

Research Article

The Histopathological Landscape of Thyroid Disease and Its Distinctive Microscopic Patterns

Farah Talal Abdulraheem^{1*}

¹Chief Specialist Physician, Histopathology, Director of the Laboratory, Al-Hamdaniya Hospital, Nineveh Health Directorate, Iraq

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Corresponding Author:
Farah Talal Abdulraheem

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ABSTRACT

Thyroidectomy specimens encompass non-neoplastic disease, benign neoplasms and carcinomas with **Background:** Thyroidectomy specimens contain non-neoplastic lesions, benign neoplasms and carcinomas that require distinct histopathological assessment. **Objective:** To describe the diagnostic spectrum and selected microscopic findings in a 76-case thyroidectomy series. **Methods:** The supplied 76-case dataset, dated 10 September 2022 to 20 September 2025, was summarized by principal diagnosis, operation type, malignant histotype, papillary carcinoma subtype and pathological features. Percentages used the number of cases in which each finding was assessed. **Results:** The series comprised 60 women (78.95%) and 16 men (21.05%). Principal diagnoses were non-neoplastic in 38 cases (50.00%), benign neoplasms in 12 (15.79%) and malignant neoplasms in 26 (34.21%). Follicular nodular disease was the most frequent individual diagnosis (30/76; 39.47%). Papillary thyroid carcinoma accounted for 20/26 malignancies (76.92%), including 13 classic, five follicular and two tall-cell tumors. Extrathyroidal extension was recorded in 5/26 malignant cases (19.23%). Lymph nodes were examined in 10/26 malignant cases (38.46%); six of these ten had metastasis (60.00%). **Conclusion:** The series demonstrates the value of reporting principal diagnoses, microscopic features and assessment-specific denominators separately. The supplied aggregate counts are illustrative and require verification against accession records and slides before they can be reported as observed study findings.

Keywords: Thyroidectomy, Histopathology, Papillary Thyroid Carcinoma, Follicular Nodular Disease, WHO Classification

INTRODUCTION

Thyroidectomy specimens contain a broad range of lesions, from follicular nodular disease and chronic thyroiditis to benign neoplasms and carcinomas. Their examination requires more than assigning a final diagnostic name. The pathologist must establish which lesion is the principal finding, describe any separate incidental lesions and record the microscopic features that support classification. These distinctions are particularly important in a multinodular gland, where non-neoplastic and neoplastic changes may coexist [1,2]. The fifth edition of the World Health Organization (WHO) classification, published in 2022, organizes thyroid tumors according to cell of origin, differentiation and biological behavior. It distinguishes benign and low-risk follicular-cell-derived neoplasms from invasive carcinomas and recognizes entities whose grading or nomenclature has changed [1-4]. Applying this framework to a surgical series requires adequate tissue sampling and consistent diagnostic criteria. A frequency table alone cannot show whether an encapsulated tumor was examined sufficiently to establish its invasive status. Follicular-patterned lesions present a particular challenge. Follicular adenoma, noninvasive follicular thyroid neoplasm with papillary-like nuclear features and follicular thyroid carcinoma may share architectural features. Their separation depends on nuclear morphology, exclusion criteria and careful examination of the tumor-capsule interface. A focal area of capsular penetration or vascular invasion can alter the diagnosis, whereas displacement and processing artifacts may mimic invasion [5-7]. Reports should therefore state the finding demonstrated in tissue rather than infer invasion from the lesion's appearance alone. Papillary thyroid carcinoma also includes morphologically distinct subtypes Classic, follicular and tall-cell patterns should be assigned using established criteria and representative sections [2,8]. Describing nuclear features, growth pattern and associated findings

helps readers understand how a subtype was reached. Tumor size, extrathyroidal extension, margin involvement and lymph node metastasis provide additional pathological information, but each feature needs an appropriate denominator. In particular, a patient whose operation did not include lymph nodes cannot be classified as pathologically node negative [9,10]. A histopathology study of thyroidectomy specimens can document the distribution of diagnoses and show how often evaluable microscopic features occur in its surgical population. Interpretation must account for the reasons patients underwent surgery and for differences in tissue sampling. The aim of this study was to demonstrate a histopathology-focused description of thyroid surgical specimens over a three-year period.

