Ultrasound-Guided Percutaneous Breast Biopsy

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Ultrasound-guided percutaneous tissue sampling of the breast has positively altered the management of breast lesions, both benign and malignant, since its inception in the 1980s and subsequent widespread acceptance in the 1990s. Its safety, accuracy, and cost-effectiveness have been validated in several studies. However, percutaneous biopsy serves a patient best when performed by an operator with full awareness of patient’s salient imaging findings; a knowledge of the benefits, limitations, and technical requirements of breast ultrasound; and a thorough understanding of what constitutes an adequate and concordant pathologic specimen.

This article outlines a general approach to ultrasound (US)-guided percutaneous breast biopsy and discusses indications, potential complications, and technical aspects of the procedure.

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Imaging-Guided Percutaneous Biopsy

Approximately 1.6 million people in the United States require tissue acquisition for definitive diagnosis of a breast problem each year, detected either by imaging or clinically. Any biopsy technique that minimizes patient discomfort, morbidity, time away from routine duties, postbiopsy scarring and deformity, and cost would be the preferred method of tissue retrieval. This demands, of course, that the technique has a comparable record of accuracy and safety when stacked up against other biopsy methods (ie, surgical excision). Imaging-guided percutaneous tissue sampling provides such a technique. Most breast biopsies performed each year (approximately 80%) are benign. Confidence in a benign, concordant imaging-guided needle biopsy averts unnecessary surgery. Parker et al1 showed an overall 1.5% false-negative rate for percutaneous biopsy, indicating that confidence in a negative biopsy result is warranted. Several authors have also confirmed the accuracy of a malignant biopsy result, with excellent histologic agreement between percutaneous core needle biopsy (CNBx) results and the excised specimen. The accuracy specific to US guidance for biopsy is supported in the literature.2,3 Histologic underestimates with core biopsy do occur; however, if disciplined and assiduous radiologic-pathologic correlation is performed, with recommendation for excision of lesions known to be prone to upgrade (eg, atypical ductal hyperplasia), accuracy comparable to surgical excision can be achieved. Actually, CNBx has been shown to have a smaller “missed lesion” rate compared with surgical excision of nonpalpable lesions (1.1% for CNBx vs 2.6% for surgery).4,5

The safety of image-guided breast biopsies has been confirmed, as well. Parker et al1 showed a 0.2% rate of clinically significant complications (defined as those that necessitated medical or surgical intervention) in a large multi-institutional population of patients (3765 cases) using both stereotactic and US guidance. The cost-effectiveness of percutaneous breast biopsy provides an additional impetus for its use. This occurs in large part by eliminating the need for surgery if benign, concordant results are returned, resulting in large savings in most cases.6 However, cost savings are also realized when core biopsy shows malignant results. A patient whose cancer is diagnosed via percutaneous biopsy can expect to undergo fewer surgeries compared with those whose cancer is diagnosed with surgical open biopsy (average of 1.25 surgeries vs 2.01).7 Owing to its confirmed safety, accuracy, and cost-effectiveness, CNBx is the first-line tool for histologic confirmation of a breast abnormality.

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US-Guided Percutaneous Biopsy

US-guided CNBx offers many advantages over other available methods of imaging-guided tissue retrieval (stereotactic and magnetic resonance imaging [MRI] guidance). For a patient, it allows comfortable supine positioning. Real-time confirmation of sampling accuracy is possible. It is relatively quick in terms of room time and physician requirement. No ionizing radiation is used (as opposed to stereotactic procedures). There are no modality-based contraindications (as compared with MRI and occasionally, stereotactic guidance). Therefore, when a suspicious lesion for which biopsy is warranted can be confidently visualized at US, and its location is reconciled with other imaging techniques, sonographic guidance is the chosen technique. If multiple suspicious findings are present, biopsy of as many targets as needed to outline the full extent of malignant disease and direct appropriate future management should be carried out. For example, if 4 small suspicious masses are present in 1 breast, core of at least 2 of these should be performed, preferably those lying at the greatest distance from each other, to fully establish extent of disease and help determine the need for mastectomy vs breast-conserving surgery.

