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ORIGINAL ARTICLE

Sonographic Features of Breast Fibroepithelial Masses: Distinguishing Fibroadenoma from Phyllodes Tumour

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ABSTRACT

Objective: *Fibroepithelial tumours of the breast, which include fibroadenoma (FA) and phyllodes tumour (PT), are benign entities. Although they show different biological behaviours, distinguishing between them using imaging features or core needle biopsy (CNB) is challenging. We evaluated sonographic and CNB features, that could be useful for distinguishing between the two.*

Methods: *A total of 121 patients with 125 lesions diagnosed as fibroepithelial tumours on ultrasound-guided CNB from March 2017 to April 2020 were studied. Among them, sonographic features of 68 lesions were retrospectively analysed. Clinicopathological results of CNB and surgical excision were reviewed using electronic medical records.*

Results: *On ultrasound, tumour size, echogenicity, presence of an internal cleft, vascularity, and elasticity revealed significant differences between FA and PT. Tumour size ≥ 3 cm, presence of an internal cleft, and hard elasticity were common sonographic features in PTs. CNB revealed similar pathological results with surgical excision performed in 61 cases of 68 cases (89%).*

Conclusion: *Ultrasonographic features can be useful imaging factors for distinguishing between FA and PT. Ultrasound-guided CNB can replace surgical excision with a high diagnostic accuracy in some cases.*

Key Words: *Breast; Fibroadenoma; Phyllodes tumor; Ultrasonography*

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Data Availability: All data generated or analysed during the present study are included in this published article (and its supplementary information files).

Ethics Approval: This retrospective study was approved by the Institutional Review Board of Busan Paik Hospital, South Korea, and the requirement for informed consent was waived (Ref: BPIRB 2020-01-026-009).

中文摘要

乳腺纖維上皮腫塊的超聲特徵：區分纖維腺瘤和葉狀腫瘤

GY Lee、GW Shin、HY Park、HK Yoon、TH Kim、A Lee、YJ Heo、YJ Lee、JY Han、YM Park

目的：乳腺纖維上皮腫瘤，包括纖維腺瘤（FA）和葉狀腫瘤（PT）為良性病變。儘管它們表現不同的生物學行為，但用影像學特徵或核心針活檢（CNB）來區分兩者並不容易。本研究評估可能有助於區分兩者的超聲和CNB特徵。

方法：研究2017年3月至2020年4月超聲引導CNB診斷為纖維上皮腫瘤的 121例患者共125個病灶。其中回顧性分析了68個病灶的超聲特徵，並通過電子病歷回顧CNB和手術切除標本的臨床病理學結果。

結果：在超聲學上，腫瘤大小、迴聲、內裂的存在、血管分佈和組織彈性顯示FA 和PT間存在顯著差異。腫瘤大小≥3 cm、存在內裂和彈性較硬是PT的常見超聲特徵。CNB在68例中的61例（89%）中顯示與手術切除相似的病理結果。

結論：超聲影像學特徵有助於鑑別FA和PT。在某些情況下，超聲引導的CNB 可以替代手術切除，具有很高的診斷準確性。

INTRODUCTION

Fibroepithelial tumours of the breast, including fibroadenoma (FA) and phyllodes tumour (PT), are composed of a biphasic proliferation of both epithelial and stromal components.[1] The distinction between FA and PT is clinically important. While FAs generally regress with age and can be safely followed without further investigations, PTs continue to grow, requiring wide local excision to prevent local recurrence.[2-4] The risk of local recurrence in PTs ranges from 17% in benign PT to 27% in malignant PT, with metastasis occurring in approximately 25% of malignant PTs.[5] Most recurrent PTs are histologically similar to the initial tumour; however, in up to 26% of initially benign PTs, there is a risk of recurrence as borderline or malignant PTs.[6,7]

Although the two disease entities show different biological behaviours, distinguishing between them using imaging features or core needle biopsy (CNB) is challenging.[8,9] Histologically, PT is usually distinguished from FA based on the presence of hypercellular stroma that show leaf-like projection. However, a definite diagnosis with CNB is difficult owing to the small sample size and because hypercellularity also can be present in juvenile FAs and in the breast tissue of women receiving hormone replacement therapy.[10-12] If the disease entities can be distinguished using imaging findings and CNB results, unnecessary surgical excision can be avoided. Therefore, we evaluated the sonographic features that could distinguish FA from PT.

