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"A PROSPECTIVE COMPARATIVE STUDY OF FUNCTIONAL OUTCOME OF SYNDESMOTIC SCREW FIXATION IN ANKLE FRACTURES WITH THREE AND FOUR CORTEX FIXATION"

Orthopaedics

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ABSTRACT

Aim : To compare functional outcome between three and four cortices syndesmotic screw fixation for management of ankle fractures.
Study Design : A prospective, time bound, hospital based, comparative study. Cases satisfying the inclusion criteria admitted in District hospital, Tumakuru during the study period of 2019- 2021 have been included. Patients were followed up for a period of 1 year at intervals of 6 weeks, 3 months, 6 months, and 1 year and evaluated functionally with Olerud Molander Ankle Score.
Study Intervention : 72 patients with ankle fracture have been treated operatively by syndesmotic screw fixation either tricortically or quadricortically with either 3.5-mm or 4.5-mm cortical screws. The patients were alternately selected for three and four cortex fixation.
Results : Males constituted majority of the cases. Supination-external rotation was the most common mechanism of injury. Most of the cases were Weber type-B injuries. Road traffic accidents were the most common mode of injury. The mean age of the cases was 39.34. Most of the cases were bimalleolar fractures and only 3 patients had trimalleolar fractures. 47 patients out of 72 had good to excellent outcome and 25 had fair to poor outcome. Average score of the patients was 78.94 ± 9.30 out of a total of 100. Average score for 3-cortex fixation patients was 78.33±10.00 and average score for 4- cortex fixation patients was 79.17 ± 8.82 .
Conclusion : The present study indicates that 4-cortex fixation has slightly better functional outcome than 3-cortex fixation but it had no statistical significance (p value = 0.709).

KEYWORDS

INTRODUCTION:

Ankle fractures are quite common and one of the most frequently treated injuries. Without adequate treatment, injuries of the syndesmosis of the ankle whether isolated or in combination with a fracture can result in syndesmotic instability. In the long term this can cause degenerative changes. To prevent these sequelae, adequate reduction and stabilization of the syndesmosis is required.

There are some controversies regarding the foot position, type of screw to be inserted, number of cortices to be engaged and screw removal. There is no universal agreement on which particular injuries/fractures need syndesmotic screws, or on how many cortices should be engaged[6,23,40].

The present study was done in government district hospital to assess functional outcome after treating ankle syndesmotic injuries with syndesmotic cortical screw fixation with both three cortex and four cortex fixation and comparing functional outcome between the two types of fixation.

MATERIALS AND METHODS

The patients who presented to inpatient department with history of RTA and also with history of accidental falls leading to twisting injury to ankle and satisfying all the inclusion and exclusion criteria were included in the study. A total of 72 patients were included who had sustained ankle fractures associated with distal syndesmotic injuries. Thorough history taking followed by orthopaedic clinical examination and radiological imaging was done to confirm primary diagnosis for patients to be included in the study. These patients were initially managed with below knee POP slab application with sufficient padding and with ankle in neutral flexion position and limb elevation and were subjected to surgical work-up.

Syndesmotic injuries were assessed by performing the following specific tests in the casualty-

1. Cotton test
2. External rotation stress test
3. Fibular translation test
4. Squeeze test
5. Dorsiflexion compression test
6. Heel thump test.

The distal fibular fracture was addressed through a standard lateral approach. The incision was taken centrally over the palpable distal fibula at the level of the fracture. Soft tissues interposing between the fracture fragments were cleared. Displaced or unstable infrasyn desmotic (Weber A) fractures were fixed with either an intramedullary screw or tension band wiring. For larger fragments, a 1/3rd tubular plate was used.Transsyndesmotic (Weber B) injuries were fixed with one or two lag screws when needed along with a lateral neutralization plate. Suprasyndesmotic (Weber C) fractures were also fixed with a lateral plate.

