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Research article

ASSOCIATION OF VISCERAL FAT WITH DETERIORATED PULMONARY FUNCTION IN NEWLY DIAGNOSED HYPOTHYROID PATIENTS

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ABSTRACT

Objectives: To assess the pulmonary function and its association with visceral fat in newly diagnosed hypothyroid patients. **Materials & methods:** The study group subjects were 37 females and the control group subjects (n=37) were age and gender matched healthy volunteers. Pulmonary functions were assessed by computerized spirometer. The readings for Forced vital capacity (FVC), Forced expiratory volume in the first second (FEV1), Forced expiratory volume percent (FEV1 /FVC%) and Peak expiratory flow (PEF) were noted for participants in both the groups. Body fat assessment was done with Omron HBF 375, a body fat analyzer. **Results:** The baseline parameters like mean age and height for each group are comparable and there was a significant difference in weight and BMI between the groups (p = 0.000). The pulmonary function test parameters were significantly less in hypothyroid patients when compared to controls (p = 0.000). Further, association between visceral fat pulmonary function test parameters showed negative correlation for (FVC (L): r = - 0.888; p = 0.000), (FEV1 (L): - 0.811; p = 0.000) and (FEV1/FVC (%): r = 0.430; p = 0.008). **Conclusion:** It is concluded that deteriorated pulmonary function in hypothyroidism is associated with increased visceral fat. Therapeutic interventions like diet, exercise, yoga to reduce visceral fat should be incorporated as part of treatment to improve the pulmonary function.

Keywords: Body fat distribution, Thyroid hormones, Visceral fat, Pulmonary function

INTRODUCTION

Hypothyroidism is a clinical state resulting from decreased secretion of thyroid hormone from thyroid gland due to functional or structural impairment of production of thyroid hormone and affects most the organ systems. Major clinical findings are weakness, fatigue, coarseness and dryness of the skin, intolerance to cold, poor concentration and memory, weight gain, constipation, paraesthesis, menorrhagia, disorders of hearing, bradycardia, delayed relaxation of tendon reflexes etc., [1] Most of these signs and symptoms may recover after thyroid hormone replacement therapy [2]. Earlier reports showed that both myxedema and hypothyroid states induces depression of hypoxic ventilatory drive that is responsive to thyroid hormone replacement therapy. This alteration of ventilatory control may contribute to the hypoventilation seen in myxedema and hypothyroidism [3] Hypothyroidism affects respiratory

muscle strength which is linearly related to the thyroid hormone levels. Respiratory muscle weakness is present in both Inspiratory and expiratory muscles and is reversible with treatment [4] . Studies showed that sleep apnea episodes are common in patients with untreated hypothyroidism even with normal respiratory function. Thyroxin replacement therapy decreases apnea frequency, even without change in body weight [5].

However the information about deteriorated pulmonary function in newly diagnosed hypothyroid patients is scanty. Further the association of visceral fat levels with deteriorated pulmonary function was not studied in detail.

Therefore, the present study was designed to determine the pulmonary function and its association with visceral fat in newly diagnosed hypothyroid patients.

MATERIALS & METHODS

Study design

The study was approved by Institute Ethics Committee. This study was carried out in the Department of Physiology in our college.

Inclusion criteria: The study group subjects were 37 females between 25 – 30 years. The control group subjects (n=37) were age, gender and BMI matched healthy volunteers. Patients with serum T4<5.53 µg/dl and serum TSH>4.68 mIU/L by Chemiluminiscence technique [5] were taken as hypothyroid.

Exclusion criteria: Participants with any systemic disease or with any organ system dysfunction were excluded.

Sample size**:** N=74 (Control n=37, Test group n=37)

Methodology:

Pulmonary functions were assessed by using computerized spirometer (Spirowin Version 2.0 of Genesis Medical systems pvt. Ltd) which gives ERS-93 predicted values at BTPS conditions. The test procedure was explained to the participants and a demonstration of the test procedure was given. The participants were allowed to sit quietly for 10 minutes to become mentally and physically relaxed prior to testing. Participants were asked to inspire as much as possible and hold the sterile mouth piece in the mouth with the lips forming a tight seal around the mouth piece and expire rapidly and forcefully through the mouth piece.

After preliminary trials, the test was performed three times and the best recording was taken. The readings for Forced Vital Capacity (FVC), Forced Expiratory Volume in the first second (FEV1), Ratio between FEV1/ FEVC%, Peak Expiratory Flow (PEF) were noted for participants in both the groups.

Assessment of Total body fat % (TBF %), Sub Cutaneous Fat (SCF %), Visceral Fat (VF%) was done by Omron HBF 375, a body fat analyzer working under principle of bio impedance analysis (BIA) method[6].

Statistical analysis: Data were expressed as mean ± SD. Unpaired t test was used to compare between group parameters and Pearson's correlation was used to study the association between visceral fat and pulmonary function parameters.

RESULTS

Seventy four participants were included in this study: 37 newly diagnosed hypothyroid patients and 37 apparently healthy individuals. The baseline parameters like mean age and height for each group are comparable and are summarized in Table 1. and it shows the significant difference in weight and BMI between the groups (p = 0.000).

Table 2. Shows the between group differences of body fat distribution. As shown in Table 3. The pulmonary function test parameters were significantly less in hypothyroid patients when compared to controls (p = 0.000).

