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INTERNAL FIXATION OF INTRA ARTICULAR CALCANEUM FRACTURES USING LOCKING COMPRESSION PLATE

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ABSTRACT: INTRODUCTION: Calcaneum is the most frequently fractured tarsal bone. Historically intra articular calcaneum fractures treated non-operatively which led to increased morbidity due to incongruity of articular surface resulting in subtalar arthritis. With advent of CT scan, better implants and improved methods of fixation. Operative treatment has now become a standard method. **AIM OF THE STUDY:** To study the functional and radiological outcome of intra articular calcaneum fractures treated by open reduction and internal fixation using locking compression plate. **MATERIALS AND METHODS:** Fifteen patients with intra articular calcaneum fractures treated by open reduction and internal fixation using locking compression plate from May 2012 to September 2014 at Rajah Muthiah Medical College Hospital with follow up of 6 months. The fractures were classified on the basis of computer tomography (CT) findings as Sanders type I to IV. The aim of our treatment is to achieve anatomical reconstruction of all articular surfaces, restore Bohler's and Gissane angles, to carry out primary stable fixation and begin early mobilization. The patients were evaluated by Modified Maryland Foot Score, with excellent defined as 90 - 100 points, good as 75 - 89 points, fair as 50 - 74 points and poor as <50 points. **RESULTS:** Fourteen patients were male and only one female. Twelve patients sustained fractures due to fall from height, three patients due to RTA. The mean pre-operative Bohler's angle was 13 degree and mean post-operative angle was 26.2 degree. The mean pre-operative Gissane angle was 147.6 degree and the mean post-operative angle was 121 degree. Excellent modified Maryland Foot score were achieved in 9 patients, good in 3, fair in 1 patient. Only 2 had poor outcome. **CONCLUSION:** Surgical treatment of intra-articular calcaneum fractures using locking compression plate by lateral approach has good functional outcome. CT scan is required for understanding the geometry of fractures and to assess subtalar disruption. Good timing of surgery is of paramount importance to avoid early complications. Reconstruction of subtalar anatomy prevents subtalar arthritis & maintains the foot biomechanics.

KEYWORDS: Calcaneum, locking compression plate, bohler's angle, gissane angle.

INTRODUCTION: Calcaneum is the most frequently fractured tarsal bone, accounting for approximately 2% of all fractures. Displaced intra articular fracture constitutes 60-70% of calcaneum fractures. Peak incidence in men is between 21 - 45 years of age^[1] Bilateral calcaneum fractures in 5-10% of cases. Fall from height is the most common cause of injury.^[1]

Intra articular calcaneum fracture with comminution remains a challenge to the treating orthopedic surgeon. Because of serious potential complications controversies persisted regarding the best treatment. Historically displaced intra articular fractures have been treated non-operatively. Non-operative treatment led to increased morbidity due to incongruity of articular surface resulting in subtalar arthritis and post-traumatic stiffness with loss of subtalar motion, widening of heel.

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With the advent of CT scan with 3D reconstructions, appropriate timing of surgery, better implants – locking compression plates, improved methods of fixation and rehabilitation, operative treatment of intra articular calcaneum fracture has now become a standard method.

Operative goal includes - Restoration of congruity of subtalar articulation, restoration of Bohler's and Gissane angles, restoration of normal width and height of calcaneus, neutralization of varus deformity of fracture.

Surgical treatment includes closed reduction and percutaneous k wire or cancellous screw fixation, external fixation, primary fusion, open reduction and internal fixation using locking compression plates with or without bone grafting.

In this study we are reporting the results of open reduction and internal fixation using locking compression plate with or without bone grafting from our experience.

MATERIALS AND METHODS: Fifteen patients with intra articular calcaneum fractures treated by open reduction and internal fixation using locking compression plate from May 2012 to September 2014 at Rajah Muthiah Medical College Hospital with a follow up longer than 6 months.

INCLUSION CRITERIA: Patient diagnosed to have intra articular fracture of calcaneum by x ray –AP, lateral and Harris axial view. The fractures were classified on the basis of computer tomography (CT) findings as Sanders type I to IV.

EXCLUSION CRITERIA:

- Extra articular fractures.
- Fractures associated with compartment syndrome.
- Fracture associated with other tarsal bone injuries.
- Compound fractures.
- Head injury and poly trauma patients with GCS less than 8.

Surgery was performed only after edema had resolved. The aim of our treatment is to achieve anatomical reconstruction of all articular surfaces, restore Bohler's and Gissane angles, to carry out primary stable fixation and begin early mobilization.

In cases with impending compartment syndromes & soft tissue compromise closed reduction and percutaneous K wire or cancellous screw fixation was done. In cases with gross comminution where the posterior facets could not be reduced primary orthrodesis was done.

Patient was given a below knee slab. Strict limb elevation and anti-edema measures were done. Watched for "wrinkle sign". CT scan with 3D reconstruction was done to classify the fracture and planned for surgery.

All patients were operated with an average of 7-15 days from the time of fracture if the soft tissue condition was good. Locking plates of 3 sizes small, medium and large are available. In Indian population the calcaneum is small, so small plate was used in all cases. The plate was fixed with 3.5 cancellous screws. Artificial G bone was used to fill large gaps with internal fixation to yield good results.

