Chapter 12
Breast Biopsy and Breast MRI Wire Localization

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Abstract Breast MRI guided intervention has become an increasingly important technique for breast radiologists largely due to increasing diagnostic breast MRI examination volumes. Alongside this there has been improved diagnostic image quality with a resulting number of breast lesions detected only on MRI requiring further clarification. International guidelines now insist that institutions performing breast MRI should provide the option of an MRI-guided intervention for further lesional work up, whether in their own unit or at a local center that can be referred to. This chapter covers the indications for these interventions, in particular which lesions require biopsy and when a lesion can just be managed with imaging follow up. Technical aspects are considered such as MRI scanner hardware and software requirements, as well as which biopsy needles are most appropriate. Limitations and complications are covered including "tips and tricks" that may be of use in certain specific clinical situations. Outcomes of MRI-guided biopsies are discussed based on current literature with a final view taken on future directions.

Keywords Breast • Biopsy • Diagnostic • Intervention • Magnetic resonance imaging • Wire • Localisation • Vacuum • Diagnosis • Therapy

12.1 Background and Indications

Breast MRI has controversially found increasing use as a diagnostic imaging investigation over the last decade or so [1, 2]. While its sensitivity is unquestionably high in cancer detection, this unfortunately comes at the expense of a lower specificity [3–5]. Where additional lesions are demonstrated on MRI, the initial follow up investigation is a focused ultrasound exam but unfortunately this has variable accuracy at

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S.L. Heller, L. Moy (eds.), *Breast Oncology: Techniques, Indications, and Interpretation*, DOI 10.1007/978-3-319-42563-4_12

locating and characterizing the abnormality [6, 7]. There are sometimes landmarks in the breast such as cysts or scars that will allow correlation on follow up imaging but clearly this is not always the case. Larger lesions are reportedly easier to locate as well as lesions characterized as BIRADs 5 [8–10]. Non mass enhancement is less commonly delineated and overall a "MRI-directed second look" ultrasound will detect an area of MRI abnormality in just over half of cases (16–65 %) [9–11]. The second look or MRI-directed US will be further discussed in chapter 11.

Where lesions are characterized by the MRI BIRADs lexicon as 3 or above, the reported final malignancy rate is 20–62 % [10–14]. There are several MRI characteristics such as lesional enhancement pattern, shape and size that may predict the likelihood of malignancy.

Where ultrasound or indeed mammography shows a lesion, then a targeted biopsy should be performed stereotactically or under ultrasound guidance as these are the most accessible, fast and least expensive guidance methods. A marker clip is then ideally left in place. A repeat MRI after a time interval (typically 6 months) may be recommended if the imaging pathological correlation is good and the histological result is non malignant.

If no concordant abnormalities are seen in a low risk situation and enhancement is not suspicious, then once again a follow up MRI exam could be performed at 6 months. Where ultrasound is negative, the malignancy rate falls but lesions that are suspicious on MRI and lack a correlate on "MRI-directed second look" ultrasound are malignant in 13–22 % of cases [11–17]; these should also be histologically verified via an MRI-guided biopsy. Lesions that should be considered suspicious include BI-RADS 4 or 5 abnormalities (Fig. 12.1). BI-RADS 3 lesions in high risk women undergoing MRI screening or those with an index primary breast cancer (ipsilateral or contralateral) may also be indicated for biopsy. Where there is uncertainty, and indeed wherever possible, the decision for MRI guided biopsy is made following a multidisciplinary team discussion where all the imaging can be considered alongside clinical and pathological factors in order that the correct recommendation can be made on a case by case basis.

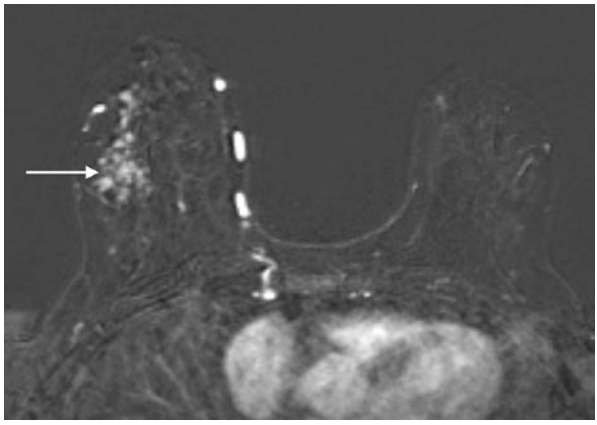

Fig. 12.1 An axial fat saturated contrast enhanced subtraction image showing a focal area of non mass-like enhancement in the outer right breast (*arrow*). This was not demonstrated mammographically or on ultrasound and was considered indeterminate. An MRI guided biopsy was recommended

