



Outcome analysis of Calcaneal fractures: Conservative vs Operative

¹Bhabani Sankar Mohapatra, ²Vikram Nigam, ³Vinod Singh, ⁴Ajay Kumar Verma*

¹FNB Fellow, Indian Spinal Injury Centre, New Delhi.

²Associate Professor, ³Ex Senior Resident, ⁴Associate Professor,

^{2,3,4}Department of Orthopaedics, M.L.N. Medical College, Prayagraj

*Corresponding Author:

Ajay Kumar Verma

Associate Professor, Department of Orthopaedics, M.L.N. Medical College, Prayagraj

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

The treatment of calcaneum fracture is debatable. The aims and objectives of the study is to compare the outcome of different modes of management and their complications after proper assessment of the fracture stability, anatomy as well as functional outcome in followup.

MATERIAL AND METHOD

This was a prospective Cohort study and patients were randomly allocated into the two treatment groups (group 1 patients were managed operatively and group 2 patients were managed conservatively). Only 30 patients were included in the study who turned up for at least 6 months duration. The cases were evaluated clinically and functionally by American Orthopaedic Foot Ankle Society (AOFAS), Ankle-Hindfoot Scoring Method at 3 weeks, 6 weeks, 12 weeks and 6 months interval.

RESULT

In this study out of 20 cases of intra-articular fracture calcaneum, 9 cases were managed conservatively and 11 cases were managed operatively. Mean (AOFAS) Ankle Hindfoot score at 3 weeks, 6 weeks, 12 weeks and 6 months follow up for intraarticular fracture were found to be statistically significant at $p < 0.05$ whereas out of 10 cases of extra-articular fracture calcaneum 6 cases were managed conservatively and 4 cases were managed operatively and the mean (AOFAS) Ankle Hindfoot score at 3 weeks, 6 weeks, 12 weeks and 6 months follow up for extraarticular fracture were found to be statistically insignificant at $p > 0.05$. This shows that operative management of intraarticular and extraarticular calcaneum fracture gives better results than conservatively managed patients. In our study it was found that post-traumatic arthritis was the most common complication in both conservative 6(20.0%) and operative 8(26.7%) of cases followed by wound dehiscence and sural nerve injury which was observed only in operative type in 7(23.3%) and 2(6.7%) cases respectively.

CONCLUSION

It is concluded that conservative management for calcaneum fracture is cost effective, especially for patients with poor financial ability. But operative management gives better functional outcome particularly in intraarticular fracture if patients are selected after evaluating the risk factors.

Keywords: Calcaneal fracture, Conservative, Operative, Nonoperative.

INTRODUCTION

The calcaneum, or os calcis is the largest tarsal bone. It forms the prominence heel and transmit the total body weight to the ground. It accounts approximately 1% to 2% of all fractures¹. It is the most frequently

fractured tarsal bone and 70% of calcaneum fractures resulted from falls^{2,3}. Parmar et al⁴ showed no significant differences regarding outcomes between operation and non operation. However, Thordarson

DB et al³ and Buckley et al¹⁵ revealed superior outcome following operative treatment. The fracture calcaneum is managed surgically using either the standard open technique by plating or percutaneous technique by screw fixation or conservatively by different immobilization technique with slab and cast. The aims and objectives of the study is to compare the outcome of different modes of management and their complications after proper assessment of the fracture stability, anatomy as well as functional outcome in followup.

Material and Methods

The present study was conducted in department of Orthopaedics, M.L.N. Medical college and associated S.R.N. Hospital Allahabad from Aug, 2015 to July 2016 in a consecutive series of patients who presented in out patients department (OPD) and in emergency department with history of acute fracture calcaneum during the period of 1 yr. and who satisfied the inclusion criteria.

This was an prospective Cohort study and patients were randomly allocated into the two treatment groups (group 1 patients were managed operatively and group 2 patients weremanaged conservatively) according to their order of presentation (one by one).

The prospect of treating the problem with operative or conservative was offered to the patients who accepted after detailed explanation. After getting approval from hospital ethical committee and taking written consent, patients were enrolled for the study.

