e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(5); 955-960

Original Research Article

Pathophysiological Effects of Hypothyroidism on Vocal Cord Structure and Function

Viddya Nand Pal[1], Rajesh Kumar[2], Vivek Kumar[3]

[1]Senior Resident, Department of E.N.T, Patna Medical College & Hospital, Patna, Bihar, India
[2]Senior Resident, Department of E.N.T, Patna Medical College & Hospital, Patna, Bihar, India
[3]Associate Professor, Department of E.N.T, Patna Medical College & Hospital, Patna, Bihar, India

Received: 01-02-2026 / Revised: 15-03-2026 / Accepted: 21-04-2026
Corresponding author: Dr. Rajesh Kumar
Conflict of interest: Nil

Abstract

Background: Endocrine disorder is common in Hypothyroidism including important involvement of the larynx and vocal apparatus with widespread systemic effects. Tissue metabolism and neuromuscular function changes due to thyroid hormone deficiency lead to characteristic variations in the quality of voice. Vocal manifestations of hypothyroidism are often under recognized and ineffectively assessed in routine clinical practice.

Methods: This retrospective observational study was done at Patna Medical College and Hospital (PMCH) over a 1-year period from January to December 2025. 40 patients with biochemically confirmed hypothyroidism medical records are reviewed. Demographic details, thyroid function test results (TSH, T3, T4), ENT examination findings, voice-related symptoms, and laryngoscopic observations are included in the data collection. To assess the association between thyroid hormone levels and vocal cord abnormalities, was performed by correlation analysis and to summarize the data descriptive statistics were used.

Results: Most patients (35%) were 41–50 years old, and 70% were women. Voice hoarseness was 70%, vocal fatigue 60%, and pitch alteration 55%. Typical serum TSH levels were 12.8 ± 4.6 mIU/L, with T3 and T4 averaging 72.5 ± 18.4 ng/dL and 4.1 ± 1.2 µg/dL, respectively. In 65% of patients, laryngoscopic examination indicated vocal cord oedema, 55% thickening, and 40% mobility impairment. Higher TSH levels were positively connected with vocal cord oedema ($r = 0.62$, $p < 0.01$).

Conclusion: A significant structural and functional vocal cord changes is associated with Hypothyroidism, which interrelates with severity of disease. Initial recognition of voice variations and timely thyroid hormone modification are important to avoid persistent vocal dysfunction.

Keywords: Dysphonia, Hypothyroidism, Laryngoscopy, Thyroid Hormones, Vocal Cords.

DOI: 10.25258/ijcpr.18.5.156

Introduction

Endocrine disorder which is characterized by lacking production or action of thyroid hormones is common in Hypothyroidism that leads to a widespread slowing of metabolic processes all over the body [1]. The multiple organ system like cardiovascular, respiratory, neuromuscular, gastrointestinal, and integumentary systems are affected [2].

In the middle-aged and elderly population, the prevalence of hypothyroidism is high and also incidence among women are high. Cellular metabolism, consumption of oxygen, protein synthesis, and tissue variance are regulated by Thyroid hormones triiodothyronine (T3) and thyroxine (T4) [3]. Thus, widespread systemic manifestations such as fatigue, weight gain, cold intolerance, myxedema, bradycardia, and neuromuscular dysfunction are resulted from their deficiency. The Vocal folds are often referred to as vocal cords, which is located within the larynx as a paired mucosal structure that are essential for airway protection, phonation and respiration [4]. Each vocal cord comprises a stratified squamous epithelial covering, the lamina propria is divided into intermediate, superficial, and deep layers and the thyroarytenoid muscle is primary [5].

Optimal vibration and sound production are allowed by the layered microstructure of the vocal cords. The coordinated interaction of airflow from the lungs, control of neuromuscular, and the viscoelastic properties of the vocal fold tissues physiologically creates phonation [6]. The voice quality can be impaired due the disruption in the vocal cord's structural integrity or neuromuscular

function. In maintaining the structural and functional integrity of laryngeal tissues, thyroid hormones play a significant role [7]. Within the vocal cord mucosa and muscle fiber, cellular metabolism, turnover of protein, mitochondrial activity, and glycosaminoglycan regulation are influenced by the laryngeal tissues [8]. In hypothyroidism, accumulation of mucopolysaccharides and water within interstitial tissues is led to by reduced thyroid hormone levels, resulting in myxedematous changes. Tissue stiffness and thickness are increased, and the vibratory characteristics of the vocal cords are affected due to the biochemical alterations [9]. The reduced neuromuscular excitability and altered nerve conduction are related to the hypothyroidism to compromise the fine motor control which is essential for exact vocal fold movement [10].

