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A prospective observational study of the functional outcome of pott's fracture managed with operative modalities

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Abstract

Introduction: The movement around the ankle joint is very important because of the cultural practices, which involve squatting and sitting cross-legged. Bimalleolar Pott's fractures are very common in ankle joint injuries because of the increased incidence of road traffic accidents and industrial trauma. Accurate reduction of fractures around the ankle joint is important for a painless ankle joint.

AIM: To study the functional outcome of surgically managed closed bimalleolar fractures of the ankle in adults; to evaluate the restoration of the anatomy of malleoli and ankle perfectly by operative treatment with internal fixation; to assess the union of fractures after surgical management; and to achieve stable fixation and early mobilization of the ankle.

Materials and Methods: We have evaluated clinical, radiological and functional outcomes of 50 patients treated with different treatment modalities, which include - tension band wiring (TBW), Kirschner (K)-wire, malleolar screw (MS) and cannulated cancellous screws (CCS) for medial malleolus fracture and rush nail, one-third tubular plate, fibular locking plate for lateral malleolus fracture.

Results: The present study of 50 patients with ankle fractures treated by open reduction and internal fixation. Excellent results were achieved in 27 (54%) patients, good in 14 (28%), Fair in 5 (10%) and Poor in 4 (8%) patients. The patient with poor results had mild pain with activities of daily living, diminution in the abilities to run and to do work, the reduced motion of the ankle and narrowing of joint space.

Conclusion: Closed treatment is often inadequate for restoring the proper biomechanics and anatomical structure of an injured ankle joint, internal fixation is an excellent method. Treating malleolar fractures with the use of anatomic fixation and open reduction was found to be very effective.

Keywords: Functional outcome, pott's fracture managed, operative modalities

Introduction

An ankle fracture is the most common fracture type treated by orthopedic surgeons. It has increased significantly over the last two decades [1, 2].

Most ankle fractures are complex and difficult to manage. They are characterized by instability and pain. The injuries can cause long-term disability and even early degenerative arthritis if they are not treated correctly [3].

The various strategies utilized for treating ankle fractures have evolved by the time and improvement in the biomechanics of the ankle. The effective treatment strategies for ankle fractures have evolved owing to the improved understanding of the ankle. The goal of treatment is to achieve restoration of the ankle joint anatomically & functionally contact-loading characteristic of it and minimal or no pain. It's also beneficial for minimizing the risk of injury [4].

The ankle fractures have been generally considered noncontroversial for the indications of operative intervention. However, recent studies have shown that the operative techniques used for treating these injuries are evolved as previously believed. As owing radiographic assessment of ankle fractures and surgical techniques advanced [5].

This study aims to determine the functional outcome of patients after undergoing various surgical management techniques for treating bimalleolar fractures of the ankle.

AIM: To evaluate the Functional outcome in Pott’s fracture treated with operative modalities.

Objectives

1. To study the functional outcome of surgically managed closed Pott’s fractures of ankle in adults by using Baired and Jackson scoring system.
2. To evaluate restoration of the anatomy of malleoli and ankle by operative treatment with internal fixation (Fixation of the fibula with one third tubular plate / Fixation of medial malleolus with partially threaded screws/ Fixation of medial malleolus by tension band wiring/ Fixation of the fibula with Percutaneous Rush Nail / Tens Nail) by using Baired and Jackson scoring system
3. To assess clinically and radiographically the union of fractures after surgical management.

Material and Method

This study was carried out Dr. S.N.M.C Jodhpur, India. It involved 50 adult cases. and followed up for 6-9 months.

For the study, patients with closed bimalleolar fractures of the ankle were included. Those with open fractures and age other than 18 to 70 year were excluded.

All the patients were informed about the study procedures and the consent forms were obtained before being included in the study.

The neurovascular status of the patient was also evaluated. The lower ends of the tibia and the malleolar parts were paled and looked for bony tenderness crepitus. PTA & dorsalis pedis also checked.

The instability of the syndesmos was assessed through various tests, including the external rotation stress test and the manual-lateral compression test. It was also checked by lateral movement of the talus to the tibia.

Radiograph images of the ankle were used to evaluate fractures. The fractures were classified using the Lauge Hansenen classification system AO system.

