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 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 [6], 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 Zadravec 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 subfascial space available for the peroneal tendons, (5) realignment of the tuberosity into a valgus position, and (6) reduction of the calcaneocuboid joint if fractured. Inspirite 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

<table>
<thead>
<tr>
<th>Fracture type</th>
<th>Groups</th>
<th>Total</th>
<th>Operative-A (%)</th>
<th>Cast-B (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint depression</td>
<td></td>
<td>13(65)</td>
<td>7(70)</td>
<td>6(60)</td>
</tr>
<tr>
<td>Tongue type</td>
<td></td>
<td>5(25)</td>
<td>2(20)</td>
<td>3(30)</td>
</tr>
<tr>
<td>Comminuted</td>
<td></td>
<td>2(10)</td>
<td>1(10)</td>
<td>1(10)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

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

Table 2: Showing distribution of different variables in two groups

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

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.

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., 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. Bohler angle in operative group was seen to improve from a mean of 11° 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., where Bohler angle increased from 11° to 26° in operative and decreased from 9° to 8° in conservative group. Argen et al., 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 (2-4 months) and by Thordarson DB et al. [33]. 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
28. Hildebrand KA, Buckley RE, Mohtadi NG, Faris P.


