

Original Article

Radiological and functional outcome of talus fracture in local population: Our experience in Government tertiary care trauma center.

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Abstract

Background: Talus fractures pose significant challenges in orthopedic management, particularly in lower socioeconomic populations. Open Reduction and Internal Fixation (ORIF) is a commonly employed surgical approach to restore joint congruity and function. However, outcomes in such populations may be influenced by factors like access to healthcare and postoperative rehabilitation. This retrospective study aimed to evaluate the radiological and functional outcomes of talus fractures treated with ORIF in a lower socioeconomic class population.

Methodology: The study was conducted at a Tertiary Care Trauma Centre and involved 11 patients aged 18-25. Preoperative planning included X-rays and 3-dimensional Computed Tomograms (CT Scans) of the ankle joint. Surgical approaches included the standard medial approach, a dual approach, and an approach with medial malleolus osteotomy. Functional outcomes were assessed using the American Orthopedic Functional Ankle Scoring (AOFAS). Radiological outcomes were evaluated through postoperative X-rays, with reduction considered satisfactory if <2 mm joint step was achieved. Incidence of avascular necrosis of the Talus (ANT), post-traumatic arthritis (PTA), and other complications were analyzed.

Results: With a mean follow-up of 18 months, concentric reduction was achieved in 85% of cases. Postoperative complications included PTA of the subtalar joint in 45.4% of patients, PTA of the ankle joint in 20%, AVN in 18.1%, delayed union in 9%, and surgical site infection (SSI) in 9%.

Conclusion: Despite advancements, talus fractures treated with ORIF remain challenging, especially in lower socioeconomic populations. High complication rates highlight the importance of meticulous surgical planning and postoperative management. Nonetheless, ORIF offers acceptable functional outcomes and facilitates early return to work in these patients.

Keywords

Talus Fracture, Open Reduction and Internal Fixation (ORIF), Radiological Outcome, Functional Outcome, American Orthopedic Functional Ankle Scoring (AOFAS).



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Introduction

Talar fractures, though infrequent, pose significant challenges in orthopedic management, constituting less than 1% of all fractures^{1,2}. They represent the second most common type of fracture among tarsal bones, with calcaneum fractures being the most prevalent. Talar body fractures, accounting for 7% to 38% of all talus fractures, are relatively rare, while talar neck fractures can either involve extra-articular regions or affect the middle facet of the subtalar joint. In contrast, talar body fractures are typically intra-articular, impacting both tibiotalar and subtalar joint surfaces. These fractures often result from intense external stress, typically involving a forceful upward bending of the foot³.

Despite their severity, the literature on talus fractures and treatment outcomes remains limited, with a significant portion of patients managed non-surgically in previous studies⁴. Despite advancements in diagnostic imaging and surgical techniques, complication rates remain high, with AVN occurring in 12% to 53% of cases⁵.

ORIF have been associated with reduced rates of osteonecrosis, arthritis, malunion, and non-union in talar fractures⁶. However, achieving optimal outcomes requires a delicate balance between achieving precise anatomical alignment and preserving soft tissues to minimize complications such as skin issues or talus osteonecrosis⁷.

While early intervention with ORIF has been suggested to reduce complications, recent literature suggests that the timing of surgery may not significantly impact outcomes⁸. Considering factors such as soft tissue swelling before performing definitive surgery is crucial to minimize the risk of postoperative tissue necrosis^{9,10}.

This retrospective study aims to evaluate the radiological and functional outcomes of talus fractures treated with ORIF in a lower socioeconomic population. Specifically, we aim to assess the timeframe for these patients to resume normal daily activities, shedding light on the challenges and outcomes in this demographic.

Through this study, we seek to contribute valuable insights to optimize treatment strategies and improve outcomes for patients with talus fractures, particularly in resource-limited settings.

Methodology

Study Design

This retrospective study was designed to evaluate the outcomes of open reduction and internal fixation (ORIF) in patients with talus fractures.

Setting

The study was conducted at the Department of Orthopedic Surgery, SMBBIT, a tertiary care trauma center, between January 2017 and January 2022.

Participants

This study included all patients who presented with displaced talar neck and body fractures treated with open reduction and internal fixation (ORIF). Eligible participants were between 18 and 85 years of age and had provided prior informed consent to participate in the study. Patients who did not provide consent or those managed conservatively were excluded from the study to ensure a homogeneous study population.

Fracture Classification and Imaging Assessment

Before surgery, CT scans and X-rays were employed to detect fractures in the talar neck and talar body. Talar neck fractures were classified as fractures occurring in front of the lateral process, while talar body fractures were classified as fractures extending to or occurring behind the lateral process¹¹. The categorization of talar neck fractures was determined using the Hawkins classification¹², which Canale and Kelly later updated¹³.

