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SYNDESMOSIS FIXATION IN BIMALLEOLAR WEBER C ANKLE FRACTURES;

COMPARISON OF 3.5 AND 4.5-MM SCREWS

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ABSTRACT... sajidhfh@yahoo.co.uk. **Objective:** To study the influence of size of screws for syndesmosis fixation in bimalleolar Weber C ankle fracture. Design: A prospective randomised controlled clinical trial. **Place and Duration of Study:** Orthopaedic Department at Combined Military Hospital Malir. **Period:** From October 2002 to September 2005. **Patients and Methods:** 17 consecutive young active patients with Weber type C bimalleolar ankle fractures having syndesmotic injuries treated with open reduction and internal fixation were randomly allocated to two groups. In group I (n_1 = 9) 3.5mm small fragment and in group II (n_2=8) 4.5mm large fragment AO cortical screws were used for syndesmotic fixation. All patients were followed up for 12 months. Fracture healing or loss of reduction of syndesmosis was taken as the study end point. Hardware loosening or breakage and need for hardware removal were the outcome measures. Subjective and objective assessment with Olerud-Molander Ankle (OMA) scores[1], range of motion and radiographic criteria was done. **Results:** Loss of reduction was not seen in any patient in both groups. Comparing two groups using paired sample t-test, there was no difference in screw loosening and breakage (p values > 0.05). We did not find a statistically significant difference between range of motion (p = 1.08) and OMA score (p-value = 0.805). **Conclusion:** Size of the syndesmotic screw does not appear to influence healing of syndesmotic injury. Screw loosening, which can result in reduced range of ankle motion postoperatively was more common in smaller screw group though the difference was not significant.

Key words: Ankle Fractures, Syndesmotic injuries, Syndesmotic fixation, Screw size

INTRODUCTION

Syndesmosis disruption is most commonly associated with Weber type C ankle fractures. Syndesmosis instability may lead to talar displacement and deranged ankle mechanics[2]. The diagnosis of unstable syndesmosis injuries is based on preoperative radiographs, intraoperative stability testing, and sometimes on intraoperative fluoroscopy[3]. The use of both MRI and CT scanning has been reported as an adjunct to evaluating syndesmosis injury[4,5]. Exact

method of syndesmotic fixation remains a matter of debate[6]. Screws, K-wires, staples, nonabsorbale sutures, button-sutures and biodegradable implants all have been used with their proponents[7,8]. Technique of screw placement, tricortical or quadricortical fixation and whether or not the screws should be removed remain controversial subjects[9,10]. Types of screws studied have ranged from stainless steel, titanium and bone screws[11].

Great variability exists in methods of stabilization for syndesmotic disruptions of the ankle. Influence of size of the stainless steel screw has been studied earlier in cadaver models[12,13]. To our knowledge this has not been subjected to scientific research in ankle fracture patients with syndesmotic disruption. We hypothesized that syndesmotic screw fixation with 3.5-mm and 4.5-mm fully threaded cortical screws through four cortices would have similar strength and rate of mechanical failure. A prospective randomised controlled trial was conducted to prove or disprove this null hypothesis. All other factors were matched besides the screw size.

PATIENTS AND METHODS

A prospective randomised controlled clinical trial was conducted at Combined Military Hospital Malir from October 2002 to September 2005. Written informed consent was obtained from all patients. The study was approved by the medical ethics and scientific committee of the hospital.

17 patients were recruited for the trial (Table I). Young males, involved in competitive physical activities, having bimalleolar Weber C ankle fractures with syndesmotic disruption were included in the study. Those patients in whom preoperative radiographs and intraoperative clinical testing could not establish syndesmotic disruption were excluded from the study. All patients were admitted on the day of injury and their ages ranged from 21 to 35 years (mean 28). In 5 patients injury was open and 12 had closed injury. Syndesmotic injury was diagnosed on the basis of plain radiographs and preoperatively and confirmed intraoperative by cotton or hook test[14].

Table-I. Details of patients in our study

Patients details	Group I	Group II
No of patients	9	8
Age range	21-33 years	24-35 years
Open injuries	2	1
Closed injuries	7	7

More than 5mm clear space, the distance from the medial fibular border to the posterolateral border of the tibia measured 1cm above the joint was taken as a radiological evidence of syndesmotic injury on a preoperative anteroposterior radiograph. Syndesmotic injury was also diagnosed if the tibiofibular overlap, the distance from the medial fibular border to the anterolateral border of the tibia as measured 1cm above the joint was less than 6mm or approximately 40% of the fibular width[15]. This was confirmed intra-operatively using the conventional hook test done by grasping the stabilized fibula, through the lateral incision, with a hook or clamp and pulling it in the coronal or sagittal planes. If more than 3 or 4 mm of lateral displacement in coronal or more than 10-12 in sagittal planes occurs, syndesmotic disruption was confirmed[16,17]. Those patients in whom intra-operative testing could not confirm syndesmotic disruption were excluded from the study.

