

# Imaging Spectrum of Breast Papillary Lesions: With Special Emphasis on Atypical Appearances

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**Abstract:** Papillary breast tumors are rare breast tumors. Presentation of papillary breast lesions varies clinically and radiologically. Standard diagnostic work-up for papillary breast lesions includes various radiological modalities such as mammography, galactography, ultrasound and MRI. Papillary lesions often have a wide spectrum of appearance on different radiological modalities, so that optimal differentiation of papillary lesions is not easy with various imaging methods. The purpose of this review article is to describe the different imaging appearances of benign and malignant papillary lesions of the breast with special emphasis on atypical appearances.



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## INTRODUCTION

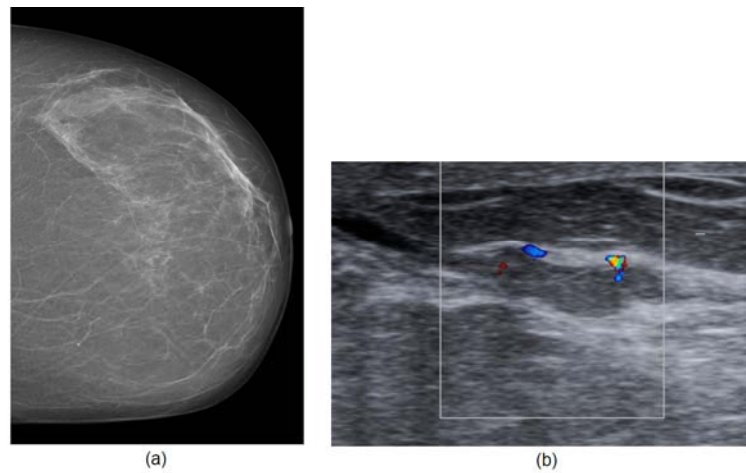
Among solid breast tumors, papillary lesions are rare, occurring less than 3% of the time [1]. The papillary lesions can be classified into 5 categories as solitary intraductal papillomas, multiple intraductal papillomas, atypia-ductal carcinoma in situ (DCIS) within a papilloma, micropapillary DCIS, and papillary carcinoma [2]. Presentation of papillary breast lesions varies clinically and radiologically. A clinical examination may disclose nipple discharge, or a palpable mass may be present in papillary lesions. A standard papilloma diagnostic work-up includes mammography (MG), galactography, or directed sonography of the retroareolar region. Within the past few years, however, magnetic resonance imaging (MRI) has been reported to be a useful adjunct to other imaging modalities in detecting papillary breast lesions [2, 3, 4]. Papillary lesions often exhibit a wide spectrum of appearance on ultrasound (US), mammography, and MRI. Besides that, imaging features of certain benign and some nonpapillary tumoral lesions may overlap with papillary lesions; therefore, differentiation of papillary lesions by means of imaging is often difficult.

This article reviews the appearance of different imaging appearances of benign as well as malignant papillary lesions of the breast, highlighting atypical appearances of papillary lesions that may result in misdiagnosis.

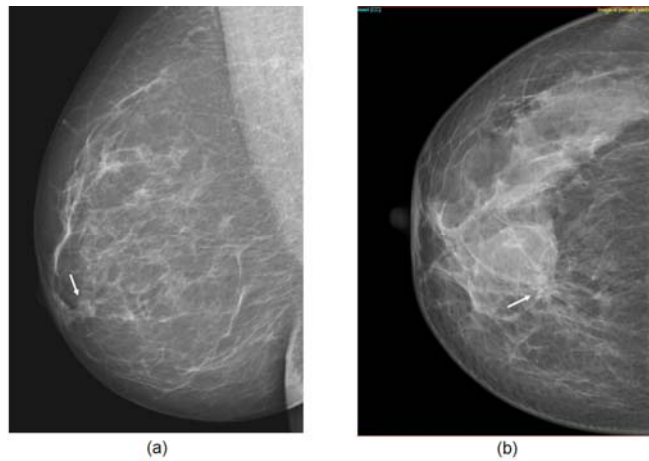
## MAMMOGRAPHIC APPEARANCE

Benign small papillary lesions are usually not visible on mammograms, particularly in the retroareolar areas, because of the typical density of a normal breast tissue and its relative lack of compression (Fig. 1a, b). MGs mostly show larger lesions as solitary masses, typically in the retroareolar region. They usually demonstrate benign features with well-defined round or oval-shaped masses [1]. Peripherally located multiple masses may also appear, especially in multiple intraductal papillomas which have arisen from terminal ductal lobular units. Not uncommonly, a papillary lesion may present as a cylindrical mass consistent with dilated duct extending towards the nipple (Fig. 2a). Focal architectural distortion can be seen in benign papillomas (Fig. 2b) [5]. Clustered amorphous or punctate calcifications, and large, irregular, coarse calcifications may be seen in benign papillary lesions [6]. Rarely, pleomorphic microcalcifications suggesting malignancy may also be seen (Fig. 3) [7]. The radiological appearance of atypia within a papilloma is similar to benign papilloma. DCIS within papilloma may be associated with microcalcifications (Fig. 4).

