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Dr. T. H Prakashappa
Professor and Head,
Department of Orthopaedics,
SGITO, Bengaluru, Karnataka,
India

Dr. Bharath Raja B S
Assistant professor, SGITO,
Bengaluru, Karnataka, India

Dr. Yogananda Gali Hanumaih
Junior Resident, SGITO,
Bengaluru, Karnataka, India

Dr. Appasab Jaipal Murugunde
Junior Resident, SGITO,
Bengaluru, Karnataka, India

Corresponding Author:
Dr. Yogananda Gali Hanumaih
Junior Resident, SGITO,
Bengaluru, Karnataka, India

Functional outcome of surgical management of ankle fractures with syndesmotic injury

Dr. T. H Prakashappa, Dr. Bharath Raja B S, Dr. Yogananda Gali Hanumaih and Dr. Appasab Jaipal Murugunde

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Abstract
Background: Ankle fractures with Syndesmotic injury are common in Orthopaedic practice. Ankle fractures are the second most common significant lower extremity fractures. Syndesmotic ankle injuries disrupt normal joint functioning, hence need meticulous diagnosis and surgical management to prevent crippling disabilities.
Objective: To evaluate the functional outcome of surgically managed ankle fractures with Syndesmotic injury using AOFAS score.
Materials and methods: In this study, 40 patients diagnosed as ankle fractures with Syndesmotic injury, underwent Syndesmotic screw fixation using 3.5mm cortical screws in addition to anatomical fixation of medial and lateral malleolus. Functional outcome was analyzed at 6 months using AOFAS score.
Results: In this study, 42.5% (17 patients) of patients had excellent outcome, 45% (18 patients) patients had good outcome, 7.5% (3 patients) had fair outcome, while 5% (2 patients) had poor outcome. 2 patients developed superficial wound infection, treated with IV antibiotics. One patient developed non union and one patient with ankle stiffness.
Conclusion: For all cases of Ankle fractures with Syndesmotic injury, open reduction and internal fixation of ankle fracture with Syndesmotic screw fixation helped to achieve good union of fractures and pain free, stable ankle joint.

Keywords: syndesmotic injury, AOFAS

Introduction
Ankle is a complex uniaxial hinge joint consisting of the tibiotalar joint, the subtalar joint and the inferior tibiofibular joint. The ankle joint is comprised of the distal fibula, distal tibia, and the dome of the talus. The bony architecture and the supporting syndesmotic ligaments stabilize the distal tibiofibular joint. The main function of the ligament complex is to maintain the integrity between the tibia and fibula, as well as resist axial, rotational, and translational forces. The Syndesmotic ligament makes an important contribution to the stability of the ankle [1]. The ankle syndesmosis is made up of four ligaments, including the anterior inferior tibiofibular ligament (AITFL), the posterior inferior tibiofibular ligament (PITFL), the transverse tibiofibular ligament (TTFL), and the interosseous ligament (IOL), a distal extension of the interosseous membrane.
Ankle fractures are among the most commonly treated fractures in adults [2]. Syndesmosis injuries are severe form of ankle injuries and are important to detect, because they lend stability to the ankle joint. These Syndesmotic injuries are less common than ankle malleolar fractures and account for approximately 10% of all the ankle fractures [3]. Syndesmosis instability is often associated with fibula fractures above the level of the distal syndesmosis ligaments [4]. Syndesmotic injuries are most commonly associated with pronation external rotation or pronation abduction [5] and less frequently with supination external rotation [6] ankle fractures.
These injuries require thorough evaluation and optimal treatment to prevent crippling disabilities. These ankle injuries are disastrous if not treated properly especially to athletes and to those engaged in heavy work, particularly on rough or irregular surfaces. Hence treating these ankle injuries are of utmost importance.

