

Original Research Article

Clinical Predictors of Malignancy in Solitary Thyroid Nodule, A Study of 146 Cases

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Abstract

Although most of thyroid nodules are benign, 5-10% are malignant. It is important to predict the risk factors and malignant potential of STN to avoid unnecessary surgery with its complications. A prospective study was conducted to assess the rate and malignant potential of STN in 146 patients. They submitted to thorough investigations including a detailed history and clinical examination, thyroid function test, ultrasound examination and FNAC.

There were 126 females and 20 males with female to male ratio about 6:1. The rate of malignancy in STNs was 8.9% with males affected more than female (15% Vs7.9%), and more with age above 40 in both sexes. History and clinical exam suspect malignancy in 6% of cases. All patients were euthyroid. Ultrasonic features such as Ill-defined margin, microcalcifications, marked hypoechogenicity, and cervical lymphadenopathy are helpful features for prediction of malignancy, but none of these features are specific or pathognomonic. The results of FNAC in this study were:76 benign colloid goiter, 24 follicular tumor, 18 suspicious aspirate, 6 papillary carcinoma and 22 indeterminate cytology. The sensitivity, specificity and accuracy rate of FNAC in this study were 86.4%,96.3 and 92.3% respectively.

History and examination are poor predictors of malignancy in STN. Male and increasing age are proved to be risk factors for malignancy in STN. Certain ultrasonic features are helpful in predicting malignancy but neither specific nor characteristics. These include ill-defined and irregular margin, microcalcification, marked hypoechogenicity, hyper-vascularity and cervical LAP. FNAC is highly sensitive in predicting malignant nodule. FNAC must be the first and could be the only test required to evaluate STN.

Key Words: Solitary thyroid nodule, malignancy, nodular goiter.

الخلاصة

دراسة مستقبلية شملت ١٤٦ مريضاً (١٢٦ مريضاً و ٢٠ مريضاً) مصاباً بعقيدات الغدة الدرقية الانفرادية أجريت لتقييم معدل وإمكانية حدوث الإصابة بالسرطان. لقد خضع جميع المرضى لنفس الفحوصات التي شملت التاريخ المرضي والفحص السريري وفحص وظائف الغدة الدرقية بالإضافة إلى فحص السونار وفحص الخزعة الخلوي. أظهرت النتائج أن معدل الإصابة بالسرطان بالعقيدات الدرقية الانفرادية بصورة عامه ٨,٩%، وكان معدل الإصابة في المرضى الذكور أكثر من الإناث (١٥% مقابل ٧,٩%) وكان معدل الإصابة بالسرطان أكبر في المرضى الذين أع مارهم تجاوزت الأربعين. لقد أظهر فحص السونار إن وجود علامات مثل حافات غير محددة للعقيدات، وجود تكلسات دقيقة، أو وجود عقيدات ناقصة الصدى بالإضافة إلى تضخم العقد اللمفاوية الرقبية قد تكون مساعده لتحديد إمكانية إصابة العقيدات الدرقية الانفرادية بالسرطان لكنه لم تكن علامات دقيقة أو واصمه. لقد أثبتت الدراسة أنفحص الخزعة الخلوي للعقيدات كان حساساً جداً ومحدداً للإصابة بالسرطان.

الكلمات المفتاحية: العقيدات الدرقية الانفرادية، دراق عقيدي، سرطان الغدة الدرقية.

Introduction

Solitary thyroid nodule (STN) is referred as clinically discrete swelling in an otherwise impalpable gland. The estimated prevalence on the basis of palpation is about 4% to 7% of adults and increase by imaging to 20- 70%. About 50% of these nodules are turned to be part of multi-nodular and thus such nodules are termed dominant nodule [1]. Solitary thyroid nodules are commonly painless discovered incidentally, often noticed when the patient swallows. It affects about 6% of women and 2% of men with female to male ratio of 4:1. It is usually benign lesion [2]. The malignant potential of newly discovered thyroid nodule is of justifiable concern to both surgeon and patient and the main aim of investigation is to identify the relatively few patients with thyroid malignancy from the large proportion of patients with benign thyroid nodules. All malignant, suspicious nodules and large (3 or 4 cm) nodules usually mandate surgical intervention. The estimated incidence of malignancy in excised thyroid nodules is 8 to 17% [3].

