Clinico-Radiological Outcome after Surgical Interventions in Ankle Fractures at a Tertiary Care Centre in Moradabad, Uttar Pradesh

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ABSTRACT

BACKGROUND

Ankle fractures are among the most common injuries encountered by orthopaedic surgeons. An ankle is considered unstable when the loss of normal constraints around the ankle permits the talus to move in a non-physiologic pattern. Under such circumstances, the dynamic joint surface contact area within the ankle is diminished, which predisposes to articular cartilage damage and premature degeneration. In today's time, many modalities are available for surgical fixation of bimalleolar fractures. Such interventions restore anatomy and biomechanics of the ankle joint. Even though there are plethora of foreign studies on similar matter, deficiency of such analysis has been depicted in literature from developing countries, particularly from South-East Asian region. In this study, we wanted to assess various methods of internal fixation in ankle fracture & evaluate their clinical and radiological outcome post-operatively.

METHODS

26 ankle fracture patients in the age group of 18 - 60 years were included in this study. Fractures were classified pre-operatively based on Lauge-Hansen classification. Patients were followed up at regular intervals of 1st, 2nd, 3rd, 6th & 12 month after surgery and assessed by Baird and Jackson scoring system based on subjective, objective and radiographic criteria. Complications like infection, arthritis, stiffness & implant failure were assessed on regular follow-up.

RESULTS

Variety of methods (including k-wires, plates & screws) were used for surgical fixation. Majority of fractures resulted from road traffic accident (RTA). Patients were evaluated using Baird & Jackson scoring system during follow-up at 1st, 2nd, 3rd, 6th & 12 month. All patients had poor scores for initial 3 months. Patients showed good to excellent result on final follow-up at 9 to 12 months after surgery. Complications were observed in 19 % cases with arthritis being most common.

CONCLUSIONS

Open reduction and internal fixation restores the articular congruity of the ankle joint. The operative result was satisfactory with good clinical outcome.

KEYWORDS

Ankle, Fracture, Anatomy, Modalities

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BACKGROUND

Fractures and sprains around the talocrural joint are one of many common injuries. Improper treatment and inadequate reduction of these fracture can lead to significant disability in the form of pain, instability, and early onset of arthritic changes.[1] These injuries gain importance because the whole bodyweight is transmitted through the ankle and locomotion depends upon the stability of the ankle joint.[2] Ankle injuries are one of the routine clinical conditions managed by orthopaedic surgeons & they account for nearly 10 % of traumatic cases seen in emergency. The ankle joint is made of the talus, that articulates with tibial plafond superiorly and the malleoli both medially & laterally. This whole construct of the joint is held by 3 different groups of ligaments. An ankle is considered unstable when the loss of normal constraints around the ankle permits the talus to move in a non-physiologic pattern. Under such circumstances, the dynamic joint surface contact area within the ankle is diminished, which predisposes to articular cartilage damage and premature degeneration.[3,4]

Conservative method was effective in closed reduction of ankle fractures, but had drawbacks in terms of prolonged immobilization, stiffness of joint & atrophy of adjoining soft tissues. Arthritis of the joint was commonly confronted later once articular fragments of the fracture were reduced in closed manner. Treatment of ankle fractures has come a long way from conservative treatment to an era of open reduction and internal fixation as a result of contributions of Lauge Hansen, Danis and Weber & many others.[5] Surgical restoration of fractured malleolar fragments was suggested in cases of unsuccessful attempt of precise reduction of fractured fragments or in tibiofibular syndesmosis injury making joint unstable. Aim of the treatment is to establish the anatomy & early rehabilitation of ankle joint to pre-trauma status.

We wanted to assess the outcome of operated cases of ankle fractures clinically and radiologically, as well as to assess any complications.

METHODS

26 patients who were operated at Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh were followed up from January 2019 to September 2020 in this prospective on retrospective study. Inclusion criteria included all the cases of bimalleolar ankle fracture between the age of 18 - 60 years including both gender & closed fracture and Gustilo Anderson open grade 1 & 2. Exclusion criteria included posterior malleolus fracture, pathological fracture, associated injury to ipsilateral limb, patients previously operated over ipsilateral affected limb & neuromuscular disorders.

We obtained approval from the ethical committee of our institute to conduct this study. All the patients involved were informed about the purpose of the study & its methodology in their native language after taking proper written informed consent. Patients were diagnosed by pre-operative anterior-posterior and lateral radiographs of ankle joint done as the patient presented to the hospital. Closed reduction of all malleolar fractures was done followed by below knee plaster of paris (POP) slab application. Patients with displaced malleolar fragment of more than 2 - 3 mm along with medial clear space and/or tibiofibular clear space of more than 5 mm were considered for operative fixation. All cases were classified as per Lauge-Hansen classification system[6] based on the mechanism of injury.

