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Original Article

Ear,Nose and Throat Section

Pattern of Thyroid Disorders: A Cross-sectional Study in a Tertiary Care Hospital of Coastal Odisha, India

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ABSTRACT

Introduction: Thyroid disorders have been reported to be highly prevalent in India, particularly in coastal regions where iodine excess may contribute to structural and functional abnormalities. Data from Ear, Nose and Throat (ENT) outpatient settings in eastern India remain limited.

Aim: To evaluate the demographic profile, clinical spectrum, and biochemical patterns of thyroid dysfunction among patients presenting to the Otorhinolaryngology outpatient department of a tertiary care hospital in coastal Odisha, India.

Materials and Methods: This cross-sectional study was conducted in the Department of Otorhinolaryngology of Sri Jagannatha Medical College and Hospital (SJMCH), Puri, Odisha, India. The study enrolled 213 consecutive patients with clinical or biochemical evidence of thyroid dysfunction over one year. Detailed history, examination, serum Thyroid Stimulating Hormone (TSH), free Triiodothyronine (T3), Tetraiodothyronine (T4) {Chemiluminescence Immunoassay (CLIA)}, Ultrasonography (USG), and Fine Needle Aspiration Cytology (FNAC) (where indicated) were performed. Patients were classified as euthyroid, overt/subclinical hypo- or hyperthyroid using standard reference ranges. Statistical analysis used Python 3.12 (Python Software Foundation) with the SciPy (version 1.11).

Results: The cohort was 88.7% female (mean age 35.14±13.54 years). Euthyroid status predominated (n=139, 65.3%), followed by hypothyroidism (n=50, 23.5%) and hyperthyroidism (n=24, 11.3%). Goitre was present in 158 (74.2%) patients including diffuse goitre (n=44, 20.7%), colloid cyst (n=38, 17.8%), and solitary thyroid nodule (n=30, 14.1%). Hormone levels differed significantly across groups (p-value <0.0001). A significant difference in age group was observed across the three thyroid function groups (p-value=0.0415); no significant differences were found by gender (p-value= 0.630).

Conclusion: Euthyroid structural thyroid disorders constituted the majority of ENT referrals in coastal Odisha. Female predominance and high goitre rates highlight the need for integrated ENT-endocrine evaluation and region-specific screening strategies.

Keywords: Euthyroid, Goitre, Hypothyroidism

INTRODUCTION

The thyroid gland serves as the central regulator of the body's metabolic rate, growth, and development, influencing nearly every organ system from the cardiovascular to the central nervous system. Thyroid disorders can range from functional abnormalities like hypothyroidism and hyperthyroidism to structural issues like goitres and nodules, representing a significant global health challenge [1,2].

In India, these disorders have emerged as one of the most common endocrine problems, second only to diabetes mellitus, necessitating localised research to understand their evolving patterns [3,4]. Current estimates suggest that approximately 42 million people in India suffer from thyroid dysfunction [5]. While iodine deficiency was historically the primary driver, the post-Universal Salt Iodisation (USI) era has seen a rise in autoimmune thyroiditis (such as Hashimoto's thyroiditis) and subclinical disorders [6,7]. Geographical and environmental factors play a pivotal role in the manifestation of thyroid diseases. Despite the proximity to the sea and a diet naturally rich in seafood (high in iodine), coastal populations often exhibit a high prevalence of thyroid disorders. This is sometimes attributed to the excessive intake of iodine, which can trigger thyroid autoimmunity or thyroid nodules [8].

While national data provides a broad overview of thyroid dysfunction in India, it overlooks regional variations driven by distinct geographical and dietary factors. Coastal Odisha presents a unique ecological matrix; despite a diet naturally rich in marine iodine, the region exhibits a high volume of thyroid disorders. The interaction between this high baseline iodine intake and post- USI mandates remains poorly understood in this demographic, with a stark scarcity of prospective data mapping local autoimmune and structural patterns. This study addresses this literature gap, offering essential regional data to differentiate local aetiologies and optimise clinical management in a coastal tertiary care. Clarifying the local aetiology, whether autoimmune or iodine-related, may facilitate more precise therapeutic interventions and reduce the risks of over-treatment or under-diagnosis.

