

Research Article

Cardiovascular manifestations in hyperthyroidism

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ABSTRACT

Background: It is well known that thyroid hormone directly affects the heart and peripheral vascular system. In hyperthyroidism, cardiovascular manifestations are frequent findings. Atrial arrhythmias, limitations in exercise tolerance, and congestive heart failure were reported to occur more common in older patients as a result of hyperthyroidism. Cardiovascular signs of hyperthyroidism include tachycardia, widened pulse pressure, marked increase in cardiac output with impaired cardiovascular and respiratory exercise capacity. Most of the cardiac abnormalities return to normal once a euthyroid state has been achieved in a majority of patients. There are very few studies which address the most important cardiovascular manifestations of hyperthyroidism particularly in Indian population. Hence this study is aimed at addressing this area. The aim was to study the prevalence of various cardiac manifestations in overt and subclinical hyperthyroidism.

Methods: 50 patients of hyperthyroidism who visited general medicine department of Sri Ramachandra Medical College, Chennai, India was included in the study. Patients with other co-morbidities which could contribute to cardiovascular manifestations were excluded from the study. All the patients underwent clinical evaluation, basic laboratory tests like CBC, RFT, LFT, serum electrolytes, fasting lipid profile (which included serum triglycerides, LDL, HDL, total cholesterol), FT₄, FT₃ and TSH and radiological variables were studied in these patients. ECG and 2D ECHO were performed in these patients to analyze the presence of any cardiac manifestations in these patients..

Results: In this study females (60%) were more than males (40%), commonest cardio vascular symptoms were palpitation (78%), followed by dyspnoea (26%) and chest pain (4%). The commonest cardio vascular signs were found to be tachycardia (82%), widened pulse pressure (50%) and pedal edema (12%). The commonest ECG finding was found to be Sinus tachycardia (46%) followed by atrial fibrillation (28%), Non-Specific ST-T changes, left ventricular hypertrophy, RV hypertrophy and RBBB. Systolic dysfunction and chamber enlargement (18%) were the commonest echo findings.

Conclusions: This study shows that cardiovascular manifestations are quite common and varied in hyperthyroidism which are to be looked for in the management.

Keywords: Hyperthyroidism, Cardiovascular manifestations, Atrial fibrillation

INTRODUCTION

Thyroid hormones have a profound effect on numerous metabolic processes, virtually in all tissues and hence every tissue in the body gets affected to a greater or lesser extent in thyroid hormone disturbances, the heart being

particularly sensitive to its effect. Thyroid hormone directly affects the heart and peripheral vascular system. The hormone causes increase in heart rate, myocardial ionotrophy and increases the cardiac output by dilating the peripheral arteries.¹ In hyperthyroidism, cardiovascular manifestations are frequent findings. Hyperthyroidism can produce changes in blood pressure,

myocardial oxygen consumption, cardiac contractility, cardiac output and systemic vascular resistance.² Atrial arrhythmias, limitations in exercise tolerance, and congestive heart failure were reported to occur more common in older patients as a result of hyperthyroidism.³

Hyperthyroidism results in excessive mortality from increased incidence of circulatory diseases and dysarrhythmias.⁴ Incidence of cerebral embolism is common in the hyperthyroid patients with atrial fibrillation, especially in the elderly group and anticoagulation was indicated in them. Numerous studies have shown that treatment of hyperthyroidism results in conversion to sinus rhythm in up to two-third of patients. Drugs like beta-blockers help to reduce left ventricular hypertrophy and atrial and ventricular arrhythmias in patients with hyperthyroidism.⁵

Cardiovascular signs of hyperthyroidism include tachycardia, widened pulse pressure, marked increase in cardiac output with impaired cardiovascular and respiratory exercise capacity.⁶ In the elderly hyperthyroid patient the symptoms and signs of heart failure or worsening of angina pectoris may dominate the clinical picture and mask the more classical endocrine manifestations of the disease.

Long-term follow-up studies had revealed increase in the mortality in those with a past history of overt hyperthyroidism, as well as those with subclinical hyperthyroidism.⁷ Supraventricular arrhythmias in particular AF, in elderly patients may account for some of the excess in the cardiovascular and cerebrovascular mortality described, especially because of the AF, which is known to predispose to embolic phenomena.⁷

Most of the cardiac abnormalities return to normal once a euthyroid state has been achieved in a majority of patients, although AF may persist in a minority group of patients.⁸ Many studies have been done on the clinical presentation and lab manifestations of hyperthyroidism. However there are very few studies which address the most important cardiovascular manifestations of hyperthyroidism particularly in Indian population. Hence this study is aimed at addressing this area.

