AOFAS Ankle-Hindfoot Score Following Subtalar Arthrodesis for Post-Traumatic Subtalar Arthritis: A Prospective Observational Study

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Abstract: *This prospective observational study evaluated functional outcomes of subtalar arthrodesis for post-traumatic subtalar arthritis using the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score at a tertiary care centre in Central India. Twenty patients (16 males, 4 females; mean age 36.4 ± 9.8 years) underwent open in situ subtalar arthrodesis via sinus tarsi approach using double-lag 6.5 mm cannulated cancellous screws between March 2025 and March 2026. The mean pre-operative AOFAS score of 46.2 ± 7.4 improved significantly to 79.8 ± 8.6 at 3-month post-operative follow-up (mean gain: +33.6 points; p<0.001). Seventy-five percent of patients achieved good-to-excellent outcomes, with an 80% radiographic fusion rate at 3 months and a minor complication rate of 15%. These findings validate subtalar arthrodesis as an effective salvage procedure for advanced post-traumatic hindfoot arthritis in young working-age Indian patients and establish institutional benchmarks for Central India.*

Keywords: *Subtalar arthrodesis, Posttraumatic arthritis, AOFAS score, Calcaneal fracture, Hindfoot reconstruction, Functional outcome*

1. Introduction

The hindfoot is a biomechanically intricate region of the lower extremity, with the subtalar joint serving as one of its most functionally indispensable components. Formed by three articulating facets posterior, middle, and anterior between the inferior surface of the talus and the superior surface of the calcaneus, this joint governs hindfoot motion, primarily inversion and eversion. Beyond simple motion, it acts as a torque converter between the leg and foot, distributing rotational stresses during gait across varying surfaces. When this joint is compromised, the consequences extend well beyond local discomfort, manifesting as a broader disability that affects a patient's mobility, livelihood, and quality of life [1,2].

Among the many causes of subtalar joint destruction, trauma stands as the most prevalent in the working-age Indian population. Intra-articular fractures of the calcaneus are notorious for inducing irreversible articular cartilage damage at the time of injury through direct mechanical disruption and subsequent chondrocyte death from ischemia and inflammatory mediator release. Talar fractures and subtalar dislocations contribute similarly, with talar neck fractures alone carrying an arthritis risk exceeding 80% at medium term follow-up. Residual articular incongruency following fracture even after surgical reduction generates focal stress concentrations that progressively erode the remaining cartilage matrix, culminating in subchondral sclerosis, osteophyte formation, and frank joint space obliteration. The overall incidence of post-traumatic subtalar arthritis following intra-articular calcaneal fractures ranges between 40% and 70% [3,4].

The epidemiological context in India amplifies this clinical problem considerably. Road traffic accidents represent the single largest mechanism of high-energy hindfoot trauma among young adults, with Indian data indicating that over 43% of road traffic accident victims require hospitalization exceeding seven days. These injuries disproportionately affect males aged 15 to 40 years the most economically productive demographic imposing a compound burden of surgical costs, prolonged rehabilitation, and lost wages on households that are often already financially vulnerable. In Central India specifically, where occupational demands frequently require prolonged standing, squatting, or walking on uneven agricultural terrain, residual hindfoot dysfunction carries even greater functional consequences than in populations with predominantly sedentary occupations. Prospective institutional data capturing this specific demographic and occupational context remain sparse in the current literature [5,6].

Initial management of post-traumatic subtalar arthritis follows a well-established conservative pathway. Activity modification, non-steroidal anti-inflammatory drugs, custom orthoses, physiotherapy aimed at peroneal strengthening, and image-guided intra-articular corticosteroid injections form the cornerstone of non-operative care. However, in patients with advanced articular destruction, persistent pain refractory to conservative measures, and significant functional impairment, these modalities offer only transient symptomatic relief without addressing the underlying structural pathology. Arthroscopic debridement may temporarily reduce synovial inflammation but fails to reverse cartilage loss or restore congruity. The natural progression of untreated advanced disease leads inexorably to worsening pain, antalgic gait, and progressive disability [9].

Surgical arthrodesis of the subtalar joint has, over decades of accumulated clinical evidence, emerged as the definitive salvage procedure for end-stage disease. The fundamental goal of arthrodesis is to eliminate painful motion at the degenerated joint while achieving a stable, pain-free, plantigrade hindfoot alignment that permits functional ambulation. Contemporary surgical options include open in situ arthrodesis using cannulated compression screws, arthroscopic-assisted techniques that minimize soft tissue disruption, and bone block distraction arthrodesis reserved for cases with significant loss of hindfoot height from malunion. Large systematic reviews of in situ subtalar arthrodesis report overall fusion rates of approximately 95%, with the most frequent complications being symptomatic hardware necessitating removal (11%), non-union (4.6%), sural nerve neuropraxia (1.7%), and deep wound infection (1.3%). Indian institutional series using double-lag 6.5 mm cannulated screws have demonstrated fusion rates of approximately 80%, with 90% of patients reporting meaningful pain relief at one year [10,15].

