Serum lipid profile in patients with thyroid disorders in central Nepal

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ABSTRACT

Thyroid dysfunction is a major public health problem among Nepalese population. Hence the study is aimed to find out the prevalence of thyroid dysfunction and to investigate the effect of it in serum lipids. Serum fT3, fT4, TSH, total cholesterol (TC), low density lipoprotein (LDL), high density lipoprotein (HDL) and triglycerides (TG) were measured using standardized assays. Overall thyroid dysfunction was detected in 25.7% of the study population with the higher prevalence among females. The distribution of overt hypothyroidism, subclinical hypothyroidism, overt hyperthyroidism and subclinical hyperthyroidism were 3.7%, 14.1%, 3.3% and 4.6% respectively. There was a positive association between hypothyroidism and TC>200, LDL>130 and TG>200mg/dl; 48.4% of hypothyroid patient had hypercholesterolemia and 32.3% had hypertriglyceridemia. The mean TC, LDL and TG levels were increased progressively with the increase in the serum TSH. It was noteworthy in this study that even a slight increase in serum TSH (between 6.2-10mIU/L) showed significant increase in serum lipid level. However there was no association among patients with hyperthyroidism and control group.

Keywords: Thyroid dysfunction, dyslipidemia, cardiovascular disease.

INTRODUCTION

Diseases of thyroid gland are amongst the most abundant endocrine disorder in the world second only to diabetes mellitus.[1] Thyroid diseases are primarily conditions that affect the amount of thyroid hormones being produced. Excess production leads to hyperthyroidism while diminished production leads to hypothyroidism.[2] Thyroid hormones are important modulator of intermediary metabolism. They affect synthesis, mobilization and degradation of lipids, although degradation is influenced more than synthesis. Consequently, thyroid dysfunction particularly hypothyroidism is associated with dyslipidemia which increase the risk of endothelial dysfunction, hypertension and cardiovascular diseases.[3]

Hypothyroidism, like obesity is one of the pathological conditions most frequently associated with disorders of lipid metabolism[4] and finally dyslipidemia which is one of the major risk factors of coronary disease.[5] Overt hypothyroidism is characterized by hypercholesterolemia and a marked increase in LDL because of a decreased fractional clearance of LDL by a reduced number of LDL receptors in the liver. However the controversy persists regarding the lipids level in subclinical hypothyroidism and its clinical significance. Moreover it is likely to be a risk factor for atherosclerosis and coronary diseases.[3,6]

Endocrine diseases are increasing worldwide. It has been estimated that 0.2% of death in Nepal results from endocrine disorders of which Iodine deficiency has been a major cause.[7] Thyroid disorders other than iodine deficiency disorders in the form of thyroiditis, hypothyroidism or autoimmune thyroid dysfunctions are on rise. The WHO estimates that substantially greater than 190 millions suffer from iodine deficiency disorders.[8] Nepal is an endemic area with regard to iodine deficiency and the nutritional iodine deficiency is thought to be prevalent in all Himalayan, sub-Himalayan and Terai regions of Nepal.[9] On one hand, the prevalence of thyroid disorder is very high in Nepal and on the other, studies focusing on the association between thyroid function markers and lipids are sparse. So, this study aims to estimate the prevalence of thyroid dysfunction and the relationship between thyroid dysfunction and serum lipids.

METHODS

The study was conducted in 567 patients visiting National Public Health Laboratory (NPHL), Teku, Kathmandu with suspicion of thyroid disorders from October 25, 2009 to January 24, 2010, among them 146 had thyroid dysfunction. One hundred subjects with normal thyroid function and no history of chronic diseases were taken as control. Detailed information of the patients was collected with the help of pre-test

