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Breast Biopsies Under Magnetic Resonance Imaging Guidance: Challenges of an Essential but Imperfect Technique

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Magnetic resonance imaging (MRI)–guided breast biopsy is an essential tool of a breast imager; yet, a decade after its introduction, this technique remains challenging and imperfect. This article presents the technique of MRI-guided biopsy, with an emphasis on challenges particular to the technique: technical considerations related to adequate lesion sampling and difficulties in confirming radiologic-pathologic correlation for enhancing lesions. Through clinical vignettes, challenges unique to MRI-guided biopsy are discussed and practical tips are offered. Prebiopsy planning including second-look targeted studies, patient preparation, and equipment is covered. Challenging situations pertaining to breast size, lesion location, or type of enhancement are illustrated, as well as the topic of performing multiple MRI-guided breast biopsies in a single session and biopsies of women with implants. Postbiopsy management is discussed. Success of MRI-guided biopsies requires careful prebiopsy planning, as well as appropriate choice of biopsy device, optimized for the specifics of breast shape and lesion size and location. Special features of biopsy systems (smaller apertures and blunt tips) facilitate the sampling of lesions in challenging locations. Vanishing lesions should undergo short-term follow-up, because malignancy cannot be excluded, as should lesions diagnosed as benign after pathologic analysis when the result is felt to be concordant with imaging features. To this end, radiologic-pathologic correlation is essential. Underestimation rates after MRI-guided breast biopsy are superior to those for vacuum-assisted stereotactic biopsy and ultrasound-guided biopsy. Close follow-up and rebiopsy should be considered when there is imaging-discordant histology. For benign and concordant histology, a first follow-up can be offered at 6 months.

Introduction

Breast magnetic resonance imaging (MRI) is growing in use, and along with it, there is increasing need for MRI-guided biopsies. In 2010, the American College of Radiology stated that facilities seeking breast MRI accreditation must be able to perform MRI-guided breast biopsies or have an agreement with a referral center to do so.[1] More than a decade after its introduction, this technique remains challenging, particularly for lesion access, confirmation of adequate lesion sampling, and correct radiologic-pathologic correlation for enhancing lesions.

In this article, we review the technique of MRI-guided breast biopsy through clinical vignettes retrieved from the 400 MRI-guided biopsies performed at our center since January 2005, to illustrate some of the challenges that result from lesion position as well as lesion size and enhancement characteristics. Management tips are presented for specific clinical situations such as the vanishing lesion or biopsies in women with implants. Radiologic-pathologic correlation cases illustrate management issues for the postbiopsy follow-up of lesions diagnosed as benign or high-risk after biopsy. False-negative diagnoses are also discussed, including how to identify them and how to minimize their effect.

The Technique of MRI-Guided Biopsy

The technique of MRI-guided biopsy has previously been described[2,3] and confirmed safe at 1.5 and 3 T.[4,5] We present a brief overview of the intervention, with an emphasis on difficulties that may be encountered when planning or during the procedure.

Prebiopsy Planning

Second-Look Targeted Studies

Second-look targeted studies after MRI are done in our center before MRI-guided biopsy for almost all women; suspicious foci or small areas on non–mass enhancement occasionally are directly recommended for MRI-guided biopsy. An ultrasound correlate to enhancing lesions at MRI is reported in 23%-71% of cases, with a malignancy rate of 15%-56%.[6-11] An ultrasound correlate is more frequent if the enhancing lesion is larger and more suspicious (breast imaging-reporting and data system [BIRADS] 5 compared with BIRADS 3-4) and in case of a mass rather than non–mass enhancement (25%-62% ultrasound correlate in masses vs 11%-42% for non–mass enhancements).[6-11] In the absence of an ultrasound

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correlate, the malignancy rate remains significant (6%-27%), and MRI-guided biopsy may be required to rule out malignancy.

The performance of second-look targeted studies before recommending MRI-guided biopsy affects the likelihood of malignancy of lesions that are ultimately referred for MRI-guided biopsy. Indeed, when more lesions are identified at second-look ultrasound and biopsied with this modality, the probability of malignancy of MRI-biopsied lesions decreases.[12]

The time of second-look studies is also an opportunity to discuss with the patient the need to perform an MRI-guided biopsy should no correlation to a suspicious enhancing lesion be seen. The radiologist can also assess the feasibility of the procedure, evaluating the ability of the patient to cooperate, as well as the absence of technical limitations relating to breast size or the lack of a safe biopsy approach.

Patient Preparation

On the day of the biopsy, it is important to obtain a signed informed consent from every patient. The MRI-guided biopsy procedure is described to the patient with explanation of its goals and presentation of potential risks. An MRI-guided breast biopsy is a safe procedure with a low risk of complications. Common complications are minor: most patients develop a small hematoma at the biopsy site; infections are very rare; and occasionally, skin damage may occur at the time of tissue sampling, but this risk can be minimized with careful biopsy planning and selection of an appropriate biopsy device. Women with breast implants may be at risk of implant rupture during the procedure, depending on implant size relative to breast and lesion size and location, and they should be informed before scheduling the biopsy.

