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COMPARING CLOSED REDUCTION AND PERCUTANEOUS SCREW FIXATION VERSUS BELOW KNEE CAST FOR CLOSED DISPLACED INTRA-ARTICULAR CALCANEAL FRACTURE – FUNCTIONAL AND RADIOLOGICAL OUTCOME

Orthopaedics

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ABSTRACT

Introduction: Calcaneum is the most commonly fractured tarsal bone. Approximately 75% are intra-articular and mostly associated with poor outcomes. The treatment of these fractures is still controversial. This study will guide us to take appropriate treatment decision.

Methods: The 44 eligible patients with calcaneal fracture were randomized into two groups i.e. closed reduction and percutaneous screw fixation and B/K cast. Primary outcomes were measured in terms of functional and radiological outcomes.

Results: The AOFAS score, VAS score and complication rate did not differ significantly between two groups. All fractures in both groups united at 3 months follow up. There was significant restoration of Bohler angle (p=0.000), calcaneal height (p=0.000) and stable calcaneal width (p=0.000) in operative group than cast group at 6 months follow up.

Conclusion: There was no significant difference between both groups despite the significantly better radiological outcomes in the operative group.

KEYWORDS

calcaneum, cast, outcome, percutaneous

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]

In early 1900s, conservative management was preferred and surgical management considered inappropriate for these fractures.[7] 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[8], 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.[9-14]

Compared to open procedures, minimally invasive technique offers the prospect of good reduction and fewer complications.[15-17] 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.[18] In 1983, Forgon and Zadravecz introduced less invasive technique that involved semiclosed reduction and percutaneous screw fixation.[19]

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.[20-21] 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 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.[22]

This study will help us in answering the question that, with improved surgical and imaging techniques, whether these fractures should be operated or should we stick to conventional conservative management.

METHODS:

This is a randomized study conducted in the Department of Orthopaedics, B.P.K.I.H.S, Dharan for 15 months from March 2014 to May 2015. Patients presenting with calcaneal fracture were screened for eligibility by clinico radiological evaluation. Forty four eligible patients were randomized into two groups i.e. group A - closed reduction and percutaneous screw fixation and group B - B/K cast by computer generated random number selection. The patients in group A were treated by closed reduction and percutaneous screw fixation under image intensifier and the patients in group B were treated with B/K cast. Twenty two patients of group A and 20 of group B were followed up on 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. Data were entered in Microsoft Excel 2010 and converted into SPSS 20 version.

For descriptive purpose mean, median, standard deviation, percentage and proportion were calculated. For interventional statistics Chi-square test, Fisher's exact test and t-test were applied to find out significant difference between the two procedures with related variable at 95% confidence interval where $p<0.05$.

RESULTS:

Total of 58 patients of calcaneal fracture presented to BPKIHS during the study period. Out of these, 44 cases that fulfilled the inclusion criteria and gave consent were enrolled. Randomisation was done to divide these cases in their respective groups (22 each). Two cases in the B/K cast group were lost to follow up. So, 22 cases of operative group and 20 cases of cast group were included in the final analysis.

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

Fracture type	Group		Total	P- value
	Operative-A (%)	Cast-B (%)		
Joint depression	15(68.2)	12(60.0)	27(64.3)	0.580
Tongue type	5(22.7)	6(30)	11(26.2)	
Comminuted	2(9.1)	2(10)	4(9.5)	
Total	22	20	42	

There was no significant difference between the two groups in relation to types of fracture.

Table 2: Showing distribution of different variables in two groups

Variables	Groups		P value
	Operative-A (n=22)	Cast-B (n=20)	
Age(Years)	41.14±13.69	40.10±10.76	0.788
Bohler angle(Degree) Preoperative 6 months	11.73±3.97 19.50±3.84	11.50±4.10 10.70±4.00	0.856 <0.001
Height(mm)	44.68±3.73	34.35±2.94	<0.001
Width(mm)	33.27±2.39	37.70±2.32	<0.001
VAS score (6months)	56.73±6.61	54.00±5.19	0.147
AOFAS score(6months)	74.55±4.58	72.60±4.21	0.161

There was no significant difference in between the two groups with respect to age, initial Bohler angle, VAS pain and function score and AOFAS score at 6 months (p>0.05). There was significant difference in the Bohler angles between the two treatment groups at 6 months follow up (p<0.001). The calcaneal height was also significantly different between the two treatment groups at 6 months follow up (p<0.001). There was significant difference in the calcaneal width between the two treatment groups at 6 months follow up (p<0.001).

