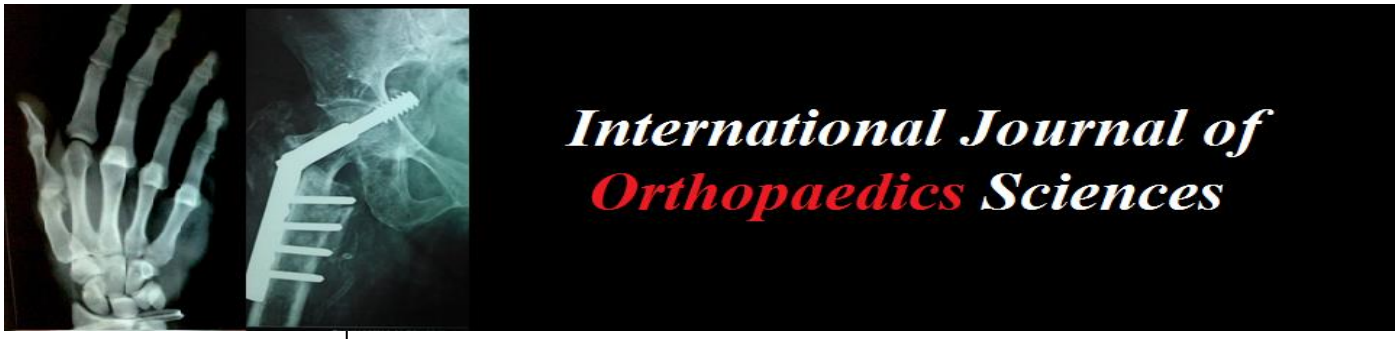

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Dr. Shariff Fardeen
Senior Resident, Department of Orthopaedics, Yenepoya Medical College, Mangalore, Karnataka, India

Dr. Murali Prashant
Final Year Resident, Department of Orthopaedics, Yenepoya Medical College, Mangalore, Karnataka, India

Dr. Ahmed Afroz M
Final Year Resident, Department of Orthopaedics, Yenepoya Medical College, Mangalore, Karnataka, India

Corresponding Author:
Dr. Shariff Fardeen
Senior Resident, Department of Orthopaedics, Yenepoya Medical College, Mangalore, Karnataka, India

Functional outcome of ankle fractures with Syndesmotic diastasis managed surgically using AOFAS

Dr. Shariff Fardeen, Dr. Murali Prashant and Dr. Ahmed Afroz M

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Abstract
Background: Ankle fractures with Syndesmotic injury are common in Orthopaedic practice. Fractures of the ankle are the second most common significant lower extremity fractures. Surgical management for Syndesmotic injuries is indicated to prevent crippling disabilities. Syndesmotic ankle injuries disrupt normal joint functioning, hence need meticulous diagnosis and management.
Objective: To evaluate the functional outcome of surgically managed ankle fractures with Syndesmotic diastasis using AOFAS score.
Materials and methods: In this study, 21 patients diagnosed as ankle fractures with Syndesmotic diastasis, 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, 33.3% (7 patients) of patients had excellent outcome, 42.9% (9 patients) patients had good outcome, 14.3% (3 patients) had fair outcome, while 9.5% (2 patients) had poor outcome.2 patients developed superficial wound infection, treated with IV antibiotics. One patient developed non union and one patient with delayed union.
Conclusion: For all cases of Ankle fractures with Syndesmotic diastasis, 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. It also facilitated early mobilization of the patients.

Keywords: Functional outcome, Syndesmotic diastasis, AOFAS

Introduction
Ankle is a complex uniaxial hinge joint consisting of the tibiotalar joint, the subtalar joint and the inferior tibiofibular joint. The bony architecture of the ankle is formed by the distal end of tibia, distal fibula and the talus. Its axis of rotation is dynamic, shifting during dorsiflexion and plantar flexion. The malleoli along with supporting ligaments stabilize the talus underneath the tibia. The ankle joint is bound by strong deltoid ligament which supports the medial side of the joint and the three lateral ligaments: the anterior talofibular ligament and the posterior talofibular ligaments which support the lateral side of joint and the calcaneofibular ligament. Though it does not span across the ankle joint itself, the Syndesmotic ligament makes an important contribution to the stability of the ankle [1]. The syndesmosis is madeup of the anteroinferior tibiofibular ligament, the interosseous ligament and the Postero inferior tibiofibular ligament.
Ankle fractures are among the most common injury treated orthopedic surgeons [2]. Syndesmotic ankle injuries are severe form of ankle injuries which is predominantly caused by external rotation force in a supinated or pronated foot. These Syndesmotic injuries are less common than ankle malleolar fractures. These injuries are difficult to evaluate, have a long recovery period, and may disrupt normal joint functioning if not treated properly. They account for approximately 10% of all the ankle fractures [3]. The tibiofibular syndesmosis are complex of ligaments that provides dynamic stability to the ankle joint [3]. This is essential for the integrity of the ankle mortise and thereby for weight bearing and walking [3].
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.