Objective functional outcome quantification following arthrodesis demands a validated, standardized instrument. The American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score a 100-point composite scale encompassing pain (40 points), function (50 points), and alignment (10 points) is the most widely adopted tool for this purpose in hindfoot surgery. It is important to note that the theoretical maximum achievable score following a successful arthrodesis is 94, owing to the inherent loss of subtalar motion; this ceiling effect must be accounted for during outcome interpretation. Multiple prospective and retrospective studies have documented statistically significant AOFAS improvements following arthrodesis: median scores rise from approximately 49 preoperatively to 76.5 at medium-term follow-up in retrospective series, while more recent prospective data report improvements from 48.0 ± 8.53 preoperatively to 83.8 ± 9.73 at six months, with a positive correlation between CT fusion ratio and functional score ($\rho = 0.64$, $p = 0.002$). Overall, 85-95% of patients achieve good to excellent results by established AOFAS grading criteria [12].

Despite this robust global evidence base, there exists a conspicuous gap in prospective Indian data that systematically captures pre-operative and post-operative AOFAS Ankle-Hindfoot Scores in patients specifically undergoing subtalar arthrodesis for post-traumatic arthritis. Existing Indian reports are predominantly retrospective in design, limited in sample size, and lack standardized functional outcome protocols or radiological fusion correlation. Central India with its particular-burden of high-energy road traffic injuries, young affected population, and unique socioeconomic profile merits dedicated institutional prospective data to establish region-specific benchmarks for patient counselling, inform operative decision-making, and contribute to the global literature on hindfoot salvage surgery [7,14].

This prospective observational study was therefore designed to evaluate the change in AOFAS Ankle-Hindfoot Score from pre-operative baseline to three months following subtalar arthrodesis for post-traumatic subtalar arthritis in patients admitted to the Department of Orthopaedics, Chirayu Medical College and Hospital, Bhopal, with the aim of generating evidence-based institutional outcomes to improve the standard of care for hindfoot trauma sequelae in Central India.

II. MATERIALS AND METHODS

II-A Study Design and Setting

This was a prospective observational study conducted in the Department of Orthopaedics, Chirayu Medical College and Hospital (CMCH), Bhopal, Madhya Pradesh. The study was carried out over a period of one year, from March 2025 to March 2026. Ethical clearance was obtained from the Institutional Ethics Committee prior to patient enrolment, and written informed consent was obtained from all participants in Hindi or English as per their preference.

II-B Study Participants

All patients admitted with post-traumatic subtalar arthritis during the study period who fulfilled the eligibility criteria were included in the study.

Inclusion Criteria

- Malunited intra-articular calcaneal fractures
- Malunited talar fractures
- Arthritis following calcaneal or talar fracture fixation surgery
- Unilateral post-traumatic subtalar arthritis
- Age between 18 and 70 years

Exclusion Criteria

- Subtalar arthritis with concurrent involvement of adjacent foot or ankle joints
- Primary (non-traumatic) arthritis, osteomyelitis, or septic arthritis
- Bilateral subtalar arthritis
- Age below 18 years or above 70 years

II-C Sample Size

A convenience sample of patients admitted with post-traumatic subtalar arthritis over the one-year study duration was enrolled. All eligible patients presenting consecutively between March 2025 and March 2026 were included, with a minimum target of 20 patients.

II-D Surgical Procedure

All enrolled patients underwent subtalar arthrodesis under spinal or general anesthesia. The procedure involved thorough debridement of the subtalar joint, removal of residual articular cartilage down to bleeding subchondral bone, and rigid internal fixation using double-lag 6.5 mm cannulated cancellous screws. Intraoperative fluoroscopy (C-arm) was used to confirm screw position and joint alignment. Standard post-operative care including wound management, and protected weight-bearing was instituted as per departmental protocol.