Analysis of data for association between visceral fat pulmonary function test parameters showed negative correlation for (FVC (L): r = - 0.888; p = 0.000), (FEV1 (L): r = - 0.811; p = 0.000) and (FEV1/FVC (%): r = 0.430; p = 0.008).

Table 1: Baseline characteristics of control and hypothyroid subjects

Parameter	Control group	Hypothyroid group	P value
Age (years)	30.30 ± 3.61	29.43 ± 4.41	0.360
Height (cms)	158.43 ± 5.47	159.76 ± 5.62	0.308
Weight (kg)	57.59 ± 3.47	68.03 ± 6.53	0.000
BMI (Kg/m^2)	22.98 ± 1.58	26.70 ± 2.79	0.000

Values are expressed as mean ± SD.

Table 2: Body fat distribution of control and hypothyroid subjects.

Parameter	Control group (n=37)	Hypothyroid group (n=37)	P value
TBF %	25.63 ± 2.92	28.02 ± 3.98	0.004
SCF %	18.32 ± 3.36	20.53 ± 5.40	0.038
VF %	6.85 ± 1.63	10.65 ± 3.89	0.000

Values are expressed as mean ± SD.

Table 3: Pulmonary function test parameters in control and hypothyroid groups

Parameter	Control group(n=37)	Hypothyroid group (n=37)	P value
FVC (L)	2.85± 1.64	2.29 ± 0.36	0.000
FEV1 (L)	2.34± 0.34	1.37 ± 0.34	0.000
FEV1/FVC (%)	82.26± 11.16	59.21 ± 8.78	0.000
PEF (L/sec)	5.19± 1.00	3.02 ± 0.72	0.000

Values are expressed as mean ± SD.

Table 4: Pulmonary function test parameters and its association with visceral fat in hypothyroid patients

Parameter	Visceral fat %	
	Hypothyroid group	
	r value	p value
FVC (L)	- 0.888	0.000
FEV1 (L)	- 0.811	0.000
FEV1/FVC (%)	- 0.430	0.008

DISCUSSION

The key findings of this study were that in newly diagnosed hypothyroid patients, the pulmonary functions were deteriorated. Further, this deteriorated pulmonary function was correlated with visceral fat.

Earlier studies reported a significant reduction in FVC, FEV1, FEV1/FVC % in hypothyroidism when compared to control subjects [7].

However, the information about pulmonary function in newly diagnosed hypothyroid patients and its association with visceral fat is scanty. This study is distinct that, we reported the pulmonary function in newly diagnosed hypothyroid patients and it association with visceral fat. The components of respiratory system (respiratory centre, upper airway and lower respiratory system) can be affected by deficiency in body hormones as well as excess hormonal secretion [8,9] . Both expiratory and Inspiratory respiratory muscles are weakened in hypothyroidism in association with the thyroid hormone levels and it may be reversible with thyroxine therapy[4]. Furthermore, "thyroid deficient muscles have impaired free fatty acid utilisation, which enhances their glycogen consumption, thereby reducing skeletal muscle endurance. One of the major Inspiratory muscles that are involved in hypothyroidism is the diaphragm. Diaphragm weakness can be very severe and associated with hypoventilation" [10,11]. In this study, we found that the values for FVC and FEV 1 were significantly lower in recently diagnosed hypothyroids as compared to controls. These findings are supported by studies by other researchers [6,7]

The changes observed in our spirometric findings can be explained on the basis of earlier reports by other researchers which suggests that depression of respiratory centre, interference of neuro muscular junction and nerve conduction to the muscles of respiration and respiratory muscles diseases in hypothyroidism may leads to alveolar hypoventilation which in turn affect central ventilatory control and impairs ventilation[12]. In addition, in hypothyroid state, reduction of surfactant, surfactant phospholipid, phosphatidyl glycerol and phosphatidic acid along with increase in surface active lipids phosphatidylserine and phosphatidylinositol in alveolar epithelium may decrease alveolar septation and decreased lung compliance and absorption of adsorption. [12,13]

Moreover, deposition of mucopolysaccharides in the lungs leads to fibrosis and alveolar wall thickening with loss of elastic tissue and may increase the work of breathing. All above modifications reduces ventilatory lung functions [14,15] . Infections of respiratory system are very common in hypothyroidism than healthy individuals which may be a reason for low PFT parameters[16].

Further, in this study the association between visceral fat and deteriorated pulmonary function can be explained as that patients with visceral obesity had lower ERV than patients with subcutaneous obesity and same body mass index levels. The reduction of ERV was associated with a reduction of the arterial oxygen tension[17] and the decrease of ERV and FVC associated with abdominal obesity has been attributed to a mechanical effect played by accumulation of visceral fat. The raised intra-abdominal pressure observed in visceral obesity is

able to pump upwards the diaphragmatic muscle, parenchymal compression, particularly at the basal regions. Moreover, the over-stretching of the diaphragmatic muscle fibres due to the elevation of the diaphragmatic domes produced by visceral fat can decrease the contractile efficiency of the diaphragmatic muscle [18]. Therefore it is possible that the improvement of pulmonary function in hypothyroid patients can be achieved by reducing the visceral fat. **Limitations:** Further studies are required to test this hypothesis directly.

CONCLUSION

From this study, it is concluded that deteriorated pulmonary function in hypothyroidism is associated with increased visceral fat. Therapeutic interventions like diet, exercise, yoga to reduce visceral fat should be incorporated as part of treatment to improve the pulmonary function.

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Conflict of Interest: Nil.

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