Radial Scar of the Breast

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ABSTRACT

Radial scar is a distinctive disease not only because of its similarity with breast cancer but also because of the controversy of diagnosing methods. Here we report two cases of radial scar with different clinical approaching strategies. We pose two questions based on the inconsistency between these two cases and review recent studies to come up with some reasonable answers. The first question is about the predictive values of several diagnostic methods. According to the recent studies, mammography and excisional biopsy are the most practical examinations. Ultrasonography only has some value in the biopsy procedure. MRI is still unreliable to confirm the final diagnosis but may be a promising tool to guarantee that a lesion is in fact a benign entity. Second question concerns the reasonable time to perform an excisional biopsy. Based on the results of current research, it seems rational to always carry out an excisional biopsy at the time when radial scar is noticed. The reason is because the only well-documented method until now to confirm the diagnosis of radial scar is excisional biopsy. All other biopsy procedures including fine-needle aspiration biopsy, core biopsy and vacuum-assisted biopsy have variable degree of malignancy underestimation rate. However, more complex criteria may improve the strength of these three biopsy methods in the future.

Radial scar of the breast is an uncommon entity. Basically, it is considered as a benign lesion but can quite mimic breast cancer. There are several characteristic morphologic patterns of radial scar, such as long dense radiating lines interspersed with trapped fat and no visible central mass. As a result, there are some lucent zones near the center of the affected area. Nonetheless, biopsy is still regarded as a necessary procedure to make a definitive diagnosis because some cancers may have same presentation. Even after evaluation by means of mammography, ultrasonography, magnetic resonance imaging (MRI), radial scar still cannot be absolutely distinguished from cancer.

CASE REPORT

Case 1:
A 64-year-old woman had left breast cancer status post modified radical mastectomy thirteen years ago. Ten months ago, this patient went to the outpatient department due to a palpable nodule in her right breast; therefore, further workup was arranged. This palpable nodule was noticed sonographically as a 7 × 5 × 5-millimeter irregular-shaped hypoechoic lesion located at 2 o’clock position (Fig. 1). Meanwhile, fine needle aspiration was performed but the cytology report showed that the specimen was negative for malignant cells. Furthermore, the mammogram of the right breast showed a small star-like lesion with marked focal architectural distortion at about 2 to 3 o’clock position and 4.5 centimeters away from the areola (Fig. 2). The tumor marker of CA-153 was within normal limit. The above imaging findings were persistent for ten months. In addition, close to ten months after the detection of the right breast lesion, a chest computed tomography (CT) was performed for evaluating the condition of the chest area because of her underlying left breast cancer. There was an
incidental finding of a 5-millimeter nodule with relatively
good enhancement as compared to the rest of breast tissue
at the medial upper zone of the right breast (Fig. 3). Because
this lesion presented the same location and size as the
above-mentioned lesion, we assumed that they are the same
one. However, it was difficult to absolutely confirm whether
or not the lesion detected by the chest CT was definitely
the one noted by the mammography and the breast ultra-
sonography. Since the possibility of malignancy still could
not be ruled out, a core biopsy and a partial mastectomy
were carried out. The lesion was proved to be a radial scar
eventually.

Case 2:
A 51-year-old woman had serous cancer of fallo-
pian tube status post staging operation about three years
ago. Nine months ago, a surveillance mammography was
performed and showed a small area in the right breast with
architectural distortion at 9 o’clock position and 6 centim-
eters away from the areola (Fig. 4). However, there was no
abnormality detected by means of breast ultrasonography at
the time. Six months later, breast MRI presented that there
was a 1.3x1.4-centimeter asymmetric focal area with slight
reticular enhancement at the same location of the above
lesion (Fig. 5). Nonetheless, the kinetic curve assessment
for this lesion favored a benign entity. Then, another breast
ultrasonography was performed three months after the
breast MRI and there was a 12- millimeter irregular-shaped
hypoechoic lesion noted at the same region where the
original nidus was located (Fig. 6). Due to the possibility
of malignancy, surgical excision for this lesion was carried
out and the pathology report confirmed the final diagnosis
as radial scar.