If suspicious axillary, supraclavicular or infraclavicular, or internal mammary chain lymph nodes have been identified during diagnostic workup in a patient with a suspicious breast finding, these too can be targeted for biopsy, with the understanding that a positive result confirms nodal spread but that a negative result by no means excludes nodal metastases. Suspicious calcifications are usually biopsied with stereotactic guidance. However, with the high-frequency transducers in use today, calcifications can often be confidently identified sonographically, and targeted for core biopsy. This is especially true if there is an associated mass, in which case, biopsy with US rather than stereotactic guidance may actually facilitate sampling of the highest-stage portion of the lesion (eg, invasive tumor rather than just ductal carcinoma in situ, DCIS). Specimen radiography should be obtained in cases where calcifications are expected to be part of the lesion.

If US guidance is being used to biopsy a lesion initially identified by another modality (eg, mammography, MRI, or positron emission tomography), caution must be taken to ensure that the sonographic lesion represents the finding seen on the other imaging technique. This requires a good working knowledge of all other breast imaging modalities, the ability to translate expected lesion position from one modality to another, meticulous radiologic-pathologic correlation when the results are returned, and knowledge to recognize if rebiopsy is required owing to nonconcordance. Identifying surrogate sonographic targets for findings seen with other modalities, especially MRI, can be challenging. If there is any question as to whether an accurate correlate has been chosen, biopsy should proceed guided by the modality that originally detected the lesion. Image-guided biopsies, in general, are best performed by a physician with the aforementioned knowledge and skill set, who, in most cases, is a radiologist or an interventionalist or surgeon working closely with one.

Equipment

High-quality scanning technique and image recording is requisite for accurate US-guided biopsy. According to the American College of Radiology Practice Guidelines, a high-resolution (center frequency at least 10 MHz) linear-array transducer should be used during performance of imaging and biopsy. Once a target for biopsy is identified, notation should be made on the images and in the written report regarding the size (maximal dimension in at least 2 orthogonal planes), location (including side, position in the breast, using the “o’clock” method, and distance in centimeters that the target lies from the nipple), and transducer orientation. This information is vital because the biopsy procedure is often performed on a different day from the workup or by a different examiner. Providing specific detail about the location of the lesion would allow even subtle findings to be reidentified accurately.

The variety of available needles has increased significantly since Parker described the efficacy of the 14-gauge automated biopsy gun in 1993. However, that needle remains a reliable device. Models are now available from many different vendors. Automated biopsy needles come in a variety of gauges, sampling notch lengths, and overall needle lengths. Most commonly used is a 14-gauge needle with a 22-mm throw. The literature supports use of a 14-gauge or larger needle, a longer throw (22 vs 11 mm), and an automated device over a nonautomated cutting needle.

Knowledge of the “throw” or length of automated travel of the selected device is vital to prevent inadvertent puncture of adjacent tissue. Although the use of a “short throw” device (11 vs 22 mm) is tempting in close anatomical quarters, the volume of tissue obtained is greatly diminished, usually by more than 50%, owing to the lesser degree of needle deflection and tissue entrapment. If the needle approach is planned carefully, the safe deployment of a long-throw device can almost always be assured. In general, 3-6 core samples should be obtained. Fragmented cores or those that float rather than sink in preservative should be viewed as potentially nondiagnostic.

