



Pictorial Review

Imaging findings of papillary breast lesions: A pictorial review



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The aim of this review is to describe the different imaging appearances of benign and malignant papillary breast lesions on mammography, ultrasound, and magnetic resonance imaging, according to the World Health Organization histopathological classifications. The classification and morphological imaging characteristics of papillary lesions remain challenging for pathologists and radiologists. Despite the difficulty of classifying these lesions, our review and those of others suggest that morphology is associated with clinically meaningful staging and outcome implications. Imaging can help to differentiate the forms of papillary lesion, but surgical specimens are required for definitive diagnosis in the majority of cases.

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Introduction

Papillary breast neoplasms are characterized by epithelial proliferation supported by fibrovascular stalks, with or without an intervening myoepithelial (ME) cell layer.¹ These lesions may be benign (i.e., papillomas) or malignant. Benign forms include intraductal papilloma, classified as central, peripheral, or atypical. Malignant papillary lesions may be non-invasive (intracystic and intraductal papillary carcinomas, intraductal micropapillary carcinoma) or invasive (invasive papillary and micropapillary carcinomas).²

Different terminologies and criteria have been used to classify papillary lesions, and distinction of these heterogeneous groups and their subtypes is not always simple. The most important question to answer is whether a lesion is benign or malignant. The complete absence of an ME cell layer in the fibrovascular fronds of a papillary lesion indicates carcinoma, but the presence of ME cells does not invariably exclude the diagnosis of intraductal papillary carcinoma.³

Papillary lesions are challenging for radiologists because benign and malignant tumours have a wide spectrum of appearances on magnetic resonance imaging (MRI), ultrasound, and mammography⁴ (Table 1). A few benign lesions and some non-papillary tumours may exhibit features overlapping with those of papillary lesions. Thus, the objective of this review is to describe the different imaging appearances of benign and malignant papillary lesions of the breast on mammography, ultrasound, and MRI, according to World Health Organization histopathological classifications.^{1,2}

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Table 1
Imaging features of papillary lesions.

	Mammography	Ultrasound	MRI
Intraductal papilloma (central and peripheral differ in location)	Circumscribed mass Solitary dilated duct Microcalcification frequently associated with atypia	Oval, circumscribed, hypoechoic solid mass into a dilated duct	T1: Circumscribed mass, intensely enhancing in correspondence to a dilated duct T2: Filling defect in high signal dilated duct
Intraductal papillary carcinoma and intraductal micropapillary carcinoma ^a	Amorphous or pleomorphic microcalcification	Ill-defined hypoechoic mass Microcalcification	Non-mass-like enhancement, frequently clumped
Intracystic papillary carcinoma	Circumscribed mass	Hypoechoic solid mass or a complex cyst with septa or mural-based papilliform nodularity	Solid enhancing mass into a cystic lesion
Invasive papillary carcinoma	Irregular mass with spiculate margins frequently without microcalcifications	Irregular, hypoechoic solid mass	T1: Hypointense irregular mass with washout T2: Heterogeneous hyperintense mass
Invasive micropapillary carcinoma	Dense irregular mass with spiculate margins with or without microcalcifications	Irregular, hypoechoic solid mass with indistinct margins	T1: Hypointense irregular mass with washout T1: Heterogeneous non-mass-like enhancement T2: Heterogeneous hyperintense mass

^a Intraductal micropapillary carcinoma: associated more frequently with multicentricity and microinvasion.

Intraductal papilloma

Central papilloma

Central or solitary papillomas are tumours of the major lactiferous ducts that arise in large subareolar ducts. These lesions are encountered most commonly in perimenopausal women who present clinically with spontaneous nipple discharge that may be bloody, serous, or clear. However, the increasingly widespread use of breast ultrasound has led to the detection of solitary intraductal papillomas with increasing frequency in younger asymptomatic patients.³

Small papillomas can be mammographically occult, particularly when located in the retroareolar region, due to the density and relative lack of compression in that area. Sonography may be necessary to visualize these lesions. Larger lesions may appear as round or oval masses with well-circumscribed margins,^{4–6} which are rarely calcified or present as solitary dilated retroareolar ducts. On sonography, a papilloma appears as an intraductal mass in a dilated duct, an intracystic mass, or a solid mass with a well-defined border (Fig 1).⁷ Ductography, although not widely used, may show an intraluminal filling defect or ductal dilatation due to partial or complete ductal obstruction. Recently, MRI has been reported to be a useful adjunct technique for the detection of intraductal papilloma of the breast (Fig 2).⁸

Peripheral papilloma

Multiple or peripheral papillomas arise in the terminal ductal lobular units. Compared with solitary intraductal papillomas, multiple lesions tend to occur in younger patients, are associated less often with nipple discharge, and are more frequently peripheral.¹ Their basic

histopathological features are similar to those of central papillomas, but ductal epithelial cells are more frequently associated with hyperplasia, atypia, ductal carcinoma *in situ* (DCIS), or invasive carcinoma, as well as with sclerosing adenosis or radial scar.⁹ The presence of proliferative epithelial change increases the risk of carcinoma in patients with these lesions.^{1,3} Haagensen et al.¹⁰ found that five of 51 patients with multiple papillomas developed cancer, in marked contrast to four of 174 patients with solitary papillomas.

The imaging appearance of peripheral papilloma is very similar to that of central papilloma, differing only in location. However, it is not a frequent mammographic or ultrasonographic finding.⁷ A round mass can be observed in relation to a duct, but its appearance does not differ from that of other benign disease. MRI findings are not pathognomonic, and these lesions resemble benign masses, such as fibroadenoma.

Atypical papilloma

These lesions are characterized by the presence of focal atypical epithelial proliferation with low-grade nuclei.¹ Atypia within a papilloma is defined by the presence of a uniform population of neoplastic cells in an area ≤ 3 mm, whereas DCIS is defined by the presence of such cells in an area >3 mm. Atypical ductal hyperplasia (ADH) within a papilloma may represent a precursor lesion and is regarded as an increased risk factor for the development of breast cancer.¹⁰ No particular imaging characteristic would lead a radiologist to suspect atypia in a central or peripheral papilloma (Fig 3).

Papillomas associated with ADH or DCIS may appear identical to benign papillomas on all imaging techniques. Although indeterminate calcifications within a papilloma

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