Pattern of Dyslipidemia in Hypothyroid Patients –A cross sectional study

KG Kibria,[1] MR Alam, [2] HK Paul,[3] M Fariduddin4 MA Hasanat[5]

[1] FCPS part-II examinee, Dept. of Medicine, [2]Associate Professor, [3] Associate Professor [4] Professor & Chairman, [5] Associate Professor, BSMMU, Dhaka, Bangladesh

Abstract:

Background: An association between thyroid dysfunction and dyslipidemia prevails. Levels of total cholesterol, low density lipoprotein cholesterol, triglycerides tend to increase as thyroid function declines. Objective: To find out the pattern of dyslipidemia in hypothyroid patients. **Methods:** Sixty cases were selected as a sample of convenience in this cross sectional study from in-patient department of Medicine and Endocrinology, BSMMU. Meticulous history taking and thorough clinical examinations were done. Report of lipid profile and thyroid function tests were recorded from patients file. All the information's were recorded in a pre-designed structured questionnaire. Collected data were classified, edited, coded and entered into the computer for statistical analysis by using SPSS. **Results:** Among the 60 cases, 43 (72%) were female; 17(28%) were male. Age range was 24-59 years with a mean age of 38.80 (±10.35) years. Majority 38(65%) were housewife, followed by service holder 11(18.33%), 08(13.3%) were business men and 02(3.3%) had other occupations. Majority 42(70%) patients were taking thyroxin. Mean Total cholesterol (TC), LDL cholesterol, Triglyceride (TG) and HDL were 222.20(±42.25); 138.63(±31.51); 243.36(±83.13) and 37.30(±5.12) respectably. **Conclusion:** All hypothyroid subjects had dyslipidemia. The present study indicated that hypothyroidism was associated with an abnormal lipid profile, especially with respect to the levels of total cholesterol and triglyceride.

Key words: hypothyroidism, dyslipidemia.

[BSMMU J 2013 ; 6 (2) : 156-160]

Introduction :

Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones, which in turn results in a generalized slowing down of metabolic process.[1] It is a common metabolic disorder in general population.[2] The thyroid dysfunction increases with age, especially in women.[3] Hypothyroidism is associated with many biochemical abnormalities. An association between thyroid dysfunction and dyslipidemia was first reported in 1930.[4] Levels of total cholesterol (TC) and low density lipoprotein (LDL) cholesterol tends to increase as thyroid function declines.[2] Decreased thyroid secretion greatly increase the plasma concentration of cholesterol because of decreased rate of cholesterol secretion in the bile and consequent diminished loss in the faeces due to decreased number of LDL receptors on liver cells.[5] Decreased activity of LDL receptors resulting in decreased receptor-mediated catabolism of LDL and LDL is the main cause of the hypercholesterolemia observed in hypothyroidism.[6] Thus hypothyroidism constitutes a significant cause of secondary dislipidemia.[7]

Serum concentration of high density lipoprotein (HDL) cholesterol. was reported to be higher among newly diagnosed hypothyroid patients whereas serum concentration of HDL cholesterol were significantly lower among euthyroid and previously reported hypothyroid cases who were on thyroid replacement therapy.[8] It is mainly due to increased concentration of HDL particles.[9] HDL cholesterol level was found reduced in some studies on hypothyroid patients.[9] Decreased thyroid secretion greatly increases the plasma concentration of triglycerides.[5] It is due to decreased activity of lipoprotein lipase (LPL), which results in decreased clearance of triglyceride lipoproteins.[2]

Multiple epidemiologic studies have demonstrated a strong relationship between serum cholesterol and

Address for Correspondence: Dr. Md. Rafiqul Alam, MBBS, FCPS, MD
Associate Professor, Department of Medicine
BSMMU, Dhaka. Tel: 01199156094 (cell)

coronary heart disease (CHD). Randomized controlled clinical trials have unequivocally documented that lowering plasma cholesterol reduces the risk of clinical events due to atheroselerosis.[10] So early diagnosis and proper management significantly reduce the mortality and morbidity of dyslipidemic cardiovascular diseases.

Many studies were done regarding the biochemical status of hypothyroid patients including lipid profile and its consequences in developed countries but there is no such study in our population. In our country hypothyroid cases are diagnosed late due to limited health facilities and many other reasons which may lead to more adverse consequences in our population. So, we have designed this study for evaluation of TC, HDL, LDL and TG level in hypothyroid patients.

