

Research Article

Altered thyroid profile in metabolic syndrome

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Abstract

Objectives: The study was intended to assess metabolic syndrome in hypothyroid patients and to investigate the association between hypothyroidism and metabolic syndrome in Meerut district.

Methods: The study was done on patients with symptoms of hypothyroidism or follow up cases of hypothyroidism having metabolic syndrome. T₃, T₄ and TSH were analysed by enzyme linked fluorescent assay (ELFA) technique using Minividas auto analyser from Biomerieux, France. Fasting blood sugar and lipid profile were estimated by Vitros-250 auto analyser using readymade dry chemistry kits from Ortho-Clinical diagnostics, Johnson & Johnson, USA. The data was analysed using SPSS-16 software package.

Result: In overt hypothyroid cases T₃ values were found to be negatively correlated with waist circumference (WC), diastolic BP, FBS and TG level and positively correlated with FBS (p=0.03, r=0.24) in subclinical hypothyroidism.

T₄ values negatively correlated with FBS and TG level in overt hypothyroid group and with WC, systolic and diastolic BP in subclinical group. But there was significant positive correlation with TG levels (p=0.04, r = 0.23).

TSH values shows negative correlation with WC, FBS, TG and HDL levels in overt hypothyroidism.

Conclusion: This study on metabolic syndrome in thyroid dysfunction population may help us to plan management strategies, resulting in significant reduction in cardiovascular morbidity and mortality due to metabolic syndrome.

Keywords: T₃, T₄, TSH, Hypothyroidism, Metabolic syndrome

1. Introduction

Thyroid hormones play an important role in regulating energy homeostasis, glucose and lipid metabolism¹. Hypothyroidism is a major cause of secondary dyslipidemia, the cause of which resides in decrease of cholesterol catabolism and excretion². Thyroid function affect metabolic syndrome (Met Syn) parameters including high density lipid cholesterol (HDL-C), triglycerides (TG), blood pressure (BP) and fasting blood glucose (FBS). It is known that overt hypothyroidism lead to an increase in plasma cholesterol levels and blood pressure. Thyroid hormones appear to serve as a general pacemaker accelerating metabolic process and may be associated with metabolic syndrome³. The Met Syn is one of the major public health issues of this country. Met Syn is a cluster of physical condition and metabolic abnormalities commonly found in association with increased risk for development of Type 2 Diabetes Mellitus (Type 2 DM), cardiovascular disease and other medical conditions^{4,7}. According to most recent definitions proposed by the International Diabetes Federation (IDF) 2005, a person is identified as having the metabolic syndrome if they have central obesity (defined as waist circumference with ethnicity specific values) plus any two of the following: raised TG; reduced HDL-C; raised BP; or raised fasting blood glucose⁸. Considerable overlap occurs in the pathogenic mechanism of atherosclerotic cardiovascular disease by Met Syn and hypothyroidism⁵. Perhaps TSH elevation stimulates the secretion of inflammatory cytokines, which lead to increase in the component of the Met Syn⁹. This study was intended to assess metabolic syndrome in hypothyroidism patients and to investigate the association between hypothyroidism and metabolic syndrome in Meerut district.

2. Material and Methods

The present study was undertaken on the patients attending medicine OPD of Chatrapati Shivaji Subharti hospital associated with Subharti Medical College, Meerut, with symptoms of hypothyroidism or follow up cases of hypothyroidism. After obtaining the informed consent each patient was subjected to detailed history and clinical examination which include anthropometric measurements, blood pressure, fasting blood sugar and lipid profile. On this basis only those patients were selected who were having hypothyroidism with or without metabolic syndrome. T₃, T₄ and TSH were analysed by enzyme linked fluorescent assay (ELFA) technique using Minividas auto analyser from Biomerieux, France. Fasting blood sugar and lipid profile were estimated by Vitros-250 auto analyser using readymade dry chemistry kits from Ortho-Clinical diagnostics, Johnson & Johnson, USA.

The data was analysed using SPSS-16 software package. Mean, Standard deviation and correlation coefficient (r) were applied. Correlation coefficient was calculated for evaluating the strength of association between each components of metabolic syndrome and thyroid function test parameters (T₃, T₄ & TSH). A p value < 0.05 was considered as statistically significant.

3. Results

Our study was a hospital based cross sectional study in which 100 hypothyroid subjects, with or without metabolic syndrome, were recruited. Of the 100 hypothyroid patients in the study group, 62 were females and 38 were males with mean age of 41.5 ± 11.2 years.

Patients were distributed in to different age groups. The percentage of hypothyroidism and metabolic syndrome in each group were determined.

Table 1: Age wise distribution of subjects in metabolic syndrome

Age group (in years)	Hypothyroid (total no patients)	Non metabolic syndrome		Metabolic syndrome	
		No of patients	% in age group	No of patients	% in age group
20-29	11	7	63.6 %	4	36.3 %
30-39	42	18	42.8 %	24	57.1 %
40-49	22	9	40.9 %	13	59.1%
50-59	15	6	40 %	9	60 %
60-69	10	3	30 %	7	70 %
Total	100	43		57	

The percentage of metabolic syndrome is increasing with age with maximum (70 %) in age group 60-69 years and we have observed that maximum percentage of overt and subclinical hypothyroid patients were in age group of 30-39 years with 57.14 % (n=24) of metabolic syndrome.(Table 1)

Table 2: Distribution of subjects on the basis of disease

Hypothyroid	Metabolic syndrome			Non metabolic syndrome			Total
	Male	Female	Total	Male	Female	Total	
Overt	3	9	12(63%)	2	5	7 (37%)	19
Subclinical	9	27	45(56%)	18	18	36(44%)	81
Total	21	36	57	20	23	43	100

