



Original Article

A Study of Evaluation of Cardiac Functions in Patients of Hypothyroidism

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Abstract

Background: *Echocardiography is used to assess cardiac parameters. Altered parameters can affect the morbidity in patients of hypothyroidism so echocardiography can be used to assess morbidity in such cases.*

Aims and Objective: *To measure cardiac functions in patients of hypothyroidism and to correlate cardiac functions with euthyroid state.*

Material and Methods: *The study conducted at M.M.I.M.S.R, Mullana. Ambala. Fifty individuals were included in the study out of them 25 were cases and 25 were control. The patients were taken from both from OPD and Indoor wards of department of Medicine. The patients were studied during October 2014 to December 2016. All the patients were scrutinized and investigated as per the plan. All were subjected to evaluation by echocardiography, electrocardiography and x-ray chest.*

Results: *In our study there was significant increase in left ventricular mass with preserved left ventricular systolic function.*

Conclusion: *Echocardiography can be used as a sensitive tool to assess morbidity associated with hypothyroidism.*

Keywords: *Echocardiography, Left ventricular mass, hypothyroidism, euthyroid.*

Introduction

Hypothyroidism is a condition characterised by abnormally low thyroid hormone production. Because thyroid hormone affects growth, development and many cellular processes, inadequate thyroid hormone has widespread consequences for the body. Laboratory determinations will confirm whether there is

excess, normal, or insufficient supply of thyroid hormone to verify the inferences from the clinical history and physical examination. It is estimation of T₄ and T₃ and TSH concentration in serum. Hypothyroidism produce changes in cardiac contractility, myocardial oxygen consumption, cardiac output, blood pressure and systemic vascular resistance^{1,2}. In contrast to

hyperthyroidism, which can lead to atrial arrhythmias, a variety of case reports have demonstrated that hypothyroidism may cause a prolongation of QT interval that predisposes the patients to ventricular irritability. Hypothyroidism is characterized by a decrease in oxygen and substrate utilization by all the major organ systems of the body. As a result, the demands for cardiac output decrease; in addition, hypothyroidism directly alters cardiac function through changes in myocyte-specific gene expression.³ Cardiac contractility which is a measure of left ventricular performance is impaired in both short and long term hypothyroidism leading to a reduction in cardiac output. There is also a decrease in the rate of ventricular diastolic relaxation; as a result, compliance and diastolic filling are impaired.⁴

Materials & Methods

Study Design

The study was conducted at M.M. Institute of Medical Sciences and Research, Mullana, Ambala. The patients were studied during October 2014 to December 2016. Total Fifty individuals were included in the study out of them 25 are cases and 25 are control. The patients were taken from Outpatient department (OPD) and Indoor wards of the department of Medicine and Emergency Department.

Those patients suspected to be suffering from hypothyroidism on clinical evaluation and confirmed by serum TSH, T4 and T3 levels estimation were taken for the study

Inclusion Criteria

All patients were subjected to following investigations at the beginning of the study like

1. Complete Blood Count
2. X Ray chest PA view.
3. Fasting Blood Sugar
4. Serum Electrolyte
5. Blood Urea and Serum Creatinine
6. Serum concentrations of T3,T4, TSH.

7. Echocardiography-Echocardiography assessment was done using an ultrasound system.
8. Written and informed consent from all the patients were taken.
9. Electrocardiography-12 lead ECG's was recorded on ECG machine

Exclusion Criteria

Patients with the following were excluded from the study.

- (1) Age < 18 and > 80 years
- (2) Patient with known primary cardiac disease
- (3) Patient with hypertension, severe anaemia and diabetes mellitus or any other endocrinal disorder.
- (4) Patient taking medicines that could alter cardiac functions like amiodarone, beta blockers, calcium channel blockers

Electrocardiogram (ECG)

ECG was recorded in all the patients, in all the 12 standard leads, at a paper speed of 25mm per sec. Abnormalities on the ECG often provide the first evidence of cardiac dysfunction in patients in whom it is suspected. Diagnosis of bradycardia, low voltage graph, prolonged PR interval, LVH (if any) was made using standard guidelines.

Chest Roentgenogram

Postero anterior films were obtained in all subjects. The following parameters were noted: Cardiac Silhouette: Cardiomegaly.

Echocardiogram

Echocardiography was done in ECHO lab of Cardiology unit in M.M.I.M.S.R. Echocardiography assessment was done by using Model vivid Colour Doppler Echocardiography machine of GE make. Patients were examined in the left lateral and supine position in quiet respiration.

a. M Mode Echocardiography

b. Two Dimensional Echocardiography

Left Ventricular Indices were assessed and then were used to calculate Left Ventricular Mass by using the cube formula proposed by Devereux.⁵

$$LV\ Mass = Myocardial\ Volume \times 1.05g/cm^3$$

$$= [(IVSd + LVIDd + LVPWd)^3 - (LVIDd)^3] \times 1.05g/cm^3.$$

Doppler Parameters of Mitral Valve

- a) E wave velocity
- b) A wave velocity
- c) E:A ratio
- d) Deceleration time
- e) IVRT

Patients included in the study were treated as per the standard treatment schedule. The data obtained was analysed with appropriate statistical analysis tools at the end of the study and conclusive evidence was derived.