METHODS

This study was done in Sri Ramachandra Medical College in the Department of General Medicine with close association with the Department of Cardiology. This observational study included 50 patients with hyperthyroidism based on FT₃, FT₄ and TSH levels, who fulfilled the inclusion criteria and exclusion criteria. The study protocol was duly approved by the institutional ethics committee of Sri Ramachandra University, Chennai, India. All the patients underwent clinical evaluation, basic laboratory tests like CBC, RFT, LFT, serum electrolytes, fasting lipid profile (which included serum triglycerides, LDL, HDL, total cholesterol), FT₄,

FT₃ and TSH and radiological variables were studied in these patients.

ECG and 2D ECHO were performed in these patients to analyze the presence of any cardiac manifestations.

Inclusion criteria

- Age >18 years
- All patients with overt hyperthyroidism of any etiology
- All patients with subclinical hyperthyroidism of any etiology

Exclusion criteria

- Patients with hypertension, diabetes mellitus, coronary artery disease, chronic kidney disease on treatment
- Patients on antiarrhythmic drugs

Statistical analysis

The collected data of the 50 patients was statistically analyzed with SPSS 16.0 version. To describe about the data descriptive statistics frequency analysis, percentage analysis, cross tabulation were used for categorical variables and the mean and SD were used for continuous variables. To find the significance in categorical data Chi-square test was used. In all the above statistical tools the probability value 0.05 is considered as significant.

RESULTS

In this current study 50 patients with hyperthyroidism who consulted Sri Ramachandra Medical College Hospital, Chennai, India during the study period were included. In this study of 50 patients of hyperthyroid, majority of the patients are females of age group between 41-60 years. Similarly majority of incidence in the same age group (Table 1).

In this study out of the total patients, 18% had pallor, 12% had edema, 20% had eye signs and 28% had moist skin. Out of 50 patients 9 had pallor, 6 had edema, 10 had eye signs and 14 had moist skin (Table 2). In this study 66.7% of the female patients and 95% of the male patients had palpitations. In this study 16.7% of the female patients and 40% of the male patients presented with breathlessness. In this study 6.7% of the females presented with chest pain (Table 3).

In this study out of the total patients, 78% presented had palpitations with a highly significant P value; hence these patients might be prone for arrhythmias and tachycardia so they need further cardiac evaluation (Table 3). In this study 26% of patients presented with breathlessness and 4% with chest pain. Out of 50 patients 39 had palpitations, 13 had breathlessness and 2 had chest pain (Table 3). In this study of 50 patients of hyperthyroidism,

among the female patients 96.7% and 85% of males, with an average of around 92% of total patients had BMI ranging from 18.5 to 24.99. 3.3% of females and 5% of males, with an average of around 4% of total patients had

between 25 to 29.99. And 10% of males, with an average of around 4% of total patients had less than 18.5 (Table 4).

Table 1: Age and gender distribution among hyperthyroid patients.

			Sex		Total
			F	M	
Age-range	Upto 40 years	Count	14 (46.7%)	8 (40%)	22 (44%)
	41-60 years	Count	15 (50%)	10 (50%)	25 (50%)
	>60 years	Count	1 (3.3%)	2 (10.0%)	3 (6.0%)
Total		Count	30	20	50

P value-0.603

Table 2: General symptoms of hyperthyroid patients.

General examination	Absent			Present			Total	P-value
	F	M	T	F	M	T		
Pallor	27 (90%)	14 (70%)	41 (82%)	3 (10%)	6 (30%)	9 (18%)	50	0.071
Edema	27 (90%)	17 (85%)	44 (88%)	3 (10%)	3 (15%)	6 (12%)	50	0.594
Eye signs	30 (100%)	10 (50%)	40 (80%)	0 (0%)	10 (50%)	10 (20%)	50	0.001
Moist skin	24 (80%)	12 (60%)	36 (72%)	6 (20%)	8 (40%)	14 (28%)	50	0.123

Table 3: Cardiovascular symptoms of hyperthyroid patients.

