Cardio-Vascular Effects in Hypothyroidism – A Cross-Sectional Study

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ABSTRACT

Introduction: The low serum concentrations of thyroid hormones are associated with a decrease in cardiac output, heart rate, stroke volume, and myocardial contractility, and an increase in systemic vascular resistance. Several potential cellular mechanisms by which chronic low thyroid function may contribute to HF have been identified. Hypothyroidism may lead to altered blood lipids and accelerated atherosclerosis, Stimulation of myocardial fibrosis, Vasoconstriction, Induction of a gene program resembling that of pathological hypertrophy. Current study was done with the objective to study various cardiac manifestations in hypo-thyroidism patients

Material and methods: It was a cross sectional study consisting of 54 cases of hypo-thyroidism patients, is undertaken to study the cardiac manifestations by ECG and ECHO at tertiary care hospital from January 2016 to December 2016.

Results: In the present study which included 54 hypothyroid patients, 40 were females and 14 were males. Among cardiovascular symptoms breathlessness was commonest symptom being present in 27 patients followed by palpitation in 17 patients and chest pain in 6 patients. Among ECG changes, sinus bradycardia was commonest being present in 20 patients, followed by Low voltage complexes in 11 patients, ST-T changes in 10 patients, Long QT in 6 patients, Ectopics in 3 patients, Axis deviation in 2 patients, Prolonged PR in 1 patient, RBBB in 1 patient. Diastolic dysfunction seen in 17 patients, pericardial effusion (25 cases) being commonest echo-cardiographic changes in hypothyroid patients followed by, Left ventricular hypokinesia in 8 patients, LVH in 4 patients.

Conclusion: The study showcases the significant cardio-vascular changes among the vulnerable age group between 20-40 years. Predominantly females were more affected than males. Hypo-thyroidism patients can have significant cardio-vascular symptoms, breathlessness being the most common symptom followed by palpitation and chest pain. Study of serial ECG changes revealed sinus bradycardia as the commonest finding followed by low voltage complexes, ST-T changes, long QT, ectopics, axis deviation, prolonged PR interval and RBBB.

Keywords: Cardio-Vascular, Hypothyroidism, Sinus Bradycardia, Low Voltage Complex, ECG, Echo-Cardiography.

INTRODUCTION

The low serum concentrations of thyroid hormones are associated with a decrease in cardiac output, heart rate, stroke volume, and myocardial contractility, and an increase in systemic vascular resistance.¹

Several potential cellular mechanisms by which chronic low thyroid function may contribute to HF have been identified. Hypothyroidism may lead to altered blood lipids and accelerated atherosclerosis, Stimulation of myocardial fibrosis, Vasoconstriction, Induction of a gene program resembling that of pathological hypertrophy.²

The most consistent cardiac abnormality recognized in patients with overt hypothyroidism is impairment of LV diastolic function, which is characterized by slowed myocardial relaxation and impaired early ventricular filling.³² Hypothyroidism led to severe, progressive systolic dysfunction and increased chamber diameter/wall thickness ratio despite a reduction in cardiac mass.³

Both phases of heart cycle are early and contemporary involved in subclinical hypothyroidism causing the decrease of intramyocardial contractility and the impairment of both active and passive phases of diastole. Left ventricular ejection fraction, measured by radio-nucleotide ventriculography, was reduced in hypothyroid patients at rest and on exercise. Hypothyroid cardio-myopathy is an uncommon manifestation of hypothyroidism that can take the form of dilated cardiomyopathy.⁴

Clinical hypothyroidism is associated with premature atherosclerosis and increased prevalence of coronary disease. This is at least partly due to the lipid abnormalities often found in hypothyroidism. Possible mechanisms behind the link between hypothyroidism and atherosclerosis, other than dyslipidemia, include the effects of thyroid hormones on coagulation, vasodilation, parasympathetic function, and homocysteine metabolism. Hypothyroidism is associated with decreased endothelium-dependent vasodilatation, and

Age group (years)	Male		Female		Total	
	No.	%	No.	%	No.	%
21-40	8	15	20	37	28	52
41-60	1	2	18	33	18	35
>60	5	9	2	4	8	13
Total	14	26	40	74	54	100