Table-1: Frequency distribution of thyroid dysfunction according to age

Age group (years)	Overt hypothyroid Frequency (%)	Subclinical hypothyroid Frequency (%)	Overt hyperthyroid Frequency (%)	Subclinical hyperthyroid Frequency (%)
<20	2 (6.45)	2 (6.45)	7 (22.58)	-
20-40	8 (5.48)	22 (15.07)	7 (4.78)	20 (13.70)
40-60	6 (2.14)	41 (14.64)	5 (1.79)	6 (2.14)
60-80	5 (4.55)	15 (13.64)	-	-

Table-2: Frequency distribution of thyroid dysfunction according to gender

Gender	Overt hypothyroid Frequency (%)	Subclinical hypothyroid Frequency (%)	Overt hypothyroid Frequency (%)	Subclinical hypothyroid Frequency (%)
Male	8 (3.62)	20 (9.05)	5 (2.26)	6 (2.71)
Female	13 (3.76)	60 (17.34)	14 (4.05)	20 (5.78)

proforma that included age, sex and family or personal history of chronic diseases.

After 12 hours overnight fasting, 6ml blood was withdrawn by standard venipuncture, serum was separated and fT3, fT4, TSH, TC, HDL and TG were estimated according to the protocol mentioned in the test kits from HUMAN, Germany. Data were analysed using softwere program SPSS 11.5, and were expressed as mean ± SD and Pearson correlation coefficient.

RESULTS

Among the 567 patients suspected, 74.2% were euthyroid. Subclinical hypothyroidism was the most prevalent thyroid disorder overall (14.1%). There was a trend toward a higher prevalence of overt thyroid dysfunction in the age group <20 and that of subclinical thyroid dysfunctions in the age group 40-60 (Table- 1). Gender wise female had higher prevalence of all forms of thyroid dysfunctions (Table- 2).

Positive correlation was observed between TSH and TC (p=0.432), TSH and HDL (p=0.424) and TSH and LDL (p=0.472) in case of overt hypothyroidism and between TSH and TC (p=0.214) and TSH and LDL (p=0.277) in case of subclinical hypothyroidism (Table- 3). The serum TC and LDL levels in hypothyroid individuals (both overt and subclinical) were significantly higher than euthyroid subjects (p<0.001) but the levels were comparable between hyperthyroid and euthyroid group (Table- 4). The TC and LDL were also increased progressively with the increasing TSH values.

Table-3: Pearson correlation coefficient between fT3, fT4, TSH and lipid profile

		TC	HDL	LDL	TG
Overt hypothyroidism	fT3	-.056	.007	-.004	-.243
	fT4	-.360	-.085	-.387	.046
	TSH	.432*	.424*	.472*	-.304
Subclinical hypothyroidism	fT3	-.095	-.051	-.042	-.216
	fT4	-.111	.099	-.107	-.076
	TSH	.214**	.023	.277**	-.122
Overt hyperthyroidism	fT3	-.506	-.234	-.470	.354
	fT4	-.344	.261	-.422	.157
	TSH	.351	-.407	.361	.318
Subclinical hyperthyroidism	fT3	-.374	-.216	-.309	.086
	fT4	-.293	-.375	-.235	.231
	TSH	.213	.019	.274	-.217

**Correlation is significant at the 0.01 level (1-tailed), *Correlation is significant at the 0.05 level (1-tailed).

DISCUSSION

Thyroid dysfunction, along with a higher prevalence of goiter, is a major public health problem in Nepalese population as Nepal lies in an endemic iodine deficiency area.[7] In this study, the prevalence of hypothyroidism was slightly higher (17.8%) and of hyperthyroidism is slightly lower (7.9%) than that reported in eastern Nepal by Baral *et al*.[10] The prevalence of overt thyroid disorder was found to be higher in the age group <20 which is in accordance with the findings by Baral *et al*.[10] while that of subclinical thyroid disorder was found to be higher in the age group 40-60 years like that reported by Holowell *et al*.[11] This could be due to lesser number of elderly patients being referred for the test. Further the clinical features of thyroid disorders tend to be non-specific and fewer in elderly compared to younger patients and the symptoms are often confused with normal ageing process and coexisting diseases[12] which may result in greater number of elderly patients being undiagnosed.