Materials and Methods

A prospective Randomized study was performed on Bimalleolar ankle fracture with Syndesmotic injury among 40 patients during the period of November 2018 to March 2020 in Sanjay Gandhi Institute of Trauma and Orthopaedics Bengaluru, treated surgically with medial malleoli fixation, fibular plate and syndesmotic screw fixation. Inclusion criteria included PER type 4 and SER type 4 injuries, confirmed syndesmotic joint injury intra-operatively by cotton's and modified cotton's test. Ankle fractures associated with ipsilateral distal 3rd tibia fracture, evidence of arthritis of the ankle joint, revision surgery cases were excluded. Syndesmotic diastasis was diagnosed based on both radiological examination and intra-op fluoroscopic evaluation. When a syndesmotic injury is suspected clinically but not confirmed on conventional radiographs, a stress view may be obtained [7]. The following protocols were followed in the study with regards to treatment:

Surgical technique

Under spinal anaesthesia, patient was placed in supine position. Under all standard aseptic sterile precautions the affected limb was prepared and surgical draping was done. First fixation of the lateral malleolus was done using standard postero-lateral approach. After fixing the lateral malleolus syndesmotic integrity was assessed by cotton's test under fluoroscopy and checked for medial tibio-talar clear space (TTCS) and tibio-fibular clear space (TFCS) [8]. The fibula was reduced into the insura and 3.5mm tricortical syndesmotic screw was put approximately 1-2 cm above the tibial plafond about 30 degree postero-lateral to antero-medial direction and the syndesmosis was assessed using fluroscopy. The medial malleolus was fixed with cannulated cancellous screws, or tension band wiring. Soft tissue interposition between fracture fragments of the medial malleolus, was observed in all cases. All the patients were operated under tourniquet control and the duration of surgery varied from 45 minutes to 90 minutes. Sterile dressing and compression bandage applied. The patient is kept on non-weight bearing on the affected limb.

Post-operative protocol

Parenteral antibiotics were given in the post-op period for 3 days according to the wound condition. After 10 to 12 days, the sutures were removed and the ankle mobilization was started.

Follow up

Regular follow up at the end of 1, 3 and 6months were done. X-rays were taken to monitor the progress of fracture healing, to check the ankle mortise and whether the implant is well in place or not. Patients were started with ankle mobilization after the surgery and assisted toe touch walking with walking aid for 6 weeks and then full weight bearing. Removal of the screw was done after at least 4 to 8 weeks, if there is persistent pain while walking. AOFAS scoring system was used to assess the functional outcome at 6 months follow up.

Table 1: Age distribution

Age	Frequency	Percent
21-30	13	32.5
31-40	17	42.5
41-50	7	17.5
>50	3	7.5
Total	40	100.0