Surgeon must be aware of anatomy of both affected and normal ankle, various clinical test to diagnose various types of ankle injuries, limb biomechanics and treatment methods to achieve good results.

Materials and Methods

Prospective study involving 21 patients with syndesmotic diastasis treated surgically with syndesmotic screw fixation. Inclusion criteria includedSER4 and PER4injuries, confirmed 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. Stoffel *et al*. (2009) [4] compared two methods of operative assessment of syndesmotic instability and found the lateral stress test to be better than the external rotation stress test. General radiographic criteria for syndesmotic fixation were of low value compared with intraoperative impression of the syndesmotic stability in all operated ankles [5-7].

With regards to treatment, the following protocols were followed for the study:

Surgical technique

Under spinal anesthesia, patient was placed in supine position. The affected limb was prepared and surgical draping was done using the standard aseptic sterile precautions. Standard postero-lateral approach for the fixation of the lateral malleolus was done. 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 insuraand 3.5mm tricortical syndesmotic screw was put approximately 1-2 cm above the tibial plafond about 30^0 postero-lateral to antero-medial direction. 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. The medial malleolus was fixed with cannulated cancellous screws, or tension band wiring. With the help of radiographs fracture healing status was judged and full weight bearing was started gradually after removal of syndesmotic screw. At the end of 6 months, patients were evaluated for functional outcome using the AOFAS score.

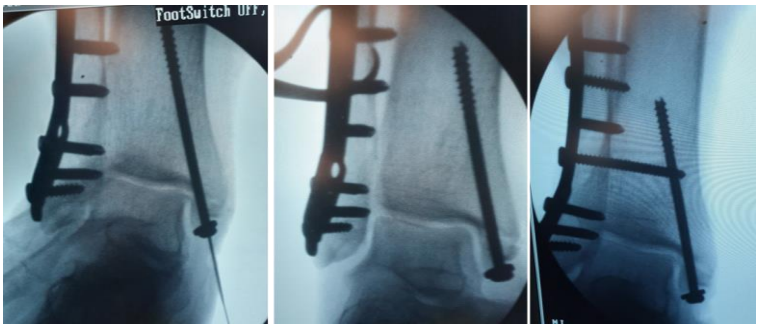

Fig 1: Left (Showing before syndesmotic screw fixation), Middle (Cotton's test being performed intraoperatively. Note the increase in Tibio-fibular clear space) and Right (After syndesmotic screw fixation).

Fig 2: Intra operative image showing cotton's test being performed.

Fig 3: Case developed superficial wound infection, which later healed by dressings and antibiotics.

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 slab was removed at first follow up, started with ankle mobilization and assisted toe touch walking with walking aid till the removal of syndesmotic screw. AOFAS scoring system was used to assess the functional outcome at 6 months follow up.

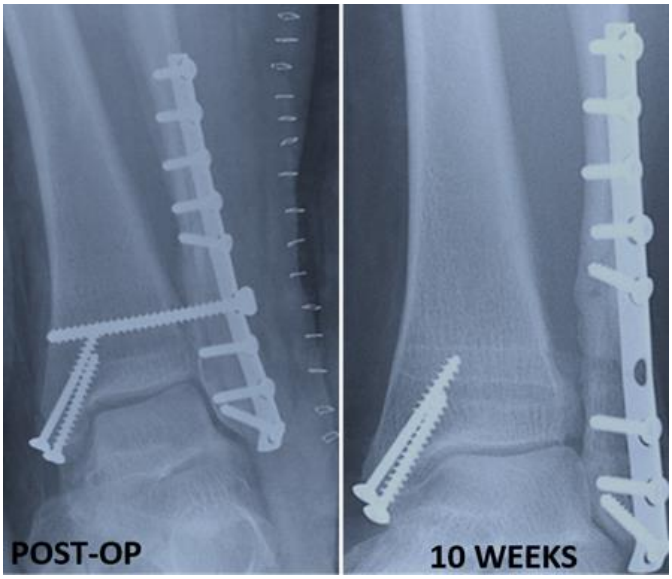

Fig 4: Showing immediate post-op and after removal of syndesmotic screw at 10 weeks

Results

All the 21 cases underwent open reduction and internal fixation and were followed up at 1 month, 3 months and 6 months post op. They were put on a below knee slab for 6 weeks following surgery. Ankle movements were encouraged after removal of the slab. Syndesmotic screw was removed at a mean period of 10 weeks (range 8 to 24 weeks) and then gradual weight bearing was started. At the end of 6 months, the functional outcome was assessed based on the AOFAS score [9].

The mean age was 38 years ranging from 19 years to 60 years. 61.9% (13 patients) of patients were under 40 years of age where as 38.1% (8 patients) of patients were between 41 to 60 years of age. 57.1% (12 patients) of patients were malesand 42.9% (9 patients) were females. There was no statistically significant difference inthe side affected (right-12, left-11). Twisting injury (66.7%) was the most common mode of injury in this study compared to other mode of injuries like RTA, Fall from height.Pronation external rotations accounted for 71.4% (15 patients) while supination external rotation for 28.6% (6 patients) of patients as per Lauge-Hansen classification [10]. Weber C accounted for 66.7% (14 cases) where as Weber B for 33.3% (7 cases).

