Original Article

Pulmonary functions in patients with subclinical hypothyroidism

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Abstract

Objective: To determine whether alterations in pulmonary function takes place in subclinical hypothyroidism by examining the diffusion lung capacity and muscle strength of such patients.

Methods: This is a descriptive study conducted in 2009 at Haseki Training and Research Hospital, Istanbul, Turkey. Hundred and twenty-six patients with subclinical hypothyroidism and 58 age and sex matched individuals were recruited. Simple spirometry tests were performed, and pulmonary diffusion capacity (DLco) and muscle strength were measured.

Results: ScH patients showed a significant reduciton of the following pulmonary function tests (% predicted value) as compared with control subjects: FVC, FEV_1, FEV_1 %, FEF_{25-75}, FEF_{25-75}%, DL_{CO}, DL_{CO}/VA, Pi_{max}, Pi_{max}% and Pe_{max}%.

Conclusion: These data indicate that pulmonary functions are effected in subclinical hypothyrodism. Therefore patients with or who are at high risk of having subclinical hypothyroidism, should be suubjected to evalutaion of pulmonary functions with simple spirometry.

Keywords: Hypothyroidism, Subclinical, Spirometry, Lung, Muscle strength, Turkey (JPMA 61: 951; 2011).

Introduction

Subclinical hypothyroidism (ScH) is rather important since it is commonly seen in the general population. The progresssion to clinical hypothyroidism is evident in 17% of cases.[1] Subclinical hypothyroidism reflects the earliest stage of thyroid dysfunction with subjects having normal or decreased free thyroxine (fT_4) normal free tri-idothyronine (fT_3) and increased Thyroid stimulating hormone (TSH) levels.[1] Since diagnosis depends on laboratory values, theoretically, no symptoms or signs are expected but still, patients may suffer from somnolence, weakness and fatigue.[1-3] Muscle strength is also effected in subclinical hypothyroidism. The decrease in muscle strength effects pulmonary functions accordingly.[4,5] There are not many studies in literature concerning the influence of subclinical hypothyroidism on pulmonary functions. This study evaluates the spirometric values, pulmonary diffusion capacity and muscle strength of patients with subclinical hypothyroidism in order to determine the effect of ScH on pulmonary functions.

Patients and Methods

This is a descriptive study which took place in 2009 during months of August- November in Haseki Training and Research Hospital in Istanbul, Turkey. Among 1556 outpatients, admitted for nonspecific reasons, 126 of 322 patients with ScH agreed to participate in the study. They were newly diagnosed and treatment naive. The controls were 58 people who were the healthy relatives of the patients and volunteering to participate.

None of the participants had a history of smoking, any respiratory illness or any other systemic pathology effecting the respiratory system. None of the patients had a physiologic condition affecting the respiratory functions such as pregnancy. The patients did not suffer from goitre disturbing the respiratory function. The body mass indices (BMI) of all of the participants were under 30 kg/m^2. Patients with a history of smoking, systemic disease, any respiratory disorder, obesity, goitre and pregnancy were excluded.

Following the approval of the local ethics committee, written informed consent was obtained from all of the participants. Clinical histories were recorded and the participants underwent a general physical examination. Whole blood sample was obtained in order to determine the concentrations of TSH, fT_3 and fT_4. Pulmonary functions were estimated by simple spirometry.

Serum fT_3, fT_4 levels were assessed by Chemiluminescent Competitive Enzyme Immunoassay method with Immulite 2000 of BIODPC. Serum TSH analysis was performed by Enzyme Chemiluminescent Immunometric Assay method with the same analyser. Normal range for TSH was <4.0 uIU/ml, 1.57-4.71 ng/ml

for fT_3, and 0.8-1.8 ng/ml for fT_4. If the patients' serum fT3 level was between 1.57-4.71 ng/ml, fT_4 was between 0.8-1.8 ng/ml and TSH level was >4.0 uIU/ml, they were included in the subclinical hypothyroidism group. The control group consisted of subjects having normal fT_3, fT_4 and TSH values.

Spirometric analysis was performed with Jaeger Master Scobe (version 4.5). All respiratory parameters including force vital capacity FVC, FVC %, force expiratory volume FEV_1, FEV_1%, FEV_1/FVC, force expiratory flow FEF_{25-75}, FEF_{25-75}%, peak expiratory flow PEF, PEF % were assessed. The lung diffusion capacity of the patients were measured using Sensor Medics Vmax 229 and spirometer. DL_{CO} and DL_{CO}/VA were measured using single breath method.

Spirometric volumes were expressed in as mL and DL_{CO} values were expressed as mL/mmHg/min. The assessment of predictive values for DLco and other spirometric parameters was predicated on the guidelines of American Thoracic Society (1995).

