Ann Surg Oncol (2019) 26:3478–3488
https://doi.org/10.1245/s10434-019-07377-w

Annals of
SURGICAL ONCOLOGY
OFFICIAL JOURNAL OF THE SOCIETY OF SURGICAL ONCOLOGY

ORIGINAL ARTICLE – BREAST ONCOLOGY

Clinical Management of Mucocele-Like Lesions of the Breast with Limited or no Epithelial Atypia on Core Biopsy: Experience from Two Institutions

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ABSTRACT

Purpose. Mucocele-like lesions of the breast identified on core biopsy are rare high-risk lesions associated with variable upgrade rates to carcinoma on excision. We aimed to identify the clinicoradiopathological features that can help optimize management of this lesion.

Methods. We evaluated 50 mucocele-like lesions identified on core biopsies from two institutions, including 36 with no atypia and 14 with limited atypia. Outcome data from excision or clinicoradiological follow-up were reviewed with core biopsy results.

Results. Radiological targets were calcifications in 74% of cases, calcifications with associated mass or density in 16%, and mass in 10%. One of the 16 excised lesions without atypia on core biopsy, which was a mass lesion, was upgraded to mucinous carcinoma on excision. Of the 12 excised lesions with limited atypia, none were upgraded on excision. Among the lesions not excised, 20 without atypia had a median follow-up of 61 months, and 2 with limited atypia had follow-up of 97 and 109 months. None of these 22 patients had new development of their lesions on follow-up. The upgrade rate was 2% in our entire cohort, 3% for lesions without atypia, and 0% for lesions with limited atypia.

Conclusions. Clinicoradiological surveillance can be appropriate when a mucocele-like lesion without atypia is identified on core biopsy for a non-mass lesion with pathological-radiological concordance. For mucocele-like lesions with limited atypia, a nonsurgical approach could be considered if the atypia by itself does not warrant excision. The latter recommendation requires careful clinicopathological correlation and support from additional studies.

Mucocele-like lesions (MLLs) of the breast were first described by Rosen in 1986 and considered analogous to mucoceles of the minor salivary glands.[1] These are characterized by mucin-filled ducts or cysts with associated extracellular mucin in the adjacent stroma. MLLs usually have an unremarkable epithelial lining, but they can be associated with a spectrum of epithelial changes that range from hyperplasia without atypia to atypical ductal hyperplasia (ADH) or ductal carcinoma in situ (DCIS). Therefore, when an MLL is identified on a core biopsy, surgical excision often is considered to ensure that a worse epithelial lesion is not missed. In addition, a benign MLL and a paucicellular mucinous carcinoma may be difficult to distinguish in limited biopsy material, especially if only extravasated mucin is found, given that the proportion of extracellular mucin in a pure mucinous carcinoma may be as high as 99.8%.[2] For these reasons as well as the low incidence of the lesion, which is estimated to be less than 1% in core biopsies,[3–5] management of MLL identified on core biopsy has been a subject of debate.

Tanya W. Moseley and Sejal S. Shah are co-first authors.

First Received: 12 February 2019;
Published Online: 11 June 2019

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ADH is another lesion that is associated with upgrade to carcinoma when diagnosed on core biopsy. In the literature, several studies have indicated that when the amount of ADH is confined to rare foci in the core biopsy, together with other radiological features, the vast majority of cases can be managed without surgical excision.[6–11]

In this study, we retrospectively examined breast core biopsies with a diagnosis of benign MLL or of MLL with limited ductal epithelial atypia, with the goal to identify pathological, radiological, and clinical features that can help to optimize the management of MLL and avoid unnecessary surgical excision.

MATERIALS AND METHODS

Case Selection

This study was approved by the Institutional Review Boards of both institutions. The pathology files from January 2003 through June 2014 at MD Anderson and from January 1997 through June 2016 at Mayo Clinic were retrospectively searched for all patients with the terms "mucocele," "mucin," or "extravasation" in their breast core biopsy reports. Yielded cases were excluded from the study if the patient had a history of or concurrent invasive or in situ breast cancer in the ipsilateral breast or if the patient had less than 24 months of clinical follow-up if the lesion was not excised. The core biopsy slides were reviewed by two pathologists (SS or LH) to confirm the presence of MLL with mucin extravasation and limited or no epithelial atypia. Limited epithelial atypia was defined as ADH or ductal atypia not sufficient for ADH involving up to two terminal duct-lobular units. Atypia not sufficient for ADH referred to low-grade lesions with architectural or cytological atypia, but not both. Cases with atypical lobular hyperplasia were not included.