Acute calcaneum fracture was defined as a fracture of duration less then 6 weeks. 40 patients of calcaneum fracture were admitted out of which 5 patients were excluded as they had malunited fracture calcaneum due to calcaneum fracture occurring more than 6-8 weeks back and came to hospital for management of complications and deformity correction. Rest 35 patients of calcaneum fracture with acute injury were managed operatively or conservatively after admission and discharged later. Each patient was called upon for followup at 3 weeks, 6 weeks, 12 weeks and 6 months duration but only 30 patients were included in the study who turned up for at least 6 months duration. The cases were evaluated clinically, findings were recorded in the proforma and patient were followed and evaluated at 3 weeks, 6 weeks, 12 weeks and 6 months interval. The results

were evaluated clinically and functionally by American Orthopaedic Foot Ankle Society (AOFAS), Ankle-Hindfoot Scoring Method.

Inclusion Criteria

1. Patient having acute injury (<6 weeks duration) of fracture calcaneum.
2. Patient of age 20 years or more.

Exclusion Criteria

1. Duration of injury >6 weeks
2. Age <20 years
3. Lack of followup for at least 6 months
4. Compound injury
5. Patient not willing for surgery.
6. Patients not willing / complying for undergoing the post-op rehabilitation programme.
7. Active infection.

History and Examination

Detailed history was elicited in all cases regarding H/o smoking,, alcoholism, H/o chronic diseases like diabetes, hypertension, bleeding disorder, peripheral vascular disease etc, mode of injury, duration of injury and other associated injury. Diagnosis was confirmed by routine radiographs (AP, Lat, Oblique and axial view) and CT scan of calcaneum and 3D reconstruction. Bohler's angle was measured.

Methods of Conservative Management

It consists of initial **RICE** (Rest, Ice, Compression, Elevation) regimen followed by a supportive splint. After the swelling subsides, a prefabricated fracture boot, with ankle locked in neutral flexion to prevent an equinus contracture and an elastic compression stocking to minimize dependent edema, was applied. Usually below knee slab followed by below knee cast was applied for upto 6-8 weeks or longer until radiographic union was confirmed.

Early, sub talar and ankle joint range of motion exercise were initiated. NSAIDs were used to control pain in early period. After 3 months, gradual progressive weight bearing was started.

Methods of Operative Management

Each patient was thoroughly worked up for pre-anaesthetic evaluation and surgery was attempted only after swelling of foot and ankle has been

adequately dissipated. Surgery is done with the patient in the lateral position. The incision starts about 5 cm proximal to the lateral malleolus almost in the posterior midline, and extends distally anterior to the tendo achilles along the posterior edge of the heel. It then curves anteriorly along the edge of the foot to the base of the fifth metatarsal. The incision passes posterior to the sural nerve which is elevated with the anterior flap.

The incision is deepened to the bone. Anteriorly the calcaneocuboid joint is exposed by splitting the abductor muscles along its fibers. A thick subperiosteal flap is raised till the subtalar joint by sharp dissection. The peroneal tendons along with its sheath is elevated along with this flap. By placing a level into the talar neck, the soft tissues are retracted exposing the posterior aspect of the subtalar joint. Sometimes an osteotomy may be required on the lateral wall, and the fragment turned down to visualize the lateral joint fragment.

Percutaneous Reduction by Essex-Lopresti maneuver⁶ can be achieved with K-wires or Steinman pins inserted from the posterior tuberosity. Post-op

below knee slap was applied in full dorsiflexion at ankle joint. Antibiotic prophylaxis against infection was given to all patients.

OBSERVATION AND RESULT

A total of 35 patients were included in this study out of which 5 patients did not turn up for follow up for 6 months so that they were excluded from the study. Observations are based on the study of 30 patients, out of which 15 patients were managed conservatively and 15 patients were managed operatively.

Statistical analysis was performed using the software SPSS 21.0 for windows. Test used was the student t test for the comparison of means which was considered significant at $P < 0.05$.

AGE AND SEX

In this study maximum number of patients 15(50%) were from the age group 31-40 followed by 7(23%), 6(20%) and 2(17%) of patients in the age groups 41-50 years, 21-30 years and 51-60 years respectively (Table 1). In every age group, it was found that males were predominant over females.

Age Group (years)	Male	Female	Total no. (%)
21 -30	6	0	6 (20 %)
31 - 40	8	7	15 (50 %)
41 - 50	6	1	7 (23 %)
51 - 60	1	1	2 (17 %)

Table 1. showing age and sex incidence of fracture calcaneum.

