



A Study of the Clinical Profile and Radiological Findings in Patients with Multinodular Goiter in Central India

Authors

Dr Dharmendra Jhavar¹, Dr Abhishek Agrawal^{2*}, Dr Shivshankar Badole³,
Dr V. P. Pandey⁴

¹MD Medicine, Professor, Department of Medicine, MGM Medical College, Indore, MP, India

²Junior Resident, Department of Medicine, MGM Medical College, Indore, MP, India

³MD Medicine, Senior Resident, Department of Medicine, MGM Medical College, Indore, MP, India

⁴MD Medicine, FRCP, Professor and Head, Department of Medicine, MGM Medical College, Indore, MP,

*Corresponding Author

Dr Abhishek Agrawal

Junior Resident, Department of Medicine, MGM Medical College, Indore, MP, India

Abstract

Introduction: Multinodular non-toxic goiter is the most prevalent thyroid pathology characterized by unilateral or bilateral thyroid growth with morphologically and/or functionally transformed follicles and euthyroidism. At thyroid sonography, in unselected populations, 20 to 30% incidence of thyroid nodules has been reported. Beside morphologic variability, lack of hyperstimulation in the majority of the multiplied follicles is the hallmark of the disorder. Most nodular goiters grow slowly and annual growth potential of approximately 20% can be assumed.

Materials and Methods: This prospective observational study was conducted in 50 consecutive patients who attended department of medicine, M.G.M. Medical College & M.Y. Hospital, Indore, MP, India, from one year of study duration.

Results: Cardiomegaly was present in 20% and 70% of hypothyroidism and hyperthyroidism patients respectively. 5% hyperthyroidism patients had feature of pulmonary congestion. All hypothyroidism patients had number of nodules >3 with a mean size of 4cm, 95% of hyperthyroidism patients had a mean of 3.9cm, while 96% euthyroidism patients mean size of nodule was 3.8cm. 80% of hypothyroidism patients had number of nodules >4 with a mean size of 4cm, 90% of hyperthyroidism patients had a mean size of 4.8cm, while 88% euthyroidism patients had mean nodule size of 5.2cm. 60% of hypothyroidism patients had number of nodules >5 with a mean of 5cm, 75% of hyperthyroidism patients had a mean of 5.4cm, while 92% euthyroidism patients had mean 5.3cm.

Conclusions: All patients with hypothyroidism, hyperthyroidism, or euthyroidism with multinodular goiter should offer ultrasonographical examination and timely follow up to see the echogenicity of the thyroid gland. There is no significant correlation with numbers or size of thyroid nodules with type of thyroid disorders in our study.

Keywords: Multinodular goiter, thyroid nodules, thyroid sonography.

Introduction

The normal thyroid gland is a fairly homogenous structure but nodules often form within its

substance. These nodules may be only the growth and fusion of localized colloid-filled follicle or more or less discrete adenomas, or cysts. Nodules

larger than 1 cm may be detected clinically by palpation. Careful examination discloses their presence in at least 4% of the general population. Nodules less than 1 cm in diameter not clinically detectable unless located on the surface of the gland are much more frequent. The terms adenomatous goiter, on toxic nodular goiter and colloid nodular goiter are used interchangeably as descriptive terms when a multinodular goiter(MNG) is found.

Multinodular non-toxic goiter is the most prevalent thyroid pathology characterized by unilateral or bilateral thyroid growth with morphologically and/or functionally transformed follicles and euthyroidism¹. At thyroid sonography in unselected populations, 20 to 30% incidence of thyroid nodules has been reported. Beside morphologic variability, lack of hyperstimulation in the majority of the multiplied follicles is the hallmark of the disorder. Most nodular goiters grow slowly and undergo different morphologic changes encompassing diffuse hyperplastic enlargement in the early phase development of large follicles loaded with abundant colloid and with increasing age, formation of functionally autonomous tissue. Annual growth potential of approximately 20% can be assumed.

