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Sagittal Resection Osteotomy With Bone Block Distraction Subtalar Fusion for Treatment of Malunited Calcaneal Fractures

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ABSTRACT

The aim of this prospective study was to evaluate the results of combined lateral sagittal resection osteotomy with subtalar distraction fusion in heels with painful malunion of the os calcis. This case series included 22 patients (23 feet). The mean age of the patients was 37.52 years. Sixteen (69.6%) patients were initially treated conservatively, 5 (21.7%) patients were treated surgically, and 2 (8.7%) patients were missed. The mean time lapsed before surgery was 11.43 months. A wedge of bone was resected to reduce the width of the malunited os calcis and was used as a local graft for subtalar joint fusion and to increase the height of the os calcis. The mean follow-up period was 56.83 ± 6.09 months. According to the scoring system, satisfactory results were found in 18 (82.6%) patients, and 4 (17.4%) patients had unsatisfactory results. Postoperative radiographic assessment revealed an average increase in the heel height of 7.70 ± 1.22 mm and an average decrease in heel width of 8.39 ± 1.47 mm. The average correction in the coronal axis was approximately 8.04° ± 1.26°. Complications included infection and nonunion in 3 (13%) heels. Two heels still had residual varus postoperatively, and 1 patient had injury to the sural nerve. The restoration of heel height, the reduction in heel width, and the primary fracture pattern had a significant relation with the final score. This method is a successful method for the management of subtalar arthritis caused by malunited calcaneal fractures with broadening leading to lateral abutment.

Calcaneal fractures are the most common fractures of the tarsal bones (1–3). Males are inflicted 5 times as often as females, with a high proportion in industrial workers, which has a considerable socioeconomic impact (4,5). Most of these fractures are produced by axial force, as occurs when falling from a height or as the result of a motor vehicle accident (6), resulting in a varus deformity with heel widening, loss of calcaneal height, and subtalar incongruency (7).

Controversy remains regarding the best line of treatment for these disabling injuries, and surgeons are often frustrated by the difficulties in managing such fractures (8,9). In general, the goals of the treatment of calcaneal fractures are restoration of congruency of the posterior subtalar facet; restoration of calcaneal height; reduction in the width of the calcaneus; decompression of the calcaneofibular space; realignment of the tuberosity; and reduction in the calcaneocuboid joint, if affected (10–13). Inadequate or inappropriate primary treatment frequently results in persistent pain and deformity in the foot, especially if there is intra-articular involvement (14).

A spectrum of complications may occur with the primary management, including poor wound healing, infection, pain, thromboembolism, neurologic complications (eg, cutaneous nerve injury, neuromas, nerve entrapment, or reflex sympathetic dystrophy), compartment syndromes, Sudeck atrophy, peroneal tendon problems (eg, tendinitis, subluxation, or tendinopathy), and footwear problems (15–17). Arthritis of the subtalar joint may develop as a result of damage to the cartilage at the time of the injury.

Calcaneal malunion may be a complication of nonoperative treatment or inadequate operative reduction resulting in impingement, subluxation, or dislocation of the peroneal tendons, posttraumatic arthritis of the subtalar joint or the calcaneocuboid joint or both joints (18). The most common deformity is residual varus of the hindfoot owing to incomplete reduction of the tuberosity, leading to malalignment of the

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hindfoot and altered footwear and gait and to posterior tibial or sural neuritis (17).

When the subtalar joint becomes stiff and arthritic, the patient loses eversion and inversion, and because the ankle and subtalar joints are coupled with the subtalar joint locked, the lateral motion is borne by the ankle, so lateral ankle pain becomes noticeable to the patient in the form of a chronic sprain (17,18). Moreover, malunion of the calcaneus with upward displacement of the tuberosity usually results in effective relaxation of the Achilles tendon and reduction in calf muscle power and take-off (17).

We were interested in determining if the correction of the distorted calcaneal anatomy combined with the subtalar fusion would lead to better results in the treatment of malunited calcaneal fractures with subtalar arthritis. We hypothesized that the combination of lateral sagittal resection osteotomy with subtalar distraction fusion would relieve the patient's arthritic pain through fusion and improve the deficient hindfoot function through a decrease in the calcaneal broadening and an increase in the calcaneal height after at least 6 months of postoperative follow-up.

Our primary aim was to measure patient satisfaction after combined subtalar fusion and calcaneal osteotomy in the treatment of arthritic malunited calcaneal fractures, and our secondary aim was to determine the relation between the correction of the calcaneal width and height and the final score. We undertook a prospective case series study to evaluate the results of combined lateral sagittal resection osteotomy with subtalar distraction fusion in heels with malunited calcaneal fractures.

Patients and Methods

This prospective study was approved by the ethics committees of Alexandria University and Mansoura University. The study included 22 patients (23 feet) who presented consecutively to our hospital from June 2012 to October 2013 with malunited calcaneal fractures. The inclusion criteria included painful malunited calcaneal fracture with the source of pain confirmed to be subtalar arthritis through a subtalar local anesthetic block by lidocaine. The exclusion criteria included active wound infection of previous fixation surgery and secondary reflex sympathetic dystrophy. The mean age of the patients was 37.52 years. Of the 22 patients, 19 (86.4%) were males. The left side was affected in 12 (52.1%) patients, and the right side was affected in 9 (39.1%) patients; 1 patient had bilateral malunited fractures (0.47%). Twenty (90.9%) patients were manual workers. According to the Sanders classification (19), 15 (65.2%) fractures were type IV, 7 (30.4%) were type III, and 1 (4.3%) was type II. Falling from a height was the mechanism of injury in 19 (86.4%) patients, and motor vehicle accident was the mechanism in 3 (13.6%). A spectrum of associated injuries was found in 7 patients.