MATERIALS AND METHODS

This cross-sectional, hospital-based study was conducted in the Department of Otorhinolaryngology of Sri Jagannatha Medical College and Hospital (SJMCH), Puri, a tertiary care teaching hospital in coastal Odisha, India over one year (February 2025 - January 2026). Approval from the Institutional Ethics Committee was obtained prior to the commencement of the study (IEC ref no. 86/IEC SJMCH/15.02.25).

Inclusion criteria: All adult patients presenting with clinical signs/symptoms of thyroid dysfunction or abnormal thyroid profiles were enrolled after informed consent.

Exclusion criteria: Patients on prior thyroid medications, pregnant/lactating women, critically ill patients, and those with non-thyroid neck swellings were excluded from the study.

Sample size calculation: The sample size for this cross-sectional study was calculated using the standard single-proportion formula: $n=\{Z^2\ p\ (1-p)\}/d^2$ where, 'n' represents the required sample size, and 'Z' is the standard normal deviate set at 1.96 to achieve a 95% confidence interval. The anticipated regional prevalence of thyroid

dysfunction (p) was conservatively estimated at 15% (p=0.15), based on multicentre epidemiological data in India indicating an overall hypothyroidism prevalence of 10.95% (with an additional 8.02% subclinical cases) and female prevalence of 15.86% [9,10], with an allowable absolute precision (d) set at 5% (d=0.05). A formal power calculation was not performed, as the single-proportion formula does not incorporate Type II error; the anticipated precision (d=5%) provides adequate estimation accuracy. Substituting these values into the formula yielded a baseline requirement of approximately 196 patients. Accounting for a potential 10% attrition rate due to incomplete laboratory data or loss to follow-up, the final target sample size was rounded out. Ultimately, a final of 213 patients meeting all predefined inclusion criteria was enrolled and evaluated.

Study Procedure

A detailed history and physical examination of the thyroid gland were performed. Biochemical evaluation included serum TSH, fT3, and fT4 measured by CLIA. Patient thyroid status was categorised according to the established operational reference intervals of our institution: TSH 0.30-5.50 mIU/mL, fT3 3.0-7.0 pmol/l, fT4 10.0-22.0 pmol/l. Patients were classified as euthyroid, overt hypothyroidism (high TSH, low fT4/fT3), subclinical hypothyroidism (high TSH, normal fT4/fT3), overt hyperthyroidism (low TSH, high fT4/fT3), or subclinical hyperthyroidism (low TSH, normal fT4/fT3) [11].

The USG neck was utilised to classify structural lesions according to American College of Radiology (ACR) Thyroid Imaging Reporting and Data System (TI-RADS) system (2017) [12]. FNAC was performed under USG guidance using a 23-gauge needle with 2-3 passes per targeted lesion. Cytological reporting followed Bethesda System for Reporting Thyroid Cytopathology (2017) [13].

STATISTICAL ANALYSIS

Analyses were performed using Python 3.12 (Python Software Foundation) with the SciPy (version 1.11) and NumPy libraries. Data visualisation was carried out using Matplotlib (version 3.10.0). Prior to analysis, data were screened for missing values, outliers, and entry errors. Continuous variables, such as patient age, were summarised using descriptive statistics, including mean, Standard Deviation (SD), median, and range. The normality of continuous data distributions was assessed using the Shapiro-Wilk test; all the variables were non-normally distributed. Categorical variables, including gender, thyroid function status (euthyroid, overt hypothyroidism, subclinical hypothyroidism, overt hyperthyroidism, and subclinical hyperthyroidism), and morphological types of thyroid swellings, were expressed as frequencies (n) and percentages (%). The Chi-square (χ^2) test of independence was used to evaluate the association between gender (female vs male) and abnormal thyroid function status, with abnormal status defined as the presence of any hypothyroidism or hyperthyroidism. When expected cell frequencies were less than five, Fisher's exact test was applied as an alternative. Although five functional categories were defined, the age distribution was compared across three clinically meaningful groups {euthyroid versus hypothyroid (overt + subclinical) versus hyperthyroid (overt + subclinical)} using the Kruskal-Wallis H test, as this grouping is standard and clinically relevant while preserving statistical power. All statistical tests were two-tailed, and a p-value <0.05 was considered statistically significant.

