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CASE REPORT

Function of the Infrapatellar Fat Pad and Advanced Hoffa's Disease With Ossification

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Being one of the conditions presenting with patellar pain, Hoffa's syndrome is characterized with inflammation of the fat tissue in the patellar region. In advanced stage, this may lead to transformation of the fibrocartilage tissue and ossification of the infrapatellar fat pad. Some cases can be associated with tumors or tumor-like conditions. In this article, we describe a 72-year-old female case suffering from knee pain for a long time and discuss the end-stage Hoffa's disease and function of the infrapatellar fat pad in the light of literature.

Keywords: Hoffa's syndrome; infrapatellar fat pad; ossification.

Hoffa's disease (or Hoffa's fat pad syndrome) is a clinical condition, which develops as a result of impingement of the infrapatellar fat pad (IFP) between the femorotibial and femoropatellar spaces after inflammation and edema, and may cause knee pain.[1] It generally begins with trauma at early ages. This condition can be confused with frequent meniscal pathologies of the knee joint. The infrapatellar fat pad is one of the three pads located on the anterior knee together with quadriceps and prefemoral fat pads.[2] It is a tissue with known biomechanical functions. However, its endocrine functions are not fully understood.[3]

Wicham et al.[4] showed that the IFP contains multipotent root cells capable of changing into chondrocyte, osteoblast and adipocyte cells under suitable culture conditions. In recent years, many radiologists and clinicians have been working on the development of IFP into metaplasia and chondroma due to these mesenchymal cells.[4] Recurrent acute traumas, micro-traumas and surgical procedures on the knee joint may cause hypertrophy following inflammation of the IFP. In chronic phase, this may lead to transformation of the fibrocartilage tissue and ossification of the IFP (imitating enchondroma).[5-7]

This case study aims at presenting a Hoffa's syndrome patient who suffered a trauma on the anterior knee years ago and developed advanced ossification of tissue together with anterior knee pain in the course of time.

CASE REPORT

A 72-year-old woman presented to our clinic with complaint of pain in both knees, which was more pronounced in the right knee lasting for 20 years. The patient had a history of a fall, which occurred nearly 40 years ago. Once presented

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with a swollen knee, the patient admitted to an orthopedic outpatient clinic and was operated.

The patient had no complaints after the operation, however, he later developed pain in the anterior right knee joint, which responded to treatment with non-steroidal anti-inflammatory drugs (NSAIDs). The patient participated in numerous physical therapy programs to-date with the diagnosis of bilateral gonarthrosis (more marked in the right).

In the physical examination, the patient had an incision scar on the right knee. A difference of 5 cm was found in the right calf compared to the left calf. The right quadriceps muscle had an atrophic appearance. Palpation revealed no effusion. Active flexion of the right knee joint was limited to 110 degrees, and the end of the movement was painful. The right knee joint was capable of full active extension. Bilateral crepitations were present. Anteroposterior view of the X-ray scan showed joint space narrowing and coarse osteophytic formations predominately involving the medial compartment (Figure 1). A right lateral radiograph revealed opacity in the suprapatellar region and an ossific focus measuring 2.25 cm on the longitudinal axis and 2.75 cm on the horizontal axis, located in IFP (Figure 2). Magnetic resonance imaging (MRI) of the right knee showed increased fluid in the suprapatellar bursa and joint. There were loose body formations in the suprapatellar bursa and joint, and a smooth contoured lesion that was hypointense to muscle in the IFP (Figure 3). Routine biochemistry tests showed no abnormalities. The erythrocyte sedimentation rate was 43 mm/h, considered normal for the patient's age. Based on her medical history, physical examination and imaging findings, the patient was evaluated to have advanced Hoffa's disease developing secondary to past trauma or surgery, considering also the ossific focus later forming in the IFP region. Orthopedic consultation was requested. Surgery was recommended. However, medical treatment and physical therapy program was initiated for long-term monitoring, as since the patient did not have severe symptoms and did not consent to surgery. In the course of time, the patient's symptoms relieved.

