Original Article

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Association between Thyroid Stimulating Hormone with Components of Metabolic Syndrome in Postmenopausal Women

Biochemistry Section

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ABSTRACT

Introduction: Metabolic Syndrome (MS) identifies a group of metabolic disorders that includes glucose intolerance, central obesity, hypertension and dyslipidaemia that place the affected individual at exaggerated risk for developing disorder, in addition as exaggerated mortality from all causes.

Aim: To evaluate serum Thyroid Stimulating Hormone (TSH) levels and to determine the correlation between serum concentrations of TSH with components of MS among postmenopausal women with MS.

Materials and Methods: A cross-sectional observational study was conducted for the period of four months on 100 postmenopausal women between 45-65 years who attended Outpatient Department (OPD) of Obstetrics and Gynaecology, Adichunchanagiri Institute of Medical Sciences (AIMS), Mandya, Karnataka, India. A fasting blood sample was collected from all the subjects, serum was used for estimating Fasting Plasma Glucose (FPG), Lipid profile, and Serum TSH. Results were presented on Mean±SD (Standard Deviation) (Min-Max) and in Number (%). For the comparison of means, Analysis of Variance (ANOVA) test was used. Correlation was examined by determining Pearson correlation coefficient (r-value). A p-value <0.05 was taken as statistically significant.

Results: Among the study population, the dysfunction in thyroid gland was found in 35 (35%). The major thyroid dysfunction was found to be hypothyroidism (32%) and only three had hyperthyroidism (3%). Waist Circumference (WC), Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) were 98.2±12 cm, 128.84±13.65 mmHg and 79.2±9.2 mmHg, respectively. Fasting Blood Glucose (FBS), Triglyceride (TAG), High Density Lipoprotein (HDL) cholesterol (HDL-C) and TSH were 166.7±71 mg/dL, 125.94±90.67 mg/dL, 45.46±13.13 mg/dL and 3.35±2.01 mIU/L, respectively. Statistically significant positive correlation was observed between FPG (p=0.049) and both SBP (p=0.0008) and DBP (p=0.001) and negative correlation was observed between TAG, HDL and TSH but not statistically significant in women with hypothyroidism when compared to euthyroid. A statistically negative correlation was found with WC (p=0.001) and positive correlation was found with TAG (p=0.008) and TSH among women with euthyroid condition.

Conclusion: Hypothyroidism alters lipid levels and increases blood pressure leading to increased risk for cardiovascular disease (CVD). Together hypothyroidism and metabolic syndrome could increase the risk for CVD in postmenopausal women. Thus, assessing thyroid function in postmenopausal women with metabolic syndrome may aid in early detection of CVD risk and better clinical management among these patients and reduces the already existing high incidence of CVDs.

Keywords: Cardiovascular disease, Dyslipidaemia, Hypothyroidism, Thyroid dysfunction

INTRODUCTION

The MS identifies a group of metabolic disorders that includes glucose intolerance, central obesity, hypertension and dyslipidaemia that can put an individual at exaggerated risk for developing disorder, in addition as exaggerated mortality from all causes [1,2]. Oestrogen deficiency and alteration of oestrogen with androgen magnitude relation becomes the determining factor for the emergence of MS at menopausal transition [3]. Oestrogen deficiency alterations the lipid metabolism, are thought to be a substantial component for the risk of CVD in postmenopausal women [4], however there are several direct effects of oestrogen deficiency on body fat distribution (central obesity), insulin action, the arterial wall and on fibrinolysis that may influence cardiovascular risk. Thus, contributing towards increased prevalence of the MS in postmenopausal women compared with premenopausal women [3]. On the other hand, thyroid pathology is an additional risk factor for CVD, mediated by the results of thyroid hormones effect on lipid metabolism and BP [2]. Studies have reported that Insulin Resistance (IR) or hyperinsulinemia is associated with overt or subclinical hypothyroidism and MS in general population [1,4]. There is need to identify the hypothyroid status in postmenopausal women with components of MS, as the risk of CVD increases with hypothyroidism and MS.

