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Papillary Tumors of the Breast: US Findings of the Benign and Malignant Lesions[1]

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Purpose: To determine which sonographic findings usefully differentiate between benign and malignant papillary tumors.

Materials and Methods: We retrospectively reviewed the ultrasonographic findings of 42 surgically proven cases of papillary breast lesions [11 malignant lesions (7 invasive papillary carcinomas, 4 intraductal papillary carcinomas) and 31 benign intraductal papillomas]. All 42 cases were classified sonographically as cystic or ductal, or solid type, and the shape, wall change, margin, internal echo-pattern, posterior echo change and other associated findings for the two types were then analysed.

Results: Among the 25 cases (5 malignant and 20 benign) of cystic or ductal type, tubular shaped lesions were more frequently benign (60%). In all 20 benign lesions the wall of cystic portion was well-defined, smooth and thin. The solid portion of the cystic type showed an ill-defined irregular margin in four malignant lesions (80%) and a smooth margin in 19 which were benign (95%). The internal echo-pattern was heterogeneous mixed-echo in three cases of malignancy, and homogeneously hypoechoic in 19 benign lesions (95%). Posterior enhancement was seen in two malignant lesions (40%), while in 19 benign lesions (95%), there was no posterior echo change.

There were 17 solid type lesions (6 malignant cases, 11 benign cases), and most of these, whether benign or malignant, were smooth, oval or lobulated, hypoechoic masses. Posterior enhancement, however, was more frequently observed in malignant lesions (three cases, 50%) than in those which were benign (one case, 9%).

Conclusion: In cystic or ductal type lesions, an ill-defined irregular thick cystic wall, an ill-defined irregular margin, a heterogeneous mixed internal echo-pattern and posterior enhancement of the solid portion suggested malignancy. In solid type lesions, posterior enhancement was more frequently found in malignant than in benign lesions.

Index words : Breast, neoplasms
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Papillary tumors of the breast account for less than 10 % of benign breast neoplasms and 1-2% of breast carcinomas (1-3). Both benign papillomas and papillary carcinomas show macroscopic villous arborescent lesions and can present as intraductal, intracystic or solid-type lesions. Papillary carcinomas may occur in situ or be invasive (4, 5), while the intracystic type is a variant of intraductal papillary carcinoma, taking the form of papillary fronds within the wall of a cystically dilated duct (6, 7). If cell proliferation becomes so dense that the basic papillary properties are obscured, the term 'solid papillary carcinoma' is used.

The purpose of this study is to determine which sonographic findings usefully differentiate between benign and malignant papillary tumors.

Materials and Methods

We retrospectively reviewed the clinical presentation and breast sonographic findings in 42 cases of surgically proven papillary tumors [11 cases of malignancy (invasive papillary carcinoma, n = 7; intraductal papillary carcinoma, n = 4) and 31 cases of intraductal papilloma]. Patients with malignant lesions ranged in age from 43 to 79 (mean, 61) and those with benign lesions from 30 to 72 (mean, 51) years. The clinical findings are summarized in Table 1. We used high-resolution real time ultrasound units (Acuson 128XP/10, Mountain View, California, U.S.A., and Logiq 700, General Electric, Milwaukee Wis., U.S.A.) with 5 to 10 MHz linear array transducers. Sonographically, lesions were classified as cystic or ductal, or solid type, and for each of these two groups, the sonographic findings were analysed with regard to shape, change of ductal or cystic wall, margin, internal echo-pattern, lateral shadowing, posterior echo change, duct dilatation, obliteration of adjacent normal structure, and thick peritumoral echo. To determine sta-

Table 1. Clinical Symptoms and Signs of Papillary Lesions

Clinical Findings	Discharge			Mass	Screening
Pathology	serous	bloody	milkish		detect
Papillary Ca (n = 7)	2	1	6		
Intraductal papillary Ca (n = 4)	1	4			
Papilloma (n = 31)	8	12	2	11	2

Ca : Carcinoma

Table 2. Number, Location and Size of Papillary Lesions on Ultrasonography

Pathology	Malignant			Benign
US Findings	Papillary Ca (n = 7)	IDPCa (n = 4)	Total (n = 11) (%)	Papilloma (n = 31) (%)
Number*				
Single	6	3	9 (81)	11 (35)
multiple	1	1	2 (19)	20 (65)
Location				
subareolar	2		2 (18)	13 (42)
central	3	2	5 (46)	15 (49)
peripheral	2	2	4 (36)	3 (9)
Size (mm)	10-42	7-120		3-33
mean	26	63.5		18

