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Cardiovascular Risk in Patients of Thyroid Disorders

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Abstract:
Background: *Hypothyroidism is a common condition; it causes symptoms that reduce the functional capacity of the bodily systems and negatively affects the quality of life. The risk of CHD and other forms of atherosclerotic vascular disease increases with elevated plasma levels of cholesterol. So, we have designed the study to see the effects of thyroid dysfunction on lipid parameters and cardiovascular disease (CVD) risk factors.*
Material & Methods: *A Case Control Study was conducted on Patients with thyroid disorder, attending both OPD and IPD in the Department of Medicine in Mahatma Gandhi Medical College, Jaipur, Rajasthan between December 2015 to December 2016. A total of 80 Subjects, 40 subjects with thyroid disorder and 40 euthyroid controls were included in the study. Presence of thyroid dysfunction was defined as per American Thyroid Association's Guidelines.*
Results: *In our study it was observed that 77.5% cases were below 45 years of age as compared to 57.5% in control group. A significant decline in TSH levels was noted after treatment (9.523±3.954 µIU/ml v/s 3.107±1.973 µIU/ml; P<0.0001***). However, there was no significant difference between before treatment and after treatment in cases when mean value of FT3 & FT4 were compared. 60% patients had RWMA abnormalities on 2D-Echo evaluation for cardiovascular disease. None in the control group showed such findings.*
Conclusion: *The study showed a higher prevalence of thyroid disorders in elderly females. Patients with both, clinical and subclinical, hypothyroidism showed dyslipidemic abnormalities. Also a large percentage of hypothyroid patients showed 2-D echocardiographic abnormalities as a marker of underlying CV disease; thus suggesting the need for detailed cardiovascular evaluation of all such patients.*
Keywords: *Hypothyroidism, TSH, FT3, FT4, Lipid profile*

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I. Introduction

Hypothyroidism is a clinical syndrome resulting from a lack of thyroid hormones. These hormones regulate a wide array of metabolic activities[1].Hypothyroidism is a common condition ; it causes symptoms of reduced functional capacity of various bodily systems, thus affecting the quality of life. Hypothyroidism is defined as a deficiency of thyroid activity. It results from reduced secretion of either total thyroxine (T4) or triiodothyronine (T3). The most prevalent thyroid disorder across the country is sub-clinical hypothyroidism. It is a milder form of the disease and remains largely undiagnosed or silent.[2].

Disordered lipid profile is a common risk factor for CVD. The risk of CHD and other forms of atherosclerotic vascular disease increases with elevated levels of plasma cholesterol. A weak positive correlation of CHD with plasma triglyceride concentration has also been noted.[3] The prevalence of subclinical hypothyroidism in the general population is between 0.7 and 12.4%. Approximately 1-5% of patients with subclinical hypothyroidism develop overt disease annually. In India, the prevalence has been found to vary from 0.5-3.9% for subclinical and 1.2-1.3% for overt hypothyroidism. As opposed to this, the incidence of hyperthyroidism has been found to be very low in patients with dyslipidemia. It has been borne out in the study by Tsimihodimos et al, who observed hyperthyroidism in only 1.2% of patients attending their lipid clinic.[4]

Various researchers have studied the effects of hypothyroidism on the lipid profile. But there are controversies which have not yet been resolved. There is a need to undertake further research ,so that a clear picture emerges, and a consensus of opinion can be reached. The present study has been designed to observe the effects of thyroid dysfunction on lipid parameters and cardiovascular disease (CVD) risk factors.

II. Material & Methods

A Case Control Study was conducted on Patients with thyroid disorder attending both OPD and IPD in Department of Medicine in Mahatma Gandhi Medical College, Jaipur, Rajasthan between December 2015 to December 2016. A total of 80 Subjects, 40 subjects with thyroid disorder and 40 subjects with euthyroid controls, were included in the study.

