Enlarging knee masses

Hatem Mawi¹ · Denis Gravel² · Joel Werier³ · Zaid Jibri¹

Received: 16 April 2021 / Revised: 25 June 2021 / Accepted: 30 June 2021 / Published online: 8 July 2021
© ISS 2021

1. Diagnosis

Intra-articular fat-forming solitary fibrous tumor

2. Discussion

In this case, the initial MRI demonstrated multiple lobulated intra-articular soft tissue masses throughout the right knee, including the suprapatellar recess, Hoffa's fat pad, and posterior knee (Fig. 1). These were relatively well-defined lesions showing intermediate to high signal on the fluid-sensitive sequences with associated prominent flow voids, in keeping with collateral vessels. There were areas of high signal on proton density sequences that demonstrate suppression on the fat-saturated sequences consistent with intralesional fat (Fig. 1). One of the lesions also demonstrated scalloping of the underlying bone secondary to the local mass effect. T2 gradient-echo images did not demonstrate blooming within the lesion. Ultrasound-guided biopsy was subsequently performed. Histopathologic examination revealed spindle cell neoplasm within a fibrous stroma, prominent vascular component, and perivascular hyalinization. The cells were strongly immunoreactive to STAT 6 with staining of CD34. The features were consistent with solitary fibrous tumor (SFT). A follow-up MRI (20 months after the initial scan) was performed prior to planned surgical resection and showed interval enlargement of the known tumor masses

(Fig. 2). After reviewing the tumor biology, rate of progression, and following multidisciplinary discussion, surgical resection of the anteromedial and lateral soft tissue masses was performed for regional oncologic and symptomatic control. The surgical pathology specimen revealed the presence of adipose tissue among the other features of SFT noted in the prior biopsy (Fig. 3). The overall findings were consistent with fat-forming SFT.

Solitary fibrous tumors are rare ubiquitous spindle cell neoplasms of mesenchymal origin [1]. They have been reported in the pleura and several extra-thoracic locations including the abdominal cavity, the extremities, and head and neck [2]. The vast majority of solitary fibrous tumors are benign however approximately 12–22% are malignant [3]. These tumors commonly present in the fifth and sixth decades of life without gender predilection [3]. Although typically asymptomatic, they may present with signs and symptoms related to mass effect on adjacent structures and can also be associated with hypoglycemia secondary to the secretion of insulin-like growth factor [4].

On MRI, most solitary fibrous tumors are typically well circumscribed and present as a single mass. They demonstrate intermediate signal on T1-weighted images and heterogeneous intermediate to high signal on T2-weighted images [4]. The presence of a T1 high signal corresponding to intralesional fat has been previously recognized on MRI in a minority of cases [4]. Intralesional fat was demonstrated in this case and it is seen in the rare fat-forming variant of SFT [5]. Flow voids consistent with perilesional/collateral vessels can be seen in large lesions and these are characteristically vascular tumors, which show avid enhancement after the administration of IV contrast, as demonstrated in this case [1]. Intra-articular SFT is a rare but recognized entity with previously reported case that also involved the knee in which the tumor was multifocal as in the presented case [6].

Histologically, SFTs are composed of spindle cells with a fibrous background, often in a whorled or patternless distribution [3]. The tumors are classically highly vascular, and the nuclei generally show no significant mitoses [3]. The diagnosis is confirmed by characteristic positive

The case presentation can be found at <https://doi.org/10.1007/s00256-021-03859-9>

✉ Zaid Jibri
zaid.jibri@icloud.com

¹ Department of Medical Imaging, Department of Radiology, The Ottawa Hospital, Ottawa, ON K1H 8L6, Canada

² Division of Anatomical Pathology, The Ottawa Hospital, Ottawa, ON, Canada

³ Department of Surgery, The Ottawa Hospital, Ottawa, ON, Canada

Fig. 1 Initial right knee MRI including **a** and **b** sagittal T2FS, **c** sagittal PD, and **d** axial PDFS images demonstrating multifocal intra-articular masses associated with several flow voids compatible with collateral vessels (arrowheads). The masses are heterogeneous with intermediate to high signal on these fluid-sensitive sequences. Areas of high signal on PD that demonstrate suppression on the fat-suppressed sequences compatible with intralesional fat (arrows)

immunohistochemical staining for CD34 and negative staining for S-100 [1]. The STAT6 immunohistochemical marker is considered highly sensitive and specific for solitary fibrous tumor and highly useful in distinguishing solitary fibrous tumor from other histologic mimics [6].