Methods :

This Cross-sectional study was conducted in the Indoor and Outdoor patient Department (OPD) of Medicine & Endocrinology, Bangabandhu Sheikh Mujib Medical University from July 2012 to December 2012. A total of 60 cases were selected by convenient sampling. Clinically and biochemically diagnosed cases of hypothyroidism with age ranges between 12 to 60 years, irrespective of sex, whether or not on thyroxine were included. Patients with known secondary hypothyroidism, chronic renal failure, diabetes mellitus, liver diseases, pregnancy, were on lipid lowering medications and who did not give consent were excluded. Informed written consent was taken from the patients. Socio-demographic and relevant information were gathered through face to face interview, general medical condition of the patients was evaluated through history, physical examination and with the help of investigations. Data were collected in a predesigned structured questionnaire. After collection, data editing and clearing was done manually and the data were entered in a computer and analysis was done by using SPSS version 14.

Results :

Sixty patients were enrolled in the study; of them male were 17(28%) and female were 43(72%). Fourteen (23.3%) were in 21-30 years age group, 24(40%) were in 31-40 years age group, 08(13.3%) were in 41-50 years age group and 14(23.3%) were in 51-60 years age group. Mean age was 38.80(±10.35), and mean age range was 24-59 years. Majority 38(65%) were housewife, followed by service holder 11(18.33%), 08(13.3%) were business men and 02(3.3%) have other occupations (Table-I). Thyroxine was taken by majority 42(70%) patients (Table-II). Of patients in whom total cholesterol (TC) was ≤200 mg/dl, mean TSH was 6.79(±3.35); and in whom total cholesterol (TC) was >200 mg/dl, mean TSH was 7.94(±5.48). Patients having total cholesterol (TC) ≤200 mg/dl, mean FT4 was 7.38(±5.92), whereas having total cholesterol (TC) >200 mg/dl, mean FT4 was 6.94(±4.84) ($p<0.05$). That was statistically significant (Table-III). Those who had LDL level ≤130 mg/dl showed mean TSH 9.45(±4.48), whereas having LDL >130 mg/dl showed mean TSH 6.20(±4.75) ($p<0.05$). Patients who had LDL level ≤130 mg/dl, mean FT4 was 5.67(±5.25), whereas LDL level >130 mg/dl shoed mean FT4 8.53(±4.25). ($p<0.05$) (Table-IV). When TG level was ≤150 mg/dl mean TSH was 5.51(±3.31), but when TG level >150 mg/dl, mean TSH was 7.74(±4.97). Patients having TG level ≤ 150 mg/dl mean FT4 was 3.24(±3.05) whereasd having TG) level >150 mg/dl showed mean FT4 7.71(±4.84) ($p<0.05$; Table-V). Again who had HDL level ≤150 mg/dl, mean TSH was 5.51(±3.31), and having HDL >150 mg/dl showed mean TSH 7.74(±4.97) ($p<0.05$). Patients having HDL level ≤150 mg/dl, showed mean FT4 3.24(±3.05), whereas having HDL >150 mg/dl showed mean FT4 7.71(±4.84) ($p<0.05$; Table-VI). Mean ±SD total cholesterol (TC) was 222.20 (±42.25) (minimum 127 and maximum 331). Number of patients with total cholesterol >200 mg/dl was 40(66.7%). Mean LDL was 138.63 (±31.51) (minimum 77 and maximum 265). Thirty seven had LDL >130 mg/dl which was the cut-off value. Mean Triglyceride (TG) level were 243.36(±83.13) minimum were 141 and maximum were 617. Cut of value >150 mg/dl were 55(91.67%) Mean HDL level 37.30(±5.12) Minimum were 28 and maximum were 48. Cut of value >35 mg/dl were 36(60%) (Table-VII).

Discussion :

Though Iodine deficiency is endemic in Bangladesh, the magnitude of thyroid problem and its consequences is not-entirely known and the exact relationships to other

is a clinical state resulting from an insufficient amount of circulating thyroid hormone to support normal body function. It may exist in utero or develop in infancy, childhood or even in adult life. This is a cross-sectional study, was conducted to compare lipid profile status in hypothyroid patients.

Majority 42(70%) patients were taking Thyroxine and 18(30%) patients were not taking thyroxine. Mean ±SD TC were 222.20(±42.25), range 127-331, Total cholesterol (TC) level >200 mg/dl were in 40(66.7%). Mean LDL were 138.63(±31.51), range 77-265. Cut of value >130 mg/dl were 37(61.7%).Mean Triglyceride (TG) level were 243.36(±83.13), range 141-617. Cut of value >150 mg/dl were 55(91.67%). Mean HDL level was 37.30(±5.12), range 28-48. Cut of value >35 mg/dl were 36(60%). From this study we can not clearly identify the influence of thyroxine therapy.

