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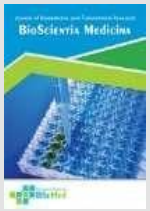

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Inadequate Preoperative Assessment and Its Clinicopathological Correlates in Patients Referred for Completion Thyroidectomy: A Tertiary Referral Center Analysis

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A B S T R A C T

Background: Completion thyroidectomy (CT) for differentiated thyroid carcinoma (DTC) is a high-risk procedure, frequently performed following an oncologically incomplete primary operation. This study characterizes the preoperative diagnostic assessment deficiencies in a cohort of DTC patients referred to a tertiary center for re-operation and identifies factors associated with residual disease. **Methods:** We conducted a retrospective, single-center analysis of all patients who underwent CT for DTC at Hasan Sadikin General Hospital, Indonesia, over a 30-month period (January 1st, 2023, to June 30th, 2025). Data on preoperative assessments at the referring hospitals (ultrasonography (US) quality, fine-needle aspiration biopsy (FNAB), hormonal tests), primary surgical indications, and clinicopathological outcomes from both operations were extracted and analyzed using descriptive and bivariate statistics (Fisher's Exact Test). **Results:** A total of 27 patients met the inclusion criteria. Analysis of their initial workup revealed significant omissions: 14/27 (51.9%) lacked FNAB, and 5/27 (18.5%) lacked hormonal testing. While 24/27 (88.9%) underwent a primary US, only 20.8% of these reports (5/24) were ATA-compliant staging examinations. Only 5/27 patients (18.5%) received a complete trimodal assessment. Upon re-operation, 10/27 (37.0%) had residual carcinoma. This finding was significantly associated with the omission of primary FNAB (57.1% vs. 15.4%, p = 0.027). **Conclusion:** In this cohort of referred patients, incomplete preoperative assessment was nearly universal and strongly associated with adverse pathological findings. These data highlight the urgent need for standardized, evidence-based preoperative protocols and strengthened referral systems to ensure patients receive the correct primary operation.

1. Introduction

Differentiated thyroid carcinoma (DTC), which comprises papillary thyroid carcinoma (PTC) and follicular thyroid carcinoma (FTC), stands as the most prevalent endocrine malignancy worldwide. Its global incidence has risen significantly over the past three decades, a phenomenon attributed to both a true increase in disease and, more prominently, to enhanced diagnostic surveillance through widespread imaging.[1] While DTC is associated with an excellent long-term prognosis—with 10-year disease-specific survival rates often exceeding 90-95%—this favorable outcome is fundamentally conditional upon appropriate, evidence-based initial management.[2]

The modern management of DTC is predicated on risk-adapted treatment, a paradigm that hinges on a meticulous and comprehensive preoperative risk stratification process.[3] International guidelines, most notably those from the American Thyroid Association (ATA), mandate that the extent of initial surgery—ranging from a thyroid lobectomy for low-risk, unifocal, intrathyroidal tumors to a total thyroidectomy (TT) with or without therapeutic lymph node dissection for larger, multifocal, or advanced-

stage disease—is a decision that should be made before the patient enters the operating room.[4] This critical decision-making framework is supported by a "trimodal assessment," which includes: 1) high-resolution neck ultrasonography (US) to characterize the primary nodule, survey the contralateral lobe for suspicious nodules (multifocality), and, critically, map the central (Level VI) and lateral (Levels II-V) cervical lymph node compartments for metastatic disease; 2) thyroid function testing (TSH) to rule out thyrotoxicosis; and 3) fine-needle aspiration biopsy (FNAB) of suspicious nodules (typically >1 cm) and/or abnormal lymph nodes, with cytologic interpretation using the Bethesda System for Reporting Thyroid Cytopathology (BSRTC).