The pathogenesis of nodular goiter is multifactorial and probably differs from patient to patient. In contrast to the endemic goiter, iodine deficiency is not a primary causal factor. Environmental factors such as natural goitrogenesis, iodine intake, malnutrition, drugs, stress, pollution or infections, constitutional factors such as female gender and several genetic factors, i.e. circulating thyroid growth factors contribute to different degree to the development of nodular thyroid enlargement. Also controversially debated, thyroid-stimulating hormone (TSH) presumably has an important role in the maintenance of thyroid growth and goitrogenesis. The observation that TSH- suppressive treatment may cause a reduction of goiter volume underlines the role of TSH as goitrogen factor.

In this study, a group of patients with MNG were examined clinically and investigated to find the radiological correlation.

Materials and Methods

In our study 50 individuals from Department of Medicine, M.G.M. Medical College & M.Y. Hospital, Indore, MP, India, were taken in the study.

Period of study – March 2017 to February 2018

Group: Cases included of all cases & control subjects was taken and all ethical issues considered.

A written consent of all cases & control subjects was taken and all ethical issues considered.

Inclusion Criteria

50 Diagnosed cases of MNG with symptoms and signs of hypothyroidism or hyperthyroidism or no symptoms and signs.

Patients with biochemical evidence of hypothyroidism or hyperthyroidism.

Exclusion Criteria

Patients suffering from Hypertension, Diabetes Mellitus, Coronary artery disease or other cause of LV dysfunction.

Patients with history of chronic alcoholism.

Study Protocol

Following criteria were used for selection of the patients

1. Age: Patients from all age groups were included in this study.
2. Sex: Patients from all age groups were included in this study
3. Therapy: only fresh cases were selected
4. Population: Indian patients of all socio-economic classes, castes and rural and urban habitat were studied.

All the patients of thyroid swelling were subjected to further clinical and laboratory evaluation

1. Bio-data: The particulars of the patients including age, sex, locality etc were recorded.
2. Symptomatology: Non-cardiac general symptoms were recorded to aid the clinical diagnosis of thyroid dysfunction.

- a. For hyperthyroidism history of weight loss, fatigability, weakness, nervousness, intolerance to heat, excessive sweating, increased appetite, increase frequency of bowel movement, insomnia emotional disturbance, tremors, muscle weakness, eye complaints pruritus, gynaecomastia, menstrual irregularity and fever with chills was noted.
- b. For hypothyroidism weight gain, fatigability, intolerance to cold decreased appetite, increased sleep, decreased frequency of bowel movement, skin changes, hoarse voice, swelling of face and extremities, menstrual disturbance, galactorrhea, loss of body hair, decreased hearing, memory impairment, ataxia, paresthesias, arthralgia and muscles cramps were noted.
- c. For both the groups, history of a swelling in the neck, dyspnea, dysphagia and dysphonia were looked for.

All patients were evaluated on the basis of a detailed history, general physical and systemic examination as per Performa with investigations including estimation of T3, T4 and TSH, and thyroid ultrasound.

USG of Thyroid

Method

Longitudinal and transverse scans are performed allowing the measurements of the depth (D), the

width (W) and the length (L) of each lobe. The volume of the lobe is calculated by the formula:

$$V (ml) = 0.479 \times D \times W \times L (cm)$$

The thyroid volume is the sum of the volumes of both lobes. The volume of the isthmus is not included. Thyroid volume can be easily calculated using a calculator or personal computer during data entry. Portable ultrasound equipment is relatively rugged, but required electricity. However, it can be operated from a car battery with the aid of a transformer. Trained operators can perform up to 100 or more examination per day.

It should be emphasized that by using the ultrasonographic criteria a thyroid gland will be called goitrous when its values was above the 97th percentile of the volume found in an iodine repleted population used as control. Normal values for the median and 97th percentile for thyroid volume as a function of both age and body surface area (BSA) are being developed. In areas with a high prevalence of protein energy malnutrition, the BSA reference is recommended.

Results

No X-Ray chest abnormality was observed in multi-nodular euthyroid patients. In case of hypothyroidism patients, cardiomegaly was seen in 1 patient (20%). In hyperthyroidism patients, cardiomegaly was seen in 14 patients (70%) and 1 patient (5%) had feature of pulmonary congestion (table 1).