As per the imaging findings, the main initial differential diagnosis in this case was a tenosynovial giant cell tumor (pigmented villonodular synovitis). However, in this entity, the characteristic MRI findings include intermediate to low T1, predominantly low T2 signal, and pathognomonic blooming artifact on gradient echo secondary to hemosiderin deposition, and the latter was not demonstrated in this case [7]. Other potential imaging differential considerations

include hemangioma, intra-articular liposarcoma, synovial sarcoma, and non-neoplastic entities such as gouty tophi [8, 9]. Albeit rare, SFT (including the fat-forming variant) should also be included in the differential given the resemblance of imaging characteristics to the more common extra-articular counterpart. Typically, a biopsy is required for a definitive diagnosis.

In summary, this case highlights that fat-forming solitary fibrous tumor needs to be at least suspected based on the MRI appearances and should be considered in the differential diagnosis of hypervascular fat-containing intra-articular masses of the knee.

Fig. 2 Follow-up (20 months) MRI images of the right knee including **a** sagittal PD, **b** axial T1, and **c** sagittal fat-suppressed T1 post-IV gadolinium, demonstrating interval enlargement of the intra-articular masses with heterogenous enhancement post-IV contrast. Note the T1 high signal intensity within the masses compatible with intral-
esional fat (arrows)

Fig. 3 Histopathology photomicrographs. **a** Well-circumscribed tumor predominantly composed of adipose tissue (hematoxylin–eosin, 40 $\times$). **b** Fibrous area with spindle cells and underlying collagenous stroma. A branched vascular space reminiscent of hemangiopericytoma and some adipocytes are also demonstrated (hematoxylin–eosin, 100 $\times$). **c** Spindle cells and small vessels with perivascular hyalinization (hematoxylin–eosin, 200 $\times$). **d** STAT-6 immunohistochemical stain shows strong nuclear staining (400 $\times$)

Author contributions **Dr. Hatem Mawi** Performing the primary literature search Primary writer of the article Final approval of the version to be published Agree to be accountable for all aspects of the work if questions arise related to its accuracy or integrity **Dr. Denis Gravel** Editing and writing of the article Final approval of the version to be published Agree to be accountable for all aspects of the work if questions arise related to its accuracy or integrity **Dr. Joel Werier** Editing and writing of the article Final approval of the version to be published Agree to be accountable for all aspects of the work if questions arise related to its accuracy or integrity **Dr. Zaid Jibri (Corresponding author)** Performing literature search Writing and editing the article Final approval of the version to be published Agree to be accountable for all aspects of the work if questions arise related to its accuracy or integrity

Declarations

Conflict of interest The authors declare no competing interests.

References

1. Ginat DT, Bokhari A, Bhatt S, Dogra V. Imaging features of solitary fibrous tumors. *AJR Am J Roentgenol*. 2011;196(3):487–95.
2. Luciano C, Francesco A, Giovanni V, Federica S, Cesare F. CT signs, patterns and differential diagnosis of solitary fibrous tumors of the pleura. *J Thorac Dis*. 2010;2(1):21–5.
3. Ronchi A, Cozzolino I, Zito Marino F, Accardo M, Montella M, Panarese I, et al. Extrapleural solitary fibrous tumor: a distinct entity from pleural solitary fibrous tumor. An update on clinical, molecular and diagnostic features. *Ann Diagn Pathol*. 2018;34:142–150.
4. Wignall OJ, Moskovic EC, Thway K, Thomas JM. Solitary fibrous tumors of the soft tissues: review of the imaging and clinical features with histopathologic correlation. *AJR Am J Roentgenol*. 2010;195(1):W55–62.
5. Tariq MU, Din NU, Abdul-Ghafar J, Park YK. The many faces of solitary fibrous tumor; diversity of histological features, differential diagnosis and role of molecular studies and surrogate markers in avoiding misdiagnosis and predicting the behavior. *Diagn Pathol*. 2021;16(1):32.
6. Roth M, Alowami S, Popovic S, Harish S. Intra-articular solitary fibrous tumor of the knee. *Skeletal Radiol*. 2018;47(9):1305–10.
7. Murphey MD, Rhee JH, Lewis RB, Fanburg-Smith JC, Flemming DJ, Walker EA. Pigmented villonodular synovitis: radiologic-pathologic correlation. *Radiographics*. 2008;28(5):1493–518.
8. Shaerf DA, Mann B, Alorjani M, Aston W, Saifuddin A. High-grade intra-articular liposarcoma of the knee. *Skeletal Radiology*. 2011;40(3):363–5.
9. Sheldon PJ, Forrester DM, Leach TJ. Imaging of intraarticular masses. *Radiographics*. 2005;25(1):105–19.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.