The pathophysiological connection of the vocal cords is multifactorial in hypothyroidism. Impairment in mucosal wave propagation is caused due to the Structural changes such as vocal fold edema, thickening, and infiltration of mucopolysaccharides [11]. Dysphonia is contributed by the alterations in functions such as reduced vocal cord mobility and delayed neuromuscular response [12]. Persistent voice changes may be led to by chronic untreated hypothyroidism, some of which may not fully improve even after hormonal correction.

Despite the clinical relevance of these manifestations, voice and laryngeal changes in hypothyroid patients remain underexplored, particularly in retrospective clinical settings. Systematic evaluation of vocal cord structure and function in patients with hypothyroidism is needed to enhance early recognition and multidisciplinary management.

The PMCH retrospective investigation on hypothyroidism's pathophysiological impact on vocal cord structure and function can improve diagnostics and clinical outcomes. Retrospective clinical studies of hypothyroid patients' voice and laryngeal alterations are lacking.

Objectives

- To evaluate vocal cords structural and functional changes among patients with hypothyroidism
- To correlate thyroid hormone levels with vocal cord abnormalities
- To assess common laryngeal results in hypothyroid patients

Materials and Methods

Study Design: A retrospective observational study design was used to evaluate pathophysiological effects of hypothyroidism on vocal cord structure and function.

Study Setting and Duration: PMCH, a tertiary care hospital with a varied patient population, was the study place of this research. The Endocrinology and Otorhinolaryngology departments provided patient data from January to December 2025. The study examined all eligible patient records from this period using specific selection criteria.

Inclusion Criteria

- 18 years and above aged patients are included
- Demonstrated hypothyroidism through high TSH levels and/or lower T3 and T4 levels.
- Including thyroid function tests and ENT evaluation, Accessibility of complete medical records.
- Patients with voice-related symptoms or having laryngeal examination findings

Exclusion Criteria

- Laryngeal surgery or trauma patients are excluded.
- Smoking, alcohol abuse, or occupational voice abuse
- Neurological problems influencing voice
- Acute upper respiratory tract infections at examination
- Incomplete or missing medical records
- Known vocal cord disorders other than hypothyroidism, such as nodules, polyps, or cancer

Data Collection: Detailed data was collected through the review of hospital medical records on the case files, which used a structured data extraction format. Demographic details were recorded through age and gender. The clinical data included the duration of presenting symptoms, hypothyroidism and treatment status. The severity of the hormonal imbalance was measured and documented through the thyroid function parameters, namely serum TSH, T4 and T3 levels.

Examination of ENT records is reviewed and identified through the documented abnormalities of the larynx. Specifically, laryngoscopic findings include vocal cord edema, reduced mobility, thickening, congestion or incomplete glottic closure. Voice-related symptoms such as vocal fatigue, reduced vocal range, hoarseness, voice instability and pitch changes were recorded by complaints and documented based on the patients' medical files.

Statistical Analysis: The collected data were analysed using SPSS software. When descriptive statistics are employed and summarize through the laryngoscopic findings, demographic variables, thyroid hormone levels and clinical features are expressed, where appropriate for the standard

deviations. The correlation analysis to assess which is performed a relationship between thyroid hormone levels and vocal cord abnormalities. For all analyses, a p-value of less than 0.05 was assumed to be statistically significant.

A total of 40 patients with biochemically confirmed hypothyroidism who fit the inclusion criteria were analyzed.

The results were presented in tabulated data and their interpretations.

Results

Table 1: Demographic Distribution of Patients

Variable	Number of Patients	Percentage (%)
Age (years)		
18–30	6	15.0
31–40	10	25.0
41–50	14	35.0
51–60	10	25.0
Gender		
Male	12	30.0
Female	28	70.0

Most of the patients (35%) fits to the 41–50 years age group, then followed by 31–40 and 51–60 years (25% each) aged. Females represented most of the study group (70% of the cases), which shows that hypothyroidism is more common in women.