After fixation of all bony injuries, syndesmotic stability was tested with a hook that pulls the fibula laterally and posteriorly .In cases with TFCS widening of ≥ 2 mm, the fibula was reduced into the tibial notch with a curved point-to-point reduction (Weber) clamp under direct vision and palpation of the anterior tibial and fibular rim. A distal tibiofibular syndesmotic screw was introduced 1–4 cm above the joint at an angle of about 30° anteriorly which corresponds to the axis between the tip of the lateral and medial malleolus. The syndesmotic screw was inserted into only lateral tibial cortex in half of the patients(3-cortex fixation) and into both the distal tibial cortices (4-cortex fixation) in the other half patients.

Fluoroscopic image to confirm placement of syndesmotic screw

The medial malleolus was approached via a direct epimalleolar medial incision that is slightly curved anteriorly in its distal end. The fracture was freed from intervening periosteum and small fragments. Fixation of the medial malleous was achieved with either malleolar screws or tension band wiring depending on bone quality and fragment size.

Follow-up X-rays were taken and functional outcome was assessed with the help of Olerud – Molander Ankle Score(OMAS).

Post-operative Radiography showing a) 3-cotical fixation and b)4-cortical fixation

The data was entered in Excel spread sheet. Descriptive statistical analysis was carried out by mean and standard deviation for quantitative variables and frequency and percentages for categorical variables. The association between categorical variables was analysed by using Chi square test. Functional outcome between the two groups was measured by applying Student's T–Test. Statistical software SPSS version-20 was used for the analysis.

RESULTS

Mean age of all the patients was 39.34 (range 20-60 years). Majority of the patients were male (79.16%). 75% of our study patients sustained ankle fractures after road traffic accidents and rest were due to falls. Majority of falls were sustained by women with osteoporotic bones. About 65% of our study patients had right sided ankle fractures. 70.8 % of the patients had supination –external rotation(SER) injury, 23.6% had pronation-external rotation(PER) injury and rest 5.6% patients had pronation-abduction(PAB) injuries in the present study. 69.44% patients had Weber type 'B' fractures and 30.56% patients had Weber type 'C' injuries.

According to OMA scoring system, out of 72 patients in this study, at the end of 1 year, 15 (20.8%) had excellent outcome, 32 (44.4%) had good outcome , 14(19.4%) had fair outcome and 11 (15.2%) had poor outcomes. Among ≤30 year old patients 93% had good/ excellent outcome, 79% had good/excellent outcome in the 31-40 age group, 46.67% had good/excellent outcome in the 4th decade and only 23% good/ excellent outcome inpatients in 51-60 year age group.

Weber Type C injuries had slightly better outcome than Type B injuries but was not statistically significant (p-value = 0.156). Supination-External rotation injuries had 59% patients with good/excellent outcome, Pronation – External rotation Injuries had 76% Good/excellent outcome , and 4 of the Pronation –Abduction injuries had 100% Good/Excellent outcome.

The below table shows the functional outcomes of the two groups in terms of percentages.

3 – Cortex Fixation		4 – Cortex Fixation	
Excellent	19.4%	Excellent	22.2%
Good	41.7%	Good	47.2%
Fair	22.2%	Fair	16.7%
Poor	16.7%	Poor	13.9%

Average OMA score of the patients under study was 78.94 ± 9.30 . Average score for 3- cortex fixation patients was 78.33±10.00 and average score for 4- cortex fixation patients was 79.17 ± 8.82 . Hence the present study indicates that 4-cortex fixation has slightly better functional outcome than 3-cortex fixation but it had no statistical significance (p value = 0.709) .

DISCUSSION

The general principle is to restore the ankle joint congruency and maintain the distal tibiofibular syndesmostic stability. Ideally, the implant should stabilize the syndesmosis but allow physiologic micro-motion and early mobilization. Isolated malleolar fractures that are displaced more than 2 mm or unstable on plain imaging or stress testing/weight bearing and all bimalleolar and trimalleolar fractures should be treated operatively. According to biomechanical and clinical studies, any fibular displacement of 2 mm or more compared to the uninjured side carries the risk of posttraumatic arthritis.42 The timing of definitive surgical treatment depends mainly on the soft-tissue findings. Immediate, definitive surgery is possible only if the soft tissues are not critically vulnerable; this is usually true only for a few hours after the trauma.32

The syndesmosis should also be tested for injury. Many surgeons assess the need for a diastasis screw intra-operatively by pulling laterally on the fibula with a bone hook (The Hook test) .

