Radial Scar at Percutaneous Breast Biopsy That Does Not Require Surgery

Rachelle Y Leong, MD, Manpreet K Kohli, MD, Nebraz Zeizafoun, MD, Amy Liang, MD, Paul I Tartter, MD, FACS

BACKGROUND: Surgical excision is currently recommended after pathologic radial scar is found on breast core needle biopsy because surgical upgrade to carcinoma is not uncommon. The goal of our study was to identify the true pathologic upgrade rate for a "pure" radial scar, those without associated proliferative lesion, based on indication for biopsy, biopsy type, and needle size.

STUDY DESIGN: The pathology database of Continuum Health Partners was searched for the terms *radial scar* and *radial sclerosing lesion*, from January 2007 to December 2015. From review of 1,513 pathology reports, 292 cases of core biopsies without malignancy were identified. Age, indication for biopsy, type of biopsy, and excisional pathology were obtained. Data were then analyzed using SPSS.

RESULTS: Two hundred nineteen (75%) of the 292 core biopsies showed pure radial scar without associated proliferative lesion, and 161 (74%) of these patients had surgical excision. Only 1 of these patients had disease that was upgraded to ductal carcinoma in situ—a 2-mm focus located 5 mm away from the radial scar biopsy cavity. This patient also had residual calcifications on mammography after the stereotactic biopsy. Six additional malignant upgrades were found in patients who had radial scar associated with atypical ductal hyperplasia (n = 5) or lobular neoplasia (n = 1) on needle biopsy.

CONCLUSIONS: Surgical excision is unnecessary when radial scar is found at percutaneous needle biopsy without an associated proliferative lesion. Surgical excision is still indicated when radial scar is associated with atypical ductal hyperplasia or lobular neoplasia. (J Am Coll Surg 2016;223:712–716. © 2016 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)

Radial scar can refer to a finding on mammography characterized by a stellate architectural distortion with central radiolucency[1] or to a pathologic finding characterized by a stellate arrangement of compressed ductal structures with elastotic center[2] (Figs. 1 and 2). In many cases, mammographic radial scar is shown to be due to pathologic radial scar. However, the majority of pathologic radial scars are found incidentally in breast tissue removed for unrelated conditions. Pathologic radial scars are frequently found at the core needle biopsy of mammographic calcifications or mass on ultrasound, and less frequently by needle biopsy of enhancing areas on MRI. Mammographic radial scars are not infrequently due to malignancy; pathologic radial scars can best be described as occasionally occurring adjacent to a malignancy.

There is tremendous variability in the reported likelihood of finding malignancy at surgical excision after a core biopsy shows radial scar; it ranges from 0% to 40%.[3] When radial scar on core biopsy is found with atypical ductal hyperplasia, lobular neoplasia, or papilloma, the frequency of malignant upgrade by surgery averages 26%, as compared with 7.5% when radial scar is found without an associated proliferative lesion.[3]

Recently it seemed that we were doing many operations for radial scar at core biopsy and seldom finding

CME questions for this article available at http://jacscme.facs.org

Disclosure Information: Authors have nothing to disclose. Timothy J Eberlein, Editor-in-Chief, has nothing to disclose.

Received June 16, 2016; Revised July 27, 2016; Accepted August 2, 2016.

From the Departments of Breast Surgery (Leong, Liang, Tartter) and Pathology (Zeizafoun), Mount Sinai West, New York, NY, and the Department of Breast Surgery, Monmouth Medical Center, Long Branch, NJ (Kohli).

