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ORIGINAL ARTICLE

MANAGEMENT OF INTRA-ARTICULAR CALCANEAL FRACTURES BY CLOSED REDUCTION WITH PERCUTANEOUS STEINMANN PIN

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ABSTRACT: BACKGROUND & OBJECTIVES: Calcaneum is the most common tarsal bone to fracture and is attended by considerable morbidity. Many treatment techniques are described in literature but indications for specific techniques are vague. This study analyzes the outcome of treatment of intra articular calcaneum fractures treated by Essex-Lopresti technique. **METHODS:** Between January 2011 and December 2012, 20 patients with tongue-type fracture of Calcaneum who got admitted at Srinivas Institute of Medical Sciences, Mangalore in the Department of Orthopedics were subjected to closed reduction and percutaneous pin fixation (Method of Essex-Lopresti). Creighton Nebraska Health Foundation Assessment sheet for calcaneum fractures was used for analysis. **STATISTICAL ANALYSIS**: Wilcoxon Rank-sum test was used to compare repeated measurements on a single sample to assess whether their mean population ranks differ. Kruskal Wallis test was used for analysis of variance. **RESULTS**: Incidence was more common in males with right and left side involvement being almost equal and no bilateral involvement. The commonest mechanism of injury was fall from height and landing on the heel. It was found to be more common in age group 30-39 years. Associated spine and lower extremity injuries were seen in 30%. There were 45% excellent, 30% good, 25% fair results and no poor results. **CONCLUSION:** The Essex-Lopresti method of closed reduction and pin fixation is a safe technique with overall good results and an acceptable complication rate for the treatment of tongue-type fracture of calcaneum.

KEYWORDS: Essex-Lopresti, Closed reduction, CNHF Score, Bohler's angle.

INTRODUCTION: Cotton in 1908 said "Ordinarily speaking, the man who breaks his heel is 'done'". Historically most fractures were treated non-operatively because open reduction and internal fixation was associated with high complication rates and did not result in significantly improved outcomes.[1-5] With better understanding of fracture patterns and improved surgical and fixation techniques, there appears to be a renewed interest in the surgical treatment of displaced intra-articular fractures of the calcaneus.[6-10]

Calcaneal fractures make up about 2 percent of all fractures. They account for 60 percent of major tarsal injuries. The economic importance of these fractures is apparent in that although they represent only 2 percent of all fractures, 90 percent occurs in males between 30 and 45 years of age. The economic impact becomes even more apparent when one considers that 20 percent of patients may be incapacitated for up to 3 years following the fracture and many are still partially incapacitated as long as 5 years after the fracture.[11]

Over the years, various techniques have been developed to accomplish this goal. All these techniques have certain steps in common including disimpaction of the fragments, reduction of the displaced fragments either manually or percutaneously and protection of reduction with pins and plasters, external fixation and open reduction and internal fixation.[12]

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The technique of closed reduction and percutaneous fixation was introduced by Westheus in 1934 and popularized by Gissane. But the credit for describing the technique and introducing the shoe plaster goes to Essex-Lopresti.[13, 14] The effectiveness of this technique in the restoration of Böhler's angle and calcaneal height in tongue shaped is well documented.[15, 16]

MATERIALS AND METHODS: This was a prospective study which was done at Department of Orthopedics, Srinivas Institute of Medical Sciences, Mangalore. Records of 20 patients diagnosed with tongue-type intra-articular fractures of the calcaneum were reviewed. The period of the study was from January 2011 to December 2012. Only patients with tongue-type intra-articular calcaneum fractures between the age group of 18 to 55 were included in the study. All patients underwent closed reduction and percutaneous fixation by Essex-Lopresti technique. All open fractures and patients presenting later than 2 weeks of injury were excluded. The period of follow up was from 6 months to 1 year.

Radiographic analysis was done by Antero-Posterior, Lateral and Harris axial views of the calcaneum. Bohler's tuber joint angle was measured in normal foot, and affected foot at the time of presentation and at radiological union and ratio was calculated. The basic aim of the surgery was to achieve as near anatomical realignment and perfect subtalar joint congruity as possible.

Surgery was performed in prone position under Spinal or General Anesthesia depending on the patient's general condition. Closed reduction with percutaneous Steinmann pin fixation (Essex-Lopresti Method) was done for all patients. A simple shoe plaster was applied post-operatively and patients were allowed to ambulate without weight-bearing on 1st post-operative day. Almost all patients were discharged by 2nd or 3rd post-operative day.

Initial cast and pin was removed at 6 weeks and below-knee cast was applied. The cast was removed and weight-bearing started only after radiological evidence of union. Patients were followed up for a period of 6 months to 1 year. The results were assessed according to: Creighton Nebraska Health Foundation Assessment Sheet for Fractures of the Calcaneum (Table 1); Status of radiological union; Bohler's angle ratio (Ratio between Bohler's angle of the side of the fracture to the normal side measured in lateral view of the foot); Heel Width (Heel width of both feet measured (in mm) using simple calipers at a fixed point below malleolus).

