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Proportion of Postoperative Histopathological Diagnosis of Malignancy in Patients Undergoing Surgery for Clinically Diagnosed Benign Thyroid Swellings in A Tertiary Care Centre

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ABSTRACT

Background: Thyroid disorders are one of the common problem encountered in clinical practice with majority of them benign in nature. Incidental malignancy of the thyroid is frequently found in people undergoing thyroidectomy for a benign condition. The incidence of incidental thyroid carcinoma ranges from 3–16% in different studies. This study aims to determine the proportion of postoperative histopathological diagnosis of malignancy in patients undergoing surgery for clinically benign thyroid swellings.

Methods: A retrospective record-based cross sectional study conducted in the Department of General Surgery, Government Medical College, Thiruvananthapuram, among patients who underwent surgery for clinically diagnosed benign thyroid swellings. A total of 550 cases were analysed for clinical, radiological, cytological, and histopathological characteristics. **Results:** Among the 550 cases, 45 (8.2%) were diagnosed with thyroid malignancy postoperatively. The most common malignancy was papillary carcinoma thyroid (82.2%), followed by follicular carcinoma (15.5%) and medullary carcinoma (2.2%). The majority of incidental malignancies were detected in cases categorized as TIRADS 2 and 3 preoperatively. A statistically significant association was found between increasing TIRADS scores and Bethesda classifications and postoperative detection of malignancy.

Conclusion: The chance of concealing malignancies in clinically benign thyroid swellings is significant. Comprehensive preoperative examination with ultrasound-based TIRADS classification and FNAC-based Bethesda classification may be helpful in the identification of high-risk patients. Close postoperative follow-up is required for conservatively managed cases.

Keywords: Thyroid swellings, Thyroid malignancy, Papillary carcinoma thyroid, Histopathological evaluation.

INTRODUCTION

Thyroid abnormalities are probably one of the most prevalent endocrine disorders across the world. The same is true in India. Based on estimates from numerous thyroid illness research, around 42 million Indians are thought to be affected by thyroid conditions. In clinical practice, thyroid nodules (TNs) are frequently observed. A TN is described as a "discrete lesion in the thyroid gland that is distinct radiologically from the surrounding thyroid parenchyma" by the American Thyroid Association[1]. Differentiating truly benign nodules from those harboring malignancies is difficult since some cases that were deemed benign based on preoperative evaluations may turn out to be malignant during post-surgery histological analysis[2,3]. This is referred as incidental thyroid cancer (ITC), a malignant tumor that is occasionally detected during pathological investigation after thyroidectomy for benign thyroid illness[4]. Incidental malignancies are frequently detected in patients undergoing thyroidectomy for conditions initially deemed benign based on clinical,

radiological, and cytological findings. The prevalence of incidental thyroid carcinoma varies across studies, with reported rates ranging from 3% to 16%[1,2,5].

Papillary thyroid cancer (PTC) is the most frequently found histological subtype in these cases, followed by follicular thyroid carcinoma (FTC) and, less frequently, medullary thyroid carcinoma (MTC)[6–8].The management of patients is significantly impacted when these cancers are discovered after surgery since they may require further surgery, radioactive iodine treatment, or ongoing monitoring. The increased use of imaging tools, biopsy procedures [such as fine-needle aspiration (FNA)] as well as greater access to healthcare, have made it easier to discover small, asymptomatic PTCs. The diagnosis, screening, and management of malignant thyroid disease are constantly changing and new guidelines have been recently published concerning the extent of surgical resection of thyroid, role of lymphadenectomy, and adjuvant therapies[9].

This study aims to find out the proportion of postoperative histopathological diagnosis of malignancy in patients undergoing surgery for benign thyroid swellings. The aim of this study is to improve clinical decision-making in thyroid surgery by bridging the gap between preoperative diagnostic results and final histopathological outcomes. We want to give useful information that will help doctors reduce the risk of undetected malignancies and prevent needless surgical procedures in genuinely benign cases by illuminating the frequency and trends of postoperative thyroid malignancies.

MATERIALS AND METHODS

Study population

This record-based retrospective study was undertaken at the Department of General Surgery, Government Medical College, Thiruvananthapuram, on patients who had surgery for clinically confirmed benign thyroid enlargement. The study involved 550 participants who had thyroid surgery between January and August 2018. Patients in the research had fine-needle aspiration cytology (FNAC) results that indicated benign thyroid illness (Bethesda classifications I-IV) and had thyroid surgery for swelling. Patients with established or suspected thyroid cancer, metastatic cervical lymphadenopathy, or a history of neck radiation or thyroid cancer were excluded.

