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Case Report

Postoperative early load-bearing walking by an adult with painful bilateral os intermetatarsea treated surgically: A Case Report

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Conflict of Interest

The authors did not receive and will not receive any benefits and funding from any commercial party related directly or indirectly to the subject of this article.

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INTRODUCTION

The os intermetatarseum is a rare accessory bone of the foot that is usually located between the bases of the first and second metatarsals. Most cases of os intermetatarsea are symptomless [1]. Good results were reported in cases of painful unilateral os intermetatarseum that were treated with surgery [2, 3]. By contrast, to the best of our knowledge there have been no reports of simultaneous bilateral surgical treatment in cases of bilateral os intermetatarsea, and there is a lack of knowledge regarding how to approach postoperative therapy in such cases. The present case report appears to be the first on the surgical treatment of bilateral os intermetatarsea followed by successful postoperative early walking training.

CASE REPORT

A 22-year-old Japan Ground Self-Defense Force member with no remarkable medical history complained of pain over the dorsum on both of his feet. From childhood, he was aware of ridges on the dorsum on both feet and occasionally had pain at these sites, but the symptoms had always been temporary. However, prior to his seeking medical treatment, the symptoms had recurred for 6 months without an obvious cause. He went to a clinic and received symptomatic treatment over a period of 3 months, but because his symptoms did not improve, he came to our hospital.

A physical examination revealed bilateral bony prominences between the first and second metatarsal bases and swelling around the bony prominences. Tenderness and hypesthesia were present in the deep peroneal nerve domains on both feet, with a Tinel-like sign on the right foot. The Japanese Society for Surgery of the Foot (JSSF) midfoot scale [4] scores were 67 points bilaterally.

Weight-bearing plain radiographs revealed ossicles between the bases of the first and second metatarsals in both feet (Fig. 1A, B). There was a difference in the distance between the base of the second metatarsal and the medial cuneiform bilaterally, but the patient had no symptoms and no history of injury. Three-dimensional

computed tomography (3D-CT) showed that the ossicle on the right side was 7.3 mm × 9.9 mm × 12.0 mm in size, and that on the left side was 6.1 mm × 7.7 mm × 10.7 mm (Fig. 2). No osseous fusion or articular surface formation with the surrounding bone was observed on either side. Magnetic resonance imaging (MRI) showed a bone fragment deep in the dorsal Lisfranc ligament (Fig. 3A,B). Based on these findings, we diagnosed this case as painful bilateral os intermetatarsea.

For 2 months we administered conservative treatments such as medication with non-steroidal anti-inflammatory drugs and rest with local decompression by changing the patient's shoes, but the pain persisted. We thus performed surgical excision of the ossicles on both sides in a single surgical procedure.

Under lumbar anesthesia, an approximately 20-mm vertical skin incision was made just above the ridge of the right foot. To preserve the DLL, we approached from the distal side and expanded the deep layer. The os intermetatarseum was identified between the bases of the first and second metatarsals, and it compressed the deep peroneal nerve dorsally. There was DLL on the dorsal side of the proximal portion of the ossicle. However, the DLL was not exposed to prevent damage. The nerve was carefully avoided, and the os intermetatarseum was exposed from distal to proximal to protect the DLL (Figs. 4 A,B). The os intermetatarseum was loosely connected to the

surrounding tissue (including the DLL), so it was easy to strip between the ossicle and them and perform an en-bloc resection. Therefore, the DLL itself largely untreated and we determined that it is not damaged.

The same procedure was then performed on the left foot, and similar findings were obtained. The histopathological findings showed that the bone tissue was mature, and no evidence of malignancy or osteonecrosis was observed.

From the first day post-surgery, pain-limited weight bearing was permitted without any other restrictions. No bandages or orthotics were used. One week after the surgery, the patient was able to walk independently. Three weeks after the surgery, he was able to return to daily life, and weight-bearing plain radiographs of the bilateral feet showed no changes in the distance between the base of the second metatarsal and the medial cuneiform bone compared to the distance pre-operation (Fig. 5A,B). Although it did not interfere with daily life, the patient had to restrict his work for 4 months after the surgery because of scarring, irritation, and pain caused by his military-issue boots.

One year after the surgery, the patient has no pain and no sensory disorder of the deep peroneal nerve, and the JSSF midfoot scores were 100 points bilaterally. Weight-bearing plain radiographs of the bilateral feet showed no re-ossifications and no changes in the distance between the base of the second metatarsal and the medial

cuneiform bone compared to the distance pre-operation (Fig. 6A,B). Institutional review board approval was not required for this case report of a single patient. Informed consent for his case and the images to be published was obtained from the patient preoperatively.

