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Original Research Article

Assessment of Spirometry in Patients with Subclinical Hypothyroidism

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Abstract:

Background: Elevated thyroid stimulating hormone (TSH) levels in the presence of normal serum free T4 concentrations are indicative of subclinical hypothyroidism (SCH). Therefore, the required test for the diagnosis of moderate thyroid insufficiency is the blood TSH measurement. The purpose of this study was to examine the results of pulmonary function tests in a group of female subclinical hypothyroid patients who had just received a diagnosis, and to compare the results of these tests to those of controls.

Methods: The current study was conducted from July 2022 to December 2022 at the ANMMC, Gaya, Bihar, and Department of Physiology. Study subjects included thirty women in the 20–40 age range who had recently been diagnosed with subclinical hypothyroidism and did not have any history of cardiopulmonary diseases. They lived in and around Gaya city. As a control group, another group of thirty females—who were comparable to the research group but in good health—was drawn from the staff and friends. Spirometers were used to gather data on lung function for the current study. Data from spirometry, biochemistry, and clinical studies were analyzed using statistical software (Excel, Microsoft Corp.) before being moved to EPI6 Info, another statistical program, for further analysis.

Results: Spirometry measurements of FVC, FEV1, FEV1/FVC, FEF25-75%, and PEF revealed a significant decline in patients when compared to controls.

Conclusion: The subclinical hypothyroidism cases in the current study had spirometry alterations, with substantial decreases observed in parameters such as FVC, FEV1, FEV1/FVC, FEF25-75%, and PEF when compared to controls. This could be the result of the weariness, somnolence, and muscle dysfunction that SCH participants have been shown to experience.

Keywords: Spirometry, FEV1/FVC; Subclinical hypothyroidism, Lung functions.

Introduction

The presence of normal serum fT4 concentration along with an elevated TSH level is indicative of subclinical hypothyroidism. Serum TSH and circulating thyroid hormone levels are correlated logarithmically (a two-fold change in free thyroxin will result in a 100-fold change in TSH). Serum TSH measurement, therefore, is required when peripheral thyroid hormone levels are within normal laboratory range in order to diagnose mild thyroid insufficiency. [1]

The subject may exhibit mild hypothyroidism symptoms (such as weariness, cold sensitivity, and steady weight gain), as well as decreased quality of life and overall wellbeing, mood swings, altered cognitive performance, and elevated TSH. [2]In 17% of cases, the development to clinical hypothyroidism is apparent. [3]Hypothyroidism impairs lung function in a number of ways, including obesity causing a modest loss in vital capacity and lung volumes, hypoventilation caused by depressed ventilatory drive, and respiratory muscle weakness brought on by skeletal muscular myopathy. [4]

The most popular test for pulmonary function is spirometry, which measures the volume and/or flow of air that can be inhaled and expelled, respectively.

Although there is a wealth of literature on the impact of hypothyroidism on pulmonary function, there aren't many that discuss the impact of subclinical hypothyroidism on pulmonary functions.

Therefore, the purpose of this study is to evaluate the pulmonary function tests in a group of female subclinical hypothyroid patients who have just received a diagnosis, and to compare the results with those of controls.

Material and Methods

From July 2022 to December 2022, the current study was conducted in the physiology department of the Anugrah Narayan Magadh Medical College in Gaya, Bihar. Patients in the outpatient department of ANMMCH, Gaya, Bihar who had generic complaints such weariness, modest weight gain, dry skin, and depression were grouped together to create the study group. They had a thyroid profile performed as part of a normal evaluation. The study group comprised patients who were not receiving treatment and subjects who had just received a SCH diagnosis. Healthy medical professionals in the same age range as the study group served as the controls.

Every participant was between the ages of 20 and 40, and their BMI was less than 30 kg/m2. None of them had a recognized medical condition or were on any medications. They did not use drink or smoke. Participants in the study were not allowed to have any pathologic or physiological condition that could impair their ability to breathe.

Written consent was obtained from each participant. A thorough physical examination and clinical history were conducted on them. Simple spirometry was used to assess pulmonary function and blood samples were obtained for the thyroid hormone assay.Thyroid hormone concentrations [fT3, fT4, and TSH] were assessed with Immunology Analyzer, a tool intended to identify glow-based chemiluminescent reactions. Spirometer was used to do lung function testing; it was selected due to its precision and portability. The SCH group included of subjects with normal fT3 and fT4 and TSH levels of more than 5.0 mIU/L and less than 10 mIU/L. Normal TSH, fT4, and fT3 levels were seen in the controls.