Correspondence address: Paul I Tartter, MD, FACS, Comprehensive Breast Center, 425 West 59th St, Suite 7a, New York, NY 10019. email: ptartter@chpnet.org

http://dx.doi.org/10.1016/j.jamcollsurg.2016.08.003
ISSN 1072-7515/16

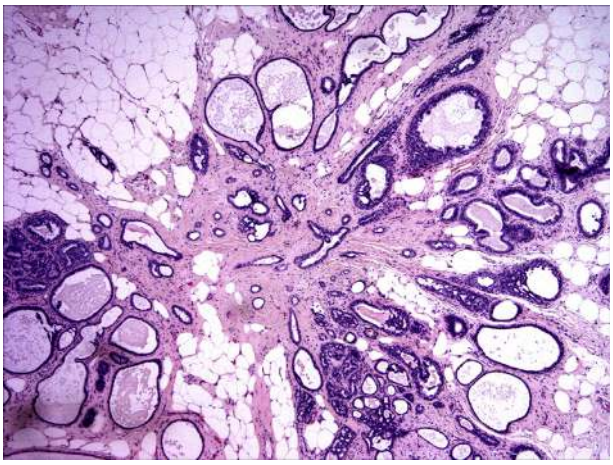

Figure 1. Low-power view showing the stellate lesion (flower head pattern).

malignancy. As a consequence, we reviewed the Continuum Health Partners experience with surgical excision after radial scar was found at core needle biopsy.

METHODS

This study was approved by the Institutional Review Board of Mount Sinai School of Medicine. The pathology database of Continuum Health Partners was searched for the terms *radial scar* and *radial sclerosing* from 2007 to 2015. From review of 1,513 pathology reports containing the search terms, 292 core biopsy results without malignancy were identified. The corresponding surgical excision pathology reports were also obtained.

Core needle biopsies were performed with ultrasound guidance for masses, generally with 14- or 16-gauge needles, most without vacuum assistance, obtaining at least 3 cores. Stereotactic biopsies for calcifications on mammography and for enhancement on MRI were performed with 9-gauge vacuum-assisted needles and generally, 12 cores were obtained. Specimen x-ray was used for the stereotactic biopsies to confirm that the calcifications were removed. Titanium clips were placed at the biopsy sites after obtaining the specimen. Clip placement after ultrasound biopsy of masses was not universal.

Biopsy specimens were received in 10% neutral buffered formalin and submitted entirely for overnight processing. Tissues were embedded in paraffin block(s) and at least 3 levels were obtained and stained with hematoxylin and eosin. Excision specimens were also received in 10% formalin, serially sectioned, and entirely submitted for overnight processing. The next day, the tissues were embedded in multiple blocks and then 1 level from each block was obtained and stained with hematoxylin and eosin.

Microscopically, radial scar was diagnosed by the presence of a stellate lesion (flower head pattern) on low power magnification. On high power magnification, a central fibroelastic zone with basophilic elastic material with hyalinized stroma was noted, along with radiating compressed glands composed of 2 layers (ductal epithelium and myoepithelium). Some cases may have showed epithelial hyperplasia, adenosis, and cysts. Cases were considered "pure" radial scar if no other proliferative lesions were identified on the core biopsy specimen.

Data collected included patient age, indication for core biopsy, method of core biopsy, pathology of the core biopsy, and pathology of the surgical excision specimen. Data were analyzed using SPSS.

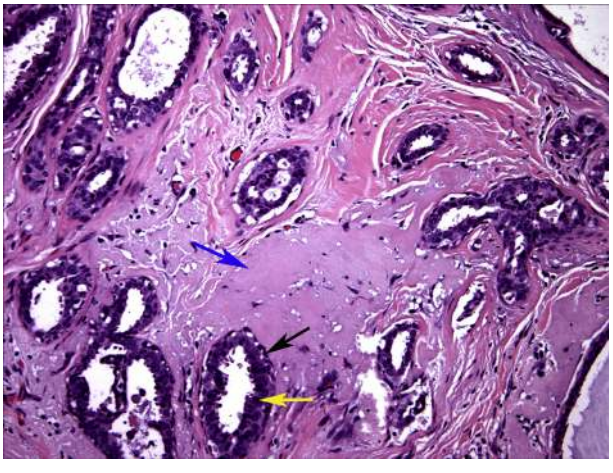

Figure 2. High-power view showing (blue arrow) central fibroelastic zone along with glands composed of 2 layers: (yellow arrow) ductal epithelium and (black arrow) myoepithelium.

