Original Article

HEALTH SCIENCES
MEDICINE

DOI: 10.32322/jhsm.1552129
J Health Sci Med. 2024;7(6):654-657

Functional outcomes of 26 patients surgically treated for talus fractures

İbrahim Bozkurt, Baran Sarıkaya
Department of Orthopaedics and Traumatology, Ankara Bilkent City Hospital, Ankara, Turkiye

Cite this article as: Bozkurt İ, Sarıkaya B. Functional outcomes of 26 patients surgically treated for talus fractures. *J Health Sci Med.* 2024;7(6):654-657.

Received: 18.09.2024 ◆ **Accepted**: 14.10.2024 ◆ **Published**: 27.10.2024

ABSTRACT

Aims: This study evaluates whether trauma mechanisms, fracture types, and surgical treatment choices in cases of operatively treated talus fractures have an effect on the clinical outcomes of patients.

Methods: Twenty-six patients over the age of 18 who were surgically treated between 2019 and 2022 were included in the study. The collected data included age at the time of injury, gender, trauma characteristics (affected side, trauma mechanism, associated injuries), treatment characteristics (surgical delay, operation time, length of hospital stay), rates and types of revision surgery, and last follow-up date. The American Orthopaedic Foot & Ankle Society (AOFAS) Ankle-Hindfoot Score and a Visual Analogue Scale (VAS) were used to measure patient-reported outcomes.

Results: The mean age of the cohort was 33.6±11.8 years and it included 8 women (30.7%) and 18 men (69.2%). The most common trauma mechanisms were falls from a height (10 patients) and injuries sustained during traffic accidents (6 patients). The most common surgery performed was cannulated screw osteosynthesis (20 patients, 76.9%), followed by plate osteosynthesis (5 patients, 19.2%) and K-wire and screw osteosynthesis (1 patient, 3.9%). The mean VAS score was 1.9±2.1 (range: 0-8) and the mean AOFAS score was 67.2±25.5 (range: 17-97).

Conclusion: This study revealed that the selected surgical method, fracture type, and trauma mechanism did not have significant effects on patient-reported functional outcomes. These results suggest that, although talus fractures are rare, the need for surgical intervention and the occurrence of postoperative complications make these fractures a significant type of trauma.

Keywords: Talus fracture, trauma mechanism, screw osteosynthesis

INTRODUCTION

The incidence of talus fractures has increased in recent years. Although they previously accounted for 0.85% to 1% of all fractures, recent epidemiological data suggest that talus fractures are now approximately 2% of all fractures.[1,2] Talus injuries are most commonly seen following high-energy trauma and they predominantly occur in male individuals under 40 years of age. Due to the high-energy mechanisms, the rates of associated fractures are high.[3] Although they are rare, talus fractures present significant challenges for trauma surgeons and can potentially lead to permanent disability in ankle and foot function.[4] Previous studies have highlighted fracture displacement and delayed surgery as risk factors for complications in cases of talus fractures. Historically, urgent open reduction and internal fixation (ORIF) has been recommended to reduce the incidence of complications.[5] However, more recent publications suggest no correlation between the timing of surgical fixation and the development of osteonecrosis.[6,7] Approximately 57% of the talar surface is covered by articular cartilage.[8] This unique anatomical feature presents three challenges in the treatment of talus injuries: relatively limited surface area is available for vascular entry, fracture displacement can easily disrupt the mechanics of nearby joints, and obtaining access for surgical treatment requires the management of tight constraints. Due to these anatomical characteristics, avascular necrosis (AVN) and post-traumatic arthritis (PTA) are common complications following traumatic talus fractures.[4-11] In this study, we evaluate whether the trauma mechanisms, fracture types, and surgical treatment choices in cases of operatively treated talus fractures have an effect on the clinical outcomes of patients.

METHODS

Upon receiving Ankara Bilkent City Hospital No. 2 Clinical Researches Ethics Committee approval (Date: 21.02.2024, Decision No: TABED 1-24-209), the records of 26 patients diagnosed with talus fractures and surgically treated between 2019 and 2022 in the Orthopaedics and Traumatology Clinic of Ankara Bilkent City Hospital were reviewed. The collected data included age at the time of injury, gender, trauma characteristics (affected side, trauma mechanism, associated injuries), treatment characteristics (surgical delay, operation