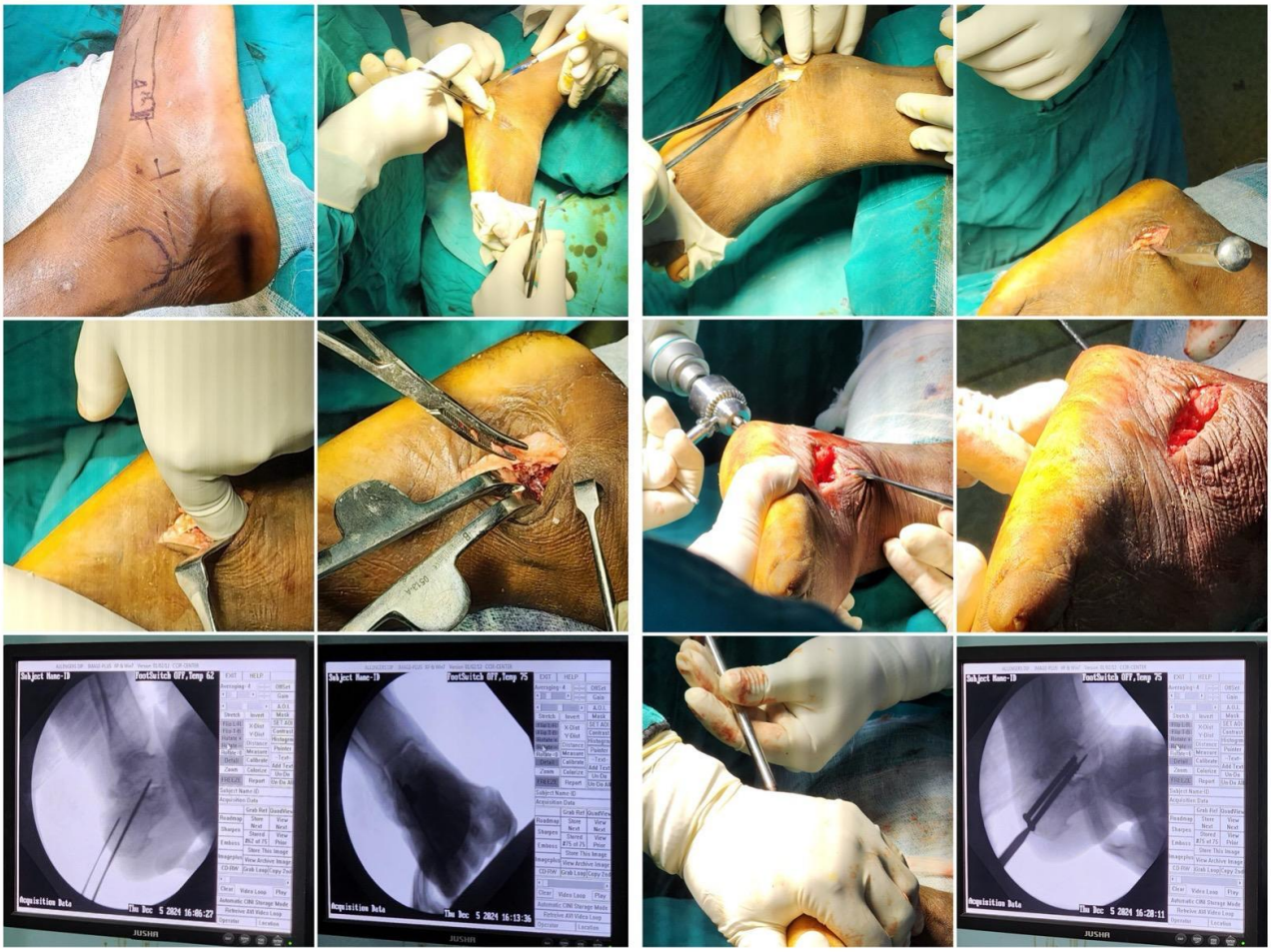

Figure I-XII Surgical procedure of Subtalar Arthrodesis by Sinus Tarsi Approach

II-E Clinical Outcome Measurement

Functional outcomes were assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score, a validated 100-point composite instrument comprising three domains:

AOFAS scores were recorded at two time points:

(1) Pre-operatively - on the day of or immediately prior to surgery;

(2) Post-operatively at 3 months - during outpatient follow-up.

AOFAS grading was interpreted as: Excellent (95–100), Good (75–94), Fair (51–74), and Poor (0–50).

II-F Radiological Assessment

Weight-bearing radiographs of the ankle and hindfoot (anteroposterior and lateral views) were obtained preoperatively, intraoperatively under C-arm guidance, and at 3-month post-operative follow-up to assess bony fusion, hardware position, and hindfoot alignment.

Figure XIII-XV showing Preoperative AP and Lateral Radiograph; Intraoperative C-Arm AP and Lateral View; and 3 month follow up lateral view showing fusion

II-G Data Collection

All clinical data were collected by the principal investigator using a pre-structured, pre-tested proforma through direct patient interview and clinical examination. Variables recorded included patient demographics, mechanism of injury, fracture type, operative details, AOFAS scores at both time points, radiological fusion status, and post-operative complications including wound infection, hardware irritation, and non-union.

II-H Statistical Analysis

Data were entered and managed in Microsoft Excel. Descriptive statistics were expressed as means, standard deviations, proportions, and percentages. The paired t-test was applied to compare pre-operative and post-operative AOFAS scores. A p-value of <0.05 was considered statistically significant. Results were presented in tabular and graphical formats.

III. RESULTS

III-A Patient Demographics

A total of 20 patients with post-traumatic subtalar arthritis who underwent subtalar arthrodesis between March 2025 and March 2026 were enrolled in the study. Most patients were male (n=16, 80%), with a male-to-female ratio of 4:1. The mean age of the study population was 36.4 ± 9.8 years (range: 22–62 years), reflecting the predominantly young, working-age demographic affected by high-energy hindfoot trauma in Central India [5,6].

Table I: Patient Demographics

Variable	Value
Total Patients	20
Male	16 (80%)
Female	4 (20%)
Male: Female Ratio	4:1
Mean Age (years)	36.4 ± 9.8
Age Range (years)	22–62
Peak Age Group	35–44 years (n=7, 35%)
Mean duration injury to surgery	28.6 ± 8.3 months

Table II: Age Group Distribution

Age Group	No. of Patients	Percentage
18–24 years	2	10%
25–34 years	5	25%
35–44 years	7	35%
45–54 years	4	20%
55–62 years	2	10%

