Original Article

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A prospective study to evaluate clinico-radiological and functional outcomes of Weber type B and Weber type C ankle fractures treated with syndesmotic screw fixation where the screw was removed before starting weight bearing compared to those where the screw was retained in situ indefinitely

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Abstract

Introduction: *It is crucial to adequately stabilize an injury to the distal tibiofibular syndesmosis. A transyndesmotic screw engaging three cortices from fibula to the tibia is an acceptable method to treat this injury. Surgeons typically tend to remove this screw prior to weight bearing to avoid complications of implant failure and enhance ankle function. There is ongoing contradistinction and studies have documented higher rates of wound infections, added morbidity and the costs incurred after routine syndesmotic screw removal. Many studies likewise have advocated against the routine removal of syndesmotic screw. This study aims to compare the functional outcomes in patients with ankle fractures, for whom transsyndesmotic screws were placed and afterwards were either retained or removed.*

Materials and Methods: *Our prospective study sample was chosen from patients of closed malleolar fractures presenting to our Hospital between May 2017 and April 2019. 43 subjects of malleolar fractures were operated with ORIF and tricortical transyndesmotic screw fixation was done. Syndesmotic screw was removed electively in 20 patients at 12 weeks; and the screw was retained in situ in 23 patients. At 6 months follow-up, functional outcomes of the patients were evaluated as per the rating of the Baird and Jackson criteria.*

Results: *The groups were comparable considering age, gender and follow-up time. Mean age of the patients in the two groups were 41.2 years and 46.78 years respectively. Mean follow up in the two groups were 11.75 and 8.47months respectively. Overall good to excellent results were seen in >75% patients in both groups. The difference in the incidence of complications in both groups was not significant. However osteolysis was observed around the syndesmotic screws in 18 of 23 patients with retained screws after weight bearing was initiated.*

Conclusion: *There was no significant difference (p = 0.74) between functional outcome or range of motion between the groups. Our study does not support routine removal of syndesmotic screws with regard to functional outcome. However it is acknowledged that the risk of syndesmotic screw breakage and failure exists if the screw is retained.*

Keywords: *Ankle fracture, Syndesmosis, Syndesmotic screw, Screw removal*

Introduction

Ankle fractures are amongst the commonly encountered musculoskeletal injuries, and 10% of patients have a associated distal tibiofibular syndesmosis injury necessitating surgical stabilization(1).

The ankle mortise is stabilized by the syndesmotic ligaments by providing strong dynamic support and opposition of the fibula to the fibular notch of the tibia.(2) Untreated injury to the syndesmosis leads to abnormal contact pressures in the ankle joint and development of early arthritis(3). Thus it is vital to diagnose and adequately stabilize an injury to the distal tibiofibular syndesmosis.(4)

Intraoperatively to assess syndesmotic stability an external rotation stress or a lateral distraction force is applied by placing the bone hook on the fibula in an attempt to separate the fibula from the tibia. On AP and Mortice view radiographs of the ankle, this may demonstrate an increase in tibiofibular clear space, decreased tibiofibular overlap and increased medial clear space, which would indicate injury to the syndesmotic ligaments. (5)(2)

The surgical motive is to keep the structures in their correct position so that the ligaments can heal properly.(6) Recent studies have reasoned to place a syndesmotic screw at 2.0 cm above tibiotalar joint as acceptable method to stabilize the syndesmotic diastasis.(7)(5)

There is lack of consensus in the recent literature pertaining to removal of syndesmotic screws prior to weight bearing. The

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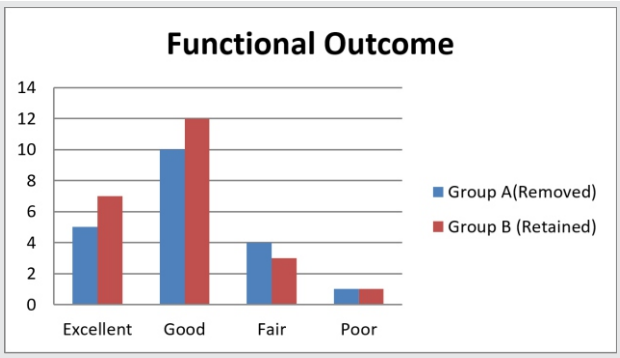

