

Ultrasonographic analysis of subcutaneous angioliipoma

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Abstract

Objective To describe and analyze the ultrasonographic appearance of subcutaneous angioliipoma in pathology-proven cases.

Materials and methods We retrospectively searched the January 2004 to May 2011 surgical pathology database for cases of pathology-proven angioliipoma. The ultrasonographic findings were analyzed for angioliipoma size, shape, margin, echo texture, echogenicity, acoustic enhancement, calcifications, and color Doppler flow.

Results Of 31 angioliipomas, 19 lesions occurred in an upper extremity, one in a lower extremity, nine in the chest and abdominal wall, and two in the back. The mean tumor size was 17.7 mm. Twenty-five cases (80%) appeared as oval mass and all tumors had well-defined margins. All cases showed hyperechoic; 14 (45%), homogeneous; 17 (55%), heterogeneous. Seven cases (23%) showed blood flow in the mass. Acoustic enhancement and calcification was not shown in any cases. A correct preoperative diagnosis was made in three cases (10%) by ultrasonography.

Conclusions Most subcutaneous angioliipomas are oval-shaped, have well-defined margins, and hyperechoic

appearance on ultrasonography. Although color Doppler flow of subcutaneous angioliipoma is not seen in many cases, it may help in differentiating angioliipoma from ordinary subcutaneous lipoma.

Keywords Neoplasms · Adipose tissue · Angioliipoma · Ultrasonography

Angioliipoma was originally described by Howard and Helwig in 1960 [1]; it is a common vascular lipoma variant which accounts for 5–17% of all lipomas [2], which are classified as a noninfiltrating form and a rare, deeper infiltrating form involving skeletal muscle and deep soft tissues [3]. The noninfiltrating type occurs on the trunk and extremities of young adults, with the forearm being the most common location [2, 3]. Lesions previously described as being deep infiltrating angioliipomas have now been recognized by the World Health Organization (WHO) as intramuscular hemangiomas [4, 5]. Angioliipomas manifest as small (< 2 cm), slowly growing, subcutaneous mass that are painful on palpation. The pain often diminishes over time and is not intensified by thermal changes. Trauma has been suggested as a possible contributing cause of the lesion [6].

There are several clinical reports of subcutaneous angioliipoma in the English pathology and dermatology literature [7, 8]. Because of their subcutaneous location and indolent clinical appearance in young patients, angioliipomas are only rarely imaged. The ultrasonographic appearance of subcutaneous angioliipoma has been described in a case report [9], however, ultrasonographic findings including the internal vascularity in a large number of subcutaneous angioliipomas, have not been reported in the literature.

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In the present study, we analyze and describe the ultrasonographic findings of subcutaneous angioliipoma.

Materials and methods

We retrospectively searched our hospital's surgical pathology database from January 1, 2004 and May 31, 2011 for cases of pathologically proven angioliipoma. Sixty-eight cases were identified. We excluded 35 angioliipomas without preoperative imaging studies as well as two patients who had undergone MRI. Therefore, 31 angioliipomas with preoperative ultrasonography were included in this study. Two patients had four angioliipomas, three patients had three angioliipomas, and one patient had two angioliipomas in different anatomic sites. The study population consisted of five female patients and 13 male patients (mean age, 40.8 years; range, 22–58 years). The study was conducted according to the principles of the Declaration of Helsinki, and all patients gave informed consent for the use of their information.

Ultrasonography was performed by an experienced musculoskeletal radiologist (B.S.K.) using either an HDI 5000 (Philips Medical Systems, Bothell, WA) or an iU-22 scanner (Philips Medical Systems, Bothell, WA) equipped with a 5- to 12-MHz or 7- to 15-MHz linear array transducer. Gray-scale and color Doppler flow ultrasonographic images were obtained. Scanning was done in both the transverse and longitudinal planes. The images were reviewed in consensus by two musculoskeletal radiologists (B.S.K. and S.Y.L.) with 8 years and 3 years, respectively, of musculoskeletal ultrasonography.

