



## ASSESSMENT OF THYROID FUNCTIONS IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE IN IGIMS, PATNA, BIHAR.

### Medicine

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### ABSTRACT

**Background:** Chronic obstructive pulmonary disease (COPD) is no longer considered to affect only the lungs and airways but also the rest of the body. The systemic manifestations of COPD include a number of endocrine disorders, such as those involving the pituitary, the thyroid, the gonads, the adrenals and the pancreas. The severity of airway obstruction in chronic obstructive pulmonary diseases (COPD) is associated with the impairment of thyroid gland function.

**Aim of work:** This study was carried out to evaluate thyroid abnormalities in patients with COPD and relationship between pulmonary function tests, arterial blood gases and thyroid functions.

**Material and methods:** Serum free triiodothyronine (ft3), free thyroxine (ft4), and thyroid stimulating hormone (TSH) were measured in 50 patients with COPD and 50 healthy volunteers (control group) and its relation to some ventilatory function tests (FEV1/FVC, FEV1, FVC%, and FEF25-75) and ABG parameters (PH, Pao2, Pao2, Hco3 and O2 saturation) were studied.

**Results:** There was no significant difference in mean levels of TSH, FT3 and FT4 between COPD and control group. The mean values of free T3, free T4, and TSH were within normal limits in both groups however, free T3 values in the case group were toward upper normal limits and the mean values of free T3 were increased in the case group compared to their values in the control group. The mean values of free T3 of the cases were significantly increasing with increased severity of COPD. Significant negative correlations were present between free T3 levels and pulmonary function tests of the cases. Significant negative correlations were present between free T3 levels and both PaO2 and SO2 of the cases and also show a significant positive correlation between free T3 levels and PaCO2 of the cases.

**Conclusion:** Thyroid function tests among COPD patients showed a significant increase of the mean free T3 values and a non significant decrease of the mean free T4 and TSH values compared to the control group. With increasing severity of COPD, the mean free T3 values showed a significant increase. Significant negative correlations were noticed between free T3 levels and both PaO2 and SO2 of the cases. A significant positive correlation was observed between free T3 levels and PaCO2 of the cases. Significant negative correlations were observed between free T3 levels and pulmonary function tests of the cases.

### KEYWORDS

Thyroid function, Chronic obstructive pulmonary disease

### Introduction

Chronic obstructive pulmonary disease (COPD) is a prevent-able and treatable disease with significant extra-pulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung due to exposure to noxious particles or gases. COPD affects the lungs and produces systemic consequence. Abnormalities in thyroid hormone regulation are encountered frequently in nonthyroidal diseases; these include normal or decreased total and free thyroxine (TT4 and FT4 respectively), decreased total (TT3) and free (FT3) triiodothyronine along with usually normal thyroid-stimulating hormone (TSH) levels. These changes have been observed primarily in critical illness, such as starvation, sepsis, surgery, or myocardial infarction, but also in diverse chronic, systemic conditions, i.e., in chronic heart failure, chronic liver or hematological dis-eases, cancer, diabetes, and in connective tissue disorders. Chronic obstructive pulmonary disease (COPD) is a major cause of chronic morbidity and mortality throughout the world, leading to years of suffering and premature death from it or its complications. The severity of airway obstruction in COPD is associated with the impairment of thyroid gland function. There is an apparent clinical resemblance between a hyperthyroid state and advanced COPD. Early detection of thyroid disturbances may therefore be clinically important in COPD. In the present study, we evaluated thyroid abnormalities in patients with COPD and relationship between pulmonary function tests, arterial blood gases and thyroid functions.

### Aim of the Work:

This study was carried out to evaluate thyroid abnormalities in patients

with COPD and relationship between pulmonary function tests, arterial blood gases and thyroid functions.

### Material and methods

This study was conducted on 50 patients with COPD and 50 healthy volunteers (control group). They were selected from the Department of General Medicine, Indira Gandhi Institute of Medical Sciences, Patna, Bihar from January 2017 to December 2018.

#### Study design

Case control study

#### Subjects

Fifty patients diagnosed as COPD according to (GOLD); 47 males and 3 females with an age range of 48 to 75 years (mean  $61.8 \pm 7.5$  years).

A control group of 50 healthy smokers' subjects with age and sex match was included; 45 males and 5 females with age ranging from 47 to 72 years (mean  $59.4 \pm 6.8$  years).

### Inclusion criteria

- Patients diagnosed as COPD according to Global Initiative for chronic obstructive lung disease criteria (GOLD).

