. Malreduction of the malleolar fracture can lead to inadequate alignment of the syndesmosis, resulting in a suboptimal functional outcome.[5]

For compound fractures, a temporary external fixator that extends across the ankle joint can be employed to facilitate wound management. The fixator can be withdrawn upon the completion of soft tissue recovery.

The introduction of A.O principles of management has improved the outcomes of bi malleolar ankle fractures with syndesmotic injury. The focus is on achieving anatomical alignment of the fracture, using stable internal fixation, restoring the full length of the fibula, preserving the distal tibiofibular syndesmosis, and promoting early pain-free mobilization to prevent long-term complications.

This study highlights the need of not just treating ankle fractures, but also addressing syndesmotic disruption and malleolar fractures.

MATERIAL AND METHODS

The present study was conducted at Andhra Medical College, Visakhapatnam, Andhra Pradesh, India. After obtaining clearance from institutional ethical committee for the research work, informed consents were taken from the participants.

Inclusion Criteria

The inclusion criteria were as follows: Ankle fractures with Syndesmotic disruption, individuals aged more than 18 years; patients who comes under Grade I and II open fractures, Ankle fractures with or without subluxation and Polytrauma cases.

Exclusion Criteria

Patients under the age of 18, diagnosed with Grade III compound fractures, Local skin diseases, previous arthrodesis at target level, Pathological fractures, neglected fractures and Severe comorbid conditions.

Sample Size: 30 patients who full fill the inclusion and exclusion criteria.

Study Design: Prospective examination of 30 cases of ankle fractures with accompanying syndesmotic damage. All instances were between the 18–60 age range, with a slight majority occurring in the 4th decade.

Male patients made up roughly 60% of the cases (18 cases). Left side injuries made up around 66% of cases (20 instances), and self-fall is most frequent mechanism injury, accounting for approximately 66% of cases (20 cases) following a RTA. 33% of the patients—9 patients—had injuries from falls from height.

The most frequent type of injury, accounting for around 60% of cases, was a supination external rotation type, which was followed by a PER.

Most of the patients had closed fractures, were first managed with below-knee slabs and then fixed internally. Seven days was the typical time between injuries operations. (Interval range: minimum 3 days, maximum 16 days.) All patients were approved as candidates for anaesthesia surgery. The remaining patients had no substantial concurrent illnesses, whereas three of them had hypertension and two of them had diabetes mellitus.

Clinical and radiological examinations were performed on the patients who presented to the casualty and outpatient departments. All instances required below-knee plaster of Paris immobilisation. X-rays were done, and surgery was scheduled as a result.

In certain instances, stress radiographs were used to evaluate preoperative syndesmotic damage. There was a shattered ball sign and a dime sign present in syndesmotic instability. In a few cases, radiographic images of the opposite ankle are taken for comparison.

By using computed tomography and unique radiological views (ankle mortise view), the size, location, and involvement of the distal tibiofibular joint were evaluated. In two cases, MRI imaging was used to evaluate soft tissue damage and ligament involvement. This is helpful to achieve a satisfactory functional outcome. Other times, to retain tibiotalar congruity, displaced fractures and subluxations required a quick closed reduction and slab. After reduction, an X-ray was taken to confirm the joints' alignment and congruity.

All cases were completed in the supine position while under spinal anaesthesia, with no tourniquet control.

AOFAS scoring

The American Orthopaedic Foot and Ankle Score (AOFAS), this score contains three factors (pain, function and alignment), was used to score the results and categorise them into 4 groups.[6]

Excellent [90-100]
Good [80-89]
Fair [70-79]
Poor [less than 69].

RESULTS AND DISCUSSION

In the current study 30 cases of ankle fractures with accompanying syndesmotic damage. All instances were between the 18–60 age range, with a slight majority occurring in the 4th decade. [Table 1]

Male patients made up roughly 60% of the cases (18 cases) [Figure 1]. Left side injuries made up around 66% of cases (20 instances), and self-fall is most frequent mechanism injury, accounting for approximately 66% of cases (20 cases) following a RTA. 33% of the patients—9 patients—had injuries from falls from height [Figure 2].

