Comparison of Thyroid Fine-Needle Aspiration and Core Needle Biopsy

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Key Words: Thyroid; Neoplasia; Carcinoma; Cytology; Fine-needle aspiration; Core needle biopsy; Diagnosis; Adequacy; Accuracy

DOI: 10.1309/07TL3V58337TXHMC

Abstract

We compared the adequacy and accuracy of fine-needle aspiration (FNA) with core needle aspiration in a total of 377 patients who underwent both tests.

The adequacy rate for core needle biopsy (82.2%) was significantly higher than that of FNA (70.3%; $P < .001$*), but the combined adequacy was significantly higher than that for either test alone (88.9%;* $P < .001$*). Overall concordance between the tests was 67.9%. In 70 cases, the core was adequate and negative (55 cases) or atypical (15 cases) and the aspirate was nondiagnostic; in 25 cases, the aspirate was adequate and negative (15 cases) or atypical (10 cases) and the core was nondiagnostic. In 21 cases, the FNA diagnosis was atypical and the core was negative; histologic follow-up supported the FNA diagnosis in all 14 cases with resection, of which 9 were malignant, and 8 of the 9 were papillary carcinoma. On review, it seemed that the core biopsy missed the lesion.*

Core needle biopsy has a higher adequacy rate than FNA but seems less sensitive, especially for papillary carcinoma. The combination of FNA with core needle biopsy seems to have the highest adequacy rate and sensitivity.

Fine-needle aspiration (FNA) is an established test for the evaluation of thyroid nodules.[1-17] However, in some cases, even repeated aspiration does not yield diagnostic material. In addition, very scant aspirates of borderline adequacy may be a source of diagnostic error.[18] Core needle biopsy presents an alternative method to obtain tissue for diagnosis. Although the method is well studied in other body sites, there are only a few reports concerning the yield and accuracy of core needle biopsy of the thyroid.[19-24] While studies comparing FNA and core needle biopsy exist,[19,20,23,24] some of the studies compare the 2 methods on different patients and different lesions.[19] Others compare the results of core needle biopsy primarily in patients who have had previously nondiagnostic aspirates.[20] Some series are relatively small.[21,24] In addition, although some studies suggest that the core has a lower nondiagnostic rate,[19] others suggest it is higher.[23,24] Nevertheless, the largest series (100 patients) suggests that the 2 tests are complementary, and the adequacy rate is highest with both tests taken together.[23]

In our centers, the radiologists who perform many of these thyroid aspirates have been interested in using core needle biopsies of the thyroid, especially in patients who have had a previous nondiagnostic aspiration or have a nodule that is difficult to aspirate. We sought to compare the adequacy rate and accuracy of FNA and core needle biopsy in patients who underwent both procedures.

Materials and Methods

All patients who underwent FNA and core needle biopsy at the Baptist Hospital of Miami, Miami, FL, from September 2000 to December 2006 and at Memorial Regional Hospital, Broward, FL, during the same time period were identified.

The indications for core needle biopsy varied during this period. Initially, core biopsy was performed at the request of the clinician in cases in which a previous aspirate had been nondiagnostic (43 patients), and the rate of core biopsy was less than 5% of all thyroid aspirates. However, with the recognition that core biopsy increased the adequacy rate while the complication rate remained low, core biopsy increased to as much as 63% of all thyroid biopsies in 1 hospital by the end of the study period.

The diagnoses from these biopsies were reviewed and compared. In cases in which there was a discrepancy in the diagnosis, the slides were reviewed and histologic follow-up pursued.

All aspirates were performed by radiologists under ultrasound guidance with immediate evaluation. Between 2 and 12 passes were made using a combination of 25-, 23-, and 21-gauge needles for the FNA. Direct smears were made in all cases, and all were alcohol fixed and stained with Papanicolaou or H&E. If sufficient material was obtained, cell blocks were also made. At the same sitting and after the FNA, a core needle biopsy was performed using an 18- or a 20- or 21-gauge needle. This material was formalin fixed and stained using H&E.

