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Original Research Article

Predictors of malignancy in solitary nodule thyroid

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ABSTRACT

Background: Solitary nodule thyroid is one of the common surgical problems and incidence of malignancy is also high compared to multinodular goiter. If you can avoid aggressive surgery in benign cases, we can reduce the occurrence of complications. So it's important to look for the malignant predictors. The aim of the study was to evaluate the malignant predictors in solitary nodule thyroid.
Methods: Total of 80 patients with solitary thyroid nodule were included in prospective study. The study was done from January 2015 to January 2016.
Results: Most of the malignant cases are occurring in females' middle age group. Most common one found to be papillary. Experienced radiologist can clearly detect malignancy preoperatively. Most common finding in USS is solid internal architecture.
Conclusions: Solitary thyroid nodule is a common problem encountered in the surgical department and it has got a high malignant potential.

Keywords: Carcinoma, Solitary nodule thyroid, USS thyroid

INTRODUCTION

Solitary thyroid nodule (SNT) is a common thyroid disorder, clinically palpable nodules are encountered in about 8% of the adult population and the incidence of malignancy in SNT is very high compared to other thyroid swelling. The risk of malignancy in SNT is 15% compred to 3% in multinodular goiter. With the use of ultrasound, the chance of detection of thyroid nodules has increased considerably.[1-6]

At present no single investigation will tell the thyroid malignancy with 100% accuracy. Current studies shows that the occurrence of thyroid carcinoma is increasing over the years.[1,3] To differentiate benign thyroid nodule from malignant is very important to avoid unnecessary extensive surgery and surgery related complications, such as hypothyroidism, hypocalcaemia, and recurrent laryngeal nerve injury.[1] In this study am focusing on the various factors that will predict malignancy in SNT such as age, sex, and radiological features.

METHODS

In this study we included a total of 80 patients with solitary thyroid nodule who underwent thyroidectomy in surgical department of our hospital. All patients followed for a period of 2 years from January 2014 - January 2016. All patients underwent a detailed history, clinical examination, basic investigations including thyroid function test and ultrasound neck.

All cases underwent routine FNAC of the thyroid as an outpatient procedure using 10 cc syringe with 22 G needle. The entire slide was examined after proper staining under both low and high power microscope. Ultrasound of neck was done for all cases to look for size of the thyroid and nodule, presence of any non-palpable

nodule, echogenicity, vascularity, calcification and enlargement of lymphnodes.

All included cases were underwent total, subtotal, hemi thyroidectomies and the final histopathological report were analysed. The lymphnodes were treated with selective neck dissection. All these patients were followed up in the post-operative period for the complication like hypothyroidism, hypoparathyroidism, hypocalcaemia and recurrent laryngeal nerve injury.

Inclusion criteria

- Patients presenting with solitary nodule thyroid
- Patients who underwent thyroidectomy for SNT during January 2014 to 2016.

Exclusion criteria

- Patients having multi nodular or diffuse thyroid disease thyroid
- Patients not undergone surgery.

Statistical analysis

Diagnostic value of USG will be calculated by sensitivity, specificity, positive predictive value, negative predictive value and by calculating percentage of false negative cases.

Analysis will be done on 2 x 2 tables for sensitivity and specificity. The statistical analysis software used is SPSS and values < 0.05 considered as significant. Final HPR will be taken as gold standard and results of USG will be taken as positive cases.

- Sensitivity =TP/TP+TN
- Specificity =TN/TN+FP
- Positive predictive value=TP/TP+FP
- Negative predictive value=TN/TN+FN TP- True positive
- TN- True negative FP-False Positive FN-False negative

RESULTS

This study was a hospital based prospective study conducted from January 2015 - January 2016 to detect the malignant predictors in solitary nodule thyroid.

Both benign and malignant thyroid lesions were found to be more common in females. The male to female ratio was found to be 1:5.7 (Table 1). Most of the thyroid cases were found to be in the middle age group. 96.25% fall in the age group of 20-60. There were twelve male patient in our study. Of which half cases were found to be malignant. But in females only 23.52% found to be malignant.

Table 1: Benign diseases.

Histological type	Sex No. of cases		Total	
	Male	Female	No of cases	Percentage
Colloid nodule	6	28	34	58.62
Thyroiditis	0	19	19	32.75
Adenoma	0	5	5	8.62

Table 2: Malignant diseases.

Histological type	Sex (no of cases)		Total	
	Males	**Females**	**No. of cases**	**Percentage**
Papillary carcinoma thyroid	4	11	15	68.1
Follicular carcinoma thyroid	2	5	7	31.8
Others	0	0	0	0

Table 3: Age and sex distribution for malignancy.

