



## A STUDY OF THE CLINICAL, RADIOLOGICAL, CYTOLOGICAL AND HISTOPATHOLOGICAL CORRELATION OF SOLITARY THYROID NODULE

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### ABSTRACT

**Background:** Solitary thyroid lesions are a common presentation in the surgical OPD. The significance of solitary nodule is its malignant potential. Thyroid nodule is an elusive clinical problem. Surgeons and Physicians are often required to make a diagnostic or management decision in its treatment. **Aim and Objectives:** To study the correlation between Clinical, Radiological, Cytological and Histopathological finding in patients who presented with "solitary thyroid nodule". **Materials and Methods: Study design:** A prospective observational study. **Study area:** Ramakrishna Mission Seva Pratishthan Hospital, Kolkata. **Study period:** July 2019 to June 2022(3 years). **Sample size:** 40 patients. **Inclusion criteria:** Patients presenting with solitary thyroid nodule. **Exclusion criteria:** Patients with multinodular goitre, patients with carcinoma thyroid with distant metastasis, paediatric patients and those unwilling. **Methodology:** Thorough history, clinical examination, investigation (FNAC/USG/Isotope Scan, TSH), appropriate surgical intervention and HPE of excised specimen was done. **Results:** In our study of 40 cases, 28(70.0%) were colloid goiter, 7(17.5%) were papillary carcinoma, 2(5%) were follicular adenoma, 1(2.5%) was follicular carcinoma, 1(2.5%) was adenomatoid hyperplasia and 1(2.5%) was Hashimoto thyroiditis. 28(70%) cases underwent hemithyroidectomy, 11(27.5%) underwent total thyroidectomy and 1(2.5%) underwent hemithyroidectomy followed by revision total thyroidectomy. 2 cases of papillary carcinoma with enlarged neck nodes underwent total thyroidectomy with neck node dissection. **Conclusion:** Solitary nodule is most common in woman and in third and fourth decade of life, more common in the right lobe. USG and FNAC are common modalities of investigations with high specificity and sensitivity. Isotope scan is only indicated to confirm the toxic nodule. Malignancy reported in my study was 20%. Early diagnosis and prompt treatment will cure the disease since carcinoma thyroid is more curable amongst all cancers.

**KEYWORDS :** solitary thyroid nodule(STN), Papillary carcinoma thyroid(PTC), Follicular carcinoma thyroid(FTC), Ultrasonography(USG), Fine needle aspiration cytology(FNAC), Histopathological Examination(HPE)

### INTRODUCTION

A thyroid nodule is defined as a discrete lesion within the thyroid gland that is distinct from the surrounding thyroid parenchyma either on clinical examination or radiological imaging<sup>1</sup>. In recent years, more and more thyroid gland malignancies are being encountered presenting as thyroid nodule. The epidemiological studies have shown that prevalence of solitary thyroid nodule in adult population and children ranges from 4-10% and 0.2-1.2% respectively<sup>2</sup>. Nodules are more common in iodine-deficient areas, in women, and with aging<sup>3</sup>. Thyroid carcinoma is the leading cause of death among endocrine cancers second to carcinoma of the ovary<sup>4</sup> and accounts for approximately 1% of all malignancies. Thyroid cancer occurs primarily in young and middle-aged adults and rarely in children<sup>5</sup>. Thyroid nodules are more common in women (5%) than men (1%) and very rare in children. Peak incidence of thyroid cancer occurs in women in their twenties and forties. Benign thyroid tumours are common and although cancers are relatively rare, they represent the most common malignancies of the endocrine system<sup>5</sup>. Nodules in younger patients are more likely to be neoplastic than those in older patients<sup>6</sup> whereas thyroid cancer occurs primarily in young and middle-aged adults and is rare in children<sup>5</sup>. The mean age at diagnosis is the mid-forties to early fifties for the papillary type, fifties for the follicular and medullary types and sixties for the considerably less common poorly differentiated and undifferentiated types<sup>5</sup>. Solitary nodules, in general, are more likely to be neoplastic than multiple nodules<sup>6</sup>. Nodules in males are more likely to be neoplastic than females<sup>6</sup>. A history of radiation treatment to the head and neck region is associated with an increased incidence of thyroid malignancy<sup>6</sup>. Clinical features

associated with increased risk of malignancy include age <20 years and >60 years, firm, irregular, non-tender, fixed appearance, regional lymphadenopathy, rapid growth, hoarseness of voice due to vocal cord paralysis, history of neck irradiation and family history of thyroid carcinoma<sup>7,8</sup>. Ultrasound is very sensitive technique and most frequently used modality to investigate thyroid nodules. It is non-invasive, widely available and inexpensive<sup>1</sup>. It can frequently distinguish malignant from benign nodules, aid in the decision making of which nodules to biopsy and increase the rate of successful fine needle aspiration cytology<sup>10</sup>. Patients with solitary nodules should undergo fine needle aspiration cytology (FNAC) and as they have malignant potential, hence evaluation of these nodules are essential. FNAC is simple, convenient, rapid, cost effective and safe method. It plays important role in pre operative screening in the diagnosis of thyroid lesions and is a valuable tool in management<sup>11</sup>. CT or MRI can be helpful in assessing larger thyroid masses, extrathyroidal extension, involvement of trachea or major vessels, mediastinal lymph nodes. Radionuclide thyroid scanning can be done in patients with abnormal thyroid function test to identify autonomous "hot" nodules. Hyperactive nodules are most likely to be benign, while non active nodules have a risk of about 10-20% malignancy<sup>1,9,12</sup>. Thyroid function tests must be performed as low or elevated TSH levels could be an indication that a nodule is respectively either benign or malignant.<sup>1,6,9,12</sup>

### AIM

To study the correlation between Clinical, Radiological, Cytological and Histopathological finding in patients who presented with "solitary thyroid nodule".

