

High-Resolution Ultrasonography in an Aggressive Thenar Intramuscular Lipoma

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Lipomas are seen mainly during mid adulthood and represent the most common benign soft tissue tumors of this age group. Subcutaneous, most often asymptomatic, soft mobile masses are by far the most frequent manifestation and are known to arise typically from superficial areas of the trunk and proximal extremities. Conversely, deep-seated lipomas, such as the intramuscular lipoma, are relatively rare but may pose a diagnostic challenge, especially regarding their differentiation from liposarcomas. Certain morphologic features described in magnetic resonance imaging (MRI), such as irregular margins and interdigitations with skeletal muscle, isointensity with subcutaneous fat, and absence of solid nonadipose tissue, seem to favor the diagnosis of an intramuscular lipoma. Although ultrasonography has played a major role in the study of subcutaneous fatty tumors, at times the appearance can be variable. We believe that the combination of high-frequency transducers and Doppler flow studies, together with appropriate training, can be of considerable value in the assessment of these lesions. Here we describe ultrasonographic details of this neoplasm, obtained with the use of high-resolution transducers.

Abbreviations

MRI, magnetic resonance imaging

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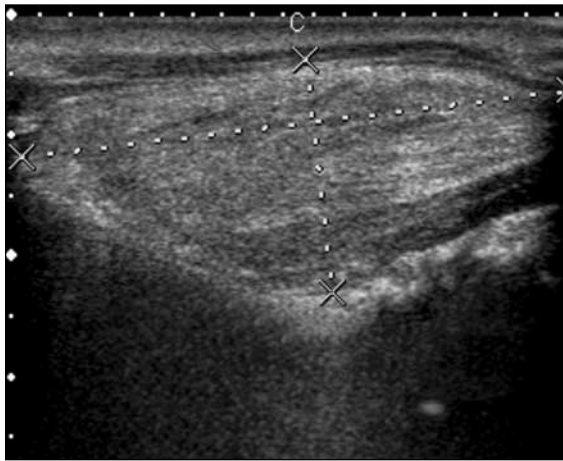
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Case Report

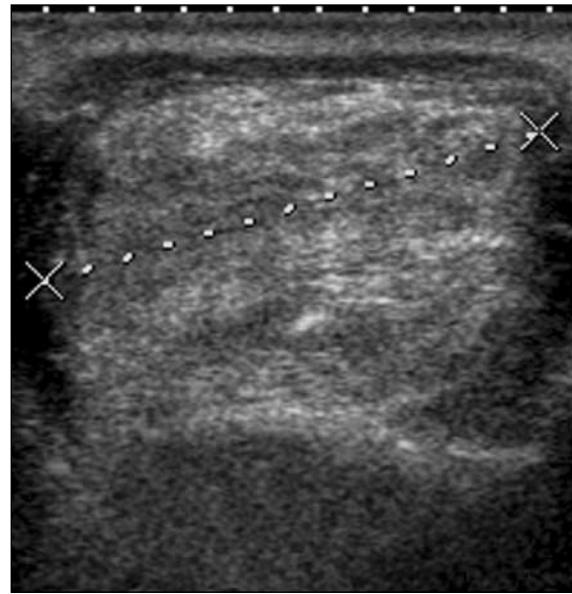
A 48-year-old woman was referred to our institution with a mass in her right hand. The lesion was located in the thenar eminence and had been associated with pain and paresthesias in a median nerve distribution. During physical examination, the lesion was relatively mobile and painful on palpation. There was no discoloration or any other change in the skin.

Musculoskeletal ultrasonography of the area with 9- and 14-MHz Aplio high-frequency linear transducers (Toshiba America Medical Systems, Tustin, CA) and with power Doppler imaging showed a 4.5 × 2.8 × 1.9-cm hyperechoic and avascular mass (Figure 1). The overall imaging characteristics were suggestive of a fatty tumor. Because of slight extension to the carpal tunnel, there



A

Figure 1. Long-axis (A) and short-axis (B) sonograms of the thenar region of the right hand showing a well-defined mass between the palmar skin and the first metacarpal bone, hyperechoic relative to the adjacent musculature, and slightly inhomogeneous, which was proved pathologically to be a lipoma.



