Ultrasound-Guided Fine Needle Aspiration Biopsy of Thyroid Nodules Performed in the Office

Kristin A. Seiberling, MD; Jose C. Dutra, MD; James Gunn, MMS, PA-C

Introduction: The majority of thyroid fine needle aspiration biopsies (FNAB) today are performed in the office freehand by palpation. Not infrequently, patients are sent to radiology for an ultrasound-guided FNAB (USG-FNAB). Real-time ultrasound (US) allows for continuous visualization of the needle during insertion and sampling. Historically, USG-FNAB has been a procedure performed by a radiologist in a designated radiology suite. In more recent years, with the development of smaller more portable US machines, there has been a push for clinicians other than radiologists to perform the procedure.

Objective: To evaluate the accuracy and specimen adequacy of thyroid FNAB performed in the office under US guidance by one senior otolaryngologist.

Methods: Retrospective chart review of 203 patients who underwent ultrasound-guided USG-FNA of the thyroid gland between September, 2005, to February, 2007, in the office setting by one senior otolaryngologist. Specimens were reviewed onsite at the time of biopsy for cellular adequacy by a cytotechnologist.

Results: A total of 203 patients, 176 females and 27 males, underwent USG-FNA of the thyroid gland. The average age of the females was 52 years, and 59.4 years for the males. A total of 271 FNA biopsies were performed. Two hundred and twenty FNAB were satisfactory specimens (81.2%), 26 were unsatisfactory (9.6%), and 25 (9.2%) were limited due to blood clotting or hypocellularity. Of the FNA specimens that had enough cells to evaluate, 159 were benign, 48 were indeterminate for malignancy, and 13 were positive for malignancy. Of the nodules biopsied, 143 were greater than 1.5 cm (average 2.59 cm, unsatisfactory rate 12.6%), and 128 were less than 1.5 cm (average 1.21 cm, unsatisfactory rate 6.3%).

In 44 patients, one or more nodule was biopsied at the same office visit.

Discussion: Thyroid US is an indispensable tool in the workup and diagnosis of thyroid disease. It may be used to help identify pathology and physical features suspicious for malignancy and guide FNAB of suspicious nodules. The availability of an office US machine allows the referring physician to perform a service that is normally done in a different department. This ultimately frees up time for both the patient and physician and reduces health care costs by eliminating extra office visits. More importantly, it allows the primary physician to be more knowledgeable and hands on with the patient’s overall care.

Conclusion: This study shows that a trained physician may perform a USG-FNA of the thyroid gland in the office with results comparable to that in the radiology literature.

Key Words: Thyroid disease, thyroid nodule, fine needle aspiration, ultrasound.


INTRODUCTION

Thyroid fine needle aspiration biopsy (FNAB) is the gold standard diagnostic modality used for evaluating patients with a thyroid nodule. The majority of FNAB today are performed in the outpatient clinic, freehand by palpation. There are, however, limitations to the palpation-guided approach, including difficulty sampling nodules that are small or non-palpable, indistinct, posterior or deep in location, and cystic. These factors lead to an unsatisfactory cytology rate that is between 5 and 43.1%.

Studies have shown a decrease in the number of inadequate samples with ultrasound USG-FNAB and a diagnostic accuracy rate of 85 to 94%. Real-time ultrasound (US) allows for continuous visualization of the needle during insertion and sampling. It allows for accurate sampling of multiple nodules, precise placement into the cyst wall, and correct sampling of solid portions of complex nodules. Historically, ultrasound-guided FNAB (USG-FNAB) have been performed by trained radiologists. In these cases, the referring physician sends the patient to have the procedure performed at a different date and location. This ultimately is inconvenient to the patient,
delays time of diagnosis, and incurs additional cost. Over the past decade, newer portable US machines have been made that can conveniently fit into a practitioner’s office. These US machines are equipped with high-tech transducer technology, high-sensitivity color Doppler, and virtual format imaging, bringing more clinical capabilities within reach to practices. Thus, the same procedure may be done in the referring physician’s office if a real-time US machine is available and the physician is trained in the procedure. In addition, the physician may use the US to accurately and thoroughly examine the thyroid gland for features associated with malignancy and to watch for growth in previously imaged nodules. This ultimately benefits both the patient and physician and allows the office to bill for a procedure that would otherwise be performed elsewhere.

**Objective**

To evaluate the accuracy and specimen adequacy of thyroid FNAB performed in the office under US guidance by one senior otolaryngologist. Results will be compared to those found in the radiology and endocrinology literature. In patients who underwent surgery, FNAB results will be compared with final surgical pathology.

**METHODS**

We performed a retrospective chart review of 203 patients who had an ultrasound-guided FNAB of a thyroid nodule between September 2005, to February 2007. The FNAB was performed in the office by one senior otolaryngologist. Institutional Review Board approval was obtained prior to data collection.