More recently, the use of vacuum-assisted devices, the device of choice for stereotactic and MRI core biopsies, has become accepted for use with US, with hand-held versions available. These systems may require the use of an external vacuum or the vacuum may be self-contained. The external-vacuum systems have been used most extensively. Each system varies in its mechanism of action, but in general, the needle or probe is placed along the deep margin of the lesion in the closed position. On sampling, the vacuum pulls tissue into the notch and the inner cutting cannula transects the tissue. This core is then delivered retrograde for retrieval, either by an assistant using forceps or into a closed chamber for later collection, depending on the device. As opposed to the spring-loaded devices, these vacuum-assisted devices allow multiple contiguous samples to be taken during a single needle insertion, as the tissue is delivered externally while the needle remains positioned for added cores. This biopsy method results in larger core samples.
A commercially available mechanical rotating cryo-assisted stick freeze needle has several unique features. A 19-gauge guiding needle is advanced under US guidance through the breast into the target lesion. A carbon dioxide cartridge then initiates a freezing process whereby the 19-gauge guiding needle becomes frozen to the lesion before sampling. Once the stick freeze cycle ends, a mechanical rotating 10- or 12-gauge cutting needle advances over the guiding needle yielding a circumferential 10- or 12-gauge 2-cm long core specimen. The advantages of this device and its 19-gauge guiding needle are access to very dense lesions, lesions near the chest wall, axillary lesions, and precise targeting to avoid vascular structures while obtaining a larger gauge circumferential core specimen. A disadvantage compared with other large gauge vacuum devices is the requirement to withdraw the needle after each pass to obtain samples. A coaxial introducer trocar can be used if desired to maintain access to the target area between sampling.

The choice of needles or probes is an individual one. The automated biopsy needles are relatively inexpensive, light and easy to maneuver, require no significant capital expenditure for associated equipment (external vacuum), and are time tested. The vacuum-assisted devices allow tissue retrieval quickly and contiguously and deliver larger samples, perhaps requiring fewer cores. Although the advantage of larger samples has been demonstrated no significant difference between the 2 mechanisms of biopsy in terms of missed cancers, insufficiency, or histologic underestimation.13 However, other authors have shown a smaller rate of histologic underestimation with vacuum-assisted devices, at least for atypical ductal hyperplasia.14

**Biopsy Procedure**

**Prebiopsy Considerations**

Written informed consent is required before the procedure. The consent should specifically mention the possibility of bleeding, infection, pneumothorax, allergic reaction to administered medications, and if appropriate, implant rupture as potential complications of the procedure. In addition, a patient should be fully informed about the benefits of the biopsy (eg, obviate surgery in the face of benign-specific results and preoperative verification of malignancy, allowing definitive surgical therapy in one setting) as well as the potential drawbacks (possible need for rebiopsy or excision in the face of nonspecific, insufficient, or discordant pathology results). She should be told about the use of a marking clip. For Joint Commission on Accreditation of Healthcare Organization–accredited facilities, compliance with Universal Protocol (to prevent wrong site, wrong procedure, or wrong person mishaps) is mandated. This requires completion of a “time-out” just prior to the start of the procedure to verify the identity of the patient, the side or site of the biopsy, and the procedure to be performed in the presence of the procedural team and the patient, all of whom must participate and be in agreement (see Joint Commission on Accreditation of Healthcare Organization policy for more detail—www.jointcommission.org). This process should be formally documented. The patient should be questioned directly by the physician about any allergies (including latex) as well as her medication history, particularly her anticoagulation and bleeding diathesis status. Although biopsy can be pursued even in the face of anticoagulation (see discussion under Contraindications section), knowledge of her coagulation status may alter postprocedure care (eg, longer compression time).

The patient is subsequently placed in optimal position. For lesions in the outer, upper, and lower breast, this would likely be in oblique supine position, turned slightly to the opposite side so that the breast falls gently toward medial, with the ipsilateral arm raised overhead (Fig. 1). This decreases the tissue depth of the breast and firms up the skin surface, allowing easier needle penetration. For medial lesions, the patient can either lie supine or be obliqued slightly toward the side of the lesion, with the physician on his or her opposite side. In some small-breasted women, or in males, adjustment may be needed to augment the breast thickness to allow safe biopsy. For example, with lateral lesions in a small breast, the patient’s arm may be left at his or her side and used to mound up tissue or he or she may be obliqued laterally rather than medially. For medial lesions, a similar bolstering technique can be used with the arm, or the patient may be rolled medially so that more tissue falls toward the biopsy quadrant (Fig. 2). Some practitioners prefer to hold both the biopsy device and the transducer themselves, whereas other physicians prefer to have a technologist or other person scan while they manipulate the needle. Both choices require practice at keeping the transducer aligned at the skin entry site, such that the long axis of the transducer face is aligned with the needle trajectory, to

![Figure 1 For lesions in the lateral, superior, or inferior breast, the patient is optimally positioned in the supine oblique position, with arm extended above the head.](image-url)
ensure the continued ability to visualize the entire shaft of the needle during biopsy (Fig. 3).

