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Audit

Variation of total serum cholesterol among the patient with thyroid dysfunction

Risal P[1], Maharjan BR[1], Koju R[2], Makaju RK[3], Gautam M[4]

[1]Lecturer, Department of Biochemistry, [2]Assistant Professor**,** Department of Medicine, [3]Assistant Professor, Department of Pathology, [4]Professor**,** Department of Biochemistry, Kathmandu University School of Medical Sciences, Dhulikhel, Nepal

Abstract

Background: Thyroid hormone has its effect in the lipid metabolism. Thus, thyroid disorder is usually associated with the dyslipidaemia. Hypercholesterolemia is an established risk factor for the cardiovascular disease (CVD) and therefore in case of overt hypothyroidism which is associated with hypercholesterolemia, CVD is most likely to occur.
Objectives: controversies still persist about the hypercholesterolemia and sub clinical hypothyroidism. Hence, we conducted our study to elucidate the relation of thyroid hormone with cholesterol in different thyroid disorder.
Material and Method: All patients suspected of thyroid disorder within a period of one year were included in the study and free thyroxine-3 (fT3), free thyroxine-4 fT4, Thyroid Stimulating Hormone (TSH) and total cholesterol (TC) in the serum were estimated. Statistical analysis was carried out by using SPSS. 13.
Results: Among the 169 cases, 32.5% of the patients were having thyroid disorder. In which 8.3% were of hypothyroid, 7.1% were of sub clinical hypothyroid, 8.3% were of hyperthyroid, 7.7% were of sub clinical hyperthyroid and 1.2% cases were of pan hypothyroid. We observed significant negative correlation between TC & fT3($r = -0.226$, $p = 0.003$), significant negative correlation between total cholesterol & fT4($r = -0.197$, $p = 0.010$) and significant positive correlation between TC & TSH($r = 0.365$, $p = 0.000$). Total cholesterol was significantly raised in hypothyroidism (Mean ±SD 283±53, $p = 0.000$) in comparison to euthyroid population (mean ±SD, 195±58). But cholesterol was not significantly increased in sub clinical hypothyroidism (mean ±SD, 240±46)
Conclusion: Our results show that total cholesterol level in serum is affected by the blood thyroid hormone level. Therefore, screening for hypercholesterolemia could be useful in patients with hypothyroidism to reduce associated disease.

Key words: Thyroid hormone, Cholesterol, Nepal

Thyroid dysfunction is one of the major public health problems in Nepal. The detection of hyperthyroidism and hypothyroidism in hospital based thyroid screening of suspected patient in eastern part of Nepal was reported to be 13.68% and 17.19% respectively[1].

Relation between thyroid dysfunction and cardiovascular diseases has been a subject of interest for many clinical investigators for a long time. Overt hyperthyroidism and hypothyroidism is the established risk factor for Cardiovascular Disease (CVD) but the relation between Subclinical Hypothyroidism (SHT) defined as an elevated Thyroid Stimulating Hormone (TSH) with normal thyroid hormones (fT3, & fT4) and hypercholesterolemia related to cardiovascular risk is still controversial. Many research articles have been published supporting the role of SHT in CVD[2-3], in addition recently carried meta-analysis of selected population-based cohort studies also supported the role of both subclinical hyperthyroidism and hypothyroidism in CVD[4]. However there are evidences which showed the conflicting association of SHT with CVD[5, 6].

Thyroid has also important effects and influences in the Basal Metabolic Rate (BMR) and the metabolism of carbohydrate, lipid and proteins[7]. Hypothyroidism has been generally considered as cardiovascular risk factor in majority of studies, mainly because of its association with elevated Total Cholesterol (TC) and LDL-cholesterol. Hypercholesterolemia in hypothyroidism probably results from reduced catabolism of

Correspondence
Mr. Prabodh Risal
Department of Biochemistry
School of Medical Sciences, Kathmandu University
Dhulikhel Hospital, KUTH
E-mail: prabodh07@hotmail.com

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lipoproteins, a phenomenon that may be explained by a decreased expression of lipoprotein receptors[8]. Hence, it is important to see the relation of total cholesterol and thyroid dysfunction and further very few studies have been done in our region in this regard. We believe that the information derived from this research could be valuable to look over serum lipid profile including other cardiovascular risk factors in patient with thyroid dysfunction. The result can also be useful for screening thyroid dysfunction in the patient having high total cholesterol level in the serum.