Inclusion criteria:

- All the patients with thyroid dysfunction

Exclusion criteria:

- Patients with chronic liver disease.
- Patients who had already taken treatment.
- Coagulation disorders.
- Severe systemic disease.
- Pregnancy.
- Renal failure
- Malignancy
- Underlying known cardiac disorder

Procedure:

Fasting blood samples were taken in a plain gel vaccutainer tube with an aseptic blood collection technique. The samples were centrifuged within 1 hour at 3000 rpm for 5 min. These were processed to obtain serum for the estimation of lipid profile and thyroid hormone levels. Estimation of fasting lipid profile (TG, cholesterol, and HDL) was carried out on a fully automated Cobas Integra 400 plus clinical chemistry analyzer. LDL value was derived by Friedwald's formula: {LDL = Total Cholesterol – [HDL + (Triglyceride/5)]}. And thyroid function test was evaluated by electrochemiluminescence method on Elecsys 2010. T3, T4, and FT4 levels were estimated by competitive principle and TSH by sandwich principle.

Presence of thyroid dysfunction was defined as per American Thyroid Associations Guidelines and Dyslipidemia as per NCEP ATP II and IDF Guidelines:

- Total cholesterol>200mg/dl
- Triglyceride>150mg/dl
- HDL<40 mg/dl
- LDL>100 mg/dl
- 2-D echocardiography study of all subjects and controls was done with the view to find out cardiovascular involvement.

Data Analysis:-

Statistical analysis of the data was done by SPSS (version 2016) where the values ≤ 0.05 were considered as significant.

III. Results

In our study it was observed that 77.5% cases were below 45 years of age as compared to 57.5% in the control group. However the age difference between cases and control group was statistically insignificant (P=0.2424) (table 1).

A significant decline in TSH levels was noted in cases of Hypothyroidism when pre-treatment and post-treatment values were compared (9.523±3.954µIU/ml v/s 3.107±1.973 µIU/ml; P<0.0001***). However, a similar significant difference between pre-treatment and post-treatment levels of mean values of T3 & T4 was lacking (table 2).

In this study a significant decline was noted between pre-treatment and post-treatment levels of cholesterol (184.0±39.72mg/dl v/s 151.6±33.25mg/dl; P=0.0002***), serum LDL (120.7±27.36 mg/dl v/s 106.9±16.86 mg/dl; P=0.0082**), serum VLDL (25.68±7.043 mg/dl v/s 22.28±4.019 mg/dl; P=0.0097**) and serum TG (143.8±40.62 mg/dl v/s 111.5±22.27 mg/dl; P<0.0001***). Levels of serum HDL were seen to rise significantly after treatment of the thyroid disease (38.53±6.421 mg/dl v/s 45.27±7.995 mg/dl; P<0.0001***) (table 3).

Echocardiographic evaluation of patients as well as controls was carried out with a view to detect the possibility of associated cardiovascular disease. Regional wall motion abnormalities (RWMA) were discovered in 60% patients of thyroid disorders whereas 40% had no echocardiographic abnormalities. Also no echocardiographic abnormalities were observed in the control group. (Table 4)

IV. Discussion

Hypothyroidism is a clinical syndrome resulting from a lack of thyroid hormones. These hormones regulate a wide array of metabolic activities. Subclinical hypothyroidism has appeared as independent risk factor for atherosclerosis in the aorta and also for myocardial infarction. However, the results of lipid profile abnormalities in subclinical hypothyroidism have been controversial in previous studies; some have shown positive correlation and prompt reversal of changes following treatment[5-7], while others have not shown any correlation between the two.[8-10]

Our results showed that 77.5% of our cases were below 45 years of age as compared to 57.5% in control group. However the difference between cases and control group was statistically insignificant (P=0.2424). Higher incidence of thyroid disorder in the middle age and younger age groups may be attributed to stress and environmental pollutants.[11]

Our observations suggested that the effect of hypothyroidism on the lipid metabolism was more noticeable in patients with raised serum TSH levels. Even slightly raised levels of TSH were related with changes in lipid levels, which could be considered sufficient to increase the cardiovascular risk in the affected individuals.

In the present study, we observed that significant rise was noted in case with regards to serum cholesterol (184.0±39.72 mg/dl v/s 132.5±18.63 mg/dl; P<0.0001***), serum LDL (120.7±27.36 mg/dl v/s 101.6±12.66 mg/dl; P=0.0001***), serum VLDL (25.68±7.043 mg/dl v/s 20.35±3.009 mg/dl; P<0.0001***) and serum TG (143.8±40.62 mg/dl v/s 116.3±14.81 mg/dl; P=0.0001***). However, there was no statistically significant difference between cases and controls when mean values of HDL were compared.