Radiopathological Features and Biopsy Procedures

The mammographic or sonographic targets included calcifications only (n = 37), mass only (n = 5), and calcifications associated with a mass or density (n = 8). Stereotactic core biopsy was performed for all the calcification-only lesions using 14G to 9G needles or an RF probe. The RF probe, which was used for two lesions, coupled with Advanced Breast Biopsy Instrumentation System, was designed to remove a large, cylindrical tissue sample 5 to 20 mm in diameter in one pass. Ultrasound-guided core biopsy was performed for all mass-only lesions using 18G to 14G needles. Six of the eight lesions with calcifications associated with a mass or density were biopsied using a stereotactic approach, and the other two underwent ultrasound-guided core biopsy, all using either 9G or 11G needles. A radiological clip was placed immediately following the biopsy procedure to designate the biopsy site. The type and size of the target, biopsy needle gauge, number of cores sampled, number of cores containing target material, and, in the cases with calcifications, whether residual calcifications were present after the biopsy were obtained from the patients' radiological images and medical records.

For ultrasound-guided biopsies at MD Anderson, ten tissue sections were routinely prepared from each tissue block, and the first and tenth levels were stained with hematoxylin and eosin (H&E). For stereotactic biopsies at MD Anderson, six tissue sections were routinely prepared from each tissue block, and the first and sixth levels were stained with H&E. For both ultrasound-guided and stereotactic biopsies at Mayo Clinic, two tissue sections were routinely prepared from each tissue block, and both were stained with H&E. For stereotactic biopsies targeting calcifications at both institutions, cores were radiographed immediately following the biopsy procedure to identify cores with calcifications, which were submitted separately. The extent of microcalcifications seen on histologic sections was correlated with specimen radiographs to ensure that the calcifications were well represented on the slides. Additional levels were stained or sectioned if necessary for microscopic diagnosis. The association of MLL with calcifications, number of foci with atypia, and association of atypia with calcifications were reviewed on the biopsy slides.

Twenty-eight patients underwent excision by either segmental mastectomy or total mastectomy. Excision specimens were radiographed to ensure adequate removal of the targeted area and appropriate sampling or were submitted for intraoperative frozen-section diagnosis. The pathology reports of patients with excision, the slides of the excision if available, and clinical and radiologic follow-up outcomes in patients without excision were reviewed in association with the core biopsy results.

RESULTS

Patients' Clinicoradiopathological Characteristics

Fifty patients were selected for this study: 36 patients with MLL without atypia and 14 with MLL with limited atypia on core biopsy. The clinicoradiopathological characteristics of the patients are summarized in Table 1. All patients were women. Twenty-six patients had the core biopsy performed from the right breast and 24 from the left. All biopsied lesions were Breast Imaging Reporting and Data System (BIRADS) 4 radiographically. Twelve