However, the presence of an association between deranged TSH levels and metabolic derangement in postmenopausal women remains controversial and diagnosis of thyroid disease is difficult because of common symptoms that occur both in thyroid and ovarian dysfunction [4]. With this background, present study intended to see the correlation between serum concentrations of TSH with components of MS among postmenopausal women with MS in order to provide better clinical management among these patients.

MATERIALS AND METHODS

A cross-sectional observational study was conducted for the period of four months from November 2020 to Feburary 2021. Informed consent was obtained from all the study participants before intervention and Ethical Committee approval (no. AIMS/IEC/4864/2019-2020) was obtained from the institute. By simple random sampling method, 100 postmenopausal women who attended OPD of Obstetrics and Gynaecology between the age group of 45-65 years were involved in the study.

Inclusion criteria: Postmenopausal women who had at least one-year history of cessation of menses were included. Postmenopausal women were considered to have MS if they have any three or more of the following components, according to the NCEP ATP III Criteria [5].

Abdominal obesity: WC >88 cm.

Hypertriglyceridemia: Serum TAG level >150 mg/dL,

Low HDL-C: <50 mg/dL,

High blood pressure: SBP >130 mmHg and/or DBP >85 mmHg or on treatment for hypertension,

High fasting glucose: Serum glucose level >110 mg/dL or on treatment for diabetes.

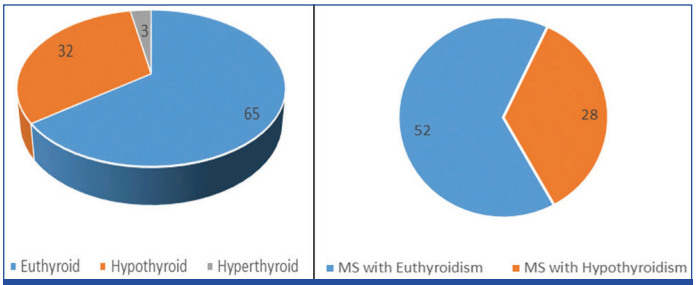
Exclusion criteria: Smokers, alcoholics, subjects with chronic or acute illness, inflammatory diseases and those who were on hormone replacement therapy were excluded from the study. Waist Circumference, measured at the point halfway between the lower border of ribs and the iliac crest in a horizontal plane and hip circumference was measured at the widest level over the greater trochanters. Both SBP and DBP recorded in sitting position from the right hand. A fasting blood sample was collected from all the subjects and serum was used for estimating FPG and Lipid profile (TAGs, total cholesterol, and HDL-C) by biochemical kit using Meril autoanalyser. Serum TSH measured by electrochemiluminescence immunoassay using Elecys-hormone analyser.

STATISTICAL ANALYSIS

Data generated was entered on Excel Sheet and analysis was carried out using the Statistical Package for the Social Sciences (SPSS) 18.0 software. Results were presented on Mean±SD (min-max) and in number (%). ANOVA test used for comparison of means. Pearson correlation coefficient (r-value) was used to determine the correlation. A p-value <0.05 was taken as significant.

RESULTS

The study population consisted of 100 postmenopausal women, with mean age of 62.11±9.51 years. Among them the thyroid dysfunction was found in 35 (35%). The major thyroid dysfunction was found to be hypothyroidism (32%) and only three had hyperthyroidism (3%) as shown in [Table/Fig-1]. In this study population, 80 patients fulfilled either three or four parameters of MS [Table/Fig-2]. Out of these 80 subjects, 28 had hypothyroidism (35%) and there were no hyperthyroidism patients in this group. WC, SBP and DBP were 98.2±12 cm, 128.84±13.65 mmHg and 79.2±9.2 mmHg, respectively. Similarly, biochemical parameters; FBS, TAG, HDL-C and TSH were 166.7±71 mg/dL, 125.94±90.67 mg/dL, 45.46±13.13 mg/dL and 3.35±2.01 mIU/L, respectively [Table/Fig-3]. Components of MS among different thyroid dysfunction group are shown in [Table/Fig-4]. WC (0.009) and blood glucose (0.012) was significantly different across the thyroid dysfunction groups. [Table/Fig-5] shows the correlation of components of MS with TSH in postmenopausal women with MS. Statistically significant positive correlation was observed between FBS (p=0.49) and both SBP (p=0.0008) and DBP (p=0.001) and there was negative correlation observed between TAG, HDL and TSH but not statistically significant in women with hypothyroidism when compared to euthyroid. There was statistically negative correlation and positive correlation was observed between WC (p=0.001), TAG (p=0.008) with TSH, respectively among women with euthyroid condition.



