

ACCURACY AND SIGNIFICANCE OF FINE-NEEDLE ASPIRATION CYTOLOGY AND FROZEN SECTION IN THYROID SURGERY

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Objective. In the retrospective study to review the records of patients who had undergone thyroid surgery between 1986-1995 and to determine the need of frozen section (FS) following FNA biopsy.

Methods. The records of 2083 patients who had thyroid surgery in Gazi University Medical Faculty Department of General Surgery between 1986-1995 were retrospectively reviewed to determine and compare the accuracy and significance of fine-needle aspiration (FNA) cytology and intraoperative frozen section (FS).

Results. In 61 patients, both FNA and FS diagnosis were available for the comparison with the final pathologic diagnosis. In 196 patients, FNA diagnosis was available for the comparison with the final pathological diagnosis by permanent section and in 377 patients FS diagnosis was available for the comparison with the final pathological diagnosis. The sensitivity value for detection of malignancy by means of FNA was 57.1 % compared to 82.2 % by means of FS, and FS diagnosis was more specific (99 %) than FNA diagnosis (90.9 %). FNA diagnosis of benign conditions was correct in 141 of 150 (94 %) patients. FS diagnosis of benign conditions was correct in 313 of 321 (97.5 %) patients. Nine patients had the FNA findings that were positive for malignancy and FS confirmed this diagnosis in 8 patients.

Conclusions. FNA is an important diagnostic tool for eliminating benign nodules, but it is not perfect. FS is very important for determining the surgical procedure, and because of direct observation of suspicious nodule, it is even more accurate. Using these tools together is more reliable, since the number of false positive and false negative values is lower than if only the individuals methods are used.

Key words: Fine-Needle Aspiration - Frozen Section - Thyroid - Surgery

It has been estimated that palpable thyroid nodules occur in about 5 % of population and, in addition, autopsy series have revealed that as much as 80 % of the population has thyroid nodules (TUNBRIDGE 1977; VANDER 1968). With the widespread use of ultrasonography, large numbers of thyroid nodules are detected and the selection of patients for surgery appears a problem for surgeons. In the absence of pressure symptoms, the main indication for surgery is the risk of malignant disease. While the incidence of malignancy is around 20 % for single nodules, this number declines to 10 % for multiple nodules (MESSARIS 1974; ROJESKI 1985). In such countries like

Turkey, where goiter is endemic, the incidence of malignant disease is around 5 % (ÇİFTER 1987). Pre-operative assessment of thyroid nodules is generally performed by ultrasonography, radionuclide scanning and fine-needle aspiration (FNA). FNA biopsy is the most preferred test and has improved the selection of patients for thyroid surgery (ASHCRAFT 1981; ROJESKI 1985; HAWKINS 1987; LENGUIST 1987; KÖHLER 1988). However, it is not clear whether the extent of surgery can be determined with FNA biopsy alone or whether frozen section examination should be done to confirm the diagnosis. In a number of hospitals in developing countries, frozen section exam-

ination is not available and, when available, it may be time consuming and expensive. Furthermore, in developing countries FNA and frozen section examinations are carried out by pathologists who are not specialized in thyroid pathology and therefore the sensitivity and specificity may be different from these in specialized centers.

In this retrospective study, the records of patients who had undergone thyroid surgery between 1986-1995 were reviewed to determine the need of frozen section (FS) following FNA biopsy.

Materials and Methods

The records of 2083 patients who had thyroid surgery between 1986-1995 were retrospectively reviewed. A total of 634 patients had either FNA biopsy, FS examinations or both. For remaining patients FNA or FS was either not indicated or was not available. Thus, 634 patients (52 males and 582 females, median age 47 years, range 21-67) were the objective of this study.

All 634 patients had their final pathological examination by permanent section of the resected specimen. Out of them, a total of 196 patients had preoperative FNA, 377 patients had FS examinations and 61 had both FNA and FS diagnosis. The findings obtained by FNA and FS were compared with the final pathological diagnosis and from these data the accuracy, sensitivity, specificity, positive and negative predictive values, false positivity and false negativity rates were calculated.

Results

A total of 126 thyroid malignancies were detected among the total 2083 patients who had thyroidectomies (6 %) (Tab. 1). On the other hand, 53 patients had malignant disease among the 634 patients who had FNA, FS, or both (8.4 %).