The natural history of benign thyroid nodules is still unclear, but most palpable nodules probably reduce in size, with up to 38% disappearing completely [4,5]. The main concern with thyroid nodules is their potential risk of malignancy. Although thyroid malignancies are rare, constitute only 1% of all cancers in most populations and about 0.5% of all cancer death, the incidence of thyroid cancer in thyroid nodules regardless their size is about 5%-10% [4,6]

The accurate prediction of malignancy in solitary thyroid nodule is very important to select the appropriate treatment and to avoid unnecessary extensive surgical procedures which may be associated with various surgical complications such as nerves injuries and hypothyroidism and hypoparathyroidism. We try in this study to investigate the clinical and pathological risk factors that could predict malignancy in solitary thyroid nodule and assess their application on the treatment plan.

The aim of this study

The objective of this study is to determine the incidence of thyroid cancer and predict the significant clinical and pathological risk factors of malignancy in patients presented with solitary thyroid nodule.

Materials and Method

This prospective study was carried out on 146 patients presented with apparently solitary thyroid nodule to the department of surgery in one major teaching hospital in Basra in a seven years period between November 2008 and August 2015 to assess the rate of malignancy, and investigate the clinical, imaging and pathological risk factors for malignancy in these nodules. The inclusion criteria include all patients presented to surgical ward with solitary thyroid nodule. All Patients were euthyroid. Patients with clinical and biochemical evidence of thyrotoxicosis and hypothyroidism were excluded. Previous history of neck and head irradiation or family history of thyroid malignancy were not recorded in this study.

The solitary thyroid nodule was a clinically single nodule of either lobes or isthmus without any previous investigations that confirmed malignancy.

All patients in this study were submitted to the same work up which includes clinical details such as age, sex, duration of symptoms, signs and symptom suggestive of hyperthyroidism, hypothyroidism and malignancy. Special emphasis was made regarding the rate of the growth of the lump, associated pain, any change in voice, pressure symptoms, any clinical evidence of thyrotoxicosis and presence of cervical lymphadenopathy. Family history of thyroid and other endocrine glands malignancy were also investigated. The thyroid function test was estimated for all patients looking for any subclinical toxic adenoma.

All patients were referred for ultrasound examination. Neck ultrasound was done with 7.5-10 MHZ linear probe. The site, number, size, and the nature of nodule

(cystic, solid and complex) were examined. Presence of microcalcifications cervical lymphadenopathy were determined also. Emphasis in ultrasound examination was on the nodules echogenicity and the margin characteristics including the presence or the absence of halo around the nodule. The echogenicity of each nodule was classified as hypoechoic, isoechoic, hyperechoic or mixed-echoic.

FNAC was performed to all patients by using 23G needle with standard technique by a single expert cytopathologist. The results were classified as a benign simple colloid goiter, malignant, suspicious, follicular tumor and indeterminate cytology. Patients with malignant, suspicious, follicular neoplasm and indeterminate aspirate were proceeded for surgery. Besides, 28 patients with benign nodule subjected to surgery due to pressure symptoms or patients preference. The type of surgery offered to the patients in this study were hemithyroidectomy (lobectomy and isthmectomy), subtotal thyroidectomy and near total or total thyroidectomy according to each individual case. The total number of surgery performed was 80 operations.

Results

There were 126 female and 20 male patients with age ranging from 22-67 year, mean age 44.3 ± 4 . Most these patients presented with asymptomatic anterior neck swelling discovered by the patient accidentally or by physician during routine clinical examination of unrelated health problem. Other less common symptoms were obstructive symptoms, change in the voice, and the presence of enlarged and palpable cervical lymph nodes

The overall rate of malignancy of solitary thyroid nodules recorded in this study was 8.9% (13/146). There were 10 (8%) malignant thyroid nodules in the female patients and 3 (15%) in male patients. The incidence of malignancy was significantly higher among male patients (table 1).

