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ORIGINAL ARTICLE

Extruded Talus Injuries: A Cross-sectional Survey of Indian Orthopedic Surgeons

[1]Mandeep S Dhillon, [2]Siddhartha Sharma, [3]Sharad Prabhakar, [4]Sameer Aggarwal, [5]Devendra K Chouhan

ABSTRACT

Introduction: Management of extruded talus (ET) injuries poses a dilemma, owing to its rarity as well as the paucity and diversity of the published literature.

Materials and methods: We designed an eight-item questionnaire-based survey, which was administered to Indian orthopedic surgeons.

Results: A total of 379 participants completed the survey, 265 (69.9%) reported having seen or treated a case of ET; 172 participants reported following up their case for >1 year. Of these, 33 cases (8.7%) had a well-retained talus without any evidence of avascular necrosis (AVN), arthrosis, or infection; 104 (27.4%) cases had AVN with or without infection; 42 (11.1%) cases developed ankle arthrosis and the talus was not retained and arthrodesis done in 12 (3.1%) cases. A total of 235 (62%) participants chose AVN as the most feared complication, followed by infection (20.3%, n = 77) and arthroses (7.4%, n = 28); 359 (94.7%) participants preferred primary repositioning of ET; 320 (84.4%) participants were not aware of any studies reporting long-term outcomes of these injuries.

Conclusion: Most Indian surgeons prefer primary repositioning of ET to talectomy and arthrodesis. Avascular necrosis remains the major concern after repositioning. Awareness on long-term outcomes of these injuries is lacking, and more studies reporting long-term outcomes are needed.

Keywords: Extruded talus, Missing talus, Survey, Talar dislocation, Talar extrusion, Talus.

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INTRODUCTION

Extruded talus injuries, also referred to as *"total talar extrusions"* or *"missing talus,"* are rare injuries wherein the talus is completely dislocated from the ankle and subtalar and talonavicular joints, and may often lie partially or completely outside the body through an open wound. The mechanism of trauma is a high-velocity force applied to the plantarflexed and supinated foot.[1,2]

Traditionally, these injuries have been associated with poor outcomes, attributable to the associated severe soft-tissue injury, wound contamination, and disruption of vascular supply.[3] The ideal management of such injuries remains controversial owing to the rarity of this injury and paucity of literature on the subject; primary repositioning *vs* primary arthrodesis has been the subject of most debates.[4-6] However, recent literature has shown primary repositioning to be a good treatment modality, with low rates of AVN, infection, and arthrosis.[7-9]

The aim of this survey was to assess the beliefs and practices of Indian orthopedic surgeons in treating ET injuries, using a cross-sectional survey. We hypothesized that a majority of the surgeons would prefer repositioning of the ET as the primary modality of treatment and that AVN would be reported as the most common complication. Furthermore, we also hypothesized that there would be no differences in these parameters based on the surgeon's level of experience and the number of foot and ankle cases operated per month.

MATERIALS AND METHODS

An eight-item questionnaire was designed; both print and web-based versions were created. The web-based version was created using the SoSci survey website (https://www.soscisurvey.de/).

Attendees at specified AO Trauma courses in 2014 and 2015, viz., AO Trauma Principles of Operative Management Course (May 2015), AO Trauma Advances in Operative Management Course (July 2015), AO Trauma Masters Course (2014), AO Trauma Osteotomy (2014) course, and the annual conference of the Indian Foot and Ankle Society (August 2015), were administered the print version of the survey. This allowed us to take the views of a cross-section of the Indian orthopedic surgeons. The link for the web-based survey was sent out via e-mail and social media and was available from October 2014 to January 2015. Participation was entirely voluntary and anonymous; no incentives were offered to those completing the survey.

[1]Professor and Head, [2]Assistant Professor, [3,5]Associate Professor, [4]Professor

[1-5]Department of Orthopaedics, Postgraduate Institute of Medical Education and Research, Chandigarh, India

Corresponding Author: Siddhartha Sharma, Assistant Professor, Department of Orthopaedics, Postgraduate Institute of Medical Education and Research, Chandigarh, India, Phone: +919988793537, e-mail: sids82@gmail.com

The survey questionnaire is presented in Table 1. The first two questions of the survey dealt with demographic data: years of individual orthopedic practice and the number of foot and ankle cases managed per month. The remaining questions focused on individual beliefs and practices of orthopedic surgeons with regard to talar extrusions. Specifically, the participants were asked whether they had ever managed or seen a case of ET and whether they had followed up their case for at least 1 year. Those who confirmed having managed a case of ET with at least 1 year follow-up were also asked about the final outcome of their case. Participants were also asked what they thought was the most common complication they feared, their preferred modality of treatment (repositioning *vs* excision), and whether they were aware of any studies reporting long-term outcomes of these injuries.

Data from the survey were imported into Microsoft Excel™ spreadsheets for analysis. The χ^2 test was used to determine significance for nominal variables and Kendall's rank correlation was used for comparison of ordinal variables. Statistical significance was defined at the 5% ($p \leq 0.05$) level. All statistical analysis was done with Statistical Package for the Social Sciences version 20.