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**Fig. (1).** a, b. Benign papillary lesion in a 50 year-old-woman. Lesion located in the retroareolar region is not visible on mammography (a), Ultrasound image shows intraductal lesion in the retroareolar region (b).

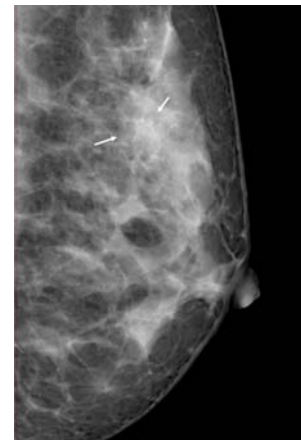


**Fig. (2).** a, b. Right mediolateral oblique mammogram of a benign papillary lesion in a 39-year-old woman. Oblique tubular opacity directed towards the nipple is visible (a) Right craniocaudal mammogram of a benign papillary lesion in a 52-year-old woman. Architectural distortion with central high density is present (b).

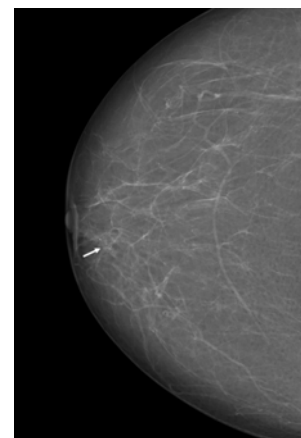
Papillary carcinomas, which make up 2-5% of all breast carcinomas, occur most frequently in postmenopausal women [8]. Benign and malignant papillary tumors share a histologic hallmark: a fibrovascular stalk that supports an epithelial frond-forming growth pattern [9]. Noninvasive form of tumors can be presented as intracystic or intraductal [10]. Mammography typically show papillary carcinomas as oval, round, or lobulated masses (Fig. 5a), mostly with well-defined margins, although sometimes masses with indistinct margins may be seen [2]. Multiple masses may occur, often within the same quadrant (Fig. 5b). Spiculated margins are rarely observed due to the minimal surrounding fibrotic reaction (Fig. 5b). Microcalcifications, if present, are usually pleomorphic or amorphous but occasionally may have a coarse or stippled appearance (Fig. 5c) [1].

#### **GALACTOGRAPHIC APPEARANCE**

Galactography is an invasive method and usually shows a well-defined intraluminal filling defect with smooth or lobulated contours, ductal dilatation, ductal wall irregularity, and

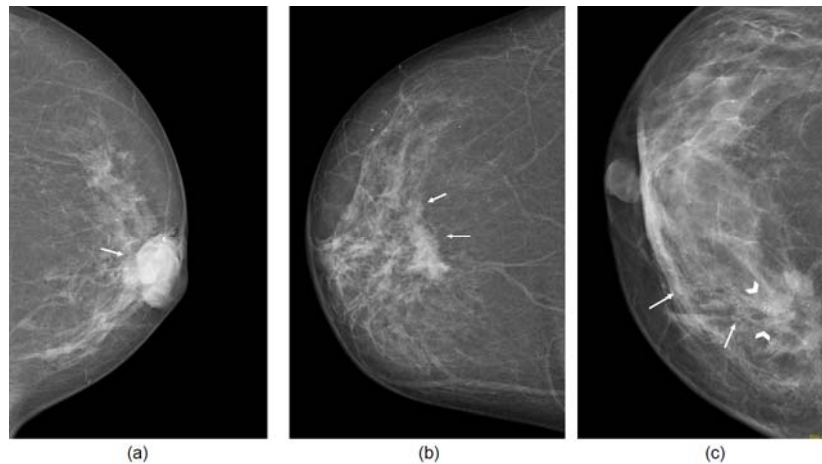


**Fig. (3).** Left mediolateral oblique mammogram of benign papillary lesion in a 43-year-old woman. Low density amorphous and fine pleomorphic microcalcifications with regional distribution are seen in the upper quadrant.

