Published in final edited form as:

Clin Breast Cancer. 2013 December ; 13(6): 439–449. doi:10.1016/j.clbc.2013.08.007.

Benign Papillomas Without Atypia Diagnosed on Core Needle Biopsy: Experience From a Single Institution and Proposed Criteria for Excision

Anupma Nayak¹, Selin Carkaci², Michael Z. Gilcrease¹, Ping Liu³, Lavinia P. Middleton¹, Roland L. Bassett Jr.³, Jinxia Zhang¹, Hong Zhang¹, Robin L. Coyne⁴, Therese B. Bevers⁴, Nour Sneige¹, and Lei Huo¹

¹Department of Pathology and Laboratory Medicine, The University of Texas MD Anderson Cancer Center, Houston, TX

²Department of Radiology, The University of Texas MD Anderson Cancer Center, Houston, TX

³Department of Biostatistics, The University of Texas MD Anderson Cancer Center, Houston, TX

⁴Department of Clinical Cancer Prevention, The University of Texas MD Anderson Cancer Center, Houston, TX

Abstract

The management of benign papilloma (BP) without atypia identified on breast core needle biopsy (CNB) is controversial. We describe the clinicopathologic features of 80 patients with such lesions in our institution, with an upgrade rate to malignancy of 3.8%. A multidisciplinary approach to select patients for surgical excision is recommended.

Background—The management of benign papilloma (BP) without atypia identified on breast core needle biopsy (CNB) is controversial. In this study, we determined the upgrade rate to malignancy for BPs without atypia diagnosed on CNB and whether there are factors associated with upgrade.

Methods—Through our pathology database search, we studied 80 BPs without atypia identified on CNB from 80 patients from 1997 to 2010, including 30 lesions that had undergone excision and 50 lesions that had undergone 2 years of radiologic follow-up. Associations between surgery or upgrade to malignancy and clinical, radiologic, and pathologic features were analyzed.

Results—Mass lesions, lesions sampled by ultrasound-guided CNB, and palpable lesions were associated with surgical excision. All 3 upgraded cases were mass lesions sampled by ultrasound-guided CNB. None of the lesions with radiologic follow-up only were upgraded to malignancy. The overall upgrade rate was 3.8%. None of the clinical, radiologic, or histologic features were predictive of upgrade.

Address for correspondence: Lei Huo, MD, PhD, Department of Pathology and Laboratory Medicine, The University of Texas MD Anderson Cancer Center, Unit 85, 1515 Holcombe Blvd, Houston, TX 77030 Fax: 713-745-5709; leihuo@mdanderson.org.

Disclosure

The authors have stated that they have no conflicts of interest.

Conclusion—Because the majority of patients can be safely managed with radiologic surveillance, a selective approach for surgical excision is recommended. Our proposed criteria for excision include pathologic/radiologic discordance or sampling by ultrasound-guided CNB without vacuum assistance when the patient is symptomatic or lesion size is ≥ 1.5 cm.

Keywords

Breast; Core needle biopsy; Criteria; Papilloma; Upgrade

Introduction

Papillary lesions of the breast are uncommon. The incidence in core needle biopsy (CNB) specimens of the breast is reportedly up to 6%.^{1–3} Histologically, they include intraductal papillary lesions (intraductal papilloma, intraductal papillary carcinoma, encapsulated papillary carcinoma, and solid papillary carcinoma) and invasive papillary carcinoma.⁴ Clinically, papillary lesions may present with nipple discharge or as a palpable mass, or both. They may be located centrally or peripherally in the breast parenchyma and may be solitary or multiple. With widespread breast cancer screening programs, the majority of these papillary lesions are now being detected by ultrasonography or mammography as asymptomatic masses or calcifications. There are no specific radiologic features differentiating a benign papilloma from its atypical or malignant counterparts.^{5,6}

To date, there is substantial evidence that a diagnosis of atypical intraductal papilloma on CNB requires surgical excision because of a significant risk of associated carcinoma (ductal carcinoma in situ [DCIS] and/or invasive carcinoma [IC]).^{1,7–15} However, debate continues on the appropriate management of a benign papilloma (BP) without atypia diagnosed on CNB. Some authors believe that BPs without atypia can be managed safely with clinical and radiologic follow-up if the radiologic and pathologic findings are concordant,^{10,11,16–24} whereas others recommend excision for this group of patients to rule out any associated malignancy.^{6,25–42} Reasons for excision stem from the inherent sampling issues of CNB and potential heterogeneity in the distribution of atypia or carcinoma, if present, within a papillary lesion. In addition, the fact that papillary lesions can be diagnostically challenging, especially on CNB, may prompt some to recommend excision.⁹ In published studies, the upgrade rate to carcinoma with a diagnosis of BP without atypia on CNB ranges from 0% to 29%.^{1–3,6,10–57} We present here our institution's experience with BP without atypia diagnosed on CNB and propose criteria for surgical excision.

Materials and Methods

Case Selection

Our pathology database was searched using keywords for all cases of papilloma of the breast diagnosed on CNB specimens from January 1997 to December 2010. Medical records and histologic slides were reviewed. Exclusion criteria included (1) nonavailability of the CNB material for review, (2) concurrent diagnosis of DCIS or IC in the ipsilateral breast, (3) presence of any atypia within the papilloma or atypical ductal hyperplasia (ADH) outside the papilloma in the same CNB specimen, (4) incidental papillomas such as microscopic

papillomas not associated with microcalcifications if the CNB was performed for suspicious calcifications, or (5) clinical and radiologic follow-up < 2 years if excision was not performed. The resulting 80 lesions from 80 patients were the subjects of this study, including 30 lesions found on CNB with corresponding surgical excision specimens and 50 cases with a minimum of 2 years of radiologic follow-up. Eighteen cases published in an earlier study from our institution¹⁶ fulfilled the selection criteria and were included. This project was approved by the Institutional Review Board of MD Anderson Cancer Center.

Radiologic, Pathologic, and Clinical Features

Ultrasound-guided biopsies were performed using 12-, 14-, 16-, or 18-gauge automated Bard Core Disposable Needles (C.R. Bard, Covington, GA). Stereotactic and magnetic resonance imaging (MRI)-guided biopsies were performed using a 9-gauge vacuum-assisted Suros ATEC breast biopsy device (Suros Surgical systems/ Hologic, Indianapolis, IN). A metallic marker clip was placed at the biopsy site. For stereotactic biopsies, a postprocedural radiograph of tissue cores was obtained to ensure adequate sampling of calcifications.

