

# Benign Intraductal Papilloma Diagnosed on Imaging-Guided Breast Biopsy: Upgrade Rate to Carcinoma and to High-Risk Lesion

Kamolwan Jungmeechoke MD<sup>1</sup>, Chatipat Khamkajorn MD<sup>1</sup>, Supakajee Saengruang-Orn PhD<sup>1</sup>

<sup>1</sup> Department of Radiology, Phramongkutklao Royal Thai Army Hospital, Bangkok, Thailand

**Objective:** To determine the upgrade rates to carcinoma and to high-risk lesion (HRL) of benign intraductal papilloma (IDP) diagnosed on core needle biopsy (CNB) at Phramongkutklao (PMK) Hospital and to identify clinical or radiologic factors associated with the upgrading.

**Materials and Methods:** Benign IDPs diagnosed on CNB between 2012 and 2020 were retrospectively reviewed. The ones with subsequent surgical excision or with more than two years of imaging follow-up to confirm benignity were included. The upgrade rates to carcinoma and to HRL were determined. Clinical and radiologic factors associated with the upgrade were analyzed.

**Results:** Fifty-six benign IDPs diagnosed on CNB including 41 with subsequent excision and 15 with follow-up management were included. Of the 56 lesions, four (7.14%) were upgraded to carcinoma including three DCIS and one DCIS with grade 1 invasive carcinoma. Upgrade to HRL was found in two lesions (3.57%). No factor was found to be associated with the upgrading.

**Conclusion:** At PMK Hospital, the upgrade rates of benign IDP diagnosed on CNB to carcinoma and to HRL were 7.14% and 3.57%, respectively. No factor was found to be associated with the upgrading. All upgraded cancers were of the early stage and low grade. Case-by-case management is recommended, based on these results together with patient's risk, patient's concern, and follow-up compliance.

**Keywords:** Benign intraductal papilloma; Breast carcinoma; Breast biopsy; High risk lesion; Upgrade

Received 22 February 2021 | Revised 27 May 2021 | Accepted 1 June 2021

J Med Assoc Thai 2021;104(9):1452-8

Website: <http://www.jmatonline.com>

Intraductal papilloma (IDP) is a benign breast tumor accounting for 3% to 6% of the core needle biopsy (CNB) diagnosed breast lesions<sup>(1)</sup>. It is one of the spectrum of papillary tumor of the breast that includes benign IDP, IDP with atypia or ductal carcinoma in situ (DCIS), papillary DCIS, solid papillary carcinoma, encapsulated papillary carcinoma, and invasive papillary carcinoma<sup>(2)</sup>. Imaging-guided CNB is the gold standard for diagnosis but undersampling can occur. Furthermore, pathological differentiation between benign, atypia, and carcinoma from small tissue sample of CNB is also challenging. Subsequent excisional upgrade of

IDP to atypia, DCIS, or invasive carcinoma can be found.

IDP with atypia has high upgrade rate to cancer, up to 71%, and more than 30% in most studies<sup>(3)</sup>, thus surgical excision is the standard treatment. On the contrary, benign IDP has a wide range of upgrade rates at 0% to 29%<sup>(4)</sup>, and management is still controversial.

The primary aim of the present study was to determine the upgrade rates to carcinoma and to high-risk lesion (HRL) of benign IDP diagnosed on CNB at Phramongkutklao (PMK) Hospital. The secondary aim was to identify any clinical or radiologic factors associated with the upgrading, to help guide appropriate clinical management.

## Materials and Methods

The present retrospective study was approved by the Institutional Review Board of PMK Hospital (R014h/63\_Exp). Benign IDPs diagnosed on CNB between September 2012 and September 2020 were searched from the pathological database and 81 lesions were identified. The inclusion criteria were the lesions with subsequent surgical excision or with more than two years of imaging follow-up to confirm benignity. Twenty-five IDPs were excluded. Twenty-

### Correspondence to:

Jungmeechoke K.

Department of Radiology, Phramongkutklao Hospital, 315, Ratchawithi Road, Thung Phaya Thai, Ratchathewi, Bangkok 10400, Thailand.

