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Delayed surgical treatment for neglected or mal-reduced talar fractures

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Abstract From 1993 to 2002, we treated nine patients for neglected or mal-reduced talar fractures. Average patient age was 39 (20–64) years and average follow-up 53 months. The time interval between injury and index operation ranged from 4 weeks to 4 years. Surgical procedures included open reduction with or without bone grafting in six cases, open reduction combined with ankle fusion in one case, talar neck osteotomy in one case, and talar neck osteotomy combined with subtalar fusion in one case. All cases had solid bone union. One patient developed avascular necrosis of the talus needing subsequent ankle arthrodesis. In six patients, adjacent hindfoot arthrosis occurred. The overall AOFAS ankle–hindfoot score was in average 77.4. We conclude that in neglected and mal-reduced talar fractures, surgical treatment can lead to a favourable outcome if the hindfoot joints are not arthritic.

Résumé De 1993 à 2002, nous avons traité neuf malades pour fracture du talus négligée ou mal réduite. L'âge moyen des malades était de 39 ans (20–64) et la moyenne de suivi était 53 mois. L'intervalle de temps entre le traumatisme et l'opération étudiée était de 4 semaines à 4 années. Les techniques chirurgicales ont inclus la réduction ouverte, avec ou sans greffe d'os dans six cas; la réduction ouverte combiné avec l'arthrodèse de la cheville dans un cas; l'ostéotomie du col de talus dans un cas, et l'ostéotomie du col du talus combiné avec l'arthrodèse sous-talienne dans un cas. Tous les cas avaient une union osseuse solide. Un malade a développé une nécrose avasculaire du talus

et a pour cela été arthrodésé. Chez six malades une arthrose de l'arrière-pied s'est développée. Le score de cheville AOFAS était en moyenne de 77.4. Nous concluons que dans les fractures astragaliennes négligées et mal réduites, le traitement chirurgical peut mener à un résultat favorable si les articulations de l'arrière pied sont sans arthrose.

Introduction

Fractures of the talus rank second in frequency (after calcaneal fractures) of all tarsal bone injuries. The incidence of fractures of the talus ranges from 0.1% to 0.85% of all fractures [17]. The outcome varies widely and is related to the degree of initial fracture displacement and the accuracy of fracture reduction. Failure to recognise fracture displacement can lead to under-treatment and poor outcome. Inaccurate reduction of the talar fracture also leads to mal-union, osteonecrosis and hindfoot arthrosis. Although the mal-union rate has been reported to vary from 28% to 47% [3, 11], the treatment for this complication was seldom reported except when fusion was performed. But the results of triple arthrodesis have not been shown to be satisfactory. An osteotomy for talar neck mal-union has also been reported [13]. In our opinion, every effort should be made to preserve the hindfoot joints and the talar anatomy before a triple arthrodesis is suggested. Here we report our experience with delayed surgical treatment for mal-reduced talar fractures.

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Materials and methods

A retrospective study was undertaken to assess the outcome of our patients. The inclusion criteria for this study was talar fracture with delay in treatment of more than 4 weeks. From 1993 to 2002, nine patients received delayed surgical treatment for neglected or mal-reduced talar fractures at our hospital (Table 1). Average patient age was 39 (20–64) years. The time interval between injury and

