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Research Article

Hormonal Dysfunctioning and its Consequences upon Emergence of Goiter

Muhammad Ameen*

Department of Zoology/Biology, Pir Mehr Ali Shah Arid Agriculture University, Pakistan

Abstract

The abnormal concentration of Thyroid Stimulating Hormone (TSH), iodine deficiency and goitrogens substances can stimulate thyroid gland. Diffuse goiter is only the enlargement of thyroid gland while nodular goiter is the presence of separate lumps (nodules) in the enlarged thyroid gland at the age of puberty. Hypothyroid and hyperthyroid patients have higher and lower concentration of TSH respectively. Current study has incorporated 454 patients of various types of goiter as experimental group and 50 individuals as control group having no goiter that have diagnosed through thyroid scan, physical examination and ultrasound examination. These have evaluated through various statistical techniques in order to investigate thyroid dysfunctioning. It has investigated that diffuse goiter has been exhibiting equivalence with diffuse radioactive iodine uptake. Hypothyroidism and hyperthyroidism can be accurately diagnosed with laboratory tests performed at Nuclear Medicine, Oncology and Radiotherapy Institute (NORI). The data along with detailed history were collected with the help of clinicians in Nuclear Medicine, Oncology and Radiotherapy Institute (NORI) and entered in the Performa. The diagnostic evaluation relating to functional and morphological characterization has examined through serum TSH concentration and imaging. The results have determined non-significant difference between hypothyroid and hyperthyroid patients of diffuse goiter and control group individuals. The study has concluded that the prevalence of goiter may be dependent on the higher and lower concentration of Thyroid Stimulating Hormone (TSH).

***Corresponding author:** Muhammad Ameen, Department of Zoology/Biology, Pir Mehr Ali Shah Arid Agriculture University, Pakistan, Tel: 03005839161; E-mail: muhammadameen_1@live.com

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Introduction

Thyroid gland is a highly vascular endocrine gland. It is situated in the neck in front of trachea extending from the fifth cervical to the first thoracic vertebrae [1]. Evered et al., have investigated that at the state of mild hypothyroidism serum TSH remains high and the values of T3 and T4 are in normal range [2].

Vander Pump et al., has reported that the enlargement of whole thyroid gland in case of diffuse goiter at the state of both hypothyroidism and hyperthyroidism is observed at the age of puberty and toxic diffuse goiter is also known as grave's disease is more prevalent in hyperthyroid patients [3]. Kumar et al., have reported that diffuse Goiter (Simple) or physiological goiter is the most common thyroid disorder among different thyroid diseases. They have further investigated that diffuse goiter has been exhibiting equivalence with diffuse radioactive iodine uptake, while multi nodular goiter has not been exhibiting equivalence with irregularity in iodine uptake and activity throughout the thyroid gland [4].

Schwartz et al., have observed the follicular cells of the thyroid gland have produced and have secreted the two basic forms of thyroid hormone that are T4 (3,5,3′,5′-tetraiodothyronine) and T3 (3, 3′,5-triiodothyronine) [5]. They have further revealed that these hormones have played extremely important role in the normal development of cellular metabolism, cell proliferation and cell differentiation.

Surks et al., have described that a thyroid disorder is physical ailment that arises from its dysfunctioning that produces Triiodothyronine (T3) and thyroxin (T4) [6]. They have further observed that this dysfunctioning have influenced functions of the pituitary gland and hypothalamus and consequently their secretions.

Oppenheimer et al., have revealed that Tetraiodothyronine (T4) is generated by the thyroid gland as an inactive compound. They have further described that this is transformed into the tissues to Triiodothyronine (T3) that combines to the nuclear receptors in order to initiate Thyroid Hormone (TH) action [7]. Guyton and Hall et al., have analyzed that thyroid gland have produced about 7% triiodothyronine (T3) and about 93% thyroxin (T4). Triiodothyronine (fT3) has 3-5 folds greater biological potency than thyroxin (fT4) [8].

Morreale et al., have reported that thyroid hormones as being critical regulatory molecules have regulated normal brain functioning during development of vertebrate brain [9]. They have further examined that these are Tyrosine based hormones that are partially composed of iodine and their deficiency enlarges the thyroid tissue which is known as simple goiter.

