

Prevalence of Thyroid Dysfunction in Moderate to Severe Chronic Obstructive Pulmonary Disease Patients – A Cross-sectional Study

R V Sebasan¹, K V Baliga²

¹Assistant Professor, Department of Medicine, ESIC Medical College and PGIMSR, Chennai, Tamil Nadu, India, ²Professor, Department of Medicine, ESIC Medical College and PGIMSR, Chennai, Tamil Nadu, India

Abstract

Introduction: Thyroid dysfunction can cause inspiratory and expiratory muscle weakness in patients with or without the chronic obstructive pulmonary disease (COPD). Thyroid dysfunction in COPD results in increased frequency of exacerbation, thus leading to poor quality of life. It may further increase cardiovascular disease risk, thereby increasing mortality.

Aim: To study the prevalence of Thyroid dysfunction in moderate to severe COPD patients.

Materials and Methods: This cross-sectional study was conducted in the department of general medicine at ESIC Medical College and PGIMSR, KK Nagar, Chennai, in which 50 patients who were all diagnosed to have COPD based on pulmonary function test/Spirometry test to assess airflow obstruction and classify the severity of disease based on (Global initiative for the management of chronic Obstructive Lung Disease [GOLD]) specific cut points for forced expiratory rate (forced expiratory volume [FEV]₁/forced vital capacity <0.7 after bronchodilator) and FEV₁ (GOLD 1; Mild >80% predicted, GOLD 2; Moderate 50–80%, GOLD 3; Severe 30–49% predicted, GOLD 4; Very Severe, 30% predicted) were included in this study. Patients categorized as Moderate and Severe COPD stages as per GOLD guidelines were included in the study. Those patients were screened for thyroid dysfunction.

Results: In this study, 72% of patients had moderate COPD and 28% of patients had severe COPD. In the 50 patients with COPD taken up for the study, 36% of patients had normal thyroid hormone levels, 54% had Overt Hypothyroidism, and 10% had subclinical hypothyroidism. In 36 patients with moderate COPD, 47.2% had overt hypothyroidism, and 8.3% had subclinical hypothyroidism. In 14 patients with moderate COPD, 71.4% had overt hypothyroidism, and 14.3% had subclinical hypothyroidism.

Conclusion: Thyroid dysfunction can be one of the major reasons for morbidity in COPD patients. The study shows a high prevalence of thyroid dysfunction in COPD patients, especially in those with more severe diseases.

Key words: Chronic obstructive pulmonary disease, Hypothyroidism, Thyroid-stimulating hormone

INTRODUCTION

Chronic Obstructive Pulmonary Airway Disease is a preventable and treatable disease characterized by irreversible airflow limitation which is progressive in Nature occurring due to chronic inflammatory response affecting the lung parenchyma and airways due to noxious

stimulants and various toxic pollutants in the atmosphere. The Global Burden of Disease Society States that chronic obstructive pulmonary disease (COPD) will become the “THIRD” leading cause of death by 2020.^[1] COPD is a chronic systemic disease affecting the vital organ systems in the body. So it affects not only the respiratory system but often leads to Anaemia, Osteoporosis, Ischemic Heart Disease, Muscle Wasting, Depression and various other systemic ailments.^[2]

Several characteristics of COPD patients could increase their likelihood of developing altered thyroid hormone levels in the blood. Only a few studies and data are available on the prevalence of thyroid diseases among patients suffering from COPD.^[3] Hypothyroidism in COPD leads

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Corresponding Author: Dr. R V Sebasan, Department of Medicine, ESIC Medical College and PGIMSR, Chennai, Tamil Nadu, India.

to decreased respiratory drive, acute on chronic alveolar hypoventilation, Decreased lung volumes, depression of respiratory centers to its stimulants, Upper airway obstruction, respiratory Failure and frequent exacerbations. The altered endocrine function can worsen the clinical manifestations of COPD through several mechanisms, including decreased protein anabolism, increased protein catabolism, nonenzymatic glycosylation and activation of the renin-angiotensin-aldosterone system.^[3]

Hypothyroidism causes inspiratory and expiratory muscle weakness due to impaired expression of myosin heavy chains IIB and decreased neuromuscular transmission.^[4] Diaphragmatic dysfunction and myopathy can occur.^[5] The severity of hypothyroidism linearly correlates with muscle weakness and myopathy. All these factors result in frequent exacerbations of COPD, which significantly affects COPD individuals' quality of life. Hence, determining the functional status of the thyroid gland is of critical importance in the management of COPD.^[6]

Aim

To study the prevalence of Thyroid dysfunction in moderate to severe COPD patients.