Table 3: Complications in the two groups

Complications	Group		P value
	Operative-A (%)	Cast-B (%)	
Present	3(13.6)	1(5)	0.608
Absent	19(86.4)	19(95)	
Total	22	20	

In the operative group, 3 patients developed infection, out of which 2 developed superficial infection and 1 developed screw track infection. In the cast group 1 patient developed complication in form of cast sore. There was no significant difference in relation to complications among the 2 groups.

Table 4: Union at 6 months in two groups

Union	Group		P value
	Operative	Cast	
Present	22	20	NA
Absent	0	0	
Total	22	20	

All the patients in both groups had union at 6 months (p value not applicable).

DISCUSSION

In our study 64.3% of the patients had joint depression type of fracture, 26.2% had tongue type fracture and 9.5% had comminuted type of fracture which is similar to a study done by Stulik J et al.[23] The mean age in both groups were comparable. Buckley Ret al[9], found the mean age of patient at the time of injury to be 40±11, which is similar to our study.

Bohler angle in operative group was seen to improve from a mean of 11.73°±3.97° to a mean of 19.50°±3.84° at 6 months. In the cast group, Bohler angle was seen to decrease from a mean of 11.50°±4.10° to a mean of 10.70°±3.94° at 6 months follow up. This was comparable to Thordarson et al.[24], where Bohler angle increased from 11° to 26° in operative and decreased from 9° to 8° in conservative group. Argen et al.[21] found Bohler angle to increase from 11° to 26° in operative group.

The mean calcaneal height in the operative and cast group was 44.68±3.73 mm and 34.35±2.94 mm respectively at 6 months follow up. There was significant difference in the mean calcaneal height between the two groups (p<0.001). This shows that the operative group had significantly less height loss than the cast group. This agrees with Leung KS et al.[25] and Xia et al.[26] The calcaneal width in the operative and cast group was 33.27±2.39 and 37.70±2.32 respectively. The calcaneal width difference between the two groups was also significant (p<0.001). Leung KS et al.[25] and Xia et al.[26] reported the similar findings. This shows that patients managed operatively had significantly more stable calcaneal width than those managed with B/K cast.

In the operative group, the VAS[27] pain and function score (56.73±6.61) at 6 months was better than that of cast group (54.00±5.19). But, it was not statistically significant. This agrees with the findings of Argen et al.[21], recent meta-analysis of current evidence by Jiang et al[28] and a Cochrane report by Bridgman et al.[29] The AOFAS[30] score of the operative group at 6 months (74.55±4.58) was better than the AOFAS score of cast group at 6 months (72.60±4.21). This was not statically significant. This is similar to the study done by Argen et al.[21], Jiang et al.[28] and a Cochrane report by Bridgman et al.[29]

Union occurred in all cases of both groups at 3 months. This is similar to a study done by Meraj A et al.[31] in which the average time to union was 3 months (2-4months) and by Thordarson DB et al.[24]

In the operative group, 13.6% (3) cases were infected. Two cases had superficial infection and one had screw track infection for which implant removal was done. Five percent (1) case in cast group was complicated with cast sore, with no significant difference in the rate of complication between the two groups. Thomesen T et al.[20] reported similar findings. Argen PH et al.[21] 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. Twenty three percent of infection rate was probably because both the cases, open reduction plating and percutaneous screws, were included in the operative group. Plating might be the cause of increased significant infection rate in this group.

CONCLUSION

This study showed significantly better radiological outcome (Bohler angle, Calcaneal height and Calcaneal width) after closed reduction and percutaneous screw fixation as compared to B/K cast. The functional (AOFAS and VAS) scores were not significantly different between two groups. The time to union and the rates of complications between the two groups were also comparable.

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