B

was mild compression of the median nerve with elevation of the palmar retinaculum. There was no other evidence of disease under ultrasonographic examination.

The patient underwent laborious excision of the mass 1 week after consultation. Hematoxylin-eosin-stained sections of the removed tissues showed mature adipocyte lobules with areas of myxoid transformation. There was no clear evidence of atypia, mitosis, necrosis, or other findings suggestive of malignancy, and the mass was finally diagnosed as a lipoma.

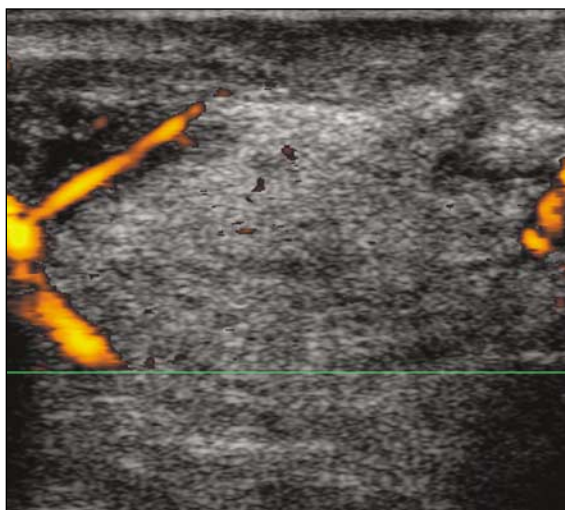
The patient was discharged and her symptoms improved thereafter; however, 2.5 months after surgery, the patient again had similar symptoms and evident regrowth of a mass in the same region. Additional ultrasonographic imaging revealed a $3 \times 2 \times 1.8$ -cm mass with characteristics that were remarkably similar to those of the first mass (Figure 2). Also, there was some degree of infiltration of adjacent muscle by hyperechoic strands at the periphery of the mass (Figure 3). Power Doppler imaging once more showed an avascular mass with negligible peripheral flow that proved to be arterial after color mapping and acquisition of a spectral trace. The patient underwent MRI (Signa EXCITE 2, 1.5 T; GE Medical Systems, Milwaukee, WI) with the purpose of establishing a more confident diagnosis. The following MRI findings helped us confidently exclude malignancy: frank fatty nature in all

sequences, homogeneous signal intensity, absence of solid nonadipose components, and irregular margins and interdigitations with skeletal muscle (Figure 4).

Discussion

Ultrasonography allowed us to diagnose a thenar lipoma that returned with an unusually aggressive recurrence 2.5 months after surgical resection. Lipomas frequently involve the superficial soft tissues and can be evaluated on ultrasonography. They appear as elongated lesions, with their greatest diameter parallel to the skin and an average length–anteroposterior diameter ratio of approximately 3:1. These lesions usually have well-defined to poorly defined margins and are typically homogeneous in echo texture, most commonly slightly hyperechoic relative to the adjacent subcutaneous fat; however, this appearance is variable, and some lipomas show isoechogenicity or hypoechogenicity.¹

The lipoma represents the most common soft tissue neoplasm, accounting for almost 50% of all soft tissue tumors in the largest series to date by Myhre-Jensen.² The prevalence of soft tissue lipomas has been estimated at 2.1 per 100 people.^{2–5} Lipomas are much more frequent than liposarcomas by an estimated ratio of 100:1.^{2,5} Soft tissue lipomas can be categorized as superficial or deep. Superficial lipomas are subcuta-



A

Figure 2. Longitudinal (A) and transverse (B) sonograms of the medial aspect of the thenar region showing a subcutaneous hyperechoic mass in the same location as identified in the first examination.