Suzuki et al., have examined that alteration in TSH and free thyroid hormones have been observed in gender and during aging [10]. They have further investigated that in males the process of aging have restrained the free thyroid hormones concentration but have not influenced on the concentration of TSH. While, in females the free thyroid hormones levels have not been changed with aging but TSH level have been increased in age-dependent areas of severe iodine deficiency can be as high as 80%.

Khan et al., have observed that two major ailments of thyroid gland, one is higher generation of thyroid hormones that is called hyperthyroidism and other is lower generation of thyroid hormones that is called hypothyroidism [11]. Khan et al., also have examined that serum TSH level has been elevated in case of primary hypothyroidism but values of T3 and T4 have remained below the normal range [11]. Evered et al., have been investigated that in case of mild hypothyroidism serum TSH also have been observed high and the values of T3 and T4 have remained in normal range. Caldwell et al., have been reported that in case of hyperthyroidism the values of triiodothyronine and Thyroxin have been observed above high level and TSH has subdued due to negative feedback mechanism [12].

The objective of study is to compare the hormonal profile of subclinical and clinical hypothyroid and hyperthyroid patients with normal healthy individuals and will be evaluated statistically. Various medical disorders and abnormalities in thyroid hormones will be explored in Pakistani population. Further, profile of thyroid hormones will be analyzed via level of different hormones and antibodies like TSH, FT4, T3 and anti thyroglobulin respectively will be analyzed from serum samples of patients. Analytical evaluation of the hormonal profile of patient will be carried out via Electro Chemiluminescent Immunoassays (ECLIA).

Materials and Methods

The current study was carried out at Nuclear Medicine, Oncology and Radiotherapy Institute (NORI), Islamabad in patients of goiter and control group individuals having no diffuse goiter. The population sample is comprised of 454 patients of diffuse goiter and 50 individuals having no goiter. The whole population was categorized into two major groups, one is experimental group and other is control group. The blood tests reports showing normal values of Thyroid Functions Tests (TFTs) were designated as normal while patients having not normal values of Thyroid Functions Tests (TFTs) were designated as abnormal. The experimental group constituted 454 patients of goiter and 50 individuals as a control group. In a whole sample of population 286 were observed as normal and 168 as abnormal patients. The abnormal patients were further categorized into hyperthyroid and hypothyroid according to the values of TSH levels. Hypothyroidism and hyperthyroidism can be accurately diagnosed with laboratory tests performed at NORI. The patients having higher concentration of TSH were designated as hypothyroid and patients having low concentration of TSH were designated as hyperthyroid. Individuals having no goiter were taken as control group but they can have hypothyroidism or hyperthyroidism. The patients having diffuse goiter were diagnosed through physical examination, clinical examination, thyroid scan, and ultrasound reports. The blood reports of thyroid function tests were collected from various laboratories of Pakistan and normal TSH concentration (0.27 to 4.2μIU/ml) was kept as criteria for the diagnosis of thyroid dysfunction.

Setting and study area

The present study was carried out in Nuclear Medicine, Oncology and Radiotherapy Institute (NORI).

Study population

Total 504 patients that were referred for thyroid scan were included in the study.

Inclusion criteria

All patients having goiter in any age group will be included in the study.

Exclusion criteria

- Pregnancy
- Liver disease as evidenced by raised ALT level
- Drugs: Amiodarone, lithium, anti-thyroid medications (neomercazole/procarbizole), thyroxin

Study group

The whole population sample constituting the patients of diffuse goiter was based on the incidence of Thyroid Functions Tests (TFTs).

Data collection

After having informed consent (Annexure-I) from patients, the data along with detailed history was collected with the help of clinicians in NORI and entered in the Performa (Annexure-II).

Data analysis

The data were analyzed using SPSS version 17. The average values for age, history of goiter (duration) etc., were calculated. The percentage of different thyroid dysfunctions (hypothyroid, hyperthyroid) in patients of diffuse goiter was analyzed through confidence interval (0.05). Statistically defined P-value of the study is (0.000).

