Treatment of peroneal spasmodic valgus foot with posterior subtalar fusion using a tightly packed iliac crest bone graft without fixation

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Purpose
The aim of this work is to study the result of posterior subtalar fusion as a modality of treatment of idiopathic spasmodic valgus feet. We study the effect of using a tightly impacted iliac crest bone graft to achieve stable joint distraction without additional fixation.
Materials and Methods
The study was done in the period between June 2017 and January 2019. Patients' age ranged from 12 to 16 years. Patients were all treated with subtalar fusion at the level of the posterior facet. A wedged tricortical iliac crest bone graft was tightly impacted in the joint with its base facing laterally. No additional fixation methods were used. Patients were followed radiologically and functionally using the American Orthopedic Foot and Ankle Society Ankle–Hind foot scale (AOFAS-AHS).
Results
The study included 12 males and one female with a mean age of 13.5 ± 1.2 years. Five cases were bilateral and eight cases had unilateral affection with a total 18 feet. The mean follow-up period averaged 12 months (6–18) months. The AOFAS-AHS significantly increased from a preoperative mean of 41.2 ± 1.8 points to a postoperative mean of 82.8 ± 3.6 points (*P* value <0.001), with a significant improvement in the radiological parameters used to evaluate the deformity.
Conclusion
Operative treatment in form of subtalar fusion is a good surgical option that showed significant improvement of symptoms and deformity correction. The technique of distraction bone block using wedged iliac graft allows a stable fusion and avoids hardware complications.

Keywords:
planovalgus, spasmodic, subtalar fusion

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Introduction

Idiopathic peroneal spastic flat foot is a term used to describe cases with stiff planovalgus feet with peroneal muscle spasm that has no apparent etiology [1]. The disorder is more common in obese male adolescents [2]. The cause remains unknown. Peroneal muscle spasm appears to initiate the deformity and inhibit its correction. Muscle spasm may be associated with hindfoot arthritis, neuromuscular disorders, or tarsal coalition [3,4], however, in the 'idiopathic' variant, no definite cause can be identified. Pain and planovalgus deformity are the main presentations. Radiological evaluation is mandatory to adequately assess the degree of deformity and form a treatment plan [5].

Nonoperative treatment can be initiated for most cases in the form of manipulation under general anesthesia, sinus tarsi steroid injections and short-term casting in neutral position [6]. Surgical intervention is reserved for cases with failed conservative management. Subtalar fusion is one of the surgical options that give good a chance for deformity correction with relief of pain and improvement of function [7].

In this study, we present a new technique of subtalar joint distraction-fusion using a wedged iliac crest bone graft without fixation. The procedure is evaluated regarding deformity correction, radiological union, pain and functional improvement.

Materials and Methods

Our study is a prospective case series one. It was performed in the period between June 2017 and January 2019. It includes eighteen feet in thirteen adolescents

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with symptomatic idiopathic spasmodic planovalgus deformities not responding to conservative treatment. Twelve males and one female constitute the material of the study. The condition was bilateral in five patients and unilateral in eight. The duration of symptoms ranged from 6 to 9 months. Patients presented with chronic pain, stiffness, typical peroneal spasm, and radiographic evidence of flatfoot. Cases with inflammatory diseases, hindfoot arthrosis, neuromuscular disorders, or bony bars were excluded from the study.

A thorough history was taken, including patient's age, weight, activity level, onset and duration of symptoms, presence of recent strenuous work, and whether there had been any recent trauma. Gait analysis, foot posture, arch status in non-weight-bearing and weight-bearing status, sinus tarsi pain, ankle and hindfoot range of motion were all assessed. Radiological evaluation included non-weight bearing and weight-bearing plain X-rays (anteroposterior [AP], lateral and oblique tarsal views). The anterior talocalcaneal angle, lateral talo-first metatarsal angle and calcaneal pitch angle were assessed pre-operatively and at the end of follow up and were compared to measure the degree of correction. A pre-operative CT was ordered to exclude talocalcaneal coalition and subtalar arthrosis. MRI was also obtained for better delineation of joint and tendon status. The American Orthopedic Foot and Ankle Society (AOFAS) Ankle–Hindfoot Scale (AHS) [8] was used for scoring patients' condition pre-and post-operatively at the end of follow-up. It evaluates pain (40 points), function (50 points) and hindfoot alignment (10 points).