TABLE 1 Clinicoradiopathological characteristics and excision outcomes

Characteristic	Biopsy without atypia (n = 36)	Biopsy with atypia (n = 14)	Entire cohort (n = 50)
Age (year)			
Range	35–75	38–68	35–75
Mean	52.9	52.5	52.8
Median	52.5	52.5	52.5
Race/ethnicity (no.)			
White	22	13	35
Black	3	0	3
Hispanic	7	1	8
Other	4	0	4
Biopsy target [no. (%)]			
Calcs (total)	28 (78%)	9 (64%)	37 (74%)
$\leq$ 0.5 cm	16	6	22
$>$ 0.5 to $\leq$ 1 cm	11	3	14
$>$ 1 to 2 cm	1	0	1
Calcs and mass/density (total)	4 (11%)	4 (29%)	8 (16%)
$\leq$ 0.5 cm	2	2	4
$>$ 0.5 to $\leq$ 1 cm	1	0	1
$>$ 1 to 2 cm	1	2	3
Mass (total)	4(11%)	1 (7%)	5 (10%)
$\leq$ 0.5 cm	1	0	1
$>$ 0.5 to $\leq$ 1 cm	2	0	2
$>$ 1 to 2 cm	1	1	2
Biopsy sampling (no.)			
Calcs only (n = 37)			
Needle gauge			
9G	21	5	26
10G or 11G	4	4	8
14G	1	0	1
RF probe	2	0	2
No. of cores			
$\leq$ 4	3	0	3
5 to 12	23	9	32
$>$ 12	2	0	2
No. of cores with target			
$\leq$ 2	5	5	10
3 to 6	18	3	21
$>$ 6	1	0	1
Unknown	4	1	5
Residual calcs			
Yes	10	2	12
No	17	6	23
Unknown	1	1	2
Calcs and mass/density (n = 8)			
Needle gauge			
9G	4	2	6
11G	0	2	2

TABLE 1 (continued)

Characteristic	Biopsy without atypia (n = 36)	Biopsy with atypia (n = 14)	Entire cohort (n = 50)
No. of cores			
≤ 4	1	1	2
5 to 12	3	2	5
Unknown	0	1	1
No. of cores with target			
≤ 2	0	0	0
3 to 6	3	3	6
> 6	0	0	0
Unknown	1	1	2
Residual calcs			
Yes	2	2	4
No	1	2	3
Unknown	1	0	1
Mass only (n = 5)			
Needle gauge			
14G	0	1	1
16G	2	0	2
18G	2	0	2
No. of cores			
≤ 4	2	1	3
5 to 12	2	0	2
Biopsy microscopic findings (no.)			
MLL associated with calcs (total)	32	13	45
Yes	27	12	39
No	5	1	6
Atypia associated with calcs			
Yes	NA	8	NA
No	NA	5	NA
Lesions excised [no. (total)]	16	12	28
Calcs	11	8	19
Calcs and mass/density	2	3	5
Mass	3	1	4
Excision microscopic findings (no.)			
Benign	15	8	23
Atypical	0	4	4
Malignant	1	0	1

Calcs calcifications; *NA* not applicable

patients had a history of or concurrent contralateral breast carcinoma, including seven with invasive breast carcinoma and five with in situ carcinoma. One of the contralateral invasive carcinomas was of the mucinous type and had been treated by segmental mastectomy eight years before the core biopsy.

Histological Features on Core Biopsy

In the 36 cases without atypia on core biopsy, calcifications were the target or part of the target of the core biopsy in 32 cases. In 27 of those 32 cases, MLL was associated with calcifications in the core biopsies. In the other five cases, calcifications were associated with benign breast tissue.

Among the 14 cases with atypia on core biopsy, one case had two foci of atypia that included ADH and