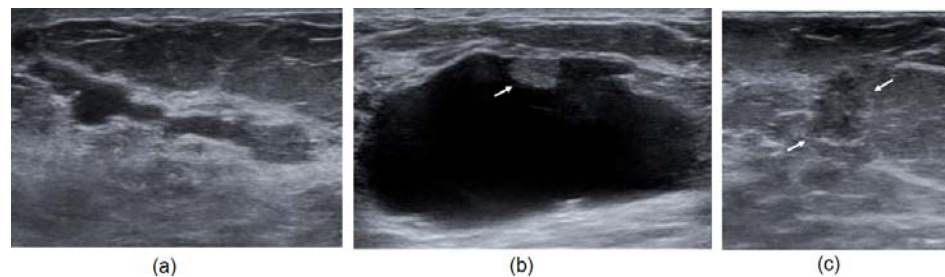


**Fig. (4).** Right craniocaudal mammogram of atypia within a benign papillary lesion in a 61-year-old woman. Fine pleomorphic microcalcifications associated with dilated duct directed towards the nipple are present.

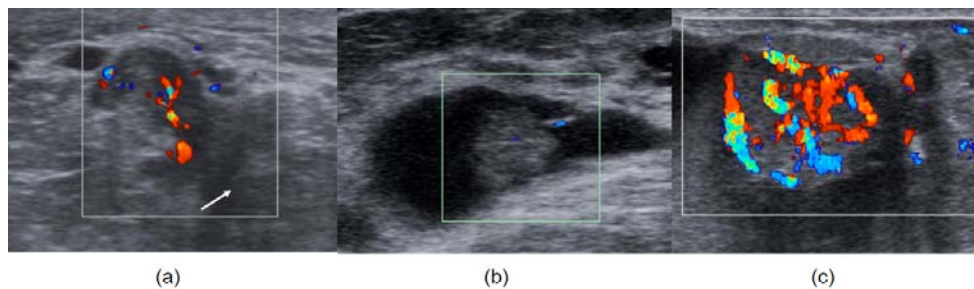
distortion. However, these findings are nonspecific. Air bubbles inadvertently injected into the ductal system during the galactography may lead to misdiagnosis [2, 11].



**Fig. (5).** a-c. Left craniocaudal mammogram of papillary carcinoma in a 64-year-old woman. High density lesion with lobulated shape and well-defined margins in retroareolar region is seen (a) Right craniocaudal mammogram of papillary carcinoma in a 54-year-old woman. Multiple high density lesions with spiculated margins and irregular shape within the same quadrant are present (b) Right craniocaudal mammogram of papillary carcinoma in a 48-year-old woman. Fine pleomorphic calcifications are seen (c).



**Fig. (6).** a-c. Radial ultrasound image of benign papillary lesion in a 59-year-old woman. Intraductal mass with ductal dilatation is seen (a) Ultrasound image of benign papillary lesion in a 48-year-old woman, intracystic mass is present (b) Ultrasound image of benign papillary lesion in a 44-year-old woman. Vertically oriented hypoechoic mass lesion with microlobulated margin is seen (c).

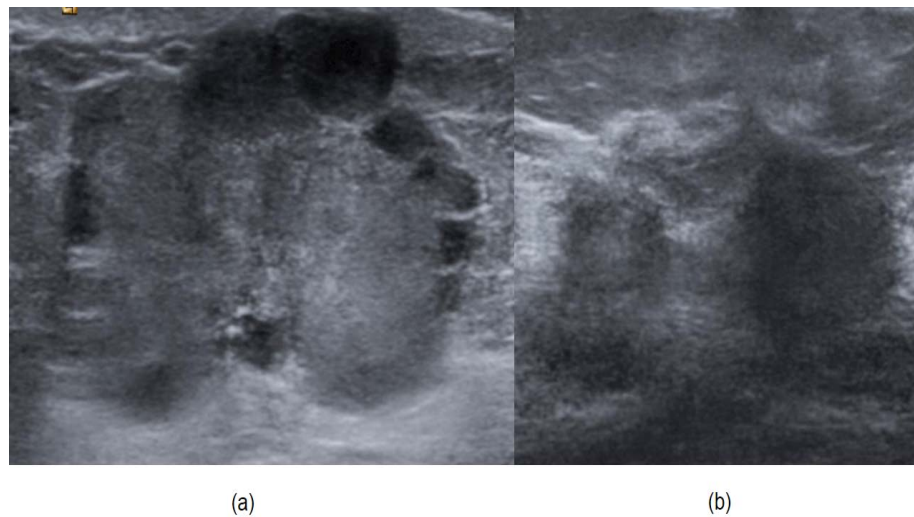


**Fig. (7).** a-c. Radial colour Doppler image of benign papillary lesion in a 34-year-old woman. An intraductal lesion is seen that fill the entire dilated duct with distinct vascular pedicle (a) Colour Doppler image of benign papillary lesion in a 31-year-old woman, intracystic lesion with vascular pedicle is present (b) Ultrasound image of papilloma with DCIS in a 67-year-old woman, complex cyst with papillary projections and increased internal vascularity is present (c).