Radiologic features of the lesions were reevaluated retrospectively by an experienced breast radiologist (SC). Features evaluated for all lesions included lesion size, number, location (retroareolar, central, or peripheral), and Breast Imaging Reporting and Data System (BI-RADS) scores according to the American College of Radiology. In addition, features evaluated for mass lesions included shape (oval/ round, lobular, irregular), margins (circumscribed, not circumscribed), echo pattern (isoechoic, hypoechoic, hyperechoic, mixed or complex cystic), associated dilated duct (present, absent), mammographic correlate (present, absent), and degree of sampling (whether the lesion was entirely removed by CNB). Features evaluated for lesions with suspicious calcifications included their type (pleomorphic, amorphous, coarse/heterogeneous, punctate, fine linear branching) and distribution (clustered/grouped, linear, segmental, regional), ultrasonographic correlate (present, absent), and percentage of calcifications remaining after the biopsy procedure. For lesions identified on MRI and lesions with calcification-associated masses or asymmetry, the features described earlier for mass lesions and calcifications were evaluated when appropriate. Biopsy approach, needle gauge, and number of cores obtained were recorded for each lesion. To assess the stability of papillary lesions without atypia diagnosed on CNB, a short-term radiologic follow-up (6 months) was performed in our institution for > 2 years using the imaging modality by which the lesion was detected (mammography and/or ultrasonography and MRI). A lesion with no change at 2 years was considered benign, and return to annual follow-up was recommended.

Hematoxylin and eosin-stained slides of the CNB specimens were reviewed independently by 2 breast pathologists (AN and LH) to confirm the diagnosis of BP without atypia. The number of cores involved by papilloma and the presence of apocrine metaplasia within the papilloma were recorded. The diagnoses rendered for the excision specimens, when applicable, were extracted from the pathology reports. Upgrade to malignancy was defined as DCIS or IC identified at excision. Histologic slides of excision specimens, including all 3 upgraded cases, were reviewed whenever available.

Medical records were reviewed for patient age, menopausal status, personal or family history of breast cancer, palpable lesion, associated nipple discharge (including type of discharge—bloody or clear), and radiologic follow-up data.

Statistical Analysis

All statistical tests were performed using SAS, version 9.2 (SAS Institute, Inc, Cary, NC) and R, version 2.15.1 (R Core Team; <http://www.R-project.org>). For analyzing the correlation between 2 categorical variables, the Fisher exact test was used. For analysis of continuous variables, the Wilcoxon rank-sum test was used. A *P* value of < .05 indicated statistical significance.

Results

All 80 eligible patients were women between the ages of 31 and 81 years (median, 52 years; mean, 53 years). Thirty patients underwent subsequent excision and the remaining 50 patients had radiologic follow-up of 2 years (range, 24–150 months; median, 50 months; mean, 58 months). Clinical and radiologic characteristics of the 80 cases are summarized in Table 1.

Radiologically, 40 lesions were masses detected by ultrasonography, 28 were calcifications identified by mammography, 10 were calcifications with an associated mass or asymmetry identified by mammography with or without ultrasonography, and 2 were clumped enhancement or masses detected by MRI. Thirty-seven patients with mass lesions and 4 patients with calcifications with an associated mass or asymmetry underwent ultrasound-guided CNB. Twenty-eight patients with calcifications, 6 patients with calcifications with an associated mass or asymmetry, and 3 patients with mass lesions underwent stereotactic biopsy. The 2 patients with clumped enhancement or masses detected by MRI underwent MRI-guided biopsy.

As shown in Table 1, mass lesions, lesions sampled by ultrasound-guided CNB, and palpable lesions were associated with surgical excision. At the time of CNB, 18 patients had a history of IC or DCIS, including 14 contralateral and 4 ipsilateral cases. The intervals between the excision of the previous carcinoma and the CNB for papilloma in the 4 ipsilateral cases were 3 months for 1 and 6 to 17 years for the other 3.

Among patients with ultrasound-guided CNB, the only clinical or radiologic variable associated with excision was the presence of a palpable lesion (Table 2). None of the clinical or radiologic variables was associated with excision in patients who underwent stereotactic or MRI-guided biopsy (Table 3).

The reason for excision was not known for every patient. Fifteen patients who underwent excision had a palpable mass and/or nipple discharge. Eleven of the 80 cases were discussed at breast multi-disciplinary management conferences held weekly since 2004. Excision was recommended in 3 of these 11 cases because of the small and fragmented nature of the CNB specimen in 2 patients and a clinical history of increase in lesion size in 1 patient. Three cases that were upgraded to DCIS were not presented at the conference but had specific

reasons for excision, as described further on. Seven lesions with a BI-RADS score of 3 were biopsied, including 4 excised because of an increase in size during radiologic follow-up or because of the patient's or surgeon's preference. The only BI-RADS 5 lesion was excised and showed benign pathologic characteristics. Surgical excision was performed within 6 months of the CNB diagnosis in 26 of 30 patients. The remaining 4 lesions, including 1 case upgraded to DCIS on excision, were excised 9 to 25 months later on detection of a clinical or imaging abnormality during follow-up.

Three of the 30 cases were upgraded to carcinoma in the excised subgroup. Although all 3 presented with mass lesions identified and biopsied by ultrasonography, the presence of a mass lesion (vs. calcifications) was not significantly associated with upgrade ($P = .25$). Among the 3 patients, 1 patient had a concurrent diagnosis of DCIS in the contralateral breast and a concurrent diagnosis of ADH in the ipsilateral breast in a separate CNB specimen. The biopsied areas with ADH and papilloma were approximately 2 cm apart. The papilloma was a 0.7-cm oval hypoechoic mass lesion biopsied with a 14-gauge needle (Fig. 1A). The patient had clear nipple discharge. In the total mastectomy specimen, low-grade DCIS was identified in a 1-cm area around the biopsy site of the papilloma and farther away from the biopsy site showed ADH. No residual papilloma remained at the biopsy site (Fig. 1B and C). The second patient presented with a palpable lesion, corresponding to a 1.5-cm solid hypovascular mass biopsied with an 18-gauge needle, which yielded small pieces of fragmented tissue with a portion of a cyst wall and a focal epithelial lesion consistent with a papilloma (Fig. 1D). Because of inadequate sampling, an excisional biopsy was performed, which revealed 0.4 cm intermediate-grade DCIS involving an infarcted papilloma (Fig. 1E). The third patient had a remote history of contralateral breast cancer. She presented with a palpable periar-eolar mass that had a complex cystic appearance on ultrasonography and measured 1.6 cm. A CNB specimen obtained with a 14-gauge needle showed a papilloma (Fig. 1F). Excision was not performed at the time and the patient was followed radiologically every 6 months for a year and then annually. Two years after the initial biopsy for the papilloma, she was found to have a hypoechoic ill-defined area on ultrasonography that was almost contiguous with the previous papilloma. A CNB showed DCIS. A total mastectomy revealed a 1.9-cm area of high-grade DCIS immediately adjacent to the papilloma (Fig. 1G and H). Although it was unclear whether the DCIS was already present at the time of the CNB for the papilloma, because of their close proximity this case was considered as an upgrade. Although invasive tumor was not identified in the breast specimen, a micrometastasis of 0.22 mm was identified in an axillary sentinel lymph node.