After the initial trauma, 16 (69.6%) feet were treated conservatively with a below-knee plaster cast, 3 (13%) feet were managed by open reduction and internal fixation with a plate and screws, 2 (8.7%) feet were managed by open reduction and internal fixation by Kirschner wires, and 2 (8.7%) feet were missed at the initial presentation. The mean time before surgery was 11.43 months (Table 1).

Moderate pain while walking was noted in 18 (78.26%) feet, and the affected patients continued to take analgesics. Five (21.73%) feet had severe pain that caused limitation of walking capacity. Twenty (90%) patients could not walk >0.5 km. Two (10%) patients walked only indoors. Moderate hindfoot swelling was noted in 19 (82.6%) feet, and 4 (17.4%) had severe swelling that was attributed to broadening of the os calcis. All patients had difficulty during take-off or when standing on the tips of the toes. Moderate varus deformity of the heel was noted in 16 (69.5%) heels, and 7 (30.4%) heels showed approximately normal alignment of their axes with that of the legs. Ipsilateral ankle motion was free in all patients, and loss of subtalar motion was found in all heels.

Radiological assessment included plain radiographic views of both sides for comparison and measurements. This included the lateral view of the ankle to study the calcaneal angles and the degree of subtalar arthritis, the axial view of the heel to measure the amount of calcaneal broadening and the degree of varus deformation, and the anteroposterior view of the ankle to study the calcaneofibular abutment. Computed tomographic scanning was performed to define the pathomorphology of the calcaneal fragments according to the Sanders classification (19); to demonstrate more clearly the amount of joint incongruity; and to measure the degree of subtalar arthritis, the amount of broadening of the calcaneus, and the calcaneofibular abutment.

An abnormal Bohler angle was observed in 19 (82.6%) heels. The mean value was 16.87° ± 5.59°. All (100%) heels had abnormal increased Gissane angles; the mean value was 155.26° ± 7.48°. A decreased calcaneal pitch angle was noticed in 21 (91.3%) heels; the mean value was 13.0° ± 2.41°. Substantial heel height reduction was encountered in 7 (30.4%) heels (ie, >1-cm loss compared with the normal side). In the other 16 (69.6%) heels, there were mild height reductions (ie, >0.5-cm and <1-cm loss compared with the normal side). All heels (100%) were broadened with marked narrowing of the calcaneofibular space ranging from a 5- to 15-mm increase compared with the normal side. Moderate varus malalignment was noted in 16 (69.5%) heels, mild varus was noted in 4 (17.5%), and 3 (13%) heels showed normal alignment.

Table 1
Distribution of patients according to the age, the initial management, and the time before surgery (22 patients, 23 feet)

Age, n (%)	
≤35 y	10 (45.5)
>35 y	12 (54.5)
Total	22 (100)
Min–max	21.0–57.0
Mean ± SD	37.18 ± 8.07
Median	36.50
Initial treatment, n (%)	
Below-knee plaster cast	16 (69.6)
Open reduction internal fixation by plate	3 (13.0)
Open reduction internal fixation by Kirschner wires	2 (8.7)
Missed	2 (8.7)
Total	23 (100)
Time before surgery, n (%)	
≤10 mo	13 (56.5)
>10 mo	10 (43.5)
Total	23 (100)
Min–max	5.0–24.0
Mean ± SD	11.43 ± 5.54
Median	10.0

Abbreviation: SD = standard deviation.

Surgical Technique

The surgery was done by the first and the fourth authors (M.S.K. and F.F.). Spinal anesthesia and a tourniquet were used in all cases. Through an extended lateral approach, the lateral wall of the calcaneus is elevated by an oscillating saw until the level of the subtalar joint is reached. A sagittal intercalary parallel osteotomy is carried out using the oscillating saw, the thickness of which is determined preoperatively according to the amount of broadening present (Fig. 1). The resected bone wedge is used as a local bone graft.

The articular surfaces of the arthritic subtalar joint are denuded using a bone nipper until the underlying subchondral bone is exposed. The prepared resected bone slice is then introduced as a local graft into the distracted subtalar joint, keeping in mind that it should be oriented with its thickest dimension located medially and posteriorly. This is done to neutralize the amount of varus and to tighten the lax Achilles tendon. The hindfoot with the graft is internally fixed with 2 cannulated screws passing up from the heel and to the talus (Figs. 2 and 3).

The intact lateral operculum is then returned to the calcaneus and fixed by 2 Kirschner wires (Fig. 4). The skin is closed, sterile dressing is applied, and a below-knee plaster

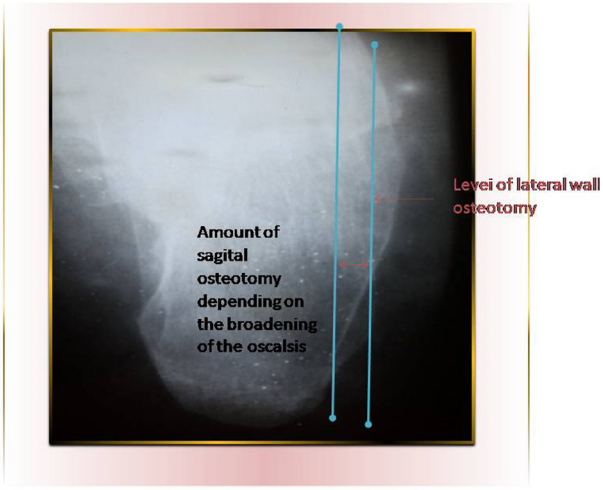

Fig. 1. Preoperative planning of the lateral wall osteotomy and sagittal wedge osteotomy.

