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Study of Cardiac Dysfunction In Patients of Hypothyroidism

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Conflicts of Interest: Nil

Abstract

Introduction

Thyroid Hormones are vital for the normal functioning of heart. Heart being more sensitive, cardiovascular manifestations are frequent findings in thyroid disorders (2,3).

Hypothyroidism often called as underactive thyroid or low thyroid. It can be due to iodine deficiency, autoimmune disorders, central, iatrogenic etc(13,14). Annual risk of development of hypothyroidism is 4%. The prevalence of autoimmune hypothyroidism is 4 per 1000 women and 1 per 1000 men(1,2).Primary hypothyroidism accounts for over 99.5% of cases of thyroid gland failure and < 0.5% result from disorder of the pituitary gland or hypothalamus (central hypothyroidism) (9,11).

In overt hypothyroidism, following changes occur in Thyroid Function Tests(TFT).Serum thyrotropin (TSH) concentration is elevated and S. T4 (free thyroxin) is below normal, while in subclinical hypothyroidism elevated serum TSH is associated with normal S. free T4(2,3).

Cardiac manifestation of hypothyroidism are[5,6,7]

- ❖ Decrease in cardiac output, heart rate, stroke volume, and myocardial contractility.
- ❖ Increase in systemic vascular resistance.
- ❖ Diastolic dysfunction is a earlier cardiac manifestation.
- ❖ Pericardial effusion seen significant.
- ❖ Interventricular septal dimensions are raised in hypothyroidism.
- ❖ Left ventricular posterior wall thickness increased in overt hypothyroidism.
- ❖ Hypothyroidism can cause atherosclerosis and congestive cardiac failure & pericardial effusion (30%)19.Decreased cardiac output, heart rate, stroke volume, and myocardial contractility, and an increase in systemic vascular resistance are features of hypothyroidism.[7,8,10]

These all cardiovascular manifestations of hypothyroidism are well diagnosed earlier on electrocardiogram (ECG) & echocardiography(ECHO) .The mortality and morbidity rate hypothyroidism can be reduced by early treatment.

Thyroid is endocrine gland produces Triiodothyronine (T3) & Thyroxine (T4),maintains thermogenic & metabolic homeostasis of body(1). Thyroid hormones are very

Aims & Objectives -

- To study clinical profile, ECG changes &echocardiography study in patients with hypothyroidism.

Material & Methods

- Newly diagnosed cases of hypothyroidism by TFT who fulfill inclusion and exclusion criteria from outpatients and inpatients of Bharati Vidyapeeth Deemed University Medical College and Hospital at Sangli and referred from Dr. Patwardhan's Endocrinology Research Centre, Miraj who were willing to do echocardiography were taken for study.

Study Design- A cross sectional study.

Sample size- 35 cases

The Institutional Ethical committee approval was taken

Study period: October 2014 to October 2015**.**

Sampling method: Simple random sampling.

Inclusion Criteria -

- Newly diagnosed cases of hypothyroidism& subclinical hypothyroidism.
- Age of 18-70 years**.**

Exclusion Criteria

- Known cases of Rheumatic valvular heart disease.
- Known cases of ischemic heart disease, cardiomyopathy and congestive cardiac failure.
- Known case of COPD, Asthma.
- Secondary causes of pulmonary artery hypertension.
- Acute or chronic kidney disease.
- Patient already known case of thyroid dysfunction not on treatment.

Study procedure

- Written consent was obtained from patient or relative.
- All the patients in the study were thoroughly examined and investigated with CBC, blood sugar level, blood urea, serum creatinine, thyroid function test, HIV, lipid profile, chest X-ray, ECG, 2D ECHO.
- 2D ECHO was done by using "**GE healthcare Vivid S5 220-240V ~500VA 50/60HZ**"machine.
- Patients were categorized according to thyroid function test into hypothyroidism and subclinical hypothyroidism.