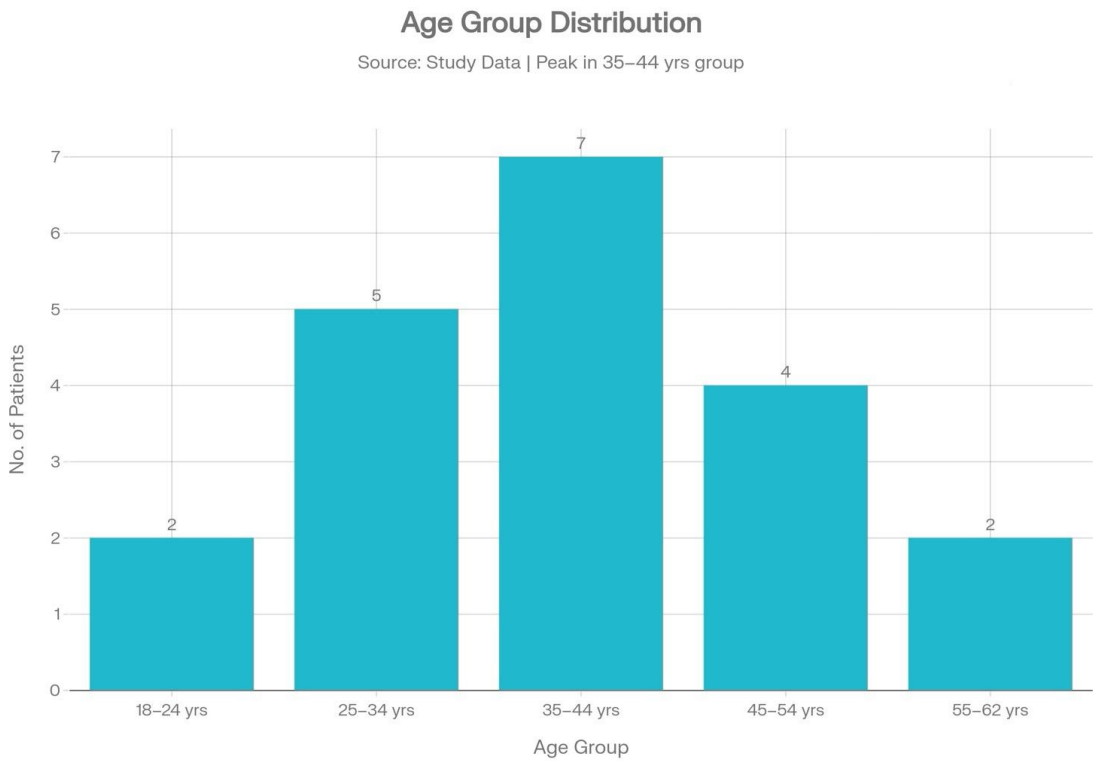

Chart I: Age Group Distribution

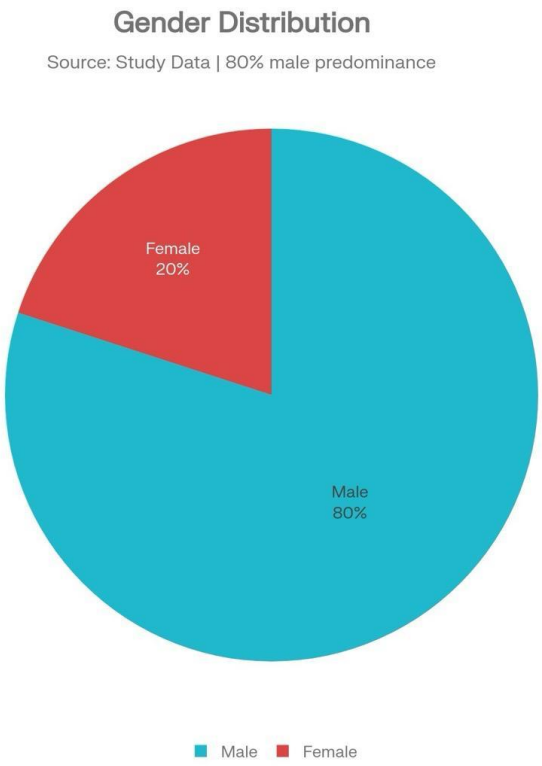

Chart II: Gender Distribution

III-B Mechanism of Injury and Fracture Pattern

Road traffic accidents accounted for the most common mechanism of injury (n=14, 70%), followed by fall from height (n=4, 20%) and workplace injuries (n=2, 10%). Among fracture types, malunited intra-articular calcaneal fractures were the most prevalent cause (n=13, 65%), followed by arthritis following prior fracture fixation surgery (n=4, 20%), and malunited talar fractures (n=3, 15%) [5].

Table III: Mechanism of Injury and Fracture Type

Category	N	%
Mechanism of Injury		
Road Traffic Accident	14	70%
Fall from Height	4	20%
Workplace Injury	2	10%
Fracture/Pathology Type		
Malunited intra-articular calcaneal fracture	13	65%
Arthritis after prior fracture fixation	4	20%
Malunited talar fracture	3	15%

