



**SHORT TERM OUTCOME OF VARIOUS MODALITIES OF INTERNAL FIXATION FOR TREATMENT OF CALCANEUM FRACTURES-A PROSPECTIVE NONRANDOMISED STUDY OF 50 CASES**

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**ABSTRACT**

**Objectives**

To study different modalities of the fixations in displaced intraarticular fractures as well as to evaluate the outcome of displaced intraarticular calcaneum fractures treated by different methods of surgical treatment according to Creighton Nebraska scoring system

**Materials and Methods**

This prospective study was carried out at the department of orthopaedics, Sir T Hospital, Bhavnagar. In this study, around 50 patients with calcaneum fractures were included. 36 patients having joint depression type of fractures treated with either ORIF with plating or percutaneous fixation while rest 14 patients having tongue type fractures treated with percutaneous fixation. The patients were evaluated using Creighton Nebraska scoring system.

**Observations**

The Creighton Nebraska score in the category of excellent as well as good was found to be 25% for open reduction group of joint depression fractures, 19% for percutaneously treated joint depression fracture and 57% for the percutaneously treated tongue type fracture group.

**Conclusion**

In case of joint depression fractures, ORIF yields comparatively better results than percutaneous reduction. The operative treatment yields better results in tongue type fracture compared to joint depression type fracture.

**SUMMARY**

For joint Depression fractures; 25% of patients treated with ORIF & Plating had excellent to Good outcome whereas 58% of patients had Fair Outcome. For Tongue type Fractures All Patients were treated in closed manner and 57% of the patients had excellent to good outcome whereas 43% had fair outcome. For Joint Depression Fractures treated Percutaneously 19% patients had Good Outcome whereas 50% patients had Fair Outcome.

**KEYWORDS :**

**INTRODUCTION**

The calcaneus (os calcis) is the largest and most often fractured tarsal bone. It is the major weight bearing osseous structure of the foot and is one of the components of the tri-tarsal articulation and has important functional tasks with regard to normal ambulation. So, any intraarticular fracture of calcaneum can cause subtalar arthritis.

Objective of this thesis is to get conclusion which operative technique will be useful in particular case to get maximum good results and improved outcomes.

**AIMS AND OBJECTIVE**

1. Study the occurrence, mechanism of injury and type of displaced intraarticular calcaneus fracture according to Essex-lopresti classification.
2. Study different modalities of the fixations in displaced intraarticular calcaneum fractures.
3. To evaluate the outcome of displaced intraarticular calcaneum fractures treated by different methods of surgical treatment according to Creighton Nebraska scoring system.

**MATERIALS AND METHODOLOGY**

**INCLUSION CRITERIA:**

- Closed displaced intraarticular fracture of calcaneum
- Age: 18 years to 60 years
- Patients with minimum 6 month follow up
- Patients with ASA Grade 1 & 2

**EXCLUSION CRITERIA:**

- Compound fractures.
- Extraarticular fracture.
- Age less than 18 years and more than 60 years.
- Pathological fractures.
- Fracture which do not satisfy the inclusion criteria.
- Patients with ASA Grade > 2.

History were obtained through verbal communication, clinical examination both local and systemic was done. All polytrauma patients were managed initially as per emergency care protocol. Once patients were vitally stable, X-rays were done i.e. calcaneum lateral view and Harris axial view as well as X-ray foot AP and oblique view. According to X-rays, Bohler as well as crucial angle of Gissane were measured in all patients.

Fractures were classified according to Essex-lopresti classification as it is universal so easy to compare data as well as it helps in decision making regarding surgical management of the fracture.

If needed as per fracture type, CT scans were obtained and fracture were classified according to Sander's classification. Once diagnosis was confirmed, patients were given below knee posterior splint with elevation and analgesics. The further management of fracture was decided after senior consultant's opinion and treated accordingly.

The technique used was selected on basis of type of fracture, quality of bone and soft tissue and functional demands of the patients. The following different surgical modalities were used :

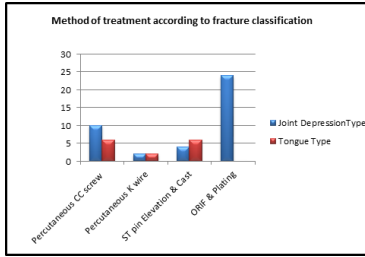
1. Percutaneous reduction and fixation with either K-wires or CC screw.
2. Close reduction and ST pin incorporation into cast.
3. Open reduction and Plating.

