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Outcome of Operative Treatment of Intraarticular Fractures of Calcaneum

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ABSTRACT

Backgroud: Calcaneum is the most commonly fractured tarsal bone. Approximately 75% are intra-articular fractures. Controversy continues regarding the management of calcaneal fractures. Earlier conservative management was preferred and surgical management considered inappropriate for these fractures. This trend is gradually changing with better understanding of disabling nature of injuries in combination with improved implant and routine use of intra-operative imaging. Closed treatment with cast invariably leads to long-term complications. However, still clinical evidence supporting operative treatment is limited and complications are frequently documented. Objectives: To evaluate the functional outcome of intraarticular fractures of calcaneum in terms of American Orthopaedic Foot and Ankle Society (AOFAS) score and Visual Analogue Scale (VAS) score. Methods: This study was a retrospective analytic study. The study was conducted in the Department of Orthopaedics, B.P. Koirala Institute of Health Sciences, Nepal. Data collection and analysis of patients operated from July 2017 to June 2019 was done. Twenty six cases that fulfilled inclusion criteria were analysed. Results: Average age of the patients was 32 years. Sanders type 2B was the most common fracture pattern. There was significant improvement in Bohler angle (25.1°), calcaneal height (4.3cm) and width (3.9cm). Average AOFAS score and VAS score at final follow up were 81.4 and 7.9 respectively. Conclusion: Open reduction and internal fixation with plate is associated with good clinical and functional outcome in Sander type II and III fractures. With good surgical techniques, improved implant and proper use of fluoroscopy, proper restoration of Bohler angle, calcaneal height and width can be achieved.

Key words: Calcaneum, Intraarticular fracture, Outcome, Plate.

INTRODUCTION

Calcaneum is the most commonly fractured tarsal bone (1). Approximately 75% are intra articular (2) and 10% of the fractures are associated with spine fractures (3). Intra-artricular fractures are usually associated with poor outcomes (4, 5). The economic burden of these injuries is considerable as 80-90% occurs in working age group of population (6) and many are unable to return to their original occupation (4). The most common mode of injury is fall from height (7).

Controversy continues regarding the management of calcaneal fractures (6). Earlier conservative management was preferred and surgical management considered inappropriate for these fractures (8). This trend is gradually changing with better understanding of disabling nature of injuries in combination with improved implant and routine use of intra-operative imaging (9-14). However, still clinical evidence supporting operative treatment is limited while complications like arthritis, subfibular impingement causing peroneal stenosis, tendinitis, or dislocation (9, 15-19) are frequently documented with conservative management.

Open reduction and internal fixation is difficult and strict adherence to surgical principles along with meticulous soft tissue handling is mandatory to achieve a good outcome (7, 20-22). Recently, some studies have shown advantage of internal fixation whereas some show no difference (23, 24).

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Calcaneal plating is being done in our institute for few years now. So, in this study we will study the functional and radiological outcome of intra-articular calcaneal fracture treated with calcaneal plate.

Objectives

To observe the functional outcome of Operative treatment of intraarticular fractures of calcaneum in adults in terms of American Orthopaedic Foot and Ankle Society (AOFAS) score and Visual Analogue Scale (VAS) score.

MATERIALS AND METHODS

This study was a retrospective analytic study. The study was conducted in the Department of Orthopaedics, B.P Koirala Institute of Health Sciences, a tertiary care hospital in Eastern Nepal. Data collection and analysis of patients operated from July 2017 to June 2019 was done. Patients with age between 18-45 years with closed isolated intraarticular calcaneal fracture operated during the study period were included in the study. Twenty six cases who fulfilled inclusion criteria were analysed. Clinical data and radiological data were collected.

Study of X-rays of anteroposterior, lateral and Harris views of calcaneum and CT scan were done to assess the amount of comminution and articular depression whenever possible. Calcaneal height, calcaneal width and Bohler's angle were measured from pre-operative, post-operative and 6 month follow up x-rays. Socio-demographic, clinical parameters and operative data were recorded from documents recovered from hospital record section and patient' record file. Descriptive analysis was done in terms of mean, percentage and standard deviation. Graphical and tabular presentations were made.

Intervention

All of the patients were operated in lateral decubitus position under pneumatic tourniquet. IV antibiotic was given half an hour before induction. Following appropriate anaesthesia L-shaped incision was made deep down to periosteum and bone to create full thickness periosteal-cutaneous flap, from 4 cm above the lateral malleolus midway between posterior border of fibula and Achilles tendon and curving into the transition zone between glabrous and nonglabrous skin parallel to sole to the base of the 5th metatarsal.