**Technique**

US was performed with a Siemens Sonoline G40 ultrasound system equipped with color Doppler and MultiHertz transducer technology. First, using a hand-held probe, the thyroid gland was imaged to evaluate size, presence of nodules, calcifications, cystic masses, and compression of surrounding structures. Next, US-guided FNAB was performed by one senior otolaryngologist (J.D.). Biopsies were obtained using either a 25-gauge needle alone or on a 10-mL syringe under negative pressure. Needle placement into the nodule was verified with real time visualization on the US monitor. Aspiration biopsy was performed with a to-and-from movement with each pass. Multiple passes were taken for each nodule biopsied. Specimens were reviewed onsite at the time of biopsy for cellular adequacy by a cytopathologist fellow. Repeat biopsy of the same nodule was taken if the sample appeared inadequate to the onsite technician. In several patients more than one nodule was biopsied at the same visit. FNAB were subsequently submitted and reviewed by an experienced cytopathologist for final diagnosis.

FNAB samples were categorized into those that were satisfactory, satisfactory but limited due to blood clotting or poor cellularity, and unsatisfactory (no cells or too much crush artifact). The former two groups were further broken down into those that were benign (hyperplastic adenoma, chronic lymphocytic thyroiditis or Hashimoto thyroiditis, colloid nodule, cyst), indeterminate (follicular neoplasm, hurthle cell neoplasm) or malignant/suspicious for malignancy.

Subsequent thyroid surgery was performed only on a subset of the patients. An experienced head and neck pathologist reviewed surgical specimens. Pathology results were compared to FNAB results. Sensitivity (SN), specificity (SP), positive predictive value (PPV) and negative predictive value (NPV) were calculated. Statistics were calculated using a $\chi^2$ test with a $P$ value <0.05 as statistically significant. Results were compared with those found in the radiology, surgical, and endocrinology literature.

**RESULTS**

The patients included 176 females and 27 males ranging in age from 23 to 87 years (average age, 52 years). Of the 203 patients, a total of 271 FNAB were performed, which included 44 (16.3%) patients who had more than one nodule biopsied at the same office visit. Ten patients (3.7%) patients underwent a repeat biopsy of the same nodule at a later office visit (Table I).

The FNAB was satisfactory in 220 (81.2%), satisfactory but limited due to blood clotting or poor cellularity in 25 (9.2%) and unsatisfactory in 26 (9.6%). The diagnostic rate was 90.4%. Of those with satisfactory FNAB, 159 were benign, 14 were indeterminate, and 13 positive for malignancy (Figures 1 and 2).

One hundred and forty three FNABs were performed on palpable nodules (defined as >1.5 cm) and 128 FNABs on non-palpable nodules (defined as ≤1.5 cm). There was no statistical difference ($P = 1$) between the number of unsatisfactory samples in the two groups (Table II).

Surgical pathology was available for 54 patients who underwent thyroid surgery (total thyroidectomy or thyroidectomy).

**TABLE I. Breakdown of Thyroid Fine Needle Aspiration Biopsies Performed.**

<table>
<thead>
<tr>
<th>Patients (n)</th>
<th>Total FNA (n)</th>
<th>Satisfactory</th>
<th>Limited*</th>
<th>Unsatisfactory</th>
<th>1+ Nodule Biopsied†</th>
<th>Repeat Biopsy of Same Nodule</th>
</tr>
</thead>
<tbody>
<tr>
<td>203</td>
<td>271</td>
<td>220 (81.2%)</td>
<td>25 (9.23%)</td>
<td>26 (9.60%)</td>
<td>44 (16.24%)</td>
<td>10 (3.69%)</td>
</tr>
</tbody>
</table>

*Limited, satisfactory but limited due to blood clotting or poor cellularity.
†Patient had more than one nodule biopsied at the same encounter.
FNA = fine needle aspiration biopsies.
lobectomy). Surgical pathology was broken down into papillary carcinoma, hyperplastic adenoma,22 follicular adenoma, Hashimoto thyroiditis and multinodular goiter (MNG).1 Patients who were incidentally found to have microscopic papillary carcinoma were excluded from the data. FNAB had a sensitivity (SN), specificity (SP), positive predictive value (PPV) and negative predictive value (NPV) of 100%, 73%, 57.1%, and 100%, respectively. The six patients with false positive FNAB had surgical pathology consistent with adenomatous nodule (n = 3), Hashimoto thyroiditis (n = 1) and follicular adenoma (n = 2). The 24 patients with indeterminate FNAB had surgical pathology consistent with papillary cancer (n = 5), follicular adenoma (n = 12), Hashimoto thyroiditis (n = 1), and adenomatous hyperplasia (n = 6) (Table III).