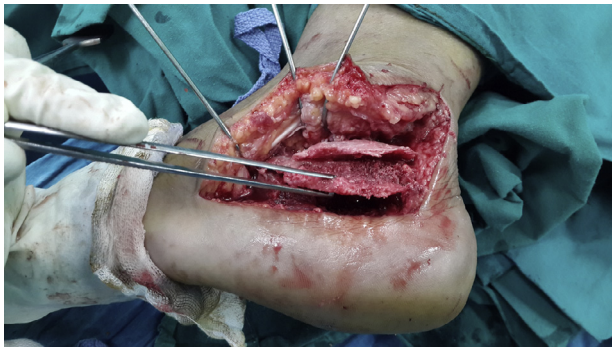

Fig. 2. The lateral wall is elevated using an oscillatory saw, and the intercalary sagittal resection osteotomy is performed, which will be used as the bone graft.

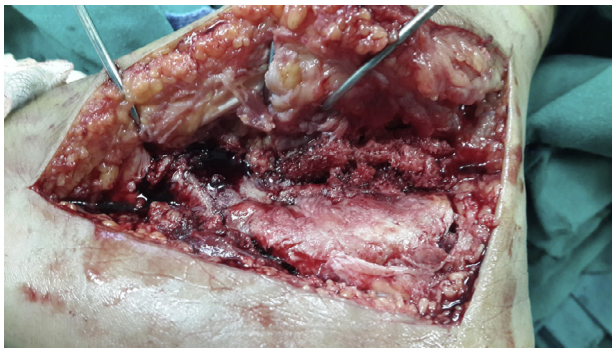

Fig. 3. The bone graft is inserted in the subtalar joint, and the joint and the graft are affixed by 2 screws; the lateral wall is back in its place.

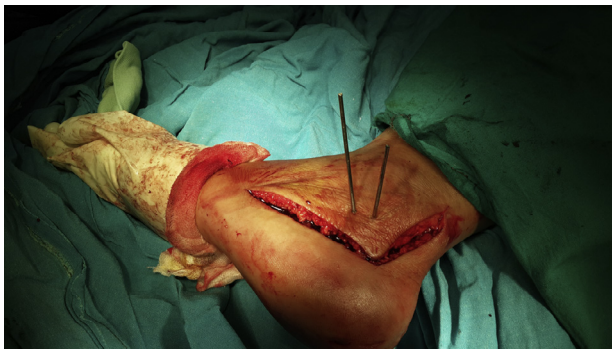

Fig. 4. The lateral wall is affixed with 2 Kirschner wires.

cast is applied. After 2 weeks, the cast and sutures are removed, a check of the wound status is done, and another below-knee plaster cast is applied. After 6 weeks, the Kirschner wires are removed, and after 8 weeks, if there is radiological evidence of ongoing good fusion, partial weightbearing is allowed with the fusion. The cast is removed at the end of 10 weeks.

At the end of follow-up, the patients were assessed both clinically and radiographically by the second and the third authors (A.E. and M.B.). The clinical assessment was done according to the method of assessment described by Paley et al (20). This foot score includes a figure based on subjective criteria, including pain, activities of daily life and occupation, sports and recreational activities, walking distance, walking on different surfaces with or without support, and objective evaluation such as the range of movement of the ankle and the midfoot. The subjective criteria contributed 70%, and the objective contributed 30%. A score ≥70 is considered satisfactory, and a score <70 is considered unsatisfactory.

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0 (IBM, Armonk, NY). Qualitative data were described by using a number and percentage. Normally quantitative data were described with the use of mean ± standard deviation (SD) values, and abnormally distributed data were expressed by using the median (minimum–maximum). The distributions of quantitative variables were tested for normality by using the Kolmogorov-Smirnov test, the Shapiro-Wilk test, and the D'Agostino test; in addition, a histogram and QQ plot were used for the vision test. If results revealed a normal data distribution, parametric tests were applied. If the data were abnormally distributed, nonparametric tests were used. For normally distributed data, comparisons between 2 studied groups were made by using a *t* test; for >2 groups, the *F* test (analysis of variance; least significant difference) was used. In addition, a paired *t* test was used to analyze 2 paired data. Correlations between 2 quantitative variables were assessed using Pearson coefficients regarding normality of the data. Significance of the obtained results was judged at the 5% level.

Results

The mean follow-up period was 56.83 ± 6.09 (range 55 to 71) months. According to the scoring system, the mean score was 81.04 ± 13.71, the minimal score was 50, and the maximal score was 95.

Satisfactory results were found in 18 patients (19 heels) (82.6%), and 4 (17.4%) patients had unsatisfactory results. Twenty-one (95.5%) patients had no or mild pain while walking. One (4.5%) patient had moderate pain while walking. According to the scoring system, 19 (86.4%) patients could work only part-time. Seventeen (73.9%) feet had no or mild hindfoot swelling. Six (26.1%) heels had moderate persistent swelling. In 18 (78.3%) feet, the shoe size was reduced to the normal preinjury size because of the correction of heel width and varus deformity; in 5 (21.7%) feet, the shoe size was the same as the preoperative size.