The fracture was reduced and temporarily fixed with K-wires under radiographic guidance. When the reduction was satisfactory, as seen with the radiographic intensifier, final stabilization was obtained with a low-profile plate.

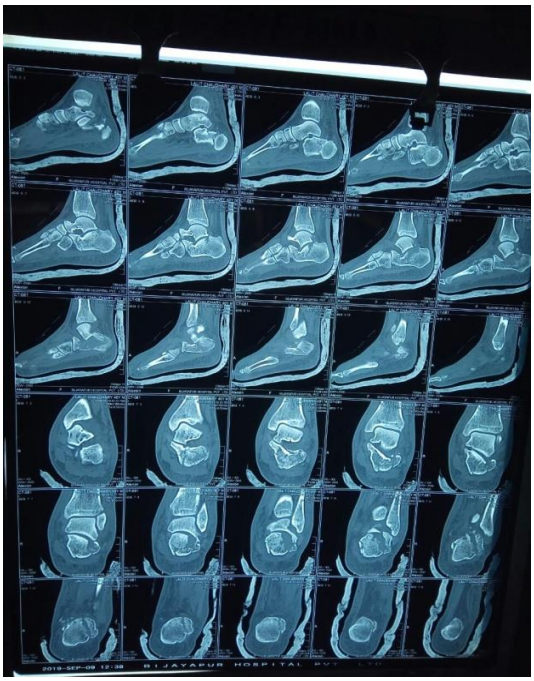
Patients were admitted in ward after surgery and monitored for any immediate post-operative complication. They were discharged after 2 days of antibiotics on below knee slab, general condition permitting.

After discharge patients were reviewed after 2 weeks (for suture removal and to assess signs of wound infection), 8 weeks, 3 months and 6 months.

Slab was removed and partial weight bearing was allowed from 8 weeks and gradually increased to full weight bearing at 12 weeks.

During follow-up, functional outcome was evaluated with the use of the American Orthopaedic Foot & Ankle Society (AOFAS) score and the Modified Visual Analogue Scale (VAS). Physical examination was done to assess the alignment, stability, and ability to walk. The range of motion of ankle joint and subtalar joint was measured using goniometer.

Radiological assessment was done with plain x-ray of calcaneum in lateral and Harris view. Bohler angle and calcaneal height measured in lateral view while calcaneal width was measured in Harris view. Clinical and radiological union were evaluated at 3 months and 6 months follow up. Complications were looked for during follow ups. Proper documentation of all the records was done.



(A) Sagittal and Coronal cuts

(B) 3-D Reconstruction

Figure 1: Pre-operative CT scan of Foot

Figure 2: Pre-operative X-ray of foot

Figure 3: Post-operative X-ray of foot

Figure 4: Pre-operative X-ray

Figure 5: 6 months follow up clinical picture

RESULTS

Twenty six cases were included in the final analysis.

Mean ankle ROM at final follow up was 44.09±5.40. Mean subtalar ROM at 6 months follow up was 18.46±6.24. Average AOFAS score at final follow up was 81.4 (81% had score > 75). Average VAS score at final follow up was 7.9±1.3.

Union was present in all cases at 12 weeks follow up. Of the total operated cases, 3 developed superficial infection. They were managed with IV antibiotics. One patient had wound dehiscence which was managed with vacuum assisted closure.

Table 1: Socio-demographic and operative parameters

Average Age	32 years (22-54)
Sex (M:F)	10:3
Side (Right:Left)	15:11
Mode of Injury	RTA-24(92%) Fall from height-2(8%)
Injury to Operation time	8 days±4.4 days
Operation to Discharge time	5 days±2.6 days
Average Blood loss	80±20ml