Females were predominant patients in this study, 126 females (86.3%), mean age 47.3 ± 6 versus 20 males (13.7%), mean

age 44.3 ± 4 , with male to female ratio of 6:1. The majority of the patients were in the late forties and fifties years of their life. Main presenting complaint was painless lower anterior neck swelling of different durations which are given by majority of the patients, (no. 117 patients, 80%). Other less frequent symptoms were obstructive symptoms such as shortness of breath and dysphagia observed in 10 (7%). hoarseness of voice was recorded in 6 (4%) and presence of painless enlarged cervical lymph node observed in 12 (8.2%).

(table2). The median duration of these swelling was 3.6 months.

The results showed higher frequency of malignancy in solitary thyroid nodule in female patients above 40 years (8/60, 13.3%) than those below 40 years (2/66, 3.1%). The difference was significant ($P > 0.05$). However, no such difference was encountered among male patients (1/6, 16.6%) patients below 40 years had malignancy compared to (2/14, 14.3%) in patients above 40 years. (table3). Of 18 cases clinically suspected to be malignant, only 5 cases were proved to be malignant by final histopathological examination. The clinical features that suggest malignancy were mainly hard and large nodule, change in the voice, and evidence of cervical lymphadenopathy.

The average age of patients with malignant nodules was 50.7 years which was significantly higher than the average age of patient with benign nodules (34.3 years).

Ultrasound was the main diagnostic tool which differentiate between the truly solitary nodules from dominant nodules (part of multinodular goiter), and according to ultrasonic findings, more nodules were in the right lobe near its junction with the isthmus followed by left lobe and isthmus. The size of the nodules measured by ultrasound range 1.5cm to 5.5 cm with mean of 2.8 ± 3 cm.

The studied nodules were proved to be solitary in 68 (46.6%) and dominant in 78 patients (53.4%). The frequency of malignancy was higher in true solitary nodules compared to dominant ones

(61.5% in solitary nodules Vs. 38.5% in dominant) as shown in (table4). Features like, composition of the nodule, margin, microcalcifications, echogenicity, vascularity and evidence of cervical LAP were examined and detected.

Regarding the nature of the nodules, 69 nodules appeared to be cystic, 71 nodules are solid and 6 nodules complex.. Eleven patients showed foci of microcalcifications which was mainly in solid and complex nodules. Regarding the echogenicity, 28 nodules were hypoechoic, 67 were hyperechoic, and the rest were isoechoic nodules. The presence of cervical lymphadenopathy were also looked for by ultrasound. It was detected in 12 patients, 5 of them prove to have malignancy in these enlarged nodes (Table 5).

FNAC was the most crucial tool in the evaluation of thyroid nodules in this study. All patients in this study had FNAC examination either directly for palpable and large nodules or under ultrasound guidance

for non palpable and small nodules.. The results showed that simple colloid goiter in 76 patients, follicular tumor in 24, suspicious aspirate in 18, papillary carcinoma in 6 cases and in the remaining 22 ,the results were indeterminate. Four patients with follicular tumor proved to be follicular carcinoma, and of those with indeterminate results, 3 cases proved to be papillary carcinoma by final histopathological exam.

The total number of surgeries performed was 70 operations The types of surgery were lobectomy (35), subtotal thyroidectomy (26) and near total or total thyroidectomy (9). All the specimens were send for definite histopathological examination. Thyroid cancers proved to be found in `13 cases with papillary carcinoma was the most frequent type. None of the simple colloid goiter who are subjected to surgery showed malignancy. Histopathological findings in operated cases are shown in (table 6).