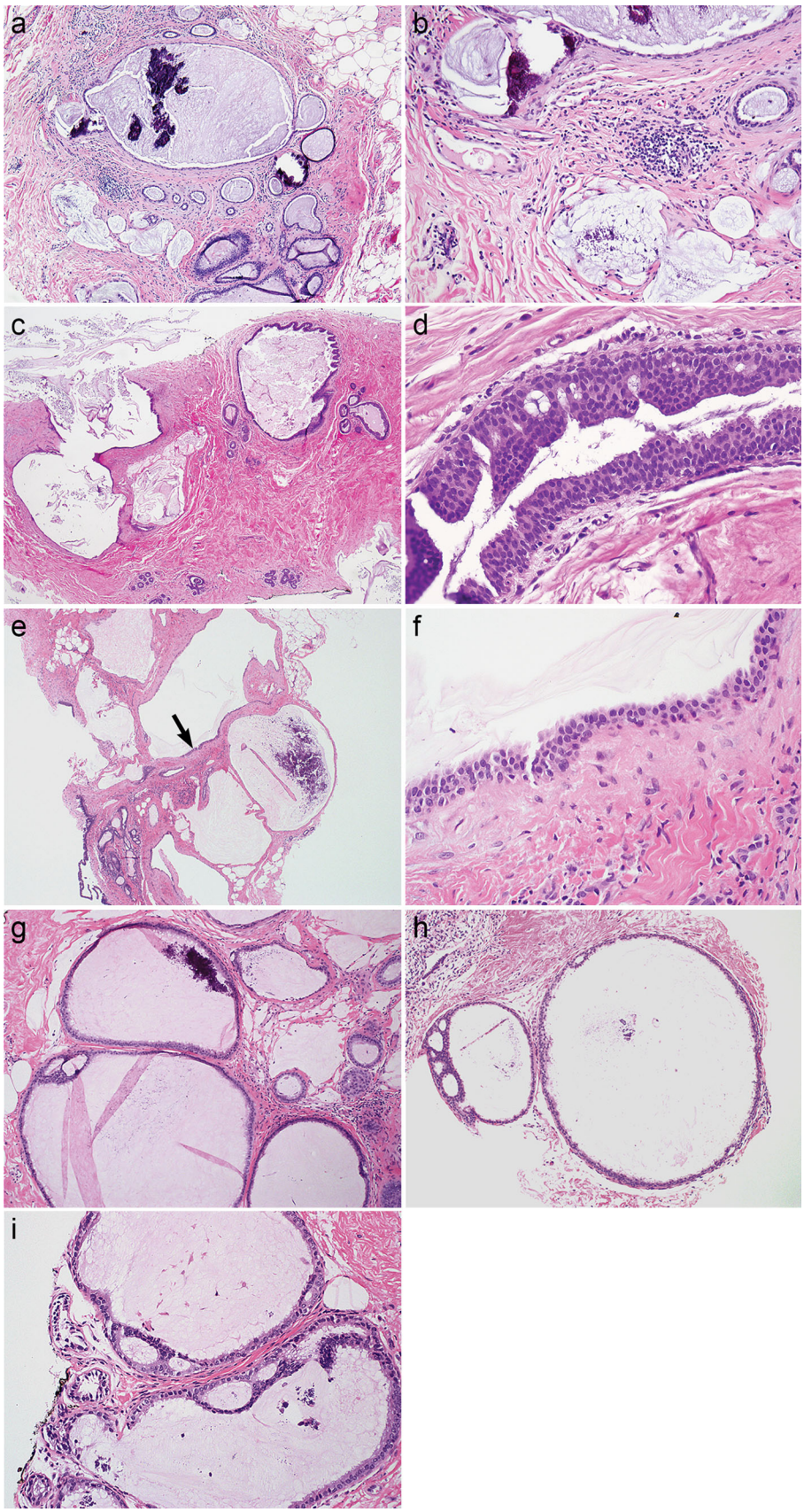

FIG. 1 Mucocele-like lesions with no upgrade on excision. **a**–**b** Mucocele-like lesion without atypia with associated microcalcifications. **c**–**d** Mucocele-like lesion (**c**) and atypical ductal hyperplasia (**d**) in the same biopsy. **e**–**f** Mucocele-like lesion (**e**) and flat epithelial atypia (**f**) in the same biopsy (arrow in e indicates the area shown in **f**). **g**–**i** Mucocele-like lesion (**g**) with atypical ductal hyperplasia (**h**) and architectural atypia (**i**) in the same biopsy. Original magnifications, **a**, **c**, **e** × 40; **b**, **g**, **h** × 100; **d**, **f**, **i** × 200

