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Case Report

Cavovarus deformity of one foot with planovalgus deformity of the contralateral foot (Wind-swept heels): A case report

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ABSTRACT

Normal alignment of the arches and adequate stability is essential for the foot to function correctly. Pes planus and pes cavus are fairly common foot deformities, but it is uncommon to see both in the same patient simultaneously. This study aimed to describe the clinical presentation and prognosis of an uncommon combination of bilateral foot abnormalities named "windswept heels" resembling windswept knees. A 43-year-old female employee experienced frequent pain in her right foot and swelling and pain in her left foot, mainly when walking barefoot. She had a severe cavovarus deformity of the right foot with pressure callosities on the lateral side, clawing of the toes, and a positive Coleman's block test. With the loss of the medial arch, severe heel valgus, and forefoot abduction, the left foot developed a planovalgus deformity. The left foot's talus-first metatarsal angle and the right foot's calcaneal inclination angle increased on weight-bearing radiographs. The left foot underwent staged surgical treatments, including medial sliding calcaneal osteotomy, gastrocnemius recession, and cotton osteotomy. For the right foot, lateral sliding calcaneal osteotomy, plantar fasciotomy, and peroneus longus tendon transfer. The American Orthopaedics Foot and Ankle Society Score (AOFAS) was used to measure the clinical and functional outcomes. At 1 year, her AOFAS scale was 85 compared to 59 before surgery. Since this presentation resembles the windswept knee deformity, we propose calling this disorder windswept heel deformity.

Keywords: Ankle, Calcaneal osteotomy, Cavo-varus, Flatfoot, Foot deformities, Plano-valgus, Wind-swept heels

INTRODUCTION

The foot has a complex structure. It comprises 26 bones, ten extrinsic tendons, 33 joints, and intrinsic tendons and ligaments, forming three arches together.[1,4] The foot can support standing weight, absorb impact, and adapt to shifting loads during activity thanks to the coordination of these structures.[5] The three primary arches in the foot are a lateral arch, a longitudinal transverse arch, and a longitudinal medial arch at the level of the distal tarsal bones. Because they are connected, failure at one causes malfunction at all of them.[6,7] Along with the medial three metatarsals, the calcaneus, talus, navicular, and cuneiform bones form the foot's medial arch. These bones are considered higher and more flexible, allowing for a more dynamic

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shape and configuration during gait.[1-4] The cuboid bone, calcaneus, and fourth and fifth metatarsals make up the rigid lateral arch, which supports body weight.[4] The metatarsals, cuneiforms, and cuboid bones form the transverse arch. The three arches converge to form a curved dome-like structure at the transverse tarsal or mid-tarsal joint in the medial midfoot (calcaneocuboid and talonavicular articulations). The keystone of the triple arch complex is the talonavicular joint.[5-9] The foot and ankle require normal alignment and adequate stability to function properly. Due to its distinctive form and function, the talus bone is essential to the foot and ankle structure. The ligaments and local muscle groups (intrinsic and extrinsic) keep this bone strong. An imbalance of the extrinsic muscles may cause valgus and varus deformities of the hindfoot. In contrast to pediatric patients, adults frequently require bone procedures to correct these deformities.

Pes-plano-valgus (flatfoot) is a common condition in adults and young children. It could be caused by a lack of neuromuscular control and ligamentous laxity in children.[10] The most common cause of acquired pes planus is dysfunction in the posterior tibial tendon.[11] In addition, it may result from trauma to the midfoot or hindfoot, which results in injury to the navicular, first metatarsal, calcaneal, or Lis-Franc ligament.[12] As the foot grows stronger and musculature develops, congenital pes-planus disappear with age. During the non-weight-bearing activity, flexible pes planus has a normal foot arch, but when standing, the arch flattens when tiptoeing. The foot arch in rigid pes-planus remains rigid and collapses whether weight bearing is present or not. For flexible cases of pes-planus, treatment options include non-steroid anti-inflammatory drugs, orthotics, and physiotherapy. For rigid cases, surgery is an option, from the tenosynovectomy of the tibialis posterior to the calcaneal osteotomy, forefoot correction osteotomy, spring ligament repair, lateral column lengthening, medial column arthrodesis, subtalar arthrodesis, and hindfoot arthrodesis. The surgery goals are to achieve forefoot pronation, valgus, hindfoot varus, forefoot adduction, plantar flexion of the first ray, and elevation of the foot's longitudinal plantar arch. Pes-cavus is frequently associated with neurological disease manifestation. Nevertheless, according to published research, a subset of patients may present with a subtler form of cavus foot without an underlying disease process.[13,14] Surgical treatment for rigid pes-cavus is soft-tissue reconstruction, lateralizing calcaneal valgus-producing osteotomy, and triple arthrodesis. Our case is an adult with acquired pes-planus deformity of one foot and contralateral pes-cavus deformity. The cause of left foot deformity was tibialis posterior dysfunction reflecting an adult-acquired flat foot probably because of teno-synovitis. The cause of the right foot cavo-varus deformity is unclear. However, there was little information about previous surgery on the right foot when she was a child. Therefore, an over-correction could not be excluded as a possible cause of the cavo-varus. The neurological assessment of the patient is unremarkable. Both deformities were treated surgically. No previous published papers described the rare combination of both deformities in the same patient.

