DOI: https://doi.org/10.53350/pjmhs2216842

ORIGINAL ARTICLE

Spectrum of Thyroid Dysfunctions in Metabolic Syndrome in a Tertiary Care Hospital of Karachi, Pakistan

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ABSTRACT

Aim: To determine the frequency and spectrum of thyroid dysfunction in patients with metabolic syndrome.
Study design: Observational and descriptive study
Place and duration of Study: Department of Medicine, Dr. Ruth Kum Pafu Civil Hospital Karachi from 1st January 2020 to 31st December 2020.
Methodology: Four hundred and sixty eight patients were enrolled. Every patient was thoroughly examined and anthropometric measurement done (height, weight, waist circumference) and body mass index was calculated. Fasting blood samples were collected to measure fasting blood glucose, lipid profile and thyroid profile (Thyroid stimulating hormone, Free T_4 and Free T_3).
Results: There were 186 (39.65%) males and 282 (60.34%) females. Patients aged between 30 to 69 years mean age was 48 years, mean BMI was 30.07. Thyroid profile including TSH, FT_3, FT_4 were normal in 246 (52.58%) patients, hyperthyroidism in 48 (10.34%) patients, subclinical hypothyroidism in 105 (22.41 %) and hypothyroidism in 69 (14.65%) patients. Results suggest positive correlation between BMI, TG, and thyroid profile while negative correlation between HDL cholesterol and thyroid profile.
Conclusion: The positive correlation between thyroid dysfunction and metabolic syndrome. So it is suggested that patients with metabolic syndrome may require a thyroid profile which results in early detection of disease and timely treatment.
Keywords: Thyroid dysfunction, Body mass index, Metabolic syndrome, Hypothyroidism, hyperthyroidism

INTRODUCTION

Thyroid hormone is basically of two types triiodothyronine (T_3) and thyroxine (T_4) released from the thyroid gland and TSH (thyroid stimulating hormone) is released from the pituitary gland and it stimulate the thyroid gland to produce T_3 and T_4. It has been observed that thyroid hormone can affect on fatty acid and cholesterol synthesis[1] and thyroid dysfunction can be associated with components of metabolic syndrome such as obesity, increased waist circumference, impaired fasting and increased triglyceride (TG) and high density lipoprotein (HDL) cholesterol[2]. Metabolic syndrome in different populations can be around 20% in different studies[3,4]. Metabolic syndrome consist of central obesity, raised blood pressure, increase glucose levels, increased triglyceride and decreased HDL cholesterol as per International Diabetes Federation (IDF) and National Cholesterol Education Program (NCEPT) - Adult Treatment Panel III (ATPIII; NCEPT-ATPIII)[4,5].

Thyroid dysfunction, especially hypothyroidism is commonly observed in many studies and it is associated with the components of metabolic syndrome; Khatiwada et al[6] find 31.1% thyroid dysfunction in patients with metabolic syndrome. Hypothyroidism and metabolic syndrome are independent risk factors for cardiovascular disease and both presence increases the risk of cardiovascular events[7]. Thyroid dysfunction is needed to be performed in people with metabolic syndrome who are at the risk of developing cardiovascular events. Thyroid dysfunction may be of subclinical hypo and hyperthyroidism and clinical hypo and hyperthyroidism. A meta-analysis from Europe also proves to be undiagnosed hypothyroid patients in the general population.[8] Hypothyroidism is also associated with poor prognosis of congestive cardiac failure[9].

Because of increased risk of cardiac abnormalities and its association with infertility, a study conducted on patients with metabolic syndrome significantly showed an association of obesity with subfertility and subclinical hypothyroidism; in those patients timely start of treatment thyroxine increases the chance of fertilization[10]. The purpose of this study was to assess the frequency and spectrum of thyroid dysfunction in patients with metabolic syndrome which will help in timely management and prevention of complications.

Received on 12-03-2022
Accepted on 22-07-2022

MATERIALS AND METHODS

The current study was conducted in the Medical Department of Dr. Ruth Kum Pafu Civil Hospital Karachi from 1st January 2020 to 31st December 2020. Before the start of data collection an ethical review certificate (ERC) was taken from IRB (institutional review board) of Dow University of Health Sciences Karachi. Every participant was given informed consent on prescribed proforma.