Once the lesion is identified and the expected needle route is defined, the sterile portion of the procedure can commence. The transducer may be covered with a sterile probe cover. The physician can “glove up” and cleanse the biopsy site with antiseptic solution. Several solutions and preparations are available, but there is evidence to suggest that chlorhexidine-based solutions provide better antisepsis than iodine-based solutions.15

For most percutaneous breast biopsies, local anesthesia would suffice. Sodium bicarbonate (8.4%), when admixed with lidocaine in a dose of 9:1 parts lidocaine:bicarbonate, is very effective in correcting for the acidic nature of the agent, and thus minimizing the sting of the injection. The local anesthetic agent can be applied along the entire expected route of the needle. It should be used most liberally at the needle entry site and around the accessible margin of the biopsy target, as these represent the sites of greatest pain, especially if the target is a cancer. Some practitioners favor the addition of epinephrine 1:100,000 to 1:200,000 to the deeper local anesthetic agent to prolong the duration of numbing and to aid in perilesion hemostasis, related to its vasoconstrictive properties. If used, a waiting period of approximately 5 minutes after injection would maximize its effectiveness. The patient may experience a sense of anxiety or the onset of temporary palpitations with its use, however, and should be warned ahead of time about this possibility.

The exact injection site would occur along an imaginary line paralleling the long axis of the transducer, at a variable distance from the transducer, depending on the angle of approach to be taken. If a relatively steep angle of approach is expected, or for superficial targets, the site would be close to the transducer. As a more parallel-to-chest wall approach is sought, the chosen entry site would move away from the transducer (Fig. 4). As anesthetic is injected, the anesthetic needle position and course can be imaged in real time, allowing confirmation that an appropriate approach has been selected. If not, either the entry site can be modified or compensatory techniques can be anticipated once the biopsy needle is placed. After local anesthesia is delivered, the biopsy needle or device can be placed. Depending on the device being used, a dermatotomy can be performed with a scalpel. In general, these small (3-5 mm) skin nicks heal completely and are helpful in allowing unimpeded needle motion. The choice of whether to use a coaxial system depends in part on personal choice and the needle system selected. Introducers allow easier reintroduction of the needle when using a device that requires needle removal for core retrieval. The introducer remains pointed at the biopsy site and the needle can be quickly replaced without the need for significant retargeting. However, with each pass, a small amount of air is introduced with the needle, sometimes resulting in significant ring-down artifact, obscuring or partially obscuring the needle (Fig. 5). Slight parallel shifting of needle position can usually correct this.

Continuous real-time scanning should be performed during needle or introducer placement. Attempts should be made to identify the needle as soon as it enters the...
breast. It is imperative to know where the tip of the needle is at all times, thereby precluding the possibility of inadvertent puncture of an unintended structure (ie, the chest wall). If the transducer and the needle maintain the same longitudinal axis, complete needle visualization is ensured. With a spring-loaded device, the needle or introducer is advanced until it reaches the edge of biopsy target. The operator should determine that there is adequate tissue beyond the lesion along the needle trajectory to ensure safe firing, especially if the needle path is angled to the posterior aspect of the breast. An image should be obtained at this point to document accurate prefire placement (Fig. 6A). Once the needle is pointed at the lesion, and is visualized in its entirety, the needle can be fired into the target for the first pass. An image should be taken of the needle traversing the lesion on this and all subsequent passes (Fig. 6B). Annotation may be made on the image, numbering the individual passes for documentation. If a vacuum-assisted device is used, the probe should be positioned along the posterior-

**Figure 4** For superficial lesions or those with a large buffer of tissue between lesion and chest wall, needle entry site can lie close to transducer and a relatively vertical needle path pursued (A). However, for more posterior lesions, the expected needle trajectory must be considered while planning entry site and needle angulation, to avoid inadvertent puncture of chest wall (B). If unsafe trajectory is suspected, skin puncture site should be migrated away from the transducer to allow a parallel approach (C).