CASE REPORT

A 43-year-old employed black lady suffered from recurrent attacks of the left foot pain and swelling. She also mentioned occasional lateral pain on the same foot. The pain is worse with exercise and standing for a long time. For the past few years, she has limited her activities and stopped doing sports because of her foot problem. The right foot is also painful sometimes, especially when she walks barefoot. She is otherwise healthy and not suffering from any chronic diseases. She wears sports shoes and well-padded insoles most of the time and complained about the frequent wear of her shoes. She mentioned a previous surgical intervention in her right foot when she was a child, but she has no idea about the nature of that surgery. History taking, clinical examination and intervention were made by our first two authors, who are senior orthopedics foot and ankle surgeons. Moreover, reliability was checked by the second author. Their assessment revealed severe cavo-varus deformity of the right foot with pressure callosities on the lateral side and toe clawing. Coleman's block test was negative on the right foot. The left foot developed plano-valgus deformity staged 2 with significant heel valgus, forefoot abduction, and medial arch loss. She managed to stand on the tips of her toes with difficulty. Jack's test was positive in her left foot, and she had too many toes signs [Figures 1 and 2]. The Gastrocnemius complex was tight on the right side. Her body mass index was 22, and her general examination was unremarkable. The left foot weight-bearing radiograph showed a decreased talocalcaneal angle,

Figure 1: Anterior view of the deformity.

loss of calcaneal pitch, and an increased angle between the talus and the first metatarsal (talar head uncoverage). The right foot weight-bearing radiograph showed an increased calcaneal inclination angle and the mid-talar axis extending above the first metatarsal axis [Figures 3 and 4].

Intervention

Two surgical interventions were performed at 6 months intervals. After a discussion with the patient, the first surgery was performed on the left foot. The symptoms of the left foot were more severe and demanded intervention. The left foot was corrected first (as it was more problematic), followed by the right 6 months later. A medial sliding calcaneal osteotomy, gastrocnemius recession, and a cotton osteotomy (medial cuneiform open wedge osteotomy) were performed on the left foot. The left foot was in a walker boot for 2 months, and a structured physiotherapy program was carried out. In comparison, we performed lateral sliding calcaneal osteotomy, plantar fasciotomy, and peroneus longus tendon transfer in the right foot. Open gastroc recession was performed on the right side as part of the surgical procedure.

In the right foot, the deformity was driven by the hindfoot rather than the forefoot (negative Coleman block test). This was the reason behind doing calcaneal osteotomy and plantar fasciotomy without considering the first metatarsal osteotomy. Again, immobilization in a walker boot for 2 months was done, and physiotherapy followed. The patient has been followed for 1 year and has shown good progress. Her wounds healed uneventfully. The American Orthopaedics Foot and Ankle Society Score (AOFAS) Ankle-hindfoot scale is used to measure clinical and functional outcomes. At 1 year, her AOFAS scale was 85 compared to 59 before surgery [Figures 5 and 6].

Figure 2: Posterior view of the deformity.

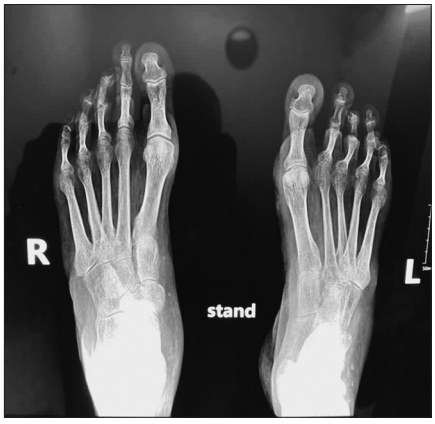

Figure 3: Radiograph showing anterioposterior view of the deformity.