Contraindications for breast MRI biopsy are the same as those for a diagnostic MRI (pacemaker, other implantable devices etc.), contrast medium injections (allergy, severe renal impairment) and biopsies (poor coagulation, allergy to local anesthesia) [18, 19]. These contraindications may be relative and careful consultation with clinical colleagues such as cardiologists and hematologists may facilitate the biopsy procedure depending on each individual case. Radiofrequency excisional biopsy devices (Intact®) cannot be used because of interference with the electromagnetic wave.

MRI-guided biopsies should only be carried out in experienced breast centers where these are preformed regularly [20–22]. The team must have suitable experience in performing both breast MRI and vacuum-assisted breast biopsy, although the exact training requirements in MRI-guided vacuum-assisted biopsies varies enormously internationally. In some countries where access to MRI is more limited, the initial training involves only a few procedures, but 15 procedures are required according to the European guidelines [20].

12.2 Technical Aspects

Most MRI scanners currently used in clinical practice have a field strength of either 1.5 T or 3 T. In the latter system the sensitivity of detecting the cancer is greater for the same specificity [23], although artefacts are generally increased. Susceptibility artifact is more than double in size at 3 T vs 1.5 T [24].

Open MRI scanners in theory provide easier access to the breast and real time monitoring of insertion of the cannula. However, to date these scanners utilize a low field (0.2–0.5 T), which is not of sufficient quality imaging for breast imaging [25].

The coils used for biopsy should if possible be the same as those used for diagnosis in order to reproduce the diagnostic scan (and hence lesion requiring biopsy) as close as is possible. It must be possible to access the breast to take the samples, which assumes that the coil is open. Current dual breast coils allow either external, internal or even superior access although the lateral approach is preferred as this is technically the most straightforward as shall be discussed (Fig. 12.2).

As an alternative to biopsy coils, perforated plate systems can be used together with flexible ring coils placed around the breast. Perforated plate systems are sometimes advantageous for reaching findings close to the thoracic wall. Compared to multi-channel breast biopsy coils, however, a ring coil is associated with a reduced signal-to-noise ratio and thus inferior image quality. This is true particularly for findings far from the coil (for example near the nipple).

Internal access is limited for deep (medial) lesions and this is technically more challenging. However historically where the whole breast would be traversed by the biopsy system, the contralateral breast can now be positioned on a board and the radiologist works from beneath in a tunnel. In principle, the shortest possible access should be selected and newer generation coils allow for medial and lateral access for biopsy. The medial access may be more difficult due to the longer distance in

Fig. 12.2 An image showing a breast biopsy compatible MRI coil

conjunction with the reduced light and operating space beneath the patient. As a general principal post-biopsy, a clip insertion is recommended to ensure the ability for localization through subsequent ultrasound or mammographic guided wire marking of the clip.

Regardless of targeting method, an opaque landmark such as a vitamin E capsule is attached to the compression plate. The end of this is positioned in contact with the breast and used as the landmark for the three spatial planes and to allow subsequent targeting. This appears as a focal area of hyperintensity on the unenhanced T1 weighted views.

The MRI scanner itself will likely have a targeting software package or this can be obtained separately depending on the manufacturer. These are particularly useful for posterior contrast enhancement. Computer aided detection software (CAD) purchased usually as a stand alone software package can facilitate better lesion delineation particularly in relation to the subtraction imaging. The biopsy system used is then computed with calculation of the necessary depth taking account of the materials and thickness of the grid.

The principle used is that the same image is taken on four occasions: before biopsy (target identification), after positioning a guide (checking correct position of the biopsy system), after taking the biopsy (confirming that the biopsy cavity is consistent with the target) and after positioning the clip (checking the correct position of the marker).