Data collection included obtaining patient records from the medical records library. The collected data included demographic details such as age and gender, clinical findings such as solitary nodules, multinodular goiters, and diffuse thyroid swellings, thyroid function tests (TFT), ultrasound evaluation based on the TIRADS classification, FNAC reports classified using the Bethesda system, and postoperative histopathological examination (HPE) findings. The statistical analysis was carried out using SPSS version 20.0. Categorical data were reported as percentages, whereas continuous variables were presented as mean ± standard deviation. A p-value of <0.05 indicated statistical significance. The study adhered to institutional ethical norms, preserving data confidentiality and patient anonymity.

Statistical analysis

The data were analysed with SPSS version 20.0. Categorical factors were given as percentages, while quantitative data was shown as mean ± SD. A p-value of <0.05 was judged statistically significant.

RESULTS

This study examined 550 patients who had surgery for clinically confirmed benign thyroid swellings at the Department of General Surgery, Government Medical College, Thiruvananthapuram, between January and August 2018.

Demographics & Clinical Characteristics:

The average age of the patients was 44.9 years, and the majority (33.6%) were between the ages of 41 and 50. There was a significant female predominance (85.6%). This reflecting the well-established higher prevalence of thyroid disorders in women compared to men. More than half (54%) of the patients had thyroid enlargement for less than a year, with 81.5% experiencing gradual disease development. The mean duration of swelling was 31.2 months, suggesting that a substantial number of patients seek medical attention within a few years of symptom onset. The most prevalent manifestation was multinodular goiter (MNG) (79.1%), followed by single thyroid nodules (16.5%) and diffuse thyroid edema (4.4%). This demonstrates that most benign thyroid swellings are multinodular in character, rather than solitary nodules or widespread enlargement. A minor percentage (6.7%) of patients exhibited retrosternal extension, which might cause compressive symptoms and impact the surgical technique **(Table 1)**.

Table 1. Demographic and Clinical Characteristics of Patients Undergoing Thyroid Surgery (N=550)

Variable	Category	n (%)
Age Distribution (years)	≤ 20	14 (2.5)
	21 - 30	41 (7.5)
	31 - 40	145 (26.4)
	41 - 50	185 (33.6)
	51 - 60	108 (19.6)
	61 - 70	53 (9.6)
	71 - 80	4 (0.7)
	Mean ± SD	**44.9 ± 11.8**
Sex Distribution	Male	79 (14.4)
	Female	471 (85.6)
Duration of Swelling	< 1 year	297 (54.0)
	1 - 5 years	189 (34.4)
	> 5 years	64 (11.6)
	Mean ± SD (months)	**31.2 ± 42.8**
Progression of Disease	Slow	448 (81.5)
	Rapid	102 (18.5)
Clinical Findings	Multinodular Goiter (MNG)	435 (79.1)
	Solitary Thyroid Nodule (SNT)	91 (16.5)
	Diffuse Swelling	24 (4.4)
Retrosternal Extension	Yes	37 (6.7)
	No	513 (93.3)

Diagnostic Findings:

The diagnostic findings of 550 patients who underwent thyroid surgery provide valuable insights into their thyroid function, ultrasound classification, cytological findings, and Bethesda classification. The majority (72.2%) were euthyroid, indicating normal thyroid function, while 20.5% were hypothyroid and 7.3% were hyperthyroid.

Ultrasound-based TIRADS classification revealed that most patients fell into TIRADS 2 (51.6%), suggesting a low likelihood of malignancy, followed by TIRADS 3 (19.3%), indicating an intermediate risk. Higher-risk categories, TIRADS 4 (7.3%) and TIRADS 5 (0.4%), were less common, though these cases warrant closer evaluation due to their increased malignancy potential.

FNAC results indicated that colloid nodules (74.7%) were the most frequent diagnosis, supporting the predominance of benign thyroid conditions. Other findings included Hashimoto's thyroiditis (8.5%), scanty cells (4.5%), and follicular neoplasm (4.2%), the latter of which requires histopathological confirmation to rule out malignancy.