The tibiofibular clear space and the widening of the medial clear space indicate that syndesmotic instability. and routine bolld investigation HbsAg, HVC, HIV, Hb% blood sugar, blood urea, s creatinin, chest xray ECG

Table 1: Classification of the fractures using the Lauge-Hansen classification system

I. Supination–adduction (SA)	
1	Transverse avulsion-type fracture of the fibula below the level of the joint or tear of the lateral collateral ligaments
2	Vertical fracture of the medial malleolus
II. Supination–everson (external rotation) (SER)	
1	Disruption of the anterior tibiofibular ligament
2	Spiral oblique fracture of the distal fibula
3	Disruption of the posterior tibiofibular ligament or fracture of the posterior malleolus
4	Fracture of the medial malleolus or rupture of the deltoid ligament
III. Pronation–abduction (PA)	
1	Transverse fracture of the medial malleolus or rupture of the deltoid ligament
2	Rupture of the syndesmotic ligaments or avulsion fracture of their insertions
3	Short, horizontal, oblique fracture of the fibula above the level of the joint
IV. Pronation–eversion (external rotation) (PER)	
1	Transverse fracture of the medial malleolus or disruption of the deltoid ligament
2	Disruption of the anterior tibiofibular ligament
3	Short oblique fracture of the fibula above the level of the joint
4	Rupture of posterior tibiofibular ligament or avulsion fracture of the posterolateral tibia
V. Pronation–dorsiflexion (PD)	
1	Fracture of the medial malleolus
2	Fracture of the anterior margin of tibia
3	Supramalleolar fracture of the fibula
4	Transverse fracture of the posterior tibial surface

Table 2: Classification of the fractures using the AO/OTA classification system

Type A: Fibula fracture below syndesmosis (infrasyndesmotic)
A1—Isolated
A2—With fracture of medial malleolus
A3—With a posteromedial fracture
Type B: Fibula fracture at the level of syndesmosis (trans-syndesmotic)
B1—Isolated
B2—With medial lesion (malleolus or ligament)
B3—With medial lesion and fracture of posterolateral tibia
Type C: Fibula fracture above syndesmosis (suprasyndesmotic)
C1—Diaphyseal fracture of fibula, simple
C2—Diaphyseal fracture of fibula, complex
C3—Proximal fracture of fibula

Operative Technique

In spinal and epidural anesthesia, the patient was placed in a supine position. The buttock was elevated on a sandbag to

expose the lateral side. and pneumatic tourniquet was also used for better feild visibility.

Surgical Approaches and Fracture Fixation

Lateral Malleolus

This procedure involves the repair of a displaced malleolar fracture. and reduced in anatomical manner.

A direct lateral approach to the fibula is commonly used to reduce & internally fixatation of fractures. The procedure involves a dissection and made plan in between peroneus tertius and peroneus longus & bravis fracture fixatation. AO type A The fractures were reduced using a reduction procedure and were stabilized by either a tenion band wiring technique or a lag screw. An avulsed fragment from the distal malleolus should be fixed with a tension band wire.

AO type B fracture was fixed with one or two melleolar screws placed perpendicular to the line of the fracture. A more secure fixation was achieved by adding a one third semitubal plate to the concave section of the fibular bone. In

spiral oblique fracture a lag screw also used for stable fixation.

AO type C fracture was treated with a one-third concave tubular plate. It was reduced and fixed according to level of fracture.

Medial Malleolar Fixation

Approach:-The medial approach to the medial malleolus is used to access the joint or posterior portion of the tibia as needed incision placed anterior or posterior and straight or slight curvilinear.

Fracture Fixation:- An anteromedial incision was made over the medial malleolus that begins approximately 2 cm proximal to the fracture line, extends distally and slightly posteriorly, and ends approximately 2 cm distal to the tip of the medial malleolus. The skin with its underlying subcutaneous tissue was retracted anterior and posteriorly. The great saphenous vein and its accompanying nerve were retracted anteriorly. The fracture site was exposed and the fracture fragments were curetted to remove any loosed osseous or chondral fragments. With a bone-holding clamp or towel clip, the detached fragments were brought into normal position and internally fixed with two 1.5mm smooth