In 196 patients FNA diagnosis was reported as malignant in 26 patients (13.3 %), benign in 150 (76.5 %), and undetermined in 20 (10.2 %). When compared with the final permanent section there were 9 false negative and 14 false positive FNA diagnosis. Among 20 FNA undetermined patients permanent section diagnosis were benign in 19 and malignant in only one which was papillary carcinoma. On the

Table 1
Distribution of malignant thyroid tumors

Papillary carcinoma	78	62%
Occult papillary carcinoma	19	15%
Follicular carcinoma	15	12%
Anaplastic carcinoma	8	6%
Hurtle Cell carcinoma	2	1.6%
Medullar carcinoma	1	0.7%
Immunoblastic lymphoma	1	0.7%
Follicular and hurtle Cell carcinoma	1	0.7%
Malignant fibrous histiocytoma	1	0.7%
TOTAL	126	

other hand, final permanent section pathological diagnosis revealed malignant disease in 6 % and benign disease in 94 % of 2083 patients. FNA diagnosis of benign conditions was correct in 141 of 150 patients (94 %). Among the nine false negative FNA patients, permanent section revealed seven papillary carcinomas, one hurtle cell carcinoma, and one follicular carcinoma. Of the 26 patients with FNA diagnosis of malignant disease, 14 had benign and 12 had malignant nodules. In 20 patients with undetermined FNA diagnosis, one had papillary carcinoma and 19 had benign pathologies. When undetermined FNA diagnosis were excluded, FNA sensitivity was 57 %, accuracy 87 %, positive predictive value 46 %, negative predictive value 94 %, false positivity rate 8 %, and false negativity rate was 5 % (Tab. 1).

FS examination was performed in 377 patients. FS diagnosis was reported to be malignant in 40 patients (11 %), benign in 321 (85 %), and diagnosis was undetermined in 16 patients (4 %). Final pathological examination showed benign disease in 329 (87.3 %) and malignant disease in 48 (12.7 %). FS diagnosis of benign conditions was correct in 313 of 321 patients (98 %). Among the eight false negative FS diagnosis, permanent section showed five papillary carcinomas and three follicular carcinomas. Of the 40 patients with malignant disease in FS, 37 (92.5 %) had malignant and 3 (7.5 %) had benign pathologies on permanent section. FS sensitivity was 82 %, accuracy 97 %, positive predictive value 93 %, negative predictive value 98 %, false positivity rate 0.8 %, and false negativity rate was 2 % (Tab. 2).

Sixty one patients had both preoperative FNA and FS examination. The details of pathological findings

Table 2
Frozen section and permanent section results

		PERMANENT SECTION		
		Malignant	Benign	Total
FROZEN SECTION	Malignant	37	3	40
	Benign	8	313	321
	Undetermined	3	13	16
	Total	48	329	377

Table 3
Thyroid FNA and permanent section results

		PERMANENT SECTION		
		Malignant	Benign	Total
FNA	Malignant	12	14	26
	Benign	9	141	150
	Inadequate	1	19	20
	Total	22	174	196

are given in Tab. 3. Sensitivity was 89 %, accuracy 96 %, positive predictive value 89 %, negative predictive value 98 %, false positivity rate 2 %, and false negativity rate was 2 %.

Discussion

The large number of thyroid nodules in the countries where goiter is endemic, complicates the selection of patients for surgery. Before the advent of FNA biopsy, the decision was based on physical examination, radionuclide scanning and ultrasonography. However, this schedule forced the surgeons to operate a number of patients, while relatively small number of malignant nodules were detected. In other words, several patients underwent the thyroidectomy which was not absolutely necessary. Thus, ÇİFTER (1987) reported the group of patients in which the incidence of malignant nodules was significantly higher in those who had preoperative histopathologic diagnosis with FNA and/or FS. It can be argued that these tests are preferred for suspicious nodules and this can be, at least partly, true for FS examination. But FNA is now routinely done in all cases of palpable thyroid nodules and a selection bias is prevented. Mainly from such reason FNA appeared to be great help for surgeons.

