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Research Article

Hypothyroidism and its Physiological Consequences in Pulmonary Functions

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ABSTRACT

Background & Objectives: Hypothyroidism is very common globally and there is exponential elevation in hypothyroidism in Nepal as well. There are very few studies done in past to assess effect of hypothyroidism on pulmonary function. This study was conducted to study pulmonary function test in hypothyroid patients and to evaluate and asses the pulmonary function with thyroid stimulating hormone levels in newly detected hypothyroid patients.

Materials and Methods: A total of 51 (21 Male & 30 Female) hypothyroid patients were selected and equal number 51 (21 Male & 30 Female) of matched control groups were taken. Participants participated voluntarily after being given a detailed explanation of the purpose of the study. All newly detected hypothyroid patients visiting medicine OPD of KMCTH were included in the study. Smokers, former smokers, patients suffering from debilitating and pulmonary diseases were excluded from the study.

Results: Pulmonary function tests were evaluated by computerized spirometer HELIOS 702. Data obtained was analyzed with the help of SPSS. Both FVC (Cases: 1.77 ± 0.35 & Controls: 2.85 ± 0.46) and FEV_1 (Cases: 1.30 ± 0.35 & Controls: 2.38 ± 0.41) means were decreased in hypothyroid patients. Forced vital capacity (FVC) and forced expiratory volume in one sec (FEV1) showed strong negative correlation with Thyroid stimulating hormone levels (TSH).

Conclusion: Hypothyroidism affects the pulmonary function to variable degree with higher levels of TSH. All hypothyroid patients must be assessed for abnormalities of pulmonary function to prevent from adverse outcomes.

Keywords: Forced Vital Capacity, Hypothyroidism, Pulmonary Function Test, Thyroid Stimulating Hormone.

INTRODUCTION

Thyroid hormones play a vital role in regulating the functions of various systems of the human body including respiratory, cardiovascular, musculoskeletal and central nervous system [1]. Hypothyroidism is a common disease globally. It is defined as a clinical state resulting from inadequate secretion from thyroid gland due to some physiological impairment in thyroid hormone production [2,3]. Thyroid ailments are endemic in mountainous hilly areas as well as non-mountainous hilly areas which are far from sea [4]. Thyroid gland secretes various hormones such as triiodothyronine (T3), thyroxine (T4) and calcitonin. Abnormalities in hormones production by thyroid gland comprises of group of commonly stated endocrinological disorders. The occurrence and prevalence of all the thyroid disorders are associated with multiple risk factors [5]. Respiratory complications may range from mild dyspnoea to life threatening conditions. There is also a high prevalence of obstructive sleep apnoea in uncontrolled hypothyroidism. Altered pulmonary response to hypoxia and hypercapnia are observed in primary hypothyroidism [6]. Mild to severe diaphragmatic dysfunction has also been obtained in patients with hypothyroidism [7]. There are minimal studies done in Nepal to assess the effect of hypothyroidism on pulmonary functions, further studies correlating with Hypothyroidism and PFT are required [8]. This study was aimed to focus on evaluating the effects of hypothyroidism on pulmonary functions.

MATERIALS AND METHODS

This study was a case control study conducted in the Department of Physiology at Kathmandu Medical College and Teaching Hospital from 15th May 2022 to 12th May 2023. The study was approved by Institutional Review Committee (Ref: 9022022/02). Written informed consent was taken from all participants who were included in the study. A total of 102 patients with age between 40 to 55 years were included in the study. The study included 2 groups, group 1 consisted of 51 newly detected hypothyroid and group 2 with 51 controls who were matched as that of cases. Group 1 hypothyroid patients include both clinical (TSH>5 milliunits/L with clinical features of hypothyroidism or low fT4) and subclinical hypothyroidism (TSH>5 with no clinical features of hypothyroidism or normal fT4). Patients already on thyroxine therapy, history of smoking, anaemia, respiratory abnormalities, CVS patients and pregnant women were excluded from the study. All patients underwent a detailed clinical examination and investigations such as thyroid function test (TSH, fT3 fT4) and PFTs were done. All patients were asked to rest for 15 to 20 minutes in a quiet room and they were explained about the technique and procedures. Blood Pressure was measured by both palpatory and auscultatory. PFT was carried out in a quiet room in sitting position with a nose clip. An average of 3 readings was taken. Spirometric parameters taken and recorded for analysis were: Forced vital capacity (FVC), Forced expiratory volume in 1st second (FEV1), FEV1/FVC. Patients with aged between 40-55 years were included in the study. Newly detected hypothyroidism both clinical (TSH >5milliunits/L with clinical features of hypothyroidism or low fT4) and Subclinical hypothyroidism (TSH>5 with no clinical features of hypothyroidism or normal fT4). Patients already on thyroxin treatment were excluded. Smokers, patients having respiratory diseases, pregnancy, anaemia and cardiac ailments were also excluded. Data were tabulated in Microsoft Office Excel 2010,

and statistical analysis was done by using SPSS for windows (version 20.0). The thyroid function tests and respiratory parameters were analyzed. P value less than 0.05 was considered statistically significant.

