RESEARCH ARTICLE

Evaluation of solitary thyroid nodule at AL-Yarmouk teaching hospital

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Abstract

Objectives: To define the value of clinical, imaging and histopathological investigations in the evaluation of solitary thyroid nodule, and to predict malignant risk or any abnormal functional activity.

Method: The prospective study was conducted at AlYarmouk Teaching Hospital, Baghdad, Iraq, from March 2016 to March 2018, and comprised patients with thyroid nodule who underwent thyroidectomy. The patients were evaluated by history, clinical examination, thyroid isotope scan, thyroid ultrasonography, and fine needle aspiration cytology, and the results were correlated with post-operative histopathological examination. Data was analysed to determine sensitivity, specificity, accuracy, positive predictive value and negative predictive value.

Results: Of the 108 patients, 88(81.5%) were females and 20(18.5%) were males. The highest incidence occurred in those aged <30 years 56(51.9%). Besides, 65(60%) patients had cold nodules on thyroid isotope scan, and 8(7.4%) had malignancy. Thyroid ultrasonography had a sensitivity 70% and specificity 94%. Fine needle aspiration cytology had sensitivity 75% and specificity 96%.

Conclusion: By using clinical data, and with the assistance of ultrasound, thyroid isotope scan, thyroid function test and fine needle aspiration cytology, unnecessary surgeries could be avoided.

Keywords: Fine needle aspiration cytology. Thyroid malignancy. Thyroidectomy. Thyroid nodule. Thyroid isotope scan. (JPMA 69: S-45 (Suppl. 3); 2019)

Introduction

Thyroid nodules are a common problem affecting females more than males. It is seen in 3-7% of patients during routine clinical examination, increasing to 67% by the use of ultrasonography. In the United States, approximately 63,000 new cases of thyroid cancer were predicted to be diagnosed in 2014. The early detection of thyroid cancer supports the evidence that survival rates for thyroid cancer have remained fairly stable.[1]

A complete history and physical examination provide the basis for making a decision in the treatment of thyroid nodules. Many factors in the history and physical examination suggest malignancy in a thyroid nodule,[2] including: extremes of age, male gender, history of dysphagia, dysphonia, and family history of thyroid carcinoma and neck irradiation, hard firm fixed immobile nodule, and the presence of cervical lymphadenopathy. Factors that suggest a benign diagnosis are: a family history of benign thyroid diseases, thyroid hormone dysfunction, tender thyroid nodule, and mobile soft nodule with smooth surface.

Thyroid-stimulating hormone (TSH) test is the most sensitive laboratory test used to screen hypothyroidism and hyperthyroidism. Estimation of serum triiodothyronine (T3) and thyroxine (T4) levels may be helpful when TSH levels are high-normal or low-normal. Usually, the TSH level is normal in most cases of solitary thyroid nodules. In case of suspected autoimmune disease, like Hashimoto thyroiditis, serum antithyroid peroxidase antibodies and antithyroglobulin antibody levels are assessed. Diagnosis of Hashimoto thyroiditis does not exclude the presence of malignancy.[3]

Previously, radioisotope scans were an important imaging study used routinely in the initial evaluation of a thyroid nodule. Now most centres no longer use nuclear imaging studies for the routine initial diagnostic assessment of a solitary thyroid nodule. Radioisotope scan used to describe a nodule as cold, warm or hot on the basis of relative uptake of a radioactive isotope. Hot nodules indicate autonomously hyper-functioning nodules that are rarely malignant, but 5-8% of warm or cold nodules are malignant.[2,4]

For determining the size and number of thyroid nodules, ultrasonography is highly sensitive, but it is not reliable enough to distinguish between benign and malignant nodules. But a combination of high-resolution sonography with Doppler and spectral analysis for the vascularity of a thyroid nodule becomes a useful tool in screening thyroid nodules for malignancy. The vascular characteristics of thyroid nodules are combined with their ultrasonographic parameters, which include micro-

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calcification, halo, cross-sectional diameter, and echogenicity, and the predictive value of this imaging approach may increase.[4,5]

The American Thyroid Association (ATA) guidelines in 2015 recommended fine needle aspiration cytology (FNAC) for nodules ≥1 cm with a high or intermediate suspicion on sonography, nodules ≥1.5cm with a low suspicion on sonography, and nodules ≥2cm with a very low suspicion pattern on sonography. Any suspicious features in cervical lymph nodes should be aspirated.[1,6]