*P < 0.05, IDPCa; Intraductal Papillary Carcinoma

Table 3. Sonographic Types of Papillary Lesions

Pathology/US Type	Intracystic	Intraductal	Solid
Papillary Ca (n = 7)	3	1	3
Intraductal papillary Ca (n = 4)	1		3
Papilloma (n = 31)	4	16	11

Ca : Carcinoma

Table 4. Sonographic Findings of Cystic or Ductal Typed Papillary Lesions

Pathology	Malignant			Benign
US Findings	Papillary Ca n = 4	IDPCa n = 1	Total n = 5(%)	Papilloma n = 20(%)
Shape*				
oval/ lobulated	3	1	4 (80)	7 (35)
irregular/lobulated	1		1 (20)	1 (5)
tubular				12 (60)
Wall(cyst or duct)				
smooth/thin	3	1	4 (80)	20 (100)
irregular/thick	1		1 (20)	
Margin* (solid portion)				
Smooth		1	1 (20)	19 (95)
Irregular	4		4 (80)	1 (5)
Internal echo-pattern (cystic portion)				
anechoic/homogeneous	4	1	5 (100)	20 (100)
(solid portion)*				
a) homogeneous	2		2 (40)	19 (95)
heterogeneous	2	1	3 (60)	1 (5)
b) hypo-echoic	2		2 (40)	19 (95)
hyper-echoic		1	1 (20)	1 (5)
mixed-echoic	2		2 (40)	
Posterior change*				
enhancement	1	1	2 (40)	
shadowing	1		1 (20)	1 (5)
no change	2		2 (40)	19 (95)
Ductal dilatation*	1		1 (20)	16 (80)
Others				
obliteration of adjacent normal structure*	2	1	3 (60)	
thick peritumoral echo	2		2 (40)	1 (5)

* p < 0.05, IDPCa; Intraductal Papillary Carcinoma

tistical significance, Fisher's-exact test was performed.

Results

The number, location and size of papillary lesions seen on ultrasonography are shown in Table 2. Sixty-five percent of benign lesions were multiple and 81% of malignant lesions were single. As for the sonographic types, the malignant lesions were predominantly solid or cystic but in the case of benign lesions, ductal or solid types were dominant (Table 3).

The sonographic findings of cystic and ductal type papillary lesions are summarized in Table 4 and shown in Figure 1. There were five malignant and 20 benign lesions. Twelve of the latter (60%) were tubular in shape. The margin of the solid portion was irregular in four malignant lesions (80%), and smooth in 19 benign lesions (95%). As for the internal echo-pattern, this was heterogeneously mixed-echoic in the solid portion of three malignant lesions (60%), and homogeneously hypo-echoic in 19 benign lesions (95%). Posterior enhancement of the solid portion was seen in two malignant tumors (40%), but in 19 benign lesions (95%) there was no posterior echo change. Ductal obstruction or dilatation was

