The Case for Pathologist Ultrasound-guided Fine-Needle Aspiration Biopsy

John S. Abele, MD

1 Fine Needle Biopsy Clinic, Outpatient Pathology Associates, Sacramento, California.
2 Department of Pathology, University of California at San Francisco, San Francisco, California.

One of the questions considered at the “National Cancer Institute (NCI) Thyroid Fine Needle Aspiration State of the Science Conference” held October 22 through 23, 2007, is whether ultrasound guidance should be used during the fine-needle aspiration (FNA) biopsy of a thyroid nodule.1 I would like to make the case that the answer to the question of ultrasound-guided FNA (USGFNA) is “absolutely yes,” if the pathologist has a strong clinical interest and desire to improve his patients’ care.

This answer is given from the point of view of an experienced FNA pathologist who, for a while, resisted ultrasound (US) technology. After all, if, in 20 years of practice, I had consistently obtained seemingly fully diagnostic samples by physical examination and manual FNA sampling, what then could US add? However, after only a few months of using US in my clinic, I quickly came to understand that US imaging does improve patient care. US imaging greatly augments the physical assessment of the thyroid, which often only vaguely reflects the underlying anatomic reality. Moreover, USGFNA allows for precise and selective needle placement during the biopsy.

If a pathologist already has the experience, dexterity, and passion to perform a quality biopsy via traditional methods and to make quality smears,2 then, he or she can easily learn to perform USGFNA on some or all cases. Although formal training is optimal and will be detailed below, the basic technique can be acquired from hands-on training, often provided by the US equipment manufacturer as a condition of sale. Also, many of us who have already incorporated US guidance into our practices will gladly tutor our colleagues in the techniques during visits to the clinic.

In addition, practice US phantoms are wonderfully uncomplaining practice objects on which the pathologist can sharpen his US guidance skills until the motions are automatic. A phantom is a commercially available object constructed of rubber and plastic in the form of a body part, such as a breast, that contains US detectable objects of varying sizes, shapes, and depths. Examples include the Blue Phantom (available at: http://www.bluephantom.com/) and the Ultra/Phonic BP Breast Phantom (available at: http://www.pharminnovations.com). Early in my US self-training, I would come...
to the clinic and spend 15 to 30 minutes just practicing needle placement before seeing my first patient. Dedicated practice on the phantom is 1 of the first and key steps in the acquisition of USGFNA skills.

US has a reputation for being a complex technology, but in reality it is not when it is being used simply to place the needle precisely where the pathologist wishes to place it. Indeed, US is a tool that the pathologist can easily learn and that provides a new dimension to patient care. Any pathologist who routinely performs FNAs can easily incorporate US to augment the care he or she already provides. Contrary to what one might expect, the hardest part of US-directed thyroid FNA is not using the US to obtain the sample; rather, it is the same as that encountered in traditional biopsies: getting the material from the needle onto the slides and creating optimal monolayered smears.

There are similarities and differences between biopsies performed in the traditional manner and those performed using USGFNA. In a traditional biopsy, 1 hand guides the needle or gun while the other hand secures the nodule, using the sense of touch to aim the needle and determine its depth of penetration. With US-guided biopsies, although 1 hand still guides the needle, the other hand manipulates the US probe. In a traditional FNA, the pathologist's eyes are on the physical needle and nodule to estimate where the needle tip is; during USFNAs, the pathologist's eyes are on the actual needle tip, following its movement toward the intended target area via the monitor.

US imaging allows the pathologist to better understand the target in many ways that are not available using a manually directed sampling. Here are just a few examples. A patient may indeed have a palpable "nodule," but, if the US shows only thyroid enlargement without a sonographically definable nodule, no biopsy is needed. Other nodules, such as those in a very posterior location or those occurring in a patient with a thick neck, can present a false physical image (ie, the nodule is not really where one's hands would suggest it is). Still other patients who appear to have a large, single nodule may be found to have 2 or more component nodules on US, the sonographic details of which may lead to better selection. For example, a somewhat larger nodule may not demonstrate increased blood flow on Doppler or any other worrisome US features, whereas a smaller, adjacent nodule may have markedly increased blood flow and microcalcifications, thus enabling the biopsy to be directed toward the smaller but more sonographically worrisome nodule.

The management of a colloid cyst can also be optimized with US evaluation in that one can detect and assess blood flow in a mural nodule, monitor cyst drainage safely using larger (eg, 12-20-gauge) needles, and then, with US guidance, specifically sample a vascular mural nodule or wall of the cyst. In addition, thoroughly draining a large cyst before attempting a biopsy of a mural nodule has 2 advantages. By eliminating the adjacent cystic content, the potential for dilution of the primary solid-phase sampling is diminished. Second, a nodule "stretched" over the surface of the cyst will often appear as a larger, more accessible target once the cyst is drained. None of these options is available when the biopsy is limited to manual methods.

