Sikora-Wiórkowska Agnieszka, Pucułek Małgorzata, Wiórkowski Krzysztof, Konopelko Michał, Porada Dominik. A sesamoid fracture as a cause of foot pain. Journal of Education, Health and Sport. 2017;7(8):965-973. eISSN 2391-8306. DOI http://dx.doi.org/10.5281/zenodo.996197
http://ojs.ukw.edu.pl/index.php/johs/article/view/4880

The journal has had 7 points in Ministry of Science and Higher Education parametric evaluation. Part B item 1223 (26.01.2017).
1223 Journal of Education, Health and Sport eISSN 2391-8306 7

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 05.08.2017. Revised: 10.08.2017. Accepted: 31.08.2017.

A sesamoid fracture as a cause of foot pain

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Conflict of interest: The authors declare no conflict of interest. No honorarium, grant or other form of payment was given to anyone to produce the manuscript.

Introduction: A sesamoid bone is an important element of a foot construction. Its function is to properly distribute weigh while walking and to provide correct amortization. The bone is a point which transfers weight in the central part of a foot and that is why it is more prone to damage because of repeated loads. Sesamoid fracture is most often a stress fracture which is common among athletes.

Case presentation: 22-year-old patient visited the Orthopedist due to constant pain focused in the plantar range of metatarsophalangeal joint in the left foot with swelling which lasted for 2 months. The pain occurred without any injury and it intensified during physical activity, especially walking. On the basis of performed medical imagining (computerized tomography and magnetic resonance) comminuted lateral sesamoid fracture was diagnosed. Unburdening

of foot, cold compresses, physiotherapeutic procedures, kinesiotherapy and intake of non-steroid anti-inflammatory drugs were recommended. Conservative treatment which was used did not provide long-lasting improvement. Surgical interventions were not performed. The patient developed complications due to the abnormal loads of painful foot - locomotion and balance disturbances, pain in the lumbosacral spine.

Results: Despite the fact that stress fracture of the sesamoid most often affects athletes who overload forefoot, it can occur also among people with moderate physical activity. During the diagnostic process precise history and magnetic resonance (MR) ought to be taken. The most sensitive and specific imagining exam is MR. At the beginning patient should be treated conservatively. Sesamoidectomy can be considered only when other treatment methods have failed.

Key words: sesamoid, sesamoidectomy, fracture, physiotherapy, kinesiotherapy

Introduction

A sesamoid bones are bone structures formed on the cartilaginous cartilage, which are partially or fully supported in the tendons. The number of sesamoid bones in the human body may vary, however, the most distinctive and typical occurrence is the patella and sesamoid bones at the metatarsal-phalangeal joint in toes [1]. A sesamoid bones act like a blocks, providing a smooth surface for the tendons that are sliding over them, increasing their ability to carry the force [2]. Foot sesamoid bones are responsible for the correct distribution of pressure when walking, as well as perform a cushioning function. They are the point of transmission of forces in the middle of the foot and are therefore susceptible to damage during the repetitive overloads [3]. The vascularization of sesamoid bones in foot is poor, which results in reduced regenerative capacity of these bones [4]. Their fracture may occur following an injury (e.g. in footballers), but most often it is an overload fracture (eg runners, athletes and dancers) [2,3,5-7].

A case report

The patient at the age of 22 reported to the Orthopedic Clinic in July 2012 because of a persistent, blunt pain for about 2 months on the plantar side of the left foot metatarsophalangeal joint, accompanied by edema. The pain intensified during loading rates, while activities such as walking, dancing, and standing on the tiptoes. She noted that the intensity of the pain depended on the level of activity, but she denied any foot injury. At that time the woman used to walk a lot. In the physical examination, some painful compression,