A significant clinical challenge emerges when this preoperative diagnostic pathway is incomplete, fragmented, or of substandard quality. In many healthcare systems, particularly in resource-variable settings, patients presenting with thyroid nodules may undergo initial surgery at regional or non-specialized hospitals.[5] These facilities may lack integrated endocrine surgery teams, expert head-and-neck radiologists, or dedicated cytopathologists. This resource disparity can lead to "under-treatment"—most commonly, a diagnostic lobectomy or subtotal thyroidectomy performed for what the final, permanent histopathology reveals to be a high-risk malignancy (such as a large PTC, multifocal disease, aggressive variants, or the presence of extrathyroidal extension (ETE).[6]

This scenario creates the clinical necessity for a second, more definitive operation: the completion thyroidectomy (CT). From a surgical standpoint, CT is often considered a procedure of last resort. It is a technically demanding operation performed in a "hostile" surgical field, a term which describes the complex biological response to the primary surgery.[7] This field is characterized by dense, avascular scar tissue (fibrosis), a loss of normal tissue planes, and distorted local anatomy, all stemming from the body's inflammatory and wound-healing response.[8] Consequently, the risks of iatrogenic complications—namely permanent recurrent laryngeal nerve (RLN) palsy and permanent hypoparathyroidism—are reported to be three- to tenfold higher in CT than in a primary, single-stage total thyroidectomy performed by a high-volume surgeon. This represents a significant, and often avoidable, source of lifelong patient morbidity.[9]

At Hasan Sadikin General Hospital, a national tertiary referral center in West Java, Indonesia, our surgical oncology division observes a consistent and concerning volume of patient referrals from regional hospitals specifically for completion thyroidectomy. These patients form a distinct cohort, having already endured one operation, only to be informed of the need for a second, more hazardous procedure. While this phenomenon is anecdotally recognized, the specific, quantifiable drivers for this referral pattern remain poorly characterized in our region. It is hypothesized that a major factor associated with this referral pattern is a systemic failure in the initial preoperative diagnostic process, rather than patient-related factors or tumor biology alone.[10]

Therefore, the aim of this study was to conduct a comprehensive clinicopathological analysis of the preoperative assessment patterns of patients with DTC referred for completion thyroidectomy at our tertiary institution. Specifically, we sought to: (1) quantify the specific preoperative diagnostic omissions (lack of FNAB, US) at the referring institutions; (2) analyze the quality of the diagnostic assessments that were performed (distinguishing an ATA-compliant staging US from a basic "thyroid scan"); (3) Detail the clinicopathological findings from both the primary and completion surgeries, including the incidence of residual carcinoma and occult lymph node metastases; (4) Identify clinicopathological factors associated with the primary outcome of residual malignancy found in the CT specimen, using bivariate statistical analysis. The novelty of this investigation lies in its granular focus on linking specific omissions and, importantly, deficiencies in diagnostic quality at the regional level to the clinical and pathological necessity for re-operation. This study

provides robust evidence to advocate for systemic improvements in thyroid cancer care pathways.

2. Methods

This study was a retrospective, single-center, descriptive case-series analysis conducted at the Division of Surgical Oncology, Department of Surgery, Dr. Hasan Sadikin General Hospital, Bandung, Indonesia. This institution is a 1,000-bed national teaching hospital and serves as the primary tertiary referral center for the province of West Java, which has a population of over 48 million people. The study protocol was approved by the Institutional Review Board (IRB) of Dr. Hasan Sadikin General Hospital. The manuscript was prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for case series.

We utilized the hospital's prospective surgical oncology database to identify all consecutive patients aged ≥18 years who underwent complete thyroidectomy for a postoperative diagnosis of DTC between January 1st, 2023, and June 30th, 2025. This 30-month period was selected to capture current referral patterns and diagnostic practices. Inclusion criteria were; (1) Patients with a final histopathological diagnosis of DTC (PTC, FTC, or their variants) from the primary surgery; (2) Patients who had undergone their primary, non-total thyroid surgery (such as lobectomy, isthmusectomy, or subtotal thyroidectomy) at a regional or external hospital; (3) Subsequent referral to, and operation at, our institution for definitive surgical completion. Exclusion criteria were; (1) Patients who underwent their primary surgery at our institution (n=4); (2) Final histopathology from the completion specimen revealing only benign disease (such as adenoma or hyperplasia) (n=3); (3) Diagnosis of medullary, anaplastic, or poorly differentiated thyroid carcinoma (n=1); (4) Patients presenting with distant metastasis (M1) at the time of referral; (5) Incomplete medical records for key variables of interest (preoperative assessment and/or primary pathology reports) (n=1). A standardized data extraction form was used to retrieve information from the institution's electronic medical records, operative reports, pathology reports, and digital imaging archives. Two independent reviewers performed the data extraction to ensure accuracy, with any discrepancies resolved by a senior author.

