



Echocardiographic and Electrocardiographic Manifestations of Newly Diagnosed Adult Patients Suffering with Overt Hyperthyroidism

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Abstract

Background: Thyroid hormones directly affect the heart and cardiovascular system. Cardiovascular symptoms like hypertension, palpitations, dyspnoea, chest pain, pedal edema and exercise intolerance are common presenting symptoms of hyperthyroidism. These symptoms usually revert back to normal when a euthyroid state is restored and maintained with help of antithyroid drugs initially and a definitive treatment later. Hyperthyroid patients can be easily evaluated using two non invasive modalities namely electrocardiography and echocardiography. This study aims at understanding the various electrocardiographic and echocardiographic manifestations of newly diagnosed patients with overt hyperthyroidism.

Aim: To evaluate electrocardiographic and echocardiographic manifestations of newly diagnosed adult patients suffering with overt hyperthyroidism.

Methods: 77 patients with overt hyperthyroidism who visited the thyroid clinic of Institute of nuclear medicine and allied science (INMAS), Timarpur, Delhi were enrolled for the present study. All the patients were asked about the symptoms including cardiac symptoms with the help of a structured questionnaire. Detailed clinical, biochemical evaluation and nuclear imaging was done for all the patients and it included estimation of freeT3, free T4, TSH, Technetium 99 scan and Radio-active iodine uptake. Cardiovascular evaluation included a 12 lead resting electrocardiogram (ECG) and a two dimensional transthoracic echocardiogram.

Conclusion: Symptoms pertaining to cardiovascular system are the common presenting feature in patients with hyperthyroidism. Apart from clinical examination of the cardiovascular system electrocardiography and echocardiography are two non-invasive modalities that can evaluate the cardiac abnormalities in such patients.

Keywords: Hyperthyroidism; Hemodynamic Changes; Arrhythmias

Introduction

Thyroid Hormones virtually affect all organ systems in the body but the heart and the cardiovascular system are particularly affected. Patients with untreated or newly diagnosed hyperthyroidism usually present with cardiovascular symptoms like palpitations, Dyspnoea, chest pain, pedal oedema and congestive cardiac failure. Hyperthyroid patients are more prone to develop arrhythmias particularly atrial fibrillation. It occurs in 10-25% of patients suf-

fering from overt hyperthyroidism. Hyperthyroidism causes hyper dynamic circulatory state, which is characterized by a high cardiac output with lesser systemic vascular resistance.

Hyperthyroid state is also characterized by tachycardia, systolic and diastolic dysfunction, and chamber enlargement. Electrocardiography and echocardiography are two non-invasive methods, which help in recognizing cardiac rhythm and functional abnormalities of the heart. Very few studies are available in Indian Medi-

cal literature looking at the Echocardiographic abnormalities in freshly diagnosed (untreated) overt hyperthyroid patients. The present study is an observational study, which was carried out in a tertiary care center of North India.

Materials and Methods

Study design

This was an observational study carried out from November 2016 to February 2019 in the Department of Cardiology, at Institute of Nuclear Medicine and Allied Sciences, Timarpur, Delhi. 77 consecutive patients with overt hyperthyroidism who visited the Thyroid clinic of INMAS were included in the study.

Inclusion criteria

Both male and female patients more than 18 years of age with a recent confirmed diagnosis of hyperthyroidism with signs and symptoms suggestive of cardiac involvement who agreed to sign the consent form were eligible for the study.

Exclusion criteria

Patients already suffering with congenital heart disease, rheumatic Heart disease and ischemic Heart Disease were excluded from the study. Patients on amiodarone and those who had a previous history of hyperthyroidism were also excluded. Patients suffering from any other systemic illness like chronic disease, chronic renal disease and severe anemia were also excluded. Pregnant women were also not included. The study was approved by the institute’s ethical committee.

Methods

A detailed history was obtained from each patient with special emphasis on cardiovascular symptoms. History of smoking and other personal habits was also asked.

Physical examination included measurement of weight/height, pulse rate, Blood Pressure, presence of pedal oedema, raised jugular venous pressure, displaced cardiac apex, cardiac murmurs and auscultation of chest for presence of wheezing and crepitations. Eighty (80) age and sex matched healthy controls were also studied in a similar manner.

All the patients underwent clinical and bio-chemical evaluation as diagnosis of hyperthyroidism was made by increased serum concentrations of Free T3 and Free T4 and a suppressed TSH. An increased value of 2 hour and 24-hour radio-active Iodine uptake

was also confirmatory of a hyperthyroid state. All those with a nodular goiter were also subjected to Technetium 99 scan. All these patients underwent a resting 12 lead ECG and a 2-dimensional echocardiography.

