3 Tesla Magnetic Resonance Imaging Role in Articular Degenerative Pathology

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ABSTRACT: Osteoarthritis is one of the most common degenerative diseases, affecting most of the middle and advanced age population. It is responsible for joint pain, and reduces mobility to functional impotence, thus becoming a public health problem. It is characterized by the destruction of articular cartilage and bone structures forming joints. Although osteoarthritis is considered a disease that occurs predominantly in the elderly, we present herein the case a young female patient, known for pelvic limb inequality and flat leg with advanced arthrosis in the left ankle, secondary to multiple surgical interventions performed at the lower limb. Because of the degenerative phenomena, the patient had reduced mobility, functional impairment and local pain. For the quantification and therapeutic management of degenerative changes produced by this pathology, magnetic resonance imaging (MRI) exploration technique is recommended, allowing visualization of alterations in bone structures and cartilage. This is the standard diagnosis method due to important details on bone structures and cartilages, even in the early stages of the disease. The importance of this case is suggested by the young age of the patient (28 years old) and the advanced stage of the degenerative phenomenon, being rare at this age.

KEYWORDS: Osteoarthrosis, magnetic resonance imaging, degenerative diseases.

Introduction

Osteoarthritis is characterized by the structural destruction of the bone, which leads to a decrease in bone mass, being associated with an increased risk of fracture [1] and represents the main cause of functional impotence and the most common disease translated by degenerative phenomena [2-4].

It is a major problem for public health, considering the side effects translated by the socio-economic impact of patients with osteoporosis [5].

Degenerative phenomena may be primary or secondary. Primary arthrosis occurs primarily in the elderly, mainly in the hand, spine, hip or knee. The secondary causes that may cause degenerative events include inflammatory disorders, dysphasia, hemophilia, traumatic lesions [6-9].

Until recently, articular degenerative disease (arthrosis) was defined by damaging of the articular cartilage, joint stiffness and pain. It was shown that, besides these degenerative phenomena, it also affects the structure of the subchondral and periarticular bone, favoring the occurrence of bone cystic lesions and osteophytes [10].

Being a multi factorial disease, the damage of the articular cartilage to its full degradation is central and contributes to the progression of the disease [11].

Osteoporosis was considered as part of the aging process of the bone, but nowadays it can be prevented and treated. Several strategies have been developed to prevent it, including: good calcium and vitamin D absorption, maintaining optimal body weight, moderate alcohol and tobacco consumption, avoiding bone traumatic lesions [12].

These features of osteoarthrosis are also found in the case presented by us. Although it is a young female patient, degenerative phenomena are advanced in the left ankle, with damage to articular cartilage, narrowing of joint spaces at this level, reduced mobility and functional impairment.

Case Report

A written informed consent was obtained from the patient regarding the publication of this case.

We present a special case of advanced osteoarthritis in a 28-year-old female, known with flat leg diagnose and pelvic limb inequality. The patient presented to the hospital at the beginning of 2018 with left ankle pain and reduced left ankle mobility.

From the medical history, we found that she has undergone multiple surgical interventions in the left lower limb.
The first surgical procedure was 23 years ago to prolong the Achilles tendon, having unequal inferior limbs, when she was 5 years old. At Marie Curie Hospital, 10 years ago, she underwent a surgical intervention of lengthening the left leg with an external fixator Ilizarov and underlying Grice athrodesis.

A year later (2009) she suffered a fracture of the left lateral post-suppressant external fixator with consecutive gypsum immobilization for one month, followed by a surgical procedure for plaque osteosynthesis and eight left tibia screws. 5 years ago, she was surgically reinstated to extract the osteosynthesis material from the tibia.

Currently, following clinical examination, left ankle mobility is considerably diminished, and she cannot reverse and evoke, flexion and extension being performed up to 10 degrees.

The patient performed ankle and knee X-ray (Fig.1) and pango gram (radiography of the whole inferior limb in orthostatism) (Fig.2).

In order to complete the imaging investigation palette, she required a magnetic resonance examination, being the method of choice in this case.
The device used was a Philips 3 Tesla magnetic resonance imaging (3T MRI) with the following features: configuration-cylindrical, type-superconducting, 3T field strength, minimum finished bore L-R diameter (close magnet)-70cm, table capacity-550 lbs, which allows the direct acquisition of sections in all 3 spatial-axial, sagittal and coronal planes.