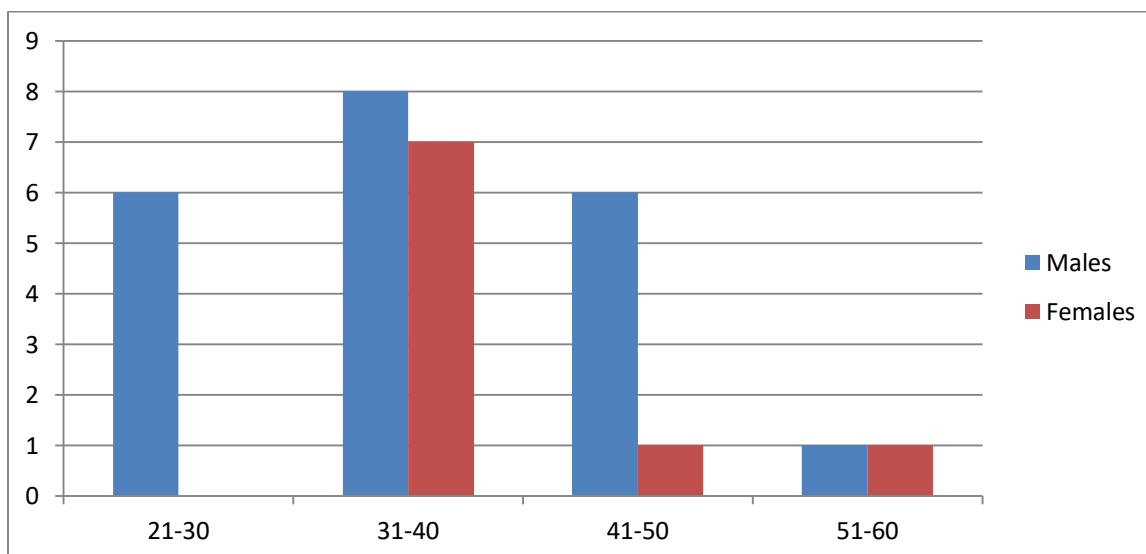


Fig 1 : showing age and sex distribution of fracture calcaneum.

MODE OF INJURY

In our study, it was found that fall from height was the most common causative factor with intraarticular calcaneum fracture in 18(60%) of patients and extraarticular calcaneum fracture in 8(26.7%) of patients (Fig. 2).