The ECG findings were designated as normal, sinus tachycardia, atrial fibrillation, left ventricular hypertrophy and left Bundle Branch Block, right ventricular hypertrophy and right Bundle Branch Block and non-specific ST/T changes.

2D-Echocardiography was carried out in the Department of Cardiology on a GE; Vivid 7 Dimension Machine and Echocardiographic findings were designated as Systolic dysfunction, diastolic dysfunction, chamber enlargement, regurgitant lesions and pulmonary hypertension.

Statistical analysis

The collected data of all the cases and controls was statistically analyzed using SPSS version. Continuous variables were expressed as mean ± standard deviation.

Results

Patients with overt hyperthyroidism were leaner than the controls as their body mass index was significantly lower (Table 1). Most of the patients were in age group of 30 - 40 years (31%). There were 48 females and 29 males in our study. This female preponderance in hyperthyroidism is well known and seen in many other studies probably due to the autoimmune nature of Grave’s disease.

Parameters	Hyperthyroid patients: mean (SD) n = 77	Control: mean (SD) n = 80	P-value
Age	34 (3.1)	33.5 (2.2)	>0.05
Weight (kg)	48.0 (4.5)	66 (6.1)	<0.05*
Height (meters)	151.9(5.8)	154.8 (9.3)	>0.05
Body mass index (kg/m ²)	22.04 (6.4)	25.09 (5.4)	<0.05*
Pulse (beats/min)	112 (8.4)	76 (4.5)	<0.01*
Systolic blood pressure (mmHg)	124.8(12.5)	120.2 (2.8)	>0.05
Diastolic blood pressure (mmHg)	70 (8.1)	69.1 (4.5)	>0.05

Table 1: Anthropometric data and other parameters of patients and controls.

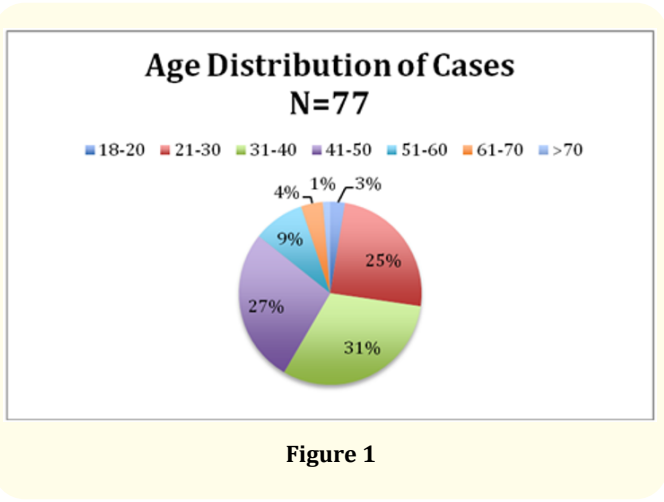


Figure 1

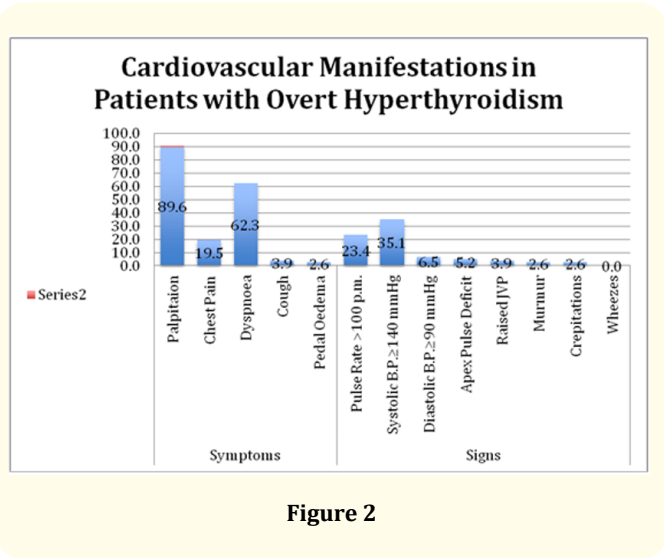


Figure 2

In the present study sinus tachycardia (pulse rate more than 100 beats per minute) was the most common sign seen in 89.6% cases followed by breathlessness, which occurred in 62.3% cases. 35% patients presented with systolic hypertension (systolic blood pressure more than 140 mmHg) and 6.5% cases had a diastolic hypertension (diastolic blood pressure more than 90 mmHg). On auscultation, 2.6% cases had a pan systolic murmur, which was suggestive of a regurgitant valvular lesion.