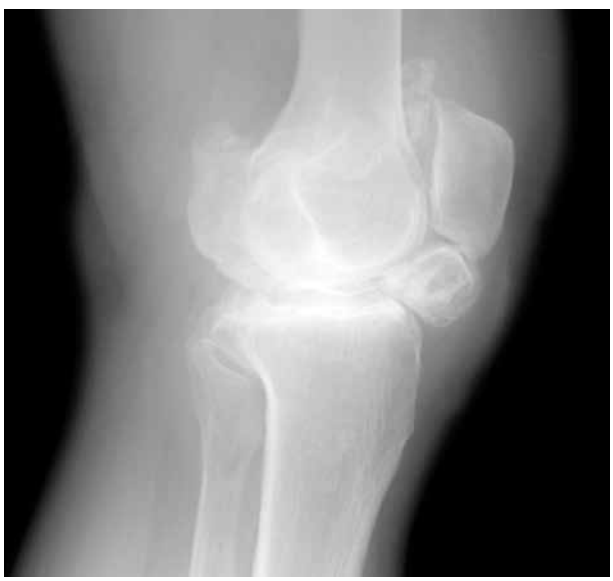

Figure 1. Right lateral knee X-ray showing osseous lesion in infrapatellar fat pad, opacities consistent with calcified loose body in the suprapatellar bursa, narrowing of the knee joint space, and osteophitic changes in femoral condyles and tibia.

DISCUSSION

Infrapatellar fat pad becomes impinged on the anterior knee, leading to Hoffa's disease, which presents with pain, dysfunction and effusion.[2] The main function of the Hoffa's fat pad is not fully understood. It is considered to be associated with knee kinetics and patellar

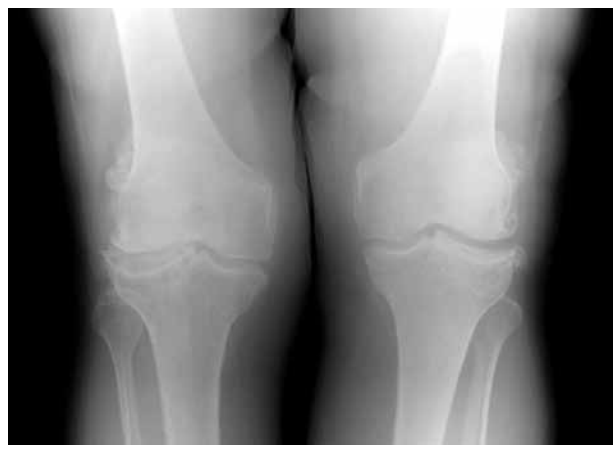

Figure 2. Anteroposterior knee X-ray showing osseous lesion in infrapatellar fat pad, opacities consistent with calcified loose body in the suprapatellar bursa (in the right knee), narrowing of the knee joint space, and osteophitic changes in the femoral condyles and tibia.

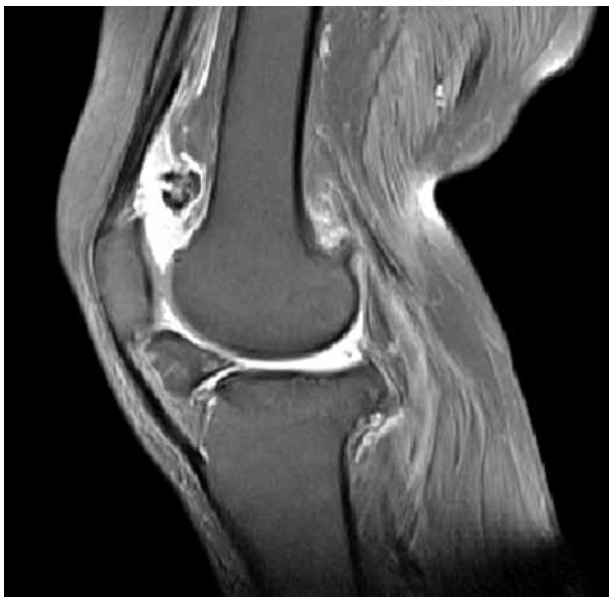

Figure 3. Sagittal T_2-weighted magnetic resonance image of the knee showing distension and distortion in Hoffa's fat pad; a smooth contoured lesion in the infrapatellar fat pad that is hypointense to muscle and isointense to tibia and femur; increased fluid in joint space and suprapatellar bursa; a lesion consistent with loose body in the suprapatellar bursa that is isointense to muscle in the center and hypointense in the periphery; meniscus and knee joint space.