Table 1: Radiological findings in hypothyroidism and hyperthyroidism cases

Radiological findings		No. of Cases	Percentages
Hypothyroidism (n=5)	Cardiomegaly	1	20%
	Pulmonary congestion	-	-
Hyperthyroidism (n=20)	Cardiomegaly	14	70%
	Pulmonary congestion	1	5%

4 patients with hypothyroidism (80%) had transverse diameter >2.5cm with a mean of 2.6cm, 18 patients (90%) of hyperthyroidism had a mean of 2.8cm, while in euthyroid patients (88%) mean was 2.85cm. 5 patients with hypothyroidism (100%) had longitudinal diameter >4.5cm with a mean of 4.7cm, 19 patients (95%) of

hyperthyroidism had a mean of 4.9cm, while 24 euthyroid patients (96%) mean was 4.8cm. 3 patients with hypothyroidism (60%) had AP diameter >2.1cm with a mean of 2.3cm, 15 patients (75%) of hyperthyroidism had a mean of 2.4cm, while 23 euthyroid patients (92%) mean was 2.3cm(table 2).

Table 2: USG findings in cases studied

USG findings	Hypothyroidism			Hyperthyroidism			Euthyroidism		
	No.	%	Mean	No.	%	Mean	No.	%	Mean
Transverse diameter >2.5cm	4	80	2.6	18	90	2.8	22	88	2.85
Longitudinal diameter >4.5cm	5	100	4.7	19	95	4.9	24	96	4.8
AP diameter >2.2cm	3	60	2.3	15	75	2.4	23	92	2.3

4 patients with hypothyroidism (80%) had number of nodules >4cm with a mean of 4cm. 18 patients (90%) of hyperthyroidism had a mean of 4.8cm, while for 22 euthyroid patients (88%) mean was 5.2cm. 5 patients with hypothyroidism (100%) had number of nodules >3cm with a mean of 5cm. 19 patients (95%) of hyperthyroidism had a mean

of 3.9cm, while for 24 euthyroid patients (96%) mean was 3.8cm. 3 patients with hypothyroidism (60%) had number of nodules >5cm with a mean of 5cm, 18 patients (75%) of hyperthyroidism had a mean of 5.4cm, while for 23 euthyroid patients (92%) mean was 5.3cm(table 3).

Table 3: USG thyroid on the basis of nodularity in cases

Nodules	Hypothyroidism			Hyperthyroidism			Euthyroidism		
	No.	%	Mean	No.	%	Mean	No.	%	Mean
No. of nodules >4	4	80	4	18	90	4.8	22	88	5.2
Nodules >3cm	5	100	5	19	95	3.9	24	96	3.8
Nodules >5cm	3	60	5	15	75	5.4	23	92	5.3

All the patients studied had mixed type of echogenicity on doppler study of the thyroid gland (table 4).

Table 4: USG thyroid on the basis of echogenicity in cases studied

Echogenicity	Hypothyroidism		Hyperthyroidism		Euthyroidism	
	No.	%	No.	%	No.	%
Hypochoic	3	60	16	80	20	80
Hyperechoic	4	80	17	85	24	96
Isoechoic	5	100	15	75	21	84

Discussion

This study included 50 cases, 5 of hypothyroidism and 20 of hyperthyroidism & 25 of euthyroid cases.

Chest roentgenogram showed enlargement of the cardiac shadow in a few cases in both the groups i.e. hypothyroidism and hyperthyroidism. Of course the cause of cardiac shadow enlargement was different in both the groups. In hypothyroidism pericardial effusion, while in hyperthyroidism left ventricular hypertrophy or a dilated heart was the cause of an enlarged cardiac shadow. Evidence of pulmonary congestion was seen in 1 patient of hypothyroidism.

USG findings in all the three groups showed enlarged lobes and transverse diameter with a mean of 2.6cm, 2.8cm, and 2.85cm for hypothyroid, hyperthyroid and euthyroid groups respectively. For longitudinal diameter, it was

mean of 4.7cm, 4.9cm, and 4.8cm respectively for all the three groups mean was 2.3cm, 2.4cm, and 2.3cm for AP diameter in the three groups studied respectively.