Bethesda classification, a key risk stratification tool, showed that 83.5% of cases were Bethesda 2 (benign). However, Bethesda 3 (4.4%) and Bethesda 4 (6.0%) represented indeterminate categories, carrying an increased malignancy risk.

These findings suggest that while most thyroid surgeries were performed for benign conditions, a subset of cases exhibited cytological or imaging features that warranted further investigation. The study underscores the importance of combining ultrasound, FNAC, and Bethesda classification to optimize preoperative risk assessment and identify cases requiring thorough histopathological evaluation post-surgery **(Table 2)**.

Table 2. Diagnostic Findings of Patients Undergoing Thyroid Surgery (N=550)

Variable	Category	n (%)
Thyroid Function Status	Euthyroid	397 (72.2)
	Hypothyroid	113 (20.5)
	Hyperthyroid	40 (7.3)
Ultrasound (TIRADS Classification)	TIRADS 1	118 (21.5)
	TIRADS 2	284 (51.6)
	TIRADS 3	106 (19.3)
	TIRADS 4	40 (7.3)
	TIRADS 5	2 (0.4)
FNAC Reports	Colloid Nodule	411 (74.7)
	Lymphocytic/Hashimoto's Thyroiditis	47 (8.5)
	Scanty Cells	25 (4.5)
	Follicular Neoplasm	23 (4.2)
	Follicular Lesion of Uncertain Significance (FLUS)	23 (4.2)
	Hurthle Cell Neoplasm	9 (1.7)
	Cyst Fluid Only	7 (1.3)
	Follicular Adenoma	3 (0.5)
	Suppurative Lesion	1 (0.2)
	Hyperplastic Nodule	1 (0.2)
Bethesda Classification (TBSRTC)	Bethesda 1	34 (6.2)
	Bethesda 2	459 (83.5)
	Bethesda 3	24 (4.4)
	Bethesda 4	33 (6.0)

TYPE OF SURGERY

In this study, the majority of patients (86%) underwent total thyroidectomy, indicating that complete removal of the thyroid gland was the preferred surgical approach. This high proportion suggests that most patients had conditions that necessitated the excision of the entire gland, such as multinodular goiter, thyroid malignancy, or compressive symptoms. Total thyroidectomy is often performed to eliminate the risk of recurrence, particularly in multinodular goiters and malignancies. Hemithyroidectomy, accounting for 12% of cases, was likely performed for unilateral benign nodules or follicular lesions, where preserving the remaining thyroid tissue was deemed beneficial. This approach is often recommended for patients with low-risk, indeterminate, or localized lesions, as it maintains some thyroid function and reduces dependency on lifelong thyroid hormone replacement therapy. A small percentage of patients (1.8%) underwent near-total thyroidectomy, a procedure where a small remnant of thyroid tissue is left behind. This technique is sometimes employed to minimize risks of complications such as hypoparathyroidism and recurrent laryngeal nerve injury, which are more common in total thyroidectomy. The lowest proportion (0.2%) underwent subtotal thyroidectomy, a less common procedure where part of the gland remains **(Figure 1).**

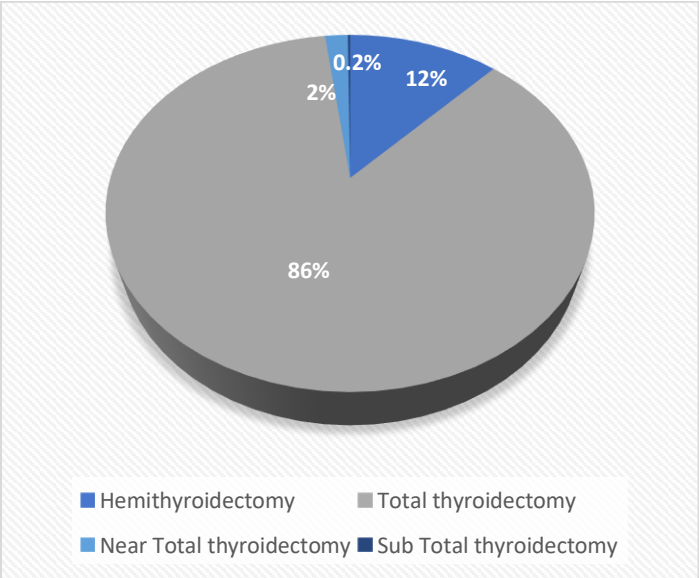


FIGURE 1: Percentage distribution of sample according to the type of surgery

Histopathology Reports

Postoperative histopathological evaluation of 550 thyroid specimens revealed that 91.8% were benign, predominantly representing multinodular goiter (70.5%). Only 8.2% of cases demonstrated malignant pathology, with papillary carcinoma thyroid being the most frequent incidental malignancy (6.7%). These findings underscore that while the vast majority of thyroid swellings appear benign, a significant minority harbor malignancy **(Table 3)**.

