Efficacy of Diagnostic Ultrasonography of Lipomas, Epidermal Cysts, and Ganglions

Yoshihiro Kuwano, MD, PhD; Kazuho Ishizaki, CT; Rei Watanabe, MD, PhD; Hiroko Nanko, MD, PhD

Objective: To determine the efficacy of ultrasonography for the diagnosis of subcutaneous benign lesions.

Design: Retrospective study.

Setting: Tokyo Kousei-Nenkin Hospital, Tokyo, Japan.

Patients: The study included 183 patients with subcutaneous benign lesions who underwent ultrasonography and then received a pathologic diagnosis after surgery.

Main Outcome Measures: The study evaluated the number of cases in which the preoperative diagnosis after ultrasonography or just after palpation agreed with the pathologic diagnosis.

Results: Ultrasonography significantly increased the preoperative diagnostic yield of subcutaneous benign lesions (after palpation, 29%; after ultrasonography, 46%; P < .001). The sensitivity for the diagnosis of lipoma (after palpation, 54.8%; after ultrasonography, 88.1%; P < .01) and the specificity for the diagnosis of epidermal cyst (after palpation, 93.5%; after ultrasonography, 99.3%; P < .05) significantly increased after ultrasonography. The sensitivity for the diagnosis of epidermal cyst and ganglion also tended to increase after ultrasonography.

Conclusion: The study results suggest that ultrasonography is useful for the preoperative examination of subcutaneous benign lesions.

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ULTRASONOGRAPHY IS AN IMPORTANT diagnostic tool in many aspects of clinical medicine. It is a noninvasive method of examination that provides high-resolution images in real time. The instrument for ultrasonography is generally cheaper than that for computed tomography or magnetic resonance imaging and can sometimes even be found in small clinics in Japan.

There are 2 basic types of ultrasonography with dermatologic applications.1 Ultrasonography with 20-MHz probes is used to obtain preoperative information about tumor thickness in superficial skin tumors, including melanoma, basal cell carcinoma, and squamous cell carcinoma.1-2 Scanning with 20-MHz probes is also used to measure skin thickness during the treatment of inflammatory diseases such as scleroderma or psoriasis.3-5 Therefore, ultrasonography is an important diagnostic tool in the field of dermatology.1-6 Furthermore, probes with a frequency higher than 20 MHz (eg, 50 MHz) can be used to examine the skin and skin lesions. In contrast to the well-established role of the high-frequency ultrasound systems, the use of ultrasound scanning with 7.5- to 10-MHz probes is not as widespread, although promising results have been reported from specialized diagnostic units, especially for the assessment of peripheral lymph nodes and subcutaneous tumors.1-7-10 Ultrasonography of subcutaneous tumors is useful for acquiring information about the nature, size, and depth of the lesions as well as their relationship to adjacent vessels and other structures. An elongated isoechoic or echogenic mass in the subcutaneous tissues should suggest the diagnosis of lipoma.11 The echo phenomena caused by the tumor are very much like those of subcutaneous fat tissue.12 The existence of striated echoes in the tumor corresponding to the septa increases the possibility of lipoma. Epidermal cysts have the typical characteristics of cysts; ie, they have a round to oval structure along with the phenomena of dorsal acoustic amplification and lateral shadowing.6-12-14 They also show central echoes of nonanechoic intensity owing to their contents as well as partial indentation to the dermis when they are subcutaneous. Subcutaneous metastases of malignant melanoma often show a spheroidal lesion that demonstrates partial or even extensive vascularization,15 and they appear almost anechoic, often with a dorsal acoustic attenuation, while subcutane-

