Operative Outcome of Bimalleolar Fractures

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ABSTRACT

Background

Ankle fractures are common injury occurring due to low energy trauma. Unstable ankle fractures are usually treated with operative management.

Objective

To find out demographic and the relationship between various clinical variables and outcome of operative treatment in ankle fractures in patient who underwent operative treatment for bimalleolar ankle fractures.

Method

A retrospective observational study of 32 patients who underwent operative treatment of bimalleolar ankle fracture in between January 2012 and December 2015 at Dhulikhel Hospital, Kathmandu University Hospital was performed. Skeletally mature individual of age greater than 16 years with bimalleolar ankle fractures operated within two weeks of injury were included in the study. Operating surgeon chose the type of surgery and implants required for the patient. Post operatively patients were kept in non-weight bearing for six weeks.

Result

The average age of the patients was 36.72 ± 19.97 years. The most common cause for the injury was twisted ankle. The mean follow up period of the patients was 20.94 ± 16.32 months. The most common fracture type was Weber B (supination external rotation injury). Most common technique for fixation for medial malleolus fracture was open reduction and modified tension band. Most of the lateral malleolus fractures were treated with open reduction and fixation with reconstruction plate. Six cases were treated with syndesmotic screws. Most of the patients had excellent AOFAS score with mean score of 90.56 ± 10.92 out of maximum 100. Average pain score was 32.81 ± 36.34 out of 40, average function score was 47.81 ± 6.05 out of 50 and average alignment score was 9.94 ± 0.35 out of 10.

Conclusion

The outcome of surgically treated bimalleolar ankle fractures was excellent for our patients. The fracture patterns and requirement of syndesmotic screw failed to show any significance when comparing the outcome.

KEY WORDS

Ankle, American Orthopedic Foot and Ankle Society Score, Bimalleolar fractures

INTRODUCTION

Ankle fractures are classified using two major classifications, AO (Danis-Weber) and Lauge Hansen Classification, which help determine the mode of injury and also treatment of the fracture.[1] Ankle stability also determines the treatment; stable ankle fractures are treated non-operatively and unstable ones are operated.[2,3] There is need of near anatomical reduction of bony structures and restoration of ligaments as there is narrow threshold for error in treatment of these fractures.[4] Studies have shown that outcomes of these fractures depend on restoration of anatomy than form of treatment.[3,5,6]

There are various choices for both medial and lateral malleoli fractures, lateral plating, anti-glide plating, screws, tension band wiring, K wire fixation, staples, intramedullary rush nails are few commonly used ones.[7-10] Some authors have shown bio-absorbable implants to be better for the fixation of these fractures.[11] There has been debate for the optimal timing of the surgery, but there is lack of high quality evidence to support early or late surgery.[2] Also rehabilitation protocols are debated for early motion and weight bearing, literature shows better outcome with early motion but long term outcome of early weight bearing is dubious.[12-18]

Although we have been used various methods for management of bimalleolar ankle fractures at our setting, we have not evaluated the radiological and functional outcome of these patients. We have tried to find out the relationship between various clinical variables and outcome of operative treatment in ankle fracture in patient who underwent operative treatment for bimalleolar ankle fractures.

METHODS

A retrospective observational study of 32 patients who underwent operative treatment of bimalleolar ankle fracture during the four years period of January 2012 to December 2015 at Dhulikhel Hospital, Kathmandu University Hospital was performed. All patients were evaluated and operated by orthopaedic surgeons of the Department of Orthopaedics and Traumatology at the hospital.

Skeletally mature individual of age greater than 16 years with bimalleolar ankle fractures operated within two weeks of injury and with minimum follow up period of 6 months were included in the study. Open fractures, trimalleolar fractures, unimalleolar fractures, associated pillion fractures, osteochondral fractures, patient with previous history of ankle fractures were excluded from the study. Patient who underwent conservative management or not available for final follow up and AOFAS scoring were also excluded. The patients who had their implants removed were also included and reason for removal noted.

Demographic data from patient records were obtained. Type of operation, implant used, syndesmotic screw fixation, hardware removal, complications and American Orthopedic Foot and Ankle Society (AOFAS) score at final follow up were also noted.[19] The serial radiographs from the initial presentation to the final follow up were analyzed for Lauge Hansen and AO Classification, time for radiological union, alignment, osteoarthritic changes and hardware loosening.

Operating surgeon chose the type of surgery and implants required for the patient. Requirement of syndesmotic screw was determined intra operatively using hook test for all patients. Whenever it was used only three cortices were purchased and removed at eight weeks. Post operatively patients were kept in non-weight bearing for six weeks.