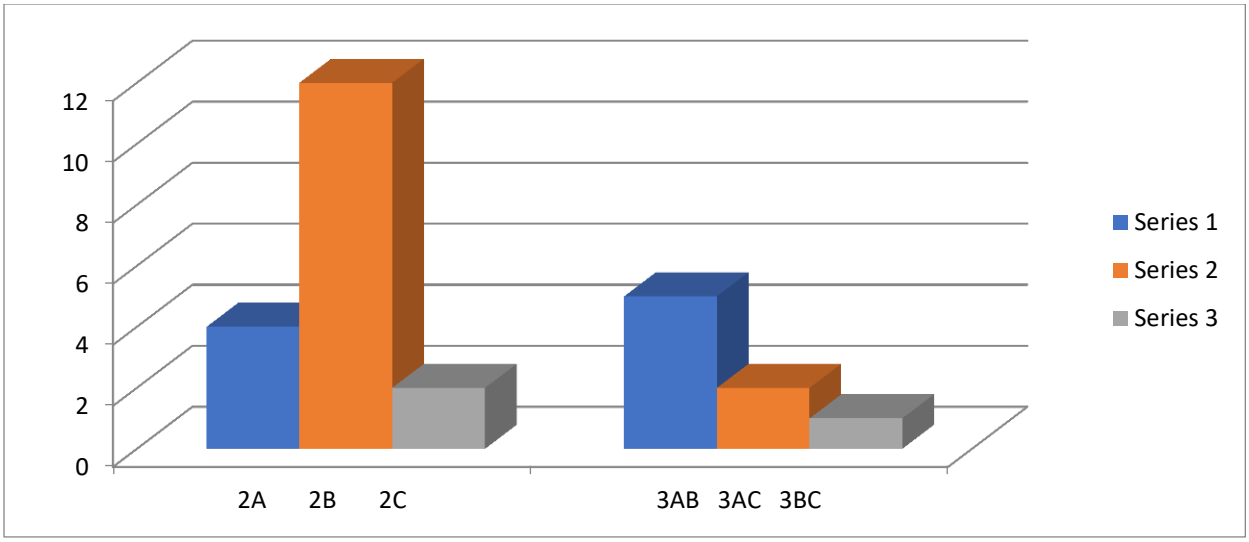


Figure 1: Bar Diagram showing the pattern of fracture as per Sanders classification

Table 2: Radiological parameters

Parameters	**At Presentation**	**Post- reduction**	**6 months**
Bohler angle	5.6°	26.4°	25.1°
Calcaneal height	3.6 cm	4.4 cm	4.3 cm
Calcaneal width	4.2 cm	3.7 cm	3.9 cm

DISCUSSION

There is controversy regarding the choice of treatment of intra-articular calcaneal fractures (6, 8). Previously conservative management was more popular because of the complications associated with surgical treatment (4, 8). But some recent studies have shown improvement in functional outcomes with proper restoration of Bohler angle, calcaneal height and width (25, 26).

In our study, average age of the patient was 34 years with age ranging from 22 to 54 years (Table 1) . The average age is similar to study done by Jain S *et al.* (27), Shrestha R *et al.* (28) and Mustafa SM *et al.* (29), which showed the average age to be the 4th decade of life. Most of the patients sustaining calcaneal fracture were male in our study (Table 1) which was similar to other studies (9, 27, 28). In our study, the most common mechanism of injury was fall from height (92%) followed by RTA (8%)(Table 1) . This is similar to the study done by Mustafa SM *et al.* (29) in which 95.8% cases resulted from fall from height. Sander's Type II was the most common fracture pattern in this study (Figure 1) which is similar to the study done by Shrestha R *et al.* (28) and Mustafa *et al.* (29).

Some recent studies have shown better results in cases which are treated with open reduction and fixation with plate, especially when reduction is anatomical (26-31). However, a study done by Griffin D *et al.* (32) found no significant difference in the primary outcome (mean Kerr-Atkins score 69.8 in operative group *v* 65.7 in non-operative group; adjusted 95% confidence interval of difference −7.1 to 7.0) or in any of the secondary outcomes between treatment groups. Complications and reoperations were more common in those who received operative care (estimated odds ratio 7.5, 95% confidence interval 2.0 to 41.8). In our study,

Average AOFAS score at final follow up was 81.4 (81% had score > 75). Average VAS score at final follow up was 7.9±1.3. This is similar to some recent studies that shows good to excellent AOFAS score in majority of the patients treated operatively (26, 27, 33). Similarly, study done by Agren PH *et al.* (30) showed good primary VAS score in patient treated operatively.

In our study, the mean Bohler angle improved from 5.6° to 25.1°at final follow up (Table 2). This is comparable with a study done by Thordarson *et al.* (33) in which Bohler angle increased from 11° to 26° in operative case. Also in Argen *et al.* (30) Bohler angle was seen to increase from 11° to 26° in operative group. This is also comparable to some other recent studies treated with open reduction and plating (26- 28, 31). The mean calcaneal height and width at presentation was 3.6 cm and 4.2 cm respectively. At final follow up calcaneal height and width was 4.3cm and 3.9cm respectively (Table 2) . In 2013 Jain S *et al.* (27) did a case series in ORIF of intra-articular fractures fixed with locking calcaneal plates and found similar results.

