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Clinicopathologic Case Series of Thyroglossal Cyst in a Tertiary Care Center

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KEYWORDS

Thyroglossal duct cyst; Midline neck mass; Ultrasonography; MRI; Infrahyoid cyst; Histopathology; Congenital neck lesion.

ABSTRACT:

Background:

Thyroglossal duct cysts (TGDCs) are the most common congenital midline neck lesions resulting from persistent remnants of the thyroglossal duct. Although typically presenting in childhood, TGDCs may manifest at any age with varied clinical and radiological features, occasionally posing diagnostic challenges.

Aim:

To analyze the clinicopathological characteristics, anatomical distribution, and radiological features of histopathologically confirmed TGDCs in a tertiary care center.

Materials and Methods:

A retrospective observational study was conducted in the Department of Pathology at Sri Ramachandra Medical College and Research Institute from January 2016 to September 2025. A total of 65 formalin-fixed paraffin-embedded tissue blocks of surgically resected TGDCs were reviewed. Clinical details, including age, sex, site, and radiological findings, were retrieved from the laboratory information system. Hematoxylin and eosin–stained sections were examined, and results were correlated with clinicopathological parameters.

Results:

Among the 65 patients evaluated, males constituted the majority at 74%, while females accounted for 26%, reflecting a clear male predominance, with ages ranging from 2 to 50 years (mean: 17.3 years; median: 12.5 years). The infrahyoid region was the most common site (90.8%), followed by suprahyoid and intralingual locations (4.6% each). Classical clinical presentation of a midline neck swelling moving with deglutition and tongue protrusion occurred in 72.3% of patients. Ultrasonography was performed in 86.2% of cases and demonstrated typical anechoic cystic lesions, while CT and MRI were utilized in 18.5% of cases each, aiding in the identification of atypical features and tract delineation. In this study of 65 cases, respiratory epithelium alone was seen in 7.69%, squamous epithelium in 1.54%, and a combination of both in 10.77%. Inflammation was present in 18.46%, mucoserous glands in 3.08%, and hyoid bone involvement in 20.00%. Thyroid tissue was identified in 15.38% of specimens. Cyst wall alone was noted in 7.69%, with skeletal muscle or adipose tissue components each occurring in 1.54%. Skeletal muscle alone was found in 3.08%, adipose tissue alone in 1.54%, and no case showed a combination of both. Papillary thyroid carcinoma was detected in 7.69% of cases.

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Conclusion:
Thyroglossal duct cysts are predominantly benign congenital neck lesions that commonly present in the infrahyoid region during childhood and adolescence. Ultrasonography remains the primary diagnostic tool, with CT and MRI aiding in atypical cases. Histopathologic evaluation confirms their embryologic origin and low malignant potential. Accurate clinicopathological correlation ensures appropriate surgical management and minimizes recurrence.

INTRODUCTION

The thyroglossal duct originates during early embryonic development of the thyroid gland. [1,2] As the thyroid primordium descends from its site of origin at the foramen cecum on the tongue, it remains connected to this point by a narrow epithelial tract known as the thyroglossal duct. [3,4] Normally, this duct undergoes complete involution between the seventh and tenth weeks of gestation, once the thyroid reaches its definitive pretracheal position in the lower neck. While most of the duct regresses, vestigial tissue may persist, and remnants near the inferior portion commonly form the pyramidal lobe of the thyroid gland. Persistence of other segments of the duct may result in the formation of thyroglossal duct cysts. [5,6,7]

Thyroglossal duct remnant cysts (TGDC) are among the most frequently encountered congenital neck lesions in infants and children, though they are also identified in adults. These cysts may occur at any point along the migratory descent of the thyroid gland, reflecting their embryologic origin. [8,9,10] Histologically, TGDCs are typically lined by respiratory or squamous epithelium, or a combination of both, and may contain microscopic foci of ectopic thyroid tissue. Studies of laryngeal and pediatric autopsy specimens have demonstrated that thyroglossal duct remnants are more common than clinically appreciated, suggesting a higher prevalence of embryologic persistence than the number of symptomatic cases might indicate. [11] Population-based estimates further imply that TGDCs, although relatively uncommon in clinical practice, represent a notable proportion of congenital cervical anomalies due to their developmental origin and the wide potential for anatomical variability. [12, 13] We correlated the histopathologic findings of TGDC with clinical features including age, sex, anatomical location, symptomatology and radiology findings in our study.

