

Efficient Evaluation of Thyroid Nodules by Primary Care Providers and Thyroid Specialists

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Abstract

Objective: To determine whether primary care providers and thyroid specialists at Gundersen Lutheran Medical Center are evaluating thyroid nodules efficiently by following recently published clinical guidelines.

Study Design: One-year retrospective chart review.

Patients and Methods: We reviewed patient records from 1996 and tabulated the use of fine-needle aspiration cytology, radionuclide scanning, and thyroid ultrasonography by 49 primary care physicians evaluating 81 thyroid nodules and by 5 thyroid specialists evaluating 29 thyroid nodules. The results were compared with our previous findings and those recently reported by others.

Results: Fine-needle aspiration cytology was widely used by both groups of Gundersen Lutheran healthcare providers. Primary care physicians used imaging studies modestly and generated \$106 per patient in unnecessary costs. Thyroid specialists occasionally used radionuclide scanning but did not use thyroid ultrasonography; they generated \$41 per patient in unnecessary costs. Overall, the introduction of fine-needle aspiration cytology at our institu-

tion has reduced the use of radionuclide scanning from 90% to 12% and the use of thyroid ultrasonography from 30% to 10%. We also found that the frequency of surgery in patients with thyroid nodules fell substantially, yet detection of thyroid cancer in the operative specimens increased from 16% to 43% while the cost of removing a thyroid carcinoma decreased from \$64,000 to \$25,000.

Conclusions: Fine-needle aspiration cytology, adopted as the initial test for diagnosing thyroid nodules by most of our healthcare providers, has reduced the use of imaging studies far below the frequency reported by others and has substantially decreased the cost of thyroid nodule management

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Palpable thyroid nodules are found in 4% to 7% of the adult population in the United States. Of the 275,000 new thyroid nodules discovered annually (incidence, 0.1%), only 15,600 are malignant.^{1,2} Thus the challenge for healthcare providers is to identify malignant nodules that require surgery but avoid operations in patients with benign lesions. Traditionally, radionuclide scans and thyroid sonograms were used to distinguish benign from malignant nodules. However, in 1981, after an extensive review of the literature, Ashcraft and Van Herle³ concluded that these tests produced nonspecific results and recommended fine-needle aspiration (FNA) cytology as the first diagnostic test to evaluate thyroid nodules. We introduced FNA cytology at our medical center in 1982.^{4,5} Although we performed only a modest number of aspirations, FNA

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cytology proved to be a safe and accurate test, and our results were similar to those published by larger institutions.^{6,7}

Although practice guidelines published by the American Thyroid Association and the American Association of Clinical Endocrinologists advocate the use of FNA cytology as the initial test for evaluating thyroid nodules in most patients,^{8,9} primary care physicians continue to use nonspecific radionuclide scanning and thyroid ultrasonography.¹⁰⁻¹² A recent survey by the American Thyroid Association indicates that clinical endocrinologists are also not evaluating thyroid nodules efficiently.¹³

In this study, we looked at the evaluation of thyroid nodules by primary care providers and thyroid specialists in our healthcare system and compared the results with our previous findings^{4,5} and those recently reported by others.¹⁰⁻¹³

... METHODS ...

We reviewed the medical records of patients evaluated for thyroid nodules at the Gunderson Lutheran Medical Center in 1996. Our institution serves a patient population of approximately 600,000 people and consists of a multispecialty clinic, a tertiary care hospital, 2 branch clinics in the immediate La Crosse, Wisconsin, area, and a rural health network consisting of 25 branch clinics. In addition, more than 80 nonaffiliated medical offices and small clinics use our facility for consultations and tertiary care. The medical records of patients with thyroid nodules were identified from computer-generated billing and FNA cytology lists. We designated 3 board-certified endocrinologists and 2 endocrine surgeons as "thyroid specialists" and 49 other practitioners as "primary care providers." None of the primary care providers had a special interest in thyroid diseases. Each primary care provider evaluated between 1 and 4 thyroid nodules. We compared the practice patterns of the primary care providers with those of the thyroid specialists. The number of patients evaluated at the various clinic locations were as follows: main clinic, 72; surrounding branch clinics, 11; rural branch clinics, 19; and affiliated clinics, 8.