FNA of thyroid nodules has been shown to be safe, accurate, and superior to clinical assessment in cases

Table 4
Thyroid FNA and FS results

FNA (-)	Frozen (-)	Permanent (-):	45
FNA (+)	Frozen (+)	Permanent (+):	8
FNA (+)	Frozen (-)	Permanent (+):	2
FNA (+)	Frozen (-)	Permanent (-):	2
FNA (+)	Frozen (+)	Permanent (-):	1
FNA (-)	Frozen (-)	Permanent (+):	1
FNA (-)	Frozen (+)	Permanent (+):	2
Total:			61

(-) are benign and (+) malignant

of malignant thyroid disease (COLACCHIO 1980; GRIFFIES 1985; HOLLEMAN 1985; MANDREKER 1995; BURCH 1996). Several studies have revealed that, the incidence of false positive findings ranged from less than 1 % to 9 % and false negatives from 0 % to 4 % for FNA (LOWHAGEN 1979; COLACCHIO 1980; BOEY 1984; GRIFFIES 1985; TAKASHIMA 1994). If such accurate FNA data are available, continued use of FS procedures can be justified only if they would provide more accurate information or if they would alter the choice of surgical approach. Our results are in accordance with the previous findings, since FNA sensitivity was 57 %, accuracy was 87 %, positive predictive value was 46 %, negative predictive value was 94 %, false positive rate was 8 % and false negative rate was 5 %. In previous studies, the evaluation of FS diagnosis shows that the incidence of false positive is 2 % and false negative value is 9 % (KELLER 1987; LAYFIELD 1991; GIBB 1995). Our results are in accordance with the previous findings as; FS sensitivity was 82 %, accuracy was 97 %, positive predictive value was 93 %, negative predictive value was 98 %, false positive rate was 0.8 % and false negative rate was 2 %. When FNA and FS results are considered together; sensitivity was 89 %, accuracy was 96 %, positive predictive value was 89 %, negative predictive value was 98 %, false positive rate was 2 % and false negative rate was 2 % (BOUVET 1992; SCHMID 1989; VOJVODICH 1994). The efficiency of FNA is better when it is guided by ultrasonography and also core needle biopsy showed better results than FNA (TAKASHIMA 1994; LIU 1995).

FNA alone seems to be reliable to diagnose benign nodules, but positive predictive value and sensitivity were found to be low in this study. FS alone or FS following FNA has improved the results considerably. Both FS and FNA biopsies were not carried out by pathologists specialized in thyroid diseases as in most developing countries. As this study was carried out in a university hospital, it should be born in mind that lower accuracy rates should be expected in other hospitals. In the absence of specialized cytologists, FS examination has yielded a better result with pathologists.

It is thus concluded that, FNA biopsy should be used routinely for thyroid nodules as a preoperative screening test. This improves the selection of patients for surgery and may reduce the number of unnecessary thyroidectomies. However, FS examination should be used when ever possible, as this significantly improves the diagnosis of malignant thyroid disease. This obviously, is very important for the surgeon in deciding the extent of surgery.