An informed written consent, showing the details of the procedure, risks, and possible complications, was obtained from the parents of all patients. This article does not contain any experimental studies with human participants performed by any of the authors, and the ethical committee of our institution approved it.

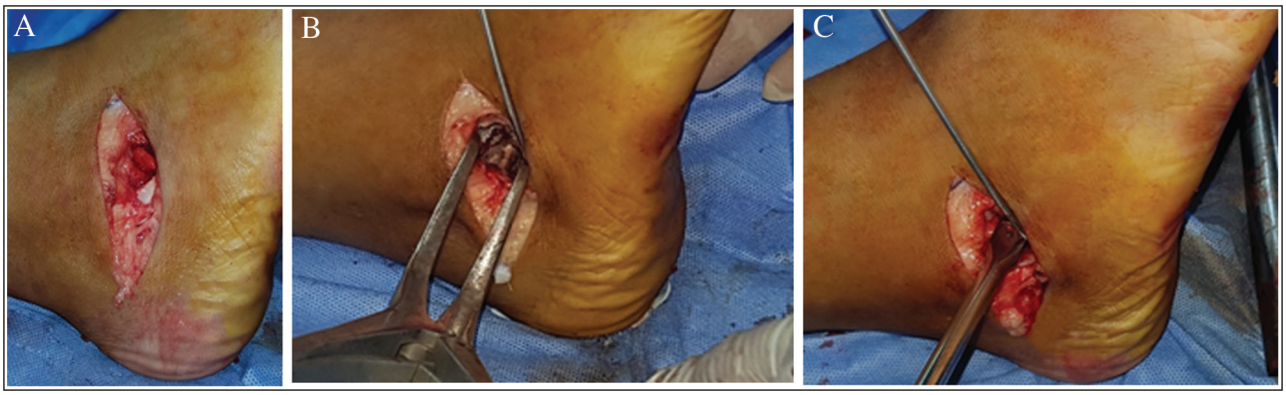
Surgical technique

Surgery was performed under general anesthesia; however, spinal anesthesia could be used for older adolescents. The patient was placed in the supine position. A cushion was put beneath the ipsilateral buttock to allow internal rotation of the affected leg and improve the access to the lateral aspect of hindfoot. A pneumatic tourniquet was applied. A second-generation cephalosporin was given routinely to all cases 20 min before tourniquet insufflation. The leg was draped to the level of the knee. The ipsilateral iliac crest was prepared for graft harvesting,

The subtalar joint is approached via a lateral subfibular incision starting just distal to the tip of the fibula and extending to the base of the fourth metatarsal and the anterior process of the calcaneus (Fig. 1). Skin incision was followed by blunt dissection of the subcutaneous tissue to avoid injury to the branches of the sural nerve. Avoidance of extensive soft tissue dissection was important to avoid wound breakdown.

Peroneal tendons were identified without opening their sheath. They were then retracted with a Langenbeck retractor. A Kirshner wire was inserted transversely in the calcaneus to help retraction of the tendons. The fat bad in front of the sinus tarsi was mobilized away from the extensor digitorum brevis from distal to proximal. The subtalar joint capsule was opened via a horizontal incision to expose the posterior facet of the calcaneus. A lamina spreader was inserted into the subtalar joint with distraction to expose the opposing articular surfaces. The cervical ligament was preserved. The articular cartilage was removed using sharp osteotomes an a small rongeur.

Figure 1:



A, The lateral subfibular approach used to access the posterior facet of subtalar joint. **B,** Peroneal tendons were retracted with the help of a K-wire inserted transversely in the calcaneus. **B,** The joint distraction is maintained by a lamina spreader