Age in years	Males		Females	
	Benign	**Malignant**	**Benign**	**Malignant**
0 - 20	0	0	0	0
21 - 30	3	0	2	6
31 - 40	6	0	22	5
41 - 50	2	4	11	4
51 - 60	0	0	0	2
61 - 70	0	0	2	1
>70	0	0	0	0
Total	**11**	**4**	**52**	**18**

Table 4: Comparison between FNAC and histopathology report.

FNAC	Histopathology report	
	Benign	**Malignant**
Benign	53	7
Malignant	5	15

Most common benign disorder was found to be nodular colloid goiter in SNT (58.62%) and thyroiditis came as the second one its incidence was found to be 32.75% (Table 1). Incidence of adenoma was found to be less in our study. All the benign disorders were found to be

common in females. In our studies there were no cases of adenoma and thyroiditis in males, and all the cases were found to be colloid nodule.

Table 5: Comparison between USG and histopathology report.

USG	Histopathology report	
	Benign	**Malignant**
Benign	55	4
Malignant	3	18

Table 6: Sonographic features in malignancy.

Echotexture	No. of cases	Percentage
hypoechoic	18	81.81
Isoechoic	3	13.63
Mixed	1	4.54
Hyperechoic	0	0
Internal architecture		
Solid	19	86.36
Solid with cystic elements	2	9.09
Predominantly cystic	1	4.54
Margin		
Poorly defined	12	54.54
Well defined	10	45.45
Halo		
Absent	15	68.18
Present	7	31.81
Vascularity		
Intrinsic	15	68.18
Perinodular	5	22.72
None	2	9.09
Calcification		
Microcalcification	10	45.45
Coarse calcification	1	4.54
Peripheral calcification	1	4.54
None	10	45.45
Shape		
Taller than wide	17	77.27
Ovoid to round	5	22.72
Lymphnodes		
Present	10	45.45
Absent	12	54.54

The incidence of malignancy in SNT was found to be 27.5% in our study series. Of the malignancy 68.1% was constituted by the papillary carcinoma, the most common malignant thyroid neoplasm. In our study group we got only two types of thyroid malignancy only in SNT papillary and follicular. Of which follicular constitute only 38.1% (Table 2) (Figure 1). In both males and females, the most common was found to be papillary. The incidence of male to female ration in malignancy was found to be 1.5:4.

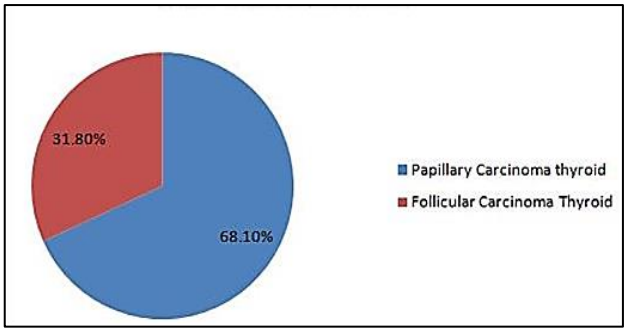

Figure 1: Malignant disease.

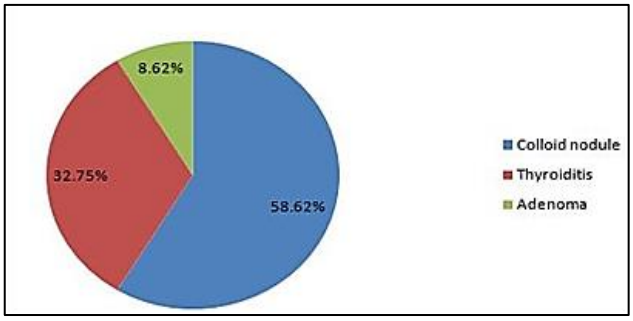

Figure 2: Benign disease.

Of the malignancy in SNT 18.1% was occurred in males (4 cases), 81.2% was that in females (18 cases). So the proportion of malignancy in males and females were found to be 26.6 and 25.7% respectively. All the cases in males belongs to the age group of 40-50. In females most of the cases occurred in 20-30 age groups. Majority of the cases that occurred were in between 20-50 age group (Table 3).

Of the total 22 malignant cases FNAC diagnosis made in preoperatively only for 15 cases. Five cases were diagnosed as malignancy by FNAC was found to be benign in the histopathology. Of the 53 benign cases diagnosed by FNAC seven cases turned out to be malignant in the final histopathology. Sensitivity and specificity were found to be 68.1% and 91.3% respectively (Table 4).

Table 7: Predictive value of FNAC and USG to detect thyroid malignancy.