Kirschner wires drilled across the fracture site as temporary fixation devices. Then a through and through antero posterior drill hole was made on the tibia above 3 cm proximal to fracture and a length of 20 or 22 gauge stainless steel wire (SS Wire) was passed through the hole. The end was crossed over, with one end passing under the 2 k- wires and ends were tightened and twisted in a figure of eight fashion. After thorough irrigation the wound was closed in layers and below knee plaster of paris was applied

A similar incision was made on the medial malleolus to expose the medial malleolus, and after reducing the fragment a towel clip was used to hold it in position and two k-wires was passed parallel to each other through the fragment For intermediate-sized fragments, the hole is prepared by using a wire and a drill bit. In large-sized fragments, two drills are required to be used to secure a fracture. These drills are commonly replaced with 4-mm partially threaded screws. When the medial malleolar section was too small for screw or comminuted, the Kirschner wires were used for fixation. After 12 to 15 days stitch was removed and below knee slab was applied for 4 week. A non-weight-bearing gait was started the first or the second day after the cast was removed. partial weight allowed after some sign of union becom visible on radiograph and clinical

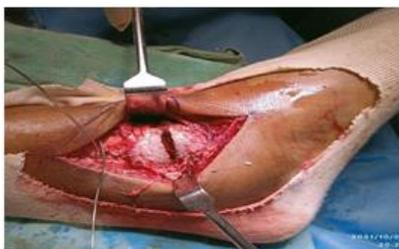


Fig 1: Periosteum retracted



Fig 2: Medial malleolus fixed with k-wire



Fig 3: Tension band wiring done



Fig 4: Sub cutaneous closure



Fig 5: Skin closure



Fig 6: Below knee slab



Fig 7: Pre op x-ray



Fig 8: Dorsiflexion and plantar flexion of ankle



Fig 9: Post op x-ray



Fig 10: Standing and Squatting



Fig 11: Follow up at 10 week



Fig 12: Inversion and Eversion



Fig 13: Pre op x-ray



Fig 14: Dorsiflexion and plantar flexion of ankle



Fig 15: Post op x-ray



Fig 16: Standing and Squatting



Fig 17: Follow up at 12 week



Fig 18: Inversion and Eversion

The follow-up of cases was done for at least 6 months. Evaluations were done using the ankle scoring system of Baird and Jackson.

Scoring System of Baird and Jackson ^[6]

Scoring System for Subjective, Objective, and Radiographic Criteria

Criteria points

I. Pain:

- A. No pain 15
- B. Mild pain with strenuous activity 12
- C. Mild pain with activities of daily living 8
- D. Pain on weight bearing 4
- E. Pain at rest 0

II. Stability of ankle:

- A. No clinical instability 15
- B. Instability with sports activities 5
- C. Instability with activities of daily living 0

III. Ability to walk:

- A. Able to walk desired distances without limp or pain 15
- B. Able to walk desired distances with mild limp or pain 12
- C. Moderately restricted inability to walk 8
- D. Able to walk short distances, only 4
- E. Unable to walk 0

IV. Ability to run:

- A. Able to run desired distances without pain 10
- B. Able to run desired distances with slight pain 8
- C. Moderate restriction inability to run, with mild pain 6
- D. Able to run short distances, only 3
- E. Unable to run 0

V. Ability to work:

- A. Able to perform usual occupation without restrictions 10
- B. Able to perform usual occupation with restrictions in some strenuous activities 8
- C. Able to perform usual occupation with substantial restrictions 6
- D. Partially disabled; selected jobs only 3
- E. Unable to work 0

VI. Motion of the ankle

- A. Within 10° of uninjured ankle 10
- B. Within 15° of uninjured ankle 7
- C. Within 20° of uninjured ankle 4
- D. <50% of the uninjured ankle or dorsiflexion < 5° 0

VII. Radiographic result

- A. Anatomic with intact mortise (normal medial clear space, normal superior joint space, no talar tilt) 25
- B. Same as A with mild reactive changes at the joint margins
- C. Measurable narrowing of superior joint space, with

superior joint space >2 mm or talar tilt >2 mm 10

D. Moderate narrowing of superior joint space, with superior joint space between 2 mm and 1 mm 5

E. Severe narrowing of superior joint space, with superior joint space <1 mm, widening of medial clear space, severe reactive changes (sclerotic subchondral bone and osteophyte formation) 0

Maximal Possible Score 100

Functional Grading Score

Excellent 96–100

Good 91–95

Fair 81–90

Poor 0–80

Result

All the fractures were followed until fracture union occurred. Results were analysed both clinically and radiographically. Almost all fractures united at the end of 10 weeks.

