ORIGINAL RESEARCH PAPER
Volume - 9 | Issue - 7 | July - 2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

AIRWAY RESISTANCE AND SPECIFIC AIRWAY CONDUCTANCE IN SUBJECTS WITH ELEVATED TSH BEFORE AND AFTER TREATMENT WITH LEVOTHYROXINE

Physiology

Dr. Pushpa G Assistant professor, Dept of Physiology, Akash institute of Medical science and research centre, prasanahalli road, Devanahalli, Bangalore.

Chaitra M S* Associate Professor, Dept of Physiology. Bowring and Lady curzon medical college and research Institute, 1, Lady Curzon Rd, Shivaji Nagar, Bengaluru, Karnataka 560001 Bangalore.*Corresponding Author

ABSTRACT

There is a global increase in hypothyroidism and prevalence of hypothyroidism in adult population in India is estimated to be around 11%. Hypothyroidism affects all the organ systems including respiratory system. As there is an increased prevalence of hypothyroidism in India, and limited study on airway resistance and conductance in hypothyroid subjects, this study is undertaken to know the airway resistance (RAW) and specific airway conductance (sGAW) in subjects with elevated TSH before and after treatment with levothyroxine.

A non-randomized trial before and after comparison studies was done which included 40 patients with elevated TSH. RAW and sGAW was recorded using M.E.C PFT body plethysmography, at the time of diagnosis and again when the TSH value returned to normal range. The results of the study showed significant decrease in airway resistance and significant increase in specific airway conductance after normalization of TSH by treatment with Levothyroxine.

The above study thus concludes that hypothyroidism affects airway resistance and specific airway conductance which is reversible on treatment and regular follow up. This is the first study to include airway resistance and specific airway conductance and hence studies in similar lines with larger sample size is required to compare and correlate.

KEYWORDS

hypothyroidism, airway resistance, specific airway conductance, body plethysmography

Introduction

There is a global increase in hypothyroidism and Iodine deficiency remains the most common cause of hypothyroidism worldwide. India is considered to be moderate to severe iodine deficient region [1]. Prevalence of hypothyroidism in adult population in India is estimated to be around 11 %[2].

Patients with hypothyroidism had an increased cough reflex sensitivity and airway hyper responsiveness [3]. As a part of the generalized skin and soft tissue infiltration in hypothyroidism, the upper airway and particularly the pharynx gets narrowed. Mucopolysaccharides and proteins infiltrate the skin causing skin thickening, infiltrate the tongue causing enlargement and infiltrate the soft tissue of the neck resulting in variable degrees of upper airway obstruction [4, 5,6] .There are studies documented showing hypothyroidism cause decrease in lung functions which is reversible on treatment [7,8]. But only one study has studied specific airway conductance after inhalation of increasing dose of salbutamol[9].

As there is an increased prevalence of hypothyroidism in India, and limited study on airway resistance and conductance in hypothyroid subjects, this study is undertaken to know the airway resistance (RAW) and specific airway conductance (sGAW) in subjects with elevated TSH before and after treatment with levothyroxine.

OBJECTIVES OF THE STUDY

1. To record the airway resistance and conductance in subjects with increased TSH.
2. To record the airway resistance and conductance after normalization of TSH with Levothyroxine.
3. To compare the results after normalization of TSH with treatment.

METHODOLOGY

This study is a non-randomized trial before and after comparison studies which included 40 patients with elevated TSH. Institutional ethical committee clearance was obtained before starting the study. Subjects were selected from Victoria hospital attending medicine OPD and diagnosed as hypothyroidism for 1st time and also following later at 6 to 8 weeks as part of treatment review with levothyroxine when TSH values returned to normal.