The data acquired was entered in MS Excel 2010 and was analysed using SPSS v 20. Frequency tables and descriptive statistics were presented for all variables. Chi square test, student's t-test and ANOVA test were used to compare between categorical variables. Statistical significance for the tests was set at 5%.

RESULTS

Of the 32 patients, 14 were female and 18 were male. The average age of the patients was 36.72±19.97 years. The average age was significant different between male and the female patient. (Male 26.12±12.56 years, Female 50.35±19.46 years)

The most common cause for the injury was twisted ankle accounting for half of the patients, followed by road traffic accident, (10) fall from height (3) and fall on level ground (3). The mean follow up period of the patients was 20.94±16.32 months.

All the fractures were classified according to Weber and Lauge Hansen Classification; the most common fracture type was Weber B (supination external rotation injury) accounting for 62.50% of all fractures. (Table), followed by Weber C 25% (pronation abduction 15.6%, pronation external rotation 9.4%) and supination adduction 12.5%.

There were various choices of implant for operation for both malleoli. Most common technique for fixation for medial malleolus fracture was open reduction and modified tension band wiring with Kirschner wire (K-wire) and stainless steel wires in 27 cases (84.38%), followed by open reduction and canulated cancellous screw and tension band wire fixation in three cases (9.38%) and closed reduction and malleolar screw fixation in two cases (6.25%).

As for the lateral malleolus, most of the cases were treated with open reduction and fixation with reconstruction plate. Reconstruction plate was used in neutralization mode with lag screws in 15 cases (46.87%), only reconstruction plate

was used in 10 cases (31.25%), reconstruction plate with stainless steel wire cerclage was done in two cases (6.25%). Four cases were treated with tension band wiring with K-wire and SS wire and one of the cases was treated with closed reduction and rush pin fixation.

After the fixation of the lateral malleolus hook test was done in all cases that was opened to see for the status of syndesmotic joint. The test was interpreted by the surgeon for the requirement of syndesmotic screws. Six cases (18.75%) were treated with syndesmotic screws. All the cases had syndesmotic screw removed at eight weeks.

Surgery for removal of the implants was done in 11 cases (34.37%). The most common cause for implant removal was the choice of the patient in five patients, followed by pain in the lateral aspect of ankle in four patients, deep infection in one and prominence of implant over fibula in one. The patient with deep infection was treated with removal of fibular implant, debridement, a course of intravenous antibiotics and below knee cast with window for dressing for 4 weeks.

Early complications were seen in five cases, and none of the cases had late infection. Blister formation was seen in two cases, deep infection in one and superficial infection in two of the cases. No case of clinically presenting deep vein thrombosis was seen and none of the cases treated had non-union.

AOFAS score was used to evaluate the outcome in all the patients. Most of the patients had excellent AOFAS score with mean score of 90.56±10.92 out of maximum 100. Average pain score was 32.81±36.34 out of 40, average function score was 47.81±6.05 out of 50 and average alignment score was 9.94±0.35 out of 10. There was no significant difference in the AOFAS score between the fracture types according to both classifications (table 1).

Table 1. AOFAS score and fracture type.

Weber type	AOFAS score	N	P	Lauge Hansen Type	AOFAS Score	N	P
A	90.25±6.70	4	0.61	PA	87.40±9.32	5	0.73
B	90.50±12.54	20		PER	96.67±5.77	3	
C	90.88±9.32	8		SA	90.25±6.70	4	
				SER	90.50±12.54	20	

DISCUSSION

The literatures quotes age of incidence of ankle fractures between 41–51 years almost a similar mean age of 36.72±19.97 years in our study.[1,2,20-23] Literatures suggest that there is significantly different age for incidence between male and female patients, with younger male between 15–42 years and older female > 50 years more affected, which was also seen in our case.[1,24-26] The cause of this difference between is not clearly answered, but they have stated that higher rate in older female is less likely a fragility fracture.[1,27] A prospective cohort of healthy women and women sustaining ankle injury found no difference between their bone mineral densities.[27] Other studies have also failed to show increase in incidence with increasing age, which is in contrast to pattern of fragility fractures.[24,25,28,29] The numbers of treated patients are fairly low to derive a significant power to study such correlation in our study.

Open ankle fractures occur in just 2% of ankle fractures.[1] These ankle fractures in not independent events but are part of spectrum with increasing force of injury causing more damage, which forms the basis for Lauge Hansen Classification.[1,26,30] Most of studies on ankle fractures hence include all or some specific type of fractures described by Lauge Hansen Classification rather than going for more traditional formal of uni-, bi-, or tri-malleolar fractures. However the decision for surgery is not always decided as per the classification.

