

Ultrasound Imaging Findings of Subcutaneous Masses

Deri Altı Kitlelerde Ultrasonografi Bulguları

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Abstract

Objectives: We aimed to investigate ultrasonography (US) imaging findings of palpable superficial soft-tissue masses in routine practice.

Materials and Methods: We retrospectively investigated 92 patients with palpable subcutaneous masses, who underwent US imaging in our department between October 2012 and March 2018. Patients' electronic medical records were reviewed for US reports, pathology results if available, and clinical/radiological follow-up. Lipomas and simple cysts were considered as "absolutely benign". Hypoechoic/heterogenous solid lesions with oval shape and smooth margins, with minimal or no vascularization were determined as "probably benign". "Indetermined lesions" were defined as heterogeneous masses with irregular margins or disorganized vascularity. Heterogeneous lesions with irregular margins in patients with a primary malignancy were considered as "highly suspicious for metastases".

Results: In 9% of the patients, no lesion was detected on US. Forty-Six patients showed typical US imaging findings of lipoma, 16 lesions were defined as simple or complex cystic masses. Fourteen lesions were classified as "probably benign" on US and all of them were benign on histopathological examination. Four lesions were classified as "indeterminate" on US and histopathological diagnosis was fat necrosis in two lesions, ruptured epidermal inclusion cyst in one lesion, and leiomyosarcoma in one lesion.

Three patients with a known primary malignancy had lesions suggesting malignant infiltration, and they were all confirmed on histopathological examination. Accessory breast tissue was detected in one patient presenting with axillary palpable mass.

Conclusion: US is useful in demonstrating the presence and the nature of a mass and can diagnose benign incomplex masses. Further investigation should be considered when US findings are inconclusive.

Key Words: Ultrasound, Lipoma, Epidermal Cyst

Özet

Amaç: Günlük pratikte karşılaştığımız, yüzeysel yerleşimli, palpabl yumuşak doku kitlelerinin ultrasonografi (US) görüntüleme bulgularını araştırmak amaçlanmıştır.

Gereç ve Yöntem: Bölümümüzde Ekim 2012-Mart 2018 tarihleri arasında, palpabl deri altı lezyon nedeniyle US yapılan 92 hasta retrospektif olarak değerlendirildi. Hastane arşiv sisteminden hastaların US raporları, mevcutsa patoloji raporları, klinik ve radyolojik takipleri araştırıldı. Lipom ve basit kistler "kesinlikle benign" olarak kabul edildi. Hipoekoik/heterojen, oval şekilli ve düzgün kenarlı, minimal kanlanma gösteren ya da avasküler solid lezyonlar "olasılıkla benign" olarak sınıflandırıldı. Düzensiz kontürlü ve/veya disorganize kanlanma gösteren, heterojen solid kitleler "şüpheli lezyon" olarak belirlendi. Primer malignitesi olan hastalarda düzensiz kontürlü heterojen kitleler "yüksek olasılıkla metastaz" olarak değerlendirildi.

Bulgular: Hastaların %9'unda US ile herhangi bir lezyon saptanmadı. Kırk altı hasta lipom için tipik US bulgularına sahipti. On altı hastada basit ya da komplike kistik lezyon mevcuttu. On dört hastada "olasılıkla benign" lezyon saptandı ve hepsinde histopatolojik sonuç benign idi.

Dört hastada "şüpheli lezyon" vardı ve histopatolojik tanı ikisinde yağ nekrozu, birinde ruptür epidermal inklüzyon kisti ve birinde leiomyosarkom idi. Primer malignitesi olan üç hastada "yüksek olasılıkla metastaz" olarak değerlendirilen yüzeysel lezyonlar vardı ve hepsi patoloji ile doğrulandı. Bir hastada aksesuar meme dokusu saptandı.

Sonuç: US yüzeysel kitleleri göstermede, iç yapılarını ortaya koymada ve basit/benign kitleleri tanımda oldukça başarılıdır. İleri inceleme, US bulgularının tanımlayıcı olmadığı ya da şüpheli olduğu lezyonlarda gereklidir.