Nine of the remaining 27 excised cases demonstrated ADH on excision. The ADH was within the papilloma in 3 cases, outside the papilloma in 3 cases, and both within and outside the papilloma in 3 cases. The other excised cases showed BPs without atypia in 17 cases and fibrocystic changes in 1 case.

Among the 50 patients who had follow-up without excision, ipsilateral low-grade metaplastic carcinoma developed in 1 patient 54 months after the initial biopsy for a 0.7-cm papilloma. The area of the papilloma was distinct from the carcinoma and was stable on imaging but was not sampled in the excision specimen. Therefore, this case was considered

as if it had follow-up only without excision. The remaining 49 patients showed no evidence of malignancy on follow-up.

The overall upgrade rate to malignancy in this cohort was 3.8% (3 of 80 cases). None of the clinical, radiologic, or histologic features were predictive of upgrade in the entire cohort, in the excised group, in the group with mass lesions, or in the excised mass lesion group ($P > .05$). Selected clinical and radiologic features of the upgraded and not upgraded cases within the mass lesion group are shown in Table 4.

Discussion

Although excision of BP with atypia is generally recommended, the clinical management of BPs without atypia diagnosed on CNB is controversial. Studies in the past have yielded divergent results on the actual risk of upgrade to malignancy after a CNB diagnosis of BP without atypia. One apparent factor to contribute to the difference in the literature lies in the variable exclusion criteria, which makes it difficult to compare all the studies. Nonetheless, as shown in Table 5, the reported upgrade rate ranges from 0% to 29%. More than 10 studies found a 0% upgrade rate,^{1,10,11,16–18,20–24,44,46,47} although most had a relatively small number of lesions. The series with > 100 BPs without atypia, in which most of the lesions were surgically excised, demonstrated a range of upgrade rate of 5% to 12%.^{3,28,30,34,35,39,41,54,56,57} Although the majority of the studies were retrospective, 3 were prospective.^{22,25,52} One of these studies showed an upgrade rate of 6.5% in 31 surgically excised BPs without atypia. The authors recommended surgical excision.²⁵ In that study, all but 2 of the cases were sampled by a 14-gauge automated biopsy needle. Another prospective study included 100 BPs without atypia identified by 14-gauge ultrasound-guided biopsy. On excision, 4 were upgraded to malignancy.⁵² Because the mean lesion size on imaging in this study was significantly associated with upgrade, the authors recommended considering excision in BPs without atypia that are > 1.5 cm. The third prospective study of 49 BPs without atypia concluded that surgical excision may not be required after ultrasound-guided 11-gauge vacuum-assisted biopsy (VAB).²² In their series, none of the lesions was upgraded to malignancy on excision. The overall upgrade rate in our retrospective study was 3.8%, which is within the reported range but toward the lower end of the spectrum. In our study, we defined upgrade as finding DCIS or invasion at surgical excision. Although the presence of atypia such as ADH or atypical lobular hyperplasia at excision may prompt the consideration of chemoprevention, the significance of such findings on reducing the mortality and morbidity of patients is not clear enough to warrant excision.

Several studies have attempted to correlate clinical, imaging, and histologic features of papillomas with malignancy on excision. Some of these identified older age, postmenopausal status, mixed hyper-echoic/hypoechoic or complex cystic echo pattern and non-circumscribed margin on imaging, peripheral location, larger lesion size, nipple discharge, and microcalcifications among the factors associated with malignancy.^{3,12,15,22,28,33,39,42,50} However, having included atypical papillomas in the study cohorts when making such correlations, they could not effectively identify predictors of upgrade within the BPs without atypia group. Only a few studies evaluated BPs without atypia separately.^{26,34,35,37,40,52,54,56,57} Although some failed to find any factors associated

with upgrade on excision,^{26,34,41} others showed that larger lesion size (cutoffs, 1–1.5 cm),^{37,52,54} palpable lesion,^{35,40} mass,^{35,56} biopsy by non-VAB approach,⁵⁶ older age (cutoff, 50 years), peripheral lesion, higher BI-RADS score, and pathologic/imaging discordance⁵⁴ were associated with upgrade. One study that included largely BPs without atypia that were identified on ultrasound-guided CNB found that the presence of microcalcifications on histologic slides of the CNB specimens was associated with upgrade to malignancy.⁵⁷ In our series, we did not find any clinical, radiologic, or histologic variable that could reliably predict malignancy on excision. All of the 3 lesions with upgrade were mass lesions. One had inadequate sampling on CNB, 1 had a separate but adjacent area of ADH identified on a different CNB specimen, and the third had new findings on radiologic follow-up immediately adjacent to the papilloma, prompting further intervention.

