

ORIGINAL RESEARCH

A STUDY ON FUNCTIONAL OUTCOMES FOLLOWING SURGICAL MANAGEMENT OF ANKLE FRACTURES

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ABSTRACT

Background: Orthopaedic doctors treat ankle fractures frequently. Few studies have studied functional recovery after ankle fracture surgery, and none have analysed predictors. Ankle injuries can be caused by low-energy rotational forces in sports, a misstep in daily activities, or RTA. Young and middle-aged are more at risk. Early and optimal ankle function restoration is a prerequisite. Surgical reduction and internal fixation are used to treat most ankle fractures. In ankle fractures, the anatomic repair is the goal. For ankle fractures, open reduction and internal fixation are typical. This study analyses the causes, patterns, and surgical outcomes of ankle fractures.

Materials and Methods: It is a prospective study which was carried out from December 2017 to December 2018 in Great Eastern Medical School & College. In this study period 30 cases of ankle fractures, meeting the inclusion and exclusion criteria were treated by open reduction and internal fixation using appropriate implants.

Results: Most incidences (38%) were in the 31-40 age group. In this study, the right ankle was involved in 35 (70%) cases and the left in 15.0 (30%). 9 (30%) of our cases were between the ages of 31-40, followed by 8 (26.7%) between 41-50. The eldest patient was 65. 42.07 was the mean age. In this series, the right ankle was involved in 20 (66.7%) instances and the left ankle in 10 (33.3%) cases. 26.7% of fracture patients were farmers and 20% were housewives. 14 (46.7%) instances exhibited supination-external rotation damage, followed by 8 (26.7%) pronation-abduction injury. In this study, 30 bimalleolar ankle fractures were treated by open reduction and internal fixation. Excellent results were seen in 8 (26.7%) patients, good in 17 (56.7%), and fair in 5. (16.7 percent). No patient did poorly. Good to outstanding functional outcomes in 83.4% of cases and fair results in 16.6%.

Conclusion: Surgery for bimalleolar ankle fractures yields good functional results. Early weight bearing and mobility are obtained. Anatomical reduction and articular congruence restoration are necessary for all intraarticular fractures, especially if a weight-bearing joint like the ankle is involved. Open reduction and internal fixation restore ankle joint congruency.

Keywords: Cancellous Lag Screws, Malleolar Screw, Tension Band Wiring, 1/3rd Tubular Plate, Bimalleolar Ankle Fractures, Lauge-Hansen's Classification.

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INTRODUCTION

Orthopaedic surgeons see the most patients with ankle fractures, making them the most prevalent type of fractures they treat. Over the past two decades, there has been a rise in the incidence of fractures of this kind, and this trend has been observed in patients of all ages, including younger, more active people as well as older people.^[1,2] Ankle injuries are important to pay attention to since the entire body weight is transmitted through the ankle joint, and the stability of the ankle joint is necessary for proper mobility. They carry the risk of causing considerable long-term handicaps as well as consequences, such as discomfort, instability, and early onset degenerative arthritis.^[3] When treating fractures around the ankle joint, the goal of treatment is to restore the joint's anatomical structure. Treatment for unstable ankle fractures typically entails an open reduction and internal fixation procedure.^[4] However, relatively few researchers have looked into the functional recovery that occurs after surgical treatment of ankle fractures.^[5] The functional result of ankle fractures treated surgically will be evaluated as part of this research study.

Objectives:

1. To assess the etiology, mechanism of injury and the patterns of ankle fractures.
2. To assess the union of ankle fractures after surgical management.
3. To assess the functional outcome of surgically managed fractures of the ankle by open reduction and internal fixation in adults.

MATERIALS & METHODS

Thirty patients with Bimalleolar fractures who attended between December 2017 to December 2018 at Great Eastern Medical School & College, Ragolu, Srikakulam District, AP, India were studied.

Inclusion criteria:

1. Patients diagnosed with an ankle fracture.
2. Age above 18 years.
3. Closed fractures.
4. Fresh fractures.

Exclusion criteria:

1. Patients below 18 yrs of age.
2. Associated fractures in the ipsilateral limb.
3. Compound fractures.
4. Pilon fracture.
5. Neurovascular injuries.

All the patients have been informed of the aims of the study, the methods involved and informed written consent was obtained before being included in the study. On admission of the patient, a careful history was elicited from the patient and/or attendants to reveal the mechanism of injury and the severity of trauma.

The patients were then assessed clinically to evaluate their general condition, and a complete survey was done to rule out other significant injuries.

