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Original Research Article

Functional and radiological outcomes of Essex-Lopresti procedure in intra-articular calcaneal fractures: a prospective study

Varshant Pareek*, Ananya Mishra, Mohit Yadav, Kartik Yadav, Deepak Khandelwal

Department of Orthopaedics, S.M.S. Medical College and Hospital, Jaipur, Rajasthan, India

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***Correspondence:**
Dr. Varshant Pareek,
E-mail: varshantpareek@gmail.com

ABSTRACT

Background: Calcaneal fractures are among the most common tarsal bone injuries, often leading to significant morbidity. The Essex-Lopresti procedure is a minimally invasive surgical technique used to treat intra-articular fractures of the calcaneum. Objective of the study was to evaluate the functional and radiological outcomes of the Essex-Lopresti procedure in patients with intra-articular calcaneal fractures and assess post-operative pain relief and complication rates.
Methods: A hospital-based prospective study was conducted at tertiary care centre, Jaipur, on 85 patients. Functional outcomes were assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) score, while radiological outcomes were evaluated using Bohler's angle.
Results: The mean preoperative Bohler's angle (15.19°) improved to 29.55° postoperatively and stabilized at 27.38° at the 6-month follow-up. The AOFAS score improved significantly from 47.56 preoperatively to 87.38 at 6 months. The mean Visual Analog Scale (VAS) score decreased from 7.53 preoperatively to 0.54 postoperatively, indicating significant pain relief.
Conclusions: The Essex-Lopresti procedure is an effective treatment for intra-articular calcaneal fractures, achieving favorable functional and radiological outcomes with minimal complications.

Keywords: Calcaneal fractures, Essex-lopresti procedure, Bohler's angle, Minimally invasive surgery

INTRODUCTION

Calcaneal fractures are among the most complex fractures of the lower extremity, accounting for approximately 60% of all tarsal bone fractures.[1] These fractures often result from high-energy trauma such as falls from heights or motor vehicle accidents, leading to significant disability if not properly managed. The majority of these fractures are intra-articular, affecting the subtalar joint and making treatment more challenging.[2]

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Historically, non-operative management was preferred due to high complication rates associated with open surgery. However, advancements in imaging techniques, surgical methods, and postoperative care have led to a shift towards surgical intervention.[4] Among the various surgical techniques, the Essex-Lopresti procedure has emerged as a preferred method due to its minimally invasive approach, which reduces complications while achieving satisfactory anatomical restoration.

The Essex-Lopresti procedure is particularly beneficial for tongue-type intra-articular calcaneal fractures. It involves indirect reduction and percutaneous fixation, restoring critical angles such as Bohler's angle and calcaneal height, which are essential for maintaining foot biomechanics.[5] This technique offers advantages over open reduction and internal fixation (ORIF), including a lower risk of soft tissue complications, faster recovery, and improved patient outcomes.

Despite the advancements in surgical techniques, there remains a need for further research to establish the best treatment approach for intra-articular calcaneal fractures. Previous studies have demonstrated variable success rates with different surgical techniques, and there is ongoing debate regarding the ideal management approach.[6] Additionally, many studies have focused on open reduction and internal fixation (ORIF), while limited data exist on the long-term outcomes of the Essex-Lopresti procedure.[7] This gap in research highlights the necessity of evaluating the effectiveness of this minimally invasive technique. Many previous studies have reported mixed outcomes, and there is still no universal consensus on the ideal management strategy.[8] Given the increasing adoption of the Essex-Lopresti procedure, it is crucial to evaluate its efficacy systematically.

This study aims to fill this gap by assessing the functional and radiological outcomes of the Essex-Lopresti procedure in treating intra-articular calcaneal fractures. By evaluating changes in Bohler's angle, AOFAS scores, and pain levels over time, this research seeks to provide valuable insights into the efficacy and safety of this minimally invasive technique, ultimately guiding clinical decision-making for better patient outcomes.[9]

METHODS

The study was carried out in the Department of Orthopaedics, SMS Medical College and Attached Hospitals, Jaipur, Rajasthan, India after approval from the institutional ethics committee. and included patients aged 18 to 60 years who were diagnosed with intra-articular calcaneal fractures and provided written informed consent. The study was conducted over a period of 12 months from May 2023 to April 2024. On admission, all patients underwent a detailed clinical evaluation, including history taking and thorough general and local examination. Routine preoperative investigations were performed, including complete blood count (CBC), coagulation profile, renal and liver function tests, blood sugar, viral markers (HIV, HBsAg, HCV), blood grouping, and pre-anesthetic clearance. Radiological assessment involved plain radiographs of the calcaneus in lateral and axial views. Bohler's angle was measured to assess the extent of the deformity. Fractures were classified according to the Essex-Lopresti classification system.