DISCUSSION

The os intermetatarseum is an uncommon accessory ossicle located on the dorsal aspect of the mid-foot between the first and second metatarsal bases and proximally by the medial cuneiform [5]. It was first described in 1856 by Gruber [6]. Os intermetatarsea exhibit various shapes and sizes [5]. The reported incidence of os intermetatarseum ranges from 0% to 14% [7], and diagnosis tends to be difficult using plain radiographs [5]. Os intermetatarsea can be divided into three basic types: freestanding, articulating, and fused [7]. The most frequently reported type of os intermetatarseum is the freestanding type at 63%, followed by the articulating type at 30%; only 7% have been the fused type [8]. This case was of the freestanding type. Most os intermetatarsea are asymptomatic [1], and most are unilateral; good treatment results have been achieved with surgical excision [2,3]. Bilateral cases of os intermetatarsea are very rare. Kose et al. have reported a case of conservative treatment [1], and Noguchi et al. have reported a case with bilateral symptoms in which surgical treatment was performed only on one side [9]. To the best of our knowledge, the present report is the first to describe the bilateral simultaneous surgical treatment of bilateral os intermetatarsea.

The Lisfranc ligament is a complex of three different ligaments: the DLL, the interosseous Lisfranc ligament (ILL), and the plantar Lisfranc ligament (PLL). Theoretically, excision from directly above an os intermetatarseum using the dorsal approach may damage the DLL. The reported areas of the three ligaments are as follows: DLL, 15.3±4.0 mm^2; PLL, 33.1±12.2 mm^2; and ILL, 74.8±17.5 mm^2 [10]. The ligaments' strength values are as follows: DLL, 170±33 N; PLL, 305±38 N; and ILL, 449±58 N [11]. The DLL therefore has the highest ultimate load per unit area. The DLL is located on the dorsal side of the Lisfranc joint, which is the apex of the transverse arch structure of the foot. The in vivo strain pattern that occurs when the Lisfranc ligament is injured is not accurately known [12], but it is expected that the ILL and PLL will be overloaded when only the DLL is injured. Therefore, we consider that gentle post-operative management may be required when only the DLL is injured. In fact, relatively long-term load limits or activity limits were reported in previous studies [2,3]. Noguchi et al. performed surgical excision to treat the free-standing type of os intermetatarseum, and, after a non-weight-bearing period, their patient started partial weight-bearing 2 weeks post-surgery and started full weight-bearing 5 weeks post-surgery [2]. Nakasa et al. reported four patients who returned to athletic competition 4–6 months after surgical treatment [3].

In the present case, we preoperatively evaluated the positional relationship between the DLL and the os intermetatarseum, and we shifted the approach distally to minimize invasion of the ligament. We believe that the DLL was preserved without any iatrogenic tear because it was not exposed and the bone fragments were resected under the periosteum. Therefore, we permitted early weight bearing after the surgery. Comparing the radiographs of the feet before and after surgery, these showed no changes in the distance between the base of the second metatarsal and the medial cuneiform bone. These findings suggest that there was no DLL tear associated with this surgery.

Our patients were able to carry out their daily activities soon after surgery. In young patients such as our case, a similar prognosis could likely be obtained by having the patient walk on the heel while reducing or eliminating the load on the Lisfranc joint. However, it is not known whether all patients with painful os intermetatarseum are young and/or healthy. We believe that our report will serve as a reference when dealing with a variety of cases. On the other hand, it took 4 months postoperatively for the patient to fully return to work in our case. This delay was due to the patient's special work environment (i.e., the need to wear cramped military shoes), and except for this special circumstance, it should have been possible for the patient to return to work

earlier after this surgery. We believe that the value of conducting unlimited rehabilitation soon after surgery is universal.

In conclusion, bone resection for os intermetatarsea that preserves the DLL can be expected to enable early load-bearing walking.

