

Clinicopathological Spectrum and Diagnostic Utility of Ultrasonography and Fine Needle Aspiration Cytology in Neck Masses: A Prospective Observational Study in a North Indian Population

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Abstract

Background: Neck masses comprise a diverse group of lesions with inflammatory, congenital, benign, and malignant etiologies. Accurate diagnosis is essential for timely management. This study evaluated the clinicopathological spectrum of neck masses and assessed the diagnostic role of ultrasonography (USG) and fine needle aspiration cytology (FNAC). **Material and Methods:** This prospective observational study included 100 consecutive patients with palpable neck swellings attending the Department of Otorhinolaryngology, Baba Raghav Das Medical College, Gorakhpur, from December 2023 to January 2026. All patients underwent clinical evaluation, ultrasonography, and FNAC. Thyroid lesions were classified using the ACR TI-RADS and Bethesda systems. Histopathological examination was performed in surgically managed cases wherever available. **Results:** Females constituted 83% of cases, and the 31–40-year age group was most commonly affected (30%). The thyroid gland (44%) was the commonest site, followed by cervical lymph nodes (32%). Ultrasonography demonstrated predominantly solid lesions (74%), with TI-RADS III being the most frequent category (37.5%). FNAC showed benign lesions in 67%, inflammatory lesions in 26%, neoplastic lesions in 4%, suspicious lesions in 2%, and malignant lesions in 1%. Granulomatous/tubercular lymphadenitis (23%) was the most common final diagnosis, followed by inflammatory lesions (18%) and colloid goitre (16%). A significant association was observed between TI-RADS category and FNAC diagnosis ($p = 0.018$). **Conclusion:** Neck masses predominantly involved the thyroid gland and were mostly benign. The combined use of clinical examination, ultrasonography, and FNAC provides an accurate, minimally invasive, and cost-effective approach for evaluating neck masses.

Keywords: Neck masses, Fine-needle aspiration cytology, Ultrasonography, Clinicopathological correlation, Cervical lymphadenopathy, Thyroid lesions, Diagnostic accuracy, Prospective observational study.

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INTRODUCTION

Neck masses are among the most common clinical problems encountered in otorhinolaryngology and continue to pose a diagnostic challenge because of their varied etiology.^[1] They may arise from inflammatory, congenital, benign, or malignant conditions, each requiring a different therapeutic approach. While many neck swellings are benign and respond well to medical treatment, some may represent the earliest manifestation of an underlying malignancy. Therefore, timely evaluation is essential to avoid delayed diagnosis and improve patient outcomes.^[2]

The pattern of neck masses varies with age, geographical region, and associated risk factors. In developing countries such as India, infectious diseases, particularly tuberculous lymphadenitis, remain an important cause of cervical swellings.^[3] At the same time, thyroid disorders and tobacco-associated head and neck cancers contribute substantially to the disease burden. Because these conditions often present with similar clinical features, establishing the exact diagnosis

on clinical examination alone is frequently difficult.^[4]

A systematic diagnostic approach combining careful history, thorough physical examination, radiological investigations, and pathological evaluation is therefore indispensable. Ultrasonography is widely used as the initial imaging modality because it is safe, readily available, and capable of differentiating cystic from solid lesions while guiding fine - needle aspiration cytology.^[5] FNAC is a simple, minimally invasive, and cost effective investigation that provides valuable preoperative information. However, histopathological examination remains

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the definitive method for confirming the diagnosis.^[6]

Considering the diverse spectrum of neck masses encountered in routine ENT practice and the need for early and accurate diagnosis, the present prospective study was undertaken to evaluate the clinicopathological profile of neck masses presenting to a tertiary care centre.^[7] The study also aimed to correlate clinical findings with cytological and histopathological diagnoses, thereby assessing the usefulness of routinely employed diagnostic modalities in day to day clinical practice.

MATERIALS AND METHODS

Study Design and Participants: This prospective observational study was conducted in the Departments of Otorhinolaryngology (ENT), Radiodiagnosis, and Pathology at Baba Raghav Das Medical College and Nehru Chikitsalaya, Gorakhpur, India, from December 2023 to January 2026. The study included 100 consecutive patients presenting with clinically palpable neck swellings in the ENT outpatient department. Ethical approval was obtained from the Institutional Ethics Committee and written informed consent was obtained from all participants prior to enrolment.