	USG	FNAC
Sensitivity	81.8%	68.1%
Specificity	94.8%	91.3%
Positive predictive value	85.7%	75%
Negative predictive value	93.2%	88.3%

Sensitivity of ultrasound has been demonstrated in this study as sensitivity of 81.8% and specificity of 94.8% (Table 5, Table 7). The higher values of sensitivity and specificity ultra sound may be due to experienced radiologist.

The most common sonographic features in malignancy are Solid internal architecture (86.36%) followed by hypo echoic echo texture (81.81%), then taller than wide shape (77.27%) and absence of halo and intrinsic vascularity (68.18%) Table 6.

DISCUSSION

Aetiological factors

Family history was present in only one case and that was a case of papillary thyroid. History of irradiation was not directed in any case.

Sex distribution

Almost all thyroid disorders were more common in females, in total the ratio found to be 1:5.7 which is always similar to values in the literature ie.1:8.[7]

Age distribution

More of the thyroid disorders were found to be clustered within the middle age group, 96.25% of the case belong to 20 - 60 age groups. It is accordance with the literature.[8]

Proportion of various benign disorders

Among various benign disease of thyroid, colloid nodule was the commonest (58.62%) Thyroiditis was second (32.75%). Proportion of follicular adenoma was 8.62%.

Age and sex predilection for various benign disorders

For colloid nodule male: female ratio is found to be 1:4.67 which is in accordance to the values in literature 1:6.[9] Thyroiditis, follicular adenoma was found only in females in literature.

Proportion of various malignancies thyroid

Coming to proportion of various malignant disease that of papillary carcinoma was 68.1% follicular carcinoma thyroid was 31.8% and that of other malignancies were 0% while the values given in literature are papillary carcinoma thyroid 60 - 80%, follicular carcinoma thyroid 10 - 17%.

Age and sex prediletion for malignancy thyroid

Male: female ratio for malignancies was found to be 1:2.6 which is almost similar to ratio given in the literature i.e. 1:3.[10]

Role of FNAC

Sensitivity of FNAC was 68.1% and specificity was 91.3%. Positive predictive value of FNAC was 75% and negative predictive value of FNAC was 88.3%.[11]

Role of USG

Sensitivity of USG was 81.8% and specificity was 94.8%. Positive predictive value 85.7% and negative predictive value was 93.2%.[12]

Thyroid malignancy is relatively rare and is diagnosed in approximately 25,000 patients per year in the United States although less than 7% of thyroid nodules are malignant it is critical that they be accurately identified.[13,14] The imaging modality of for the investigation of thyroid nodules is high-resolution US. It is commonly misperceived as unhelpful in distinguishing between benign and malignant thyroid nodules. Although individual US features may be of limited value, when multiple signs of thyroid malignancy appear in combination it is possible to make an accurate prediction. The most common sonographic features in malignancy are solid internal architecture (86.36%) followed by hypoechoic echotexture (81.81%), then taller than wide shape (77.27%) and absence of halo and intrinsic vascularity (68.18%).

USG Features of malignancy

Calcifications

Thyroid calcifications may occur in both benign and malignant disease. It can be classified as micro calcification, coarse calcification, or peripheral calcification. Thyroid micro calcifications are psammoma bodies, which are 10 - 100 μm round laminar crystalline calcific deposits They are one of the most specific features of thyroid malignancy, Micro calcifications are found in 29% - 59% of all primary thyroid carcinomas, most commonly in papillary thyroid carcinoma. Their occurrence has been described in follicular and anaplastic thyroid carcinomas as well as in benign conditions such as follicular adenoma and Hashimoto thyroiditis.[10,14-17] At US, micro calcifications appear as punctate hyper echoic foci without acoustic shadowing. In this study micro calcifications are found in 45.5% of malignant cases and only in one benign case

Halo

The halo or hypo-echoic rim around a thyroid nodule is produced by a pseudo-capsule of fibrous connective tissue, a compressed thyroid parenchyma, and chronic inflammatory infiltrates.[18] In this study it is found that about 94% 0f benign cases and 31.81% of malignant cases have presence of halo. A completely uniform halo around a nodule is highly suggestive of benignity, with a specificity of 95%.[19] However, a halo is absent at US in more than half of all benign thyroid nodules.[18,20] Moreover, 10% - 24% of papillary thyroid carcinomas have either a complete or an incomplete halo so absence of halo is not a typical predictor of malignancy.[16,20,21]

Margin

A thyroid nodule is considered ill-defined when more than 50% of its border is not clearly demarcated. An ill-defined and irregular margin in a thyroid tumor suggests malignant infiltration of adjacent thyroid parenchyma with no pseudo capsule formation. The reported sensitivity of ill-defined margins and irregular margins, however, ranges widely (53%–89%).[22] The specificity of ill-defined margins is variable, with 15% - 59% of benign nodules having poorly defined margins with macro- or microlobulations.[22,23] Therefore, unless frank invasion beyond the capsule is demonstrated, the US appearance of the nodule margins alone is an unreliable basis for determining malignancy or benignity. In this study we found irregular margins in 5 benign and 6 malignant cases. Irregular margin is seen in 54.54% of malignant cases in this study.