The thyroid nodules are variable in size, but most benign thyroid nodules remain stable in size. In papillary thyroid cancer, the risk of cancer does not increase consistently with the increasing size of the nodule, although the proportion of follicular thyroid cancer increases with the nodule size. Even in the absence of suspicious ultrasonographic features, a study of many patients with nodules ≥4cm undergoing FNAC and surgery, suggested that the larger nodules were associated with an increased risk of cancer.[7]

In the US, approximately 1900 deaths occurred due to thyroid cancer in 2014. Thyroid cancer is currently the fifth leading cancer diagnosis in women. By the year 2030, it is estimated that it will be the 2nd leading cancer in women and the 9th leading cancer in men.[8]

If the nodule is benign on cytology, further immediate diagnostic studies or treatments are not required. This is supported by many studies demonstrating that the risk of malignancy is quite low in a thyroid nodule with benign cytology.[9]

The ATA guidelines recommend that all patients with thyroid cancer >1\cm need a total thyroidectomy or near-total thyroidectomy unless there are contraindications to this surgery. For patients with <1cm, low-risk, thyroid papillary carcinomas, lobectomy may be considered in the absence of history of radiation or clinically involved cervical lymph node metastases.[10] The National Comprehensive Cancer Network (NCCN) guidelines recommend total thyroidectomy and bilateral central neck dissection (level VI).[11] for all patients with medullary cell carcinoma of the thyroid gland whose tumour is 1cm or larger with bilateral thyroid disease.

The current study was planned to define the value of clinical, radiological and histopathological investigations in the evaluation of solitary thyroid nodule, and to predict malignancy risk or any abnormal functional activity.

Patients and Methods

The prospective study was conducted at Al-Yarmouk Teaching Hospital, Baghdad, Iraq, from March 2016 to March 2018, and comprised patients with thyroid nodule who underwent thyroidectomy. The study was approved by local ethical committee and consent was obtained from the participants for the study.

Patients presenting with swelling in anterior neck and diagnosed by clinical examination to have a thyroid nodule were assessed through history, clinical examination and a series of investigations, including thyroid ultrasonography, thyroid function test, thyroid isotope scan and FNAC. Histopathological examination of all specimens removed by surgery were compared with the FNAC results.

Those included were patients having a solitary thyroid nodule clinically and radiologically, while those with multinodular goiter (MNG) in the imaging study were excluded.

Detailed history was taken from each patient to assess the risk of malignancy such as male gender, extremity of age (<20 and >70 years), rapidity of growth, dysphagia, dysphonia, airway compression, prior head and neck irradiation (especially during childhood), family history of thyroid carcinoma, symptoms of hyperthyroidism or hypothyroidism, and any treatment for these conditions. Physical examination was done. Shape and consistency, mobility or fixation of the mass to the underlying structure, the presence of lymphadenopathy, centrally located or deviated trachea, and any signs of hyperthyroidism or hypothyroidism.

Apart from general investigations, serum T3, T4 and TSH levels were checked to determine whether the patient was euthyroid, hypothyroid or hyperthyroid.

Thyroid isotope scanning was done for all the patients at the Department of Nuclear Medicine. It was done to determine the state of the nodule uptake from the isotope material which includes hot nodule (hyperactive); warm nodule (active) and cold nodule (underactive) on the basis of the distribution of the isotope material. Neck ultrasonography was done for all the patients at the Department of Radiology using a high-frequency rectilinear transducer (typically 5-10 MHz). It was performed to measure the size of the thyroid gland and to assess malignant changes. FNAC was done at the Department of Histopathology and Cytology, and the results were categorised as benign, malignant, suspicious, or no diagnosis.

Surgery was done for all patients under general anaesthesia (GA) using a sub-collar incision. Thyroid was assessed intraoperatively for the presence of other

nodules or any suspicious area. Lobectomy with isthmectomy, subtotal thyroidectomy and total thyroidectomy were done. The type of surgery performed depended on preoperative clinical, radiological and FNAC findings of the solitary thyroid nodule and intraoperative findings. Postoperatively, antibiotics, airway observation and haemodynamic evaluation were done. The patients were followed up in the immediate postoperative period until the result of histopathology after which the patient was dealt with accordingly.