[Table/Fig-1]: Shows thyroid dysfunction among study participant.
[Table/Fig-2]: Shows thyroid dysfunction among study participant with metabolic syndrome. (Images from left to right)

Parameters assessed	Total number of postmenopausal women (n=100)	Total number of postmenopausal women with metabolic syndrome (n=80)	Total number of postmenopausal women without metabolic syndrome (n=20)	p-value
Age (years)	62.11±9.51	61.15±8.71	65.3±11.79	0.215
Average age at women attained menopause (in years)	47.83±5.71	47.66±6.20	48.7±2.71	0.766
TSH (mIU/L)	3.35±2.01	3.53±2.04	2.58±1.6	0.168
SBP (mm of Hg)	128.84±13.65	131.7±12.49	116.7±8.63	<0.0001**
DBP (mm of Hg)	79.2±9.2	80.45±9.42	74.2±5.34	0.022*
WC (cm)	98.2±12	100.42±12.33	91.05±9.2	0.009**
FBS (mg/dL)	166.7±71	177.28±68.49	126.2±47.21	0.012*
TAG (mg/dL)	125.94±90.67	156.8±17.48	146.25±13.42	0.042*
HDL-C (mg/dL)	45.46±13.13	45.58±6.28	49.7±7.66	0.043*

[Table/Fig-3]: Baseline details of postmenopausal women {total Postmenopausal women and Postmenopausal women with and without Metabolic Syndrome (MS)}.
*p-value <0.05 is considered as significant; **p-value <0.01highly significant ANOVA test

Parameters assessed	Euthyroid n=65	Hypothyroid n=32	Hyperthyroid n=3
SBP (mm of Hg)	131±11.65	127±14.96	120±20
DBP (mm of Hg)	78.4±9.91	81.68±7.18	81.33±4.16
WC (cm)	97.15±12.05	101.37±12.89	89.33±2.51
FBS (mg/dL)	161±61	176±77	181±17
TAG (mg/dL)	190±70	200±55	158±75
HDL-C (mg/dL)	50±16	51±11	49±1

[Table/Fig-4]: Details of components of Metabolic Syndrome (MS) among different thyroid dysfunction group.

Parameters assessed	Euthyroid (n=52)		Hypothyroid (n=28)	
	R	p-value	R	p-value
SBP (mm of Hg)	-0.065	0.647	0.596	0.0008*
DBP (mm of Hg)	0.125	0.377	0.584	0.001*
WC (cm)	-0.423	0.001*	-0.219	0.262
FBS (mg/dL)	0.109	0.441	0.375	0.049*
TAG (mg/dL)	0.363	0.008*	-0.087	0.659
HDL-C (mg/dL)	-0.240	0.086	-0.025	0.899

[Table/Fig-5]: Correlation of components of Metabolic Syndrome (MS) with TSH in postmenopausal women with Metabolic Syndrome (MS).
*p-value <0.05 is considered as significant

DISCUSSION

Females have a higher prevalence of MS than males worldwide and are highly age dependent. Prevalence of MS was 7% and 44% in people aged 20-29 and 60-69 years, respectively [3]. In South India, according to various studies the prevalence of MS, ranged from 22.1-41% [6]. The prevalence of thyroid dysfunction (5.9%) and hypothyroidism (4.6%) is also increasing in MS patients when compared to healthy population [7].

Moreover, thyroid dysfunction is known to be associated with MS, if left untreated, will increase the burden of Coronary Heart Diseases (CHD). Screening for thyroid should be pursued in menopause in order to treat hyperglycaemia and cardio-metabolic components. It underlies that assessment of thyroid function and lipid profile may become important in early identification risk and helps in management of postmenopausal women. Thus, study was intended to check whether there existed a relationship between the levels of thyroid hormone and components of MS in postmenopausal women.

