ORIGINAL RESEARCH PAPER

Biochemistry

RELATIONSHIP BETWEEN OVERT HYPOTHYROIDISM AND DYSLIPIDEMIA: A CROSS-SECTIONAL STUDY IN TRIBAL POPULATION OF BANKURA, WEST BENGAL

KEY WORDS:
Hypercholesterolemia, Hypertriglyceridemia, Hypothyroidism.

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ABSTRACT

Hypothyroidism is one of the most commonly encountered endocrine noncommunicable diseases, associated with various kinds of metabolic problems. Hyperlipidemia is one of the metabolic complications occurring in hypothyroidism. In present study, among tribal participants who were found to be suffering from uncompensated overt hypothyroidism, it was found that 73.3% participants were having hypercholesterolemia; whereas 70% hypothyroid cases were found to have triacylglycerol level above than the reference range. Female preponderance was noted in present study (~58%). It was also found that level of TSH had shown a significant positive correlation with total cholesterol (correlation = 0.404; p = 0.027) and triglyceride (correlation = 0.687; p < 0.001) but negative significant correlation with free T4 (correlation = -0.896; p <0.001). Triglyceride was in negative significant correlation with free T4 (correlation = -0.686; p < 0.001) as well.

INTRODUCTION

Thyroid gland is an important part of endocrinal system. The butterfly shaped gland, on the anterior aspect of neck produces mainly two hormones, named thyroxine (T4) and triiodothyronine (T3), which have extensive effects of cellular differentiation, development, metabolism etc. The gland is under direct influence of the pituitary, the master endocrine gland by the liberated hormone thyroid stimulating hormone (TSH). Hypothalamic thyrotropin releasing hormone induces secretion of TSH and TSH induces the secretion of thyroid hormones but T4 and T3 have a feedback inhibition on adenohypophysis which downregulates the production of TSH. Hypothyroidism occurs primarily due to decreased production or activity of thyroid gland or secondarily due to some pathologic causes of hypothalamic and pituitary inactivity. Hypothyroidism is one of the most common endocrine conditions in India (prevalence ~ 11%) [1]. Overt hypothyroidism is meant by TSH level >10 mIU/L (Reference ranges of TSH is <5.5 mIU/L) and serum free T4 (fT4) is subnormal or within normal range. Subclinical hypothyroidism is defined as TSH level 5.5- 10 mIU/L and free T4 is within reference range (0.7- 1.9 ng/dL). In different studies it was found that hypothyroidism was associated with hypercholesterolemia and hypertriglyceridemia and dyslipidemia is a well known high risk factor for cardiovascular disease. So keeping this in mind we had framed a study to delineate relationship between thyroid profiles and lipid abnormalities in the tribal population of Bankura, which might be helpful for the management of hypothyroid induced dyslipidemia.

OBJECTIVES

To assess total cholesterol (TC) and triglyceride (TG) level in tribal population in Bankura with overt hypothyroidism. TSH and fT4 were estimated to assess thyroid function.

MATERIAL AND METHODS

A cross-sectional, descriptive, tertiary care hospital based study was conducted in the Bankura Sammilani Medical College and Hospital, Bankura over a period of 6 months and 30 tribal patients, who were suffering from overt hypothyroidism and willing to take part in the study, were selected from Medicine out- patient department by systemic random sampling method.

Exclusion Criteria:

Acute illness, malignancy, any known thyroid disease or patient was on treatment for any thyroid disease, cardiac, hepatic or renal disease, drugs that alter the thyroid functions or lipid profiles (OCP, steroids etc.), any known metabolic or hormonal disorder.

Patients were interviewed with predesigned and pretested questionnaire. Five mL of blood was taken from each participant in plain vial for laboratory tests as per the standard protocol of blood collection and stored accordingly. Clotted blood was centrifuged @ 3000rpm for 10 min to get serum and ELISA tests for TSH and fT4 were done; total cholesterol, triacylglycerol were done by semiautomatic chemistry analyzer by end point method.
Reference range of TC is <200 mg/dL and TG <150 mg/dL; moderately increased triglyceridemia is 150- 200 mg/dL and hypertriglyceridemia is defined as >200 mg/dL.

RESULTS AND ANALYSIS

30 participants, who voluntarily wanted to take part of the study, were selected as per the inclusion and exclusion criteria, and the data were obtained by interviewing them. Data was codified in excel spreadsheet and statistical analyses were done with suitable statistical software package (SPSS. version 20).

In the present study, female participants (57.7%) outnumbered the males (43.3%).