Statistical analysis was performed using SPSS version 25 (IBM Corp., Armonk, N.Y., USA) continuous variables were presented as mean ± standard deviation. Statistical data was analysed to determine sensitivity, specificity, accuracy, positive predictive value (PPV) and negative predictive value (NPV).

A chi square test were used for discrete variables and percentages. P-value <0.05 considered as statistically significant.

Result

Of the 138 patients assessed, 108(78.3%) comprised the final sample; 88(81.5%) females and 20(15%) males. The highest incidence occurred in those aged <30 years which were 56(51.9%). Of these 56 patients, 52(93%) were females. Among the 12(11%) patients in the >50 years age group, 8(66.7%) were females.

Clinically, all cases presented with a swelling in the thyroid gland. Variable degrees of dysphagia and dyspnoea were encountered in 12(11%) and 8(7.4%) patients respectively, while 2(1.9%) presented with an associated unilateral lymphadenopathy.

Table-1: The investigations of solitary thyroid nodules.

investigation	Number	%
Thyroid function test		
Euthyroid	92	85.19
Hyperthyroid	12	11.1
Hypothyroid	4	3.7
Thyroid Isotope Scan		
Cold	65	60.185
Hot	22	20.370
Warm	21	19.444
Ultrasonography finding		
Solid	28	25.9
Cystic	80	74.1
Fine Needle Aspiration Cytology		
Benign	98	90.7
Malignant	6	5.6
Suspicious	4	3.7

Table-2: Result of histopathology after surgery for solitary thyroid nodules.

Histopathology	Male no %	Female no %	Patients No.	%
Follicular adenoma	4 (40%)	6 (60%)	10	9.3
Hashimoto's	1 (25%)	3 (75%)	4	3.7
Colloid nodule	12 (16.22%)	62 (83.78%)	74	68.5
Nodular colloid goiter	3 (25%)	9 (75%)	12	11.1
Papillary carcinoma	Zero (0%)	8 (100%)	8	7.4
Total			108	100%

Table-3: Comparison between histopathological results and preoperative assessment.

Histopathology	Malignant		Benign	
	No.	%	No.	%
Thyroid Scan				
Cold	8	100.0	57	57
Hot	-	-	22	22
Warm	-	-	21	21
Thyroid Function				
Hyperthyroidism	-	-	12	12.0
Euothyroid	8	100.0	84	84
Hypothyroid			4	4
F.N.A.C				
Malignant	6	75.0	-	-
Suspicious	2	25.0	2	2
Benign	-	-	98	98
U/S Finding				
Solid	8	100.0	20.0	20.0
Cystic	-	-	80.0	80.0

FNAC: Fine needle aspiration cytology.
U/S: Ultrasound.

In terms of the site of the gland involved by the nodule, the right lobe was involved in 70(64.8%) patients, left lobe 32(29.6%), and isthmus 6(5.6%).

T3, T4 and TSH showed 92(85.19%) patients were euthyroid, 4(3.7%) hypothyroid and 12(11.1%) were hyperthyroid.

Isotope scanning showed 22(20%) patients as having a hot nodule, 21(20%) warm, and 65(60%) cold nodules (Table-1).

Ultrasonography showed 80(74.1%) cases with cystic features and 28(25.9%) with solid features. Ultrasonography had sensitivity 70%, specificity 94% and accuracy 87%.

FNAC showed 98(90.7%) benign cases, 4(3.7%) suspicious and 6(5.5%) malignant. FNAChad sensitivity 75%, specificity 96% and accuracy 94%. All patients were treated surgically; 82(76%) undergoing lobectomy and isthmectomy, 16(14.8%) having subtotal thyroidectomy,

which was chosen intraoperatively because of the operative findings of multiple small nodules in both lobes, and unhealthy tissues), and 10(9.2%) patients getting total thyroidectomy. All the surgically-removed specimens were sent for histopathology, which showed 74(68.5%) patients had colloid nodule with cystic fibrosis and haemorrhage, colloid nodule with cystic degeneration, and colloid nodule with calcification, 12(11.1%) patients had nodular colloid goiter, 4(3.7%) had Hashimoto's thyroiditis, 10(9.3%) had follicular adenoma, and 8(7.4%) had papillary carcinoma (Table-2). Histopathological results were compared with preoperative assessment (Table-3).