Postoperative radiographic assessment revealed an average increase in the heel height of 7.70 ± 1.22 (range 5 to 10) mm. An average decrease in heel width of 8.39 ± 1.47 (range 5.0 to 10.0) mm was successfully achieved through a sagittal intercalary resection osteotomy. The average correction in the coronal axis was about 8.04° ± 1.26°. Correction of >8° was achieved in 18 (78.3%) heels (Table 2). Sound solid

Table 2
Distribution of the patients according to final results, restoration of the heel height, and correction of the heel width (N = 22 patients, 23 feet)

Result	Min–Max	Mean ± SD
Subjective score		
Pain	5–20	
Activities of daily living and occupation	0–20	
Sports and recreational activities	0–15	
Walking surfaces	0–5	
Walking distance	0–4	
Walking aids	1–5	
Total subjective	19–65	53 ± 9.83
Objective score		
Ankle ROM	0–15	
Chopart joint	0–10	
Limp	0–5	
Total objective	5–30	23 ± 5.42
Total score		
Min–Max	50.0–95.0	81.04 ± 13.71
Unsatisfactory	4	
Satisfactory	18	
Heel height, n (%)		
<8 mm	6	26.1
≥8 mm	17	73.9
Total	23	100
Min–Max	5.0–0.0	
Mean ± SD	7.70 ± 1.22	
Median	8.0	
Heel width (mm)		
<8	5	21.7
≥8	18	78.3
Total	23	100
Min–Max	5.0–10.0	
Mean ± SD	8.39 ± 1.47	
Median	9.0	

Abbreviation: ROM, range of motion.

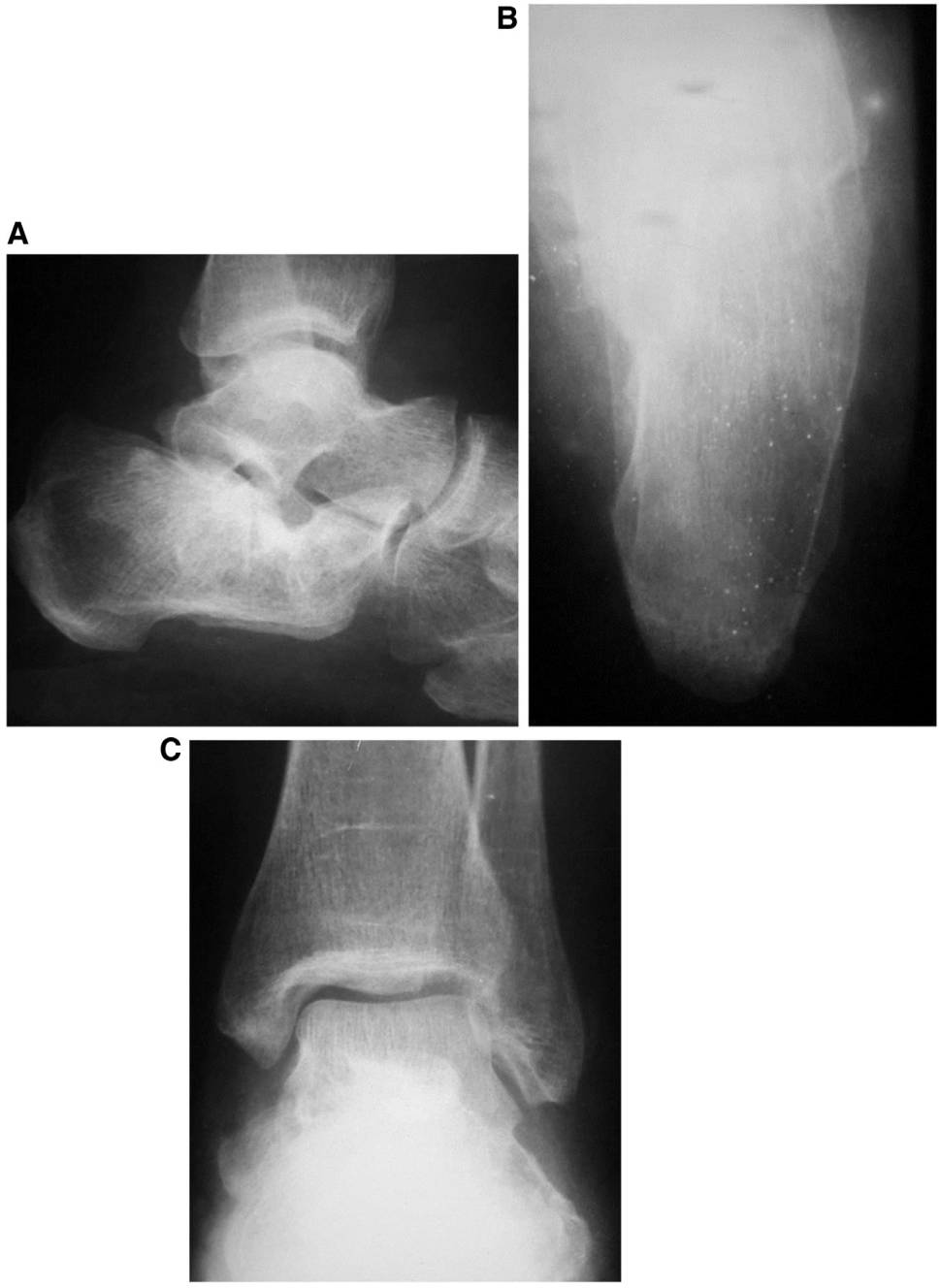

Fig. 5. Preoperative radiographs. (*A*) Lateral view of the heel; changes in Bohler angle and calcaneal pitch angle can be traced. (*B*) Axial view of the heel; varus angulation can be visualized. (*C*) Anteroposterior view of the heel; lateral wall of the calcaneus is extruded, increasing the calcaneal width.

subtalar fusion was achieved in 19 (82.6%) heels with a mean fusion time of 11.8 (range 8 to 22) weeks. One heel had delayed fusion, and 3 heels had infected nonunion (17.4%) (Figs. 5–8).