Surgical management involved closed reduction under fluoroscopic guidance, followed by percutaneous fixation using a 4.5 mm Steinmann pin inserted through the posterior aspect of the calcaneus to achieve and maintain reduction. The pin was placed under sterile conditions in the operating room under regional or general anesthesia. Postoperatively, patients were managed with limb elevation, analgesia, antibiotics, and a below-knee posterior slab for immobilization. Patients were monitored during hospitalization for any immediate postoperative complications and were discharged with advice on non-weight-bearing ambulation and scheduled follow-ups.

Follow-up assessments were conducted at 6 weeks, 3 months, and 6 months. Functional outcomes were evaluated using the American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot score, radiological outcomes were measured by comparing changes in Bohler's angle, and pain was assessed using the Visual Analog Scale (VAS). Data were analyzed using SPSS software version 23, with results expressed as mean ± standard deviation for continuous variables and percentages for categorical variables. A paired t-test was used for comparing pre- and postoperative values, and a p value < 0.05 was considered statistically significant.

Inclusion criteria

Patients with intra-articular calcaneal fractures (Sander's classification types III and IV) were willing to participate in the study and provided written consent. Patients with a history of recent trauma (within 12 weeks). Patients with closed injuries that could be managed with surgical intervention. Patients aged 18-60 years.

Exclusion criteria

Patients with open fractures. Patients with concomitant fractures in the lower extremities and spinal anatomical locations. Patients unwilling to participate in the study. Patients with psychological issues.

Statistical analysis

Data was analyzed using SPSS software. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as percentages. A paired t-test was used to compare preoperative and postoperative values of Bohler's angle, AOFAS scores, and VAS scores. A chi-square test was performed for categorical data analysis. A p value < 0.05 was considered statistically significant.

RESULTS

The total number of participants is 85, summing to 100%. The mean age of the participants is 40.95 years, with a standard deviation of 11.12 years, indicating the central tendency and variability of the age distribution within the study population (Table 1).

Table 1: Age-wise distribution of study participants.

Age group (years)	Frequency	Percentage
18-29	12	14.12
30-39	19	22.35
40-49	36	42.35
50-60	18	21.18
Total	85	100
Mean age ± SD		
40.95±11.12 years		

Table 2: Gender-wise distribution of study participants.

Gender	Frequency	Percentage
Male	44	51.76
Female	41	48.24
Total	85	100.00

The data indicates that out of the total 85 participants, 44 are male, constituting 51.76% of the study population. Conversely, 41 participants are female, accounting for 48.24% of the total (Table 2).

Radiological outcomes

Radiological assessment showed significant improvement ($p<0.001$) in Bohler's angle, increasing from a preoperative mean of 15.19° to 29.55° postoperatively. At 6 months follow-up, the angle stabilized at a mean of 27.38°, indicating maintained fracture reduction (Figure 1).

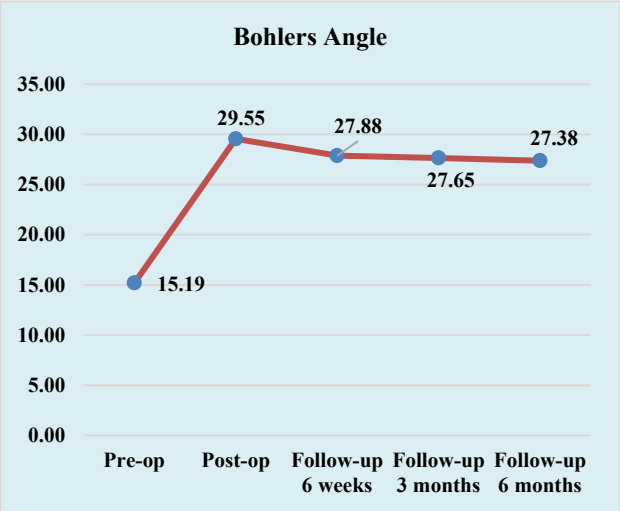

Figure 1: Mean Bohler's angle of study participants at different time of examination.

Functional outcomes

The AOFAS score improved significantly over time ($p<0.001$) from 47.56 preoperatively to 87.38 at 6 months postoperatively, indicating excellent functional recovery (Figure 2).

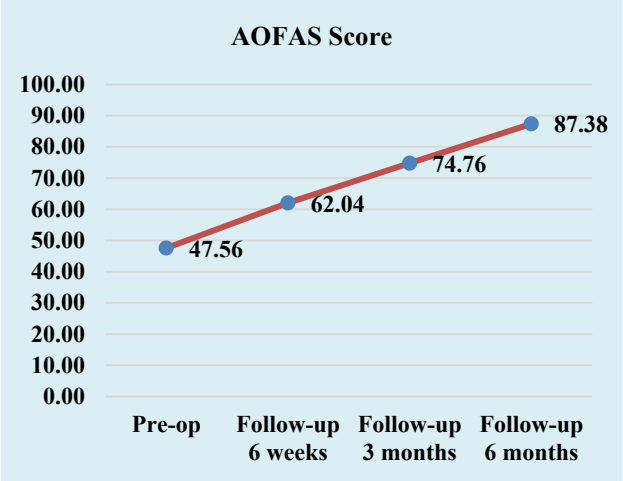

Figure 2: Mean AOFAS score of study participants at different time of examination.