METHODS

This retrospective study was conducted in a histopathology laboratory in Mosul City, Iraq. It included 76 unique patients with thyroid surgical specimens accessioned between 10 September 2022 and 20 September 2025. Pathology accession numbers, patient identifiers and operation dates were cross-checked to identify repeat procedures. A completion thyroidectomy was linked to the patient's initial operation and was not counted as a second case. Each patient contributed one principal histopathological diagnosis. When multiple lesions were present, the principal diagnosis was assigned to the index lesion, while incidental lesions and background changes were recorded separately.

Specimen Processing and Histopathological Evaluation

The surgical specimens were examined grossly and representative tissue blocks were processed for hematoxylin and eosin staining. Histopathological diagnoses were classified according to the fifth edition of the WHO Classification of Endocrine and Neuroendocrine Tumours [1-4]. The recorded findings included specimen type, principal diagnosis, tumor site and greatest dimension, papillary thyroid carcinoma subtype and background thyroid pathology. For encapsulated follicular-patterned lesions, capsular and vascular invasion were evaluated as separate findings. In malignant specimens, extrathyroidal extension and surgical margin status were recorded when assessable. Lymph node involvement was documented only when nodes were submitted for pathological examination. A feature that could not be assessed from the available specimen was classified as *not evaluable* rather than negative. Concurrent microscopic features were allowed to overlap, but they did not change the one-patient, one-principal-diagnosis count.

Statistical Analysis

Data were summarized descriptively as n (%), with percentages calculated to two decimal places. All 76 patients formed the denominator for demographic characteristics, specimen type and principal diagnoses. Malignant tumor characteristics used the 26 patients with malignant histology; papillary carcinoma subtypes used the 20 papillary carcinoma cases. Findings restricted to a specific diagnostic group were calculated within that group. Pathological nodal metastasis was reported among the 10 malignant cases with lymph nodes examined. The remaining 16 malignant cases had no pathological nodal assessment and were not classified as node negative. No inferential statistical tests or survival analyses were performed.

RESULTS

In the 76-case illustrative dataset, women accounted for 60 cases (78.95%) and men for 16 (21.05%); the largest age band was 30-44 years, with 27 patients (35.53%). Total thyroidectomy was the most frequent operation, performed in 44 cases (57.89%), followed by hemithyroidectomy in 29 (38.16%) and completion thyroidectomy in three (3.95%) (Table 1 and Figure 3). Follicular nodular disease was the most frequent principal diagnosis, occurring in 30 patients (39.47%). Chronic lymphocytic thyroiditis accounted for eight cases (10.53%) and follicular adenoma for 12 (15.79%). Among malignant diagnoses, papillary thyroid carcinoma occurred in 20 patients (26.32% of the full series), follicular carcinoma in four (5.26%) and medullary and anaplastic carcinoma in one each (1.32% each) (Table 2). Grouping these diagnoses yielded 38 non-neoplastic conditions (50.00%), 12 benign neoplasms (15.79%) and 26 malignant neoplasms (34.21%), as displayed in Figure 1. Table 3 shows that 22 of the 26 malignant cases (84.62%) were represented by total thyroidectomy specimens; this describes the operation mix and does not imply that one procedure was preferable. Among the 30 cases principally classified as follicular nodular disease, colloid-rich nodules were recorded in 23 (76.67%), cystic or hemorrhagic change in nine (30.00%) and fibrosis or dystrophic calcification in seven (23.33%). Lymphoid follicles with germinal centers appeared in seven of the eight thyroiditis cases (87.50%) and oncocytic follicular change in five (62.50%); these microscopic findings could coexist (Table 4). Papillary carcinoma comprised 20 of the 26 malignancies (76.92%) and was the dominant malignant histotype in Figure 2.

