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Original Research Article

A study of surgical pathology of thyroid lesions

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ABSTRACT

Background: Thyroid lesions commonly present as midline neck swelling that move with deglutition. These lesions are broadly divided into non-neoplastic and neoplastic. Non-neoplastic can be developmental, inflammatory, hyperplastic. Neoplastic are stratified into benign tumors, low risk neoplasms and malignant neoplasms. Most of these lesions are amenable to surgical resection. This study aims to analyse the demographic features and histopathological spectrum of surgically resected thyroid lesions.
Methods: A total of 55 surgically resected thyroid specimens received in Department of Pathology, World College of Medical Sciences and Research Hospital were included. Demographic and clinical details were obtained from departmental records. Histopathological examination was conducted according to standard protocol. Percentages and simple frequency tables were used for analysis.
Results: Age ranged from 20-97 years. Maximum number of cases were reported in 3rd to 5th decade. Female: male ratio was 5.1:1. Non-neoplastic lesions were 29 (52.72%) and 26 (47.27%) neoplastic lesions were encountered in which colloid goitre and papillary carcinoma thyroid were the commonest ones respectively.
Conclusions: Non-neoplastic lesions were slightly more common than neoplastic lesions. Ultrasonography (USG), thyroid function test and fine needle aspiration cytology (FNAC) give a clue but study of histomorphologic features is the final confirmatory test guiding a clinician towards further patient management.

Keywords: Thyroid lesions, Non-neoplastic, Neoplastic

INTRODUCTION

Thyroid gland is the largest endocrine gland. It is in known to play a vital role in carrying out physiological functions and maintaining metabolic homeostasis in the human body.[1]

A variety of lesions affect the thyroid gland. They are broadly categorized into the following groups - functional, autoimmune, non-neoplastic, neoplastic. Variation among the lesions is seen as a result of variation in the incidence, prevalence, age, sex, diet, environmental factors and pathological features.[2]

Smoking, obesity, metabolic syndrome, alcohol consumption, increased level of insulin like growth factor 1 and uterine fibroids lead to increased risk of thyroid nodules. Oral contraceptive (OC) pills and statins decrease the risk.[3]

Only 4-5% of thyroid lesions comprise of nodules in thyroid gland.[2,4] A 20-year surveillance study observed prevalence of thyroid nodules as 0.8% and 5.3% in men and women respectively. But the cancer rate was found to be two times higher in men as compared to women (8% versus 4%).[5-7]

The American thyroid association (ATA) defines thyroid nodule as a discrete lesion within the thyroid gland. These nodules can be solitary, multiple, cystic/solid. Majority of the detected nodules are found to be benign and clinically

insignificant, the clinically important ones represent thyroid cancer in 4.0–6.5% of cases.[8-10]

These patients are subjected to ultrasonography (USG), thyroid function test (TFT), and fine needle aspiration cytology (FNAC) and if required radionucleotide scan before surgery. However, excision and histopathological evaluation are the final step towards establishment of accurate diagnosis.

METHODS

The present study included all the patients presenting with thyroid swelling and who underwent any type of thyroid surgery (lobectomy, subtotal thyroidectomy, hemit-hyroidectomy, near total thyroidectomy and total thyroidectomy). Paediatric specimens were excluded.

The present study was conducted over a period of 1 year (January 2024 to December 2024). A total of 55 thyroid specimens were received in Department of Pathology, World College of Medical Sciences and Research Hospital, Jhajjar, Haryana. Specimens were fixed in 10% formalin and tissue processing and staining was done according to standard protocol. The lesions were broadly classified into non-neoplastic and neoplastic. Percentages and frequency tables were used for data analysis.

RESULTS

A total of 55 surgically resected specimens were studied over a period of 1 year. Age of the patients ranged from 20-97 years. Maximum number of patients were found in the age group of 21-30 years (29.09%) followed by 41-50 years (23.63%). Minimum number of cases were reported in patients of age more than 70 years (1.81%) (Table 1).

Table 1: Age distribution of thyroid lesions.

S. no.	Age range (years)	Number of cases (n=55)	Percentage
1	0-10	00	-
2	11-20	01	1.81
3	21-30	16	29.09
4	31-40	09	16.36
5	41-50	13	23.63
6	51-60	10	18.18
7	61-70	05	9.09
8	71-80	00	-
9	81-90	00	-
10	91-100	01	1.81

Out of all the thyroidectomy specimens 46 (83.63%) were from females and 09(16.36%) were from males, with a female to male ratio of 5.1:1 (Table 2).