warming and limitation of mobility in the first metatarsophalangeal joint were fund. No significant pathological changes were observed in the imaging studies (ultrasonography, anterior and posterior ultrasonography). Computed tomography showed a multi-broken fracture of the lateral sesamoid bone of the left foot toe, osteosklerotic remodelling of the bone structure of fractures with unequal outlines without adhesion. Besides, left foot bones showed no pathological changes (Figure 1-3). It was recommended to relieve the left foot, ice compresses, the use of some relief liners for forefoot and taking oral, non-steroidal anti-inflammatory drugs. The patient was directed to the physiotherapeutic treatment (ultrasounds, magnetic field, vortex baths). Due to the lack of a long-term improvement, also steroid blockade was made in the area of the first MTP joint of the left foot. As a result, the pain has subsided for about 2 months. After that time, the symptoms returned with the same intensity. The patient was instructed to continue saving lifestyle, the elevation of the foot and periodic checks at the clinic. The uric acid level was determined, which did not exceed the standard. No new changes have been reported in the ultrasound examinations. In the first quarter of 2013, four shockwave treatments were performed in the patient, which resulted in a 3-month improvement. Because of the recurrence of symptoms, the patient was again subjected to some physiotherapeutic procedures (laser therapy, vortex baths, DD currents, cryotherapy, manual therapy - mobilization and manipulation). The symptoms periodically subsided. Kinesiotaping was included to the treatment to stabilize the painful area. It was commissioned to determine the level of C-reactive protein (CRP), and rheumatoid factor (RF), to give the standard results. Due to the lack of a persistent long-term improvement, a magnetic resonance imaging was commissioned to show a significantly increased amount of fluid in the metatarsophalangeal joint and the fracture gap in the sesamoid bone on the exterior side. Other metatarsal bones showed no abnormalities (Figure 4 -6). In 2014 physiotherapeutic treatment (iontophoresis, laser therapy) was continued. Due to the lack of effectiveness of conservative methods, surgical removal of the cyst (sesamoidectomy) was considered, but due to the risk of irreversible changes in the depreciation of the locomotive force and the associated overloading of the foot structures, other limbs and the spine, the surgery was abandoned after the consultation with the patient. The pain persisted, the quality of life of the sick person worsened. The next visit to the clinic was not related to any therapeutic proposals. In 2016 the patient contacted a physiotherapist, where during the physical examination the hollow foot and the transverse plane were diagnosed. In addition, some molds on the soles of the feet were observed. During the stability study, weakening of the balance mechanisms in the dynamic conditions of the left foot was noticed. A manual therapy procedure was

performed but it did not bring the expected improvement due to persistent pathological changes. The therapy to strengthen the short muscles of the foot and periodic controls were recommended. Because of the persistent and chronic pain, the patient did not strain the left foot, what resulted in overloading of the knee and hip, pelvic and lumbar spine and a change in the gait mechanics. Two years after the sesamoid fracture, a severe pain appeared in the lumbar-spine section of the spine, what was related to an ineffective therapy.

Discussion

A sesamoid fracture is the most common fatigue fracture. It occurs mainly in the bones that carry the weight of the body (mainly in the lower limbs) [6] and develop in situations of the repeated and increased load [8]. With this type of fracture crack, the pain occurs during some physical exercises without any prior injuries [9]. At the beginning it occurs at the end of activity, eventually becoming a continuous pain throughout the entire effort [3,6]. Even after several days of rest, is returns again when attempting to load the foot [6]. Although overload fractures occur mainly in professional athletes, they may also occur in non-professional athletes [3]. During the diagnostic process, an accurate interview is very important [5], because on the basis of it you can put the preliminary diagnosis of fatigue fracture. It is necessary to pay attention to the activity in the patient's lifestyle, occupation, hobbies and the footwear. [3]. Apart from the considerable effort, its repeatability is also important [6]. In the physical examination, swelling, redness, difficulty in bending and straightening of the toes can be observed in addition to pain [2]. Attention should be paid to the presence of calluses, which, like the fracture, is the result of incorrectly decomposed forces in the foot and can form below the sesamoid damaged [3]. During the diagnostic process the gout, degenerative disease, rheumatoid arthritis and inflammation should be excluded[2]. Diagnosis is made with the use of an X-ray, bones scintigraphy, computed tomography (CT) and magnetic resonance imaging (MR) [6]. Despite its low sensitivity, an X-ray imaging is recommended as the first stage of imaging diagnostics. CT is characterized by improved sensitivity, but the most sensitive tests are bones scintigraphy and MR. In the case of scintigraphy, 13-24% of false positive results may occur, and MR has therefore been identified as a test of choice in the case of the sesamoid disease. MR and CT testing can also be used to assess the healing process and the need for an operation [6]. MR and scintigraphy also allow for the distinction between the sesamoid and the congenital malformation in the form of bipartite sesamoid. Before making a therapeutic action, such a distinction should be made. Previously taken X-ray images may also be helpful [3,8]. Asano, Duarte and Silva shared the factors contributing to the