RESULTS

Patients ranged in age from 23 to 91 years, with a median age of 52 years. The majority of the patients (n = 163, 56%) had biopsies for calcifications, 90 (31%) for masses, 25 (9%) for enhancement on breast MRI, 10 (3%) for architectural distortion on mammography, and 4 (1%) for asymmetry on mammography. The majority of the biopsies were stereotactic (n = 169, 58%,), 98 (34%) were with ultrasound guided core needle, and 25 (9%) with MRI-guided core needle.

Pathology for 219 (75%) of the core needle biopsies was radial scar without associated lobular neoplasia, papilloma, or atypical ductal hyperplasia (Table 1). The remaining 25% of patients were nearly equally divided between those with radial scar associated with papilloma (n = 25), lobular neoplasia (n = 23), and atypical ductal hyperplasia (n = 26). The associated proliferative lesions

Table 1. Core Needle Biopsy Pathology (N = 292)

Core biopsy result	n	%
"Pure" radial scar	219	75
Radial scar with atypical ductal hyperplasia	26	9
Radial scar with lobular neoplasia	23	8
Radial scar with papilloma	24	8

were generally adjacent to the index radial scar, not within the actual radial scar. There was no significant relationship between indication for biopsy and the finding of associated pathology with radial scar on needle biopsy. However, indication for biopsy was significantly related to finding pure radial scar (without associated proliferative lesion): 83% of core biopsies for masses were found to be pure radial scar compared with 71% of biopsies for calcifications, asymmetry, enhancement, or architectural distortion (chi square = 4.82, p = 0.028). Because presentation determined the biopsy method, and masses were most frequently biopsied with ultrasound-guided core needle, pure radial scars were significantly more frequently found with this biopsy method: 85% of ultrasound-guided cores were pure radial scar compared with 70% of stereotactic biopsies, and 20% of MRI-guided biopsies (chi square = 7.39, p = 0.007).

Two hundred seventeen (74%) of the 292 patients had surgical excision. There were no significant differences between patients who had surgical excision and those who did not in age, indications for biopsy, biopsy method, or pathologic findings. Because we did not have access to the records of the patients' primary care physicians, we do not know why the 75 patients did not have surgical excision. Among the 161 patients with radial scar only on needle biopsy (Table 2), 41 (25%) had a pathology upgrade by surgical excision: 18 (11%) were found to have a papilloma at surgery, 12 (7%) had lobular neoplasia, 10 (6%) had atypical ductal hyperplasia, and 1 patient had ductal carcinoma in situ.

Among the 56 patients with radial scar associated with papilloma (Table 3), lobular neoplasia, or atypical ductal hyperplasia at needle biopsy, 9 (16%) had additional pathology at surgical excision: 4 patients with atypical ductal hyperplasia associated with radial scar on needle biopsy were found to have ductal carcinoma in situ at surgical excision, 1 patient with atypical ductal hyperplasia and radial scar on core needle biopsy was found to have invasive ductal carcinoma, 1 patient with lobular neoplasia on needle biopsy was found to have atypical ductal hyperplasia at surgery, 1 patient with lobular neoplasia on needle biopsy had invasive lobular cancer at surgery, 1 patient with papilloma at needle biopsy had lobular neoplasia at surgery, and 1 patient with papilloma at needle biopsy had atypical ductal hyperplasia at surgery.

Table 2. Surgical Pathology for "Pure" Radial Scars at Needle Biopsy (n = 161)

Surgical pathology	n	%
Radial scar	70	43
Benign	50	31
Papilloma	18	11
Lobular neoplasia	12	7
Atypical ductal hyperplasia	10	6
Ductal carcinoma in situ	1	0.6

Because both indication for biopsy and biopsy method were significantly related to finding pure radial scar at needle biopsy, both were also related to finding pure radial scar at surgical excision. Sixty-two percent of surgical excisions for radial scar presenting as a mass were radial scar alone at surgical excision compared with 41% of surgical excision for radial scar presenting as calcifications (chi square 6.22, p = 0.013).