Aspirates and core needle biopsy specimens were classified as adequate or nondiagnostic. For the purposes of this study, the original diagnoses were used. To be adequate, all negative smears had to contain at least 6 groups of epithelial cells with 10 cells per group.[5,17] Cases consisting of overwhelmingly abundant colloid and fewer cells than this were classified as a colloid nodule and, for the purposes of this report, were treated as negative and adequate. Adequacy criteria for core needle biopsies have not been previously defined and, for the purposes of this study, consisted of the presence of any identifiable thyroid tissue.

Cases that were adequate were classified as negative, atypical, "suspicious," or positive. For the purposes of this analysis, cases that were atypical, suspicious, or positive were grouped together.

For cytologic and histologic specimens, specimens deemed suspicious for a follicular neoplasm were hypercellular and predominantly arranged in microfollicles. Colloid was scarce, and often the cells were crowded and overlapped and showed nuclear size and outline variation and hyperchromatic chromatin. We prefer to designate this group of cases as suspicious rather than positive for a follicular neoplasm as some other centers do because it is not always possible to distinguish nodules from hyperplastic lesions from those of neoplasms, and some of our clinicians may misinterpret the word positive to mean malignant (even with the specific designation listed directly afterward). However, this is essentially a semantic change because the patients are treated the same as if they had been given a diagnosis positive for a follicular neoplasm (ie, they underwent surgery).

Specimens deemed suspicious for a Hürthle cell neoplasm contained a monomorphous population of Hürthle cells, which were often small, uniform, and dyshesive.

Specimens diagnosed as atypical, papillary carcinoma cannot be ruled out, most often had only 1 or 2 groups of cells with enlarged crowded nuclei, pale chromatin, and rare grooves. Nuclear inclusions were typically not identified.

Specimens diagnosed as suspicious for papillary carcinoma had cells with the aforementioned features as well as intranuclear inclusions but were hypocellular, poorly preserved, or complicated by other features (such as Hürthle cell change) that did not allow a definitive diagnosis to be made.

For the purposes of this study, accuracy was determined only for cases in which a subsequent resection was available for use as a "gold standard." Because this represented only 16% of all cases (although 51% of all atypical, suspicious, and positive cases), an overall accuracy is not reported. Instead, the accuracy of the 2 techniques is compared within specific diagnostic categories as described subsequently.

Categorical analysis was done using a 2-tailed Fisher exact test.

Results

A total of 377 cases were reviewed. The cases involved 301 women and 76 men with ages ranging from 14 to 86 years (median, 52 years). For 373 patients, the aspirate and the core were performed at the same time, and 4 had the aspirate first and the core needle biopsy second. The cores were all 20 or 21 gauge except for 6 cases of 18-gauge cores. All consisted of a single pass. The only reported complication from core needle biopsy was a large hematoma that did not require hospitalization.

The overall results are summarized in **Table 1**. A total of 62 patients (16.4%) had subsequent resections. This included a total of 32 malignancies in 31 patients, including 14 papillary carcinomas, 9 follicular variants of papillary carcinoma, 2 follicular carcinomas, 1 medullary carcinoma, 1 anaplastic carcinoma, 1 spindle cell carcinoma, not otherwise specified, 2 lymphomas, and 2 metastatic renal cell carcinomas. One patient had follicular and papillary carcinomas. Although we were often able to see a biopsy tract at the time of resection, in no case were we unable to make a diagnosis for the nodule. In the entire series, there were no false-positive diagnoses. In addition, there were no cases in which both the aspirate and core biopsy specimen yielded a false-negative result, although only 3 patients with a possible false-negative result underwent resection. However, there were false-negative diagnoses on aspiration and core specimens as detailed subsequently.