RESULTS

A total of 213 patients were included in the final analysis. The baseline demographic, clinical, and laboratory characteristics are presented in [Table/Fig-1]. The study population was predominantly female (n=189, 88.7%) with a mean age of 35.14±13.54 years (median 35 years; Interquartile Range (IQR) 25-44 years). The largest proportion of patients was in the 31-40 year age group 64 (30.0%). Euthyroid status was the most common finding (n=139, 65.3%). Hypothyroidism was present in 50 patients (23.5%; overt 14.6%, subclinical 8.9%), while hyperthyroidism was seen in 24 patients (11.3%; overt 6.6%, subclinical 4.7%). Goitre was clinically or radiologically evident in 158 (74.2%) patients. The most frequent primary diagnoses were diffuse goitre 44 (20.7%), colloid cyst 38 (17.8%), solitary thyroid nodule 30 (14.1%), and multinodular goitre 20 (9.4%). No statistically significant differences were observed in the distribution of colloid cyst, diffuse goitre, or solitary thyroid nodule between females and males (all p-value >0.05).

Characteristics	Value
Total study population, N	213
Age (years)	
Mean±SD	35.14±13.54
Median (IQR)	35 (25-44)
Gender, n (%)	
Female	189 (88.7)
Male	24 (11.3)
Age group (years), n (%)	
<20	27 (12.7)
20-30	43 (20.2)
31-40	64 (30.0)
41-50	48 (22.5)
>50	31 (14.6)
Thyroid function status, n (%)	
Euthyroid	139 (65.3)
Overt hyperthyroidism	14 (6.6)
Subclinical hyperthyroidism	10 (4.7)
Overt hypothyroidism	31 (14.6)
Subclinical hypothyroidism	19 (8.9)
Clinical features, n (%)	
Goitre present	158 (74.2)
Abnormal thyroid function	74 (34.7)
Primary diagnosis/clinical finding, n (%)	
No goitre/other	55 (25.8)
Diffuse goitre	44 (20.7)
Colloid cyst	38 (17.8)
Solitary Thyroid Nodule (STN)	30 (14.1)
Multinodular Goitre (MNG)	20 (9.4)
Thyroiditis	14 (6.6)
Thyroglossal cyst	8 (3.8)
Papillary carcinoma	3 (1.4)
Follicular adenoma	1 (0.5)
Laboratory parameters	
TSH (mIU/L), median (IQR)	2.92 (1.23-5.21)
T3 (ng/mL), median (IQR)	1.18 (0.90-1.48)
T4 (µg/dL), median (IQR)	8.34 (6.23-10.25)

[Table/Fig-1]: Baseline demographic, clinical, and laboratory characteristics of 213 patients.

The association between gender and the pattern of thyroid status is displayed in [Table/Fig-2]. Among the female study participants, 125 (66.1%) were euthyroid, 44 (23.3%) were diagnosed with hypothyroidism, and 20 (10.6%) presented with hyperthyroidism. Similarly, among the male cohort, the majority were euthyroid (n=14, 58.3%), while 6 (25.0%) were hypothyroid and 4 (16.7%) were hyperthyroid. The analysis revealed that the distribution of euthyroid, hypothyroid, and hyperthyroid states did not differ significantly between male and female patients.