Table 1: The survey questionnaire

1	Please select your experience level
	a. Trainee
	b. 0–5 years after completion of training
	c. >5 years after completion of training
2	How many foot and ankle cases do you operate per month
	a. <5 cases
	b. 6–10 cases
	c. 11–20
	d. >20 cases
3	Have you managed any case of ET?
	a. No
	b. Yes
4	According to you, what is the most feared complication of ET?
	a. Infection
	b. AVN
	c. Arthritis
	d. Others (specify)
5	What is your personal preference of management of ET?
	a. Reposition the talus
	b. Discard the talus, do something else (specify)
6	Have you seen any case of ET with more than 1 year of follow-up?
	a. Yes
	b. No
7	If so, what was the outcome at last follow-up? (Answer this question only if you have seen a case of ET with >1 year follow-up)
	a. Talus retained well, no AVN, no ankle arthroses, no infection
	b. Talus retained but with AVN with or without infection
	c. Talus retained but ankle arthroses without evidence of AVN or infection
	d. Talus not retained, arthrodesis done
	e. Amputation
8	Are you aware of any studies reporting long-term outcomes of ET injuries?
	a. Yes
	b. No

ET: Extruded talus

RESULTS

A total of 379 participants completed the survey; 108 participants completed the web-based version, whereas 271 participants completed the print version. The response rate for print version of the survey was 80.89% (271 of 335 participants).

Of those who completed the survey, 27 (7.1%) were orthopedic trainees, 107 (28.2%) had <5 years of experience, and 245 (64.6%) had >5 years of experience. A total of 143 (37.7%) participants operated <5 foot and ankle cases per month, 157 (41.5%) operated between 6 and 10 cases per month, 45 (11.9%) operated between 11 and 20 cases per month, and 34 (9%) operated >20 cases per month (Table 2).

A total of 262 (69.9%) participants reported having either seen or treated a case of talar extrusion. Of these, 169 (44.6%) respondents had followed up their case for >1 year. At 1-year follow-up, 33 cases (8.7%) had a well-retained talus without any evidence of AVN, arthrosis, or infection; 104 (27.4%) cases had AVN with or without infection; and 42 (11.1%) cases were reported to have developed ankle arthrosis. No mention of talar collapse was made, as this was not specified in the questionnaire. The talus was not retained and arthrodesis was done in 12 (3.1%) cases. Amputation was not reported in any case.

Talus repositioning was preferred by 288 of 305 (94.42%) participants as the primary management of talar extrusion. There was no significant difference in the preferred modality of treatment based on the level of experience ($p = 0.5$) and volume of foot and ankle cases seen by orthopedic surgeons per month ($p = 0.12$).

A total of 235 (62%) participants thought that AVN was the "most feared" complication of talar extrusions. Infection (20.3%, n = 77) and arthritis (7.4%, n = 28)

Table 2: Demographics of orthopedic surgeons completing the survey (n = 379)

Experience	*Total number*	*Percentage*
Trainee	27	7.1
0–5	107	28.3
>5 years	245	64.6
Number of foot and ankle cases operated per month		
0–5	143	37.7
6–10	157	41.5
11–20	45	11.8
>20	34	9

Table 3: Summary of the survey results

Sl. no.	*Question*	*Response*
1	Ever managed an ET	Yes: 265 (69.9%)
		No: 114 (30.1%)
2	Ever seen any case of ET with >1 year follow-up	Yes: 172 (45.4%)
		No: 207 (55.6%)
3	Outcome of ET with >1 year follow-up	Talus well retained, no AVN, infection, or arthroses: 33 (8.7%)
		Talus retained but with AVN, with or without infection: 104 (27.4%)
		Talus retained, arthroses present: 42 (11.1%)
		Talus not retained, arthrodesis done: 12 (3.1%)
		Amputation: 0
4	Most feared complication	AVN: 235 (62%)
		Infection: 77 (20.3%)
		Arthrosis: 28 (7.4%)
5	Personal preference for management of ET	Reposition: 359 (94.7%)
		No repositioning: 20 (5.3%)
6	Awareness on studies with long-term follow-up of ET	Yes: 59 (15.6%)
		No: 320 (84.4%)

All percentages expressed as a function of total survey respondents (n = 379); ET: Extruded talus; AVN: Avascular necrosis of talus)

were selected as the second and the third most common answers. Soft-tissue loss and neurovascular injury were chosen by 1 (0.2%) participant each; 37 (9.8%) participants chose more than one complication as the "most feared complication" (infection and AVN = 19; AVN and arthrosis = 7; infection and arthrosis = 1; all = 10). There was no significant difference in anticipated complication based on the level of experience (p = 0.25) and volume of foot and ankle cases per month (p = 0.94).

A total of 315 (83.1%) participants were not aware of any studies reporting long-term outcomes of these injuries (Table 3).