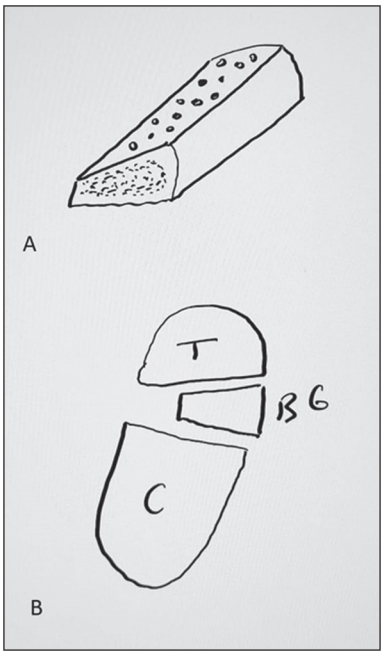
A wedged iliac crest graft was harvested from the ipsilateral side. The size of the base of the wedge was about 2 cm. Drilling of the cortical sides of the graft was done to enhance union (Fig. 2). The graft was inserted with the base facing laterally and the drilled cortical surfaces opposing the denuded joint surfaces. Joint distraction was maintained by using the lamina spreader. This distraction allowed a 'ligamentotaxis effect', compressing and fixing the graft into place upon removal of the spreader. The lateral part of the graft was fashioned using a high-speed burr to be flushed with the lateral wall of the calcaneus to avoid peroneal tendons impingement.

Finally, the wound was closed, and a posterior slap was applied. Follow-up visits were scheduled for wound examination and suture removal. Non-weight bearing for 6 weeks was instructed until signs of bony consolidation could be seen on radiographs. Partial weight bearing was then allowed. Full weight bearing was allowed at 3 months after full radiological consolidation.

Statistical analyses

Data were fed to the computer and analyzed using IBM SPSS software package version 25 (Armonk, NY: IBM Corp). Categorical data were represented as numbers and percentages. For continuous data, they were tested for normality by the Shapiro-Wilk test. Quantitative data were expressed as range (minimum and maximum), mean, standard deviation and median. Paired *t*-test was used to compare two normally distributed variables. Wilcoxon signed-rank test was used to compare two non-normally distributed variables. Significance of the obtained results was judged at the 5% level.

Figure 2:



A, The trapezoidal iliac bone graft is illustrated. We perforate the superior and inferior cortical surfaces to enhance bone union. **B,** Inserting the graft in the posterior facet helps correct heel valgus. (T: talus, C: calcaneus, BG: bone graft

Results

The study included 12 males (92.3%) and one female (7.7%) with a mean age of 13.5 ± 1.2 years (range 12:16). Five cases were bilateral, and eight cases had unilateral affection with a total of 18 feet. The duration of symptoms before surgery ranged from 6-9 months. Five cases (38.5%) had a history of strenuous activity before the appearance of symptoms,which started as acute pain followed by deformity an all these cases were presented as bilateral affection. Four cases (30.8%) presented with unilateral complaint give a history of ankle sprain (Table 1). The loss of clarity of the subtalar joint was a characteristic finding with narrowing of the posterior facet of the joint (Fig. 3). On MRI,

Table 1: Distribution of the studied cases according to different parameters

	Number (%)
Sex	
Male	12 (92.3%)
Female	1 (7.7%)
Age (years)	
Mean±SD.	13.5 ± 1.2
Median (Min. – Max.)	13 (12–16)
Side	
Unilateral	8 (61.5%)
Bilateral	5 (38.5%)
Strenuous activity	5 (38.5%)
History of ankle sprain	4 (30.8%)
BMI (kg/m^2)	
Mean±SD.	30.5 ± 2.5
Median (Min. – Max.)	30.1 (26.1–36.6)

SD, Standard deviation

Figure 3:

Pre-operative standing lateral view. Narrowing of the posterior facet of the joint is observed

Figure 4:

A pre-operative coronal T2-weighted MRI showing a periarticular edema signal of the subtalar joint. This sign was noticed in most cases

a characteristic bone marrow edema signal and high signal intensity within the sinus tarsi were detected in most cases (Fig. 4). The Mean hospitalization time was 6 days (range 3–10), the mean follows up period averaged 12 months (6-18) months.

The AOFAS-AHS significantly increased with a pre-operative estimated mean of 41.2 ± 1.8 point versus a mean of 82.8 ± 3.6 points post-operatively (*P*-value <0.001). Improvement of pain was found to be significant with preoperative mean of pain score of 18.5 ± 3.8 and postoperative mean of 35.4 ± 6.6 (*P* value <0.001). Pre-operative function score mean was 27.8 ± 3.3 and post-operative mean was 39.1 ± 2 (*P*-value<0.001). The pre-operative alignment score (mean: 4 ± 0) improved significantly to a post-operative mean score of 9.4 ± 0.5 (*P*-value <0.001).