References

1. Kose IC, Hizal M, Bulut EG, Atil E, Ergen FB. Bilateral fused os intermetatarseum presenting as dorsal foot pain: a case report. Surg Radiol Anat 2014 Jul;36(5)5:503-5.
2. Noguchi M, Iwata Y, Miura K, Kusaka Y. A painful os intermetatarseum in a soccer player: a case report. Foot Ankle Int 2000 Dec;21(12):1040-2.
3. Nakasa T, Fukuhara K, Adachi N, Ochi M. Painful os intermetatarseum in athletes: report of four cases and review of the literature. Arch Orthop Trauma Surg 2007 May;127(4):261-4.
4. Niki H, Aoki H, Inokuchi S, Ozeki S, Kinoshita M, Kura H, Tanaka Y, Noguchi M, Nomura S, Hatori M, Tatsunami S. Development and reliability of a standard rating system for outcome measurement of foot and ankle disorders I: Development of standard rating system. J Orthop Science 2005 Sep;10(5):457-65.
5. Chavali VH. Os intermetatarseum – A case report. J Clin Orthop Trauma 2012 Jun;3(1):54-7.
6. Henderson RS. Os intermetatarseum and a possible relationship to hallux valgus. J Bone Joint Surg Br 1963 Feb;45-B:117-21.

7. Case DT, Ossenberg NS, Burnett SE. Os intermetatarseum: a heritable accessory bone of the human foot. Am J Phys Anthropol 1998 Oct;107(2):199-209.
8. Van Aswegen T, Low R, Pass B. Os intermetatarseum: An analysis of morphology and case reports of fracture. J Med Imaging Radiat Oncol 2020 Dec;64(6):794-9.
9. Noguchi M, Ikoma K, Inoue A, Kusaka Y. Bilateral hallux valgus associated with os intermetatarseum: a case report. Foot Ankle Int. 2005 Oct;26(10):886-9.
10. Johnson A, Jill K, Ward J, Ficke J. Anatomy of the Lisfranc ligament. Foot Ankle Spec 2008 Feb;1(1)19-23.
11. Solan MC, Moorman CT, Miyamoto RG, Jasper LE, Belkoff SM. Ligamentous restraints of the second tarsometatarsal joint: a biomechanical evaluation. Foot Ankle Int 2001 Aug;22(8):637-41.
12. Sripanich Y, Steadman J, Krähenbühl N, et al. Anatomy and biomechanics of the Lisfranc ligamentous complex: A systematic literature review. J Biomech 2021 Apr 15;119:110287.

FIGURE LEGENDS

Fig. 1. Dorsoplantar view of the weight-bearing plain radiographs. A: Left foot. B: Right foot. White arrow indicates the os intermetatarseum bilaterally. Red bar indicates the distance between the base of the second metatarsal and the medial cuneiform bone, and left side has 2.5mm, right side has 3.5 mm.

Fig. 2. 3D-CT of both feet demonstrating freestanding os intermetatarsea between the base of the first and second metatarsals (*light blue parts*).

Fig. 3. MRI findings of os intermetatarseum and surrounding tissues (axial view in parallel to the dorsal Lisfranc ligament of a T2-weighted image). A: Left foot. B: Right foot. *White arrowheads:* The dorsal Lisfranc ligaments. MC: medial cuneiform, M2: 2nd metatarsal, IM: os intermetatarseum.

Fig. 4. Intraoperative findings of the right foot. A: Before resection. The os intermetatarseum was compressing the deep peroneal nerve upwards from the bottom. B: After resection. Avoiding the deep peroneal nerve, the os intermetatarseum was resected as a mass.

Fig. 5. Three weeks post-surgery, anteroposterior plane radiographs of both feet. A: Left foot. B: Right foot.

Fig. 6. One year post-surgery, anteroposterior plane radiographs of both feet. A: Left foot. B: Right foot. Red bar indicates the distance between the base of the second metatarsal and the medial cuneiform bone, and these are same distances at pre-operation.