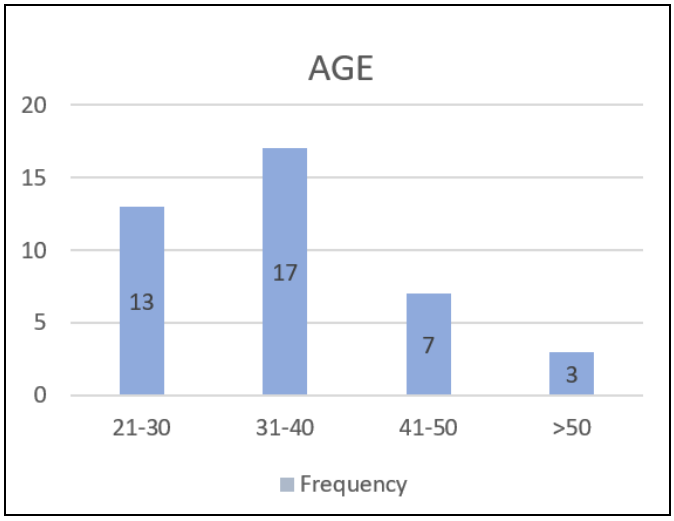

Fig 1: Age distribution

Table 2: Gender distribution

SEX	Frequency	Percent
FEMALE	12	30.0
MALE	28	70.0
Total	40	100.0

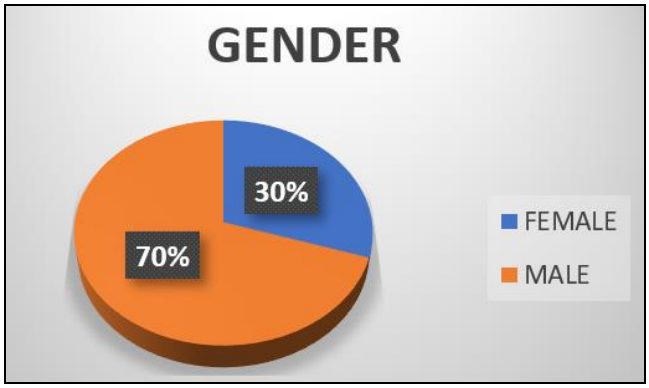

Fig 2: Gender distribution

Table 3: Side of injury

Side of injury	Frequency	Percent
LEFT	17	42.5
RIGHT	23	57.5
Total	40	100.0

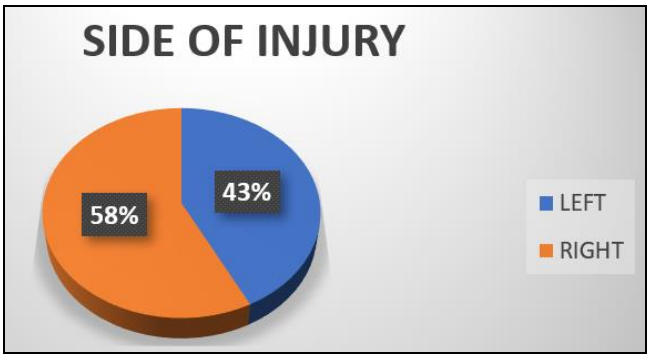

Fig 3: Side of injury

Table 4: Mechanism of injury

Mechanism of injury	Frequency	Percent
Pronation-external rotation	27	67.5
Supination-external rotation	13	32.5
Total	40	100.0

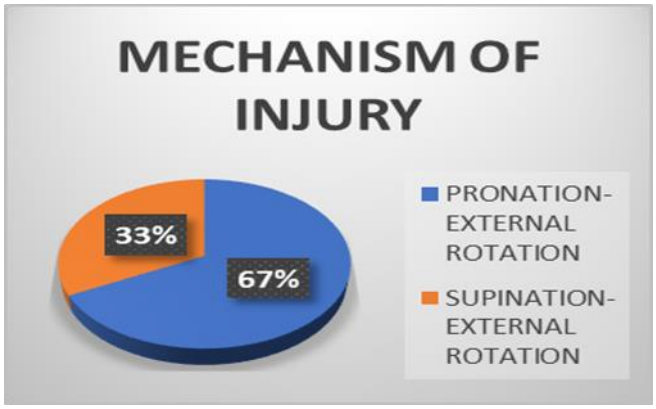

Fig 4: Mechanism of injury

Table 5: AOFAS Score

AOFAS Score	Frequency	Percent
Excellent	17	42.5
Good	18	45.0
Fair	3	7.5
Poor	2	5.0
Total	40	100.0

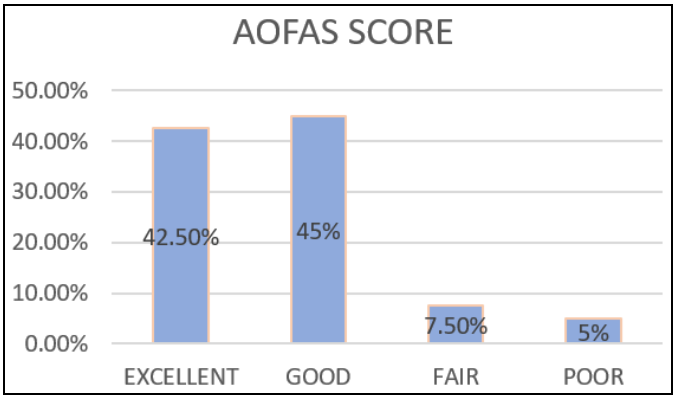

Fig 5: AOFAS Score

Table 6: AOFAS Score

AOFAS Score	N	Mean	Std. Deviation	T	P
Excellent	17	92.88	2.027	75.012	<0.05
Good	18	85.39	2.429		
Fair	3	76.67	1.155		
Poor	2	65.00	1.414		

Results

Study subjects belonged to an age group ranging from 21 years to 53 years and the majority belonged to age group of 31-40 years. In this study 12 (30%) were females and 28 (70%) were males. Among 40 patients 17 (42.5%) on left side and 23 (57.5%) on right side were affected. Twisting injury was the most common mode of injury. Pronation external rotations accounted for 67.5% (27 patients) while supination external rotation for 32.5% (13 patients) of patients as per Lauge-Hansen classification[9].