Khan MAH et al (2013)[12] found that mean serum total cholesterol, LDL cholesterol and triacylglycerol levels in cases and controls were 241.56 mg/dl ± 60.05 mg/dl vs 146.94 mg/dl ± 23.21 mg/dL, 151.96 ± 59.60 mg/dl vs 71.43 ± 26.83 mg/dL and 212 ± 100.73 mg/dl vs 98.87 ± 39.69 mg/dL respectively with p values < 0.001 whereas HDL cholesterol was found significantly decreased in cases compared to controls (49.59 ± 11.69 mg/dl vs 55.89 ± 11.70 mg/dL with p value < 0.05). Another study done by R Farah Aziz Khan et al (2014)[13] found increased lipid levels in hypothyroid subjects, but did not find any effect on the lipid levels in hyperthyroid subjects.

Walsh JP et al (2005)[14] found that subjects with subclinical hypothyroidism had a significantly higher prevalence of coronary heart disease as compared to euthyroid subjects. Our study also showed 2D-Echo abnormalities in the form of RWMA in 60% of the patients.

Finding of our study demonstrated that dyslipidemia in thyroid disorder patients. Therefore, patients presenting with lipid profile disarranged are advocated to be investigated for hypothyroidism. As our sample size was less and limited duration of study. So, other study done with increase sample size and prolonged duration is also advocated**.**

Subjects in the study group who had hypothyroidism, showed derangements in their lipid profile in the form of raised cholesterol, LDL , and triglyceride levels, which was true even for patients who had subclinical disease. Thus it goes without saying that conversely, an attempt should be made to rule out clinical or subclinical hypothyroidism in all dyslipidemic patients.

V. Conclusion

Thyroid dysfunction was found to be more common in elderly female patients as compared to those from the younger or middle age groups. Raised levels of cholesterol , LDL and triglycerides were commonly found in those with clinical as well as subclinical hypothyroidism. The abnormalities related well with the raised TSH levels. Patients who were hypothyroid showed RWMA abnormalities on echocardiographic evaluation suggesting the possibility of underlying CV disease. This was true for both clinical as well as subclinical disease. Thus it can be reasonably concluded that all hypothyroid patients who show dyslipidemic abnormalities need detailed evaluation for undetected CV disease, so that they may be offered appropriate prophylactic and therapeutic options.

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Table 1: Age wise distribution of case and control group

Age (yrs)	Cases		Control		Chi-square test	P-value
	Number	Percentage	Number	Percentage		
<30 yrs	11	27.5%	10	25%	4.182	0.2424
30-45	20	50%	13	32.5%		
46-60	5	12.5%	11	27.5%		
>60 yrs	4	10%	6	15%		
Total	40	100%	40	100%		

Table 2: Comparison of Thyroid Level of baseline and after treatment in case

Parameters	Baseline	After Treatment	T	P- value
TSH (µIU/ml)	9.523±3.954	3.107±1.973	9.182	<0.0001***
tT3 (ng/ml)	124.7±36.22	134.9±19.53	1.576	0.1191NS
tT4 (µg/dl)	7.206±4.236	7.403±1.381	0.2803	0.78 NS

Table 3: Comparison of Lipid Parameters (mg/dl) of baseline and after treatment in case

Parameters	Baseline	After Treatment	T	P- value
TC	184.0±39.72	151.6±33.25	3.965	0.0002***
LDL	120.7±27.36	106.9±16.86	2.717	0.0082**
HDL	38.53±6.421	45.27±7.995	4.251	<0.0001***
VLDL	25.68±7.043	22.28±4.019	2.652	0.0097**
TG	143.8±40.62	111.5±22.27	4.407	<0.0001***

Table 4: 2D-Echo in case and control group

2D-Echo	Cases		Control	
	Number	Percentage	Number	Percentage
Positive	24	60%	0	0%
Negative	16	40%	40	100%
Total	40	100%	40	100%

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