Anahtar Kelimeler: Ultrason, Lipom, Epidermal Kist

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Introduction

Patients usually present with a significant anxiety when they palpate a soft-tissue mass but a great majority of superficial soft tissue masses are benign. Malignant subcutaneous masses are relatively uncommon, and soft tissue sarcomas constitute less than 1% of all cancers (1,2). The major concern in the imaging of a soft tissue mass is to rule out sarcomas, or to diagnose a sarcoma in an early stage as this would influence the prognosis (3).

Many imaging methods including ultrasonography (US), computed tomography (CT), magnetic resonance imaging (MRI), angiography and positron emission tomography may be used in the diagnosis of soft tissue masses. US is very useful to detect or rule out superficial soft tissue masses but usually not successful enough to differentiate malignant lesions from benign ones (4). However, as it is a cost effective, safe, relatively easy to reach, and easy to perform technique, US is usually preferred for initial evaluation. As the use of imaging techniques increase, radiologists get more familiar with the imaging findings of superficial lesions. Simple or complicated cysts and lipomas have well defined sonographic features and usually no further examination would be necessary for the diagnosis. Further imaging or biopsy can be recommended for patients with indeterminate or malignant sonographic findings (2).

We aimed to investigate US imaging findings of palpable superficial soft-tissue masses in routine practice.

Materials and Methods

We retrospectively investigated 130 consecutive patients with palpable subcutaneous masses who underwent US imaging (Toshiba Aplio XG; Tokyo, General Electric Logiq S8; Milwaukee, Wisconsin) in our department between October 2012–March 2018. All examinations were performed by a radiologist with 15 years of experience in US imaging using a 10–15 MHz linear transducer. There were 43 male, and 87 female patients with a mean age of 52 years (age range: 21–80 years). Patients' electronic medical records were reviewed for US reports, pathology results if available, and clinical/radiological follow-up. Twenty-four patients who were referred to US with a suspicion of abdominal/inguinal hernia, eight patients who did not have available medical records, two patients with superficial venous thrombophlebitis and four patients with supraclavicular, axillary or inguinal lymphadenopathy were excluded from the study. US imaging findings of the remaining 92 patients were re-evaluated by two radiologists in consensus. Location, shape, size, margin, internal echogenicity and vascularity of the lesions were noted.

Lesions which had echogenicity similar to that of fat tissue were considered as lipoma. Lipomas and cystic lesions without any solid component, thick septae, irregular margins or internal vascularity were considered as absolutely benign lesions. Hypoechoic or heterogenous solid lesions with oval shape (wider than taller) and smooth margins, with peripheral/minimal vascularization or no vascularization were determined as probably benign lesions. Indetermined lesions were defined as masses with heterogenous internal echogenicity, irregular margins or internal/disorganized vascularity. Heterogenous lesions with irregular or ill-defined margins in patients with a primary malignancy were considered as "highly suspicious for metastasis".

The Institutional Ethics Committee approved this retrospective study and waived informed consent (date: 11.02.2019, decision no: 03–209–19).

Results

In eight of the 92 (9%) patients presenting with a palpable mass, no lesion was detected on US scan. The most common site of the lesions in the remaining 84 patients was upper or lower limbs, followed by head and neck. The anatomic location of the lesions are summarized in Table 1. The maximum diameter of the lesions was between 6–150 mm. The maximum diameter was between 9–150 mm in malignant, and 6–80 mm in benign lesions. Internal vascularity was detected in nine lesions (10%), and all these nine patients underwent biopsy. Three of them were epidermal inclusion cysts, one of which was ruptured. Endometriosis was detected in one patient, mesenchymal reparation was seen in one patient and lipoma with myxoid degeneration was diagnosed in one patient. Malignant infiltration was found in three of the nine patients (33%); one leiomyosarcoma, one malignant melanoma, and one lymphoma infiltration.

Forty-six patients showed typical US imaging findings of lipoma (50%). Biopsy or excision was not considered in 33 of these 46 patients. Excisional biopsy was performed in 13 lesions

Table 1: Site of the lesions

Anterior abdominal wall	11
Dorsum	11
Arm	11
Head/face and anterior neck	11
Back of the neck	6
Inguinal region	4
Thoracic wall	8
Axilla	9
Lomber/gluteal region, thigh and cruris	15

which were defined as lipoma on US scan; one lesion with internal heterogeneity and minimal vascularity was diagnosed as lipoma with myxoid degeneration on histopathological examination, two lesions were diagnosed as angioliipoma, and one lesion was diagnosed as steatocystoma. Nine of the 13 lesions were proved to be simple lipomas on histopathological examination.