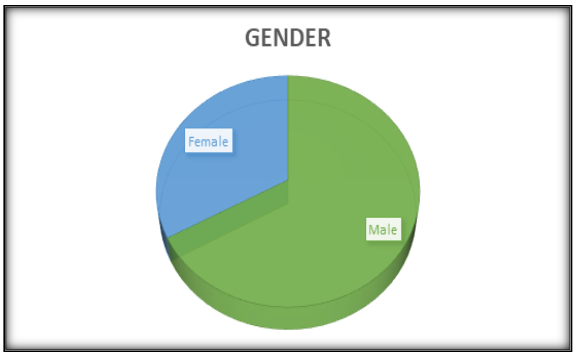

Figure 1: Represents the gender of the study population

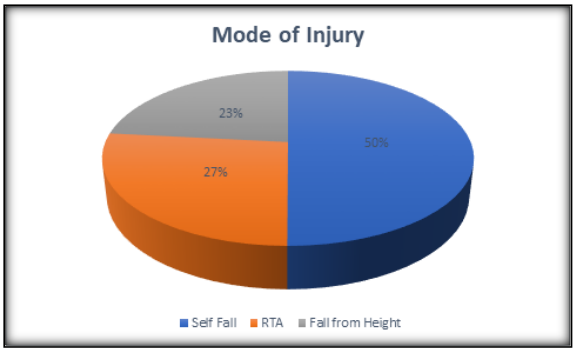

Figure 2: Represents the mode of injury in the study population

In our investigation, which comprised 30 cases of ankle fractures with syndesmotic dysfunction, 18patients had an isolated lateral malleolus fracture, while the other 12 patients had bi malleolar fractures. The injury most frequently occurred in the 2nd decade of life, with 10 [33.3 percent]. Beauchamp et al study's described bimodal age distributions, which include people between the ages of 20 and 55.[7]

Injury was more frequent in males, with 18 and females with 12, similar to the walking-related self-falls (twisting injuries) accounted for 50 percent of injuries, with traffic accidents (27 percent) and falls from height following (23 percent). Williams et al. found that automobile accidents more frequently resulted in syndesmotic disruption in young people than twisting injuries, which were more prevalent in older groups.[8] 15 patients out of 30 had SER, 7had PER, 4had SAD, and 4 had PAB patterns of damage. The injury pattern with the highest frequency in our study was supination-external rotation type. [Figure 3]

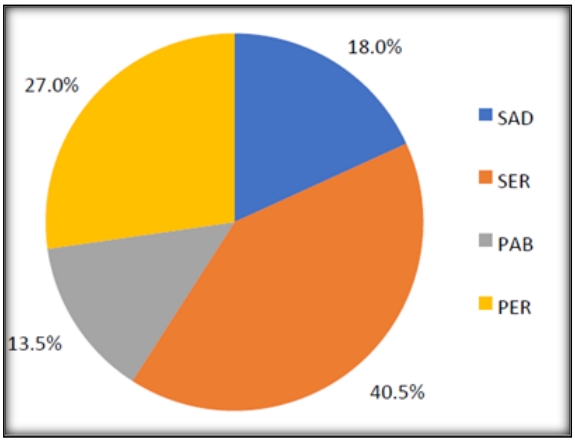

Figure 3: Represents the injury pattern in the study population

In this study, there was an average of 7 days between accidents and procedures, and patients who sought care earlier rather than later had better functional outcomes. These outcomes matched those presented by Fogel and others.[9] All the patients had good to exceptional functional results because of early open reduction, internal fixation, and syndesmotic fixation in supination external type patients. According to Amendola et al., the outcome would be worse if a supination external type injury was not treated surgically.[10] According to Weening et al., people who suffered supination adduction type injuries had excellent functional results. Results for all four individuals ranged from satisfactory to outstanding.[11]

Ankle mortise and syndesmotic stability are deemed to be the most crucial factors in the healing of fibular length and rotation following pro nation external rotation damage by Maverick. Because we were able to retain syndesmotic stability and fibular length with fibular plating and syndesmotic screws in 7 cases of pronation external rotation damage, we achieved good to extraordinary results. Additionally, syndesmotic injury was frequently observed across all fracture types, according to our findings. Compared to Weber B and supination injuries, Weber C and pronation injuries are more frequently linked to syndesmotic injuries. All patients whose fibulae were fixed with contoured one-third tubular plates.

This might be because the contoured plates' ability to tolerate the fibula's valgus bend made the fibular reduction sufficiently stable. We have used the cotton test or hook test to evaluate syndesmotic stability intraoperatively. This study used intraoperative hook or cotton testing, which has been proven to be effective in assessing syndesmotic disruption, which may result in ankle instability, according to the AO foundation. According to Jenkinson et al., the intraoperative hook test had indisputable value in showing syndesmotic damage and radiological results following the repair of the syndesmotic diastasis.[12] In this investigation, trans syndesmotic screw fixation, medial malleolar screw fixation, and fibular plating were performed on every patient.