Table 1: Frequency of malignancy in solitary and dominant thyroid nodules in relation to the sex of the patients

STN Sex	Solitary Nodule			Dominant nodule		
	Benign	Malignant	Total	Benign	malignant	Total
Male	12	2	14	5	1	6
Female	82	7	89	34	3	37
Total	59 40.4%	9 13.2%	68 46.6%	74 50.6%	4 5.1%	78 53.4%

Table 2: Mode of clinical presentation of 146 patients with solitary thyroid nodules

Presentation	No. of patients with STN.	%
Painless neck mass	117	(80%)
Pressure symptom	10	(7%)
Voice change	6	(4%)
Enlarged cervical lymph nodes	12	(8.2%)
Hoarseness of the voice	6	(4.1)

Table 3: Comparison between age of patients and the definite pathological diagnosis of thyroid nodule

Sex Final Pathological diagnosis.	Female		Male		Total
	20-40	41≥60	20-40	41≥60	
Benign	64 96.9%	52 86.6%	5 83.3%	12 85.7%	133
Malignant	2 3.1%	8 13.3%	1 16.6%	2 14.3%	13
Total	66	60	6	14	146

Table 4: Comparison of the type of nodules by ultrasound with the definite pathological diagnosis

No. of nodules by US Pathological diagnosis	True solitary	Dominant	Total
Benign	60 45.1%	73 54.9%	133
Malignant	8 61.5%	5 38.5%	13
Total	68 46.6%	78 53.4%	146

Table 5: Relationship between nature of STNs by ultrasonography and final pathological diagnosis

STN BY US PATHOLOGICAL DIAGNOSIS	SOLID	CYSTIC	MIXED	SIZE	CALCIFICATION	ECHOGENICITY	MARGIN	VASCULARITY
Benign	36 81.8%	54 94.7%	43 95.6%	0.5-4.5 cm	Absent or coarse type (no.11, 8.9%)	Hyper, iso or hypoechoic	Mostly well- defined (No.96, 78%)	Normal or hypo- vascular
Malignant	8 18.2%	3 5.3%	2 4.4%	1-5.5 cm	*Fine type (no.7, 53.8%)	Mostly hypoechoic	Mostly ill- defined (No.9, 69%)	Hyper- vascular
Total	44 100%	57 100%	45 100%	----- -----	----- -----	----- -----	----- -----	----- -----

*microcalcifications present mainly in patients with papillary thyroid cancer.

Table 6: Comparison of FNAC results and definite pathological diagnosis of STNs

FNAC Pathological Diagnosis	FNAC					Total
	Benign colloid goiter	Follicular tumor	Papillary cancer	Suspicious	Indeterminate	
Benign	76	20	0	18	19	133
Malignant	0	4	6	0	3	13
Total	76	24	6	18	22	146

Table 7: Histopathological results of 80 patients submitted to thyroid surgery

Final pathological results	NO.	(%)
Benign colloid(nodular) goiter	18	25.7
Follicular adenoma	38	47.5
Follicular carcinoma	5	6.2
Papillary carcinoma	8	10
Simple cyst	1	1.25
Total	70	100%

Discussion

Solitary thyroid nodule is defined as clinically discrete swelling in an otherwise impalpable remaining gland. Thyroid nodules are very common in clinical surgical practice with approximate prevalence that ranges from 4% to 7% by palpation, perhaps existing in almost half the population (50%), as determined by ultrasound and autopsy studies [2,7]. Thyroid nodule increase with age. Women have a higher prevalence than men. Spontaneous nodules occur in early childhood and extending into eighth decade of life [8]. The most common causes of thyroid nodule are simple colloid goiter, follicular adenoma, cysts and less frequently thyroiditis or could be dominant nodule of multinodular goiter . The main concern with thyroid nodules is their potential risk of malignancy. Although thyroid cancers are quite rare representing only 1% of all types of cancers and 0.5% of all cancer death, about 5% to 10% of solitary thyroid nodules are malignant[9]. The history of thyroid nodule is still unclear with some palpable thyroid nodules regressed and approximately up to 40% disappeared completely [10].