Sixteen lesions (17%) were defined as simple or complex cystic masses on US scan. Six of these 16 lesions were excised or aspirated and the diagnosis was inclusion cyst in three, hemorrhagic cyst in two, and suppurative cyst in one patient. Ten of these 16 patients did not undergo biopsy or surgical excision. Three of them were inflammatory/infectious cystic lesions and were treated by antibiotics, three lesions were described as benign inclusion cysts, three were simple subcutaneous cysts and one was a hematoma under resorption.

Fourteen lesions were classified as "probably benign" lesions depending on US imaging findings and histopathological diagnosis was available in 13 of these patients. The diagnosis was chondroid syringoma in one patient, recurrent pleomorphic adenoma in one patient, perineural tumor in one patient, endometriosis in two patients, chronic inflammation/granulation tissue or fibrosis in three patients, epidermal inclusion cyst in five patients (Figures 1, 2). One of the 14 probably benign lesions, the lesion regressed during follow up and was considered as an inflammatory lesion.

Four lesions were classified as "indeterminate" lesions depending on US imaging findings and histopathological diagnosis was available in all these patients. Two of these lesions were fat necrosis, and one of them was accompanied by an incarcerated hernia on abdominal wall. One was a ruptured epidermal inclusion cyst with accompanying granulation

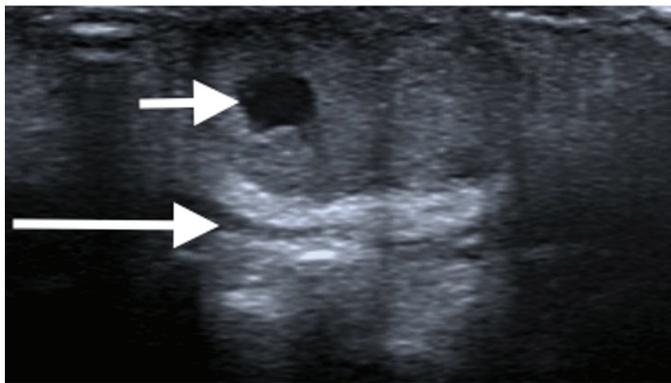


Figure 1: US image of a 44-year-old male patient presenting with a palpable mass on his chin. The lesion is located just under the skin. It is well defined, homogenous except for a small cystic component (short arrow), and shows posterior acoustic enhancement (long arrow). The lesion was classified as "probably benign" on US and the histopathological diagnosis was chondroid syringoma

US: Ultrasonography

tissue. One lesion with central necrosis was diagnosed as leiomyosarcoma (Figures 3, 4).

Three patients with a known primary malignancy who underwent US imaging had lesions suggesting malignant infiltration. One patient with malignant melanoma had a multilobulated large mass with internal vascularization on chest wall (Figure 5). One patient with lymphoma had multiple solid lesions smaller than 1 cm with smooth contours, and peripheral vascularization. One patient with T cell leukemia had a heterogenous solid lesion in the subcutaneous soft tissue of the arm. The lesion was larger than 1 cm and showed no vascularization on Doppler imaging.

Accessory breast tissue was detected in one patient who presented with a palpable axillary mass. Biopsy was not performed.

Histopathological diagnoses of the lesions are summarized in Table 2.

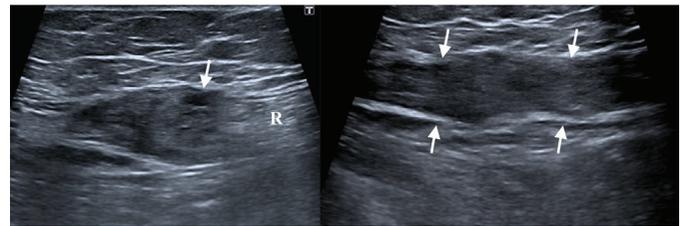


Figure 2: A 48-year-old female patient presented with a palpable mass on the lower abdominal wall. She had a history of caesarean section and endometriosis. US imaging revealed a hypoechoic fusiform mass (multiple arrows) with small cysts (single arrow) within rectus abdominis muscle (R). The lesion resembled endometriosis and was classified as "probably benign" on US. Histopathological analysis confirmed the diagnosis

