Synovial Tumors and Proliferative Diseases

Benjamin D. Levine, MD[a,*], Kambiz Motamedi, MD[b], Leanne L. Seeger, MD[c]

KEYWORDS

• Synovial • Tumors • Proliferative processes • Imaging • MRI

KEY POINTS

- Clinical diagnosis of synovial tumors and proliferative processes remains difficult.
- Advanced imaging, particularly MRI, can provide accurate diagnosis of synovial tumors and proliferative processes.
- Most synovial tumors are benign but can be locally aggressive and cause significant morbidity.

INTRODUCTION

Accurate clinical diagnosis of synovial tumors and synovial proliferative diseases is difficult because symptoms and physical examination findings are often nonspecific. Advanced imaging modalities, such as MRI, high-resolution ultrasound, and computed tomography (CT), can aid clinical decision-making by providing accurate diagnosis of such diseases in many cases. Conventional radiography proves useful in the imaging evaluation of synovial processes not only serving as a baseline examination but also as a complement to advanced imaging. This article focuses on imaging features of synovial tumors and proliferative processes that can provide accurate diagnosis and guide appropriate patient management. In addition, technical and anatomic considerations pertinent to imaging the synovium are discussed.

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[a] Musculoskeletal Imaging, Department of Radiological Sciences, UCLA David Geffen School of Medicine, 1250 16th Street, Suite 2340, Santa Monica, CA 90404, USA; [b] Musculoskeletal Imaging, Department of Radiological Sciences, Beach Imaging & Interventional Center, UCLA David Geffen School of Medicine, 200 Medical Plaza, Suite 165-59, Los Angeles, CA 90095-6952, USA; [c] Radiology & Orthopaedic Surgery, Musculoskeletal Imaging, Department of Radiological Sciences, UCLA David Geffen School of Medicine, 200 Medical Plaza, Suite 165-57, Los Angeles, CA 90095-6952, USA
* Corresponding author.
E-mail address: blevine@mednet.ucla.edu

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ANATOMIC CONSIDERATIONS

Synovial joints are composed of 2 layers, a thick superficial fibrous capsule and a thin inner layer, the synovial membrane. The fibrous capsule functions to stabilize the articulation between apposing bones, whereas the synovial membrane is composed of specialized mesenchymal tissue. This tissue lines intra-articular structures, including intra-articular ligaments, tendons, and the intracapsular periosteal surfaces not covered by hyaline cartilage.[1] Synovial membranes also line tendon sheaths and bursae about the body.

Synovial membranes are also divided into 2 layers, the synovial intima and the subsynovial tissue.[2] The synovial intima is composed of synoviocytes, macrophages, and fibroblasts and is one to 4 cell layers in thickness.[3] Underneath the intima is the subsynovium that consists of adipocytes, macrophages, lymphatics, and loose connective tissue.[4,5] The subsynovium contains a vascular and lymphatic network through which fluid enters a joint as an ultrafiltrate of plasma. It is this plasma plus the hyaluronic acid secreted by synovial cells that forms joint fluid and that nourishes and lubricates the articular surface. The synovial membrane also functions as a shock absorber and filter system for the joint.

The synovial membrane may give rise to a variety of tumors and tumorlike proliferative processes, the most common of which are giant cell tumor of the tendon sheath (GCTTS), pigmented villonodular synovitis (PVNS), localized nodular synovitis (LNS), synovial chondromatosis/osteochondromatosis, lipoma arborescens, synovial hemangioma, and fibroma of the tendon sheath. Synovial tumors and proliferative diseases can be part of either a systemic disease or a primary synovial process that can affect a single joint. Rarely, malignant synovial tumors can be present de novo, via malignant transformation from a benign synovial process, or from local extension.

IMAGING EVALUATION AND TECHNICAL CONSIDERATIONS

Routine radiography should be a part of any imaging workup of a suspected synovial-based process and, at the very least, can serve as a baseline imaging examination for future follow-up. Radiographs are well suited to assess for mineralization, erosions, joint effusion, and joint space loss. CT can complement routine radiography and with its multiplanar ability can further characterize mineralization, subtle erosions, and joint fluid density. PET-CT does not currently play a significant role in the evaluation of synovial tumors and synovial proliferative processes.[6] In the past decade or so, utilization of ultrasound has markedly increased for musculoskeletal evaluation, particular when there is a palpable soft tissue mass. Some synovial tumors can present as palpable masses, such as those in the hand where GCTTS commonly occur. Ultrasound in this setting is an appropriate imaging modality for evaluation.

Because of its excellent soft tissue contrast and multiplanar capability, MRI is the imaging modality of choice for the comprehensive evaluation of suspected synovial-based processes. Controversy remains, however, with regard to the optimal MRI technique to use for this indication, particularly whether or not to use intravenous gadolinium contrast.

On MRI, the fibrous joint capsule is normally seen as a thin low-signal intensity linear structure on both T1- and fluid-sensitive sequences. The vascular inner synovial membrane is, however, difficult to distinguish from this outer capsule. When visible the synovial membrane is intermediate in signal intensity on proton-density and T1-weighted sequences and high signal intensity on fluid-sensitive sequences, similar to joint fluid.[1]

Although the synovium can definitely be evaluated well without the use of intravenous contrast, it is generally accepted that the use of contrast delineates the synovial