There was a significant improvement in the three radiological parameters used to evaluate the degree of deformity correction; the AP-talocalcaneal angle significantly improved from a pre-operative mean of 9.4 ± 1.6 degrees to a post-operative mean of 18.2 ± 2.5 degrees; the AP talus-first metatarsal angle improved from a pre-operative mean of 38.7 ± 3.5 degrees to a post-operative mean of 10.1 ± 1.5; and the lateral calcaneal pitch angle improved from a pre-operative mean of 11.6 ± 2.2 degrees to a post-operative mean of 23.0 ± 1.9 degrees. Bony consolidation was obtained in all cases (Fig. 5, Table 2).

Discussion

It has long been recognized that there is a form of rigid flat foot that is associated with peroneal muscle contraction. The cause is unknown. Tension of the peroneal muscles appears to inhibit the correction of deformity [3]. Peroneal muscle spasm can be triggered by painful stimuli. Pain may be due to inflammatory conditions like rheumatoid arthritis, oncological diseases, or tarsal coalition. In some cases, no obvious cause could be detected; a condition known as 'idiopathic spasmodic valgus foot' [9,10].

According to Sir Robert Jones, there is no consensus on the occurrence, etiology, or mechanism of acquired peroneal spastic planovalgus foot [11]. The abnormal strains placed on the tarsal joints by severe degrees of flat foot may play a rule in the development of peroneal muscle spasm, which potentiates the rigidity of the deformity [3,12].

Conservative treatment of idiopathic spasmodic valgus foot was described in a considerable number of series [11,13,14]. According to Jayakumar and Cowell, about 25–30% of their patients recovered after casting [5]. Blocky conducted research on thirty rigid flat feet with a 2-year follow-up; total cure was reported in 6.6% of cases, partial relapse in 53.4%, and complete relapse in 40% [13].

In a recent study comparing operative versus nonoperative treatment of painful, rigid flat foot in cases of the talocalcaneal coalition. Nonoperative treatment was in the form of manipulation under general anesthesia, followed by cast immobilization and shoe insert after cast removal. Operative treatment was in the form coalition resection with tissue interposition followed by subtalar arthroereisis. At the end of follow-up, the operative group showed significantly better results according to AOFAS-AHS [15].

In the study done by Danilo and Shalga, the results of subtalar arthrodesis were compared to those of subtalar arthroereisis. Positive results were achieved in the arthrodesis group and treatment was ineffective in the arthroereisis group [16].

Technique of distraction bone block arthrodesis was initially described for subtalar fusion following complicated calcaneal fractures in adults in order to restore the height of the subtalar joint. This procedure has showed good results [17]. In our series, solid bony fusion was obtained in all cases.

Figure 5:

A, Pre-operatively the patient has a notable valgus hindfoot that cannot be corrected with tiptoeing denoting rigid deformity (**B**). **C,** Pre-operative radiograph showing a diminished calcaneal pitch angle, that was corrected at the final follow-up (**D**); the graft is in place with good consolidation. **E,** The patient at the final follow-up showing improvement in hindfoot valgus

Table 2: Comparison between the two studied periods according to different parameters

	Pre-operative	Post-operative	*P*
Total end score			
Mean±SD.	50.3±4.2	83.8±7.0	<0.001*
Median (Min. – Max.)	50 (44–56)	86 (69–91)	
Pain score			
Mean±SD.	18.5±3.8	35.4±6.6	=0.001*
Median (Min. – Max.)	20 (10–20)	40 (20–40)	
Function			
Mean±SD.	27.8±3.3	39.1±2	<0.001
Median (Min. – Max.)	30 (22–32)	39 (36–42)	
Alignments			
Mean±SD.	4±0	9.4±0.5	=0.001*
Median (Min. – Max.)	4 (4–4)	9 (9–10)	

SD, Standard deviation

Conclusion

In conclusion, the etiology idiopathic spasmodic valgus is still obscure and needs farther investigation. There is no consensus about the best modality of treatment. Conservative treatment is the first line of treatment and should be exhausted. Operative treatment in the form of subtalar fusion is a good surgical option that showed significant improvement of symptoms and deformity correction. The technique of distraction bone block using a wedged iliac graft allows a stable fusion and avoids hardware complications [17].

