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Atherogenic index of plasma and lipid profile in hypothyroidism.

KEYWORDS: Atherogenic risk, HDL-cholestrol, triglycerides.

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ABSTRACT

Objectives- *The aim was to study association of blood lipids and Atherogenic index of plasma between hypothyroid and controls.*

Material and Methods- *Thyroid function test and lipid profile were done in 50 hypothyroid cases and compaired with controls. AIP was calculated as log TG/HDL-C using CZECH online calculator of Atherogenic risk.*

Result - *We found there is significant elevation in levels of cholesterol, Triglycerides, LDL,HDL,VLDL in hypothyroidism as compared to control. The increase in mean levels of AIP in hypothyroid (0.280±0.108) was highly significant statistically (p value < 0.0001) as compared to controls (0.165±0.099). Our AIP results indicates controls may have moderate risk for CVD though they have normal lipid profile and need to be screened for dyslipidemia and AIP.*

Conclusion- *The Atherogenic index of plasma is significantly elevated hypothyroidism along with standard lipids, hence it can be used for risk assessment of atherosclerosis in hypothyroid patients.*

INTRODUCTION

Hypothyroidism is one of the most common endocrine disease. Hypothyroidism is a disease resulting from deficiency of thyroid hormone activity, which results from reduced secretion of both triiodothyronine(T3) and tetraiodothyronine (T4) irrespective of cause [1,2]. In India 42 million people are suffering from thyroid diseases,hypothyroidism being the commonest thyroid disorder [3]. The prevalence of hypothyroidism in India is 4 – 15 % as compaired to the western countries where prevalence is approximately 4%. The risk of hypothyroidism in females (15.8%) is three times more as compaired to the males (5.01%) [4]. The cause of hypothyroidism may be either pathlogy of thyroid gland itself known as primary hypothyroidism or due to deficiency in pituitary thyroid stimulating hormone (TSH) secretion.This results in decrease in thyroid hormones T3 & T4 concentration which stimulates secretion of pituitary hormone TSH resulting in increase in serum TSH level1.

Hyperlipidemias are of interest to the clinicians in the context of risk factors for ischemic heart disease and peripheral vascular disease. A strong association between the risk of coronary artery diseases (CAD), high levels of low density lipoprotein (LDL) cholesterol and low levels of high density lipoprotein (HDL-C) cholesterol has been well established [5]. Similarly high levels of triglycerides have been associated with an increased incidence of CAD. A lot of work has been done on the relationship between TG and HDL-C and it has been shown that the ratio of TG to HDL-C was a strong predictor of myocardial infarction [6].

Thyroid function significantly affects lipoprotein metabolism as well as some CVS risk factor [7,8,9,10]. Thyroid failure is seen to be commen in women and its prevalence rises with age. Various studies proved that hypothyroidism is a common cause of secondary dyslipidemia [10,11,12]. Clinical hypothyroidism is associated with premature atherosclerosis and increased prevalence of coronary disease. This is atleast partly due to the lipid abnormalities found in hypothyroidism [13].

Atherogenic index of plasma (AIP) is the ratio calculated as log TG/HDL-C, as is the new marker of atherogenicity. Hyper triglyceridemia will increase the activity of hepatic lipase which results in increase in HDL-C catabolism. Each degradation of 1mg of HDL-C will correlate with 2% increase in the risk of CHD [14,15]. According to work done on relationship between TG and HDL-C, and it has been shown that the ratio of TG to HDL-C is a strong predictor of myocardial infarction.

Therefore the present study was planned to evaluate the changes in indices of lipid profile parameters in hypothyroid patients and to correlate these values with controls. We use atherogenic index to better understand the risk for atherosclerosis and coronary heart disease in hypothyroidism.