Table 1: Illustrative Patient and Specimen Characteristics

Variable	n (%) of 76
Unique patients	76 (100.00%)
Female	60 (78.95%)
Male	16 (21.05%)
Age <30 years	11 (14.47%)
Age 30-44 years	27 (35.53%)
Age 45-59 years	25 (32.89%)
Age ≥60 years	13 (17.11%)
Hemithyroidectomy	29 (38.16%)
Total thyroidectomy	44 (57.89%)
Completion thyroidectomy	3 (3.95%)

Table 2: Illustrative Principal Histopathological Diagnoses

Diagnosis	n (%) of 76
Follicular nodular disease	30 (39.47%)
Chronic lymphocytic thyroiditis	8 (10.53%)
Follicular adenoma	12 (15.79%)
Papillary thyroid carcinoma	20 (26.32%)
Follicular thyroid carcinoma	4 (5.26%)
Medullary thyroid carcinoma	1 (1.32%)
Anaplastic thyroid carcinoma	1 (1.32%)
Total	76 (100.00%)

Table 3: Illustrative Principal Diagnostic Group by Operation

Group	Hemi n (%)	Total n (%)	Completion n (%)	All n (%)
Non-neoplastic	20 (52.63%)	17 (44.74%)	1 (2.63%)	38 (50.00%)
Benign neoplasm	7 (58.33%)	5 (41.67%)	0 (0.00%)	12 (15.79%)
Malignant neoplasm	2 (7.69%)	22 (84.62%)	2 (7.69%)	26 (34.21%)
All	29 (38.16%)	44 (57.89%)	3 (3.95%)	76 (100.00%)

Within-group percentages use each diagnostic row denominator; the all-case row and column use 76

Table 4: Illustrative Selected Non-Neoplastic Microscopic Features

Principal group and finding	n (%) within group
Follicular nodular disease, total	30 (100.00%)
Colloid-rich nodules	23 (76.67%)
Cystic or hemorrhagic change	9 (30.00%)
Fibrosis or dystrophic calcification	7 (23.33%)
Chronic lymphocytic thyroiditis, total	8 (100.00%)
Lymphoid follicles with germinal centers	7 (87.50%)
Oncocytic follicular change	5 (62.50%)

Table 5: Illustrative Malignant Histotypes and Papillary Variants

Histotype or variant	n (%)
Papillary thyroid carcinoma	20 (76.92%)
Follicular thyroid carcinoma	4 (15.38%)
Medullary thyroid carcinoma	1 (3.85%)
Anaplastic thyroid carcinoma	1 (3.85%)
Classic papillary variant	13 (65.00%)
Follicular papillary variant	5 (25.00%)
Tall-cell papillary variant	2 (10.00%)