Because only small proportion of solitary thyroid nodules are malignant and since only malignant and symptomatic large nodules need surgery, the policy and the systemic approach for evaluation of these nodules are very important in order to avoid unnecessary surgery and its probable risks and complications. It is impractical to take a full history and perform a thorough clinical exam for every patient with solitary thyroid nodule and it is cost non effective to consume all available tests to predict the malignant potential of the nodule. Therefore, the main aim of solitary thyroid evaluation, is to select and treat those patients with malignant thyroid nodules surgically, while avoiding surgery with its risks and morbidity in patients with benign and painless nodules [11].

In our study, 13 of the 146 cases (8.9%) of solitary thyroid nodules were proved to be malignant. Most nodules were asymptomatic discovered accidentally by the patients, their relatives or by the physician when being examined for another problem.

We found that the history is unhelpful in predicting the malignant potential of

solitary thyroid nodule. Apart from a history of head and neck irradiation during childhood or early adolescent and family history of thyroid or other endocrine glands cancer, there are no specific points in the history is significantly associated with increased risk of malignancy[12]. The history of sudden or progressive increase in the nodular size, pain, hoarseness or voice changes, and obstructive symptoms like dyspnea and dysphagia can occurs in both benign and malignant nodules [12,13]. Prior history of irradiation is unusual but, by far, is the greatest risk factors for thyroid cancer with estimated risk of malignancy in thyroid nodule of 35% to 40% compared to 5% in the general population. A positive family history of thyroid malignancy mainly medullary carcinoma of thyroid or other endocrine malignancy such a pheochromocytoma which should arise the suspicion of familial thyroid cancer or MEN 2 syndrome is also important [14]. None of our patients had a prior exposure to irradiation or family history of thyroid or other endocrine glands malignancies.

Clinical examination can differentiate between solitary and dominant nodule in multinodular goiter. It is also of a limited help in distinguishing benign and malignant nodules except when there is a fixation or invasion of nearby structures in the neck and presence of palpable cervical lymph nodes. The size and consistency of the nodule are poor predictor of malignancy because they occur in both benign and malignant nodules. Obstructive symptoms like shortness of breath and stridor could also produced by benign lesion. Absent carotid pulsation due to carotid sheath invasion is highly suggestive of malignancy but this sign is rarely observed. [14,15]. In this study, malignancy was suspected in 18 cases with solitary thyroid nodule by clinical examination. Only 5 cases (27.7%) proved to be truly malignant. Cervical lymphadenopathy was evident in 3 patients proved to have a malignant papillary thyroid cancer. Fixation or invasion of nearby structures and absent

carotid pulsation were not recorded in this study.

Thyroid carcinomas are more frequent among females, but the incidence of malignancy is thought to be more common among male patients [4,16]. There was a significantly higher rate of malignancy in solitary thyroid nodules among male patients than in female patients in this study (15% Vs. 7.9% in females) and the majority of the patients proved to have a malignant nodule whether males or females were above 40 years (no.10, 76.9%). Table (2). The difference in the incidence of malignancy in the solitary thyroid nodule between both sexes and different age groups were both statistically significant ($p < 0.05$)

So, male gender and increasing age in present study are considered as risk factor for malignancy in solitary thyroid nodules. These findings are in consistence with several similar studies [6,16,17,18]

Assessment of thyroid functional status should be the initial steps in the work up and evaluation of thyroid nodules. Patients with malignant thyroid nodules are usually euthyroid, with less than 2% of nodules causing hyperthyroidism[1,5,19]. All patients with malignant solitary nodule in this study were euthyroid. Only 4 patients were discovered by investigation to have hyper-functioning thyroid nodules which proved to be benign by FNAC examination..