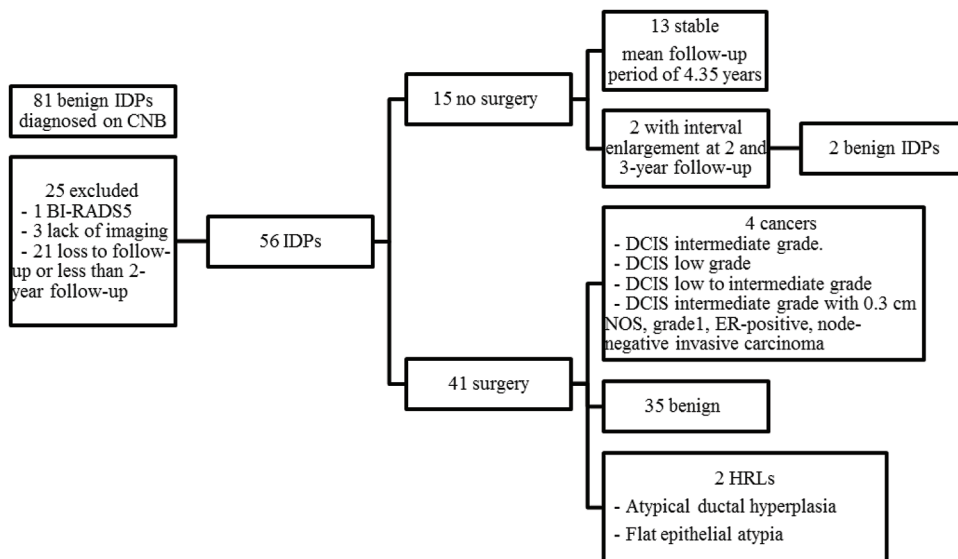
Phone: +66-2-7633817, Fax: +66-2-3545243

Email: [k.jungmeechoke@hotmail.com](mailto:k.jungmeechoke@hotmail.com)

### How to cite this article:

Jungmeechoke K, Khamkajorn C, Saengruang-Orn S. Benign Intraductal Papilloma Diagnosed on Imaging-Guided Breast Biopsy: Upgrade Rate to Carcinoma and to High-Risk Lesion. J Med Assoc Thai 2021;104:1452-8.

[doi.org/10.35755/jmedassocthai.2021.09.12590](https://doi.org/10.35755/jmedassocthai.2021.09.12590)



**Figure 1.** Experiment design and outcome.

BI-RADS, Breast imaging reporting and data system; CNB, core needle biopsy; DCIS, ductal carcinoma in situ; HRL, high risk lesion; IDP, intraductal papilloma; NOS, not otherwise specified

one lesions were excluded due to the loss to follow-up or less than two years of follow-up, three lesions lacked the imaging for review, and one lesion due to being BI-RADS5 lesion. Thus, 56 IDPs were included in the present study. The demographic information of the patients, clinical presentation, radiologic features, biopsy detail, types of treatment, and pathological reports were reviewed from the medical records. A breast radiologist reviewed the imaging appearance and assessed the size, location, and BI-RADS category of the lesions. A pathological slides review by breast pathologist was not done.

All biopsies were done with imaging guidance, mostly by the breast radiologist, with 14-gauge spring-loaded needle. The average numbers of tissue sample cores per lesion were five for ultrasound and 12 for stereotactic guidance. The stereotactic biopsy was used only when the lesions presented as microcalcifications. Most pathological diagnoses were interpreted by the general pathologists. The discordance case was defined at PMK Hospital as BI-RADS 4b, 4c, or 5 lesion with benign pathological CNB result. Treatment varied from surgeon to surgeon, with some that did excisions for all IDP, and some that did in case of discordance, large size, symptomatic, or as requested by the patient.

The lesion was considered to be an upgrade to carcinoma if DCIS or invasive cancer was found on excisional specimen. In addition, if atypia or lobular carcinoma in situ was found on excision, it was called

upgrade to HRL. The upgrade rate was defined as the number of upgraded lesions divided by the total number of included lesions. Clinical and radiologic factors associated with the upgrades were evaluated.

Statistical analyses were performed by using the IBM SPSS Statistics software, version 22.0 (IBM Corp., Armonk, NY, USA). For numeric covariates, the median, mean, and standard deviation were calculated. Frequency and its percentage were shown for categorical variables. Fisher's exact test or chi-squared test was applied to compare between groups of categorical variables and independent t-test was used to evaluate the continuous variables. Results were considered as significant at p-value less than 0.05.