Individuals who visited the medical OPD of the above said hospital were enrolled after meeting the inclusion criteria. Age less than 20 years, pregnant and lactating mothers, known cases of hypo or hyperthyroidism and clear history of metabolic diseases such as hyperlipidaemia, diabetes mellitus were excluded. Every participant were thoroughly examined and bio data were collected as age, sex, predisposing illness, height, weight were calculated, blood pressure were measured after 10 min of rest with appropriate cuff size. Anthropometric measurements of height in cm and weight in kg were calculated by barefoot with light clothes. BMI was calculated by weight and height formula. On fasting status samples were collected for FBS, TG, HDL cholesterol, TSH, FT_3 and FT_4.

Definition of subclinical hypo and hyperthyroidism and clinical hypo and hyperthyroidism were used as follows: Thyroid profile including TSH, FT_3, FT_4, measurement done by radioimmunoassay method and reference ranges of TSH was 0.4 to 4.2µm/L, FT_3 (1.4-4.4pg/ml), FT_4 (0.8-1.8ng/dl). TSH measurement above 10µm/L labelled as hypothyroidism while in between 4.4 to 10 µm/L as subclinical hypothyroidism and below 0.005µm/L as clinical hyperthyroidism. Same rule applied for FT_3 and FT_4.[11] Metabolic syndrome was defined by well accepted criteria[4,5]. Statistical analysis done on SPSS-26. Between groups BMI, age, TG, HDL, TSH, FT3 and FT4 were compared by Pearson's coefficient and through Pearson's calculator R and P values sought. P value less than 0.05 was considered statistically significant, and the odds ratio (OR) as well as 95% confidence interval (CI) were also calculated.

RESULTS

There 186(39.65%) males and 282(60.34%) females. Body mass index (BMI) ranges between 19.8 to 46.9 and our 69(14.65%) patients had BMI between 19.8 to 24.4 remaining 399(85.34%) patients were in ranges above 25.3 and average BMI in metabolic syndrome patients were 31.5. The patients were between the ages of 30 to 69 years and the average age was 48 years. Average BP was 141/94 mmHg and TG was higher in those having increased BMI and raised BP. TG cholesterol ranges between 77 to 600 and 387 (82.75%) patients were having more than 161 mg/dl. HDL cholesterol in our 436 (93.10%) patients was less than 39mg/ dl and average was 31.82 mg/dl. LDL cholesterol was higher in 150 (32%) patients and the average range was 131 mg/dl. FBS were more than 110 mg/dl in 290 (62.06%) patients and average was more than 165 mg/dl. TSH were normal in 246 (52.58%) patients, below 0.005 µm/L was seen in 48 (10.34%) patients, 105 (22.41%) patients were having TSH in between 4.8 and 8.32 µm/L while 69 (14.65%) patients were having TSH above 10.17 µm/L. FT_3 was less than 1.4 pg/ml were observed in 89 (18.96%) patients, 48 (10.34%) patients were having more than 4.5 pg/ml while 335 (71.55%) patients were having normal FT_3 values (1.4-4.4 pg/ml). FT_4 less than 1.2ng/dl were seen in 69(14.65%) patients, 44(9.48%) were having more than 1.9ng/dl while 355(75.86%) patients were having normal FT_4 values (1.2-1.9ng/dl). Waist circumference was more than normal as per National Cholesterol Education Program (NCEPT) - Adult Treatment Panel III (ATPIII; NCEPT-ATPIII) were observed in 432(92.24%) patients. Our patients mean BMI was 30.07, median 30.3 and mode 31.1 while TSH mean was 3.7, median 1.98 and mode 0.005. Spectrum of thyroid dysfunction in metabolic syndrome was calculated by Pearson's coefficient calculator and Pearson's R and P values were shown in Table 1. Results suggest positive correlation between BMI, TG, and thyroid profile while negative correlation between HDL cholesterol and thyroid profile. Thyroid abnormalities in metabolic syndrome were shown in Table 2. Results suggest 105 (22.41%) patients were having subclinical hypothyroidism, 69 (14.65%) patients were diagnosed as hypothyroidism and all were female. Hyperthyroidism was seen in 48 (10.34%) patients and normal thyroid function was observed in 246 (52.58%) patients. The results confirmed that 226 (48.27%) patients with metabolic syndrome had abnormal thyroid profile.