DISCUSSION
Radial scar is a benign lesion. The majority of radial
scar is invisible radiologically and the highest reported
incidence is 28% based on an autopsy study. When radial
scar is found by imaging, mammography is usually the one
which detects this lesion and the mammographic detection
rate of this specific lesion ranges from 0.03% to 0.09%.
The predominantly affected women are between 40 and 60
years [1-3]. According to Tabar and Dean, there are several
helpful mammographical characteristics that may be used
to differentiate radial scar from carcinoma: (1) Varying
appearances in different projection, (2) No discrete central
mass, (3) Long thin radiating spicules against a background
of a radiolucent center, resulting into a “black star appear-
ance”, and (4) Absence of a palpable mass or skin changes
[4]. However, even with these criteria, the final diagnosis
still depends on the histology report [5]. In addition to the
physical examination and the mammography, there are
several other diagnostic methods ranging from imaging
studies: MRI, ultrasonography to biopsy: fine-needle aspi-
ration biopsy (FNAB), core biopsy, excisional biopsy [6].
The interesting aspect of radial scar is that except for exci-
sional biopsy, controversy exists over the predictive values
of all the other aforementioned examinations [5, 6].

Focusing on the comparison between the two cases
we report, the approaches of the same disease are not

![Figure 1](image-url)

**Figure 1.** Breast ultrasonography shows a $7 \times 5 \times 5$-millimeter irregular-shaped hypoechoic lesion without posterior acoustic features.
uniform either in the choice of diagnosing methods or in the sequence of arranged examinations. Therefore, we have reviewed a large number of recent studies related to the diagnosis of radial scar to explore the predictive values of current examinations and whether it is suitable to perform an excisional biopsy as soon as possible, since this procedure will be inevitably carried out in the end.

First of all, one reason why this benign lesion, radial scar, is so important is because it is considered that there are some relations between radial scar and breast cancer. Around 31-50% cases of radial scars may be in association with atypical ductal hyperplasia and carcinoma [7]. Another study further hints that radial scar may be the precursor of breast cancer [8]. On the contrary, some other studies argue that radial scar does not increase or just increase slightly the risk of breast cancer and it is the coexistent proliferative disease that significantly contributes to this risk [9, 10]. In brief, the role radial scar plays in the field of breast cancer is still under debate. However, even though it is well documented that radial scar does not tend to become breast cancer in the future, definitely confirming a radial scar without any possibility of breast cancer is still challenging.

In the following section, we will discuss several distinct diagnostic modalities and evaluate the values related to radial scar.

Ultrasonography is one of the most convenient imaging studies to survey the condition of breasts. There are some researchers stating that ultrasonography does not have...
**Figure 3.** The enhanced chest CT shows a 5-millimeter enhanced nodule at the medial upper zone of the right breast.

**Figure 4.** Mammograms of the right breast on the craniocaudal **a.** and mediolateral oblique **b.** projections present a small area in the right breast with architectural distortion at 9 o’clock position and 6 centimeters away from the areola. The magnified views of the problematic region are shown.
clear-cut advantages [11]. Nevertheless, others consider sonographic evaluation for radial scar as an important part because ultrasonography may not only visualize a subtle lesion noted on a mammogram, but also facilitate percutaneous biopsy or hookwire localization. It is also worth mention that by means of ultrasonography, it may be easier to sample the periphery of the lesion, where carcinoma more likely exists [12].

