Tips and Tricks: Initial Management of Unknown Soft Tissue Masses

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Introduction

Soft tissue masses are common and can initially present to a variety of providers, including primary care or emergency physicians, dermatologists, plastic surgeons, general surgeons, and orthopaedic surgeons. The majority of these masses are benign processes, whether reactive, traumatic, or neoplastic. Though much more rare, 20 soft tissue malignancies are diagnosed per every 1 million individuals in the US per year.[1] The presentation of benign and malignant tumors can be similar; however, appropriate management ranges from reassurance, to simple excision, to wide resection with radiation and occasionally chemotherapy.[2] Delay in diagnosis, poor biopsy technique, or inadequate excision can complicate treatment, even leading to amputation or mortality. Therefore, it is critical that soft tissue tumors are appropriately evaluated and accurately diagnosed. The purpose of this paper is to provide an overview of the key aspects of history, exam, and imaging that help elucidate which soft tissue masses are concerning for malignancy and should be referred to an orthopaedic oncologist.

History

Key questions to ask any patient presenting with a soft tissue mass include when they first noticed the mass and if it has changed in size. Masses that have rapid growth tend to be more concerning for malignancy, while benign entities are often slow growing, fluctuating in size, or can even resolve over time. The clinician should also ask whether there is a history of trauma or radiation exposure to the area. Antecedent trauma makes the diagnosis of a hematoma or myositis ossificans more likely; conversely, without a history of trauma, the possibility of sarcoma must be strongly considered.[3] Prior radiation therapy is a known risk factor for development of soft tissue sarcoma.[4] A personal or family history of cancer should be noted but is often unrelated, as the vast majority of soft tissue tumors are sporadic. Conditions such as Li-Fraumeni, Gardner syndrome, and Neurofibromatosis are very rare but associated with high risk of osteosarcoma, desmoid tumors, and benign or malignant peripheral nerve sheath tumors, respectively. Most soft tissue sarcomas are asymptomatic; they do not cause pain until they are large enough to compress surrounding structures. This may cause patients to delay seeking evaluation of the mass. Conversely, several benign soft tissue tumors, such as schwannomas, can be quite painful, as can non-neoplastic masses such as abscesses or inflammatory processes. Finally, soft tissue sarcomas do not cause unplanned weight loss or constitutional symptoms, with a notable exception of lymphoma.

Physical Exam

On exam the mass should be fully visualized, and the contralateral extremity should be exposed for comparison. The size, depth, and consistency of the mass are critical in determining further work up. Masses that are large (>5cm), deep to fascia, nonmobile, and firm compared to surrounding tissue are most suspicious; however, any mass warrants some form of imaging prior to consideration of monitoring or removal.3 Skin changes should be noted; cutaneous ulceration is more suggestive of skin cancer, but angiosarcoma is often superficial, and other sarcomas that have grown large enough can also present as a fungating mass. Warmth, erythema, tenderness, and fluctuance are more suggestive of an abscess, especially with a history of constitutional symptoms. Lastly a diagnosis of hematoma should not be made without a history of trauma, the presence of ecchymosis on physical exam, and confirmatory imaging.[4]

Imaging

MRI is the gold standard in the work up of a soft tissue mass. T1 weighted images are best for anatomic visualization, whereas T2 weighted images are best for demonstrating water-gradients such as edema and reactive changes. The administration of gadolinium contrast allows improved differentiation of cystic and solid lesions and allows the

diagnosis of neovascularization. There is great variation in the specific sequences used, and their interpretation should be left up to the orthopaedic oncologist or experienced musculoskeletal radiologist. On MRI, soft-tissue sarcomas typically grow centrifugally and respect anatomic planes. They tend to be hypointense on T1, hyperintense on T2, demonstrate heterogeneity on both sequences, and often are solid with angiogenic contrast patterns.3 MRI is capable of definitive diagnosis of many lesions including lipomas, hemangiomas, ganglion and synovial cysts, myositis ossificans, and pigmented villonodular synovitis.[4]