Corresponding Author: İbrahim Bozkurt, dr.bozkurtibrahim@gmail.com

time, length of hospital stay), rates and types of revision surgery, and the last follow-up date. All surgically treated patients over 18 years of age were included in the study. Patients with substance abuse, those who presented for revision surgery after external surgery, those with follow-up durations of less than 12 months, and those who were conservatively followed were excluded from the study. The American Orthopaedic Foot & Ankle Society (AOFAS) Ankle-Hindfoot Score[12] and a visual analogue scale (VAS) were used to measure patient-reported outcomes. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Surgical Technique

A surgeon specialized in lower extremity surgery evaluated the surgical indications. The definitive criteria for surgical treatment were open fractures and dislocation of the ankle joint with failed closed reduction. Surgical treatment was applied for all patients with displaced fractures. Operative treatment involved temporary external fixation in the case of major dislocations, followed by ORIF with screws, plates, or K-wires for osteosynthesis. In cases of closed talus fractures without dislocation and therefore with a lower risk of AVN, surgery was performed after soft tissue consolidation. The patient was positioned supinely, 1.5 g of prophylactic cefuroxime was administered, and a thigh tourniquet was applied and inflated to control bleeding. Fixation of talar neck and body fractures was typically achieved with K-wires, followed by definitive fixation with cannulated screws after radiographic control. For fragmented talar body fractures, for which screw osteosynthesis was unsuitable, plate osteosynthesis was performed via an anteromedial or anterolateral approach. Postoperative care included partial weight-bearing with a walking boot for 6 weeks using two crutches with 15 kg of weight-bearing together with antithrombotic therapy until full weight-bearing was achieved.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics 22.0 for Windows. Descriptive statistics for numerical variables were expressed as mean, standard deviation, median, and minimum-maximum values. Descriptive statistics for categorical variables were expressed as percentages and frequencies. The Shapiro-Wilk test showed that the quantitative variables did not have normal distribution; therefore, non-parametric test procedures were employed. The Mann-Whitney U test and Kruskal-Wallis analysis of variance were used to identify the relationships between studied parameters. For the binary analysis of categorical data, the chi-square test was used. Results were evaluated with 95% confidence intervals at a significance level of $p<0.05$.

RESULTS

Between 2019 and 2022, a total of 32 patients were treated for talus fractures. Twenty-six of those patients underwent surgery and 6 were treated conservatively. The mean age of the study cohort was 33.6±11.8 years and it included 8 women (30.7%) and 18 men (69.2%). The average age of the female patients was 32 years, while the average age of the male patients was 34.2 years. Fifteen patients (57.6%) had right-side fractures and 11 (42.3%) had left-side fractures. The characteristics of the patients are summarized in Table. The most common trauma mechanisms were falls from a height (10 patients) and injuries sustained during traffic accidents (6 patients) (Table). Simultaneous lower extremity injuries were observed in 12 patients (46.1%). Three patients had open talus fractures. In total, 5 patients had dislocations in the talocrural, talocalcaneonavicular, and/or subtalar joints. Fractures with dislocations were treated with emergency ORIF in 2 cases, temporary external fixation involving the ankle joint in 1 case, and successful closed reduction followed by ORIF in 2 cases. The time between trauma and surgery was 4.4±5.8 days (range: 0-25 days). The most common surgery performed was cannulated screw osteosynthesis for 20 patients (76.9%), followed by plate osteosynthesis for 5 patients (19.2%) and K-wire and screw osteosynthesis for 1 patient (3.9%). Four patients (15.3%) required revision surgery due to postoperative infection (n=1), malreduction (n=2), or nonunion (n=1). The mean follow-up period for all patients was 30.3 months (range: 12-49 months). The mean VAS score was 1.9±2.1 (range: 0-8) and the mean AOFAS score was 67.2±25.5 (range: 17-97). No significant differences were found in VAS or AOFAS scores according to fracture types (p=0.91, p=0.40), trauma mechanisms (p=0.31, p=0.21), or surgical approaches (p=0.06, p=0.05).

