Concomitant Use of Fine-Needle Biopsy and Large-Needle Biopsy in the Diagnosis of Thyroid Nodules

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Original Article

Concomitant Use of Fine-Needle Biopsy and Large-Needle Biopsy in the Diagnosis of Thyroid Nodules

Yuji Mizukami, Takatoshi Michigishi*, Motoji Hisatomi**,
Masakuni Noguchi***, Akihiro Takemura, Katsuhiro Ichikawa

Abstract

Fine-needle aspiration biopsy (FNA) and large-needle (cutting) biopsy (LNB) were performed on 109 patients with thyroid nodule or goiter who later underwent thyroidectomy. FNA alone provided a correct diagnosis in 84 (77%) of the 109 cases and LNB alone in 84 (77%) of the 109 cases, with the two methods yielding the same accuracy rate. Ninety-nine (91%) of the 109 cases were diagnosed correctly when both results were considered together. As to the causes for the discrepancies between the FNA or LNB results and the corresponding surgical diagnoses, the most common one was cytologic interpretive errors and, in descending order, insufficient material and sampling errors in FNA. On the other hand, in LNB, histologic interpretive errors were less but sampling errors were more frequently found compared with FNA. The present study indicated a need to concomitantly perform FNA and LNB in the diagnosis of thyroid nodules. Careful attention is required to distinguish between the follicular variant of papillary carcinoma and follicular adenoma, between encapsulated follicular carcinoma and follicular adenoma, and between malignant lymphoma and chronic thyroiditis at FNA as well as LNB diagnosis.

Key words

fine-needle aspiration biopsy (FNA), large-needle biopsy (LNB), thyroid nodule

Introduction

Thyroid needle biopsy is an excellent and direct diagnostic method for thyroid nodules. There are two basic categories of needle biopsy of the thyroid gland: fine-needle aspiration biopsy (FNA) and large-needle (cutting) biopsy (LNB)[1]. FNA can provide cytologic specimens for cytologic diagnosis, and is methologically simple, safe and easy to perform. On the other hand, LNB can provide histologic samples for histologic diagnosis. More information regarding the lesion is provided by an LNB specimen than by an FNA specimen, but the former is more difficult technically, and small nodules cannot be biopsied by the LNB procedure[2),3)].

The simultaneous use of FNA and LNB for thyroid nodules was begun from the late 1970s at Kanazawa University Hospital, and we have already experienced more than 2,000 such cases. In the present study we compared the diagnostic accuracy of FNA and LNB in 109 patients with thyroid nodule or goiter, and examined the usefulness of the concomitant use of the two techniques. We also reviewed the cytologic and histologic slides, and investigated the causes for discrepancies between the FNA or LNB results

Division of Health Sciences, Graduate School of Medical Science, Kanazawa University
* Department Nuclear Medicine, Kanazawa University Hospital
** Pathology Section, Kanazawa University Hospital
*** Department of Surgery, Kanazawa University Hospital

and the surgical diagnoses.

Materials and Methods

Three thousand nine hundred patients with thyroid nodule or goiter, who visited the Department of Nuclear Medicine of Kanazawa University Hospital (Kanazawa) between l989 and 1993, were evaluated. Nodules smaller than 1 cm or located in the prior of the trachea or with cystic nature were usually subjected to FNA aspiration only. The larger nodules that were proven to be solid and accessibile for LNB underwent FNA aspiration first, followed by LNB.

During the same period, 655 patients had needle biopsies for thyroid nodules, and 352 of them had concomitant FNA and LNB, 109 of whom subsequently underwent thyroidectomy (Table 1). Ninety-four of the 109 patients were women and the remaining 15 men, with age ranging from 12 to 83 (mean 46.9 years). The aspirates were obtained through a 22-gauge needle and a 10 ml syringe in a holder. LNB was performed using a biopsy gun (Biopty-gun, C.R. Bard Inc., Covington, GA) with a 18-gauge needle under real-time ultrasound guidance. Cytologic smears were fixed in 95% alcohol and stained by the Papanicolaou method. LNB histologic specimens were fixed in 10% formalin and processed routinely and stained with hematoxylin-eosin.