### Exclusion criteria

- Patients with known chronic chest diseases other than COPD.
- Patients with known hypothyroidism, hyperthyroidism, or previous thyroid surgery.
- Patients with other diseases or illnesses that might affect thyroid functions e.g., endocrinal, metabolic, autoimmune disorders, etc.
- Patients on any regular medication, other than the COPD drugs, that might affect thyroid functions, such as iodine-containing

drugs, amiodarone and immuno-suppressive drugs.

#### All patients were subjected to the followings:

- Full history taking and clinical examination.
- Plain chest X-ray postero-anterior view.
- Complete blood picture, liver and kidney functions.
- Pulmonary function (Spirometry): In IGIMS, Patna pulmonary function Test was done. Reversibility test was done to differentiate between COPD and bronchial asthma, pre and 15 min post bronchodilator (400 micrograms salbutamol by meter dose inhaler) FEV1 done. All COPD patients had post bronchodilator response less than 12% of absolute FEV1.

The severity of COPD was rated according to GOLD, 2010 and depends on post bronchodilator FEV1.

- Arterial blood gas analysis (ABG): it was done in all cases.
- Serum levels of free triiodothyronine (FT<sub>3</sub>), free thyroxine (FT<sub>4</sub>) and thyroid-stimulating hormone (TSH) were analyzed in the Laboratory of the Clinical Pathology Department of IGIMS, Patna. All patients were ex-smokers and they were clinically in exacerbation. All patients received medication related to COPD (inhaler/oral bronchodilators and intravenous/oral steroid, and antibiotics). The patients were not receiving iodine-containing drugs.
- The control group was recruited from the outpatient clinic of non-chronic chest diseases and from other departments as those assessed before minor surgeries. Control groups comprised of patients without COPD. They submitted to history taking, examination, and measurement of T3, T4, TSH, and spirometry.

#### Results

The mean  $\pm$  SD of age in the COPD group was  $61.7 \pm 7.7$  years while that of the control group was  $59.4 \pm 6.8$  years and there was no significant difference between two groups (P-value = 0.123). 47 COPD patients were men (94%) and 3 patients were women (6%), while 45 persons of control group were men (90%) and 5 were women (10%). 94% of COPD patients were smokers and 80% of control subjects were smokers.

**Table 1:** The mean values of smoking index of the cases were significantly higher than those of controls.

- The mean values of oxygen saturation (SO<sub>2</sub>) of the cases were significantly lower than those of controls.
- The mean values of pulmonary function tests (FEV1, FVC and FEV1/FVC) of the cases were lower than those of controls with a statistical significant difference.
- The mean values of thyroid function tests (free T<sub>3</sub>, free T<sub>4</sub> and TSH) of the cases were higher (to upper normal range) than those of controls however; statistical significance was observed only regarding free T<sub>3</sub> levels.

**Table 2:** With increased severity of COPD:

- The mean values of arterial blood gases (PaO<sub>2</sub> and SO<sub>2</sub>) of the cases were significantly decreasing while the mean values of PaCO<sub>2</sub> were significantly increasing.
- The mean values of pulmonary function tests (FEV1, FVC and FEV1/FVC) of the cases were significantly decreasing. The mean values of free T3 of the cases were significantly increasing.

**Table 3:** Significant negative correlations present between free T3 levels and PaO<sub>2</sub>, SO<sub>2</sub> and pulmonary function tests of the cases and also a significant positive correlation present between free T3 levels and PaCO<sub>2</sub> of the cases.

#### Statistical analysis of data

Statistical analysis was carried out using the SPSS computer package version 17.0 (SPSS Inc., Chicago, IL, USA). The mean  $\pm$  SD was used for quantitative variables while number and % were used for qualitative variables. In order to assess the differences in means of quantitative variables between patients and controls, Independent samples t-test was applied. In order to assess the differences in means of quantitative variables within the patients group, One-Way ANOVA test was used. Correlation analysis (using Pearson's correlation coefficient) was used to assess the strength of association between various quantitative variables within the patients' group. The statistical methods were verified, assuming a significance level of  $p < 0.05$  and a highly significant level of  $p < 0.001$ .