US: Ultrasonography, R: Right

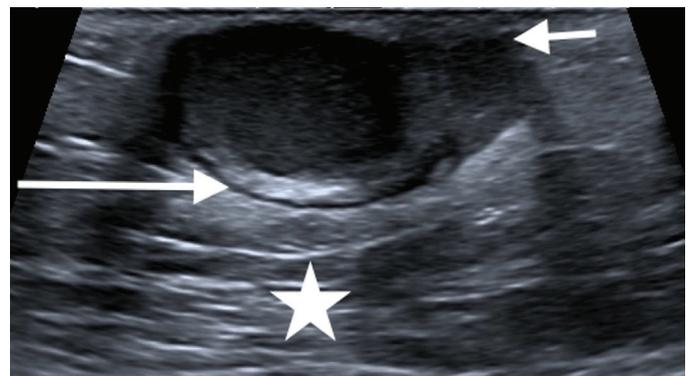


Figure 3: US image of a 44-year-old female patient presenting with a superficial mass on her right thigh. A subcutaneous hypoechoic solid mass with lobulated contours (short arrow), and a dependent hyperechoic component (long arrow). Also note the posterior acoustic enhancement (asterisk). The mass was classified as "indeterminate" and histopathological diagnosis was ruptured epidermal cyst and accompanying granulation tissue

US: Ultrasonography

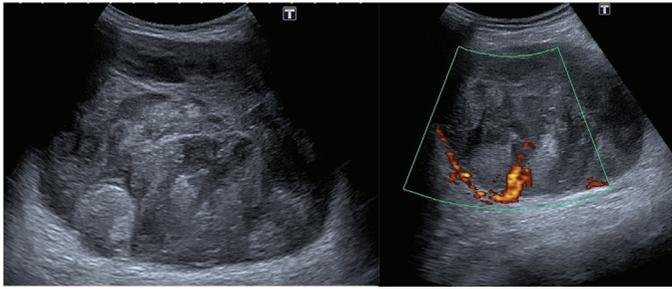


Figure 4: US imaging of a 56-year-old female patient shows a large heterogenous mass with peripheral vascularization on Power Doppler. The lesion was located in left gluteal region. Histopathological diagnosis was leiomyosarcoma

US: Ultrasonography

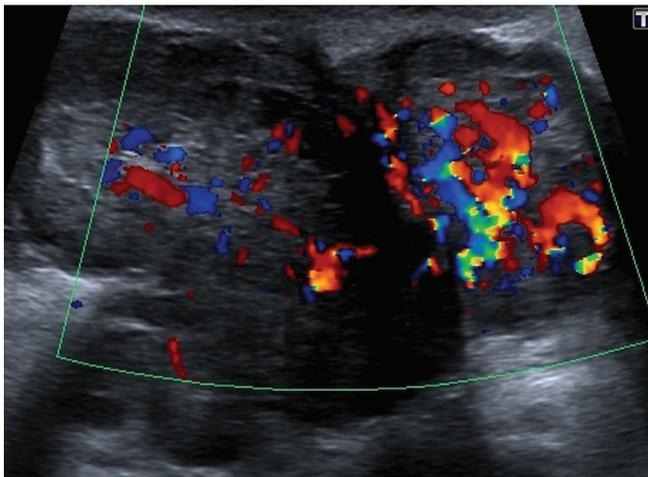


Figure 5: A 41-year-old female patient with malignant melanoma presented with palpable lesions on the chest wall. US image showed a highly vascularized, multilobulated heterogenous solid mass. It was reported as "highly suspicious for metastasis" and the diagnosis was confirmed by histopathological examination

US: Ultrasonography

Table 2: Histopathologic Diagnosis

Benign mesenchymal tumor	13
Epidermal inclusion cyst	8
Malignant infiltration	5
Chronic suppurative inflammatory lesions	3
Complex cyst	4
Endometriosis	2
Benign cutaneous tumor	1
Pleomorphic adenoma	1
Peripheric nerve sheath tumor	1
Fat necrosis	2

Discussion

Palpable superficial lumps and bumps are frequently encountered in routine practice. Physical examination is

important but imaging is almost always necessary. In our study approximately 9% of our patients did not have a mass on US scan. So, the first step in evaluating a patient complaining about a subcutaneous lump or bump is to prove the presence of a lesion. US can quickly and easily demonstrate the presence of a mass as well as its cystic or solid nature. Depending on sonographic findings, need for further examination, biopsy, excision or radiological follow-up can be determined.