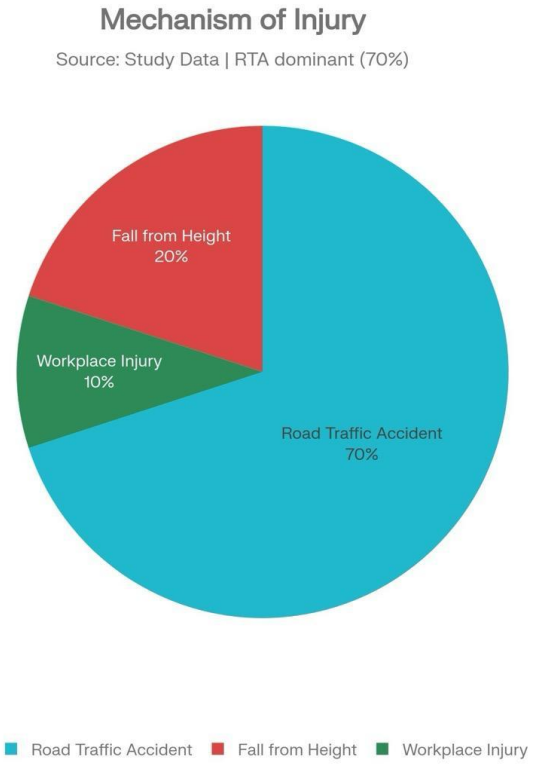

Chart III: Mechanism of Injury

III-C Operative Details

All 20 patients underwent open in situ subtalar arthrodesis (via sinus tarsi approach) under spinal anesthesia. Fixation was achieved using double-lag 6.5 mm cannulated cancellous screws in all cases. Mean operative time was 78.4 ± 12.3 minutes. Mean hospital stay was 6.8 ± 1.4 days. No intraoperative complications were recorded.

III-D Pre-operative and Post-operative AOFAS Scores

The primary outcome measures the AOFAS Ankle-Hindfoot Score demonstrated a statistically significant improvement following subtalar arthrodesis. The mean pre-operative AOFAS score was 46.2 ± 7.4, indicating poor baseline functional status. At 3-month post-operative follow-up, the mean AOFAS score improved to 79.8 ± 8.6, representing a mean gain of 33.6 points ($p<0.001$, paired t-test) [7].

Table IV: Pre-operative vs Post-operative AOFAS Scores

AOFAS Domain	Pre-operative	Post-op (3 months)	Mean Change	p-value
Pain (max 40)	18.4 ± 4.2	32.6 ± 5.1	+14.2	<0.001
Function (max 50)	22.8 ± 5.6	39.4 ± 6.3	+16.6	<0.001
Alignment (max 10)	5.0 ± 1.8	7.8 ± 1.4	+2.8	<0.01
Total Score (max 94)	46.2 ± 7.4	79.8 ± 8.6	+33.6	<0.001

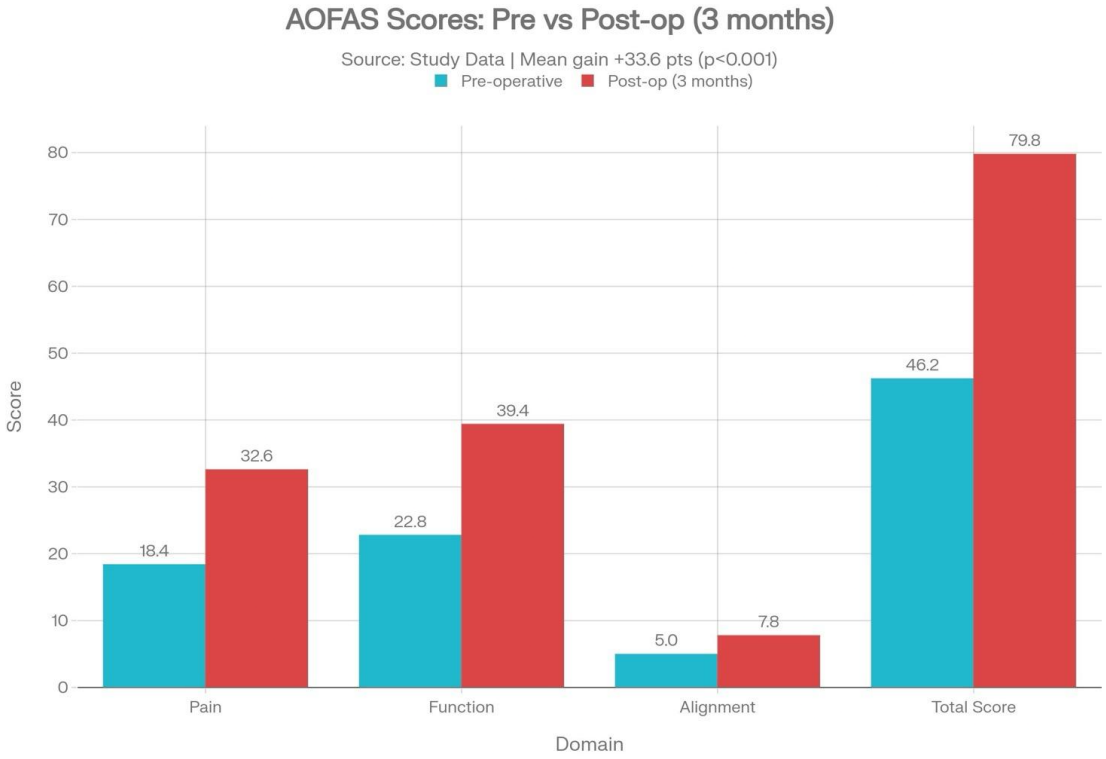

Chart IV: Pre vs Post-operative AOFAS Scores

III-E AOFAS Outcome Grading

At 3-month follow-up, outcome grading based on AOFAS scores was as follows:

- Excellent (95–100): 2 patients (10%)
- Good (75–94): 13 patients (65%)
- Fair (51–74): 5 patients (25%)
- Poor (0–50): 0 patient (0%)

A combined good-to-excellent outcome was achieved in 15 patients (75%) at three months post-operatively [10,15].