Other imaging modalities have utility in soft tissue mass work-up, with the caveat that they are less sensitive than MRI. For example, ultrasound imaging is considerably less expensive and time-consuming; it can be valuable to confirm certain benign diagnoses including cysts and lipomas but has an unacceptably high misdiagnosis rate for other conditions. Doyle et al. found that of 43 patients with biopsy-proven soft tissue tumors, ultrasound imaging had a 23% rate of incorrect initial diagnosis. In their cohort, 5/43 patients suffered a delay in diagnosis as a result. Notably, the most common error was misdiagnosing a true malignant mass as a hematoma.[5] Because of this, any uncertainty on ultrasound should prompt further work-up with an MRI. CT can be useful in the diagnosis of osseous lesions but offers less value in the work up of soft-tissue masses.[6] The presence of phleboliths on either CT or XR can suggest a hemangioma, and the presence of mature appearing trabecular bone in the periphery of a soft tissue mass suggests myositis ossificans. However, this information alone is often not enough to fully exclude the diagnosis of soft tissue sarcoma and must be correlated with clinical presentation.

Biopsy

Any soft tissue mass that cannot be confidently diagnosed with the history, physical exam, and imaging studies should undergo biopsy. A mass can be biopsied via percutaneous or open methods. Percutaneous biopsy techniques include fine needle aspiration (FNA) and core needle biopsy (CNB). The key difference between fine needle aspiration and core needle biopsy is that only cytologic studies examining cell characteristics can be conducted on a FNA sample, whereas CNB samples can undergo histologic analysis examining the structural relationship of the cells to one another. Therefore, FNA is adequate for hematologic cancers, but CNB is more accurate for sarcoma.

Open biopsy is considered the most sensitive and accurate diagnostic test and may be necessary in certain scenarios, such as highly necrotic or dedifferentiated tumors. Verheijen et al. showed that in diagnosing soft tissue sarcomas open/incisional biopsy had an affirmative diagnosis of 95%, 78% after CNB, and 38% after FNA. After a FNA and a subsequent histological biopsy the sensitivity increased to 71%.[7] After a negative CNB in patients where there was a high suspicion for malignancy a subsequent open biopsy increased the sensitivity to 90%. Pohlig et al. found no difference in the diagnostic accuracy between CNB and open biopsy. However, open biopsy carries risks of increased morbidity and contamination of surrounding tissues, so CNB remains the most commonly performed type of biopsy for sarcoma.[8] If open biopsy is undertaken, an orthopaedic oncologist or surgeon who will ultimately do the resection should be involved to ensure both that the appropriate sample is collected and that future treatment will not be jeopardized by the biopsy itself.

Case Report

Patient John Doe is a 57 year-old male with no significant past medical history who initially presented to his primary care physician with one year of mild pain in his right posterior thigh and no antecedent trauma. The pain worsened with extension of his knee and was recalcitrant to a course of physical therapy. He eventually saw an outside orthopaedic surgeon who believed the mass was consistent with a hematoma but ordered an MRI for diagnosis. The MRI demonstrated a $4.5 \times 4.0 \times 10.1$ cm intramuscular mass along the myotendinous junction of the semitendinosus with a final radiology read of a hematoma (Figures 1,2). An intra-lesional removal of the mass was performed with findings of dark-colored serous fluid deep to muscle fascia. The surrounding cavity was described as “dead muscle tissue.” A sample was sent to pathology and described as “dense fibrosis, fibrin, focal hemosiderin, compatible with site of organizing hematoma/scar formation.” No evidence of malignancy was noted.

Due to continued pain around his surgical site, a repeat MRI without contrast was ordered, demonstrating