The distribution of age across the three thyroid function groups was evaluated and stratified by gender. [Table/Fig-3] shows that the

Gender	Euthyroid	Hypothyroid	Hyperthyroid	Total	Chi² statistic	p-value*
Female	125 (66.1)	44 (23.3)	20 (10.6)	189 (100)	0.925	0.630
Male	14 (58.3)	6 (25)	4 (16.7)	24 (100)		
Total	139	50	24	213		

[Table/Fig-2]: Thyroid function status by gender (N = 213). Data is expressed as frequency (%).
*Pearson's chi-square test, 'p' is significant at <0.05

Thyroid function status	Gender	n	Age in years median (IQR)	Kruskal-Wallis test score (H)	p-value*
Euthyroid	Female	125	34.0 (25.0-45.0)	df=5 11.55	0.0415
	Male	14	41.0 (34.0-59.5)		
Hypothyroid	Female	44	32.0 (22.5-39.0)		
	Male	6	42.5 (37.0-53.0)		
Hyperthyroid	Female	20	36.5 (29.5-45.5)		
	Male	4	41.0 (37.5-46.0)		

[Table/Fig-3]: Age distribution across thyroid function groups stratified by gender (N=213).
*Kruskal-Wallis test, 'p' is significant at <0.05

overall median age across all the three cohorts of thyroid disorders remained consistently between third and fourth decades of life. Across all three functional status groups, male patients consistently exhibited a slightly higher median age than their female counterparts, though the male sub-populations were notably smaller. The analysis demonstrated significant difference in age distribution among the euthyroid, hypothyroid, and hyperthyroid groups (p-value= 0.0415).

Laboratory parameters stratified by thyroid function status group are detailed in [Table/Fig-4]. Median TSH, T3, and T4 levels differed significantly across euthyroid, hypothyroid, and hyperthyroid groups (Kruskal-Wallis p-value <0.0001 for all three parameters), validating the biochemical classification criteria used in the study.

Parameters	Euthyroid (n=139)	Hypothyroid (n=50)	Hyperthyroid (n=24)	p-value*
TSH (mIU/L), median (IQR)	2.56 (1.65-3.98)	8.86 (5.34-19.09)	0.04 (0.02-0.11)	<0.0001
T3 (ng/mL), median (IQR)	1.28 (1.02-1.48)	0.59 (0.30-1.05)	3.54 (1.96-5.45)	<0.0001
T4 (µg/dL), median (IQR)	8.65 (6.79-9.79)	4.15 (3.68-7.74)	15.74 (12.30-23.01)	<0.0001

[Table/Fig-4]: Laboratory parameters stratified by thyroid function status group. Data is represented as median (inter-quartile range).
*Kruskal-Wallis test, 'p' is significant at <0.05

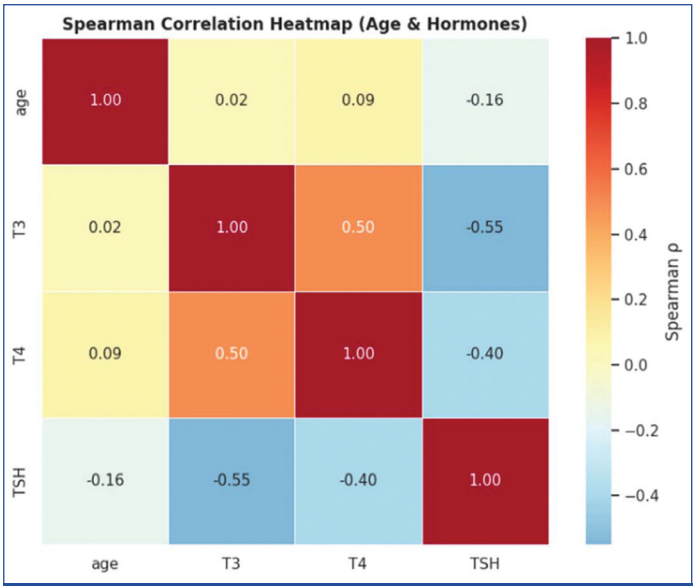
The findings indicate that structural thyroid abnormalities are highly prevalent in this coastal population cohort, whereas functional derangements follow expected biochemical patterns without significant demographic variation within this selected cohort.