Observations

The observations hence made have been tabulated and presented as follows.

Table 1: Age group

Age Group	Case Control		Total
	Hypothyroid	Euthyroid	
<30	8(32%)	4(16%)	12(24%)
31-40	10(40%)	7(28%)	17(34%)
>40	7(28%)	14(56%)	21(42%)

Although patients from 18-60 years were included in the study. Mean age of the patient was 36.56±10.66 years in hypothyroid cases.

Table 2: Sex group

Sex	Case Control		Total
	Hypothyroid	Euthyroid	
Male	2(8%)	5(20%)	7(14%)
Female	23(92%)	20(80%)	43(86%)

In this study hypothyroidism was more common in females

Table 3: Percentage of cases according to TSH Level

TSH level (µIU/ml)	Hypothyroid
<7	0(0%)
7-20	9(36%)
21-30	3(12%)
31-40	4(16%)
41-50	6(24%)
51-60	3(12%)

In this study hypothyroid patients were divided according to their TSH level with normal TSH value between 0.28-6.82µIU/ml.

Table 4: Blood Pressure

Blood Pressure	Case Control		Total	p=0.355
	Hypothyroid	Euthyroid		
Normotensive	16(64%)	19(76%)	35(70%)	
Diastolic Hypertension (BP>90mmHg)	9(36%)	6(24%)	15(30%)	

In this study 36% having diastolic hypertension which was statistically not significant.

Table 5 Showing cardiac silhouette (Cardiomegaly)

Cardio Thoracic ratio	Case Control		Total	p=0.470
	Hypothyroid	Euthyroid		
Increased	2(8%)	0(0%)	2(4%)	
Normal	23(92%)	25(100%)	48(96%)	

In this study cardiomegaly in chest x ray PA view was seen in 2 hypothyroid cases which is statistically not significant.

Table 6: Bradycardia in ECG

Bradycardia	Case Control		Total	p=0.59
	Hypothyroid	Euthyroid		
Absent	20(80%)	25(100%)	45(90%)	
Present	5(20%)	0(0%)	5(10%)	

In this study 20% patients had bradycardia in ECG which is statistically not significant.

Table 7: Low voltage complex in ECG

Low Voltage Graph	Case Control		Total	p=0.003
	Hypothyroid	Euthyroid		
Absent	16(64%)	25(100%)	41(82%)	
Present	9(36%)	0(0%)	9(18%)	

In this study low voltage graph was seen in 36% of patients which is statistically significant.

Left Ventricular Indices

Table 8 (a): Showing Left ventricular dimensions.

Dimensions	N	Mean± SD	P value
IVS d case	25	14.80±2.75	0.000
control		9.28±1.67	
IVS s case	25	20.52±4.22	0.000
control		12.60±1.44	
LVPW d case	25	11.12±1.39	0.038
control		10.12±1.87	
LVPW s case	25	12.47±0.22	0.000
control		7.064±0.99	

LVID d case	25	44.88±6.94	0.104
control		42.56±0.76	
LVID s case	25	36.28±0.39	0.033
control		34.29±0.21	

In this study LV mass increase was statistically significant.

Table 8 (c): Showing Mean value of Left ventricular volumes

Dimensions	N	Mean± SD	P value
IVS d case	25	14.80±2.75	0.000
control		9.28±1.67	
IVS s case	25	20.52±4.22	0.000
control		12.60±1.44	
LVPW d case	25	11.12±1.39	0.038
control		10.12±1.87	
LVPW s case	25	12.47±0.22	0.000
control		7.064±0.99	
LVID d case	25	44.88±6.94	0.104
control		42.56±0.76	
LVID s case	25	36.28±0.39	0.033
control		34.29±0.21	

- a) IVSd was found to be in cases mean value of 14.80mm and while in control mean value was 9.28mm which was statistically significant.
- b) IVSs was mean value of 20.52mm in cases and 12.60mm in control which was statistically significant when hypothyroid were compared with euthyroid.
- c) LVPWd was with mean value of 11.12mm in cases and 10.12mm in control group which was statistically significant.
- d) LVPWs was with cases mean value of 12.4mm and in control 7.06 mm which was statistically significant
- e) LVIDd was in cases 44.88mm and in control 42.56mm which was not statistically significant
- f) LVIDs was in 36.28mm and in control 34.29mm which was not significant statistically.