development of fatigue fractures in two groups: internal and external. The external types include: the type and rhythm of training, some bad footwear and the ground used in training, wearing high heels and the insufficient recovery time after the previous fracture [3,6]. Among the internal factors are: age, sex, mass, bones density, hormonal imbalances (eg hypothyroidism), nutrition, metabolism and collagen diseases. There was also an increased risk of Caucasians, seniors and women stated[6]. In addition to these internal factors some defects in the foot structure may be included: high, long arch (hollow foot), flat foot (transverse flat foot), foot heel, reflex, misalignment due to the difference in the limbs length [6,8]. Treatment of the sesamoid fracture is a big challenge, and the conservative treatment is often inadequate [10]. The first step is the conservative therapy that involves relieving the foot, a significant reduce in the physical activity increasing the pressure on the forefoot, and the use of non-steroidal anti-inflammatory drugs, as well as the ice compresses [5, 6, 6]. It is also worth to pay attention to the correction of modifiable risk factors [6]. Patients should be advised to use comfortable footwear, low heels, soft soles, suitably fitted pads, as well as holding the large toe in the neutral position or in the plantar fold to avoid excessive pressure on the dorsiflexion [3]. At this stage, physiotherapy (especially ultrasound) and cineotherapy are used [6,8]. Another way of treatment are the steroid injections administered precisely to the painful area, best under the radiological control [3]. According to some researchers, they should not be used in the case of the sesamoid fracture and ischemic necrosis [11], as in the case described above. Immobilization may also be used in the stabilizer foot (4-6 weeks). [2] or shoe gypsum (6-8 weeks) [6,8]. In the case of ineffectiveness of these methods, the next step is the surgical treatment [6]. The following are applicable: fixation with intramedullary screws - transdermal or open (the method recommended by most authors of medical literature [6], however, it may be difficult to carry out this operation and the recovery time after this surgery is longer [10]); hybrid method (combination of fixation with bone graft) [6]; open bone graft; operational friction of plantar part of patellar (this treatment can provide relief without having to cut the seamoid completely, but it can only be performed if the I of the metatarsal bone has normal mobility [3]); and the total cutout of the sesamoid (sesamoidectomy) [3]. It should be remembered that only one sesamoid bone can be removed, since cutting both would cause significant deformation of the foot and biomechanical dysfunction [3]. Despite obvious benefits after surgery, there are also complications that result in irreversible changes in the foot function [10]. In our patient there was also applied a shock wave therapy. The treatment with this method is considered safe and effective, has analgesic effect, removes calcium deposits and causes disintegration of the fibers, it accelerates

metabolic processes and increases blood supply in the affected area. For example it is used with inflammation of muscles and tendons, tennis elbow or golfer player elbow, chronic pain, arthritis, persistent osteonecrosis [12,13]. A common problem after the treatment of the unresectable sesamoid fracture is the survived nonunion or develop osteonecrosis [5,9,10]. It results in persistent chronic pain of the foot, as in the case described of the patient. In such a situation, the only solution remains the operation [5]. Due to the important function of the sesamoid in proper locomotion, long-term abnormal load distribution, it leads to biomechanical changes in the foot. This causes a change in the deepening arch of the foot, arthritic conditions, to develop calluses. There are also some depreciation disorders during the walk, imbalance, limiting movements in the foot [8,14]. Consequently overloading of the upper joints results in: knee, hip, pelvis and spine in the lumbar-sacral segment, accompanied by significant pain and impaired functioning of the patient [8].

Conclusions

A sesamoid fracture is the most often fatigue fracture. The most important elements of diagnostics are well-documented interviews and imaging studies. Magnetic resonance is the study of choice and is characterized by the highest sensitivity in the diagnosis of the sesamoid disorders. In the initial stage of treatment of the sesamoid feet some conservative methods should be applied. In the absence of their effectiveness, it is worth to consider the method of surgical removal of the sesamoid bones, which can prevent the patient from acting impaired.

