

Os Intermetatarsium: A Rare Variation of Great Relevance

Os Intermetatarsium: Una Rara Variación de Gran Relevancia

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SUMMARY: The os intermetatarsium is an accessory bone located in the foot, usually between the first 2 metatarsals and the cuneiform bone. It can be presented as free, articulated or in a fused fashion. It is a very unusual variation found in less than 13 % of the population. A 27-year-old patient presented to the emergency service due to an ankle lesion. Physical exam showed pain and limited range of motion while supporting partial load. Radiographic imaging showed a bony trace near the base of the first and second metatarsals, diagnosed as the os intermetatarsium. Formation of this supernumerary bone begins as a separate ossification center. Most cases are asymptomatic; however, compression of the deep peroneal nerve branches by the os intermetatarsium can lead to pain. Some authors suggest that the presence of this bone may cause hallux valgus. The intermetatarsium can lead to diagnostic confusion, mainly related to Lisfranc fracture. Its origin is still little understood.

KEY WORDS: Os intermetatarsium; Foot; Anatomical variation; Tarsal bones.

INTRODUCTION

The os intermetatarsium is a small accessory bone situated in the foot between the base of the first and second metatarsal bones but has been reported to occur near the metatarsal heads or between the fourth and fifth metatarsal bases. The intermetatarsium can be divided into three basic types: free, articulated and fused. Most are completely independent, with no joint or bony connections with any of the neighboring bones. Its description was initially conceived by Gruber in 1877, while its description was further expanded by Pfitzner, in 1896 (Nakasa *et al.*, 2007; Chan *et al.*, 2019).

It is a relatively uncommon anatomical variation, with a reported prevalence of around 0.1 % to 12.5 % in the general population (van Aswegen *et al.*, 2020; Kalbouneh *et al.*, 2021). While often asymptomatic, the os intermetatarsium can be associated with pain and other symptoms that can significantly affect quality of life (de Oliveira *et al.*, 2018).

In this context, it is essential to understand the clinical significance of the os intermetatarsium, including its diagnosis, management, and potential complications, to provide effective treatment and care for individuals affected by this condition (Case *et al.*, 1998; Chan *et al.*, 2019).

The treatment for a present os intermetatarsium will depend on the severity of the symptoms experienced by the patient. In many cases, this accessory bone may be asymptomatic and may not require any treatment. For patients who experience pain or other symptoms related to the os intermetatarsium, conservative treatments such as rest, ice, and physical therapy may be recommended. Non-steroidal anti-inflammatory drugs may also be used to manage pain and discomfort (Kose *et al.*, 2014; de Oliveira *et al.*, 2018).

Due to its rarity, the present work aims to report a case of incidental and rare finding of os intermetatarsium in a patient with ankle trauma.

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CASE REPORT

A 27-year-old male patient was admitted to the emergency service complaining of pain at the ankle. On physical examination, painful limitation of range of motion while supporting partial load was found. The leg was painless on examination and deformities in the ankle and foot were not found. A slight perimaleolar edema was found and the neurovascular exam was unremarkable.

The patient complained of a previous pain in the sole of the foot associated with paresthesia between the first and second ray during a soccer match. Radiographic examination of the ankle showed no evidence of dislocations and misaligned fractures. The x-ray showed a bony trace between the base of the first and second metatarsals in the anteroposterior (Fig. 1) and oblique views promptly diagnosed as the os intermetatarsium. The patient was referred to the Foot and Ankle clinic for possible treatment and follow-up.



Fig. 1. Radiographic image of the os intermetatarsium (black arrowhead).

DISCUSSION

The foot is a well-known site for anatomical variations and is one of the most common regions to present supernumerary bones, ranging from 12 to 21 accessory bones (de Oliveira *et al.*, 2018). They are usually derived from the failure of union of secondary ossification centers adjacent to the main bony mass (Keles-Celik *et al.*, 2017). The os intermetatarsium, however, is controversial as it is not exclusively associated with the cuneiform, but it can also possess anatomical relations with the first and second metatarsals, while a case of an os intermetatarsium between the fourth and fifth metatarsals was described (Noguchi *et al.*, 2005; Sakci *et al.*, 2021).

Formation of the os intermetatarsium usually begins as a separate ossification center and can be found by age 2 years in females and age 3 years in males (Trolle *et al.*, 1948). Trolle *et al.* (1948) observed several examples of cartilaginous intermetatarsiums in fetuses over 14 weeks of age, concluding that the intermetatarsium does not ossify along with the digital bones during the prenatal period, but postnatally, as do most of the tarsal bones (Chavali *et al.*, 2012). A genetic component has been suggested, as previous studies showed family members possessing the os intermetatarsium, however, there is insufficient data (Sakci *et al.*, 2021).