STATISTICAL ANALYSIS: Data was analyzed using software program SPSS 13.0 (SPSS Inc., Chicago). Wilcoxon Rank-sum test was used to compare repeated measurements on a single sample to assess whether their mean population ranks differ. Kruskul Wallis test was used for analysis of variance.

RESULTS: Of the 20 patients 18(90%) were males and 2(10%) were females. The mean age was 35.2 yrs. and mean follow-up duration was 9 months. From Table 2, it is seen that the maximum age incidence in this study was from 30-39 years age group (60%). Of the 20 patients, 11(55%) were affected on the right side and 9(45%) were affected on the left side. There were no cases of bilateral involvement. The predominant mechanism of injury was fall from height and landing on the heel, 17 cases (85%). The other mechanism was road traffic accident, 3 cases (15%). Total of 6 patients had associated injuries, of which Thoraco-Lumbar spine injuries were commonest.

Both were compression fractures and none of them had neurological compromise. One patient had closed head injury which was managed conservatively. One patient had malleolus

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fracture, treated with open reduction and internal fixation. One patient had Colle's fracture and another patient with closed metatarsal fracture was treated conservatively. All the results were graded as per criteria of Creighton Nebraska Health Foundation assessment sheet for fracture of calcaneum. Of the 20 cases, (Table 3) 9 cases (45%) had excellent results, 6 cases (30%) had good and 5 cases (25%) had fair results. None of the patients in this series had poor results.

Table no.4 shows the association of age with final outcome. Using Kruskul test: p value = 0.306 > 0.05, we found no significance between age of incidence and outcome. This could be due to the fact that none of the patients were above 50 years age.

Table No.5 shows the association of Bohler's ratio with outcome. Applying the Wilcoxon rank-sum test, p>0.025 NS; we found no significant difference in the Bohler's angle ratio between the excellent, good and fair result groups. The Bohler's angle ratio of the side of the fracture to the normal side was significantly lower in patients who had an unsatisfactory result compared with those who had a satisfactory result, indicating that the decrease in this ratio can be used as a predictive factor for the outcome.

A total of 9 patients (45%) had surgery related complications. There were 4 cases (20%) of heel widening. Of these 4 patients, 3 patients (15%) developed subtalar arthritis and one had Peroneal Tenosynovitis. Overall there were 3 cases of Peroneal Tenosynovitis which was managed conservatively. One case recurred and was offered surgery.

Subtalar arthrodesis was done for 2 cases and one patient refused surgery. All 3 patients with subtalar arthritis ended up with fair results. 2 cases (10%) of Plantar spur was managed conservatively of which 1 patient had severe pain limiting his activities. There was only 1case (5%) of superficial infection at pin entry site. Infection subsided with antibiotics and the patient had uneventful recovery. At final follow up, 6 patients did not return to their previous job due to limitation of activities.

All the fractures united within 8-12 weeks. There were no cases of non-union.

DISCUSSION: This present study was instituted to analyze the outcome of closed reduction and percutaneous pin fixation for tongue-type calcaneal fractures. In 1951 Essex Lopresti[13] described this technique for all calcaneal fractures but in a further analysis in 1952, proposed his technique only for tongue-type fractures of calcaneus[14]. This was the time when Gallie's subtalar arthrodesis was the preferred method to treat such fractures. Although Essex Lopresti showed excellent results, his technique was not favored.

Poupa and Pribyl[17] reviewed 34 cases of tongue-type fracture of calcaneum and evaluated the surgical results using the Creighton-Nebraska scoring system. They reported 20(58%) excellent, 10(29%) good and 4(13%) fair results. King[18] assessed the results of 75 consecutive fractures of Os calcis involving the posterior facet treated by Essex-Lopresti method. He concluded that the best results were encountered in tongue-type fracture and less satisfactory results were seen in joint depression type.

Tornetta[15] evaluated 26 consecutive patients with Essex-Lopresti tongue-type fracture. There were 12(55%) excellent, 7(32%) good and 3(13%) fair results. He concluded that the Essex-Lopresti spike reduction is a useful method for the treatment of tongue-type fractures of the calcaneus and the results were superior to those in previous series of intra-articular fractures treated with open reduction and internal fixation. Tornetta[16] again in 2000 analyzed the results of 46 cases. At an

average follow up of 3.4 years, 50% patients had excellent results, 35% had good results, 15% had fair results and no patients had poor results.