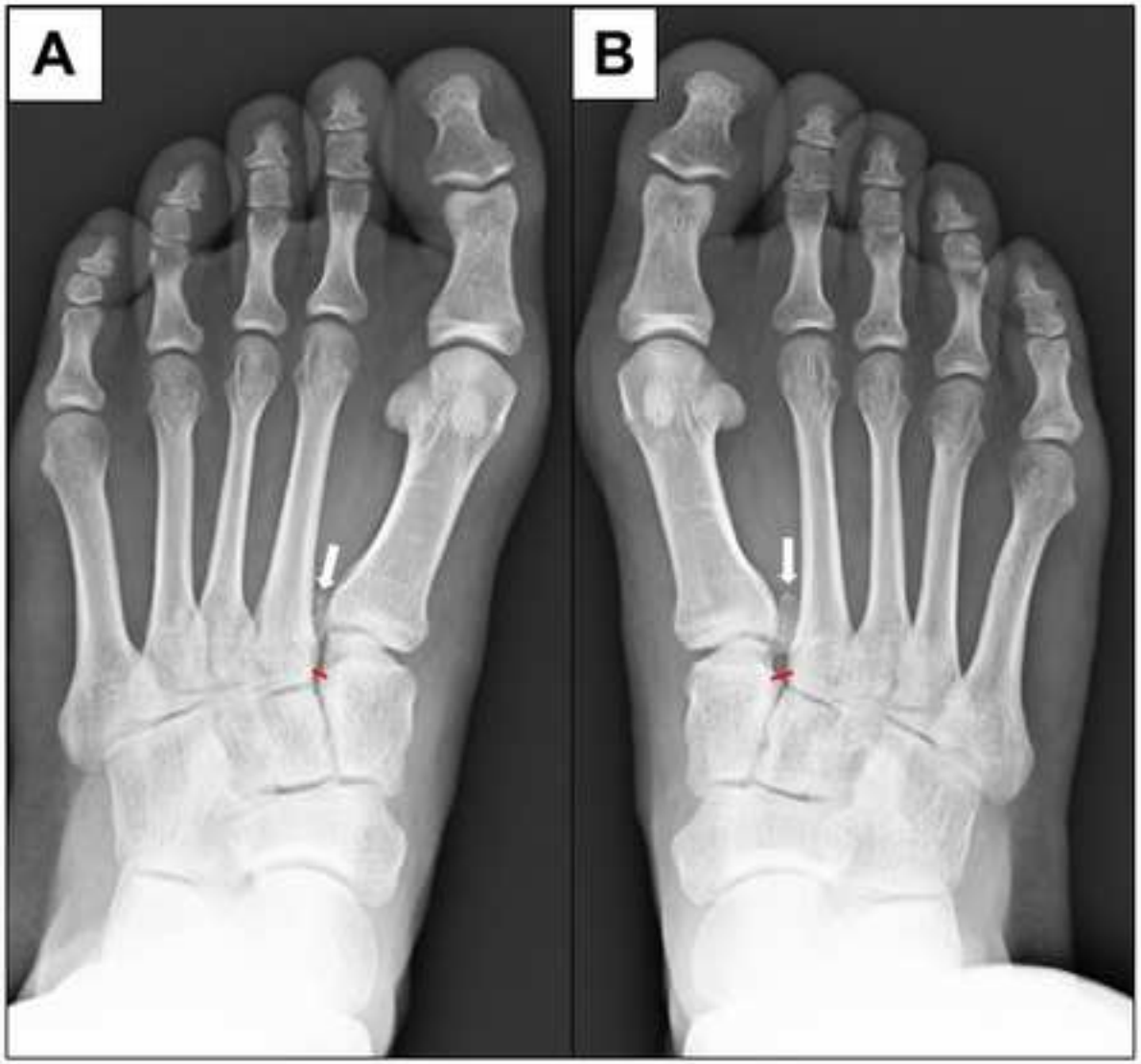


Figure 1

