

## Original Article

# Fine-Needle Aspiration of Thyroid Nodules has high sensitivity and specificity

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## ABSTRACT

**Objective:** To evaluate the cytological accuracy of fine needle aspiration (FNA) of solitary thyroid nodules in correlation with post-surgical histological findings.

**Patients and Methods:** A total of 105 patients with clinically palpable solitary thyroid nodules were included in the study. Thyroid function tests were initially performed. Subsequently, thyroid ultrasound and FNA of the thyroid nodules were performed exclusively for all euthyroid patients with normal TSH. Only 88 patients underwent thyroid surgery.

**Results:** One hundred (95%) patients were euthyroid and 5 (5%) were hyperthyroid. Thyroid ultrasound of euthyroid patients showed solid nodules in 44 (41%) patients, cystic nodules in 35 (31%) patients, multinodular goiter in 15 (12%) patients, diffuse enlargement of the gland in 6 (4%) patients. FNA showed benign lesions in 58 patients,

no definite diagnosis in 13, papillary carcinoma in 13, follicular neoplasms in 11, autoimmune disease in 3 and Hurthle cell neoplasm in 2.

**Conclusion:** FNA of thyroid nodules had sensitivity of 95% and specificity of 90%. This procedure is cost effective, reliable and highly accurate for rapid diagnosis of thyroid disease, and has reduced the need for unnecessary surgery. (Rawal Med J 2008;33:221-224).

**Key words:** Thyroid nodules, fine-needle aspiration, TSH.

## **INTRODUCTION**

Palpable thyroid nodule is a common reason for seeking medical advice all over the world. It occurs in 4-7% of the population, but nodules found incidentally on thyroid ultrasound suggest a prevalence of 19-67%.<sup>1</sup> The majority of thyroid nodules are asymptomatic, and they are 4 times more common in women than men.<sup>2</sup> The incidence increases with age, history of radiation exposure, and diet containing goitrogenic material.<sup>3</sup> The primary aim in investigating thyroid nodules is to exclude malignancy that occurs in 5% of nodules.<sup>4</sup> Fine needle aspiration (FNA) biopsy provides highly accurate cytologic information from which a definitive management plan can be arranged and has similar sensitivity and accuracy levels of frozen section.<sup>4</sup>

Neoplasms of the thyroid have a wide spectrum of phenotype, which range from benign follicular lesions to violently aggressive anaplastic cancer.<sup>5</sup> Papillary carcinoma is the most common malignancy of the thyroid, and its pathologic diagnosis is based on demonstration of characteristic cytohistologic features.<sup>6</sup> Total thyroidectomy is considered the preferable initial surgical approach for papillary thyroid cancers when

there is no evidence of lymph node metastasis.<sup>7</sup> The overall morbidity of total thyroidectomy includes temporary hypocalcemia (1%), temporary recurrent nerve palsy (3%), permanent recurrent nerve palsy (1%), hemorrhage (3%), tracheomalacia (5%), and wound infection in (3%).<sup>5</sup> This study was conducted to evaluate the diagnostic cytological accuracy of FNA of solitary thyroid nodules in correlation with post-surgical histological findings.

## **PATIENTS AND METHODS**

This prospective study was performed at King Hussein Medical Center, over 4 years from 2003 to 2007. Ethical approval was obtained from the Research Ethical Committee of the Royal Medical Services, King Hussein Medical Center, Amman, Jordan. The study included 105 patients with clinically palpable solitary thyroid nodules. Thyroid function tests including free thyroxine, free tri-iodothyronine, and thyroid stimulating hormone were initially performed. Subsequently, thyroid ultrasound and FNA of the thyroid nodules were performed exclusively for all euthyroid patients with normal TSH. FNA using 22-25 gauge needles was performed under ultrasound guidance. A total of 88 patients underwent thyroid surgery; 54 had hemi-thyroidectomy and 34 total thyroidectomy. The cytological findings of FNA were correlated with post-surgical histological findings. Sensitivity and specificity were calculated using standard statistical formulas.

## **RESULTS**

The mean age of 105 patients was 45 years, with female:male ratio 5:1. Five patients (5%) had low TSH levels and were considered hyperthyroid. They were found to have

hot nodules on radioiodine scan, referred for therapeutic radioactive iodine, and were excluded from the study.

One hundred (95%) patients had normal TSH levels and were considered euthyroid. Thyroid ultrasound examination of these patients showed solid nodules in 44 (41%) patients, cystic nodules in 35 (31%), multinodular goiter in 15 (12%), and diffuse enlargement of the thyroid gland in 6 (4%) (Table 1).