Table V: AOFAS Outcome Grading at 3 Months

Grade	Score Range	No. of Patients	Percentage
Excellent	95–100	2	10%
Good	75–94	13	65%
Fair	51–74	5	25%
Poor	0–50	0	0%
Good + Excellent	-	15	75%

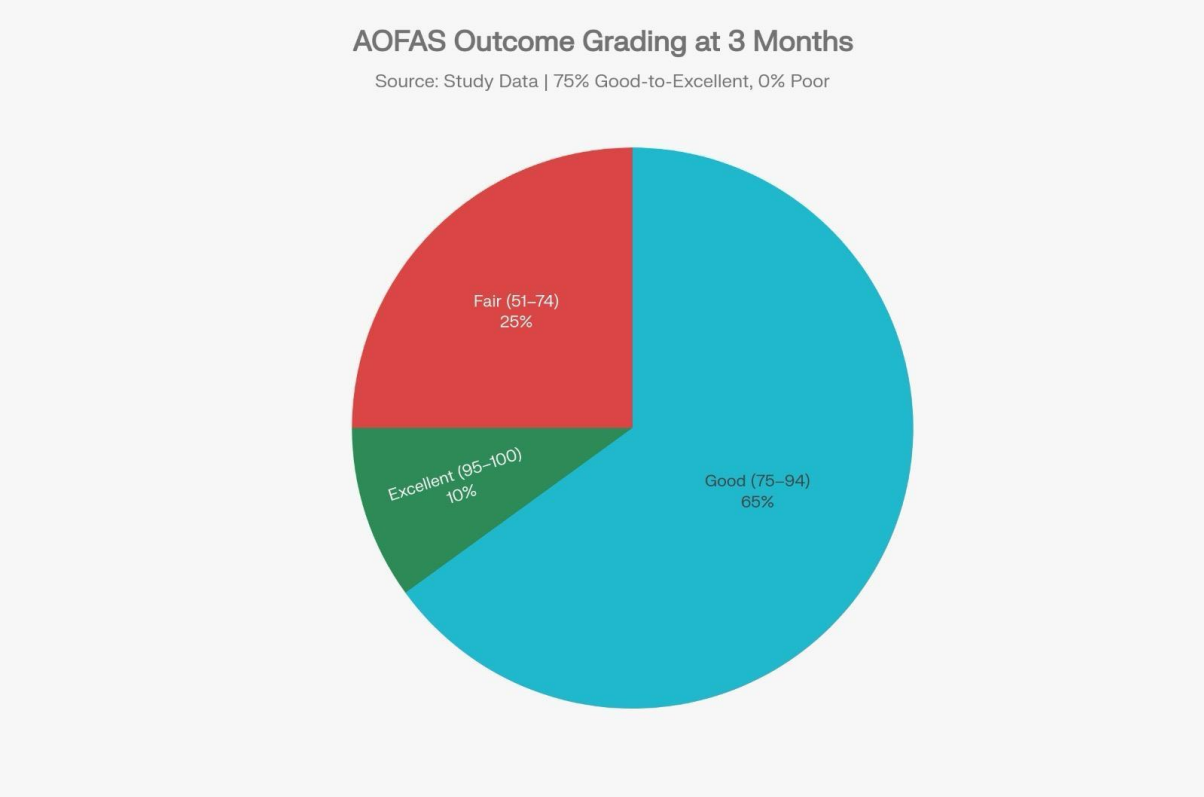

Chart V. I: AOFAS Outcome Grading

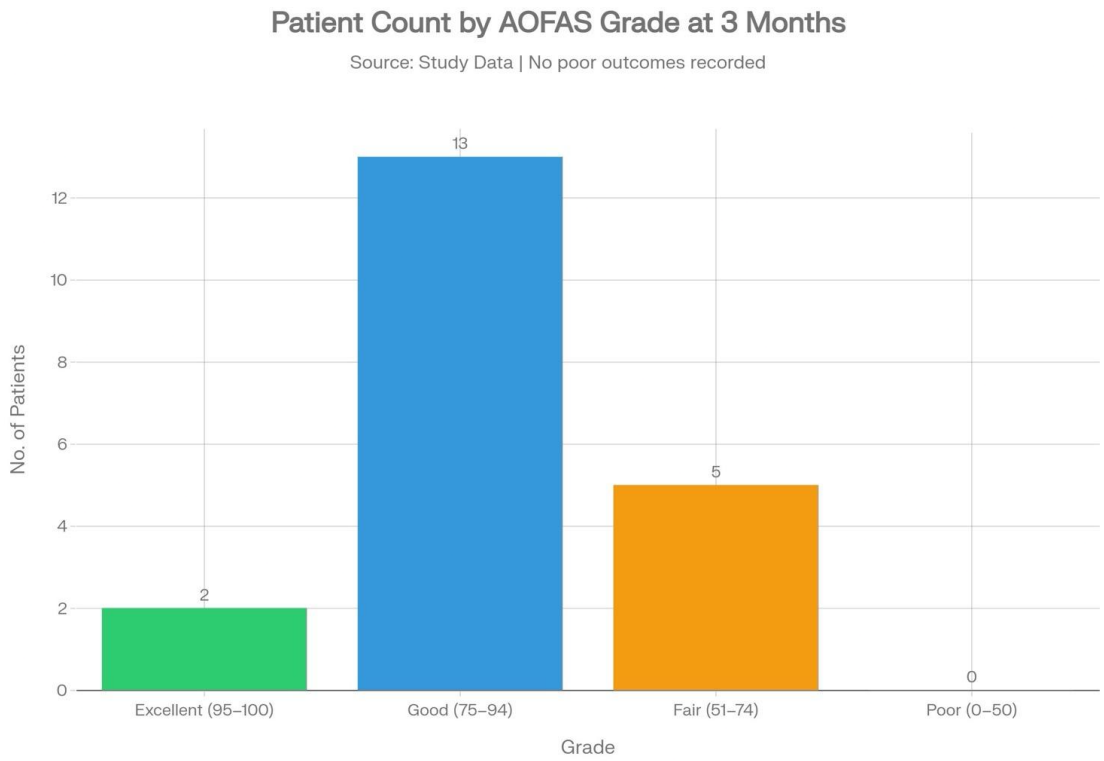

Chart V. II: AOFAS Outcome Grading

III-F Radiological Fusion Assessment

Radiological evidence of bony fusion on weight-bearing anteroposterior and lateral ankle radiographs at 3 months was observed in 16 out of 20 patients, yielding a fusion rate of 80% at the three-month mark. The remaining 4 patients (20%) demonstrated progressive consolidation with no clinical signs of non-union and were continued on follow-up [14,16].

III-G Complications

Post-operative complications were recorded in 3 patients (15%):

- Hardware irritation: 2 patients (10%), managed with footwear modification and hardware removal after fusion
- Superficial wound infection: 1 patient (5%), managed conservatively with oral antibiotics and wound dressing

No cases of deep infection, deep vein thrombosis, hindfoot malalignment, or revision surgery were recorded during the study period.

Table VI: Post-operative Complications

Complication	No. of Patients	Percentage	Management
Hardware irritation	2	10%	Footwear modification; hardware removal after confirmed fusion
Superficial wound infection	1	5%	Oral antibiotics and wound dressing
Sural nerve injury	0	0%	—
Deep infection	0	0%	—
Deep vein thrombosis	0	0%	—
Hindfoot malalignment	0	0%	—
Revision surgery	0	0%	—
Total	3	15%	—

Hardware irritation was observed in 2 patients (10%), both managed conservatively with footwear padding initially, followed by elective hardware removal after radiological confirmation of fusion, with complete symptomatic resolution. Superficial wound infection in 1 patient (5%) resolved fully with oral antibiotics and wound care within three weeks. No cases of sural nerve injury were recorded despite its recognized risk due to proximity to the surgical exposure, attributable to meticulous nerve identification during dissection. No deep infections, thromboembolic events, malalignment, or revision procedures were encountered throughout the study period [10].

IV. Discussion