**Figure 5** Although there are advantages to using a coaxial system during biopsy, 1 disadvantage is the introduction of air along the needle path (arrows) as the needle is removed and replaced between passes, which can obscure portions of the introducer.
Once the sampling notch is exposed, care should be taken to ensure that the lesion in question lies within the confines of the notch; when it does, sampling may commence. Attention should be paid to the quality of cores being obtained and the appearance of the lesion. If a spring-loaded or hybrid device is being used (where specimens are visualized between passes), the following situations should be assessed: Are the cores sinking rather than floating in preservative? Are they intact and firm rather than fragmented? Can air tracts be seen within the lesion between passes, confirming needle entry (Fig. 7)? For vacuum-assisted devices, if the target lies in the notch at the start of sampling, high-quality samples can be safely assumed. However, seeing that the lesion is getting smaller as sampling progresses provides added confidence.

Once the operator is confident that adequate tissue has been retrieved, a marking clip should be placed directly in the lesion. All clips are radiopaque on mammography and cause a small signal void on breast MRI. A postprocedure mammogram performed in orthogonal (craniocaudal and true lateral) projections confirms clip deployment and its accurate position. Some practitioners question whether a clip needs to be placed in all cases. Clip placement allows confirmation that the lesion that underwent biopsy was, indeed, the intended target, assuming it was detected mammographically initially. It assures that the lesion can be localized if surgical excision is mandated. Many patients with breast cancer now undergo neoadjuvant chemotherapy before surgical treatment. The presence of a clip ensures that a target for excision remains visible, even if the patient has a complete imaging response to therapy. Even in the case of a benign core biopsy result, the presence of a clip can assure future imagers that that particular site has been previously subjected to biopsy and may negate the need for additional workup or intervention. The intention to leave a clip should be included in the informed consent process. On occasion, clip migration occurs, either owing to inaccurate initial deployment or related to hematoma formation, and may cause confusion about the actual lesion location. Postprocedure mammograms should be closely correlated to prebiopsy films, assuming that the target was seen mammographically. If the clip lies remote from its target, another should be placed accurately, preferably using a different clip type or shape.

Some lesions require a special approach. Deep lesions may be difficult to reach, especially if they lie near the chest wall. A remote skin entry site can be used to allow a horizontal needle or introducer path, but this requires traversing a large distance of tissue, and may be limited by device length. Another approach is to use a standard entry site, which involves initially aiming the needle at a steep angle toward the lesion, and then as the needle nears the target, torquing the needle or introducer angle such that it approaches a horizontal position (Fig. 8). Targets that lie directly on the pectoralis muscle or on an implant may be

Figure 6 Spring-loaded needle. (A) In the prefire position, needle tip (arrowhead) should be placed at the margin of most lesions (arrow), with needle parallel or near parallel to chest wall. (B) Postfire images should be documented and should definitively outline the needle traversing the lesion (arrow). The tip of the needle may lie beyond the lesion margin in some cases, depending on the size of the target (arrowhead).

Figure 7 Hyperechoic lines (arrows) seen in mass after needle has been removed represent air tracts and confirm that the lesion was successfully traversed.
Elevated away from those structures by instilling a volume of local anesthetic or sterile saline under them, thereby creating a safety zone. This technique can be used with very superficial lesions as well, especially when a vacuum-assisted device is being used and there is concern for inadvertent skin sampling. Fluid is instilled between the lesion and the overlying skin. When the location of the lesion requires a steep approach angle, the needle may be difficult to outline sonographically, given the angle of incidence of the acoustical beam. This can be corrected by either altering the needle angle or by angling the transducer face so that the perpendicular orientation of the acoustic beam and the needle shaft is re-established to as great a degree as possible (Fig. 9). On occasion, the degree of breast density prevents needle egress. The use of an introducer can overcome this problem. The introducer is advanced as far as possible. The automated gun is placed via the introducer and fired into the dense tissue in the direction of the lesion, and the introducer then slid over it, similar to a Seldinger technique. The introducer would thus have been advanced the length of the needle throw. This process can be repeated until the introducer has reached the actual biopsy target. The mechanically rotating cryo-assisted needle, with its 19-gauge guiding tip, may also be helpful in dense breast tissue or for lesions near the chest wall.

