

Original Article

Localized tenosynovial giant cell tumor in the infrapatellar fat pad: a very rare location

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Abstract: Localized form of tenosynovial giant cell tumor (TGCT) is rarely intraarticular in the knee. We report an unusual case of a 32-year-old female patient in their infrapatellar fat pad of knee joint. Excision biopsy were performed by surgical removal. Histopathological examination revealed that they were localized TGCT. Owing to its few and non-specific symptoms, and local recurrence, its early diagnosis and treatment is necessary. A literature review of localized TGCT in the infrapatellar fat pad is present. The present study reports the clinical features and imaging findings of localized TGCT in the infrapatellar fat pad.

Keywords: Tenosynovial giant cell tumor, knee, localized type, magnetic resonance imaging

Introduction

Tenosynovial giant cell tumor (TGCT) first described by Jaffe et al in 1941, is also known as pigmented villonodular synovitis (PVNS) [1]. TGCT arises in the synovial tissue of the joint, mucosal bursa, tendon sheath, and fibrous tissue adjacent to the tendon. There are localized and diffuse forms. The localized form of tenosynovial giant cell tumor predominantly involves the fingers [2-4], which is rarely intraarticular in large joints like the hip [3, 5], knee [6-8] and the ankle [9, 11].

The reported tenosynovial giant cell tumor involving areas in the knee include the anterior cruciate ligament (ACL) [11, 12], posterior cruciate ligament (PCL) [13-16], medial plicae [17] and fat pad [8, 18, 19], etc. There are only three reported cases of localized form of tenosynovial giant cell tumor or pigmented villonodular synovitis in the infra-patellar fat pad [8, 18, 19]. We report one such rare case of TGCT located the infra-patellar fat pad.

Case report

A 32-year-old female patient presented with an insidiously growing swelling on her right knee for nearly 5 months. The pain was dull in nature

and aggravated by strenuous activity. There was no history of trauma. Upon physical examination, a 3.0×3.0×2.5 cm firm, fixed mass was identified during flexion at the lateral side of the infrapatellar region of the right knee. Lachman, anterior drawer, posterior drawer, and medial and lateral stress tests were negative. Mc Murrey and Apley tests were also negative. The laboratory tests were normal. MRI of the right knee revealed a well-circumscribed lesion, which was localized into the infrapatellar fat pad in the right knee. The signal of tumor was isointense to the normal muscle on the T1WI (**Figure 1A**) and hyperintense on the T2WI (**Figure 1B**). Hypointense capsule can be found on the T1WI and T2WI. On the contrast-enhanced T1WI, a marked homogeneous enhancement was identified following the intravenous administration of gadolinium (**Figure 1C**). In this case, we considered the possibility of synovial sarcoma. The patient later underwent an excision biopsy. Histopathological examination showed bland round to oval mononuclear cells with scattered multinucleated giant cells in a dense stroma (H&E stain ×10) (**Figure 2**). The patient later underwent an excision biopsy. During the 16 months follow-up period there was no evidence of local tumor recurrence.