TABLE 3: Percentage distribution of the sample according to HPE

HPE	Count	Percent
Benign	505	91.8
Malignant	45	8.2

Postoperative Histopathological Diagnoses:

Postoperative histopathological analysis of 550 thyroidectomy specimens revealed that the majority of cases (70.5%) were diagnosed as multinodular goiter (MNG), highlighting its prevalence among benign thyroid conditions. Lymphocytic thyroiditis, including Hashimoto's thyroiditis (6.6%), and colloid nodules (5.1%) were also common, reinforcing the significance of autoimmune and degenerative thyroid disorders. Follicular adenomas (2.8%) and nodular goiters with Hurthle cell changes (2.4%) were also observed, indicating benign neoplastic processes in a subset of patients. Among malignant cases (8.2% of total specimens), papillary carcinoma thyroid (6.7%) was the most frequently detected malignancy, aligning with global trends that recognize it as the most common thyroid cancer. Follicular carcinoma (1.3%) was less frequent but remains clinically relevant due to its potential for distant metastasis. Rare cases included medullary carcinoma thyroid (0.2%) and non-invasive follicular thyroid neoplasm with papillary-like nuclear features (0.2%), which is considered a borderline neoplasm rather than overt malignancy **(Table 4).**

TABLE 4: Percentage Distribution of Thyroid Pathologies

HPE	**Count**	**Percent**
Multinodular goitre	388	70.5
Papillary carcinoma thyroid	37	6.7
Lymphocytic thyroiditis /Hashimoto thyroiditis	36	6.6
Colloid nodule	28	5.1
Follicular adenoma	15	2.8
Nodular goitre with hurthle cell change	13	2.4
Adenomatoid nodular goitre	13	2.4
Follicular carcinoma	7	1.3
Lymphocytic thyroiditis with hurthle cell change	6	1.1
Hurthle cell adenoma	3	0.5
Medullary carcinoma	1	0.2
Sclerosing thyroiditis	1	0.2
Noninvasive follicular thyroid neoplasm with papillary like nuclear features	1	0.2
Nodular goitre with papillary hyperplasia	1	0.2

Incidental Malignancies and Tumor Size:

Among the 45 cases of incidental thyroid malignancies, papillary carcinoma (82.2%) was the most prevalent, followed by follicular carcinoma (15.5%) and medullary carcinoma (2.2%). The majority of tumors (48.9%) measured between 2-4 cm, while 44.4% were smaller than 2 cm, indicating that a significant proportion of incidental malignancies were small, early-stage cancers. Only 6.7% of tumors exceeded 4 cm, suggesting that most incidental malignancies were detected at an early stage, reinforcing the importance of detailed histopathological evaluation. The mean tumor size was 2.1 cm ± 1.4, highlighting the subclinical nature of many thyroid malignancies **(Table 5).**

TABLE 5: Percentage Distribution of Tumor Size in Incidental Malignancy

Tumor size(in cm)	**Count**	**Percent**
<2	20	44.4
2 - 4	22	48.9
>4	3	6.7
Mean ± SD	2.1 ± 1.4	

Percentage distribution of the sample according to selected variables for malignancy in patients

Incidental thyroid malignancy cases reveal a female predominance (95.6%). Multinodular goiter (71.1%) was the most common preoperative diagnosis, followed by solitary nodules (26.7%). Among ultrasound findings, TIRADS 2 and 3

(31.1% each) were the most frequent, while higher TIRADS scores (4 and 5) were associated with malignancy (28.9%), indicating an increasing cancer risk with higher TIRADS classifications. Bethesda category 2 (66.7%) was the most common cytology finding, with higher Bethesda scores (3 and 4) correlating with malignancy (33.3%). Papillary carcinoma (46.7%) was the predominant histopathological diagnosis, emphasizing the need for careful evaluation of clinically benign thyroid swellings **(Table 6).**

TABLE 6: Percentage distribution of the sample according to selected variables for malignancy in patients