**OBJECTIVES**

- 1) To study the various modes of clinical presentation of solitary thyroid nodule.
- 2) To study the different clinical signs elicited in solitary thyroid nodule.
- 3) To study the role of Radiological investigation (especially Ultrasonography in diagnosis of solitary thyroid nodule) in pre-operative evaluation.
- 4) To study the role of FNAC(Fine Needle Aspiration Cytology) in pre-operative evaluation.
- 5) To study Histopathology in post-operative evaluation for arrival at a conclusive diagnosis.

**MATERIALS & METHODS**

**Study Design:** A prospective observational study. Study Area: Ramakrishna Mission Seva Pratishthan Hospital, Kolkata

**Study period:** July 2019 to June 2022.

**Sample size:** 40 patients

**Inclusion criteria:** Patients presenting with solitary thyroid nodule

**Exclusion criteria:**

- 1) Patient with clinical features of multinodular goiter.
- 2) Patient with carcinoma of thyroid with distant metastasis.
- 3) Paediatric patients.
- 4) Unwilling patients.

**METHODOLOGY:**

**History:** A detailed history was taken including notable history of swelling, pressure symptoms(hoarseness, dyspnoea, dysphagia), sudden unexplained weight loss/gain, nervousness, palpitation, tremor, intolerance to heat/cold, appetite increased/decreased, diarrhea/constipation, oligomenorrhoea/menorrhagia.

**Clinical Examination:** for tremor, anemia, tachycardia, dry/moist or warm/cold skin, cachexia, alopecia, eye signs(exophthalmos, Von Graefe's sign, Dalrymple's sign, Stellwag sign, Joffroy's sign, Ophthalmoplegia, Mobius sign, chemosis), Pemberton's sign, proximal myopathy, delayed tendon reflex and nodule assessment(site, size, shape, extent, surface, margin, consistency, mobility, toxic signs, lymph nodes).

**Investigations:**

- 1) Routine blood examinations(Hb%, TLC, DLC, ESR, Platelet, Na<sup>+</sup>, K<sup>+</sup>, Urea, Creatinine, Ca<sup>++</sup>, FBS, PPBS, LFT).
- 2) Thyroid function test(free T3, free T4, TSH) (Thyroid profile by IMMULITE 1000 chemiluminescence assay machine).
- 3) USG of neck and thyroid with guided FNAC
- 4) X-ray of chest(PA view), X-ray of neck(AP+lateral), CT Scan/MRI neck(if required).
- 5) FNAC and HPE.
- 6) Indirect laryngoscopy(if required).
- 7) Post-operative HPE of the excised specimen.

**Statistical Analysis:**

Done using IBM SPSS v25. Correlation amongst USG, FNAC and HPE using McNemar test and Pearson's Chi square test. P value <0.05 was considered significant.

**RESULTS AND ANALYSIS**

The mean age of presentation(Years)(mean±SD) for all patients was 35.7±13.9. The mean age(Years)(mean±SD) for males was 40.4±7.8. The mean age(Years)(mean±SD) for females was 34.5±14.9. The mean age(Years)(mean±SD) for carcinoma of solitary thyroid nodule 38.9±10.9. The overall female to male ratio is 4:1.

All patients presented with neck swelling. 5(12.5%) had additional cosmesis problem, 1(2.5%) with dysphagia and 1(2.5%) with dyspnoea.

Systemic signs and symptoms related to hypothyroidism or hyperthyroidism were present in 11 cases of which 7 were

hypothyroid and 4 were hyperthyroid. Features of thyrotoxicosis were seen in 2 cases of hyperthyroidism.

Most of the benign cases presented in the duration range of 5-10 years. Most of the malignant cases presented in the duration range of <12 months. Duration of swelling ranged from 2 months to 14 years.

Majority of the nodules were in size range 1-4 cm(in maximum dimension). Size of the nodules varied from 1.8 to 5.2 cm(in maximum dimension). In size range of 1-4 cm(n=26), 23(57.5%) cases were benign, 3(7.5%) were malignant. In size >4 cm(n=14), 5(12.5%) were malignant and 9(22.5%) benign. Larger nodules (>4cm in maximum dimension) had 35.7% chances of malignancy. Most of the malignant nodules (62.5%) had size >4cm in maximum dimension.

Most of the nodules (n=25, 62.5%) were located in the right lobe and 15(37.5%) in the left lobe. None were present in the isthmus. 20(50%) nodules present in the Right lobe was benign, while 5(12.5%) were malignant. 12(30%) nodules present in the Left lobe was benign and 3(7.5%) malignant.

9(22.5%) cases had cystic consistency which were all benign. 4(10%) had soft consistency which were all benign. 17(42.5%) cases had firm consistency out of which 12(30%) were benign and five (12.5%) malignant. Only 1(2.5%) had hard consistency that was malignant. 9(22.5%) cases had variable consistency, of which 7(17.5%) were benign and 2(5%) were malignant.