Lauge-Hansen Classification

- Supination-Adduction (SA)
- Supination-Eversion (External Rotation) (SER)
- Pronation-Abduction (PA)
- Pronation-Eversion (External Rotation) (PER)

After routine investigations & pre-operative surgical fitness, patient were taken up for surgical fixation under spinal/general anaesthesia. With patient in supine position, cleaning painting and draping of operative site was done. Lateral malleolus was approached through posterolateral approach.

Proper reduction was done by applying the reverse of force that led to fracture and fixation was done either by 1 / 3rd tubular plate or tension band wiring with k wire based on the fracture morphology. Medial malleolus was approached by giving incision posterior to medial malleolus. Fractured ends in some cases were reduced with the help of clamps and fixed with k-wires, malleolar screws or tension band wiring based on fracture morphology. Majority of cases were treated in similar manner. Injectable antibiotics and analgesics were given as per post-operative protocol. Post-operative radiographs of ankle joint in anterior-posterior and lateral views were obtained to assess fixation. Assisted physiotherapy of foot and ankle was started as soon as pain was relieved.

Patients were not allowed to bear weight over operated limb till 6 weeks of surgery. All cases were followed up at 1st, 2nd, 3rd, 6th & a final follow-up at 12 months after surgery. Radiographs of ankle joint were taken in anterior-posterior and lateral view at each visit. Patients were assessed using Baird and Jackson scoring system.[7] This scoring system consists of 7 questionnaires based on subjective, objective and radiographic criteria.

Baird and Jackson Scoring System

1. 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

2. Stability of Ankle

a. No clinical instability: 15
b. Instability with sports activities: 5
c. Instability with activities of daily living: 0

3. 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 in ability to walk: 8
d. Able to walk short distances only: 4
e. Unable to walk: 0

4. 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 in ability to run, with mild pain: 6
d. Able to run short distances only: 3
e. Unable to run: 0

5. 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 substantia restrictions: 6

6. 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 uninjured ankle, or dorsiflexion < 5 degrees: 0

7. 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: 15
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

Functional Grading	Score
Excellent	96 - 100
Good	91 - 95
Fair	81 – 90
Poor	0 – 80

Table 1. Functional Grading and Scores

Statistical Analysis

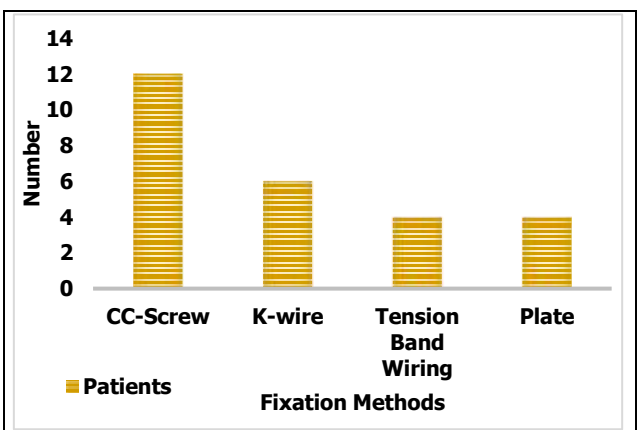
Data was collected and subjected to statistical analysis using statistical package for social sciences (SPSS) software, version 24.

RESULTS

A total of 26 patients within the mean age group of 34 years were included. More than one third of the cases were below the age of 30 years (42.3 %). 54 % cases in this study were male.

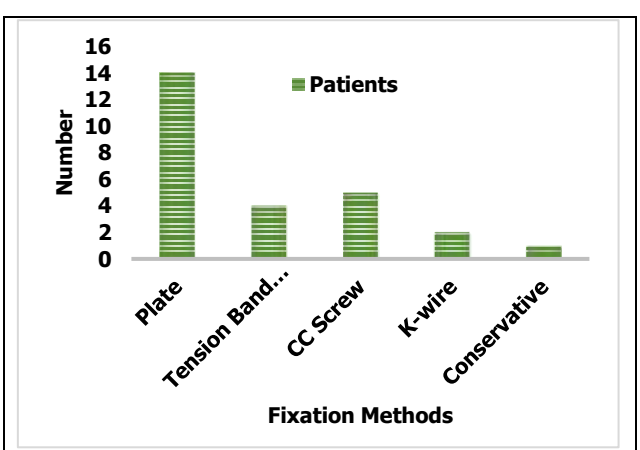
65 % cases in ankle injury in present study were of right side. Majority of the patient's sustained injury as a result of road traffic accident (65.3 %), 11 % cases sustained injury due to slip on floor & 23 % cases due to fall from stairs. Patients were categorized as per Lauge-Hansen classification & 30 % cases had supination-external rotation as well as pronation-external rotation injury, 27 % cases had supination adduction injury & 11 % cases had pronation abduction injury.