Figure 1: Comparison of functional outcomes in Group A(Screw Removed) and Group B(Screw Retained)

presence of the screw may limit the dynamic motion of the fibula during walking, thereby some studies advocate removal of screws to restore physiological biomechanics of the syndesmosis and improve function.(8)(5) There is difference in opinions among authors if there is correlation between loss of radiographic syndesmotic parameters and removal of syndesmotic screw. However it is agreed that the ankle mortise remained intact whether the syndesmotic screws were removed, were loosened or broken, or remained solid.(9)(10)

In a study by Qamar and coworkers it was suggested that although routine removal of syndesmotic screws is not required, surgeons electively remove screws to avoid the possibility of hardware irritation or reduced range of motion after four to six months.(11)

On the other perspective in a study by Hamid et al it was related that there was no difference in clinical outcome of patients with intact or removed syndesmotic screws.(12) A study by Andersen et al documented higher rates of wound infections after routine syndesmotic screw removal. They related that the patients with postoperative infection reported more pain and were lesser satisfied with their ankle compared to those without infection.(13) In this study we aimed to compare the functional outcomes in adult patients with ankle fractures, for whom syndesmotic screws were inserted and were either subsequently retained or removed.

Materials & Methods

From May 2017 to April 2019, total of 43 subjects of malleolar fractures undergoing ORIF at our Institute, were studied prospectively. This study was approved by the ethics committee of our hospital, and informed consents were obtained from patients or their legal relatives. All the adult patients of closed malleolar fractures were eligible for the study, cases which did not prove syndesmotic instability during intraoperative stress testing were not included in the study.

Affected ankle and tibia AP and lateral radiographs were taken. The fractures were then classified as per the Weber's classification. Patients were given below knee POP slab with strict limb elevation till the time of surgery.

Table 1: Distribution of patients according to their demographic and clinical characteristics

	Group A (Screw Removed)		Group B (Screw Retained)	
Total patients	20		23	
Age Distribution	n	%	n	%
20-29	3	15	2	8.695652
30-39	7	35	6	26.08696
40-49	2	10	6	26.08696
50-59	6	30	5	21.73913
60-69	2	10	4	17.3913
Mode of Injury				
RTA	7	35	6	26.08696
Fall	11	55	14	60.86957
Sports	2	10	3	13.04348
Side affected - Right	13	65%	17	73.91%
Fracture Pattern				
Bimalleolar	12	60	13	56.52174
Lateral Malleolar	3	15	2	8.695652
Trimalleolar	5	25	8	34.78261
Webers Classification				
B	13	65	16	69.56522
C	7	35	7	30.43478

Operative Procedure

Spinal anesthesia was administered to all patients. Second generation Cephalosporins Antibiotics were administered at the time of induction of anesthesia.

Under all aseptic surgical precautions, as per the standard approaches, Lateral malleolar fixation was done in 43 cases.

At our institute for reduction of the distal tibio-fibular syndesmosis, a large bone reduction clamp was used to maintain compressive force between fibula and tibia after reducing the fibula by putting it back into the fibular notch of the tibia, evaluating the alignment and reduction via fluoroscopy. During screw insertion the ankle joint was kept in neutral to mild dorsiflexion position at our institute. Fixation involved a three cortex purchase from the fibula to the tibia using 3.5mm cortical screw 2cm above the tibiotalar joint line.

Medial malleolus fixation was done in 38 patients. Posterior malleolar fracture was noted in 13 cases. The posterior malleolar fracture was fixed using the standard approach and mode of fixation decided intraoperatively.

In all cases, tibio talar articular congruence was restored < 1 mm of normal, confirmed via fluoroscopy. All the patients were operated under tourniquet control. The duration of surgery varied from 30 to 80 minutes. IV Antibiotics were administered for 2 days postoperatively. Radiological evaluation was done in the postoperative period which included both Anteroposterior and Lateral views. Regular daily dry dressings were done. Patient was mobilized on the

Table 2: Comparision of functional outcomes and complications between Group A (Screw Removed) and Group B (Screw Retained).