DISCUSSION

In this case, the patient had symptomatic pes-planus of the left foot, stage two and cavo-varus deformity of the right foot. Both deformities can result in a significant effect on foot function. However, the combination of the two causes more functional impairment. Surgical correction was performed in the form of medial sliding calcaneal osteotomy and cotton osteotomy. These two procedures help to correct the heel valgus and to restore the medial arch of the foot, respectively. Hirose and Johnson studied 16 feet (15 patients) with plantarflexion opening wedge medial cuneiform osteotomies to correct the forefoot varus part of flatfoot deformities.[15] They concluded that opening wedge medial cuneiform osteotomy is a crucial adjunctive procedure for correcting the forefoot varus in flatfoot deformities.

Figure 4: Radiograph showing lateral view of the deformity.

Figure 5: Radiograph showing post-operative anterioposterior and the oblique and lateral views of the left foot.

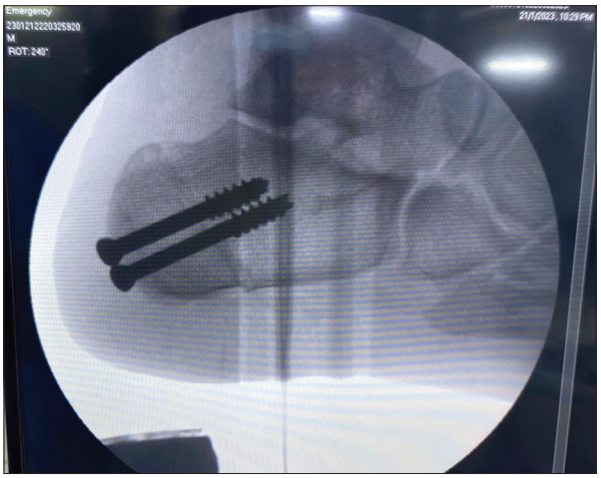

Figure 6: Radiograph showing post-operative lateral view of the right foot.

Compared to first tarsometatarsal arthrodesis, this method has many advantages, including predictable union, preservation of first ray mobility, and the ability to adjust the correction. Tao *et al.* collected and analyzed 498 patients from 21 studies.[16] This network meta-analysis found that medial displacement calcaneal osteotomy is among the best treatments for adult-acquired flatfoot deformity, with an impressive improvement in the functional status reflected by the increase in the AOFAS scale. Boffeli and Schnell studied 32 consecutive patients with flatfoot reconstruction who had cotton osteotomies performed on 37 feet.[17] Meary's angle increased by −17.24° ± 8.00°–0.51° ± 3.81°, and this improvement was statistically significant (P = 0.01). They concluded that our experience using the cotton osteotomy as an adjunctive procedure in flatfoot reconstructive surgery is highlighted in this retrospective series. In addition, our patient's right foot had a rigid pes-cavus deformity. Six months after the surgery on the left foot, a lateral sliding calcaneal osteotomy, plantar fasciotomy, and transfer of the peroneus longus tendon were performed on the right foot. Barg *et al.*[18] conducted a study between January 2009 and June 2013. Thirty-one patients, with a mean age of 45.7 ± 16.3 years and a range of 21.5–77.4 years, underwent a Dwyer osteotomy. The pre-operative moment arm of the calcaneus was −17.9 ± 3.3 mm (range −22.5–10.5 mm) in all patients, indicating a significant improvement to 1.6 ± 5.9 mm (range −16.9–9.9 mm). The visual analog scale revealed significant pain relief of 1.1 ± 1.1 (range 0–4)–6.3 ± 1.9 (range 4–10). AOFAS score went from 33.1 ± 14.2 (range: 10–60) to 78.0 ± 10.5 (range: 55–95), which is a significant improvement.

CONCLUSION

The rare combination of plano-valgus and cavo-varus deformities significantly impacts the foot function. An impressive functional outcome can be achieved by staged surgical correction. The name *windswept heel* may fit the description of this condition.

AUTHORS' CONTRIBUTIONS

SAN conceived and designed the study, conducted research, provided research materials, and MAO collected and organized data. AMK analyzed and interpreted data. MSF and HMA wrote the initial and final draft of the article, and OGN provided logistic support. All authors have critically reviewed and approved the final draft and are responsible for the manuscript's content and similarity index.

ETHICAL APPROVAL

The approval of the Research Ethics Review Committee at Future Hospital is secured. Approval number: 10-122154, dated 2/12/2022.

DECLARATION OF PATIENT CONSENT

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be

reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal her identity, but anonymity cannot be guaranteed.

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CONFLICTS OF INTEREST

There are no conflicting relationships or activities.

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