Stachowiak G et al., in his review article coated that manifestations of symptoms in both menopause and thyroid disease are similar and this may cause difficulty in differential diagnosis on the line vasomotor

symptoms-thyroid disorders, particularly when postmenopausal women complain of weight gain, fatigue and mood swings [8].

In the present study, population (n=100), 80 postmenopausal women fulfilled either three or four parameters of Ziaei S and Mohseni H in their study conducted in Iran reported the prevalence of MS 39.09% [9]. Study by Uma MA et al., reported that prevalence of MS among males was 46.7% (n=43), among females, it was 53.3% (n=49) and the female participants were in the age group of 61-70 years, indicating a female predominance [10]. The increased prevalence of MS in postmenopausal females can be attributed to decreased HDL-C, increased abdominal obesity, hyperandrogenism and Insulin Resistance (IR) [11].

In the present study, among 100 postmenopausal women, 65 were in euthyroid state, 35 had hypothyroidism and only 3 had hyperthyroidism. Study also identifies thyroid dysfunction in postmenopausal women with components of MS; hypothyroidism (35%). Study done by Uma MA et al., reported thyroid dysfunction in 18.47% (n=17) among the study population; subclinical hypothyroidism was seen in 14.13% (n=13), and overt hypothyroidism was seen in 4.34% (n=4) among MS patients [10]. Similar to present study, none of cases was present on either overt or subclinical hyperthyroidism in their study. A study by Gyawali P et al., done including both male and female participants in Kavre district of central Nepal reported thyroid dysfunction in 31.84% of MS patients, the most common dysfunction was subclinical hypothyroidism (29.32%) [12]. Other studies in Indian done by Kota SK et al., and Shantha GP et al., also reported the prevalence of hypothyroidism as 26% and 29.3% respectively among people with MS [13,14].

The mean value of TSH level of postmenopausal women with MS in present study was slightly elevated than postmenopausal women without MS but it was not statistically significant, which suggests some degree of thyroid dysfunction in such patients. The study by Gyawali P et al., reported the TSH level above the reference range for normal population in and observed significantly higher TSH level in MS patients as compared to controls [12].

In the present study, it has been observed that among postmenopausal MS patients with hypothyroidism state have mean values of DBP, HDL-C, WC and TAG have higher compared to euthyroid patients as shown in [Table/Fig-4].

In this study, correlation between TSH and each component of MS was studied. Statistically significant positive correlation was observed between FBS (p=0.049), both SBP (p=0.0008) and DBP (p=0.001). There was negative correlation observed between TAG, HDL and TSH but no statistically significant in women with hypothyroidism when compared to euthyroid. There was statistically negative correlation and positive correlation between WC (p=0.001), TAG (p=0.008) and TSH respectively among women with euthyroid condition. Thyroid hormones affect lipid metabolism and thus alters the components of MS. In the present study among hypothyroid cases there was negative relation between TSH and both TAG and HDL cholesterol but not statistically significant this could be because small sample size in the study.

MS includes cluster of diseases, which elevates the risk factors for the development of CVD. Hypertriglyceridemia and elevated abdominal obesity accounts for IR, which per se increases risk of diabetes mellitus and cardiovascular events.

Limitation(s)

As the sample size was small, it was difficult to generalise the results to a larger population and only serum TSH was analysed.

CONCLUSION(S)

As the ageing process occurs there are some changes which occurs in the body system controlling mechanism. Consequently, thyroid hormone levels may show variations reflected by TSH level in elderly people, more in postmenopausal women. Higher prevalence of hypothyroidism in postmenopausal women with MS as observed in present study may have an ill effect on cardiovascular health. Hypothyroidism results in derangement of lipid levels and increases BP leading to increased risk for CVD. Both hypothyroidism and MS could increase the risk for CVD in postmenopausal women. Thus, assessing thyroid function which may aid in early detection of CVD risk among postmenopausal women with MS also helps in better clinical management and reduces the already existing high incidence of CVDs among these patients.

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