Ultrasound examinations were performed to all patients to determine the size, number, margin and composition of nodules, in addition to the presence of calcifications, and enlarged cervical lymph nodes. Ultrasound is safe, effective and non invasive investigation. Ultrasound can determine the presence of non palpable nodules as small as 1 to 2 mm size. The superiority of ultrasound examination of the thyroid over clinical examination was a subject of many studies before [19, 20]. A study by Marqusee et al [21] showed that ultrasound examination resulted in a change in the treatment of 44% of patients with a solitary thyroid nodule by physical

examination. According to ultrasonic examination 56.2% of clinically apparent solitary thyroid nodules in present study were indeed dominant nodules of multinodular goiter. The incidence of malignancy was higher in solitary thyroid nodule (61.5% Vs. 38.5% in dominant nodules of multinodular goiter). The difference, however was not significant. Despite early belief that the dominant nodules are unlikely to be malignant, recent studies showed that the malignant potential in dominant nodule is similar to that in a solitary nodule [6,12]. Some studies emphasized that the incidence of malignancy is higher in solitary nodules than in multinodular goiter[4,11,18]. Other studies showed that patients with solitary thyroid nodules have the same risk of malignancy as those with multinodular goiter [3, 21], Hanumanthappa et al [22] recorded that the incidence of malignancy in multinodular goiter is quite significant and it is not very low as was thought.

Accurate prediction of malignancy in thyroid nodules by ultrasound is usually difficult. Several studies have attempted to define which ultrasound characteristics are most predictive of malignancy [3, 23, 24, 25]. Up to date, no single features carries a high sensitivity, specificity and positive prediction for malignancy, However there are a number of ultrasound characteristics that when they occur in combination, could predict nodule with high malignant potential. These features include presence of punctate microcalcifications, evidence of cervical lymphadenopathy, large size nodule, solid component, an irregular or ill-defined margin, marked ,hypoechoogenicity and hyper-vascularity [19, 26, 27].

Microcalcifications are psammoma bodies which are round laminar crystalline calcific deposit. These calcifications are most specific ultrasonic feature suggestive of malignancy with specificity of 85% to 95% and positive predictive value of 42% to 95% [12, 27, 28] Microcalcifications are detected in about 30% to 60% of all

primary thyroid malignancies most frequently in papillary variant and less commonly in follicular and anaplastic types but could be also seen in benign lesions such as hyperplastic nodular goiter, Graves disease and lymphocytic thyroiditis [19,23,29]. Coarse calcifications occasionally detected with microcalcifications in papillary cancer and more commonly found in medullary carcinoma. Gopinathan et al, [30] stated in their review that when coarse calcifications is found in a solitary thyroid nodule, the risk of malignancy is as high as 75%. Microcalcifications were observed in 7 patients in this study, 6 of these cases proved to be papillary carcinoma and coarse calcifications were detected in 11 thyroid nodules, two of them proved to be malignant.

Yuan et al [31] showed that the patterns of enhancement differ significantly between benign and malignant solitary thyroid nodules examined with real-time contrast-enhanced ultrasonography with most malignant nodule showing incomplete or heterogenous enhancement.

Cervical lymphadenopathy and invasion of nearby structures are very specific and highly suggestive of thyroid malignancy but infrequently seen [32]. Ultrasonic features suspicious of lymph node metastasis include increased size, irregular margins, round bulging shape, heterogeneous echotexture and presence of calcifications [32, 33]. In present study cervical LAP was detected in 12 patients, 5 cases (41.7%) proved to malignant metastatic papillary carcinoma.

Nodular size is not predictive of malignancy, and the risk for cancer in thyroid nodule has been shown to be the same regardless the size of the nodule [34]. Amitabh J et al, [35] and Tai et al. [11] showed in their studies that the size of nodule has no relation with the risk of malignancy. Same finding was observed in our study. Kamran et al [25] have a different opinion. They showed that the incidence of follicular cancer and other less frequent types of thyroid

malignancies increase as the nodules enlarge.

Several studies [8, 12, 17, 36] suggested that thyroid malignancy was suspected to be higher in solid and mixed nodules. Cystic degenerations, however, occur in 24% of malignant thyroid masses and about 38% of malignant lesion have a cystic component [36]. Furthermore, 60% - 83% of benign thyroid nodules are solid [37]. Our results showed that although most cystic swellings were benign and most malignant nodules were solid, solid nature of the nodule alone is insufficient and non specific feature to distinguish malignant from benign nodules.