References

- ASHCRAFT MW, VAN HERLE AS: Management of thyroid nodules. II scanning techniques, thyroid suppressive therapy and fine needle aspiration. *Head Neck Surg* **3**, 297-322, 1981
- BOEY J, HSU G, COUSINS R, WONG J: A prospective controlled study of FNA and thru-cut needle biopsy of dominant thyroid nodules. *World J Surg* **8**, 459-475, 1984
- BOUVET M, FELDMAN JI, GILL GN, DILLMANN WH, NAHUM AM, RUSSACK V, ROBBINS KT: Surgical management of the thyroid nodule: patient selection based on the results of fine needle aspiration cytology. *Laryngoscope* **102**, 12 Pt 1, 1353-1356, 1992
- BURCH HB, BURMAN KD, REED HL, BUCKNER L, RABER T, OWNBEY JL: Fine needle aspiration of thyroid nodules. Determinant of insufficiency rate and malignancy yield at thyroidectomy. *Acta Cytol* **40**, 1176-1183, 1996
- COLACCHIO TA, LOGERFO P, FEINT CR: Fine needle cytologic diagnosis of thyroid nodules. *Am J Surg* **140**, 568-571, 1980
- CRILE G, HAWK WA: Aspiration biopsy of thyroid nodules. *Surg Gynecol Obstet* **136**, 241-245, 1975
- ÇİFTER Ç, AKTAN Ö, ONUK E, GÖKOK NH: Unnecessary thyroidectomies. *Mediterranean Surgical Meeting'87*. Istanbul 1987
- GIBB GK, PASIEKA JL: Assessing the need for frozen section: still a valuable tool in thyroid surgery. *Surgery* **118**, 1005-1009, 1995
- GRAND CS, HAY ID, GOUKH IR: Long term follow-up of patients with benign thyroid fine-needle aspiration cytologic diagnoses. *Surgery* **106**, 980-986, 1989
- GRIFIES WS, DONEGAN ED, ABEZ ME: The role of fine-needle aspiration in the management of the thyroid nodule. *Laryngoscope* **95**, 1103-1106, 1985
- HAWKINS F, BELLIDO D, BERNAL C, RIGOPOULOU D, VALDEANAS MPR, LAZARO E, PEREZ- BARRIOS A: Fine needle aspiration biopsy in the diagnosis of thyroid cancer and thyroid disease. *Cancer* **59**, 1206-1209, 1987
- HOLLEMAN F, HOEKSTRA JB, RUITENBERG HM: Evaluation of fine needle aspiration (FNA) cytology in the diagnosis of thyroid nodules. *Cytopathology* **6**, 168-175, 1995
- KELLER MP, CRABBE MM, NORWOOD SH: Accuracy and significance of FNA and frozen section in determining the extend of thyroid resection. *Surgery* **101**, 632-635, 1987
- KÖHLER F, KÖHLER H: Aspiration biopsy cytology of the thyroid gland. A valuable tool for diagnosis and therapeutic strategy. *Prog Surg* **19**, 30-39, 1988
- LAYFIELD LJ, MOHRMANN RL, KOPALD KH, GIULIANO AE: Use of aspiration cytology and frozen section examination for management of benign and malignant thyroid nodules. *Cancer* **1**, 130-134, 1991
- LENGUIST S: The thyroid nodule diagnosis and surgical management. *Surg Clin North Am* **67**, 213-249, 1987
- LIU Q, CASTELLI M, GATTUSO P, PRINZ RA: Simultaneous fine needle aspiration and core needle biopsy of thyroid nodules. *Am Surg* **61**, 628-632, 1995
- LOWHAGEN T, GRANBERG P, LUNDELL G, SKINNARI P, SUNBLAD R, WILLEMS J: Aspiration biopsy cytology in nodules of the thyroid gland suspected to be malignant. *Surg Clin North Am* **59**, 4 -18, 1979
- MANDREKER SR, NADKARNI NS, PINTO RG, MENEZES S: Role of fine needle aspiration cytology as the initial modality in the investigation of thyroid lesions. *Acta Cytol* **9**, 898-904, 1995
- MAZZAFERRI EL: Current concepts: management of solitary thyroid nodule. *N Eng J Med* **328**, 553-559, 1993
- MESSARIS G, KYRAKOU K, VASILOPAULAS P, TAUNTAS C: The single thyroid nodule and carcinoma. *Br J Surg* **61**, 943-944, 1974
- ROJESKI MT, GHARIB H: Nodular thyroid disease ;Evaluation and management. *N Eng J Med* **313**, 428-436, 1985

- SCHMID KW, LADUMER D, ZECHMANN W, FEICHTINGER H: Clinicopathologic management of tumors of the thyroid glands in an endemic area. Combined use of preoperative fine needle aspiration biopsy and intraoperative frozen section. *Acta Cytol* **33**, 27-30, 1989
- TAKASHIMA S, FUKUDA H, KOBAYASHI T: Thyroid nodules: Clinical effect of ultrasound-guided fine needle aspiration biopsy. *J Clin Ultrasound* **22**, 535-42, 1994
- THOMSON NW: Current diagnostic techniques for single thyroid nodules. *Curr Surg* **40**, 255-259, 1983
- TUNBRIDGE WMG, EVERED DC, HALL R: The spectrum of thyroid disease in community: The Whickham survey. *Am J Med* **63**, 967-978, 1977
- VANDER JB, GASTON EA, DAWBER TR: The significance of nontoxic thyroid nodules. Final report of a 15 year study of the incidence of thyroid malignancy. *Ann Intern Med* **69**, 537-540, 1968
- VOJVODICH SM, BALLAGH RH, CRAMER H, LAMPE HB: Accuracy of fine needle aspiration in the pre-operative diagnosis of thyroid neoplasia. *J Otolaryngol* **23**, 360-365, 1994
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