MATERIAL & METHODS:

The present retrospective observational study was conducted in the Department of Pathology at Sri Ramachandra Medical College and Research Institute. The study period extended from January 2016 to September 2025, and included a total of 65 paraffin blocks. The study participants comprised archived formalin-fixed, paraffin-embedded (FFPE) tissue samples obtained from surgically resected and histopathologically confirmed cases of thyroglossal cyst.

All resected specimens diagnosed as thyroglossal cyst were included, while those identified as non-neoplastic lesions were excluded. The materials used consisted of freshly cut 5 µm sections obtained from FFPE tissue blocks. Hematoxylin and eosin (H&E)–stained sections of these specimens were reviewed, and clinicopathological data such as age, sex, site of the lesion, and radiological findings were collected from the laboratory information system.

Following institutional ethical approval, the study protocol involved the collection and review of histopathology slides, tabulation of observations, and statistical analysis, with subsequent correlation of the results with relevant clinicopathological parameters.

RESULTS

Demographic Profile, Site of TGDC, Clinical Presentation & Imaging Modalities Used

Among the 65 patients evaluated, males constituted the majority at 74%, while females accounted for 26%, reflecting a clear male predominance.

The **site of the cyst** was predominantly **infrahyoid in 59 cases (90.8%)**, followed by **suprahyoid in 3 cases (4.6%)**, and **intralingual in 3 cases (4.6%).**

Clinically, **47 patients (72.3%)** demonstrated the classic presentation of a midline anterior neck swelling that moved with deglutition and protrusion of the tongue, while **18 patients (27.7%)** exhibited atypical clinical features.

Radiological assessment involved USG in 56 patients (86.2%), which commonly showed a well-defined anechoic cyst; multiloculation and intracystic solid components were noted in 3 cases each. CT was

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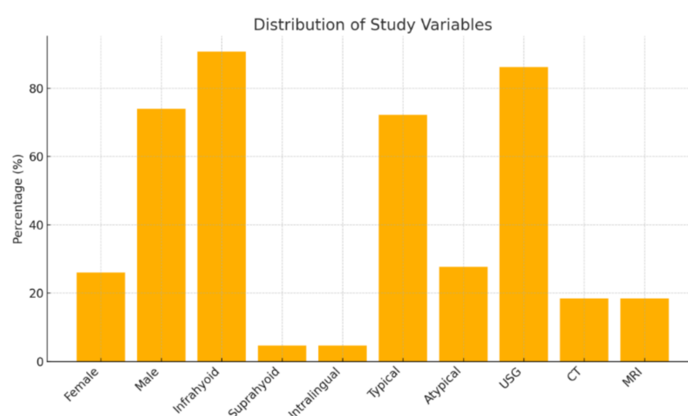
performed in 12 patients (18.5%) and revealed well-circumscribed, low-density cysts, with peripheral rim enhancement suggestive of prior infection in 6 cases. MRI, done in 12 patients with atypical features, demonstrated characteristic T1 hypointense and T2 hyperintense signals, confirming a tract toward the tongue base in 9 cases and toward the thyroid gland in 3 cases.

Table 1: Demographic Profile, Site of TGDC, Clinical Presentation & Imaging Modalities Used

Variable	Category	n	Percentage (%)
Gender	Female	17	26%
	Male	48	74%
Age	Range	2–50 years	—
	Mean	17.3 years	—
	Median	12.5 years	—
Site		**n**	**Percentage (%)**
Infrahyoid		59	90.8%
Suprahyoid		3	4.6%
Intralingual		3	4.6%
Presentation		**n**	**Percentage (%)**
Typical		47	72.3%
Atypical		18	27.7%
Imaging Modality		**n**	**Percentage (%)**
Ultrasonography (USG)		56	86.2%
Computed Tomography (CT)		12	18.5%
MRI		12	18.5%

Figure 1: **Demographic Profile, Site of TGDC, Clinical Presentation & Imaging Modalities Used**



