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Case Reports and Series

A Rare Intermetatarsal Coalition With Rigid Fifth Metatarsal Deformity and Symptomatic Plantar Lesion

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ABSTRACT

Coalition or synostosis of the foot is a relatively uncommon abnormality. Some cases of synostosis of the foot, primarily involving the midfoot and hindfoot, have been reported. However, intermetatarsal coalition is extremely rare, with only a small number of cases reported. We report a case of a unilateral, congenital metatarsal coalition between the fourth and fifth metatarsal bones in a 27-year-old female. She had initially been referred because of a symptomatic plantar lesion under the fifth metatarsal head. Surgery consisted of separating the affected metatarsals, combined with a proximal osteotomy, which proved successful in establishing pain-free and more natural weightbearing.

Congenital coalitions of the foot are relatively uncommon abnormalities and occur in approximately 1% of the population (1). Talocalcaneal and calcaneonavicular are the most common types of coalitions. Most cases are asymptomatic and appear to be more common than previously reported. The actual prevalence is likely higher (2). Intermetatarsal coalitions (ICs) in the forefoot are extremely rare, with only a small number of cases reported. Most cases were congenital ICs between the base of the fourth and fifth metatarsals and, less commonly, between the first and second metatarsals (3–8). We report a rare case of a unilateral symptomatic coalition between the fourth and fifth metatarsals in a young adult female, who was treated successfully using proximal metatarsal osteotomy.

Case Report

A 27-year-old female with no medical history of interest had presented with metatarsalgia at the head of the fifth metatarsal in her left foot that had been refractory to conservative treatment (ie, periodic debridement, padding, and plantar orthoses). The patient had no history of previous trauma and stated that the deformity had been present since childhood. Her mother reported that the patient had had a delayed onset of walking with an unsteady gait and frequent

Fig. 1. Photograph showing the presence of plantar keratosis under the fifth metatarsal head.

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Fig. 2. Photograph showing marked plantar flexion of the fifth ray.

Fig. 3. Podoscope examination revealed excessive weightbearing pressure in the fifth metatarsal head and the absence of contact of the fourth metatarsal ray.

Fig. 4. The podoscope examination also revealed the external section of the longitudinal arch region with a plantar flexed first ray in the left foot and dorsal fourth ray protrusion in the left foot.

Fig. 5. Radiograph with lateral load view showing a mild or subtle cavus foot with a markedly increased fifth ray declination angle (30°) and dorsally flexed fourth ray in the left foot.

falls. Clinical examination revealed the presence of plantar keratosis under the fifth metatarsal head and marked plantar flexion of the fifth ray (Figs. 1 and 2). Joint exploration in the left foot showed the presence of a rigid deformity at the fifth metatarsal with no joint displacement between the fourth and fifth metatarsals. The ankle, subtalar, and metatarsophalangeal joint motion was normal. The Silfverskiold test did not reveal the presence of gastrocnemius

Fig. 6. Dorsoplantar radiograph showing the bony connection between the fourth and fifth metatarsals in the left foot.

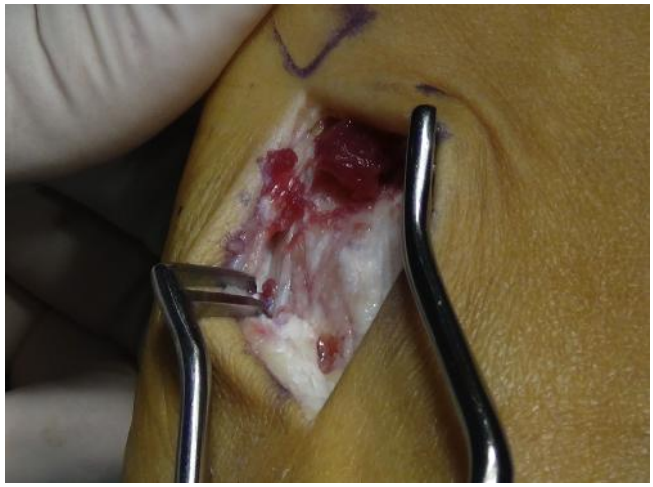

Fig. 7. Intraoperative view showing a bony bridge between the fourth and fifth metatarsals.

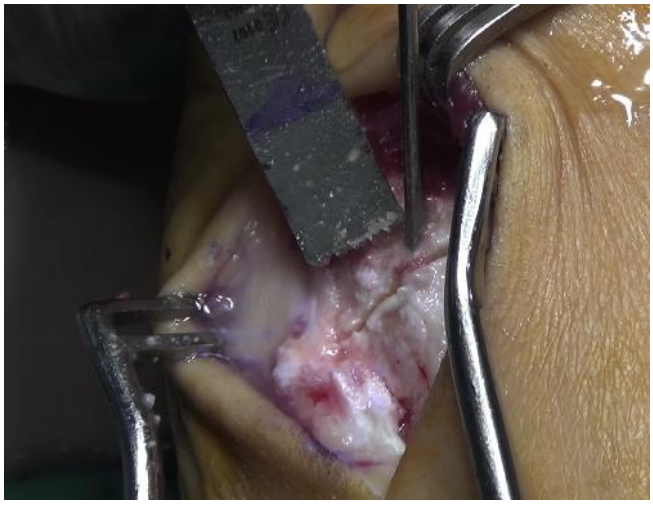

Fig. 9. Intraoperative view showing wedge resection to enable the fourth and fifth metatarsals to remain positioned in the same plane.