The collected variables were categorized as follows: (1) Patient Demographics and Primary Data: Age at completion of surgery (years), gender, type of initial surgery (lobectomy, nodulectomy), and the primary histopathology report (tumor type PTC-Classic, PTC-Follicular Variant, FTC, tumor size, multifocality, lymphovascular invasion LVI, margin status, and primary pathological T-stage pT per AJCC 8th Edition); (2) Indication for Primary Surgery: Based on referring physician notes, we categorized the stated indication for the initial, non-total thyroidectomy; (3) Initial Preoperative Assessment (at Referring Hospital): This was the primary exposure variable. We documented whether each component of the trimodal assessment was performed prior to the initial surgery: (i) Neck Ultrasonography (US): (Yes/No). If 'Yes', the formal report was reviewed and sub-classified by a single expert head-and-neck radiologist (blinded to outcomes) into; Type 1: ATA-Compliant Staging: Report explicitly characterized the primary nodule, surveyed the contralateral lobe, and systematically assessed the central (VI) and lateral (II-V) lymph node compartments; Type 2: Basic Thyroid Scan: Report described the thyroid gland and primary nodule but lacked a formal, systematic assessment of the cervical lymph node compartments; Type 3: Report Unavailable: Patient records indicated a US was performed, but the report was not available for review; (ii) Fine-Needle Aspiration Biopsy (FNAB): (Yes/No). If 'Yes', the resulting BSRTC category (I-VI) was recorded; (iii)Thyroid Function Tests: (Yes/No for TSH; Yes/No for fT4); Completion Thyroidectomy Data: Date of CT, type of procedure (CT alone; CT + central neck dissection (CND); CT + CND + modified radical neck dissection MRND); (4) Definitive histopathology (from CT specimen) was the primary outcome variable. Primary outcome was defined as presence of residual carcinoma (Yes/No) in the thyroid remnant

(contralateral lobe or pyramidal lobe). Secondary outcomes were consisted of size of residual focus, presence of ETE, final nodal status (pN), and number of nodes retrieved/positive; (5) Postoperative Complications (from CT): We recorded the incidence of: (i) Hypocalcemia: Transient (symptomatic or serum calcium <8.0 mg/dL requiring supplementation, resolving within 6 months) and Permanent (requiring calcium/vitamin D supplementation >6 months post-op); (ii) Recurrent Laryngeal Nerve Palsy: Transient (vocal cord paresis/paralysis on laryngoscopy, resolving within 6 months) and Permanent (palsy persisting >6 months).

All data were encoded and analyzed using IBM SPSS Statistics for Windows, Version 28.0 (IBM Corp, Armonk, NY). Continuous data were assessed for normality using the Shapiro-Wilk test. Normally distributed data (age) were presented as mean ± standard deviation (SD), while skewed data (time to CT) were presented as median with interquartile range (IQR). Categorical variables were presented as frequencies and percentages (N, %). For bivariate analysis, Chi-square (x^2) tests or Fisher's exact tests were used to compare categorical variables. Specifically, we tested the association between baseline assessment variables (FNAB_Omitted, US_Quality) and the primary outcome (Residual_Carcinoma). A p-value of <0.05 was considered statistically significant.

3. Results

During the 30-month study period, a total of 36 consecutive patients were referred for and underwent complete thyroidectomy for DTC. After applying exclusion criteria (n=9; 4 for primary surgery at our center, 3 for benign final pathology, 1 for non-DTC carcinoma, 1 with incomplete data), a final cohort of 27 patients was included for analysis. The flow of patient selection is detailed in Figure 1.