Defined criteria were not clear as to whether surgical excision or radiologic follow-up was appropriate in all the patients in our cohort. A few factors were associated with the decision to perform surgical excision in our study. The presence of a palpable or mass lesion and an ultrasound-guided CNB approach were each associated with surgical excision (Table 1). The last 2 factors were most likely related, because the biopsy approach was largely dependent on whether a mass lesion was present. In the mass lesion group, the presence of a palpable lesion remained associated with excision (Table 2). Our results share some similarities with 1 previous report, which showed that the radiographic type of lesion (micro-calcifications) and the biopsy approach (stereotactic) were associated with the decision not to excise.³⁶ Two other studies failed to find any associations with excision.^{30,50}

Renshaw et al. pointed out that the incidence of carcinoma at excision associated with a diagnosis of BP without atypia is related to sampling rather than to any increased risk pertaining to the diagnosis itself.¹⁷ Others have also emphasized the role of sampling in this context.^{8,9} The development of directional VAB devices in the mid-1990s, now usually coupled with 9-gauge or 11-gauge needles, provides an approach to harvest a larger volume of tissue than is possible with the automated large-core biopsy device commonly equipped with a 14-gauge needle. Although 1 earlier study did not find any association between the biopsy approach and upgrade to malignancy on excision of BP without atypia,²⁶ some series showed no upgrade when BPs without atypia were diagnosed by VAB, in contrast to those biopsied by automated needle.^{15,37} Similarly, in our study, all 3 lesions upgraded to malignancy were biopsied using automated needles. However, the difference did not reach statistical significance in either of these reported studies of BPs without atypia or in ours. Several studies that focused on BP without atypia identified by VAB, including 1 recent prospective study and 1 study on lesions identified by MRI, demonstrated a combined overall upgrade rate of 5.3% (18 of 337 BPs without atypia, including 305 that underwent excision and 32 with follow-up).^{2,20,22,30,40,42,44,51} Of note, this is similar to the upgrade rate of 5.4% when all the studies are considered (Table 5). Although data on VAB of BP without atypia are limited, some authors have suggested that those diagnosed by large-needle VAB may not need excision.^{22,51,58} VAB has also gained recognition lately as an approach to manage patients after BPs without atypia are diagnosed on automated needle biopsy specimens, hence sparing a subset of patients from surgery.^{47,54,59–62} Experience is still accumulating in this regard.

Retrospective in nature, our study has its limitations. The number of cases is small. As stated earlier, our exclusion criteria limited the study to a group of 80 patients. Of note, we required histologic review of the CNB material in all cases and eliminated incidental papillomas. Selection bias could have masked the true upgrade rate. The fact that not all patients underwent excision is also a limitation, although the follow-up time in the patients who did not undergo excision was relatively long (mean, 58 months). We could not discern the reasons for excision vs. radiologic follow-up in all cases, and unknown bias for excision cannot be excluded. It may be reasonable to postulate that the true upgrade rate of our cohort is between 3.8% (3 of 80 cases) and 10% (3 of 30 excised cases), although one would hope that the number is closer to the former after carefully selecting patients for excision.

Conclusion

In conclusion, the upgrade rate for BPs without atypia diagnosed on CNB was 3.8% in our series, and there were no clinical, radiologic, or histologic features predictive of upgrade. Although there appears to be a small risk of upgrading to malignancy based on our experience as well as that of others, we are cautious in recommending excision of all BPs without atypia because the majority of patients can be safely followed by radiologic surveillance. Patients who undergo CNB with adequate sampling and good radiologic/pathologic correlation, especially those who undergo VAB, may be candidates for conservative management. Based on our experience and careful review of the literature, we propose the following approach for selecting patients for surgical excision:

When the preceding approach is applied to our study cohort, 24 patients would undergo surgical excision, including 16 of the 30 patients who underwent excision and 8 of the 50 patients who did not undergo excision. All 3 patients with upgrade would undergo excision. Thus, the proposed criteria would be comparable to or perhaps slightly more selective than our actual practice. We advocate selective excision with a multidisciplinary approach. Patients who do not undergo excision must be educated about the need for close radiologic follow-up.

Acknowledgments

The authors would like to thank Kim-Anh Vu for excellent assistance on the figures and Ariana Trevino and Kelly Phan for their clerical support. This work is supported in part by the institutional start-up funds to LH from MD Anderson Cancer Center.

References

1. Liberman L, Bracero N, Vuolo MA, et al. Percutaneous large-core biopsy of papillary breast lesions. *AJR Am J Roentgenol.* 1999; 172:331–7. [PubMed: 9930777]
2. Mercado CL, Hamele-Bena D, Singer C, et al. Papillary lesions of the breast: evaluation with stereotactic directional vacuum-assisted biopsy. *Radiology.* 2001; 221:650–5. [PubMed: 11719659]
3. Kim MJ, Kim SI, Youk JH, et al. The diagnosis of non-malignant papillary lesions of the breast: comparison of ultrasound-guided automated gun biopsy and vacuum-assisted removal. *Clin Radiol.* 2011; 66:530–5. [PubMed: 21353213]
4. Lakhani, SR.; Ellis, IO.; Schnitt, SJ., et al. WHO Classification of Tumours of the Breast. 4. Lyon, France: International Agency for Research on Cancer (IARC); 2012. World Health Organization Classification of Tumours.
5. Lam WW, Chu WC, Tang AP, et al. Role of radiologic features in the management of papillary lesions of the breast. *AJR Am J Roentgenol.* 2006; 186:1322–7. [PubMed: 16632726]
6. Bode MK, Rissanen T, Apaja-Sarkkinen M. Ultrasonography-guided core needle biopsy in differential diagnosis of papillary breast tumors. *Acta Radiol.* 2009; 50:722–9. [PubMed: 19488890]
7. Page DL, Salhany KE, Jensen RA, et al. Subsequent breast carcinoma risk after biopsy with atypia in a breast papilloma. *Cancer.* 1996; 78:258–66. [PubMed: 8674001]
8. Ueng SH, Mezzetti T, Tavassoli FA. Papillary neoplasms of the breast: a review. *Arch Pathol Lab Med.* 2009; 133:893–907. [PubMed: 19492881]
9. Mulligan AM, O'Malley FP. Papillary lesions of the breast: a review. *Adv Anat Pathol.* 2007; 14:108–19. [PubMed: 17471117]
10. Rosen EL, Bentley RC, Baker JA, et al. Imaging-guided core needle biopsy of papillary lesions of the breast. *AJR Am J Roentgenol.* 2002; 179:1185–92. [PubMed: 12388496]
11. Agoff SN, Lawton TJ. Papillary lesions of the breast with and without atypical ductal hyperplasia: can we accurately predict benign behavior from core needle biopsy? *Am J Clin Pathol.* 2004; 122:440–3. [PubMed: 15362376]
12. Sydnor MK, Wilson JD, Hijaz TA, et al. Underestimation of the presence of breast carcinoma in papillary lesions initially diagnosed at core-needle biopsy. *Radiology.* 2007; 242:58–62. [PubMed: 17090707]
13. Ashkenazi I, Ferrer K, Sekosan M, et al. Papillary lesions of the breast discovered on percutaneous large core and vacuum-assisted biopsies: reliability of clinical and pathological parameters in identifying benign lesions. *Am J Surg.* 2007; 194:183–8. [PubMed: 17618801]
14. Ko ES, Cho N, Cha JH, et al. Sonographically-guided 14-gauge core needle biopsy for papillary lesions of the breast. *Korean J Radiol.* 2007; 8:206–11. [PubMed: 17554187]
15. Kil WH, Cho EY, Kim JH, et al. Is surgical excision necessary in benign papillary lesions initially diagnosed at core biopsy? *Breast.* 2008; 17(3):258–62. [PubMed: 18054232]
16. Ivan D, Selinko V, Sahin AA, et al. Accuracy of core needle biopsy diagnosis in assessing papillary breast lesions: histologic predictors of malignancy. *Mod Pathol.* 2004; 17:165–71. [PubMed: 14631369]
17. Renshaw AA, Derhagopian RP, Tizol-Blanco DM, et al. Papillomas and atypical papillomas in breast core needle biopsy specimens: risk of carcinoma in subsequent excision. *Am J Clin Pathol.* 2004; 122:217–21. [PubMed: 15323138]
18. Carder PJ, Garvican J, Haigh I, et al. Needle core biopsy can reliably distinguish between benign and malignant papillary lesions of the breast. *Histopathology.* 2005; 46:320–7. [PubMed: 15720418]
19. Sohn V, Keylock J, Arthurs Z, et al. Breast papillomas in the era of percutaneous needle biopsy. *Ann Surg Oncol.* 2007; 14(10):2979–84. [PubMed: 17549566]