## Results

The present study population consisted of 56 IDPs, found in 52 female patients. Two patients had two and three lesions on the same visit and the other two had two lesions on different visits. Forty-one lesions underwent subsequent surgical excisions, while 15 lesions were treated by observation with more than two years of imaging follow-up (Figure 1).

### The demographic data, clinical presentation, radiologic characteristics, and detail of biopsy of study population (Table 1-3)

The mean patient age was 52.9 years with a range of 28 to 86 years. Most of the patients (94.64%) had no

**Table 1.** Demographic and clinical characteristics of benign IDPs diagnosed on CNB, with comparison of upgrade and non-upgrade groups

Characteristics	Total IDPs (n=56); n (%)	IDPs without upgrade (n=50); n (%)	IDPs with upgrade (n=6); n (%)	p-value
Age (year); mean±SD	52.9±13.08	52.8±13.37	53.5±11.38	0.903 <sup>b</sup>
Range	28 to 86	28 to 86	43 to 75	
Personal history of breast cancer				0.707 <sup>a</sup>
Yes	3 (5.36)	3 (6.00)	0 (0.00)	
No	53 (94.64)	47 (94.00)	6 (100)	
Symptom				0.271 <sup>a</sup>
Palpable mass	14 (25.00)	14 (28.00)	0 (0.00)	
Nipple discharge	11 (19.64)	10 (20.00)	1 (16.67)	
Pain	4 (7.14)	4 (8.00)	0 (0.00)	
No	27 (48.21)	22 (44.00)	5 (83.33)	

IDP=intraductal papilloma; SD=standard deviation

<sup>a</sup> Fisher's exact test or chi-squared test, <sup>b</sup> Independent t-test, significant if p<0.05

**Table 2.** Radiologic characteristics of benign IDPs diagnosed on CNB, with comparison of upgrade and non-upgrade groups

Characteristics	Total IDPs (n=56); n (%)	IDPs without upgrade (n=50); n (%)	IDPs with upgrade (n=6); n (%)	p-value
Imaging findings				0.738 <sup>a</sup>
Microcalcifications on mammogram	6 (10.71)	6 (12.00)	0 (0.00)	
Intraductal mass on U/S	5 (8.93)	4 (8.00)	1 (16.67)	
Intracystic mass on U/S	9 (16.07)	9 (18.00)	0 (0.00)	
Complex cyst Berg type1 on U/S	6 (10.71)	5 (10.00)	1 (16.67)	
Solid mass/complex cyst with ductal dilatation	21 (37.50)	18 (36.00)	3 (50.00)	
Solid mass/complex cyst without ductal dilatation	9 (16.07)	8 (16.00)	1 (16.67)	
BI-RADS category				0.721 <sup>a</sup>
4a	29 (51.79)	25 (50.00)	4 (66.67)	
4b	26 (46.43)	24 (48.00)	2 (33.33)	
4c	1 (1.78)	1 (2.00)	0 (0.00)	
Size (mm)				
Median (range)	9 (3 to 49)	9 (3 to 49)	9 (5 to 15)	0.747 <sup>b</sup>
≥10	24 (42.86)	22 (44.00)	2 (33.33)	0.482 <sup>a</sup>
<10	32 (57.14)	28 (56.00)	4 (66.67)	
Subareolar location				0.593 <sup>a</sup>
Yes	30 (53.57)	27 (54.00)	3 (50.00)	
No	26 (46.43)	23 (46.00)	3 (50.00)	
Multiplicity				0.669 <sup>a</sup>
Yes	9 (16.07)	8 (16.00)	1 (16.67)	
No	47 (83.93)	42 (84.00)	5 (83.33)	

BI-RADS=breast imaging reporting and data system; IDP=intraductal papilloma; U/S=ultrasound

<sup>a</sup> Fisher's exact test or chi-squared test, <sup>b</sup> Mann-Whitney test, significant if p<0.05

personal history of breast cancer. Slightly more than half of the patients (51.78%) had symptoms, including palpable mass (25%), nipple discharge (19.64%),

and pain (7.14%). Most lesions were demonstrated on ultrasound (89.3%), with only a minority shown as microcalcifications on mammogram (10.7%). The