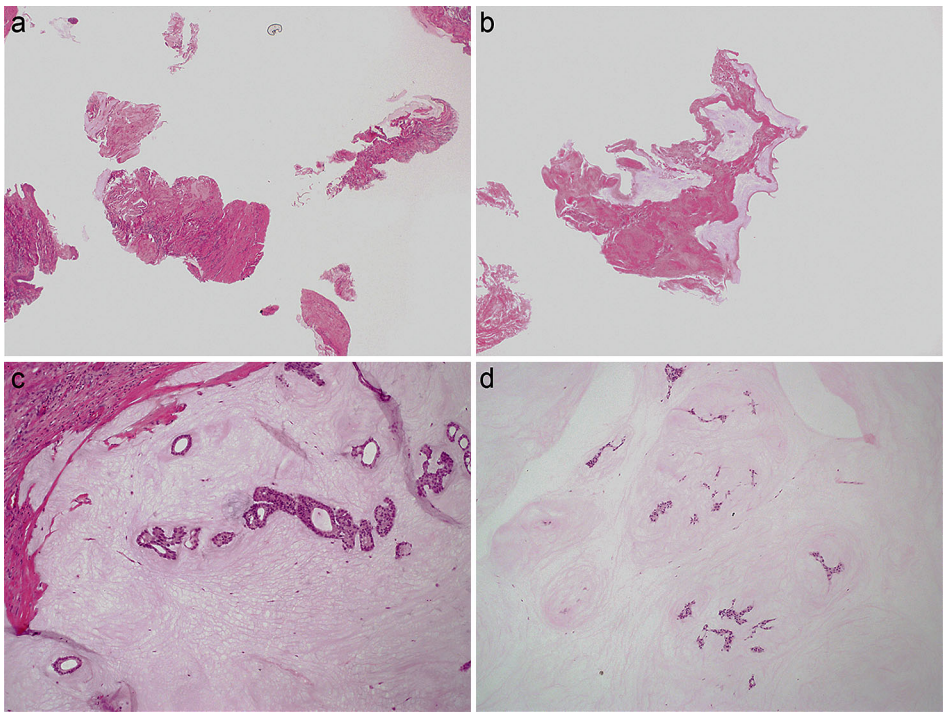

FIG. 2 A mucocele-like lesion with upgrade to mucinous carcinoma on excision. **a–b** 18G core biopsy showing mucocele-like lesion. **c–d** Excision of the lesion showing mucinous carcinoma. Original magnifications, **a**, **d** × 40; **b**, **c** × 100

architectural atypia, eight cases each had one focus of ADH, and five cases each had one focus of epithelial atypia not sufficient for the diagnosis of ADH. Two cases with ADH and two cases with atypia not sufficient for ADH were found in biopsies targeting calcifications with a mass/density. One case with epithelial atypia not sufficient for ADH was found when a mass-only lesion on imaging was biopsied. The remaining nine cases were identified in biopsies targeting calcifications only. MLL was associated with calcifications in 12 of the core biopsies showing atypia; in eight of them, the atypia was associated with calcifications (Fig. 1).

Excision and Follow-up

Among the 36 MLLs without atypia on core biopsy, 16 lesions were excised, and the other 20 had clinicoradiological follow-up ranging from 25 to 232 months (median, 61 months; mean, 74 months). Among the 16 excised lesions, 1 was upgraded to invasive mucinous carcinoma (Fig. 2), and the others showed benign findings without atypia on excision. The patient with the upgrade had a 2-cm mass on imaging, which was biopsied using an 18G needle under ultrasound guidance. None of the patients with clinicoradiological follow-up had new development of the lesions.

Among the 14 MLLs with atypia on core biopsy, 12 lesions were excised, and the other 2 had clinicoradiological follow-up for 97 months and 109 months. None of the excised lesions were upgraded to malignancy. Four patients had atypia on excision, including three patients who were biopsied for calcifications only, and one patient who was biopsied for calcifications with a mass. None of the cases with atypia not sufficient for ADH on core biopsy had any atypia on excision. The atypia on excision was ADH in one case, ADH and atypical lobular hyperplasia in one case, and ductal atypia not sufficient for ADH in two cases. The two lesions that were not excised each had one focus of ADH on core biopsy and showed no changes during clinicoradiological follow-up. Thus, the overall upgrade rate was 2% (1/50) in the entire cohort, 3% (1/36) in the group without atypia on core biopsy, and 0% (0/14) in the group with limited atypia on core biopsy.