Table 1: Pearson's R Correlation with components of metabolic syndrome and thyroid profile (BMI, Triglycerides, HDL, TSH, FT_3 and FT_4)

Gender	BMI & TSH	BMI & FT3	BMI & FT4	BMI & TG	BMI HDL	TG & TSH	TG & FT3	TG & FT4
Male Pearson's R	0.3052	0.1468	0.0449	0.2761	- 0.0019	0.4143	0.0276	0.3065
P value	0.09	0.0449	0.767	0.63261	0.994	0.0042	0.81975	0.0386
Female Pearson's R	0.214	1	0.0964	0.2146	-0.3245	0.6325	1	-0.458
P value	0.07	≤0.00001	0.425	0.072311	.0056	≤00001	≤.00001	0.0005

Table 2: Thyroid abnormality in patients with metabolic syndrome

Gender	Subclinical hypothyroidism TSH (4.5 to 8.7) FT3 (Less than 1.4 pg/ml) FT4 (less than 0.8 ng/dl)	Hypothyroidism TSH (above 10) FT3 (Less than 1.4 pg/ml) FT4 (less than 0.8 ng/d	Hyperthyroidism TSH below 0.005 FT3 (more than 4.4 pg/ml) FT4 (more than 1.8 ng/d	Normal TSH (0.5- 4.2) FT3 (1.4- 4.4 pg/ml) FT4 (0.8 – 1.8 ng/dl
Male	36 (7.75%)	-	4 (0.862%)	149 (31.89%)
Female	69 (14.65%)	69 (14.65%)	44 (9.48%)	97 (20.68%)

DISCUSSION

This study showed that there was positive correlation between body mass index and thyroid stimulating hormone, body mass index and FT_3, boyd mass index and FT_4, results are comparable with a study by Patrícia de et al[12] in which every component of metabolic syndrome was compared with thyroid hormone and found positive correlation between abnormal thyroid function and metabolic syndrome. A study by Reinehr et al[13] found positive association of obesity with hypothyroidism which also supports our results as we found positive correlation of BMI with thyroid dysfunction. Hamlaoui et al[14] also found thyroid dysfunction in 59.3% patients; out of which hypothyroidism seen in 45.3% and hyperthyroidism in 14% of patients, prevalence of metabolic syndrome was seen in 48% of patients which were positively correlated with the components of metabolic syndrome. These results are comparable with our study.

We found thyroid abnormality in 226(48.27%) patients, 105(22.41%) patients were having subclinical hypothyroidism, 69(14.65%) patients were diagnosed as hypothyroidism and all were female. Hyperthyroidism was seen in 48(10.34%) patients. A large health examination studies on Chinese population for sex different sub clinical hypothyroidism shows female participants prevalence was 4.90% in comparison to male 2.26% but in our study we found slight higher prevalence in female 69(14.65%) and male 36(7.75%) patients[15]. A study by Cheserek et al[16] found subclinical hypothyroidism associated with metabolic syndrome in male workers and not in female workers which was against our findings in which both sex shows increase prevalence of sub clinical hypothyroidism. A study on adolescent population disfavoured our finding in which researchers did not find any association of subclinical hypothyroidism with metabolic syndrome but it was associated with abdominal obesity and raised blood pressure readings.[17] A study on depressed patients with subclinical hypothyroidism was associated more likely with metabolic syndrome than the patients without subclinical hypothyroidism which also favour our findings of subclinical hypothyroidism in metabolic syndrome patients.[18] In another study also finds the complex nature of association of hypo and hyperthyroidism with abnormal glucose metabolism and raised blood pressure reading which is comparable with our findings.[12] A study on thyroid and lipid metabolism finds a healthy association between subclinical hypothyroidism and increased total and LDL cholesterol and with decreased HDL cholesterol which also favour our positive correlation with TG and negative correlation with low HDL cholesterol.[19] Saluja[20] were seen thyroid abnormalities on 100 metabolic syndrome patients and found 37% subclinical hypothyroidism, 12% overt hypothyroidism and 2% were having hyperthyroidism and thyroid dysfunction was clinically significant in participants with increased waist circumference ; these data correlate with our observation of strong association between thyroid abnormalities and metabolic syndrome. Gyawali[21] also found 31.84% of thyroid dysfunction in patients with metabolic syndrome but could not be found with all components of metabolic syndrome.

It is found that thyroid dysfunction is strongly associated with metabolic syndrome and its components and it is recommended to keep an eye on thyroid functioning test in patients with metabolic syndrome which help in timely management and prevention of long term complications associated with thyroid abnormalities and medical illnesses seen in patients with metabolic syndrome.

CONCLUSION

There is positive correlation between thyroid dysfunction and metabolic syndrome. So patients with metabolic syndrome may require a thyroid profile which results in early detection of disease and timely treatment.

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