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Nil.

Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of our institute.

Consent to participate

Informed consent was obtained from parents or caregivers of all individual participants included in the study.

Consent for publication

Parents or caregivers signed informed consent regarding publishing their children's data and photographs anonymously.

Conflicts of interest

The authors declare no competing interests.

References

1 Rizk AS, Kandil MI. Functional outcome after the nonsurgical treatment for adolescent spasmodic valgus foot. J Orthop Surg 2019:1:2309499018822221. https://doi.org/10.1177%2F2309499018822221

2 Butterworth PA, Landorf KB, Smith SE, Menz HB. The association between body mass index and musculoskeletal foot disorders: a systematic review. Obes Rev 2012; 13:630–642. https://doi.org/10.1111/j.1467-789x.2012.00996.x

3 Harris RI, Beath T. Etiology of peroneal spastic flat foot. J Bone Joint Surg Br 1948; 30:624–634.

4 Luhmann SJ, Rich MM, Schoenecker PL. Painful idiopathic rigid flatfoot in children and adolescents. Foot Ankle Int 2000; 21:59–66. https://doi.org/10.1177/107110070002100111

5 Jayakumar S and Cowell HR. Rigid flatfoot. Clin Orthop Relat Res 1977; 122:77–84.

6 Blitz NM. Pediatric & adolescent flatfoot reconstruction in combination with middle facet talocalcaneal coalition resection. Clin Podiatry Med 2010; 27:119–133. https://doi.org/10.1016/j.cpm.2009.08.009

7 Frances JM, Feldman DS. Management of idiopathic and nonidiopathic flatfoot. Instr Course Lect 2015; 64:429-440.

8 Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA, Myerson MS, Sanders M. Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes. Foot Ankle Int 1994; 15:349-353. https://doi.org/10.1177/107110079401500701

9 Giannini S, Faldini C, Cadossi M, Luciani D, Pagkrati S. Surgical treatment of flexible flatfoot in adolescents with bioabsorbable implant. In: Saxena A editor. International Advances in Foot and Ankle Surgery. London: Springer-Verlag; 2012:p. 367–376. https://doi.org/10.1007/978-0-85729-609-2_35

10 Harris EJ, Vanore JV, Thomas JL, Kravitz SR, Mendelson SA, Mendicino RW, *et al*. Diagnosis and treatment of pediatric flatfoot. J Foot Ankle Surg 2004; 43:341–369. https://doi.org/10.1053/j.jfas.2004.09.013

11 Jones R. Peroneal spasm and its treatment. Report of meeting of Liverpool Medical Institution held 22nd April 1987. Liverp Med Chir J 1987; 17:442.

12 Downey MS. Keys to treating tarsal coalitions. Podiatry Today 2011; 24:48–56.

13 Blockey NJ. Peroneal spastic flat foot. J Bone Joint Surg Br 1955; 37:191–202. https://doi.org/10.1302/0301-620x.37b2.191

14 Varner KE, Michelson JD. Tarsal coalition in adults. Foot Ankle Int 2000; 21:669–672. https://doi.org/10.1177/107110070002100807

15 Di Gennaro GL, Stallone S, Olivotto E, Zarantonello P, Magnani M, Tavernini T, *et al*. Operative versus nonoperative treatment in children with painful rigid flatfoot and talocalcaneal coalition. BMC Musculoskelet Disord 2020; 21:185. https://doi.org/10.1186/s12891-020-03213-5

16 Danilov OA, Shulga AV. Optimization of surgical treatment of rigid flat feet in children with posterior tibialis tendon dysfunction. Paed surg Ukraine 2020; 4:72–80. https://doi.org/10.15574/PS.2020.69.72

17 Schepers T. The subtalar distraction bone block arthrodesis following the late complications of calcaneal fractures: a systematic review. Foot 2013; 23:39–44. https://doi.org/10.1016/j.foot.2012.10.004