Widening of the syndesmosis by more than 2 mm on the mortise radiograph suggests the need for a screw.18

The present study was done to assess the functional outcome of the patients with ankle fractures associated with syndesmotic diastasis treated with syndesmotic screw fixation through 3-cortex fixation and 4-cortex fixation and comparison was done between the two groups of patients by means of Olerud-Molander Subjective Ankle Score. The present study indicates that 4-cortex fixation has slightly better functional outcome than 3-cortex fixation but it had no statistical significance (p value = 0.709) . In the classic study done by Per Høiness et al in 2004 , at 1-year follow-up, the difference in the functional score between the groups was 5.5 points in favor of the tricortical group. However, at 1 year, there were no statistical differences between the 2 groups in functional score, pain, and dorsiflexion. In a more recent study by Annette Wikerøy et al OMA score was 82.8 (19.9) for 4-cortex group and for 3-cortex group it was 82.3 (19.4) and the differences were also not statistically significant.

Among the individual parameters in the OMA score, patients in the present study had slightly better scores for pain and stiffness among the 3- cortex group than 4-cortex group at 1-year follow-up but these differences were not statistically significant. All other subjective parameters in the OMA score had slightly better scores for 4- cortex group but these were not statistically significant.

Annechien Beumer et al conducted a study on cadaver models and found that no statistically significant difference was found between the three- or four-cortical fixation. Regarding fixation the methods are equal, and thus the surgeon may choose whichever is convenient. The advantage of four-cortical fixation is that screw removal after screw breakage is a much easier via a small window in the medial tibial cortex. In another study done on fresh frozen ankle specimens by Markolf et al , there were no significant differences in forces acting on the distal fibula or displacements of the distal fibula between tricortical or quadricortical techniques.

Brad Weening and Mohit Bhandari in 2005 suggested that the single most important factor influencing "clinically important" differences in functional outcome is anatomic reduction of the syndesmosis irrespective of the technical aspects of the syndesmotic screw insertion. R.Dattani et al also mentioned in their review article that the single most important predictor of good functional outcome is accurate reduction of the syndesmosis.

In the study conducted by N. Hamid et al they reported that the number of cortices engaged did not correlate with screw breakage or clinical outcome. In the present study 5 patients had syndesmotic screw breakage at the time of 1 year follow up, and among them 4 had 4-cortex fixation and one patient had 3-cortex fixation. N.Hamid et al mentioned that patients with screw breakage paradoxically had the best clinical outcome.

Nousiainen et al reported that no difference was seen between 3 or 4 cortices, it is the surgeon's choice in determining how many cortices of fixation are achieved. Angelo del Buono et al in their article mentioned that there appears to be no clinical difference when using 4-cortex or 3-cortex screws, but, biomechanically, two 3-cortexl 3.5-mm screws are more stable than one screw and are recommended in heavier individuals or in highly unstable injuries. Even though two 3-cortex screws provide secure fixation, they are less secure than 4-cortex screws. On the other hand, 4-cortex screws are more likely to break because of the rigidity of the fixation and should definitely be removed prior to weight-bearing. In the current study majority of screw breakages occurred in the 4-cortex group. David Porter et al also mentioned that in cases using syndesmotic screws, no study has found

statistical differences between 4-cortical and 3-cortical screws or the number of screws used. Romero et al in their review article on management of syndesmotic injuries of the ankle mentioned that quadricortical fixation with two 4.5-mm screws is preferred, as this technique is more rigid, with less occurrence of syndesmotic widening during healing, and easier removal if screw failure occurs.

CONCLUSION

There was slight difference in outcomes between the two types of syndesmotic screw fixation in favor of 4-cortex fixation but it was not statistically significant and accurate and stable reduction of the syndesmosis is more important to prevent long term complications.

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