Complications included infection; 3 (13%) heels developed infection with delayed wound healing. After repeated debridement and antibiotics, the result was unsatisfactory with nonunion despite complete healing of the wounds (Fig. 9). After the wounds healed, 1 patient had a revision surgery and the other 2 refused to undergo repeat surgery.

Two (8.7%) heels still had residual varus deformity postoperatively, leading to unsatisfactory results with shoe modification. One (4.3%) patient had postoperative numbness and loss of sensation on the lateral aspect of the heel. This was attributed to an injury to the sural nerve during surgery. Five (21.7%) patients had delayed wound healing. Repeated sterile dressings were applied until complete closure of the wound. Eventually, the patients had satisfactory results. Three (13%) patients had a malpositioned screw (ie, a screw at the point of the heel). This had caused plantar heel pain while walking. The screws were removed after sound fusion was ensured, and the pain disappeared later.

Age, sex, side affected, occupation, mode of trauma, associated injuries, initial management, and time lapsed until surgery did not have a significant relation with the outcome. However, restoration of heel

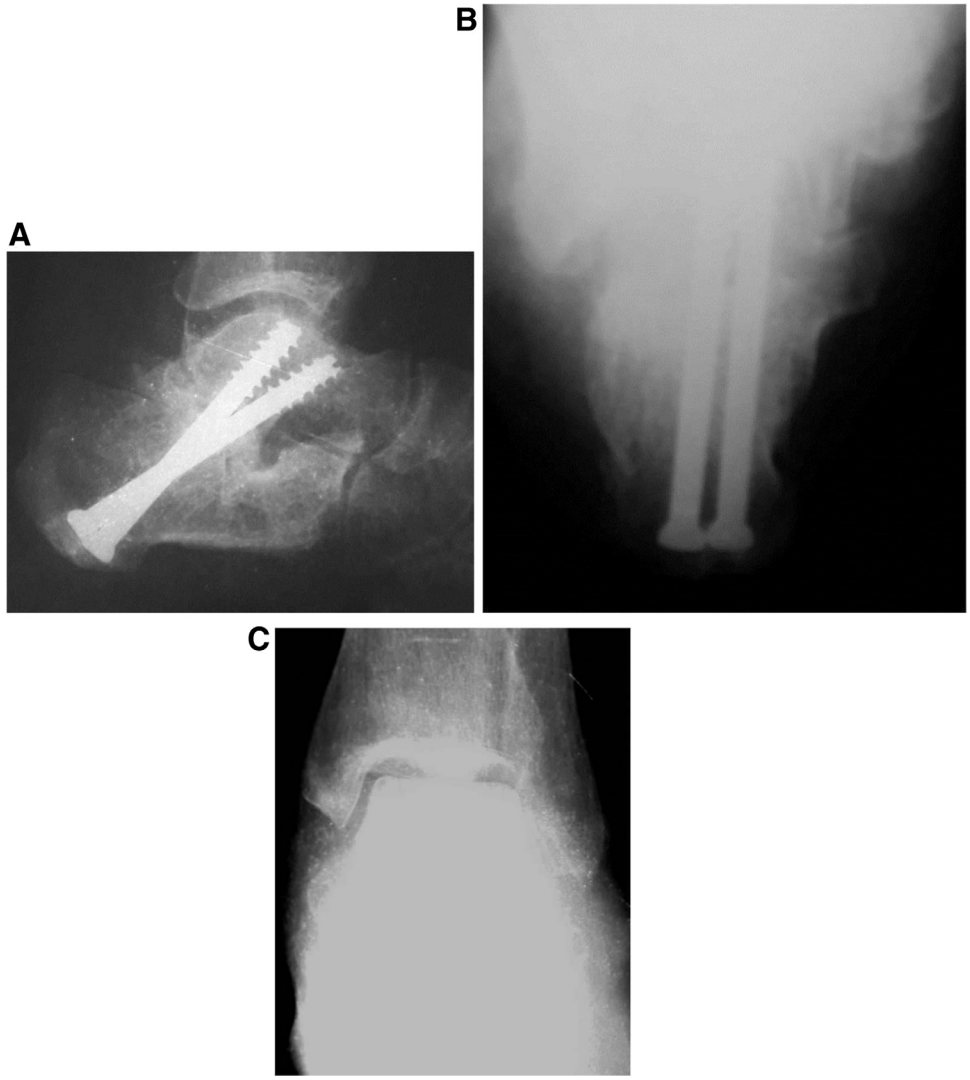

Fig. 6. Postoperative radiographs of patient shown in Fig. 4. (*A*) Lateral view of the heel; the graft is inserted between the talus and calcaneus. (*B*) Axial view of the heel; correction of varus angulation can be visualized in comparison with the preoperative radiograph. (*C*) Anteroposterior view of the heel with correction of lateral impingement.

height, reduction of heel width, and the primary fracture pattern had a significant relation with the final score (Tables 3 and 4).

Discussion

Surgeons are often frustrated by the difficulties in managing calcaneal fractures, and controversy remains regarding the best line of treatment for these disabling injuries. However, a better understanding of fracture patterns with computed tomographic scanning and hardware advances has led to improved outcomes with lower morbidity (21). Malunion of calcaneal fractures may occur in varus, valgus, shortening, or broadening with disturbed calcaneal angles. These may present clinically as loss of height, broadening of the heel, lateral impingement of the peroneal tendons, impingement of the sural nerve, hindfoot malalignment, weak plantarflexion, posttraumatic subtalar arthritis, and calcaneofibular abutment (22). Options for the treatment of malunited calcaneal fractures with subtalar arthritis vary from distractional subtalar fusion or triple fusion to lateral decompression and to reconstruction osteotomies (22).