We compared the results from this 1996 study with those from other study periods that included 1 before (1980-1981) and 2 after (1982-1983 and 1984-1985) the introduction of FNA cytology.^{4,5} We also compared our practice patterns with those published by others.¹⁰⁻¹³

All but 4 FNA cytology specimens were obtained by an endocrine surgeon and were prepared as previously described.^{4,5} The other 4 cytology specimens were obtained by general surgeons practicing at branch clinics. One pathologist (SMW) interpreted all slides and classified the results as follows: benign, suspicious, malignant, or nondiagnostic.^{6,7} Nondiagnostic meant that too few follicular cells were present for diagnosis. This classification was usually seen in cystic or hemorrhagic nodules or poorly prepared slides. Aspirations were repeated in 8 patients with nondiagnostic cytology results. Benign nodules were usually colloid nodules, adenomatous nodules, or macrofollicular adenomas. Benign cytology was also seen in chronic (Hashimoto's) thyroiditis, cystic degeneration, or rarely other benign disorders. The suspicious classification included cytology specimens with cellular atypia or features suggestive of but not diagnostic for malignancy. Malignant cytology indicated that unequivocally malignant cells were present. Because surgery was not performed in all cases, we could not calculate the false-negative rate. The false-negative rate, sensitivity, and specificity of our previous FNA cytology results were 9.3%, 91%, and 99%, respectively.⁷

Radionuclide scans were obtained by standard techniques after the administration of ¹²³I or Tc 99m pertechnetate. We classified the scan results as "cold" (nonfunctioning), "warm" (indeterminate), and "hot" (hyperfunctioning). Thyroid ultrasonograms were classified as solid, cystic, mixed, or normal. We measured serum thyroxine (T₄), triiodothyronine (T₃) uptake, thyroid-stimulating hormone (TSH) (analytic sensitivity, 0.01 μU/mL), and antithyroid antibodies and calculated a free thyroxine (FT₄) index using standard methods.

We estimated the cost of evaluating thyroid nodules from the charges directed to third-party payers or, in some instances, the patient. We could not accurately calculate other costs, such as provider fees, charges for long-term management, travel expenses, and lost wages. We considered only a TSH measurement and an FNA cytology to be necessary for the initial evaluation of thyroid nodules unless we suspected hyperthyroidism.^{4,5} In this circumstance, we obtained a radionuclide scan rather than use FNA cytology because the presence of a hot nodule excludes the diagnosis of a clinically important thyroid cancer.^{8,9} In the 10 patients with abnormal TSH values, other tests were obtained. We estimated unnecessary costs from the charges for tests (including 2 computed tomographic scans) that were ordered outside the clinical guidelines outlined above. The cost per car-

cinoma removed was estimated from the charges for surgery, FNA cytology (including 8 repeat aspirations in patients with nondiagnostic cytology results), radionuclide scanning, and thyroid ultrasonography. We did not evaluate the cost of long-term management of benign nodules (eg, charges for thyroxine suppression, follow-up visits, and repeat FNA cytology in patients with benign cytology).

Statistical Analysis

We used chi-square analysis to compare the frequency of tests obtained by primary care providers and thyroid specialists. For statistically significant chi-square analysis, a nonparametric binomial comparison was done as a post hoc follow-up to examine where the significant differences were. Comparisons with *P* values less than .05 were considered statistically significant.

...RESULTS ...

Ninety-five women and 15 men were evaluated for thyroid nodules at our institution in 1996. They ranged in age from 14 to 84 years (mean age, 49 years). Eighty-one patients were initially evaluated by primary care providers and 29 by thyroid specialists.

Fine-needle aspiration cytology was obtained in all but 8 patients (Table 1). The reasons primary care providers did not obtain FNA cytology in these patients were as follows: nodule considered too small, 4; normal radionuclide scan, 2; nodule spontaneously resolved, 1; and patient refusal, 1. Thyroid specialists obtained FNA cytology in all patients, including a hyperthyroid patient who had a low TSH value and a hot nodule. The results of FNA cytology were as follows: benign, 46; suspicious, 37; malignant, 7; and nondiagnostic, 12.