This prospective observational study evaluated the functional outcomes of subtalar arthrodesis for post-traumatic subtalar arthritis using the AOFAS Ankle-Hindfoot Score at a tertiary care centre in Central India. The results demonstrated a statistically significant improvement in mean AOFAS scores from 46.2 ± 7.4 preoperatively to 79.8 ± 8.6 at 3 months post-operatively ($p<0.001$), with 75% of patients achieving good-to-excellent outcomes and no patient recording a poor result. These findings align with and reinforce the existing global literature on subtalar arthrodesis outcomes [7,10,14].

IV-A Demographic Profile

The demographic characteristics of our cohort reflect the well-established epidemiological pattern of hindfoot trauma in India. The overwhelming male predominance (80%) and young mean age (36.4 ± 9.8 years) are consistent with data from other Indian series, where road traffic accidents disproportionately affect young working-age males. In our study, road traffic accidents accounted for 70% of injury mechanisms, followed by fall from height (20%) and workplace injuries (10%), mirroring national trauma epidemiology data. The mean duration from index injury to arthrodesis was 28.6 ± 8.3 months, indicating that patients endured prolonged conservative management before surgical intervention a pattern consistent with the natural history of post-traumatic subtalar arthritis in resource-limited settings where surgical referral may be delayed [5,6].

IV-B Functional Outcomes and AOFAS Scores

The mean improvement of 33.6 AOFAS points observed in our study is comparable to findings reported in published literature. Zanolli et al. reported a median AOFAS improvement from 49 to 76.5 in a long-term retrospective cohort, while a systematic review of in situ subtalar arthrodesis by Aibinder et al. documented mean pre-operative scores of 49.6 improving to 79.4 post-operatively. More recently, Agarwal et al. reported even greater gains with arthroscopic techniques, with mean AOFAS scores rising from 48.0 ± 8.53 to 83.8 ± 9.73 at six months. The slightly lower post-operative score in our series (79.8 vs 83.8) is likely attributable to the shorter follow-up period of 3 months, during which full bony consolidation and rehabilitation may not yet be complete. It is anticipated that scores would improve further at 6 and 12 months as fusion matures [7,13,14].