Nambiar[19] evaluated the efficacy of closed reduction and percutaneous fixation in 36 intra-articular fractures of calcaneum in 29 patients. In this series they obtained 61% excellent, 33% good and 6% poor results. As recently as in 2007, Pillai[20] described a modification of the classical technique of Essex-Lopresti. Using the Maryland Foot Score, they achieved fair to excellent results in 67% patients.

Compared to open procedures, percutaneous reduction and fixation offers lower complication rates, shorter operating times and more rapid healing due to the undisturbed soft tissue envelope. For carefully selected patients, this technique provides good results comparable with open reduction and internal fixation[5, 21]. In this study, 16 patients (80%) were males involved in heavy manual labor. Both of these are associated with poor outcomes after open reduction.[21]

Delayed wound healing is one of the most commonly encountered complications in open reduction of calcaneal fractures. With the use of percutaneous technique, this problem can be obviated.[12, 22] The scope of percutaneous techniques for the treatment of intra-articular fractures of the calcaneus is limited. In tongue-shaped fractures, the posterior articular facet is contiguous with the posterior tuberosity. Direct manipulation of the facet is possible by traction and a pin inserted into the posterior tuberosity.

This allows the fracture to be reduced accurately percutaneously. Our results thus support earlier publications that the percutaneous technique is best suited for tongue shaped fractures[15, 16, 22]. Significantly reduced Bohler's angle ratio was associated with unsatisfactory results in this study and decrease in this ratio can be used as a negative predictive factor for the outcome.

Although the sample size in this study was smaller, we feel that Essex-Lopresti technique has benefits in treatment of tongue-type fracture of calcaneum especially in patients with significant co-morbidities, poor wound healing and soft tissue compromise.

CONCLUSION: Closed reduction and percutaneous fixation appears to be a safe technique with overall good results and an acceptable complication rate, compared with other treatment modalities for displaced intra-articular calcaneal fractures.

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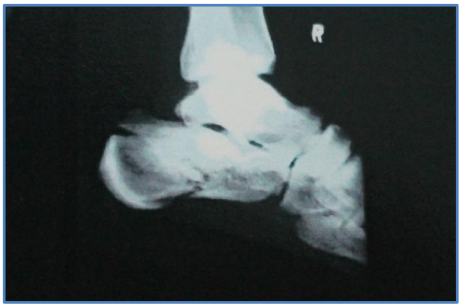

Image 1: xray of tongue-type fracture of calcaneum

Image 2: Intra-operative picture of pin insertion to reduce fracture

Image 3: C-arm image of reduction of fracture

Image 4: Post-operative Xray showing pins in place and well reduced fracture

Item	Points*
Pain (30 points)	
Activity	
No pain when walking or ignores pain	15
Mild pain when walking; takes aspirin	10
Moderate pain when walking; takes codeine	5
Severe pain when walking; severe limitations	0
Rest	
No pain at rest or ignores pain	15
Mild pain at rest	10
Moderate pain at rest	5

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Item	Points*
Severe pain at rest	0
Activity (20 points)	
Unlimited walking and standing	20
Walks 5–10 blocks; stands intermittently for more than half an hour	15
Walks 1–5 blocks; stands half an hour or less	10
Walks less than 1 block (indoor only)	5
Cannot walk	0
Range of inversion/eversion (20 points)	
25°–20° = 80–100%	20
20°–15° = 60–80%	15
15°–10° = 40–60%	10
10°–5° = 20–40%	5
5°–0° = 0–20%	0
Return to work (20 points)	
Full time, same job	20
Full time, with restrictions	15
Full time, change job	10
Part time with restrictions	5
Cannot work	0
Change in shoe size (5 points)	
No change	5
Change	0
Swelling (5 points)	
None	5
Mild	3
Moderate	2
Severe	0

Table 1: Creighton-Nebraska Health Foundation assessment sheet for fractures of the calcaneus

* 90–100 points is an excellent result; 80–89 a good result; 65–79 a fair result; and 64 or less a poor result

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Age Group	No. of cases	Percentage
18-20	0	0
21-29	3	15
30-39	12	60
40-49	5	25
50-55	0	0

Table 2: Age incidence

Grade	No. of cases	Percentage
Excellent	09	45
Good	06	30
Fair	05	25
Poor	00	00

Table 3: Results

Age group	CNHF scores
18-20	00
21-29	85, 90, 95
30-39	95, 98, 93, 90, 88, 80, 75, 70, 90, 93, 80, 80.
40-49	80, 75, 65, 93, 73
50-59	00

Table 4: Association of Age with Outcome

CNHF Outcome	Average ratio	Range of Ratio	P value >0.025 NS
Excellent	91.66	90-95	0.17
Good	87.16	83-94	0.047
Fair	68	63-72	0.111
Poor	--	--	--

Table 5: Association of Bohler's ratio with Outcome

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