Surgical specimens were analysed on morphological basis which showed non-neoplastic lesions 29 cases (52.72%) and neoplastic 26 cases (47.27%).

Table 2: Sex distribution of thyroid lesions.

S. no.	Sex	Number of cases (n=55)	Percentage of cases
1	Females	46	83.63
2	Males	09	16.36

Non-neoplastic cases comprised of predominance of colloid goiter 19 cases (65.51%) followed by multinodular goiter 04 cases (13.79%), adenomatous goiter 05 cases (17.24%) and one case (3.44%) of hashimoto's thyroiditis (Table 3).

Table 3: Morphological distribution of non-neoplastic thyroid lesions (n=29).

S. no.	Name of lesion	No. of cases	Percentage
1	Colloid goiter	18	62.06
2	Multinodular goiter	05	17.24
3	Adenomatous goiter	05	17.24
4	Hashimoto thyroiditis	01	3.44

Neoplastic lesions were further subdivided into benign tumors, low risk neoplasms and malignant neoplasms according to World Health Organization (WHO) classification of thyroid neoplasms 5th edition (Table 4).

Table 4: Morphological distribution of neoplastic thyroid lesions (n=26).

S. no.	Name of lesion	No. of cases	Percentage
1	**Benign neoplasm**		
	Follicular adenoma	10	38.46
	Hurthle cell adenoma	04	15.38
2	**Low risk neoplasm**		
	NIFTP	01	3.84
3	**Malignant neoplasm**		
	Papillary thyroid carcinoma	11	42.30

NIFTP: Non-invasive follicular thyroid neoplasm with papillary like nuclear features

Amongst the benign tumors, follicular adenoma was the commonest 10 cases (38.46%) followed by 4 cases (15.30%) of hurthle cell adenoma.

A single case (3.8%) of non-invasive follicular thyroid neoplasm with papillary like nuclear features (NIFTP) was observed in the low risk neoplasm group.

The malignant neoplasms encountered were papillary carcinoma 11 cases (42.3%) of which 09 cases were conventional type and 02 were follicular variant of papillary thyroid carcinoma.

Colloid goiter was predominant non-neoplastic lesion comprising of 19 cases (65.51%). It was noted in 15

females and 3 males with male: female (M: F) ratio of 0.2:1. Colloid goiter was more prevalent in the right lobe, size ranged from 2-15 cm and was found predominantly in 4th to 6th decade. Grossly there was diffuse enlargement of the gland with brown glassy cut surface in majority of cases. Solid cut surface was seen in 7 cases where nodule formation was evident. Cystic degeneration was noted in 4 cases. Microscopy showed colloid filled distended thyroid follicles lined by flattened to low cuboidal epithelium. Few cases also showed Sanderson pollsters (papillary projections in cystically dilated follicles). They mimic papillary carcinoma; hence one has to be careful during microscopic examination.

All 04 cases of multinodular goiter were seen in female patient, age ranged from 3rd to 6th decade. Grossly external surface was distorted, nodular and cut surface showed variegated appearance with foci of haemorrhage and cystic change. Microscopy showed colloid filled thyroid follicles of varying sizes lined by flattened epithelium, foci of haemorrhage and cystically dilated follicles with papillary projections.

Adenomatous goiter was observed in 05 cases all were females with age range of 3rd to 6th decade. Gross features are similar to multi nodular goiter (MNG) and microscopy show many hyperplastic nodules seen along with features of MNG.

A single case of Hashimoto's thyroiditis was seen in a 54-year male patient. Grossly diffuse enlargement of thyroid gland was noted which was firm in consistency with pale yellow tan homogenous cut surface (Figure 1). Microscopy showed diffuse lymphoplasmacytic infiltrate in thyroid parenchyma with formation of lymphoid follicles having germinal centre. Surrounding thyroid follicles show atrophic changes (Figure 4).

Figure 1: Hashimoto's thyroiditis: firm yellow tan cut surface resembling lymph node.

Follicular adenoma was the commonest benign neoplasm accounting for 10 cases (38.46%). Female predominance was noted with 9 (90%) cases and age ranging from 20-67years. Ratio of right lobe involvement to left lobe involvement was 1: 1. Grossly cut surface was fleshy grey white to grey tan. Microscopy showed encapsulated tumor with thyroid follicles of varying sizes (normofollicular, microfollicular, and macrofollicular) lined by cuboidal to low columnar epithelium. No evidence of capsular or vascular invasion.