Table 1. Practice Patterns of Primary Care Providers and Thyroid Specialists in the Evaluation of Thyroid Nodules

	Cost (1997 Dollars)	Primary Care Providers (n = 49)	Thyroid Specialists (n = 5)	<i>P</i>
Nodules evaluated (no.)		81	29	
Fine-needle aspiration cytology	232	73 (90%)	29 [†] (100%)	NS
Radionuclide scans	200	11* (14%)	2 (7%)	NS
Thyroid ultrasonograms	224	11 (14%)	0 (0%)	<.05
Computed tomography	1016	2 (2%)	0 (0%)	NS
FT ⁴ index	73	4 (5%)	0 (0%)	NS
TSH	84	41 (51%)	22 (76%)	<.02
FT ⁴ index and TSH	157	16 (20%)	1 (3%)	<.05
Antithyroid antibodies	55	5 (6%)	14 (48%)	<.001
Unnecessary costs		\$106	\$41	

FT⁴ = free thyroxine; NS = not significant; TSH = thyroid-stimulating hormone.

* One ¹²³I uptake study (\$190) performed.

[†]FNA cytology performed in one hyperthyroid patient.

Radionuclide scans were obtained by thyroid specialists in 2 patients (Table 2), one of whom had a low TSH level. The scans revealed 1 hot and 1 cold nodule. The 11 scans obtained by primary care practitioners were cold in 7 patients, indeterminate in 1 patient, and normal in 3 patients. Family practitioners and general internists obtained radionuclide scans in 37% and 8% of patients, respectively ($P < .001$), a significant difference between the two types of primary care providers (Table 2). A thyroid uptake measurement was obtained in conjunction with a radionuclide scan in only 1 patient.

Thyroid ultrasonography was performed in 11 patients, all at the request of a primary care provider (Table 2). This imaging study was also obtained in 2 patients to evaluate the carotid arteries. (The ultrasounds in these 2 patients are not included in the tables.) Ultrasonography was ordered for 53% of patients seen by family practitioners, but in no patient evaluated by a general internist ($P < .001$ between the 2 provider types) (Table 2). Although the frequency of radionuclide scanning was not different at the various clinic locations, ultrasonography was obtained in more patients (40%) at the rural clinics ($P < .001$). Thyroid ultrasonography revealed solid nodules in 8 patients, a cystic nodule in 1 patient, and other findings in 4 patients. Three patients were evaluated with both radionuclide and ultrasonographic imaging.

The FT⁴ index measurements revealed normal levels in 20 patients and an elevated level in 1 patient. The TSH level was elevated in 7 patients, normal in 70 patients, and low in 3 patients (Table 1). Antithyroid antibodies were detected in 2 of the 19 patients for whom this test was ordered (Table 1).

Unnecessary costs generated by the primary care providers and thy-

roid specialists averaged \$106 and \$41 per patient, respectively (Table 1). The introduction of FNA cytology at our institution decreased the use of radionuclide scanning from 90% of patients to 12% and decreased the use of thyroid ultrasonography from 30% of patients to 10% (Table 3). Although the frequency of surgery in patients with thyroid nodules fell substantially, detection of thyroid carcinoma in the operative specimens increased from 16% to 43% (Table 3). The cost of removing a thyroid carcinoma decreased from \$64,000 to \$25,000 (Table 3).

...DISCUSSION ...

The evaluation of thyroid nodules by our primary care providers differed only slightly from the approach used by the thyroid specialists. The latter obtained FNA cytology in all 29 patients they evaluated, while the primary care providers obtained it in 73 of the 81 patients (90%) evaluated. The test was ordered (by a thyroid specialist) but not necessary in a hyperthyroid patient who had a hot nodule, because the cytologic results would not have influenced treatment. Although primary care providers did not obtain aspirations in 8 of 81 patients, this difference in practice patterns between the primary

Table 2. Frequency of Thyroid Imaging Studies

Provider (No.)	No. Nodules Evaluated	Radionuclide Scans	Ultrasonograms
Thyroid specialists (5)	29	2 (7%)	0
General internists (17)	37	3 (8%)	0
Family practitioners (13)	19	7 (37%)*	10 (53%) [†]
General surgeons (3)	5	0	0
Physician assistants (6)	7	0	1 (14%)
Internal medicine subspecialists (4)	5	1 (20%)	0
Other (6)	8	0	0

* $P < .02$.