Variety of fixation methods were adapted for management of medial malleolus as well as lateral malleolus fractures. Fixation of Medial malleolus was mostly done with CC screws, followed by K-wire, tension band wiring and plating. In some cases of medial malleolus fracture, CC screw was supplemented with K-wire (Graph 1).



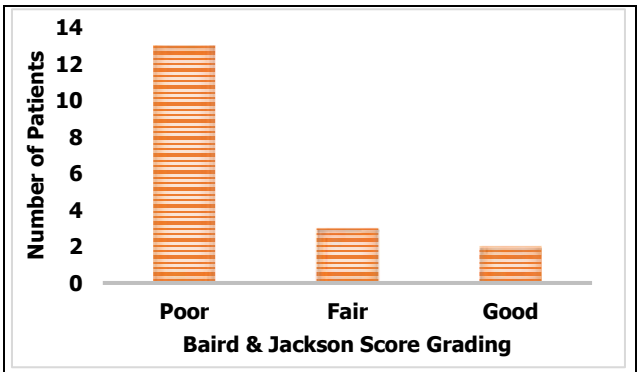
Graph 1. Management of Medial Malleolus in Each Case

Fixation of lateral malleolus was mostly done with plating, followed by tension band wiring CC screws or K - wire. In some cases, the fracture did not require operative intervention (graph 2).

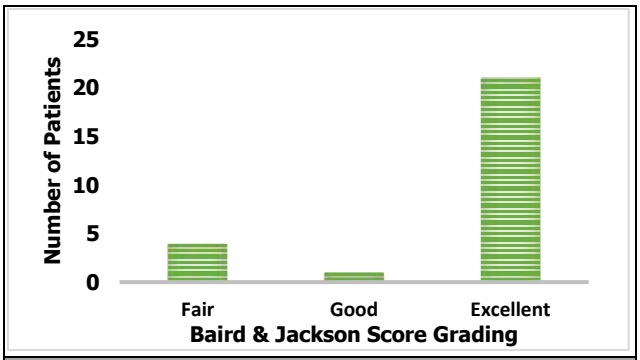


Graph 2. Management of Lateral Malleolus in Each Case

Assessment of all operated cases was done according to Baird and Jackson scoring system. Score at 3 months was found to be 65 in 50 % of cases, 60 in 30 % of cases and 55 in 20 % of cases. Based on Baird and Jackson score, poor outcome was observed during initial 3 months of assessment. Scoring at 6 months was found to be less than 80 in almost 70 % of cases (Graph 3, 4).



Graph 3. Graphical Distribution of Each Case Based on Baird & Jackson Score Grading at 6 Months of Review



Graph 4. Graphical Distribution of Each Case Based on Baird & Jackson Score Grading at Final 12 Months of Review

Figure 1. Immediate Post-Operative Radiograph (AP & Lateral View)

Figure 2. Radiograph at 6 Months (AP & Lateral View)

The overall mean score on final follow-up was 95.19. Operated patients were evaluated radiologically for union, displacement of malleoli and talar tilt (Figure 1, 2). Signs of callus formation were seen at 12 weeks in 18 cases. Displacement of malleolar fragment was seen in 6 cases. Talar tilt was observed in 5 cases at regular radiological assessment of operated cases. Patients were also assessed for complications like infection, arthritis, stiffness, and implant failure. Arthritis was observed in 5 cases, infection in 4 cases, stiffness in 3 case & implant failure in 1 case.

DISCUSSION

Ankle fracture is a variety of articular injury that alters the congruency of tibial plafond. Treatment is aimed at providing thorough articulation of tibial plafond with talus. This provides stability to the ankle joint. Fractures and sprains around the talocrural joint are one of many common injuries. Improper treatment and inadequate reduction of these fracture can lead to significant disability in the form of pain, instability and early onset of arthritic changes.[1]

These injuries gain importance because the whole bodyweight is transmitted through the ankle and locomotion depends upon the stability of the ankle joint.[2] An ankle is considered unstable when the loss of normal constraints around the ankle permits the talus to move in a non-physiologic pattern. Under such circumstances, the dynamic joint surface contact area within the ankle is diminished, which predisposes to articular cartilage damage and premature degeneration.[3,4] Aim of the treatment is to establish the anatomy & early rehabilitation of ankle joint to pre-trauma status.