The gray-scale images were evaluated for the following characteristics: size (maximum diameter); shape (round, oval, or lobular); margin (well-defined or ill-defined); echogenicity relative to the adjacent muscle (hyperechoic, isoechoic, or hypoechoic); echotexture (homogeneous or heterogeneous); acoustic enhancement; and internal calcification. The presence of vascularity was determined and its pattern (peripheral, central, or peripheral and central) was identified on color Doppler ultrasonographic images.

Results

Of the 31 angioliipomas included in this study, 19 (61%) were located in the upper extremity [forearm ($n=11$), upper arm ($n=4$), elbow ($n=4$)], one (3%) was in the lower extremity, nine (29%) were in the chest and abdominal wall, and two (7%) were in the back. All 31 lesions appeared as painless, palpable masses according to our medical records. Thirty tumors (97%) were slow-growing over several months or years.

The ultrasonographic features of subcutaneous angioliipoma are shown in Table 1. On examination, the largest tumor diameters varied from 7 to 44 mm (mean, 17.7 mm) and 20 (65%) were between 11 and 20 mm. With regard to lesion shape, 25 (80%) were oval, three (10%) were round, and three (10%) were lobular. All tumors had well-defined margins and showed hyperechoic appearance versus muscle echogenicity. Internal echogenicity had as homogeneous appearance in 14 cases (45%) (Fig. 1) and heterogeneous appearance in 17 cases (55%) (Fig. 2a). No tumor showed acoustic enhancement or internal echogenic foci representing calcification. Doppler flow signals were observed in seven cases (23%) but not in the other 24 cases (77%); they were also visible in the peripheral region in all cases (Fig. 2b).

A correct preoperative diagnosis was made in three cases (10%) by ultrasonography. The common ultrasonographic misdiagnoses were lipoma and hemangioma.

Discussion

Angioliipoma is a common vascular lipoma variant. Subcutaneous angioliipoma is a distinct lesion differing from the most common ordinary lipoma in several respects. It is usually smaller than a lipoma and appears at an earlier

Table 1 Ultrasonographic features of subcutaneous angioliipoma

Ultrasonographic findings	No. of lesions (%)
Largest diameter, mm	
≤10	3 (10)
11–20	20 (65)
≥21	8 (25)
Shape	
Oval	25 (80)
Round	3 (10)
Lobular	3 (10)
Margin	
Well-defined	31 (100)
Ill-defined	0 (0)
Echo texture	
Homogeneous	14 (45)
Heterogeneous	17 (55)
Echogenicity	
Hyperechoic	31 (100)
Hypoechoic	0 (0)
Posterior acoustic enhancement	0 (0)
Calcification	0 (0)
Doppler flow	
Peripheral	7 (23)
Central	0 (0)

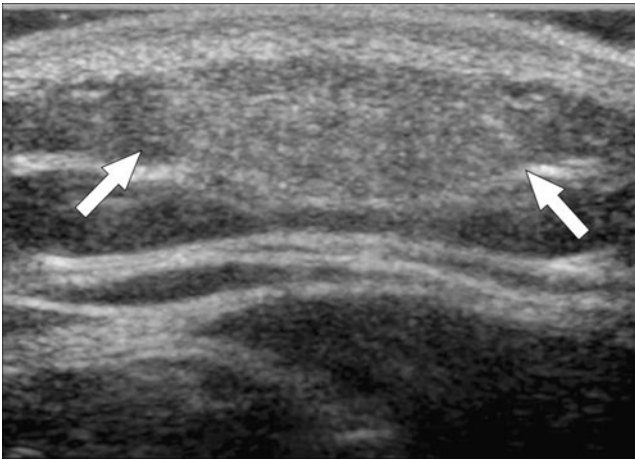


Fig. 1 A 27-year-old male with a subcutaneous angioliipoma on the left forearm. Ultrasonography shows a well-circumscribed, homogeneous, hyperechoic mass (*white arrows*)