Inclusion and Exclusion Criteria

Patients of either sex and all age groups presenting with palpable neck swellings who consented to undergo ultrasonography (USG) and fine needle aspiration cytology (FNAC) were included. Patients with known bleeding or coagulation disorders, previously diagnosed or treated neck swellings, those unwilling to undergo FNAC, and cases with inadequate or unsatisfactory cytological smears were excluded.

Clinical Evaluation: All patients underwent a detailed clinical evaluation using a standardized case record form. Demographic variables including age and sex were recorded. Clinical assessment included duration of swelling, side involved, onset, progression, associated pain, fever, weight loss, smoking history, previous thyroid disease, and previous neck surgery. Local examination assessed the anatomical site, size, number, surface, consistency, tenderness, mobility, and movement with deglutition of the swelling. Regional examination included evaluation for cervical lymphadenopathy and tracheal deviation.

Ultrasonographic Evaluation: Ultrasonographic examination was performed in the Department of Radiodiagnosis using a 7 - 12 MHz high-frequency linear array transducer with the patient in the supine position and the neck adequately extended. Both longitudinal and transverse scans were obtained.

The ultrasonographic parameters evaluated included lesion location, size, shape, margins, echogenicity, internal echotexture, composition (solid, cystic, or mixed), presence of septations, calcifications, cystic degeneration, comet-tail artefacts, peripheral halo, vascularity on colour Doppler imaging (central, peripheral, mixed, or absent), involvement of adjacent structures, extrathyroidal extension, and the presence of cervical lymphadenopathy. Thyroid nodules were categorized according to the American College of Radiology Thyroid Imaging Reporting and Data System

(ACR TI-RADS).

Fine Needle Aspiration Cytology: Fine needle aspiration cytology was performed under strict aseptic precautions using a 22 - 25 gauge disposable needle attached to a 10 mL syringe. The swelling was stabilized manually, and multiple passes were made using negative pressure to obtain representative cellular material. In cystic lesions, fluid was aspirated initially, followed by aspiration of the residual solid component or cyst wall whenever necessary.

The aspirated material was immediately smeared onto clean glass slides. Air dried smears were stained with May - Grünwald - Giemsa (MGG) stain, while alcohol fixed smears were stained with Hematoxylin and Eosin (H&E). Papanicolaou (PAP) staining was performed in selected cases requiring better nuclear detail.

Cytological evaluation included assessment of smear adequacy, cellularity, architectural pattern, colloid, background characteristics, inflammatory cells, cyst macrophages, giant cells, necrosis, nuclear morphology, chromatin pattern, nucleoli, nuclear grooves, intranuclear cytoplasmic inclusions, cytoplasmic features, and atypical or malignant cells. Thyroid lesions were classified according to the Bethesda System for Reporting Thyroid Cytopathology (Categories I - VI), whereas non thyroid lesions were categorized as inflammatory, benign, or malignant.

Histopathological Evaluation: Histopathological examination was performed in patients who subsequently underwent surgical excision. The histopathological diagnosis served as the reference standard wherever available and was correlated with both ultrasonographic and cytological findings.

Correlation of Ultrasonography and FNAC: The ultrasonographic findings were correlated with FNAC diagnoses to evaluate the diagnostic agreement between the two modalities in differentiating inflammatory, benign, and malignant neck swellings. Correlation with histopathological findings was performed in surgically managed cases.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 30.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages.

RESULTS



Figure 1: Anterior neck swelling suggestive of thyroid enlargement.



Figure 2: Midline neck swelling suggestive of a thyroglossal cyst.



Figure 4: Tuberculous cervical lymphadenitis.



Figure 3: Cervical lymphadenopathy.



Figure 5: Multinodular goitre showing irregular nodular enlargement of the thyroid gland.