DISCUSSION

In our study of the core biopsy characteristics of MLLs and the results of surgical excision or clinicoradiological follow-up, the overall rate of upgrade to carcinoma was 2% in the whole cohort, 3% in the group without atypia on biopsy, and 0% in the group with limited atypia on biopsy. Studies investigating whether all MLLs diagnosed on core biopsy should be excised are limited by the low incidence of MLLs. In recent series with relatively large cohorts of MLLs without atypia on core biopsy, the collective upgrade rate was below 4% (Table 2a).[4,5,12–15] There was one case without excision that developed invasive carcinoma on follow-up, but the carcinoma occurred at a site

TABLE 2 Mucocele-like lesions identified on core biopsy in recent series

a. Without atypia[a]

Reference	Total no. of lesions	No. with calcifications as target	Biopsy type and needle gauge	No. of lesions excised	No. of upgrades to carcinoma (type of carcinoma)	Follow-up time if not excised	No. of carcinomas on follow-up
Jaffer et al. [12]	50	Majority	Majority stereotactic, 11G-14G	45	1 (DCIS)	Over 1 year	0
Sutton et al.[13]	30	Majority	Majority stereotactic	22	0	Mean, 43 months	0
Rakha et al.[14]	54	41	Majority stereotactic	37	2 (DCIS)	Not specified	
Park et al.[15]	21	10	Ultrasound, 14G	21[b]	0	Not applicable	
Diorio et al.[4]	51	47	Majority stereotactic	35	2 (DCIS)	Mean, 6 years	1[c]
Dash et al.[5]	117	100	Majority stereotactic, 14G or 9G	103	5 (DCIS)	Mean, 6 years	0
Total	323			263	10		1

b. With atypia[d]

Reference	Total no. of lesions	No. with calcifications as target	Biopsy type and needle gauge	No. of lesions excised	No. of upgrades to carcinoma on excision (type of carcinoma)
Begum et al.[16]	13	Majority	Majority vacuum-assisted biopsy, 11G	13	1 (DCIS)
Sutton et al.[13]	19	Majority	Majority stereotactic	16	5 (DCIS)
Edelweiss et al.[17]	17	16	Majority stereotactic, 9G-11G	17	3 (DCIS)
Ha et al.[3]	12	11	Majority stereotactic	12	1 (DCIS)
Gibreel et al.[18]	14	Majority	Majority stereotactic	14	0
Total	75			72	10 (14%)[e]

[a]Each series included greater than 20 lesions

[b]Excision included surgical excision and vacuum-assisted excision

[c]The carcinoma identified on follow-up was not at the previous biopsy site

[d]Each series included greater than 10 lesions

[e]The percentage is based on the number of excised lesions. The other three lesions that were not excised did not have follow-up for at least 2 years

DCIS ductal carcinoma in situ

TABLE 3 Impact of number of foci on upgrade among ADH cases

Reference	Total no. of lesions	No. of calcifications as target (%)	Biopsy type	Needle gauge	No. of upgrades for entire cohort (%)	No. of foci of ADH on core biopsy for stratification	No. of upgrades when cutoff of foci of ADH is applied	Other pathology-imaging factors that may decrease the risk of upgrade
Ely et al.[6]	47	30 (64%)	Stereotactic	11G, 14G	17 (36%)	Up to 2	0/24 (0%)	
Sneige et al.[7]	42	42 (100%)	Vacuum assisted	11G, 14G	3 (7%)	Up to 2	0/28 (0%)	Complete removal of calcifications
Forgeard et al.[8]	116	116 (100%)	Vacuum assisted	11G, 14G	29 (25%)	Up to 2	5/44 (11%)	Smaller size of the lesion Complete removal of calcifications
Wagoner et al.[9]	123	110 (89%)	Stereotactic (94.3%) and ultrasound guided	11G, 14G	22 (17.9%)	Up to 2	6/82 (7%)	Complete removal of calcifications
Kohr et al.[21]	101	101 (100%)	Stereotactic vacuum assisted	9G, 11G	20 (19.8%)	Up to 2	5/48 (10%)	
Nguyen et al.[10]	140[a]	140 (100%)	Vacuum assisted	9G, 11G, 14G	16 (11.4%)	Up to 2	5/81 (6.2%)	Absence of significant cytologic atypia suspicious for intermediate or high-grade DCIS Absence of necrosis Removal of > 95% of calcifications
Peña et al.[11]	399	72%	Vacuum assisted in 86%	11G or larger needle in 84%	64 (16%)	1	8/110 (7.3%)	Absence of individual cell necrosis Removal of majority of calcifications