MATERIALS AND METHODS

This cross-sectional study was conducted in the department of general medicine at ESIC Medical College and PGIMS, KK Nagar, Chennai, in which 50 patients who were all diagnosed to have COPD as per the laid down criteria were included in this study. Patients who were hypothyroid and hyperthyroid earlier or who underwent thyroid surgery or others who were on anti-thyroid medications were excluded from the study. Patients were categorized into moderate and severe as per the Global initiative for the management of chronic Obstructive Lung Disease (GOLD) Classification of COPD based on Spirometry. Patients underwent pulmonary function tests 3 times at every 15 min interval and the best of 3 readings was taken. The Forced Vital Capacity (FVC), Forced Expiratory Volume at the end of 1 s (FEV1), FEV1/FVC ratio were recorded. Patients belonging to moderate and severe COPD stages as per GOLD guidelines were included in the study. Those patients were taken up for thyroid function tests. The serum concentration of thyroid hormones was analyzed using electrochemiluminescence immunoassay. Subclinical hypothyroidism is defined as a thyroid-stimulating hormone (TSH) level above the upper limit of normal despite normal levels of serum-free thyroxine. Overt hypothyroidism is characterized by an increased TSH and a decreased T4 level. Normal range of TSH: 0.35–5.50 μ IU/mL, Total thyroxine (T4): 5.01–12.45 μ g/dl, triiodothyronine (T3):

0.6–1.81 ng/ml. Data were collected and tabulated as frequency, percentage, mean and standard deviation.

RESULTS

In this study, 50 patients with the COPD were included. The maximum number of patients were in the age group of more than 51 years (82%). The mean age of the patients was 58.11 years [Figure 1].

Of the 50 patients, 64% of patients were male and 36% of patients were female [Figure 2]. In this study, 72% of patients had moderate COPD and 28% of patients had severe COPD [Figure 3].

The thyroid hormone level of moderate COPD patients was TSH 7.28 ± 3.15 μ IU/mL, T3 1.94 ± 0.52 ng/ml, T4 11.23 ± 2.41 μ g/dl and in severe COPD patients, TSH 9.45 ± 1.28 μ IU/mL, T3 1.76 ± 0.49 ng/ml, T4 11.40 ± 3.24 μ g/dl [Table 1].

In 50 patients with COPD, 36% of patients had normal thyroid hormone levels, 54% had overt hypothyroidism, and 10% had subclinical hypothyroidism [Figure 4].