METHODS

Patient Population

This retrospective study was approved by the Institutional Review Board of our hospital, and the requirement for informed consent was waived. Three radiologists retrospectively reviewed the medical and imaging records of patients diagnosed with breast fibroepithelial tumours on ultrasound (US)-guided CNB. From March 2017 to April 2020, 125 lesions in 121 patients were confirmed to be fibroepithelial tumours. Among them, cases without surgical excision after CNB (n = 46), cases with US-guided vacuum-assisted biopsy after CNB (n = 8), cases confirmed as another lesion (sclerosing adenosis) [n = 1], and cases confirmed as both FA and PT (n = 2) were excluded, resulting in a total 68 cases in 65 patients.

Data Acquisition and Data Analysis

Breast ultrasonography was performed using a 15-4 MHz (Aixplorer, SuperSonic Imagine, Aix-en-Provence, France) or a 5-12 MHz (iU22; Philips Healthcare, Bothell [WA], United States) linear array transducer.

The sonographic features of the 68 lesions were analysed independently by three dedicated breast radiologists, with 1, 5 and 20 years of experience, according to the ACR BI-RADS (American College of Radiology Breast Imaging Reporting and Data System) Atlas (5th ed.).[13] The maximum elasticity value (E_{max}) of shear-wave elastography was categorised into hard (E_{max} ≥144 kPa), intermediate (72 kPa < E_{max} < 144 kPa) and soft elasticity (E_{max} ≤72 kPa).[14] US-guided CNB was performed using a 14-gauge cutting needle with freehand technique, and five core specimens were retrieved from each lesion. Clinicopathological results of the CNBs and surgical excision were reviewed using the images from the electronic medical records. We analysed the concordance between the pathology reports of all the CNBs and the pathological results of surgical excision.

Statistical Analysis

Comparison of the categorical variables between FA and PT was performed using the Chi-square and Fisher's exact tests. The level of significance was set at P<0.05 for all tests. The statistical analysis was conducted using SPSS (Windows version 26.0; IBM Corp, Armonk [NY], United States).

RESULTS

Among the 68 lesions analysed in this study, the pathological results of surgical excision revealed 32 FAs and 36 PTs. The mean age of patients with FA was 41.7 years (range, 20-68) and those with PT was 39.3 years (range, 18-52). Among the 36 cases of PTs, the histological subtypes were benign in 32 cases (88.9%), borderline PT in two cases (5.6%) and malignant PT in two cases (5.6%).

On US, tumour size, echogenicity, presence of internal clefts, vascularity, and elasticity showed significant differences between FA and PT (Table). FAs were frequently small (<3 cm), hypoechoic masses with soft or intermediate elasticity and without internal clefts (Figure 1, Table). PTs were significantly larger than FAs (Figure 2). Among the PTs, 11 lesions were ≥3 cm (11/36, 30.6%), whereas only one lesion (1/32, 3.1%) was >3 cm among FAs. The echogenicity in PTs was frequently heterogeneous (PT = 13.9% vs. FA = 3.1%) and showed a significantly more frequent complex cystic and solid pattern (PT = 19.4% vs. FA = 0%). The presence of internal clefts (PT = 44.4% vs. FA = 15.6%), internal vascularity (PT = 75% vs. FA = 43.8%), and hard elasticity (PT = 22.2% vs. FA = 3.1%) were significantly more often observed in PT than in FA (Figure 3).