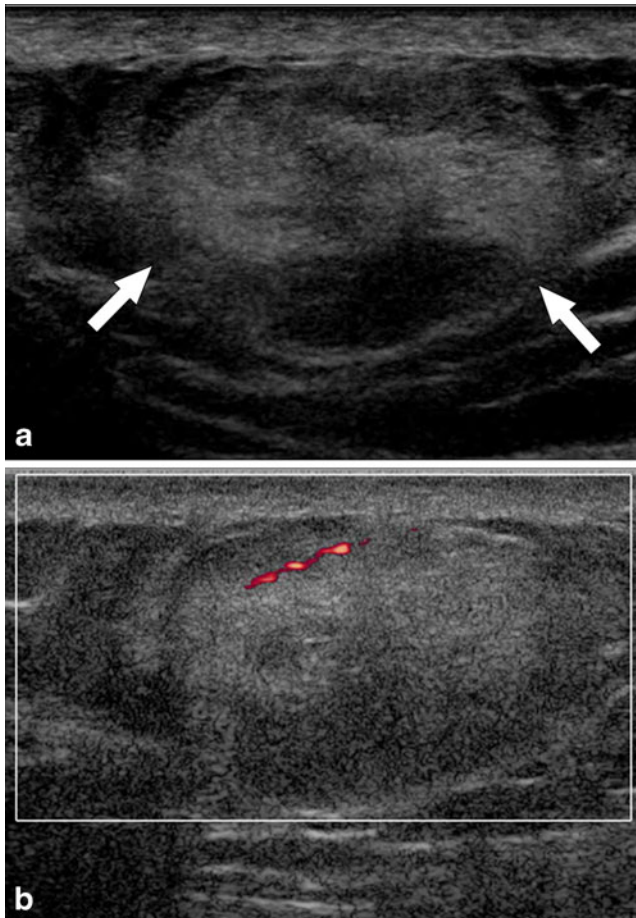


Fig. 2 A 29-year-old male with a subcutaneous angioliipoma on the left abdominal wall. **a.** Ultrasonography of the palpable mass shows its well-circumscribed, hyperechoic appearance with occasional, internal hypoechoic areas (*white arrows*). **b.** Color Doppler image shows the inner peripheral vascularity of the mass

patient age, usually as multiple subcutaneous small nodules in young adults [1, 10]. Angioliipoma generally occurs sporadically, although a familial tendency has been noted in approximately 10% of patients [1].

Histologically, angioliipoma has a normal karyotype in contrast to ordinary lipoma with karyotypic abnormalities. The fact that subcutaneous angioliipoma has a virtually consistent normal karyotype would be more in keeping with their non-neoplastic nature, and this supports the clinicopathologic impression of this lesion as being reactive or hamartomatous [11]. Microscopic examination of angioliipoma revealed mature adipose tissue separated by a branching network of small blood vessels. Vessels often appear as lobulated collections at the tumor periphery and may be plugged with hyaline thrombi, both of which are highly suggestive of the diagnosis [3, 12].

At our institution, 51% of all subcutaneous angioliipomas were excised without preoperative imaging studies. This is mainly due to the superficial location of subcutaneous angioliipomas. Also, the ultrasonographic features of this tumor are not well known due to excision without preoperative imaging studies. Choong et al. [9] reported the ultrasonographic appearance of subcutaneous angioliipoma as being well-defined, predominantly hyperechoic masses containing small, patchy, hypoechoic areas and with a sparse internal vasculature. Similarly, the subcutaneous angioliipoma appeared as a well-defined and hyperechoic mass compared to the muscle in a published study [13]. According to case reports regarding the ultrasonographic findings of angioliipoma in the breast, common findings also included a well-circumscribed, hyperechoic mass without posterior acoustic enhancement or shadowing [14, 15]. Most of the subcutaneous angioliipoma seen in our study showed well-defined margins, hyperechoic appearance, and no acoustic enhancement or calcification; these findings are similar to those of previous case reports.