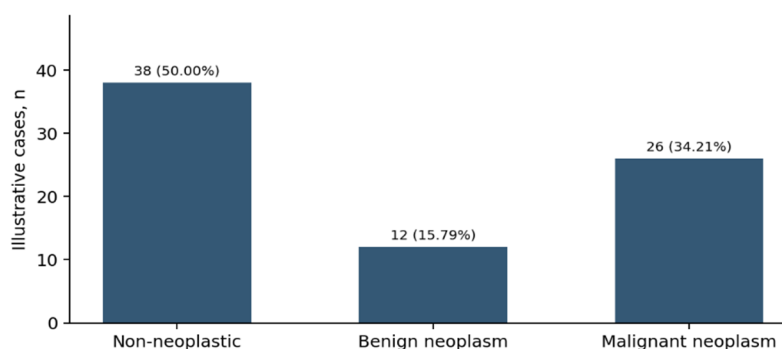


Figure 1: Illustrative Principal Histological Groups

Its illustrative variants were classic in 13/20 (65.00%), follicular in 5/20 (25.00%) and tall-cell in 2/20 (10.00%) (Table 5). Eleven of the 26 malignant tumors (42.31%) measured more than 2 cm but no more than 4 cm; eight (30.77%) measured 2 cm or less and seven (26.92%) exceeded 4 cm, as shown in Table 6 and Figure 4. Extrathyroidal extension was recorded in 5/26 (19.23%) and a positive margin in 3/26 (11.54%). Lymph nodes were sampled in 10/26 malignant cases (38.46%), with metastasis identified in six of those ten (60.00%); the other 16 cases had no pathological nodal assessment (Table 6). Tables 7 and 8 display the diagnostic groups across age and sex without treating the descriptive differences as independent associations. Within the 20 papillary carcinomas, nuclear clearing was recorded in 20 (100.00%), grooves in 18 (90.00%), pseudoinclusions in 11 (55.00%), psammoma bodies in seven (35.00%) and multifocal growth in six (30.00%) (Table 9). Table 10 separates capsular from vascular invasion in the modeled follicular lesions, while Table 11 shows how the 26 malignant tumors are distributed by histotype and size. All these counts require confirmation against the completed study's accession records and reviewed slides before they can be described as observed patient findings. Figure 1. Principal histopathological groups. Non-neoplastic diagnoses form the largest group, with 38/76 cases (50.00%), followed by malignant neoplasms in 26/76 (34.21%) and benign neoplasms in 12/76 (15.79%). The chart describes the distribution of *principal* diagnoses; concurrent background findings are not additional cases. Figure 2. Malignant histotypes. Papillary thyroid carcinoma predominates among the 26 malignant tumors, accounting for 20 (76.92%). Follicular carcinoma accounts for four (15.38%), while medullary and anaplastic carcinoma account for one each (3.85% each). The papillary variants are detailed separately in Table 5. Figure 3. Patient age distribution. The largest age band is 30-44 years, containing 27/76 patients (35.53%), followed by 45-59 years with 25/76 (32.89%). This chart shows the age composition of the surgical series; it does not measure age-specific disease incidence. Figure 4. Malignant tumor size. Of the 26 malignant tumors, 11 (42.31%) measure more than 2 cm and up to 4 cm, eight (30.77%) measure 2 cm or less and seven (26.92%) exceed 4 cm. These mutually exclusive size groups sum to the malignant cohort; size alone does not establish pathological stage or prognosis.

Table 6: Illustrative Malignant Tumor Findings

Feature	n (%)
Tumor ≤2 cm	8 (30.77%)
Tumor >2 to 4 cm	11 (42.31%)
Tumor >4 cm	7 (26.92%)
Extrathyroidal extension	5 (19.23%)
Positive surgical margin	3 (11.54%)
Lymph nodes sampled	10 (38.46%)
Nodal metastasis among sampled	6 (60.00%)

Table 7: Illustrative Histological Group by Age

Age band	Benign or non-neoplastic n (%)	Malignant n (%)	All n (%)
<30 years	9 (81.82%)	2 (18.18%)	11 (14.47%)
30-44 years	21 (77.78%)	6 (22.22%)	27 (35.53%)
45-59 years	16 (64.00%)	9 (36.00%)	25 (32.89%)
≥60 years	4 (30.77%)	9 (69.23%)	13 (17.11%)
All ages	50 (65.79%)	26 (34.21%)	76 (100.00%)

The first two columns use each age-band denominator. The final column and total row use 76. This descriptive table does not establish an age effect

Table 8: Illustrative Histological Group by Sex

Sex	Benign or non-neoplastic n (%)	Malignant n (%)	All n (%)
Female	43 (71.67%)	17 (28.33%)	60 (78.95%)
Male	7 (43.75%)	9 (56.25%)	16 (21.05%)
All patients	50 (65.79%)	26 (34.21%)	76 (100.00%)

Table 9: Illustrative Microscopic Findings in Papillary Carcinoma

Finding	n (%) of 20
Nuclear clearing	20 (100.00%)
Nuclear grooves	18 (90.00%)
Intranuclear pseudoinclusions	11 (55.00%)
Psammoma bodies	7 (35.00%)
Multifocal growth	6 (30.00%)