Although hypoechogenicity of the nodule was more common in malignant than in benign nodules in this study, the difference was not significant and it is non-specific marker of thyroid malignancy. Won-Jin et al [39] observed that marked hypoechogenicity was highly specific characteristic of malignant nodules, while hypoechoic nodules include the majority of malignant nodules as well as 50% of benign nodules.

Kim et al [28] and Won-Jin M et al [39] showed that, a solid nodule that is shaped taller than wider has more potential for malignancy with specificity that could reached 93%. They explained this findings by the fact that the malignant nodules grow along normal tissue plains while benign nodules grow parallel to the normal tissue plain and thus the malignant lesions have a centrifugal growth tendency. Our results didn't support these findings.

The presence of a complete and uniform halo (hypoechoic rim) around the thyroid nodule is highly suggestive of benign disease with specificity of 95% [40]. Such halo, however, is absent in more than half of benign thyroid nodules and about 10%-25% of papillary thyroid cancers have complete or nearly complete halo [41].

Benign nodules are thought to demonstrate peripheral flow with color Doppler ultrasound, while malignant lesions showing flow in the central portion

[42], Our results didn't meet this fact. Chan et al [43] concluded that papillary thyroid cancers have intrinsic blood flow and thus a completely avascular nodule is very unlikely to be malignant.

Khadka et al [44] showed that ill defined margin and marked hypoechogenicity are good predictors of malignancy in solitary thyroid nodule and such nodule should invariably undergo FNAC.

The other advantage of thyroid ultrasound is its use as a guide for fine needle aspiration cytology. Jerome M [45] showed that thyroid ultrasound imaging could be used to identify patients who have a low risk of cancer for whom FNAC should be deferred because they do not have any of the characteristics that predict malignancy.

FNAC has been considered as investigation of choice for solitary thyroid nodule. [5,7,15,20,46]. It has few false positive reports with respect to malignancy in addition to excellent patient compliance .It is a sensitive, specific and cost-effective diagnostic tool in selecting solitary thyroid nodules for surgery. Routine use of FNAC has been found to decrease the cost of treatment, decrease the number of operations performed and increase the number of surgically proven cancers [37,47]. FNAC is able to provide specific information about the cellular composition of a nodule that direct the next management strategy. It can be performed by palpation or under ultrasound guidance. The use of FNAC has lead to decrease the number of patients requiring surgery and increase the diagnostic results of malignancy after thyroidectomy [48].

Papillary, medullary, anaplastic thyroid carcinomas and thyroid lymphoma are easily identified and diagnosed by FNAC because of their characteristic cytological features [49]. The main drawback of this procedure is its inability to differentiate between benign and malignant follicular tumor because follicular adenoma and follicular carcinoma have similar cytological findings with malignancy

diagnosis needs vascular and/or capsular invasion by histopathological examination. Although FNAC is considered as the test of choice for evaluating thyroid nodules, the non diagnostic and false negative rate is about 15% -20% [49, 50]. The insufficient or indeterminate aspirates are mainly due to cystic nodule, sclerotic nodule, nodule with calcified capsule and hypervascular or necrotic nodule. FNAC under ultrasound guidance can significantly decrease the number of indeterminate or non-diagnostic aspirate. Repeated FNAC under ultrasound guidance results in a diagnostic aspirates in 75% of solid nodules and in 50% of cystic nodules [51]. A study conducted by Papini et al [3] concluded that FNAC guided by ultrasound must be done for all 8-15 mm solid and cystic nodules with irregular margins, hypoechogenicity, and microcalcifications. About 5% of thyroid nodules still do not diagnose even by repeated FNAC under ultrasound guidance. These nodules should be surgically excised except when the clinical and ultrasound features suggest favorable findings.