The adequacy rate for core needle biopsy (82.2%) was significantly higher than that of FNA (70.3%; $P < .001$), but the combined adequacy was significantly higher than that for

DOI: 10.1309/07TL3V58337TXHMC

Table 1
Distribution of Thyroid Biopsy Diagnoses

Biopsy Diagnosis				
Fine-Needle Aspiration	**Core**	**No. of Cases**	**No. (%) of Cases With Follow-up**	**No. of Cases With Malignancy**
Nondiagnostic	Nondiagnostic	42	2 (5)	0
Nondiagnostic	Negative	55	1 (2)	0
Nondiagnostic	Atypical, "suspicious," or positive	15	4 (27)	1
Negative	Nondiagnostic	15	0 (0)	0
Negative	Negative	155	3 (1.9)	0
Negative	Atypical, suspicious, or positive	5	2 (40)	1
Atypical, suspicious, or positive	Nondiagnostic	10	5 (50)	2
Atypical, suspicious, or positive	Negative	21	14 (67)	9
Atypical, suspicious, or positive	Atypical, suspicious, or positive	59	31 (53)	18
Total		377	62 (16.4)	31

either test alone (88.9%; $P < .001$). Overall concordance between the 2 tests was 67.9%. In 70 cases, the core was adequate and negative (55 cases) or atypical (15 cases) and the aspirate was nondiagnostic; in 25 cases the aspirate was adequate and negative (15 cases) or atypical (10 cases) and the core was nondiagnostic.

The majority (56/110 [50.9%]) of all atypical, suspicious, and positive cases had follow-up resection for comparison. There were 21 cases in which the FNA was atypical and the core was negative; histologic follow-up supported the FNA diagnosis in all 14 cases with resection, 9 of which were malignant, and 8 of the 9 were papillary carcinoma. On review, it seemed that the core biopsy missed the lesion.

There were 5 cases in which the core needle biopsy specimen was atypical and the FNA specimen negative; resection in 1 case supported the core needle biopsy diagnosis and showed a papillary carcinoma. In a second case, a resection only showed hyperplasia with microfollicular areas that were present in the core needle biopsy specimen.

There were 10 cases in which the FNA specimen was atypical, suspicious, or positive and the core specimen was nondiagnostic. Resection in 5 cases revealed 1 follicular variant of papillary carcinoma, 1 medullary carcinoma, and 3 follicular adenomas. There were 15 cases in which the core needle biopsy diagnosis was atypical, suspicious, or positive and the FNA diagnosis was nondiagnostic. Resection in 4 cases with follow-up showed 1 follicular variant of papillary carcinoma, 2 follicular adenomas, and 1 hyperplastic nodule. The hyperplastic nodule had a microfollicular architecture that was present in the resection and core needle biopsy specimens.

Discussion

The goal of this study was simple. We wanted to compare the yield and accuracy of FNA with core needle biopsy of the thyroid. Although FNA is an excellent test and remains the gold standard, it is increasingly apparent that the size of the lesions that are being aspirated continues to decrease,[25] which makes obtaining an adequate sample increasingly difficult. Our results suggest that core needle biopsy is a safe and effective way to increase the yield of thyroid biopsy.

The cases reported herein represent a subset of all thyroid biopsies performed at our institutions, and as such they may not be representative of the results of FNA or core needle biopsy of all thyroid nodules. However, not all thyroid nodules are suitable for core needle biopsy, and it is up to the radiologist to decide whether he or she feels comfortable aspirating a particular lesion, and different radiologists have different levels of enthusiasm for the technique. As a result, the adequacy and accuracy of FNA reported herein may not reflect the adequacy of FNA of all thyroid lesions. Indeed, the adequacy rate for FNA alone in the present study (70.3%) is lower than in many previously published series, including our own.[26] In fact, some lesions in this series underwent core biopsy specifically at the request of the clinician because the original aspirate was nondiagnostic. This suggests that the cases in this series may be harder to aspirate than those reported in other series of thyroid nodules in which only aspiration was performed. Finally, in every case, the FNA was performed before the biopsy, and this may have compromised the material that could be obtained at core needle biopsy. Nevertheless, keeping these possibilities in mind, the data we present represent a direct comparison of the 2 techniques on the same nodules performed at the same setting in the vast majority of cases.

