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Management of closed displaced intra-articular calcaneal fractures: Closed reduction & percutaneous screw fixation versus below knee cast application

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Abstract
Introduction: Calcaneum is the most commonly fractured tarsal bone. Most calcaneal fractures are intra-articular and mostly associated with poor outcomes. The treatment of these fractures is still controversial. This study aims at guiding us to take appropriate treatment decisions in the management of closed displaced intra-articular calcaneal fractures.
Materials and Methods: This prospective randomized comparative study was carried out over a period of 12 months in a sample size of 20 patients at Rajendra Institute of Medical Sciences (RIMS), Ranchi. 10 patients were treated by closed reduction and percutaneous screw fixation (Group A) and 10 by below knee cast application (Group B). Patients were followed up for 6 months and functional and radiological outcomes were compared.
Results: The AOFAS score, VAS score and complication rates between the two groups were comparable. All fractures in both the groups united at 3 months follow up. There was better restoration of Bohler angle, calcaneal height and calcaneal width in operative group as compared to cast group at 6 months follow up.
Conclusion: The present study shows that although the operative group was associated with better radiological outcomes, however the functional outcomes between the two groups were comparable.

Keywords: Calcaneum fracture, percutaneous screws, cast

Introduction
Calcaneum is the most commonly fractured tarsal bone [1]. Approximately 75% of calcaneal fracture are intra-articular [2, 3] and many are associated with poor outcomes [4, 5]. The economic importance of the injury is considerable as 80-90% occur in working age group of population[6]and these people are disabled for several years and many are unable to return to their original occupation [4]. The general attitude to these injuries at the beginning of the twentieth century was that "the man who breaks his heel bone is finished" [7].
In early 1900s, conservative management was preferred and surgical management considered inappropriate for these fractures [8]. Although open reduction has been performed since the early 1930s, technical problems, infection and, on occasion, the need for amputation, prejudiced surgeons against operative treatment [4]. This trend prevailed till 1990s when the unsatisfactory function result of conservative management [9], a better understanding of disabling nature of injuries in combination with improved implant and routine use of intra-operative imaging resulted in renewed interest in surgical fixation [10-15]. Compared to open procedures, minimally invasive technique offers the prospect of good reduction and fewer complications [16-18]. Closed treatment of intra-articular calcaneal fracture include closed manipulation and casting, compression dressing and early mobilization, and pin fixation as recommended by Essex-Lopresti [19]. In 1983, Forgon and Zadravecz introduced less invasive technique that involved semiclosed reduction and percutaneous screw fixation [20]. The treatment of displaced intra-articular calcaneal fracture is controversial. Some studies done in other parts of world have shown that closed reduction and percutaneous screw fixation is suitable technique for most types of intra-articular calcaneal fracture [21-22].

Whatever the treatment modality may be, goals common to all types of treatment of calcaneal fractures are as follows: (1) restoration of congruency of the posterior facet of the subtalar subtalar joint, (2) restoration of the height of the calcaneus (Bohler angle), (3) reduction of the width of the calcaneus, (4) decompression of the subfibular space available for the peroneal tendons, (5) realignment of the tuberosity into a valgus position, and (6) reduction of the calcaneocuboid joint if fractured [23].

Inspite of improved surgical and imaging techniques, there is still a debate whether these fractures should be operated or treated conservatively. This study aims to compare the outcomes of these two modalities of treatment.

Materials and Methods

This is a prospective randomized study conducted in the Department of Orthopaedics, Rajendra Institute of Medical Sciences (RIMS), Ranchi for 12 months from March 2018 to February 2019. Patients presenting with calcaneal fracture were screened for eligibility by clinico-radiological evaluation, following which they were enrolled into the study after taking a written, informed and understood consent. Patients less than 18 year of age, extra-articular fractures, open fractures, bilateral calcaneal fractures, cases with pre-existing ankle/foot pathology, and cases with compartment syndrome were excluded from the study.

Twenty eligible patients were randomized into two groups i.e. group A - closed reduction and percutaneous screw fixation and group B – Below Knee cast by computer generated random number selection. Below knee POP slab was applied on admission for 1 week and patients were advised for strict limb elevation following which patients in Group A were treated by closed reduction and percutaneous screw fixation whereas those in Group B were treated by B/K cast application.

Ten patients in group A and 10 in group B were followed up at 2 weeks (only group A), 8 weeks, 3 months and 6 months. The outcome was measured in terms of American Orthopaedic Foot & Ankle Society (AOFAS) and Visual Analogue Scale (VAS) score, Bohler angle, calcaneal height and width, union and complications.

Results

Total of 51 patients of calcaneal fracture presented to RIMS during the study period. Out of these, 20 cases that fulfilled the inclusion criteria and gave consent were enrolled. Randomisation was done to divide these cases in their respective groups (10 each).