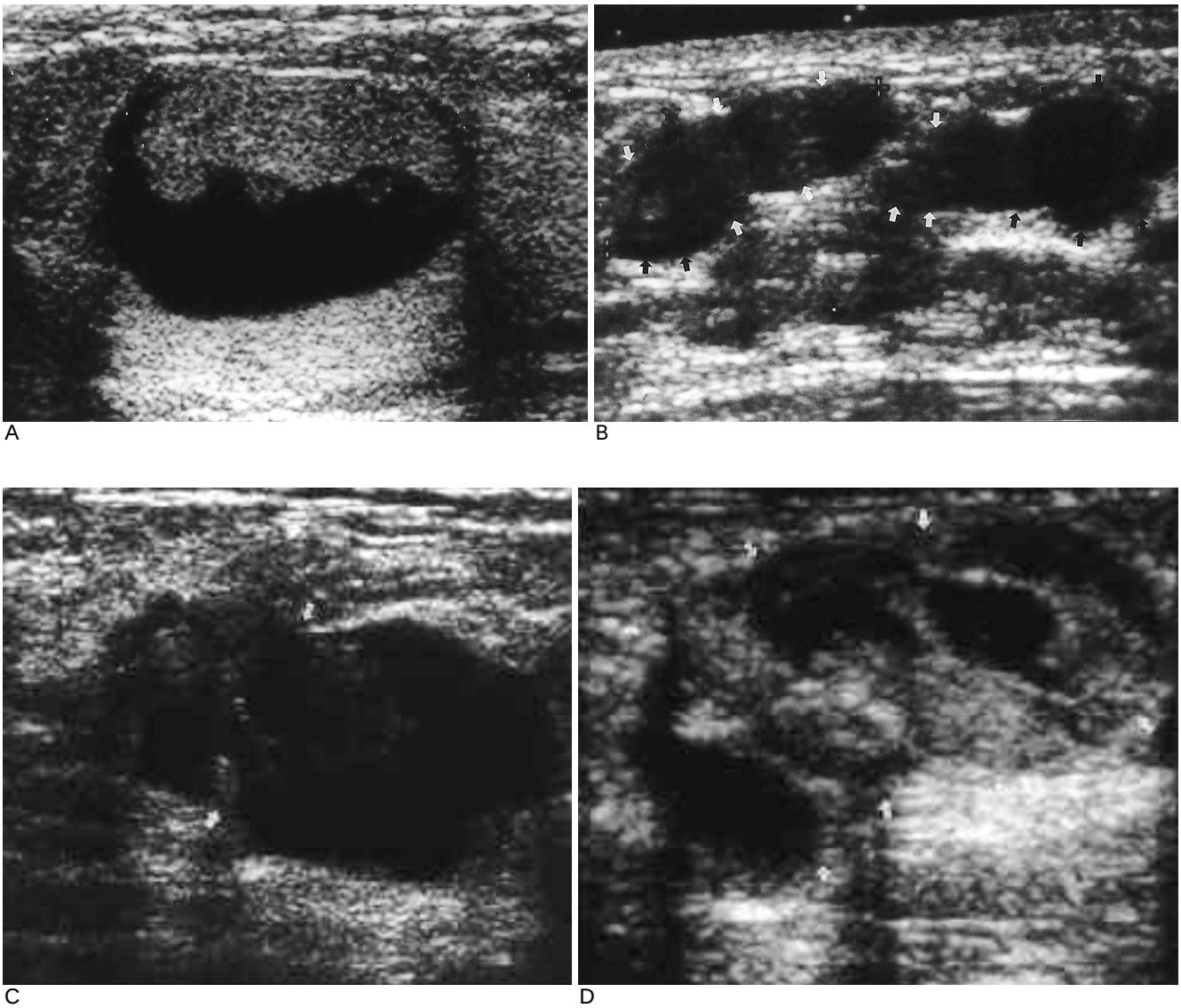
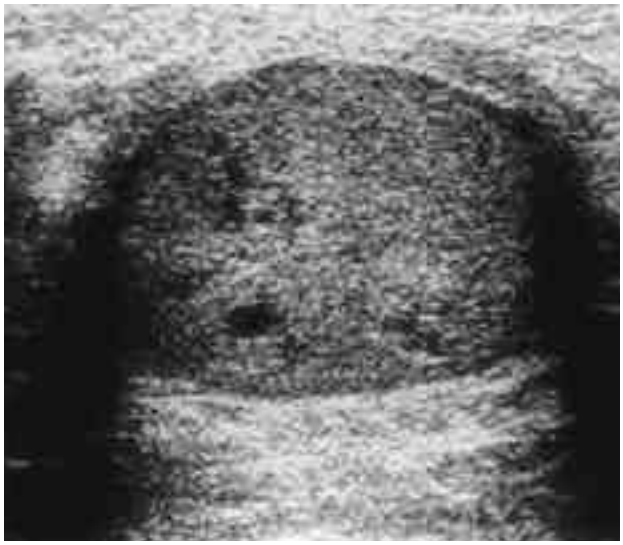
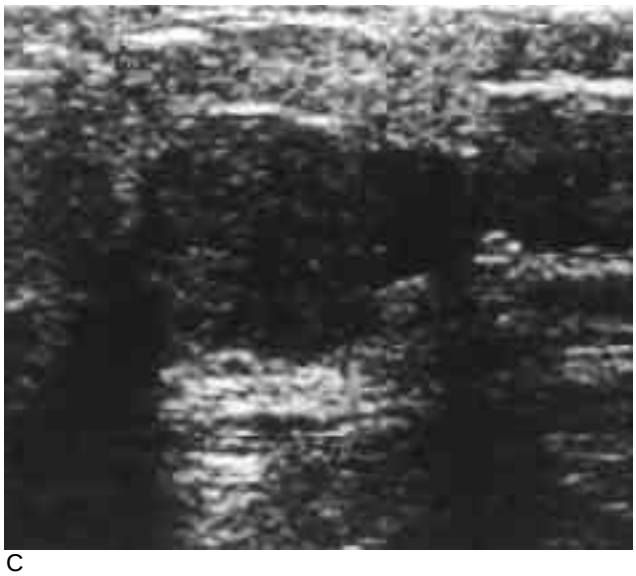


