

SOFT TISSUE CHONDROMA OF HOFFA'S FAT PAD

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We report multimodal imaging findings of an extraskeletal chondroma of the Hoffa's fat pad. Plain radiographic or CT scan studies demonstrate a large soft tissue mass with calcifications and central ossification, characteristic features of these tumors. Magnetic resonance (MR) imaging shows heterogeneous signal due to polymorphic histopathological appearance. Correlation between MR imaging and plain film or CT findings is essential to restrict differential diagnosis. The knowledge of this particular pathology is the key to the diagnosis.

Key-word: Chondroma.

Case report

A 64-year-old female presented with chronic pain at the anterior and inferior part of her right knee. There was no history of relevant trauma.

Initial MRI showed a well delimited mass lesion (4 × 2,7 × 4,6 cm) in the infrapatellar fat pad (IFP), displacing the patellar tendon forward. On T1-weighted spin-echo (SE) sequence, signal intensity was mostly intermediate (similar to adjacent muscle) (Fig. 1A) with some areas of high signal, corresponding to fatty bone marrow. On T2-weighted spin echo sequence, signal intensity was overall high, corresponding to chondroid matrix (Fig. 1B). On both sequences, curves of very low signal were related to calcified or ossified parts. Enhancement areas were seen on fat-suppressed (FS) T1-weighted after intravenous contrast administration (Fig. 1C).

A lateral radiograph of the knee (Fig. 2) showed an infrapatellar ossified mass, independent from adjacent bony structures.

Ultrasound revealed a well defined hypoechoic lobulated mass with central hyperechoic linear interfaces due to focal ossifications (Fig. 3).

On CT, the lesion contained central and peripheral areas of ossification and several zones of calcification surrounded by hypodense tissue (Fig. 4).

Based on these morphological features, the diagnosis of a soft tissue chondroma was made, which was confirmed by surgical resection and histological examination. A well-circumscribed cartilaginous mass was found, surrounded by a capsular fibrous tissue, and mostly composed of chondrocytes and areas of ossification. The microscopic examination revealed focal areas of myxoid

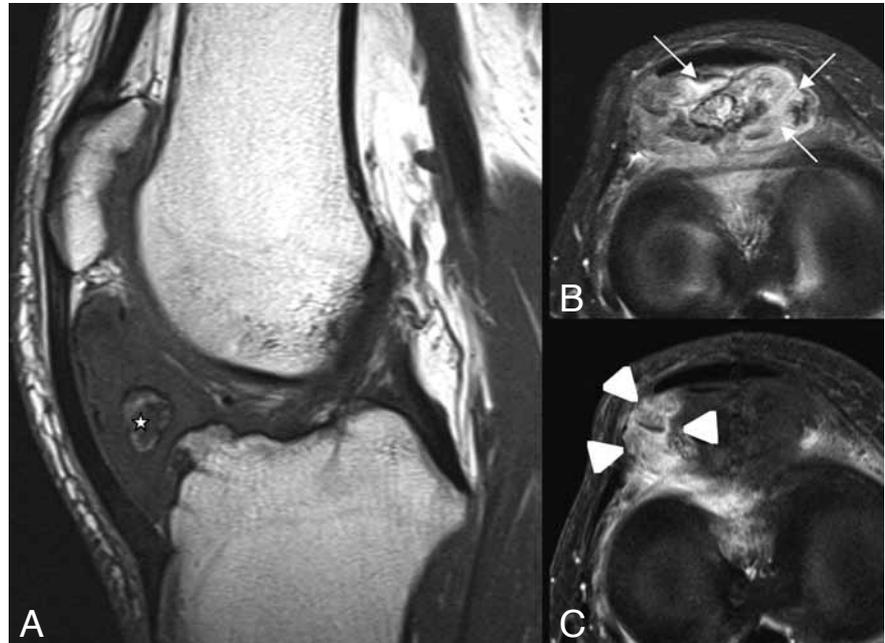


Fig. 1. — Sagittal T1-weighted SE MR-sequence (A) revealed a well delimited mass of the Hoffa's fat pad with polymorphic features: global low signal, isointense to muscle, and high intensity signal areas corresponding to medullary bone (white star). This mass provoked a bulge of the patellar tendon. Axial T2-weighted image (B) showed the high T2-signal of the cartilaginous component of the soft tissue chondroma (white arrows). Axial T1-weighted post-gadolinium (C) revealed some enhancement areas in the mass (white arrow-heads).

change but no sign of atypia. Surgical excision was performed and the follow-up was uneventful.