Table 1: Age Group

	Frequency	Percent
<40	13	61.9
41 - 60	8	38.1
Total	21	100.0

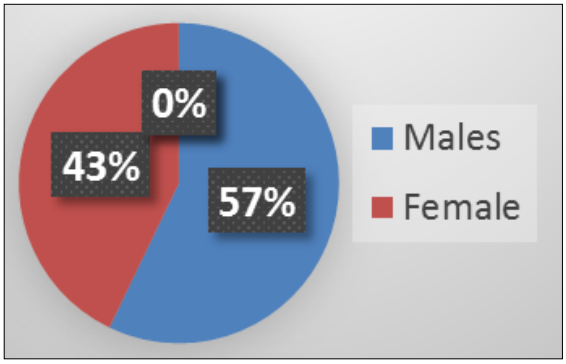

Fig 5: Gender Distribution

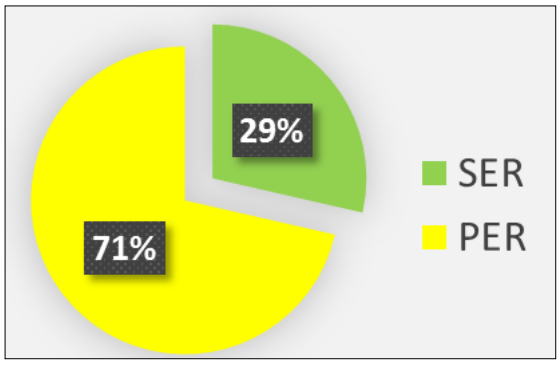

Fig 6: Lauge Hansen's Classification

33.3% (7 patients) of patients had excellent outcome (AOFAS score 90-100), 42.9% (9 patients) patients had goodoutcome (AOFAS score 80-89), 14.3% (3 patients) had fair outcome (AOFAS score 70-79), while 9.5% (2 patients) had poor outcome(AOFAS score <69) according to AOFAS grading criteria.

Table 2: AOFAS Score

	N	Mean	Std. Deviation	F	p
Excellent	7	95.571	3.047		
Good	9	82.778	2.819		
Fair	3	75.000	2.000		
Poor	2	52.500	10.607	74.663	<0.001 VHS

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 delayed union. The patient with non union had severe uncontrolled diabetes and chronic renal disease.

Fig 5: Post-operative ankle movements (left side operated)

Discussion

The syndesmosis connecting the distal tibial and fibular bony structures normally sustains large three-dimensional loads in daily activity [11-13]. Ankle stability depends greatly on the intact ankle mortise. Once SD occurs, the ankle immediately loses mediolateral restriction provided by the bony contour. Therefore, patients immediately lose walking ability. An ankle with non-anatomically reduced syndesmosis may progress to osteoarthritis and cause lifelong disability [14].

The primary goal of treatment in these cases is to obtain stable, pain free ankle joint and to restore maximum function. Mean age group in this study was 38 years in comparison to 43.7 years in study done by David *et al*. [1] 36.5 years in study by Nimick *et al*. [15]**.** There were 12 males and 9 females with a male: female ratio of 1.3: 1, which is more towards the former which is similar to the results of the study conducted by Nimick *et al*. [15].

Pronation external rotation accounted for syndesmotic injury in 15 patients (71.4%) and 6 patients (28.6%) 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*. [16, 17]. Hence it indicates that pronation external rotation injuries are more prone for syndsmotic injury. However the most common type of ankle injury is by supination external rotation, Pronation external rotation injuries are more commonly associated with syndesmotic diastasis [18].

We have employed tricortical screw fixation using 3.5 mm screws. No difference in outcome was reported with the use of tricortical vs quadricortical fixation [19]. None of the patients showed screw breakage on full weight bearing after eight weeks. In our study the mean duration of which patients had secondary procedure of syndesmotic screw removal was 10 weeks. Naqvi *et al*. [20] evaluated clinical outcomes and syndesmotic reduction with CT imaging using two different methods of syndesmotic stabilization using syndesmotic screw fixation versus tight rope; found that there is no statistically significant difference in the outcomes.

The mean AOFAS score in our study was 83.04 which is in par with study by Littenta *et al*. [18]. In contrast, Egol *et al*. demonstared poor functional outcomes at one year follow up patients with syndesmotic injury [21]. Sagi *et al*. [22] 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 [23-25].

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 we achieve good anatomical reduction. Literature says there is no benefit of tight rope over syndesmotic screw, no difference between tricortical vs quadricortical fixation. We achieved good results with tricortical syndesmotic screw fixation. No breakage of syndesmotic screw was observed, that may be primarily due to weight bearing after screw removal.

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