In this study, the malunited calcaneal fractures with subtalar arthritis and lateral impingement in 22 patients were treated by combined subtalar distractional arthrodesis with lateral decompression through sagittal intercalary resection osteotomy. The results were satisfactory in 18 patients (82.6%) and unsatisfactory in 4 patients (17.4%).

Regarding the pain, preoperatively, 18 feet (78.26%) had moderate pain while walking and the patients depended on analgesics, and 5 feet (21.73%) had severe pain that caused limitation in walking capacity. Postoperatively, 21 (95.5%) patients had no or mild pain while walking, and 1 patient (4.5%) had moderate pain. Chen et al (23) reported, in their study of 34 patients who had subtalar distractional realignment arthrodesis and lateral decompression that 12 patients were free of pain after work or exercise, 14 had mild discomfort, 6 had moderate pain, and none had severe pain. Trnka et al (24), using the same technique as Chen et al (23), also reported in their study that of the 31 patients (32 feet) with successful fusion, 26 had less pain, 4 had similar pain, and 1 had increased pain at follow-up.

As for the activity, all patients used to walk with antalgic gait preoperatively, and 20 patients (90%) could walk only <0.5 km. Two (10%) patients only moved indoors. Postoperatively, 19 (86.4%) could walk

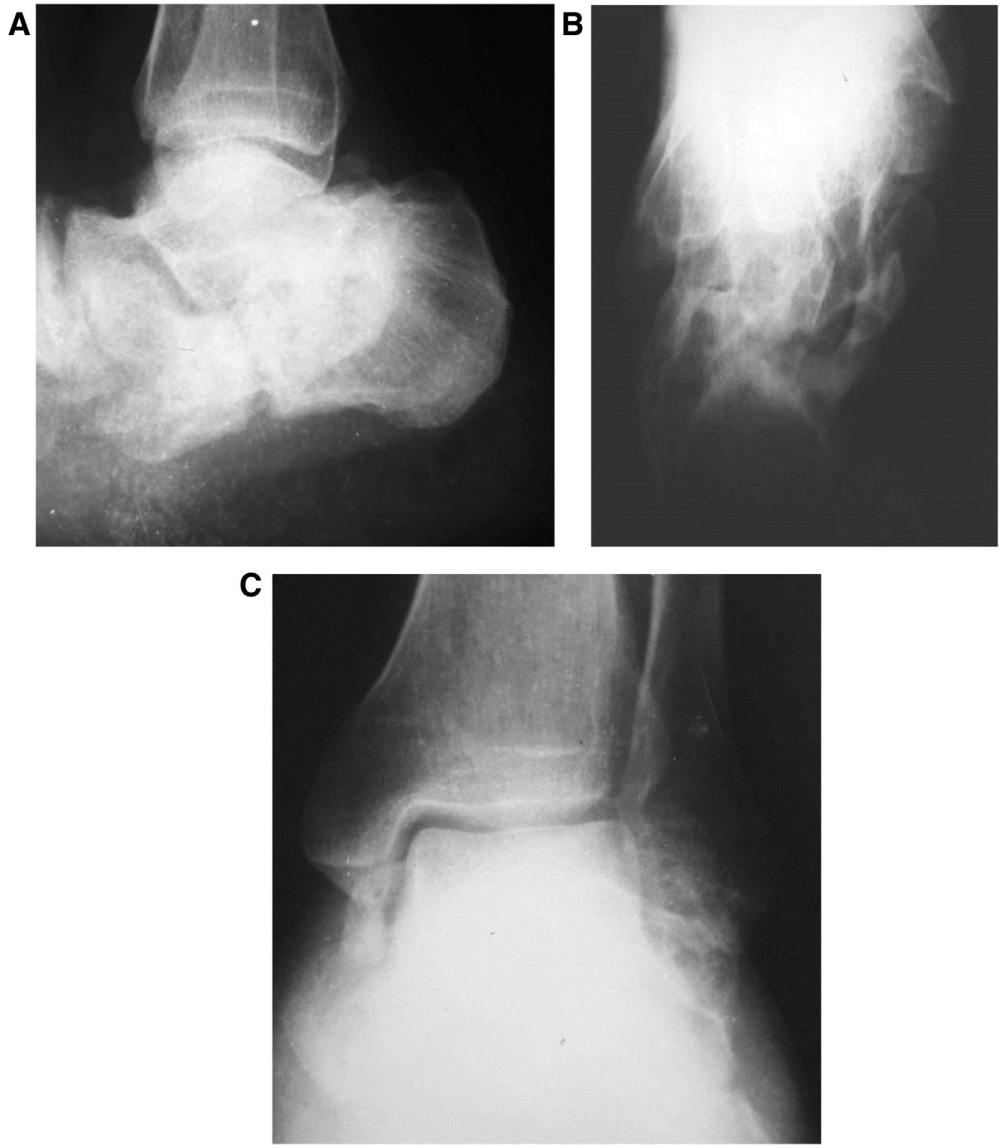

Fig. 7. Preoperative radiographs. (*A*) Lateral view of the heel with malunited os calcis and subtalar arthritis. (*B*) Axial view of the heel with broadening of the heel. (*C*) Anteroposterior view of the heel with medial and lateral impingement.

>0.5 km or stand for longer than 30 minutes, and 3 (13.6%) patients could walk indoors with limited outdoor activities. Chen et al (23) reported that 5 patients resumed preinjury sports, 21 patients could run slowly without pain, and 6 patients could walk well but were unable to jump or run.

Three (13.6%) patients returned to their same job in a full-time capacity. Thirteen (59.1%) patients returned to their same job but with restricted duties. Six (27.3%) patients could work only part-time. Trnka et al (24) reported at the final follow-up that 3 patients (3 feet) were not working. The remaining 26 patients (28 feet), including those with nonunion, returned to the same type of occupation.