Key to the success of the procedure is patient collaboration: the patient is reminded of the importance of maintaining a steady position throughout the biopsy for a fast, safe, and efficient procedure. To ensure this, the radiologist and other members of the biopsy team should strive to maximize patient comfort so that she remains as comfortable as possible throughout the procedure. This includes, for example, ensuring the patient does not get cold and is offered support to maintain steady arm and leg positions.

The patient should also be informed of the possibility of lesion nonvisualization after contrast injection, as well as the possibility, depending on lesion location within the breast, that there will be no safe access for sampling. Should either of these situations arise, the procedure would need to be canceled and an alternate management plan chosen. Appropriate follow-up can be discussed after the procedure both the treating physician and the patient.

Equipment

Different manufacturers have developed their own products designed for MRI-guided breast biopsies. We present the basic design of the equipment required for MRI-guided biopsies, without discussing the specifics of the different vendors.

To perform MRI-guided biopsies, one must have an open interventional breast coil, a localizing device, a sampling device, as well as postbiopsy metallic markers to indicate the biopsy site after the intervention (Fig 1). The support of a computer-based system to plan the biopsy procedure is an added value. It is beyond the scope of this article to present all available commercial systems for MRI-guided biopsy. Rather, we discuss in general terms the purpose of each component required for MRI-guided biopsy. Figure 1 shows the equipment used in our center.

Interventional Breast Coils

With their open design necessary for breast access, interventional breast coils are often not as high resolution as diagnostic coils are, the open design limiting the number of receiving elements that can be allowed. Newer coils have optimized this need to compromise resolution and access and offer a single coil to be used for diagnostic evaluations as well as interventions. The interventional breast coil should be designed to allow for an alternate approach to the standard lateral approach, most often a medial approach. Some coils also allow for a superior approach, although this may be more difficult for the patient to tolerate, with

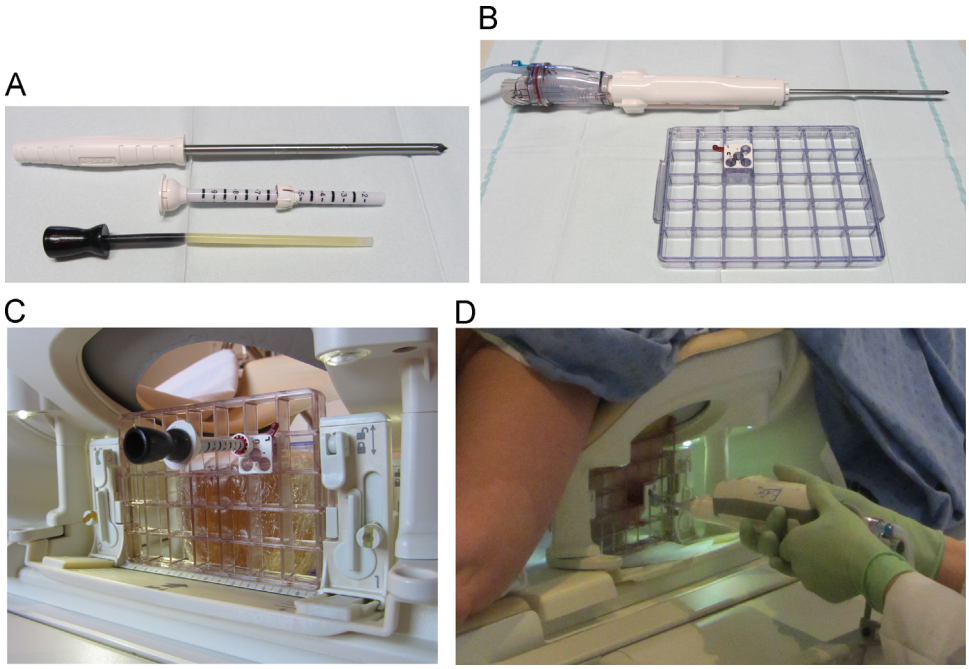

Fig. 1. Basic MRI-guided biopsy equipment. (A) Coaxial system used for biopsy, showing needle trocar, plastic introducer with numeric gradation, and obturator. (B) Example of a localizing grid and guiding block, with vacuum-assisted biopsy device and collecting chamber for biopsy specimens. (C) Localizing grid and guiding block positioned for biopsy of a breast phantom. Coaxial system with introducer is in place. (D) The patient is positioned prone with arms over her head. The radiologist performs the sampling after confirmation of adequate targeting. (Color version of figure is available online.)