Thyroid disorders are known to influence lipid metabolism and are common in dyslipidemic patients.[11] These hormones appear to serve as a general pacemaker, accelerating the metabolic processes and they may also be associated with metabolic syndromes.[12] The serum cholesterol level generally varies inversely with the thyroid activity.[13] This condition is more common in the elderly.[14] Also, women are more likely than men to develop thyroid disease.[15] In this study, the percentage of female subjects in the hypothyroid group was significantly higher than that of the male subjects. Moreover, the hypothyroid respondents were more commonly found in the elderly group rather than in the young or the middle aged groups. These results were well correlated with the findings of other research groups.[14,15] Serum total cholesterol was significantly increased in the hypothyroid subjects. Some other studies have also supported this finding.[16] Specifically, the thyroid hormone stimulates the hepatic de novo cholesterol synthesis by inducing HMG-CoA reductase that catalyzes the conversion of HMG-Co A to Mevalonate, the first step in the biosynthesis of cholesterol.[17] Despite the reduced activity of HMG-CoA reductase, hypercholesterolaemia in hypothyroidism probably results from the reduced catabolism of lipoproteins, a phenomenon that may be explained by a decreased expression of lipoprotein receptors and LDL cholesterol.[18] Hypothyroid patients usually exhibit elevated levels of HDL, mainly due to the decreased activity of the cholesterol ester transfer protein (CETP), resulting in reduced transfer of cholesteryl esters from HDL to VLDL, thus increasing the HDL cholesterol levels. Furthermore, the decreased activity of hepatic lipase (HL) leads to the decreased catabolism of HDL2 HDL OR HDL2 Particles.[12] But no significant difference was found between these groups and the values remained within the reference range. This result corroborated the findings of a previous study.[14] The serum triglyceride levels were also higher in the subjects with hypothyroidism, which concurred with the reports of a previous study.[12] These changes were attributable to the decreased activity of lipoprotein lipase (LPL), which resulted in a decreased clearance of triglyceride-rich lipoproteins.[17]All these abnormalities resolved as the serum T4 concentration became normal.[19] Furthermore, the clearance of the chylomicron remnants was found to be decreased in hypothyroidism.[20] Higher TC and TG were observed to be common in hypothyroidism. But no significant relation was found for HDL and LDL. Hypothyroidism has been generally considered as a cardiovascular risk factor in a majority of studies, mainly because of its association with elevated serum total and LDL cholesterol. Important associations have been identified for other risk factors for atherosclerosis.

The present study indicated that hypothyroidism was associated with an abnormal lipid profile, especially with respect to the levels of TC and TG. Hence, persons suffering from hypothyroidism should make lifestyle and dietary adjustments to avoid future cardiovascular complications. A large-scale study is warranted to further validate the findings of the present study.

Conclusion :

All hypothyroid subjects had dyslipidemia. The present study indicated that hypothyroidism was associated with an abnormal lipid profile, especially with respect to the levels of TC and TG.

Table-I

Socio-demographic variables (N=60)

Variables	Frequency (%)	
Sex		
Male	17(28%)	
Female	43(72%)	
Age group		Mean±SD
21-30 years	14 (23.3)	38.80(±10.35)
31-40 years	24 (40.0)	
41-50 years	08(13.3)	
51-60 years	14 (23.3)	
Total	60 (100)	
Range 24-59 years.		
Occupation		
Service holder	11 (18.33)	
Business	08 (13.33)	
Housewife	39 (65.00)	
Others	02 (3.33)	
Total	60 (100)	

Table-II

Thyroxine taken or not taken in the study population

Events	Frequency (%)
Thyroxine taken	42 (70)
Thyroxin not taken	18 (30)
Total	60 (100)

Table-III

Mean TSH and FT4 with Total cholesterol (TC) level

Events	Level		P value
TC	≤200 mg/dl	>200 mg/dl	
TSH	6.79(±3.35)	7.94(±5.48)	0.04
FT4	7.38(±5.92)	6.94(±4.84)	0.03

Table-IV

Mean TSH and FT4 according to LDL level

Events	Level		P value
LDL	≤130 mg/dl	>130 mg/dl	
TSH	9.45(±4.48)	6.20(±4.75)	0.01
FT4	5.67(±5.25)	8.53(±4.25)	0.03

Table-V

Mean TSH and FT4 according to Triglyceride (TG) level

Events	Level		P value
TG	≤150 mg/dl	>150 mg/dl	
TSH	5.51(±3.31)	7.74(±4.97)	0.03
FT4	3.24(±3.05)	7.71(±4.84)	0.04

Table-VI

Mean TSH and FT4 according to HDL level

Events	Level	P value	
HDL	≤35 mg/dl	>35 mg/dl	
TSH	10.88(±5.07)	5.34(±2.25)	0.002
FT4	5.10(±2.91)	8.41(±4.44)	0.001