Table 1 Patient data

Patient no.	Gender	Age	Mechanism of injury	Fracture type	Previous treatment	Time of delay	Surgery	Hindfoot arthritis change	AOFAS score	Complication	Further surgery
1	F	23	Motorcycle accident	Neck fracture+body fracture	ORIF	3 months	Neck osteotomy+ORIF for body fracture	Subtalar OA	66	AVN	Ankle fusion
2	M	64	Fall from height	Neck fracture+ankle fracture	ORIF for ankle fracture	3 years	Neck osteotomy+subtalar fusion	Ankle OA	70		
3	M	20	Fall from height	Neck fracture	Casting	3 months	ORIF+bone graft	–	97		
4	M	40	Fall from height	Neck fracture	Manipulation by bone setter	4 weeks	ORIF	–	87		
5	M	25	Motor vehicle accident	Neck fracture	ORIF	4 years	ORIF + bone graft	Subtalar OA	76		
6	M	42	Motor vehicle accident	Neck fracture	ORIF	4 weeks	ORIF	–	83		
7	F	48	Fall from height	Neck fracture	Casting	2 years	ORIF+ankle fusion	Subtalar OA Chopart OA	54	Delayed wound healing	
8	M	34	Motorcycle accident	Neck fracture	Manipulation by bone setter	6 weeks	ORIF+bone graft	Subtalar OA	83		
9	M	45	Motor vehicle accident	Post-med process fracture	Manipulation	10 weeks	ORIF	Subtalar OA	81	Tarsal tunnel syndrome	Neurolysis

ORIF open reduction internal fixation, *OA* osteoarthritis, *AVN* avascular necrosis

index operation ranged from 4 weeks to 4 years. Average follow-up period was 53 months. Surgical procedures included open reduction in three cases, open reduction with bone grafting in three cases, open reduction combined with ankle fusion in one case, talar neck osteotomy in one case and talar neck osteotomy combined with subtalar fusion in one case.

An incision just medial to the tibialis anterior was used in all cases. This incision starts at the navicular tuberosity and exposes the talar neck. If necessary, the incision can be extended proximally to facilitate fixation of a malleolar fracture or to perform a malleolar osteotomy and reduction of a talar body fracture. An additional anterior incision was used in one case to perform ankle arthrodesis, and an additional lateral foot incision was used in another case to perform subtalar arthrodesis. In these two cases, the X-ray study showed severe degenerative changes at the respective joints. In three cases treated with open reduction, there was also significant comminution of the talar neck, and a bone graft taken from the tibial tuberosity was therefore impacted into the medial talar neck defect before the fracture was compressed and fixed with screws (Fig. 1). Two patients needed talar neck osteotomy. The neck was osteotomised through the fracture callus using an oscillating saw. A wedge-shaped, autogenous, tri-cortical iliac crest bone graft was taken and was placed into the osteotomy to correct the varus mal-alignment. The osteotomy was fixed with small AO screws.

After the operation, a short leg cast was applied, and the patients were kept non-weight bearing for 6 weeks. Then gradual weight bearing was initiated. The cast was removed at 10 weeks. In this study, we used the AOFAS ankle–hindfoot score [10] for evaluation of clinical result. A score between 90 and 100 was graded as excellent, 75–89 as good, 60–74 as fair, and below 60 as poor. Patients were also followed up for complications related

to the surgery, and follow-up weight-bearing X-ray of both ankle and foot were done to determine if there was solid union of the fracture and/or union of the fusion. Osteoarthritic changes in the adjacent hindfoot joints were also recorded.

Results

All of our cases showed solid bone union at the final follow-up. The two talar neck osteotomies also united, and the two arthrodesis cases had achieved solid fusion at the ankle and subtalar joints. The AOFAS ankle–hindfoot score was 77.4 on average. In one case, the outcome was graded as excellent, in five good, in two fair, and in one poor. Complications occurred in three cases. One case, case 1, developed avascular necrosis (AVN) of the talus and leading to ankle fusion to treat this problem. In one case, case 7, there was delayed wound healing after an ankle arthrodesis. This problem resolved after local wound care and oral antibiotics. Another patient, case 9, developed tarsal tunnel syndrome requiring tarsal tunnel release and tibial nerve neurolysis 6 months after the index operation. In six patients, osteoarthritic changes were seen in the adjacent ankle and hindfoot joints and in four in the subtalar joints. In one patient, there were osteoarthritic changes of the subtalar and the Chopart joints and another, developed osteoarthritic changes in the ankle joint. This patient, case 2, had a subtalar fusion in the index operation and the initial injury was complicated by an ankle fracture. Although six cases showed osteoarthritic changes in the adjacent joints on follow-up, only one, case 1, needed a hindfoot fusion. Most of the patients only had minor complaints, which did not interfere with their daily living, and some patients were even asymptomatic.