Table 1. Study Group

	n
Patients who had no biopsies	3245
Patients who had FNA only	245
Patients who had LNB only	58
Patients who had FNA+LNB	352
(Patients who had FNA+LNB+thyroidectomy	109)
Total	3900

The aspirates were reported as "benign" (Class I and II), "suspicious" (Class III) or "malignant" (Class IV and V). In this study, "suspicious" results were considered as malignant in making clinical decisions.

For 40 patients with noncorrelating results between the FNA or LNB results and the surgical diagnoses, the cytologic and histologic slides were reviewed for determination of the causes of the discrepancies. The causes for the discrepancies were divided into three types: cytologic or histologic interpretive (diagnostic) error, cytologic or histologic sampling error and insufficient material for cytologic or histo1ogic diagnosis.

No serious complications associated with the FNA or LNB procedures occurred in any patient.

Results

In the present study the diagnoses made by the examination of the FNA and LNB specimens were compared with those made histologically for 109 patients who later underwent thyroidectomy. The detailed correlation of the results of the FNA and LNB with the final diagnoses was shown in Table2, and was summarized in Tables 3 and 4. Insufficient

Table 2. Comparison of FNA and LNB with Postoperative Pathologic Diagnoses in 109 Cases

Surgical diagnosis	No. of Cases	F(+):L(+)	F(+):L(-)	F(-):L(+)	F(+):L(∗)	F(∗):L(+)	F(-):L(-)	F(∗):L(-)	F(-):L(∗)
Papillary carcinoma	67	48	5	8	1		4		1
Follicular carcinoma	2						1	1	
Anaplastic carcinoma	2		1	1					
Medullary carcinoma	2	1		1					
Malignant lymphoma	1						1		
Adenoma	24	16	1	2	4		1		
Cyst	2	1	1						
Adenomatous nodule	4	2	2						
Graves' disease	1	1							
Chronic thyroiditis	4			3			1		
Total	109	69	10	15	5		8	1	1

F: FNA; L: LNB
(+): correct diagnosis; (-): incorrect diagnosis; (∗): insufficient material

Table 3. Individual Diagnostic Accuracy of FNA and LNB in 109 Cases

Surgical Diagnoses		No. of Cases with Correct Diagnosis FNA		LNB	
Malignant	74	56	(75.6%)	59	(79.7%)
Benign	35	26	(80.0%)	25	(71.4%)
Total	109	84	(77.1%)	84	(77.1%)
Insufficient material		1		6	

Table 4. Diagnostic Accuracy in 109 Cases When FNA and LNB Were Evaluated Concomitantly

		No. of Cases Diagnosed Correctly by				No. of Cases Which could not be Diagnosed Correctly by Either FNA or LNB
		Either FNA or LNB	Both FNA and LNB	FNA only	LNB only	
Malignant	74	66 (89.2%)	49 (66.2%)	7 (9.5%)	10 (13.5%)	8 (10.8%)
Benign	35	33 (94.3%)	20 (57.1%)	8 (22.9%)	5 (14.3%)	2 (5.7%)
Total	109	99 (90.8%)	69 (63.3%)	15 (13.8%)	15 (13.8%)	10 (9.2%)

materials for diagnosis were obtained in 1 (0.9%) of the 109 cases subjected to FNA, and 6 (5.5%) of the 109 cases subjected to LNB (Table 3).

As to the individual accuracy of the FNA or LNB of the 109 cases, FNA and LNB had the same diagnostic accuracy with the correct diagnoses in 84 (77.1%) of the 109 cases (Table 3). When the FNA and the LNB results were considered concomitantly, 69 (63.3%) of the 109 cases had a correct diagnosis with both FNA and LNB. Fifteen cases had a correct diagnosis with FNA alone: 10 case with a correct FNA diagnosis and an incorrect LNB diagnosis and the remaining 5 with a correct FNA diagnosis and insufficient LNB material. The other 15 cases had a correct diagnosis with LNB alone: all these 15 cases with a correct LNB diagnosis and an incorrect FNA diagnosis. In the remaining 10 of the 109 cases a correct diagnosis could not be reached even by concomitant use of FNA and LNB. These 10 cases consisted of 5 papi11ary carcinomas, 2 follicular carcinomas, 1 malignant lymphoma, 1 fo11icular adenoma and 1 chronic thyroiditis (Tables 2 and 4).