Normal values of thyroid function test

Types	SI Unit	Conventional Units
S.T3 (triidothyronine)	1.2 to 2.1 nmol/L	77-135 ng/dl
S.T4(thyroxine)	70-151 nmol/L	5.4-11.7µg/dl
S.TSH	0.34-4.25 mlu/L	0.34-4.25µlu/ml

Interpretation of Hypothyroid disorders was done by thyroid function tests-

TSH	T3	T4	Interpretation
High	Normal	Normal	Subclinical Hypothyroidism
High	Low Or Normal	Low	Hypothyroidism

- Echocardiography recordings were done in end expiratory phase, and mean of three measurements on adjacent heart beats in a recording of adequate quality was used in the analyses. The conventional M mode, four chamber, two chamber views were used recommended by the American Society of Echocardiography.
- The M mode tracing was used to measure the left ventricular end systolic and end diastolic diameters, Interventricular septum thickness and posterior wall thickness. From these variables we calculated left ventricular volume, cardiac output, ejection fraction.
- From four chamber view we measured the peak flow velocity in early diastole (E wave) and during atrial contraction (A wave). With these values, E/A ratios were determined, and diastolic dysfunction was calculated as E/A ratio <1.0

- Systolic dysfunction was measured by left ventricular ejection fraction(LVEF)< 40%.
- Diastolic dysfunction is a earlier cardiac manifestation and we selected newly detected thyroid disorders patients so the diastolic dysfunction was commonest finding in present study.
- Pulmonary arterial hypertension was measuring the pulmonary arterial pressure >25mmHg.
- Pericardial effusion measured in parasternal short and long axis view in systole by measuring the parasternal collection of fluid or blood. It was measured as, ECHO free space if <5mm called small effusion, if 5-10mm called moderate effusion and if >10mm called as large pericardial effusion.

Statistical analysis -

Statistical analysis was done by using Microsoft Excel and SPSS-22

Methods - Cross sectional study.

Age & Sex Distribution –

Age in years	Male	%	Female	%	Total	%
21-30	3	8.57	7	20	10	28.57
31-40	2	5.71	12	34.29	14	40
41-50	1	2.86	6	17.14	7	20
51-60	0	0	4	11.43	4	11.43

This study suggests that hypothyroidism was common in females than male.

The maximum patients were between31-40 year age group present in 14 (40%)

Type of Hypothyroidism & Distribution-

Type of hypothyroidism	Male	%	Female	%	Total	%
Subclinical hypothyroidism	0	0	6	17.14	6	17.14
Overt hypothyroidism	6	17.14	23	65.71	29	82.86

In present study there were about 35 females found suffering from Hypothyroidism ,in which overt hypothyroidism were 29 (82.86%) & subclinical hypothyroidism were 6 (17.14%)

Symptoms & Signs in Hypothyroid Patients –

Symptoms and Signs	Male	%	Female	%	Total	%
Weight gain	5	14.28	25	71.43	30	85.71
Easy fatigue	6	17.14	17	48.57	23	65.71
Hoarseness of voice	4	11.43	21	60	25	71.43
Neck swelling	0	0	5	14.28	5	14.28
Cramps ,aches	4	11.43	11	31.43	15	42.86
Depression	2	5.71	19	54.29	21	60
Hair loss	4	11.43	17	48.57	21	60
Cold intolorance	2	5.71	10	28.57	12	34.28
Pillting Edema	4	11.43	23	65.71	27	77.14
Delayed ankle reflex	3	8.57	10	28.57	13	37.14

In this study the most common symptom was weight gain, present in 30 (85.71%) patients followed by hoarseness of voice 71.43% ,Easy fatigue 65.71%, depression 60%, hair loss 60%, crams & aches 42.86%, cold intolerance 34.28% neck swelling 14.28%.