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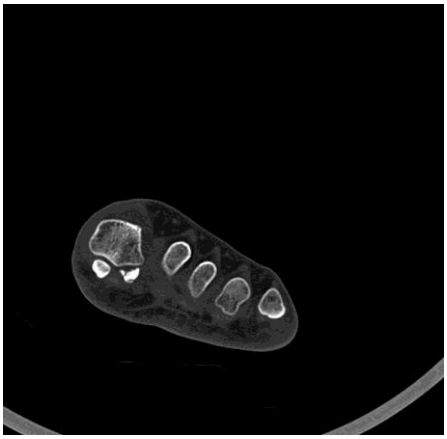

Fig.1. CT scan of the left foot.

Fig. 2. CT scan of the left foot.

Fig. 3. CT scan of the left foot.

Fig. 4. MRI scan of the left foot.

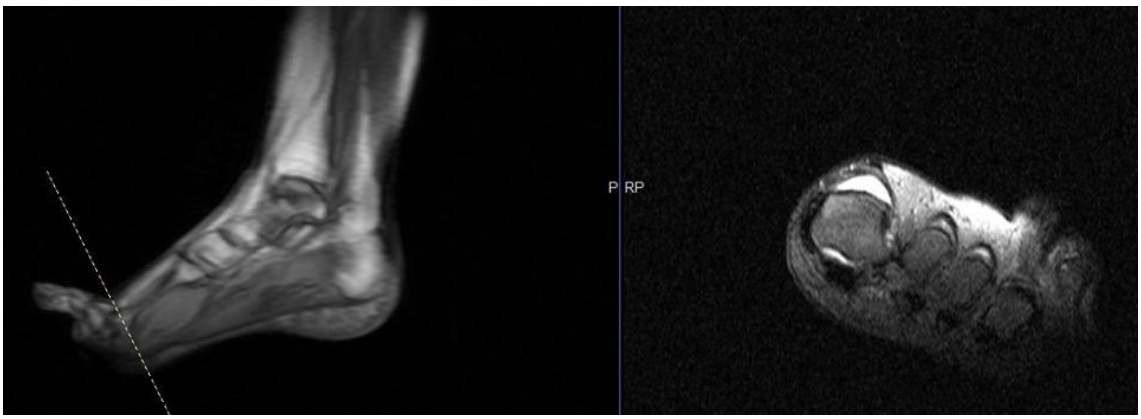

Fig. 5. MRI scan of the left foot.

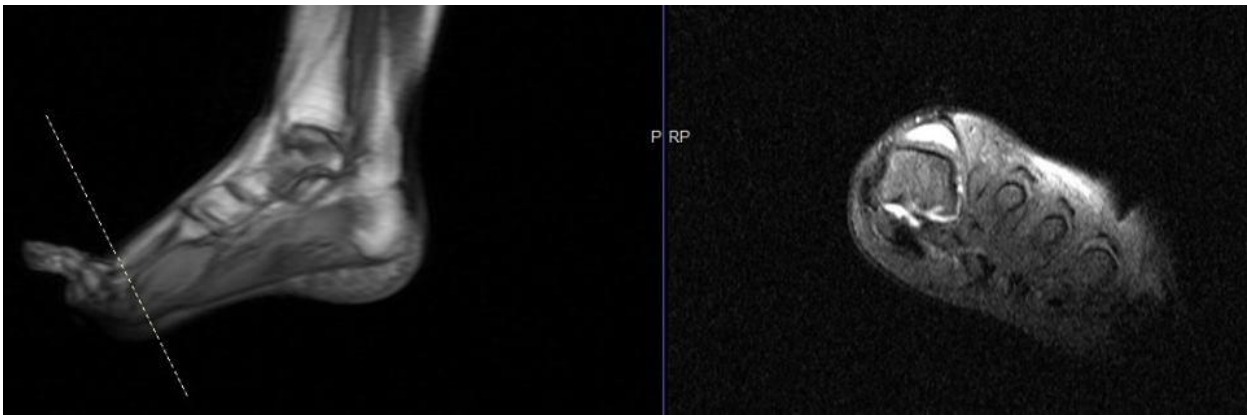

Fig. 6. MRI scan of the left foot.