The domain-wise analysis revealed that the greatest functional gain was recorded in the function domain (+16.6 points), followed by pain (+14.2 points) and alignment (+2.8 points). The predominance of functional improvement over pain relief at 3 months may reflect the fact that immediate post-operative pain reduction is rapid, while gait normalization and activity resumption components of the function domain improve progressively as rehabilitation advances and weight-bearing confidence increases. The alignment domain showed a smaller absolute gain, which is expected given that surgical correction of hindfoot alignment is achieved intraoperatively and remains relatively stable thereafter.

IV-C Outcome Grading

In our cohort, 75% of patients achieved good-to-excellent outcomes at 3 months, which is slightly lower than the 85-95% reported in longer-term series. This difference is expected, as AOFAS outcome grading at 3 months represents an intermediate assessment; ongoing bone remodeling, soft tissue healing, and progressive rehabilitation typically translate into further score improvement at 6 and 12 months. The absence of any poor outcome at 3 months is an encouraging early indicator of procedural success and appropriate patient selection [8,10].

IV-D Radiological Fusion

An 80% fusion rate at 3 months on plain radiographs is consistent with published data from Indian institutional series. It is important to note that plain radiographic assessment of subtalar fusion is known to underestimate actual fusion rates compared to CT scanning, which remains the gold standard for fusion assessment. Nork et al. and subsequent series have demonstrated that CT-confirmed fusion rates consistently exceed those detected on radiographs at equivalent time points. The 4 patients in our series demonstrating progressive consolidation without clinical non-union signs are likely to achieve complete radiographic fusion by 6 months. Future studies at our institution should incorporate CT-based fusion assessment to more accurately quantify union rates [14,16].

IV-E Complications

The overall complication rate of 15% in our series, comprising hardware irritation (10%) and superficial wound infection (5%), is within the range reported in published literature. A systematic review of in situ subtalar arthrodesis reported hardware removal in 11.4% and deep infection in 1.3% of cases. Our series recorded no deep infections, no sural nerve injuries, no thromboembolic events, and no revision surgery a favorable profile attributable to meticulous surgical technique and structured post-operative care [10,15].

The absence of sural nerve injury is noteworthy, as this structure lies near the standard sinus tarsi approach and is one of the most cited complications of subtalar arthrodesis in the literature. Deliberate identification and retraction of the nerve during surgical exposure likely contributed to its preservation in all 20 cases [16].

IV-F Clinical Implications

This study establishes preliminary institutional benchmarks for AOFAS-based functional outcomes following subtalar arthrodesis at CMCH Bhopal, contributing to the sparse prospective data from Central India. The consistent functional improvement observed across all domains supports the use of subtalar arthrodesis as a reliable salvage procedure for post-traumatic subtalar arthritis in young Indian patients. These findings provide a foundation for structured patient counselling regarding realistic outcome expectations, standardization of operative and rehabilitation protocols, and justification for resource allocation toward early surgical intervention in advanced disease.

IV-G Limitations

Several limitations of this study merit acknowledgment. First, the sample size of 20 patients, while adequate for a single-institution pilot study, limits generalizability. Second, the follow-up period of 3 months is relatively short; longer follow-up at 6 and 12 months would provide more definitive outcome data and allow assessment of long-term fusion rates and complications. Third, radiological fusion was assessed on plain radiographs rather than CT scanning, which may underestimate true fusion rates. Fourth, the absence of a control group or comparative cohort (e.g., conservative management or arthroscopic arthrodesis) limits comparative inference. Fifth, health-related quality-of-life measures such as SF-36 or VAS pain scores were not incorporated alongside the AOFAS score, which would have provided a more comprehensive outcome assessment. Future prospective studies with larger sample sizes, longer follow-up, CT-based fusion assessment, and multi-dimensional outcome tools are recommended.

V. CONCLUSION

Subtalar arthrodesis for post-traumatic subtalar arthritis in young Central Indian patients yielded significant functional improvement, with mean AOFAS Ankle-Hindfoot Scores rising from 46.2 ± 7.4 preoperatively to 79.8 ± 8.6 at 3 months post-operatively ($p<0.001$), representing a clinically meaningful gain of 33.6 points [7,14].

II-G Data Collection

All clinical data were collected by the principal investigator using a pre-structured, pre-tested proforma through direct patient interview and clinical examination. Variables recorded included patient demographics, mechanism of injury, fracture type, operative details, AOFAS scores at both time points, radiological fusion status, and post-operative complications including wound infection, hardware irritation, and non-union.

II-H Statistical Analysis

Data were entered and managed in Microsoft Excel. Descriptive statistics were expressed as means, standard deviations, proportions, and percentages. The paired t-test was applied to compare pre-operative and post-operative AOFAS scores. A p-value of <0.05 was considered statistically significant. Results were presented in tabular and graphical formats.

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Seventy-five percent of patients achieved good-to-excellent outcomes, with 80% radiographic fusion at 3 months and a low minor complication rate of 15%; no major complications, sural nerve injuries, or revision surgeries were recorded [8,10].

These prospective institutional data establish reliable benchmarks for patient counselling, validate subtalar arthrodesis as an effective salvage procedure for advanced post-traumatic hindfoot arthritis, and highlight the need for larger multi-centre studies with longer follow-up and CT-based fusion assessment to further optimize outcomes in the Indian trauma population [7,14].

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