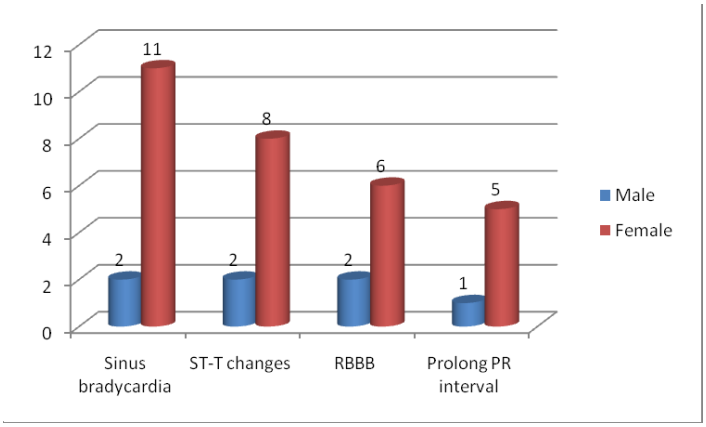
The most common sign in hypothyroid patient was edema present in about 77.14% patients followed by delayed Ankle reflex 37.14%

Cardiovascular Symptoms –

Symptoms	Male	%	Female	%	Total	%
Palpitation	3	8.57	9	25.71	12	34.28
Chest pain	3	8.57	11	31.43	14	40
Breathlessness	4	11.43	18	51.43	22	62.86

ECG In Hypothyroid

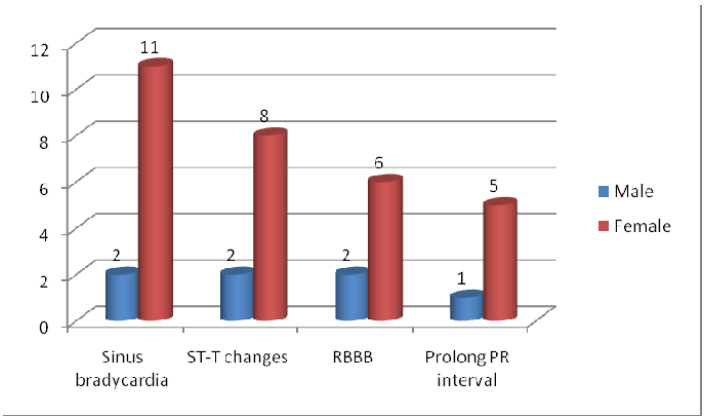
Ecg changes	Male	%	Female	%	Total	%
Sinus bradycardia	2	5.71	11	31.43	13	37.14
ST-T changes	2	5.71	8	22.86	10	28.57
RBBB	2	5.71	6	17.14	8	22.86
Prolong PR interval	1	2.86	5	14.28	6	17.14



In present study On ECG the sinus bradycardia was commonest finding present in about 13 (37.14%) patients followed by Non- specific ST-T changes in 10 (28.57%), RBBB in 8 (22.86%) and prolong PR interval present in 6 (17.14%) patients.

ECHOCARDIOGRAPHY FINDINGS IN HYPOTHYROID

ECHO	Male	%	Female	%	total	%
Pericardial effusion	1	2.86	9	25.71	10	28.57
Diastolic dysfunction	1	2.86	14	40	15	42.86
Left ventricular hypokinesia	1	2.86	3	8.57	4	11.43
LVH	1	2.86	3	8.57	4	11.43
Systolic dysfunction	1	2.86	1	2.86	2	5.72



In present study, the most common finding was diastolic dysfunction present in 15 (42.86%) ,pericardial effusion in 10 (28.57%), left ventricular hypokinesia 4 (25.71%) & left ventricular hypertrophy 4 (22.86%), systolic dysfunction 2 (5.72%) patients.

Discussion

1. In the present study the maximum patients were between31-40 year age group. Of this 14(40%), followed by 21-30 year 10(28.57%), then 41-50 years – 7(20%)& 51-60 years – 4(11.43%).
2. In the present study 29 patients were females and 6 were male had ratio of female: male was 4.8:1. It shows that females had more prevalence of hypothyroidism.
3. Of 35 patients overt hypothyroidism was present in29 (82.86%) patients & subclinical hypothyroidism was present in 6 (17.14%) patients.
4. The most common symptom found was weight gain in 30(85.71%) patients followed by hoarseness of voice in 25(71.43%). Easy fatigue in 23 (65.71%), depression in 21 (60%), hair loss in 21 (60%), crams & aches in 15 (42.86%), cold intolerance in 12 (34.28%) and neck swelling in 5 (14.28%) patients. In this study delayed Ankle reflex was present in about in 13 (37.14%) patients
5. In present study prolong PR interval was present in 6 (17.14%).In present study the RBBB present in 8 (22.86%) patients.