RESULTS

Table 1 reveals no vital difference in the weight between the two groups though weight was more in the cases than controls. The height was remarkably more in controls than the hypothyroid. TSH values were higher in hypothyroid patients. In our study, we observed a highly significant decreased FVC and FEV1 in hypothyroid patients as shown in Table 2 & Figure 1. Diastolic Blood Pressure was increased in hypothyroid patients as compared to controls as shown in table 1.

Table 1: Baseline characteristic features of the study population.

Variables	Cases (Mean ± SD)	Controls (Mean ± SD)	p-value
Weight	56.88 ± 9.55	53.66 ± 7.87	0.41
Height	1.52 ± 0.05	1.58 ± 0.07	< 0.05
BMI	23.86 ± 4.85	20.55 ± 2.15	< 0.05
SBP	120 ± 12.75	119 ± 9.56	0.323
DBP	83 ± 9.45	79 ± 9.95	0.297
TSH	34 ± 11.54	2.56 ± 1.22	< 0.05
fT_4	0.75 ± 0.32	1.22 ± 0.42	< 0.05

(p< 0.05 is considered as statistically significant).

Table 2: Pulmonary Function Tests

Variables	Cases (Mean ± SD)	Controls (Mean ± SD)	P Value
FVC(L)	1.77 ± 0.35	2.85 ± 0.46	< 0.05
FEV_1(L)	1.30 ± 0.35	2.38 ± 0.41	< 0.05
FEV_1/FVC	69 ± 8.85	80 ± 9.70	< 0.05

(p< 0.05 is considered as statistically significant).

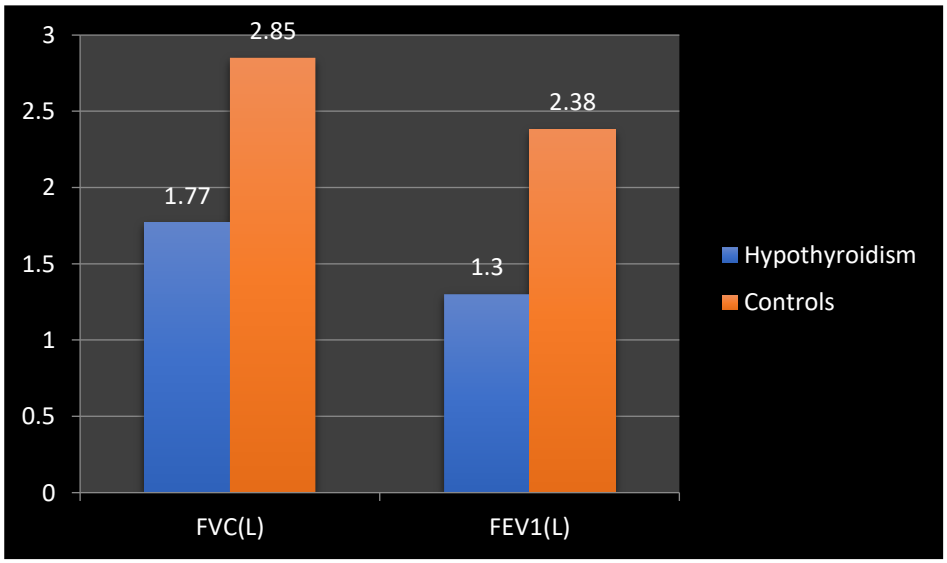

Fig1: Pulmonary Function Test (PFT) findings in the study subjects

DISCUSSION

Our study found the decrease in pulmonary functions in newly detected hypothyroid patients. Most of the parameters like FVC, FEV_1 and FEV_1/FVC ratio were remarkably decreased in study patients when compared to controls. Hypothyroidism can cause alterations of pulmonary functions and abnormalities in ventilation. It is characterized by hypoventilation and the pulmonary response to hypoxia and hypercapnia are compromised in hypothyroidism [9]. Thyroid hormones play significant role in almost all physiological functions. Thyroid hormones do play crucial role in maintenance of normal respiratory function by regulating respiratory drive and maintaining compliance of respiratory interstitial tissue. Hypothyroidism is characterised by decrease in levothyroxine levels and rise in TSH levels. As TSH levels are single most important test for evaluation of thyroid function. Present study showed higher levels of TSH are associated with lower values of FVC and FEV_1 but value of FVC is affected more than FEV_1 these findings are similar with research study done by Sadek SH et al [10]. Hypothyroidism may cause myopathy and the affect can be attributed to alter the function of inspiratory, expiratory muscles and diaphragm being one of the most important muscles for respiratory functions [11]. Roel et al. [12] in resemblance with our results found that both FVC and FEV_1 reduced in hypothyroid patients compared to normal subjects.

A large study on respiratory functions in hypothyroidism observed a significant reduction in FVC, FEV_1, FEF25%-75% in overt hypothyroid and subclinical hypothyroid patients compared to healthy subjects which was similar with our study [13].

Hypothyroidism also leads to dysfunction of respiratory muscles and deposition of mucopolysaccharides in pulmonary interstitium. All these may lead to restrictive type of lung disease in hypothyroid patients [14, 15]. However, for the complete justification of present study results large studies with large sample size are required.

CONCLUSION

We concluded that in patients with hypothyroidism there was remarkable reduction in the pulmonary functions. There was statistically significant reduction observed on during the assessment of lung functions in these patients.

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