Initial and then dynamic images are preferably taken in high- resolution T1 weighted sequences. This could be a 2D exam but is preferably a 3D echo gradient with fat saturation [26]. It is ideally the highest possible spatial resolution at a temporal resolution of 60–120 s per series, with either transverse or sagittal slice orientation. The acquisition may be taken through axial sections although resolution is often better in sagittal sections [27]. For reliable lesion imaging, subtraction series of every contrast enhanced series should be acquired. Rapid T1 W spin echo (TSE) images are preferable in order to reduce artifact from the needles [27].

The maximum intravenous contrast dose (0.2 ml/kg) or a half dose is injected depending on whether or not a repeat end of procedure injection is planned. This is performed at an injection rate of 2–3 ml/s and the contrast agent is then washed out with a subsequent bolus injection of 20 mls of physiological saline solution (0.9 % NaCl).

The Mammotome® (Devicor Inc., Cincinnati, USA) was the earliest available vacuum biopsy system and was used for MRI-assisted biopsy in the late 1990s. However currently there are several manufacturers that now produce equipment for MRI-guided VAB of the breast. In Europe the EnCorTM (Senorx or Enspire, Bard GmbH, Karlsruhe, Germany) and the ATEC® (Hologic Inc., Bedford, USA) are now widely popular and have superseded the less automated Vacora® (Bard GmbH, Karlsruhe, Germany) system.

MRI-guided VAB was initially performed using an 11-gauge needle, but as with mammogram guided VAB, MRI-guided vacuum-assisted biopsy have trended toward larger needle gauges (up to 7G). These allow the collection of the same tissue volume with fewer samples in a shorter examination time. There are no specific guidelines defining the number of samples for MRI-VAB, but a European consensus paper on the use of MRI-VAB recommends taking at least 24 11G samples or an equivalent tissue volume if larger needle gauges are used [21]. However, the recommended sample here is based on very limited evidence. The number of samples reported in the literature ranges from 2 to 75 with a median of 12 [28–33].

Most VAB devices have a cable connection to the vacuum source located outside the MRI examination room. Non-magnetic materials should be used in preference to ferromagnetic materials (needles, biopsy guns, etc.) in order to minimize the chances of an accident from magnetic attraction. As these various guns are non-magnetic (Vacora® less than the others), they are not attracted by the magnet although interference with their operation does occur if they come too close to the magnet.

The Vacora® is a battery-operated system and thus a true handheld system. The disadvantage of this system is that the device has to be removed from the breast after each sample is taken. This causes more difficulty from blood [30] and air and it is essential to use a support for the gun in order to reduce the risk of displacing the cannula. The vacuum aspirate is reported to be less powerful and the sampling process slower (69 min vs 39 min). Automated coaxial systems are reported to be able to biopsy smaller lesions (10 mm vs 19 mm) in a shorter exam time [34]. While the automated devices mentioned also take individual samples, the biopsy system remains in the breast during the entire intervention. The samples are then automatically transported to a chamber in the handle, where they can later be removed. The ATEC® and EnCorTM provide the advantage of the automated removal of multiple samples in immediate succession. The ATEC® additionally provides the option of rinsing the biopsy cavity with saline.

12.3 The Procedure

Efficiency and speed are of particular importance during this type of biopsy procedure. Because of the transient nature of contrast enhancement on MRI. there is a narrow window of time in which to perform the procedure and verify needle placement. Although variable to some extent, a 15–20 min time frame is expected. The more prolonged the procedure becomes, the more likely the contrast will wash out

and also the more likely the patient is to move, resulting in motion artifact and potentially leading to incorrect targeting.

Patient positioning may vary slightly depending on institutional practice. The patient may be positioned on her side with her head turned to the opposite side and her arm above her head. Alternatively, the patient's head may be placed on a head rest or positional device so that the patient is looking straight down. A venous line with long connection tubing is in place. The breast is wedged in the surface coil and the guiding system is set up from the beginning. The skin marker is positioned in contact with the skin as close as possible to the projection of the lesion if no CAD system is being used, or further away in order to avoid obstruction of it if one is being used. Vitamin E capsules are often used as fiducial markers and are taped over the expected site of the lesion.

Modest compression is used to avoid masking the enhancement [35] and to reduce the accordion effect (decompression of the breast may cause displacement of a clip or coil). Accessibility of the presumed site of the lesion is then checked and positioned in the effective grid compression area (Fig. 12.3).

The patient is brought into the magnet and an initial contrast enhanced image is taken to find the lesion and locate it against the opaque landmark (this usually appears as a T1 weighted hyperintensity on the unenhanced image) (Fig. 12.4). Distances are measured manually or by software in the 3 spatial planes between this reference point ("zero") and the lesion.