Amongst 40 patients, 29(72.5%) were euthyroid, 7(17.5%) were hypothyroid and 4(10%) were hyperthyroid. Among the 8 malignant cases, 4(50%) were euthyroid, 3(37.5%) were hypothyroid and 1(12.5%) was hyperthyroid. Amongst 32 benign cases, 25(78.1%) were euthyroid, 4(12.5%) were hypothyroid and 3(9.4%) were hyperthyroid.

Out of 32 females, 24(60% of total) were benign and 8(20% of total) were malignant. Amongst 8 males, all of them (20% of total) were found to be benign.

**Table 1: USG features of Solitary Thyroid Nodule**

Usg Feature	Malignant(%) (on Hpe)	Benign(%) (on Hpe)	Total(%)
<b>Internal Architecture</b>			
Solid	6(15%)	11(27.5%)	17(42.5%)
Cystic	0(0)	16(40%)	16(40%)
Solid-cystic	2(5%)	5(12.5%)	7(17.5%)
<b>Echotexture</b>			
Hyperechoic	0(0)	16(40%)	16(40%)
Hypoechoic	6(15%)	3(7.5%)	9(22.5%)
Isoechoic	1(2.5%)	1(2.5%)	2(5%)
Heteroechoic	1(2.5%)	5(12.5%)	6(15%)
Anechoic	0(0)	7(17.5%)	7(17.5%)
<b>Margins</b>			
Well-defined	3(7.5%)	31(77.5%)	34(85%)
Ill-defined	5(12.5%)	1(2.5%)	6(15%)
<b>Shape</b>			
Taller than wider	7(17.5%)	8(20%)	15(37.5%)
Ovoid to round	1(2.5%)	3(7.5%)	4(10%)
Wider than taller	0(0)	21(52.5%)	21(52.5%)
<b>Calcification</b>			
Microcalcification	4(10%)	0(0)	4(10%)
Coarse calcification	1(2.5%)	2(5%)	3(7.5%)
No calcification	3(7.5%)	30(75%)	33(82.5%)
<b>Vascularity</b>			
Perinodular	2(5%)	22(55%)	24(60%)
Intrinsic	5(12.5%)	3(7.5%)	8(20%)

Avascular	1(2.5%)	7(17.5%)	8(20%)
<b>Halo</b>			
Present	2(5%)	28(70%)	30(75%)
Absent	6(15%)	4(10%)	10(25%)
<b>Neck nodes</b>			
Present	2(5%)	0(0)	2(5%)
Absent	6(15%)	32(80%)	38(95%)

On USG, the following features (as depicted in table 1) was noted:

**A) Internal architecture-** Out of 8 malignant cases (HPE), 6(15% of total) were solid, 2(5% of total) were solid with cystic degeneration and 0(0) were purely cystic on USG. All the 6 solid malignant nodules(on HPE) were correctly diagnosed on USG as TIRAD 4/5. 2 cases of malignant nodules(on HPE) with solid-cystic internal architecture: both were papillary carcinoma thyroid on HPE, one was correctly diagnosed as TIRAD 4 on USG and another one was falsely diagnosed as TIRAD 3 on USG. Out of 32 benign cases, 11(27.5% of the total) were solid, 16(40% of the total) were cystic and 5(12.5% of the total) were solid with cystic degeneration. All the 16 cystic degenerative nodules were correctly diagnosed as benign on USG. 3 solid benign nodules out of which 2 were follicular adenoma and one was colloid goiter were falsely diagnosed as TIRAD 4 on USG.

**B) Echotexture-** Out of 8 malignant nodules(HPE), 6(15% of the total) were hypoechoic, 1(2.5% of the total) were isoechoic and 1(2.5% of the total) were heteroechoic, 0(0) were hyperechoic and 0(0) were anechoic on USG. All the 6 hypoechoic cases were TIRAD 4/5 on USG, one isoechoic solid nodule – TIRAD 3 (colloid goiter on FNAC) was reported as papillary carcinoma on HPE. One heteroechoic solid-cystic nodule – TIRAD 4 was reported as papillary carcinoma on both FNAC and HPE. Out of 32 benign nodules, 16(40% of the total) were hyperechoic, 3(7.5% of the total) were hypoechoic, one (2.5% of the total) were isoechoic, 5(12.5% of the total) were heteroechoic and 7(17.5% of the total) were anechoic. All the 7 anechoic benign thyroid nodules were TIRAD 2 (colloid type 1).On USG, 3 hypoechoic nodules were reported as TIRAD 4 which was subsequently diagnosed 2 cases of follicular adenoma and one case of colloid goitre: benign on HPE(False positive on USG).

**C) Margins-** Out of 8 malignant nodules(HPE), 5(12.5% of the total) had ill-defined margins and 3(7.5% of the total) had well defined on USG. All 5 nodules with ill-defined margin were TIRAD 4/5 on USG and malignant on HPE. One case of papillary carcinoma thyroid on HPE had well defined margin on USG and was falsely diagnosed as TIRAD 3 benign colloid nodule. One case of papillary carcinoma thyroid on HPE had well defined margin and was correctly diagnosed as TIRAD 4 on USG. One case of follicular carcinoma thyroid on HPE had well defined margin and was correctly diagnosed as TIRAD 4 on USG. Out of 32 benign cases, 31(77.5% of total) had well defined margins(TIRAD 1,2,3) and one (2.5% of total) had ill-defined margin which was falsely diagnosed as TIRAD 4 on USG and follicular adenoma on HPE.