Material and methods

This study was done in the department of clinical biochemistry, Kathmandu University Teaching Hospital, Dhulikhel Hospital, from January 2007 to December 2007. The study was approved by the ethical committee of the institution. Subjects in our study were with the suspected thyroid disorder. Prior verbal consent was taken before interviewing the subject. One hundred and sixty nine samples were collected during the period and analyzed for fT3, fT4, TSH, and total cholesterol. Thyroid function test was done with stax fax -2100, awareness company, U.S.A, using TFT kit supplied by RFCL Ltd, India. Reference ranges according to the manufacturer were 1.4 to 4.2 pg/ml, 0.8 to 2.0 ng/dl and 0.4 to 6.0 μIU/ml, respectively for fT3, fT4, and TSH. Serum total cholesterol was estimated with Chem-5 $plus_{V2,}$ Erba, mannheim, Transasis, biomedical pvt. Ltd. India, by enzymatic method using kit supplied by Accurex Biomedical Pvt. Ltd., India. ≤ 200 mg/dl desirable cholesterol was considered as reference range according to the manufacturer. Statistical analysis was done by using SPSS version 13.

Results

Among 169 cases obtained for thyroid screening of suspected patients at hospital form Jan - Dec 2007, 114 were euthyroid, 14 were hypothyroid, and 12 sub clinical hypothyroid, 14 were hyperthyroid, 13 were sub clinical hyperthyroid and 2 panhypothyroid (Table 1). Analysis of Pearson correlation coefficient for TC vs. fT3 and fT4 shows significant negative correlation and TC vs. TSH shows significant positive correlation (Table 2). Further, comparison of total cholesterol between euthyroid and hypothyroid shows significant increase in total cholesterol level in hypothyroid. Similarly, sub clinical hypothyroid also shows increased cholesterol level but were not significant statistically. But comparison of TC between euthyroid and hyperthyroid, and euthyroid and sub clinical hyperthyroid did not show discernible difference (Table 3). Chi square test done after categorizing different thyroid states into normocholesterolemia (Cholesterol < 200 mg/dl) and hypercholesterolemia (Cholesterol ≥ 200 mg/dl) showed highly significant association (table 4).

Table 1: Thyroid status and its occurrence

Thyroid condition	Frequency (%)	TSH Mean±SD	fT3 Mean±SD	fT4 Mean±SD
Euthyroid	114 (67.5)	1.84± 1.24	2.55± 0.83	1.11 ±0.23
Hypothyroid	14 (8.3)	39.87 ±17.86	1.09±0.82	0.36±0.25
Sub clinical hypothyroid	12 (7.1)	11.43±5.50	2.45±0.62	1.05±0.21
Hyperthyroid	14 (8.3)	0.49±1.09	6.00±1.68	2.12±0.48
Sub clinical hyperthyroid	13 (7.7)	0.52±0.76	2.40±0.91	1.05±0.41
Pan hypothyroid	2 (1.2)	1.20±0.14	0.50±0.56	0.68±0.11
Total	**169 (100)**			

Table 2: Correlation analysis between TC and $fT_{3,}$ $fT_{4,}$ TSH in total subjects

Parameter	Pearson Correlation	P-value
Total Cholesterol Vs fT_3	- 0.226	0.003
Total Cholesterol Vs fT_4	- 0.197	0.010
Total Cholesterol Vs TSH	0.365	0.000

Table 3: Independent Sample T test of TC between euthyroid Vs hypothyroid, sub clinical hypothyroid, hyperthyroid and sub clinical hyperthyroid