A careful examination was done to rule out fractures at other sites. A local examination of the injured ankle was done, and the following clinical signs were looked for.

Inspection:

Swelling of the ankle, any deformity, skin condition.

Palpation:

Skeletal components of the ankle i.e., lower ends of tibia and fibula including both malleoli, calcaneus and talus are looked for local bony tenderness bony irregularities, displacement, abnormal painful mobility and crepitus. Dorsalis pedis artery and posterior tibial artery pulsations were checked and noted. Active and passive movements of ankle joint are noted. Instability of the syndesmosis was identified on the basis of the mechanism of injury and the fracture pattern. Pain elicited with the squeeze test (manual medial-lateral compression across the syndesmosis) and the external rotation stress test was considered indicative of clinical syndesmotic instability. Fractures of the ankle were evaluated using plain radiographs in anteroposterior, lateral, and mortise views. The fractures were classified using the Lauge–Hansen classification. A below knee posterior POP slab was applied. Routine investigations were done. The patients were taken up for surgery as early as possible once the general condition was stable and fit for surgery.

Preoperative preparation of patients:

- ✓ Patients were kept fasting for 8-10 hours before surgery.
- ✓ Intravenous fluids were given as needed.
- ✓ Adequate amount of blood was kept ready for any eventuality.
- ✓ The whole of the extremity including the private parts were prepared.
- ✓ A properly written and informed consent was taken.
- ✓ Tranquilizers were given as advised by anesthetists.
- ✓ An intravenous antibiotic was administered 30 minutes before surgery.
- ✓ Xylocaine test dose and Tetanus toxoid was given.

Operative technique:

Under spinal and /epidural anaesthesia, the patient was placed in supine position. The ipsilateral buttock was raised on a sandbag to improve the exposure of the lateral side. Pneumatic tourniquet was applied in all cases. The procedure was performed in a bloodless field, which facilitates good visibility to describe the fracture pattern and thus facilitating anatomical reduction.

The affected limb was draped from the knee joint to the nail tip and then painted with betadine solution. The foot was covered with a glove. Timing of surgery lasted around 1 to 1 ½ hours, open reduction and internal fixation of the malleolar fractures were performed by tension band wiring, malleolar screw, K- wire fixation, 4mm cannulated cancellous screws, one third tubular plating with screws or recon plate and screws.

Postoperative management:

IV fluids were infused as appropriate. Antibiotics consisting of the third generation of cephalosporin and Amikacin were continued for 5 days. Analgesics and Serratiopeptidase were given.

Elevation of the affected limb was done. After 24 hrs x- rays of anteroposterior and lateral views were taken. Wounds were inspected on 3rd day. Sutures were removed on the 12th postoperative day on average.

Below the knee, a pop cast was given and discharged with instruction of non-weight bearing over the affected limb for 6 weeks.

Partial weight bearing was started after the removal of the cast (after clinical and radiological signs of union become evident). Active exercises of the ankle were advised. In patients with syndesmotomic screw fixation, weight bearing was delayed till screw removal.

Follow up of cases was done at regular intervals of 6 weeks for a minimum of 6 months. At each assessment, all patients were questioned concerning pain, use of analgesics, stiffness, swelling, activities of daily living, use of walking aids, and return to work and participation in sports. At the examination, the gait, any thickening, swelling, tenderness of the ankle and the range of motion of the ankle were evaluated. Anteroposterior, lateral and mortise radiographs of ankle were taken at the time of examination. Baird and Jackson's ankle scoring system of subjective, objective and radiographic criteria were used for the study. All the patients were evaluated and scores were given.

Operative photographs



Figure 1: Draping



Figure 2: Skin incision over lateral malleoli



Figure 3: Fracture reduction



Figure 4: Fracture fixation using 1/3rd tubular plate



Figure 5: Skin incision over medial malleolus



Figure 6: Exposure to fracture site

RESULTS

In our study 30 bimalleolar cases operated in Great Eastern Medical School & College between December 2017 and December 2018 were studied. Following were the observations made.

Age Distribution:

Table 1: ?

Age	Frequency	Percent
<=20 yrs	1	3.3
21-30 yrs	5	16.7
31-40 yrs	9	30.0
41-50 yrs	8	26.7
51-60 yrs	6	20.0

>60 yrs	1	3.3
Total	30	100.0

In our series, majority of the cases i.e; 9 (30%) were in the age group of 31-40 years, followed by 8 (26.7%) cases in the age group of 41-50. The youngest patient was 18 year old and the eldest was 65 years. The mean age was 42.07.