After sterile preparation the local anesthesia is administered. In the absence of a contraindication, this usually consists of a large volume of lidocaine with epinephrine (lidocaine HCL 1 % and epinephrine 1:100,000). 20–40 cm^3 is commonly infiltrated in split doses, with 10–20 cm^3 administered before insertion of the biopsy device, and 10–20 cm^3 is administered by the device just prior to and during sampling. Epinephrine may sometimes minimise parenchymal hematoma formation, which amongst other things could potentially obscure the biopsy site. Initial subcutaneous anesthesia, however, is ideally obtained by using a small volume of lidocaine only with epinephrine not administered to the skin. It is of particular importance to ensure that no air bubbles are present within the syringe at the time of administration as even small air bubbles can cause significant artifact on the MRI.

Following the anesthetic, a skin incision is made. Depth is then adjusted by adding 20 mm for Senorx®, 10 mm for Vacora®, but nothing for Mammotome®. Once in place the metal sheath is replaced with a silicone sheath or with the position marker. The patient is returned inside the magnet and a rapid image is then taken to check the correct position of the introducer (Figs. 12.5, 12.6, 12.7, and 12.8).

The introducer is replaced by the cannula and then a series of samples are taken. The number of samples depends on the size of the lesion and quality of targeting. The ability to sample in a designated direction is a major advantage to performing this test with a vacuum biopsy needle. Prior to sampling it may be obvious that the lesion is slightly eccentrically site in relation to the needle tip. In this situation, the biopsy window can be targeted towards the lesion rather than just sweeping a full 360 degree circle. Early rounds of sampling usually produce the highest yield and the more samples that are obtained, the more likely it is that there will be hematoma formation in the target area. The result of this is that the biopsy device becomes

Fig. 12.3 An image showing a patient within the breast biopsy coil and demonstrating the grid localisation system

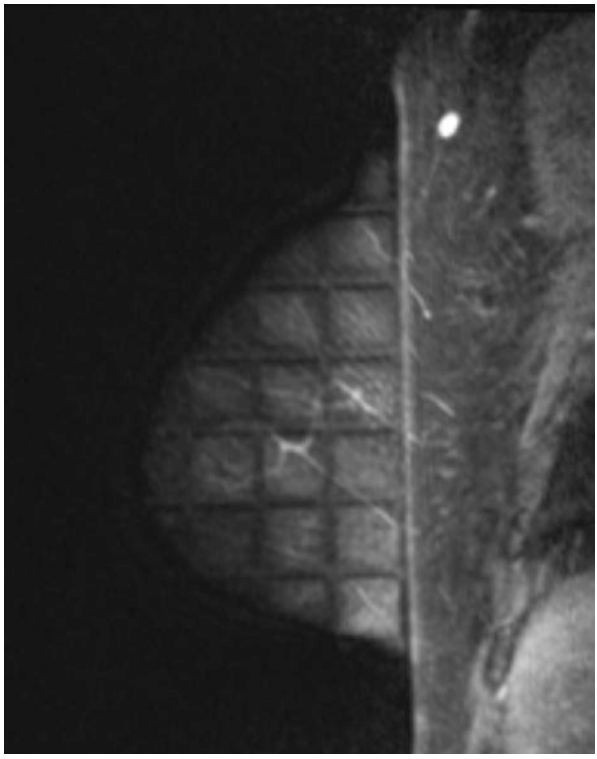

Fig. 12.4 A pre biopsy fat saturated contrast enhanced sagittal image showing the grid system over the skin allowing appropriate skin marking for needle entry point

more distant from the target lesion and there are thus diminishing returns of later and continued sampling in this scenario. For MRI guided biopsies, it is important to remember that the clock face is relative to the grid and not to the breast or to the patient. The aperture of the vacuum needle needs to be adjusted to reflect this. The samples are then placed in formalin and sent to pathology. The specimens are fixed and then sectioned and interpreted by an experienced breast histopathologist.