Table. Ultrasonographic findings in fibroadenomas and phyllodes tumours.*

Lesion characteristics	Fibroadenoma (n = 32)	Phyllodes tumour (n = 36)	p Value
Size			
<3 cm	31 (96.9%)	25 (69.4%)	0.003‡
≥3 cm	1 (3.1%)	11 (30.6%)	
Shape			
Oval	28 (87.5%)	28 (77.8%)	0.504†
Round	1 (3.1%)	1 (2.8%)	
Irregular	3 (9.4%)	7 (19.4%)	
Orientation			
Parallel	32 (100%)	32 (88.9%)	0.116‡
Non-parallel	0	4 (11.1%)	
Echogenicity			
Hypoechoic	31 (96.9%)	21 (58.3%)	0.002†
Heterogeneous	1 (3.1%)	5 (13.9%)	
Isoechoic	0	3 (8.3%)	
Complex cystic and solid	0	7 (19.4%)	
Margin			
Sharp	18 (56.3%)	21 (58.3%)	0.380†
Indistinct	7 (21.9%)	9 (25.0%)	
Angular	0	2 (5.6%)	
Microlobulated	7 (21.9%)	4 (11.1%)	
Spiculated	0	0	
Internal cleft			
Present	5 (15.6%)	16 (44.4%)	0.017‡
Absent	27 (84.4%)	20 (55.6%)	
Vascularity			
No	10 (31.3%)	5 (13.9%)	0.032†
Internal vascularity	14 (43.8%)	27 (75.0%)	
Vessels in rim	8 (25.0%)	4 (11.1%)	
Elasticity			
Soft	12 (37.5%)	7 (19.4%)	0.028†
Intermediate	9 (28.1%)	5 (13.9%)	
Hard	1 (3.1%)	8 (22.2%)	
No result	10 (31.3%)	16 (44.4%)	
Posterior features			
None	23 (71.9%)	20 (55.6%)	0.161†
Enhancement	8 (25.0%)	16 (44.4%)	
Shadowing	1 (3.1%)	0	
Calcifications			
In the mass	3 (9.4%)	1 (2.8%)	0.336‡
Absent	29 (90.6%)	35 (97.2%)	
Distortion			
Present	0	0	-
Absent	32 (100%)	36 (100%)	
Ductal change			
Present	1 (3.1%)	3 (8.3%)	0.616‡
Absent	31 (96.9%)	33 (91.7%)	
Skin change			
Present	0	0	-
Absent	32 (100%)	36 (100%)	
Oedema			
Present	0	0	-
Absent	32 (100%)	36 (100%)	

* Data are shown as No. (%), unless otherwise specified.
† Chi-square test.
‡ Fisher's exact test.

