Sonographic Evaluation of Palpable Superficial Masses

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KEYWORDS

• Ultrasound • Superficial soft tissue masses • Lipoma • Solid and cystic masses
• Soft tissue malignancy

KEY POINTS

- Palpable soft tissue masses are common and ultrasonography is a first-step imaging modality in their evaluation.
- Most soft tissue masses are benign, and ultrasonography has high sensitivity and specificity for many common diagnoses.
- Knowledge of proper scanning technique as well as the sonographic appearance of specific disease entities is key to generating and refining a differential diagnosis.

INTRODUCTION

Superficial soft tissue lesions are commonly encountered in clinical practice, and often manifest as palpable masses. With an incidence of approximately 3 per 1000 people per year, 99% of these lesions prove to be benign.[1] Ultrasonography is an attractive way to image these lesions because it is inexpensive, readily available, and does not rely on ionizing radiation. With proper scanning technique, ultrasonography can readily confirm the presence of a mass, differentiate solid from cystic lesions, define the anatomic extent of the lesion, and detect vascular lesions with high sensitivity. In most cases, ultrasonography can accurately characterize the lesion, obviating biopsy and reducing unnecessary further work-up.[1] When needed, ultrasonography can also provide guidance for percutaneous biopsy. This article reviews the capabilities of ultrasonography in evaluating superficial soft tissue lesions and the sonographic appearance of common and uncommon disease entities.

APPROACH TO SONOGRAPHIC EVALUATION

Unlike many ultrasonography examinations that involve screening entire organs in search of an abnormality, often a superficial soft tissue lesion is directly palpable, aiding the radiologist or technologist in performing a focused sonographic examination. Once a brief visual inspection and physical examination have been performed, selection of the appropriate ultrasonography probe should be made in consideration of the potential depth of the lesion and the tissue penetration required. Good sonographic technique includes adjustment of the field of view to the appropriate depth, with concomitant adjustment of the focal zone to center on the suspected area of abnormality (**Fig. 1**). Superficial lesions are best evaluated with high-frequency transducers, whereas lower frequency transducers are necessary for deeper lesions. For very superficial lesions, a thick layer of gel should be used to provide some separation between the probe and the lesion and thus avoid near-field reverberation artifacts (**Fig. 2**).

Disclosure: The authors have nothing to disclose.
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Radiol Clin N Am 52 (2014) 1295–1305
http://dx.doi.org/10.1016/j.rcl.2014.07.011

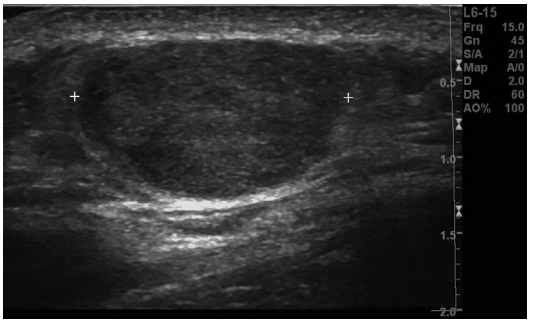

Fig. 1. Solitary fibrous tumor. Proper selection of ultrasound transducer and correct adjustment of depth and focal zone enable visualization of a superficial soft tissue mass (*cursors*) in the soft tissues of the base of the neck. The technical parameters at the right aspect of the image show that a linear 6-MHz to 15-MHz transducer was used, set at a transmit frequency of 15 MHz (optimal for superficial imaging), and penetrating to a depth of 2.0 cm. The small hourglass shapes at the right edge of the image show the focal zones corresponding with the depth of the mass.

Because some palpable abnormalities are caused by conditions other than masses, the first priority of a sonographic examination is to identify the mass. If no mass is seen, determination of alternate causes of the palpable abnormality is important. For instance, hernias can present as a mass in the abdominal wall and muscle hernias can produce palpable abnormalities in the extremities. In both situations, the dynamic nature of sonography allows real-time imaging during various maneuvers, such as real-time compression of a mass, Valsalva maneuver, or muscular contraction (**Fig. 3**).

Once identified, the next step in evaluating a superficial soft tissue lesion should be to determine whether it is solid, cystic, or mixed (**Fig. 4**). Solid lesions have an internal echotexture of variable echogenicity relative to surrounding normal tissues. Cystic lesions and fluid collections are either anechoic or very hypoechoic and can produce increased through-transmission of the ultrasound beam manifested as increased echogenicity seen posterior to the lesion. More complex cysts or fluid collections may have varying degrees of internal echoes and/or thick walls. This descriptive information should be documented because it should correlate with the suggested differential diagnosis.

The next consideration should be to determine the site of origin of the lesion, its relationship to adjacent structures, and whether it is mobile or fixed (**Fig. 5**). The margin, shape, and size have been shown to correlate with the presence or absence of malignancy. Of these criteria, tumor size of greater than 5 cm and infiltrative or lobular margins have been shown to be highly suggestive of malignancy.[2]

A particular strength of ultrasonography is its ability to detect blood flow within a lesion. Color or power Doppler evaluation (**Fig. 6**) can provide crucial information as to the presence and extent of vascular flow to a lesion, and this information can aid in generating and/or narrowing the differential diagnosis. In general, the presence of internal vascularity indicates at least the possibility that the lesion is neoplastic, either benign or malignant (**Fig. 7**). Therefore, it is crucial to optimize technical factors so that Doppler sensitivity is maximized. For superficial lesions, using a high Doppler transmit frequency is beneficial. It is also important to avoid putting pressure on the lesion with the transducer. For deeper lesions, lower Doppler transmit frequencies are needed to maximize sensitivity. It is often necessary to try various transmit frequencies to determine which is optimal. Color Doppler can detect the relative speed and direction of blood flow, whereas power Doppler is slightly more sensitive for detecting the presence or absence of flow.

A unique aspect of ultrasonography as an imaging modality is that clinicians can assess the compressibility of a mass by applying pressure

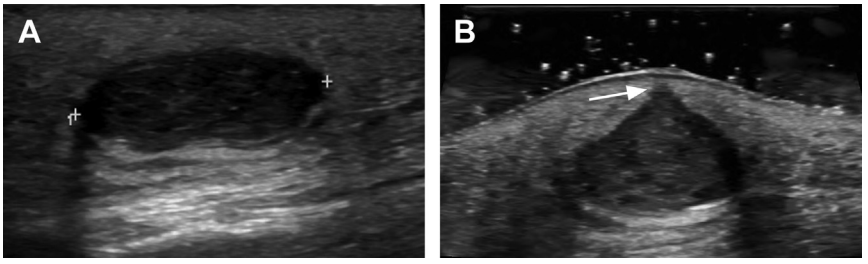

Fig. 2. Epidermal inclusion cyst. (*A*) A superficial mass (*cursors*) is shown to be hypoechoic and well circumscribed, with increased through-transmission of the ultrasound beam. (*B*) Using a thick layer of overlying gel allows better visualization and reveals a tract leading to the skin surface, consistent with an epidermal inclusion cyst (*arrow*). Small air bubbles in the gel layer cause hyperechoic reflectors.