B

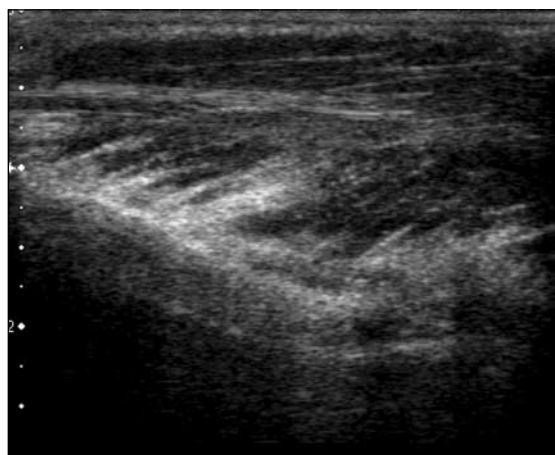
neous and extraordinarily common, accounting for 16% to 50% of all soft tissue tumors, according to several large series.^{2,5} In contrast, deep lipomas are far less common than their superficial counterparts. The series by Myhre-Jensen² showed only 1% to 2% of lesions as being deep-seated. Weiss and Goldblum⁶ separated deep lipomas according to their intramuscular or intermuscular location. Although deep lipomas involving the extremities are most commonly intramuscular, lesions may also be primarily intermuscular. The large size of deep lipomas is often associated with involvement of both intramuscular and intermuscular tissues, and the term “infiltrating lipoma” has been applied to these lesions.⁷

Most lipomas are asymptomatic; however, associated clinical symptoms have been reported in up to 25% of patients and may include local pain, tenderness, limitation of range of motion, and nerve compression.⁷ Clinical evaluation is limited and will commonly yield a nonspecific mass.

The ultrasonographic appearance is usually that of a hyperechoic mass.^{8,9} There is no posterior acoustic enhancement, and heterogeneity caused by septa or other nonlipomatous components may be identified at times. Intramuscular lipomas may also show irregular margins and

interdigitations with skeletal muscle that create a striated appearance.^{7,9} This feature has not been described with liposarcoma and allows confident diagnosis of intramuscular lipoma. To date, however, this appearance to our knowledge had not been described ultrasonographically. In this

Figure 3. Longitudinal sonogram in a border of the mass with a 14-MHz transducer showing heterogeneity caused by echogenic fatty septa components of an intramuscular lipoma, which has irregular margins and interdigitations within skeletal muscle that create a typical striated appearance. The margins of this infiltrative lipoma arise around the first metacarpal bone and blend with muscle fibers.



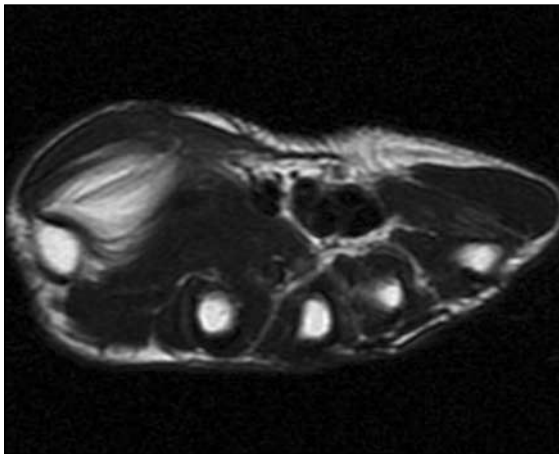


Figure 4. Axial T1-weighted spin echo (repetition time/echo time, 500/20 milliseconds) MR image showing a mass with increased signal intensity infiltrating the thenar muscles. The lesion appears isointense relative to subcutaneous fat and is compatible with a deep infiltrating intramuscular lipoma.

case, a very clear ultrasonographic depiction of such infiltrative margins and intermingled muscle fibers suggested a benign lesion rather than a malignancy. Other features that would have suggested a liposarcoma, such as heterogeneous echogenicity with a central poorly defined echo-free area (due to central necrosis or hemorrhage) and increased vascularity, were absent. Although well-differentiated liposarcomas may mimic lipomas, sarcomas are more vascular.