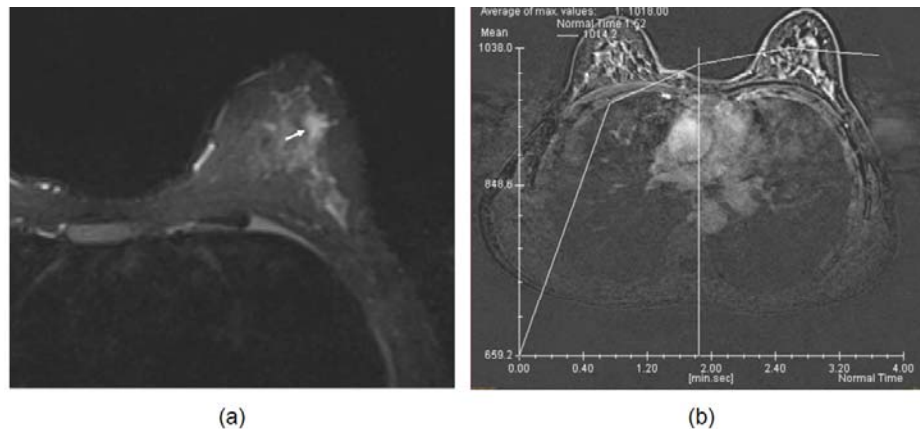
## ULTRASOUND APPEARANCE

Compared with mammography, ultrasound (US) is more sensitive in detecting all types of papillary lesions [1]. The US features of a papillary lesion depend primarily on the lesion's gross macroscopic appearance. US appearances, though variable, typically fit into one of three basic patterns [12]. The most common pattern is an intraductal mass with or without ductal dilatation (Fig. 6a). Dilated ducts may contain echogenic fluid if bleeding occurred. A good indicator of an intraductal papillary lesion is a solitary dilated duct (>3mm), particularly if the patient presents with serous anginous nipple discharge [12]. An intracystic mass (Fig. 6b) and

focal hypoechoic mass are the other two patterns of papillary breast lesions (Fig. 6c). Hallmarks of intraductal papillary lesions are a duct dilated with an intraductal mass, or a complex cyst with an intracystic solid mass component. In benign papillary lesions, indistinct margins may be seen due to pseudoinvasion (Fig. 6c). If the mass is so large that it can fill the dilated duct or the cyst, it may not be possible to delineate the peripheral ductal or cystic component, and so intraductal papillary lesions may mimic a solid mass. Intraductal papillary lesions have a characteristic flow pattern (highly vascular pedicle with branching vessels) on color Doppler imaging (Fig. 7a, b) [12]. Doppler imaging is



**Fig. (8).** a, b. Ultrasound image of papillary carcinoma in a 62-year-old woman. Solid lesions with cystic components and posterior acoustic enhancement is seen (a) Ultrasound image of papillary carcinoma in a 65-years-old woman. Solid lesions with irregular margin and shape is seen (b).



**Fig. (9).** a, b. MRI images of benign papillary lesion in a 43-year-old woman. Hyperintense solid mass with irregular margins is seen on fat-saturated axial T2-weighted MRI (a), Rapid contrast enhancement in early phase, plateau kinetics in late phase time is present on time intensity curve (b).

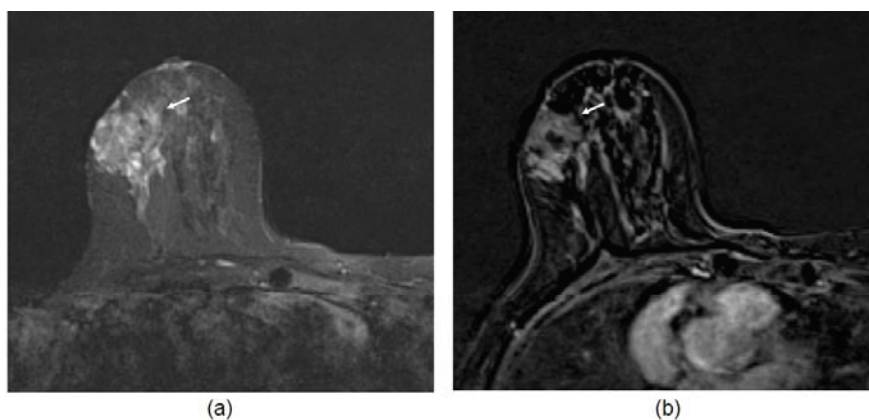
sensitive in identifying even very small intraductal papillary lesions and distinguish echogenic intraductal debris material from intraductal masses because of their characteristic vascularity.