Table- 1: Statistical distribution of different parameters

Attributes	Mean	Std. Deviation	Std. Error	Median
Age (years)	44.77	17.379	3.173	45
TSH (mIU/L)	22.06	9.287	1.696	19.30
TC (mg/dL)	228.17	45.114	8.237	224.50
TG (mg/dL)	187	49.411	9.021	194
fT4 (ng/dL)	1.0177	0.318	0.058	0.95

Table- 2: Statistical distribution of parameters according to gender

Gender		fT4 (ng/dL)		TC (mg/dL)		TG (mg/dL)		
		≤ 0.7	0.7- 1.9	≤ 200	> 200	≤ 150	150- 200	> 200
Male	**Count**	4	9	4	9	4	4	5
	%	**30.8**	**69.2**	30.8	**69.2**	30.8	**30.8**	**38.5**
Female	**Count**	7	10	4	13	5	4	8
	%	**41.2**	**58.8**	23.5	**76.5**	29.4	**23.5**	**47.1**
Total	**Count**	11	19	8	22	9	8	13
	%	**36.7**	**63.3**	26.7	**73.3**	30.0	**26.7**	**43.3**

Derangements of lipid profiles were more in females than males. Total cases of hypercholesterolemia were 73.3% and hypertriglyceridemia were (26.7 + 43.3) 70%.

Table- 3: Distribution of lipid parameters with respect to free T4

fT4 (ng/dL)	TC (mg/dL)		TG (mg/dL)		
	≤ 200	**> 200**	**< 150**	**150- 200**	**> 200**
≤ 0.7	1	10	0	2	9
	9.1%	**90.9%**	0.0%	**18.2%**	**81.8%**
0.7- 1.9	7	12	9	6	4
	36.8%	**63.2%**	47.4%	**31.6%**	**21.1%**
Significance (2- tailed)	0.104		**0.003 (highly significant)**		

Hypercholesterolemia and hypertriglyceridemia were more when fT4 level was subnormal; So overt hypothyroidism led more deterioration of the lipemic status of the patients (Table- 3).

Table- 4: Correlation table

		Age (years)	TSH (mIU/L)	TC (mg/dL)	TG (mg/dL)	fT4 (ng/dL)
Age	Pearson Correlation	1	0.546	0.003	0.157	-0.501
	Significance (2-tailed)		**0.002**	0.988	0.407	**0.005**
TSH	Pearson Correlation	0.546	1	0.404	0.687	-0.896
	Significance (2-tailed)	**0.002**		**0.027**	**< 0.001**	**< 0.001**
TC	Pearson Correlation	0.003	0.404	1	0.317	-0.279
	Significance (2-tailed)	0.988	**0.027**		0.088	0.135
TG	Pearson Correlation	0.157	0.687	0.317	1	-0.686
	Significance (2-tailed)	0.407	**< 0.001**	0.088		**< 0.001**
fT4	Pearson Correlation	-0.501	-0.896	-0.279	-0.686	1
	Significance (2-tailed)	**0.005**	**< 0.001**	0.135	**< 0.001**	

Age of the patients was in positive significant correlation with TSH and negative significant correlation with free T4. TSH showed significant positive correlation with TC and TG but negative significant correlation with free T4. Triglyceride was in negative significant correlation with free T4 as well.

DISCUSSION

Present study showed (Table- 4) a positive linear association between TSH and TC, TG which was corroborative with different studies by Asvolt et al.[2], Liberopoulos et al.[3], Tagami et al.[4], Pearce et al.[5], Al-Tonsi et al.[6], Canaris et al.[7], Lee et al.[8]. Hypothyroidism had been found to be a risk factor for secondary hypercholesterolemia.

In present study, >73% cases were found to be suffering from hypercholesterolemia and 70% cases were found to be suffering from hypertriglyceridemia; that was supported by a study done by Pearce.[9]

Thyroid hormones (T3 and T4) induce 3-Hydroxy-3-methylglutaryl Coenzyme-A reductase, which is the rate limiting step in cholesterol biosynthesis.[10] T3 upregulates LDL receptors by controlling the LDL receptor gene activation, which is done by the direct binding of T3 to specific thyroid hormone responsive elements (TREs).[11] T3 controls the sterol regulatory element binding protein-2, and thus in turn, upregulates LDL receptor's gene expression and protects LDL from oxidation.[12] So in hypothyroidism, LDL cholesterol clearance is reduced due to reduced expression of LDL receptors on the surface of liver cells. Overt hypothyroid patients may also present with elevated TG levels.[6, 8, 13, 14] In hypothyroidism, lipoprotein lipase activity in the adipose tissue has been found normal or decreased, in addition to decreased hepatic lipase activity resulting in normal or high levels of triglycerides.[14,15,16]The low activity of Cholesteryl Ester Transport Protein and particularly of hepatic lipase in hypothyroidism leads to reduced transport of cholesteryl esters from HDL_2 to VLDL, IDL and HDL_3.[17] Decreased LPL activity results in reduced conversion of VLDL into LDL and predisposes to increase in TG, IDL and VLDL with small, dense, highly atherogenic particles.[17] In some study it was found that a significant reduction in TC, HDL cholesterol, LDL cholesterol, and apolipoprotein-A1 and apolipoprotein -B after giving only thyroid hormone replacement in hypothyroid patients.[18] So total cholesterol level is also increased in hypothyroidism.

CONCLUSION

Hypothyroidism leads to develop hypertriglyceridemia and hypercholesterolemia. So in case of hypothyroidism with abnormally high levels of lipid profile, thyroid hormone replacement therapy is mandate and to be administered earlier before giving antihyperlipidemic drugs. In this connection, abnormal lipid profiles can be normalized only by thyroid hormone replacement therapy or with very low dose of antihyperlipidemic drugs.

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