(International Print/Online Journal)

SJIF IMPACT FACTOR: 4.617
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 2, Issue 5, Page No: 303-307
September-October 2019

IJMSCR

Correlation between Thyroid dysfunction and Dyslipidemia - Cardiovascular Risk

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

ABSTRACT

Background – Thyroid function regulates a wide array of metabolic parameters. Thyroid function significantly affects lipoprotein metabolism as well as some cardiovascular disease (CVD) risk factors.[1,2] A linear increase in total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C) and triglycerides (TGs) and a linear decrease in high-density lipoprotein cholesterol (HDL-C) levels has been observed with increasing TSH [3]. So, aim of this study is to study the correlation between Thyroid hormone dysfunction and dyslipidemia (alteration in lipid profile) risk factor for Cardiovascular diseases.

Materials & Methods – This Observational study included about 100 patients attending the outpatient department of clinical Biochemistry, IGGMC, and Nagpur. All patients who were attending biochemistry OPD for thyroid hormonal tests ie estimation of T3, T4 & TSH were selected for this study. History was taken as per designed proforma and consent form was obtained. Their Blood samples was analyzed for thyroid profile as well as lipid profile test ie Serum cholesterol, Triglycerides, HDL, and LDL & VLDL in clinical Biochemistry Laboratory. Thyroid tests was run on Elisa reader & washer while Serum Cholesterol, Triglycerides, HDL, LDL & VLDL tests was done on Autoanalyser EM 460. Serum values of Thyroid stimulating hormone (TSH), thyroxine (T4) and tri-iodo thyronine (T3) were assayed by ELISA tests and compared with lipid Profile tests and values were compared & correlated. The data was analysed & Student's T-test was used for the calculation. $P < 0.05$ was considered significant.

Result – Our results shows positive correlation between Serum TSH (Mean=4.63) and serum cholesterol level (Mean= 182) as well as serum Triglycerides,LDL and VLDL level (Mean 163,100,32) while TSH shows negative correlation with HDL (Mean=48) .This positive correlation was found to be statistically significant between TSH and Serum cholesterol, Triglycerides,LDL & VLDL . Similarly vice versa with T3 and T4

Conclusion – Results of our study indicates how the risk factors for coronary heart disease ie lipid profile affected by alteration in the level of Thyroid hormones in the body. This study showed a significant increase in cholesterol,Triglycerides,HDL & LDL in patients with hypothyroidism. So early screening of thyroid patients for lipid profile must be advised to prevent future cardiovascular related disorders & its further complications.

Keywords: Lipid Profile(Dyslipidemia), Cardiovascular Risk ,Thyroid dysfunction

INTRODUCTION

Lipid Profile one of the marker of cardiac risk factor include Cholesterol,Triglycerides,LDL & VLDL, while HDL has protective role in Heart diseases.[1,3] There is alteration in lipid profile ie dyslipidemia observed in thyroid dysfunction . Thyroid hormones regulate different body metabolism including lipid metabolism.[4,5] Thyroid hormones induce the 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, which is the first step in cholesterol biosynthesis.So hyperthyroidism causes increase level of cholesterol. Triiodothyronine (T_3) upregulates LDL receptors by controlling the LDL receptor gene activation. Furthermore, T_3 controls the sterol regulatory element-binding protein-2 (SREBP-2), which in turn regulates LDL receptor's gene

expression [6]. T_3 has also been associated with protecting LDL from oxidation [7].

Thyroid hormones can influence HDL metabolism by increasing cholesteryl ester transfer protein (CETP) activity, which exchanges cholesteryl esters from HDL_2 to the very low density lipoproteins (VLDL) and TGs to the opposite direction [8,16,17]. In addition, thyroid hormones stimulate the lipoprotein lipase (LPL), which catabolizes the TG-rich lipoproteins, and the hepatic lipase (HL), which hydrolyzes HDL_2 to HDL_3 and contributes to the conversion of intermediate-density lipoproteins (IDL) to LDL and in turn LDL to small dense LDL (sdLDL) [9, 10,19,20].

So, hypothyroidism is one of the most common causes of secondary dyslipidemia. Therefore, before starting hypolipidemic therapy, the evaluation of thyroid function is needed.

Objectives of the study

The aim of this study is

i) To study the correlation between Serum T3,T4 & TSH with Renal function test ie Serum cholesterol, Triglycerides, HDL,LDL & VLDL level

ii) To study correlation of Thyroid hormone dysfunction and cardiovascular diseases so that early screening and prevention of heart diseases in thyroid patients can be advised

Method of collection of data &selection of subjects:

100 patients attending the outpatient department of clinical Biochemistry, IGGMC, and Nagpur were selected for study. 5 ml of Fasting blood sample was drawn from patients who were attending biochemistry OPD for thyroid hormonal tests ie estimation of T3, T4 & TSH. History was taken as per designed proforma and consent form was obtained. Their Blood samples was analysed for thyroid profile as well as Lipid Profile test ie Serum cholesterol, Triglycerides, HDL,LDL & VLDL in clinical Biochemistry Laboratory to know status of kidney function tests .