Pathologic Features of Thyroglossal Duct Remnant Cysts

In this study of 65 cases, respiratory epithelium alone was seen in 7.69%, squamous epithelium in 1.54%, and a combination of both in 10.77%. Inflammation was present in 18.46%, mucoserous glands in 3.08%, and hyoid bone involvement in 20.00%. Thyroid tissue was identified in 15.38% of specimens. Cyst wall alone was noted in 7.69%, with skeletal muscle or adipose tissue components each occurring in 1.54%. Skeletal muscle alone was found in 3.08%, adipose tissue alone in 1.54%, and no case showed a combination of both. Papillary thyroid carcinoma was detected in 7.69% of cases.

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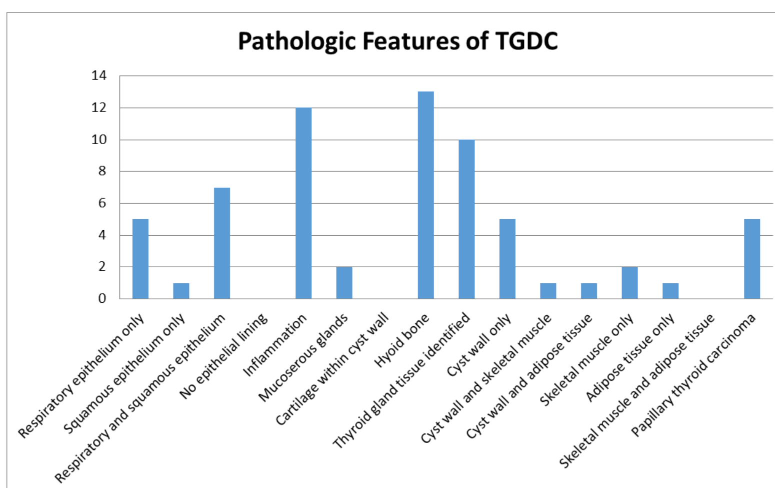
Table 2. Pathologic Features of Thyroglossal Duct Remnant Cysts (n = 65)

Characteristics	Number (n)	Percentage (%)
Respiratory epithelium only	5	7.69%
Squamous epithelium only	1	1.54%
Respiratory and squamous epithelium	7	10.77%
No epithelial lining	0	0.00%
Inflammation	12	18.46%
Mucoserous glands	2	3.08%
Cartilage within cyst wall	0	0.00%
Hyoid bone	13	20.00%
Thyroid gland tissue identified	10	15.38%
Cyst wall only	5	7.69%
Cyst wall and skeletal muscle	1	1.54%
Cyst wall and adipose tissue	1	1.54%
Skeletal muscle only	2	3.08%
Adipose tissue only	1	1.54%
Skeletal muscle and adipose tissue	0	0.00%
Papillary thyroid carcinoma	5	7.69%

Figure 2: Pathologic Features of Thyroglossal Duct Remnant Cysts



Benign & Malignant lesions of Thyroglossal Duct Remnant Cysts

The majority of thyroglossal duct cyst (TGDC) specimens in the study were benign. Out of 65 cases, 60 lesions (92.5%) demonstrated benign pathology, indicating that TGDCs are overwhelmingly non-malignant. Only 5 lesions (7.5%) were found to be malignant, reflecting the well-recognized but rare occurrence of carcinoma within TGDCs.

Table 3. Benign & Malignant lesions of Thyroglossal Duct Remnant Cysts (n = 65)

Characteristics	Number (n)	Percentage (%)
Benign TGDC lesions	60	92.5%
Malignant TGDC lesions	5	7.5%