Echocardiography Findings

Diastolic dysfunction-

In present study, the most common finding found was diastolic dysfunction. About 15 (42.86%) patients had diastolic dysfunction. While in study done by Gupta et al. it was 18.18%, while in R. Verma in 1995 study it was 27%, diastolic dysfunction was present in 21.4% in Mulkli Shilpa et al. (2012) study and about 26.67% in Vishwananth et al.[77] (2007) study.

Diastolic dysfunction is a earlier cardiac manifestation and we selected newly detected thyroid disorders patients so

the diastolic dysfunction was commonest finding in present study.

(A) Pericardial effusion-

Second most common finding was pericardial effusion present in 10 (28.57%) patients. In other studies the pericardial effusion found to be in Hardisty et al.32.5% in Gupta et al. it was 45.45% & in Rawat et al. it was 72%. The study by R. Verma[75] in 1995 showed the prevalence of pericardial effusion was reported to occur in 30% to 80% of patients of hypothyroid (Rawat B, and satyl A2, Kumj (2003 Volume 2)

The Verma et al. conclude from his study that pericardial effusion and diastolic dysfunction was seen significant. The heart is more sensitive to thyroid disorders. So due to the hypoalbuminemia & capillary leak it causes the pericardial effusion. The present study showed higher prevalence of pericardial effusion in hypothyroidism.

(B) Left ventricular hypokinesia & LVH-

In present study the left ventricular hypokinesia was present in 4 (11.43%) patients & left ventricular hypertrophy in 4 (11.43%) patients. The Rawat B et al study showed relatively increased left ventricle hypertrophy.

(C) Systolic dysfunction-

The systolic dysfunction present in this study about 2 (5.72%) patients. Forfar et al.(1982) and others had described low systolic function indices in hypothyroid patients.

In present study the overt hypothyroid patients were 29 (82.86%). The diastolic dysfunction was present in 11 (37.93%) patients, pericardial effusion was present in 9 (31.03), left ventricular hypokinesia in 4 (13.79%), LVH in 4 (13.79%), and systolic dysfunction was present only in 2 (6.89%) patients. So in over hypothyroidism diastolic dysfunction and pericardial effusion present significantly.

In this study there were total 6 patients had subclinical hypothyroidism in which 4 (66.67%) patients had diastolic dysfunction while 1 (16.67%) patients had pericardial effusion. From this diastolic dysfunction was more common in subclinical hypothyroid patients. But the data for comparison was very less so test of significance could not be applied.

In present study 20(57.14%) patient had left ventricular ejection fraction >50% While 15(42.86%) patient had LVEF <50%. So as compared to hyperthyroid, the hypothyroid patients had more number of patients of ejection fraction less than 50%.

In present study the left ventricular posterior wall thickness increased in about 6 (17.14%) patients and interventricular septum thickness increased in about 7 (20%) patients. The study done by Gupta et al. found significant increase in interventricular septum (IVS) and left ventricular posterior wall thickness.

The study done by Rawat B1. and Satyal A2. (In 2008) suggestive of relatively increased thickness of interventricular septum and posterior wall thickness

There was significant correlation between severity of disease and pericardial effusion. In present study out of 35 patients 16 patients had severe hypothyroidism. Pericardial effusion was present in 10 patients. In which 9 (90%) patients had severe hypothyroidism. From this pericardial effusion was significantly seen in severe hypothyroidism. P value is 95% confidence interval for difference: 0.1874 to 0.6126

z = 3.424; P = 0.000.so from this more severe the hypothyroidism there is higher chances of pericardial effusion.

Similar study done by Rawat B and Satyal A. Their study suggestive of 11 out of 20 i.e. 55% have correlation of severity of disease and pericardial effusion.