**D) Shape-** Out of 8 malignant nodules(HPE), 7(17.5% of the total) were taller than wider, one(2.5% of total) was ovoid to round and 0(0) was wider than taller on USG. All 7 cases(malignant on HPE) were TIRAD 4/5 on USG and one (TIRAD 3 on USG )which was ovoid to round shaped detected as papillary carcinoma on HPE( false negative on USG) .Out of 32 benign cases, 21(52.5% of total) were wider than taller, 8(20% of total) were taller than wider and, 3(7.5% of total) were ovoid to round.

**E) Calcification-** Out of 8 malignant cases(HPE), 4(10% of total) had microcalcification, one(2.5% of total) had coarse calcification and 3(7.5% of total) had no calcification on USG. All the 5 malignant cases having calcification were correctly diagnosed on USG as malignant. Out of 32 benign cases, 2(5% of total) had coarse calcification and 30(75% of total) had no calcification. These 2 benign cases with coarse

calcification were correctly diagnosed on USG as benign(TIRAD2).

**F) Vascularity-** Out of 8 malignant cases(HPE), 5(12.5% of total) had intrinsic vascularity, 2(5% of total) had perinodular vascularity, and one(2.5% of total) was avascular on USG. 5 malignant cases with intrinsic vascularity were correctly diagnosed on USG as TIRAD 4/5 category. One malignant nodule (papillary carcinoma on HPE) with perinodular vascularity(on USG) was falsely diagnosed as TIRAD 3 colloid nodule on USG and one malignant nodule(papillary carcinoma on HPE) with perinodular vascularity (USG) was correctly diagnosed as TIRAD 4 on USG. One malignant nodule(follicular carcinoma on HPE) was avascular(on USG) and was correctly diagnosed as TIRAD 4(on USG). Out of 32 benign cases, 22(55% of total) had perinodular vascularity, 3(7.5% of total) had intrinsic vascularity and 7(17.5% of total) were avascular. 22 cases of benign thyroid nodules(on HPE) with perinodular vascularity were correctly diagnosed as benign(TIRAD 2, colloid type 2 and 3, TIRAD 3) on USG. 3 benign thyroid nodules (on HPE – one colloid goiter and two follicular adenoma) had intrinsic vascularity(on USG) were falsely diagnosed as TIRAD 4 on USG. All the 7 benign nodules(on HPE) were avascular(on USG) and were correctly diagnosed as TIRAD 2 colloid type 1 on USG.

**G) Halo-** Out of 8 malignant cases on HPE, 6(15% of total) had no halo and 2(5% of total) had halo present. All the 6 malignant nodules without halo were correctly diagnosed on USG as TIRAD 4/5. Of 2 malignant nodules with presence of halo(on USG), one was papillary carcinoma on HPE, falsely diagnosed as TIRAD 3 on USG and another one was follicular carcinoma on HPE, correctly diagnosed as TIRAD 4 on USG. Out of 32 benign cases (on HPE), 28(70% of total) had halo present and 4(10% of total) had no halo. Out of 28 benign cases(HPE), 26 benign nodules with presence of halo were correctly diagnosed on USG as TIRAD 2 and 3 and two benign nodules were falsely diagnosed on USG as TIRAD 4. These two benign cases(follicular adenoma on HPE) had presence of halo on USG indicating presence of capsule. One benign nodule (colloid goiter on HPE) with absence of halo was falsely diagnosed as TIRAD 4 on USG. 3 cases of anechoic benign TIRAD 2 type 1 colloid nodule had absence of halo.

**H) Neck nodes-** Out of 40 total cases, only 2(5%) had enlarged neck nodes which were papillary carcinoma on HPE and TIRAD 4 and 5 on USG respectively.

**I) Comet tail sign-** 4(10% of total) cases of anechoic benign TIRAD 2 type 1 colloid nodules had presence of comet tail sign.

**Table 2: USG Findings of Malignant Solitary Thyroid Nodules**

Usg Feature	Cases	Percentage(%)
<b>ECHO Texture</b>		
Hypoechoic	6	75
Heteroechoic	1	12.5
Isoechoic	1	12.5
Hyperechoic	0	0
<b>INTERNAL ARCHITECHTURE</b>		
Solid	6	75
Solid with cystic components	2	25
Predominantly cystic	0	0
<b>MARGINS</b>		
Poorly defined	5	62.5
Well-defined	3	37.5
<b>SHAPE</b>		
Taller than wider	7	87.5
Ovoid to round	1	12.5
<b>CALCIFICATION</b>		
Microcalcification	4	50
Coarse calcification	1	12.5
Peripheral Calcificaton	0	0
None	3	37.5
<b>HALO</b>		



Absent	6	75
Present	2	25
<b>VASCULARITY</b>		
Intrinsic	5	62.5
Perinodular	2	25
None	1	12.5
<b>LYMPH NODES</b>		
Present	2	25
Absent	6	75

On FNAC, out of 40 cases, 28(70%) were colloid goiter, 6(15%) were papillary carcinoma, 5(12.5%) were follicular neoplasm and 1(2.5%) was Hashimoto thyroiditis.