SELECTED VARIABLES		Count	Percent
Sex	Male	2	4.4
	Female	43	95.6
Clinical	MNG	32	71.1
	Diffuse	1	2.2
	SNT	12	26.7
USS - TIRADS	TIRADS 1	4	8.9
	TIRADS 2	14	31.1
	TIRADS 3	14	31.1
	TIRADS 4	12	26.7
	TIRADS 5	1	2.2
Bethesda	Bethesda 2	30	66.7
	Bethesda 3	4	8.9
	Bethesda 4	11	24.4
HPE	Follicular carcinoma	7	15.6
	Papillary microcarcinoma	12	26.7
	Papillary carcinoma thyroid	21	46.7
	Follicular variant of papillary carcinoma	4	8.9
	Medullary carcinoma	1	2.2

Comparison of progression based on HPE diagnosis

The bar chart compares the progression of thyroid swellings based on histopathological examination (HPE) diagnosis. Among benign cases, 83.6% exhibited slow progression, whereas only 16.4% showed rapid progression. In contrast, among malignant cases, the proportion of slow progression was lower (57.8%), while a higher percentage (42.2%) exhibited rapid progression. This statistically significant association ($p < 0.05$) suggests that rapidly growing thyroid swellings have a higher likelihood of being malignant. The findings highlight the importance of monitoring the growth rate of thyroid swellings, as rapid progression could indicate a potential risk of malignancy, necessitating further evaluation and timely surgical intervention **(Figure 2)**.

FIGURE 2: Comparison of progression based on HPE diagnosis

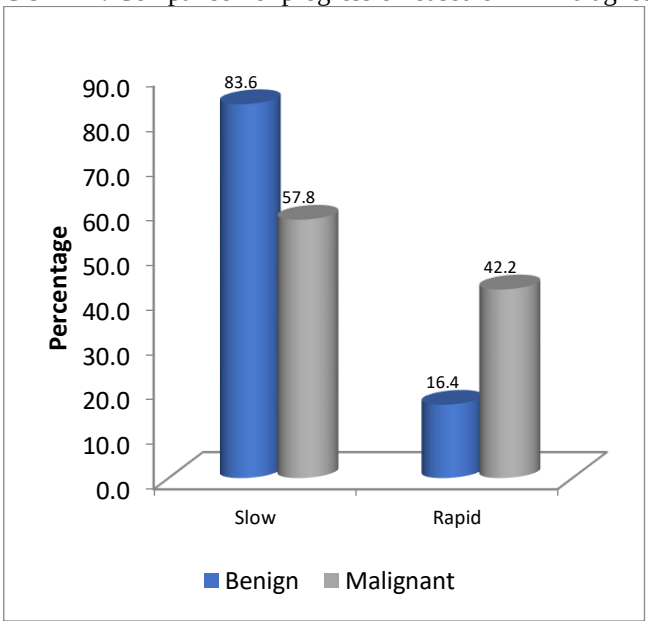
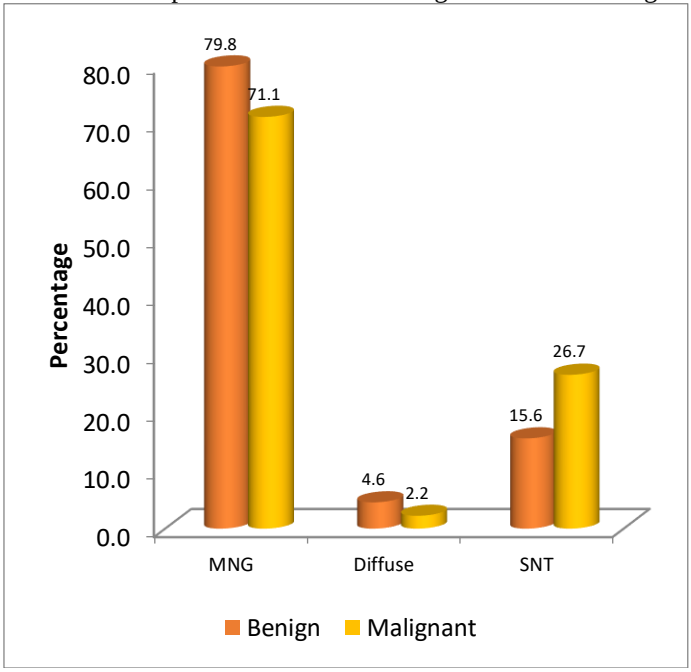