Fig. 12.5 An image showing the needle introducer being assembled prior to MRI guided biopsy

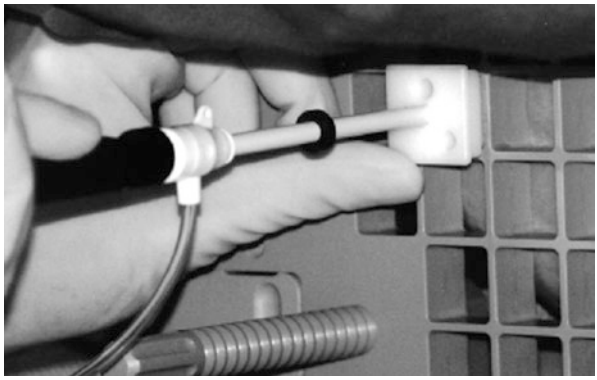

Fig. 12.6 An image showing a patient within the breast biopsy coil and demonstrating the introducer being passed through the grid localisation system

A marker clip is routinely positioned as this may be only landmark, which could be used to guide any subsequent surgery if required [29, 36–39]. It is ideally placed through the cannula prior to its removal or alternatively following the check image, through the introducer. The patient is repositioned in the tunnel for a final sequence in order to determine whether the contrast uptake dissipated although it is often sufficient to check that the biopsy area is correctly centered on the lesion (by comparing with the pre-biopsy image) and that the clip has been deployed. This sequence is

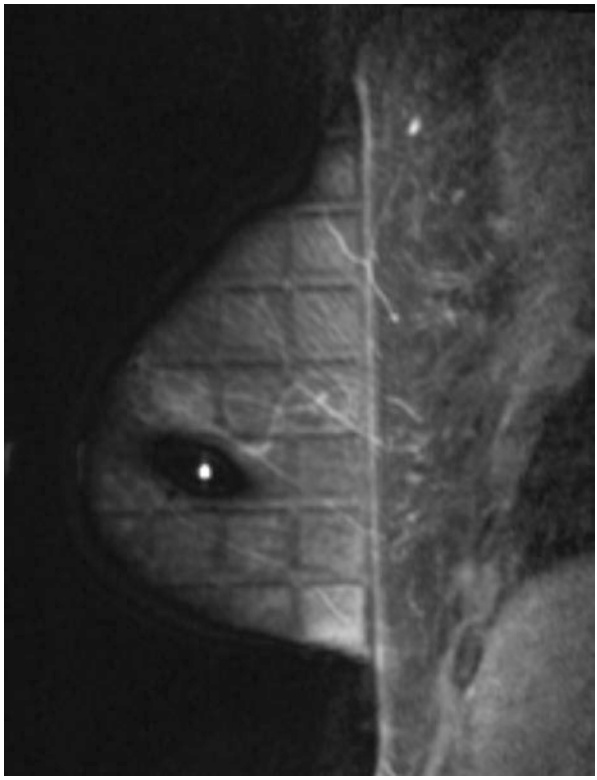

Fig. 12.7 A pre biopsy fat saturated contrast enhanced sagittal image showing the grid system over the skin with the biopsy needle passing through the image in position for biopsy

carried out with or without contrast enhancement and may facilitate further sampling or lesion retargeting (Fig. 12.9).

At the termination of the procedure, the patient is removed from the tunnel, placed flat on her back and manual compression to the breast biopsy site is applied followed by a compressive dressing. Monitoring following the procedure should be as per local protocols for a vacuum biopsy and be dependent on various patient factors as well as the degree of hematoma that has formed.

Signal void from the marker clip may be indistinguishable from signal void from air introduced during the procedure and so in order to ensure that the marker has deployed correctly, a post biopsy mammogram is usually recommended. A craniocaudal and mediolateral mammogram would typically be obtained. The position of the marker clip on the mammogram should be compared with the expected site of the lesion based on the diagnostic MRI examination. Any marker displacement needs to be clearly noted as a future wire localization may be required dependent on the histopathology from the biopsy.