Subjects were selected according to inclusion and exclusion criteria. Subjects were selected in the age group of 15 – 50 yrs with elevated TSH. Smokers and tobacco chewers, subjects with chronic respiratory disease, subjects with signs and symptoms of respiratory infections at the time of test, history of cardiovascular illness and hypertension, any other metabolic disorder except for hypothyroidism, pregnant women, subjects with musculo skeletal chest deformities, Subjects taking drugs which will alter the thyroid hormonal profilewere excluded from the study. Procedure was explained and a written informed consent obtained from the subjects and those willing for the study underwent examination as per proforma.

RAW and s GAW was recorded using M.E.C PFT body plethysmography [10], at the time of diagnosis and again when the TSH value returned to normal range. Procedure was done in the morning hours after light breakfast. Calibration of body box and spirometer was done. Procedure was explained and subjects were made to sit straight with proper back rest, without leaning backward or forward with slightly open neck in the chair inside body box. They were made comfortable and familiarized with the procedure. Nose clip was applied. Subjects were made to perform panting manoeuvre in body plethysmography with door closed to measure airway resistance and specific airway conductance. Minimum of 3 recordings were taken at the interval of 5 minutes and best of the 3 recording was selected.

RESULTS AND ANALYSIS

Study design: A non-randomized trial before and after comparison study consisting of 40 subjects with elevated TSH was undertaken to study RAW and sGAW before and after treatment with Levothyroxine.

Statistical Methods:

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance.

+ Suggestive significance (P value: 0.05<P<0.10)
* Moderately significant (P value:0.01<P 0.05) ** Strongly significant (P value: P0.01)

Table 1: Distribution of Baseline information in study group

Variables	No. of subjects (n=40)	%
Age in years		
21-30	17	42.5
31-40	17	42.5
41-50	6	15.0
Gender		
Female	31	77.5
Male	9	22.5

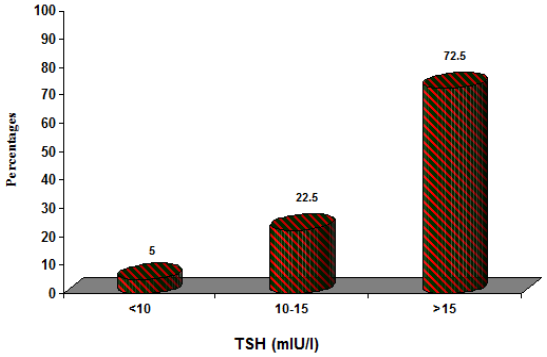
BMI (kg/m2)		
18-23	5	12.5
23.1-30	25	62.5
>30	10	25.0

Table 1 show age, gender and BMI distribution of the hypothyroid subjects with elevated TSH. 42.5% belonged to 21-30 yrs of age, 42.5% belonged to 31-40 yrs and 15% belonged to 41-50 yrs of age. 77.5% were females and 22.5% were males. 12.5% of subjects had BMI of 18-23, 62.5% had BMI of 23.1-30 and 25% had BMI of >30.

Table 2: An evaluation of TSH (mIU/l) in study group before and after treatment

	Before treatment	After treatment	P value
TSH (mIU/l)	27.43±22.45	2.11±0.85	<0.001**

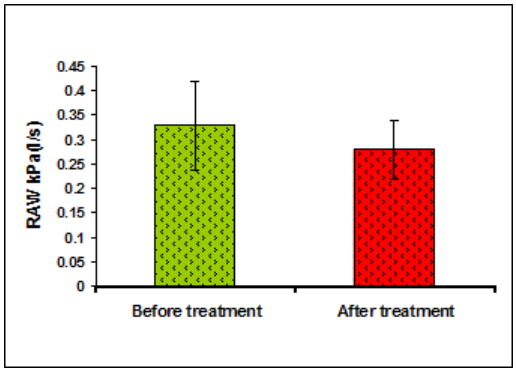
Table 2 shows the TSH value in study group before and after treatment with levothyroxine. As shown in the table, after treatment the TSH has reduced to mean of 2.11±0.85 mIU/l which is in the normal reference range