Patients were randomly divided into two groups using randomisation sequence generated by random table (Table I). All patients in both groups were operated with standard open reduction and internal fixation using a 3.5mm Dynamic Compression Plate with 3.5mm cortical screws on the lateral side and two 4mm screws for the medial malleolus fracture. Quadricortical fixation with a single fully threaded AO cortical screw in position mode inserted from the lateral side was done for each syndesmotic injury in both groups using either small or large fragment screws[9,10]. In group I small fragment 3.5mm screw was used and large fragment 4.5mm screw was used for the group II. The syndesmosis was anatomically reduced and held with provisional Kirschner wires or a reduction clamp before the syndesmotic screws were inserted. The screws were positioned 2 to

3 cm proximal to the tibial plafond, directed parallel to the joint surface, and angled 30 degrees anteriorly so that they were perpendicular to the tibiofibular joint.

Postoperatively all patients were treated non weight bearing for 10 weeks and gradual weight bearing allowed initially on crutches and in another two weeks time full weight bearing without crutches. All patients were discharged from the hospital after removal of sutures on 12th postoperative day. Follow up was done on monthly basis for 12 months in all patients. All patients were seen at 6, 10, and 16 weeks and then at 6, 9 and 12 months postoperatively in the outpatient department. At every follow up visit patients were assessed subjectively and objectively with OMA scores[1] range of motion assessment and two views (anteroposterior and lateral) roentgenography. Study outcome measures included healing of the fracture or loss of reduction, screw loosening and breakage. Loosening of the screw was diagnosed according to predefined criteria of osteolysis around the two third length of the syndesmotic screw seen on an anteroposterior radiograph[18].

STATISTICAL ANALYSIS

SPSS version 12.0 was used for data analysis. Statistical analysis was done using paired sample t-test and p-value was considered significant at the level of <0.05.

RESULTS

There were nine patients in group I, in whom 3.5mm screws were used (Table II). All were young active males, age range 21-33 years. Two patients had an open injury and seven had a closed fracture. Loss of reduction was not seen in any patient, screw loosening was seen in six patients and broken screw was not found in any patient in group I Mean OMA Score noted was 84 and reduced postoperative range of movement was seen in three out of nine patients in group I.

There were 8 patients in group II in whom 4.5mm screws were used (Table II). Loss of reduction was not seen in any patient, screw loosening was seen in four and screw breakage in one out of eight patients in group II. Mean OMA Score noted was 91 and range of motion was reduced postoperatively in two out of eight patients in group II. Range of motion improved in both groups by average 5-8 degrees when loose screws were removed after radiological healing of the fracture. Screw breakage was seen in one patient in group II, late after the fracture had united and he was weight bearing. This broken screw was later removed because it caused pain.

Table-II. Postoperative outcomes in our study

Outcome measures	Group I	Group II
Reduction in range of movement	3	2
OMA Score	84 (mean)	91(mean)
Loss of reduction	-	-
Screw loosening	6	4
Screw breakage	-	1

On plain radiography all patients in both groups showed complete healing in 14-18 weeks time. We did not find a statistically significant difference in screw loosening and breakage (p values > 0.05). Differences noted between the two groups as regards the postoperative the range of motion (p = 1.08) and OMA score (p-value = 0.805) were also not significant.

DISCUSSION

Syndesmotic screws are a subject of considerable debate. Some have challenged even the very concept of the need of syndesmotic screw fixation[19,20]. Techniques of fixation, types of implants and the need for hardware removal are all controversial matters[16,21]. Weight bearing with the screw in place has been reported to lead to screw breakage in a few patients but this is relatively unusual and in our study this happened only in one patient in group II[22]. There do not appear to be significant adverse clinical consequences of broken screws. Many more screws loosen than break, and evidence of screw loosening is seen on radiographs as bony lysis around the screw in both the fibula and the tibia[18]. If tricortical fixation is used, the screw usually loosens rather than breaks and may not disrupt normal ankle mechanics. If fixation through four cortices is used, both ends of the screw can be removed easily if breakage occurs. In our study quadricortical screw fixation was done using single

3.5mm fully threaded cortical screws in one group and 4.5 mm screws were used in group II. Lysis was seen around these syndesmosis screws in 10 patients (six in group I and four in group II), the difference being not significant.

Loos of reduction presents a bigger problem than screw loosening or breakage, as it would entail a second operation to fix the syndesmosis again[23]. However, none of our patients developed loss of reduction in either group in our study. The timing of screw removal is important. If weight bearing is delayed until the screw is removed, there is a reason to consider removing it early, at 8 weeks if possible. However, late mortise displacement from recurrent diastasis of the syndesmosis after screw removal has been reported[24]. Our protocol was to leave the screws in place indefinitely. Hardware is removed only after complete fracture healing in case of loose or broken screws. We removed three screws in group I for loosening in order to give chance for improvement in the range of motion, which was noted later (average 5-8 degrees). Three screws were removed from patients in group II, two for loosening and one for breakage. Loose screws removal led to improved range of motion by 8 degrees in both these patients. Broken screw was removed because it was the cause of pain and anxiety for the patient.

CONCLUSION

The start point in our study was the null hypothesis that no difference exists between the two types of screws used for syndesmotic fixation. We were not able to defy this. We conclude that the syndesmosis can be fixed either with 3.5 or 4.5mm AO cortical screws without difference in the outcomes.

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