biomechanics,[3] express algesic molecules such as the substance P, and cause pain in the anterior knee compartment.[8]

In the acute phase of Hoffa's syndrome, inflammation occurs following impingement, fibrin-hemosiderin builds up in macrophages and degenerative lipocytes develop. In the chronic phase, massive fibrosis and scar tissue formation is observed. During this phase, Hoffa's disease causes transformation of fibrocartilaginous tissue and ossification of degenerative IFP tissue (imitating soft tissue chondroma).[5-7] There are different names for the mineralized lesions of IFP in the literature. These include Hoffa's disease, IFP ossification, solitary intra-articular chondroma, acquired intra-articular osteochondroma, intracapsular chondroma, para-articular chondroma/osteochondroma and capsular osteoma.[9]

In Hoffa's syndrome, there is increased T_2 sequence signal due to edema and hemorrhage in MRI during the acute phase; and fibrin and hemosiderin build-up during the chronic phase. This is visualized as reduced T_1 and T_2 signals and a hypointense image on MRI. Magnetic resonance imaging also shows reduced signal activity in case of ossification. Therefore, X-ray findings are critical for the differential diagnosis. Intracapsular chondroma appears as a heterogeneous mass on MRI. Chondroid matrix and edema generate high signals, while signals are reduced with ossification.[10] The relationship between osteochondroma and Hoffa's syndrome is not yet clear. The most likely explanation is the following: IFP, which contains multipotent stromal cells, exercises which has a promoter effect due to impingement following recurrent traumas. This leads to differentiation into osteochondroma, which is however rare.[9]

A study by Ushiyama et al.[11] showed that this IFP has endocrine functions. It was found that cytokines involved in chondrocyte metabolism are produced in IFP, such as the basic fibroblast growth factor, vascular endothelial growth factor, tumor necrosis factor-alpha and interleukin-6. Basic fibroblast growth factor and vascular endothelial growth factor, which have a specific mitogenic effect on endothelial cells, were identified to be also present in osteoarthritic cartilage tissue in humans.[11] They may change gene expression depending on environmental conditions. The IFP contains these root cells which can transform into adipocyte cells containing chylomicron and releasing leptin, chondrocyte cells synthesizing the cartilage matrix and osteoblast cells that mineralize, depending on environmental conditions.[4]

Turhan et al.[9] presented a young patient diagnosed with Hoffa's syndrome. In this case, there was a history of trauma dating back to seven years ago, and an X-ray scan revealed ossific focus in the infrapatellar region. T_2-weighted MRI images showed a lesion with heterogeneous intensity in this region. In the post-surgical histological examination of this structure, extrasynovial osteochondroma was reported in the IFP since the well-differentiated osteocartilaginous tissue was surrounded by fibroadipose tissue and contained hemosiderin pigments.

Singh et al.[2] identified Hoffa's syndrome in a 55-year-old man who had anterior knee pain. They reported findings consistent with ossified enchondroma after post-surgical histopathological examination of the dissected material.

Ghate et al.[12] found a ganglion cyst in one patient, hemangioma in one patient and intra-articular cystic lesion in the medial region originating from IFP in another patient, as a result of post-surgical histopathological examinations in the Hoffa's syndrome case series.

In our case, there was a history of trauma and surgical intervention. The patient complained about pain in the anterior knee in time, which was alleviated with numerous physical therapy programs. Based on the anamnesis, physical examination and imaging methods, the patient was diagnosed as having advanced Hoffa's syndrome with ossification seen in the X-ray scan. The patient did not consent to surgery although it was recommended. As a result, histological examination was not possible. This can be considered a limitation. However, considering the hypointense lesions observed on MRI, ossified chronic-stage Hoffa's syndrome can also be mentioned. As aforementioned, considering the role of IFP in the release of various cytokines, fibrosis on the cartilage tissue and the degenerative process, it may be possible to explain the findings in favor of a more advanced stage of osteoarthritis in the patient's right knee.

In conclusion, Hoffa's disease, which presents with inflammation in the IFP mostly after trauma or surgical interventions, is a rare condition and may not be considered at first. Often presenting with pain in the anterior knee, this condition may accelerate the degenerative process in the joint and transform into tumors or other pathologies. Further large-scale studies are required to establish a conclusion.

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