Breast MRI used to be regarded as a less influential examination because radial scar can present similar presentations as breast cancer on MRI [13]. Interestingly, there is a new study whose purpose is to search possible breast MRI criteria helping to distinguish between radial scar related to benign proliferative disease and radial scar associated with breast cancer. The most significant result of this study is that the negative predictive value is 100% by means of enhancement rate and time-signal intensity curve [14]. In other words, a lesion without these two features can be considered as a benign entity safely and then it may be not necessary to perform further workup. However, because

Figure 5. Fat-saturated contrast-enhanced T1-weighted axial breast MR image [400/13(TR/TE)] shows a 1.3 × 1.4-centimeter asymmetric focal area with slight reticular enhancement and focal architecture distortion in the deeper portion at 8-9 o’clock position of the right breast. The kinetic curve assessment (not shown) for this lesion presents slow initial rise and persistent enhancement in the delayed phase (10 minutes). The magnified view is presented.

Figure 6. Breast ultrasonography shows a 12-millimeter irregular-shaped hypoechoic lesion without posterior acoustic features.
Radial scar

of the limited case number, this conclusion is still not reliable enough for others to follow the rule in reality.

Biopsy tends to be the most controversial topic concerning radial scar. Basically, there are four types of biopsy: fine-needle aspiration biopsy, core biopsy, vacuum-assisted biopsy, and surgical excision. It has been wondered for a long time that before the final surgical excision is carried out, is there any chance of differentiating exactly radial scar from breast cancer only on the basis of the former three relatively less invasive methods? There is a study including about 200 samples, showing that 5 percent cancers are missed by core biopsy, while no cancers are missed by vacuum-assisted biopsy [15]. On the other hand, a more recent and larger scale study indicates that the malignancy underestimation rate is 9% for ultrasonography guided core biopsy and 5% for vacuum-assisted biopsy. This study further suggests that surgical excision is demanded for lesions yielding radial scars at percutaneous biopsy [16]. Moreover, one study creates more reliable criteria of core biopsy in order to avoid an excisional biopsy. The criteria consist of the following: (1) no associated atypical hyperplasia at percutaneous biopsy, (2) including at least 12 specimens, (3) mammographic findings which are reconciled with histologic findings. An excisional biopsy is indicated for any radial scar which does not meet these criteria [17]. However, one study suggests that a missed cancer is still possible to exist in radial scars without atypia at core biopsy, although the specimens are not so adequate in that study [16]. Also, there is another study signifies that if no atypia is detected in enough sampled tissue of the lesions and there is low imaging suspicion for malignancy, surgery is not mandatory but close follow-up is advised [18]. Regardless of these various opinions, until now, the predominance of research advocates surgical excision as only reliable strategy to eliminate the potential risk of cancer [16, 19, 20, 21].

After having discussed the mainstream in the field of diagnosing radial scar, there are also some other interesting studies in which the researchers want to use a few immunohistochemical substances to differentiate between benign and malignant processes of the breast; for instance, p63, CD10, 1A4, calponin, and Caveolin-1 [22, 23]. All of them may be deemed as extra supporting examinations.

In conclusion, we will try to answer the first question: the diagnostic values of the examinations other than excisional biopsy. Mammography is undoubtedly the most important examination to detect the visible radial scar but it is not appropriate to confirm the final diagnosis of radial scar only with the typical findings on mammography. Ultrasonography seems to be quite insignificant unless it is used to perform a biopsy. Breast MRI may be a promising imaging study if the dynamic breast MRI can be verified as a useful tool to distinguish benign entities from malignant ones. Generally speaking, except for excisional biopsy, the other three types of biopsy are still unable to guarantee that cancer can be ruled out exclusively. Nonetheless, more complex criteria may elevate the potential of these less invasive biopsy methods and thus replace excisional biopsy in the future. For the other questions related to the time to perform an excisional biopsy, in light of current research, lesions presenting the characteristics of radial scar almost necessitate excisional biopsy to reach a convincing diagnosis. Therefore, whenever we encounter with a lesion which looks like radial scar on mammography, it seems inevitable that we will perform an excisional biopsy sooner or later. As a result, it is reasonable to carry out this procedure just when we first notice such a lesion.

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