[†] $P < .001$.

These are significant differences compared with general internists.

care practitioners and the thyroid specialists was not statistically significant, and clinical circumstances reasonably explained why FNA cytology was not obtained. Primary care providers ordered radionuclide scans for 11 patients and thyroid ultrasonograms for 11 patients; both studies were obtained in 3 patients. Most of the thyroid ultrasonograms were ordered by family physicians practicing in rural branch clinics. Thyroid specialists obtained radionuclide scans in 2 patients, one of whom was hyperthyroid and had a low TSH level. The specialists, however, did not use ultrasonography. Primary care providers obtained computed tomographic scans of the neck in 2 patients, including one in whom a nonthyroidal malignancy was initially suspected.

Primary care providers assessed thyroid function by obtaining both TSH and FT⁴ measurements in 16 of the 81 patients, whereas thyroid specialists obtained both measurements in only 1 patient. Use of TSH measurements only is a more efficient approach, because TSH levels measured using a sensitive technique are adequate to evaluate thyroid function in outpatients.¹⁴ If the TSH value is abnormal, however, further testing is necessary. Endocrinologists measured antithyroid antibodies more frequently than did primary care providers. Because a diagnosis of chronic thyroiditis does not exclude the presence of an associated thyroid malignancy, and because FNA cytology is an excellent method for diagnosing chronic thyroiditis, measuring

antithyroid antibodies before knowing the cytology results is not efficient.¹³

Assuming that only a TSH measurement and FNA cytology are necessary for the initial evaluation of a euthyroid patient with a thyroid nodule, the unnecessary charges per patient generated by primary care providers and thyroid specialists were \$106 and \$41, respectively.

Our results differ substantially from recently published findings (Table 4). Gossain et al¹⁰ studied 83 patients referred between 1981 and 1989 to a university-based endocrinologist by community physicians for the evaluation of thyroid nodules. Community physicians ordered radionuclide scans in 64 patients (77%) and thyroid ultrasonograms in 38 patients (46%). The authors studied 45 additional patients in 1995 and 1996. Despite publications discouraging the use of thyroid imaging, the primary care physicians actually ordered more studies in the later period.

Ortiz et al¹¹ determined the cost of unnecessary testing performed in 70 patients referred by primary care physicians to a single consulting endocrinologist for the evaluation of thyroid nodules. Thirty-seven radionuclide scans, 39 ultrasonograms, and 3 computed tomographic scans contributed to unnecessary costs totalling \$390 per patient.

Tangpricha et al¹² examined the pattern of testing in 89 patients with solitary nodules evaluated at a university medical center over a 2-year period. Although referral to an endocrinologist improved the

FNA cytology rate from 29% to 82%, the frequency of additional testing (especially radionuclide scanning) remained high.

In a survey of members of the American Thyroid Association, Solomon et al¹³ reported that in the diagnostic assessment of thyroid nodules, 96% of survey respondents reported that they performed FNA cytology, but 56%

Table 3. Impact of Fine-Needle Aspiration (FNA) Cytology on Thyroid Nodule Management

	Before FNA Cytology		After FNA Cytology	
	1980-1981	1982-1983	1984-1985	1996
No. patients	84	115	127	110
Radionuclide scans (%)	90	54	41	12
Ultrasonograms (%)	30	10	6	10
Surgery (%)	61	43	28	44
Carcinoma (%)	16	27	40	43
Cost per carcinoma removed (\$)	64,000	39,000	27,000	25,000

also ordered a radionuclide scan and 28% obtained thyroid ultrasonograms.