MATERIAL & METHODS

The study was done at Govt. medical college & Hospital, Akola, Maharashtra. The study group comprised of 50 patients randomly selected from patients coming for thyroid function tests in the biochemistry diagnostic laboratory. There were 50 hypothyroid cases and 50 age & sex matched persons were taken as controls. Exclusion criteria was taken to rule out other diseases which can alter the results of study like cardiovascular diseases, renal dysfunction, type II diabetes mellitus and patients on antilipidemic drugs, women on oral contraceptives. All patients were screened for any drug history, especially drugs which can affect lipid profile or thyroid hormone levels. Informed written consent was obtained for venepuncture. Fasting Venous blood was withdrawn for investigations taking all aseptic precautions. Serum was separated and investigated either immediately or it was preserved at 2-80C.

A. Lipid profile was measured on fully automated biochemistry analyser XL640 by Transasia.

1. Serum total cholesterol was estimated Enzymatic CHOD/PAP Trinder,s method16.
2. Serum triglycerides were estimated by GPO-PAP Trinders method 17.
3. HDL Cholestrol was estimated by Liquizyme direct reagent kit 18.

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4. Friedewald,s formula was used for calculating LDL and VLDL cholesterol.
VLDL = TG/5 mg/dl.
LDL cholesterol = Total cholesterol – (HDL + TG/5) mg/dl.

5. Atherogenic index of plasma (AIP) = log TG/HDL-C15, by using CZECH online AIP calculator.

B. Serum T3, T4, TSH were measured by enzyme immunoassay on STAT FAX 4300 CHROMATE ELISA Reader using ERBA Thyrokits by ERBA Diagnostics Mannheim GmbH, Germany.

The data obtained were statistically analysed using Graph Pad In Stat Version 3.0. P value < 0.05 was considered as level of significance and analysed by using unpaired ´t´ test. Correlation between variables were estimated by Pearson's correlation coefficients.

RESULTS

Table 1 shows that number of females (36/50) were more as compared to males (14/50) and it is evident that hypothyroidism is much more prevalent in females as compared to males (female to male ratio 2.57). Maximum number of patients in our study was in the age group of 31 to 40 years with mean age in cases was 36.72±7.78 years and mean age in controls was 34.68±6,83 years.

Table 2 shows values of thyroid profile in cases and controls. The T3 and T4 values were significantly decrease in hypothyroid patients as compared to controls with mean T3 in cases as 0.462±0.290 ng/ml and T4 as 5.113±1.201 ng/ml. The seum TSH values were significantly raised (p value < 0.0001) in cases, was found to be 16.992±8.275 IU/ml in hypothyroidism.

All the lipids measured, namely total cholesterol, triglyceride, LDL, HDL and VLDL were found to be significantly elevated in hypothyroid patients when compaired with controls (p value < 0.0001). The increase in mean levels of Atherogenic index of plasma in hypothyroid (0.280±0.108) was highly significant statistically as compared to controls (0.165±0.099) [Table 3].

DISCUSSION

The present study was done to evaluate predictive values for atherosclerosis and CVS events by evaluating lipid profile and AIP in patients with hypothyroidism.

In our study majority of our patients were women (36/50) and in age group of 31-40. Hypothyroidism is 6 times common in women as compaired to men[4]. This is mostly attributed to the effect of estrogen. Estradiol has an antagonistic effect on hormones T3 and T4. The reason being estradiol competes with T3 andT4 for binding sites on the receptor protein[19].

In our study the levels of total cholesterol,TG, LDL, HDL & VLDL are found to be raised in patients of hypothyroidism. Hypothyroidism is a condition resulting from insufficient secretion of thyroid hormone. Thyroid hormone stimulates the metabolic activities. In lipid metabolism, thyroid hormone stimulates lipid metabolism and turnover. Hypothyroidism tends to have hyperlipidemia, which is a known risk factor for development of CVD.