Figure 3. Benign & Malignant lesions of Thyroglossal Duct Remnant Cysts

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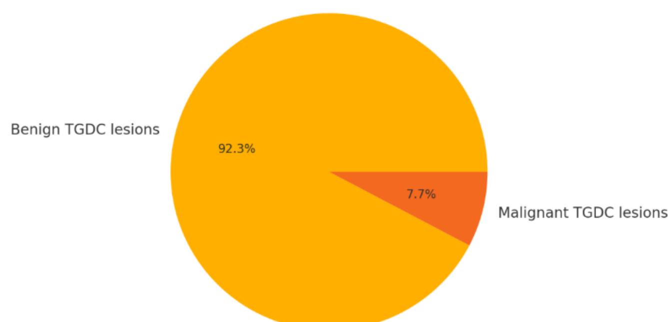
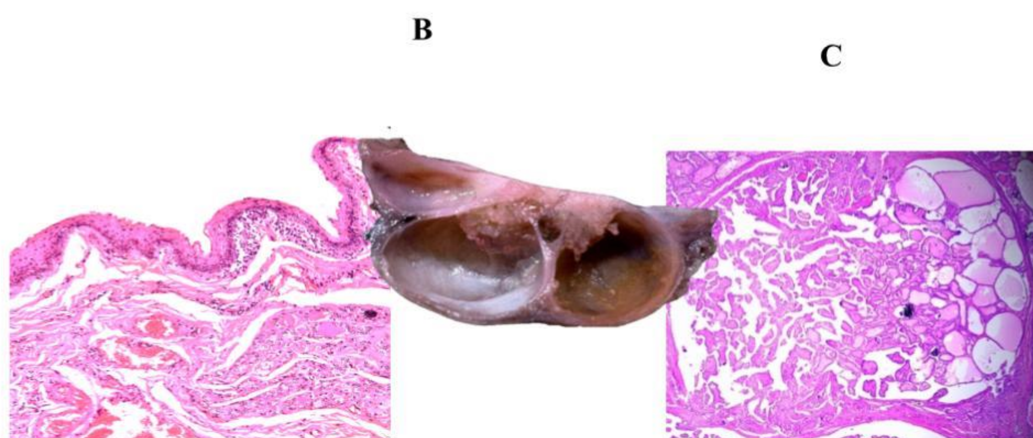
Distribution of TGDC Lesions (n=65)





A

Figure 1:A]Cyst lined squamous epithelium underlying subepithelium shows chronic inflammatory infiltrate (100x). B]Gross image-Cut surface shows multiloculated cyst filled with colloid and papillary projections noted over cyst wall. C]H&E-Encapsulated cyst shows papillary architecture admixed with colloid (40x).

DISCUSSION

In the present study of 65 patients diagnosed with thyroglossal duct cysts (TGDCs), the demographic and clinicoradiological patterns observed were largely consistent with prior reports. TGDC exhibited a slight female predominance (53.8%), although earlier studies have demonstrated no definitive gender bias. Mondin et al. noted a similar epidemiological distribution in their literature review, highlighting TGDC as a common congenital midline neck lesion affecting both sexes without strong predilection [14]. The mean age of 17.3 years and median age of 12.5 years observed in our data further support the notion that TGDC typically presents during childhood and adolescence, yet may remain asymptomatic until adulthood—a trend also described by Allard, who established a broad age range and emphasized the embryological origin of the lesion [15]

Clinically, most patients (72.3%) presented with the characteristic painless midline anterior neck swelling that moves with deglutition and tongue protrusion, reflecting traction along the persistent embryogenic tract. This classical presentation closely mirrors the findings of Arshad, who reported similar clinical profiles in his cohort of pathologically confirmed TGDC cases [16] Atypical presentations were observed in 27.7% of our cases, highlighting the challenge of diagnosis when deviations from classical features occur. Thabet et al. described analogous atypical variants, including intralaryngeal, intralingual, and laterally displaced cysts

that mimic other cervical lesions, reinforcing the diagnostic vigilance required in such presentations .[17]

The anatomical distribution in our study was dominated by infrahyoid cysts (90.8%), consistent with the embryological course of descent of the thyroid gland. Allard's landmark review of 381 TGDC cases reported a predominance of infrahyoid lesions, validating this developmental pathway as the most vulnerable location [15] Suprahyoid and intralingual lesions accounted for 4.6% each, aligning with documented rarity in these regions.