USGFNA allows for a more thorough sampling of a palpable nodule. One of the first realizations encountered when transitioning from manual to US guidance of thyroid FNAs is that the thyroid extends much more posteriorly than one would think. Shortly after introducing USGFNA into my practice, I realized that I had most likely never biopsied any part of the thyroid beyond the level of the carotid. Yet, much of the thyroid and its nodules can lie far more posterior to the level of the carotid. Moreover, US guidance allows for better and more thorough sampling of those portions of a thyroid nodule residing close to the trachea or carotid than would be attempted under manual guidance.

Although the majority of thyroid nodules are painless, a few are painful, sometimes exquisitely so, such as with subacute thyroiditis and certain cysts. Using US, the pathologist can easily direct anesthetic to the surface of the thyroid through which the biopsy needle will pass for greatly improved patient comfort. Quality, comfortable anesthesia can be obtained using the 30-gauge tubex system, which is available through dental supply houses and is thoroughly detailed in the NCI document. Paradoxically, the smaller 30-gauge needle is often easier to observe on US guidance than the standard 25-gauge to 27-gauge needle, presumably because it offers less blurring because of soft tissue distortion.

USGFNA is simply a technologic improvement over traditional manual sampling. Both methods have a final common clinical pathway: the expulsion of the material onto a slide and its monolayered smearing. The experienced FNA pathologist who consults with clinicians regarding their FNA smears knows that the spectrum of smear quality often runs the gamut from poor to fair to excellent. FNA pathologists have an advantage over the clinician in that they critically review the technical character of their smears when examining them under the microscope.
the next day. Most clinicians do not examine the smears they make and thus lack the experience of quality control feedback.

All of this brings up the issue of specialty “turf” and its natural outgrowth, “turf wars.” Fortunately, neither has been an issue for me because I had a well-established private FNA practice with no hospital or large multispecialty physician group affiliation, unlike some of my colleagues, particularly those in academic practices, who have had conflict with other specialties such as radiology, endocrinology, and surgery in the arena of USGFNA. Because I have no personal experience in this intrainstitutional problem, I will leave this subject for others to address.

However, I do have operational experience working in the private practice environment with those same subspecialty groups and believe it appropriate to comment on this issue. In 1 sense it comes down to attitude. I have always believed that there is plenty of room in the marketplace for a quality, service-oriented patient practice. With that in mind, I approached my colleagues in the subspecialty practices, such as radiology, not as competitors, but rather as patient care team members. For example, I have been frustrated many times to read a US report of “a 9 mm smoothly contoured mass in the right breast,” only to find in the FNA examining room that that right breast was quite sizable. Thus, when another radiologist detailed a nodule’s location as “right breast, at the 2:00 location, 5 cm from the nipple,” I immediately telephoned her and complimented her on the very helpful detail of her report, explaining how it helped me in completing my US-directed biopsy examination. She was very grateful and we had a friendly conversation. I suspect that her experience was similar to mine in pathology in that the majority of telephone calls from physicians are error-based or complaint-based, rarely complimentary.

A similar case exists in thyroid biopsies in which one can encounter several similar nodules with a report that notes “abnormal flow in a 10-mm nodule in the left aspect of the thyroid,” only to find in examining the patient that the left thyroid measures 9 cm in length. After explaining to several radiologists that having a more precise localization would save us both time in that I would not need to request the US films, I am receiving more reports describing more precise locations (eg, upper, middle, or lower one-third and even as anterior, middle, and posterior).

Subspecialty physicians, such as surgeons and endocrinologists, are usually not primary care providers. Thus, it would behoove the private practice pathologist to provide a high level of availability to primary care physicians, nurse practitioners, and the physician assistants who serve them so that they come to the pathologist first. In my practice, I seek to always be helpful to all providers in a primary care physician’s office, particularly nurse practitioners and physician assistants who may have experienced discrimination by other physicians who will not communicate with the physician’s “underlings.” By having a service-oriented and respectful attitude toward all in the primary care office, everyone in that office comes to know that he or she can bring a particular issue regarding a FNA biopsy to my attention first and it will receive my full and immediate attention.

A side issue to this approach is to bring that same personal level of service to each patient during his or her clinic visit. A FNA practice can have no better advertisement than that of patients who, having felt they were well treated, return to their primary care physician with grateful praise for the pathologist’s FNA service. Thus, I seek to establish empathetic working relationships with the staff at all levels in the primary care office in arranging a FNA appointment and then returning patients to them who are pleased with our service.