FIGURE 3: Comparison of clinical finding based on HPE diagnosis



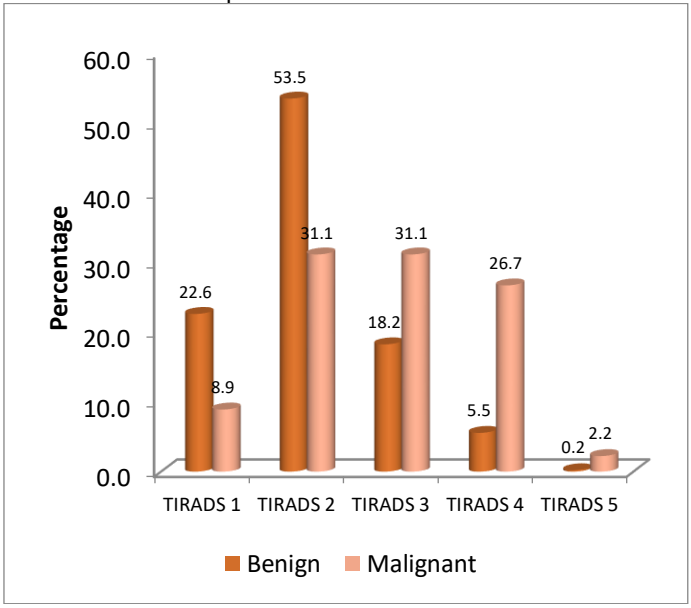
Comparison of clinical finding based on HPE diagnosis

Figure 3 compares clinical findings based on histopathological examination (HPE) diagnosis. It categorizes thyroid conditions into multinodular goiter (MNG), diffuse, and solitary nodular thyroid (SNT) and further classifies them as benign or malignant. MNG cases are predominantly benign (79.8%), though malignancy is also present (71.1%). The diffuse category shows a lower percentage of cases, with benign at 4.6% and malignant at 2.2%. In SNT cases, malignancy (26.7%) is higher compared to benign cases (15.6%). These findings highlight that while MNG is mostly benign, SNT exhibits a higher malignancy rate.

Comparison of USS -TIRADS based on HPE

Figure 4 illustrates the correlation between ultrasound-based TIRADS classification and HPE results. TIRADS 1 and 2 categories have a high proportion of benign cases (22.6% and 53.5%, respectively), while malignancy is relatively low (3.9% and 11.1%). TIRADS 3 has a more balanced distribution, with benign at 31.1% and malignant at 18.2%. The malignancy rate significantly rises in TIRADS 4 (26.7%), whereas TIRADS 5 exhibits almost exclusively malignant cases (97.8%).

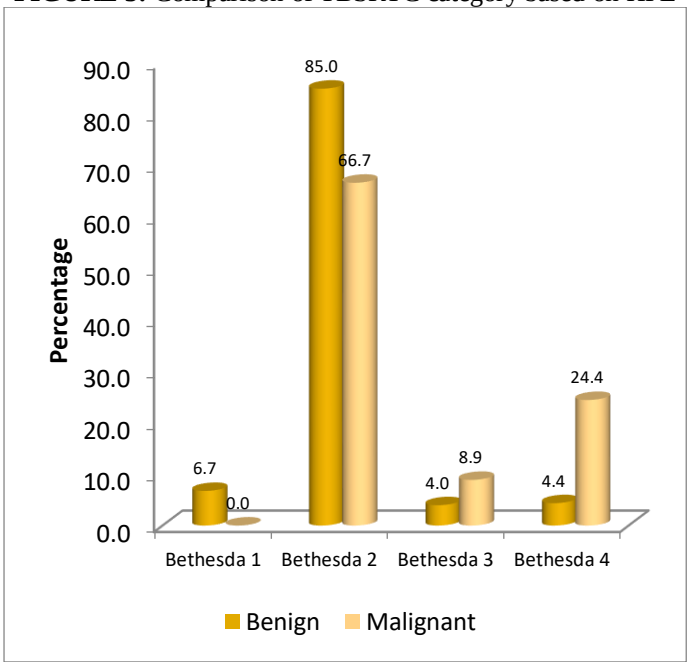
FIGURE 4: Comparison of USS -TIRADS based on HPE