On ECG, in the present study, tachycardia was seen in 55.8% patients followed by atrial fibrillation in 10.4%. The less common ECG findings included non specific ST/T changes, Right Ventricular Hypertrophy, P-pulmonale, and conduction blocks (Table 2).

Parameters	Frequency	%
Normal Sinus Rhythm	7	9.1
Sinus Tachycardia	43	55.8
Atrial Fibrillation	8	10.4
Atrial Flutter	1	1.3
Non specific ST/T Changes	5	6.5
Right Ventricular Hypertrophy	3	3.9
P-Pulmonale	4	5.2
Left Bundle Branch Block	1	1.3
Right Bundle Branch Block	5	6.5

Table 2: ECG abnormalities in hyperthyroid patients.

2-Dimensional Echocardiography was done in all the patients by a single investigator on a GE; Vivid 7 Dimension Machine. Trans-thoracic echocardiographic examinations were performed in all the patients with 4 MHz transducer. These examinations were made in accordance to the recommendations made by the American society of Echocardiography. The left ventricular end diastolic volume was significantly higher in hyperthyroid patients than the controls (99.26 ml ± 23.66 SD in cases versus 79.12 ml ± 19.63 SD in controls). The left ventricular end systolic volume was also significantly higher in thyrotoxic patients when compared to age and sex matched controls (25.94 ± 11.31 versus 21.15 ± 9.54). The interventricular septal was thicker in hyperthyroid patients as compared to controls (it was 1.6 ± 0.17 cms which was thicker than the controls 0.94 cms).

Echocardiographic findings of patients with overt hyperthyroidism and that of controls are shown in table 3.

S. No.	Echocardiographic findings	Mean ± S.D. Patients with overt hyperthyroidism	Mean ± S.D. (controls)	P value
1	LVEF	70.5(9.8)	50.5(4.3)	0.001
2	FS%	42(7.6)	35(6.2)	0.001
3	LVEDV (ml)	99.26 ml ± 23.66	79.12 ml ± 19.63	0.001
4	LVESV (ml)	25.94 ± 11.31	21.15 ± 9.54	0.001
5	Interventricular septal thickness.	1.6 ± 0.17 cms	0.94 ± 0.56	0.05

Table 3: Showing echocardiographic data of hyperthyroid patients.

Left ventricular ejection fraction was greater in patients with overt hyperthyroidism as compared to the controls.

Discussion

In hyperthyroid patients the prevalence of atrial fibrillation varies between 2% and 20% in different studies [1]. In the present study 10.4% patients had atrial fibrillation. Osman et al had reported that 6% of their hyperthyroid patients had atrial fibrillation [2].

RBBB occurred in about 11% of patients with overt hyperthyroidism without any associated heart disease as reported by Zarger, et al [3]. In our study 6.5% cases had right bundle branch block.

Our study demonstrated increased cardiac systolic and diastolic function in newly detected patients with overt hyperthyroidism when they were compared with controls.

Marcisz., et al. also reported an increase in systolic function of hyperthyroid patients in their study from Poland [4]. In their study they had demonstrated an increased LV ejection fraction, fractional shortening and cardiac index. Our study demonstrated that patients with overt hyperthyroidism had increased left ventricular mass and contractility. It has been suggested that thyroid hormones mediate changes in the relative ratio of phospholamban to Ca²⁺ ATPase and regulate the Ca²⁺ uptake rates by sarcoplasmic reticulum and thereby regulates the relaxation properties of the myocardium [5].

Mintz., et al. had reported the presence of enhanced diastolic function in nine newly detected and untreated overtly hyperthyroid patients. According to them, thyroid hormones enhance the diastolic relaxation rate, which contributes to the increase in LVEDV [6]. In our study patients with overt hyperthyroidism had a significantly higher left ventricular end diastolic volume compared to the controls (99.26 ml ± 23.66 SD in cases versus 79.12 ml ± 19.63 SD in controls). The enhanced systolic and diastolic functions in overtly hyperthyroid patients can be managed by rendering the patient euthyroid as early as possible and this can be achieved by initiation of anti thyroid therapy.

Patients with isolated diastolic dysfunction who are asymptomatic can be detected using echocardiography, and can then be suitably managed with anti-thyroid drugs (for achieving euthyroidism), β-blockers, and diuretics in moderate doses [7].

Conclusion

Echocardiography is a cheap, non invasive and is an in -dispensable investigation for studying cardiac functions in patients with untreated or newly detected hyperthyroidism. The finding of increased left ventricular systolic and diastolic function in such patients can be easily detected on echocardiography. Once such cardiac abnormalities are detected, they can be promptly treated with anti thyroid drugs and beta blockers.

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