A working relationship with the surgeon or endocrinologist can also be strengthened by focusing on quality patient care. Whenever I deliver a diagnosis that would likely require referral to a consultant physician to a primary care provider, I offer to call that consultant physician on behalf of that primary care provider to expedite the patient’s care. The primary care physician appreciates my saving him having to make that telephone call and the consulting physician appreciates the advanced notification of the patient’s diagnosis and any related problems so that the consultant can consider a treatment strategy.

Actual clinical experience using US imaging can be obtained by simply introducing it in a progressive fashion into one’s existing palpable nodule practice. There is a simple mantra: “Needle high, hub higher” or “Needle low, hub lower.” In other words, if you see the needle reflection on the monitor above the intended target, withdraw the needle a bit and angle the hub higher, which redirects the needle track lower toward the target, and rebiopsy.

The initial learning curve in this setting is quite short, perhaps 20 cases or so. By simply performing a US examination of the thyroid before doing the traditional FNA sampling of palpable thyroid nodules, the pathologist can quickly become familiar with the anatomy of the thyroid and the various echogenic patterns of nodules, and then begin to progressively incorporate USGFNA as his skills improve.
At this point, the question might be reasonably raised as to what are the limits, if any, to the acquisition of cellular and tissue materials from the patient. Some limits are obvious and simply decrease with time and experience, such as being able to sample ever smaller nodules and those nodules located in ever more difficult anatomic positions as one’s basic US skill set improves. After approximately 6 months to 1 year, the practical limiting factor is more the ability to observe a nodule sonographically than in absolute size as one can place needle within a millimeter or so of any intended point.

However, being able to do something does not necessarily mean that it should be done, because good clinical judgment remains an overriding operational consideration. For example, if one has a patient with 6 thyroid nodules measuring <10 mm without suspicious US findings, the time that could be used for an FNA sample might be much better spent discussing with the patient the role of ongoing US evaluation rather than simply providing a biopsy of a “challenging” nodule. Conversely, if a patient has a 5-mm nodule and a strong family history of thyroid carcinoma and great personal concern, then a biopsy might well be the better approach both medically and compassionately, particularly if there are worrisome US findings.

Similar questions of judgment arise with regard to breast findings. For example, a 5-mm, hypoechoic, completely smoothly contoured nodule in the breast has limited differential diagnoses. Because it is not perfectly anechoic and therefore cannot be concluded to be benign, sampling is relatively indicated. On the benign side would be a cyst or fibroadenoma versus a circumscribed carcinoma, of which the 2 most common would be medullary and colloid carcinoma. These 4 options have vastly different cytologic characteristics at biopsy and can be reasonably approached by USGFNA.

Core needle sampling with 20-gauge needles can often be used in these circumstances, which can easily be introduced through an 18-gauge to 16-gauge needle puncture of anesthetized skin and requires no suturing. In addition, a core needle sample usually provides a sufficient volume of material with which to verify the presence of invasion and to allow additional special studies to be performed, such as hormone receptors. In addition, small deep nodules, which cannot be mobilized manually, will often simply be pushed forward by an advancing FNA needle, rather than entered. The extremely fast advancement of the core needle sampler simply thrusts the sampling needle through the nodule before it has a chance to move.

In contrast, other image findings, such as calcifications or vague stromal irregularities, are targets that I would decline to sample because these require large volumes of tissue well beyond what FNA and 20-gauge needles can provide.

It may take many years to demonstrate that USGFNA of the thyroid favorably affects mortality from a research standpoint, given the low mortality rate and generally slow growth of well-differentiated thyroid carcinomas. In contrast, clinically speaking, the use of US-directed thyroid biopsies immediately improves the level of care the pathologist can give his patient by providing that patient with the most thorough sampling available by US guidance, not at some point in the future, but today.

We live in a visual age: television, digital video discs (DVDs), and even cell phones that take and transmit photographs. With US, the pathologist can immediately personalize a discussion concerning the patient’s thyroid nodule by showing the patient the actual image of his or her lesion, which naturally leads to a discussion about the biopsy and what it can accomplish. The patient’s anxiety can be reduced as the pathologist explains how US monitoring during the biopsy protects the patient’s airway and neck vessels. Finally, any specific concerns that the pathologist has regarding the details observed on the US images, such as microcalcifications, can be discussed with the patient. In this setting, the patient has the advantage of seeing the microcalcifications as opposed to simply being told about them. In other words, seeing the microcalcifications on the monitor makes that finding more “real.” This open visual and verbal communication has the potential to increase the patient’s confidence in the pathologist, reduce anxiety, and improve the patient’s overall biopsy experience.