20. Zografos GC, Zagouri F, Sergentanis TN, et al. Diagnosing papillary lesions using vacuum-assisted breast biopsy: should conservative or surgical management follow? *Onkologie*. 2008; 31:653–6. [PubMed: 19060502]
21. Bennett LE, Ghatte SV, Bentley R, et al. Is surgical excision of core biopsy proven benign papillomas of the breast necessary? *Acad Radiol*. 2010; 17:553–7. [PubMed: 20223685]
22. Chang JM, Han W, Moon WK, et al. Papillary lesions initially diagnosed at ultrasound-guided vacuum-assisted breast biopsy: rate of malignancy based on subsequent surgical excision. *Ann Surg Oncol*. 2011; 18:2506–14. [PubMed: 21369740]
23. Swapp RE, Glazebrook KN, Jones KN, et al. Management of benign intraductal solitary papilloma diagnosed on core needle biopsy. *Ann Surg Oncol*. 2013; 20:1900–5. [PubMed: 23314624]
24. Sohn YM, Park SH. Comparison of sonographically guided core needle biopsy and excision in breast papillomas: clinical and sonographic features predictive of malignancy. *J Ultrasound Med*. 2013; 32:303–11. [PubMed: 23341387]
25. Puglisi F, Zuiani C, Bazzocchi M, et al. Role of mammography, ultrasound and large core biopsy in the diagnostic evaluation of papillary breast lesions. *Oncology*. 2003; 65:311–5. [PubMed: 14707450]
26. Liberman L, Tornos C, Huzjan R, et al. Is surgical excision warranted after benign, concordant diagnosis of papilloma at percutaneous breast biopsy? *AJR Am J Roentgenol*. 2006; 186:1328–34. [PubMed: 16632727]
27. Mercado CL, Hamele-Bena D, Oken SM, et al. Papillary lesions of the breast at percutaneous core-needle biopsy. *Radiology*. 2006; 238:801–8. [PubMed: 16424237]
28. Shin HJ, Kim HH, Kim SM, et al. Papillary lesions of the breast diagnosed at percutaneous sonographically guided biopsy: comparison of sonographic features and biopsy methods. *AJR Am J Roentgenol*. 2008; 190:630–6. [PubMed: 18287432]
29. Skandarajah AR, Field L, Yuen Larn Mou A, et al. Benign papilloma on core biopsy requires surgical excision. *Ann Surg Oncol*. 2008; 15:2272–7. [PubMed: 18473143]
30. Rizzo M, Lund MJ, Oprea G, et al. Surgical follow-up and clinical presentation of 142 breast papillary lesions diagnosed by ultrasound-guided core-needle biopsy. *Ann Surg Oncol*. 2008; 15:1040–7. [PubMed: 18204989]
31. Tseng HS, Chen YL, Chen ST, et al. The management of papillary lesion of the breast by core needle biopsy. *Eur J Surg Oncol*. 2009; 35:21–4. [PubMed: 18640002]
32. Bernik SF, Troob S, Ying BL, et al. Papillary lesions of the breast diagnosed by core needle biopsy: 71 cases with surgical follow-up. *Am J Surg*. 2009; 197:473–8. [PubMed: 18723154]
33. Sakr R, Rouzier R, Salem C, et al. Risk of breast cancer associated with papilloma. *Eur J Surg Oncol*. 2008; 34:1304–8. [PubMed: 18440190]
34. Jaffer S, Nagi C, Bleiweiss JJ. Excision is indicated for intraductal papilloma of the breast diagnosed on core needle biopsy. *Cancer*. 2009; 115:2837–43. [PubMed: 19402174]
35. Jung SY, Kang HS, Kwon Y, et al. Risk factors for malignancy in benign papillomas of the breast on core needle biopsy. *World J Surg*. 2010; 34:261–5. [PubMed: 19997916]
36. Cyr AE, Novack D, Trinkaus K, et al. Are we overtreating papillomas diagnosed on core needle biopsy? *Ann Surg Oncol*. 2011; 18:946–51. [PubMed: 21046266]
37. Chang JM, Moon WK, Cho N, et al. Management of ultrasonographically detected benign papillomas of the breast at core needle biopsy. *AJR Am J Roentgenol*. 2011; 196:723–9. [PubMed: 21343519]
38. Rozentsvayg E, Carver K, Borkar S, et al. Surgical excision of benign papillomas diagnosed with core biopsy: a community hospital approach. *Radiol Res Pract*. 2011; 2011:679864. [PubMed: 22191029]
39. Rizzo M, Linebarger J, Lowe MC, et al. Management of papillary breast lesions diagnosed on core-needle biopsy: clinical pathologic and radiologic analysis of 276 cases with surgical follow-up. *J Am Coll Surg*. 2012; 214:280–7. [PubMed: 22244207]
40. Shouhed D, Amersi FF, Spurrier R, et al. Intraductal papillary lesions of the breast: clinical and pathological correlation. *Am Surg*. 2012; 78:1161–5. [PubMed: 23025963]
41. Fu CY, Chen TW, Hong ZJ, et al. Papillary breast lesions diagnosed by core biopsy require complete excision. *Eur J Surg Oncol*. 2012; 38:1029–35. [PubMed: 22959140]