Table-1: Age wise distribution of Hypothyroidism patients

Cardiovascular symptoms	Male	Female	Total
Breathlessness	6	21	27
Palpitation	3	14	17
Chest pain	1	5	6
Multiple symptoms	1	3	4

Table-2: Cardiovascular symptoms of hypothyroid patients

ECG changes	Male	Female	Total
Sinus bradycardia	8	12	20
Low voltage complex	3	8	11
ST-T changes	1	9	10
Long QT	2	4	6
Ectopics	1	2	3
Axis deviation	1	1	2
Prolonged PR	0	1	1
RBBB	1	0	1

Table-3: Electrocardiographic changes in hypothyroidism

Echo-cardiographic changes	Male	Female	Total
Diastolic dysfunction	4	13	17
Pericardial effusion	4	21	25
Left ventricular hypokinesia	0	8	8
LVH	2	2	4

Table-4: Echocardiographic studies in hypothyroidism

animal studies have proposed that the thyroid status alters the capacity for both formation and response to nitric oxide. Endothelial dysfunction in patients with SCH may result from reduction in nitric oxide availability, with resultant impairment of flow-mediated vasodilatation with resultant impairment of flow-mediated vasodilatation.⁵

Hypothyroidism has important electrophysiological effects, such as prolongation of the QRS complex and the QT interval which may predispose to the development of ventricular tachyarrhythmias.¹⁶ Electrocardiographic changes includes sinus bradycardia, prolongation of PR interval, low amplitude of P waves and QRS complex, alteration of ST segments and flattened or inverted T waves. This may be due to pericardial effusion. RBBB, LBBB and rarely complete heart block may present. Singh et al. describes three cases with varying degrees of atrioventricular block in myxedema, which reverted to normal sinus rhythm following thyroid hormone replacement.⁶

Echocardiography shows Asymmetrical septal hypertrophy, pericardial effusion, Wall motion abnormalities, Systolic dysfunction, Diastolic dysfunction – abnormalities were reported. The cardiac manifestations of hypothyroidism

include sinus bradycardia, pericardial effusion, heart failure and coronary atheroma. Overt hypothyroidism is associated with hyperlipidaemia and coronary artery disease. 2D echocardiography uses the principle of ultrasound reflection of cardiac structures to produce images of the heart. For a transthoracic echocardiogram (TTE), the imaging is performed with a handheld transducer placed directly on the chest wall. In selected patients, a TEE may be performed, in which an ultrasound transducer is mounted on the tip of an endoscope placed in the esophagus and directed toward the cardiac structures.⁷ Study aimed to study various cardiac manifestations in hypo-thyroidism patients

MATERIAL AND METHODS

A cross sectional study was conducted on 54 cases of hypothyroidism patients, was undertaken to study the cardiac manifestations by ECG and ECHO at tertiary care hospital. Study period was from January 2016 to December 2016. Cardiac symptoms studied were breathlessness, palpitation and chest pain. Sinus bradycardia, Low voltage complex, ST-T changes, Long QT, Ectopics, Axis deviation, Prolonged PR, RBBB were studied by taking repeated ECG.

Diastolic dysfunction, Pericardial effusion, Left ventricular hypokinesia, LVH were studied by doing Echo-cardiography.

Inclusion criteria: All thyroid patients attending medicine OPD.

Exclusion criteria: cardiac patients who has undergone cardiac surgery.

RESULTS

In the present study which included 54 hypothyroid patients, 40 were females and 14 were males (Table 1). Among cardiovascular symptoms breathlessness was commonest symptom being present in 27 patients followed by palpitation in 17 patients and chest pain in 6 patients (Table 2). Among ECG changes, sinus bradycardia was commonest being present in 20 patients, followed by Low voltage complexes in 11 patients, ST-T changes in 10 patients, Long QT in 6 patients, Ectopics in 3 patients, Axis deviation in 2 patients, Prolonged PR in 1 patient, RBBB in 1 patient (Table 3). Diastolic dysfunction seen in 17 patients, pericardial effusion (25 cases) being commonest echocardiographic changes in hypothyroid patients followed by, Left ventricular hypokinesia in 8 patients, LVH in 4 patients (Table 4).