Method of treatment according to fracture classification:

| Method of treatment | Joint depression type | Tongue type        |                    |
|---------------------|-----------------------|--------------------|--------------------|
|                     |                       | No of patients (%) | No of patients (%) |
| Surgical            | Percutaneous CC screw | 10 (19%)           | 6(11%)             |
|                     | Percutaneous K wire   | 2(4%)              | 2(4%)              |

|       |                         |          |        |
|-------|-------------------------|----------|--------|
|       | ST pin Elevation & Cast | 4(7%)    | 6(11%) |
|       | ORIF & Plating          | 24 (44%) | 0 (0%) |
| Total | 40 (74%)                | 14 (26%) |        |

Method of treatment according to fracture classification:



**OPERATIVE TECHNIQUE:**

1. Close reduction and Percutaneous fixation with CC screw/K wire Patient taken on simple table and semi lateral or lateral position given. After painting and draping one ST pin was inserted into tuberosity fragment from lateral to medial direction and used for manipulating the tuberosity fragment to disimpact it and to correct the alignment and once the alignment was achieved any joint depressed fragment if present was elevated using ST pin. Now fracture was temporarily fixed with K-wires from posterior to anterior direction through tuberosity fragment across the fracture site. Now fluoroscopic lateral and axial image were taken and reduction as well as position of wire checked. Now if reduction was found to be acceptable, then it was permanently fixed CC screw from posterior to anterior direction. If additional fixation was required to support posterior facet depressed fragment then it was fixed with additional CC screw from lateral to medial direction aiming to fix it to sustentaculum fragment. Final reduction and implant position was checked under fluoroscopy.



**2. Close reduction and ST pin incorporation into cast**

Patient was taken on simple table and semi lateral or lateral position given. After painting and draping Steinmann pin is introduced into the tongue fragment in a longitudinal direction angling slightly to the lateral side, under radiological control. The pin should be well into the tongue fragment but not across the fracture site. The fracture is reduced by manipulating the pin. Once the fracture is reduced and brought up into position, at this point the pin is advanced across the fracture into the anterior fragment of the calcaneus. Final reduction checked under fluoroscopy and the pin in position is incorporated in a short leg non weight bearing cast

**3. Open reduction and Plating**

Surgical steps of ORIF of calcaneum fracture:

- Perform extensile lateral approach to calcaneus.
- Place K-wire retractors in cuboid, talar neck, and fibula.
- Mobilize lateral wall and superolateral articular fragments
- Mobilize tuberosity through primary medial fracture line
- Place Schanz pin in tuberosity
- Reduce superolateral articular fragment to sustentacular fragment
- Provisionally stabilize with K-wires
- Reduce anterior process and anterolateral fragment(s) to articular fragments to restore crucial angle of Gissane.

- Provisionally stabilize with K-wires.
- Reduce tuberosity to body of calcaneus.
- Provisionally stabilize with K-wires.
- Replace lateral wall fragment; add bone void filler as needed.
- Apply anatomic calcaneal plate. Place cortical or cancellous screws through perimeter holes in plate in box configuration.
- Place cortical lag screws to stabilize articular fragment(s).
- One screw through plate; one screw outside plate.
- Assess stability of superior peroneal retinaculum.
- Flap closure over deep drain; sutures tied sequentially from ends to apex; skin closure in identical sequence.



**POSTOPERATIVE PROTOCOL:**

All patients were given BK slab and limb elevation and advised toe movement. Injectable antibiotic given for three day followed by oral antibiotic for 5 days. Stiches were removed after 14-20 days. Below knee slab was removed after stitch removal and ankle and subtalar ROM was started. At 6 weeks X-rays were done. Subtalar and ankle ROM was continued with strict non weight bearing for another 4-6 weeks. Gradual weight bearing was started after 12-16 weeks post operatively to full weight bearing. Patients were regularly followed up at every 2 month thereafter. At each visit patients were physically examined regarding the condition of scar, any sign of infection, heel width, subtalar and ankle movement and any other possible complications. Radiological assessment was done for union and subtalar arthritis as well as Bohler and Gissane angle were also measured at each follow up. At final follow up visit patient were also asked about change in occupation and change in shoe size.

At final follow up patient functional assessment was done using Creighton Nebraska score.

The score is devised in six following points of total 100 point.