On USG, 30 cases were benign out of which 29 cases were benign on FNAC and one case was malignant on FNAC. On USG, 10 cases were reported as malignant out of which 5 cases were malignant on FNAC and 5 cases were indeterminate on FNAC (follicular neoplasm BETHESDA IV). On USG, 30(75%) were benign and 10(25%) were malignant whereas in FNAC, 29(72.5%) were benign, 6(15%) malignant and 5(12.5%) were indeterminate- follicular neoplasm BETHESDA IV.

There was one left-sided solid-cystic heteroechoic thyroid nodule TIRAD 2 (colloid type 2) on USG which came out to be papillary carcinoma (BETHESDA V) thyroid on FNAC (final HPE report was colloid goitre). 5 cases diagnosed malignant on USG (TIRAD 4) turned out to be follicular neoplasm on FNAC (BETHESDA IV); finally on HPE, two were follicular adenoma, one follicular carcinoma, one papillary carcinoma and one colloid goitre. Five cases diagnosed malignant (TIRAD 4/5) on USG, came out to be papillary carcinoma thyroid on FNAC (these five cases were papillary carcinoma on HPE). 29 cases were diagnosed benign on both USG and FNAC. One case of solid hyperechoic benign nodule (TIRAD 3) on USG turned out to be Hashimoto thyroiditis on FNAC (BETHESDA II), was Hashimoto thyroiditis on HPE. One case of hyperechoic colloid nodule (TIRAD 3) diagnosed on USG turned out to be colloid goitre on FNAC and on HPE it was reported as adenomatoid hyperplasia. One isoechoic solid colloid nodule with cystic degeneration (TIRAD 3 on USG) was diagnosed as colloid goitre on FNAC; final HPE report was papillary carcinoma. Rest all benign nodules of thyroid (TIRAD 1,2,3) diagnosed as colloid goitre on FNAC (BETHESDA II) were confirmed as colloid goitre on HPE. On USG, out of 29 cases diagnosed as colloid nodule turned out to be 28 cases of colloid goitre on FNAC.

Intertest agreement kappa = 0.89(95% confidence interval 0.68 – 1.1), the agreement is almost perfect when  $p < 0.001$ .

McNemar and chi square test done where  $\chi^2 = 0$  ( $p = 1$ ); no significant difference between the two tests.

On serial testing with USG and FNAC, sensitivity = 72.9% and specificity = 99.7%. On parallel testing with USG or FNAC, sensitivity = 97.9%, specificity = 87.5%.

Out of 40 cases, 28(70.0%) were Colloid goiter, 7(17.5%) were Papillary carcinoma, 2(5%) were Follicular adenoma, 1(2.5%) was Follicular carcinoma, 1(2.5%) was Adenomatoid hyperplasia and 1(2.5%) was Hashimoto thyroiditis.

Out of 40 cases, 7 were malignant on both HPE and USG, 29 were benign on both USG and HPE. 3 cases were reported malignant in USG but came out to be benign on HPE. On USG, right sided hypoechoic solid solitary thyroid nodule – TIRAD 4(on FNAC follicular neoplasm) was reported as colloid goiter in HPE after total thyroidectomy. On USG, two cases of solid hypoechoic solitary thyroid nodule: both were TIRAD 4(on FNAC were follicular neoplasm) were reported as follicular adenoma in HPE after total thyroidectomy. One case was

diagnosed benign on USG but came out as malignant on HPE, on USG it was left sided isoechoic solid solitary colloid nodule: TIRAD 3(colloid goiter on FNAC) was reported as Papillary carcinoma on HPE after hemithyroidectomy and thus underwent Revision total thyroidectomy.

All patients of solitary thyroid nodule palpated clinically were confirmed as solitary thyroid nodule on USG. Distribution of cases according to USG were: 30(75%) benign solitary thyroid nodules out of which 29(96.67%) were colloid nodule, one (3.4%) Hashimoto's thyroiditis and 10(25%) malignant nodules. Out of the 29 benign colloid nodules diagnosed by USG, 15 were hyperechoic, 7 anechoic, one hypoechoic, one isoechoic and 5 heteroechoic. Out of the 10 malignant nodules diagnosed by USG, 9 were hypoechoic and one heteroechoic. Out of 10 malignant cases in USG, 7 turned out to be malignant on HPE, and 3 were benign on HPE(two cases of follicular adenoma and one case of colloid goitre). Out of 29 cases diagnosed as colloid nodule on USG, 27 turned out to be colloid goitre on HPE, one came out adenomatoid hyperplasia and one was papillary carcinoma thyroid on HPE. One case of Hashimoto's thyroiditis(diagnosed on HPE) was diagnosed as benign nodule (TIRAD 3) on USG.