Spearman's rank correlation coefficients (ρ) among age, serum T3, T4, and TSH [Table/Fig-5] depicts strong positive correlation was observed between T3 and T4, while both T3 and T4 showed significant negative correlations with TSH, consistent with normal physiological feedback regulation. A weak negative correlation was noted between age and TSH (ρ=-0.16, p-value=0.019).

DISCUSSION

This cross-sectional study from a tertiary care ENT department in coastal Odisha provides important region-specific data on the pattern of thyroid disorders. The overwhelming female predominance (88.7%) aligns with global and Indian epidemiological evidence, where women are disproportionately affected due to autoimmune susceptibility and oestrogen-mediated immune modulation [13,14].

A notable finding was the high proportion of euthyroid patients (65.3%), which contrasts with reports from endocrine or general medicine



[Table/Fig-5]: Spearman Correlation Heatmap of Age, T3, T4 and TSH (n = 213).

clinics where functional disorders are more common [9]. In the ENT setting, patients predominantly present with structural complaints such as goitre, nodules, cysts, or compressive symptoms, leading to referral even when euthyroid. This referral bias accounts for the discordance with community-based studies that report higher rates of overt and subclinical dysfunction [9,15-17]. The 74.2% prevalence of goitre further underscores the structural burden in this coastal population. Hypothyroidism (23.5%) outnumbered hyperthyroidism (11.3%), consistent with the post-USI epidemiological shift in India toward hypothyroidism and autoimmune thyroiditis. The absence of significant gender differences in functional status distribution (p-value= 0.630) may reflect the selected nature of the cohort; in broader populations, females and older adults typically show higher hypothyroidism rates [16-18].

The coastal location is noteworthy. Despite national salt iodisation, excessive dietary iodine from seafood and local salt sources has been implicated in increased nodular goitre and autoimmune thyroid disease in coastal India [8]. The present study findings of high rates of diffuse goitre, colloid cysts, and multinodular goitre support this hypothesis and mirror observations from other coastal states such as Kerala and West Bengal [9,19]. Laboratory parameters showed the expected robust differences across groups (p-value <0.0001), confirming the validity of CLIA-based classification. The weak negative correlation between age and TSH observed in exploratory analysis (ρ≈-0.16) is consistent with known physiological trends but did not reach significance for group-wise age differences. Comparison with other Indian studies reveal both similarities and contrasts. Hospital-based studies from Uttarakhand and central India report thyroid dysfunction rates ranging from 30 to 40% among tested individuals [20-22]. The present study observed abnormal TFT rate of 34.7% falls squarely within this regional range, reflecting a broadly similar burden of thyroid dysfunction across tertiary care settings in these regions. Community- and hospital-based studies from Odisha have reported undetected or subclinical hypothyroidism prevalence around 16 to 17%, highlighting a significant burden of unrecognised thyroid dysfunction that may progress if untreated [23,24].

Comparison of thyroid disorder patterns with selected hospital-based studies from different regions of India reveals both striking similarities and important regional contrasts [Table/Fig-6] [20,25-27]. Across almost all hospital-based series, a marked female predominance (typically 80-90%) was observed, consistent with the well-documented 5-8-fold higher susceptibility of women to autoimmune thyroid disease and the oestrogen-related modulation of thyroid autoimmunity. In ENT and surgical outpatient settings (present study, Western Odisha series, Eastern India ENT series, and