Author Affiliations:
Departments of Dermatology (Drs Kuwano, Watanabe, and Nanko) and Clinical Laboratories (Mr Ishizaki), Tokyo Kousei-Nenkin Hospital, and Department of Dermatology, University of Tokyo (Drs Kuwano and Watanabe), Tokyo, Japan.
ous benign tumors appear rather echogenic. These features are useful for preoperative diagnosis. However, introduction of the ultrasound machine and the frequency of its use vary substantially by country or region. In Japan, the decision whether or not to use ultrasonography in cases involving subcutaneous lesions differs considerably, even among dermatologists who are working in hospitals of similar scale. Some dermatologists may be anxious about the efficacy of ultrasonography. In this study, we examined the number of cases in which the preoperative diagnosis after ultrasonography agreed with the pathologic diagnosis. Then, we compared this number with the number of cases in which the clinical diagnosis before ultrasonography corresponded to the pathologic diagnosis.

**METHODS**

**PATIENTS**

The study group comprised 183 patients with subcutaneous benign lesions and no changes in skin surface who underwent ultrasonography and received a pathologic diagnosis after surgery at Tokyo Kousei-Nenkin Hospital, Tokyo, Japan, from 1998 to 2006 (Table 1). Ultrasonography was not performed in cases in which the diagnosis of the lesions was easy, ie, made simply by clinical examination, as in an epidermal cyst with a central keratin-filled punctum. Therefore, such lesions were not included in our study. There were no patients with malignant subcutaneous tumors. Institutional review board approval was obtained for data collection and outcome analysis of cases in the institutional database.

**ULTRASONOGRAPHY AND DIAGNOSTIC ACCURACY**

First, we investigated the diagnostic accuracy just after palpation and after ultrasonography (Table 2). The number of cases in which the preoperative diagnosis agreed with the pathologic diagnosis was significantly higher after ultrasonography than after palpation (after ultrasonography: **91.5%**, clinical diagnosis: **71.4%**, **P** < .05). An elongated isoechoic mass with striated echoes corresponding to the septa in the subcutaneous tissues was diagnosed as a lipoma (Figure 1A). A round to oval nonanechoic mass with partial indentation to the dermis and with dorsal acoustic amplification was diagnosed as an epidermal cyst (Figure 1B). An anechoic amorphous mass with a relatively sharp border and joint communication was diagnosed as a ganglion (Figure 1C).
nography, 85 cases [46%]; after palpation, 53 cases [29%]; P < .001). Also, the number of cases in which the preoperative diagnosis disagreed with the pathologic diagnosis was significantly lower after ultrasonography (after ultrasonography, 4 cases [2%]; after palpation, 16 cases [9%]; P < .01). Therefore, we found that ultrasonography significantly increased diagnostic accuracy in the examination of subcutaneous benign lesions.

**DIAGNOSTIC ACCURACY WITH ULTRASONOGRAPHY FOR EACH TUMOR**

To clarify which tumors could best be detected by ultrasonography, we also examined the diagnostic accuracy for each tumor. Tumors with a large number of cases were classified according to lesion type, and the diagnostic accuracy was counted for each tumor (Table 3). The other, miscellaneous lesions, which were too few to analyze, were classified as “others” in the table. The lesions for which the suggested diagnosis agreed with the pathologic diagnosis among those classified as others were schwannoma, calcifying epithelioma, and thomibus. Higher diagnostic capabilities were shown after ultrasonography than after palpation in each tumor. Therefore, we concluded that ultrasonography is useful for diagnosing the broad range of benign tumors. Next, we investigated the sensitivity and specificity for the diagnosis of each subcutaneous benign tumor (Figure 2). Concerning lipoma, the sensitivity after ultrasonography was significantly higher than that just after palpation (after palpation, 54.8% [95% CI, 38.7%-70.2%]; after ultrasonography, 88.1% [95% CI, 74.4%-96.0%]; P < .01). The sensitivity after ultrasonography also tended to be higher than that with palpation with regard to epidermal cyst or ganglion (epidermal cyst: after palpation, 43.2% [95% CI, 28.4%-59.0%]; after ultrasonography, 65.9% [95% CI, 50.1%-79.5%]); (ganglion: after palpation, 27.8% [9.7%-53.5%]; after ultrasonography, 38.9% [95% CI, 17.3%-64.3%]). Also, while both palpation and ultrasonography showed high specificity for epidermal cyst, the specificity after ultrasonography was significantly higher than after palpation as well (epidermal cyst: after palpation, 93.5% [95% CI, 88.1%-97.0%]; after ultrasonography, 99.3% [95% CI, 96.1%-100%]; P < .05) (lipoma: after palpation, 97.9% [95% CI, 93.9%-99%]; after ultrasonography, 99.3% [95% CI, 96.1%-100%]) (ganglion: after palpation, 100% [95% CI, 97.8%-100%]; after ultrasonography, 100% [95% CI, 97.8%-100%]). We also calculated the positive and negative likelihood ratios (Table 4). Ultrasonography also improved the positive and negative likelihood ratios for each tumor. These data suggest that ultrasonography greatly improves diagnostic accuracy for subcutaneous benign tumors.