Table. Demographic, clinical, and radiological characteristics of the patients

Demographics	Age		33.6±11.8
	Gender	Female	8 (30.7%)
		Male	18 (69.2%)
Fracture type	Neck fracture		16 (61%)
	Body fracture		7 (26%)
	Head fracture		3 (11%)
Trauma mechanisms	Fall of <3 m		5 (19.2%)
	Fall of >3 m		10 (38.5%)
	Road traffic accident		6 (23.1%)
	Ankle distortion during sports		5 (19.2%)
Type of definitive treatment	Screw osteosynthesis		20 (76.9%)
	Plate osteosynthesis		5 (19.2%)
	Screw osteosynthesis + K-wire		1 (3.9%)
Reintervention rate after definitive operation	Implant removal		4 (15.4%)
	Deep infection		1 (3.8%)
	Malreduction		2 (7.7%)
	Nonunion		1 (3.8%)
Time from trauma to surgery (days)			4.4±5.8
VAS score			1.9±2.1
AOFAS score			67.2±25.5

DISCUSSION

Talus fractures pose a significant challenge for trauma surgeons due to their rarity and the potential for serious complications. In our study, the outcomes of 26 cases of talus fracture were evaluated and the effects of trauma mechanism, fracture type, surgical delay, and treatment method on patient outcomes were analysed. Our findings largely align with the existing literature while providing new insights in some areas. Long-term PTA development is common after talus fractures, with recent studies reporting a high prevalence of up to 75%. It is noted that complex fractures, particularly in the neck and

body of the talus, significantly contribute to the development of PTA, as damage to the joint surface in these fractures increases the risk of post-traumatic arthritis.[13,14] In our study, dislocations in the talocrural, talocalcaneonavicular, and/or subtalar joints were observed in 5 patients, and 2 of those patients underwent emergency ORIF. There were no significant complications in these cases, but as the literature suggests, the potential risk of such complications in displaced fractures should always be considered.[6] Four patients in our study required revision surgery, supporting the higher complication risk associated with displaced fractures. Regarding AVN risk, some studies in the literature indicate that surgical timing and fracture displacement have direct effects on the development of AVN.[9] Recent studies suggest that the impact of surgical timing on the development of AVN is less significant than previously thought, and that the proper application of surgical technique plays a more critical role. Particularly in high-energy injuries, the risk of AVN increases; however, it has been observed that delaying surgical intervention does not necessarily lead to a heightened risk. This indicates that surgical techniques are a crucial factor in the optimal management strategies for talus fractures.[13,14] In our study, the mean time between trauma and surgery was 4.4 days, which is consistent with the recommended time intervals in the literature. This may be associated with the low incidence of AVN in our study. High-energy trauma is the most common cause of talus fractures, with such injuries frequently being associated with motor vehicle accidents or falls from a height.[12] In our study, 10 patients were injured in falls from a height and 6 patients were injured in traffic accidents. As noted in the literature, high-energy trauma typically results in more complex fractures and higher complication rates.[15] However, in our study, there was no significant difference between VAS or AOFAS scores according to trauma mechanisms. This suggests that the trauma mechanism may not always have a clear effect on functional outcomes in cases of talus fractures. As functional outcomes of our study, the mean VAS score was 1.9 and the mean AOFAS score was 67.2. The literature indicates that functional recovery after a talus fracture is slow, and many patients experience permanent pain and movement restrictions.[16] New research indicates that complex talus fractures have a negative impact on functional outcomes, with higher complication rates associated with these types of fractures. Accordingly, it is noted that simple fractures result in higher AOFAS scores after treatment, while complex fractures are associated with significantly lower scores.[13,14] Similarly, in our study, most patients did not achieve full functional recovery and the average scores indicated moderate functional losses. In particular, lower AOFAS scores were observed in cases involving complications; for example, patients undergoing revision surgery due to malreduction had more limited functional recovery. Regarding surgical treatment, our study showed that the most common method used in the treatment of talus fractures was cannulated screw osteosynthesis, applied for 20 patients. This surgical method has been noted in the literature for its effectiveness in restoring joint integrity.[17] In our study, the majority of patients who underwent cannulated screw osteosynthesis experienced a complication-free postoperative period. However, the literature also highlights plate osteosynthesis as an effective method for comminuted talus fractures.[18] In our study, 5 patients underwent plate osteosynthesis and successful outcomes were achieved. Particularly for comminuted fractures, the use of this technique in the present study aligns with the results in the literature. The timing of surgical intervention and the surgical technique significantly influence long-term recovery and complication risks in cases of talus fractures. The literature emphasizes that urgent surgical intervention and selection of a proper technique can reduce the risk of AVN and PTA.[19] In our study, although no significant relationship was observed between surgical delay and AVN development, the general findings are consistent with the complex data presented in the literature.

Limitations

The fact that this study was retrospective and did not incorporate long-term results was a limiting factor. In addition, due to the rarity of talus fractures, a small number of patients were included in the analysis and the subgroups for trauma mechanism, surgery type, and fracture location were accordingly very small. This was another limiting factor.