USG study sensitivity was 87.5%(95% confidence interval 47-100%), specificity 90.63%(95% confidence interval 75-98%), false negative rate 13%(95% confidence interval 0-53%), false positive rate 9%(95% confidence interval 2-25 %), PPV(positive predictor value) 70%(95% confidence interval 35-93%) and NPV (negative predictor value) 96.67%( 95% confidence interval 83-100 %); prevalence of malignancy detected by USG 20%; kappa value was 0.71(95% confidence interval 0.45-0.97) ,where  $p < 0.001$ , positive likelihood ratio for malignancy 9.3(95% confidence interval 3-28), negative likelihood ratio for benignity 0.14 (95% confidence interval 0.02-0.86) , likelihood odd ratio (likelihood ratio for positivity/ likelihood ratio for negativity 67.7; 95% confidence interval 6.1-7.52), area under curve (AUC) 0.9, HPE and USG diagnosis significantly correlated as tested by Pearson's Chi square test ( $\chi^2 = 20.8$  where  $p < 0.001$ ), McNemar's test showed no significant difference between the two test i.e. USG vs HPE ( $\chi^2 = 1$  where  $p = 0.32$ ).

FNAC revealed 28 cases as colloid, 5 Follicular neoplasm, 6 Papillary carcinoma and one Hashimoto's thyroiditis. HPE findings stated 28 colloid, two Follicular adenoma, one Follicular carcinoma, 7 Papillary carcinoma, one Hashimoto's thyroiditis and one Adenomatoid hyperplasia. On comparing FNAC with HPE, out of 28 colloid goitre in HPE, 26 were truly diagnosed as colloid in FNAC, one was falsely diagnosed as papillary carcinoma in FNAC and one was falsely diagnosed as follicular neoplasm on FNAC. Out of 7 cases of papillary carcinoma diagnosed in HPE, 5 were truly diagnosed as papillary carcinoma on FNAC, one was falsely diagnosed as colloid goitre on FNAC and one was falsely diagnosed as follicular neoplasm in FNAC. On HPE, one adenomatoid hyperplasia was falsely diagnosed as colloid goitre in FNAC. One Hashimoto's thyroiditis on HPE was correctly diagnosed on FNAC. There were 5 follicular neoplasm on FNAC of which, two follicular adenoma, one follicular carcinoma, one colloid goiter and one papillary carcinoma thyroid came on HPE.

In our study, 70% were colloid goiter(most common benign nodule), 15% were papillary carcinoma(most common malignant nodule), 12.5% follicular neoplasm and 2.5% Hashimoto's thyroiditis on FNAC. Out of 28(70%) colloid goitre diagnosed on FNAC, on HPE, 26(65%) cases were colloid goitre, one (2.5%) turned out to be papillary carcinoma thyroid and one (2.5%) adenomatoid hyperplasia. Out of 5(12.5%) follicular neoplasm diagnosed on FNAC, on HPE, 2(5%) were follicular adenoma, one(2.5%) follicular carcinoma, one(2.5%) colloid goitre and one(2.5%) follicular variant of papillary carcinoma. Out of 6(15%) cases diagnosed as

papillary carcinoma on FNAC, o HPE, 5(12.5%) were papillary carcinoma and 1(2.5%) colloid goitre. One(2.5%) Hashimoto's thyroiditis diagnosed on FNAC was confirmed as Hashimoto's thyroiditis on HPE.

5 cases were malignant in both FNAC and HPE, 28 cases were benign in both FNAC and HPE. One case reported benign on FNAC(colloid goiter BETHESDA II) but on HPE it came out to be malignant(papillary carcinoma) and one case which was diagnosed as malignant(papillary carcinoma BETHESDA V) on FNAC, came out as benign(colloid goiter) on HPE. 5 patients were diagnosed as Follicular neoplasm by FNAC which couldn't be placed under benign/malignant category, and were placed under indeterminate group in FNAC.

Excluding indeterminate cases in FNAC, Sensitivity – 83.33%(95% confidence interval 36- 100%), Specificity – 96.55%(95% confidence interval 82-100%), false negative rate 17%(95% confidence interval 0-64%), false positive rate 03%(95% confidence interval 0-18) , PPV(positive predictor value)- 83.3% (95% confidence interval 36-100%) , NPV(negative predictor value)- 96.55%( 95% confidence interval 82-100%), kappa=0.79(95% confidence interval 0.53-1.0) where  $p < 0.001$ , prevalence of malignancy 17% (95% confidence interval 7-34) , positive likelihood ratio for malignancy 24.2(95% confidence interval 3.4- 171.4), negative likelihood ratio for benignity 0.17(95% confidence interval 0.03-1.03), likelihood odd ratio 140(95% confidence interval 7.5- 2623.4), area under curve 0.9, Pearson Chi square test were done and  $\chi^2 = 22.3$  where  $p < 0.001$  and McNemar test showed no significant difference between FNAC and HPE study,  $\chi^2 = 0$  where  $p = 1$ .

Out of 40 cases, 28(70%) underwent hemithyroidectomy, 11(27.5%) total thyroidectomy and one(2.5%) hemithyroidectomy followed by revision total thyroidectomy. In our study, all TIRAD 4 and TIRAD 5 category diagnosed on USG and/or BETHESDA IV and BETHESDA V category diagnosed on FNAC underwent total thyroidectomy. Two cases of papillary carcinoma thyroid presented with neck swelling along with enlarged cervical lymph node, underwent neck node dissection along with total thyroidectomy. One(2.5%) case which was diagnosed on USG as TIRAD 3 and BETHESDA II colloid goitre on FNAC, underwent hemithyroidectomy; final HPE report came out to be papillary carcinoma thyroid, so this patient underwent revision total thyroidectomy. Postoperative period was uneventful in all patients. Preoperative and postoperative serum calcium levels were measured in all patients planned for total thyroidectomy, serum calcium levels were within normal limit in these patients in both pre operative and postoperative period.