	Group A (Screw Removed)		Group B (Screw Retained)		p-value
Demographic Variables	**n**	**%**	**n**	**%**	
Mean age	41.2+/-13.16		46.78+/-15.18		**0.355**
Males	16	80%	17	73.91%	
Females	4	20%	6	26.09%	
Time of follow up [months]					
Mean (Range)	11.75 (6-20)		8.47 (6-18)		**0.287**
Functional Outcome [Baird and Jackson Ankle score]					
Excellent	5	25.00%	7	30.40%	
Good	10	50.00%	12	52.20%	
Fair	4	20.00%	3	13.00%	
Poor	1	5.00%	1	4.30%	
Range of Motion(plantar flexion- dorsiflexion arc)					
30-39	4	20.00%	3	13.00%	**0.165**
40-49	2	10.00%	3	13.00%	
>50	14	70.00%	17	73.90%	
Complications					
Superficial skin infection	3	15.00%	3	13.00%	**0.553**
Ankle stiffness	2	10.00%	3	13.00%	
Syndesmotic screw breakage	0	0.00%	1	4.30%	

first postoperative day, non-weight bearing on the affected leg with the help of walker. Patients were discharged on the fifth day on an average.

The patients were followed up at 2nd week, 6th week, 3rd month and 6th month. Sutures were removed at 2 weeks follow up in the outpatient clinic. Posterior slab removed same day, and range of motion of ankle started but patients were advised to continue non weight bearing ambulation with a walker for a period of four weeks. Check x rays were done at 6weeks. Signs of healing and status of the joint was noted.

At 12 weeks follow up, syndesmotic screw was electively removed in 20 patients after informed consent. Under all aseptic precautions, parts painted and draped, under local anesthesia syndesmotic screw was removed with stab incision. Single dose of intravenous antibiotic was given perioperatively, followed by 5 days of oral antibiotics. Patients were advised partial weight bearing according to the xray picture and suture removal after 15 days.

At 6 months follow-up, functional outcome of the patients were evaluated as per the rating of the Baird and Jackson criteria which included objective criteria, subjective criteria and Radiological evaluation.

Statistical Analysis

All statistical analyses were performed using SPSS and a threshold of $p < 0.05$ was set for statistical significance. The data are presented as n (%) or mean and standard deviation and was analysed by chi-square test and Student's t test, depending on distribution.

Results

During the study period 43 patients with ankle fractures were operated and underwent syndesmotic screw fixation in our department. Of all the patients, syndesmotic screw was electively removed in 20 patients (Group A) at 12 weeks; and the screw was retained in situ in 23 patients (Group B).

Mean age of the patients in group A and group B were 41.2 years and 46.78 years respectively. There was no difference in the age distribution between the two groups (p=0.35). Male predominance was seen in present study with, 33 males (76.74%) to 10 (23.25%) females. Bimalleolar fractures (25) were more common, followed by trimalleolar(13) and lateral malleolus fractures(5). Majority of the fractures belonged to Weber type B (29), while 14 were Weber type C. There were 30 (69.77%) patients with right malleolar fractures and 13 (30.23%) patients with left malleolar fractures. In our study, 25 (58.14%) patients sustained injury following road traffic accidents (RTAs), 13 (30.23%) sustained injury following fall and 5 (11.63%) patients sustained injury while playing sports. (Table 1)