Because subcutaneous angioliipoma is a lipoma variant, the ultrasonographic findings are expected to resemble those of lipoma; Fornage et al. [16] described its ovoid shape (100%), well-defined margin (60%), hyperechoic (29%) or hypoechoic (29%) appearance, whereas Ahuja et al. [17] described the ovoid shape (100%), well-defined margin (88%), and hyperechoic (76%) appearance on ultrasonography. In our study, subcutaneous angioliipomas had an ovoid shape in some cases, and well-defined margins and hyperechoic appearance in more cases when compared to a previous report regarding ordinary subcutaneous lipoma. Lipomas commonly have an internal structure very similar to the surrounding fat with internal striations, and may, therefore, sometimes be almost invisible on ultrasonography. The hyperechoic appearance of all of the angioliipomas in our study is one of the different findings from lipomas. In addition, acoustic enhancement

or calcification was not seen in all cases in our study, and these findings are also the same as those seen in previous reports regarding ordinary subcutaneous lipoma.

Vascular signal on color Doppler images is sometimes seen in a larger, ordinary subcutaneous lipoma and is prominent in a hemangioma. As the size of an ordinary subcutaneous lipoma or hemangioma increases, proliferation of the internal vessel or of adjacent adipose tissue is thought to have occurred. Therefore, color Doppler findings of ordinary lipoma or hemangioma may be similar to those of subcutaneous angioliipoma.

The presence of blood flow within subcutaneous angioliipoma has also not been assessed previously. In our study, color Doppler flows were found in only seven cases (23%) and in a peripheral region in all cases. This finding is explained by the differences in the components of lipomatous and angiomatous elements. The ratio of mature lipocytes and angiomatous proliferation elements varies, and the degree of vascular proliferation ranges from less than 5% to more than 90% of the lesion [14]. Use of the technique of Doppler ultrasonography is also important. If the soft tissue is compressed, the vascular structures can become compromised, thus leading to an underestimation of blood flow. Ideally, minimal transducer pressure should be exerted while still maintaining good contact. The most effective way to achieve this is to use copious jelly [18]. Understanding and optimization of the Doppler parameters is necessary in order to detect low velocity flow. Compared to color Doppler, power Doppler is much more sensitive to slow flow and thus usually proves to be more valuable. In our study, only the color Doppler technique was used in all cases. If we had used power Doppler, the detection rate of blood flow in subcutaneous angioliipomas may have increased.

Most angioliipomas have an excellent prognosis after complete surgical excision [19]. There is no tendency toward either malignant transformation or local recurrence. In our study, no local recurrence or distant metastasis of subcutaneous angioliipoma was found in any cases.

The ultrasonographic differential diagnosis of subcutaneous angioliipoma includes ordinary lipoma, hibernoma, hemangioma, pilomatricoma, and liposarcoma. Ordinary lipoma cannot be distinguished from subcutaneous angioliipoma on gray-scale images. On color Doppler ultrasonographic images, an ordinary lipoma usually shows no vascular signal; however, in some large, subcutaneous lipomas with internal vascularity, the differential diagnosis is very difficult. Hibernoma may have a hypervascular appearance rather than that of subcutaneous angioliipoma. Hemangioma has occasionally calcifications (phleboliths) and usually low-frequency Doppler flows are evident within anechoic vascular channels; if a hemangioma does not have calcifications or anechoic vascular channels, it is

difficult to distinguish between angioliipoma and hemangioma. Pilomatricoma has inner echogenic calcification, a peripheral hypoechoic rim, and peripheral Doppler flow. Liposarcoma, in particular the well-differentiated subtype, also appears as a well-defined, heterogeneous, multi-lobulated mass with internal vascularity; however, it rarely occurs in the subcutaneous fat layer, it appears as a larger mass, and occasionally has calcifications.

This study has several limitations. Because of its retrospective nature, we found it difficult to characterize the ultrasonographic features in a few of the earlier cases. Variability in the interpretation of the surgical specimens by the pathologists is also one of the limitations.

In conclusion, most subcutaneous angioliipomas are oval-shaped with well-defined margins and hyperechoic appearance on ultrasonography. Although color Doppler flow of subcutaneous angioliipoma is not seen in many cases, it may be helpful for differentiating angioliipoma from ordinary subcutaneous lipoma.

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Conflict of interest The authors declare that they have no conflicts of interest.

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