## DISCUSSION

Most of the patients in our study were from third and fourth decade followed by the second decade of life. The mean age of presentation was  $35.7 \pm 13.9$  years. The mean age for males was  $40.4 \pm 7.8$  years. The mean age for females was  $34.5 \pm 14.9$  years. The mean age for carcinoma of solitary thyroid nodule  $38.9 \pm 10.9$  years. Peak age of malignancy was fourth decade and all malignant cases were less than fifty years of age. The females were dominant in all age groups. The overall female to male ratio is 4:1. In Amitabh Jena et al<sup>13</sup> study, overall mean age was  $36.8 \pm 13.3$  years. Mean age of patients with malignancy was  $39 \pm 14.5$  years. Male:female in malignant patients were 1:1.9. Malignant solitary thyroid nodule reported in 20 out of 33(60.6%) males and 38 out of 113(33.6%) females. 8(20%) females were found malignant in my study and no male was found to be malignant.

Most of the nodules (62.5%) were located in the right lobe in our study. All patients presented with neck swelling, 2(5%) presented with pressure symptoms, 4(10%) had thyrotoxicosis,

and pain in 1(2.5%). In Pardhasaradhi et al<sup>14</sup> study, out of 97 cases with STN, neck swelling was the most common presentation and right lobe was more commonly affected than left lobe. In Dhanadiya et al<sup>15</sup> study, all patients presented with classical neck swelling, pressure symptoms was seen in 13% cases, signs of thyrotoxicosis in 6% and pain in 15%.

In my study, 9(22.5%) had cystic consistency which were benign. 4(10%) had soft consistency which were benign. 12(30%) benign cases and 5(12.5%) malignant cases were firm in consistency out of 17(42.5%). 1(2.5%) malignant case had hard consistency. 9(22.5%) were found to be of variable consistency out of which 7(17.5%) were benign and 2(5%) malignant. In NR Patel et al<sup>16</sup> study, on 100 patients with thyroid nodules, majority of cases(58%) were firm in consistency while 34 cases were soft in consistency of which most cases were of colloid goitre. 2 cases were of cystic consistency (cystic changes in colloid), rest were hard in consistency of which 2 were malignant and 4 were suspicious of malignancy.

Amitabh Jena et al<sup>13</sup> found that majority of solitary thyroid nodules( $n=70$ , 47.9%) was 2-4 cm in size whereas in my study, majority of the nodules were of size 1-4cm.

In Jena et al<sup>13</sup> study, out of 146 patients, 138(94.5%) patients were euthyroid, 4(2.7%) were hypothyroid and 4(2.7%) were hyperthyroid. In our study, among 40 patients, 29 (72.5%) were euthyroid, 7(17.5%) were hypothyroid and 4(10%) were hyperthyroid.

Jena et al<sup>13</sup> found 17(29.3%) out of 58 malignant nodules had lymph node involvement whereas in my study, out of 40 cases, only 2(5%) out of 8 malignant STN presented with cervical lymphadenopathy.

In NR Patel et al<sup>16</sup> study, considering histopathological data as standard, comparing the results of USG and FNAC, the sensitivity of USG was 90.56% whereas that of FNAC was 96.47%, whereas in our study, sensitivity of USG was 87.5% and sensitivity of FNAC was 83.3%.

In our study of 40 cases, 28(70.0%) were colloid goiter, 7(17.5%) were papillary carcinoma, 2(5%) were follicular adenoma, 1(2.5%) was follicular carcinoma, 1(2.5%) was adenomatoid hyperplasia and 1(2.5%) was Hashimoto thyroiditis. Jena et al<sup>13</sup> found 77(52.7%) nodular colloid goiter cases, 10(6.8%) Hashimoto thyroiditis, 1(0.7%) toxic goiter, 9(6.3%) follicular carcinoma, 46(31.5%) papillary carcinoma and 3(2.1%) medullary carcinoma cases. Out of 46 patients with papillary carcinoma, 15 were follicular variant of papillary carcinoma.

In our study, out of 40, 28(70%) cases underwent hemithyroidectomy, 11(27.5%) underwent total thyroidectomy and 1(2.5%) underwent hemithyroidectomy followed by revision total thyroidectomy. 2 cases of papillary carcinoma with enlarged neck nodes underwent total thyroidectomy with neck node dissection. In Pardhasaradhi et al<sup>14</sup> study on 97 cases with STN, hemithyroidectomy was done in all cases except for papillary carcinoma thyroid. Total thyroidectomy was done in 7 cases of papillary thyroid carcinoma, 3 of which presented with central lymph node enlargement in which central lymph-node dissection was done. Hemithyroidectomy was done in 2 cases of toxic goitre and in 4 cases of follicular neoplasms where complete thyroidectomy was done after confirmation.

