

# Incidence of Multinodular Goiter (MNG) and Thyroid Dysfunctions

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## Abstract

Multinodular goiter is the most common type of goiter in elderly and its incidence increases with age. The diagnostic evaluation relating to functional and morphological characterization has examined through serum TSH concentration and imaging. A statistical analysis called  $\chi^2$  test has done in order to evaluate the sample of 126 patients pertaining to multi nodular goiter. Laboratory tests performed at Nuclear Medicine, Oncology and Radiotherapy Institute (NORI) Islamabad (Pakistan) have observed both hypothyroid and hyperthyroid patients with high and low TSH levels respectively. The data along with detailed history was collected with the help of clinicians in NORI and entered in the patient's Performa (ANNEXURE-II). TSH levels ranging from 0.27-4.2  $\mu$ IU/ml was considered as normal for the diagnosis in thyroid function tests (TFTs). Statistically non-significant difference between hypothyroid and hyperthyroid patients of multi nodular goiter versus control group individuals was observed. The study has concluded that the prevalence of multi nodular goiter is not dependent on the higher and lower concentration of TSH.

## Introduction

Hermus and Huysmans [1] have reported that multinodular goiter is a structurally and functionally enlargement of thyroid gland. During early stages of goiter genesis, the thyroid gland is diffusely enlarged, but with the passage of time thyroid functioning becomes more prominent and autonomous and gradually develops into sub-clinical hyperthyroidism and eventually into overt hyperthyroidism. Patients having multinodular goiter serum thyrotropin and free thyroxin should be measured in order to diagnose sub-clinical or overt hyperthyroidism.

However, Vander Pump. (2011) has investigated that ultrasound examination of the thyroid gland has overestimated the prevalence of goiter in a population as compared to physical examination [2] (Chandra soma and Taylor, Mann et al.) have reported that in case of hyperthyroidism, the high serum concentration of these hormones has been observed is due to exogenous and endogenous reasons. They have further described that the first reason of hyperthyroidism is dysfunctioning within the gland like the production of antibodies against the thyroid cells that has stimulated over production of thyroid hormones, while the second reason of hyperthyroidism is the intake of excessive amount of thyroid hormones and iodine.

Oppenheimer [3] 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. Guyton and Hall. (1996) have analyzed that thyroid gland have produced about 7% triiodothyronine (T3) and about 93% thyroxin (T4). Triiodothyronine (T3) has the 3-5 folds greater biological potency than T4.

Suzuki [4] have examined that alteration in TSH and free thyroid hormones have been observed in gender and during aging. 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%.

Walsh et al. (1999) estimated approximately 23% the incidence of solitary nodules as dominant nodules with Multinodular Goiter. Mazzaferri (1992) has reported that roughly 5 to 10 percent of palpable nodules have developed thyroid carcinoma investigating that the degree of prevalence of nodular goiter depends upon the extent of iodine.

Kumar [5] have observed that hyperthyroidism is usually due to diffused hyperplasia of the thyroid gland. They have further reported that it

has been connected with Graves' disease, during which thyroid hormones are excessively in taken, hyper functional multinodular goiter and non cancerous tumor of the thyroid gland. They have further investigated that there are many other causes of hyperthyroidism that are thyroiditis, TSH secreting pituitary adenoma and the secretion of excessive amount of thyroid hormones by ectopic thyroid arising in ovarian tetramas.

Charib. (1997) has been examined the incidence of solitary and multiple nodules in gender making a proportion of 0.8% of men and 5.3% of women and their rate is increasing above 45years in case of woman. Brabant. 1990 have reported that reduced TSH levels in nontoxic goiter have shown different concentrations in circadian rhythms and slightly reduced TSH pulses have been observed. Roelfsema et al. (2009) have demonstrated that sleep wake cycle of TSH pulses has kept in unaltered condition down to 0.005mi U/l, while variation in TSH pulses during day and night have been vanished at 0.002mi U/l in case of sub-clinical hyperthyroidism (SH).

Khandelwal and Tandon (2012) have been examined that subclinical hypothyroidism is the initial stage during which thyroid-stimulating hormone (TSH) concentration rises while serum free thyroxin (FT4) and triiodothyronine (FT3) concentrations remains normal. This kind of hypothyroidism has been transformed to overt hypothyroidism in approximately 2-5% cases annually. All patients having both disorders should get treatment when TSH >10 mi U/L.