**Table 3.** Size of biopsy needle used in study population, with comparison of upgrade and non-upgrade groups

Characteristics	Total IDPs (n=56); n (%)	IDPs without upgrade (n=50); n (%)	IDPs with upgrade (n=6); n (%)	p-value
14-gauge	48 (85.71)	43 (86.00)	5 (83.33)	0.665*
Smaller than 14-gauge	3 (5.36)	3 (6.00)	0 (0.00)	
Missing data	5 (8.93)	4 (8.00)	1 (16.67)	

IDP=intraductal papilloma

a Fisher's exact test or chi-squared test, significant if p<0.05

median lesion size was 9 mm with a range of 3 to 49 mm, and about half (53.57%) of the lesions located in subareolar area. Multiple lesions were found in four patients with nine lesions. Most lesions were biopsied using 14-gauge spring-loaded needle (85.71%). No vacuum assisted biopsy (VAB) with larger needle was used.

### Lesions with subsequent surgical excisions

Among the patients that underwent surgical excisions, four lesions upgraded to breast carcinoma and two upgraded to HRLs. Three out of four cancers were low to intermediate grade DCIS. The other one was DCIS with 0.3 cm in size, not otherwise specified (NOS), histologic grade1, estrogen receptor (ER)-positive, and node-negative invasive carcinoma. Two HRLs were atypical ductal hyperplasia (ADH) and flat epithelial atypia (FEA). The mean patient age was 53.5 years with a range of 43 to 75 years, and median lesion size was 9 mm with a range of 5 to 15 mm. Out of the six upgraded lesions, only one was symptomatic with bloody nipple discharge. Four of the upgraded lesions were BI-RADS4a and two were BI-RADS4b (Table 1-3). The radiologic imaging examples of benign IDP upgraded to invasive carcinoma and ADH are shown in Figure 2 and 3, respectively.

### Lesions managed with follow-up

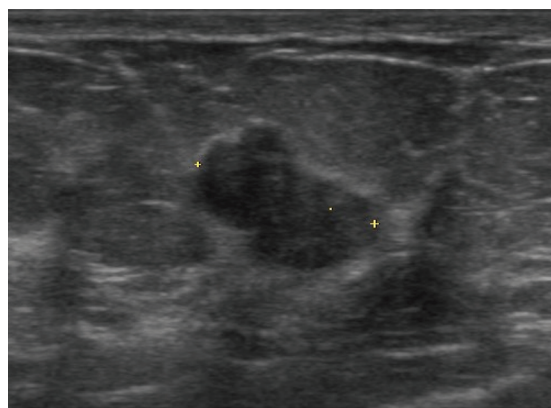
The period of follow-up duration ranged from 2.33 to 8.08 years, with a mean of 4.35 years. Two lesions out of 15 showed interval enlargement at two and three years of follow-up, of which repeated biopsy and excision still confirmed benign IDPs (Figure 1).

### Upgrade rates

The upgrade rates of benign IDP diagnosed on CNB to carcinoma and to HRL were 7.14% and 3.57%, respectively. The total upgrade rate was 10.71%.

### Factors associated with the upgrade

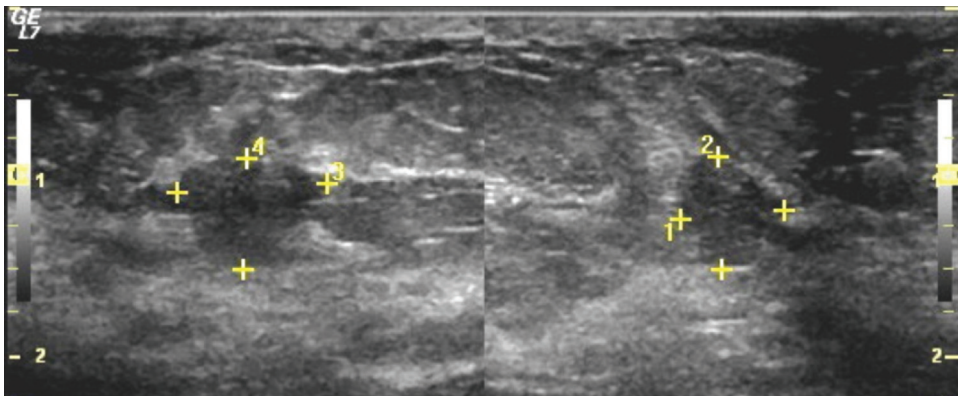
No clinical or radiologic factor was found to be associated with the upgrade as shown in Table 1-3.