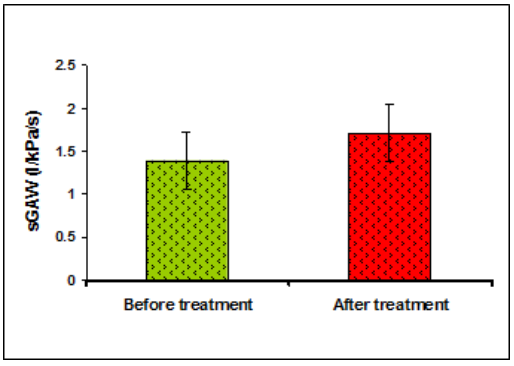
Graph 1: Distribution of subjects in accordance with TSH level

Graph 1 shows the TSH levels in the study group before treatment. As shown in this table and graph, 5% subjects had TSH value less than 10 mIU/l, 22.5% had TSH value 10- 15 mIU/l and 72.5% had TSH value more than 15 mIU/l.

Graph 2: Comparison of mean airway resistance of study group before and after treatment.



Graph 3: Comparison of mean specific airway conductance of study group before and after treatment



Graphs 2 and 3 shows airway resistance and specificic airway conductance comparison of study group with elevated TSH before treatment and after normalisation of TSH following treatment. As shown, there is decrease in airway resisance and increase in specific airway conductance after treatment which is statistically significant.

DISCUSSION

There is a global increase in hypothyroidism and Iodine deficiency remains the most common cause of hypothyroidism worldwide. India is considered to be moderate to severe iodine deficient region[2].

Hypothyroidism affects all the organ systems. It affects the cardiovascular system causing bradycardia, hypotension and atherosclerosis. Affects central nervous system causing multiple neurological symptoms like paraesthesia, hearing disorders, delayed relaxation of tendon reflexes, carpal tunnel syndrome, lack of concentration and amnesia. Affects musculoskeletal system causing arthralgia's, joint effusions and pseudogout. Affects GIT causing constipation and weight gain. Reproductive system is also affected causing menstrual irregularities, anovulation and infertility[2].

Respiratory system like other body systems and organs is affected by hypothyroidism. Many studies documented so far have shown that hypothyroidism cause decrease in lung functions which is reversible on treatment [9,10,]. But only one study has studied specific airway conductance after inhalation of increasing dose of salbutamol[9].

As per aims and objectives of this study, effort has been made to study the airway resistance and specific airway conductance in hypothyroid subjects before and after treatment with levothyroxine. RAW, sGAW were performed before treatment in 40 subjects with elevated TSH and performed again after treatment with levothyroxine. The results were tabulated and statistically analyzed.

This study included subjects with age ranging from 22-50 yrs (33 ± 7) of which 31 (77.5%) were females and 9 (22.5%) were males. The study included BMI ranging from 18.3 -36.8 (27.49±4.06) of which 12.5% of subjects had BMI of 18-23, 62.5% had BMI of 23.1-30 and 25% had BMI of >30. Table 1 shows age, gender and BMI distribution of the study group as described above.

The subjects mean BMI came under overweight category according to WHO standards of classification of BMI [11]. Weight gain is a recognized clinical indicator of hypothyroidism [2].Hypothyroidism is diagnosed by measuring serum TSH levels using chemiluminescent method [2].In the current study, only elevated TSH is taken, T3 and T4 is not taken because a normal TSH level excludes primary hypothyroidism and T3 is normal in 25% of patients. TSH is the most sensitive and is considered the single best screening test for hypothyroidism and the dose of Levothyroxine is adjusted on the basis of TSH levels[2].

Thus the study includes 95% of the subjects with TSH above 10 mIU/l who belong to overt hypothyroidism.

Graphs 2 and 3 shows comparison of airway resistance and specific airway conductance of study group before and after normalisation of TSH. As shown, there is decrease in airway resistance and increase in specific airway conductance after treatment which is statistically significant (<0.001**).