Table 2: Sex Distribution

Gender	Frequency	Percent
Male	24	80.0
Female	6	20.0
Total	30	100.0

In our series, males were more commonly involved. Majority of the patients were males i.e; 24 (80%) and 6 (20%) were females. Male: Female ratio was 4:1.

Table 3: side of fracture

Side involvement	Frequency	Percent
Right	20	66.7
Left	10	33.3
Total	30	100.0

In the present series, right ankle was involved in 20 (66.7%) cases and left ankle in 10 (33.3%) cases.

Table 4: Occupation

Occupation	Frequency	Percent
Businessman	3	10.0
Carpenter	1	3.3
Clerk	2	6.7
Coolie	1	3.3
Driver	2	6.7
Farmer	8	26.7
Housewife	6	20.0
Lic Agent	1	3.3
Student	4	13.3
Teacher	2	6.7
Total	30	100.0

In our series, 8 (26.7%) of patients who had fractures were farmers followed by 6 (20%) who were housewives.

Table 5: Mode of Injury

Mode of Injury	Frequency	Percent
Road Traffic Accident	19	63.3
Fall of Heavy Object	3	10.0
Slip	8	26.7
Total	30	100.0

In our series, 19 (63.3%) cases were due to road traffic accident, 8 (26.7%) cases were due to slip and fall and 3 (10%) were due to fall of heavy object.

Table 6: Type of Injury as Determined by Lauge Hansen

Lauge Hansen Type	Frequency	Percent
Pronation Abduction	8	26.7
Supination Adduction	3	10.0
Supination External Rotation	14	46.7
Pronation External Rotation	5	16.7
Total	30	100.0

In the present study, majority of cases i.e; 14 (46.7%) had supination-external rotation injury, followed by 8 (26.7%) cases who had pronation- abduction injury.

Table 7: time interval between injury and surgery

Time to Surgery (days)	Frequency	Percent
1 st Day	1	3.3
2 nd Day	8	26.7
3 rd Day	4	13.3
4 th Day	9	30.0
5 th Day	4	13.3
6 th Day	4	13.3
Total	30	100.0

In our series, most of the cases i.e; 21 (70%) were operated between day 2 and 4. The mean time interval was 3.63 days.

Table 8A: Treatment of Individual Fractures. A) Medial Malleoli Fracture

Medial Malleolar Fracture	Frequency	Percent
Malleolar Screw	20	66.7
Cannulated Cancellous Screw	5	16.7
Tension Band Wiring	5	16.7
Total	30	100.0

Majority of medial malleolar fractures were fixed with malleolar screws i.e; 20 (66.7%) cases. In the rest, cannulated cancellous screw and tension band wiring was used.

Table 8B: lateral malleoli fracture

Lateral Malleolar Fracture	Frequency	Percent
1/3TubularPlate	25	83.3
ReconPlate	4	13.3
MalleolarScrew	1	3.3
Total	30	100.0

Majority of lateral malleolar fractures i.e; 25 (83.3%) cases were fixed with 1/3 tubular plate and screws, followed by 4 (13.3%) cases where recon plate was used and malleolar screw was used in 1(3.3%) case.

Table 9: Syndesmotic Fixaton

Syndesmotic Screw	Frequency	Percent
Yes	2	6.7
No	28	93.3
Total	30	100.0

In two cases syndesmotic injury was noted and in these two cases it was fixed with a fully threaded cancellous screw.

Table 10: Time Taken For Union

Union (Weeks)	Frequency	Percent
8	6	20.0
9	1	3.3
10	17	56.7
12	6	20.0
Total	30	100.0

In our study, the mean time taken for union was 9.97 weeks. Most of the cases i.e; 23 (76.7%) showed union between 10 to 12 weeks.

Table 11: Complications

Complication	Frequency	Percent
SuperficialInfection	3	10.0
NoComplication	27	90.0
Total	30	100.0

In our study 3 (10%) patients had complication i.e; superficial wound infection. It was managed with debridement, regular dressing and antibiotics. The wound healed by 3 weeks.

Table 12: Final Score According to Subjective, Objective and Radiological Criteria

Category	Grade A	Grade B	Grade C	Grade D	Grade E	Total
Pain	16	14	-	-	-	30
Stability	30	-	-	-	-	30
Walking	27	3	-	-	-	30
Running	2	28	-	-	-	30
Work	28	2	-	-	-	30
Motion	9	21	-	-	-	30
Radiograph	30	-	-	-	-	30

Ankle pain:

In this series, 16 patients had no pain and 14 patients had grade B i.e; pain with strenuous activities of daily living.

