



Outcome of percutaneous Cannulated cancellus screw fixation of Calcaneum fractures

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Abstract

Purpose: To review the techniques and outcomes of percutaneous fixation, with Cannulated cancellus screw in displaced calcaneal fractures. **Methods:** This is an evaluation of 25 patients who had percutaneous calcaneal screw fixation in our hospital between April 2020 and June 2022. Bilateral fixation was accomplished on one patient. All patients underwent a series of X-rays of the damaged foot, including anteroposterior, axial, lateral, and Broden's views. Bohler's and Gissane's angles were measured before and after surgery. In serial follow-ups, the patients' conditions were continuously examined, and the clinical outcome was evaluated using the Maryland Foot Score. The angles of Bohler and Gissane were totally recovered in 13 and 17 of 25 fractures, respectively. The average length of stay in the post-operative hospital was 8 days. There were no severe complications following the surgery. Sixteen patients were able to return to their prior jobs. Maryland's Foot Score was used to evaluate the clinical outcome.

Results: The angles of Bohler and Gissane were totally recovered in 13 and 17 of 25 fractures, respectively. The average length of stay in the post-operative hospital was four days. There were no severe complications following the surgery. Sixteen patients were able to return to their prior jobs. The Maryland Foot Score assigned exceptional ratings to 13 of 25 injured limbs (52%), acceptable ratings to 9 (36%), and fair ratings to 3 (12%). There were no patients who received a bad rating. The three patients who received favorable results reported discomfort and stiffness at the subtalar joint.

Conclusion: Percutaneous fixation of displaced tongue-type calcaneal fractures is an effective treatment with acceptable clinical outcome, short hospital stay, minimal skin complications, and quick recover

Keywords :- Essex Leprositi, Bohlar angle , gissane angle , Maryland Foot score

Introduction

Calcaneal fractures are the most common fractures of the tarsal bones. Calcaneal fractures are the most common tarsal bone fractures (about 60%). These fractures can be intraarticular or extraarticular as intraarticular fractures comprise approximately 75% of all calcaneus fractures. Fractures of the calcaneus are complex injuries often associated with fractures of the spine, thorax or extremities. The bone itself has specific anatomy with thin soft tissue envelope, which further complicates surgical treatment (1). In most cases these fractures are results of high energy trauma – fall from heights or due to traffic accident. Calcaneal fractures have enormous social and economic impact due to the often prolonged period of hospitalization, long rehabilitation and difficult recovery which may exceed more than six months. Also most of these injuries affect young or middle-aged active people. As per literature, initially these fractures were managed conservative which over the years evolved to surgical modalities. Although open reduction has been performed since the early 1930s, infection and technical problems lead surgeons against operative treatment. Overall, due to better imaging techniques, minimal invasive techniques and antibiotics improved the results of operative fracture fixation.¹ In this study we tried to analyse functional outcomes of calcaneal fractures managed by percutaneous reduction and Cannulated Cannulated screw fixation. We also tried to evaluate if this management modality has any advantage over other prevailing modalities of management.

AIMS AND OBJECTIVES To analyse the functional outcomes of CCS application in management of fractures calcaneum..

MATERIAL AND METHOD

This prospective observational study was carried out on patients of intra-articular calcaneal fractures in Department of Orthopaedics Government Medical Collage, Jammu over a period of 2 years. A total 26 patients presented with calcaneum fracture out of which 3 were not fitting while 3 refused to take part in the study. Finally, 20 patients were enrolled for the study which was followed up post operatively, at 1 month, 2months, 6 months and 12 months. Ethical approval was obtained for the study from the Ethics Committee of GMC and hospital, Jammu .

Inclusion criteria:

Skeletally mature patients of both genders presenting with unilateral displaced calcaneal fractures presenting within 2 weeks of injury.

Exclusion criteria:

- 1 bilateral calcaneus fractures
- 2 undisplaced fractures
- 3 more than 2 weeks old fractures.

Pre-operative evaluation: At the time of admission radiographs (with standard magnification) with anteroposterior, lateral, axial view of calcaneum of fractured and normal side were taken. From the radiographs, the type of fracture was determined, and the pre-operative Bohler's angle 2, Gissane's angle 3 was measured of both sides. Antioedema measures were taken such as elevation of limb, below knee plaster slab, antibiotics and daily dressing in cases associated wound and anti-inflammatory drugs. On lateral view of the radiograph of the calcaneum is used to identify Bohler's angle usually 20 to 40 degree, decreases in this angle indicates the weight bearing surface of the calcaneum has collapsed and shifting the body weight anteriorly.² It is formed by drawing two lines first line starts from the highest point on the anterior process of the calcaneum to highest point on the posterior facet and the second line drawn tangential to the superior edge of the tuberosity.