Discussion

Chondroma are benign tumors arising mostly from bones (enchondroma – osteochondroma or exostosis), infrequently in the soft tissues (hand, feet) and rarely in para articular location, most often the knee (1, 2). Three well defined anterior extrasynovial fat pads are described within the knee: two suprapatellar,

and one infrapatellar (infrapatellar fat pad - IFP), the Hoffa's fat pad (3, 4). The IFP is most frequently involved in this rare occurrence of extrasynovial intracapsular chondroma.

The pathogenesis of this tumor is unclear. Para-articular chondroma, also known as extraskeletal chondroma or soft tissue chondroma, may be a result of metaplasia from mesenchymal cells (2). Some authors consider it as the end stage of Hoffa's disease (5) resulting from acute or repetitive trauma related to hyperextension, rotational sprains and also genu recurvatum. First, trauma induces inflammation and hemorrhage. Secondly hypertrophy of the inflamed fat pad predisposes to crushing and impingement

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Fig. 2. — Lateral radiograph of the knee well demonstrated arc-like calcifications and ossified areas (black arrow-heads) in the infrapatellar fat pad, corresponding to variable endochondral ossification predominant in the central areas of the lobulated mass.



Fig. 3. — Ultrasound showed a well delineated hypoechoic tissue corresponding to the cartilaginous component of the soft tissue chondroma, with peripheral and central hyperechoic areas due to peripheral calcifications and central focal ossification (white arrows) observed on radiographic image (Fig. 2).

between the tibia and femur. Fat pad impingement may also occur in absence of prior trauma. At chronic stage, the hypertrophied fat pad is colonized by fibrous tissue which may be transformed into fibrocarti-

lagous tissue. At MRI, soft tissue chondroma may show enhancement after gadolinium IV injection, probably linked to chronic inflammatory mechanisms. Enhancement does not imply malignant transformation.

Histologically, soft tissue chondroma appears as a lobulated mass of hyaline cartilage with variable endochondral ossification (mature trabecular bone) in the central areas. Fibrocartilage, myxoid areas and fibroadipose tissue are equally observed in variable proportion, accounting for the heterogeneous and variable MR appearance.

The literature describes many IFP tumors or tumor-like lesions such as primary or secondary synovial chondromatosis, synovial sarcoma, para-articular chondroma, Hoffa's syndrome, focal pigmented villonodular synovitis, chondrosarcoma, lipoma, ganglion cysts and hemangioma (4). On isolated MR imaging, differential diagnosis is large. Correlation of MR imaging appearances with plain film (6) or CT findings is essential to delineate the degree of ossification, and to restrict the differential diagnosis to para-articular chondroma, synovial chondromatosis or synovial chondrosarcoma. Ultrasound is not conclusive for the diagnosis.

Synovial chondromatosis is a non-neoplastic proliferative and metaplastic pathology of synovium, characterized by intra- or extra-articular multiple nodules consisting in chondrocyte clusters with some ossification (7), rather than a single mass. These nodules are not confined to the IFP (popliteal fossa – suprapatellar recess) (2).

Synovial hemangioma is an intraarticular tumour. Fat-pad or soft tissues invasion can occur but without significant mass effect, unlike soft tissue chondroma (3). Phleboliths can be associated but are easily differentiated from chondroma calcifications or ossifications.

Soft tissue chondrosarcoma is extremely rare, arising "de novo" in most of cases: only twelve per cent of all chondrosarcomas are developed in a pre-existing lesion (e.g. soft tissue chondroma or osteochondroma, enchondromatosis (Ollier's disease), fibrous dysplasia, Paget's disease, irradiated bone or synovial chondromatosis) (8). High-grade tumours show irregular margins. Calcifications of the tumoral matrix may be punctate, flocculent, or have a ring-like pattern, they can be small, or disseminated, dense or subtle (8). Their absence is frequent in aggressive types. Differential diagnosis with benign chondroma is very difficult, most often impossible. Stippled calcifications, irregular, thin or cobweb-like calcifications, rather than regular arciform calcification or