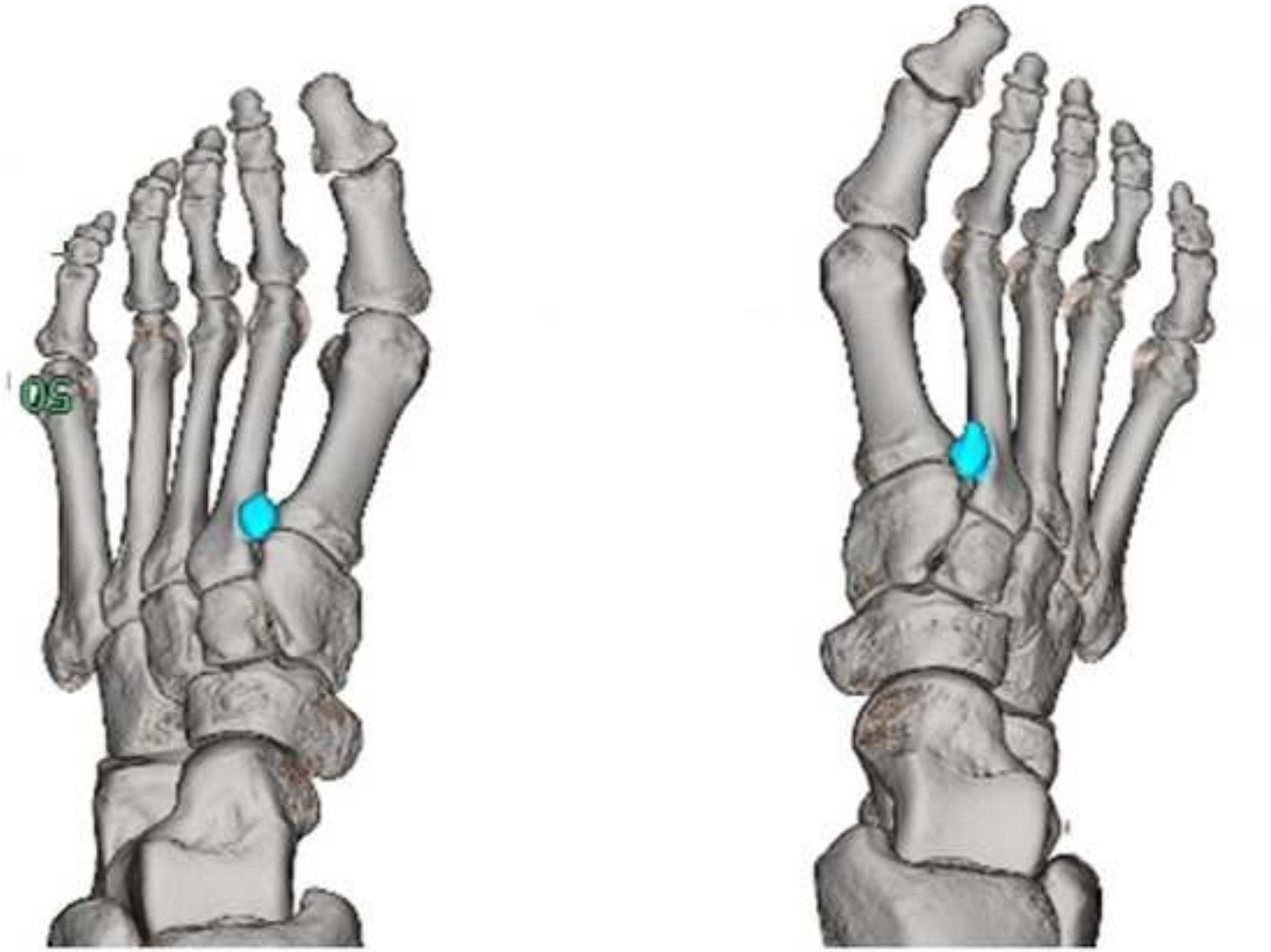
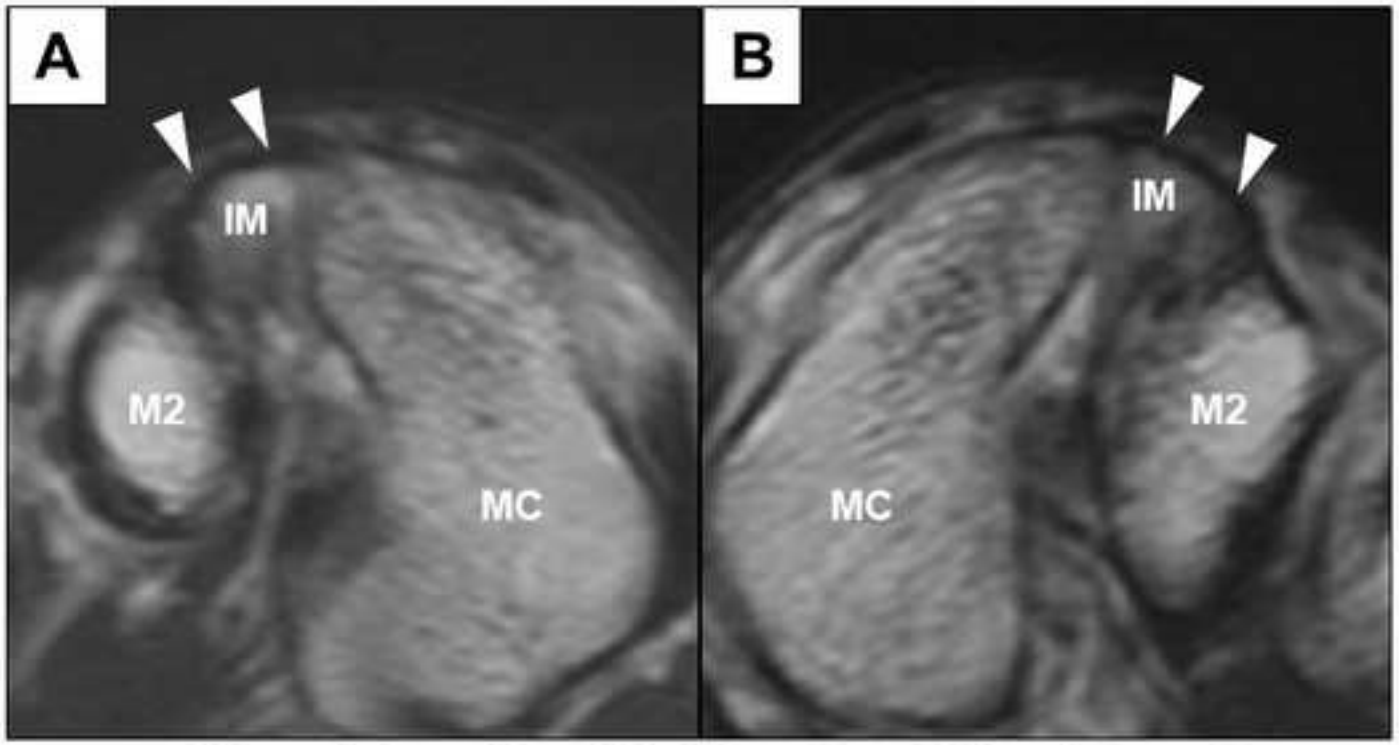