**Figure 2.** Ultrasound of an asymptomatic 42-year-old woman showed a 9×13 mm lobulated hypoechoic mass in upper inner quadrant of left breast, BI-RADS4a. CNB identified an intraductal papilloma with apocrine metaplasia. Subsequent excision revealed 0.3 cm, not otherwise specified, histologic grade1 invasive carcinoma with intermediate-grade DCIS arising in the papilloma.

### Discussion

There is a wide range of upgrade rates to malignancy of CNB diagnosed benign IDP, leading to variation in treatment recommendations. Review of the recent literatures of 2018 to 2020 still shows the wide range of 0 to 16%<sup>(1,5-21)</sup>, but most are under 4%. The suggested management is trending toward observation more than excision of all IDPs, even though the upgrade rate is higher than 2%. The upgrade rate to malignancy in the present study was 7.14%, which is still in the mentioned range, but relatively high and quite different from the study of Thai people of Wiratkapun et al<sup>(3)</sup>, which showed 0% upgrade rate to cancer. The wide range of upgrade rate may be due to different characteristics of research population, different study design and methodology, such as differences in inclusion, exclusion criteria, type and needle size of imaging guided biopsy, definition of the upgrade, and expertise of radiologist and pathologist. One of the possible causes of quite high upgrade rate in the present study was no pathological review by breast pathologist, as mentioned in some studies<sup>(8,22,23)</sup>.



**Figure 3.** Ultrasound of an asymptomatic 55-year-old woman showed a 6×9 mm hypoechoic mass with associated ductal dilatation in left subareolar area, BI-RADS4b. CNB showed an intraductal papilloma. Subsequent excision revealed upgrade of the lesion to papilloma with ADH and usual ductal hyperplasia.

Jakate et al<sup>(22)</sup> showed that the upgrade rates of IDP to carcinoma at excision were different when breast pathologist (2.5%) and non-breast pathologist (6.9%) evaluated the same cases. The other possible cause was the size of the biopsy needle. Most biopsies (85%) in the present study used 14-gauge spring-loaded needle. Spring loaded CNB is found to be associated with higher upgrade rate to carcinoma and to HRL compared to vacuum-assisted biopsy (VAB) with larger needle in some studies<sup>(11,21)</sup>, because smaller needle provides less tissue sample volume, leading to less accurate pathological diagnosis.

All the upgraded malignancy in the present study were early ones, similar to the other studies<sup>(7,10,11,14,16,17,21)</sup>. Most (75%) were low to intermediate grade DCIS. The invasive one was small with favorable prognosis. No upgraded cancer was found in the patients undergoing observation treatment, with a mean follow-up period of 4.35 years, implying the safety of follow-up. However, this could also be caused by some bias in selected cases not undergoing surgery and not having long enough follow-up periods.

HRLs are lesions associated with an elevated future breast cancer risk. The upgrade rate to HRL was 3.57% in the present study, one was ADH and the other was FEA. The rate is in the range of 1.8% to 20% found in reviewed literature<sup>(2)</sup>, but quite low. This is possibly due to the lack of breast pathologist review. Nakhlis et al<sup>(20)</sup> showed that the upgrade rate of benign IDP to HRL on excision increased from 4% to 13% after review by breast pathologists. Wiratkapun et al<sup>(3)</sup> found 19% upgrade rate to HRL and recommended excision of all IDPs diagnosed on CNB. The benefit of excision is the chance for the

patient to receive chemoprophylaxis and adhere more to screening program. However, some authors argued against excision because of the small number of breast cancer, less than 3.5%, was found in benign IDPs managed with follow-up<sup>(2,21)</sup>. In addition, Kuehner et al<sup>(14)</sup> found that only a small number of the patients with HRL on excision opted for chemoprophylaxis.

Older age<sup>(5,13-15,18,19)</sup>, presence of symptom<sup>(7,9,14)</sup>, and history of concurrent breast cancer or atypia<sup>(5,7,10)</sup> are found to be associated with the upgrade to cancer and to HRL of benign IDP diagnosed on CNB in some of the previous studies. In the present study, mean age of the upgrade group at 53.5 years, was slightly higher than the non-upgrade ones at 52.8 years, but the difference was not significant. Neither presence of symptom nor personal history of breast cancer was found to be associated with the upgrade.