42. Brennan SB, Corben A, Liberman L, et al. Papilloma diagnosed at MRI-guided vacuum-assisted breast biopsy: is surgical excision still warranted? *AJR Am J Roentgenol.* 2012; 199:W512–9. [PubMed: 22997402]
43. Philpotts LE, Shaheen NA, Jain KS, et al. Uncommon high-risk lesions of the breast diagnosed at stereotactic core-needle biopsy: clinical importance. *Radiology.* 2000; 216:831–7. [PubMed: 10966718]
44. Irfan K, Brem RF. Surgical and mammographic follow-up of papillary lesions and atypical lobular hyperplasia diagnosed with stereotactic vacuum-assisted biopsy. *Breast J.* 2002; 8(4):230–3. [PubMed: 12100116]
45. Shah VI, Flowers CI, Douglas-Jones AG, et al. Immunohistochemistry increases the accuracy of diagnosis of benign papillary lesions in breast core needle biopsy specimens. *Histopathology.* 2006; 48:683–91. [PubMed: 16681684]
46. Arora N, Hill C, Hoda SA, et al. Clinicopathologic features of papillary lesions on core needle biopsy of the breast predictive of malignancy. *Am J Surg.* 2007; 194:444–9. [PubMed: 17826053]
47. Carder PJ, Khan T, Burrows P, et al. Large volume “mammotome” biopsy may reduce the need for diagnostic surgery in papillary lesions of the breast. *J Clin Pathol.* 2008; 61:928–33. [PubMed: 18495791]
48. El-Sayed ME, Rakha EA, Reed J, et al. Predictive value of needle core biopsy diagnoses of lesions of uncertain malignant potential (B3) in abnormalities detected by mammographic screening. *Histopathology.* 2008; 53:650–7. [PubMed: 19076681]
49. Cheng TY, Chen CM, Lee MY, et al. Risk factors associated with conversion from nonmalignant to malignant diagnosis after surgical excision of breast papillary lesions. *Ann Surg Oncol.* 2009; 16:3375–9. [PubMed: 19641969]
50. Ahmadiyeh N, Stoleru MA, Raza S, et al. Management of intraductal papillomas of the breast: an analysis of 129 cases and their outcome. *Ann Surg Oncol.* 2009; 16:2264–9. [PubMed: 19484312]
51. Maxwell AJ. Ultrasound-guided vacuum-assisted excision of breast papillomas: review of 6-years experience. *Clin Radiol.* 2009; 64:801–6. [PubMed: 19589419]
52. Chang JM, Moon WK, Cho N, et al. Risk of carcinoma after subsequent excision of benign papilloma initially diagnosed with an ultrasound (US)-guided 14-gauge core needle biopsy: a prospective observational study. *Eur Radiol.* 2010; 20:1093–100. [PubMed: 19890638]
53. Tse GM, Tan PH, Lacambra MD, et al. Papillary lesions of the breast—accuracy of core biopsy. *Histopathology.* 2010; 56:481–8. [PubMed: 20459555]
54. Youk JH, Kim EK, Kwak JY, et al. Benign papilloma without atypia diagnosed at US-guided 14-gauge core-needle biopsy: clinical and US features predictive of upgrade to malignancy. *Radiology.* 2011; 258:81–8. [PubMed: 20971773]
55. Richter-Ehrenstein C, Tombakan F, Fallenberg EM, et al. Intraductal papillomas of the breast: diagnosis and management of 151 patients. *Breast.* 2011; 20:501–4. [PubMed: 21640590]
56. Holley SO, Appleton CM, Farria DM, et al. Pathologic outcomes of nonmalignant papillary breast lesions diagnosed at imaging-guided core needle biopsy. *Radiology.* 2012; 265:379–84. [PubMed: 22952379]
57. Li X, Weaver O, Desouki MM, 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. [PubMed: 23161711]
58. Kibil W, Hodorowicz-Zaniewska D, Popiela TJ, et al. Vacuum-assisted core biopsy in diagnosis and treatment of intraductal papillomas. *Clin Breast Cancer.* 2013; 13:129–32. [PubMed: 23127339]
59. Li JL, Wang ZL, Su L, et al. Breast lesions with ultrasound imaging-histologic discordance at 16-gauge core needle biopsy: can re-biopsy with 10-gauge vacuum-assisted system get definitive diagnosis? *Breast.* 2010; 19:446–9. [PubMed: 20869243]
60. Ko KH, Jung HK, Youk JH, et al. Potential application of ultrasound-guided vacuum-assisted excision (US-VAE) for well-selected intraductal papillomas of the breast: single-institutional experiences. *Ann Surg Oncol.* 2012; 19:908–13. [PubMed: 21913015]

61. Youk JH, Kim MJ, Son EJ, et al. US-guided vacuum-assisted percutaneous excision for management of benign papilloma without atypia diagnosed at US-guided 14-gauge core needle biopsy. *Ann Surg Oncol*. 2012; 19:922–8. [PubMed: 21863359]
62. Maxwell AJ, Mataka G, Pearson JM. Benign papilloma diagnosed on image-guided 14 G core biopsy of the breast: effect of lesion type on likelihood of malignancy at excision. *Clin Radiol*. 2013; 68:383–7. [PubMed: 23206431]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Clinical Practice Points

- The clinical management of BP without atypia diagnosed on CNB is controversial. The reported upgrade rate in the literature ranges from 0% to 29%, with an overall upgrade rate of 5.4% (total patient number: 4037). Although some authors believe that BP without atypia can be managed safely with clinical and radiologic follow-up, many recommend excision to rule out any associated malignancy.
- Our single-institution experience as a tertiary care center in a cohort of 80 patients with BP without atypia diagnosed on CNB demonstrated an upgrade rate of 3.8%. Mass lesions, lesions sampled by ultrasound-guided CNB, and palpable lesions were associated with surgical excision. None of the clinical, radiologic, or histologic features were predictive of upgrade.
- Based on our study and a review of the literature, we propose criteria for surgical excision in this group of patients. Lesions with pathologic/radiologic concordance, those sampled by VAB and small asymptomatic lesions may be safely followed by imaging surveillance. When the proposed selection criteria were applied to our cohort, all patients with upgrade would undergo excision. We recommend selective surgical excision and advocate a multidisciplinary management approach for this group of patients.