Figure 2



MC: medial cuneiform, M2: 2nd metatarsal, IM: os intermetatarseum

Figure 3

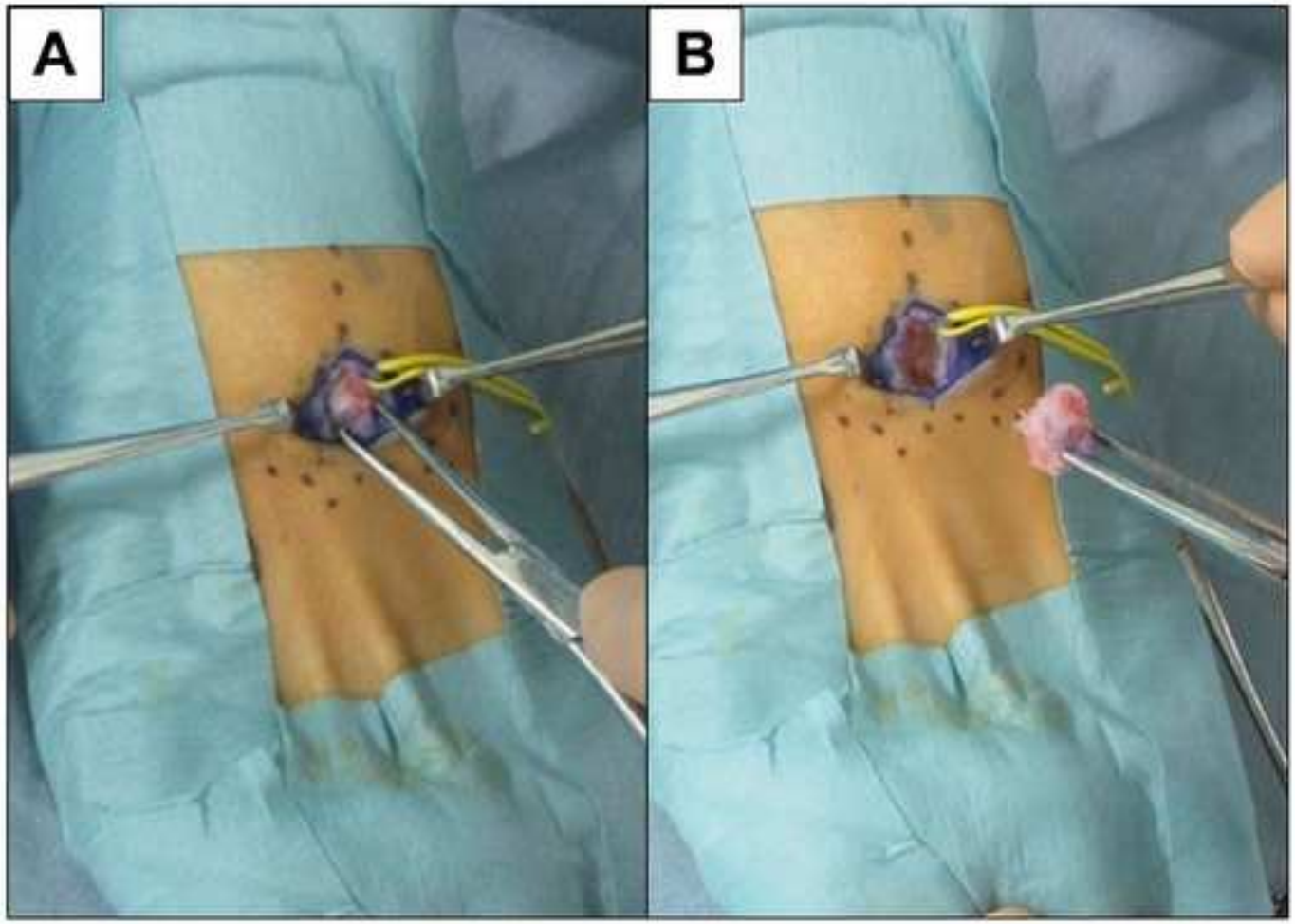


Figure 4

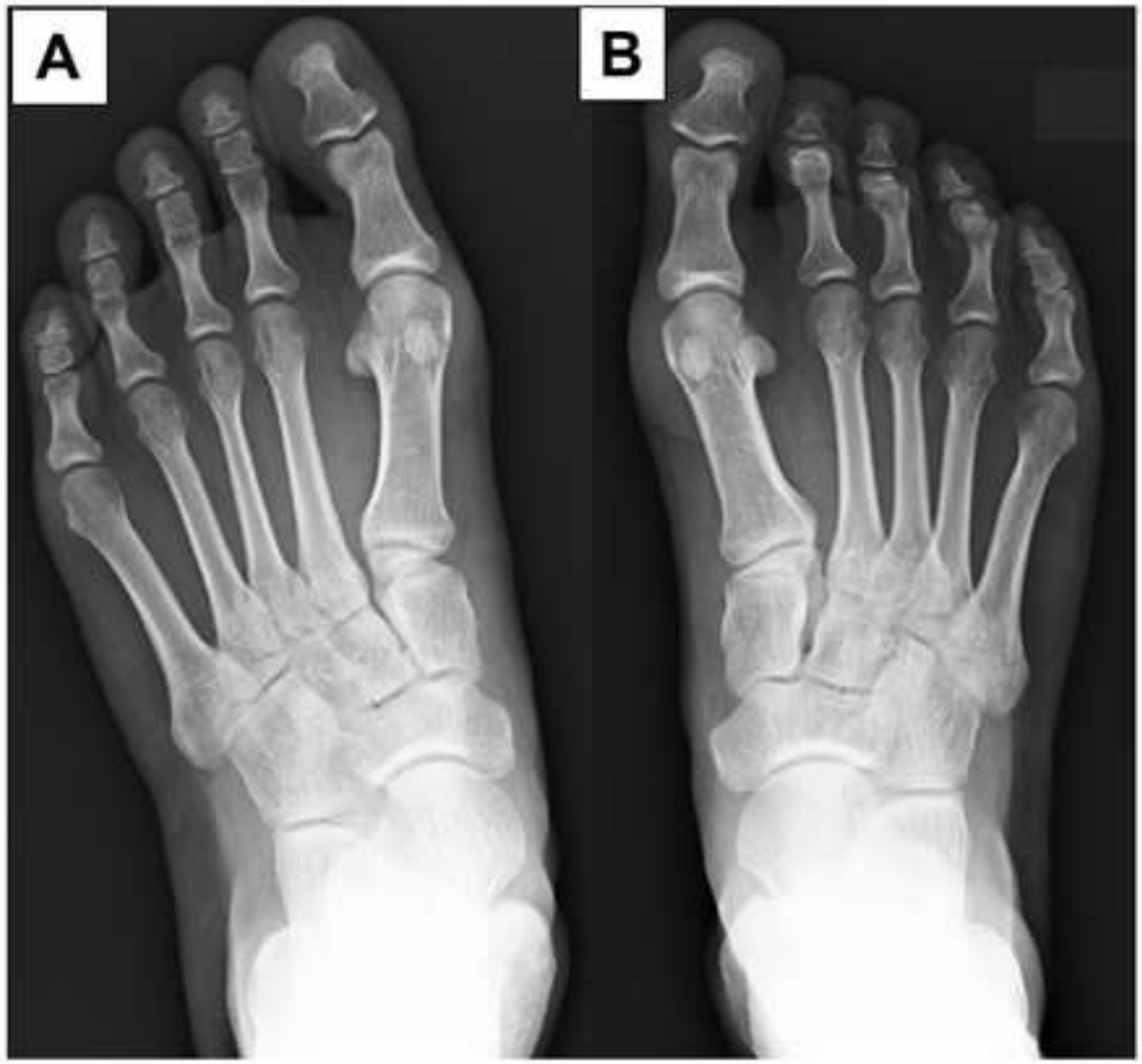