Stability of the ankle:

None of the patients had clinical instability.

Ability to walk:

Majority of the patients, i.e; 27 could walk desired distances without limp or pain and 3 patients were able to walk desired distances with slight pain.

Ability to run:

2 patients were able to run desired distances without pain, 28 patients were able to run desired distances with slight pain.

Ability to work:

28 patients were able to perform usual occupation without restriction and the rest 2 were able to perform usual occupation with restriction in some strenuous work.

Motion of the ankle:

In this series, 9 patients had range of motion within 10° of uninjured ankle, 21 patients had range of motion within 15° of uninjured ankle.

Radiographic result:

All the patients had anatomical intact mortise.

Table 13: Functional Results

Functional Results	Frequency	Percent
Excellent	8	26.7
Good	17	56.7
Fair	5	16.6
Total	30	100.0

In the present study, 30 patients with bimalleolar ankle fractures were treated by open reduction and internal fixation. Excellent result were achieved in 8 (26.7%) patients, good result in 17 (56.7%) and fair in 5 (16.7%) patients. No patient had poor result.

Case- 22



Pre-Operative X-Ray

Post-Operative X-Ray

Figure 7: Clinical and X-ray Photographs



Figure 8: 6 Months Follow Up X-Ray

DISCUSSION

Of all the intra-articular fractures occurring in weight bearing joints, the most common joint involved is the ankle joint. Methods to restore function and to prevent arthritis are either closed treatment, which includes manipulative reduction and immobilization in plaster cast or

open reduction with internal fixation. Burwell and Charnley showed that anatomical reduction and rigid fixation led to early return to function.^[6]

There has been gradual evolution in management of ankle fractures due to improved analysis of biomechanics, improvement in fixation techniques and analysis of results of recent studies. The goal of treatment is to provide fracture union with painless full motion of the ankle, with the anatomical restoration of the injured ankle.

The closed method of treatment is often inadequate in restoring the anatomy and biomechanics of the ankle in unstable malleolar ankle fractures. Conversely, open reduction with internal fixation is an excellent method for restoration of normal anatomy of joint. Several studies indicated that internal fixation of displaced malleolar fractures of the ankle provides better results.^[7,8]

The treatment of malleolar fractures with accurate open reduction and stable internal fixation using the AO method and principles was found to give a high percentage of excellent and good results. This study supports these conclusions.

In the current study, we have 30 patients with bimalleolar ankle fractures, who were operated upon. All patients were followed up for a minimum period of 6 months.

Age Distribution:

In our study, fractures were commoner in the 31-40 years age group, with mean age being 42.07 years. Our findings are comparable to the studies made by, Beris et al, Roberts RS and Lee et al.^[9-11]

Sex Distribution:

Our series had a male predominance with a male: female ratio of 4:1, which is comparable to the study made by Baird & Jackson.^[12]

Mode of injury:

In our study, road traffic accidents constituted the majority of cases, which was following a study made by Lee et al.^[12]

Laterality of fracture:

In the present study, the right ankle was more commonly affected, following the studies made by Roberts RS¹⁰ and Beris et al.^[9]

Type of injury:

In the present study, the Lauge-Hansen classification system was used for operative evaluation. The most common type of injury was Supination-external rotation (46.7%), following the studies made by Roberts RS¹⁰, Baird and Jackson.^[12]

Functional results:

The results in the current study were compared with that of Burnwell & Charnley,^[6] Colton,^[13] Beris et al,^[9] De Souza et al.^[7]

Burnwell & Charnley⁶ in their series of 132 patients, 102 (77.3%) had good results, 16% had fair results and 6% were found to have poor scores.

In the Colton,^[13] series, 70% of the patients had good to excellent results. In a study by Beris et al,^[12] of 144 patients with ankle fractures, 105 (74.3%) had good to excellent results.

In the De Souza,^[7] series, 150 cases of ankle fractures treated by open reduction and internal fixation using the AO/ASIF method, obtained 90% good results.

The functional results of the present study were comparable with that of the above-cited studies, with 83.4% having good to excellent results, and 16.4% had fair results.

CONCLUSION

Hence we conclude that surgical management of bimalleolar ankle fractures provides a good functional outcome. By stable surgical fixation of the fracture, early mobilization can be done with a good functional outcome.

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