Classifications that were used in the study included: the EssexLopresti x-ray classification modified by Stulik and Stehlik , and the CT classification of Sanders.

Operative technique :

The patient was placed in prone position on a radiolucent operating table, with the foot protruding out of the operating table. Kirschner wires (3mm) were inserted from the medial side through the calcaneal tuberosity and the talar neck respectively. Classifications that were used in the study included: the EssexLopresti x-ray classification modified by Stulik and Stehlik and the CT classification of Sanders .The goal of the operative treatment included: anatomic reduction of joint surface, restoration of normal bone morphology (correction of height – Bohler angle, length, width and position of bone), reduction of wound problems and complications, restoration of biomechanics of subtalar joint . Depending on the fracture type and dislocation, we used different types of cannulated screw for fracture fixation: 4.5 partial threaded screws, 6.5 partial or fully threaded screws. To perform a successful minimally invasive operative treatment some surgical instruments are mandatory: lamina spreader, various types of bone distractors, Steinmann pins, different size elevators, heel bone press, periarticular reduction forceps . Proper positioning of the patient on the operative table and no movement of patient or image intensifier during surgery are mandatory. Preoperative adjustment of the three X-ray views – later



Pre operative Radiographs and post operative c arm image and 1year follow up



The patient was a 51-year-old male, heavy smoker for more than twenty years, with joint-depression type fracture, preoperative X-ray and CT scan .. Reduction was performed with Hintermann distractor and lamina spreader; fixation was achieved with 3cannulated screws

RESULTS

The study included 18 men and 2 women, fixation was achieved by different types of cannulated screws. Evaluation of the results were made by using the Maryland Foot Score. Eleven patients had excellent result (55%), 7 patients - good result (35%), 2 patients - satisfactory one (10%), and 0 patients – bad result (0%). Satisfaction from the treatment was graded using the Visual Analogue Scale (VAS) score with a mean score of 7.5. The average time from admission to surgery was 4 days, the mean duration of surgery was 58 minutes. All patients were followed up and all fractures healed. There were no cases with wound healing problems – infection or skin necrosis. In the postoperative period, the regular changes of the dressings were mandatory and intensive cryotherapy was performed to reduce swelling, no cast immobilization was used and gradual early active range of motion was encouraged without weight bearing. Mean hospitalization time was 5 days. Earlier implant removal due to prominent hardware causing peroneal impingement and tendinitis was performed in one patient. Transient paresthesia of nervus suralis was recorded in one patient, which resolved spontaneously in a few weeks. The reduction was evaluated by measurement of the angle of Gissane, Bohler and Preis pre- and postoperatively on lateral and axial views. Unfortunately, no postoperative CT scan could be performed and we evaluated the short follow-up period in the study. Due to strict control and patient compliance there was no loss on reduction in the follow-up period on conventional X-ray in this study

DISCUSSION

The restoration of bone alignment and morphology, along with reconstruction of the congruence of the articular surfaces, are the key elements that influence the prognosis following surgical treatment of calcaneus fractures and preserve the normal biomechanics of the foot. As a result, the fracture must be fixed in a stable and safe manner. Clinical and biomechanical studies continue to focus heavily on the proper fixation of these fractures. Smaller plates, locking plates with angular stability, open reduction, and internal fixation procedures for calcaneus fractures continue to be used, despite the technical advancements in medicine, and there are still high rates of soft tissue problems, ranging from 10% to 25%. Additionally, in patients at high risk, such as diabetics, smokers, people with vascular disease or immunological deficiencies, and people with open wounds. The functional outcome of open procedures may be affected by the significant soft tissue stripping and dissection. After the fracture has been sufficiently reduced, the use of cannulated screws through stab incisions offers the chance to avoid many of these issues. Furthermore, this enables for quick bone consolidation and expedited rehabilitation while protecting soft tissues. Early surgery is required for cannulated screws fixation (minimally invasive procedures), which makes it simpler to mobilize the misplaced fragments and achieve better reduction. Early surgery results in less edema and prevents fracture blisters. It is difficult to implant screws accurately because of the unusual bone shape. It is difficult to implant screws accurately because of the unusual bone shape. The fracture type and the direction of the displaced fragments determine the entry points, screw routes, and screw lengths. The screws are positioned with the intention of supporting the posterior facet by providing a support in the dense, spongy bone. The tuber calcanei, anterior process, sustentaculum tali, and subchondral bone of the posterior facet are the locations that can guarantee stable screw fixation. After a correct reduction, fully treated cannulated screws are ideal for holding and restoring the length and height of the heels. The posterior facet is typically fixed with 4.5 mm screws, however they could also be put transversely to provide compression between the fragments.