Table 2: Clinical Presentation of Voice-Related Symptoms

Symptom	Number of Patients	Percentage (%)
Hoarseness of voice	28	70.0
Vocal fatigue	24	60.0
Pitch alteration (deep/rough voice)	22	55.0
Reduced vocal range	18	45.0
Voice instability	14	35.0

The most common symptom was presenting hoarseness of voice and observed 70% of patients. The pitch alternation and vocal fatigue were also reported frequently, which was suggested by the functional voice impairment and prominent clinical appearance of hypothyroidism.

Table 3: Thyroid Hormone Profile of Study Participants

Parameter	Mean ± SD	Reference Range
TSH (mIU/L)	12.8 ± 4.6	0.4–4.0
T3 (ng/dL)	72.5 ± 18.4	80–200
T4 (µg/dL)	4.1 ± 1.2	5.0–12.0

All the patients possessed high TSH levels and low T3 and T4 levels, which confirmed that they were hypothyroid. The study population is a substantial proportion that significantly raised the mean TSH level indicated moderate to severe hypothyroidism.

Table 4: Laryngoscopic Findings in Hypothyroid Patients

Laryngoscopic Finding	Number of Patients	Percentage (%)
Vocal cord edema	26	65.0
Vocal cord thickening	22	55.0
Reduced vocal cord mobility	16	40.0
Congestion/erythema	14	35.0
Incomplete glottic closure	12	30.0

The most frequently observed laryngoscopic abnormality (65%) was vocal cord edema which is followed by thickening of the vocal cords (55%). Then, reduced mobility was seen by 40% of patients, which indicates both structural and functional involvement of the larynx in hypothyroidism.

Table 5: Correlation between Severity of Hypothyroidism and Vocal Cord Changes

Parameter	Correlation Coefficient (r)	p-value
TSH vs vocal cord edema	0.62	<0.01
TSH vs vocal cord mobility	0.54	<0.01
TSH vs number of voice symptoms	0.58	<0.01

A positive correlation was statistically significant when observed elevated between TSH levels which is presence of vocal cord edema ($r = 0.62$, $p < 0.01$), that indicated an increase in structural modifications of greater disease severity. Hypothyroidism severity was increasing from a negative correlation between vocal cord mobility and TSH levels are suggested by worsening functional impairment. Moreover, the high TSH levels are associated through greater number of voice-related symptoms, with highlighting the impact of direct thyroid hormone deficiency on functions and vocal cord structure.

The findings demonstrate that hypothyroidism were associated with a high prevalence of characteristic laryngoscopic abnormalities and voice-related symptoms. Structural modifications include thickening and edema, with functional impairments are reduced mobility, higher TSH levels with more pronounced in patients. A pathophysiological link between vocal cord dysfunction and thyroid hormone deficiency was highlighted.

Discussion

The major effect of hypothyroidism on vocal cord structure and function is shown in this retrospective study. Vocal fatigue, hoarseness and pitch variation are the high symptoms related to voice is mostly seen in patients who were participated in this study. Characteristic structural abnormalities with vocal cord edema, thickening, and reduced mobility are identified in the Laryngoscopic examination. High TSH levels are closely linked with more severe vocal cord changes. This shows that low thyroid hormone levels can cause laryngeal dysfunction. The findings of this study show that people with vocal problems with hypothyroidism have subjective complaints. These symptoms are explained by the functional and anatomical changes in the vocal cords.

Mechanisms of Vocal Cord Edema and Dysfunction in Hypothyroidism: Many reasons for the voice cord problems in hypothyroidism mainly happen because of metabolic and chemical changes in the tissues. Cellular metabolism is reduced and poor protein turnover is caused by thyroid hormone deficiency which results in accumulation of mucopolysaccharides and glycosaminoglycans within spaces between laryngeal tissues. Water retention as well as myxedematous infiltration is increased because of the accumulation which leads to thickening and vocal cord edema. These changes affect the viscoelastic properties of the vocal fold mucosa, which is important for sound production and normal vibratory function. Less effective neuromuscular excitability and delayed nerve conduction velocity are related with reduced thyroid hormone levels. These changes can impair the coordinated contraction and relaxation of the intrinsic laryngeal muscles, particularly the thyroarytenoid muscle. This can cause the vocal cord to movement reduced and incomplete closure of the glottis. Altered phonation is caused by the combined effect of tissue edema and neuromuscular dysfunction, and it is showed clinically as hoarseness, vocal fatigue, and decreased vocal range.