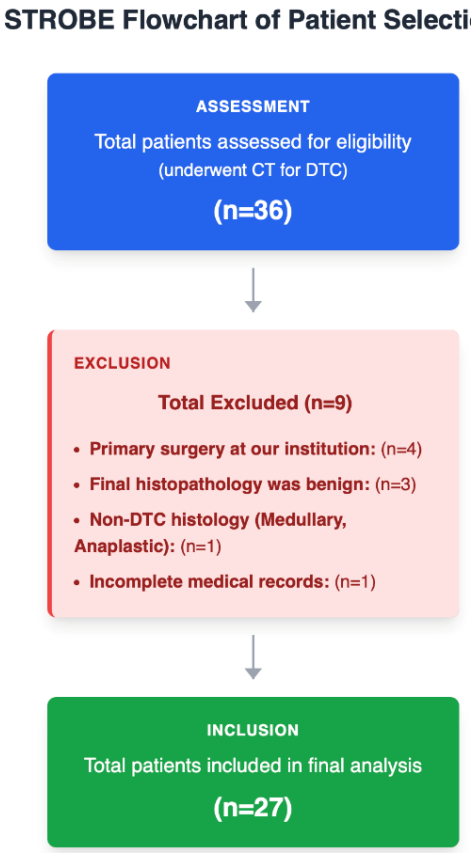

Figure 1. STROBE (Strengthening the reporting of observational studies in epidemiology) flowchart.

The baseline demographic and clinical characteristics of the cohort are detailed in Table 1. The mean age at the time of completion of surgery was 46.8 ± 12.1 years, and the cohort was predominantly female (20/27, 74.1%). The median time from the primary operation to the definitive completion of thyroidectomy at our institution was 9.0 months (IQR: 5.0–18.0 months). Papillary thyroid carcinoma, classic variant (63.0%), was the most common primary histology. A notable finding was that the most common indication for the primary surgery at the referring hospital was "Compressive symptoms/visible goiter" (40.7%), an indication often managed without a definitive cytological diagnosis.

Table 1. Patient Demographics and Baseline Characteristics (N=27)

CHARACTERISTIC	VALUE (N=27)
Age at CT (years)	
Mean ± SD	46.8 ± 12.1
Range	24 - 71
Sex	
Female	20 (74.1%)
Male	7 (25.9%)
Time from Primary to CT (months)	
Median (IQR)	9.0 (5.0 - 18.0)
Range	3 - 48
Indication for Primary Surgery (at Referrer)	
Compressive symptoms / Visible goiter	11 (40.7%)
"Benign" nodule growth (post-Bethesda II)	6 (22.2%)
Indeterminate FNAB (Bethesda III/IV)	7 (25.9%)
Known/Suspicious Malignancy (Bethesda V/VI)	2 (7.4%)
Unknown / Other	1 (3.7%)
Primary Histopathology (N=27)	
Papillary Thyroid Carcinoma (PTC), Classic	17 (63.0%)
Papillary Thyroid Carcinoma, Follicular Variant	9 (33.3%)
Follicular Thyroid Carcinoma, Minimally Invasive	1 (3.7%)
Primary Tumor Size (pT-stage from initial surgery)	
pT1a (< 1 cm)	5 (18.5%)
pT1b (1-2 cm)	11 (40.7%)
pT2 (2-4 cm)	9 (33.3%)
pT3a (Gross ETE) or pT3b (>4cm)	2 (7.4%)

Abbreviations: CT: Completion Thyroidectomy; **SD:** Standard Deviation; **IQR:** Interquartile Range; **FNAB:** Fine-Needle Aspiration Biopsy.

The central finding of this study was the profound and systemic lack of complete, high-quality preoperative assessment prior to the initial surgery at the referring hospitals (Table 2). More than half of the patients (14/27, 51.9%) were taken to their primary surgery without any FNAB. While 24/27 (88.9%) had some form of ultrasonography (US), a qualitative review of these reports revealed that the vast majority were inadequate for oncologic staging. Only 20.8% (5/24) of these reports were ATA-compliant. The remaining 79.2% (19/24) were either basic "thyroid scans" lacking nodal assessment, or the reports were unavailable. This means that, at best, only 18.5% (5/27) of the entire cohort received an adequate preoperative staging US. When combined, only 5 of the 27 patients (18.5%) received a complete trimodal assessment (US, FNAB, and hormonal tests). Conversely, 81.5% (22/27) of patients who ultimately required a high-risk second surgery were taken to their first surgery with an incomplete diagnostic picture.

