Section: Orthopaedics

Original Research Article

A STUDY ON RADIOLOGICAL AND FUNCTIONAL OUTCOME OF SURGICALLY MANAGED POSTERIOR MALLEOLUS FRACTURES IN ADULT ANKLE INJURIES

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ABSTRACT

Background: Aim: This research is aimed at the measurement of the functional and radiological out-come of the subjects surgically treated for posterior malleolus fracture.

Materials and Methods: The present study includes Adults (age group 18-60 years old) admitted with ankle fractures involving posterior malleolus who have undergone surgical management will be recruited into the study. King George Hospital, Visakhapatnam, AP.

Results: In the present study, 40 subjects were added up in to the study, of which 27 being male & 13 female patients. Among the 40 patients 31 sustained injury due to a road traffic accident and 9 due to an accidental fall from height. All the patients were initially investigated with x-rays and CT scans and classified according to Bartonicek classification. All patients were treated surgically & the posterior-malleolus was surgically treated with a buttress-plate or a CC-screw applied either anterior-to-posterior or posterior-to-anterior fashion. The subject reassessment was performed at 4th wk, 6th wk, 12th wk. Also, at 6 months and were assessed clinically by AOFAS score and radiologically using Kristenson criteria. l According to Kristenson grading 32 patients had good out come and 8 patients had fair outcome. According to AOSAF grading 12 patients had excellent out-come while 6 patients had fair outcome and 22 had good out-come functionally. 6 patients had post-operative stiffness while 4 had hardware related soft tissue irritation,2 had deep infection and 2 patients had wound dehiscence.

Conclusion: In conclusion, the patients treated operatively for posterior malleolus fracture had excellent to good radiological and functional out-come. The patients who had some degree of ankle stiffness were either due to poor mobilization and physiotherapy either due to deep infection or hardware irritation.

Keywords: Malleolus fracture, AOSAF, Radiological, Kristenson criteria, Functional outcome.

INTRODUCTION

The fractures of the ankle are one of the most common fractures which stand at about 3.92% the fractures seen in the adults.[1] The fractures of the Posterior-malleolus are seen to be associated with up-to 7%–44% of all adult ankle-fractures.[2,3] This injury is seen as a result of external-rotation of talus in the tibial-plafond when the foot is either in a position of pronation or supination.

In fractures of the ankle joint, the treating surgeon often fixes the lateral-malleolus fracture with a plate and the medial-malleolus with one or two cc screws which is one of the simplest ways of fixing these fractures and when if the posterior-malleolus is small is usually left unfixed.

Posterior-Inferior Tibio-Fibular Ligament (PITFL) is considered to be the core structure when it comes to the ankle syndesmosis stability.[4,5,6,7] The stability of the tibiofibular joint syndesmosis could be disrupted by a posterior-malleolus fracture .8 The posterior ligaments of the syndesmosis usually stays attached to the fractured fragment of the posterior malleolus and thus leading to the syndesmotic instability.

Fixing the lateral-malleolus as well as the posterior-malleolus leads to the restoration of the ligamentous tension of the posterior components of the syndesmosis.[9] The aim of the surgical-management is restoration of normal native anatomy and thus attain improved functional outcomes.[10]

The quality-of-life could be significantly influenced by post-traumatic osteoarthritis particularly for young individuals because of the pain and impaired function post the fixation of fracture.[11] The existence of a posterior-malleolar (PM) fracture is a negative prognostic- factor in ankle fractures.

After numerous studies showing poor prognosis of ankle injuries when associated with a posterior-malleolus fracture, the ideal management strategy is still a topic of debate.

With conservative management of the posterior malleolus fractures often showing poor results with syndesmotic instability, arthritis and chronic pain in the patients, the surgical fixation on posterior malleolus is gaining importance by each passing day. This study has been conducted for assessment of the clinical as well as the functional outcome of ankle-fractures with a Posterior-Malleolus fracture component in patients presenting at the OPD and ER of our institute.

Aim

1. To assess the Radiological as well as the Functional outcomes of surgically managed posterior-malleolus fractures in adult ankle-injuries.