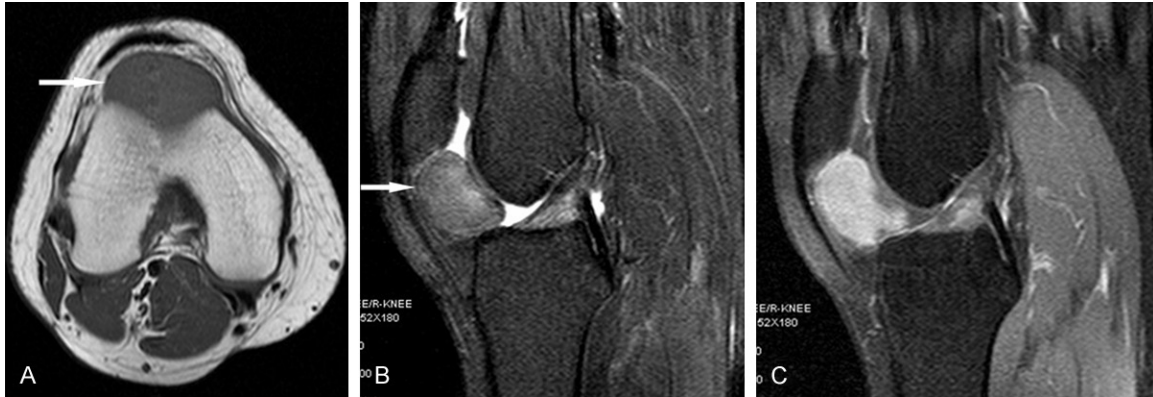


Figure 1. A-C. Magnetic resonance imaging of the right knee joint revealed a well-circumscribed lesion, which was localized into the infrapatellar fat pad in the left knee. A. On T1WI, magnetic resonance imaging of the knee joint revealed the signal intensities of the tumor were almost isointense to the normal muscle. B. On T2WI, the signal intensities of the tumor were hyperintense. A, B. Hypointense capsule can be found (arrow). C. On contrast-enhanced T1WI, a marked homogeneous enhancement was identified following the intravenous administration of gadolinium.

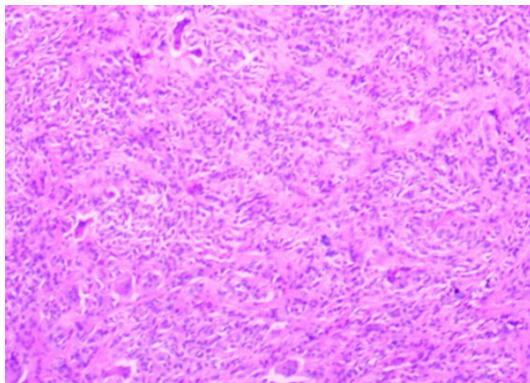


Figure 2. A hematoxylin and eosin-stained tumor tissue section revealed bland round to oval mononuclear cells with scattered multinucleated giant cells in a dense stroma (magnification, $\times 10$). T1WI, T1-weighted images; T1WI, T2-weighted images. T1WI, T1-weighted images; T1WI, T2-weighted images.

Discussion

Localized TGCT most commonly affects small joints of hands and wrists. Sites, such as the feet, knees [16], can also be involved. Localized TGCT in the knee is extremely rare. A comprehensive literature search for tenosynovial giant cell tumor or pigmented villonodular synovitis in the infra-patellar fat pad was performed and only 3 cases were found. The clinical features and imaging findings of these three cases and our case are summarized in **Table 1**. The group included 2 male and 2 female with a mean age of 19 years (range, 11-32 years). Major symptom for these cases was swelling and pain increasing with activity. Localized TGCT often

presents as a firm, multilobular, slow-growing, non-tender mass located adjacent to the synovium of the tendon sheath and infrequently erode or infiltrate the nearby bone [20]. In large joints, the symptoms are non-specific and few, thus the diagnosis is difficult to make. The soft tissue mass grows and expands into areas of least resistance, often presenting itself as a mechanical derangement of the knee and/or with indistinguishable pain [18].

Plain radiographs are usually not helpful in the diagnosis of localized TGCT. Bone erosions or soft tissue swelling is occasionally found in plain radiographs [3]. However, plain radiographs of the case 1 and 2 showed opacity at the infrapatellar region but no bone erosion in **Table 1**. MRI is currently an effective and highly sensitive modality of choice for diagnosis of localized TGCT. A differential diagnosis of a synovial cyst, synovial sarcoma, malignant fibrous histiocytoma, lipoma or ganglion must be considered. Localized TGCT typically displays small scattered foci of low signal on T1WI and T2WI due to the presence of hemosiderin [21]. The lesion may also be demarcated by a low signal intensity capsule as a result of fibrosis or hemosiderin deposition [22]. All the four cases of the infra-patellar fat pad also showed hypointense capsule can be found (**Table 1**). Localized TGCT, however, may have variability in signal intensity on MR images. Beuckeleer et al [23] observed the signal intensities of localized TGCT tended to be isointense to those of muscle on both T1WI and T2WI. Jelinek et al [24] described MR features of 9 localized TGCT. All nine lesions