Table-VII

Dstribution of various parameters in hypothyroid

	Number (%)	Mean ±SD
TC		222.20(±42.25)
<200 mg/dl	20 (33.33)	
>200 mg/dl	40 (66.67)	
Range 127-331		
LDL level		138.63(±31.51)
<130 mg/dl	23 (38.33)	
>130 mg/dl	37 (61.67)	
Range 77-265		
TG		243.36(±83.13)
<150 mg/dl	05 (8.33)	
>150 mg/dl	55 (91.67)	
Range 141-617		
HDL		37.30(±5.12)
<35 mg/dl	24 (40)	
>35 mg/dl	36 (60)	
Range 28-48		

References :

1. Greenspan FS. The thyroid gland. In: FS Greenspan & DG Gardner (eds) Basic & Clinical Endocrinology. The McGraw-Hill Companies, New York 2004; 240.
2. Liberopouls EN & Elisaf MS. Dyslipidemia in patients with thyroid disorders.Availableat: http://www.wbicrubesociety.gr/hormones/pdf/42002/05.

Dimas LH. Thyroid disease and lipids. Thyroid 2002; 12: 287-93.

3. Pearce EN. Hypothyroidism and Dyslipidemia: Modern Concepts and Approaches. Current Cardiology Report 2004; 6: 451-6.
4. Guyton AC & Hall JE. The thyroid metabolic hormones. in: textbook of Medical Physiology, 10th edn, W.B Sanders Company, New York 2000; 858-68.
5. Thompson GR, Soutar AK, Spengel FA, Jadhav A, Gavigan S & Myant NB. Defect of the receptor-mediated low density lipoprotein metabolism in homozygous familiar hypercholesterolemia and hypothyroidism in vivo. Proct Natl Acad Sci 1981; 78: 2591-95.
6. Simihodimos V, Bairaktari E, Tzallas C, Miltiadus G, Liberopoulos E & Elisaf M. The incidence of thyroid function abnormalities in patients attending an Outpatients lipid clinic. 'Thyroid 1999; 9: 365-8.
7. deCastro AV, Bononi AP, Aragon F, Padovani CR, Mazeto GM. Clinical and laboratory evaluation of hyperlipermia and hypothyroid patients. Arq, Bras Cardiol 2001; 76: 119-26.
8. Heimberg M, Olubadewo JO, Wilcos HG. Plasma lipoproteins and regulation of hepatic metabolism of fatty acids in altered throid states. Endocrine 1985; 6: 590-607.
9. Rader DJ & Hobbs HH. Disorders of lipoprotein metabolism (Eds). Harrisons Principles of internal Medicine. McGraw-Hill 2005; 2295.
10. Navab, Morris MS, Bostom AG. The biochemical basis of the thyroid hormone action in the heart. Am J Med 1995; 88: 626–30.
11. Lam KSL, Chan MK, Yeung RTT. High-density lipoprotein cholesterol, hepatic lipase and lipoprotein lipase activities in thyroid dysfunction – effects of the treatment. Quarterly J Med 1986; 229: 513-21.
12. Gueorguieva TM, Gueorguiev IP. Serum cholesterol concentration around parturition and in early lactation in dairy cows. Révue de Médecine Vétérinaire 1997; 148: 241⊠-44.
13. Hueston WJ, Pearson WS. Subclinical Hypothyroidism and the Risk of Hypercholesterolemia. Ann Fam Med 2004; 2: 351-55.
14. Nicoloff JT, LoPresti JS. Hypothyroidism. In RE Rakel, ET Bope, eds., Conn's Current Therapy; Philadelphia: Saunders Elsevier; 2007, pp. 766–771.
15. Jung CH, Sung KC, Shin HSS, Rhee EJ, Lee WY, Kim BS. Thyroid dysfunction and its correlation with cardiovascular risk factors such as lipid profile, hsCRP, and waist hip ratio in Korea. Kor Int Med 2003; 18: 146-53.
16. Nikkilia EA, Kekki M. Plasma triglyceride metabolism in thyroid disease. J Clin Invest 1972; 51: 2103-14.
17. Thompson GR, Soutar AK, Spengel FA, Jadhav A, Gavigan SJ, Myant NB. Defects of receptor-mediated low density lipoprotein catabolism in homozygous familial hypercholesterolemia and hypothyroidism in vivo. Proc Natl Acad Sci 1981; 78: 2591–95.
18. Stone NJ. Secondary causes of hyperlipidemia. Med Clin North Am 1994; 78: 117-141.
19. Weintraub M, Grosskopf I, Trostanesky Y, Charach G, Rubinstein A, Stern N. Thyroxine replacement therapy enhances the clearance of chylomicron remnants in patients with hypothyroidism. J Clin Endocrinol Metab 1999; 84: 2532-36.