- Pain (30 points)
- Activity (20 points)
- Range of inversion and eversion (20 points)
- Return to work (20 points)
- Change in shoe size (5 points)
- Swelling (5 points)

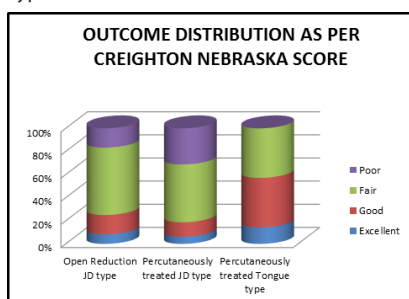
90 to 100 points is an excellent result; 80 to 89 a good result; 65 to 79 a fair result; and 64 or less a poor result

|  | Points |
|--|--------|
| <b>Pain (30 points)</b>  |        |
| <b>Activity</b>  |        |
| No pain when walking or ignores pain                                   | 15     |
| Mild pain when walking; takes aspirin                                  | 5      |
| Moderate pain when walking; takes codein                               | 5      |
| Severe pain when walking; severe limitations                           | 0      |
| <b>Rest</b>  |        |
| No pain at rest or ignores pain  | 15     |
| Mild pain at rest  | 10     |
| Moderate pain at rest  | 5      |
| Severe pain at rest  | 0      |
| <b>Activity (20 points)</b>  |        |
| Unlimited walking and staging  | 20     |
| Walks 5 to 10 blocks; stands intermittently for more than half an hour | 15     |
| Walks less 1 to 5 blocks; stands half an hour or less                  | 10     |
| Walks less than 1 block (indoors only)                                 | 5      |
| Cannot walk  | 0      |
| <b>Range of inversion/eversion (20 points)</b>                         |        |
| 25 to 30° = 80 to 100%   | 20     |
| 20 to 25° = 60 to 80%  | 15     |
| 15 to 20° = 40 to 60%  | 10     |
| 10 to 15° = 20 to 40%  | 5      |
| 0 to 10° = 0 to 20%  | 0      |
| <b>Return to work (20 points)</b>                                      |        |
| Full time, same job  | 20     |
| Full time with restrictions  | 15     |
| Full time, change job  | 10     |
| Part time with restrictions  | 5      |
| Cannot work  | 0      |
| <b>Change in shoe size (5 points)</b>                                  |        |
| No change  | 5      |
| Change   | 0      |
| <b>Swelling (5 points)</b>   |        |
| None   | 5      |
| Mild   | 3      |
| Moderate   | 2      |
| Severe   | 0      |

Outcome distribution as per Creighton-Nebraska Score according to fracture type and method of treatment

|           | OPERATIVE             |                                  |                                  |
|-----------|-----------------------|----------------------------------|----------------------------------|
|           | JOINT DEPRESSION TYPE |                                  | TONGUE TYPE                      |
|           | OPEN REDUCTION        | PERCUTANEOUS SCREW/K WIRE/ST PIN | PERCUTANEOUS SCREW/K WIRE/ST PIN |
| EXCELLENT | 2(8%)                 | 1(6%)                            | 2(14%)                           |
| GOOD      | 4(17%)                | 2(13%)                           | 6(43%)                           |
| FAIR      | 14(58%)               | 8(50%)                           | 6(43%)                           |
| POOR      | 4(17%)                | 5(31%)                           | 0(0%)                            |
| TOTAL     | 24(100%)              | 16(100%)                         | 14(100%)                         |

Outcome distribution as per Creighton-Nebraska Score according to fracture type and method of treatment



**CONCLUSION**

In the present case study of 50 patients having 54 displaced intraarticular calcaneum fracture, after evaluation of functional and radiological outcomes of various modalities of surgical treatment by Creighton-Nebraska Scoring system, we have arrived at the following conclusions:-

Displaced intraarticular calcaneum fractures commonly occur in males of active age group of 31 to 40 years of age. Labourers and persons involved in outdoor activity are prone to calcaneal fractures. The most common modes of injury of calcaneal fractures are fall from height. To reduce the oedema and “wrinkle sign” to appear it takes at least 5 to 10 days.

In case of joint depression type fracture, open reduction and internal fixation yields comparatively better results than percutaneous reduction. In tongue type fracture, operative treatment yields better results than conservative treatment. The operative treatment yields better results in tongue type fracture compared to joint depression type fracture. The overall complication rate is more in percutaneously treated group than open reduction group in joint depression type fractures.

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