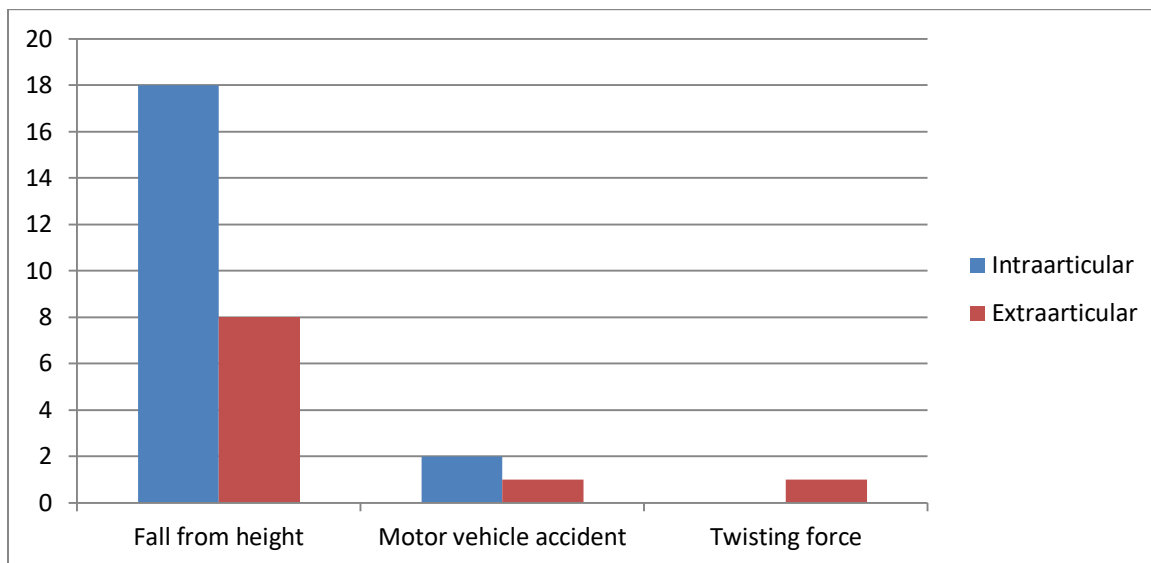


Fig 2: Showing mode of injury of fracture calcaneum

DURATION OF INJURY

Duration of injuries	Males	Females	Total No. (%)
Within 1 week	9	3	12 (40%)
2 weeks	6	2	8 (26.6 %)
3 weeks	5	0	5 (16.7 %)
4 weeks	1	1	2 (6.7 %)
4 – 6 weeks	2	1	3 (10.0 %)

Table 2: showing duration of injury before presentation to hospital.

In our study (Table 2), it was found that 12 (40 %) patients came to hospital within 1 week of injury followed by 8(26.6%), 5(16.7%) and 2(6.7%) in 2, 3 and 4 weeks respectively. 3(10%) patients came to hospital after 4 weeks for treatment.

Following management of fracture calcaneum whether by conservative or operative procedure, mean hospital stay of the patient for inarticular fracture was 5 and 13.36 days respectively whereas for extraarticular fracture it was 4.1 and 11.25 days.

Time interval	Conservative	Operative	P-value
3 weeks	73.53+-6.58	77.93+4.28_	0.0386
6 weeks	78.00+-7.04	82.53+-4.24	0.0415
12 weeks	82.86+-7.11	87.67+-4.37	0.0339
6 months	87.93+-7.48	92.4+-3.64	0.0468

Table 3 : Mean American Orthopaedic Foot Ankle Society (AOFAS) Ankle Hindfoot Score at each follow up.

The Table 3 shows the mean American Orthopaedic Foot Ankle Society (AOFAS) Ankle Hindfoot Score in the study group at each follow up at 3 weeks, 6 weeks, 12 weeks and 6 months. All p values are < 0.05 as calculated from the above table.

COMPLICATIONS

In our study it was found that post-traumatic arthritis was the most common complication in both conservative 6(20.0%) and operative 8(26.7%) of cases followed by wound dehiscence and sural nerve injury which was observed only in operative type in 7(23.3%) and 2(6.7%) cases respectively. Following surgery in post-op period screw back out occurred in

1(3.3%) case and post reduction collapse occurred in 2(6.7%) cases (Table 4).

Wound complications managed by regular dressing with I/V antibiotics, and,if,there is wound dehiscence with exposed hardware and also with purulent discharge then surgical treatment includes sequence of procedure as per clinical presentation, e.g. surgical irrigation and debridement, hardware removal, free myocutaneous flap wound coverage and amputation

Complications	Number of cases	
	Conservative	Operative
A. Post reduction collapse or inadequate reduction	3 (10 %)	2 (6.7 %)
B. Screw backout	0 (0 %)	1 (3.3 %)
C. Compartment Syndrome	1 (3.3 %)	0 (0 %)
D. Loss of full ROM of ankle joint	2 (6.7 %)	4(13.5 %)
E. Osteomyelitis of calcaneum	0 (0 %)	2 (6.7 %)
F. Post traumatic arthritis	6 (20.0 %)	8(26.7 %)
G. Sural nerve injury	0 (0 %)	2 (6.7 %)
H. Wound dehiscence	0 (0 %)	7(23.3 %)

Table 4: showing various complications in our study.

DISCUSSION

Fractures of calcaneum are more common in recent years. The causes of calcaneum fracture are multifactorial and is most commonly due to fall from height. The literature on calcaneum fracture and

associated treatment has expanded over the past decade. There is still controversy concerning the best treatment. Due to high malunion rate, arthritis of ankle joint and other complications specifically in intra-articular type fractures managed conservatively, surgical management became popular. But surgically

managed patients if not evaluated properly, also showed complications like wound dehiscences, osteomyelitis, infection, post reduction collapse and some times mis management leads to amputations.

Many studies have been performed to compare conservative management with operative management in fracture calcaneum for both intra-and extra-articular calcaneal fractures and operative management remains an acceptable mode of treatment with a comparable functional outcome if complications are properly prevented.