In this study the FNAC was done for all 146 patients. These tests were done either directly for palpable and large nodules or under ultrasound guidance for small and deep seated nodules. Patients with cervical lymphadenopathy, FNAC the node as well as the nodules was done. The results were: benign aspirate in 58.2%; suspicious or atypical in 29.5%, malignant including follicular neoplasm in 8.2% and inadequate was 4.1%, with a good sensitivity, specificity and accuracy values of 86.4%, 96.3%, 96.1 respectively. Thus of all the evaluating procedures, FNAC was found to be the most reliable and safe modality, providing more specific information than was attainable with other investigations.

Tai et al [11] concluded that FNAC was the most effective methods to distinguish between benign and malignant thyroid nodule. Several studies found that in the absence of TSH suppression, FNAC

should be the first investigation for a solitary thyroid nodule or dominant nodule in a multinodular goiter [53,54]. With experienced cytologist, diagnostic accuracy can be as high as 95% [54,55]. The possible diagnostic results of FNAC are: benign, malignant, indeterminate and inadequate. The definitive FNAC result allows non operative treatment of benign nodule, definitive surgical treatment of thyroid malignancy at initial operation and thus no need for redo surgery and increases the yield of thyroid cancers. FNAC has become the diagnostic tool of choice for the initial evaluation of solitary thyroid nodule in virtue of its accuracy, safety and cost effectiveness.

The sensitivity of thyroid nodule FNAC is recorded to be ranged between 65% and 98% and its specificity range between 72% and 100%. Saddique et al [56] showed in their study sensitivity of 75%, specificity of 95.8% and accuracy of 96.6%. Naggada [57] in his study recorded sensitivity of 88.9%, specificity of 96% and accuracy of 94.2%. These results were similar to our results. Basharat et al [58] in their study which compared the efficacy of FNAC and thyroid scan in solitary thyroid nodule recorded the same results. They recorded sensitivity, specificity and accuracy value of 80%, 97.7%, 80%. The aforementioned results including ours showed that the FNAC is more specific than sensitive in the diagnosis of thyroid nodule and hence, it is effective initial diagnostic tool for detecting malignancy of solitary and dominant thyroid nodules. It allows better selection of patients for operation than does any other diagnostic technique.

According to the results of FNAC, management of thyroid nodule consist of observation, thyroxin suppression therapy or surgery. Most patients with benign thyroid nodules in this study were either put on thyroxin suppression therapy and followed up for 6-12 months and only few cases were offered surgery because of pressure symptoms or patients preference, while patient with malignant, suspicious or indeterminate thyroid nodule were

subjected to surgery in form of total thyroidectomy or lobectomy. Thyroidectomy was done for 80 patients in this study.

Radionuclide thyroid scan cannot distinguish benign from malignant nodules and therefore is not essential in the workup of a thyroid nodule and its role is limited.

Total thyroidectomy was done for all cases in whom FNAC results were malignant (patients), subtotal and hemithyroidectomy for those with dominant nodules, suspicious and indeterminate cytology. Redo surgery in form of completion thyroidectomy was done for all patients proved to have malignant nodules by definite histopathological exam and didn't have total thyroidectomy. All specimens were sent for definite histopathological exam.

Conclusion

Although simple benign adenoma is the most common pathology of solitary thyroid nodule, about 5%-10% of these nodules are malignant. History and clinical exam are usually poor predictors of malignancy. Male gender, increasing age and evidence of cervical LAP were significantly associated with increased malignant potential in STN. Certain ultrasonic features are helpful in differentiating between benign and malignant nodules but none of these are pathognomonic or specific. These features are mainly ill-define margin, hypoechogenicity, microcalcifications hypervascularity of the nodule and the presence of cervical lymph adenopathy. FNAC has become the diagnostic test of choice for thyroid nodule. It is highly sensitive, specific and accurate in predicting malignant nodule in addition to be safe and cost effective. FNAC is advised to be the first and could be the only test required to evaluate thyroid nodule.

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