The wide availability, low costs, high spatial resolution, ability to evaluate vascularization in Doppler mode, the guidance of biopsy and advantage of real time imaging are the advantages of US scanning (5). US Elastography techniques which measure the tissue elasticity can also provide useful information in evaluating subcutaneous lesions. The stiffness of a mass and comparison of stiffness between neighbouring structures may help to differentiate benign and malignant masses depending on cellular differentiation and tissue characteristics. Nevertheless, there is no conclusion in the literature and many studies are needed (6,7).

MRI is usually preferred for further evaluation of soft tissue masses because it has a high contrast resolution, multiplanar imaging capability, and no radiation exposure. It would be valuable for differential diagnosis, and staging (8). With the advances in technology, thin-section CT scanning can allow multiplanar reconstructions but MRI is still considered superior to CT due to its higher soft tissue contrast and lack of ionizing radiation. Although histopathological examination would be necessary in patients with indeterminate findings, it is utmost importance to perform MRI before biopsy to avoid possible soft tissue signal alterations due to biopsy (9).

US characteristics are usually definitive for cysts and simple lipomas but are frequently nonspecific for other superficial soft tissue masses. In concordance with the literature lipoma was the most frequent lesion in our study (2). When internal heterogeneity and/or vascularity is detected, biopsy may be considered but none of the lesions defined as complex lipoma on US scan in our study group showed malignant features on histopathological examination.

Cystic masses encountered only 17% of the lesions in our study group. Besides hemorrhagic or suppurative cysts, epidermal cysts were also seen. Epidermal cysts are one of the most common superficial soft tissue lesions. They may contain keratinous or sebaceous particles and sonographic features may change from anechoic cysts to complex lesions or solid appearance depending on their internal composition (10). Two distinctive US findings are reported for epidermal cysts; "pseudotestis pattern" and "submarine sign". An oval shaped lesion involving more than half depth of dermal layer with homogeneous echotexture and low to medium internal echoes (pseudotestis pattern), and with a focal projection towards the

epidermis (submarine sign) can be diagnosed as an epidermal cyst (10,11).

In our study, none of the lesions classified as "probably benign" on US were malignant. So, we can suggest that US can accurately define benign lesions. On the other hand, all four lesions defined as "indeterminate" on US scan were complex masses, and one of them was diagnosed as leiomyosarcoma. We believe that if US findings are indeterminate, further imaging would be necessary and biopsy should not be avoided.

We should also keep in mind that a patient with a history of malignancy, a superficial mass may represent cutaneous or subcutaneous metastasis as seen in malignant melanoma (12). As on all imaging studies including MRI, malignant tumors might resemble benign ones, being aware of the patient's clinical history, and laboratory test results, would help the radiologist for differential diagnosis (13).

Study Limitations

Our study has some limitations. As this is a retrospective study, the study population is heterogeneous, and we could not include US elastography measurements as only some of the patients had recorded elastography images. Another limitation is that more than half of our patients did not have histopathological examination.

Conclusion

US can be used as the first line imaging method in palpable superficial lesions. Most of these lesions are benign. US is useful in demonstrating the presence, and the nature of a mass and can diagnose benign incomplex masses. MRI and biopsy should be considered when US findings are inconclusive.

Ethics

Ethics Committee Approval: This study was approved by Ethics Committee of Ankara University Faculty of Medicine (date: 11.02.2019, decision no: 03-209-19).

Informed Consent: Since this study is retrospective, informed consent was not obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: N.H., Concept: N.H., Design: N.H., M.F.A., Data Collection or Processing: M.F.A., B.G., Analysis or Interpretation: N.H., M.F.A., B.G., Literature Search: M.F.A., B.G., Writing: N.H., M.F.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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