Single case of NIFTP was observed in a 35-year female patient. Grossly solitary nodule was observed in left lobe thyroid with homogenous grey white cut surface. Microscopic findings revealed an encapsulated lesion showing colloid filled thyroid follicles of varying sizes lined by epithelium showing nuclear enlargement, crowding, overlapping, nuclear membrane irregularity with clear glassy nuclei (nuclear score 2-3). These nuclear changes are patchy and focal – sprinkling sign. Lack of papillary pattern and absence of capsular invasion differentiate it from conventional papillary thyroid carcinoma (PTC) and invasive encapsulated variant of papillary thyroid carcinoma (IEFV-PTC).

Hurthle cell adenoma was identified in 4 cases (15.30%) with M: F ratio of 1:1 and age ranged from 29-66 years. Grossly thyroid gland was diffusely enlarged. Cut surface was solid tan brown to mahogany color (Figure 2). Cystic change was seen in 2 cases. Microscopy showed the following growth patterns – follicular, solid, trabecular and at places papillary growth pattern. Individual tumor cells (known as oncocytes/Hurthle cells/oxyphil cell/Askanazy cells) are large sized with enlarge nucleus and abundant granular eosinophilic cytoplasm. No evidence of capsular/vascular invasion.

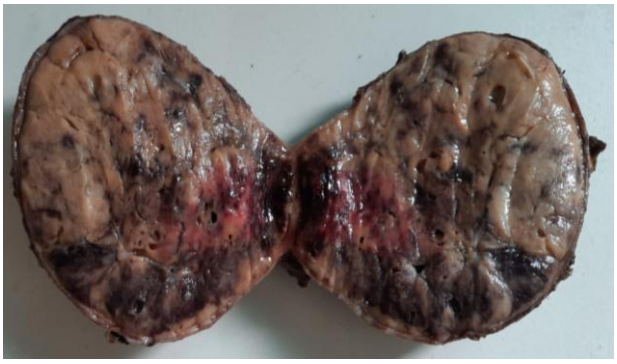

Figure 2: Hurthle cell adenoma: mahogany brown coloured cut surface with areas of haemorrhage.

Papillary carcinoma was the most prevalent malignant tumor in current study comprising of 11 cases (34.61%) with M: F ratio 1:3.5. Age ranged from 28-60 years. Grossly cut surface of thyroid gland show well demarcated nodules having fleshy – friable grey white cut surface (Figure 3). Bilobar involvement was seen in 1 case. Microscopy showed predominant papillary pattern along with insular and solid growth pattern. Characteristic nuclear features – enlarged overlapping nuclei with irregular nuclear contour and optically clear ground glass nuclei (Orphan Annie nuclei) (Figure 5). Conventional type was the commonest (09 cases) and 02 cases of follicular variant were also seen. Metastatic deposits were

found in 3 cases predominantly involving the lymph nodes and in one case background Hashimoto's thyroiditis was also noted.

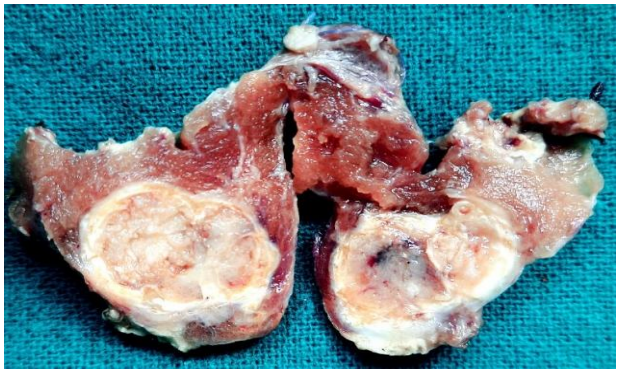

Figure 3: Papillary carcinoma thyroid: friable grey white cut surface.

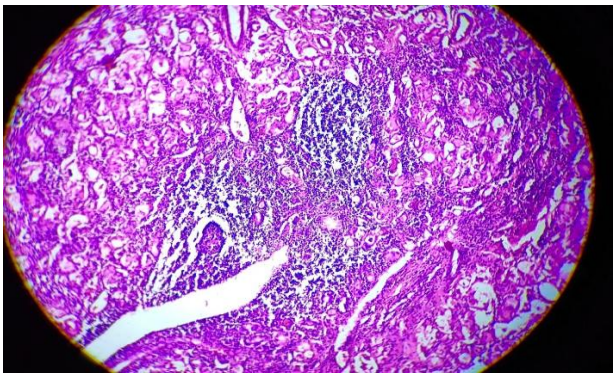

Figure 4: Hashimotos thyroiditis: lymphoid follicle formation seen in between thyroid follicles.