Malignant upgrades from needle biopsy to surgical excision were found in 7 cases (Table 3). Four of these were ductal carcinoma in situ after needle biopsy showed radial scar with atypical ductal hyperplasia. One patient with atypical ductal hyperplasia and radial scar on core needle biopsy was found to have invasive ductal carcinoma. One patient was found to have invasive lobular cancer after needle biopsy showed radial scar with lobular neoplasia. Only 1 patient with radial scar without associated proliferative lesion at needle biopsy was found to have ductal carcinoma at surgical excision. The pathology slides were reviewed and both the stereotactic and excisional diagnoses were confirmed. Review of the post-needle biopsy mammogram showed residual calcifications. The focus of ductal carcinoma in situ contained calcification, measured 2 mm, and was located 5 mm from the needle biopsy cavity.

DISCUSSION

In this study, radial scar was found most frequently in needle biopsy specimens from stereotactic biopsies for calcifications on mammography followed by ultrasound-guided core biopsies for masses. In both situations, radial scars found on pathology were incidental findings when trying to rule out an atypical proliferative lesion or a malignancy. Almost one-quarter of the core biopsy specimens also contained papilloma, atypical ductal hyperplasia, or lobular neoplasia in addition to the radial scar. An additional 25% of "pure" radial scars at needle biopsy were found to have papilloma, atypical ductal hyperplasia, or lobular neoplasia at excisional surgery. Six of the 7 cases of malignancy found at surgery were in

Table 3. Surgical Pathology Radial Scar Associated with Other Proliferative Lesions

Biopsy pathology (n = 54)	Surgical pathology upgrade
Radial scar with ADH (n = 21)	4 DCIS and 1 invasive ductal carcinoma
Radial scar with lobular neoplasia (n = 16)	1 ADH and 1 invasive lobular carcinoma
Radial scar with papilloma (n = 17)	1 lobular neoplasia and 1 ADH

ADH, atypical ductal hyperplasia; DCIS, ductal carcinoma in situ.

patients whose core biopsy showed atypical ductal hyperplasia or lobular neoplasia in addition to radial scar. Only 1 patient with "pure" radial scar at needle biopsy had ductal carcinoma in situ at surgery. This patient had residual calcifications on the post-stereotactic mammogram, and calcifications were present in the 2-mm focus of ductal carcinoma in situ found 5 mm from the stereotactic biopsy cavity.

This low malignant upgrade rate of radial scar is comparable to that reported by Li and colleagues[3] and Conlon and associates.[4] We believe that if radial scar is found at percutaneous biopsy using a 9-gauge vacuum-assisted needle taking 12 core biopsies, and no associated proliferative lesion is present, any malignancy found at surgical excision is incidental. The 1 cancer found in this series was 5 mm from the biopsy cavity and measured 2 mm. Our experience is similar to that of Li and colleagues[3]; in their study of 220 patients with radial scar alone on core biopsy, 2 cases were upgraded to malignancy by surgical excision. The malignancies found were 7 and 8 mm from the biopsy cavities. It was not stated whether residual calcifications were present on the post-needle biopsy mammogram. Conlon and coworkers[4] also had a single malignant upgrade among 48 patients; it consisted of a 2-mm focus of ductal carcinoma in situ located 5 mm from the needle biopsy cavity.

There are several explanations for the wide variability reported for malignancy upgrade by surgical excision of radial scars at core needle biopsy. The most important factor influencing an upgrade to malignancy in this study was the presence of an associated proliferative lesion. Also influencing the malignant upgrade rate is the indication for the core needle biopsy. As a consequence, studies with high numbers of cores for symptomatic patients or for patients with radial scar appearance on mammography[5-8] have the highest rate of malignancy upgrade; studies with the majority of cores for calcifications[3,9] have the lowest rates of malignant upgrade.