DISCUSSION

The present study included 54 hypothyroid patients, 40 were females and 14 were males (Table 1). Al-Farttoosi et al. in their study found breathlessness in 75% of patients, which

was seen in 37% of patients in the present study. Angina in their study was present in 11.1% of patients, whereas present study also showed 11.1%. Bradycardia was present in 47.2% of patients in their study whereas the present study showed 25.9% of patients. They also found in their study significant difference between diastolic blood pressure, in present study 62.9% patients had DBP>80.⁸

Al-Farttoosi et al. found in their study that sinus bradycardia was the commonest ECG finding in hypothyroid patients, the same is concluded from this study too. As in Al-Farttoosi et al.⁵⁸ study, present study also showed next common findings being low voltage complexes, ST-T changes, prolonged QT respectively.⁸

Among cardiovascular symptoms breathlessness was commonest symptom being present in 27 patients followed by palpitation in 17 patients and chest pain in 6 patients (Table 2). Rawat B et al.⁹ study showed relatively increased thickness of Left ventricle which was found in 7.4% of patients in present study. Pericardial effusion was present in 32.5% patients in Hardisty et al. study whereas Rawat B et al. study showed 72% and Gupta et al. had 45.45% patients with the same. In this study it was seen in 25.9% of patients.¹⁰ Gupta et al. found significant increase in interventricular septum (IVS) and left ventricular posterior wall (LVPW), whereas in our study 7.4% patients had LVH.¹⁰

Among ECG changes, sinus bradycardia was commonest being present in 20 patients, followed by Low voltage complexes in 11 patients, ST-T changes in 10 patients, Long QT in 6 patients, Ectopics in 3 patients, Axis deviation in 2 patients, Prolonged PR in 1 patient, RBBB in 1 patient (Table 3). Subclinical hypothyroidism or mild thyroid failure is a common problem, with a prevalence of 3% to 8% in the population without known thyroid disease. The prevalence increases with age and is higher in women. After the sixth decade of life, the prevalence in men approaches that of women, with a combined prevalence of 10%. Antithyroid antibodies can be detected in 80% of patients with SCH, and 80% of patients with SCH have a serum TSH of less than 10mIU/L.¹¹

Subclinical hypothyroidism affects diastolic function and that this abnormality may be reversed by L-T4 substitutive therapy.⁶¹ Rodondi et al. in their follow up study found that over 5 years, left ventricular mass increased among those with TSH $\geq$ 10.0, but other echo-cardiographic measurements were unchanged.¹²

Diastolic dysfunction seen in 17 patients, pericardial effusion (25 cases) being commonest echo-cardiographic changes in hypothyroid patients followed by, Left ventricular hypokinesia in 8 patients, LVH in 4 patients (Table 4). Singh et al. describes three cases with varying degrees of atrio-ventricular block in myxedema, which reverted to normal sinus rhythm following thyroid hormone replacement.¹³

Both phases of heart cycle are early and contemporary involved in subclinical hypothyroidism causing the decrease of intra-myocardial contractility and the impairment of both active and passive phases of diastole.¹⁴

Hypothyroid cardio-myopathy is an uncommon manifestation of hypothyroidism that can take the form of dilated cardiomyopathy.¹⁵

CONCLUSION

The study showcases the significant cardio-vascular changes among the vulnerable age group between 20-40 years. Predominantly females were more affected than males. Hypo-thyroidism patients can have significant cardio-vascular symptoms, breathlessness being the most common symptom followed by palpitation and chest pain. Study of serial ECG changes revealed sinus bradycardia as the commonest finding followed by low voltage complexes, ST-T changes, long QT, ectopics, axis deviation, prolonged PR interval and RBBB. Echo-cardiography changes commonly shows diastolic dysfunction and pericardial effusion. Left ventricular hypokinesia and LVH were other significant findings of echo-cardiography. The above analysis highlights the fact that cardiac evaluation as an important and significant role in management of hypothyroid patients.

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