equinus. Weightbearing exploration revealed the presence of bilateral hindfeet in an inverted position. The Coleman block test showed the presence of flexible deformity in both feet. The varus observed in the heel was due to plantar flexion of the first ray. Podoscope examination revealed excessive weightbearing pressure in the fifth metatarsal head, the absence of contact of the fourth metatarsal ray, and an external section of the longitudinal arch region with a plantar flexed first ray in the left foot and dorsal fourth ray protrusion in the left foot (Figs. 3 and 4). Radiographic examination with a lateral load view revealed the presence of bilateral mild or subtle cavus feet with a markedly increased fifth ray declination angle (30°) and a dorsally flexed fourth ray in the left foot (Fig. 5).

Clinical examination had raised suspicion of a bony connection between the fourth and fifth metatarsals in the left foot, which was confirmed on a dorsoplantar radiograph (Fig. 6). It was decided to perform surgery to reduce the functional weightbearing pressure of the fifth metatarsal and improve support in the left foot. The lateral radiograph showed that elevation of the fifth metatarsal by 16 mm was necessary. A basilar osteotomy was scheduled with the aim of elevating the fifth metatarsal. A dorsal approach through an

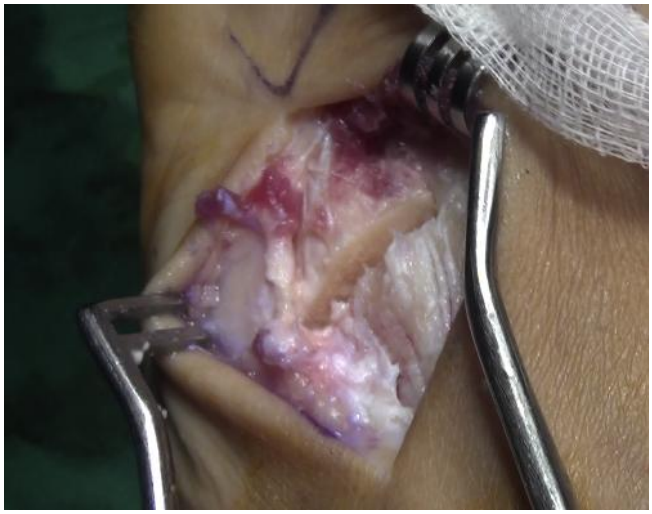

Fig. 10. Another intraoperative photograph results of the wedge resection.

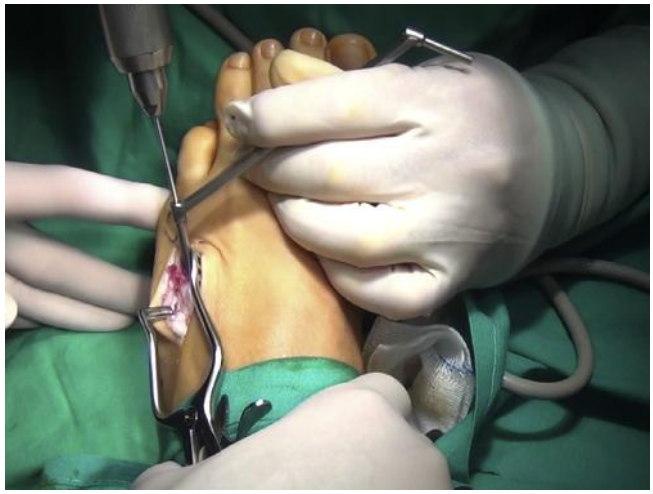

Fig. 8. Intraoperative view of the initial osteotomy to preserve the fifth metatarsal plantar cortical bone.

Fig. 11. Fixation of osteotomy with a cannulated screw and high compression.

Fig. 12. Dorsoplantar postoperative radiograph.

Fig. 14. Oblique postoperative radiograph.

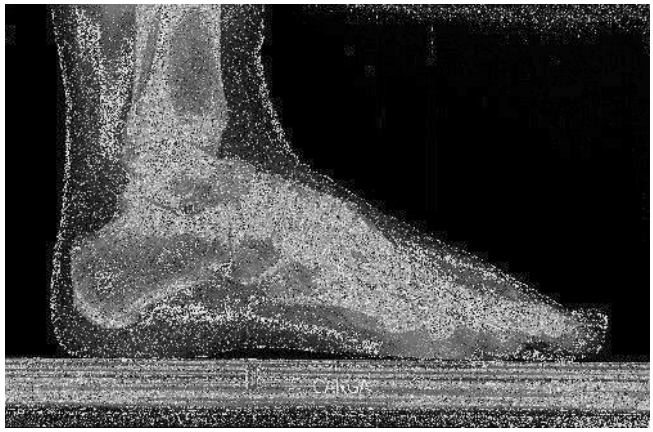

Fig. 13. Lateral postoperative radiograph.