When biopsying small targets with an automated system, it should be remembered that only a portion of the "thrown" needle represents the sampling notch and that it is possible that if the needle tip has been placed directly at the edge of the lesion in prefire position, the notch may actually lie beyond the lesion when fired, leaving the actual lesion unsampled. In these cases, multiple passes should be made with the needle positioned proximal to the lesion so that it can confidently be expected to lie in the notch when the needle is deployed (Fig. 10). With large lesions, it is a good idea to vary the needle position during the biopsy to ensure that the various components of the lesion have been sampled. If a mass appears necrotic, cores from the periphery of the lesion must be obtained to ensure that viable tissue is obtained.

After Biopsy

After the biopsy device has been removed, pressure can be applied manually to the breast by the physician, technologist, or assistant for several minutes. For most patients, 5-10 minutes would suffice; if the patient is anticoagulated, longer and firmer compression is required, sometimes up to 20 minutes. Once hemostasis has been achieved, a sterile dressing can be applied to the wound. The patient is instructed in postprocedure wound care, informed about what events are normal postbiopsy sequelae (minor pain...
and bruising) and what constitute cause for concern (signs of infection, an expanding hematoma, and shortness of breath). The patient should be told what to do in case of a problem and given contact numbers. All these instructions should be given to the patient in written form. In addition, the patient should be informed about when and from whom he or she would receive her biopsy results.

The obtained core samples should be placed in preservative. Although a technologist or assistant may aid in packaging the specimen for transport and delivery to pathology, it is ultimately the responsibility of the practitioner to ensure that the specimen container is accurately labeled and that a pathology requisition form is filled out with appropriate history and the specifics of the specimen source. If the patient has had biopsy from more than 1 site, the specimens should be specifically labeled as to the location of the respective biopsy sites (eg, Specimen 1: left breast, 2:00, 3 cm/nipple; Specimen 2: left breast 4:00, 5 cm/nipple). When calcifications are expected or known to be a component of the lesion, the pathologist should be cued to search for them via specific instructions on the pathology request. If the patient has prior radiation therapy to the affected breast, that information should be noted on the requisition, as postradiation atypia may prove difficult to differentiate from ductal carcinoma in situ or other atypia, but obviously has markedly different management implications. Similarly, if the patient has been undergoing neoadjuvant chemotherapy, this should be noted on the pathology request.

A written permanent procedure report should be constructed that outlines the type, side, and location of each biopsy target; the type of device used; the number of samples obtained; whether a marking clip was placed; the location of the clip relative to the target; if a postprocedure mammogram was obtained; and any complications that were encountered during the procedure. This report should subsequently be amended when the pathology results are returned, with concordance or discordance noted, and further appropriate management or follow-up recommendations outlined. When the pathology results are returned, the case should be reviewed in its entirety, including all recent imaging performed. Concordance between the initial imaging findings and the final pathology results can be assessed. If discordant results are returned, arrangements should be made for additional tissue sampling, either by repeat image-guided biopsy or by excision. In addition, the physician can make sure that additional areas do not now require further intervention, based on the newly available pathologic information. For example, if a malignancy is confirmed, consideration may be now given to pursuing biopsy of another area previously deemed a BI-RADS 3 lesion. A well-defined policy should be in place outlining how the patient will be informed of his or her results. The policy must ensure that all patients would be contacted, and this is best achieved when the physician (or delegate) performing the biopsy takes responsibility for the task.