Average follow-up duration in group A was 11.75 months and 8.47 months in group B (p=0.28). Functional outcome was assessed by using Baird and Jackson score. At the end of 6 months, in group A 5(25.0%) patients had excellent outcome, 10 (50.0%) had good results, 4 (20.0%) patients had fair outcome while 1 (5.0%) had poor results. At the end of 6 months, in Group B 7(30.4%) patients had excellent outcome, 12 (52.2%) had good results, 3 (13.0%) patients had fair outcome while 1 (4.3%) had poor results.(Table 2) Mean Ankle scores were 92 ± 5.33 and 92.59±5.64 in group A and group B respectively. There was no significant difference (p = 0.74) between the scores in both groups. (Figure1) The range of motion (plantar flexion-dorsiflexion) arc was more than 50° in 70% patients in group A and in 73.9% patients in group B. This difference was not statistically significant (p=0.165). There were no cases of intra operative complications in both the groups. In group A post-operative complications were noted to be 3 cases (15%) had superficial skin infections and 2 cases (10%) had Ankle stiffness. In Group B, 3 cases (13%) had superficial skin infections, 3 cases (13%) had Ankle stiffness and in 1 patient (4.3%) screw breakage was noted. The difference in the incidence of complications in both groups was not significant (p>0.05). No evidence of widening of the syndesmosis was noted on follow up radiographs even on commencing weight bearing. However osteolysis was observed around the syndesmotic screws in 18 of 23 patients with retained screws (group A) after weight bearing was commenced. No osteolytic changes were noted in the group B. Delayed diastasis or loss of reduction on follow up radiographs after screw removal was not appreciated in any of the patients from Group B. Whilst the accuracy of reduction can only be judjed by CT, it was not a primary objective of our study. No radiographic evidence of osteoarthritis in both the group of patients. This could be due to the relatively short period of follow-up in the study.

Discussion

Syndesmotic screw fixation is a proven and popular means of treatment for syndesmotic diastasis.(7)(14)(15) The current literature is of insufficient quality and lack of consensus exists to be able to draw definitive conclusions in context to removal of the syndesmotic screw. (16) A study by Schepers et al proposed favourable functional outcome of acute syndesmotic injuries treated with a syndesmotic screw. The functional outcome is influenced by patient and fracture characteristics.(17) Majority of ankle fractures occur in young adults which can be related to more outdoor activity.(18) The age distribution in present study is in accordance to the previous literature. 37 out of 43 patients were from age group 21 to 59 years in this study.

A survey by Bava and colleagues analysed the typical practice of surgeons in treatment of distal tibiofibular diastasis and also evaluated varied practice of size of the screw used , number of screws and number of cortices engaged. Their survey indicated that the use of 3.5-mm screws engaging 4 cortices routinely removed in the operating room at 3 months was most commonly practiced, 1 or 2 screws used. (14) In a review on operative aspects of syndesmotic injury by Michel P.J. and van den Bekerom et al. they reported that the larger screws caused more discomfort and the benefit of using 3.5 mm screws included a less prominent screw head.. This study found that quadricortical fixation using two screws was more rigid causing more stiffness in comparision three cortices engaged with a single syndesmotic screw. (5)

Removal of the syndesmotic screw prior to weight bearing has been advocated by many authors and is typically practiced.(19)(14) Higher rates of wound infection and complications have been related to syndesmotic screw removal. (13)(20) Secondarily there are financial costs incurred both by the institution and the patient for a second surgery and associated morbidity which may not be always necessary. This policy of routine removal thereby becomes an avoidable expenditure. A study by Tucker et al reflected that routine removal of the syndesmosis screw is not necessary. This is in keeping with several other studies in the reported literature.(12)(16) They stated that the screw should remain in situ, and removal should only be indicated in symptomatic patients with persistent hardware complaints.(21)

With the advent of bioabsorbable implants the whole debate pertaining to syndesmotic screw removal gets subdued. If bioabsorbable screws are used for transyndesmotic screw fixation, the need for a second removal surgery is obliviated. Several recent studies have documented no difference in any of the outcome measurements between the bioabsorbable screw and the conventional metal screw.(22)(23)(24) It is evident that bioabsorbable screws have advantages but incur higher costs.

We acknowledge that there are few limitations to this study. The allotment of the patients to the groups was not randomized. Patient factors, patient compliance and adherence to physiotherapy may have influenced the functional outcomes. We also accept that our study

population is small and relatively less duration of patient follow up. Lastly, this being a single centre study, the conclusions might not be generalizable to other surgical centres.

Conclusion

The difference between functional outcomes of patients in which screw was removed compared to those in which screw was retained was not significant (p=0.73). The presence of complications hampered the functional outcome in our study. We found no statistically significant difference in the incidence of complications between the two groups (p=0.55). Our study does not support routine removal of syndesmotic screws with regard to functional outcome. However it is acknowledged that the risk of syndesmotic screw breakage and failure exists if the screw is retained.

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