Table 1: Baseline demographic characteristics of the study participants

Variable	Category	Cases	Percentage
Sex	Male	17	17.0
	Female	83	83.0
Total		100	100.0
Age group (years)	0-10	5	5.0
	11-20	16	16.0
	21-30	27	27.0
	31-40	30	30.0
	41-50	6	6.0
	51-60	15	15.0
	>60	1	1.0
Total		100	100.0

Table 2: Sociodemographic profile of the study participants

Variable	Category	Cases	Percentage
District	Gorakhpur	72	72.0
	Kushinagar	9	9.0
	Maharajganj	8	8.0

	Others	11	11.0
Total		100	100.0
Socioeconomic status	Lower	61	61.0
	Middle	26	26.0
	Upper	13	13.0
Total		100	100.0
Education	Primary	32	32.0
	Secondary	45	45.0
	Graduate	23	23.0
Total		100	100.0
Occupation	Housewife	41	41.0
	Service	21	21.0
	Farmer	14	14.0
	Others	24	24.0
Total		100	100.0

Table 3: Clinical characteristics of neck swellings

Variable	Category	Cases	Percentage
Duration of swelling	<1 month	4	4.0
	1-6 months	8	8.0
	6 months-1 year	4	4.0
	1-2 years	38	38.0
	2-3 years	13	13.0
	>3 years	33	33.0
Total		100	100.0
Size	≤1 cm	8	8.0
	1-2 cm	46	46.0
	2-3 cm	16	16.0
	3-5 cm	16	16.0
	>5 cm	14	14.0
Total		100	100.0
Number of lesions	Single	71	71.0
	Multiple	29	29.0
Total		100	100.0
Tenderness	Present	27	27.0
	Absent	73	73.0
Total		100	100.0

Table 4: Clinical examination findings (n = 100)

Variable	Category	Cases	Percentage
Site of swelling	Thyroid	44	44.0
	Cervical lymph nodes	32	32.0
	Submandibular	6	6.0
	Thyroglossal	5	5.0
	Others	13	13.0
Total		100	100.0
Surface	Smooth	30	30.0
	Well-defined	25	25.0
	Matted	22	22.0
	Lobulated	14	14.0
	Irregular/Rough	9	9.0
Total		100	100.0
Consistency	Firm	85	85.0
	Soft	4	4.0
	Cystic	6	6.0
	Mixed	5	5.0
Total		100	100.0
Mobility	Immobile	44	44.0
	Less mobile	27	27.0
	Mobile		

Table 5: Ultrasonographic characteristics of neck lesions

Variable	Category	Cases	Percentage
Composition	Solid	74	74.0
	Mixed	16	16.0
	Cystic	8	8.0
	Complex	2	2.0
Total		100	100.0

Calcification	Present	66	66.0
	Absent	34	34.0
Total		100	100.0
Margins	Smooth	53	53.0
	Well-defined	15	15.0
	Ill-defined	22	22.0
	Lobulated	6	6.0
	Loss of fatty hilum	4	4.0
Total		100	100.0
Additional nodules	Present	27	27.0
	Absent	73	73.0
Total			

Table 6: Doppler and Thyroid imaging findings

Variable	Category	Cases	Percentage
Doppler vascularity	Increased	31	31.0
	Normal	31	31.0
	Minimal	22	22.0
	Septal	13	13.0
	Absent	3	3.0
Total		100	100.0
Thyroid function (n = 67)	Euthyroid	58	86.6
	Hypothyroid	5	7.5
	Hyperthyroid	4	6.0
Total		67	100.0
ACR TI-RADS (n = 40)	TI-RADS I	3	7.5
	TI-RADS II	12	30.0
	TI-RADS III	15	37.5
	TI-RADS IV	7	17.5
	TI-RADS V	3	7.5
Total		40	100.0

Table 7: FNAC findings

Variable	Category	Cases	Percentage
FNAC diagnosis	Benign	67	67.0
	Inflammatory	26	26.0
	Neoplastic	4	4.0
	Suspicious for malignancy	2	2.0
	Malignant	1	1.0
Total		100	100.0
Cellularity	Cellular	70	70.0
	Moderately cellular	16	16.0
	Paucicellular	14	14.0
Total		100	100.0