Multiple lesions can be attempted at a single appointment although this may be challenging even for the most tolerant patient. As with any biopsy procedure, the most suspicious lesion should undergo intervention first, in case the later sites are not visualized or the patient is unable to continue. When dealing with multiple lesions in the same breast, the most favourable scenario is if the lesions can be positioned

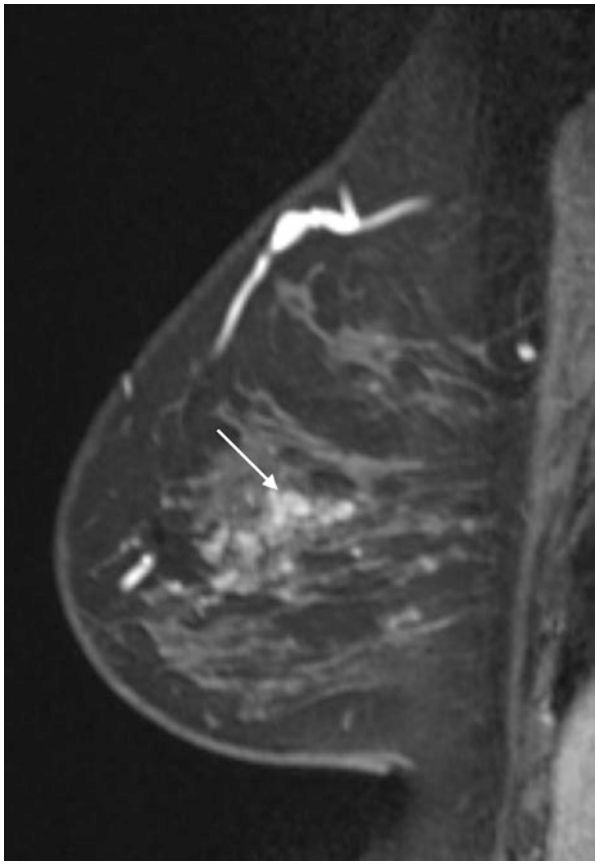

Fig. 12.8 A prelocalisation fat saturated contrast enhanced sagittal image demonstrates the lesion persists (*arrow*) and therefore a MRI biopsy was performed

beneath the grid surface simultaneously so that access to both sites can be obtained without the need to reposition. In succession, both lesions are localised, anesthetized and then introducer stylets inserted prior to biopsies. If multiple lesions within a single breast cannot be positioned at the same time (or indeed there are bilateral lesions), then the more suspicious lesion is sampled first and sampling at this site completed (including marker deployment). If washout does occur because of the time elapsed between the gadolinium injection and biopsy at the second site, then landmarks may be adequate to guide the procedure.

12.4 Pitfalls and Limitations

Unfortunately despite the latest MRI technical developments there is a procedural failure rate. This rather varies in the literature as to the frequency but may be up to 25 % [40–44]. This will occur most commonly due to either non visualisation of the target lesion or an inaccessible target area. The target may not be seen because it has

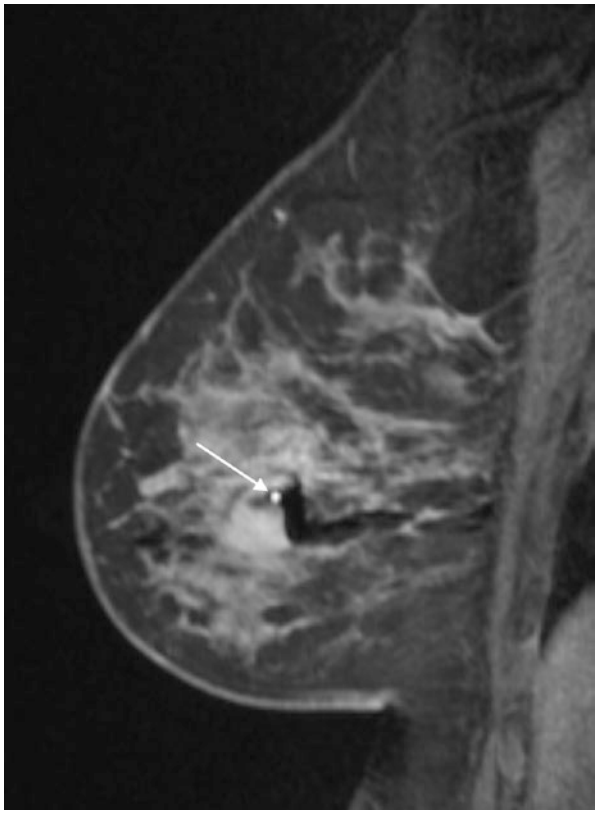

Fig. 12.9 A mid biopsy contrast enhanced sagittal image showing the needle within the target lesion (*arrow*). Biopsy related hematoma is demonstrated as signal dropout (*black* areas around the needle)

disappeared due to excessive compression. In this situation a further image could be performed with less breast compression. Alternatively the initial MRI may have been performed at the wrong time of the menstrual cycle and as such the target is no longer identifiable. This masking effect is more common in smaller sized targets (<5 mm), and where background enhancement may also obscure the area [40, 45]. If indeed the target demonstrates a clear decrease in size at the time of the procedure compared to the original MRI scan then that is an indication not to perform the biopsy.