Overall, our results with core needle biopsy are similar to those reported by others.[19,20,23] The results of core needle biopsy are generally concordant with those of FNA. In the present study, the adequacy rate for core needle biopsy was higher than that for FNA, but the adequacy rate for the combination of tests was highest. This supports the conclusion of other authors that the 2 tests are complementary.[23]

Interestingly, in the cases with follow-up, it seemed that there were issues of accuracy with the core needle biopsy. In 15 cases, the core needle biopsy seemed to miss the lesion of

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interest and, instead, showed benign thyroid tissue. On review, it was not possible to determine how the pathologist would be able to tell the core had hit a benign lesion or missed the true lesion. To date, no criteria have been suggested for adequacy for core needle biopsy specimens. These results suggest that cellularity would be a poor measure of adequacy because these cases all had plenty of material. Instead, we have used the phrase "to the extent that the material is representative of the underlying lesion, the findings would be consistent with a benign thyroid nodule," emphasizing the fact that the adequacy of sampling can be determined only by the operator performing the biopsy.

On the other hand, other authors have emphasized that poor specimen quality, in terms of cellularity and preservation, may be the underlying root cause of misdiagnoses in FNA of the thyroid.[18] These authors have emphasized increased supervision and training of those who perform aspiration and have reported an increase in accuracy with these interventions, although at a cost of nearly quadrupling their nondiagnostic rate.[27] Although this is one way to address this issue, it is unclear if clinicians will accept such an increase in nondiagnostic aspirates. In addition, similar efforts have previously been tried at our institution, without as much success as reported by these authors.[27] Also, it remains perfectly clear to all who perform these tests that there are some nodules that remain difficult to obtain high-quality aspirates from, even with experienced operators. Core needle biopsy offers an alternative method that may be more effective in improving the accuracy of diagnosis of these challenging nodules, especially in centers that may not be able to dedicate the resources or have the volume, experience, or expertise to consistently obtain high adequacy and accuracy rates for aspiration alone. Indeed, it is our opinion, and the results of this study support it, that the cases in which it is difficult to obtain an adequate diagnosis with an aspirate are not the same as those in which it is difficult to obtain an adequate diagnosis with a core. That is, in many cases, the difficulty in obtaining adequate material rests with the lesion itself, not necessarily with the skill of the operator. Trying a different technique, such as core needle biopsy, seems to be a more effective strategy to try to obtain adequate material from a nodule that is difficult to aspirate, rather than simply trying harder with a technique that simply may not be very effective in a particular case.

Previous studies have noted a low but increased incidence of bleeding complications associated with core needle biopsy.[20,23] None of these complications resulted in the need for hospitalization. In our present study, the only complication reported was a large hematoma, which also did not require hospitalization. Although the incidence of bleeding and hematoma with core needle biopsy may be higher than with FNA, there is no question that the number of passes needed is much fewer. Our radiologists may take as many as 12 passes at a nodule with a fine needle to get diagnostic tissue. In contrast, the core needle biopsy was always only 1 pass.

Overall, our results suggest that there may be a role for core needle biopsy in the assessment of thyroid nodules, especially as those nodules become increasingly smaller and more difficult to assess. Although the technique may not be necessary or appropriate in all settings, in settings in which increased education and training have failed to improve the adequacy and accuracy of aspiration alone, core needle biopsy offers an alternative technique to improve the performance of thyroid biopsy. Although the adequacy of core needle biopsy is greater than that of FNA, the combination of the 2 tests has the highest adequacy. In addition, core needle biopsy is not as sensitive a test as FNA, and the combination of the 2 tests has the greatest usefulness.

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Acknowledgment: We thank Ana Maria Agrusa, BSED, for excellent technical assistance.

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DOI: 10.1309/07TL3V58337TXHMC

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