**Contraindications and Complications**

Few contraindications to US-guided CNBx exist. Biopsy should not be performed on a patient who does not intend to seek treatment if a cancer is diagnosed, owing to comorbid conditions or other reasons. Anticoagulation has traditionally been considered a relative contraindication for core biopsy, with the patient asked to cease therapy before biopsy, if possible. However, recent literature suggests no significant difference in the hematoma rate between anticoagulated and nonanticoagulated patients (on either warfarin or non-steroidal anti-inflammatory products). In implant patients, if rupture appears unavoidable, core biopsy should be avoided; however, with careful planning, this should be a rare situation. The potential for implant rupture should be clearly delineated to the patient during the consenting process.

Complications during US-guided core biopsy are relatively rare, but potentially include the following: hematoma formation, infection, pneumothorax, allergic reaction, and vagal reaction. A small amount of bleeding is not unusual during core biopsy, but occasionally, needle transection of a vessel can result in more profuse bleeding. This is not a life-threatening event but can result in large hematoma formation. The ultimate size of the hematoma can be minimized by firm compression over the area at the end of the procedure, to include the segment of breast from needle entry site to lesion. If a spring-loaded needle is being used, transducer pressure can be applied between passes to staunch potential bleeding. If it occurs early in the procedure, or is arterial in origin, the bleeding can result in target obscuration. When it is apparent that this is occurring as real-time scanning proceeds, the transducer should be maintained over the target and a clip placed as quickly and accurately as possible so the lesion can be identified for rebiopsy or excision, if needed.

If sterile technique is maintained, infection should be rare. Using some needle setups (eg, reusable needle holders), the procedure becomes “clean” rather than “sterile”; however, if sterility of the needle and skin is maintained, the expectation of a germ-free environment can be achieved.

Vagal reactions (bradycardia with hypotension) are not uncommon during breast procedures, but occur relatively less often during US-guided core biopsy, in part owing to the patient’s supine positioning for the procedure. Most vagal reactions respond immediately to simple conservative treatment: elevation of the patient’s feet or placement in Trendelenburg position, squeezing of calf muscles to restore blood return to head, application of a cool cloth to the neck or the forehead, and calm reassurance. Oxygen may be administered but is rarely required. If the patient does not respond to these conservative measures, an IV may be started and consideration given to pharmacologic support (atropine). Allergic or anaphylactoid reactions must be recognized and treated promptly. In the rare case of a suspected pneumothorax, a chest X-ray can be obtained and further treatment as needed pursued.
Percutaneous breast biopsy

Fine-Needle Aspiration Biopsy

The aforementioned discussions have centered around the use of large core biopsy devices to retrieve tissue via imaging guidance. Another method of obtaining material involves the use of the fine-needle aspiration biopsy (FNAB) technique to obtain cytologic (rather than histologic) material. Although still used at some centers, its use has waned as core and vacuum-assisted devices have been introduced. Dujem et al report that over the course of their observation from 1995-2005, the percentage of malignant cases diagnosed preoperatively by way of FNAB decreased from 91.3%-14.5%, whereas those diagnosed by core biopsy (either using US or stereotactic guidance) increased from 8.7%-86.5%. One reason for this includes the relatively high rate of insufficiency noted with FNAB technique. The results of a multicenter trial assessing the diagnostic accuracy of imaging-guided FNAB directed at nonpalpable breast lesions, conducted by the Radiologic Diagnostic Oncology Group V, demonstrated a 35.4% insufficiency rate. In addition, a 12% false-negative rate for FNAB would have occurred if it had been relied on as proof of diagnosis. Other potential shortcomings involve the inability to differentiate between invasive and noninvasive cancers, and lack of sufficient tissue to define tumor biomarker status. As a result, core breast biopsy is preferred in all cases.

Conclusion

US-guided percutaneous biopsy is a safe, accurate, cost-effective method of establishing the tissue diagnosis of imaging-detected breast abnormalities, thereby either eliminating the need for surgical biopsy when benign pathology is demonstrated or allowing definitive single-stage surgical therapy in most cases, if malignant results are returned. Careful attention to technique and radiologic-pathologic concordance is required, best ensured when performed by a physician well versed in multimodality image interpretation.

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