Table 8: Thyroid lesion characteristics

Variable	Category	Cases	Percentage
ACR TI-RADS (n = 40)	I	3	7.5
	II	12	30.0
	III	15	37.5
	IV	7	17.5
	V	3	7.5
Total		40	100.0
Bethesda category (n = 40)	I	8	20.0
	II	18	45.0
	III	10	25.0
	IV	4	10.0
Total	-	40	-

Table 9: Final diagnosis

Diagnosis	Cases	Percentage
Granulomatous/tubercular lymphadenitis	23	23.0
Inflammatory lesions	18	18.0
Colloid goitre	16	16.0
Colloid nodule	8	8.0
Thyroglossal cyst	4	4.0
Malignant lesions	3	3.0

Autoimmune thyroiditis	3	3.0
Hyperplastic colloid nodule	3	3.0
Others*	22	22.0
Total	100	100.0

Table 10: Association between ultrasonography and FNAC

Variable	Result	p-value
TI-RADS vs FNAC	Significant	0.018
Vascularity vs malignancy	Significant	0.020
FNAC vs final diagnosis	Significant	0.010

DISCUSSION

The present study evaluated the clinicopathological profile of 100 patients with neck swellings and assessed the diagnostic role of ultrasonography (USG) and fine needle aspiration cytology (FNAC). A marked female predominance was observed, with 83% females and 17% males. Similar findings were reported by Garud et al,^[8] who observed 80.48% females, and Gupta et al,^[9] who reported 64.5% females, suggesting that the predominance of thyroid disorders among women contributes to this distribution.

The majority of patients in the present study belonged to the 31–40 years age group (30%), followed by 21 - 30 years (27%). Garud et al,^[8] similarly reported the highest incidence in the 31 - 40 years age group (28.45%), whereas Gupta et al⁹. and Basista et al. observed that most patients were between 21 and 50 years of age, indicating that neck swellings are predominantly diseases of young and middle aged adults.

Clinically, 38% of patients had swelling for 1 - 2 years, 46% had lesions measuring 1 - 2 cm, 71% presented with solitary swellings, and 73% had non-tender masses. Gupta et al,^[9] similarly reported that painless neck swelling was the commonest presenting complaint, emphasizing the slow-growing nature of most benign neck lesions.

The thyroid gland (44%) was the most commonly involved organ, followed by cervical lymph nodes (32%). Comparable findings were reported by Gupta et al,^[9] who found thyroid lesions in 47% and lymph node lesions in 42.5% of patients. Basista et al,^[10] also reported thyroid swellings as the commonest neck masses (47%), followed by lymph node lesions (23.6%), supporting the predominance of thyroid pathology in tertiary care settings.

Ultrasonography demonstrated predominantly solid lesions (74%), with TI-RADS III (37.5%) being the commonest category. A significant association between TI - RADS category and cytological diagnosis ($p = 0.018$) supports the value of USG in predicting malignancy. Previous studies by Garud et al,^[8] and Gupta et al,^[9] likewise emphasized that ultrasonography, particularly when combined with FNAC, enhances diagnostic accuracy.

FNAC revealed that the majority of lesions were benign (67%), while granulomatous/tubercular lymphadenitis (23%) was the most common final diagnosis. Similar findings have been reported by Gupta et al,^[9] and Basista et al,^[10] also emphasized the complementary role of FNAC and ultrasonography in the evaluation of neck masses. These findings reinforce the usefulness of FNAC as a rapid, minimally invasive initial diagnostic investigation, while

histopathology remains the gold standard for definitive diagnosis.

CONCLUSION

The present study demonstrated that neck swellings were more common in females and predominantly affected individuals in the 31 - 40 years age group. Thyroid gland and cervical lymph nodes were the most frequently involved sites, with most lesions being solitary, firm, non-tender, and benign in nature. Ultrasonography proved valuable in characterizing lesions, while FNAC reliably differentiated benign from malignant pathology. A significant association between TI-RADS category and cytological diagnosis highlighted the usefulness of sonographic risk stratification in thyroid nodules. Overall, the combined use of clinical examination, ultrasonography, and FNAC provides an accurate, minimally invasive, and cost-effective approach for the evaluation and management of neck swellings.

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Conflicts of interest

There are no conflicts of interest.

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