The heads of the screws should be buried below the level of the cortex to minimize the chance of irritation and possible discomfort. Incorrect placement of screws may lead to severe complications – intraarticular penetration and arthritis, pain, swelling, tendon (peroneal or flexor hallucis longus) impingement and nerve injuries (paresthesia, tarsal tunnel syndrome). In the literature there are a lot of studies regarding safe screw localization. Based on 3D bone model in a radio-anatomical study Phisitkul P et al. investigated the best trajectory for sustentacular screw.

The conclusions were that the sustentacular screw should be approximately 40 mm in length, entry point should start 15 mm below the posterior facet measured perpendicular to the joint line, the anteversion angle increases at each position along the posterolateral facet from 6 to 36 degrees from anterior to posterior and the subtalar convergence angle should be 20 degrees. In a biomechanical study, Carr et al. (16) investigated the effect of plate size on the fixation strength and their conclusion was that the reduction with bone contact is important (spongy bone), not the plate size, so a reposition should achieve the best posterior facet reduction. In a cadaveric biomechanical study by Smerek et. al. (17), it was emphasized that percutaneous screw fixation of calcaneus fractures may provide a strength similar to that of plate fixation. Different implants

can be used for fracture synthesis and the goal is to achieve enough stability to promote early active range of motion, without weight bearing and redisplacement of the fragments (18,19). Optimal reduction of the articular surface could be improved by utilizing the sinus tarsi approach. In addition, arthroscopy of the subtalar joint is an excellent option for joint reduction. Proper screw placement could be facilitated if the surgeon uses modern CT scan reconstruction intraoperatively.

CONCLUSION

Cannulated screw fixation in dislocated calcaneus fractures is a technically demanding procedure. Good spatial orientation, surgical experience and preoperative planning (CT scan in all planes and X-ray images) are mandatory (20). Patient selection, close follow up and compliance are crucial for optimal functional results. Cannulated screw fixation in calcaneus fractures is an effective surgical option with good clinical result, short hospitalization time, minimal blood loss and soft tissue dissection with reduced risk of complications.

REFERENCES

- 1.. Palmer I. The mechanism and treatment of fractures of the calcaneus. Open reduction with use of cancellous grafts. *J Bone Joint Surg Am.* 1948; 30A(1):2-8.
2. Buckley R, Tough S, McCormack R, Pate G, Leighton R, Petrie D, et al. Operative compared with nonoperative treatment of displaced intraarticular calcaneal fractures: a prospective, randomized, controlled multicenter trial. *J Bone Joint Surg Am.* 2002; 84(10):1733-44.
- 3Benirske SK, Sangeorzgan BJ. Extensive intraarticular fractures of the foot. Surgical management of calcaneal fractures. *Clin. Orthop.* 1993; 292:128-34.
- 4 Forgon M: Closed reduction and percutaneous osteosynthesis: Technique and results in 265 calcaneal fractures. In: Tscherne H, Schatzker J, eds. *Major fractures of the pilon, the talus, and the calcaneus.* New York: Springer- Verlag; 1993. p. 207-13.
- 5Stulik J, Stehlik J, Rysavy M, Wozniak A. Minimally-invasive treatment of intraarticular fractures of the calcaneum. *J Bone Joint Surg Br.* 2006;88(12):1634-41. doi: 10.1302/0301-620X.88B12.17379.
- 6 Sanders R, Fortin P, Dipasquale T. Operative treatment of 120 displaced intraarticular calcaneal fractures. Results using a prognostic computed tomography scan classification. *Clin Orthop Relat Res.* 1993;(290):87-95.
- 7 Bohler L. Diagnosis, pathology and treatment of fractures of the os calcis, *J Bone Joint Surg Am.* 1931; 13(1):75-89.
- 8 Essex – Lopresti P. The mechanism, reduction technique and results in fractures of the os calcis; *British J Surg.* 1952; 39(157):395-419.
9. Broden B. Roentgen examination of the subtalioid joint in fractures of the calcaneus. *Acta Radiol.* 1949;31(1):85-91.
- 10 Schepers T, Schipper IB, Vogels LM, Ginai AZ, Mulder PG, Heetveld MJ, et al. Percutaneous treatment of displaced intra-articular calcaneal fractures. *J Orthop Sci.* 2007; 12(1):22-7. doi: 10.1007/s00776-006-1076-z. 11.
- 11 Patel N, Bhavsar N, Lil N. Percutaneous fixation of Calcaneum fractures. *GCSMC J Med Sci.* 2014;3(1):31-4. 12.
12. Qiang M, Chen Y, Zhang K, Li H, Dai H. Effect of sustentaculum screw placement on outcomes of intraarticular calcaneal fracture osteosynthesis: A prospective cohort study using 3D CT. *Int J Surg.* 2015;19:72-7. doi: 10.1016/j.ijssu.2015.05.011.