Cholestrol,TG and LDL are found to be raised in hypothyroid patients as compaired to controls. This is due to LDL receptor activity, resulting in decrease catabolism of LDL and IDL[11]. Moreever decrease in LPL activity is found in overt hypothyroidism, decreases the clearance of TG-rich lipoproteins[20] . Thus this hypothyroid patients may also presents with elevated TG levels associated with increased levels of chylomacron and occationally fasting chylomicronemia[11].

HDL levels also seen to be raised in hypothyroidism. This is mainly due to increased concentration of HDL2 particles. There is decrease in catabolism of HDL2 mostly due to reduction in HL activity. As the activity of CETP decreases it results in reduced transfer of cholesteryl esters thus increasing HDL [21]evels[21].

On compairing the AIP of hypothyroid with healthy controls, there was significant elevation in AIP (p-value < 0.0001) in the hypothyroidism. Similar results were obtained by other authors[22]. As mean value for AIP in cases is highly raised (0.280±0.108); they have high risk for CVD. However in controls the mean value of AI (0.165±0.099) is also increased and have moderate risk for CVD. Even though they have normal lipid profile; AIP results indicates controls may have moderate risk for CVD and need to be screened for dyslipidemia and AIP.

The logarithmatically transformed ratio of TG to HDL-c closely correlated with the LDL-c partical size and could serve as an indicator of the atherogenic lipoprotein phenotype[23] . Based on researched data authors suggested risk of cardiovascular risk among patients as AIP value of -0.3 to 0.1 are associated with low risk, 0.1 to 0.24 with medium risk and above 0.24 with high risk for CVD[14] . AIP has higher predictive value for atherosclerosis and ratio of proatherogenic markers when divided by HDL-c, will increase the odds ratio value which means higher predictive value for atherosclerosis as compaired to proatherogenic markers alone[22].

CONCLUSION

Hypothyroidism is more common in middle age women.Our study also showed that the effect of hypothyroidism are associated with dysfunctions in lipid metabolism characterized by increase serum total chlolestrol, TG , LDL and HDL levels. Thus emphasizing the importance of screening of lipid profile in hypothyroid patients. So hypothyroid patients should be screened for increase in lipid parameters as it increases the risk of CVD. AIP can be easily calculated from standard lipid profile. AIP is significantly elevated in patients with hypothyroidism along with standard lipids, hence it can be used for risk assessment of atherosclerosis in hypothyroid patients. As a marker of lipoprotein particle size it adds predictive value beyond that of individual lipids.

Table 1
GENDER DISTRIBUTION AMONG CASES AND CONTROLS

GENDER	CASES		CONTROL	
	NO	%	NO	%
MALE	14	28	15	30
FEMALE	36	72	35	70
TOTAL	50	100	50	100

Table 2
THYROID PROFILE IN CONTROL AND HYPOTHYROID PATIENTS

PARAMETER	NORMAL RANGE	CONTROL (n=50)	HYPOTHYROID (n=50)	p-value
T3	0.51 – 1.58 ng/ml.	1.161±0.332	0.462±0.290	< 0.001
T4	5.3 – 12.1 g/dl.	8.720±2.331	5.113±1.201	< 0.0001
TSH	0.44 – 3.45 IU/ml.	2.560±1.271	16.992±8.275	< 0.0001

Table 3
LIPID PROFILE & AIP IN CONTROL AND HYPOTHYROID PATIENTS

PARAMETER	CONTROL (n=50)	HYPOTHYROID (n=50)	p-value
Total Cholestrol(mg/dl)	153.528±22.353	218.612±39.44	< 0.0001
Triglyceride (mg/dl)	118.405±17.912	189.015±35.132	< 0.0001
LDL (mg/dl)	86.461±22.801	145.392±32.629	< 0.0001
HDL (mg/dl)	35.418±5.803	43.386±7.341	< 0.0001
VLDL (mg/dl)	23.681±3.582	37.803±7.026	< 0.0001
AIP	0.165±0.099	0.280±0.108	< 0.0001

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