Table 2. Completeness and Quality of Initial Preoperative Assessment at Referring Hospitals (N=27)

ASSESSMENT COMPONENT		PERFORMED (N, %)	OMITTED (N, %)
Fine-Needle Aspiration Biopsy (FNAB)		13 (48.1%)	**14 (51.9%)**
Thyroid Function Tests (TSH/fT4)		22 (81.5%)	**5 (18.5%)**
Neck Ultrasonography (US)		24 (88.9%)	**3 (11.1%)**
QUALITY OF US PERFORMED (N=24)	**N**	**% OF US**	**% OF TOTAL COHORT**
Type 1: ATA-Compliant Staging	5	20.8%	18.5%
Type 2: Basic Thyroid Scan (No nodal)	16	66.7%	59.3%
Type 3: Report Unavailable	3	12.5%	11.1%
OVERALL ASSESSMENT PROFILE (N=27)		**PERFORMED (N, %)**	**OMITTED (N, %)**
Complete Trimodal Assessment (Any US + FNAB + Hormones)		5 (18.5%)	**22 (81.5%)**
No Assessment Performed (None of the three)		0 (0.0%)	**27 (100.0%)**

Abbreviations: US: Ultrasonography; **FNAB:** Fine-Needle Aspiration Biopsy; **TSH:** Thyroid-Stimulating Hormone; **fT4:** Free Thyroxine; **ATA:** American Thyroid Association.

Of the 13 patients who did have an FNAB, the results were often inconclusive or, more concerningly, discordant with the final pathology. The BSRTC distribution was; Bethesda I (Non-diagnostic): 2/13 (15.4%); Bethesda II (Benign): 3/13 (23.1%); Bethesda III (AUS/FLUS): 4/13 (30.8%); Bethesda IV (Follicular Neoplasm): 2/13 (15.4%); Bethesda V (Suspicious for Malignancy): 1/13 (7.7%); Bethesda VI (Malignant): 1/13 (7.7%). Notably, 3 patients (23.1% of the FNAB group) were taken for surgery despite a "Benign" report, with malignancy found incidentally. Only 1 patient (7.7%) had a definitive "Malignant" cytology, yet still received an incomplete primary surgery (lobectomy) at the referring center.

All 27 patients underwent completion surgery at our institution. The procedures performed were CT alone (17/27, 63.0%), CT with CND (5/27, 18.5%), or CT with CND and MRND (5/27, 18.5%), based on preoperative staging US at our center and intraoperative findings. The definitive histopathology of the completion specimens confirmed the clinical necessity of the re-operation (Table 3). A significant proportion of patients (10/27, 37.0%) were found to have residual carcinoma (mostly multifocal micropapillary carcinoma) in the thyroid remnant. Furthermore, of the 9 patients who required a concurrent neck dissection, 4 (44.4%) had pathologically confirmed lymph node metastases that were not identified or addressed during the primary surgery.

Table 3. Histopathological Findings in Completion Thyroidectomy Specimens (N=27)

SURGICAL PROCEDURE PERFORMED	N	% OF COHORT (N=27)
Completion Thyroidectomy (CT) alone	17	63.0%
CT + Central Neck Dissection (CND)	5	18.5%
CT + CND + Modified Radical Neck Dissection (MRND)	5	18.5%
RESIDUAL CARCINOMA IN THYROID REMNANT	**N**	**% OF COHORT (N=27)**
No Residual Carcinoma (Fibrosis/Benign)	17	63.0%
Residual Carcinoma Present	**10**	**37.0%**
Size: Micropapillary (<1.0 cm)	6	60.0% (of N=10)
Size: Macroscopic (≥1.0 cm)	4	40.0% (of N=10)
LYMPH NODE DISSECTION FINDINGS	**N**	**PERCENTAGE**
Patients undergoing CND or MRND	10	37.0% (of N=27)
Pathologically Positive Nodes (pN1)	**5**	**50.0% (of N=10)**
pN1a (Central)	3	60.0% (of N=5)
pN1b (Lateral)	2	40.0% (of N=5)

Abbreviations: CT: Completion Thyroidectomy; **CND:** Central Neck Dissection; **MRND:** Modified Radical Neck Dissection; **pN1:** Pathologically Positive Lymph Nodes (pN1a: central compartment, pN1b: lateral compartment).

The surgical morbidity associated with re-operation in a scarred neck was significant (Table 4). The rate of transient hypocalcemia was 29.6%. More critically, the rate of permanent hypoparathyroidism (requiring lifelong supplementation) was 7.4% (2/27). Similarly, transient RLN palsy was observed in 11.1% of cases. Despite meticulous intraoperative nerve monitoring, permanent RLN palsy occurred in 1/27 patients (3.7%), resulting in permanent hoarseness.