Measurements were made of respiratory parameters such as forced expiratory flow 25%-75% (FEF25-75%), forced expiratory volume in first second (FEV1), FEV1/FVC, peak expiratory flow (PEF), and forced vital capacity (FVC). Liters (L) were used to express them.

Data from spirometry, biochemistry, and clinical studies were analyzed using statistical software (Excel, Microsoft Corp.) before being moved to EPI6 Info, another statistical program, for further analysis. The data was displayed as means±SD. $P < 0.05$ was the threshold for statistical significance.

Results

Table 1: Clinical and biochemical data of controls and study subjects

Parameters	Controls (Mean±SD) [n=30]	Study Subjects (Mean±SD) [n=30]
Body Mass Index (BMI) {kg/m^2]	22.16±1.64	22.71±1.99
Heart Rate (HR) [bpm]	76.1±5.11	74.06±6.4
Systolic Blood Pressure (SBP) [mmHg]	116.0±3.79	118.26±3.88
Diastolic Blood Pressure (DBP) [mmHg]	76.6±3.24	75.93±4.01
Thyroid stimulating Hormone (TSH) [mlU/L]	2.5±0.7	7.39±1.49
Triiodothyronine (T3) [ug/ml]	0.13±0.03	0.12±0.03
Thyroxine (T4) [□g/dl]	8.05±1.9	7.63±1.78

Table 2: Comparison of lung function tests in controls and study subjects

Parameters	Controls (Mean±SD) [n=30]	Study Subjects (Mean±SD) [n=30]	t-value	p-value	Significance
FVC (L)	2.74±0.49	2.42±0.37	2.887	0.005	HS
FEV1 (L)	2.28±0.43	1.93±0.34	3.467	0.001	HS
FEV1/FVC%	82.76±4.25	80.29±6.11	1.822	0.0736	NS
FEF 25-75%	2.76±0.32	2.24±0.39	5.612	0.0001	ES
PEF (L/sec.)	5.75±1.05	5.06±0.64	3.074	0.0032	HS

NS – Non significant, HS – Highly significant, ES – Extremely significant

Discussion

The body of research indicates that while the effects of clinical hypothyroidism on several systems have been extensively researched, the effects of SCH have received less attention. Thus, we have attempted to examine how SCH affects the respiratory system. Clinical hypothyroidism is known to cause spirometric alterations, such as a substantial decrease in FVC, FEV1, FEF 25%–75%, FVC%, and DLCO (the lung's ability to diffuse carbon monoxide) when compared to the control group. [5] According to Bassi et al., these changes in clinical hypothyroidism were caused by alveolar hypoventilation brought on by respiratory muscle weakness, a depressed respiratory center, a low FT4 that limits neuromuscular transmission, decreased lung elasticity, and an increased work of breathing. [6] In the current investigation, we found that SCH patients' FVC (L), FEV1 (L), FEF 25-75%, and PEF (L/sec) were considerably lower than those of controls. Our findings agreed with Gulfidan Cakmak

et al. views. [7] Comparing cases and controls, FEV1/FVC% did not reveal a significant difference, which was consistent with the finding of Lokman Koral et al. [8] when comparing SCH patients to controls, there was a significant reduction in peak expiratory flow (PEF).

Similar findings were not found in any other investigations. Peak expiratory flow is mostly influenced by personal effort. Compared to FEV1, it exhibits around twice as much intra- and inter-subject variability.Patients with SCH have been shown to have a decreased ability for physical activity, which may potentially have an impact on how well they perform during the spirometry technique. [9]. We attribute this drop to subclinical hypothyroidism since no systemic or respiratory conditions could account for the difference between the individuals and controls.

Obesity and overweight make it more difficult to analyze pulmonary functions in hypothyroid patients. [10] According to NIH/WHO recommendations, the average BMI of the subjects in this study was 22.71 ±1.99, which falls within the recommended range for their age, sex, and gender. Furthermore, there was no discernible change in BMI between the controls and the SCH cases. Therefore, it is possible to rule out the cumulative effects of obesity on spirometric parameters.

Conclusion

The current study shows that subclinical hypothyroidism was associated with lower FVC, FEV1, FEV1/FVC, FEF25-75%, and PEF spirometry measures when compared to the controls.

The most likely cause of the decline in pulmonary functions could be subclinical hypothyroidism, which is characterized by malfunction of the inspiratory and expiratory muscles.

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