Synovial metastasis from lung cancer

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Intraarticular masses are infrequently encountered in clinical practice; however, the differential diagnosis can be broad. Neoplasia, both benign and malignant, and proliferative processes are the most common etiologies. We present a case of metastatic disease in the synovium in a patient with a history of lung cancer. Lung carcinoma is the most common primary malignancy to metastasize to synovial tissue, and the knee joint is the most common joint to be affected.

In this report, we discuss the differential considerations for intraarticular masses and the clinical presentation of metastatic synovial disease. We discuss some findings that are classic for specific entities; however, many radiologic findings concerning synovial pathology are nonspecific. As the differential considerations for intraarticular masses are vast, clinical history is often as necessary as radiologic findings to elucidate the correct diagnosis.

CASE PRESENTATION

A 61-year-old man who underwent a left pneumonectomy for cancer 4 months before presentation complained of knee pain with swelling since the operation. The knee joint was aspirated, and the fluid demonstrated inflammatory white blood cells but was negative for microorganisms. A diagnosis of rheumatoid arthritis had been made in the past, but the knee pain had never been of this character or intensity. The patient was unable to bear weight or straighten his leg in the emergency room. On examination, he was afebrile, normotensive, and tachycardic, with underlying atrial fibrillation and a ventricular rate of 90 to 127 beats per minute. The knee was edematous, erythematous, and warm with a range of motion of $<90^\circ$. His leukocyte count was 23,600 cells/mL.

Conventional gadolinium-enhanced magnetic resonance (MR) imaging of the left knee revealed diffuse enlargement of the knee joint space secondary to multilobulated and heterogeneous mass-like structures (*Figures 1–4*). These structures demonstrated heterogeneously increased T2 hyperintense and intermediate T1 intensity characteristics. Most of the joint space was replaced by hyperenhancing synovium. Enlarged lymph nodes were seen in the popliteal fossa. At that time, differential considerations included severe inflammatory arthritis and

synovial chondromatosis rather than unusual metastasis. Surgical pathology showed a diagnosis of synovial metastasis from primary large-cell lung carcinoma.

DISCUSSION

Approximately 48 cases of synovial metastasis have been reported. Adenocarcinoma has been the most common type of synovial metastasis encountered. Despite the highly vascular nature of synovial tissue, neoplastic masses in articular spaces are much less frequently encountered than mass lesions secondary to infectious and inflammatory arthritides. If intraarticular masses are discovered when they are still small, the tissue of origin such as synovium or cartilage may be delineated. However, commonly both cell types are involved, and the type can be impossible to decipher when the mass is as large, as in the case presented. Primary lung cancer is the most common cancer to metastasize to articular surfaces.

We present the first reported case of poorly differentiated large-cell lung carcinoma metastatic to the knee joint. Large-cell lung cancer comprises about 5% to 10% of all lung cancers. It is a diagnosis of exclusion, as it is often the diagnosis in which a lung malignancy does not show characteristics of small cell, squamous cell, or adenocarcinoma. Most cases with synovial metastasis, specifically of the knee joint, from a lung primary demonstrated adenocarcinoma features histopathologically, followed by squamous cell carcinoma features. Unfortunately, all synovial metastasis carries with it a dreadful prognosis. Average survival after discovery is 5 months.

While the mechanism of spread that causes synovial metastasis remains unproven, two theories have been postulated: hematogenous versus direct invasion from a metastatic osseous lesion. In our case, hematogenous spread is favored, as there is no evidence of osseous disease in the adjacent bone.

The main differential considerations for intraarticular masses include both benign and malignant etiologies. While innumerable intraarticular processes can mimic masses, the few that should be considered in the same discussion as synovial

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Figure 1. An unenhanced axial T1-weighted image at the level of the intercondylar notch demonstrates the knee joint space and synovium replaced by an intermediate soft tissue intensity mass (green arrowheads) with thin septations.

Figure 2. A sagittal fat-saturated T2-weighted image at the same location as the proton-density image demonstrates a mass (outlined in orange arrowheads) with associated edema, a small effusion or cystic region (yellow arrow), and distending joint space. The blue arrowhead points to a pathologic lymph node. Again, there is a minor edema signal in the tibial plateau and intercondylar notch but no aggressive subchondral osseous extension.

metastasis include granulomatous septic arthritis (particularly tuberculous and fungal), proliferative articular processes like pigmented villonodular synovitis, rheumatoid arthritis, and deposition disease such as gout or pseudogout. Malignant etiologies that should be a differential consideration include synovial sarcoma and synovial chondrosarcoma.

Concerning the benign entities, septic arthritis, particularly in immunocompromised or diabetic patients, may have an insidious or acute course. Infectious arthritides tend to produce more joint fluid than a metastatic process. More periarticular

Figure 3. A sagittal proton-density image demonstrates a mass (blue arrowheads) interdigitating throughout the knee joint surrounding stretched yet intact cruciate ligaments (red arrows). There is no evidence of osseous or extraarticular extension of the mass.

Figure 4. A precontrast fat-saturated T1-weighted image at the level of the intercondylar notch shows persistence of the signal in the mass (orange arrowheads) on fat-saturated imaging, proving a lack of fat content and the presence of proteinaceous material.

osseous erosions are expected in septic arthritis. Enhancement characteristics are not a helpful discriminator, as both entities can demonstrate avid or patchy enhancement. Rheumatoid arthritis can also have an appearance similar to that of synovial metastasis, as the pannus or hypertrophic synovium can appear T1 hypointense and T2 hyperintense. Again, marginal erosions, diffuse joint space narrowing, and periarticular osteopenia are usually seen in rheumatoid arthritis, none of which are expected in synovial metastatic disease. Pigmented villonodular synovitis is a benign proliferative synovial process that is most commonly monoarticular. While joint space and subchondral bone are commonly preserved early in the disease,

MR imaging shows a characteristic low signal for the intraarticular masses on all sequences secondary to blood products, as these lesions have a high tendency to bleed. Usually only mild enhancement is demonstrated; however, the pansequence hypointensity is a helpful discriminator. Crystal deposition disease manifests in intraarticular mass lesions as well, but classically signal characteristics demonstrate an intermediate T1 signal and hypointense T2 signal. More aggressive-appearing marginal erosions with overhanging edges are also expected in gout and pseudogout, whereas synovial metastasis does not usually result in a destructive or degenerative pattern in the subchondral bone.

After an extensive literature search, this case appears to be first documented large-cell lung carcinoma metastasis to the synovium. While the differential considerations for intraarticular masses are vast, certain MR characteristics, in conjunction with a thorough history, can help raise suspicion for the

diagnosis. Existing reports do not suggest an increased risk for metastasis to the synovium in patients with an underlying history of rheumatoid arthritis, as was present in our patient. One could conjecture that synovial tissue is more hyperemic than normal tissue in chronic inflammatory arthritides like rheumatoid arthritis, which may portend to an increased risk of hematogenous spread of tumor. However, further research is needed to see if a true association exists.

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Avocations

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