This study found higher prevalence of thyroid dysfunction in females, as it was shown by generalized odds ratio which is 1.34 (ie. >1), and satisfied the test to be confirmed that females will be more likely to have a thyroid dysfunction as compare to males which is in accordance with the study by Sisk[13] that may be due to a sex difference in the prevalence of autoimmune diseases.[14] There was an association between hypothyroidism and TC>200, LDL>130 and TG>200mg/dl; 48.4% of hypothyroid patient had hypercholesterolemia and 32.3% had hypertriglyceridemia which is in accordance with the result of Cabral *et al*.[15]

Table-4: Comparison of mean lipid profiles between normal and thyroid dysfunction patients

	Overt hypothyroid	Subclinical hypothyroid	Normal	Overt hyperthyroid	Subclinical hyperthyroid
TCmg/dl	213.05±63.80 P=0.000	202.88±50.74 P=0.000	159.51±27.13	146.33±25.67 P=0.159	162.87±39.35 P=0.656
HDLmg/dl	39.86±9.45 P=0.747	42.24±10.51 P=0.009	39.19±8.78	39.67±9.21 P=0.974	45.44±11.29 P=0.010
LDLmg/dl	136.14±60.75 P=0.000	123.62±47.25 P=0.000	89.56±29.70	79.89±25.41 P=0.342	91.81±39.46 P=0.782
TGmg/dl	177.81±61.01 P=0.069	184.02±85.70 P=0.000	147.86±71.10	121.78±31.68 P=0.277	117.50±48.50 P=0.099

P value indicates the significance of t-test

Although overt hypothyroidism has always been associated with hypercholesterolemia, there is much controversy in association of subclinical hypothyroidism and hypercholesterolemia.[16] In this study, all the parameters of lipid profile i.e., TC, HDL, LDL and TG were found to be increased in subclinical hypothyroidism and the difference was statistically significant. Increase of total cholesterol and LDL can be attributed to the effect of thyroid hormone on expression of LDL receptors and CYP7A, a rate limiting enzyme in bile acid synthesis.[17] Decreased thyroid function not only increases the number of LDL particles but also promote LDL oxidation, thereby increasing the risk of atherosclerosis.[18]

HDL was increased in both overt and subclinical hypothyroidism however, the increase was significant only in case of subclinical hypothyroidism (p=0.009). Elevation in HDL cholesterol could be due to decreased activity of cholesteryl ester transfer protein and hepatic lipase.[19] TG level is also increased in both overt and subclinical hypothyroidism which is attributable to the decreased activity of lipoprotein lipase that is responsible for the clearance of triglyceride rich lipoprotein.[20] In subclinical hyperthyroidism, however, TC and LDL levels were slightly increased but not significant statistically. Despite the increased activity of HMG-CoA reductase, the cholesterol levels tend to be increased in hyperthyroidism due to augmented excretion of cholesterol by bile[17] together with enhanced receptor mediated catabolism of LDL particles.[18] Variations, generally, not very marked, observed in TG levels could be due to the action of thyroid hormone on VLDL. Overall both overt and subclinical hypothyroidism is associated with abnormal lipoprotein levels which can lead to cardiovascular diseases. It has been observed that the abnormal lipid pattern is fully reversed to normal by treatment with thyroxine so screening of dyslipidemic patient for thyroid abnormalities is necessary along with prudent substitution therapy to counteract the cardiovascular risk from dyslipidemia.

The prevalence of thyroid dysfunction is high in Nepal as compared to other countries and that the lipid profile is unfavorably altered in thyroid dysfunction. Dyslipidemia is one of the established risk factor for cardiovascular disease. Therefore, this study indicates that monitoring of lipid level in patients with thyroid dysfunction would be helpful in preventing cardiovascular diseases.

ACKNOWLEDGEMENTS

We would like to acknowledge everyone who were directly or indirectly involved in this study.

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