Selection bias also plays a role in the variability of malignant upgrade rates. Many studies examined only patients who had both core biopsy and surgical excisions, not accounting for the patients who had core biopsy showing radial scar without subsequent surgery.[3,10,11] It is likely that subtle differences in imaging persuaded physicians to recommend surgery in some cases, while in others, to recommend follow-up imaging without surgery. As a consequence, malignant upgrades by surgery would be more frequent in studies with high percentages of patients not undergoing surgery and less frequent in studies in which all or nearly all patients had surgical excision.[9,12,13]

The size of the needle and the number of core specimens obtained also influence the malignant upgrade rate: the lowest upgrade rates are obtained with 9-gauge or larger needles taking 12 or more cores, and the highest upgrade rates are obtained with 3 or fewer cores obtained with 14-gauge or smaller needles.[12,14,15]

Our experience and that of Li and colleagues[3] and Conlon and associates[4] indicate that cancers found at surgical excision of core biopsy sites for "pure" radial scar are actually incidental findings. Supporting this hypothesis is that patients followed after excision of radial scars are not at higher risk of subsequently developing malignancy compared with women in the general population.[16,17] In addition, when patients diagnosed with breast cancer are compared with women without a breast cancer diagnosis, a history of surgery for radial scar is the same for both groups.[18,19] Also supporting the incidental hypothesis is the observation from studies that patients who decline surgery for radial scar infrequently develop cancer.[4,5] Finally, the likelihood of finding an incidental carcinoma in a reduction mammoplasty specimen is comparable to our experience of a single malignant upgrade among 161 radial scars: 0.6%. The incidental carcinoma rate in in reduction mammoplasty specimens ranges from 0.6% to 0.9%.[20-23]

We acknowledge that there are a few limitations to our study. Our study was a retrospective analysis that involved multiple surgeons, pathologists, and radiologists. As such, standardization among surgical procedures as well as biopsies was not possible, and varying techniques existed. In addition, different biopsy needles and sizes were used, which may have allowed for more or less tissue to be taken out at biopsy, although all of the stereotactic biopsies for calcifications were done with 9-gauge vacuum needles taking 12 specimens. Another limitation to our study is the lack of patient and family history, including genetic background information and personal history of abnormal biopsies or previous malignancies. We do not know if the patients who were subsequently found to have a pathologic upgrade also had associated genetic mutations or a strong family history. We also acknowledge that a longer follow-up time may show a more significant pathologic upgrade rate.

Our study had a large cohort with only 7 cases of pathologic upgrade to breast cancer. Only 1 of these 7 cases was upgraded from a "pure" radial scar and we believe this was an incidental finding. Further follow-up on those patients who did not obtain a surgical excision after core biopsy is now needed to further validate the safety in observing patients with pure radial scars.

CONCLUSIONS

We believe that with the appropriate patient selection, biopsy indication, needle size, and lack of residual calcifications on post-biopsy imaging, it would be safe to monitor patients with a pure radial scar found on core biopsy.

Author Contributions

Study conception and design: Leong, Kohli, Tartter
Acquisition of data: Leong, Kohli, Zeizafoun, Tartter
Analysis and interpretation of data: Leong, Liang, Tartter
Drafting of manuscript: Leong, Liang, Tartter
Critical revision: Leong, Tartter