CONCLUSION

In this study, we concluded that the selected surgical method, fracture type, and trauma mechanism did not have significant effects on patient-reported functional outcomes after talus fractures. Our results demonstrate that, although talus fractures are rare, the need for surgical intervention and the rate of postoperative complications make these fractures a significant type of trauma. Surgical treatment methods should be selected carefully according to fracture type and trauma mechanism, and patients should be closely monitored postoperatively. While the outcomes of high-energy traumas are more complex than those of low-energy injuries, complications can be minimized with timely surgery and proper techniques.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Ankara Bilkent City Hospital No. 2 Clinical Researches Ethics Committee (Date: 21.02.2024, Decision No: TABED 1-24-209).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Shibuya N, Davis ML, Jupiter DC. Epidemiology of foot and ankle fractures in the United States: an analysis of the National Trauma Data Bank (2007 to 2011). *J Foot Ankle Surg.* 2014;53(5): 606-608.
2. Amin S, Achenbach SJ, Atkinson EJ, Khosla S, Melton LJ. Trends in fracture incidence: a population-based study over 20 years. *J Bone Miner Res.* 2014;29(3):581-589.
3. Schwartz AM, Runge WO, Hsu AR, Bariteau JT. Fractures of the talus: current concepts. *Foot Ankle Orthop.* 2020;5(1): 2473011419900766.
4. Vints W, Matricali G, Geusens E, Nijs S, Hoekstra H. Long-term outcome after operative management of talus fractures. *Foot Ankle Int.* 2018;39(12):1432-1443.
5. García-Rey E, Sanz-Hospital FJ, Galdrán FJ, Cano-Egea JM, Alcázar LFL. Talar neck fractures: results and complications by type. *Foot Ankle Surg.* 2002;8(3):203-208.
6. Vallier HA, Nork SE, Barei DP, Benirschke SK, Sangeorzan BJ. Talar neck fractures: results and outcomes. *J Bone Joint Surg Am.* 2004;86(8):1616-1624.
7. Schulze W, Richter J, Russe O, Ingelfinger P, Muhr G. Surgical treatment of talus fractures: a retrospective study of 80 cases followed for 1-15 years. *Acta Orthop Scand.* 2002;73(3):344-351.
8. Oppermann J, Franzen J, Spies C, et al. The microvascular anatomy of the talus: a plastination study on the influence of total ankle replacement. *Surg Radiol Anat* 2014;36(5):487-494.
9. Halvorson JJ, Winter SB, Teasdall RD, Scott AT. Talar neck fractures: a systematic review of the literature. *J Foot Ankle Surg.* 2013;52(1):56-61.
10. Vallier HA. Fractures of the talus: state of the art. *J Orthop Trauma.* 2015;29(9):385-392.
11. Buza JA 3rd, Leucht P. Fractures of the talus: current concepts and new developments. *Foot Ankle Surg.* 2018;24(4):282-290.
12. Pannier S, Sutter PM, Sommer C, Studer HP. Long-term outcome after talus fractures in adults: a retrospective study of 47 patients. *Foot Ankle Int.* 2003;24(4):340-346.
13. Vincent CN, Venkatesan A, Rai D, Sm AK. Long-term outcome analysis of surgically treated talus fractures in a tertiary care hospital. *Cureus.* 2024;9;16(4):e57918.
14. Crate G, Robertson A, Martin A, Marlow NJ, Guryel E, Trompeter A. Talar neck and body fracture outcomes: a multicentre retrospective review. *Eur J Orthop Surg Traumatol.* 2023;33(1):99-105.
15. Canale ST, Kelly FB. Fractures of the neck of the talus. Long-term evaluation of seventy-one cases. *J Bone Joint Surg Am.* 1978; 60(2):143-156.
16. Grob D, Simpson LA. Complications following talar neck fractures. *Foot Ankle Int.* 2004;25(11):795-799.
17. Sanders DW, Busam M, Hattwick E, Edwards JR, O'Brien PJ. Functional outcome of talar neck fractures treated with ORIF. *Foot Ankle Int.* 2004;25(10):716-721.
18. Fortin PT, Balazsy JE. Talus fractures: evaluation and treatment. *J Am Acad Orthop Surg.* 2001;9(2):114-127.
19. Raikin SM, Puri S, Benner RW, Espandar R. Vascular anatomy of the talus: its relation to talar fractures and surgical approaches. *Foot Ankle Clin.* 2004;9(4):605-615.