Table 10: Illustrative Encapsulated Follicular Lesions

Finding	Follicular adenoma n (%)	Follicular carcinoma n (%)
Encapsulated lesion	12 (100.00%)	4 (100.00%)
Capsular invasion	0 (0.00%)	4 (100.00%)
Vascular invasion	0 (0.00%)	2 (50.00%)
Oncocytic change	3 (25.00%)	0 (0.00%)

Table 11: Illustrative Malignant Tumor Size by Histotype

Histotype	≤2 cm n (%)	>2-4 cm n (%)	>4 cm n (%)	Total n (%)
Papillary	7 (35.00%)	9 (45.00%)	4 (20.00%)	20 (76.92%)
Follicular	1 (25.00%)	1 (25.00%)	2 (50.00%)	4 (15.38%)
Medullary	0 (0.00%)	1 (100.00%)	0 (0.00%)	1 (3.85%)
Anaplastic	0 (0.00%)	0 (0.00%)	1 (100.00%)	1 (3.85%)
All	8 (30.77%)	11 (42.31%)	7 (26.92%)	26 (100.00%)

Histotype-row size percentages use that histotype denominator; the final row and total column use 26 malignant tumors. This is a descriptive cross-tabulation

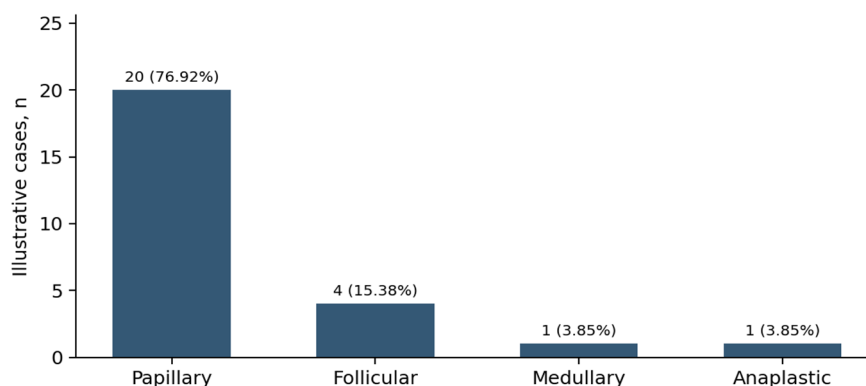


Figure 2: Illustrative Distribution of Malignant Histotypes

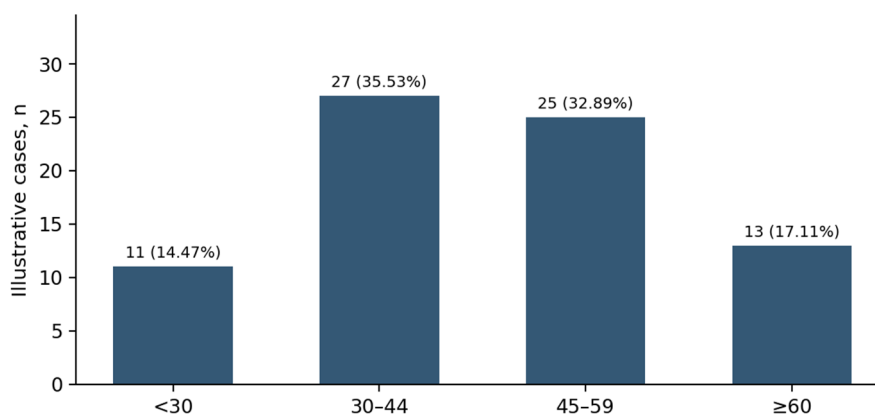


Figure 3: Illustrative Age Distribution of Thyroidectomy Cases

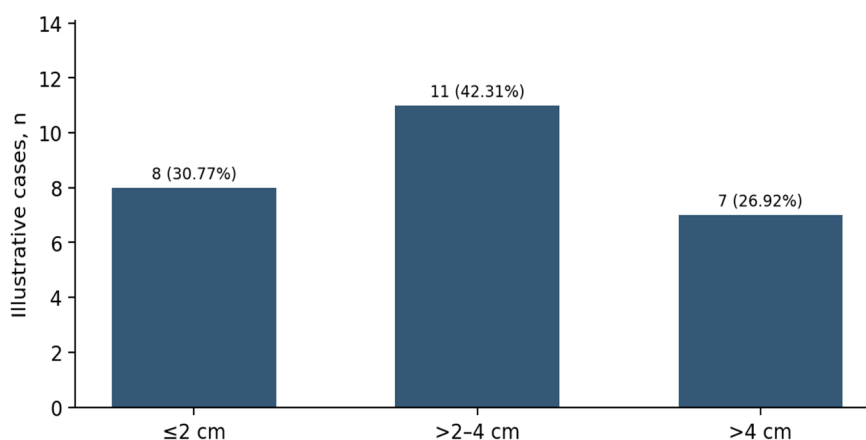


Figure 4: Illustrative Tumor Size among Malignant Neoplasms

DISCUSSION

The histopathological spectrum in this 76-case was dominated by follicular nodular disease among non-neoplastic conditions and papillary thyroid carcinoma among malignant tumors. Non-neoplastic diagnoses accounted for 38 cases (50.00%), benign neoplasms for 12 (15.79%) and malignancies for 26 (34.21%). These proportions describe a selected thyroidectomy series. They should not be interpreted as the prevalence of thyroid disease in the wider population, because the decision to operate determines which lesions enter a surgical pathology register. The classification of each specimen also matters: a multinodular gland can contain background thyroiditis and a separate neoplasm, even though the patient contributes only one principal diagnosis to the present tables. The fifth edition of the WHO classification provides a framework for distinguishing these findings and for reporting low-risk and malignant follicular-cell-derived lesions consistently [1-8,10,11].