Objectives

- Evaluation of the functional outcomes in operated ankle-fractures that has posterior-malleolus involvement using American-Orthopedic Foot-and-Ankle-Society(AOFAS) score.
- Evaluation of the Radiological outcomes in operated ankle fractures with posterior malleolus involvement using Kristenson criteria on post-operative radiographs.
- Patient will be followed up on the 4th week,6th week ,3rd month and 6th months.

MATERIAL AND METHODS

A detailed, relevant history is taken from all patients presenting to the emergency room with ankle injury associated with posterior malleolus fracture. Diagnosis is confirmed by X-ray and further evaluation will be done with CT scan. Lauge Hansen-classification system is used to classify the injury and Posterior-Malleolus Fracture as per Haraguchi and Bartonicek classification. After undergoing pre-op investigations fractures are managed following AO principles.

Study Population & Setting

Adults (age group 18-60 years old) admitted with ankle fractures involving posterior malleolus who have undergone surgical management will be recruited into the study. King George Hospital, Visakhapatnam, AP.

Study Duration

October 2022 to August 2023

Inclusion-Criteria

1. Subjects with ankle fracture involving Posterior malleolus.
2. Adults (age 18-60 years)
3. Patients prepared/willing to undergo proposed surgical therapy
4. Those who are willing to be included in the present study.

Exclusion-Criteria

1. Subjects associated with multiple compound fractures apart from posterior malleolus fracture
2. Children (<18 years) and elders (>60 years) will be excluded. 3.Medically unfit for surgery
3. Patients not willing for surgery and follow up.

Methodology

Once patient is admitted for surgical procedure after signing informed consent. Their medical history, socio demographic profile, radiographic evaluations were carried out. The fracture is classified as per the guidelines. Depending on the inclusion and exclusion criteria patients are recruited for surgery.

Table 1: Indications of surgery

We operated if one of the following criteria were met.
1. Bartonicek at al morphological classification type 2-5
2. Fragment size > 25 - 33%
3. Displacement > 2 mm
4.Ankle instability with concomitant syndesmotic injury.

Table 2: Post-Operative Protocol

S.no	Day	Management
1.	DAY 0	Post-operative IV Antibiotics, Analgesics, IVFluids Below knee plaster support and limb elevationVitals monitoring
2.	DAY 1	Continue antibiotics and analgesicsPost op x-rays Active toes and ankle movements exercise
3.	DAY 2	Drain removal and first wound inspection anddressing

4.	DAY 3	Active ankle dorsiflexion and plantar flexionstarted
5.	DAY 5	IV antibiotics will be stopped and switch overto oral antibiotics Second wound dressing
6.	DAY 12	Patient discharged on POD 12 after suture removal then reviewed in OP after 2 weeksand advised to continue ankle movement exercise. Follow up x-rays on 4th, 6th ,12th weeks weredone. Advised Physiotherapy for ankle movementexercises. Weight bearing will be evaluated depending upon both clinical and radiological evaluation.

Table 3: Radiological Assessment by X-ray

Kristenson Criteria	Good	Fair	Poor
1	Talus is correctly placed under the ankle mortise.	Talus is correctlyplaced	Talus is not correctly positioned
2	Less than 2 mm displacement ofmedial Malleolus Fracture	Medial malleolus anterior or posterior displacement of 2-5mm.	Medial malleolus displacement>5mm
3	Less than 2 mm displacement of Posterior/Lateral malleolus	Lateral malleolus/Posterior malleolus Gap 2-5mm	Lateral malleolus/Posterior malleolus Gap>5mm

Table 4: Functional assessment with AOFAS

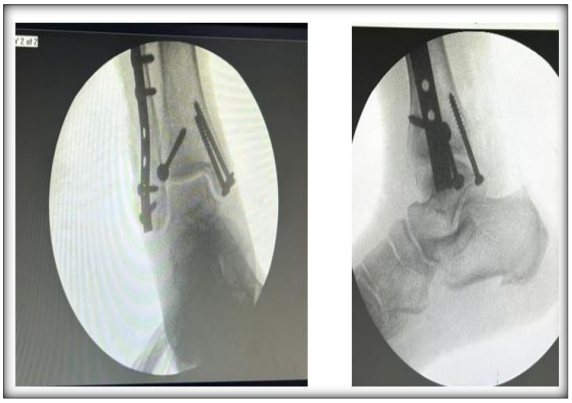
	RATING	SCORES
1.	EXCELLENT	95-100
2.	GOOD	75-94
3.	FAIR	51-74
4.	POOR	0-50