Motion artefacts can also cause false positive findings on MRI in particular on subtraction images of the T1-weighted contrast enhanced series, where they result in hyperintense findings that could be interpreted as lesions of increased contrast enhancement. To avoid these false positives, the unsubtracted series should also be evaluated [17, 28]. Overly forceful breast compression may result in reduced contrast enhancement. If there is suspicion of this, then a repeat MRI with less breast compression would be recommended. Alternatively a delayed MRI sequence may sometimes be valuable in demonstrating the target even if the early subtraction views do not [33, 46].

Benign contrast uptake in premenopausal patients that are examined at a time other than during the second week of their menstrual cycle may increase the false

positivity by 17 % [12]. If a hormonal cause for the contrast enhancement in the target lesion is suspected, an alternative approach would be to perform a follow up MRI examination [47, 48]. The malignancy rate of lesions that are not visible on a subsequent interventional MRI is low. A rate of 2 % has been reported relatively recently [22]. When lesions are no longer visible at the time of the procedure, a follow-up examination tuned to the menstrual cycle in a premenopausal woman may be performed, ideally at a 6-month interval [49]. It is more difficult to do this in patients undergoing MRI for local staging of a known breast carcinoma, as a delayed scan would undoubtedly interfere with their treatment pathway.

Superficial lesions and lesions near the nipple may be in a difficult location for biopsy. Also lesions that are far posterior in the breast near the chest wall or very lateral in the axillary tail may be inaccessible despite the best attempts at positioning. Placing the patient in the prone oblique position may allow access to the axillary tail and posterior breast tissue [36]. Lesions located posteromedially may sometimes be accessed by placing the affected breast in a contralateral coil. Minimizing padding on the coil may also be useful to reduce elevation of posterior breast tissue in certain situations [49].

Some breasts are too thin to accommodate the sampling aperture, even with the use of the reverse compression paddle. An alternative approach in these patients is an MRI guided needle localization followed by surgical excision.

The morbidity of MRI-guided vacuum-assisted biopsy is low [29, 37, 43, 50]. This is a similar rate to stereotactic procedures though higher than for ultrasound guided biopsies [51]. The most common complication is a hematoma and although generally minor, 10 % of procedures, however, have to be stopped because of adverse effects [29, 37, 52]. Bleeding requiring surgery only occurs in less than 1 % of procedures [29, 37]. Lack of significant breast compression during a sometimes prolonged procedure makes this more likely than with an ultrasound guided biopsy. In the largest multicenter study published to date, Perlet et al. [41] reported that complications occurred in only 17 of 538 (3 %) MRI-VABs using an 11G needle. Specifically, these cases involved five vasovagal reactions, one infected hematoma, six large hematomas (>3 cm) and five cases of significant bleeding during the intervention, two of which required surgical hemostasis. A more recent study involving 389 MRI-VABs using 9G and 10G needles [28] reports an even lower complication rate of 1 % (n = 4) [53].

12.5 Accuracy

Overall, MRI guided biopsy has a technical success rate of over 96 % in the larger studies regardless of lesion size and needle size [52, 54]. The malignancy rate varies widely (between 18 and 61 %) with a mean of 28 %, and this likely reflects patient cohort and local MRI evaluation variations across the world. The incidence of benign lesions exhibits a similar range of 18–70 %, with a mean of 62 %. Concordance between imaging and histopathology is as an essential component of

MRI-guided biopsies as it is with other image guided methods. Lee et al. found 7 % of MRI-guided vacuum-assisted biopsy results to be discordant, and of the discordant lesions that were surgically removed, malignancy was identified in 30 % [55]. This demonstrates the importance of imaging pathological correlation and implies a small but significant number of false negative MRI-guided biopsies although seemingly considerably higher than from breast biopsies on other imaging targeting methods. This elevated false negative rate on MRI biopsy likely relates to sampling not performed under real-time direct visualization and that lesion targeting cannot be as easily verified [56]. It may in part relate to the small size of many of the target lesions that are seen on MRI but are occult on all other imaging modalities. Another issue is patient cohort in that patients undergoing breast MRI and then subsequent MRI biopsy generally have a significantly higher prior probability of malignancy. Histology may show a specific concordant benign diagnosis such as lymph gland or fibroadenoma and no further action may be needed. Alternatively a follow up diagnostic MRI could be performed at 6 months particularly where no definitive concordant pathological diagnosis is obtained (for instance normal breast tissue). Lesions that are sufficiently suspicious on the diagnostic imaging can still be recommended for surgical excision if it is believed that there is lack of histological concordance.