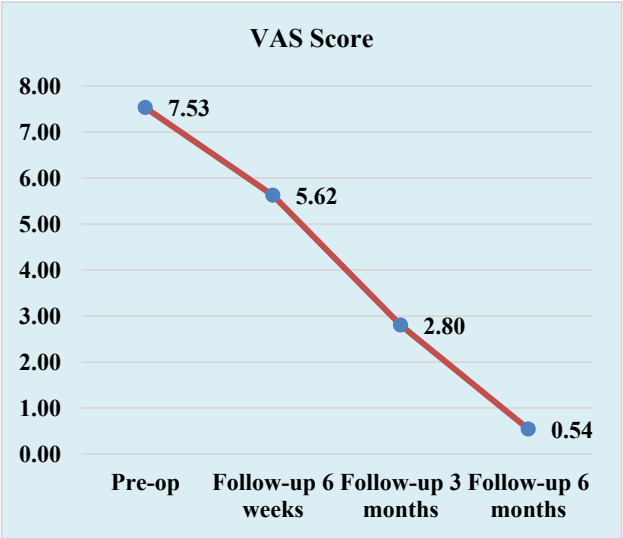

Figure 3: Mean VAS score of study participants at different time of examination.

Table 3: Postoperative complications in study participants.

Post-operative complication	Yes	No
Re-rupture	6	79
Stitch granuloma	3	82
Wound infection	11	74

Pain reduction

Pain outcomes showed statistically significant improvement ($p<0.001$), with the mean VAS score decreasing from 7.53 preoperatively to 0.54 at the final follow-up (Figure 3).

Complications

Postoperative complications were observed in a minority of patients. Wound infection was the most common complication, occurring in 11 out of 85 patients (12.9%), followed by re-rupture in 6 patients (7.1%) and stitch granuloma in 3 patients (3.5%). The majority of patients had no postoperative complications (Table 3).

DISCUSSION

The Essex-Lopresti procedure demonstrated consistent improvements in both functional and radiological outcomes in patients with intra-articular calcaneal fractures. Restoration of Bohler's angle from a preoperative mean of 15.19° to 27.38° at 6 months signifies adequate anatomical realignment, a key determinant of long-term subtalar joint function. This radiological correction aligns with previous studies by Meena et al and Kharat et al, which also reported favorable improvements in Bohler's angle and clinical results following percutaneous fixation.[10,11]

Functionally, patients showed substantial progress in AOFAS scores, increasing from a baseline of 47.56 to 87.38 at six months, indicating improved pain relief, gait, and activity level. These outcomes are consistent with findings from Philip and Girishkumar12 in 2019 and Mantri et al in 2021, who demonstrated similar functional gains using the Essex-Lopresti or related minimally invasive approaches.[13] The VAS score dropped significantly from 7.53 preoperatively to 0.54 at six months, supporting the evidence that less invasive procedures are associated with better postoperative pain control, as also noted by Shih et al in 2018.[14]

Compared to open reduction and internal fixation (ORIF), the Essex-Lopresti technique appears to offer equivalent outcomes in terms of function and alignment but with fewer wound-related complications. Buckley et al in 2002 and Griffin et al in 2014 highlighted the high rates of soft tissue issues in ORIF, which were notably lower in our cohort wound infection was seen in only 12.9% of patients.[15,16] This reinforces the growing consensus that minimally invasive procedures can be preferable, particularly in patients at risk for poor wound healing (e.g., smokers, diabetics).

Additionally, our findings resonate with the meta-analysis by Rammelt and Zwipp in 2004 and the clinical outcomes reported by de Vroome and van der Linden in 2013, who found that tongue-type fractures respond particularly well to indirect reduction methods like Essex-Lopresti, with significantly better AOFAS scores compared to joint depression types.[17,18]

While our results are promising, limitations must be acknowledged. The single-centre nature of this study may affect the generalizability of results. The relatively short follow-up period (6 months) does not capture late complications such as subtalar arthritis, malunion, or implant-related issues. Furthermore, we lacked a comparative arm against other surgical methods like ORIF or sinus tarsi approach, which would provide direct comparative effectiveness. Finally, patient-reported outcome measures beyond AOFAS and VAS (e.g., SF-36) were not utilized.

Despite these constraints, the study adds to the growing body of literature suggesting that the Essex-Lopresti procedure is a valuable technique for managing displaced intra-articular calcaneal fractures, particularly tongue-type fractures. It allows early mobilization, minimizes soft tissue compromise, and leads to predictable functional recovery.

CONCLUSION

Essex-Lopresti procedure is effective in improving both functional and radiological outcomes for patients with intra-articular calcaneal fractures. The procedure offers a viable alternative to more invasive techniques, providing significant pain relief, functional improvement, and anatomical restoration with minimal complications. These findings align with and, in some aspects, surpass the outcomes reported in previous studies, highlighting the procedure's potential as a standard treatment option for this patient population.

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