Mean ankle ROM at final follow up was 44.09±5.40 and mean Subtalar ROM at 6 months follow up was 18.46±6.24. Some other recent studies also have shown good ROM of ankle and subtalar joint after open reduction and plating (27, 29). In our study, union occurred in all the cases at 3 months. This is similar to a study done by Meraj A *et al.* (34) in which the average time to union was 3 months (2-4months) and to a study done by Thordaeson DB *et al.* (33).

Flap necrosis and infection are the most common complications associated with open reduction and plating ranging from 5% to 15% (5). However with improvement in the implant and soft tissue handling techniques complications of surgery have been reported to have decreased in recent publication (9-14). Of the total operated cases in our study, 3 developed superficial infection. They were managed with IV antibiotics. One patient had wound dehiscence and was managed with VAC.

CONCLUSION

Open reduction and internal fixation with plate is associated with good clinical and functional outcome in Sander type II and III fractures. With good surgical techniques, improved implant and proper use of fluoroscopy, proper restoration of Bohler angle, calcaneal height and width can be achieved. Restoration of radiological parameters is associated with good functional outcomes. Also concerns regarding flap necrosis and infection can be reduced by meticulous soft tissue handling.

Limitation

The limitation of this study is small sample size. Long term complications could also not be studied due to short duration of follow-up.

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No.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the study or this article.

REFERENCES

1. Daftary A, Haims AH, Baumgaertner MR. Fractures of the calcaneus: a review with emphasis on CT. Radiographics. 2005 Sep-Oct; 25(5):1215-26.
2. Fitzgibbons TC, McMullen ST, Mormino MA. Fractures and dislocations of the calcaneum. In: Bucholz RW and Heckman JD Eds. Rockwood and Green's Factures in adults, Vol.3, 5th ed. Philadelphia: Lippincott Williams & Wilkins. 2001: 2133-2179.
3. Sanders R, Fortin P, DiPasquale T, Walling A. Operative treatment in 120 displaced intraarticular calcaneal fractures: results using a prognostic computed tomography scan classification. Clin Orthop Relat Res. 1993; 290:87-95.
4. Sanders R. Displaced intra-articular fractures of the calcaneus. J Bone Joint Surg Am. 2000 Feb; 82(2):225-50.
5. Myerson M, Quill GE Jr. Late complications of fractures of the calcaneus. J Bone Joint Surg Am. 1993 Mar; 75(3):331-41.
6. Barei DP, Bellabarba C, Sangeorzan BJ, Benirschke SK. Fractures of the calcaneus. Orthop Clin North Am. 2000; 33:263-85.
7. Eastwood DM, Langkamer VG, Atkins RM. Intra-articular fractures of the calcaneum. Part II: open reduction and internal fixation by the extended lateral transcalcaneal approach. J Bone Joint Surg [Br]. 1993; 75-B:189-95.
8. Cotton FJ. Os calcis fracture. Ann Surg. 1916; 64:480-6.
9. Buckley R, Tough S, McCormack R, Pate G, Leighton R, Petrie D, Galpin R. Operative compared with nonoperative treatment of displaced intra-articular calcaneal fractures: a prospective, randomized,