Fig. 1. Cystic or ductal typed benign and malignant papillary lesions.
Intracystic (A) and multiple intraductal papillomas (B) show smooth well-defined homogeneous mass within the cyst or ducts (white arrows; solid portion, black arrows; fluid in the duct). Intraductal papillomas show tubular in shape associated with diffuse ductal dilatation. Comparing to intracystic papilloma, intracystic papillary carcinomas show ill-defined irregular margin with invasion of cystic wall (C, arrows) or smoothly well-defined margin without invasion of the cyst (D, arrows), and both lesions show heterogeneous mixed internal echo pattern that including low echoic cystic areas, and posterior enhancement of solid portion.

A



B



C

Fig. 2. Solid typed benign and malignant papillary lesions.
Solid typed papilloma shows well-defined bilobed (A) homogeneous mass without posterior change. Papillary carcinomas show well-defined margin, heterogeneous (B) or homogeneous (C) internal echo pattern that similar with papilloma, but posterior enhancement of papillary carcinomas are remarkable and characteristic.

associated more with benign (80%) than malignant (20%) lesions, and three malignant lesions (60%) showed obliteration of adjacent normal structure. All the above findings were statistically significant ($p < 0.05$).

The sonographic findings of solid type papillary lesions are shown in Table 5 and Figure 2. There were six malignant and 11 benign cases, with virtually no significant difference between benign and malignant lesions; most of both these types were oval or lobulated in shape, had a smooth margin, and showed a homo- or heterogeneously hypo-echoic internal echo-pattern. Posterior enhancement, however, was more frequently seen in malignant (three cases, 50%) than in benign lesions (one case, 9%), a difference which was statistically significant ($p < 0.05$).

Table 5. Sonographic Findings of Solid Typed Papillary Lesions

Pathology	Malignant			Benign
US Findings	Papillary Ca n = 3	IDPCa n = 3	Total n = 6(%)	Papilloma n = 11(%)
Shape				
oval/lobulated	3	3	6 (100)	11 (100)
Margin				
smooth	3	3	6 (100)	10 (91)
irregular				1 (9)
Internal echo-pattern				
a) homogeneous	1	2	3 (50)	8 (73)
heterogeneous	2	1	3 (50)	3 (27)
b) hypo-echoic	3	2	5 (83)	9 (82)
hyper-echoic				1 (9)
mixed-echoic		1	1 (17)	1 (9)
Posterior change*				
enhancement	2	1	3 (50)	1 (9)
shadowing				1 (9)
no change	1	2	3 (50)	9 (82)
Others				
thick peritumoral echo	1		1 (17)	2 (18)

* P < 0.05, IDPCa; Intraductal Papillary Carcinoma

Discussion

Papillary disease of the breast involves a spectrum of the entities which includes both benign and malignant lesions. The most common papillary breast neoplasm is

the papilloma, which consists of proliferating ductal epithelium on frond-forming fibrovascular stroma. A papillary carcinoma has similar structural characteristics but is occupied by carcinomatous epithelium (1). The term papillary carcinoma encompasses intraductal carcinoma with a papillary configuration that involves multiple ducts, solitary papillary carcinoma within a cyst, or invasive carcinoma with a papillary growth pattern characterized by microscopic frond formation (8).

Invasive papillary carcinoma is not aggressively infiltrative, and a fibrotic reaction is therefore unlikely; it is grossly well-circumscribed, often with a pseudocapsule. In cases of papillary cancer, immunohistochemical analysis may reveal the presence of both carcinoembryonic antigens and neurosecretory granules, both of which are absent in benign papillomas (9, 10). Histologically, the absence of a myoepithelial layer differentiates carcinomas from benign papillary lesions (1, 4, 9). Mammography reveals that because of pseudo-infiltration caused by sclerosis and the concomitant entrapment of benign ducts within fibrous tissue at the periphery of the breast (11), some papillomas have an ill-defined or irregular margin. For these reasons, mammography cannot reliably distinguish between benign and malignant papillary breast lesions.