Figure 5

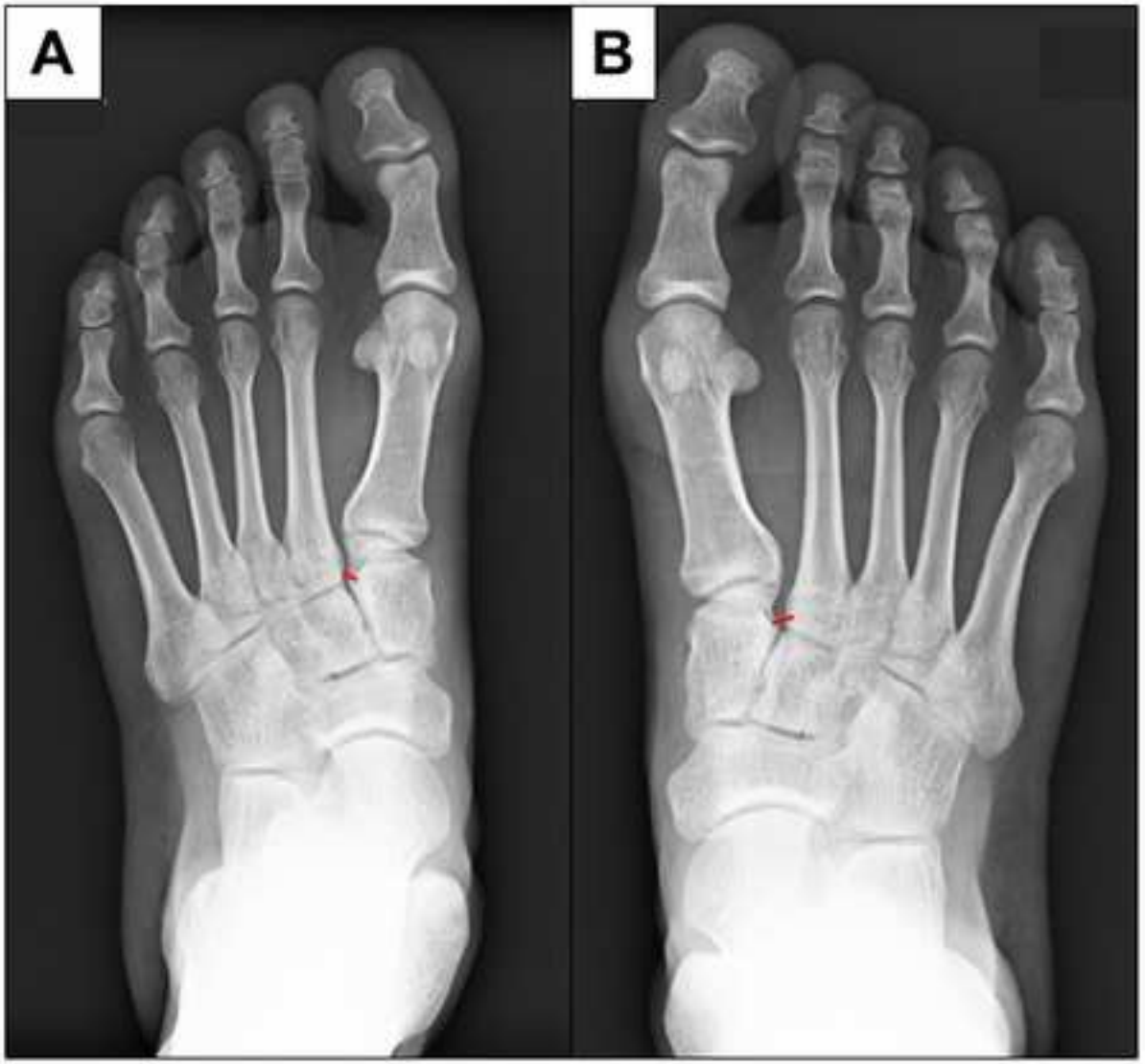


Figure 6