

Fine-Needle Aspiration, Touch Imprint, and Crush Preparation Cytology for Diagnosing Thyroid Malignancies in Thyroid Nodules

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Abstract Several methods are used to evaluate the thyroid nodules. The aim of this study was to determine the sensitivity, specificity, false positive and negative rates, positive predictive value (PPV), and negative predictive value (NPV) of touch imprint, crush preparation, and fine-needle aspiration (FNA) methods. This cross-sectional study was done in Shohada-ye Ashayer University Hospital in Khorramabad. All the patients who underwent thyroid surgery due to thyroid nodules in this hospital between March and September 2011 were evaluated. The thyroid nodules of all the patients were evaluated by touch imprint, crush preparation, FNA, and permanent pathology methods. Finally, the results of the first three methods were compared with the result of permanent pathology method. The mean age of 104 patients who underwent thyroid surgery was 42.6 ± 11.9 years old. Based on permanent pathology, touch imprint, crush preparation, and FNA methods, 15.3, 6.25, 6.25, and 4.4 % of thyroid nodules were malignant, respectively. Sensitivity, specificity, false positive rate, false negative rate, PPV, and NPV of FNA biopsy were 62.5, 100, 0,

37.5, 100, and 95.3 %, respectively. Also, sensitivity, specificity, false positive rate, false negative rate, PPV, and NPV of touch imprint and crush preparation were equal and were 80, 100, 0, 20, 100, and 96.7 %, respectively. Using touch imprint and crush preparation in evaluation of thyroid nodules for rapid evaluation of these nodules in operating rooms seems to be logical, and it can prevent further surgeries.

Keywords Cytology · Fine-needle aspiration · Thyroid nodule · Touch imprint · Crush preparation

Introduction

Thyroid nodules are common findings in physical examination. The prevalence of thyroid nodules is dependent on the evaluation method. In the USA, thyroid nodules had been found by palpation in 4–7 % of adult population [1]. Thyroid nodules had been detected by ultrasonography in more than 50 % of over 65-year-old persons [2]. Only a few percent of the thyroid nodules are malignant. Furthermore, the prognosis of thyroid carcinoma in comparison of other malignancies is favorable [3].

Several methods are used to evaluate the thyroid nodules. Fine-needle aspiration (FNA) is a common diagnostic test for evaluation of the thyroid nodules [4]. Touch imprint and crush preparation are other evaluation methods. The aim of this study was to determine the sensitivity, specificity, false positive rate, false negative rate, positive predictive value (PPV), and negative predictive value (NPV) of touch imprint, crush preparation, and FNA methods.

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Materials and Methods

This cross-sectional study was done in Shohada-ye Ashayer University Hospital in Khorramabad, in the west of Iran. All the patients who underwent thyroid surgery due to thyroid nodules in this hospital between March and September 2011 were evaluated.

All the patients that were candidates for thyroid surgery due to thyroid nodules were evaluated by FNA method. Furthermore, during the surgery, the excised tissues were evaluated by touch imprint and crush preparation methods. Also, the excised thyroid tissue was evaluated by permanent pathology method. Finally, the results of touch imprint, crush preparation, and FNA methods were compared with the result of permanent pathology method. All the samples were evaluated by one clinical pathologist.

To provide the touch imprint slide, the thyroid tissue sample was touched ten times onto a microscope slide. Then, it was fixed by alcohol and sent to the hospital pathology ward. To provide the Crush print cytology slide, we made multiple abrasions on the thyroid tissue sample, and then, we crushed it between two microscope slides gently. Then, it was fixed and sent to the hospital pathology ward.

This study was approved by the Research and Ethics Committee of Lorestan University of Medical Sciences. In this study, any intervention, compared with routine and necessary interventions, was done on the patients. The thyroid tissue samples were taken from excised thyroid tissue.

The results of paraclinic evaluations, as well as demographic and medical information of the patients were recorded. The data were analyzed using the SPSS software, and *P* values lower than 0.05 were considered as statistically significant.

Results

Between March and September 2011, 104 patients underwent thyroid surgery. The mean age of the patients was 42.6 ± 11.9 years old. Forty-two (42 %), 49 (49 %), and 2 (2 %) of the patients were between 20–39, 40–59, and 60–80 years old, respectively. The age of four patients were not recorded. The patients were predominantly female (83.7 %). Thirteen patients had neck X-ray. The most frequent finding in the X-rays was tracheal deviation (61.5 %). Frequencies of sonographic findings of the thyroid are shown in Table 1.

Based on permanent pathology, 15 (15.3 %) thyroid nodules were malignant; 9 ones (60 %) were female, 11 ones (73.3 %) were between 20 and 30 years old, and 2 ones (13.3 %) had metastasis. In four samples, calcification was seen. None of the patients gave a history of radiation, alcohol consumption, and smoking. The frequency of thyroid disorders based on permanent pathology, FNA, touch imprint, and crush preparation are shown in Table 2.