As previously stated, this accessory bone can present itself in three categories: freestanding, in which a completely independent ossicle without articular connections with neighboring bones is seen; articulating, in which the bone presents a synovial articulation with the first metatarsal, second metatarsal, medial cuneiform or even with two or three bones; or fused, known to be the rarest type of os intermetatarsium, in which the accessory bone is fused with the base of the first metatarsal, base of the second metatarsal, or the medial cuneiform (Chan *et al.*, 2019). There is divergence regarding which type is more common, a previous study stated that the articulating os intermetatarsium was more prevalent (Sakci *et al.*, 2021), while a recent study found that it was the freestanding (Chan *et al.*, 2019). Although relatively rare, the fused forms are the most easily recognizable, as they tend to form large bone projections directed towards the space between the first and second metatarsus (Noguchi *et al.*, 2005; Sakci *et al.*, 2021).

Even though the os intermetatarsium is often asymptomatic, it can lead to pain depending on the size of the bone. Tenderness may be felt upon palpation of the dorsum of the midfoot in the first intermetatarsal space

due to compression of the peroneal nerves (Smith & Welch, 2010). Moreover, it can lead to injury after local trauma and sports activities, probably due to compression of the deep peroneal nerve. Pes cavus, forced plantar flexion combined with dorsiflexion of the toes, tight footwear and ankle instability exaggerate the symptoms of pain and paresthesias (Candan *et al.*, 2022). In addition, a prominent os intermetatarsium can lead to hallux valgus, as it forces the first metatarsal into varus and deviates the base of the first metatarsal thus contributing to the onset or worsening of hallux valgus (Noguchi *et al.*, 2005; Kose *et al.*, 2014).

An incidental os intermetatarsium should be differentiated from fractures involving the base of the second metatarsal, which can occur in Lisfranc fracture-dislocations, a relatively common injury of the tarso-metatarsal complex which is found after abrupt flexion and forced plantar rotation, especially in high energy accidents (Chan *et al.*, 2019; Kalbouneh *et al.*, 2021).

When symptomatic, os intermetatarsium pain is typically managed by conservative and non-surgical methods such as resting, immobilisation, non-steroidal anti-inflammatory (Noguchi *et al.*, 2005; Chan *et al.*, 2019). and shoe wear modification (Candan *et al.*, 2022). However, in many cases, these methods are not effective, failing to alleviate the patients' symptoms (Trolle *et al.*, 1948). In these cases, it is necessary to remove the ossicle in a surgical environment. It was reported in the study by Nakasa *et al.* (2007), the excision of os intermetatarsium that pressed the deep peroneal nerve, causing pain, in order to alleviate the symptoms. All patients did not complain of any postoperative symptoms and were able to return to work and sport after this intervention.

CONCLUSIONS

The os intermetatarsium, although rare, can lead to confusion in diagnosis and can lead to pain due to nerve compression. Most of the cases are asymptomatic, and the first course is pain management and rest. Due to its rarity, the phylogeny and embryological nature of this accessory bone is little understood, as well as its role in hallux valgus.

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RESUMEN: El os intermetatarsium es un hueso accesorio ubicado en el pie, generalmente entre los 2 primeros metatarsianos y el hueso cuneiforme. Puede presentarse de forma libre, articulada o fusionada. Es una variación muy inusual que se encuentra en menos del 13 % de la población. Paciente de 27 años que acude a urgencias por lesión en tobillo. El examen físico mostró dolor y rango de movimiento limitado mientras soportaba una carga parcial. Las imágenes radiológicas mostraron un rastro óseo cerca de la base del primer y segundo metatarsianos, diagnosticado como os intermetatarsium. La formación de este hueso supernumerario comienza como un centro de osificación separado. La mayoría de los casos son asintomáticos; sin embargo, la compresión de las ramas profundas del nervio fibular en el espacio intermetatarsiano puede provocar dolor. Algunos autores sugieren que la presencia de este hueso puede provocar hallux valgus. El hueso intermetatarsiano puede llevar a confusión diagnóstica, principalmente relacionada con la fractura de Lisfranc. Su origen aún es poco comprendido.

PALABRAS CLAVE: Os intermetatarsium; Pie; Variación anatómica; Huesos del tarso.

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