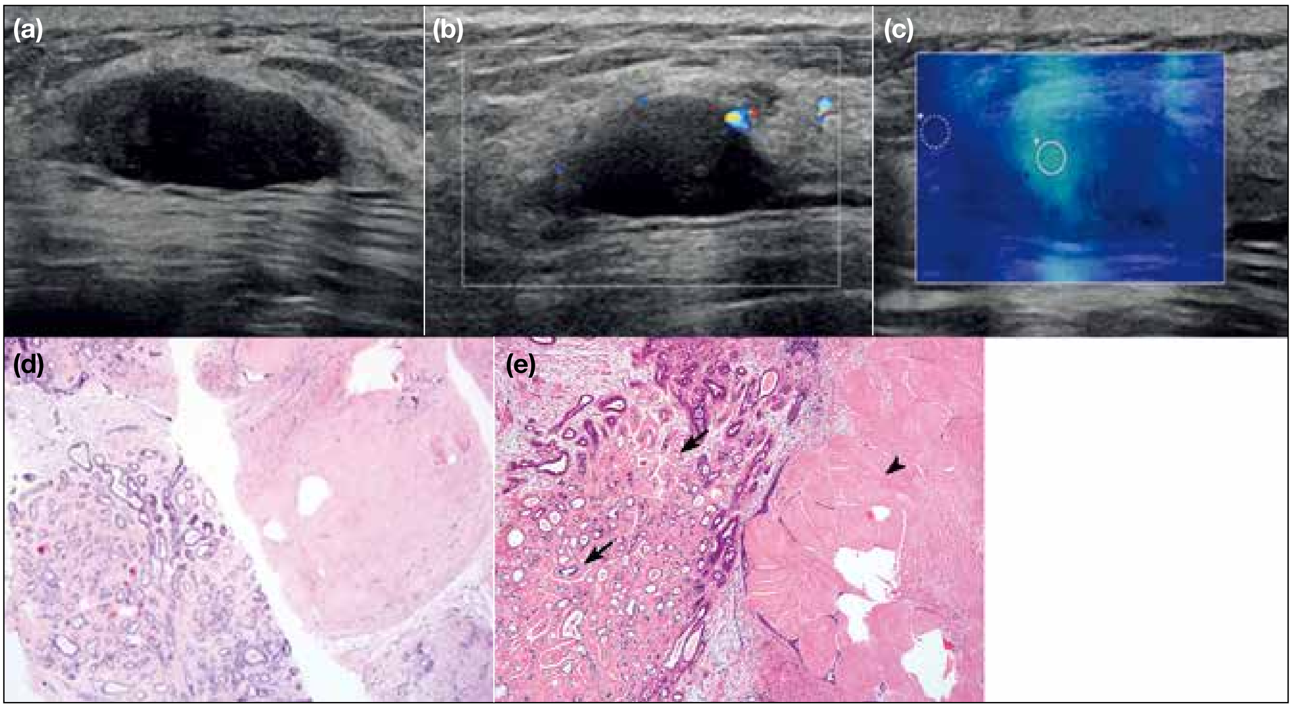

Figure 1. A 31-year-old woman with a palpable lump in the right breast. Ultrasonograms showing a 2.2 cm × 0.9 cm, oval, well-circumscribed, parallel, hypoechoic mass (a) with minimal peripheral vascularity and no cleft formation (b) and intermediate elasticity (c, E_{max} = 70.4 kPa). Microscopic examination of the ultrasound-guided CNB (d, H&E stain, ×40) and surgical excision (e, H&E stain, ×40) showing periductal (arrows) and stromal (arrowhead) hyalinisation, suggestive of fibroadenoma.

Abbreviations: CNB = core needle biopsy; E_{max} = maximum elasticity value.

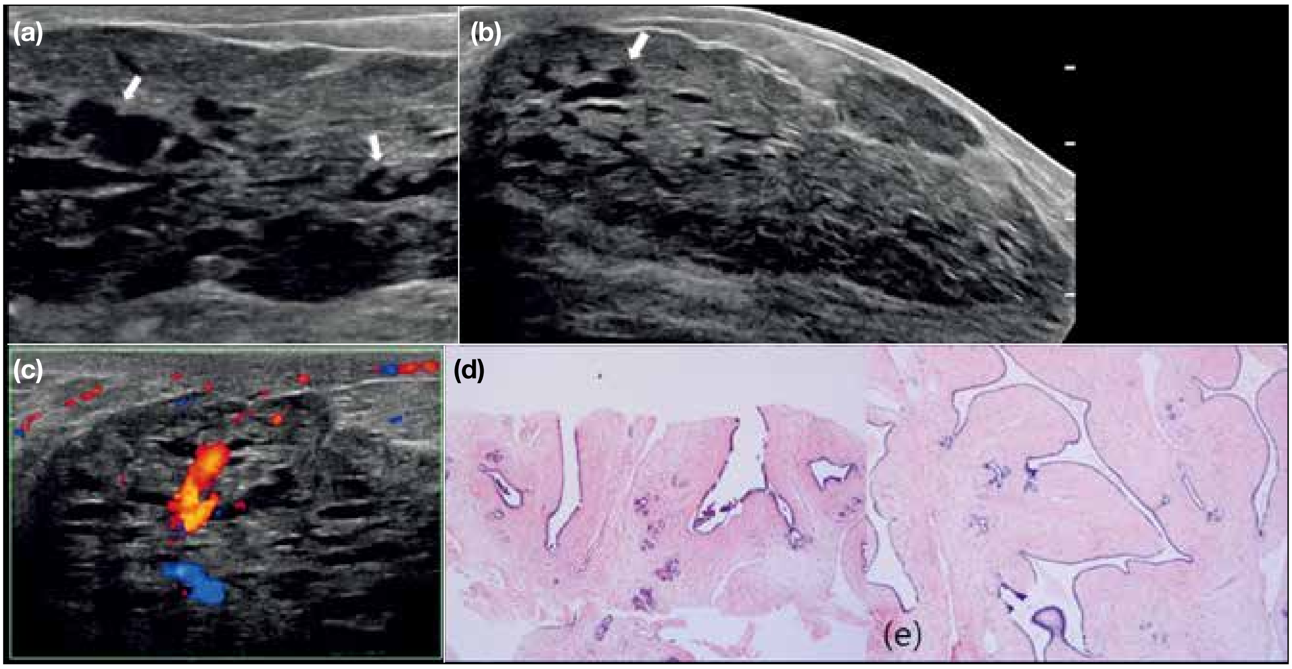

Figure 2. A 33-year-old woman with palpable lump in the right breast. Ultrasonograms showing an approximately 9-cm oval, well-circumscribed, heterogeneous, hypoechoic mass with internal fluid-filled clefts (arrows in a, b), internal vascularity (c). Microscopic examinations of ultrasound-guided core needle biopsy (d, H&E stain, ×40) and surgical excision (e, H&E stain, ×400) showing characteristic leaf-like structures, suggestive of phyllodes tumour.