AGE AND SEX DISTRIBUTION

In a study done by Tennent TD et al⁷ in 2001, the maximum number of patients with calcaneum fracture were in the age group 31-40 years and 76% patients were male. In our study maximum number of patients 15(50%) were in the age group of 31-40 years and out of total 30 patients 21(70%) were males. Similar findings also observed by Vaclav Rak et al⁸ in 2009 where out of 76 patients, 42(55%) patients were in the age group of 31-40 years and 57(75%) were males. Increases the relative risk of wound complication.

MODE OF INJURY AND TYPE

In a study done by Tennent TD et al⁷ in 2001, 88% injuries were due to fall from height which is in accordance with our study where mode of injury in 26(86.7%) patients was due to fall from height. Similar findings were also observed by O'Farrel et al⁹ and Parmar et al.⁴ 1993 where the mode of injury was fall from height in 90% and 85% patients respectively.

In our study most of the calcaneum fractures, i.e., 20 patients (66%) were intraarticular type which is in accordance to the studies done by Tennent et al⁷ 2001 and Kitaoka et al¹⁰ who reported intraarticular type fracture in 70% and 68% patients respectively.

In our study out of 20 cases of intra-articular fracture calcaneum 9 cases were managed conservatively and 11 cases were managed operatively. Their mean SD, p-value were calculated (Table – 5).

RESULT

In present study improvement in mean (AOFAS) Ankle Hindfoot score at 3 weeks, 6 weeks, 12 weeks and 6 months follow up was found to be statistically significant at $p < 0.05$ (Table 3).

This shows that operative management of calcaneum fracture gives better result than conservative management of calcaneum fracture. But complications occurring during operative management limits its use as gold standard for management of all type of fracture calcaneum.

Similar results were also observed by O'Farrel et al⁹ (1993), Parmar et al.⁴ (1993), Thordarson and Krieger³ (1996) and Richard et al¹¹ (2002) where they found that operative treatment is better than conservative treatment for management of calcaneum fracture.

Kitaoka et al¹⁰ in 1994 reviewed their results of casting in calcaneum fracture in 16 out of 27 patients and most of the patients in their series exhibited an altered gait pattern, especially on uneven ground, thus confirming that non-operative management of Calcaneum fractures led to at least some persistent functional impairment.

In a study done by Barla et al¹² (2004), out of 41 women of calcaneum fracture, 21 received conservative management and 20 were managed operatively. The SF36 and VAS indicated significantly better results in the operative group as compared to conservative group. There was also a statistically significant improvement of Bohler's angle in operative group ($p = 0.001$). Finally, the patient's personal satisfaction with gait over a 2 to 8 years follow up was reported by O'Brien et al¹³ in 2004, which also showed better result in operatively managed patients.

Time interval	Conservative	Operative	P-value
3 weeks	69.22±4.63	77.18±3.92	<0.001
6 weeks	73.22±5.19	81.63±3.88	<0.001

12 weeks	78.44±5.61	87±4.45	0.0013
6 months	83.33±5.66	92±3.58	<0.001

Table 5: Mean American Orthopaedic Foot Ankle Society (AOFAS) Ankle Hindfoot Score at each follow up for intraarticular fracture calcaneum.

From the above table – 5 improvement in mean (AOFAS) Ankle Hindfoot score at 3 weeks, 6 weeks, 12 weeks and 6 months follow up for intraarticular fracture were found to be statistically significant at $p<0.05$.

This shows that operative management of intraarticular calcaneum fracture gives better results than conservatively managed patients in long term followup. Similar results were observed in a study done by Thordarson and Krieger *et al*³ (1996) on 30 patients with displaced intraarticular fracture and the patients were evaluated through a new functional outcome questionnaire (score 0-100) on pain (30 points), daily activity limitations (10 points), shoeware (10 points). Finally they found

significantly better results from operative group than conservatively managed group.

Richard *et al*¹¹. in 2002 reported that without stratification of the groups, the functional results after conservative management of intraarticular calcaneum fracture were equivalent to those of operative management. However, after unmasking the data by removal of the patients who were receiving Worker's Compensation, the outcomes were significantly better in operatively managed patients with intraarticular calcaneum fracture.