Table 8 (b): Showing Left ventricular mass

LV mass(gm)	N	Mean±SD(gm)	p value
Case	25	284.4296±89.08	0.000
Control	25	170.0180±31.83	

In this study LV mass increase was statistically significant.

Table 8 (c): Showing Mean value of Left ventricular volumes

Volumes	Case Control		P value
	Hypothyroid (Mean±SD)	Euthyroid (Mean±SD)	
ESV(ml)	29.28±7.07	25.08±3.10	0.009
EDV(ml)	83.12±10.36	76.24±3.99	0.003

- a) Left ventricular end systolic volume (ESV) in cases mean was 29.28ml and in control 25.08ml which was statistically significant
- b) Left ventricular end diastolic volume (EDV) in cases mean value was 83.12ml and in control 76.24ml which was not significant statistically.

Table 9: Left ventricular systolic function

Ejection Fraction (%)	Case_Control	N	Mean±SD(%)	P value
	Hypothyroid		25	63.92±9.25
Euthyroid		25	63.04±2.99	

In this study ejection fraction was not statistically significant

Results

- 1) The present study was aimed to assess cardiac functions in patients of hypothyroidism and to compare it with euthyroid state.
- 2) Twenty five patients of hypothyroidism were selected for the present study. All patients were evaluated and compared with age and sex matched normal subjects.

- 3) The mean age in cases 36.56±10.66 years. With majority of patients belonged to age of 31-40 years.
- 4) In hypothyroid cases 36% have diastolic hypertension mostly had Grade 1 diastolic hypertension and euthyroid had 24% diastolic hypertension which was not statistically significant.
- 5) Cardiomegaly were found in 2 hypothyroid cases with p value of 0.470 which was not statistically significant.
- 6) On electrocardiogram assessment sinus bradycardia was found in 20% hypothyroid cases which was not statistically significant and low voltage graph was seen in 36% of cases which was statistically significant.
- 7) On echocardiography assessment interventricular septum (IVS) and left ventricular posterior wall thickness (LVPW) both in diastole and systole was statistically significantly increased when compared with euthyroid with p value < 0.05.
- 8) Left ventricular mass was statistically significantly increased in hypothyroid cases with p value < 0.01

Discussion

The cardiac complications of long standing hypothyroidism are very serious. As a non invasive method, echocardiography can play important role in recognising the cardiac pathology and dysfunction as well as to follow up effect of therapy. In previous studies of clinical profile of hypothyroidism by B.B. Samanta⁶ it was concluded that hypothyroidism was most common form of thyroid disorder. Maximum number of patients were found in age group (31-60 years) 76.6%. In our study maximum number of patients was in age Group 15-45 years with a mean of 36.56±10 years. In a study by E.N. Pearce et al⁷ conducted a study on the participants of Framingham Heart study found females were more common than males (61%). In our study number of females was 92% and males was 8%. In

a study by Velkoska Nakova V et al⁸ the effect of hypothyroidism on hypertension was studied, they found that 29% cases have diastolic hypertension compared to 15.3% in euthyroid, control group. In our study 36% hypothyroid cases had diastolic hypertension when compared with euthyroid which had 24% which was not statistically significant. In a study by Putta Rajasekhar et al⁹ cardiomegaly was seen in 8% of hypothyroid patients. In our study cardiomegaly was seen in 2 hypothyroid patients (8%) which was not statistically significant. In a study by Putta Rajasekhar et al⁹ found that in hypothyroidism low voltage graph in ECG was found in 24% and bradycardia in 40% cases. In our study in 58% ECG changes in which low voltage graph was in 36% cases which was statistically significant and bradycardia in 20% cases which was not statistically significant. In a study by Almira Hadzovic Dzuvo et al¹⁰ found that in hypothyroid patients during diastole left ventricular internal diameter and left ventricular posterior wall thickness and interventricular septum thickness was increased as compared to euthyroid. In our study it was found left ventricular posterior wall thickness and interventricular septum thickness was statistically significant both during diastole and systole. In our study mean LV mass was statistically significant in hypothyroid patients. Monzani et al¹¹ also noted higher value of LV mass and LV wall thickness in hypothyroid cases as compared with control group.

Conclusion

Hypothyroidism is a fairly common disease with female preponderance. Hypothyroid and cardiac functions are closely related and should be viewed in correct perspective. In present study echocardiographically assessed left ventricular dimensions shows statistically significant increase in left ventricular mass these are not because of increased muscle mass but because of increase in interventricular septum thickness and left ventricular posterior wall thickness due to myxomatous tissue increase. Left ventricular systolic function is

preserved in hypothyroid states. Conventional echocardiography is a simple, non invasive and affordable method to assess morbidity in hypothyroid patients. However electrocardiogram is good tool to document changes in muscle mass and to some extent effects on coronary circulation but Echocardiography remains an excellent tool for cardiac functional assessment, which makes the main stay of therapeutic decisions and prognostic assessments.

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