42.5% (17 patients) of patients had excellent outcome (AOFAS score 90-100), 45% (18 patients) patients had good outcome (AOFAS score 80-89), 7.5% (3 patients) had fair outcome (AOFAS score 70-79), while 5% (2 patients) had poor outcome (AOFAS score <69) according to AOFAS grading criteria.

In this study, only 2 patients developed superficial wound infection which subsided with regular dressings and antibiotics. Of the two patients with poor outcomes, one had non union and other with ankle stiffness.

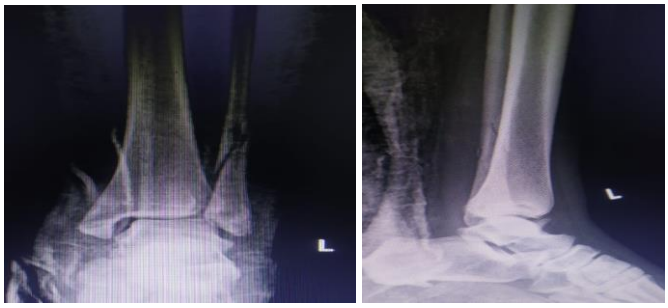

Fig 6: preoperative radiograph

Fig 7: post operative radiograph

Fig 8: 3 Month follow up

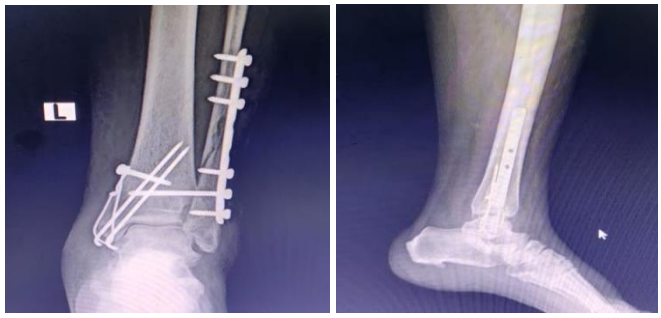

Fig 9: 6 months follow up

Discussion

The stability of the ankle depends greatly on the intact ankle mortise. Syndesmosis which connects the distal tibial and fibular bony structures normally sustains a large three dimensional loads in daily activity [10].

ankle with non-anatomically reduced syndesmosis may progress to osteoarthritis and cause lifelong disability [11] so the primary goal of treatment in these cases is obtaining a stable pain free ankle joint to restore maximum function. Pronation external rotation accounted for syndesmotic injury in 27 patients (67.5%) and 13 patients (32.5%) developed syndesmotic injury due to supination external rotation. This is in accordance with study by Riegels-Nielsen P *et al*. and

Heim D *et al*. [12, 13]. Hence it indicates that pronation external rotation injuries are more prone for syndesmotic injury. However the most common type of ankle injury is by supination external rotation and Pronation external rotation injuries are more commonly associated with syndesmotic diastasis [14].

In this study the syndesmosis was fixed with tricortical screw fixation using 3.5mm screws as there was no difference in outcome was reported with the use of quadricortical fixation [15]. A secondary procedure of syndesmotic screw removal was done at a mean duration of 6weeks if the patients were symptomatic.

The mean AOFAS score in our study was 86.9. In contrast, Egol *et al*. demonstrated poor functional outcomes at one year follow up patients with syndesmotic injury [16]. Sagi *et al*. [17] in their study on functional outcomes of malreduced syndesmosis at the end of two years concluded that malreduced syndesmotic injuries had significantly worse functional outcomes. However, many studies indicate that anatomical reduction is the most important factor which affects the functional outcome in ankle fractures. The limitations in our study being the small study group and a shorter follow up time.

Conclusion

In conclusion, treatment of ankle fracture with syndesmotic injury with open reduction and syndesmotic screw fixation gives good results provided a good anatomical reduction is achieved. Literature says there is no difference between tricortical vs quadricortical fixation. We achieved good results with tricortical syndesmotic screw fixation.

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