Table 1: Showing distribution of different fracture types according to Essex-Lopresti classification in the two groups

Fracture type	Groups		Total
	Operative-A (%)	Cast-B (%)	
Joint depression	7(70)	6(60)	13(65)
Tongue type	2(20)	3(30)	5(25)
Comminuted	1(10)	1(10)	2(10)
Total	10	10	20

Joint depression type was the most common fracture pattern in both groups.

Table 2: Showing distribution of different variables in two groups

Variables		Groups	
		Operative - A	Cast - B
Age(Years)		38.4	37.9
Bohler Angle (Degree)	Preoperative	11.9	11.7
	6 Months	19.3	11.1
Height(mm)		45.1	35.3
Width(mm)		32.9	38.1
VAS score (6months)		56.8	54.3
AOFAS score(6months)		73.8	71.6

The initial Bohler angle, VAS pain and function score and AOFAS score at 6 months between the two groups were comparable. There was better restoration of Bohler angle at 6 months follow-up in the operative group as compared to cast group. Similarly the calcaneal height and width were better restored in the operative group.

Table 3: Union at 3 months in two groups

Union	Group	
	Operative-A (%)	Cast-B (%)
Present	10	10
Absent	0	0
Total	10	10

All the patients in both groups had union at 3 months.

Table 4: Complications in the two groups

Complications	Group	
	Operative-A (%)	Cast-B (%)
Present	2(20)	1(10)
Absent	8(80)	9(90)
Total	10	10

In the operative group, 2 patients developed screw tract infection. In the cast group 1 patient developed complication in form of cast sore.

Discussion

The mean age in both groups was comparable. Buckley R *et al.* [10], found the mean age of patient at the time of injury to be 40±11, which is similar to the present study. In our study 65% of the patients had joint depression type of fracture, 25% had tongue type fracture and 10% had comminuted type of fracture which is similar to a study done by Stulik J *et al.* [24] Bohler angle in operative group was seen to improve from a mean of 11.9° to a mean of 19.3° at 6 months. In the cast group, Bohler angle was seen to decrease from a mean of 11.7° to a mean of 11.1° at 6 months follow up. This was comparable to Thordarson *et al.* [25], where Bohler angle increased from 11° to 26° in operative and decreased from 9° to 8° in conservative group. Argen *et al.* [22] found Bohler angle to increase from 11° to 26° in operative group. The mean calcaneal height in the operative and cast group was 45.1 mm and 35.3 mm respectively at 6 months follow up. This shows that the operative group had less height loss than

the cast group. This agrees with Leung KS *et al.* [26] and Xia *et al.* [27] The calcaneal width in the operative and cast group was 32.9 mm and 38.1 mm respectively. Leung KS *et al.* [26] and Xia *et al.* [27] reported similar findings. This shows that patients managed operatively had more stable calcaneal width than those managed with B/K cast. In the operative group, the VAS [28] pain and function score (56.8) at 6 months was slightly better than that of cast group (54.3). This agrees with the findings of Argen *et al.* [22], recent meta-analysis of current evidence by Jiang *et al.* [29] and a Cochrane report by Bridgman *et al.* [30] The AOFAS [31] score of the operative group at 6 months (73.8) was slightly better than the AOFAS score of cast group at 6 months (71.4). This is similar to the study done by Argen *et al.* [22], Jiang *et al.* [29] and a Cochrane report by Bridgman *et al.* [30] Union occurred in all cases of both groups at 3 months. This is similar to a study done by Meraj A *et al.* [32] in which the average time to union was 3 months (2-4months) and by Thordarson DB *et al.* [25] In the operative group, 20% (2) cases were infected with screw track infection for which implant removal was done. One case in cast group was complicated with cast sore, for which regular dressing was done and wound healed by 2° intention. Thomesen T *et al.* [21] reported similar findings. Argen PH *et al.* [22] found 23% of the operative cases infected, whereas in the non-operative group 2.4% (1) patient had compartment syndrome and 4.2% (2) patients had severe symptoms in foot.

Conclusion

From the above study it is concluded that closed reduction and percutaneous screw fixation is associated with a better radiological outcome in terms of Bohler angle restoration, calcaneal height and calcaneal width as compared to B/K cast application. However the functional outcome in terms of AOFAS and VAS were comparable between the two groups. The time to union and complication rates were also comparable.