In a study by Kerber et al², 13 out of 33 patients with myxedema had cardiomegaly on X-ray. Decreased myocardial contractility has also been proposed as one of the cause of low voltage complexes but it has not been substantiated. Thus the exact cause of this common finding in myxedema remains elusive. In our study, Chest X-ray showed an enlarged cardiac shadow in 14 patients (70%).

Normally the administration of excess T4 leads to a reproducible increase in left ventricular weight in animal³. The left ventricular hypertrophy in thyrotoxicosis is due to the direct effect of thyroxine on cardiac protein synthesis and the increased cardiac work. In the first experiment

they administered propranolol along with T to the experimental animal. None of these animals developed cardiac hypertrophy. In the second experiment they employed the model of heterotropic cardiac transplantation. This technique is accomplished by anastomosing the animal aorta of anisogenic donor heart to the side of the

It should be emphasized that by using the ultrasonographic criteria, a thyroid gland will be called goitrous when its values will be above the 97th percentile of the volume found in an iodine repleted population used as control. Normal values for the median and 97th percentile for thyroid volume as a function of both age and body surface area (BSA) are being developed. In areas with a high prevalence of protein-energy malnutrition the BSA reference is recommended.

USG thyroid was done in all the patients. Normal thyroid lobe dimensions are: 4-6 cm longitudinal and 1.3-1.8 cm AP diameter in adult population⁴. No studies were found in the literature to compare with this study. In our study, 4 patients with hypothyroidism (80%) had transverse diameter >2.5cm with a mean of 2.6cm, 18 patients (90%) of hyperthyroidism had a mean of 2.8cm, while euthyroid patients (88%) mean was 2.85cm. 5 patients with hypothyroidism (100%) had longitudinal diameter >4.5cm with a mean of 4.7cm, 19 patients (95%) of hyperthyroidism had a mean of 4.9cm, while 24 euthyroid patients (96%) mean was 4.8cm. 3 patients with hypothyroidism (60%) had AP diameter >2.1cm with a mean of 2.3cm, 15 patients (75%) of hyperthyroidism had a mean of 2.4cm, while 23 euthyroid patients (92%) mean was 2.3cm. 4 patients with hypothyroidism (80%) had no. of nodules >4cm with a mean of 4cm. 18 patients (90%) of hyperthyroidism had a mean of 4.8cm, while for 22 euthyroid patients (88%) mean was 5.2cm. 5 patients with hypothyroidism (100%) had no. of nodules >3cm with a mean of 5cm. 19 patients (95%) of hyperthyroidism had a mean

of 3.9cm, while for 24 euthyroid patients (96%) mean was 3.8cm. 3 patients with hypothyroidism (60%) had no. of nodules >5 cm with a mean of 5cm, 18 patients (75%) of hyperthyroidism had a mean of 5.4cm, while for 23 euthyroid patients (92%) mean was 5.3cm. Also echogenicity of the gland was studied which showed mixed type of echogenicity on doppler study of the gland.

Conclusions

All patients with hypothyroidism, hyperthyroidism, or euthyroidism with multinodular goiter should offer ultrasonographical examination to see the basic structural changes in thyroid gland and timely follow up to see the echogenicity and its changes with time. However, there is no significant correlation with numbers or size of thyroid nodules with type of thyroid disorders in our study.

Disclosure

Funding: No funding sources

Conflict of interest: Not declared

Ethical approval: The study was approved by the institutional ethics committee

References

1. Khatawkar AV, Awati SM. Multi-nodular goiter: Epidemiology, Etiology, Pathogenesis and Pathology. *IAIM*, 2015; 2(9): 152-156.
2. Kerber RE, Sherman B. Echocardiographic evaluation of pericardial effusion in myxedema. Incidence and biochemical and clinical correlations. *Circulation*. 1975 Nov; 52(5): 823-7.
3. Wolfgang Dillmann. Cardiac hypertrophy and thyroid hormone signaling. *Heart Fail Rev*. 2010; 15(2): 125-132.
4. Vikas Chaudhary and Shahina Bano. Thyroid ultrasound. *Indian J Endocrinol Metab*. 2013; 17(2): 219-227.