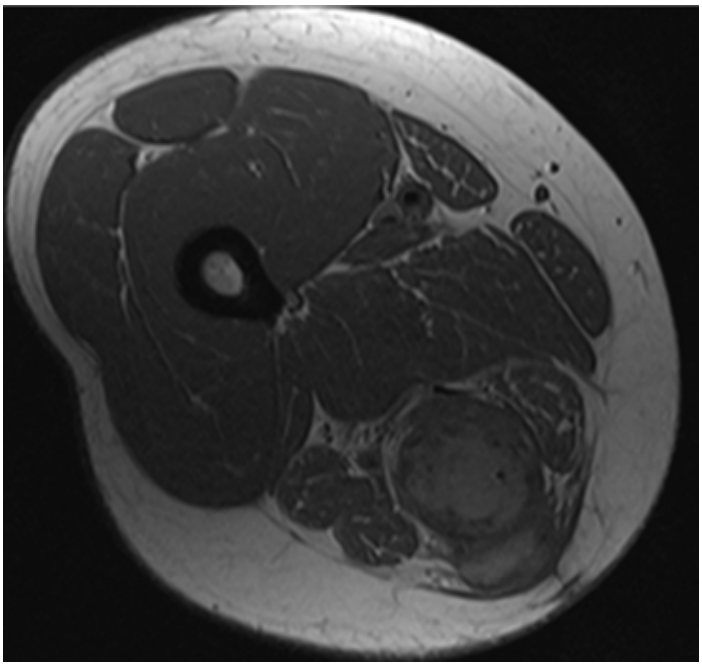

Figure 1. T1 Axial MRI at greatest cross-sectional area of tumor prior to initial biopsy and procedure demonstrates a heterogeneous mass in the posterior compartment of the thigh (4.5 x 4.0 x 10.1 cm).

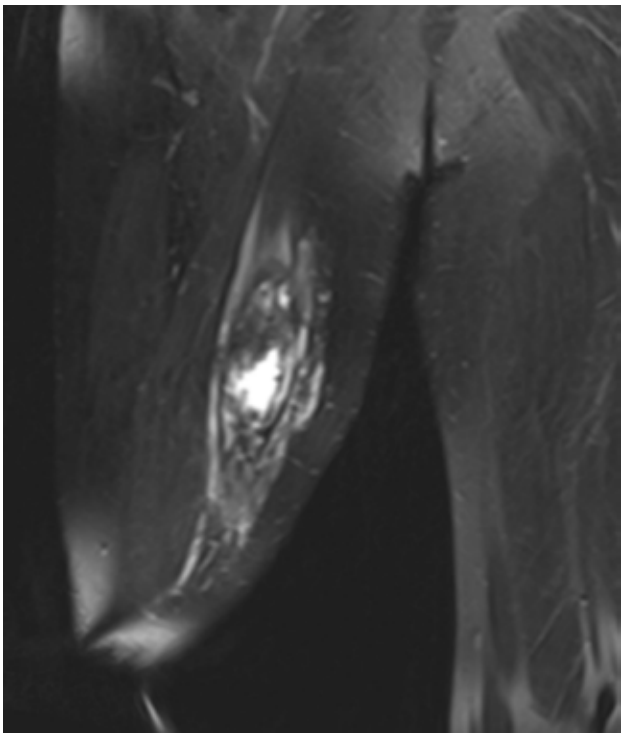

Figure 2. T2 Coronal FS of initial MRI prior to biopsy and procedure demonstrates the long, enhancing mass (4.5 x 4.0 x 10.1 cm)

reaccumulation of the mass, now 6.1 × 4.1 × 12.6 cm with heterogenous signal intensity and peripheral T2 hypointense areas of debris/nodularity as well as a peripheral T2 hypointense rim. There was a new superficial component posteriorly measuring 2.9 × 1.8 cm. This prompted concern for malignancy, but a CNB at this time was again consistent with hematoma.

The patient was then seen by an orthopaedic oncologist. At that time, he had continued pain with knee extension and a 20-degree flexion contracture. Despite negative biopsy results, concern for a malignant process was high enough to prompt a repeat ultrasound-guided biopsy. Results were consistent with a spindled and epithelioid neoplasm with necrosis with the differential including sarcomatoid carcinoma versus high grade soft tissue sarcoma.

The patient the underwent wide excision of the posterior thigh mass with orthopaedic oncology. Final pathology showed high-grade spindle and epithelioid sarcomatoid tumor with perineural and arteriolar vascular invasion. Over the course of the next year, he developed metastases to the left deltoid and presumed metastases to the lung. The patient passed 19 months after initial diagnosis.

Discussion

Soft-tissue sarcomas can be difficult to diagnose and often present with minimal or non-specific findings. Misdiagnosis can occur even after workup with appropriate imaging and biopsy, as elucidated in this case report. Hematomas are a common culprit in the misdiagnosis of soft tissue sarcomas. Negative FNA of soft-tissue sarcomas with hemorrhage was reported in 87% in a small case series.[9] In this case, the history (no clear history of trauma) and physical examination (no presence of ecchymosis) were not consistent with hematoma, so sarcoma should have been suspected even giving the initial MRI and pathology findings.

The proportion of soft tissue sarcomas that are inadvertently excised by surgeons without subspecialized oncology training at the primary surgical intervention is reported as high as 40%.[10] Educating the surgical community as well as our primary care colleagues to appropriately evaluate any new soft tissue mass can help limit unplanned excisions and improve outcomes for patients.

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