The study has considered Thyroid Stimulating Hormone (TSH) as a criterion for the diagnosis of thyroid dysfunction. The normal range of Thyroid Function (TFTs) regarding TSH diagnosed at NORI hospital is (0.27-4.2μIU/ml) and other clinical laboratories of Pakistan. The patients having high TSH concentration have been designated as Hypothyroid and the patients having low serum TSH concentration have been designated as Hyperthyroid while the patients having normal TSH values are considered as Euthyroid.

Results

The current paper has investigated that 55% of goiter patients have abnormal TSH concentration, while 45% have normal TSH concentration in a whole sample of population. In abnormal patients, about 71% have low TSH levels, while 29% have high TSH levels. TSH levels ranging from 0.27-4.2μIU/ml was considered as normal for the diagnosis in Thyroid Function Tests (TFTs). When the abnormal patients of diffuse goiter having the clinical symptoms of hypothyroid or hyperthyroid were compared with control group individuals, statistically non-significant difference was observed in this case. Comparatively, similar results were obtained in the studies of nodular goiter and multi nodular goiter. The study has worked out to determine the comparative evaluation of thyroid function tests between normal and abnormal, hyperthyroid and hypothyroid of diffuse goiter, Nodular Goiter (NG), Multi Nodular Goiter (MNG) and control group. The statistical evaluation of thyroid function tests in the group having diffused goiter has done in the statistical evaluation tables.

Discussion

Tables 1, 2 and 3 have demonstrated the statistical difference between abnormal, hypothyroid and hyperthyroid patients of goiter versus normal control individuals. The abnormal TSH levels patients (37%) and normal TSH levels patients (63%) of various types of

goiter have shown that incidence of goiter is not only dependent on thyroid dysfunction tests. Moreover, among abnormal patients 71% having low TSH levels and 29% having high TSH levels have revealed the fact that goiter is dependent on the concentration of TSH. The patients with low TSH levels have greater chance of occurrence of disease as compared to patients with high TSH levels. Comparison of lipid profile in Euthyroids, clinical and subclinical hypothyroid and hyperthyroid versus control group individuals showed non-significant differences by non-parametric tests ($p > 0.05$). Similar results were obtained pertaining to nodular goiter and multi nodular goiter. Hypothyroid, Euthyroids, Clinical and Subclinical hypothyroid, and hyperthyroid patients of diffuse goiter and Multi Nodular Goiter (MNG) have not altered lipid profile of control individuals contrary to Euthyroids of nodular goiter. However, thyroid dysfunctioning was not prominent in patients experiencing diffuse goiter and Multi Nodular Goiter (MNG). In case of nodular goiter (Table 1), the comparative evaluation of normal male and female with control group individuals has demonstrated the statistically significant difference, while in the same case, abnormal male and female patients have shown non-significant difference. The result revealed that TSH, FT3 and FT4 levels did not affect the onset goiter in both groups. Similarly, the study is correlated with the findings of Kumar et al., investigated that diffuse goiter has been exhibiting equivalence with diffuse radioactive iodine uptake [4]. The prevalence of disease is not dependent upon the concentration of TSH. Therefore, the research work has inconsistency with the findings of Dr. Firdushi Begum et al., that estimation of serum thyroid hormones and TSH concentrations has great significance for the diagnosis of thyroid problem [13]. The current study has rejected the serum TSH concentration usefulness in determining thyroid problem, on this ground it is not related to the findings of Dr. Firdushi Begum. The recent study is also not according to the findings of Ladenson et al., have also considered that the TSH test as a criterion for the diagnosis of thyroid dysfunction, especially in cases of minimal thyroid failure (subclinical hypothyroidism), while such results are rejected in this new findings [14]. The study has inconsistency with the findings of Evered et al., have been investigated that in case of mild hypothyroidism serum TSH also have been observed high and the values of T3 and T4 have remained in normal range, and while in case of present study serum TSH levels fluctuates. Moreover, current new findings have already challenged the published results. Such studies would be helpful to understand on the prevalence of various types of goiter in different subjects and will also suggest the measures to minimize the goiter associated with its onset. It is further suggested that the role of hormonal interactions in these patients may also be investigated with reference to their different metabolic disorders.