This result indicated that 15 of the 25 cases with FNA diagnostic errors or insufficiently aspirated materials were correctly diagnosed by concomitant use of LNB, resulting in an increase of the overall diagnostic accuracy of our series from 77% to 91%.

To clarify the causes of the discrepancies between the FNA or LNB results and the corresponding surgical diagnoses, 40 cases with incorrect FNA results and/or incorrect LNB results were reviewed. As to FNA, the most common cause for the discrepancies was cytologic interpretive errors, which occurred in 13 (52%) of the 25 cases. There were 8 cases (32%) with insufficient material for cytologic diagnosis, and in the remaining 4 cases (16%) sampling errors significantly contributed. On the other hand, as to LNB, the frequency of each cause for the discrepancies was similar among histologic interpretive errors, sampling errors and insufficient material for histologic diagnosis, indicating less tendency for interpretive errors and greater tendency for sampling errors with LNB than with FNA (Table 5).

Table 5. Causes for Discrepancies between FNA or LNB Results and Surgical Diagnoses in 40 Cases

Type of Error	FNA	LNB
Interpretive error	13 (52%)	8 (32%)
Sampling error	4 (16%)	9 (36%)
Insufficient materal	8 (32%)	8 (32%)

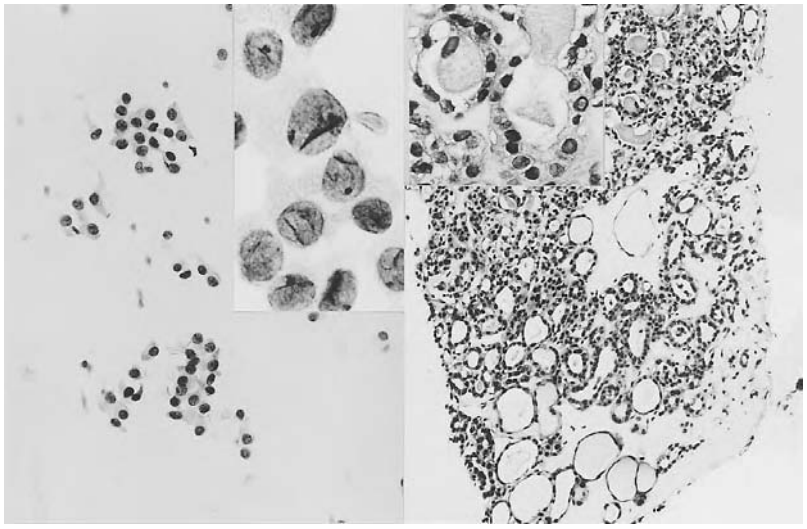
Discussion

There are two basic methods of needle biopsy of the thyroid: fine-needle aspiration biopsy (FNA) which yields cytologic specimens and large-needle biopsy (LNB) which provides histologic samples. At present extensive favorable experience with

FNA has led to its general acceptance as the preeminent diagnostic method for thyroid nodules[4),5)]. However, in FNA cytology, false-negative or false-positive results, although limited to a small proportion of the cases, cannot be avoided, and therefore the concomitant use of large-needle biopsy with FNA has been recommended by a number of investigators[6)-12)]. At our hospital, the concomitant use of LNB and FNA for thyroid nodules was introduced from the late1970s, and to date we have experienced more than 2,000 such cases.

In the present study, the individual accuracy of the FNA or LNB was comparable. With consideration of both the FNA and LNB results, however, more than half of the FNA diagnostic errors were deleted, thereby avoiding unnecessary operation or delayed surgical treatment. In 10 of the 109 cases a correct diagnosis could not be reached even by concomitant use of FNA and LNB. Papillary carcinoma was present in 5 of these 10 cases. On reviewing the cytologic and histologic specimens of these 5 cases of papillary carcinoma, cytodiagnostic errors contributed significantly in 2 and histodiagnostic errors in 1. As to the causes of the cyto- or histodiagnostic errors in these cases, the presence of prominent fo11icular arrangement of the tumor cells with a lack of papillary structure in the FNA and LNB specimens led to the misdiagnosis of papillary carcinoma as follicular adenoma (Fig. 1). These papillary carcinomas with cyto- or histodiagnostic errors were shown to be a follicular variant of papillary carcinoma on surgical specimens. Careful attention should be paid to the nuclear features of the epithelial cells on FNA cytologic or LNB histologic specimens in the diagnosis of follicular variant of papi11ary carcinoma.