REFERENCES

1. Fechner RE, Mills SE. Radial Scar, Sclerosing Adenosis and Adenosis Tumor in Breast Pathology: Benign Proliferations, Atypia and In Situ Carcinomas. Chicago: American Society of Clinical Pathologists; 1990:51–58.
2. King TA, Scharfenberg JC, Smetherman DH, et al. A better understanding of the term radial scar. Am J Surg 2000;180:426–433.
3. Li Z, Ranade A, Zhao C. Pathologic findings of follow-up surgical excision for radial scar on breast core needle biopsy. Hum Pathol 2015;48:76–80.
4. Conlon N, D'arcy C, Kaplan JB, et al. Radial Scar at image-guided needle biopsy Is excision necessary? Am J Surg Pathol 2015;39:779–785.
5. Dominguez A, Durando M, Mariscotti G, et al. Breast cancer risk associated with the diagnosis of microhistological radial scar (RS): retrospective analysis in 10 years of experience. Radiol Med 2015;120:377–385.
6. Osborn G, Wilton F, Stevens G, et al. A review of needle core biopsy diagnosed radial scars in the Welsh breast screening programme. Ann R Coll Surg Engl 2011;93:123–126.
7. Toth D, Sebo E, Sarkadi L, et al. Role of core needle biopsy in the treatment of radial scar. The Breast 2012;211:761–763.
8. Patterson JA, Scott M, Anderson N, Kirk SJ. Radial scar, complex sclerosing lesion and risk of breast cancer. Analysis of 175 cases in Northern Ireland. Eur J Surg Oncol 2004;30:1065–1068.
9. Lee KA, Zuley ML, Chivukula M, et al. Risk of malignancy when microscopic radial scars and microscopic papillomas are found at percutaneous biopsy. Am J Radiol 2012;198:141–145.
10. Nassar A, Conners AL, Celik B, et al. Radial scar/complex sclerosing lesions: A clinicopathologic correlation study from a single institution. Ann Diagn Pathol 2015;19:24–28.
11. Rajan S, Watson A, Carder PJ. Conservative management of screen-detected radial scars: role of mammotome excision. J Clin Pathol 2011;64:65–68.
12. Linda A, Zuiani C, Furlan A, et al. Nonsurgical management of high-risk lesions diagnosed at core needle biopsy: can malignancy be rule out safely with breast MRI? Am J Radiol 2012;198:272–279.
13. Houssami N, Ciatto S, Bilous M, et al. Borderline breast core needle histology: predictive values for malignancy in lesion of uncertain malignant potential. Br J Cancer 2007;96:1253–1257.
14. Becker L, Trop I, David J, et al. Management of radial scars found at percutaneous breast biopsy. Can Assoc Radiol J 2006;57:72–78.
15. Sohn VY, Causey MW, Steele S, et al. The treatment of radial scars in the modern era – surgical excision is not required. Am Surg 2010;76:522–525.
16. Berg JC, Visscher DW, Vierkant RA, et al. Breast cancer risk in women with radial scar in benign breast biopsies. Breast Cancer Res Treat 2008;108:167–174.
17. Bunting DM, Steel JR, Holgate CS, Watkins RM. Long term follow-up and risk of breast cancer after a radial scar or complex sclerosing lesion has been identified in a benign open breast biopsy. Eur J Surg Oncol 2011;37:709–713.
18. Sanders ME, Page DL, Simpson JF, et al. Interdependence of radial scar and prolifereative disease with respect to invasive breast carcinoma risk in patients with benign breast biopsies. Cancer 2006;106:1453–1461.
19. Kabat GC, Jones JG, Olson N, et al. A multi-center prospective cohort study of benign breast disease and risk of subsequent cancer. Cancer Causes Control 2010;21:821–828.
20. Dotto J, Kluk M, Geramizadeh B, et al. Frequency of clinically occult intraepithelial and invasive neoplasia in reduction mammoplasty specimens: A study of 516 cases. Int J Surg Pathol 2008;16:25–30.
21. Freedman B, Rosenbaum Smith SM, Estabrook A, et al. Incidence of occult carcinoma and high-risk lesions in mammoplasty specimens. Int J Breast Cancer 2012;2012:145630.
22. Tadler M, Vlastos G, Pelte MF, et al. Breast lesions in reduction mammoplasty specimens: a histopathological pattern in 534 patients. Br J Cancer 2014;110:788–791.
23. Hassan FE, Pacifico MD. Should we be analyzing breast reduction specimens? A systematic analysis of over 1,000 consecutive cases. Aesth Plast Surg 2012;36:1105–1113.