Table 1 Frequency of sonographic findings of the thyroid

Sonographic finding	Frequency	Percentage
Nodule	27	31.8
Nodule + cyst	23	27.1
Nodule + calcification	8	9.4
Nodule + cyst + calcification	9	10.6
Multinodular goiter	14	16.5
Cyst	1	1.2
Parathyroid abnormalities	1	1.2
Normal	2	2.4
Total	85	100

Based on FNA method, 4.4 % of the samples of thyroid nodules were malignant. Also, based on touch imprint and crush preparation, 6.25 % of the samples were malignant. Sensitivity, specificity, false positive rate, false negative rate, PPV, and NPV of touch imprint, crush preparation, and FNA methods, compared with permanent pathology, are shown in Table 3.

Discussion

Thyroid nodules are common findings in physical examination. Several methods are used to evaluate the thyroid nodules. Fine-needle aspiration is a common diagnostic test for evaluation of the thyroid nodules [4]. Also, touch imprint and crush preparation are other evaluation methods.

In our study, the mean age of the patients was 42.6 ± 11.9 years old, and 83.7 % of them were female. The higher prevalence of thyroid nodules in women is reported in the previous studies [3, 5].

Table 2 The frequency (percent) of thyroid disorders based on permanent pathology, FNA, touch imprint, and crush preparation

	Permanent pathology	FNA	Touch imprint	Crush preparation
Nodular goiter	69.4	85.5	87.6	87.6
Papillary carcinoma	11.3	4.4	4.2	4.2
Follicular adenoma	8.2	—	—	—
Hashimoto	6.1	—	1	1
Medullary carcinoma	1	—	1	1
Follicular carcinoma	1	—	—	—
Lymphoma	1	—	1	1
Anaplastic carcinoma	1	—	—	—
Thyroglossal cyst	1	1.4	—	—
Follicular neoplasm	—	8.7	4.2	4.2
Reactive node	—	—	1	1

FNA fine-needle aspiration

Table 3 Sensitivity, specificity, false positive rate, false negative rate, PPV, and NPV of touch imprint, crush preparation, and FNA methods compared with permanent pathology

	Sensitivity		Specificity	PPV	NPV		False positive	False negative	
	(%)	CI	(%)	(%)	(%)	CI		(%)	CI
Touch imprint	80	72.2–87.8	100	100	96.7	93.1–99.2	0	20	12.2–27.8
Crush preparation	80	72.2–87.8	100	100	96.7	93.1–99.2	0	20	12.7–27
FNA	62.5	53.6–71.2	100	100	95.3	91.1–99.4	0	37.5	28.1–46.9

PPV positive predictive value, NPV negative predictive value, FNA fine-needle aspiration, CI confidence interval

In our study, based on permanent pathology, 15 (15.3 %) thyroid nodules were malignant, and papillary carcinoma was the most prevalent malignancy (73.9 %). Chehrei et al. reported that the thyroid nodules of 14 of 55 patients (25.5 %) who underwent thyroidectomy were malignant [6]. Also, they declared that the papillary carcinoma was the most prevalent malignancy.

In our study, the results of touch imprint and crush preparation were completely similar. Based on touch imprint and crush preparation, 6.25 % of the samples were malignant. In our study, based on FNA method, 4.4 % of the samples of thyroid nodules were malignant. Hryhorczuk et al. evaluated 1,344 thyroid nodules between 2001 and 2007 [7]. They stated that based on FNA method, 2 % of thyroid nodules were malignant. Also, it was reported that the rate of malignancy in the thyroid nodules FNA was 3–7 % [8].

In our study, sensitivity, specificity, false positive rate, false negative rate, PPV, and NPV of FNA biopsy were 62.5, 100, 0, 37.5, 100, and 95.3 %, respectively. The sensitivity and specificity of FNA biopsy in our study are similar to those in Sung et al.'s study. Sung et al. evaluated 555 consecutive thyroid nodules and reported that the sensitivity and specificity of FNA were 68.6 and 100 % [9]. Gharib et al. reported that based on the results of other literatures, sensitivity, specificity, false positive rate, false negative rate, and PPV of FNA biopsy were 83, 92, 5, 5, and 75 %, respectively [10]. Schueller-Weidekamm et al. stated that the sensitivity and specificity of ultrasound-guided FNA in 35 patients with cold nodules were 80 and 50 %, respectively [11]. Kuru et al. [12] assessed 662 patients with thyroid nodules. They reported that sensitivity, specificity, and false negative rates of FNA were 90, 79, and 2 % [12].

In our study, sensitivity, specificity, false positive rate, false negative rate, PPV, and NPV of touch imprint and crush preparation were equal and were 80, 100, 0, 20, 100, and 96.7 %, respectively. Sensitivity, specificity, PPV, and NPV of touch imprint in Chehrei et al.'s study were 78.6, 95, 84.6, and 92.9 %, respectively. In their study, sensitivity, specificity, PPV, and NPV of crush preparation were 78.6, 92.7, 78.6, and 92.7 % [6].

Touch imprint and crush preparation are inexpensive and rapid methods for evaluation of thyroid nodules. Also,

according to our findings, the diagnostic value of these methods is acceptable. Thus, using these methods in evaluation of thyroid nodules for rapid evaluation of these nodules in operating rooms seems to be logical, and it can prevent further surgeries. We suggest more studies with more sample sizes for comparing the diagnostic value of these methods with frozen section for diagnosing thyroid malignancies in thyroid nodules.

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