Shape

The shape of a thyroid nodule is a potentially useful US feature that has not been extensively described in the literature. Kim et al found that a solid thyroid nodule that is taller than it is wide (i.e. greater in its antero posterior dimension than its transverse dimension) has 93% specificity for malignancy.[15] This appearance is thought to be due to a centrifugal tendency in tumor growth, which does not necessarily occur at a uniform rate in all dimensions. In this study it is found that 77.27% of cases showing this feature.

Vascularity

Vascular flow within a thyroid nodule can be detected with color or power Doppler US. The most common pattern of vascularity in thyroid malignancy is marked intrinsic hypervascularity, which is defined as flow in the central part of the tumor that is greater than that in the surrounding thyroid parenchyma. This occurs in 69% - 74% of all thyroid malignancies.[14,16]

However, it is not a specific sign of thyroid malignancy by itself. In this study intrinsic vascularity is seen in 68.18% of malignant cases. Frates et al showed that more than 50% of hyper vascular solid thyroid lesions were benign.[23]

In this study intrinsic vascularity is seen in 32.35% of benign cases perinodular flow is defined as the presence of vascularity around at least 25% of the circumference of a nodule. This flow pattern is more characteristic of benign thyroid lesions but also has been found in 22% of thyroid malignancies.[10] In contrast, complete avascularity is a more useful sign: Chan et al reported that all papillary thyroid carcinomas in their study had some intrinsic blood flow, and they concluded that a completely avascular nodule is very unlikely to be malignant.[16] Complete avascularity and perinodular flow pattern is seen in only 1.81% of malignancies.

Hypo echoic solid nodule

Malignant nodules, both carcinoma and lymphoma, typically appear solid and hypo echoic when compared with normal thyroid parenchyma. The combination of these two US features has a sensitivity of 87% for the detection of thyroid malignancy.[14] Marked hypoechogenicity is very suggestive of malignancy. Solid internal echo texture is seen in 86.36% of malignant cases and hypoechogenicity is seen in 81.81% of cases Although a single feature in ultrasound is not helpful in predicting malignancy, a combination of solid, hypo echoic nodule with poorly defined margins and intrinsic vascularity and micro calcifications can almost accurately predict malignancy suggestive of benignity, with a specificity of 95%.[19] However, a halo is absent at US in more than half of all benign thyroid nodules.[18,20] Moreover, 10% - 24% of papillary thyroid carcinomas have either a complete or an incomplete halo so absence of halo is not a typical predictor of malignancy.[16,19-21]

Although a single feature in ultrasound is not helpful in predicting malignancy, a combination of solid, hypo echoic nodule with poorly defined margins and intrinsic vascularity and micro calcifications can almost accurately predict malignancy. Sensitivity of ultrasound has been demonstrated as high as 86.5% and specificity as high as 92.3%which is almost similar in this study (sensitivity 81.8% and specificity of 94.8% Sensitivity and accuracy of FNAC is as high as 95% in experienced hands .It has a positive predictive value of 90-98% and negative predictive value of 94 - 99% in literature.[24] But in this study the sensitivity and specificity of FNAC is found to be 68.1% and 91.3 % respectively which is less than the values in literature. In our setting, we found that FNAC Results are usually not confirmatory. The higher values of sensitivity and specificity in ultra sound may be due to experienced radiologist.

CONCLUSION

Solitary thyroid nodule is a common problem encountered in the surgical department and it has got a high malignant potential. In this study I focused the predictors of malignancy in solitary nodule thyoid. I found that the incidence of thyroid disease is more common in females and the highest incidence found in the age group of 20 - 60 years. Majority of the case was found to be benign but 22 cases were found to be malignant. Most common type of malignancy was found to be papillary carcinoma. In present study series incidence of benign and malignant disorder in males found to be the same and against the literature view. I found it may be due to a small sample size. Most common age group with malignancy found to be in middle age. With FNAC and USS thyroid most of the solitary nodule can be diagnosed whether it’s benign or malignant. Most common USS feature found in favor for

malignancy was solid internal architecture followed by hypo echoic echotexture (81.81%) intrinsic vascularity (68.18%), poorly defined margins (54.545) micro calcification (45.45%).

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