Discussion

The primary question raised in evaluating a thyroid nodule is whether it is likely to require surgical treatment or not, and what type of surgery would be needed.

In our study, 138 cases were diagnosed clinically as having solitary thyroid nodule, but later 108 patients were found to be truly single-nodule cases. Dean et al.[12] said thyroid nodules were common and 19-35% were detected by ultrasound and 8-65% by autopsy data. Popoveniuc et al.[13] mentioned the frequencies of thyroid nodules detected by the ultrasonography correlated with the prevalence reported at surgery and autopsy within the 50-60% range.

A thyroid nodule was common in young patients aged 15-29 years, constituting 51.9% patients in the current study. One study[14] on 78 patients in Babylon found the peak incidence in the third decade. Messaoris et al.[15] found that the prevalence of palpable thyroid nodule was greatest between ages 21-40 years with a decreased prevalence at the extremes of the age bracket. In our study, solitary thyroid nodules were more common in females, with the female-to-male ratio being 5:1. The female predominance was more in adolescence (15-29 years). Kelley[16] mentioned that the female-to-male ratio was 6:1 in the same age group. Mortensen et al.[17] found the ratio 4:1 in the US. In our study, the right lobe was the most affected 64.8% followed by the left lobe 29.6% and the isthmus 5.6%. Veith et al.[18] reported 52% in the right lobe, 39% left lobe and 9% isthmus. There is no known cause for this variety in the site of involvement.

Regarding the laboratory tests, Wong et al.[19] showed results almost similar to the current study; approximately 10% patients with a solitary thyroid nodule present in the hyperthyroid state suggestive of a benign hyperfunctioning adenoma.

In our study, thyroid isotope scan showed 65(60%) patients with cold nodules, 21(20%) with warm nodules and 22(20%) patients with hot nodule. Kelley[16] mentioned that a review of published reports of radioisotope scanning showed that 84% of solitary thyroid nodules were cold, 10% warm, and 5% hot. Other studies[20] found that 84% of nodules were cold, 10.4% warm and 5.5% were hot. There was a lower incidence of the cold nodule in our study. However, all the malignant cases showed that the cold distribution of the isotope was similar to the other studies.[16,20]

In the current study, ultrasonography was used to confirm the clinical diagnosis. It showed 28(25.9%) patients with solid feature and 80(74.1%) with a cystic feature. A study[21] reported 68% patents with solid lesion and 32% cystic. The reliability of ultrasonography to identify the cystic lesions varies with the instrument, the operator's skill, and the radiologist's experience. In our study the sensitivity of ultrasonography was 70%, specificity 96%, accuracy 87%, PPV 82%, NPV71%, false positive (FP) 42%, and false negative (FN) 11%. Yunus et al.[22] had a sample of 78 patients and reported sensitivity 93.8%, specificity 66%, accuracy 56%, PPV 95.9%and NPV 74.8%.Alien et al.[23] reported 32% FP rate and 29% FN rate. Another study[21] found that only one misclassified cystic thyroid nodule was thought to be completely solid thyroid nodule, giving a 4% FN rate. It is the best method of determining the volume of the nodule and whether it is cystic or solid.

In our study, FNAC got specificity of 96%, sensitivity 75%, accuracy 94%, PPV 60%, and NPV 98% for the preoperative diagnosis of carcinoma. Other studies[14] found sensitivity 80%, specificity 96% and accuracy 97%. Another study[24] found FNAC sensitivity 95.2%, specificity 68.4%, PPV 83.3%, NPV 89.6%, and accuracy 85.14%. Asli Muratli, et al.[25] found FNAC sensitivity 87.1%, specificity 64.6%. PPV 76.1%, NPV 79.5% and accuracy 77.3%.

It can be seen that the decision of surgery should depend on many factors other than just the FNAC, like clinical findings, isotope scans and ultrasonography. In our study, two cases in which FNAC showed possibility of carcinoma and total thyroidectomy was done, while histopathology showed benign lesions. According to other studies, the incidence of malignancy in thyroid nodule proved by histopathology <5%.[14,24,25] This result is in the same range as that reported in our study in which the overall malignancy was 7.4% and all of them were female patients.

Conclusion

By use clinical data, ultrasonography, thyroid isotope scan, thyroid function test and FNAC, unnecessary

surgery could be avoided. The clinical examination remains the key to the selection of candidates for surgery.

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Conflicts of Interest: None.

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