controlled multicenter trial. J Bone Joint Surg Am. 2002; 84: 1733-44.
10. Athavale SA, Joshi SD, Joshi SS. Internal architecture of calcaneus: correlations with mechanics and pathoanatomy of calcaneal fractures. Surg Radiol Anat. 2010; 32:115-22.
11. Barla J, Buckley R, McCormack R, Pate G, Leighton R, Petrie D, Galpin R; Canadian Orthopaedic Trauma Society. Displaced intraarticular calcaneal fractures: long term outcome in women. Foot Ankle Int. 2004; 25:853-6.
12. Clare MP, Lee WE 3rd, Sanders RW. Intermediate to long-term results of a treatment protocol for calcaneal fracture malunions. J Bone Joint Surg Am. 2005; 87:963-73.
13. Csizy M, Buckley R, Tough S, Leighton R, Smith J, McCormack R, Pate G, Petrie D, Galpin R. Displaced intra-articular calcaneal fractures: variables predicting late subtalar fusion. J Orthop Trauma. 2003; 17:106-12.
14. Radnay CS, Clare MP, Sanders RW. Subtalar fusion after displaced intra-articular calcaneal fractures: does initial operative treatment matter? J Bone Joint Surg Am.2009; 91:541-6.
15. Crosby LA, Fitzgibbons T. Intraarticular calcaneal fractures. Results of closed treatment. Clin Orthop Relat Res. 1993; (290): 47-54.
16. Kitaoka HB, Schaap EJ, Chao EY, *et al.*. Displaced intraarticular fractures of the calcaneus treated non-operatively. Clinical results and analysis of motion and ground-reaction and temporal forces. J Bone Joint Surg Am. 1994; 76(10):1531-40.
17. Pozo JL, Kirwan EO, Jackson AM. The long-term results of conservative management of severely displaced fractures of the calcaneus. J Bone Joint Surg Br. 1984; 66(3):386-90.
18. Randle JA, Kreder HJ, Stephen D, Williams J, Jaglal S, Hu R. Should calcaneal fractures be treated surgically? A meta-analysis. Clin Orthop Relat Res. 2000; 377: 217-27.
19. Ibrahim T, Rowsell M, Rennie W, Brown AR, Taylor GJ, Gregg PJ. Displaced intraarticular calcaneal fractures: 15-year follow-up of a randomised controlled trial of conservative versus operative treatment. Injury. 2007; 38: 848-55.
20. Crosby LA, Fitzgibbons TC. Open reduction and internal fixation of type II intra-articular calcaneus fractures. Foot Ankle Int. 1996; 17(5):253-8.
21. Hutchinson F 3rd, Huebner MK. Treatment of os calcis fractures by open reduction and internal fixation. Foot Ankle Int. 1994; 15(5):225-32.
22. Letournel E. Open treatment of acute calcaneal fractures. Clin Orthop Relat Res. 1993; (290):60-7.
23. Jarvholm U, Korner L, Thoren O, Wiklund LM. Fractures of the calcaneum: a comparison of open and closed treatment. Acta Orthop Scand. 1984; 55: 652-656.
24. Buckley RE, Meek RN Comparison of open versus closed reduction of Intraarticular calcaneal fractures: a matched cohort in workmen. J Orthop Trauma. 1992; 6: 216-222.
25. Weber M, Lehmann O, Sagsser D, Krause F. Limited open reduction and internal fixation of displaced intra-articular fractures of the calcaneum. J Bone Joint Surg [Br]. 2008; 90B: 1608-16.
26. Griffin D, Parsons N, Shaw E, *et al.*. Operative versus non-operative treatment for closed, displaced, intra-articular fractures of the calcaneus: randomised controlled trial. BMJ. 2014; 349 :g4483
27. Jain S, Jain AK, Kumar I. Outcome of open reduction and internal fixation of intraarticular calcaneal fracture fixed with locking calcaneal plate. Chinese Journal of Traumatology - English Edition. 2013; 16(6), 355–360.
28. Shrestha R, Shrestha D, Kayastha SR, Winker H. Displaced Intra-Articular Calcaneal Fractures: Evaluation of Clinical and Radiological Outcome Following Open Reduction and Internal Fixation with Locking Branched Calcaneal Plate. Kathmandu Univ Med J. 2017; 58(2):130-36.
29. Mustafa SM, Hwaizi LJ *et al.*. Outcome of Treatment of Displaced Intrartcular Fracture Calcaneus by Plate and Screws. Open J Orthop Rheumatol. 2018; 3(1): 012-019.
30. Argen PH, Wretenberg P, Sayed-noorA S. Operative Versus Nonoperative Treatment of Displaced Intra-Articular Calcaneal Fractures: a prospective, randomized, controlled multicentrictrial. J Bone Joint Surg Am. 2013; 95:1351-7.
31. Gülabi D, Sarı F, Sen C *et al.*. Mid-term results of Calcaneal Plating for Displaced Intraarticular Calcaneus Fractures. Ulus Travma Acil Cerrahi Derg. 2013; 19(2): 145-151
32. Santosha, Gulrez S, Singh AM *et al.*. Open Reduction and Internal Fixation of Displaced Calcaneum, Intra-Articular Fractures by Locking Calcaneal Plate. J Clin Diagn Res. 2016; 10(12):RC18–RC21.
33. Thordarson DB, Krieger LE. Operative vs. nonoperative treatment of intra-articular fractures of the calcaneus: a prospective randomized trial. Foot Ankle Int. 1996; 17:2-9.
34. Miraj A, Zahid M, Ahmad S. Management of Intraarticular Calcaneal Fractures by Minimally Invasive Sinus Tarsi Approach-Early Results. Malays Orthop J. 2012 Mar; 6(1): 13–17.