In our study out of 10 cases of extra-articular fracture calcaneum 6 cases were managed conservatively and 4 cases were managed operatively. Their mean, SD, p-value were calculated (Table – 6).

Time interval	Conservative	Operative	P-value
3 weeks	80 ± 1.79	80 ± 5.16	1
6 weeks	84.67 ± 2.06	85 ± 4.76	0.88
12 weeks	89.5 ± 1.76	89.5 ± 4.12	1
6 months	94.83 ± 3.18	93.5 ± 4.12	0.58

Table 6 : Mean American Orthopaedic Foot Ankle Society (AOFAS) Ankle Hindfoot Score at each follow up for extraarticular fracture of calcaneum.

From the above table improvement in mean (AOFAS) Ankle Hindfoot score at 3 weeks, 6 weeks, 12 weeks and 6 months follow up for extraarticular fracture were found to statistically insignificant at $p>0.05$. This shows that operative management of

COMPLICATIONS

extraarticular calcaneum fracture gives better results than conservatively managed patients in long term followup but this is not significant. Similar results were also found in the studies done by Crosby and Fitzgibbons²² (1990), Omoto *et al*²³ (2001)

In our study complications rate is more in operative than conservative but if complications are properly managed, the patients managed by operative method

shows better functional outcome in follow up. Folk et al¹⁷ identified smoking, diabetics and open injury as the three risk factors. The presence of more than one risk factor increases the relative risk of wound complication requiring surgery. For diabetic smokers, the relative risk of a wound complication has been noted to be 3.6; for smokers with open fractures, the relative risk 3.1. Stephenson¹⁴ reported marginal wound necrosis in 27% of cases. Zwipp et al¹⁵ reported wound margin necrosis in 8.5% of cases, hematomas requiring decompression in 2.6%, and a 2% “deep” infection rate, and 1 percent calcanectomy rate. Sanders et al¹⁶ in a series of 120 surgically managed patients, reported 8 wound dehiscence, 3 below- knee amputations, and 5 myocutaneous free flaps to cover wounds. Folk et al¹⁷ in a series of 190 fractures noted that 25% developed some forms of wound complications, 40 of whom (21%) developed a wound complication that required surgical treatment. Out of this group of 40 surgically treated wound complications, 36 required a surgical wound debridement, 22 required hardware removal, and 11 eventually required free myocutaneous flap coverage of the wound. Four went on to amputations. On the other hand, Benirschke and Sangeorzan¹⁸ reported only 2 deep infections requiring hardware removal in a series of 80 surgically managed calcaneus fractures. In the experience of Lance et al¹⁹ skin loss at the wound margin is the most common complication and occurs in approximately 10% of patients. This problem responds well to daily dressing changes on an outpatient basis. The incidence of superficial wound infection was less than 2%, and deep infection requiring hardware removal was not encountered. Familiarity with the surgical technique and the demand for meticulous handling of soft tissues during this approach are critical factors in achieving a successful result and avoiding postoperative complications. Howard et al²⁰ reported infections and wound breakdown are the most devastating complications of displaced intra-articular calcaneal fracture (DIACF) surgery. Letournel²¹ had 3% of wound related issue in their series.

CONCLUSION

The result of the study shows that rate of complication associated with operatively managed patient of fracture calcaneum were more than conservatively managed patients of fracture

calcaneum. But the long term follow up shows better result and functional outcome in operatively managed patients if case selections done properly and risk factors are properly evaluated pre operatively.

The intra-articular fractures managed operatively show better functional outcome as compared to conservatively managed patients but for extra articular fractures nearly equal result is seen in both the groups.

It is concluded that conservative management for calcaneum fracture is cost effective, especially for patients with poor financial ability. But operative management gives better functional outcome particularly in intraarticular fracture if patients are selected after evaluating the risk factors.