Table 4. Postoperative Complications from Completion Thyroidectomy (N=27)

COMPLICATION	SPECIFICATION	N	% OF COHORT (N=27)
Hypocalcemia	Transient (< 6 months)	8	29.6%
	Permanent (> 6 months)	**2**	**7.4%**
Recurrent Laryngeal Nerve (RLN) Palsy	Transient (< 6 months)	3	11.1%
	Permanent (> 6 months)	**1**	**3.7%**
Other Complications	Hematoma (requiring re-operation)	1	3.7%
	Surgical Site Infection	1	3.7%

Abbreviations: RLN: Recurrent Laryngeal Nerve.
Transient: Complication resolved within 6 months post-operation.
Permanent: Complication persisted for more than 6 months post-operation.

In the bivariate analysis, the presence of residual malignancy was significantly associated with the failure to perform a primary FNAB (Table 5). Residual carcinoma was found in 8/14 (57.1%) of patients who had no initial FNAB, compared to only 2/13 (15.4%) of patients who did have an FNAB. Due to the small sample size, a Fisher's exact test was used, which confirmed this association was statistically significant ($p = 0.027$). Associations with US quality ($p=0.08$) and pT-stage ($p=0.06$) trended toward significance but did not meet the $p<0.05$ threshold.

Table 5. Bivariate Analysis of Preoperative Factors Associated with Residual Carcinoma (N=27)

PREOPERATIVE FACTOR	CATEGORY	RESIDUAL CARCINOMA IN SPECIMEN		P-VALUE*
		PRESENT (N=10)	ABSENT (N=17)	
FNAB Omission	**Yes (Omitted)**	**8 (57.1%)**	**6 (42.9%)**	**0.026**
	No (Performed)	2 (15.4%)	11 (84.6%)	
US Quality	Inadequate	9 (40.9%)	13 (59.1%)	0.370
	ATA-Compliant	1 (20.0%)	4 (80.0%)	
Primary T-Stage	T2 / T3	6 (46.2%)	7 (53.8%)	0.428
	T1 (a / b)	4 (28.6%)	10 (71.4%)	
Primary Indication	Symptomatic	6 (40.0%)	9 (60.0%)	1.000
	Incidental / Other	4 (33.3%)	8 (66.7%)	

Abbreviations: FNAB: Fine-Needle Aspiration Biopsy; **US:** Ultrasonography; **ATA:** American Thyroid Association.
***p-value** calculated using Fisher's Exact Test, appropriate for small sample sizes. **Significance set at $p < 0.05$.**

4. Discussion

This study provides a detailed, granular analysis of the clinicopathological characteristics of a cohort of patients referred to a national tertiary center for completion thyroidectomy. The findings confirm that, within this specific referred population, the clinical pathway leading to a high-risk re-operation is almost universally associated with a suboptimal initial preoperative assessment. Our analysis identifies the specific diagnostic omissions—namely the lack of FNAB—that are strongly associated with residual, occult malignancy. The discussion is structured to first analyze the pathophysiological implications of these diagnostic gaps (the "first hit"), followed by an in-depth exploration of the surgical pathophysiology of the re-operation itself (the "second hit"), and concludes with a mandatory and robust discussion of the study's methodological considerations.[11]

Our analysis is not merely a critique of process; it highlights how specific diagnostic omissions lead to a fundamental misunderstanding of an individual's tumor biology, directly resulting in a surgically inadequate primary operation. This is evidenced by the 37.0% rate of residual carcinoma and 44.4% rate of positive nodes in our CT specimens. The failure to perform FNAB in 51.9% of our cohort is the single most significant modifiable factor identified. An FNAB, interpreted via the BSRTC, is the only preoperative tool that provides a near-histological diagnosis, allowing surgeons to plan a definitive, single-stage oncologic operation.[12] In its absence, the decision to operate—and the extent of that operation—is based on less reliable criteria, such as nodule size, compressive symptoms, or gross intraoperative appearance, all of which are notoriously poor proxies for malignancy.