RESULTS

CASE - I

PRE-OP XRAY

INTRA-OP IMAGES



POST-OP XRAY

INCIDENCE OF SEX

In this study 40 participating patients have been assessed from October 2022 and up-to August of 2023. 27 of those subjects are male & 13 are female. [Table 1]

Incidence of Age

2rd decade to the 4th decade patients make the most of the subjects in this study
which is as much as 62.5 percent. [Table 2]

ANALYSIS OF INJURY MODE

Road traffic accidents, which are around 77% percentage are the most common mode of injury in this study. [Table 3]

ANALYSIS OF INJURY SIDE

There has been a right sided predominance in this study with up-to 60% of patients being injured on right side and up-to 40% patients injured on left side. [Table 4]

CLASSIFICATION OF INJURY

BARTONICEK classification has been used to classify the injuries in this study. [Table 5]

RADIOLOGICAL ASSESSMENT OF OUTCOME

Basing on Kristenson criteria of radiological assessment for ankle injury fixation the out-come is graded as following. [Table 6]

FUNCTIONAL ASSESSMENT OF OUTCOME

Basing on AOFAS criteria of functional assessment for ankle the out-come is graded as following. [Table 7]

Table 1: Incidence of Sex

SEX	FREQUENCY	PERCENTAGE
Male	27	67.5
Female	13	32.5
Total	40	100

Table 2: Incidence of Age

AGE	FREQUENCY	PERCENTAGE
15-30	11	27.5%
31-40	14	35%
41-50	9	22.5%
51-60	6	15%
TOTAL	40	100%

Table 3: Analysis of Injury Mode

MODE	FREQUENCY	PERCENTAGE
Road traffic accident	31	77%
Accidental fall from height	9	23%
TOTAL	40	100%

Table 4: Analysis of Injury Side

SIDE	FREQUENCY	PERCENTAGE
RIGHT	24	60%
LEFT	16	40%
TOTAL	40	100%

Table 5: Classification of Injury

TYPE	FREQUENCY	PERCENTAGE
BARTONICEK 1	6	15%
BARTONICEK 2	10	25%
BARTONICEK 3	9	22.5%
BARTONICEK 4	12	30%
BARTONICEK 5	3	7.5%
TOTAL	40	100%

Table 6: Radiological assessment of outcome

S.NO	GRADE	FREQUENCY	PERCENTAGE
1.	GOOD	32	80%
2.	FAIR	8	20%
3.	POOR	-	-

Table 7: Functional Assessment of Outcome

S.NO	GRADE	FREQUENCY	PERCENTAGE
1.	EXCELLENT	12	30%
2.	GOOD	22	55%
3.	FAIR	6	15%
4.	POOR	-	-

Table 8: Complications

S.NO	COMPLICATION	FREQUENCY
1.	WOUND DEHISENCE	2
2.	INFECTION	2
3.	MALUNION	0
4.	POST-OP STIFFNESS	6
5.	POSTTRAUMATIC ARTHRITIS	0
6.	HARDWARE IRRITATION	4
7.	NEUROLOGICAL INJURY	0
8.	POSTERIOR TIBIAL TENDONITIS	0
9.	COMPLEX REGIONAL PAIN SYNDROME	0

DISCUSSION

The management of the component of posterior malleolus fracture in un-stable ankle fractures continues to remain a topic of controversy even to this day. Though many studies have been published on this issue, there is no clear consensus on this fracture. The complications that could arise due to mismanagement of a posterior malleolus fracture could be devastating for the patient and the treating surgeon and therefore warrants extensive studies on this topic.