Pi_{max} and Pe_{max} were measured with Zan GPI 3.00 Cardiopulmonary Function device performing Respiratory Muscle Function Analysis.

The mean and standard deviation of parametric values were assessed with Students' t test. ANOVA and Chi-square tests were used when assessing the percentages of the groups and Pearson correlation was used to compare the groups. P<0.05 was considered as significant.

Results

The average age of 126 ScH patients (116F, 10M) and 58 healthy people (44F, 14M) were 45.76±11.17 and 44,58±11,61 years respectively (p=0,644). The number of females was significantly higher than males in both study groups (p<0,001). Both groups were age, sex and BMI matched. TSH levels were significantly higher in ScH group than control group (p<0,001) as expected while serum fT3 levels were siginificantly lower than control group (p = 0.027) (p <0.001) (Table-1).

Table-1: A age, gender and thyroid function values of the participants.

	Subclinical hypothyroidism (n=126)	Control (n=58)	p
Age (years)	45.76±11.17	44.58±11.61	0.644
Gender			
Female	116	44	0.001
Male	10	14	
fT_3	2.80±0.67	2.46±0.70	0.027
fT_4	1.18±0.29	1.18±0.27	0.986
TSH	11.42±7.82	2.84±0.81	0.001

Table-2: Spirometric, diffusing capacity and muscle strength measurements of the participants.

	Subclinical hypothyroidism (n=126)	Control (n=58)	p
FVC	2945.70±621.28	3638.27±761.53	0.001
FVC%	104.28±14.93	108.79±14.85	0.181
FEV_1	2358.73±443.17	2986.55±759.55	0.001
FEV_1%	96.88±14.52	104.17±14.24	0.027
FEV_1/FVC	79.39±6.47	80.68±6.50	0.377
FEF_{25-75}	2445.65±849.49	5552.75±2147.10	0.001
FEF_{25-75}%	72.07±19.74	92.03±18.40	0.001
PEF	5490.31±1208.35	6058.96±2333.51	0.224
PEF%	89.22±19.66	89.55±16.51	0.938
DLCO	21.40±3.57	25.68±1.75	0.001
DLCO%	90.93±17.00	94.55±5.60	0.133
DLCO/VA	4.94±1.00	3.15±0.74	0.001
DLCO/VA%	97.49±17.09	93.27±6.21	0.088
Pi_{max}	70.06±20.43	95.58±7.58	0.001
Pi_{max}%	88.26±22.46	97.62±6.39	0.003
Pe_{max}	103.69±31.79	102.13±7.59	0.714
Pe_{max}%	77.14±22.09	100.06±9.14	0.001

FVC, FEV_1, FEV_1%, FEF_{25-75}, FEF_{25-75}%, DL_{CO}, DL_{CO}/VA, Pi_{max}, Pi_{max}% and Pe_{max}% values were significantly lower in ScH patients than control (p<0.001) (Table-2). There was a negative correlation between TSH and FVC in ScH group which showed a statistical significance (r = -0.320; p = 0.011).

Discussion

Subclinical hypothyroidism is a clinical disorder occuring frequently in the community. It reflects the earliest stage of thyroid dysfunction. Chronic autoimmune thyroiditis, subacute thyroiditis, thyroidectomy, radioactive iodine treatment, insufficient thyroid hormone replacement therapy may be the cause of subclinical hypothyroidism.[2-8]

Subclinical hypothyroidism is a common phenomenon seen more often in women with increasing age. The prevalance in women is 6-8% and 3% in men.[1] In our study 116 (126) female patients had subclinical hypothyroidism.

Neuromuscular abnormalities and impaired respiratory functions are frequently observed in clinical hypothyroidism, but it remains controversial if they can also occur in subclinical hypothyroidism (sHT) since there aren't satisfactory number of studies concerning this aspect. Fatigue is observed in subclinical hypothyroidism because of muscle dysfunction.[4,9,10-12] Our results suggest that muscle strength was effected and FVC, DL_{CO} and DL_{CO}/VA values were significantly lower than control group. This result was also coexistant in patients without any symptoms.

The effect of subclinical hypothyroidism on several organ systems are well known, whereas the effect on respiratory system is not fully understood.[13-17] Subclinical

hypothyroidism may progress to the overt one but it is hypothesized that the impairment in respiratory function may be initiated at the subclinical state. Nevertheless we determined a decrease in spirometric parameters and DLCO values in ScH patients compared to control group. Since there is no systemic or respiratory disorder explaining this difference between the participants, we relate this decrease to subclinical hypothyroidism. Although not significant, % FVC, % DLCO and % DLCO/VA values were lower in ScH group.

Conclusion

In conclusion, ScH is a common disease therefore the systems and organs which are effected should be evaluated thoroughly and clinical approaches should be taken accordingly.

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