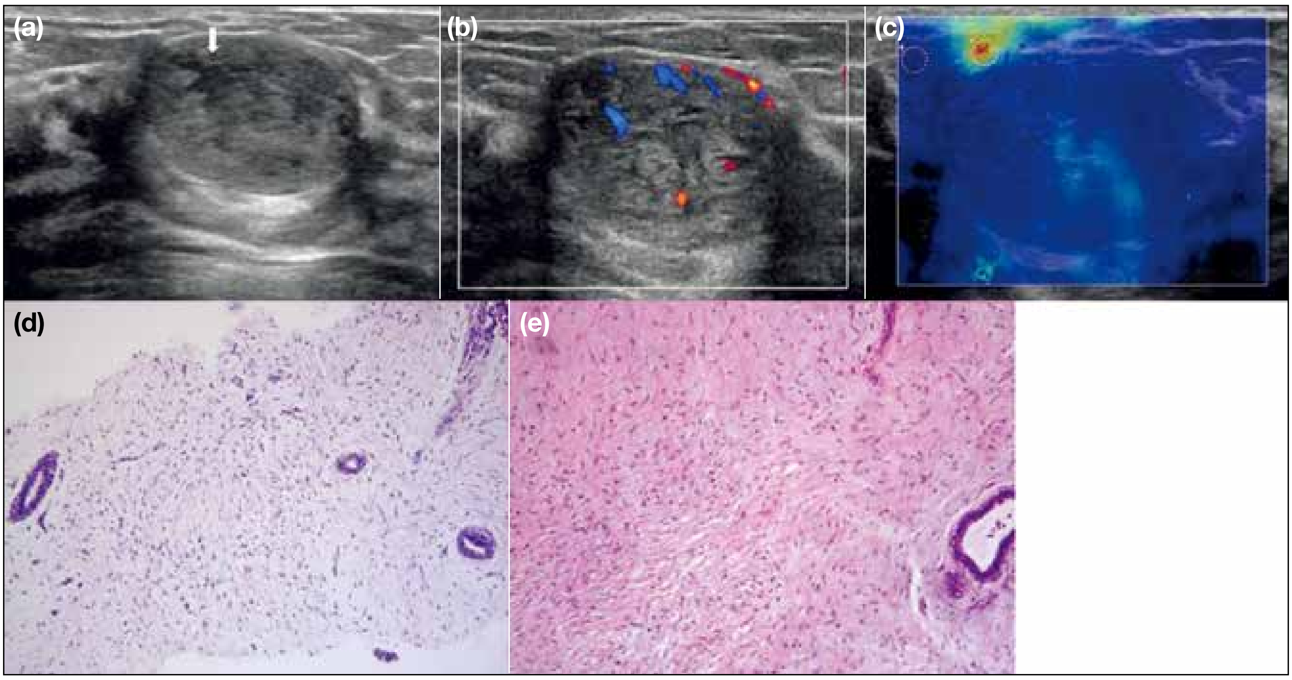

Figure 3. A 35-year-old woman with palpable lump in the left breast. Ultrasonograms showing a 2.5-cm oval, well-circumscribed, isoechoic mass with an internal cystic cleft (arrow in a), internal vascularity (b) and hard elasticity (c, E_{max} = 85.2 kPa). Microscopic examinations of ultrasound-guided core needle biopsy (d, H&E stain, ×100) and surgical excision (e, H&E stain, ×100) showing mildly increased cellularity and cellular atypia in stroma, suggestive of a benign phyllodes tumour.
Abbreviation: E_{max} = maximum elasticity value.

Other sonographic features including shape, orientation, margin, posterior features, associated calcifications, distortion, ductal change, skin change, and oedema showed no significant differences between FA and PT.

The pathological results of CNB were similar to that of surgical excision in 61 cases (61/68, 89.7%). Seven cases with discordant results were all reported as FA on CNB and benign PT at surgical excision.