The objective of study is to compare the hormonal profile of subclinical and clinical hypothyroid patients with normal healthy individuals and will be evaluated statistically. Various medical disorders and abnormalities raised due to the abnormality of 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, FT3 and ant thyroglobulin respectively will be analyzed from serum samples of patients. Analytical evaluation of the hormonal profile of patient will be carried out via electrochemiluminescent immunoassays (ECLIA). Such studies would be helpful to understand the prevalence of multinodular goiter (MNG) in different subjects and will also suggest the measures to minimize the goiter associated with its onset.

## Materials and Methods

The current study was carried out at Nuclear Medicine, Oncology and Radiotherapy Institute (NORI) between patients of multinodular goiter (MNG) versus normal control individuals. A sample of population constituting 176 individuals was categorized into two major groups, one is experimental group and other is control group. The experimental group was comprised of 126 patients of multinodular goiter (MNG) while the control group constituted 50 individuals having not multinodular goiter (MNG) but they can have hypothyroidism or hyperthyroidism. The patients having multinodular goiter (MNG) were diagnosed through Physical examination, clinical examination, Thyroid Scan, and Ultrasound reports. Hypothyroidism and hyperthyroidism can be accurately diagnosed with laboratory tests performed at NORI and other laboratories of Pakistan. Patients having blood tests reports showing normal values of thyroid functions tests (TFTs) were designated as normal while patients having abnormal values of thyroid

functions tests (TFTs) were designated as abnormal. Among a sample of population suffering from nodular goiter, 76 patients were designated as normal and 50 patients as hyperthyroid or hypothyroid according to the values of TSH levels. The clinical examination report of thyroid function tests were collected from various laboratories of Islamabad and normal TSH concentration (0.27 to 4.2 $\mu$ IU/ml) was kept as criteria for the diagnosis of thyroid dysfunction. The study has worked out to determine the statistically significant difference between control group individuals versus normal and hyperthyroid and hypothyroid of nodular goiter.

## Setting and study area

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

## Study population

Total 176 patients were included in the study

## Inclusion Criteria

All patients having multinodular goiter (MNG) 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/procarbazole), thyroxin

## Study Group

The study population was based on the prevalence of thyroid functions tests (TFTs) that were observed in the patients of multinodular goiter (MNG). Therefore, the whole population sample constituting the patients of multinodular goiter (MNG) has been based on types of goiter.

## 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 was analyzed using SPSS version 17. The average values for age, history of goiter (duration) etc. was calculated. The percentage of different thyroid dysfunctions (hypothyroid, hyperthyroid) in multinodular goiter (MNG) was calculated.

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 (0.27-4.2  $\mu$ IU/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 euthyroids.

## Results

The current study has observed that 40% have abnormal TSH concentration, while 60% have normal TSH concentration in a whole sample of population suffering from multinodular goiter (MNG). Among abnormal patients, about 30% have low TSH levels, while 70% have high TSH levels. TSH levels ranging from 0.27-4.2  $\mu$ IU/ml was considered as normal for the diagnosis in thyroid function tests (TFTs). When the patients suffering from

multinodular goiter (MNG) having the clinical symptoms of hypothyroid or hyperthyroid were compared with control group individuals, statistically non-significant difference was observed in this case. Therefore goiter is equally prevalent in both experimental and control group. The statistical evaluation of thyroid function tests in the group having multinodular goiter has done in the statistical evaluation table (1).

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

Table (1)  $\chi^2$  Calculations (Two-way Contingency) showing statistical difference between hypothyroid, hyperthyroid and normal TSH Patients of multinodular goiter (MNG) versus control individuals

## Discussions

The following above tables (1) has demonstrated the statistical difference between abnormal, hypothyroid and hyperthyroid patients of MNG versus control individuals. Comparison of lipid profile of multinodular goiter (MNG) in euthyroid, subclinical, and clinical hypothyroid and hyperthyroid versus control group individuals showed non-significant differences by non-parametric tests ( $p > 0.05$ ) indicating the prevalence of disease in both experimental group and control group. 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. (2015) that estimation of serum thyroid hormones and TSH concentrations has great significance for the diagnosis of thyroid problem. The result revealed that TSH, FT3 and FT4 levels did not affect the onset goiter in both groups. The study is also not according to the findings of Ladenson et al. (2000) 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). The study has inconsistency with the findings of Evered et al. (1973) 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. Such studies would be helpful to understand on the prevalence of multinodular goiter (MNG) in different subjects and will also suggest the measures to minimize the goiter associated with its onset. It is further suggested that 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 multinodular goiter (MNG) is not dependent on the extent of hormonal dysfunctioning specifically low and high TSH levels. In future comprehensive studies are warrant covering the epidemiological profile of the patients having multinodular goiter (MNG).

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