**DISCUSSION**

US-guided FNAB of thyroid nodules have become an integral part of the workup for thyroid disease. Many studies have already shown an improved specimen adequacy with US-guided FNAB compared to the conventional freehand FNAB. In patients with a previous non-diagnostic standard FNAB (freehand technique), US guidance may improve the diagnostic yield. In addition, small or barely palpable thyroid nodules may be missed by standard FNAB, whereas accurate needle placement may be confirmed with real-time US guidance. In 19 patients with non-palpable nodules, Kelly et al. demonstrated specimen adequacy in all 19 cases. Another advantage of US guidance is the patient with a cystic or complex (solid/cystic) nodule. In such an instance, the US may be used to confirm needle placement into the cyst wall or into the solid component of the complex nodule. Studies have shown that complex nodules are better evaluated under US guidance with an improved accuracy and sample adequacy rate.

Recently, US machines have been incorporated into several specialty clinics other than radiology as a diagnostic tool in the office. Several certification courses are available to provide the physician familiarity with the machine and US mechanics. It must be emphasized that physicians who decide to routinely use the US machine in the evaluation and diagnosis of thyroid disease should undergo accredited training. It is only with the appropriate training and experience that we, as otolaryngologists, can obtain comparable results to other specialties that use the US machine frequently. Two-day accreditation courses are available which provide basic information about neck anatomy and the physics of US, the evaluation and analysis of thyroid nodules, USG-FNAB, the use of color flow and power Doppler. Completion of the laboratory exercises and successful completion of a written test are required for accredited.

With the proper training, otolaryngologist may become experts in head and neck US and perform US-guided FNAB of thyroid nodules with the same accuracy as radiologists, surgeons, and endocrinologists. Studies report unsatisfactory rates ranging between 3.5% and 32% (Ta-

**TABLE II.**

<table>
<thead>
<tr>
<th>Size (cm)</th>
<th>n</th>
<th>%</th>
<th>Average (cm)</th>
<th>Number Unsatisfactory (%)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1.5</td>
<td>143</td>
<td>52.77</td>
<td>2.59</td>
<td>18 (12.6%)</td>
<td>0.1</td>
</tr>
<tr>
<td>&lt;1.5</td>
<td>128</td>
<td>47.23</td>
<td>1.21</td>
<td>8 (6.3%)</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE III.**

<table>
<thead>
<tr>
<th>Thyroid Fine Needle Aspiration Biopsies Pathology</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neoplasm</td>
<td></td>
</tr>
<tr>
<td>Papillary</td>
<td>8</td>
</tr>
<tr>
<td>Adenomatous nodule</td>
<td>3</td>
</tr>
<tr>
<td>Hashimoto</td>
<td>1</td>
</tr>
<tr>
<td>Follicular adenoma</td>
<td>2</td>
</tr>
<tr>
<td>Benign</td>
<td></td>
</tr>
<tr>
<td>Hyperplastic adenoma</td>
<td>13</td>
</tr>
<tr>
<td>Hashimoto</td>
<td>1</td>
</tr>
<tr>
<td>Multinodular goiter (MNG)</td>
<td>1</td>
</tr>
<tr>
<td>Follicular adenoma</td>
<td>1</td>
</tr>
<tr>
<td>Indeterminate</td>
<td></td>
</tr>
<tr>
<td>Papillary</td>
<td>5</td>
</tr>
<tr>
<td>Follicular adenoma</td>
<td>12</td>
</tr>
<tr>
<td>Adenomatous nodule</td>
<td>6</td>
</tr>
<tr>
<td>Hashimoto</td>
<td>1</td>
</tr>
</tbody>
</table>

**Fig. 2.** Breakdown of satisfactory thyroid fine needle aspiration biopsies.
ble IV). Unsatisfactory results can be due to poor technique, inadequate sampling, patient anatomy, and location of disease. However, these may be minimized with the use of a good onsite cytopathologist who can read the FNA slides at the time and indicate when additional sampling is needed. Our results, with an unsatisfactory rate of 9.6%, are comparable to those found in the literature. Our results are on the lower end of normal, which may be because both palpable and non-palpable nodules were included in the results. However, when comparing the unsatisfactory rate between nodules greater and lesser than 1.5 cm, we found no statistical difference. We are limited by the fact that this is a retrospective study and from the data, we could not categorize the nodules into those that were difficult to palpate or indistinct in nature.

Office-based US increases the efficiency in patient care and is being used more frequently by health care providers. At the present, it is unclear if there is a role for US-guided FNAB in all patients who present with thyroid nodules. Theoretically, routine use of US-guided FNAB could lead to an increase in the cost of health care. There is, however, a clear role for it for patients with non-palpable, cystic, or complex nodules. In addition, patients who have already had a standard FNAB with nondiagnostic results benefit from the US-guided technique. In those patients, US-guided FNAB is thought to bring significant benefits and is justified.

CONCLUSION
Office-based US can be readily incorporated into an otolaryngologist practice with significant benefits to a subset of patient. With the appropriate training, otolaryngologist may perform the procedure with expertise similar to fellow surgeons, radiologists, and endocrinologists.

BIBLIOGRAPHY