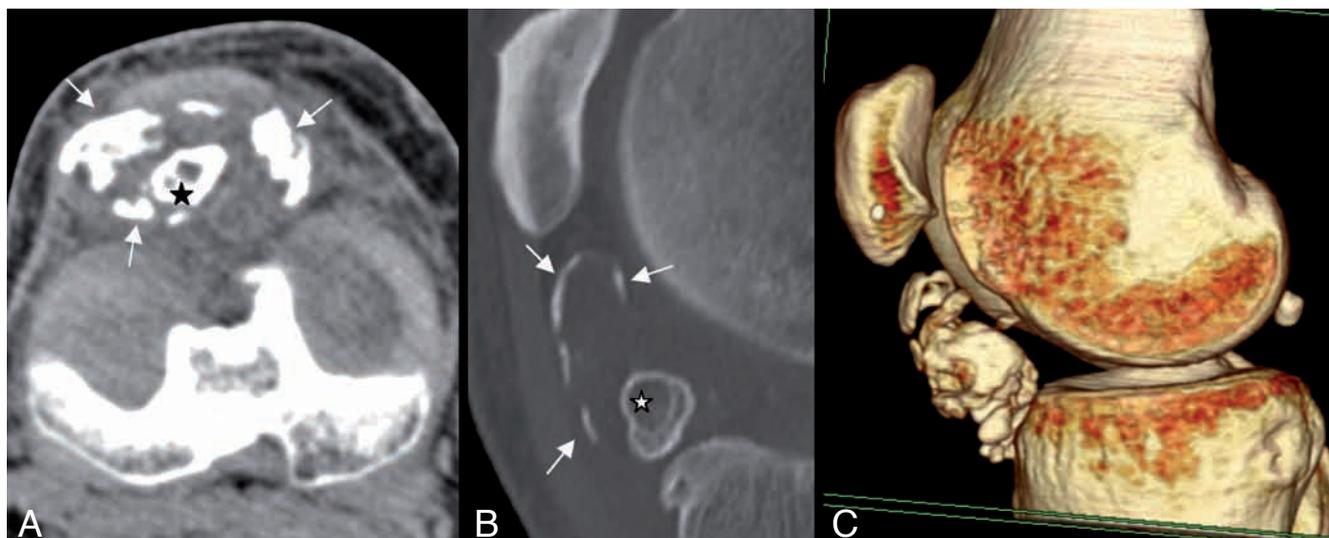


Fig. 4. — Axial CT series (A) demonstrated loss of fat density of the Hoffa's fat pad and showed a soft tissue lesion with peripheral calcifications (white arrows) and central trabecular ossification area (black or white star). (B) MPR sagittal view, bone window. 3D volume rendering image (C) is helpful for surgical treatment planning.

well delimited ossification areas, can be suspected of malignant transformation. Ill defined lesion with blurred margins on MR or CT series must be alarming.

MRI is an efficient imaging modality to characterize soft tissue tumors but will not always allow differentiating malignant from benign lesions with absolute certitude (9). Resection and histological analysis help to obtain the final diagnosis, showing signs of malignancy like increased cellularity and atypical cells.

Conclusion

IFP chondroma is a rare entity with specific imaging features, especially on conventional plain films and CT. The knowledge of this particular pathology is the key for the diagnosis and the differential diagnosis. In case of MR first imaging, correlation with plain film or CT findings is essential to delineate the

degree of ossification and to restrict the differential diagnosis. Musculoskeletal pain assessment should always start with conventional plain film imaging.

References

1. Maheshwari A.V., Jain A.K., Dhammi I.K.: Extraskeletal paraarticular osteochondroma of the knee – a case report and tumor overview. *Knee*, 2006, 13: 411-414.
2. Helpert C., Davies A.M., Evans N., Grimer R.J.: Differential diagnosis of tumours and tumour-like lesions of the infrapatellar (Hoffa's) fat pad: pictorial review with an emphasis on MR imaging. *Eur Radiol*, 2004, 14: 2337-2346.
3. Jacobson J.A., Lenchik L., Ruhoy M.K., Schweitzer M.E., Resnick D.: MR imaging of the infrapatellar fat pad of Hoffa. *Radiographics*, 1997, 17 (3): 675-91.
4. Saddik D., McNally E.G., Richardson M.: MRI of Hoffa's fat pad. *Skeletal Radiol*, 2004, 33: 433-444.
5. Turhan E., Doral M.N., Atay A.O., Demirel M.: A giant extrasynovial osteochondroma in the infrapatellar fat pad: end stage Hoffa's disease. *Arch Orthop Trauma Surg*, 2008, 128: 515-19.
6. Van Dyck P., Gielen J., Vanhoenacker F.M., De Schepper A.M., Parizel P.M.: Imaging of soft tissue tumors: general imaging strategy and technical considerations. *JBR-BTR*, 2006, 89: 204-224.
7. Gonzales-Lois C., Garcia-de-la-Torre P., SantosBriz-Terron A., Vila J., Manrique-Chico J., Martinez-Tello J.: Intracapsular and para-articular chondroma adjacent to large joints: report cases and review of the literature. *Skeletal Radiol*, 2001, 30: 672-676.
8. Ollivier L., Vanel D., Leclère J.: Imaging of chondrosarcomas. *Cancer Imaging*, 2003, 4:36-38.
9. Gielen J.L., De Schepper A.M., Vanhoenacker F., Parizel P.M., Wang X.L., Sciote R., Weyler J.: Accuracy of MRI in characterization of soft tissue tumors and tumor-like lesions. A prospective study in 548 patients. *Eur Radiol*, 2004, 14: 2320-2330.