Lesion size larger than 1 or 1.5 cm<sup>(9,14,16,21)</sup>, peripheral location<sup>(6,9,13,14)</sup>, multifocality<sup>(7)</sup>, and high BI-RADS category<sup>(15)</sup> are commonly identified as factors associated with the upgrade in previous studies. In the present study, these factors were not found to be associated with the upgrade. Most of the lesions in the present study (89.3%) were shown on ultrasound as intraductal mass, solid mass, or complex cyst with or without ductal dilatation. None of these sonographic features was found to be associated with the upgrade, which is the same result as in the studies of Raj et al<sup>(11)</sup> and Wiratkapun et al<sup>(3)</sup>. Some studies found microcalcifications as predictive factor for upgrade<sup>(15,24)</sup>, but all six lesions shown as microcalcifications, including BI-RADS4c one as punctate calcifications in linear distribution, in the present study showed no upgrade.

There are several limitations in the present

study. Retrospective nature and substantial losses to follow-up suggest some selective and confounding bias. Small research population also affects the power of statistical analyses. However, the results of the present study can be applicable to the practice in hospitals having no VAB and limited number of breast radiologists and breast pathologists as in the case of PMK Hospital.

## Conclusion

At PMK Hospital, the upgrade rates of benign IDP diagnosed on CNB to carcinoma and to HRL were 7.14% and 3.57%, respectively. No demographic, clinical, or radiologic factor was found to be associated with the upgrading. All upgraded cancers were of early stage and low grade. These results support no routine excision for all IDPs. Case-by-case management is recommended, based on these results together with patient's risk, patient's concern, and follow-up compliance.

## What is already known on this topic?

The upgrade rate of benign IDP diagnosed on breast biopsy to carcinoma has a wide range of 0% to 16%. Multiple factors associated with the upgrade are reported, but inconsistent between studies. Most of the upgraded cancers are of early stage and low grade.

## What this study adds?

The upgrade rate of benign IDP diagnosed on CNB to carcinoma at PMK Hospital is 7.14%. No factor was found to be associated with the upgrading. All upgraded cancers are of early stage and low grade.

## Acknowledgement

The authors are grateful for the assistance given by Kittisak Wongchansom, MD and Hansa Boonrat. Our special thanks also extend to all technicians and support staff of the mammography unit.

## Conflicts of interest

The authors declare no conflict of interest.

## References

1. Asirvatham JR, Jorns JM, Zhao L, Jeffries DO, Wu AJ. Outcomes of benign intraductal papillomas diagnosed on core biopsy: a review of 104 cases with subsequent excision from a single institution. *Virchows Arch* 2018;473:679-86.
2. Brogi E, Krystel-Whittemore M. Papillary neoplasms of the breast including upgrade rates and management of intraductal papilloma without atypia diagnosed at core needle biopsy. *Mod Pathol* 2021;34:78-93.
3. Wiratkapun C, Keeratitragoon T, Lertsithichai P, Chanplakorn N. Upgrading rate of papillary breast lesions diagnosed by core-needle biopsy. *Diagn Interv Radiol* 2013;19:371-6.
4. Bianchi S, Bendinelli B, Saladino V, Vezzosi V, Brancato B, Nori J, et al. Non-malignant breast papillary lesions - b3 diagnosed on ultrasound--guided 14-gauge needle core biopsy: analysis of 114 cases from a single institution and review of the literature. *Pathol Oncol Res* 2015;21:535-46.
5. Kiran S, Jeong YJ, Nelson ME, Ring A, Johnson MB, Sheth PA, et al. Are we overtreating intraductal papillomas? *J Surg Res* 2018;231:387-94.
6. Leithner D, Kaltentbach B, Hödl P, Möbus V, Brandenbusch V, Falk S, et al. Intraductal papilloma without atypia on image- guided breast biopsy: upgrade rates to carcinoma at surgical excision. *Breast Care (Basel)* 2018;13:364-8.
7. Han SH, Kim M, Chung YR, Yun B, Jang M, Kim SM, et al. Benign intraductal papilloma without atypia on core needle biopsy has a low rate of upgrading to malignancy after excision. *J Breast Cancer* 2018;21:80-6.
8. Grimm LJ, Bookhout CE, Bentley RC, Jordan SG, Lawton TJ. Concordant, non-atypical breast papillomas do not require surgical excision: A 10-year multi-institution study and review of the literature. *Clin Imaging* 2018;51:180-5.
9. Ahn SK, Han W, Moon HG, Kim MK, Noh DY, Jung BW, et al. Management of benign papilloma without atypia diagnosed at ultrasound-guided core needle biopsy: Scoring system for predicting malignancy. *Eur J Surg Oncol* 2018;44:53-8.
10. Chen YA, Mack JA, Karamchandani DM, Zaleski MP, Xu L, Dodge DG, et al. Excision recommended in high-risk patients: Revisiting the diagnosis of papilloma on core biopsy in the context of patient risk. *Breast J* 2019;25:232-6.
11. Raj SD, Phillips J, Mehta TS, Quintana LM, Fishman MD, Dialani V, et al. Management of BIRADS 3, 4A, and 4B lesions diagnosed as pure papilloma by ultrasound-guided core needle biopsy: Is surgical excision necessary? *Acad Radiol* 2019;26:909-14.
12. Choi HY, Kim SM, Jang M, Yun B, Kang E, Kim EK, et al. Benign breast papilloma without atypia: outcomes of surgical excision versus US-guided directional vacuum-assisted removal or US follow-up. *Radiology* 2019;293:72-80.
13. Yu Y, Salisbury E, Gordon-Thomson D, Yang JL, Crowe PJ. Management of papillary lesions without atypia of the breast diagnosed on needle biopsy. *ANZ J Surg* 2019;89:524-8.
14. Kuehner G, Darbinian J, Habel L, Axelsson K, Butler S, Chang S, et al. Benign papillary breast mass lesions: favorable outcomes with surgical excision or imaging surveillance. *Ann Surg Oncol* 2019;26:1695-703.
15. MacColl C, Salehi A, Parpia S, Hodgson N, Ramonas M, Williams P. Benign breast papillary lesions