Comparison with Previous Studies

Table 6: Comparison with Previous Studies

Study	Study Type	Sample Size	Key Findings
Present Study	Retrospective observational	40 hypothyroid patients	High prevalence of voice symptoms (hoarseness, fatigue), laryngoscopic changes (edema, thickening, reduced mobility), TSH levels correlated with severity of vocal cord changes
Study 1 [13]	Prospective with acoustic & perceptual analysis	47 thyroid patients	Voice quality affected in thyroid disorders, perceptual deviations significant, acoustic parameters (e.g., jitter, shimmer) altered pre- vs post-treatment
Study 2 [14]	Prospective observational	82 patients	Overt hypothyroidism significantly impacts frequency parameters and subjective voice measures, subclinical showed non-significant differences
Study 3 [15]	Prospective clinical evaluation	60 patients with voice disorders	Hypothyroidism linked with hoarseness, vocal fatigue, decreased pitch range, edema and reduced mobility seen on videolaryngoscopy in hypothyroid patients

Importance of Thyroid Correction in Voice Improvement: In hypothyroid patients, many structural and functional changes were observed by the Thyroid hormone replacement therapy. Many studies have shown a great improvement in patient's voice quality and in suitable corrections of thyroid hormone levels. After reaching euthyroid level mucosal wave dynamics have improved, vocal cord edema is reduced and restoration of neuromuscular coordination occurs. In long-period untreated cases has chronic changes and in voice restoration patient who underwent early-stage therapy had a good outcome. The importance of diagnosis in the early stage and optimal

management of hypothyroidism to prevent long-term vocal impairment are supported by the findings of this study. The voice problem has to be monitored continuously which helps the clinicians to identify the improvement in the treatment outcome.

Strengths of the Study: Focusing on structural and functional aspects of vocal cord connection in hypothyroidism with documented laryngoscopic findings is one of the strengths of this study. A detailed understanding about severity of the disease and its impact on voice is provided by the clinical symptoms with biochemical parameters. This study's tests and evaluations followed standard procedures and it was conducted in a tertiary care hospital. However, this study is retrospective; it provides important information about the effect of hypothyroidism and adds useful data to medical research.

Limitations: Medical records which were previously documented is used in this study, which may have incomplete data. Direct cause of the hypothyroidism and vocal cord changes cannot be identified because of this study design. Due to small sample size, the results may not apply to everyone. Tools like acoustic analysis, voice handicap scores, or videostroboscopy have no access in this study, which could have given a more complete assessment of how the voice works. Despite these limitations, the study provides valuable understandings into the laryngeal manifestations of hypothyroidism.

Conclusion

Hypothyroidism has an important impact on function and vocal cord structure which is shown from this retrospective study. Among the study population, many participants have voice-related symptoms like pitch variation, hoarseness and vocal fatigue. A laryngoscopic examination reveals structural problems include vocal cord oedema, thickness, and restricted mobility. The role of thyroid hormone deficiency in the pathophysiology of vocal dysfunction is highlighted by the significant correlation between elevated TSH levels and the severity of vocal cord changes. These findings are important because they show that voice changes are a common symptom of hypothyroidism that is often ignored. Vocal symptoms must be identified early and quick laryngoscopic evaluation can make the diagnosis ease also it prevents from voice impairment in the long term. If the treatment starts early, the thyroid hormone imbalance must be treated with proper medication, which can reverse many of these voice and tissue changes. For optimal patient management, a multidisciplinary approach involving endocrinologists and otorhinolaryngologists is recommended. The importance early diagnosis and hypothyroid evaluation for patients to improve voice outcomes and overall quality of life is shown in this study.