In 18 (78.3%) feet, the shoe size was reduced as before the injury owing to correction of heel width and varus deformity; in 5 (21.7%) feet, the shoe size was the same as preoperatively. Chen et al (23) reported that 24 patients had no limitations in selecting footwear; however, 8 patients continued to wear wider shoes.

Regarding the radiological assessment, it was found that there is a significant relationship between the increase in the heel height achieved and the better final score. The distraction of the subtalar joint with a bone graft is the key not only to treating subtalar arthritis but also to reestablishing a normal relationship at the talocalcaneal joint, increasing the height of the hindfoot, which leads to restoration of normal gastrocnemius-soleus function and improves the take-off.

The mean decrease in heel width in our study among the satisfactory group was 8.89 ± 0.94 mm. Although decreasing the heel width effectively reduces calcaneofibular impingement and peroneal tendinitis, it is worth mentioning that our results have shown that medial impingement is not expected to be corrected with this method.

The mean value of correction of mediolateral alignment was 8.21° ± 1.13° among the satisfactory group. In the unsatisfactory group, it was 7.25° ± 1.71°. This relationship was proved to be insignificant statistically, which may be attributed to the limited sample size. According to Chen et al (23), malposition of the heel caused by improper subtalar fusion may contribute to poor results. If the subtalar joint is fused in a varus position, it will lock the transverse tarsal joint, resulting in a rigid forefoot (24).

In the present study, the more calcaneal angles were corrected to their normal values, the more satisfactory results we obtained. This was

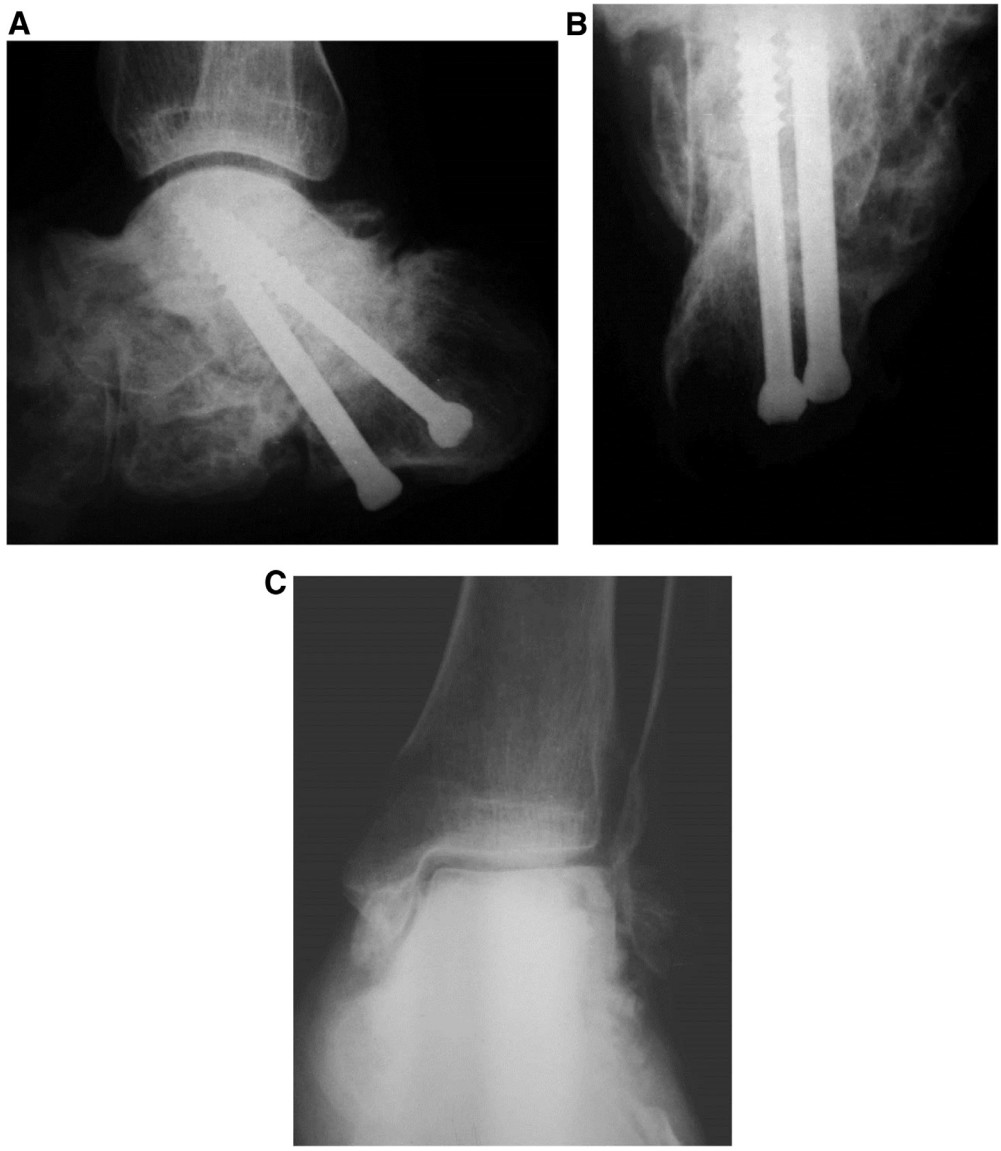

Fig. 8. Postoperative radiographs of patient shown in Fig. 7. (*A*) Lateral view of the heel with good fusion. (*B*) Axial view of the heel with correction of the varus. (*C*) Anteroposterior view of the heel with residual medial impingement.

found to be statistically significant. These findings coincide with those of Thermann et al (25) in their long-term study of 40 patients with post–calcaneal fracture subtalar fusion.