Surgery was performed in lateral position either in general or regional anaesthesia by extensile lateral approach in all patients.

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The land marks are lateral malleolus, calcaneo-cuboid joint and base of fifth metatarsal. Incision made in a right angled fashion with the vertical line started 4cm above the lateral malleoli between fibula and tendoachilles and extended downward till the junction of dorsal and plantar skin. The horizontal line is extended distally up to the base of fifth metatarsal. The incision is carried straight down to the bone at its angle and then developed to allow a single, thick flap to be lifted from the periosteal surface. A “no touch” technique may be employed by retracting the flap with k wires in the talus and cuboid.

SKIN INCISION

REDUCTION UNDER C ARM

A schanz screw, Steinmann pin or 3mm k wire is passed from the posterior inferior corner of the calcaneal tuberosity. Reduction aided by periosteal elevator or osteotome. The posterior facet and the anterior facets were reduced. Reduction verified with c- arm. Low profile locking compression plates were contoured and positioned. The plate is secured by 3.5mm cancellous locking screws of various lengths.

Subcutaneous tissue is closed using 1-0 vicryl and tension free skin closure done using 3-0 ethiolon. Multiple small drain tubes inserted in between. Tight dressing and compression bandage applied. Below knee slab was given.

POST-OPERATIVE PROTOCOL AND FOLLOW UP: All patients were immobilized in posterior plaster splint and limb elevated. Drain is removed after 48hours and first wound inspection done on 2nd day. If soakage present early wound inspection done. Suture removal done after 13th day (13 to 18th day). After suture removal below knee cast applied.

All patents were regularly followed up once a month for first three months. Two months once for next six months. Standard AP, lateral and axial views x-rays are taken to assess the radiological outcome. Bohler's and Gissane angles were drawn.

Functional outcomes were evaluated by Modified Maryland Foot Score, with excellent defined as 90 - 100 points, good as 75 - 89 points, fair as 50 - 74 points and poor as <50 points. Partial weight bearing was allowed by 12weeks and full weight bearing done after three and half months.

RESULTS: In our study of 15 patients with intra articular calcaneum fractures, twelve patients resulted from fall from height, 3 following RTA. Fourteen patients were male and only one female.

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Six patients had associated dorso lumbar spine injuries. Six patients were type 3 sander's. Nine patients had tongue type fracture and 6 patients had joint depression type fracture.

The mean pre-operative Bohler's angle was 13 degree and mean post-operative angle was 26.2 degree. The mean pre-operative Gissane angle was 147.6 degree and the mean post-operative angle was 121 degree. Excellent modified Maryland Foot score were achieved in 9 patients, good in 3, fair in 1 patient. Only 2 had poor outcome.

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DISCUSSION: In the last decade, open reduction and internal plate fixation of dislocated intra-articular calcaneal fractures has become a standard surgical method with low complication rate and better quality of life after the surgery.^[2]

With the advent of CT scanning, (AO) principles of internal fixation, and introduction of antibiotics, surgeons have been able to obtain better outcomes with operative intervention.^[3]

In 2007 Jain et al studied 48 intra articular calcaneal Fractures treated by open reduction and internal fixation with bone grafting via extensile lateral approach. Anatomic reduction of the posterior calcaneal facet was achieved in 38 of 48 fractures. The Bohler and Gissane angles were restored to between 92 and 99% of normal, respectively.^[4]

In 2004 Zwipp, presented one of the biggest studies of calcaneal fractures: 496 patients with 553 fractures (90% patients treated operatively, 95% lateral approach).

In the study implanting of the LCP enable to decrease use of bone grafting from 53% (non-locking plate) to 3.8 % (LCP).

In the group of 453 fractures treated by ORIF wound necrosis is noted in 6.7%, soft tissue infection 4.3% and bone infection in 2.2%. Good or excellent results were achieved in 72% of patients.^[2]

In our analysis we operated only after edema had resolved. All fractures were treated with extensile lateral approach. Implanting of LCP enables us to operate with less use of bone graft or G bone, only in selected cases where there was a large gap G bone was used.

Our study results are also in concordance with the above mentioned studies. Anatomic reduction of the posterior calcaneal facet was achieved in 13 of 15 fractures. The Bohler and Gissane angles were restored in 86% of cases.

Not even single case with wound necrosis, soft tissue infection or bone infection was noted. Excellent or good results were achieved in 80% of patients.

CASE PHOTOS

CT SCAN

PRE OP X RAY

CONCLUSION: Surgical treatment of intra-articular calcaneum fractures using locking compression plate by extensile lateral approach has good functional outcome. CT scan is required for understanding the geometry of fractures and to assess subtalar disruption.

Good timing of surgery and minimal handling of soft tissue is of paramount importance to avoid wound complications. Calcaneum being a cancellous bone expected to unite with collapse. Autologous cancellous bone graft or artificial G bone is needed to fill large gaps with internal fixation to yield good results. Reconstruction of subtalar anatomy prevents subtalar arthritis & maintains the foot biomechanics.

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