Intramuscular lipomas are uncommon benign unencapsulated tumors, which have also been referred to as infiltrating lipomas because of their characteristic growth pattern. Although the terms *intramuscular lipoma* and *infiltrative lipoma* have often been used interchangeably, the fact is that not all of them are truly infiltrative. A few intramuscular lipomas may be relatively well-defined and develop a pseudocapsule of compressed fibrous tissue, which depends on their growth pattern. Careful pathologic procedures have been necessary to avoid misdiagnosing a well-differentiated liposarcoma, and some surgeons recommend complete excision of all clinical evidence of a lipoma to exclude a possible malignancy, especially in fast-growing lesions. Complete resection, however, is often difficult, and the postoperative recurrence rate falls somewhere between 3% and 62%. Surgical excision of large and deep lesions is technically challenging, and the extent of resection must often be modified to avoid injury to important

neurovascular or muscular tissue and to prevent functional impairment. A lesion can be further complicated if it develops in close proximity to a nerve, where a more careful dissection is warranted, as was the case in our patient. This compromise between adequate surgical margins and functional disability may lead to incomplete resection and an obviously higher local recurrence rate. Also, although exceptionally rare, malignant degeneration into a liposarcoma has been reported.¹⁰

In this case, the resected pathologic lesion was an intramuscular infiltrating myxoid lipoma, which extended from the thenar muscles to the carpal tunnel and produced typical carpal tunnel syndrome with compression of the median nerve, reaching 23 mm² in the cross-sectional plane and elevating the palmar retinaculum. Myxoid lipoma has been called a morphologic variant of lipoma and is thought by some to be the benign counterpart of the liposarcoma.¹¹ The unusually aggressive recurrence of this lesion required a more thorough reexamination with ultrasonography and additional MRI; therefore, we evaluated the lesion with high-frequency transducers, as well as color flow and power Doppler scanning, and optimized all factors. Similar to the first examination, there were no internal flow signals except in the periphery, where arterial flow was observed that was most likely secondary to postoperative hyperemia. The mass could be clearly seen with high-resolution ultrasonography, and comparison with MRI helped establish a more confident diagnosis in this unusual case.

Recently, MRI has been used with some success to differentiate between lipomas and liposarcomas.^{12,13} In MRI, features that suggest malignancy include the following: a tumor size larger than 10 cm; septations thicker than 2 mm or with focal thickening; the presence of irregular nodular or globular conglomerate areas or both; and less than 75% of fat composition.¹⁴ This lesion clearly showed MRI characteristics suggestive of an infiltrating intramuscular lipoma and lacked any signs of malignancy.

In summary, the thenar intramuscular lipoma is a relatively rare variant of the ordinary lipoma. It should be included in the differential diagnosis of any well-defined and generally hyperechoic intramuscular mass. Our case shows the important role of ultrasonography in the diagnosis of this pathologic entity and its value in patient

treatment and follow-up. To our knowledge, a similar case has not been reported previously. Intramuscular infiltrating lipoma can be successfully diagnosed with the proper training and state-of-the-art equipment, which essentially means high-frequency transducers with color and power Doppler imaging. In any case, we are aware that this disease should be considered in the differential diagnosis of similar entities, and special attention should be given to its follow-up. In addition, whenever possible or necessary, particularly when the ultrasonographic appearance of the soft tissue mass is not distinctive, other methods such as MRI and even ultrasonographically guided biopsy may prove beneficial in establishing a diagnosis. When a definitive diagnosis is not possible, ultrasonography and MRI can be of value in narrowing the differential diagnosis and can provide valuable information regarding size, location, and involvement of important surrounding structures, such as tendons, muscular tissue, nerves, and vessels.

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