**Table 1. Ultrasound findings of thyroid nodules in correlation with post-surgical histopathological findings.**

| Ultrasound diagnosis | Number of Patients (Patients having Surgery) | Post-surgical Histopathological findings |           |
|----------------------|--|--|-----------|
|                      |  | Benign                                   | Malignant |
| Solid nodule         | 44 (41)                                      | 23                                       | 18        |
| Cystic nodule        | 35 (31)                                      | 30                                       | 1         |
| Multinodular goiter  | 15 (12)                                      | 11                                       | 1         |
| Diffuse enlargement  | 6 (4)  | 4  | 0         |
| Total                | 100 (88)                                     | 68                                       | 20        |

The cytological findings of fine needle aspiration of solitary thyroid nodules were compared with post-surgical histological findings (Table 2). The majority of patients (n=58) had benign cytological findings by FNA; however one of them was proved to have follicular carcinoma after surgery. Papillary carcinoma was detected in 13 patients by FNA; however one of them was proved to have benign histological findings after surgery. Follicular neoplasms were detected in 11 patients, however only 3 of them were proved to be follicular carcinoma after surgery. Three patients had autoimmune disease by FNA; however, none of them underwent surgery.

**Table 2. Comparison between FNA and post-surgical findings.**

| FNA cytological findings | Patients No<br>(Surgery No) | Post-surgical histopathological findings |                        |
|--------------------------|-----------------------------|--|------------------------|
|                          |                             | Benign                                   | Malignant              |
| Benign                   | 58 (49)                     | 48                                       | 1 Follicular carcinoma |
| Not diagnostic           | 13 (13)                     | 13 Benign                                | 0                      |
| Papillary carcinoma      | 13 (13)                     | 1 Benign                                 | 12 Papillary carcinoma |
| Follicular neoplasm      | 11 (11)                     | 4  | 7 Follicular carcinoma |
| Autoimmune               | 3 (0)                       | 0  | 0                      |
| Hurthle cell neoplasm    | 2 (2)                       | 2 Hurthle cell tumor                     | 0                      |
| Total                    | 100 (88)                    | 68                                       | 20                     |

The ultrasound diagnosis of solid thyroid nodules was found to have a sensitivity of 90% and specificity of 71%. FNA of solid thyroid nodules had sensitivity of 95%, and specificity of 90%.

## **DISCUSSION**

Malignancies of thyroid gland frequently threaten both young adults less than 21 years of age and above 40 years of age.<sup>8</sup> The prevalence of thyroid cancer has been shown to be similar in patients with solitary nodule and patients with multiple nodules.<sup>9</sup> Practice guidelines suggest that an initial FNA is more diagnostically helpful and cost benefit comparing to other types of exploration.<sup>10</sup> According to the guidelines of the American Association of Clinical Endocrinologists, FNA is believed to be the most effective method, available for distinguishing between benign and malignant thyroid nodule, with a sensitivity and specificity approaching 96% depending on the experience of the person

performing the biopsy and the skills of the cytologist interpreting the slides.<sup>1</sup> In our study, only 88 patients out of 100 presented with solitary thyroid nodules underwent surgery after performing FNA. Patients with benign thyroid diseases detected by FNA underwent surgery either to relieve pressure symptoms or for cosmetic purposes.

FNA showed accuracy at diagnosing papillary, medullary and anaplastic carcinoma of the thyroid gland, but was not precise enough in the pre-operative diagnosis of follicular carcinoma, especially those that were encapsulated and angioinvasive.<sup>6,11,12</sup> However in our study, FNA was accurate in diagnosing both papillary and follicular carcinomas. Sensitivity and specificity of FNA remain a matter of disagreement; especially when experienced and skilled operator and pathologist can play a great role in final outcome. There are two points of views on FNA precision. Some physicians believe that FNA is mostly specific and almost sensitive due to a number of published data, and as a consequence, thyroid FNA positive results effectively rules in the diagnosis.<sup>13</sup> Sensitivity ranged from 55-90% and specificity 90-100% in these series. The other view is that thyroid gland FNA is more sensitive and approximately specific.<sup>10</sup> Sensitivity ranged from 80-96% and specificity 45-87%, thus a negative result can effectively rule out the diagnosis of thyroid carcinoma. Our data is consistent with the second view, however, a larger sample size including more patients are needed to confirm the results.

We reported a sensitivity of 95%, and a specificity of 92% in this study. Ravetto et al<sup>14</sup> retrospectively evaluated 37,895 FNA performed between 1980-1997 and reported a sensitivity of 91.8% and specificity of 75.5%. A retrospective study from Iran reviewing FNA results of 59 patients reported a sensitivity of 100%, and a specificity of 84.2%.<sup>8</sup>

A pretest probability of thyroid carcinoma of 4% was reduced to 0.4% in patients with a cytologic diagnosis of benign nodular goiter, whereas it was increased to 90% in those patients with a positive cytologic diagnosis.<sup>15</sup> In conclusion, together with clinical and biochemical evaluation, ultrasound-guided FNA remains the first line diagnostic test in the management of palpable thyroid nodules. It is reliable, cost effective, and limits the number of inappropriate investigations. It reduces the rate of unnecessary surgeries for the thyroid nodules and makes the surgical procedures more selective.

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