## CONCLUSION

Thyroid nodules may be solitary within a thyroid gland or dominant within a multinodular goiter. Solitary nodule is most common in woman and in third and fourth decade of life. It commonly presents as neck swelling with or without any other symptoms. Right lobe is more commonly affected than left

lobe. The assessment of patients with thyroid nodule(s) include the triple modalities of clinical examination, cytological evaluation and imaging investigation. USG and FNAC are common modalities of investigations with high specificity and sensitivity. Isotope scan is only indicated to confirm the toxic nodule. The sensitivity and specificity of USG was 87.5% and 90.63 % respectively and sensitivity and specificity of FNAC was 83.33% and 96.55% respectively. No investigation was found to be 100% accurate in diagnosis of malignancy in solitary thyroid nodule preoperatively, but a combination of various diagnostic modalities (USG and FNAC) rather than any single modality will give optimal results. Colloid goiter was common pathological entity followed by carcinoma in clinically detected solitary thyroid nodule in my study. Malignancy reported in my study was 20%. Early diagnosis and prompt treatment will cure the disease since carcinoma thyroid is more curable amongst all cancers. Surgery is needed in cytologically malignant nodule, TIRAD 4/5 on USG, in case of suspicious for malignancy in both FNAC and USG, benign nodule having pressure symptoms or for cosmetic reasons. The definite diagnosis and consequent therapy are based on histopathological examination findings postoperatively.

## REFERENCES:

1. Popoveniuc G, Jonklaas J. Thyroid nodules. *Med Clin North Am.* 2012 Mar;96(2):329-49.
2. Ridgway EC. Clinical evaluation of solitary thyroid nodules. In: Ingbar SH, Braverman LE, editors. *Werner's The Thyroid: A fundamental and clinical text.* 5<sup>th</sup> ed. Philadelphia: GB Lippincott; 1986. p. 1377-85.
3. Dean DS, Gharib H. Epidemiology of thyroid nodules. *Best Pract Res Clin Endocrinol Metab.* 2008 Dec;22(6):901-11.
4. Melak T, Mathewos B, Enawgaw B, Damtie D. Prevalence and types of thyroid malignancies among thyroid enlarged patients in Gondar, Northwest Ethiopia: a three years institution based retrospective study. *BMC Cancer.* 2014 Dec 2;14:899.
5. DeLellis RA, Williams ED. Tumours of the thyroid and parathyroid. In: DeLellis A, Lloyd RV, Heitz PU, Eng C, editors. *WHO Classification of Tumors-Pathology and Genetics-Tumors of Endocrine organs.* 1<sup>st</sup> ed. Lyon: IARC Press; 2004. p. 51-56.
6. Maitra A. The Endocrine System. In: Kumar V, Abbas AK, Fausto N, Aster JC. *Robbins and Cotran Pathologic Basis of Disease.* 8<sup>th</sup> ed. India: Elsevier Inc; 2010. p.1097.
7. Shah B, Fleming WR, Lynn J. Thyroid cancer. In: Johnson CD, Taylor I, editors. *Recent advances in surgery* 27. 27<sup>th</sup> ed. London: Royal Society of Medicine Press Ltd; 2004. p. 159-77.
8. Singer PA, Cooper DS, Daniels GH, Ladenson PW, Greenspan FS, Levy EG, Braverman LE, Clark OH, McDougall IR, Ain KV, Dorfman SG. Treatment guidelines for patients with thyroid nodules and well-differentiated thyroid cancer. American Thyroid Association. *Arch Intern Med.* 1996 Oct 28;156(19):2165-72.
9. Galata G, Schulte KM. Management of the thyroid nodule. *Surgery (Oxford).* 2011 Sep;29(9):434-439.
10. Perros P, Boelaert K, Colley S, Evans C, Evans RM, Gerrard Ba G, Gilbert J, Harrison B, Johnson SJ, Giles TE, Moss L, Lewington V, Newbold K, Taylor J, Thakker RV, Watkinson J, Williams GR; British Thyroid Association. Guidelines for the management of thyroid cancer. *Clin Endocrinol (Oxf).* 2014 Jul;81 Suppl 1:1-122.
11. Muratli A, Erdogan N, Sevim S, Unal I, Akyuz S. Diagnostic efficacy and importance of fine-needle aspiration cytology of thyroid nodules. *J Cytol.* 2014 Apr;31(2):73-8.
12. Maia FF, Zantut-Wittmann DE. Thyroid nodule management: clinical, ultrasound and cytopathological parameters for predicting malignancy. *Clinics (Sao Paulo).* 2012 Aug;67(8):945-54.
13. Jena A, Patnayak R, Prakash J, Sachan A, Suresh V, Lakshmi AY. Malignancy in solitary thyroid nodule: A clinicoradiopathological evaluation. *Indian J Endocrinol Metab.* 2015 Jul-Aug;19(4):498-503.
14. Pardhasaradhi K, Vijayalakshmi M, Tati SY, Gattu VR, Ramnadh G S, Kumar VK. A clinicopathological study and the incidence of malignancy in a solitary thyroid nodule. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS).* 2018 Feb;17(2):45-48.
15. Dhanadia A, Shah H, Dave A. Ultrasonographic and FNAC correlation of thyroid lesions. *Gujarat Medical Journal* 2014;69(1):75-81.
16. Patel NR, Patel AV, Patel VV, Vadher PR, Kakadia MB. Ultrasonographic and fine needle aspiration cytology correlation of thyroid gland lesions: a study on 100 cases. *Int J Otorhinolaryngol Head Neck Surg.* 2019 Mar;5(2):319-25.