Out of total 100 subjects 19 were overt hypothyroid group and 81 in subclinical hypothyroid group. Among these groups Met Syn is almost equally distributed, 63 % in overt hypothyroidism and 56% in subclinical hypothyroidism. Whereas more number of females (n=9 and n=27) in overt and subclinical hypothyroid groups than male (n=3 and n=81). (Table 2)

In overt hypothyroid group, both T3, T4 are comparably decreased but TSH is significantly increased in both metabolic and non-metabolic syndrome group. In subclinical hypothyroid group, T3 and T4 are in normal range but TSH is raised in both metabolic and non-metabolic syndrome. (Table 3)

Table 3: Thyroid function parameter

		Sex group	T3 values	T4 values	TSH values
Overt hypothyroidism	Metabolic syndrome	Female (9)	0.67 ± 0.19	53.03 ± 5.18	15.46 ± 2.73
		Male (3)	0.81 ± 0.12	46.46 ± 4.87	18.71 ± 2.52
	Non metabolic syndrome	Female (5)	0.87 ± 0.03	51.24 ± 6.49	17.22 ± 2.84
		Male (2)	0.80 ± 0.09	55.45 ± 4.88	18.12 ± 5.66
Subclinical hypothyroid	Metabolic syndrome	Female (27)	1.67 ± 0.68	103.8 ± 19.81	12.89 ± 4.64
		Male (18)	1.79 ± 0.64	99.58 ± 21.09	13.98 ± 6.53
	Non metabolic syndrome	Female (18)	1.70 ± 0.54	108.1 ± 19.06	10.34 ± 3.53
		Male (18)	1.61 ± 0.33	106.1 ± 21.2	11.93 ± 4.29

In the present study we observed that out of total 19 overt hypothyroidism patients, 12 were having metabolic syndrome. Out of 81 subclinical hypothyroidism patients 45 were having Met Syn. Only 5 (42%) patients amongst overt hypothyroidism were showing 3 diagnostic criteria of Met Syn, 4 (33%) were showing 4 components, while remaining 3 (25%) was having all the 5 components of Met Syn in overt hypothyroidism. The 20 patients (45%) amongst subclinical hypothyroidism was having showing 3 diagnostic criteria of Met Syn, 15 (33%) were showing 4 components, while remaining 3 (22%) were having all the 5 components of Met Syn in subclinical hypothyroidism.

Among these combinations Met Syn was almost equally distributed 42% overt & 45% subclinical in 3 components; 33% in both overt & subclinical in 4 components and 25% overt & 22% subclinical in 5 components.

In overt hypothyroid cases T₃ values were found to be negatively correlated with waist circumference (WC), diastolic BP, FBS and TG level. There was positive correlation between T₃ level and all the parameters in subclinical hypothyroidism cases and was statistically significant correlation with FBS (p=0.03, r=0.24). T₄ values negatively correlated with FBS and TG level in overt hypothyroid group. Similarly in subclinical group there were negative correlation with WC, systolic and diastolic BP and statistically significant positive correlation with TG levels (p=0.04, r = 0.23).

TSH values shows negative correlation with WC, FBS, TG and HDL levels in overt hypothyroidism. In subclinical hypothyroid group negative correlation was obtained with HDL and significant positive correlation with WC (p=0.004, r=0.31.) and systolic BP (p=0.02, r=0.25).

4. Discussion

Thyroid hormones have a profound on energy homeostasis, lipid and glucose metabolism and BP^{10,11}. Thyroid hormones also have influence on various aspects of lipid metabolism including synthesis, mobilization and degradation¹². Thyroid hormone affect thermogenesis¹¹ and body energy expenditure, so low T3 and T4 may potentially lead to obesity and associated increased WC¹³. In the study of Roos *et al*¹⁴ showed positive relationship of low T3 and T4 with WC in both men and women. Serum level of TSH is a reliable index of the biological activity of thyroid hormones. Some studies showed adipocytes and pre-adipocytes expressed TSH receptors, TSH bounded with TSH receptors and induced pre-adipocytes to produce and release adipokines, some of them such as leptin played a very important role in the onset of metabolic syndrome and cardiovascular disease¹⁵. Researchers still argued the relationship between serum TSH and blood pressure in subjects with hypothyroidism⁹. Abnormal thyroid function can increase peripheral vascular resistance and activate the sympatho-adrenal system, leading to increase in BP¹⁰. Our findings are also in agreement with some researchers like Salkiti *et al*¹⁶, Waterhouse *et al* and Nagasaki *et al*¹⁸ who found that TSH positively correlated with systolic BP and or diastolic BP. Waterhouse *et al*, found that with TSH increasing by 1 mIU/L, systolic BP increased by 1.53 mm Hg, but no correlation was found between TSH and diastolic BP¹⁷. They also found, when TSH was within normal range; TG increased by 0.115 mg/dl with every 1 mIU/L increase in TSH. In the study by Park *et al*, correlation analysis showed a positive relationship of TSH with BP, in post menopausal women¹⁹. Park *et al*²⁰ found that higher levels of TSH predict the prevalence and risk of metabolic syndrome in overt hypothyroidism and subclinical hypothyroidism²⁰. Pirjo *et al*²¹ found that the prevalence of metabolic syndrome increase with age in both men and women.

5. Conclusion

Most studies available in literature concerning hypothyroidism show their association between the thyroid function and components of metabolic syndrome. A study on metabolic syndrome in thyroid dysfunction population may help us to know the magnitude of overlap of these two groups and may highlight the importance of metabolic syndrome parameter tests to identifying metabolic syndrome in hypothyroid cases. This can lead to proper planning and adequate management strategies, resulting in significant reduction in cardiovascular morbidity and mortality due to metabolic syndrome by effective management.

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