Wide varieties of treatment options are available for the ankle fracture depending upon stability of ankle.[1,2,31,32] Non operative treatments with functional braces and plasters have been studied in stable supination injuries, which show no difference of function at the end of six months between the groups.[33] The operative treatment of ankle fractures is shown have higher union rates, faster attainment of final range of motion and higher patient satisfaction rate but cast patient have significantly low cost of treatment and hospital stay.[2,32] Studies have failed to show any differences in outcome between the early and late treatment of the fractures.[34-36]

Various operative techniques have also been studied to see the difference in their outcomes.[1,2] Studies have shown that the most stable fixation methods include compression lag screws or figure-of-eight tension band wiring.[1,2] Different plating techniques, namely anti-glide and lateral plating or semi tubular plates, AO plates and mini fragment plates have no significant advantages on other, and depend upon the choice of the surgeon upon which one he favors.[1,37,38] Study has failed to show any statistical superiority of Rush pin over the AO plates.[39] The tension band technique in the treatment of lateral malleolar fractures is a cheap and clinically acceptable treatment alternative with comparable outcome to lateral plating in Weber type A and B fractures.[40] Internal splinting of K wires showed more pain while walking, less joint movement, more likely for ankylosed joints, and more likely for deep infection than rigid internal fixation, although none of the results were of statistical significance.[41] The treatment for medial malleolus is mostly open reduction and rigid fixation with either figure of eight tension band wiring or screws or closed reduction and screw fixation.[42] One study comparing standard ORIF with percutaneous screw fixation of medial malleolar fracture showed increased risk of an unhealed fracture

at eight weeks in percutaneous fixation likely due to a combination of soft tissue interposition within the fracture site and inadequate fluoroscopic reliability, leading to poor anatomic reduction and inaccurate fixation.[42] Significantly lower rates of re-operation and lower complications were observed when malleolar fractures are treated with bio-absorbable implants as compared to more traditional treatments.[43] The use of arthroscopy in the setting of ankle fractures is a upcoming field which provides safe and reliable means of diagnosis and intervention of intra-articular pathology associated with ankle fractures.[44]

The maintenance of syndesmosis reduction are essential when treating ankle fractures with accompanying syndesmosis injuries and syndesmotic screw is the most popular fixation method to achieve this. But, studies suggest that syndesmosis malreduction can occur up to more than 50% from the screw fixation. The development of new systems like Flexible Tight Rope (Arthrex, Naples, FL, USA) suture-button device for physiologic stabilisation of the ankle mortise has seen increased use rapidly.[1] But study has failed to show significant difference in the treatment methods in regard to malreduction, ankle joint osteoarthritis or functional outcome.[45] Whether or not the syndesmosis screw should be removed prior to weight-bearing is still debated, there is paucity in randomized controlled trials on the absolute need for removal of the syndesmotic screw. However, current literature suggests that it might be reserved for intact screws that cause hardware irritation or reduced range of motion after 4-6 months.[32] But our experiences with broken syndesmotic screws after patients start to bear weight have prompted us for routine removal of the screws at eight weeks. We are however aware that secondary procedures to remove hardware adds to the cost and expose the patient to the risk of complications.

The theoretical ideal outcome score would contain both subjective and objective components; however, a subjective score is less time consuming and has better patient compliance. The AOFAS score has both components, but it has been criticized for its mathematical shortcomings and the reliability of the objective component has yet to be proven.[19]

The reported rates of implant removal are 17-90% and there is little information in the literature regarding the indications for the removal of hardware after ORIF for ankle fractures. However, articles on general removal of hardware points routine removal to be the main reason followed by pain.[2,32,46] We do not perform routine removal of hardware except for syndesmotic screws. Patients' choice and pain were main cause for the hardware removal for us.

The study has several limitations. The study population was identified retrospectively, many variables were collected by a review of medical records, which limits the number, quality, and completeness of variables that can be collected. The chart and radiograph reviews were performed only by one researcher, and the interrater reliability and validity for the data extracted from the charts were not assessed. Information on the patients' postoperative rehabilitation or use of physiotherapy after the surgery was not available. Patients with high energy trauma and open fractures, representing patients with severe or complicated were not included in this study. We did not perform a comparative study with another technique or method of treatment.

CONCLUSION

The outcome of surgically treated bimalleolar ankle fractures was excellent for our patients. There appears to be a bimodal distribution of bimalleolar ankle fractures affecting young male and older female population. The fracture patterns failed to show any significance when comparing the outcome.

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