- diagnosed on core biopsy: upgrade rate and risk factors associated with malignancy on surgical excision. *Virchows Arch* 2019;475:701-7.
16. Genco IS, Tugertimur B, Manolas PA, Hasanovic A, Hajjiyeva S. Upgrade rate of intraductal papilloma without atypia on breast core needle biopsy: A clinical, radiological and pathological correlation study. *Am J Surg* 2020;220:677-81.
  17. Moynihan A, Quinn EM, Smith CS, Stokes M, Kell M, Barry JM, et al. Benign breast papilloma: Is surgical excision necessary? *Breast J* 2020;26:705-10.
  18. Lin LH, Ozerdem U, Cotzia P, Lee J, Chun J, Schnabel F, et al. Upgrade rate of intraductal papilloma diagnosed on core needle biopsy in a single institution. *Hum Pathol* 2021;110:43-9.
  19. Li X, Aho M, Newell MS, Clifford K, Patel JG, Jou S, et al. Papilloma diagnosed on core biopsies has a low upgrade rate. *Clin Imaging* 2020;60:67-74.
  20. Nakhlis F, Baker GM, Pilewskie M, Gelman R, Calvillo KZ, Ludwig K, et al. The incidence of adjacent synchronous invasive carcinoma and/or ductal carcinoma in situ in patients with intraductal papilloma without atypia on core biopsy: Results from a prospective multi-institutional registry (TBCRC 034). *Ann Surg Oncol* 2021;28:2573-8.
  21. Polat DS, Knippa EE, Ganti R, Seiler SJ, Goudreau SH. Benign breast papillomas without atypia diagnosed with core needle biopsy: Outcome of surgical excision and imaging follow-up. *Eur J Radiol* 2020;131:109237.
  22. Jakate K, De Brot M, Goldberg F, Muradali D, O'Malley FP, Mulligan AM. Papillary lesions of the breast: impact of breast pathology subspecialization on core biopsy and excision diagnoses. *Am J Surg Pathol* 2012;36:544-51.
  23. Pareja F, Corben AD, Brennan SB, Murray MP, Bowser ZL, Jakate K, et al. Breast intraductal papillomas without atypia in radiologic-pathologic concordant core-needle biopsies: Rate of upgrade to carcinoma at excision. *Cancer* 2016;122:2819-27.
  24. Li X, Weaver O, Desouki MM, Dabbs D, Shyum S, Carter G, et al. Microcalcification is an important factor in the management of breast intraductal papillomas diagnosed on core biopsy. *Am J Clin Pathol* 2012;138:789-95.