Fig. 15. View of podoscope examination showing normalization of support.

Fig. 16. Clinical photograph showing the absence of plantar keratosis under the fifth metatarsal head.

Fig. 17. Dorsoplantar radiograph at 17-month folow-up visit.

incision was applied to access the area between the base of the fourth and fifth metatarsals. With careful retraction and periosteal dissection, a bony bridge between the fourth and fifth metatarsals was identified proximally (Fig. 7). The synostosis was partially resected in the more distal portion using a sagittal saw. A Kirschner wire was subsequently placed, with an inclination of 60° in the sagittal plane orientation as an apical axis guide. An initial osteotomy was performed, preserving the fifth metatarsal plantar cortical bone (Fig. 8). A second distal osteotomy, angled slightly, was performed to obtain a wedge sufficient to attain the desired elevation. Wedge resection was extended until the fourth and fifth metatarsals remained positioned in the same plane, taking care to preserve the integrity of the plantar cortical that acts as a hinge (Figs. 9 and 10). The osteotomy was fixed with a cannulated screw using high compression, and the wound was appropriately sutured (Fig. 11). Postoperative radiographic monitoring was performed (Figs. 12 to 14), and the patient was fitted with a reverse camber shoe for 5 weeks to elevate and protect the forefoot. At 8 weeks, better support of the fourth and fifth metatarsals was observed, the alignment of the metatarsals was correct, and the osteotomy had provided steady progression to full fusion. After a 17-month follow-up period, the patient was asymptomatic, with normalization of support and complete radiographic consolidation of the osteotomy (Figs. 15 to 19).

Discussion

The etiology of tarsal coalition, either congenital or acquired, has been reported extensively in published podiatric and orthopedic studies. However, a small number of cases of IC in the forefoot have been reported. Congenital coalition is defined as an abnormal osseous, fibrous, or cartilaginous bridge between 2 bones that can be congenital, resulting from a failure of embryonic mesenchymal differentiation and separation, or acquired from trauma. Metatarsal coalitions are very rare and usually have a congenital etiology; however, acquired ICs after trauma or surgical intervention have been reported (9). ICs have also been reported in association with various congenital anomaly patterns and syndromes (10–12).

Fig. 18. Lateral view radiograph showing complete consolidation of the osteotomy.

Fig. 19. Oblique radiograph showing complete consolidation.

Different treatments of isolated coalition have been reported, although because these cases are rare, they should be treated individually and according to patient symptoms. Just as for the present patient, the method of operation should be selected in accordance with the patient's specific characteristics and the presence of associated deformities. Excision of the bony bridge and separation of the space between the affected metatarsals, combined with a dorsal closing wedge osteotomy for the affected metatarsal, has usually been the surgical management in reported cases (8). Just as in our patient, when the hindfoot varus is secondary (flexible deformity), correcting the primary deformity (plantar flexion of the first metatarsal) will usually be successful. This can be attained with a skillfully created orthosis that gives the metatarsal room for plantar flexion of the first ray with a ramp at the lateral forefoot, a lowered arch, and a heel cushion. Usually, in the presence of subtle cavovarus, a flexible deformity will not necessarily be accomplished by surgical reduction of the position of the first metatarsal. Only when the hindfoot is rigid, will surgical correction of the rearfoot and forefoot be required, because the structural deformity might be in the calcaneus.

Just as in our patient, the presence of IC can produce an alteration in foot mechanics that eliminates movement between the metatarsals involved. The presence of an increased declination angle of the fifth ray, accompanied by the lack of mobility during the midstance phase, results in increased bending along the bone with severe weightbearing pressure, a painful hyperkeratotic lesion, and disability. In the case of metatarsalgia from plantar flexion of a lesser metatarsal, osteotomy to elevate the metatarsal head should be the treatment of choice. Oblique metatarsal osteotomy (60°) is a type of proximal osteotomy with elevation of the metatarsal head (13). Osteotomies at the proximal metatarsal level have the potential risk of providing excessive elevation of the metatarsal head. However, basal elevation osteotomies of the metatarsals performed in patients with severe metatarsalgia, such as in the present case, might be a good choice (14). Oblique metatarsal osteotomy plus dorsal closing wedge resection provides a long fragment contact area; therefore, it is not only basal, but also proximal, and is almost on a horizontal plane. A proximal hinge should be carefully preserved in a cancellous part where the bone cannot break. Just as in our case, dorsiflexory wedge osteotomy of the metatarsal base can be performed when large metatarsal elevation is required (a 2-mm wedge will elevate the metatarsal head by 4 mm). However, the fifth metatarsal has a flattened proximal part where the osteotomy requires a more delicate touch. Furthermore, although the osteotomy is extra-articular, care must be taken not to jeopardize the perforating arteries.

In conclusion, although metatarsal coalition is a rare condition, early diagnosis, corrective surgery, and postoperative orthotic compensation can provide excellent results. The primary aim of surgery must be to achieve pain-free weightbearing. Proximal metatarsal osteotomy plus internal fixation to restore the normal anatomy can provide satisfactory results.

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