**Table 1 Comparison between cases and controls regarding smoking index, arterial blood gases, pulmonary and thyroid function tests.**

| Variables     | Cases No. = 50    | Controls No. = 50 | T    | P-value  |
|---------------|-------------------|-------------------|------|----------|
| Smoking index | 661.0 $\pm$ 245.2 | 79.6 $\pm$ 15.5   | 14.3 | <0.001   |
| So2 (%)       | 90.4 $\pm$ 3.9    | 96.8 $\pm$ 1.2    | 11.2 | <0.001   |
| FEV1 (%)      | 58.3 $\pm$ 19.4   | 86.4 $\pm$ 4.8    | 9.9  | <0.001** |
| FVC (%)       | 68.7 $\pm$ 12.5   | 87.6 $\pm$ 4.4    | 10.1 | <0.001** |
| FEV1/FVC (%)  | 52.1 $\pm$ 10.2   | 96.8 $\pm$ 21.6   | 3.1  | 0.003    |
| T3 (pg/mL)    | 3.0 $\pm$ 0.6     | 1.4 $\pm$ 0.6     | 6.4  | 0.002*   |
| T4 (pg/dL)    | 1.2 $\pm$ 0.4     | 1.1 $\pm$ 0.3     | 0.5  | 0.640    |
| TSH (IU/mL)   | 1.9 $\pm$ 1.2     | 1.8 $\pm$ 1.1     | 0.2  | 0.842    |

Values presented as mean  $\pm$  SD and analyzed by Independent samples t-test.

\* Significant.

\*\*Highly significant.

**Table 2 Relation between severity of COPD and arterial blood gases, pulmonary and thyroid function tests of the cases.**

| Variables         | Mild No. = 11z | Moderate No. = 13 | Severe No. = 13 | Very severe No. = 13 | F    | P-value  |
|-------------------|----------------|-------------------|-----------------|----------------------|------|----------|
| PaO <sub>2</sub>  | 76.4 $\pm$ 2.9 | 67.7 $\pm$ 4.1    | 56.8 $\pm$ 2.3  | 50.5 $\pm$ 2.6       | 16.6 | <0.001   |
| PaCO <sub>2</sub> | 38.7 $\pm$ 1.3 | 42.3 $\pm$ 1.6    | 50.0 $\pm$ 2.7  | 62.5 $\pm$ 3.3       | 24.1 | <0.001** |
| SO <sub>2</sub>   | 95.6 $\pm$ 1.4 | 92.1 $\pm$ 1.1    | 88.9 $\pm$ 0.8  | 85.6 $\pm$ 1.5       | 15.5 | <0.001** |
| FEV1              | 83.3 $\pm$ 2.6 | 70.0 $\pm$ 6.2    | 49.8 $\pm$ 5.8  | 33.9 $\pm$ 4.4       | 29.7 | <0.001   |
| FVC               | 82.8 $\pm$ 2.4 | 76.6 $\pm$ 2.3    | 64.8 $\pm$ 3.6  | 51.8 $\pm$ 4.3       | 20.0 | <0.001** |
| FEV1/FVC          | 65.9 $\pm$ 1.9 | 57.1 $\pm$ 3.3    | 48.5 $\pm$ 3.0  | 39.2 $\pm$ 2.6       | 16.6 | <0.001** |
| T3                | 2.4 $\pm$ 0.2  | 2.9 $\pm$ 0.2     | 3.4 $\pm$ 0.2   | 4.0 $\pm$ 0.1        | 78.2 | <0.001** |
| T4                | 1.0 $\pm$ 0.4  | 1.3 $\pm$ 0.3     | 1.1 $\pm$ 0.4   | 1.1 $\pm$ 0.4        | 1.7  | 0.190    |
| TSH               | 2.3 $\pm$ 1.5  | 1.8 $\pm$ 0.8     | 1.7 $\pm$ 1.0   | 1.9 $\pm$ 1.4        | 0.6  | 0.613    |

Values presented as mean  $\pm$  SD and analyzed by One-Way ANOVA test.

\*\*Highly significant.

**Table 3 Correlation between arterial blood gases and pulmonary function tests and T3 levels of the cases.**

|    | PaO <sub>2</sub> | PaCO <sub>2</sub> | SO <sub>2</sub> | FEV1   | FVC    | FEV1/FVC |
|----|------------------|-------------------|-----------------|--------|--------|----------|
| T3 | r                | 0.9 **            | 0.8 **          | 0.9 ** | 0.8 ** | 0.3 *    |
|    | P-value          | <0.001            | <0.001          | <0.001 | <0.001 | 0.005    |

r: Pearson correlation test.

\* Significant.

\*\*Highly significant.

#### Conclusion

Thyroid function tests among COPD patients showed a significant increase of the mean free T3 values and a non significant decrease of the mean free T4 and TSH values compared to the control group. With increasing severity of COPD, the mean free T3 values showed a significant increase. Significant negative correlations were noticed between free T3 levels and both PaO<sub>2</sub> and SO<sub>2</sub> of the cases and a significant positive correlation was observed between free T3 levels and PaCO<sub>2</sub> of the cases. Significant negative correlations were observed between free T3 levels and pulmonary function tests of the case.

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