Study (Author, year)	Region	N	Demographics of thyroid disorder (%)	Key findings
Present study (2026)	Coastal Odisha, Tertiary ENT OPD	213	Females=88.7% Euthyroid=65.3% Hypothyroid=23.5% Hyperthyroid=11.3% Goitre lesions=74.2%	Cross-sectional; structural predominance (diffuse goitre, colloid cyst, STN, MNG); CLIA-based classification
Swain RR et al.,/ Western Odisha (2023) [25]	Western Odisha, Surgical/ ENT tertiary	35	Females=90% Euthyroid=85% Hypothyroid=10% Hyperthyroid=5% Goitre lesions=100%	Retrospective clinico-pathological; colloid goitre dominant; high euthyroid rate among neck swellings
Abraham R et al., (2009) [26]	Coastal Karnataka/ Puducherry, Tertiary hospital	~100-200	Females=81-90% Euthyroid=50-70% Hypothyroid=15-25% Hyperthyroid=5-15% Goitre lesions= 40-70%	ENT/medicine mix; multinodular goitre common; female preponderance
Gairola K et al., (2023) [20]	Uttarakhand (hilly), Tertiary biochemistry lab	950	Females=80% Euthyroid=59.4% Hypothyroid=11.7% Hyperthyroid=4.7%	High overall dysfunction (40.6%); subclinical and euthyroid hyperthyroxinaemia dominant; younger age peak
Sengupta A et al.,/ Eastern India ENT (2012) [27]	Bihar/ Eastern India, ENT tertiary	178	Females=85-90% Euthyroid=90% Hypothyroid=6.7% Hyperthyroid=3.3% Goitre lesions=high (incidental finding)	Prospective ENT swellings; firm swellings, right lobe predominance; classic euthyroid structural pattern

[Table/Fig-6]: Comparison of thyroid disorder patterns with selected hospital-based studies from different regions of India [20,25-27].

many coastal South Indian hospital cohorts), euthyroid structural lesions predominate (often 65-90% euthyroid). This reflects referral bias: patients present primarily with goitre, nodules, cysts or compressive symptoms rather than pure functional complaints that dominate endocrine or general medicine clinics. The present coastal Odisha ENT cohort (65.3% euthyroid, 74.2% goitre) aligns closely with this ENT-specific pattern.

Goitre and structural lesion rates are substantially higher in coastal populations (present study 74.2%; Kerala and coastal South India series frequently 40-70% among those with neck swellings) compared with many inland or hilly series (e.g., Uttarakhand lab-based cohort where functional abnormalities dominate and goitre is not the primary focus) [20,26]. This supports the hypothesis that residual high dietary iodine exposure from seafood and local salt sources in coastal Odisha, Kerala and other coastal belts may promote nodular goitre, colloid cysts and multinodular disease even in the post-USI era. Functional abnormalities (especially subclinical hypothyroidism) appear more frequent in non-ENT, multispecialty or community-enriched samples (Uttarakhand 40.6% dysfunction; Kerala coastal community ~19.6%). Thus, present study observed abnormal TFT rate of 34.7% sits between pure ENT structural series [25] and broader epidemiological and clinic-based series [9,10], reflecting the mixed structural-functional presentation typical of tertiary ENT practice in coastal eastern India.

These findings reinforce the need for region-specific routine thyroid function testing in all patients presenting with goitre or neck swellings to ENT clinics, regardless of apparent euthyroid status on history. Early identification of subclinical dysfunction enables timely intervention and may prevent progression to overt disease or complications during surgical management of goitres and nodules.

Limitation(s)

This study transparently addresses single-centre design. Further, lack of autoantibody and urinary iodine data, incomplete prospective TI-RADS/Bethesda granularity, and limited power for gender-stratified analyses, highlights the need for future research. Because the primary scope of the present study investigation was strictly focused on the biochemical and epidemiological patterns of thyroid functional status rather than nodule stratification, these radiological and cytological metrics were not systematically tracked. Consequently, while clinical outcomes like papillary carcinoma were recorded as baseline characteristics, the preceding structural assessment pathway could not be characterised, which limits the morphological depth of the reported thyroid pathologies.

Future research should incorporate autoantibody profiling and community sampling to better delineate the true prevalence and aetiology in coastal Odisha, India.

CONCLUSION(S)

In this cross-sectional study from coastal Odisha, euthyroid structural thyroid disorders predominated, with a clear female preponderance and peak incidence in the fourth decade. Hypothyroidism was twice as common as hyperthyroidism, and goitre affected nearly three-quarters of patients. The lack of demographic variation in functional status and the high burden of nodular and diffuse goitre likely reflect regional dietary and environmental influences. These data support the integration of biochemical screening into routine ENT evaluation of neck swellings and advocate for region-specific public health strategies to address iodine-related thyroid pathology in coastal India.

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- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

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