Most solitary papillary carcinomas are noninvasive and localized. Although the ultrasound provides more clues to the diagnosis of breast lesions, it is not always easy to differentiate benign from malignant papillary lesions. In Han's series (12), sonography revealed an ill-defined margin in five of eight intraductal papillomas (62.5%), and pseudo-invasion was confirmed as pathologically. In our cases of ductal or cystic type lesions, four of five malignant papillary tumors (80%) showed an irregular ill-defined margin, while in 19 of 20 papillomas, the solid portion had a (90%) smooth well-defined margin. The difference was statistically significant. Sonography revealed intracystic papillary carcinoma as a well-circumscribed, complex mass containing an anechoic fluid component and intervening solid papillary fronds projecting from the inner wall of the mass (13). A cyst containing thick septations or solid mural nodules should suggest the possibility of intracystic papillary carcinoma. In our study, in the case of cystic or ductal type lesions, a heterogeneous mixed-echo pattern and posterior enhancement of the solid portion were more characteristic of papillary carcinoma than benign papilloma. A heterogeneous mixed-echoic internal echo-pattern might be related to necrosis of the tumor cells, usually occurring as a noncomedo form of DCIS (7). In most papillomas, on the other hand, a smooth well-defined homogeneous hypoechoic mass is seen within a smooth-walled cyst or duct, and there is more frequent association with ductal change than in the case of malignant lesions. Yang (14) reported the same findings.

With regard to solid type lesions, our results are the same as those of Silva (15). Papillary carcinoma manifests as a hypoechoic mass with lobulated smooth margins, similar to benign papilloma. Posterior enhancement, however, was more frequent in papillary carcinoma than in papilloma, and the difference was statistically significant. Solid papillary carcinoma is frequently associated with the production of mucin, and in most tumors, intra- and extra-cellular mucin is also found during the in situ stage. This is not, though, the finding in case of papilloma (16), and this may be why, in our study, posterior enhancement was seen to be a characteristic of papillary carcinomas rather than of benign papillomas.

In summary, in cystic or ductal type papillary tumors, an irregular ill-defined margin, a heterogeneous mixed internal echo-pattern, and posterior enhancement of the solid portion are features, which suggest malignancy. In solid type lesions, on the other hand, posterior enhancement was the only sonographic finding to suggest papillary carcinoma rather than papilloma.

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유방 유두종양의 양성과 악성의 초음파 소견[1]

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목적: 유방에 발생한 유두종양의 양성 및 악성 감별에 도움이 되는 초음파 소견을 알아보고자 하였다.
대상과 방법: 병리적으로 확진된 유두종양 42예 (악성 11예; 침윤성 유두암 7예, 유관내유두암 4예, 및 양성 유두종 31예)를 대상으로 초음파 소견상 병변을 낭형 또는 관형군과 고형군의 두 군으로 분류한 뒤, 각 군마다의 양성과 악성 병변의 유방 초음파 소견상 모양, 낭 또는 관벽의 변화, 경계, 내부에코의 특징, 후방 음영 변화, 기타 동반된 소견 등을 후향적으로 분석하였다.
결과: 낭형 또는 관형 (악성 5예, 양성 20예)군은 25예로 관모양 (60%)이 양성 병변에 많았고, 양성 20예 모두 뚜렷한 경계의 부드럽고 얇은 낭 또는 관벽을 보였다. 고형부위는 악성에서 불분명하고 불규칙한 경계 (4예, 80%), 비균질성 혼합 내부에코 (3예, 60%)를 보였고, 후방 음영 증가가 2예 (40%) 있었으며, 양성의 경우 부드럽고 명확한 경계 (19예, 95%)와 균질성의 저에코 (19예, 95%)를 보였으나 후방 음영 변화는 없었다 (19예, 95%). 고형군은 모두 17예 (악성 6예, 양성 11예)로 양성과 악성 대부분이 부드러운 경계의 난형 또는 엽상의 저에코 종괴를 보였으나, 후방 음영 변화는 악성 (3예, 50%)에서 양성 (1예, 9%)에 비해 현저히 많은 빈도로 관찰되었다.
결론: 낭형 또는 관형군의 경우 불분명하고 불규칙한 낭 또는 관의 벽, 고형부위의 불규칙한 경계, 비균질성 혼합 에코, 후방 음영 증강이 악성 병변을 시사하는 소견이었고, 고형군의 경우 후방 음영 증강은 양성과 구별되는 악성 병변의 특징적 소견이었다.