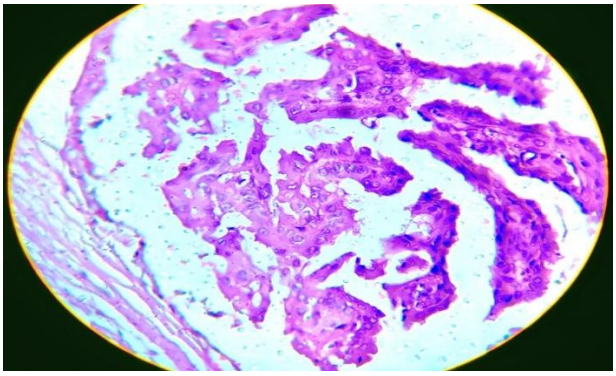

Figure 5: Papillary carcinoma thyroid – cells arranged in papillary pattern with Orphan annie eye nuclei.

DISCUSSION

Non-neoplastic and neoplastic thyroid lesions are a common problem attributed to iodine deficiency and other environmental factors. Majority of these lesions are amenable to proper medical or surgical management.

In present study non-neoplastic lesions were slightly more common than neoplastic lesions comprising of 29 (52.72%) and 26 (47.27%) respectively. Similar observations were made by other studies where the incidence of non-neoplastic lesions ranged from 66.91% to 84%.[11-13]

In present study majority patients were seen in age group of 3rd to 5th decade which was in comparison with studies conducted by Turkey and Mahadani et al and Ramesh et al whereas 4th to 6th decade was observed by Jagadale et al and 4th to 5th decade by Padmom et al. This is probably because both benign and malignant lesions are common in this age group.[14-17]

Youngest patient in present study was 20 years with a diagnosis of follicular adenoma and oldest was 97 years who was diagnosed with colloid goiter. Gupta et al showed youngest patient of 14 years and oldest 85 years both diagnosed of adenomatous goiter.[18] Turkey et al showed patient age ranging from 21-73 years whereas 10- 80 years age range was observed in study by Padmom et al. Thyroid lesions are hence seen in wide range of age groups.[14,17]

In the present study female to male ratio was 5.1:1, similar observation was made by Abdulkareem et al noted 5.7:1. F:M ratio.[21] As per study by Sudha et al, F:M ratio was 7:1.[19] Studies by Padamom et al and Nzegwu et al showed 6:1 F:M ratio.[17,20] Various theories are postulated to support this observation. Presence of oestrogen receptors in the thyroid tissue and physiological demands of puberty, menstruation, pregnancy, lactation may increase the frequency of thyroid lesions.[17]

Amongst non-neoplastic thyroid lesions colloid goiter was the commonest in majority of the research work with incidence ranging from 56.93-76%.[22] Similarly present study showed 62.06% cases of colloid goiter. Main reason for colloid goiter is iodine deficiency. The daily iodine requirement is about 100–125 µg. It is treated by iodized salt used for food and also iodine-containing preparations. If the iodine deficiency state sustains for a long period of time, it results in the accumulation of colloid material in the gland and lead to colloid goiter.[23]

Other non-neoplastic lesions in present study include equal number of cases of both multinodular goiter and adenomatous goiter 5 cases (17.2%) and 1 case (3.44%) of Hashimoto's thyroiditis. The proportion of MNG in various studies ranged from 12.5% to 98.1%.[14,17]

MNG is the end-stage result of diffuse hyperplastic goiter. Excessive metabolic demands (especially during puberty and pregnancy) will lead to the increased enlargement of the thyroid gland. In such situations there is a constant stimulation of anterior pituitary by the TSH resulting in MNG).[24] The puberty goiter, pregnancy goiter, and colloid goiter if left untreated will change to MNG.[23]

The incidence of adenomatous goiter ranged from 1.25% to 83.34% while lymphocytic thyroiditis reported by Ghartimagar et al was 2.84% and Padmom et al was 17.6%.[11,14,17,22]

Among benign neoplastic lesions we encountered 10 (38.46%) cases of follicular adenoma among which 6 patients were in the age range of 51-60 years. Study by Goyal et al showed 100% incidence of follicular adenoma whereas 29.8% was seen in Padmom et al and Prabha et al and a meagre of 10% in study by Turkey et al.[11,13,14,17] Follicular adenomas are of two types – active and inactive. Depending on their level of function a radionucleotide scan divides follicular adenoma into hot, warm and cold. A thyroid adenoma is a solitary encapsulated lesion in thyroid gland arising from a genetic mutation in a single precursor cell. Two lesions - MNG (multiple nodules) and follicular carcinoma (shows capsular and or vascular invasion) need to be differentiated from follicular adenoma via cautious histopathological examination.[25]