**COMMENT**

In the current study, we investigated the diagnostic accuracy of subcutaneous benign tumors after ultrasonography and compared this accuracy with that just after palpation. Notably, the diagnostic accuracy after ultrasonography was significantly greater than after palpation (Table 2). Improvement of diagnostic accuracy was shown in a variety of lesions (Table 3). Next, the sensitivity, specificity, and positive and negative likelihood ratios were determined for each tumor that had a large number of cases, and we found that ultrasonography increased sensitivity and specificity and improved the positive and negative likelihood ratios (Figure 2 and Table 4). These data strongly support the usefulness of ultrasonography for the preoperative diagnosis of subcutaneous benign lesions. Some small subcutaneous benign lesions may be removed in an in-office procedure. However, when the diagnosis is uncertain, patients with very small lesions are typically referred to a hospital for surgery. The improvement of diagnostic ability with ultrasonography may lead to an increase in the number of patients who require only an in-office procedure.

Ultrasound with a frequency higher than 20 MHz can be considered high frequency and is acceptable for ex-
amination of the skin or skin lesions. Ultrasound with a lower frequency (8.5 MHz was used in this study) is not as precise, but as only subcutaneous benign lesions were examined in our study, the lower frequency was adequate. Metastasis of a malignant tumor often demonstrates an oval mass with dorsal acoustic attenuation (the image shown in Figure 1B could also represent metastasis of a malignant tumor, eg, a melanoma). While the echogenicity of the mass can indicate that the mass is benign, the anamnesis and clinical symptoms are also important, and histologic analysis is still the criterion standard for differentiation.15

Inampudi et al17 demonstrated the low accuracy of ultrasonography in the diagnosis of soft-tissue lipomas (sensitivity, 40%-52%; specificity, 64%-86%). Intramuscular lipomas are relatively difficult to diagnose using ultrasonography. Therefore, the difference in accuracy between their data and ours may have occurred because their study included a large number of intramuscular lipomas. The use of ultrasonographic and histologic findings as the standard of reference may be a source of selection bias, as atypical or unusual masses may be more likely to undergo ultrasound examination and be removed. Thus, both the sensitivity and the specificity may actually be greater in the actual clinical situation than they appeared to be in our study because of this potential selection bias. Furthermore, ultrasonography and palpation were not independently performed in this study. Therefore, the respective diagnostic value of ultrasonography cannot be calculated. However, the relative improvement of the diagnostic accuracy after ultrasonography still offers valuable insight regarding the importance of ultrasonography. In conclusion, ultrasonography of subcutaneous benign lesions greatly increases the reliability of preoperative diagnosis and is useful for preoperative examination.

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Correspondence: Yoshihiro Kuwano, MD, PhD, Department of Dermatology, Tokyo Kousei-Nenkin Hospital, 5-1 Tsukudo-cho, Shinjuku-ku, Tokyo 162-8543, Japan (kuwanoy-tky@umin.ac.jp).

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REFERENCES