Parameter	N	TC Mean±SD	p- value
Euthyroid	114	195±58	
Hypothyroid	14	283±53	0.000
Sub clinical Hypothyroid	12	240±86	0.099
Hyperthyroid	14	184±77	0.626
Subclinical Hyperthyroid	13	199±54	0.804

Table 4: Cross Tabulation of thyroid disorder with cholesterol status

Description	Euthyroid	Hypothyroid	Subclinical Hypothyroid	Total
Normocholesterolemic (Cholesterol <200mg/dl)	71	0	4	75
Hypercholesterolemic (Cholesterol ≥200mg/dl)	43	14	8	65
Total	**114**	**14**	**12**	**140**

Pearson Chi- square 21.60, p value 0.000

Discussion

Among 169 subjects with suspected thyroid disorder, the distribution of hyperthyroid and hypothyroidism was same that is 8.3% and the subclinical hyperthyroidism and subclinical hypothyroidism was also almost similar that is 7.7% and 7.1% respectively. Thyroid dysfunction was altogether 32.5%. Similar hospital based study of Baral et al reported hyperthyroidism 13.68% and hypothyroidism 17.19% which is higher than our study[1]. However, epidemiological studies are necessary to provide authentic data about prevalence of thyroid dysfunction as this is a hospital based study and finding can not be generalized.

Our study revealed female male ratio of thyroid disorder to be 2.66 and female male ratio of hypothyroidism to be 1.80 which is lower to the study done by Vanderpump et al in population based study[9]. This shows females are more prone to have thyroid disorder. Also common age group of having thyroid dysfunction was 21-40 yrs in our study which is comparable to study by Baral et al in eastern Nepal[1].

Thyroid has important effect in the metabolism of carbohydrate, lipid and proteins. Level of serum total cholesterol is maintained by the level of thyroid hormone through its catabolism, by up regulating or down regulating LDL receptors. Our study has also revealed significant negative correlation between TC & fT3 (r =. - 0.226, p = 0.003), TC & fT4 (r = - 0.197, p = 0.010) and significant positive correlation between TSH and TC (r = 0.365, p = 0.000) which is comparable to the study done by Teixeira et al[10]. This positive correlation between thyroid hormone and total cholesterol suggests the role of hormone in enhancing lipid metabolism.

Hypercholesterolemia is associated with overt hypothyroidism but there is still some controversy regarding SHT and hypercholesterolemia. Many researches showing normal[11, 12] as well as elevated[13, 14] serum total cholesterol level in SHT have been published. In the cases of hyperthyroidism and subclinical hyperthyroidism, total cholesterol is comparable to the euthyroid[15].

Cholesterol was significantly higher (p = 0.00) in hypothyroidism compared to euthyroid. Cholesterol was also increased in subclinical hypothyroidism but was not statistically significant (p = 0.099). These findings are also similar to the finding of Teixeira et al. where total cholesterol was significantly high in hypothyroidism and high but not significant in subclinical hypothyrodism[10].

Incidence of cardiovascular disease is quite common which is proved by the fact that 43.01% out of 2048 admitted cases in medical ward of Shaheed Gangalal National Heart Centre in 2006/2007 were of coronary artery disease which is also in trend of rising from 2002 in which the incidence was 39.50%[16]. Thyroid dysfunction is one of the important causes of CVD. Thus, we can assume that thyroid disorder could be one of the causes of CVD in our population. However, further research in this area is essential to establish how strongly the relationship exists in our population. Therefore, screening of total cholesterol is

quite reasonable in patient with hypothyroidism and subclinical hypothyroidism in our setting to prevent cardiovascular diseases.

Conclusion

In conclusion, elevated cholesterol level in hypothyroidism and subclinical hypothyroidism can be important risk factor causing CVD. We, therefore, feel significant in screening of total cholesterol level in these patients which would help to prevent from associated CVD.

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