Undersampling as with other image guided biopsies can occur with subsequent cancer found at surgery. In a study of 557 MRI guided biopsies, there was an increased upgrade rate after histological analysis of open surgical excision compared to stereotaxis and ultrasound guidance. The number of false negatives was 3 %, 1 % and 0.4 VAB procedures, respectively. Benign and high-risk lesions were also upgraded at a significantly higher rate after open surgical excision for the MRI-guided procedure than was the case for the other modalities [51]. A further recent retrospective review of 147 high risk lesions sampled at MRI guided 9G vacuum biopsy showed 20.4 % (n = 30) were upgraded at subsequent surgery. The upgrade rate was highest for atypical ductal hyperplasia, lobular carcinoma in situ, and radial scar. No imaging features were predictive of upgrade but this was significantly higher for women with a personal cancer history than for other indications combined ($p = 0.0114$) [57].

MRI guided wire localisation is very infrequently performed. The reasons for this are simple. Lesions that are identifiable only by breast MRI will invariably have been sampled by MRI guided biopsy and as has been discussed, a marker clip is deployed at the termination of this procedure and subsequently checked mammographically. Thus if the patient has an unfavourable histology from the biopsy and subsequently requires surgery, then the target can in all likelihood be localised at the very least by stereotaxis or mammographic guidance or may be even by ultrasound (if the clip is correctly sited and is identifiable on ultrasound). On the rare occasions that a patient has a suspicious MRI abnormality and has a specific contraindication to biopsy (or indeed refuses biopsy) then an MRI wire localisation may be required. Additionally an MRI guided bracketing wire localisation of a large target may better define the target volume in cases of extensive disease seen mainly on MRI but less well on mammography and sonographically (commonly invasive lobular breast cancer in women with relatively high breast density). In a similar way to performing an

MRI biopsy, the patient is consented, positioned and an MRI exam performed. The lesion is localised and local anesthesia is administered. A smaller volume is required as the needle guide for most wires are only 18–19.5G. An MRI compatible needle and wire are then inserted through the introducer and prior to deployment of the wire itself and removal of the needle, a check sequence is performed in order to verify position of the wire tip [58–60]. Following this the needle guide is repositioned (or removed if the wire tip location is optimal). The patient will then have the wire carefully secured and bandaged in order to prevent displacement prior to heading to surgery. In practice this procedure may be more easy to perform than an MRI guided biopsy and most certainly is often of shorter duration. Historically units that were just embarking on a breast MRI biopsy service commenced by performing these in a few cases, although nowadays breast MRI biopsy experience is far more widespread that new units should be able to get adequate exposure and thus commence a full MRI biopsy without performing localisations first. Due to the infrequent nature of these localisation procedures there is relatively little published data on their outcomes, although complication rates and accuracy appear similar to other modalities [58–60].

12.6 Conclusion

Suspicious breast lesions detectable only by MRI require an MRI-guided vacuum assisted breast biopsy. As well as clarifying that the other standard image-guided methods do not demonstrate the target, presence of a false positive abnormality should be excluded. A follow-up MRI typically at six months will be required in most cases where the procedure fails to identify the target seen on the original diagnostic MRI. For premenopausal women the procedure as well as any follow-up exams should optimally be scheduled during the second week of the menstrual cycle. MRI guided biopsy is a very safe procedure with a low complication rate and MRI guided wire localisation with subsequent surgical biopsy should be used only in rare cases. In the future, tools such as spectroscopy, newer software developments and higher magnetic strength fields may increase the specificity of MRI allowing better target selection for biopsy as well as possibly the detection of post-biopsy residual tumor. Breast MRI guided biopsy is an important skill for the breast radiologist in units with a significant breast MRI workload and will allow more optimal management of their patients.

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