Intra-articular soft tissue masses of the knee: An imaging review of biopsy proven diagnoses

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Purpose

A series of 49 consecutive biopsy proven intra-articular soft tissue masses of the knee are presented with a discussion of their imaging appearances and comparison of the presumptive radiological diagnosis with the biopsy report.
Methods and Materials

A retrospective search of the local pathology department database for all patients who underwent CT guided biopsy during a 30 month period from 1 April 2011 to 30 Sept 2013 at our tertiary musculoskeletal oncology referral centre was carried out. During this period, a total of 922 biopsies were performed under CT guidance and of these 49 (5.3 %) were for IA knee lesions. These 49 cases were included in our study. Images on the picture archiving and communication system (PACS), clinic letters and pathology results were retrospectively evaluated for the 49 cases included in our study. The following parameters were collected, patient demographics, site and size of the lesion, uni-focal or multifocal, approach of biopsy needle, post-procedure complications, histopathology results including that for surgical specimen for patients operated at our local institution. This study has been approved by the local institutional research and development committee.

All cases are discussed at weekly clinical multidisciplinary meeting, where the decision on further management was made. If undergoing image guided biopsy, an appropriate route of approach were decided after consulting the operating surgeons and marked by placing an arrow on the relevant image on the PACS system which could be used as the reference image by the radiologist performing the image guided biopsy.

CT-guided biopsy was performed by experienced musculoskeletal radiologists with several years' experience in the musculoskeletal oncology imaging. In our study, all the biopsies were carried out under general anaesthesia. Depending on the operator’s preference either a 14-gauge Trucut needle (Trucut; Baxter Health Care, Deerfield, IL, USA) or a 14-gauge Temno needle (Bauer, Via del Foss, Italy) were used to sample the lesions. For lesions with heavily calcified component, a 11-gauge Jamshidi needle (Jamshidi; CareFusion, San Diego, CA, USA) was used. All the tissue specimens were sent for histopathology analysis as dry samples immediately following the procedures. These were analysed by a small group of pathologists extensively experienced in bone and soft tissue sarcoma.
Results

As described in the materials and methods section, 49 consecutive cases that underwent CT-guided core needle biopsy of the intra-articular knee lesions during the above mentioned review period were included in our study. There were 16 male and 33 female subjects, with a mean age of 39.5 years (range 13-75 years). The mean size of the lesion was 3.25 cms (range 1.2-10 cms). Nearly three-fourths (36/49) of the lesions were unifocal, while the remaining of the cases being multifocal. Antero-medial approach was the commonest approach (30//49) used followed by posterior and antero-lateral approaches. None of the patients had any significant post procedure complications recorded. Forty-five of the 49 (92%) percutaneous biopsy procedures yielded a diagnostic sample, while 4 (8%) were non-diagnostic.

In the diagnostic group, pigmented villonodular synovitis (PVNS) was the most commonest pathology encountered 28 of 49 (57%), 6 of 49 (12%) were synovial chondromatosis and remaining 12 of 49 (24%) had various other pathologies like tendon sheath fibroma, juxta articular myxoma, gout, benign fibroblastic lesion, vasculitis, leiomyosarcoma to name a few.

In our study, nearly half our cases (23 of 49: 47%) underwent surgical excision after theCT-guided core needle biopsy at our institution. On comparison of the histopathology results of the core needle biopsy with that of surgical specimens, there was complete concordance in 20 of 23 cases (87%).

Discussion:

True intra-articular lesions are relatively less common. Although tumour-like lesions are much more common rather than a true neoplasm, the appearances of these lesions can be very non-specific and pose a diagnostic challenge to a general radiologist. Unlike the intraosseous lesions, the soft-tissue lesions may have non-specific imaging appearances. This makes it difficult to reliably determine whether they are benign or malignant. Therefore, a structured approach in imaging evaluation and further assessment of these lesions will help in coming to an accurate and correct diagnosis. This will allow prompt treatment of potentially serious lesions. Only the two most commonest lesions will be briefly discussed below.

PVNS:

PVNS was the most common pathology documented in our study, comprising of 57% of our cohort. The knee followed by the hip joint is the most common location for PVNS (1). As previously reported (1), over 75% of these lesions were localised/unifocal (see
Fig 1) and infra-patellar region is the most commonest site (2) for these to occur in the knee joint.