There are some very practical reasons that now allow FNA pathologists to add US imaging to their practices. With the cost of US equipment running at approximately $20,000 to $60,000 for a good bedside portable system with a printer, monitor, and ever improving image quality, USGFNA is now affordable in an active FNA clinic setting. With expanding patient-directed health screening services, such as whole body and carotid vascular studies, nodules that the pathologist is being asked to sample are becoming ever smaller.

Finally, consider 2 active FNA pathologists who practice in the same community: Dr. A performs both manual and US-guided biopsies, whereas Dr. B performs only traditional manual biopsies. Will a referring primary care physician (or, more to the point, the physician’s staff, who actually make the tele-
phone call setting up the appointment) remember what kinds of thyroid nodules go to which physician? Or, for simplicity sake, will not the office simply refer all thyroid nodules to Dr. A?

Several excellent instructional courses are offered by professional societies, such as the American Association of Clinical Endocrinologists (AACE) (available at: http://www.aace.com/) and the American Institute of Ultrasound in Medicine (available at: http://www.aium.org/). I would strongly encourage the pathologist interested in USGFNA biopsy to enroll in the AACE Basic Head and Neck Course to benefit from the course’s outstanding teachers, all of whom have large personal practices and whose individual presentations have a very strong clinical focus and relevance.

The end product of the NCI Thyroid Fine Needle Aspiration State of the Science Conference is a 109-page, 1-megabyte (MB) document that can be downloaded from the Conference website. This is an incredibly rich source of information. Moreover, the second edition of the Thyroid Ultrasound and Ultrasound-Guided FNA textbook became available earlier this year and is a virtually unparalleled source of information regarding USGFNA of the thyroid. Many of the authors of this excellent textbook are the very people who teach the AACE head and neck course.

An excellent review article by Frates et al provided a concise presentation of the 5 basic US criteria for the evaluation of thyroid nodules using text and actual image illustrations. In addition, this very helpful article provides size and situational criteria as to when an FNA sampling is indicated, provides statistical performance parameters for the major US criteria, and offers a clinically relevant overview of thyroid nodules and cancer. The Academy of Clinical Thyroidologists (ACT) also offers succinct criteria to determine which nodules do and do not require FNA assessment, such as a minimum dimension of 10 mm (available at: http://thyroidologists.com/papers.html).

The US criteria for the evaluation of thyroid nodules are neither mysterious nor extensive. For example, although the textbook by Brant, *The Core Curriculum: Ultrasound*, is 509 pages long, the entire section regarding the thyroid comprises only 10 pages. Moreover, the pathologist’s use of USGFNA is to provide sampling of thyroid nodules chosen by others for sampling and the final diagnosis is based on a microscopic evaluation of the slides, not on US features.

In the past year, there have been 2 major changes that are relevant to pathologists who are seeking to establish or expand their USGFNA practices. First, Dr. Daniel Duick successfully spearheaded the establishment and national recognition of the AACE’s certification program for head and neck US and USGFNA, which will become mandatory for endocrinologists within 3 years (unpublished data). In private discussions with him during the NCI thyroid conference, I learned that certification rules are such that, as pathologists, we are not permitted to seek national certification through this well-thought out AACE program, even though the AACE might want to make that available to us (unpublished data). The “controlling authorities” would not even allow the AACE to certify the endocrine surgeons, a small group of perhaps a few hundred physicians who have an obvious practice overlap with endocrinologists. Furthermore, I learned that national certification is available only to physicians who organize a program within their own given subspecialty, such as the AACE has done (unpublished data). To this day, I remain baffled as to why we physicians would sit by quietly and tolerate a bureaucracy that requires that each subspecialty reinvent what is effectively the same wheel, which in my opinion is a seemingly unnecessary duplication of efforts.

Nevertheless, given this reality, several pathologists who have active FNA practices used the occasion of our gathering at the NCI thyroid conference to form the Pathologist Ultrasound Study Group. Since that time, our group has been actively engaged with Dr. Dina Mody, President of the American Society of Cytopathology (ASC) (available at: http://www.cytopathology.org/) as well as the College of American Pathologists (CAP), urging them to develop a national USGFNA certification program for pathologists who desire to use this wonderful technology to benefit their patients. On July 11, 2008, Dr. William Hickey, Chair of the CAP Ad Hoc Committee on AP Education, sent an E-mail to our group indicating that CAP has been examining ways to create a program that is valid, defensible, and appropriate for pathologists, and that significant progress has been made toward that end. I would encourage pathologists with an interest in USGFNA certification to encourage Dr. Hickey in that effort and to make their interest known to him through the CAP website (available at: http://www.cap.org/).

**Conclusions**

If a pathologist is strongly motivated to provide the very best care for his patients, he should give careful consideration to adding USGFNA to his practice and should do so now.
REFERENCES