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Table 1. Review of the clinical features and imaging findings of the localized tenosynovial giant cell tumor in the infrapatellar fat pad

No.	Author	Age	Sex	Size	Trauma history	Complaint	X-rays	MRI	Findings	Follow-up	Recurrence
1	Sun C [19]	15	M	3.8×2.0×1.7 cm	Yes	Swelling and pain	Opacity/ no bone erosion	An encapsulated mass/ isointense on T1WI/hyperintense on T2WI	5 months	no	
2	Abdullah A [18]	11	F	3.0×3.5×1.5 cm	No	Swelling and increasing painful	Opacity/ no bone erosion	An encapsulated mass/ isointense on T1WI/hyperintense on T2WI	35 months	no	
3	Beytemür O [8]	19	M	2.0×3.0 cm	No	Swelling and pain increasing with activity	NA	An encapsulated mass/ isointense on T1WI/hyperintense on T2WI	14 months	no	
4	Our patient	32	F	3.0×3.0×2.5 cm	No	Pain was dull and aggravated by strenuous activity	NA	An encapsulated mass/ isointense on T1WI/hyperintense on T2WI/ marked homogeneous enhancement	16 months	no	

F, female; M, male; N/A, not applicable; WI, weighted images.

were hypointense on T1WI. On T2WI, signal intensities were equal to skeletal muscle in two cases, lower in three cases, slightly higher in two cases, and more heterogeneous in two cases. Kitagawa et al [25] described MR features of 25 localized TGCT. The signal intensities of localized TGCT they observed were isointense to that of skeletal muscle or hyperintense on T1WI; on T2WI, the signal intensities tended to be hyperintense. In the four cases of infrapatellar fat pad, the signal intensities were all isointense on T1WI; the signal intensities were all hyperintense on T2WI (**Table 1**). These findings were consistent with the findings of Kitagawa et al [25]. Localized TGCT enhanced following gadolinium administration. Beuckeleer et al [23] described that 10 of 13 localized TGCT were strongly homogeneously enhanced because of the presence of numerous proliferative capillaries in the collagenous stroma. Kitagawa et al [25] observed 13 of 18 lesions were in homogeneously enhanced, and five lesions, showed homogeneously enhanced. The signal intensity of our case tended to be markedly homogeneously enhanced on contrast-enhanced T1WI, and the other 3 reported cases were lack of the enhanced signal performance (**Table 1**).

Excision of the tumor is usually sufficient, provided that all the affected tissue is removed. Recurrence rate is between 10 and 20%. Al-Qattan devised a classification for TGCT in the hand to prognosticate lesions with a high chance of recurrence [26]. Lesions were classified into 2 types dependent on whether the

entire tumor was surrounded by a pseudocapsule (type I) or not (type II), and further subdivided into single, multilobulated, diffuse or multicentric nodules. The classification was also enhanced by 5 potential factors that might lead to a high recurrence rate: poor surgical technique/incomplete excision; bony invasion; cellularity and mitotic activity; *nm23* gene negative; and type II tumors. Adequate initial excision may effectively limit the risk of local recurrence. Using the classification above, all the four cases of the infra-patellar fat pad fall into the type I category, without bony involvement (**Table 1**). Therefore, the probability of recurrence is low. None of the four patients developed recurrence after surgical excision during the follow-up period (**Table 1**).

In summary, TGCT localized in the infra-patellar fat pad of the knee joint are very rare. We wish to draw the practitioner's attention to the possibility of localized TGCT, even when the painless or painful mass accompanied with non-specific symptoms are found in the infra-patellar fat pad, and avoid diagnostic delay. MRI is currently the optimal modality for preoperative assessment of tumor size, extent and invasion of adjacent joint and tenosynovial space. To make a definite diagnosis, histopathological examination is required. If a possible diagnosis of localized TGCT in the infra-patellar fat pad is suspected, excision biopsy should be carried out as early as possible.

Disclosure of conflict of interest

None.

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