Variables

The primary variables of interest included the type and location of talus fractures, surgical techniques employed, postoperative alignment, time to union, development of complications such as avascular necrosis and post-traumatic osteoarthritis, and functional outcomes assessed by ankle-hindfoot scores.

Data Sources/ Measurement

Clinical and radiological data were collected retrospectively from medical records, including preoperative CT scans and X-rays for fracture characterization, intraoperative details, and postoperative follow-up evaluations. Postoperative X-rays assessed the degree of alignment, and further radiographic assessments were performed at specified intervals to monitor secondary displacement, time to union, and the development of complications.

Surgical Techniques

A standard medial talar approach was followed, with an incision extending from the talonavicular joint to the medial malleolus. The fracture was exposed, and open reduction was performed, followed by internal fixation using cannulated screws. Medial malleolar osteotomy was performed in selected cases as necessary.

Postoperative Evaluation

Postoperative evaluation included assessing alignment in lateral and anteroposterior views on X-rays using criteria suggested by Lindvall et al.¹⁴ The subtalar joint's congruency was also evaluated. Radiographs were taken at six weeks, 12 weeks, six months, and 12 months postoperatively to monitor for secondary displacement, time to union, osteoarthritis, and avascular necrosis. Osteonecrosis was characterized on plain radiographs as any region of heightened density in the talar dome compared to the surrounding structures, known as the Hawkins sign^{12,15}. Functional outcomes were assessed using ankle-hindfoot scores from the AOFAS¹⁶.

Bias

Efforts were made to minimize bias by employing standardized surgical techniques, consistent evaluation criteria, and impartial clinical assessments conducted by an independent observer, including patients who provided informed consent and excluding conservatively managed cases aimed to reduce selection bias.

Study Size

The sample comprised 11 patients, reflecting the availability of eligible cases meeting the inclusion criteria during the study period. While small, this sample size is typical for studies involving rare orthopedic injuries such as talus fractures.

Quantitative Variables

Quantitative variables included age, fracture characteristics, postoperative alignment measurements, time to union, and functional outcomes assessed by ankle-hindfoot scores.

Statistical Methods

Statistical analysis was performed using SPSS v26. The Chi-square test was employed for qualitative analysis, assessing categorical variables such as complication rates. The ANOVA test was utilized for quantitative analysis, comparing continuous variables such as time to union among different subgroups. A p-value less than 0.05 was considered statistically significant, indicating a meaningful difference between groups or associations.

Ethical considerations

This study was conducted after taking ethical review board approval (ERC000064/SMBBIT/Approval/2023; Date: 15 March 2023).

Results

Participants

The study included 11 patients who underwent open reduction and internal fixation (ORIF) for displaced talar neck and body fractures. Nine patients had associated fractures, while two had isolated talus fractures with dislocation. The participants' mean age was 31.2 years, with a standard deviation of 10.90. The average follow-up duration was 18.5 months.

Descriptive Data

The fracture classification revealed that 8 patients had talar neck fractures, 5 of which were classified as Hawkins type 3, 2 as Hawkins type 2, and 1 as Hawkins type 4. Additionally, three patients had talar body fractures. The reduction achieved

postoperatively was anatomical in 4 patients, near anatomical in 6 patients, and unsatisfactory in 1 patient.

Outcome Data

Postoperative complications were observed in the cohort. Five patients (45%) developed post-traumatic arthritis, with a higher incidence noted in Hawkins type 3 fractures. Avascular necrosis (AVN) occurred in 2 patients (18%), while delayed union was reported in 1 patient (9%). Four patients (36.3%) experienced surgical site infection (SSI), which was managed with wound irrigation and debridement.

Main Results

Functional outcomes, assessed using the American Orthopedic Foot and Ankle Society (AOFAS) score,

varied among patients. An excellent AOFAS score was reported in 1 patient (9%), good in 6 patients (54.5%), fair in 3 patients (27%), and poor in 1 patient (9%). Most patients (63.6%) reported a satisfactory return to work, while four (36.3%) required job modifications.

Comparison of Clinical and Radiological Outcome

An analysis of clinical and radiological outcomes revealed a significant association between achieving anatomical reduction and reduced incidence of AVN ($p = 0.03$). However, no significant associations were observed between anatomical reduction and other complications, such as post-traumatic arthritis and skin complications.

Table 1: Demographic Characteristics and Follow-up Duration.

Variables	N=11	
Age; mean \pm SD	31.2 \pm 10.90	
AOFAS; mean \pm SD	76.3 \pm 10.73	
Follow up duration; mean \pm SD (Months)	18.5 \pm 5.23	
Gender	Male	9 (81.8)
	Female	2 (18.18)
Fracture Type (Location)	Body	3 (27.2)
	Neck	8 (72.7)
Reduction	Anatomic	4 (36.3)
	Near Anatomic	6 (54.5)
	Poor	1 (9.09)
Complication	SSI	4 (36.3)
	Arthritis	5 (45.4)
	Delayed union	1 (9.09)
	AVN	2 (18.18)
	None	2 (18.18)



b) X-ray ankle AP view showing talus fracture dislocation



a) x-ray ankle lateral view



c) Post-op x-ray ankle lateral view with reduction with screws



d) Post-op AP view



e) Per-op image showing medial malleolus osteotomy

Figure 1 a-e: 27-year-old male with a history of fall from height with right talus fracture-dislocation treated with ORIF with 4.0mm cannulated screw.