Figure 1.

Hematoxylin and Eosin Stains of Biopsy and Excision Specimens of the 3 Papilloma Cases Upgraded to Malignancy. (A–C) First Case. (A) Biopsy Specimen Showing a Papilloma. (B) No Residual Papilloma at the Biopsy Site on Excision. (C) Ductal Carcinoma in Situ (DCIS) Surrounding the Biopsy Site on Excision. (D and E) Second Case. (D) Biopsy Specimen Showing a Papilloma. (E) DCIS Involving Papilloma on Excision (Right Side). (F–H) Third Case. (F) Biopsy Specimen Showing a Papilloma. (G) Papilloma on Excision, Showing no

Atypia. (H) DCIS Surrounding Papilloma on Excision. (Original Magnification: A, C–H, $\times 100$; B, $\times 40$.)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1

Comparison of Clinical and Radiologic Features in Excised and Not Excised Cases

Variable ^a	Excised (n = 30)	Not Excised (n = 50)	P Value
Clinical Variables			
Age range, years (median)	31–74 (51)	38–81 (53)	.214
Menopause status (n = 74)			.298
Premenopausal	11	11	
Postmenopausal	18	34	
Family history of breast cancer (n = 77)			.633
Yes	13	18	
No	16	30	
Previous history of breast cancer			.098
Yes	10	8	
No	20	42	
Nipple discharge ^b			1.000
Yes (type)	4 (2B, 1C, 1U)	6 (2B, 3C, 1U)	
No	26	44	
Palpable			< .0001
Yes	12	2	
No	18	48	
Radiologic Variables			
Radiologic appearance ^c			< .0001
Mass	26	18	
Calcifications or enhancement	4	32	
Multiplicity of lesions			.120
< 3	23	45	
Multiple (≥ 3)	7	5	
Location			.464
Peripheral	22	32	
Central/retroareolar	8	18	
BI-RADS category			.216
3	4	3	
4	25	47	
5	1	0	
Mode of biopsy			< .0001
Ultrasound-guided	25	16	
Stereotactic or MRI-guided	5	34	

Abbreviations: B = bloody; BI-RADS = Breast Imaging Reporting and Data System; C = clear; MRI = magnetic resonance imaging; U = unknown.

^aFor all variables, n = 80 unless indicated otherwise.

^b The type of nipple discharge is not significant ($n = 8$; $P = 1$; not shown in Table 1).

^c All mass lesions and calcifications with an associated mass or asymmetry biopsied under ultrasound-guidance are included in “Mass”; all calcifications, calcifications with an associated mass or asymmetry biopsied by a stereotactic approach, and lesions identified on MRI are included in “Calcifications or enhancement.”

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2Comparison of Clinical and Radiologic Features of Mass Lesions^a in Excised And Not Excised Cases

Variable ^b	Excised (n = 26)	Not Excised (n = 18)	P Value
Palpable			.006
Yes	12	1	
No	14	17	
Size in cm (median) (n = 43)	0.6–3.2 (1.2)	0.4–2.4 (1.0)	.353
Multiplicity of lesion			.211
< 3	20	17	
Multiple (≥ 3)	6	1	
Location			.525
Peripheral	18	10	
Central/retroareolar	8	8	
Shape (n = 41)			.487
Oval-round	11	5	
Lobular	5	6	
Irregular	8	6	
Margins (n = 42)			1.000
Circumscribed	10	7	
Not circumscribed	15	10	
Echo Pattern (n = 42)			.066
Isoechoic/hypoechoic	19	17	
Complex cystic	6	0	
Associated Dilated Duct (n = 42)			
Yes	8	4	.731
No	17	13	
Mammographic Correlate			
Yes	19	8	.068
No	7	10	
BI-RADS Category			
3	4	3	1.000
4	22	15	
Number of Cores Sampled (median)	3–12 (4)	2–13 (4)	.759

Abbreviation: BI-RAD = Breast Imaging Reporting and Data System.

^aThis group includes all mass lesions and calcifications with an associated mass or asymmetry biopsied under ultrasound-guidance.^bFor all variables, n = 44 unless indicated otherwise.

Table 3Comparison of Radiologic Features of Calcifications and Enhancement^a in Excised and Not Excised Cases

Variables ^b	Excised (n = 4)	Not Excised (n = 32)	P Value
Size in cm (median) (n = 32)	0.2–4 (0.75)	0.2–2.2 (0.65)	.841
Multiplicity of Lesion			.466
< 3	3	28	
Multiple (≥ 3)	1	4	
Location			.559
Peripheral	4	22	
Central/retroareolar	0	10	
Type of Calcifications (n = 31)			.232
Amorphous/punctuate	3	14	
Heterogeneous/linear/pleomorphic	0	14	
Distribution of Calcifications (n = 33)			.256
Clustered/linear	2	28	
Segmental/regional	1	2	
Ultrasonographic correlate (n = 12)			1.000
Yes	0	1	
No	1	10	
Calcifications Remaining After Biopsy (n = 24)			.590
Yes	3	9	
No	1	11	
Number of Cores Sampled (median)	3–14 (8.5)	4–17 (9.0)	.595

^aThis group includes calcifications, calcifications with an associated mass or asymmetry biopsied by a stereotactic approach, and lesions identified on magnetic resonance imaging (MRI).

^bFor all variables, n = 36 unless indicated otherwise.