At our facility, we confirmed that FNA cytology is safe and that the results obtained from a rural healthcare center performing only a moderate number of tests are accurate and compare favorably with those obtained from larger institutions.^{6,7} Similar results have been reported in other rural or community institutions.¹⁵⁻¹⁸ We also found that the use of radionuclide scanning and ultrasonography decreased from 90% to 12% and 30% to 10%, respectively, since the introduction of FNA cytology. More importantly, because of the improved diagnostic accuracy provided by FNA cytology, the frequency of carcinoma in surgical specimens increased from 16% to 43% despite a decrease in the frequency of thyroid surgery. Also, the cost of managing thyroid nodules has considerably decreased, from \$64,000 to \$25,000 per carcinoma removed, largely due to fewer surgeries being performed. Other medical centers have reported that the routine use of FNA cytology has decreased the need for thyroid surgery by at least 25%, has increased the yield of thyroid cancer by 30% to 50%, and has reduced the cost of care by 25%.¹⁹ The cost savings resulting from fewer laboratory tests is fairly small compared with the savings from fewer surgeries. Unnecessary laboratory tests, however, incurred in the evaluation of the 275,000 new thyroid nodules diagnosed each year in the United States would waste of millions of dollars.

Review articles^{6,7,19} and practice guidelines^{8,9} support the superiority of FNA cytology over thyroid

imaging studies for the evaluation of thyroid nodules. Why then do primary care physicians continue to order imaging studies that provide nonspecific results? Gossain et al¹⁰ speculated that physicians obtain ultrasonograms because of the erroneous assumption that pure cystic lesions are frequent and that the study is helpful in distinguishing malignant nodules. Also, thyroid ultrasonography is often recommended by radiologists.¹⁰ In addition, the results of the American Thyroid Association survey published by Solomon et al¹³ indicate that clinical endocrinologists are not evaluating thyroid nodules efficiently and therefore would not likely encourage their primary care colleagues to do so.

The reasons why our primary care providers evaluated thyroid nodules more efficiently than did other practitioners are not obvious. Possibly, other institutions with comparable practice patterns simply do not publish their results. Because 95% of our reimbursement remains fee for service, financial considerations are not important factors. The Gundersen Lutheran Medical Center has a reputation for efficient care dating to 1968 when Dr. Edwin L. Overholt joined the institution as director of medical education. He persistently and forcefully encouraged both house officers and attending physicians to avoid unnecessary laboratory expenses.²⁰ As a result of his visionary teaching, the utilization of laboratory services at our institution has been below benchmark levels (1997 and 1998 Gundersen Lutheran Medical Center Quality Report). Because our institution does not limit referrals to specialists

Table 4. Practice Patterns of Gundersen Lutheran Providers Compared With Other Practitioners

Author	Gossain et al (1981-1989) ¹⁰	Gossain et al (1995-1996) ¹⁰	Ortiz et al ¹¹	Tangpricha et al ¹²		Solomon et al ¹³	Present Study	
	Community Physicians	Community Physicians	Primary Care Practitioners	Endocrinologist Involved	Endocrinologist Not Involved	Clinical Endocrinologists	Primary Care Providers	Thyroid Specialists
No. of patients	83	45	70	61	28	233	81	29
Ultrasonograms (%)	46	64	56	31	11	28	14	0
Radionuclide scan (%)	77	84	53	87	96	56	14	7
FNA cytology (%)	—	—	39	82	29	96	90	100

FNA = fine-needle aspiration.

and encourages informal telephone consultations, the efficient evaluation of thyroid nodules by our thyroid specialists is conveyed to referring practitioners. Review of our own data and subsequent dissemination of the analysis by publication, lectures, and a newsletter might also influence practice patterns. Finally, radiologists at our main campus discourage the use of ultrasonography for the initial evaluation of thyroid nodules and indeed require preauthorization before this imaging study is performed. Preauthorization was not required at our branch clinics or in the studies of other investigators (personal communications).^{10,11} Therefore, preauthorization for imaging studies appears to be an important method for decreasing the costs of thyroid nodule evaluation.

...CONCLUSION ...

We found that FNA cytology as the initial test for evaluating thyroid nodules decreases the use of non-specific imaging studies. We also found that the increased use of FNA cytology was associated with a decreased frequency of thyroid surgery but an increased number of thyroid cancers found in pathology specimens. As a result, substantial cost savings were realized. Accurate FNA cytology results can be achieved by institutions performing only a modest number of aspirations. Most primary care physicians will use FNA cytology if they are properly informed and have ready access to thyroid and cytology specialists.

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