BIBLIOGRAPHY

1. Zwipp H, Rammelt S, Barthel S. Calcaneal fractures – the most frequent tarsal fractures – the Umsch 2004; 61-435-50.
2. Stulik J, Stehlik J, Rysavy M, et al. Minimally-invasive treatment of intra-articular fractures of the calcaneum. J Bone Joint Surg (Br) 2006;88(12):1634-41.
3. Thordarson DB, Krieger LE. Operative versus non operative treatment of intra-articular fractures of the calcaneus: A prospective randomized trial. Foot Ankle Int. 1996;17:2-9.
4. Parmar HV, Triffitt PD, Gregg PJ. Intra-articular fractures of the calcaneum treated operatively or conservatively. A prospective study. J Bone Joint Surg (Br). 1993;75:932-7.
5. Buckley R, Tough S, McCormack R, et al. Operative compared with nonoperative treatment of displaced intra-articular calcaneal fractures: a prospective, randomised, controlled multicentre trial. J Bone Joint Surg (Am). 2002;84(10): 1733-44.
6. Essex-Lopresti P. The mechanism, reduction technique, and results in fractures of the os calcis. Br J Surg 1952;39:395-419.
7. Tennent TD, Calder PR, Salisbury, Allen, Eastwood. The operative management of displaced intra-articular fractures of the

- calcaneum: a two-centre study using a defined protocol. *Injury*. 2001 Jul;32(6):491-6
8. Vaclav Rak, Daniel Ira and Michal Masek. Operative treatment of intra-articular calcaneal fractures with calcaneal plates and its complications. *Indian J Orthop*. 2009 Jul-Sep; 43(3): 271–280.
9. O'Farrel DA, O'Byrne JM, McCabe JP. Stephens MM. Fractures of the Os calcis: improved results with internal fixation: *Injury*. 1993;24:263-5.
10. Kitaoka HB, Schaap EJ, Chao EY, et al. Displaced intra-articular 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;76:1531-40.
11. Richard B, Suzanne T, Robert M, Graham P. Operative Compared with Nonoperative Treatment of Displaced Intra-Articular Calcaneal Fractures. *J Bone Joint Surg*. 2002;84(A): 1733-44.
12. Barla J, Buckley R, McCormack R, et al. Displaced intraarticular calcaneal fractures: long-term outcome in women. *Foot Ankle Int*: 2004;25:853-6.
13. O'Brien J, Buckley R, McCormack R, et al. Personal gait satisfaction after displaced intraarticular calcaneal fractures: a 2-8 year follow up. *Foot Ankle Int*. 2004;25: 657-65.
14. Stephenson JR. Treatment of displaced intra-articular fractures of the calcaneus using medial and lateral approaches, internal fixation and early motion. *J Bone Joint Surg*. 1987;69A:115-30.
15. Zwipp H, Tscherne H, Thermann H, et al. Osteosynthesis of displaced intraarticular fractures of the calcaneus. Results in 123 cases. *Clin Orthop Relat Res*. 1993;76-86.
16. Sanders R, Fortin P, DiPasquale T, et al. Operative treatment in 120 displaced intraarticular calcaneal fractures. Results using a prognostic computed tomography scan classification. *Clin Orthop Relat Res*. 1993;87-95.
17. Folk JW, Starr AJ, Early JS. Early wound complications of operative treatment of calcaneus fractures: analysis of 190 fractures. *J Orthop Trauma*. 1999;13(5):369-72.
18. Benirschke SK, Sangeorzan B: Extensive intra-articular fractures of the foot: Surgical management of calcaneus fractures. *Clin Orthop*. 1993;292:128-34.
19. Lance RM, Stephen KB, Bruce JS, et al. Acute calcaneal fractures: Treatment options and results. *J Am Acad Orthop Surg*. 1994;2:36-43.
20. Howard JL, Buckley R, McCormack R, et al. Complications following management of displaced intra-articular calcaneal fractures: A prospective randomized trial comparing open reduction internal fixation with nonoperative management. *J of Orthop Trauma*. 2003;17(4):241-9.
21. Letournel E: Open reduction and internal fixation of calcaneus fractures, in Spiegel P (ed): *Topics in Orthopaedic Trauma*. Baltimore: University Park Press. 1984;173-92.
22. Crosby LA, Fitzgibbons T. Computerized tomography scanning of acute intra-articular fractures of the calcaneus. *J Bone Joint Surg*. 1990;72:852-9.
23. Omoto H, Nakamura K. Method for manual reduction of displaced intra-articular fracture of the calcaneus: technique, indications and limitations. *Foot Ankle Int*. Nov 2001 ;22(11):874-9.
24. Zwipp H, Rammelt S, Barthel S. Calcaneal fractures – the most frequent tarsal fractures – the Umsch 2004; 61-435-50.