Table 4

Comparison of Clinical and Radiologic Features of Mass Lesions^a in Cases With and Without Upgrade to Malignancy

Variables ^b	Upgrade (n = 3)	No Upgrade (n = 41)	P Value
Age range (median)	47–62 (56)	31–74 (50)	.428
Previous History of Breast Cancer			.125
Yes	2	8	
No	1	33	
Palpable Mass			.204
Yes	2	11	
No	1	30	
Size in cm (median) (n = 43)	0.7–1.6 (1.5)	0.4–3.2 (1)	.774
Multiplicity of Lesion			1.000
< 3	3	34	
Multiple (≥ 3)	0	7	
Location			1.000
Peripheral	2	26	
Central/retroareolar	1	15	
Mammographic correlate			.550
Yes	1	26	
No	2	15	
BI-RADS			1.000
3	0	7	
4	3	34	
Number of Cores Sampled (median)	4–5 (4)	2–13 (4)	.940
Number of Cores Involved by Papilloma (median) (n = 37)	1–4 (1) (n = 3)	1–9 (3) (n = 34)	.264
Apocrine Metaplasia in Papilloma on Core Biopsy Specimen (n = 37)			1.000
Yes	1	11	
No	2	23	

Abbreviation: BI-RAD = Breast Imaging Reporting and Data System.

^aThis group includes all mass lesions and calcifications with an associated mass or asymmetry biopsied under ultrasound-guidance.

^bFor all variables, n = 44 unless indicated otherwise.

Table 5

Summary of Reported Studies on Malignant Upgrade of Benign Papillomas Without Atypia Diagnosed on Core Needle Biopsy

Reference	Biopsy Approach	Total Number of Lesions	Number of Surgically Excised Lesions	Number of Upgrade (%)	Recommend Excision in All Cases
Liberman et al, 1999 ¹	AN, VAB	7	4	0	No
Philpotts et al, 2000 ⁴³	AN, VAB	16	6	1 (6.3)	No
Mercado et al, 2001 ²	VAB	12	6	1 (8.3)	No
Irfan and Brem, 2002 ⁴⁴	VAB	6	3	0	NA
Rosen et al, 2002 ¹⁰	AN, VAB	33	4	0	No
Ivan et al, 2004 ¹⁶	AN, VAB	30	6	0	No
Puglisi et al, 2003 ²⁵	AN	31	31	2 (6.5)	Yes
Renshaw et al, 2004 ¹⁷	AN, VAB	18	18	0	No
Agoff and Lawton, 2004 ¹¹	AN, VAB	16	11	0	No
Carder et al, 2005 ¹⁸	AN, VAB	17	16	0	No
Liberman et al, 2006 ²⁶	AN, VAB	35	25	5 (14)	Yes
Mercado et al, 2006 ²⁷	AN, VAB	43	36	2 (4.7)	Yes
Shah et al, 2006 ⁴⁵	NA	35	35	1 (2.9)	No
Sydnor, et al, 2007 ¹²	AN, VAB	48	23	3 (6.3)	No
Ashkenazi et al, 2007 ¹³	AN, VAB	10	10	0	No
Ko et al, 2007 ¹⁴	AN	43	19	1 (2.3)	No
Sohn et al, 2007 ¹⁹	AN, VAB	174	0	2 (1.1)	No
Arora et al, 2007 ⁴⁶	AN, VAB	18	18	0	No
Shin et al, 2008 ²⁸	AN, VAB	101	86	12 (12)	Yes
Skandarajah et al, 2008 ²⁹	AN, VAB	80	80	15 (19)	Yes
Sakr et al, 2008 ³³	AN, VAB	48	48	4 (8.3)	Yes
Kil et al, 2008 ¹⁵	AN, VAB	68	68	6 (8.8)	No
Carder et al, 2008 ⁴⁷	AN	26	11	1 (3.8)	No
Zografos et al, 2008 ²⁰	VAB	40	40	0	No
Rizzo et al, 2008 ³⁰	VAB	101	101	9 (8.9)	Yes

Reference	Biopsy Approach	Total Number of Lesions	Number of Surgically Excised Lesions	Number of Upgrade (%)	Recommend Excision in All Cases
El-Sayed et al, 2008 ⁴⁸	NA	99	99	4 (4)	No
Tseng et al, 2009 ³¹	AN	24	24	7 (29)	Yes
Bemik et al, 2009 ³²	AN, VAB	47	47	4 (8.5)	Yes
Bode et al, 2009 ⁶	AN	23	23	2 (8.7)	Yes
Cheng et al, 2009 ⁴⁹	NA	77	77	3 (3.9)	Yes
Almadiyeh et al, 2009 ⁵⁰	Mammography, US, MRI guidance	71	29	1 (1.4)	No
Jaffer et al, 2009 ³⁴	AN, VAB	104	104	9 (8.7)	Yes
Maxwell, 2009 ⁵¹	VAB	26	3	0	No
Chang et al, 2010 ⁵²	AN	100	100	4 (4)	No
Jung et al, 2010 ³⁵	AN	160	160	10 (6.3)	Yes
Bennett et al, 2010 ²¹	AN, VAB	120	45	0	No
Tse et al, 2010 ⁵³	NA	68	68	7 (10)	Yes
Youk et al, 2011 ⁵⁴	AN	160	160	8 (5)	NA
Cyr et al, 2011 ³⁶	AN, VAB	193	84	10 (5.2)	Yes
Chang et al, 2011 ³⁷	AN, VAB	64	64	2 (3.1)	Yes
Chang et al, 2011 ²²	VAB	49	49	0	No
Kim et al, 2011 ³	AN, VAB	211	136	12 (5.7)	No
Richter-Ehrenstein et al, 2011 ⁵⁵	AN, VAB	64	45	2 (4.4)	No
Rozentsvayg et al, 2011 ³⁸	AN, VAB	67	67	5 (7.5)	Yes
Rizzo et al, 2012 ³⁹	NA	234	234	21 (8.9)	Yes
Shouhed et al, 2012 ⁴⁰	VAB	59	59	6 (10)	Yes
Holley et al, 2012 ⁵⁶	AN, VAB	128	86	14 (11)	No
Fu et al, 2012 ⁴¹	Needle	203	203	12 (5.9)	Yes
Brennan et al, 2012 ⁴²	VAB (MRI)	44	44	2 (5)	Yes
Li et al, 2012 ⁵⁷	Mammography, US, MRI guidance	370	370	7 (1.9)	No
Swapp et al, 2013 ²³	US, MRI	177	77	0	No
Sohn and Park, 2013 ²⁴	Needle	39	34	0	No

Reference	Biopsy Approach	Total Number of Lesions	Number of Surgically Excised Lesions	Number of Upgrade (%)	Recommend Excision in All Cases
Total		4037	3196	217 (5.4)	

Abbreviations: AN = automated needle; MRI = magnetic resonance imaging; NA = not available; US = ultrasonography; VAB = vacuum-assisted biopsy.