The posterior malleolus fracture is due to injuries involving rotational force as described by Lauge-Hansen and would often lead to some complex and highly unstable ankle injuries.[12] Since a very long time, the 25% to 33% rule13 was used to decide whether a posterior malleolus is needed to be fixed surgically or not.

According to this rule, a posterior malleolus fracture fragment is to be fixed surgically only if its size is greater than 25 to 33 percent of the articular surface of the distal tibia.

In a study conducted by Saygin et. al in the year 2017 he had concluded that, those fractures with the fragment size of less that 25% for a posterior malleolus fracture when treated conservatively had no significant difference in terms of the functional outcome when compared to the functional outcome of those fractures treated by surgical fixation, either by a percutaneous cc-screw fixation or an open plate fixation of the posterior malleolus. However those fractures with posterior malleolus fragment size less than 25% of the size of distal articular surface size of the tibia when fixed surgically had decreased requirement of a syndesmotic fixation with a trans-syndesmotic screw as the posterior malleolus fixation itself conferred the restoration of the stability of the ankle syndesmosis.

In a study conducted by Blom et. al. 73 subjects were studied retrospectively. All of them had suffered fractures of the ankle with a posterior malleolus fragment and were studied over a period of four years. They followed a computerized tomographic based Haraguchi classification system. They followed up each of these subjects included in the study for a period of two years and the outcome has been evaluated.

The results showed that the type 2 Haraguchi injury usually had poor outcome functionally compared to the other groups. Essentially the author in this emphasized upon considering the morphology of the posterior-malleolus fracture-fragment rather than the-size in deciding about on-the management stratergy.[14]

In our series we decided to operate patients who either had a fracture fragment of greater than 25 % or Bartonicek type 2 to 5, either of one was needed to be present. 6 cases had stiffness of ankle with AOFAS score below 74 (fair out-come), out of which 2 patients had deep infection, 2 patients had fair reduction according to Kristenson criteria of radiological assessment. 4 patients had hardware related soft tissue irritation and 2 patients had wound dehiscence both of which healed well later with serial dressings. None of the patients had any neurological injury or peroneal tendinitis.

STUDIES COMPARING MANAGEMENT OPTIONS OF POSTERIOR MALLEOLUS FRACTURES AND THEIR OUTCOMES

S.NO	PAPER	NUMBER OF PATIENTS INCLUDED IN THE STUDY	NUMBER OF POSTERIOR MALLEOLUS FRACTURES TREATED SURGICALLY	MEAN FOLLOWUP PERIOD	LEVEL OF EVIDENCE	OUTCOMES
1.	Blom et al [14]	73	70	24 MONTHS	III	IMPROVED CLINICAL SCORES
2.	Drijfhout van Hooff et al [15]	131	N/A	6.9 YEARS	IV	IMPROVED CLINICAL SCORES
3.	De Vries et al [16]	45	28	13 YEARS	III	IMPROVED CLINICAL SCORES
4.	Mingi-Robinet et al [17]	45	45	24 MONTHS	II	IMPROVED CLINICAL SCORES
5.	Xu et al 18	102	42	33.8 MONTHS	III	IMPROVED CLINICAL SCORES
6.	Tejwani et al [19]	456	20	24 MONTHS	III	IMPROVED CLINICAL SCORES
7.	Bua et al[20]	320	160	24 MONTHS	III	IMPROVED OUTCOMES BUT INCREASED REOPERATIONS AND HARDWARE RISKS

CONCLUSION

In conclusion, the patients treated operatively for posterior malleolus fracture had excellent to good radiological and functional out-come. The patients who had some degree of ankle stiffness were either due to poor mobilization and physiotherapy either due to deep infection or hardware irritation. Patients with fair reduction also had some amount of post-operative pain on moderate activity and could be a reason for ankle stiffness.

The Bartonicek classification based upon fracture morphology, which was used for decision making for fracture fixation had a good impact in attaining excellent radiological and functional out-come.

This study could not very well comment on incidence of post-operative arthritis due to the limited follow-up period. We recommend further studies with longer-study-period & with larger-sample-size for stronger and better evidence on outcome.

Conflict of Interest: None

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