1) Age Distribution: The majority of patients i.e. 15 (30%) were from the 41-50 years age group, followed by 12 (24%) patients in the 18-30 age group, 12 (24%) patients in the 51-60 years and 8 (16%) patients in the 31-40yr group. The youngest patient was 18 years old and the oldest was 66 years of age. The mean age in our study was 41.92 years.

2) Sex Distribution: There was distribution of male and female patients, male 28 (56%), female 22 (44%).

3) Occupation: 20 (40%) of patients who had fractures were farmers making up the majority, followed by 18 (36%) who were household workers.

4) Mode of injury: The major cause of fracture in our study was road traffic accidents in 32 (64%) and in 9 (18%) patients, fracture was due to slipping and stumbling and 9 (18%) patients fracture due to fall from height respectively.

5) Side of Fractures: Right ankle was involved in 29 (58%) patients and in 21 (42%) patients left ankle was involved.

6) Type of injury as determined by lauge Hansen classification: In the present series 23 (46%) patients had supination and external rotation injuries which is the majority, followed by 12 (24%) patients having pronation abduction, 11 (22%) patients had pronation external rotation injuries and 4 (8%) patients having supination abduction.

Statistics of surgery

Most of the patients were operated on between 2 and 6 days. The average duration between trauma and surgery was 4 days in our series. All the patients were given spinal anaesthesia.

Duration of surgery: Average duration of surgery was about 1 hour.

Lateral malleolus fracture:

There was total of 50 lateral malleolar fractures. The majority, 27 (54%) were fixed with a rush nail. Square nail was done in 8 (16%) cases.

Medial malleolus

In our series, there were 50 cases with medial malleolar fractures, tension band wiring was done in 39 (78%) of cases with medial malleoli fractures. In 10 (20%) cases 4.5 mm malleolar screws and K-wire were used 1 (2%) cases.

Complications

5 (10%) patients had superficial skin infection which got healed by 2 to 3 weeks. There were other complications like

chronic post-op swelling 4 (8%), malunion 2 (4%), Wound problem (skin necrosis)- 4(8%) and Sympathetic dystrophy only in 1 case oral antibiotics given in superficial infections and debridement and I.V. antibiotics advised in deep infections. Delay in union of medial malleolus was treated with prolonge immobilization, whichin due course united without any operative intervention.

Final functional Results

In the present study of 50 patients with ankle fractures treated by open reduction and internal fixation. Excellent results were achieved in 27 (54%) patients, good in 14 (28%), Fair in 5 (10%) and Poor in 4 (8%) patient. The patient with poor result had mild pain with activities of daily living, diminution in the abilities to run and to do work, reduced motion of ankle and narrowing of joint space

Discussion

Increased knowledge about the traditional and post traumatic anatomy and performance of the ankle has cause demands for exact reduction and rigid fixation of the ankle fractures early operative treatment of displaced bimalleolar fractures decreases morbidity and improves functional outcome [7].

The treatment of bimalleolar fractures with well reduce open reduction and stable internal fixation using AO method and principles was found to offer a high percentage of excellent and good results [2]. This study supports these conclusions.

Although the scoring of Baird and Jackson has proven to be strict allowing only very small fluctuation from normal about 27(54%) patients during this series achieved excellent results by that scoring system and 14 (28%) patients achieved good results and also had anatomical reduction of the lateral malleolus as well as anatomical reduction of talus radiologically.

In Colton 36 series he found that eighteen (70%) of patients had good to excellent results. In the study conducted by Burnwell and Charnley [33] of 132 patients, 102 (77.3%) had good to excellent results, 16% had fair results and 6% patients were found to have a poor score [8, 9].

In the study conducted by DeSouza, *et al.* [35] on 150 fractures of ankle treated by open reduction and stable internal fixation using AO ASIF method obtained 90% good results.

Beris *et al.* [2] of 144 patients with bimalleolar fracture there were excellent to good outcomes in 74.3% patients, fair results in 14.6% & poor result in 11.1%.

All these were comparable to this study where 54% patients with ankle fractures had excellent results, 28% good, 10% fair and poor results in 8% patients.