References

1. Daftary A, Haims AH, Baumgaertner MR. Fractures of the calcaneus: A review with emphasis on CT. Radiographics. 2005; 25(5):1215-26.
2. Juliano P, Nguyen HV. Fractures of the calcaneus. Orthop Clin North Am. 2001; 32(1):35-51.
3. Lutter LD, Mizel MS, Pfeffer GB. Orthopaedic knowledge update. Foot and ankle. Rosemont, IL: American Academy of Orthopaedic Surgeons, 1994.
4. Sanders R. Displaced intra-articular fractures of the calcaneus. J Bone Joint Surg Am. 2000; 82(2):225-50.
5. Myerson M, Quill GE Jr. Late complications of fractures of the calcaneus. J Bone Joint Surg Am. 1993; 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. Bowyer G. Apley`s System of Orthopaedics and Fractures. Ninth Edition. Hodder Arnold, London, 2010, 924.
8. Cotton FJ. Os calcis fracture. Ann Surg. 1916; 64:480-6. 8.
9. James ET, Hunter GA. The dilemma of painful old OS calcis fractures. Clin Orthop Relat Res. 1983; 177:112-5.
10. Buckley R, Tough S, McCormack R, Pate G, Leighton R, Petrie D *et al.* 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.
11. Athavale SA, Joshi SD, Joshi SS. Internal architecture of calcaneus: correlations with mechanics and path anatomy of calcaneal fractures. Surg Radiol Anat. 2010; 32:115-22.
12. Barla J, Buckley R, McCormack R, Pate G, Leighton R, Petrie D *et al.* Canadian Orthopaedic Trauma Society. Displaced intraarticular calcaneal fractures: long term outcome in women. Foot Ankle Int. 2004; 25:853-6.
13. 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.
14. Csizy M, Buckley R, Tough S, Leighton R, Smith J, McCormack R *et al.* Displaced intra-articular calcaneal fractures: variables predicting late subtalar fusion. J Orthop Trauma. 2003; 17:106-12.
15. 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.
16. Essex-Lopresti P. The mechanism, reduction technique and results in fractures of the Os Calcis. Br J Surg. 1952; 39:395-419.
17. Fernandez DL, Koella CH. Combined percutaneous and minimal internal fixation for displaced articular fractures of the calcaneus. Clin Orthop. 1993; 290:108-16.
18. Levine DS, Helfet DL. An introduction to the minimally invasive Osteosynthesis of intraarticular calcaneal fractures. Injury. 2001; 32:51-4.
19. Canale ST, Beaty JH. Campbell's Operative Orthopaedics. 12th ed. International: Elsevier. 2013; 88:4141.
20. Forgon M, Zadravecz G. [Repositioning and retention problems of calcaneus fractures]. Aktuelle Traumatol 1983; 13:239-46.
21. Themeson T, Biert J, Frolke JPM. Treatment of closed displaced intra articular fracture calcaneum by closed reduction and percutaneous screw fixation. J Bone Joint Surg Am. 2011; 93:920-8.
22. Argen PH, Wretenberg P, Sayed-noor AS. Operative Versus Nonoperative Treatment of Displaced Intra-Articular Calcaneal Fractures: a prospective, randomized, controlled multicentrictrial. J Bone Joint Surg Am 2013; 95:1351-7.
23. Canale ST, Beaty JH. Fractures of the Calcaneus. In: Campbell's Operative Orthopaedics. 11thed, Philadelphia (USA): Mosby Elsevier. 2008; 4(CH 86):4833-4850.
24. Stulik J, Stehlik J, Rysavy M, Wozniak A. Minimally-invasive treatment of intraarticular fractures of the Calcaneum. J Bone Joint Surg Br. 2006; 88-B(12):1634-41.
25. 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.
26. Leung KS, Yuen KM, Chan WS. Operative treatment of displaced intra-articular fractures of the calcaneum. Medium-term results. J Bone Joint Surg Br. 1993; 75:196- 201.
27. Xia S, Shi D, Wang Z, Wang X, Lu Y, Wang H *et al.* Operative versus nonoperative managements for displaced intraarticular fractures of calcaneus. Chin J Orthop Trauma. 2010; 12:1089-1091.
28. Hildebrand KA, Buckley RE, Mohtadi NG, Faris P.

Functional outcome measures after displaced intra-articular calcaneal fractures. J Bone Joint Surg Br. 1996; 78:119-23.
29. Jiang N, Lin QR, Diao XC, Wu L, Yu B. Surgical versus nonsurgical treatment of displaced intra-articular calcaneal fracture: A meta-analysis of current evidence base. Int. Orthop. 2012; 36(8):1615-22.
30. Bridgman SA, Dunn KM, McBride DJ, Richards PJ. Interventions for treating calcaneal fractures. Cochrane Database Syst Rev. 2000; 2:CD001161.
31. Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA, Myerson MS, Sanders M. Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes. Foot Ankle Int. 1994; 15(7):349-53.
32. Miraj A, Zahid M, Ahmad S. Management of Intraarticular Calcaneal Fractures by Minimally Invasive Sinus Tarsi Approach-Early Results. Malays Orthop J. 2012; 6(1):13-17.