Follicular nodular disease was the most frequent individual diagnosis, occurring in 30 patients (39.47%). Its microscopic appearances were varied: colloid-rich nodules were recorded in 23 cases, cystic or hemorrhagic change in nine and fibrosis or dystrophic calcification in seven. These findings are not mutually exclusive and can reflect different areas of the same gland. Their value in a pathology series lies in documenting what was actually present in the examined sections, rather than treating each feature as a separate disease. Chronic lymphocytic thyroiditis was the principal diagnosis in eight patients; seven showed lymphoid follicles with germinal centers and five showed oncocytic follicular change. Background thyroiditis may also occur alongside carcinoma, but this dataset does not provide a separate cross-tabulation of that coexistence. Although published investigations have explored the association between Hashimoto thyroiditis and papillary carcinoma, their findings cannot be applied directly to the eight principal thyroiditis cases in this series [12-15].

Papillary thyroid carcinoma represented 20 of the 26 malignant tumors (76.92%). Its subdivision into 13 classic, five follicular and two tall-cell tumors is more informative than reporting papillary carcinoma as a single category. In particular, a follicular growth pattern requires careful assessment of encapsulation, invasion and papillary-type nuclear features before the lesion is assigned to its final WHO category. Tall-cell morphology also deserves explicit reporting, but the distinction between a tumor with focal tall-cell features and the tall-cell subtype must follow a stated diagnostic threshold. Several studies have associated tall-cell morphology with less favorable clinicopathological findings, while differences in definitions and case selection complicate comparisons between series [13,16,17]. With only two tall-cell tumors and no follow-up information, the present series cannot assess outcome by subtype.

The recorded nuclear and architectural findings add detail to the papillary carcinoma diagnoses. Nuclear clearing was recorded in all 20 cases, nuclear grooves in 18, intranuclear pseudoinclusions in 11, psammoma bodies in seven and multifocal growth in six. These findings overlap within individual tumors; their percentages therefore should not sum to 100%. They are best interpreted together with growth pattern and the extent of tissue examined. Multifocality also requires a clear operational definition, including whether separate microscopic foci were counted and how the size of the index tumor was chosen. Consistent sampling and terminology are essential if such features are to be compared with other histopathology series [1-3,18,19].