Conclusions -

- In present study, majority of patient had hypothyroidism. Females were more than male patients. So prevalence of hypothyroidism was more in females than male patients.
- In this study most common cardiovascular symptom was breathlessness. Followed by chest pain and palpitation.
- In present study most common clinical findings were edema, weight gain, hoarseness of voice.
- In this study, sinus bradycardia was the commonest ECG finding followed by non-specific ST-T changes, right bundle branch block and prolonged PR interval.
- In this study, on ECHO, Diastolic dysfunction was the commonest finding in hypothyroidism. Which was highly significant than pericardial effusion, left ventricular hypokinesia left ventricular hypertrophy and systolic dysfunction. Also there was high prevalence of pericardial effusion in hypothyroid patient.
- In this study, there was a significant correlation present between the severity of thyroid dysfunction & pericardial effusion. The high prevalence of pericardial effusion was present in severe hypothyroid patients.
- In present study, there was increase in interventricular septum and left ventricular posterior wall thickness.

Discussion-

- The cardiac evaluation should be done in all patients of thyroid disorders.
- The ECHO is most important, easier and non-invasive investigation for earlier detection of cardiac manifestation in thyroid disorders.
- Clinically the cardiac manifestation in thyroid disorders may miss easily and also ECG may not detect the details of cardiac dysfunction, which leads to increase in mortality and morbidity.
- This can be prevented with the help of ECHO because these cardiac manifestations are completely reversible if treated earlier.
- So ECHO should be done in thyroid disorders as early as possible.

References -

1. Klein I, Danzi S. Thyroid disease and heart. Circulation 2007;116:1725-35.
2. Fazio S, Palmieri EA, Lombardi G & Biondi B. Effects of thyroid hormone on the cardiovascular system. Recent Progress in Hormone Research 2004 59 31–50.
3. Palmieri EA, Fazio S, Palmieri V, Lombardi G & Biondi B.Myocardial contractility and total arterial stiffness in patientswith overt hyperthyroidism: acute effects of beta1-adrenergic blockade. European Journal of Endocrinology 2004 150 757–762
4. Indian Pacing and Electrophysiology. 2005;5(4):305-11.
5. Garber, JR; Cobin, RH; Gharib, H; Hennessey, JV; Klein, I; Mechanick, JI; Pessah-Pollack, R; Singer, PA et al. (December 2012). "Clinical Practice Guidelines for Hypothyroidism in Adults" Thyroid 22 (12): 1200–1235
6. Forfar. Left ventricular function in hypothyroidism Responses to exercise and beta adrenoceptor blockade. Br Heart J 1982;48:278-84.
7. Tang. Low Thyroid Function Leads to Cardiac Atrophy Wit h Chamber Dilatation Impaired Myocardial Blood Flow, Loss of Arterioles, and Severe Systolic dysfunction. Circulation 2005;112:3122-30.
8. Bello. New Echocardiographic Techniques in the Evaluation of Left Ventricular Mechanics in Subclinical Thyroid Dysfunction. Echocardiography 2009 Jul;26:711-9

9. Kahaly JG, Dillmann HW. Thyroid hormone action in the heart. Endocrine Reviews 2005 Aug;26:704-28.
10. Gammage. Association between Serum Free Thyroxine Concentration and Atrial Fibrillation. Arch Intern Med 2007;167:928-34.
11. Von Olshausen K. Cardiac arrhythmias and heart rate in hyperthyroidism. Am J Cardiol 1989;63:930-3.
12. Neito. Asymmetric Septal Hypertrophy Associated with Subclinical Hypothyroidism. Rev Esp Cardiol 2004;57(8):792-6
13. R.Verma, Heart in hypothyroidism. JAPI 1995, 44:390-393
14. Singh. Reversible Atrioventricular Block in Myxedema. Chest 1973;63;582-5.
15. Ertugrul. Prevalence of Subclinical Hypothyroidism among Patients with Acute Myocardial Infarction. ISRN Endocrinology 2011.
16. Braunwald E (Ed,)Evaluation of left ventricular systolic and diastolic function Heart disease, 9th edition,pg.219-224.
17. SchulerN.G., foster E.Analysis of left ventricular systolic function.Heart (Supp 2)1996; 75:17-26
18. Rawat. An echocardiographic study of cardiac changes in hypothyroidism and the response to treatment. Kathmandu University Medical Journal 2003; 2(3):182- 7.