DISCUSSION

Fabricus provided the first account of ET in 1608.[1] Even today, talar extrusions are rare injuries and are thought to account for 0.06% of all dislocations and 2% of all talar injuries.. The exact incidence is unknown. In our survey, however, 69.9% of the participants had either seen or managed a case of talar extrusion. We believe that this may be due to a surge in high-velocity trauma cases in India in recent years.[10,11] Furthermore, there are a number of case reports and small series in the recent literature on this subject, which may have led to increased awareness of this injury among orthopedic surgeons.

To the best of our knowledge, this is the first survey of its kind looking at ET injuries. Our results show that most orthopedic surgeons would perform primary reimplantation of the ET, which is a reflection of the good results of reimplantation reported in the recent literature. Furthermore, the most common perceived complication in this survey was AVN, which is also the most common complication reported in the literature.[7-9,12,13] It is also interesting to note that the majority of the participants were not aware of studies on talar extrusions with long-term outcomes. This emphasizes the need for such studies and multicenter or even international collaboration, to evaluate the outcomes and give more specific guidelines, as the individual experience of most surgeons is limited.

It is possible that at least some orthopedic surgeons interpreted talar body or neck fractures with extrusion of the fractured body as total talar extrusions. The two entities are quite distinct. Whereas inversion and plantarflexion forces result in talar extrusions, an axial loading force applied to the plantarflexed or dorsiflexed foot results in talar neck and body fractures. Although the treatment options and possible complications for talar extrusion with and without fracture are similar, we feel that in principle, the two injuries should not be clubbed together.[14]

The management of these injuries has conventionally been considered to be controversial. Detenbeck and Kelly[3] reported a high rate of complications in their series of nine talar extrusions; infection was noted in six cases, AVN in seven cases, and arthrosis in one case. In six cases, talectomy with tibiocalcaneal arthrodesis was done, whereas amputation was needed in one case. The authors thus advised against primary reimplantation and recommended talectomy with tibiocalcaneal arthrodesis as the primary treatment modality.

Although talectomy and primary arthrodesis may seem to decrease the risk of infection and subsequent reoperations, they are not without inherent problems. Talectomy decreases the heel height, alters hind foot biomechanics, and renders subsequent reconstructive procedures difficult.[5] Primary tibiocalcaneal arthrodesis is definitely an option if the ET is lost at the scene of accident.

The more recent literature, however, seems to favor reimplantation as the primary treatment option. Reimplantation has the advantages of preserving the ankle anatomy, hind foot mechanics to some extent and helps to maintain heel height. Furthermore, it preserves bone stock, should the need for future reconstruction arise.[7-9]

Burston et al[7] retrospectively reviewed nine cases of primary reimplantation of the ET. At a mean follow-up of 42 months (13–72 months), the outcome was good in four patients, fair in two, and poor in one; one patient was lost to follow-up. Five patients developed AVN and two patients developed postoperative infections, of which one

had a joint infection and another had superficial infection around a K-wire. The authors concluded that debridement with talus salvage was a reasonable option and that joint infection was the single most important determinant of final outcome. Although AVN was the most common complication in their series, only one patient with deep infection developed collapse and needed arthrodesis.

Mohindra et al[8] also recently reported good outcomes of primary reimplantation for talar extrusions in seven cases. At a mean follow-up of 31.9 months (24–46 months), three patients were able to walk without pain and three patients had mild-to-moderate pain. Infection was not noted in any case. Three patients developed AVN, but none of them needed arthrodesis at last follow-up, although the authors noted that the outcome was expected to worsen over time.

Smith et al[9] performed primary reimplantation for five cases of talar extrusions. At a mean follow-up of 42 months, there was one case each of AVN, infection, and arthrosis.

Weston et al[10] conducted a systematic review on total talar dislocations; 39 articles with 89 total talar dislocations were included by the authors, of which 73 were open injuries and 16 were closed injuries. Forty-three cases had an associated foot or ankle fracture, 32 of those cases specifically having a fracture of the talus. The talus was preserved in the initial management of 74 cases, whereas the remaining 12 cases were managed by primary talectomy. The mean duration of follow-up was 32 months. Twenty-two cases required a secondary arthrodesis or another additional procedure. A good outcome was achieved in 35% of cases, a fair outcome in 37%, and a poor outcome in 27%. Avascular necrosis occurred in 22 cases and 14 ankles developed clinically significant arthrosis.

The major limitation of the present study was that it was confined to the Indian subcontinent, and it may be argued that the survey results may not be representative of international practices. However, our survey results tend to mirror the recent world literature on talar extrusions.

CONCLUSION

Primary reimplantation of talar extrusions is the most preferred modality of treatment as shown by our survey. Avascular necrosis followed by infection is the most feared complication of talar extrusions. Awareness on long-term outcomes of these injuries is lacking, in part due to paucity of literature and partly due to inadequate follow-up by individual surgeons. Therefore, more studies reporting long-term outcomes as well as dissemination of knowledge on these rare injuries are necessary.

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