Table 2: Talus ORIF data showing all variables.

No	Gender	Age	Fracture type	Initial reduction	Follow up (months)	Early complication	Late complication	AOFAS ¹
1	M	27	Neck	Anatomical	22	-	Arthritis	76
2	M	20	Neck	anatomical	18	SSI	None	88
3	M	19	Neck	Anatomical	23	-	Arthritis	91
4	M	36	Neck	Near anatomical	26	SSI	Arthritis	68
5	F	24	Body	Near anatomical	16	-	Delayed union	78
6	M	42	Neck	Anatomical	26	-	AVN	86
7	M	21	Body	Near anatomical	14	-	None	80
8	M	52	Neck	Poor	12	SSI	AVN	53
9	F	30	Neck	Near anatomical	12	-	Arthritis	74
10	M	29	Body	Near anatomical	20	-	Arthritis	68
11	M	44	Neck	Near anatomical	15	SSI	SSI	78

¹ANOVA test**Table 3: Comparison of clinical and radiological outcome and AOFAS score.**

Outcome	Yes (%)	No (%)	P-value ¹
Anatomic reduction	90.0	10.0	0.03
Skin complication	36.3	63.6	0.23
Arthritis	45.4	54.5	0.16
AVN	18.8	81.8	0.05

¹Chi-square test

*p<0.05 is considered statistically significant

Discussion

Talus fractures represent severe injuries typically resulting from significant force applied to the lower limb, such as those sustained in airplane crashes, motor vehicle accidents, or falls from considerable heights¹⁷. These fractures are commonly categorized into talar neck and talar body fractures, with distinct mechanisms of injury for each. Talar neck fractures often result from extreme upward movement of the ankle, while talar body fractures occur due to forceful compression along the axis^{1,17-19}. Managing these fractures poses

considerable challenges and is associated with high complications.

Conservative management is typically reserved for undisplaced fractures, yielding favorable outcomes. However, for displaced fractures, open reduction and internal fixation (ORIF) are the preferred treatment modalities^{1,14,17}, with the primary goal being to achieve anatomical alignment of the articular surfaces²⁰. Various surgical approaches have been employed, with the dual anteromedial and anterolateral approaches commonly utilized. Cannulated screws, usually 4 mm in diameter, are often used for fixation,

inserted in a divergent manner to stabilize fractures of the talus neck²¹.

Studies, including those by Suthar RD et al. and Georgina Crate et al., underscore the importance of achieving anatomical reduction and firm internal fixation to reduce postoperative complications in talus neck fractures^{22,23}. The combined anteromedial and anterolateral approach has been recommended to minimize complications such as avascular necrosis (AVN), non-union, malunion, and arthritis.

Additionally, research by Biz and colleagues highlighted the potential complications associated with talus neck fractures, including the development of arthritis in the subtalar, tibiotalar, and talonavicular joints and avascular necrosis²¹. Similarly, Azeez et al. observed a notable incidence of AVN in talus neck fractures treated with ORIF, emphasizing the importance of achieving anatomical reduction and firm internal fixation to minimize complications²⁴.

These findings resonate with the outcomes of our retrospective analysis, which demonstrated satisfactory radiological and functional outcomes in patients undergoing ORIF for talus fractures. Our approach, which aims to minimize long-term sequelae, emphasizes anatomical reduction and rigorous internal fixation. The observed high rate of early return to employment further underscores the effectiveness of our treatment approach in facilitating patient recovery and resumption of daily activities. However, continued research and refinement of surgical techniques are warranted to optimize outcomes in talus fractures.

Limitations

The study's limitations include a small sample size, a retrospective design prone to bias, and a short follow-up duration, which hinder a comprehensive understanding of talus fractures treated with ORIF. Large, prospective studies with longer follow-ups are needed to comprehend outcomes and complications better and optimize treatment strategies for these complex fractures.

Conclusion

In conclusion, treating talus fractures with fixation requires a thorough understanding of vascular and bone anatomy alongside advanced surgical techniques. Achieving successful outcomes entails a delicate balance involving precise anatomical realignment while preserving soft tissue integrity to mitigate complications. Overall, ORIF of talar fractures demonstrate favorable functional results, facilitating an early return to work. Moving forward, advancements in surgical approaches and patient management strategies are essential to optimize outcomes and minimize complications in treating talus fractures.

Conflicts of Interest

None.

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