[a]121 excised and 19 followed by imaging. All lesions in the other series listed here were excised

DCIS ductal carcinoma in situ

different from the biopsy site for the MLL.[4] In most of the previously studied patients with MLL without atypia on core biopsy, the suspicious imaging finding was a group of calcifications on mammography. We also found calcifications to be the most common abnormality in our series. Other imaging findings that have been associated with MLL included mass lesions with and without associated calcifications. In our study, the only upgrade was in a patient with a 2-cm mass lesion that was biopsied with an 18G needle under ultrasound guidance. The patients who did not have excision had no cancer at a minimum follow-up of 25 months and a mean follow-up of more than 5 years. Our findings in conjunction with the literature indicate that clinicoradiological surveillance may be an acceptable approach when MLL without atypia is identified on core biopsy for a non-mass lesion with pathology-radiology concordance, owing to the very low upgrade rate. For a mass lesion sampled under ultrasound guidance, the finding of an MLL may warrant surgical excision to exclude a mucinous carcinoma.

The current consensus on MLL with atypia diagnosed on core biopsy is surgical excision. Because of the risk of a paucicellular mucinous carcinoma, MLL with rare atypical cells floating in mucin in a core biopsy should be considered suspicious for carcinoma, especially if a mass lesion is found on imaging. Those findings should prompt surgical excision. In most cases though, the atypia associated with MLL is ADH. Historically, ADH identified on core biopsy is associated with considerable risk of upgrade to DCIS and invasive carcinoma on excision, and because MLL has been viewed as a high-risk lesion associated with upgrade to carcinoma, excision would be warranted when MLL and ADH coexist. However, there is no evidence to suggest that MLL and ADH have an additive effect on upgrade. A few recent relatively large series on MLL with atypia (which included ADH, flat epithelial atypia, and atypical lobular hyperplasia) identified on core biopsy demonstrated a collective upgrade rate of 14% (Table 2b).[3,13,16–18] This upgrade rate is not higher than that of ADH alone.

With the availability of vacuum-assisted biopsy devices as well as larger needles, the risk of upgrade to carcinoma for ADH has decreased. A summary of a series of studies showed that the overall ADH underestimate rate decreased from 44% with 14G automated needle biopsy to 24% with 14G vacuum-assisted biopsy and to 19% with 11G vacuum-assisted biopsy.[19] However, even with extensive sampling, the upgrade rate remains $> 15\%$, as demonstrated in large series,[8,19–21] calling for further consideration if a nonsurgical approach is to be adopted for ADH. Several authors have shown that the number of foci of ADH on core biopsy can be used as a parameter for patient selection (Table 3).[6–11,21] When up to two foci of ADH[6–10,21] or one focus of ADH[11] was used as criteria to stratify the lesions on core biopsy, the upgrade rate dropped from a range of 7-36% to a range of 0-11%. Some authors proposed additional pathological or radiological features to further refine the algorithm. For example, Wagoner et al. found that with up to two foci of ADH on core biopsy, if no residual calcifications were identified after biopsy, then the upgrade rate was 0%—a drastic decrease from 19.8% for the entire cohort.[9] In a similar approach, a nomogram developed to predict the likelihood of ADH upgrade based on 203 patients included the number of cores involved by ADH as a variable.[22] If one agrees that the majority of MLLs without atypia can be followed without excision, it may be reasonable to examine carefully the extent of ADH when it is present in the same biopsy with MLL to determine whether surgical excision is necessary. In our series, we included 13 MLLs with one focus of ductal atypia and one MLL with two foci of ductal atypia. None of these lesions had an upgrade on excision or after more than 8 years of follow-up, suggesting that limited atypia identified in core biopsy with MLL has a very low risk of upgrade to carcinoma. Notably, most of the lesions in our cohort were associated with calcifications and were sampled by large needles (11G or 9G) using a vacuum-assisted device. Also, atypical lobular hyperplasia was not included in our series, because there were not enough cases for a meaningful analysis.