Following the imaging examination, advanced degenerative changes were noted in the ankle with the disappearance of the talo-calcanean and talo-navicular articular space with ankylosis at this level, with contour irregularities and marginal osteophytes in the bone structures included in the acquisition plan. At the level of tibia and talus, minimal edema is observed (Fig.3). Fibril degenerescence is seen at the level of the deltoide, talo-fibular and calcaneo-fibular ligaments. The long extensor muscle of the fingers has been damaged. It is noted the reduction of tibio-talar, talo-fibular, cuneo-navicular joints such as the presence of loculated fluid at the level of the tibio-fibula-talar joint and infiltration of periarticular fat at this level.

Fig.3. A-MRI ankle, PDW_SPAIR sagittal incidence. B-MRI ankle, T1 coronal incidence

The degenerative ankle changes damaged the bone structures from the entire lower left member, so that the knee joint was damaged to a small extent by edema at the level of the external femoral condyle that extends towards the diaphysis, irregular contours at the level of the tibial insertion of the patellar ligament.

Following the imaging investigations combined with the clinical examination, the orthopedic team recommended a new surgical procedure-osteotomy for shortening, and limiting the inflammation of the left ankle with corticosteroids.

She began infiltration with corticosteroids in the left ankle, which led to the reduction of symptoms at this level, and during the next year, the above recommended surgery will be performed.

Discussion
Arthrosis is the most common degenerative disease causing joint pain, localized frequently in the hip, knee and spine, but can affect any joints, such as in our case, the ankle, which presents certain anatomic, biomechanical and biologic features compared to other joints of the lower limb. Unlike the hip or knee joint, the ankle differs both from the anatomical and metabolic point of view. The articular surface of the ankle is much smaller and its joints are unique. The cartilage of the ankle joint is special, having a thickness of 1-2mm, which gives it a better resistance and stiffness. All of these features explain the rarity of degenerative phenomena at the level of this joint [13].

All structures in the synovial joint are affected, such as the synovium, cartilage and
bone structures that form the joint. From a morpho-pathological point of view, all tissues that form the synovial joint have the ability to initiate and respond to the injuries suffered, so the first affected is cartilage [14,16].

A feature of this degenerative condition is represented by the appearance of osteochondral prominent nodules known as osteophytes. Osteophytes are the result of cartilage and bone development in the attempt to reshape in the joints affected by degenerative phenomena under the influence of humoral and mechanical factors. Although their functional significance is not fully elucidated, osteophyte development may be an indicator of degenerative damage [16-18].

Factors that increase the risk of this disease are represented by age, female gender, obesity, joint injuries, bone abnormalities, occupational and genetic factors. In order to establish the diagnosis of arthrosis, besides the patient's symptomatology, imaging explorations are necessary.

At present MRI is the technique at choice, providing a set of images in three planes: axial, sagittal and coronal including T1 weighted, T2 weighted and fat and water suppression sequences. Depending on these sequences, we can estimate the signal strength of the images and the normal or abnormal bone structures [19]. MRI capacity for assessing bone characteristics has a great potential of rendering fine bone details [9,11].

Thus, MRI exploration is widely used in articular pathology and beyond, being the most accurate method in articular degenerative pathology, besides other classical complementary investigations. The benefits of this investigation are numerous, first of all it is a noninvasive, non-irritant method and offers a favorable impact on the clinical management of this pathology, allows visualization of normal bone tracheals, fat and water distribution and bone edema. But, MRI also has some limitations or disadvantages, of which we mention the high cost of the investigation, prolonged acquisition time, exclusion of claustrophobic patients or patients with metallic devices.

In our case, the development of advanced degenerative phenomena in the bony structures translates imagistically by reduced articular space, osteophyte, edema and articular fluid, being secondary to multiple surgical interventions.

Conclusions

The case of our patient is interesting due to the appearance of degenerative phenomena at young age (28 years old patient). It presents a form of secondary osteoarthritis of multiple surgical interventions in the left inferior limb at an advanced stage, with functional left ankle impotence already installed, with a socioeconomic impact on the quality of life.

Fortunately, this disease can be discovered even in the early stages due to MRI, far superior to classical radiological explorations. The advantages of this investigation are multiple, with increased specificity and sensitivity. Besides detailed articulation images, MRI provides additional details of soft tissue (ligaments, tendons and muscles) as well as details of the bone structure.

Conflict of interest

No conflict of interest to declare.

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