Three (13%) heels developed infection and had delayed wound healing. After series of debridement and antibiotics, the result was unsatisfactory with nonunion despite healing of the wounds completely. Two of the 3 were type 1 diabetic patients who were not compliant with their medical treatment. Chen et al (23) reported 2 superficial wound infections (of 34 patients) that were treated with antibiotics without complication. Marti et al (26) reported 1 case (of 23 cases) of superficial wound infection that was treated with antibiotics. Trnka et al (24) reported 1 case (of 39 cases) of osteomyelitis at the site of the arthrodesis that was successfully treated by debridement and antibiotics.

Three (13%) patients encountered plantar heel pain while walking owing to a screw threaded at the point of the heel and not countersunk. The screws were removed after sound fusion, and pain disappeared later. They had satisfactory results. Chen et al (23) reported that there were 2 cases of screw penetration through the talar neck with resulting anterior ankle pain and another 3 cases of plantar heel pain at the point

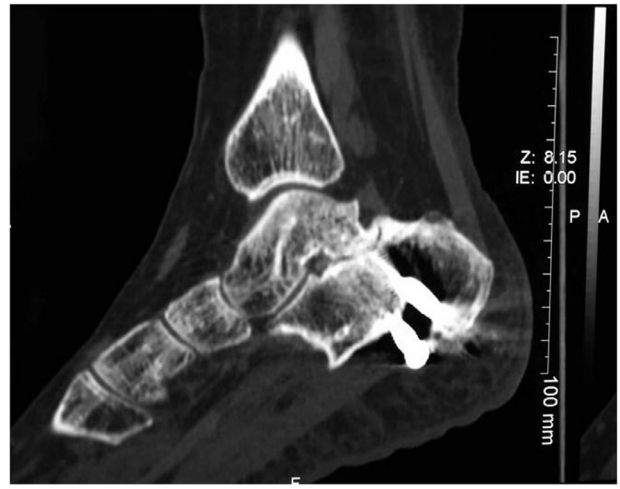

Fig. 9. Postoperative computed tomographic scan showing nonunion at the fusion site of the subtalar joint.

Table 3
Correlation between age, sex, type of the fracture, initial management, and final score (N = 22 patients, 23 feet)

	Unsatisfactory		Satisfactory		χ^2	^{FE}p
	n	%	n	%		
Age	(n = 4)		(n = 18)			
≤35 y	2	50.0	8	44.4	.041	1.000
>35 y	2	50.0	10	55.6		
	(n = 4)		(n = 18)		c^2	^{FE}p
Sex						
Male	4	100.0	15	83.3	0.772	1.000
Female	0	0.0	3	16.7		
	(n = 4)		(n = 19)		χ^2	^{MC}p
Sanders type						
II	0	0.0	1	5.3	2.426	.037*
III	0	0.0	7	36.8		
IV	4	100.0	11	57.9		
	(n = 4)		(n = 18)		c^2	^{MC}p
Initial management						
Missed	0	0.0	2	10.5	2.320	.602
BKPC	3	75.0	13	68.4		
ORIF plate and screws	0	0.0	3	15.8		
ORIF Kirschner wires	1	25.0	1	5.3		

Abbreviations: BKPC, below-knee plaster cast; ORIF, open reduction and internal fixation.
* *p* value is statistically significant.

Table 4
Correlation between time before surgery, correction of the heel height, correction of the heel width, and final score (N = 22 patients, 23 feet)

	Unsatisfactory (n = 4)		Satisfactory (n = 19)			
Time before surgery, n (%)					χ^2 = .673	^{FE}p = .604
≤10 mo	3	75.0	10	52.6		
>10 mo	1	25.0	9	47.4		
Heel height	Unsatisfactory (n = 4)		Satisfactory (n = 19)			
Min–max	5.0–6.0		7.0–10.0		*t* = 7.173	*p* <.001*
Mean ± SD	5.50 ± 0.58		8.16 ± 0.69			
Median	5.50		8.0			
Heel width	Unsatisfactory (n = 4)		Satisfactory (n = 19)			
Min–max	5.0–7.0		6.0–10.0		*t* = 5.421	*p* <.001*
Mean ± SD	6.0 ± 1.15		8.89 ± 0.94			
Median	6.0		9.0			

Abbreviation: SD, standard deviation.
* *p* value is statistically significant.

of insertion of the screw. These problems subsided when the screw was removed after radiographic evidence of fusion. In our series, sound solid subtalar fusion was achieved in 19 (82.6%) heels with a mean fusion time of 11.8 weeks. Monaco et al (27) reported a 100% subtalar fusion rate of 12 malunited calcaneal fractures that underwent subtalar joint distraction arthrodesis with femoral neck allograft with a mean final follow-up of 7.7 months. Although our rate of union is less than reported by Monaco et al (27), this series was small. Moreover, we believe that the use of the autogenic bone resected to reduce the broadening of the os calcis as a graft material to distract the joint and increase the calcaneal height avoids both the risks associated with allografts and the morbidity associated with autogenic iliac autograft.

The limitations of this report include the relatively small number of patients.

In conclusion, subtalar distractional fusion combined with lateral decompression through intercalary sagittal resection osteotomy is a successful method of management for those who have malunited calcaneal fractures leading to posttraumatic subtalar arthritis and lateral abutment. The study has proved that increasing the heel height and narrowing of the heel width significantly affect the outcome positively. Our results could be used in the development of future randomized controlled trials or prospective cohort studies that focus on the use of the same technique to treat malunited os calcis.

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