As is well known, it is impossible to distinguish accurately between follicular adenoma and encapsulated follicular carcinoma by FNA. This distinction cannot be made even by LNB, because capsule or vascular invasion can be identified only after many sections of the tumor have been made[13),14)]. Some studies, however, have indicated that follicular lesions with microfollicular, trabecular or solid growth pattern or those composed of Hurthle ce11s most likely show capsular or vascular invasion, whereas those with a macro- or normofollicular pattern are rarely malignant[3),15)]. In



(*a*) (*b*)

Fig. 1 Follicular variant of papillary carcinoma. (a) This smear was erroneously diagnosed as a fo11icular adenoma. Follicular cells are arranged as forming small follicles. Although the nuclei are round to oval and are relatively uniform, they are larger and more hyperchromatic than those of follicular adenoma. Inset: Occasional ce11s have nuclei showing ground-glass appearance with fine-chromatin pattern and nuclear grooves, suggesting the diagnosis of papillary carcinoma. (Papanicolaou, x200; inset, x1,000) (b) LNB specimen. The neoplastic follicles are generally small, but show a variation in size. Papillae are not found. This appearance simulates fo11icular adenoma. Inset: A careful search for nuclei showing nuclear inclusion and ground-glass appearance might establish the diagnosis. (hematoxylin and eosin, x200; inset, x400)

the present study, two cases, which were preoperatively diagnosed as follicular adenoma by FNA and/or LNB, turned out to be encapsulated follicular carcinomas after surgery. The FNA and LNB specimens of these two cases showed cytologic and histologic features of hypercellular adenoma with relatively uniform nuclei.

It has been reported that in chronic thyroiditis fo11icular cells tend to show considerable nuclear pleomorphism, occasionally leading to a FNA misdiagnosis of papillary carcinoma[16),17)]. In this series, the correct diagnosis of chronic thyroiditis could not be reached by FNA in any of the four cases, and two of the 4 cases were incorrectly diagnosed as papi11ary carcinoma. On the other hand, chronic thyroiditis was correctly diagnosed in three of the 4 cases in LNB, indicating the superiority of LNB in the diagnosis of chronic thyroiditis. The distinction of thyroid lymphoma from severe chronic thyroiditis is also difficult by needle biopsy[13),18),19)]. High-grade lymphoma could be diagnosed easily even by FNA, but a diagnosis of low-grade lymphoma might be difficult even by LNB. In the present series, one case of low-grade fo11icular lymphoma was preoperatively diagnosed as chronic thyroiditis by FNA as well as by LNB.

FNA is technically easy to perform and can be used on practically all nodules in any location. On the other hand, LNB requires considerable experience, and its application is limited by tumor size and location. This might lead to the high frequency of sampling errors with LNB. In the present series, "insufficient material" was initially reported in only 1 case with FNA, in contrast to 6 with LNB, but after reviewing the cytologic and histologic specimens, the number of cases with "insufficient material" was increased to 8 cases with the same frequency in FNA and LNB. This might indicate that "insufficient material" more significantly contributes to incorrect diagnoses with FNA as well as LNB.

The LNB procedure has been reported to be associated with a risk of complications such as hematoma, transient recurrent nerve palsy and needle tract implantation of cancer[2),6),9)10),12)]. In the present series, a few patients complained of local discomfort, neck pain or neck swelling, but these complaints were all self-limiting and no patient required hospitalization. No serious complications were encountered.

In conclusion, FNA and LNB techniques were in some ways complementary and both procedures refined our diagnostic accuracy of thyroid nodules. The authors hope that LNB will be more widely used for thyroid nodules large enough to undergo both types of biopsy.