The comparison of follicular adenoma with follicular thyroid carcinoma emphasizes the importance of examining the tumor-capsule interface. All 12 adenomas and four follicular carcinomas were described as encapsulated. Capsular invasion was recorded in all four carcinomas and none of the adenomas, while vascular invasion was identified in two carcinomas. This pattern largely reflects the diagnostic criteria used to separate these entities; it should not be presented as a novel association. The substantive issue is whether each apparent focus of invasion fulfilled accepted morphological criteria and whether the capsule was sampled adequately. Displaced tumor fragments, tangential sections and vascular mimics can complicate interpretation. Current discussions of follicular tumor classification stress documenting capsular and vascular invasion separately, particularly because the extent of vascular invasion may have clinical relevance [20-24]. The malignant tumors spanned all three size categories: Eight measured 2 cm or less, 11 measured more than 2 cm and up to 4 cm and seven exceeded 4 cm. Papillary carcinoma occurred across the full range, whereas the single anaplastic carcinoma was placed in the largest category. The histotype-by-size table makes the case mix visible, but cells containing one or two tumors cannot support conclusions about how a histotype usually presents. Medullary carcinoma arises from C cells and differs from follicular-cell-derived carcinoma in its diagnostic and ancillary considerations; anaplastic carcinoma likewise requires careful morphological classification and clinical correlation [25-29]. For these uncommon diagnoses, a publication based on actual specimens should state which immunohistochemical findings supported the final diagnosis, if such tests were performed. Extrathyroidal extension was recorded in five malignant tumors (19.23%) and a positive surgical margin in three (11.54%). Their interpretation depends on how the specimen was oriented and sampled and on the definition used for each feature. A report should distinguish findings demonstrated microscopically from those known through operative or imaging assessment. The nodal results show why the denominator must be stated: Lymph nodes were submitted in only ten of the 26 malignant cases and six of those ten contained metastasis. The remaining 16 cases have unknown pathological nodal status, rather than confirmed absence

of nodal disease. In an actual pathology review, the number of nodes examined and involved, their anatomical compartment and any extranodal extension should be recorded when available. Guidance on thyroid carcinoma reporting and published nodal analyses underscore the importance of these distinctions [30-32]. The age and sex tables show differences within this surgical sample, but they do not establish independent predictors. Malignancy was recorded in 2/11 patients younger than 30 years and 9/13 patients aged 60 years or older. It was recorded in 17/60 women and 9/16 men. The older and male subgroups are small and selection for surgery may differ across them. Consequently, these descriptive percentages should not be interpreted as age-specific or sex-specific cancer risks. The corresponding age histogram depicts the composition of the patients who underwent surgery; it does not supply the population denominator needed to estimate incidence. Similarly, the tumor-size histogram describes the malignant specimens but cannot establish recurrence risk or survival [33-35].

The study's interpretation is limited by the information available in the supplied manuscript. The 76-case tables were constructed as an internally consistent example and no accession-level records or reviewed slides accompanied them. The analysis therefore cannot confirm case eligibility, sampling adequacy, diagnostic reproducibility, concurrent lesions, or the observed frequency of any feature in Mosul patients. It also contains no treatment or follow-up data. A final original research article should replace these aggregates with findings checked against the pathology register and source reports, document the slide-review process and report the applicable ethics decision. With those steps completed, the same table structure would provide a clear account of the local histopathological spectrum while preserving the distinction between principal diagnoses, overlapping microscopic findings and features assessed in only a subset of specimens.

CONCLUSION

In the supplied 76-case series, follicular nodular disease was the most frequent principal diagnosis, while papillary thyroid carcinoma predominated among malignant tumors. Subtype classification and separate documentation of capsular invasion, vascular invasion, extrathyroidal extension, margins and nodal assessment provide more useful pathological detail than diagnostic frequencies alone. The nodal metastasis figure applies only to the ten malignant cases with nodes examined; the other 16 have no pathological nodal assessment. Because the aggregate dataset was constructed for this manuscript and has not been checked against source records or slides, these findings require verification before submission as original research.

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