In Hypothyroidism, there is decrease in the synthesis of phospholipids like Phosphatidyl choline, lysophosphatidyl choline, lysophosphatidyl ethanolamine, phosphatidyl ethanolamine, and sphingomycelin, thereby causing decrease in the synthesis of surfactant [12,13]. Surfactant contributes to a free airflow through conducting airways and may have an important role in the maintenance of low airway resistance [14]. Moreover, mucopolysaccharide deposition in the lungs may cause fibrosis and thickening of the alveolar wall with loss of elastic tissue and may increase the work of breathing [15]. All these changes may lead to increased airway resistance and decrease in specific airway conductance in hypothyroidism which has improved after the TSH value has returned to normal.

The above study thus concludes that hypothyroidism affects the airway resistance and specific airway conductance significantly. Since these effects are reversible on treatment and regular follow up, more emphasis is necessary to assess the lung functions in all the patients of

hypothyroidism. This is the first study to include airway resistance and specific airway conductance and hence studies in similar lines with larger sample size is required to compare and correlate.

CONCLUSION

The results of the study showed that there was a significant decrease in airway resisance (RAW) and significant increase in specific airway conductance (sGAW) in hypothyroid subjects after treatment compared to before treatment.

REFERENCES

1. Jameson JL, Weetman AP. Disorders of the Thyroid Gland. In: Harrison's Principles of Internal Medicine; vol (2). 17th edi. New York: McGraw Hill Companies; 2008. P. 2224.
2. Unnikrishnan AG, Menon U. Thyroid disorders in India. Indian J of Endocrinology and Metabolism. 2013; 17(4): 647–652.
3. Birring SS, Patel RB, Parker D, Mckenna S, Hargadon B, Monteiro, Smith JF, Pavord ID. Airway function and markers of airway inflammation in patients with treated hypothyroidism. Thorax 2005;60:249–253.
4. Batniji RK, Cevera JJ, Gavin JP, Seymour PE, Parnes SM. Supraglottic myxedema presenting as acute upper airway obstruction. Otolaryngol Head Neck Surg 2006;134:348-50.
5. Devdhar M, Ousman YH, Burman, KD. Hypothyroidism. Endocrinol Metab Clin North Am 2007;36:595-615.
6. Watson EM, Pearce RH. The mucopolysaccharide content of the skin in localized (pretibial) myxedema. Am J Clin Pathol 1949;19:442-7.
7. Sharifi F, Amari A. The Effect of Levothyroxin on Pulmonary Function Tests of Hypothyroid Patients.Int J Endocrinol Metab 2005;1:48-51.
8. Siafakas NM, Salesiotou V, Filaditaki V, Tzanakis N, Thalassinos N and Bouros D. Respiratory muscle strength in hypothyroidism. Chest 1992;102:189-194.
9. Harrison RN, Tattersfield AE. Airway response to inhaled salbutamol in hyperthyroid and hypothyroid patients before and after treatment. Thorax 1984;39:34-39
10. http://blogs.epfl.ch/document/7221 assessed on 11/10/2012
11. WHO: Global database on body mass index [online]. 2006 [cited 2014 Apr 4]. Available from: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html.
12. Kumar R, Hegde KS. Influence of thyroid hormone on the phospholipid composition of lung tissue and surfactant of rats. Indian J Physiol Pharmacol 1983;27(3):208–3.
13. Ballard PL, Hovey ML, Gonzales LK. Thyroid hormone stimulation of phosphatidylcholine synthesis in cultured fetal rabbit lung. J Clin Invest Sep 1984; 74(3):898–905.
14. Enhorning G1, Yarussi A, Rao P, Vargas I. Increased airway resistance due to surfactant dysfunction can be alleviated with aerosol surfactant. Can J Physiol Pharmacol. 1996 Jun;74(6):687-91.
15. Husain AN, Kumar V. The lung. In: Robbins and Katran Pathologic Basis of Disease, 7th ed. Philadelphia: The WB Saunders Company; 1999. p. 711–72.