Papillary carcinomas may be detected as a hypoechoic or heterogenous solid mass or as a complex cyst that US shows septae or mural-based papillary projections (Fig. 7c) [1]. Anechoic regions inside the mass may indicate cystic components or sequelae of hemorrhages. Presence of cystic components is not an indicator of benignity (Fig. 8a) [1]. An irregular margin and shape may be present (Fig. 8b). Posterior acoustic enhancement or shadowing may be seen. Doppler imaging often shows increased internal vascularity within solid areas of the lesion (Fig. 7c). Benign and malignant papillary breast lesions have a varied appearance on US and overlap considerably as to imaging features; therefore, differentiation may not be possible *via* US. In older age groups, the presence of a larger solid component and evidence of intracystic hemorrhage are more indicative of malignant papillary lesions than of benign papillary lesions [13].

## MRI APPEARANCE

On MRI, intraductal papillomas may be occult, and not be revealed neither on contrast-enhanced MRI nor on fat-saturated T2-weighted MRI. Small intraductal papillomas may appear as small enhancing masses, possibly associated with an enlarged duct, and corresponding to a “small luminal mass” appearance of the papilloma known from galactography [14]. Larger or small benign lesions can have irregular margins because of pseudoinvasion (Fig. 9a). These lesions often show rapid contrast enhancement in the early phases (Fig. 9b) [3]. Enhancement patterns of them may be regular or not regular with either plateau or washout kinetics (Fig. 9b) [4, 8]. In intraductal/intracystic papillomas, MRI shows mass with crescentic peripheral fluid and intraductal focal mass on T2 weighted [15].

MRI may show papillary carcinomas as irregularly enhancing nodules if they are solid, or as complex cysts with mural and nodular enhancement (Fig. 10a, b) [2]. With MRI, papillary lesions have variable morphologic features and enhancement patterns, making it impossible to definitively



**Fig. (10).** a, b. MR images of malign papillary lesion in 48-years-old woman, a) Hyperintense-heterogeneous lesion with irregular margin and shape is seen on fat-saturated axial T2-weighted MRI (a), Heterogeneous contrast enhancement is present on axial contrast-enhanced subtraction MR image (b).

diagnose the difference between benign and malignant papillary lesions. Spiculation and rim enhancement most reliably indicate a malignant papillary lesion [1]. Benign papillary lesions often show early and rapid uptake of gadolinium and Type 2 or Type 3 time intensity curve (TIC) on dynamic contrast-enhanced MRI (DCE-MRI), yet evaluation of a TIC for differential diagnosis is usually unhelpful [16]. The role of MRI in evaluating papillary lesions with atypical-ductal carcinoma *in situ* is uncertain [2].

Although MRI cannot help to definitively diagnose a papillary carcinoma and cannot rule out the presence of DCIS or atypia inside a papillary lesion, it is highly sensitive for detecting papillary lesions and is more reliable than US. MRI is also useful in detection of multiple intraductal papillomas, Because of this, preoperative MRI is generally required for preoperative mapping of multiple papillary lesions [17]. MRI plays a major role in determining the extent of the lesion in patients with intraductal papillomas, atypia-ductal carcinoma *in situ* (DCIS) within a papilloma or papillary carcinoma. MRI is the preferred method for follow-up of patients after surgery [15].

In the last decade, diffusion-weighted MRI has been used to differentiate breast lesions. Breast lesions that were benign, including papillomas, showed increased ADC values compared to their malignant counterparts [18].

MR ductography utilizing special microscopic coils offers a better technique for detection of intraductal papilloma than conventional breast MRI. The majority of intraductal papillomas appear as well-circumscribed masses with type 3 TIC [15]. With MR ductography, lesions as small as 1.0 mm in size could be detected [19].

## CONCLUSION

Papillary lesions of the breast have a wide spectrum of appearances depending on the imaging modality used. Different appearances can mimic various benign and malignant pathologies and make differential diagnosis difficult *via* imaging only. Although, histopathologic result is usually required for final diagnosis, to be familiar with different imaging appearances of benign and malignant papillary lesions of

the breast on various imaging modalities may help us narrowing the differential list.

## CONFLICT OF INTEREST

The author(s) confirm that this article content has no conflict of interest.

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