Fig. 1 **a** This 25 year old man had a motorcycle accident 4 years ago treated by open reduction with internal fixation. The ankle X-ray showed a talar neck fracture with varus mal-position. The body of the talus was still viable. **b** We performed revision surgery and found there was only fibrous union at the neck. After refreshing the fracture site, we reduced the talus neck and provisionally fixed it with a Kirchner wire. **c** After an intra-operative X-ray check, we

used small-fragment AO screws to fix the fracture. Because a bony defect was found, a bone graft was taken from the tibial tuberosity and impacted into the medial neck. **d** Eleven months after operation, the talar neck fracture had achieved solid union. Although arthritic changes were found in the subtalar joint, the patient had only mild discomfort

Discussion

The complications of talar fractures include osteoarthritis, AVN of the body and head, non-union, mal-union and infection [1, 13]. Reports of the incidence of complications vary widely [3, 4, 7, 9, 12, 14, 17]. However, there is a consistent trend for the incidence of complications to increase with the Hawkins stage [8]. Of these complications, mal-union may be a more common problem than has previously been reported [5]. Because the integrity of the talus is critical to normal function of the ankle, subtalar, and transverse tarsal joints, either failure to recognise fracture displacement or inaccurate fracture reduction can lead to poor outcome. Varus mal-alignment is the most common position of mal-union [2]. The amount of varus mal-alignment has been shown to correlate with the change in position of the foot and subtalar motion [6]. Canale [2, 3] noted a high incidence of subtalar degenerative arthritis in those patients with varus mal-union. Displacement of the talar neck by as little as 2 mm has

been shown to alter the contact characteristics of the subtalar joint [16]. In this study, all patients came to our clinic due to persistent pain over the hindfoot. X-ray examination showed either a neglected or mal-aligned talar fracture. The delay in treatment was more than 4 weeks in all cases. Although early anatomical reduction is the key to preventing AVN and ensuring a good outcome, we nevertheless tried to restore the talus architecture, even in cases with delays of up to 4 years. Surgical treatment included open reduction internal fixation (ORIF) in seven cases with additional ankle arthrodesis in one patient and talar neck osteotomy in two cases and additional subtalar arthrodesis in one patient. We decided to perform arthrodesis in these two patients because physical examination and X-ray findings revealed that the symptoms were originating from the ankle joint or the subtalar joint, and severe cartilage destruction was found during operation. The AOFAS ankle–hindfoot score was 77.4 on average at final follow-up. There was only one poor result in this series, which was case 7. This patient had arthritic change

in the subtalar joint and the transverse tarsal joints, but she refused to undergo any further surgery.

One case, case 1, developed AVN of the talus and required ankle fusion. We considered that with improved surgical technique and the common agreement of anatomical reduction during operation, AVN of the talus may not be as common a problem as has been suggested [4, 8, 15]. As for the issue of osteoarthritic change, six patients developed osteoarthritis of the hindfoot joints. We found that the delay of treatment is an important factor leading to the development of osteoarthritis. The three cases without hindfoot osteoarthritic change had delay of treatment of 3 months, 4 weeks, and 4 weeks, respectively which was much shorter than the cases developing osteoarthritis.

Neglected or mal-reduced talar fractures if left untreated may progress to talar mal-union. The treatment of talar mal-union has previously been limited to triple arthrodesis with unpredictable results, and mal-position of the forefoot may be unchanged even after arthrodesis. Therefore, the importance of restoration of talus anatomy must not be overlooked. It lowers the incidence of AVN, restores the contact characteristic of the peri-talar joints and prevents future arthritic changes. In our opinion, if the hindfoot joints are still healthy, every effort should be made to reconstruct the normal talar length and rotation. And in some cases, limited hindfoot arthrodesis can be done instead of triple arthrodesis, which should be considered as a final salvage operation. Our results showed that in neglected or mal-reduced talar fractures, restoration of the talus architecture could produce a favourable outcome, even in long-delayed cases.

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