In present study, 26 patients within the age group of 18 – 60 years were included. Younger population had higher incidence with 42.3 % within 18 - 30 years of age group, 23 % cases within 30 – 40 years, 11.5 % cases in 40 – 50 years & 23 % cases within 50 - 60 years. Most patients in our study were prone to injury as these patients were within 18 - 30 years, employed in laborious jobs. Similar findings were observed by Solunke and Patole[8] on 30 patients of ankle fractures as 50 % cases were from 18 - 30 years of age group. In another study by Beris et al.[9] done on 144 patients for ankle fractures, the mean age group having sustained ankle fracture was 30 years. However, Gardner MJ (2006)[10] in their study on 58 cases of ankle fractures reported cases with average age of 59 years (range 18 to 84 years). Elderly population was involved as most patients in developed country sustain injury as result of trivial injury in addition to osteoporosis. Most patients in our study were prone to injury as these patients were within 18 - 30 years, employed in developing part of country.

In our study, 17 cases sustained injury due to road traffic accidents, 6 case due to fall from stairs & 3 cases due to slip & fall on floor. Road traffic accident was observed to be most common mode as most of Indian population is involved in rigorous physical activities & comply poorly to road traffic rules. Such pattern was observed in study conducted by Lee et al.[11] on 168 cases of ankle fractures. He found that 98 patients sustained injury due to road traffic accident.

However, Beris et al.[9] in his study done on 25 ankle fracture patients found that 15 patients had sustained injury due to fall from height.

We categorized fractures as per Lauge-Hansen classification & found 8 cases with supination - external rotation injury & pronation-external rotation injury, 7 cases with supination adduction injury and 3 cases with pronation abduction injury. Similar pattern of injury was observed in study conducted by Robert RS[12] on 25 patients of ankle fractures. Supination external rotation (34 %) was the most common type of injury. In another study by Beris et al.[9] on 144 patients found supination external rotation (45 %) as most common type of injury. However, Solunke and Patole[8] in their study found pronation abduction injury (33.3 %) as the most common type of ankle injury

In Indian scenario, ankle fractures usually occur due to road traffic accident as per poor compliance to road traffic rules and most of ankle fractures occur due to twisting or external rotation injury.

All displaced fractures were treated surgically with open reduction and internal fixation by various methods followed by functional assessment of each case with Baird & Jackson score. In present study, patients followed-up for initial 3 months were found to have mean score of 70.16 (poor). Average score on 6 months of follow-up improved up to 78.9. On final follow-up, patients had a mean score of 95.19 with excellent outcome in 80 % cases. In a study done by Bell and Wong[13] over 33 cases of Weber type C ankle fractures, Functional outcomes in patients following ankle fixation were similar with ankle scores of 88 ± 5.50.

Complications such as infection, arthritis, stiffness of joint, implant failure & non-union were observed in few cases. Arthritis was observed in 5 cases & infection was observed in 5 cases as well followed by stiffness of joint in 2 cases, implant failure in 1 case & non-union in 1 case. This case of non-union was managed by freshening of fractured margins along with internal fixation with locking plate for lateral malleolus & tension band wiring for medial malleolus in our study. Beris et al.[9] in their study found that 21 % cases developed arthritis. However, Solunke & Patole[8] in their study of 30 cases of ankle fracture noted 2 cases of surgical wound infection.

Mitchell et al.[14] in their analysis of ankle fractures observed that closed reduction of fractures often was not stable enough. Such injuries involved ligamentous components that tends to displace fractured fragments & may lead to malalignment & shortening of fibula. Sequalae of arthritis was anticipated by author as joint became incongruent.

Radiological assessment of each case was done according to parameters of union, talar tilt, displacement of malleolar fragment. Another such study by Nilsson et al.[15] on operated cases of ankle fractures evaluated 55 patients for their radiological parameters. Displacement of malleolar fragments was noted in 11 cases with union in all cases that were operated.

Statistical analysis was done by functional assessment showed significant clinical outcome based on rationale of our study. We established that surgical stabilization of malleolar fragments of ankle restores motion & stability of joint allowing individuals to walk or run required distance. We inferred from this study that anatomical reduction of the fracture and restoration of the joint congruity of the ankle is of outmost importance in proper ankle joint function. Internal fixation offers the advantage of earlier motion of the ankle.

CONCLUSIONS

Operative treatment of ankle fracture has resulted in good to excellent functional outcome post-operatively at final follow-up of patients. It drastically reduces the complications inspite of few physical limitations witnessed in 5 cases that developed arthritis at ankle.

Limitations

Few limitations were encountered in our study in terms of lesser duration of study with small sample size. We also realized that Baird & Jackson scoring system used in our study had some fallacies in form of poor grading criteria of the scores (score of less than 80 considered poor and improved to fair/good after adding 5 to 10 points). This scoring system exhibited fair to good score regardless of patient's poor ability to run.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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