Future Research: Prospective studies with larger sample sizes should be focused on by future research to validate and expand upon the findings of the present study. Acoustic analysis, videostroboscopy, and standardized voice handicap questionnaires are tools for voice assessment inclusion are exact for evaluation of vocal function. Voice variations before and after thyroid hormone replacement therapy are assessed by longitudinal studies provide valued perceptions into the reversibility of laryngeal changes.

Reference

1. W. C. Mororó, K. V. de Oliveira, J. B. D. Amaral, G. Giannocco, J. R. Martins, and N. G. De Biase, "Effects of hypothyroidism on the extracellular matrix of the vocal folds of adult female rats," Otolaryngology–Head and Neck Surgery, vol. 173, no. 6, pp. 1448–1454, 2025.
2. M. Saran, B. Georgakopoulos, and B. Bordoni, "Anatomy, head and neck, larynx vocal cords," in StatPearls [Internet]. Treasure Island, FL, USA: StatPearls Publishing, 2023.
3. K. Iravani, B. Golkhar, N. Azarpira, M. Kohandel-Shirazi, and M. Vahedi, "Histopathological characteristics of larynx in hypothyroidism in an experimental rabbit model," Laryngoscope Investigative Otolaryngology, vol. 7, no. 4, pp. 1051–1056, 2022.
4. G. Salman, I. A. J. Mahdi, A. K. Mukhlef, R. A. Mohammad, M. S. H. Zaghir, and N. M. Wadaa'a, "Physiological aspects of thyroid disorders: Anatomy, hormones, diagnosis and management," Current Clinical and Medical Education, vol. 2, no. 5, pp. 17–32, 2024.
5. K. Pietsch and V. K. Dhillon, "Early assessment of laryngeal dysfunction after thyroid surgery: A narrative review on detection and treatment considerations and the role of speech language pathology," Annals of Thyroid, vol. 8, 2023.
6. E. Stogowska, K. A. Kamiński, B. Ziółko, and I. Kowalska, "Voice changes in reproductive disorders, thyroid disorders and diabetes: A review," Endocrine Connections, vol. 11, no. 3, 2022.
7. Kravos, K. Gersak, S. Gaberscek, and I. Hocevar-Boltezar, "Does thyroid dysfunction have a role in the etiology of vocal fold edema?" Clinics and Practice, vol. 15, no. 11, p. 214, 2025.
8. V. K. Jha, P. Kapoor, and A. Saini, "Voice characteristics in patients with thyroid disorders," International Journal of Communi cation, vol. 31, no. 1–2, 2021.

9. R. Batra, G. Glober, A. Gonedes, J. Patel, E. Sari, and J. El-Bahri, "Chronic uncontrolled hypothyroidism associated with dysphonia and concurrent pericardial effusion," Cureus, vol. 14, no. 5, p. e25261, 2022.
10. H. M. Farag, A. F. A. Hady, A. A. Hamid, and H. Soliman, "The effect of receiving thyroid hormone replacement on the dysphonia severity index for congenital hypothyroid children," The Egyptian Journal of Otolaryngology, vol. 38, no. 1, p. 11, 2022.
11. M. N. Hammood and E. A. Hamza, "Histological and physiological study of thyroid dysfunctions on ovary in female rats (Rattus rattus)," Plant Archives, vol. 21, no. 1, pp. 1728–1733, 2021.
12. L. Sober, U. Lepner, Ü. Kirsimägi, and P. Kasenomm, "Prethyroidectomy voice and swallowing disorders and the possible role of laryngopharyngeal reflux disease," Logopedics Phoniatrics Vocology, vol. 48, no. 3, pp. 111–116, 2023.
13. M. S. Khandaker, M. A. Rasel Ahmed, M. Hoque, and M. M. Rahman, "Thyroid imbalance and hypothyroidism: A review," Medical Education Research Journal of Pharm aceutical Sciences, vol. 5, no. 2, pp. 1–7, 2025.
14. O. Afsah, "Effects of hormonal changes on the human voice: A review," The Egyptian Journal of Otolaryngology, vol. 40, no. 1, p. 22, 2024.
15. J. M. Kim, S. C. Shin, G. C. Park, J. C. Lee, Y. K. Jeon, S. J. Ahn, et al., "Effect of sex hormones on extracellular matrix of lamina propria in rat vocal fold," The Laryngoscope, vol. 130, no. 3, pp. 732–740, 2020.