Present study revealed hurthle cell adenoma in 4 (15.38%) cases which is in correlation with Ghartimagar et al.[22] Various other research projects reported 2.46–5.88% of hurthle cell adenoma cases.[26,27]

In the low grade malignant group single case of NIFTP was observed in present study. Goyal et al observed 1 case of FT-UMP, accounting for 1% of all the cases and 4.55% of neoplastic lesion.[11] Study conducted by Padmavathi and Raj accounted for 3.2% (2 cases).[28] WHO divides tumors of uncertain malignant potential into 2 types 1. Follicular tumor of uncertain malignant potential (FT-UPM) and well-differentiated tumor of uncertain malignant potential (WDT-UMP). FT-UMP is well circumscribed/ encapsulated follicular lesion which lacks nuclear features of PTC. WDT-UMP is well circumscribed/encapsulated follicular lesion with well/partially developed nuclear features of PTC. WDT-UPM in which capsular or vascular invasion has been excluded by all means are called as non-invasive follicular thyroid neoplasm with papillary like nuclear features (NIFTP).[29]

PTC was the most common malignant neoplasm observed in present study accounting for 11 cases (42.3%). Which was in accordance with studies by Padmavati and Raj et al (58.73%) and Ghartimagar et al (56.56%).[22,28] The extent of PC spans from as low as 10% to as high as 72.97%.

PTC is the predominant form of thyroid cancer, accounting for 80 to 85% of all thyroid cancer cases. It occurs predominantly in middle-aged adults with a 3: 1 female-to-male ratio.[33] Female predominance was noted in present study with youngest patient of 26 years and age ranged from 3rd to 6th decade, which was analogous with Goyal et al.[11]

All PTCs were classified into 11 subtypes (conventional, follicular, diffuse sclerosing, cystic, solid, oncocytic, Warthin tumor-like, tall cell, columnar cell, and hobnail).

The most aggressive subtypes of PTC that exhibit distinct clinical, pathological, and molecular features include the diffuse sclerosing, solid, tall cell, columnar cell, and hobnail subtypes.[34] Present study showed 9 cases of conventional and 2 cases of follicular variant of PTC. Ghartimagar et al observed 56 (56.56%) cases of conventional PTC, 20 (35.71%) cases of follicular variant of PC, 2 (3.57%) cases of micropapillary variant of PC, and 1 (1.78%) case of intracystic PC.[22] 7 cases (31.82%) of conventional PTC, 2 cases (20%) of follicular variant and 1 (1%) case of anaplastic variant of PTC was observed by Goyal et al.[11]

One key feature of PTC is its ability to invade adjacent structures like lymphatics. About 10% of patients may present with metastatic disease at initial presentation. Nodal metastases in the lateral neck are reported in 27% of patients at presentation, most often originating from tumors in the ipsilateral thyroid lobe.[35] Metastatic deposits predominantly involving lymph nodes were found in 3 cases (27.27%) in present study.

Table 5: Comparison of distribution of non-neoplastic and neoplastic lesions of thyroid in present study with other studies.

S. no.	Name of author	Non-neoplastic lesions (%)	Neoplastic lesions (%)
1	Turkey et al (n=80)	83.75	16.25
2	Goyal et al (n=100)	78	22
3	Present study (n=55)	52.72	47.27

Limitations

The limitation of present study is that it has been conducted in a single tertiary care centre hence does not represent the entire population of the state. Similar studies with larger sample size carried out in multiple centres would provide better information regarding incidence and prevalence of thyroid lesions.

CONCLUSION

The present study analysed the histopathological spectrum of thyroid lesions revealing a distinct female predominance in both neoplastic and non-neoplastic thyroid lesions. Colloid goiter was the most common non-neoplastic lesion encountered. Follicular adenoma was the commonest benign neoplasm. Among low risk neoplasm single case of NIFTP was encountered whereas papillary carcinoma was the commonest malignant neoplasm observed.

Any case of thyroid swelling undergoes following investigations chronologically before a provisional diagnosis is made. These include USG, TFT, FNAC, and

radionucleotide scan (if required), after which lesions amenable to surgical resection are directed towards an appropriate surgical procedure. But the final diagnosis is reached after postsurgical histopathological examination is completed which is considered as gold standard. Hence, present study not only emphasises the need of post-surgical histopathological analysis but also enlightens about the epidemiological and demographic variables of thyroid disorders.

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