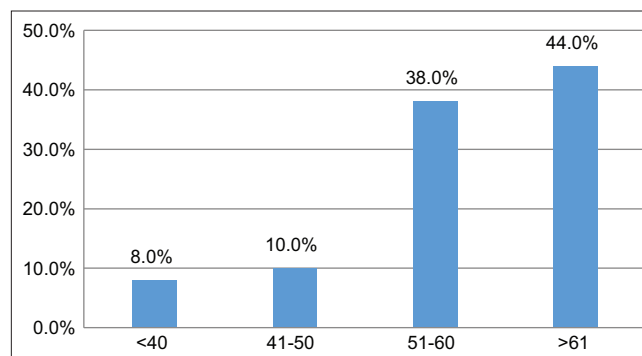


Figure 1: Distribution of Age group

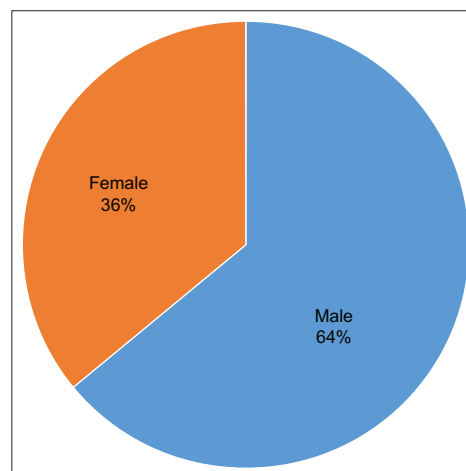


Figure 2: Distribution of Gender

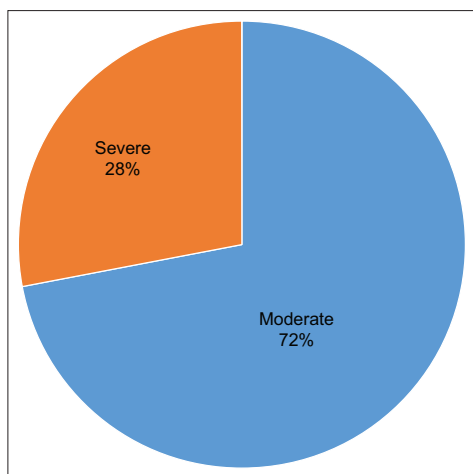


Figure 3: Distribution of chronic obstructive pulmonary disease severity

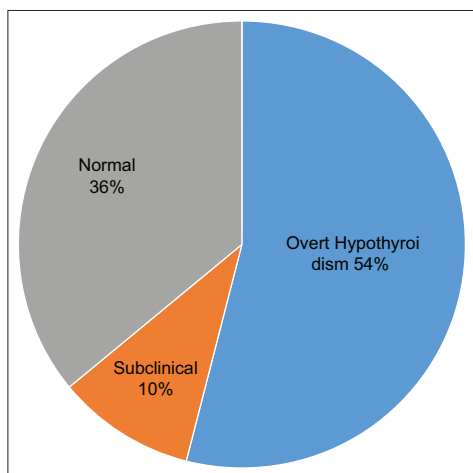


Figure 4: Distribution of thyroid hormone condition

In 36 patients with moderate COPD, 47.2% of patients had overt hypothyroidism, and 8.3% had subclinical hypothyroidism. In 14 patients with moderate COPD, 71.4% of patients had overt hypothyroidism, and 14.3% had subclinical hypothyroidism [Figure 5].

DISCUSSION

COPD is a systemic disease, affects not only the lungs. COPD has varied systemic manifestations due to the chronic inflammatory mediators, hypoxia, hypercarbia and various metabolic disorders like Type 2 diabetes mellitus, metabolic syndrome, dyslipidemia, cachexia and obesity. The severity of hypothyroidism linearly correlates with muscle weakness and myopathy. Thyroid hormones have a significant influence on cellular metabolism, and their deficiency causes impairment of the normal functioning of the cell. Thyroxine (T4) deficiency leads to a reduced mitochondrial oxidative capacity, abnormal glycogenolysis

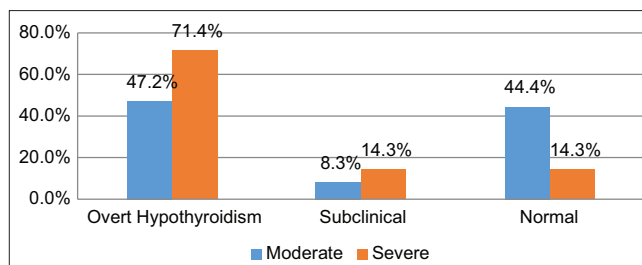


Figure 5: Cross-tabulation of chronic obstructive pulmonary disease severity with a thyroid hormone condition

Table 1: Distribution of Thyroid hormone level

Parameters	Moderate	Severe
TSH	7.28±3.15	9.45±1.28
T3	1.94±0.52	1.76±0.49
T4	11.23±2.41	11.40±3.4

and an insulin-resistant state of the cell. This leads to selective atrophy of type 2 muscle fibers (fast-twitching type) as they are dependent on glycolysis for energy causing the slowing of muscle contraction seen clinically in patients with hypothyroidism. It also interferes with the respiratory drive, diaphragmatic function and alveolar ventilation adversely in COPD patients. All these factors result in frequent exacerbations of COPD and has a significant contribution in affecting the quality of life of these individuals.^[3,5,7]

Abnormalities in thyroid hormone regulation are encountered frequently in non-thyroidal diseases.^[8] Since thyroid hormones regulate the metabolic rate, impaired thyroid function is associated with the respiratory workload.^[9] The thyroid hormone augments metabolic rate by enhancing mitochondrial oxidation.^[10] There is also a significant relationship between TSH levels and COPD exacerbation frequency which suggests that early detection of impairment of thyroid function and oral institution of thyroid replacement therapy can decrease the exacerbation frequency and improve the quality of life in COPD patients.^[11]

A study conducted by El-Yazed *et al.* showed that COPD is associated with the impairment of thyroid gland function with increased mean values of free T3 in these patients but with no significant change in TSH level.^[12] Prakash *et al.*, in 2014, conducted a study on 96 cases of acute exacerbation of COPD and analysis found that 62 (64.58%) patients had lower levels of T3, T4, and TSH.^[13]

Singh *et al.* evaluated a total of 201 cases of COPD, of which 130 (64.6%) were having thyroid disorders. Hypothyroidism was diagnosed in 119 (59.2%) cases and hyperthyroidism in 11 (5.4%) patients.^[14] Ulasli *et al.* in

their study of 128 patients and showed that TSH values and exacerbation frequency have a positive correlation.^[15]

CONCLUSION

Thyroid dysfunction is a significant cause of morbidity in COPD patients. The study demonstrates a high prevalence of thyroid dysfunction in patients with COPD, particularly those with more severe diseases. Routine thyroid function testing in COPD patients is therefore warranted to reduce the mortality in those patients.

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