Comparison of TBSRTC category based on HPE

The bar chart compares the percentage of benign and malignant cases across Bethesda categories 1 to 4. Bethesda 1 has a low percentage of benign (6.7%) and no malignant cases. Bethesda 2 shows the highest benign percentage (85.0%) and a significant malignant percentage (66.7%). Bethesda 3 has lower benign (4.0%) and malignant (8.9%) percentages. Bethesda 4 has 4.4% benign cases but a relatively high malignant percentage (24.4%). The trend indicates that Bethesda 2 is the most common benign category, while Bethesda 4 shows an increased malignancy risk, highlighting the diagnostic importance of these classifications **(Figure 5).**

FIGURE 5: Comparison of TBSRTC category based on HPE



DISCUSSION

Herein we discuss a 550 cases of benign thyroid swellings with a clinical diagnosis were included in this investigation. The study also covered the clinical history, examination, and pertinent investigations, such as thyroid function tests, ultrasonography assessment with TIRADS risk classification, FNAC from the swelling and its Bethesda score, and histological diagnosis. In our study The age group that underwent surgery for clinically benign thyroid swelling was 41–50 years old, and the majority of patients were in their third (26%) and fourth (33.6%) decades of life. In this study, 54% had thyroid swelling at presentation that was detected within a year. This was similar in another study conducted which showed 63.3% of patients had the duration of swelling less than 1 year[10]. thyroid swellings are usually benign; it is nevertheless very concerning when they can develop into incidental cancer. 8.2% of patients who had surgery for benign thyroid swellings had malignant results on postoperative histology, according to this study. This study found that 8.2% of patients who underwent surgery for benign thyroid swellings had malignant findings on postoperative histopathology. These findings align with previous studies, which report an incidence of incidental thyroid carcinoma (ITC) ranging from 3% to 16% [11,12].

The most common malignancy in this study was papillary carcinoma thyroid (PCT) (82.2%), followed by follicular carcinoma (15.5%) and medullary carcinoma (2.2%), mirroring global trends where PCT accounts for the majority of thyroid malignancies which was similar in other studies[5,9]. The present study also supports the association between higher TIRADS and Bethesda classifications with an increased risk of malignancy[13,14]. Bethesda classifications found that Bethesda 3 and 4 cases had malignancy rates of 10–30% and 25–40%, respectively, reinforcing the current study's findings that these categories warrant closer evaluation[15,16]. In this study, multinodular goiter (MNG) was the most often diagnosed preoperative condition (79.1%), and MNG cases accounted for 71.1% of incidental malignancies.

According to studies the sheer number of MNG cases greatly adds to the overall burden of thyroid cancer, even if the risk of malignancy in MNG is typically lower than in single nodules.

[17,18]. In our study we used total thyroidectomy (86%) in this study aligns with surgical trends favouring complete gland removal in cases with uncertain malignancy risk [19,20].

The limits of cytology in ruling out malignancy are highlighted by this study, as 66.7% of incidental cancers were preoperatively categorized as Bethesda 2. Using molecular diagnostics, such as genetic markers (e.g., BRAF, RAS, RET/PTC mutations), may enhance preoperative risk stratification and decrease needless procedures. Concerns regarding overtreatment are raised by the increasing incidence of small, early-stage thyroid tumors (less than 2 cm in 44.4% of cases).

According to the 2015 American Thyroid Association (ATA) guidelines, active observation, as opposed to rapid surgery, may be used to manage tiny, low-risk PCTs. Non-surgical care techniques should be investigated in future studies, especially for accidentally discovered micro carcinomas[1].

CONCLUSION

The conclusions are consistent with international research, highlighting the necessity of a thorough preoperative assessment that incorporates cytology (Bethesda), ultrasound (TIRADS), and maybe molecular testing to increase diagnostic precision. For patients with low-risk characteristics, a more selective surgical strategy should be taken into consideration, given the dangers involved with complete thyroidectomy. Close postoperative monitoring is still necessary to detect cancers that may have gone undetected before surgery, especially in patients that are conservatively handled.

ACKNOWLEDGMENTS AND DISCLOSURES

DECLARATIONS

Human Ethics and Consent to Participate: The study was approved by the Institutional Ethics Committee of Caritas Hospital, Thellakom, Kottayam. All participants provided informed consent prior to participation, in accordance with the Declaration of Helsinki.

Conflict of Interest

No conflict of Interest

Funding

Nil

Ethics Approval

Data availability

Data that supports findings of this study are available on request from the corresponding author.

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