Radiological imaging remains essential for confirming diagnosis and guiding surgery. Ultrasonography, used in 86.2% of cases, reliably showed well-defined anechoic cysts, consistent with Ahuja et al., who identified USG as the preferred initial modality [17]. Multiloculated or partially solid areas in some patients likely reflected inflammatory or hemorrhagic changes, similar to findings from the Egyptian study. CT added structural detail but was mainly useful for detecting rim enhancement suggestive of infection, as noted in earlier analyses. MRI offered the greatest anatomical clarity; in our study it visualized upward-tapering tracts in 9 cases and inferior extensions in 3, supporting Ducic et al.'s conclusion that MRI best demonstrates thyroglossal duct remnants in ambiguous cases [18]. Such precision is crucial for surgical planning, particularly the Sistrunk procedure, and remains important given the rare but documented risk of malignant transformation, emphasized by Patel et al. [19].

Collectively, the findings of our study align with existing literature, confirming TGDC as a predominantly benign congenital anomaly with predictable clinical and radiological features. Nonetheless, the occurrence of atypical variants and radiological complexity underscores the importance of integrated evaluation. MRI, in particular, remains indispensable in atypical presentations, offering diagnostic clarity and enabling safe, complete surgical excision.

The histopathological characteristics observed in our series of 65 thyroglossal duct remnant cyst (TGDC) specimens closely align with patterns described in major published studies, reinforcing their embryologic derivation and biological behavior. The involvement of the hyoid bone in **21.54%** of cases corresponds well with the known anatomical trajectory of the thyroglossal tract, which typically passes through or near the hyoid bone. Similar frequencies of hyoid bone association have been documented in large pathological reviews, where TGDCs often show direct attachment or proximity due to the tract's developmental pathway [20,21]. Likewise, the **20% prevalence of inflammation** in our series mirrors the inflammatory changes frequently reported in TGDCs, attributed to recurrent infections, mucous retention, or prior interventions—features well described by Allard and subsequent histopathological analyses [22].

The epithelial lining of TGDCs in our study also demonstrated considerable variability, reflecting the heterogeneous differentiation of the tract. While **9.23% showed purely respiratory epithelium**, and **12.31% exhibited mixed respiratory and squamous epithelium**, the latter finding is especially consistent with large-scale studies reporting that nearly half of TGDCs display a mixed epithelial lining. This variation is attributed to metaplastic changes secondary to chronic inflammation or pressure effects, and it has been extensively documented in landmark series such as those by Thompson et al. and LiVolsi et al. [20–23]. The identification of **thyroid tissue within the cyst wall in 15.38%** of cases further supports the well-established embryologic persistence of thyroid elements along the descending tract—an observation repeatedly confirmed in both surgical and autopsy series [21,23].

Of particular clinical significance is the presence of **papillary thyroid carcinoma (PTC)** arising within TGDCs in a small but important subset of cases in our cohort. Although TGDC carcinoma remains rare—accounting for <1% of all TGDCs—numerous reports underline its potential to appear incidentally in otherwise typical cysts. Studies by Patel et al. and Weiss & Ordonez emphasize that PTC is the dominant malignancy encountered, often discovered only on postoperative histopathologic examination, as clinical or radiologic suspicion is frequently absent [24,25]. The malignant cases in our series reinforce the necessity for routine and meticulous histopathological evaluation of all excised TGDCs to ensure early detection, appropriate staging, and timely adjunctive management when required.

Overall, our findings corroborate the broader consensus that TGDCs are **histologically diverse yet predominantly benign lesions**, with features reflecting their embryologic origin and susceptibility to metaplastic and inflammatory changes. The occasional but significant detection of carcinoma highlights the continued importance of complete surgical excision—typically via the Sistrunk procedure—and mandatory histopathological assessment to rule out malignant transformation.

CONCLUSION

Thyroglossal duct cysts remain the most common congenital midline neck lesions, predominantly affecting

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children and adolescents. In this study, the classical clinical presentation and infrahyoid location were consistently observed, and ultrasonography proved to be the most effective initial imaging modality. MRI and CT were valuable adjuncts in atypical cases, ensuring accurate anatomical delineation. The histopathologic findings demonstrated predominantly benign features with characteristic epithelial patterns and occasional thyroid tissue, supporting their embryological origin. Integrating clinical, radiological, and pathological data enables precise diagnosis and guides appropriate surgical management, ultimately reducing recurrence and improving patient outcomes.

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