For both MLL and ADH, apart from the associated upgrade rate, concerns lie in the long-term breast cancer risk. Two recent articles addressed long-term clinical outcomes in patients with MLL and patients with ADH. One study examined a large cohort that had benign breast biopsies, including 102 patients with the diagnosis of MLL and 13,310 patients without MLL.[23] Although the MLL patients more frequently demonstrated associated atypical hyperplasia (26.5%) compared with the control group (5%, $P < 0.001$), only 13 patients developed breast cancer on follow-up (median, 14.8 years), which was not significantly different from the rate of breast cancer in the control group ($P = 0.255$). The data also showed that the associated breast cancer risk of MLL was similar to that of proliferative disease without atypia and lower than that of atypical hyperplasia in general. Of note, cases included in this report were benign breast biopsies from 1967 to 2001, so some were from the premammographic era, when excision was done for palpable lesions, whereas the majority of the MLL cases in our study as well as those in recent publications were associated with calcifications identified on mammography. In addition, only 12 MLLs (12%) were identified on core biopsies in this series. Therefore, the data did not fully address whether MLL on core biopsy should be excised. Nevertheless, it is the only

long-term breast cancer risk study of MLL, and it did not find a significant risk associated with MLL beyond that associated with proliferative disease without atypia.

Another study assessed patients with ADH on core needle biopsy for subsequent breast cancer incidence, including 125 patients who underwent clinical observation only and 50 patients who had surgical excision and no upgrade.[24] The selection criteria for no surgery were < 3 foci of ADH on core biopsy, $> 90\%$ removal of calcifications and no necrosis associated with ADH, or a well-sampled lesion with no mass or architectural distortion, with multidisciplinary review and agreement. With a median follow-up of three years, 14 breast cancer events occurred in 13 patients. In the group with no surgery, seven cancers were found in the ipsilateral breast of seven patients, including one from the index site. In the surgery group, seven cancers occurred in six patients, including one patient with bilateral cancer; three were in the ipsilateral breast, and only one was from the index site. Between the surgery and no-surgery groups, index site events and ipsilateral cancer events were not significantly different. The authors concluded that observation is safe in selected patients with ADH on core biopsy and that index site failure is rare and is superseded by cancer risk away from the index site.

Our study had all the intrinsic limitations of a retrospective study. The cohort was small because of the rarity of the lesion. The cases were collected from two tertiary care hospitals with extensive experience in cancer care. Multidisciplinary management conferences are held at both institutions when decisions are made about the management of high-risk lesions, which may not be available in every practice. Nonetheless, along with knowledge from the current literature, our findings support a nonsurgical approach when MLL without atypia is identified on core biopsy for calcifications, is sampled with large needles and vacuum-assisted biopsy, and shows pathology-radiology concordance. It is important to consider the patient's preference and to educate the patient regarding the small risk of cancer associated with the lesion and the necessity of active surveillance. We also cautiously propose conservative management when MLL coexists with limited ductal epithelial atypia, i.e., focal ADH and atypia insufficient for ADH, in a core biopsy, when the atypia by itself may not warrant excision. This option may be considered by practices where criteria are available to spare patients from surgery when limited ADH is identified on core biopsy. In our study, although we allowed up to two foci of atypia, the vast majority of cases only had one focus of atypia. The exact cutoff of the extent of atypia needs to be assessed in additional large studies. In addition, only DCIS and invasive carcinoma on excision or follow-up were considered an upgrade in our study. Therefore, our recommendations may not be applicable in a patient with no prior history of atypia who desires chemoprevention if atypical hyperplasia is identified on excision. Interestingly, several studies have introduced the use of vacuum-assisted biopsy to excise targeted radiological lesions in place of surgical excision for some high-risk lesions identified on core biopsy, including MLL, which may serve as a promising alternative upon further evaluation.[14,15,25]

ACKNOWLEDGMENT The authors thank Kim-Anh Vu in the Department of Pathology at The University of Texas MD Anderson Cancer Center for her assistance with the figures and Sarah Bronson, ELS, in the Department of Scientific Publications at MD Anderson for editing the manuscript.

DISCLOSURE The authors have nothing to disclose.

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