Thyroid profile would be done in all patients who fulfill the inclusion criteria. Informed consent was obtained from all patients. Detailed clinical history and clinical examination were undertaken with preference to thyroid and cardiovascular diseases.

Thyroid tests was run on Elisa reader & washer while Serum cholesterol, Triglycerides, HDL, LDL & VLDL tests was done on Autoanalyser EM 460. Serum values of Thyroid stimulating hormone (TSH), thyroxine (T4) and tri-iodo thyronine (T3) were assayed by ELISA tests and compared with Serum cholesterol, Triglycerides, HDL, LDL & VLDL tests and values were compared & correlated. The data was analysed & Student's T-test was used for the calculation. $P < 0.05$ was considered significant.

Methods

For Serum Cholesterol Estimation - Kit based on CHOD-POD method (Autoanalyser)

(Normal range – 150 mg% to 200 mg %)

For Serum Triglycerides Estimation - Kit based on GPO method (Autoanalyser)

(Normal range – 130 to 200 mg %)

For Serum HDL-Chol Estimation – Kit based on Precipitation method (Autoanalyser)

(Normal range – 35 mg% to 60 mg %)

For Serum VLDL & LDL Estimation - Friedwald Formula

VLDL = TG/5 & LDL = CHO – (HDL+VLDL)

For T3, T4, TSH – Immunoassay Elisa kit method on Elisa Reader & Washer

Normal Range –T3 - 0.52 to 1.85 ng/ml, T4 - 5 to 15 ug/dl, TSH – 0.39 to 6.16 uIU/ml

Analysis was carried on Autoanalyser EM – 460 in clinical Biochemistry lab,IGGMC for Serum cholesterol, Triglycerides, HDL,LDL & VLDL while Elisa Reader for Thyroid tests . All estimations was done & their values were compared & correlated.

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Results

Table 1: Mean Values of thyroid test & Lipid Profile Test

Total (100)	T3	T4	TSH	CHO	TG	HDL	VLDL	LDL
Mean	1.0427	6.611	4.634	182.01	163.97	48.57	32.794	100.646
S. D	0.340	2.605	4.706	56.79	55.793	9.748	11.158	56.356

Table 2: Positive & Negative Correlation of Thyroid test with Lipid Profile test

Correlation	CHO	TG	HDL	VLDL	LDL
T3	-0.62075	-0.49634	0.511922	-0.49634	-0.61585
T4	-0.64154	-0.46037	0.49117	-0.46037	-0.63941
TSH	0.756942	0.547646	-0.51238	0.547646	0.743021

Table 3: Student's T test (P <0.05 was considered significant.)

p values	CHO	TG	HDL	VLDL	LDL
T3	<0.0001	<0.0001	<0.00001	<0.00001	<0.00001
T4	<0.0001	<0.0001	<0.00001	<0.00001	<0.00001
TSH	<0.0001	<0.0001	<0.00001	<0.00001	<0.00001

Discussion

Our results shows (Table 2) positive correlation between Serum TSH (Mean=4.63) and serum cholesterol level (Mean= 182) as well as serum Triglycerides,LDL and VLDL level (Mean 163,100,32) while TSH shows negative correlation with HDL (Mean=48) .This positive correlation was found to be statistically significant between TSH and Serum cholesterol, Triglycerides,LDL & VLDL . Similarly vice versa with T3 and T4

Table 3 shows positive correlation was found to be statistically significant (P value less than 0.005) between TSH and Serum cholesterol, Triglycerides, LDL & VLDL. Similarly vice versa with T3 and T4. These findings similar to findings of Canaris GJ, Manowitz NR, Mayor G,et al showing hypothyroid patients have increased levels of TC and LDL-C [3]. While in another study by Asvold BO, Vatten LJ, Nilsen TI, Bjoro T et al (4) found decrease in HDL-C levels in hypothyroidism, again these findings also correlate with finding of our study.

Ochs et al, found a possible association, while Singh et al found no significant association.[22]

The data presented here clearly indicates how the biochemical markers of cardiovascular diseases may be affected by alteration in the level of TH in the body.[11,13,14,21] This study showed a significant increase in cholesterol,triglycerides,LDL in patients with hypothyroidism.

CONCLUSION

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This study is done to simplify the importance of interactions between thyroid function and cardiovascular risk. Hypothyroidism (increased TSH) correlated with increase Serum cholesterol, Triglycerides, HDL, LDL & VLDL level which are sensitive markers of cardiac failure, our study shows there is positive correlation which is statistically significant. So these results will help to increase clinical knowledge and enable clinicians to provide better management for their patients who have thyroid dysfunction in preventing further cardiovascular risk.

Patients who receive appropriate treatment for their thyroid disease have a decreased chance of developing cardiovascular diseases, so early screening of lipid profile test is advised in thyroid dysfunction.

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