References

1) Hamburger JI, Kaplan MM, Husain M: Diagnosis of thyroid nodules by needle biopsy, In: TheThyroid 6th ed (Braverman LE, and Utiger RD, eds), JB Lippincott Philadelphia, pp 544-559, 1991
2) Wang C, Vickery ALJr, Maloof F.: Needle biopsy of the thyroid. Surg Gynecol Obstet. 143: 365-368, 1976
3) Lo Gerfo P: Coarse-needle biopsy of the thyroid. In: Diagnostic Methods in Clinical Thyroidology (Hamburger JI, ed), Springer-Verlag New York, pp 205-219, 1989,
4) SilvermanJF, West RL, Larkin EW, et al: The role of fine-needle aspiration biopsy in the rapid diagnosis and management of thyroid neoplasm. Cancer 57: 1164-1170, 1986
5) Hawkins F, Be11ido D, Bernal C, et al: Fine needle aspiration biopsy in the diagnosis of thyroid cancer and thyroid disease. Cancer 59: 1206-1209, 1987
6) Esselstyn CBJr, Crile GJr.: Needle aspiration and needle biopsy of the thyroid. World J Surg 2: 321-329, 1978
7) Vickery ALJr.: Needle biopsy pathology. Clin Endocrinol Metab 10: 275-292, 1981
8) Schwartz AE, Nieburgs HE, DaviesTF, et al: The place of fine needlebiopsy in the diagnosis of nodules of the thyroid. Surg Gynecol Obstet 92: 835-838, 1982
9) Boey J, Hsu C, Co11ins RJ, et al: A prospective controlled study of fine-needle aspiration and tru-cut needle biopsy of dominant thyroid nodules. World J Surg 8: 458-465, 1984
10) Broughan TA, Esselstyn CBJr.: Large-needle thyroid biopsy: Still necessary. Surgery 100: 1138-1141, 1986
11) Boey J, Hsu C, Collins RJ.: False-negative errors in fine-needle aspiration biopsy of dominant thyroid nodules: A prospective follow-up study. World J Surg 10: 623-630, 1986
12) Nishiyama RH, Bigos T, Goldfarb WB, et al: The efficacy of simultaneous fine-needle aspiration and large-needle biopsy of the thyroid gland. Surgery 100: 1133-1137, 1986
13) Nunez C, Mendelsohn G.: Fine-needle aspiration and

needle biopsy of the thyroid gland. PathoI Annu 24: 161－198, 1989
14) Miller JM, Kini SR, Hamburger JI.: The diagnosis of malignant follicular neoplasms of the thyroid by needle biopsy. Cancer 55: 2812－2817, 1985
15) Lo Gerfo P, Feind C, Weber C et al: The incidence of carcinoma in encapsulated follicular thyroid lesions diagnosed by large needle biopsy. Surgery 94: 1008－1010, 1983
16) Ravinsky E, Safneck JR.: Differentiation of Hashimoto's thyroiditis from thyroid neoplasms in fine needle aspirates. Acta Cytol 32: 854－861, 1988
17) Suen KC, Quenville NF.: Fine needle aspiration biopsy of the thyroid gland: a study of 304 cases. J Clin Pathol 36: 1036－1045, 1983
18) Guarda LA, Baskin HJ.: Inflammatory and lymphoid lesions of the thyroid gland: Cytopathology by fine-needle aspiration. Am J Clin Pathol 87: 14－22, 1987
19) Hamburger JI, MillerJM, Kini SR.: Lymphoma of the thyroid. Ann Intern Med 99: 685－693, 1983

甲状腺腫瘍の診断における穿刺吸引細胞診と針生検の同時併用の有用性に関する研究

水上勇治，道岸隆敏*，久富元治**，野口昌邦***，武村哲浩，市川勝弘

要　　旨

甲状腺穿刺吸引細胞診と針生検が同時に施行された109例の甲状腺手術例（良性および悪性疾患）につき、診断精度の検討を行った。穿刺吸引細胞診のみでは、109例中84例（77%）で正診が得られ、一方針生検のみでは109例中84例（77%）で正診が得られ、正診率は同じであった。穿刺吸引細胞診と針生検の両者の結果を合わせた場合は、109例中99例（91%）が正診となり、正診率が向上が認められた。穿刺吸引細胞診と針生検における診断不一致の原因としては、細胞診では細胞診断上の誤判定の頻度が最も高く、次いで検体不十分（検体不良）、穿刺部位の不適切であった。一方、針生検では、生検部位の不適切が最も頻度がたかく、診断上の誤判定は少なかった。本研究の結果より、甲状腺腫瘤の診断において、穿刺吸引細胞診と針生検を同時に行うことの有用性が明らかとなった。鑑別診断上、とくに注意を払うべき疾患は、濾胞形成型の乳頭状腺癌と濾胞腺腫、被包化濾胞癌と濾胞腺腫、悪性リンパ腫と慢性甲状腺炎であった。