Conclusion

The present study concluded that prevalence of goiter may be dependent on the extent of hormonal dysfunctioning specifically normal and abnormal TSH levels. In future comprehensive investigation is warrant covering the epidemiological profile of the patients having goiter.

Number of Patients with TSH Concentrations	Total No.	Male	Female	Control	P-Value
Normal	79 70.34 (1.07)	13 16.16 (0.62)	66 54.19 (2.57)	50 67.31 (4.45)	0.1163
Abnormal	65 60.87 (0.28)	17 13.98 (0.65)	48 46.89 (0.03)	50 58.25 (1.17)	0.8254
High	19 29.76 (3.89)	5 6.83 (0.49)	14 22.93 (3.47)	50 28.48 (16.26)	0.8919
Low	46 48.02 (0.09)	13 11.03 (0.35)	33 36.99 (0.43)	50 45.95 (0.36)	1.1157

Table 1: X^2 Calculations (Two-way Contingency) showing statistical difference between hypothyroid, hyperthyroid and normal TSH Patients of diffuse goiter versus control individuals.

$\chi^2 = 36.183$, df = 9, $\chi^2/df = 4.02$, $P(\chi^2 > 36.183) = 0.0000$

Number of Patients with TSH Concentrations	Total No.	Male	Female	Control	P-Value
Normal	131	12 18.82 (2.47)	119 112.18 (0.41)	50 50.00 (0.00)	0.0012
Abnormal	53	11 12.86 (0.27)	42 40.14 (0.09)	50 50.00 (0.00)	0.3913
High	46	9 11.02 (0.37)	37 34.98 (0.12)	50 50.00 (0.00)	0.3334
Low	7	2 1.96 (0.00)	5 5.04 (0.00)	50 50.00 (0.00)	1.0926

Table 2: X^2 Calculations (Two-way Contingency) showing statistical difference between hypothyroid, hyperthyroid and normal TSH Patients of Nodular Goiter (NG) versus control individuals.

Number of Patients with TSH Concentrations	Total No.	Male	Female	Control	P-Value
Normal	76 76.00 (0.00)	12 15.68 (0.86)	64 60.32 (0.22)	50 50.00 (0.00)	0.2534
Abnormal	50 50.00 (0.00)	8 11.00 (0.82)	42 39.00 (0.23)	50 50.00 (0.00)	0.3503
High	35 35.00 (0.00)	5 7.82 (1.02)	30 27.18 (0.29)	50 50.00 (0.00)	0.3277
Low	15 15.00 (0.00)	3 3.92 (0.22)	12 11.08 (0.08)	50 50.00 (0.00)	0.8260

Table 3: X^2 Calculations (Two-way Contingency) showing statistical difference between hypothyroid, hyperthyroid and normal TSH Patients of Multi Nodular Goiter (MNG) versus control individuals.

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ANNEXURE-I

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CONSENT

I have been told by the doctor that for the provisional diagnosis of my problem. I'll have to undergo different tests including thyroid function tests, thyroid scan, and thyroid ultrasound. One test will be done using radioactive substances. My doctor told me that these rays are not harmful and the test is helpful for the diagnosis of my disease. I'm willing for these tests.

Signature of the patient

Dated: ----------

Name of the Patient

Signature of the patient

Signature of the Witness

Name of the Patient

ID Card Number

Signature of the Witness

ANNEXURE-II

INCIDENCE OF THYROID DYSFUNCTION IN PATIENTS WITH GOITER

NORI, ISLAMABAD

PATIENT'S PERFORMA

Case No.:

Date:

Name: _____

Age/Gender: _____

Address: _____

		If Yes, Duration/Date	Remarks (if any)
H/O Goiter	Yes/No		
Type	Diffuse	Solitary nodule	MNG
Physical Examination			
Thyroid scan:			
Thyroid Ultrasound			

Referred By: _____

Presenting Complaints

Investigations:

TFTs	Date	Result	Comment/N.V
FT4			
FT3			
TSH			

GROUP ASSIGNED: _____