According to Boden et al., no syndesmotic stabilisation is necessary until complete medial fixation has been attained. Syndesmotic stabilisation is necessary if extensive medial fixation is not possible and the height of the fibular fracture is larger than 4.5 cm above the joint line.[13]

Hamid et al. yielded subjective rating scores that were exceptional and good in 84 percent, fair in 11.5 percent, and poor in 4.5 percent. The results are comparable to our study's in those 20 patients (66%) obtained excellent and good 59[16.6%] subjective scores on the AOFAS, 3 patient (10%%) received fair scores, and 2 patients received terrible scores (6.6%).[14]

Seven people in our series had issues like rheumatoid arthritis, non-union, and wound infections. The most common complication, which was caused by superficial infection, was epidermal necrosis (18%), according to our findings [Table 2].

Wikerøy et al. observed a 2.2 percent infection rate in their ankle fractures connected to syndesmotic injury.[15]

One patient who sustained a Weber type C injury as a result of pronation abduction had a deep infection that was challenging to both treat and clean. Due to early implant evacuation and non-union, the patient developed early post-traumatic arthritis, and his AOFAS score was low as a result of a significant restriction of ankle plantar flexion [Table 4]. It is necessary to remove the implant and split thickness skin graft.

A lot of experts agree that Chissell et al., and Phillips et al. linked the onset of post-traumatic arthritis to elements like a shorter fibula, a Weber B type fracture pattern, and a wider ankle mortise.[16] [Table 5] The majority of patients experienced minimal to no disturbance and had good functional outcomes; none of the patients required the use of 3.5 mm cortical screws to secure the syndesmotic. In contrast to Thompson et al., they encountered screw loosening or screw fracture. Who made the claim that 4.5 mm screws are at least as stable as 3.5 mm screws. He also discussed how 3.5 mm cortical screws could break when the patient tries to put weight on them.[17] All trial participants received therapy with a syndesmotic screw that was fixed within about 87 percent of patients who had 3 cm of tibial plafond experienced satisfactory to outstanding results.

Functional outcome according to research by McBryde et al. and Kreti et al., the radiological and functional outcomes would be equivalent about where screws should be placed. Syndesmotic screws (Trans vs. Supra).[18] All of the patients had received tans syndesmotic cortical screws as part of their treatment. Tricortical learning. No one patients experienced early onset tibio-fibular synostosis. The results of Taylor et al., who demonstrated improved screw stiffness, tibio-fibular synostosis, and ankle motion with a tetra cortical purchase and a syndesmotic screw, are analogous to these findings.[19]

One screw was used in this trial to alleviate syndesmotic diastasis, which was directed from the anteromedial portion of the distal fibula to the posterolateral parallel to the ankle joint is the distal tibia. The prognosis for almost all patients was excellent to good, which is comparable to the outcomes. Gesink et al. showed, Peter et al. described, treatment with two cortical screws increased the stability of the syndesmotic joint.[20] Ineffective management of syndesmotic disruption, according to Zendrick et al, results in talar tilt, leads to early onset arthritis. In this study, a patient who had an early implant removed due to a lingering infection developed early-onset arthritis.[21] Except for 2 cases in this investigation, all patients had retained syndesmotic screws. Good to outstanding results were achieved by all patients who had retained screws, and none Screw breakage or loosening occurred in patients. Thus, keeping the syndesmotic screw in place won't have any impact on how well it functions.

Table 3: Represents the complications in the study population

Complication	No. of Patients
Superficial infections with and without skin necrosis	4
Deep infections	1
Nonunion	1
Talar tilt	2
Talar Shift	2
Malunion	1
Arthritis	2

Table 4: Represents the AOFAS scoring in the study population

Results	No of Patients	Percentage
Excellent (>90)	20	66.6
Good (80-89)	5	16.6

Fair (70-79)	3	10
Poor (<69)	2	6.6

Table 5: Represents the fracture pattern and the functional outcome

FRACTURE PATTERN	OUTCOME			
	EXCELLENT	GOOD	FAIR	POOR
SER	10	3	2	0
PER	4	1	1	1
SAD	3	1	0	0
PAB	3	0	0	1

CONCLUSION

In the current study, tricortical purchase was used to fixate trans syndesmotic screws, and results were generally satisfactory to exceptional. Due to infection and non-union in two patients, who were not affected by syndesmotic mal reduction, they developed arthritis. These results are in favourable radiological and functional prognosis when ankle fractures are treated surgically as soon as possible with the correct reduction of distal tibiofibular syndesmosis abnormalities using the proper implants. Restoring articular congruity and accurate anatomical reduction. Therefore, it is crucial to monitor cases for a longer period of time and on a larger scale in order to reliably quantify the functional and radiological patient outcome.

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