Plain radiographs of joints affected by PVNS often appear normal or may demonstrate periarticular soft-tissue swelling. Joint spaces and bone mineralization are characteristically preserved until late in the disease (3). Bone erosions are common in joints with a tight capsule, such as the hip and ankle. On MR imaging, the masslike proliferative synovium has a lobulated mass and extensive in diffuse PVNS (see Fig 2) or limited to a single nodule in the focal form. The lesions tend to bleed, causing hemosiderin deposition and a characteristic low signal intensity with all pulse sequences (4). Areas of high signal intensity on T2-weighted images may be present and are likely caused by inflamed synovium or joint effusions (5). As most of the cases were referred from other hospitals, not all patients had gradient-echo images available. Therefore, we were unable to assess the 'blooming' artefact that is typically seen in PVNS. Although, this is characteristic of PVNS it can also be seen in synovial haemangioma and haemophiliac arthropathy (1). One of the patient in our study didn't demonstrate 'blooming artefact (see Fig 3).
Fig. 1

*Figures and Images:* Medical Imaging and Medical Physics, Royal National Orthopaedic Hospital - Stanmore/UK

**Figure 1:** Sagittal T2W FS image demonstrating a biopsy proven unifocal PVNS involving the Hoffa's fat pad in a 33-year-old patient.

**References:** Medical Imaging and Medical Physics, Royal National Orthopaedic Hospital - Stanmore/UK
Fig. 2

References: Medical Imaging and Medical Physics, Royal National Orthopaedic Hospital - Stanmore/UK
Synovial chondromatosis:

This was the second most common (12%) pathology encountered in our study. Synovial osteochondromatosis is a benign monarticular disorder of uncertain cause characterized by proliferation and metaplastic transformation of the synovium with formation of multiple cartilaginous nodules. The knee is the most commonly affected joint, followed by the elbow, hip, and shoulder. Synovial osteochondromatosis manifests clinically with joint pain, swelling, and limitation of motion (6).
On plain radiograph findings the synovial chondromatosis pathognomically appears as multiple intraarticular calcified nodules that are characteristically uniform in size. This may be associated with a small joint effusion, marginal erosions, and late secondary degenerative joint disease. The MR imaging features tend to be variable depending on the relative proportion of synovial proliferation and calcified nodule formation. Non-calcified lesions tend to form an intraarticular conglomerate mass that is isointense relative to muscle on T1-weighted images and hyperintense on T2-weighted images (3). When the cartilaginous nodules contain calcification, small areas of low signal intensity are observed with all pulse sequences. Intraarticular bodies with mature bone and fatty marrow display low signal intensity of cortical bone peripherally and high signal intensity of bone marrow fat centrally on T1-weighted images (5) (see Fig 4a,b &c).

Fig. 4: Fig 4a
Fig 4b: Biopsy proven Synovial osteochondromatosis in a 50 years old female patient. The 3 cms mass lesion in the Hoffa's fat pad shows a thick calcified wall on this CT axial image obtained at the time of biopsy planning.

Fig. 5: Fig 4b:

References: Medical Imaging and Medical Physics, Royal National Orthopaedic Hospital - Stanmore/UK
Fig. 6: Fig 4c:

References: Medical Imaging and Medical Physics, Royal National Orthopaedic Hospital - Stanmore/UK

Other pathologies encountered in our study included tendon sheath fibroma (see fig 5), juxta articular myxoma, gout, benign fibroblastic lesion, vasculitis (see fig 6) to name a few.
Fig. 5a: Biopsy proven tendon sheath fibroma presenting as a T2 hyperintense mass lesion at the posterior inter-condylar notch on this coronal T2W FS image in a 58 year old male patient.

**Fig. 7:** Fig 5a:

**References:** Medical Imaging and Medical Physics, Royal National Orthopaedic Hospital - Stanmore/UK
Fig 5b: Biopsy proven tendon sheath fibroma presenting as an iso-intense mass lesion at the posterior inter-condylar notch on this coronal PDw FS image in a 58 year old male patient.

**Fig. 8:** Fig 5b:

**References:** Medical Imaging and Medical Physics, Royal National Orthopaedic Hospital - Stanmore/UK
Fig. 9: Fig 6:

References: Medical Imaging and Medical Physics, Royal National Orthopaedic Hospital - Stanmore/UK, leiomyosarcoma (see Fig 7)

Fig 6: Biopsy proven vasculitic lesion in a 47 years old female patient with known history of porphyria. Sagittal T2w FS image shows a hyperintense lesion in the retropatellar region.
Fig 7: Biopsy proven Leiomyosarcoma in a 60 year old female patient. Post-contrast axial T1w FS image demonstrates an enhancing mass lesion abutting the posterior cortex of the distal femur.

Fig. 10: Fig 7:

References: Medical Imaging and Medical Physics, Royal National Orthopaedic Hospital - Stanmore/UK
Conclusion

Biopsy of intra-articular lesions in the knee is recommended as their imaging appearances are often non-specific and a variety of lesion types may present in this location, with a great variability in treatment / prognosis.
References