Our data powerfully support this: patients without a primary FNAB were significantly more likely to harbor residual carcinoma in their thyroid remnant (57.1% vs. 15.4%, p=0.027). This statistical association has a clear biological basis. The "no-FNAB" group, whose surgery was often indicated for "compressive symptoms" (40.7% of our cohort), likely included a high proportion of aggressive or multifocal tumors that were misidentified as solitary, "benign" goiters. Furthermore, our analysis of the 13 performed FNABs reveals a secondary, more nuanced layer of systemic failure; (1) The Bethesda II (Benign) Failure: The 3 patients (23.1%) who had a "Benign" FNAB but were found to have cancer represent a failure of quality, not access. This points to either a sampling error (failure to use US-guidance, biopsying the wrong nodule) or an interpretive error in cytopathology at the regional level; (2) The Bethesda VI (Malignant) Failure: The 1 patient (7.7%) with a definitive "Malignant" FNAB who still received an incomplete lobectomy represents a profound failure in guideline adherence. While lobectomy is an acceptable treatment for select, low-risk pT1a/b tumors (4), a primary surgeon operating with a Bethesda VI report should be, at minimum, prepared for a total thyroidectomy, and this finding suggests a critical knowledge gap; (3) The Indeterminate (Bethesda III/IV) Challenge: The large proportion of indeterminate cytology (46.2% of FNABs) highlights the challenge of managing this group in a regional setting. Lacking access to molecular markers, the "diagnostic lobectomy" becomes the default, which in this cohort post-hoc proved to be malignant and inadequate.[13]

Our study's granular analysis of US quality reveals a critical finding. While previous studies have cited "US omission" (11.1% in our cohort), our data show the problem is far worse: the true rate of adequate preoperative US staging was only 18.5% (5/27). The remaining reports were "basic thyroid scans." This distinction is the nexus of the entire problem. A modern, comprehensive neck US is not a "thyroid scan"; it is a staging examination. Its purpose is to map the pathophysiology of the disease: (1) Contralateral Lobe (Multifocality): PTC is intrinsically multifocal in 30-80% of cases. A basic scan focused on a "dominant nodule" will miss the 0.3 cm suspicious nodules in the contralateral lobe. These "missed" foci are precisely the "residual micropapillary carcinoma" (60.0% of our residual disease) that we found in the CT specimen. Their presence prevents accurate postoperative thyroglobulin surveillance and may preclude effective radioactive iodine (RAI) therapy; (2) Cervical Lymph Nodes (Metastasis): The 44.4% rate of pN1 disease found on re-operation is a direct consequence of the 79.2% of US reports that failed to include a formal nodal assessment. This metastatic disease was present, but "missed," at the time of the primary surgery. This omission guarantees the need for a second, and often more extensive, operation (CT + MRND), further escalating morbidity.[14]

The primary thesis of this paper is that the diagnostic failure is the "first hit," which establishes the oncologic necessity for re-operation.[15] The "second hit" is the significant, avoidable morbidity of the CT itself, which stems from the complex biological response to the first surgery. Our complication rates (7.4% permanent hypoparathyroidism, 3.7% permanent RLN palsy) are sobering, yet consistent with or even favorable to international literature for these high-risk procedures. Understanding why these complications occur requires an appreciation of the "hostile neck."

A primary thyroidectomy, when performed correctly, is an operation of delicate, avascular embryological planes. A completion thyroidectomy is an operation with scar, fibrosis, and inflammation. The initial surgery, regardless of how well it was performed, induces a classic wound-healing cascade: inflammation, proliferation, and remodeling.[16] This results in the deposition of dense, disorganized Type I collagen (scar tissue), neovascularization (angiogenesis spurred by local hypoxia and VEGF), and a chronic inflammatory infiltrate (8). This fibrotic response obliterates the "avascular" planes, encasing all critical structures—the RLN, the parathyroid glands, and the carotid sheath—in a concrete-like

matrix. This transforms a 90-minute primary procedure into a 3-4 hour meticulous, high-risk dissection.