DISCUSSION

In this study, we evaluated sonographic features that could be helpful to distinguish between FA and PT. Distinguishing between these two entities using imaging features or CNB has been challenging to radiologists and pathologists.[8,9] Moreover, as US-guided CNB specimens only reveal a part of the total lesion and as the two disease entities can have overlapping histological features, pathologists are often unable to make a definitive distinction between FA and PT without an excised specimen.[15-17]

We found that a large tumour with heterogeneous/complex cystic and solid echogenicity and the presence of internal clefts on greyscale ultrasonography are characteristic findings of PT, in accordance with previous studies.[3,8-10] Duman et al[8] reported that FAs were smaller than PTs and were homogeneously hypoechoic masses, while PTs showed heterogeneous/complex cystic and solid echogenicity. The presence of internal cystic lesions was significantly more commonly detected in PTs than in FAs. The presence of internal cystic lesions and clefts is regarded as a useful US feature to diagnose PTs.[3,9,10,18] In a study by Wiratkapun et al,[3] the presence of cystic spaces and clefts within the solid mass was significantly associated with PTs on both univariate ($p < 0.001$) and multivariate analyses (cystic space; $p = 0.032$, clefts; $p = 0.006$). This finding is related to microscopic features of PTs, with a prominent stromal proliferation into the epithelial-lined spaces, forming a slit-like space or a leaf-like pattern (Figure 3d and e).[19]

Posterior acoustic enhancement was also found to be an important sonographic feature of PTs in some studies.[9,20] In our study, posterior acoustic enhancement was more frequently observed in PTs, but not to a significant degree (PT = 44.4% vs. FA = 25%; $p = 0.161$).

Colour Doppler US and elastography have been investigated as ancillary tools to improve the diagnostic accuracy of conventional B-mode US for breast lesions. Kim et al[21] analysed the colour Doppler ultrasonography and shear-wave elastography features of fibroepithelial lesions and reported that PTs tend to have higher stiffness and vascularity than FAs. The median Emax was significantly higher in PTs than in FAs (76.7 vs. 21.0 kPa, $p < 0.01$), and a high vascularity (≥2 vessels) on colour Doppler US was more frequent in PTs than in FAs ($p < 0.01$).[21] Similar to that reported in a previous study, internal vascularity (PT = 75% vs. FA = 43.8%; $p = 0.032$) and hard elasticity (PT = 22.2% vs. FA = 3.1%; $p = 0.028$) were more frequently seen in PTs than FAs in this study. Histologically, on shear-wave elastography, the more abundant cellular stroma in PTs is associated with their hard elasticity.[15,19]

A definitive distinction between FA and PT is challenging, particularly with CNB specimens.[15-17] Based on the degree of stromal hypercellularity, stromal overgrowth, nuclear atypia, mitoses counts, and the amount of stroma relative to the epithelium and infiltrative borders of the tumour, PTs are distinguished from FAs and categorised into benign, borderline, and malignant lesions.[3,12,15] However, the representation of these features in CNB has not been proven to be reliably adequate for pathologists to make a definitive diagnosis of PT using CNB.[12] Wiratkapun et al[3] found a high concordance between pathologists' suggested diagnosis of FA or PT from CNB specimens and the surgical pathology after excision ($p < 0.001$). Komenaka et al[22] also found similar results, showing an 83% positive predictive value of diagnosis for fibroepithelial tumours using CNB. Our study showed a high diagnostic accuracy of the pathological results of CNB for distinguishing between FA and PT, which is similar to the findings with previous studies.[3,22]

There are several limitations to our study. First, this study had a retrospective single-centre design. Second, the small sample size could have prevented an accurate statistical analysis, with a degree of selection bias as only excised lesions were included. Third, the analysis in this study was based the comparison of only ultrasonographic findings with surgically confirmed cases of PT and FA.

CONCLUSION

In conclusion, ultrasonographic features can be helpful imaging factors for differentiating FAs and PTs. Imaging features such as a large tumour size, heterogeneous or complex cystic and solid echogenicity, presence of internal clefts, internal vascularity, and hard elasticity were significant findings in PT. US-guided CNB may replace surgical excision with high diagnostic accuracy in some cases.

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