In the study conducted by Yablon *et al.* [9] that lateral malleolus is play important role in the anatomical reduction of bimalleolar ankle fractures, because the displacement of the talus has occur when lateral melleolus not in proper reduction. malreduction of fibula would result in residual lateral displacement or persistent shortening. So both melleolus are play equally important role in contributing to the congruity of medial & latral aspect of ankle and the lateral malleolus should not be ignored in the treatment of ankle injuries. The patient who had poor compliance didn't had anatomical reduction of medial malleolus and lateral malleolus as well [10, 11].

Although early mobilization was advocated by AO immobilization also has been supported. Others have found no significant difference in the results produced after early motion or immediate plaster splintage [2]. In this sequence of treatment immobilization in a plaster slab for 3-4 weeks

followed by active & passive mobilization and partial weight bearing was used successfully. The range of motion was limited initially but after the cast removal the ankle movement rapidly improved. Burwell and Charnley^[33] advocated postoperative joint mobility exercises in bed until motion was restored followed by full weight bearing in a cast. Lund-Kristensen *et al.*^[37] either used no cast or applied one for a few days postoperatively and then allowed full joint mobilization out of the cast. They advocated the use of crutches to maintain a non-weight bearing status. Meyer and Kumler^[37] used a post-operative cast but only for an average of 3.8 weeks followed by non-weight bearing mobilization until fracture union^[12, 13].

According to Makwana^[14, 15] the risk of complications after internal fixation is low but higher with closed treatment most of the complications were minor which resolved within 3 months. Significantly in this study there were no non unions of the medial malleolus and 15 (12%) malunions which were seen in retrospective study. Some series showed 30% and 48% respectively after closed reduction.

In the present study the decisive factors that influence the results are

1. Type of fracture, severity of injury is inversely proportional to the final results obtained.
2. Plaster slab immobilization for 6 weeks did diminish the ankle motion. The rapid gaining of motion from 2 to 3 weeks may be due to the positive attitude to exercise and resumption of weight bearing at 6 weeks.
3. Proper and stable fixation of fracture site by AO guide line.
4. Proper reduction of fracture site to avoid mal-union and arthritic changes like maintaining length of fibula and ankle mortise also.
5. Proper use of instrument and proper soft tissue handling during procedure.

Malleolar fractures of the ankle have a varied presentation. A broad understanding of all aspects of mechanism of injury, patho-anatomy and treatment options coupled with training experience is required before any attempt should be made to treat these injuries with thorough understanding of injury patterns repair of the damaged ankle joint can lead to rewarding outcomes for the patient and physician.

Conclusion

Most of the time, these fractures occur in the joint that's holding the ankle. The methods used to treat these types of fractures are simple and can involve the use of closed treatment or rigid fixation. This help in restoring anatomical function and reduce chance of joint arthritis,

The management of ankle fractures has undergone significant changes in the last couple of decades due to the improvement in the techniques and equipment used. The goal of this procedure is to provide complete and painless fracture union of the ankle. Although closed treatment is often inadequate for restoring the proper biomechanics and anatomical structure of an injured ankle joint, internal fixation is an excellent method.

Treating malleolar fractures with the use of anatomic fixation and open reduction was found to be very effective. This procedure was carried out in a study that involved 50 patients. And followed up for period of 6-9 months.

Summary

1. 50 cases of unstable bimalleolar fractures managed

surgically by various techniques are presented.

2. The anatomy, classification, clinical features review of literature and methods of surgical management have been detailed out.
3. The study comprises of 56% of male patients and 44% female patients.
4. 30% fractures occurred in 41-50 years of age group.
5. Right side (58%) was more involved compared to left side.
6. Road traffic accident was major cause of injury constituting 64% of patients.
7. According to Lauge Hansens classification Supination and external rotation was the major deforming force constituting 46% of the cases.
8. Surgical techniques used were open reduction and internal fixation of the lateral malleolus with rush nail semitubular plate, tension band wire or screw and then the medial malleolus with malleolar screws or tension band wiring and k wires.
9. Most common complication faced was post-operative skin infection in 8% patients. At the end of the study 41(82%) cases had good to excellent results, 5 (10%) cases had fair result and 4(8%) cases had poor result.

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