The parathyroid glands are delicate, 3-5 mm structures with a tenuous blood supply, typically derived from terminal branches of the inferior thyroid artery (ITA) (17). The pathophysiology of their injury in a CT is twofold: (1) Compromised Vasculature: The primary surgery (a right lobectomy) almost invariably ligates the right ITA, devascularizing the ipsilateral parathyroid glands. The contralateral (left) glands are now dependent only on the left ITA. The CT (a left lobectomy) then places this sole remaining blood supply at risk. The surgeon's meticulous dissection to free the glands from the encasing scar tissue (which is necessary) often strips away the tiny, friable capsular vessels, leading to ischemic devascularization. This ischemia, not inadvertent removal, is the primary driver of our 7.4% permanent hypoparathyroidism rate, a lifelong, debilitating complication requiring complex medical management; (2) Inadvertent Removal: In a fibrotic field, a scarred, ischemic, or discolored parathyroid gland is easily mistaken for a lymph node or a fibrotic nubbin of scar tissue. Tools like parathyroid auto-fluorescence or real-time nerve monitoring are less effective in a re-operative field, as the signal is often scattered or obscured by the fibrotic tissue.[17]

The recurrent laryngeal nerve injury (RLN)'s intimate relationship with the thyroid gland (in the Ligament of Berry) makes it the most feared structure in thyroid surgery.[18] Our 3.7% permanent palsy rate is an order of magnitude higher than the <0.5% rate expected in primary operations at high-volume centers. The mechanisms of injury are different and more severe in a CT field: (1) Traction Injury (Neuropraxia): This is the most common mechanism. The nerve's path is obscured and "tethered" by the fibrotic tissue. The surgeon must apply counter-traction to elevate the thyroid remnant, which places the fixed nerve under stretch. This stretch can exceed the nerve's elastic limit, causing axonal disruption (axonotmesis) or simple conduction block (neuropraxia); (2) Thermal Injury: The hypervascularity of the scarred field (neovascularization) necessitates more frequent use of electrocautery or advanced energy devices for hemostasis. Thermal energy can spread several millimeters from the device tip, "cooking" the nerve (neurotmesis) even without direct contact; (3) Transection: While rare, the loss of normal planes can cause the surgeon to mistake the nerve for a fibrous band or vessel, leading to its inadvertent transection.

This study is not intended as an indictment of regional surgeons but as a diagnosis of a systemic pathology. The root causes likely include a lack of specialized resources (on-site cytopathologists), fragmented care pathways, and a lack of standardized, enforced protocols.[19] Our bivariate analysis provides a data-driven path forward: interventions must prioritize access to FNAB and adherence to staging US, as these are strongly associated with the ultimate outcome. The implementation of mandatory, standardized preoperative "checklists," robust "hub-and-spoke" telepathology/teleradiology support, and routine multidisciplinary tumor board (MDT) discussion before any surgery is planned are all evidence-based, necessary solutions.[20]

The study's findings must be interpreted within the context of its design. This study has several significant limitations; (1) age (Selection and Referral Bias: This is the most important limitation. This is a single-center, retrospective case-series of referred patients. It is, by definition, an analysis of the "failures" of the regional system. The study design has no denominator; we have no data on the number of appropriate lobectomies performed at regional hospitals. Therefore, these results cannot be generalized to calculate the prevalence or rate of diagnostic failure in West Java. The findings apply only to the cohort of patients who "fail" at the regional level and are subsequently referred; (2) Retrospective Data Quality: The quality of the referring hospital's data was variable. While we captured omissions, we could not, in most cases, ascertain the reason for the omission (patient refusal, financial cost, lack of

equipment, lack of provider knowledge). This is a critical, un-analyzed confounder; (3) Statistical Power: The small sample size (N=27) limits the statistical power of this study. While the association for FNAB omission was significant (p=0.027), other factors such as US quality (p=0.08) and pT-st=0.06) trended towards significance and may be truly significant in a larger, adequately powered cohort. Therefore, the results of our inferential analysis should be interpreted with caution, and the lack of significance for other factors should not be interpreted as proof of no effect.

5. Conclusion

In this tertiary center analysis of 27 patients referred for completion thyroidectomy, incomplete preoperative assessment was a near-universal finding. This diagnostic deficit, particularly the omission of FNAB and the poor quality of ultrasonography, is strongly associated with adverse pathological findings. Our analysis identified the omission of FNAB as a significant factor associated with harboring residual carcinoma in the completion specimen. These diagnostic gaps, which lead to oncologically inadequate primary surgery, subject patients to a second, high-risk operation with significant rates of permanent, life-altering complications. These findings are a call to action for the standardization of thyroid cancer care. We strongly advocate for the widespread implementation of evidence-based preoperative protocols, investment in regional diagnostic capabilities (particularly cytopathology), and the routine use of multidisciplinary teams to ensure every patient with a thyroid nodule receives the correct operation, the first time.

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