Symptoms	Absent			Present			Total	P-value
	F	M	T	F	M	T		
Palpitations	10 (33.3%)	1 (5%)	11 (22%)	20 (66.7%)	19 (95%)	39 (78%)	50	0.018
Breathlessness	25 (83.3%)	12 (60%)	37 (74%)	5 (16.7%)	8 (40%)	13 (26%)	50	0.065
Chest pain	28 (93.3%)	20 (100%)	48 (96%)	2 (6.7%)	0 (0%)	2 (4%)	50	0.239

Table 4: BMI of hyperthyroid patients.

			Sex		Total
			F	M	
BMI-range	<18.5	Count	0 (0.0%)	2 (10.0%)	2 (4.0%)
	18.5-24.99	Count	29 (96.7%)	17 (85.0%)	46 (92.0%)
	25-29.99	Count	1 (3.3%)	1 (5.0%)	2 (4.0%)
Total		Count	30	20	50

P value-0.196

Table 5: Pulse range of hyperthyroid patients.

			Sex		Total
			F	M	
Pulse	80-100	Count	6 (20%)	3 (15%)	9 (18%)
	>100	Count	24 (80%)	17 (85%)	41 (82%)
Total		Count	30	20	50

P value-0.652

In this study about 18% of the patients had heart rate ranging between 80-100 and about 82% had above 100 (Table 5). In this study about 22% of the patients had SBP of less than 120, 46% had SBP ranging between 120 to 139. 30% had SBP ranging between 140 to 159. And about 2% had above 159 (Table 6).

In this study about 60% of the patients had DBP of less than or equal to 80. 34% had DBP ranging between 80-89 and about 6% had between 90-99 (Table 7).

Table 6: Systolic blood pressure of hyperthyroid patients.

		Sex		Total	
		F	M		
SBP-range	<120	Count	5 (16.7%)	6 (30%)	11 (22%)
	120-139	Count	17 (56.7%)	6 (30%)	23 (46%)
	140-159	Count	8 (26.7%)	7 (35%)	15 (30%)
	>159	Count	0 (0%)	1 (5%)	1 (2%)
Total		Count	30	20	50

P Value-0.203

Table7: Diastolic blood pressure of hyperthyroid patients.

		Sex		Total	
		F	M		
DBP-range	<80	Count	20 (66.7%)	10 (50.0%)	30 (60.0%)
	80-89	Count	7 (23.3%)	10 (50.0%)	17 (34.0%)
	90-99	Count	3 (10.0%)	0 (0.0%)	3 (6.0%)
Total		Count	30	20	50

P Value-0.079

Table 8: Pulse pressure of hyperthyroid patients.

		Sex		Total	
		F	M		
PP-range	21-40	Count	5 (16.7%)	6 (30.0%)	11 (22.0%)
	41-60	Count	16 (53.3%)	9 (45.0%)	25 (50.0%)
	>60	Count	9 (30.0%)	5 (25.0%)	14 (28.0%)
Total		Count	30	20	50

P Value-0.537

Table 9: Cardiovascular system examination of hyperthyroid patients.

CVS examination	Absent			Present			Total	P-value
	F	M	T	F	M	T		
Loud P2	30 (100%)	18 (90%)	48 (96%)	0 (0%)	2 (10%)	2 (4%)	50	0.077
Cardiomegaly	27 (90%)	17 (85%)	44 (88%)	3 (10%)	3 (15%)	6 (12%)	50	0.594
Varying heart sounds	27 (90%)	9 (45%)	36 (72%)	3 (10%)	11 (55%)	14 (28%)	50	0.001

Table 10: ECG changes among hyperthyroid patients.

ECG changes	Absent			Present			Total	P value
	F	M	T	F	M	T		
Sinus tachycardia	11 (36.7%)	16 (80%)	27 (54%)	19 (63.3%)	4 (20%)	23 (46%)	50	0.003
AF	27 (90%)	9 (45%)	36 (72%)	3 (10%)	11 (55%)	14 (28%)	50	0.001
ST T change:	27 (90%)	19 (95%)	46 (92%)	3 (10%)	1 (5%)	4 (8%)	50	0.523
RVH	28 (93.3%)	17 (85%)	45 (90%)	2 (6.7%)	3 (15%)	5 (10%)	50	0.336
LVH	29 (96.7%)	17 (85%)	46 (92%)	1 (3.3%)	3 (15%)	4 (8%)	50	0.136
RBBB	30 (100%)	15 (75%)	45 (90%)	0 (0%)	5 (25%)	5 (10%)	50	0.004

Among the 50 patients studied 11 patients of which 5 females and 6 males had a pulse pressure ranging from 21-40. 25 patients including 16 females and 9 males had

between 41-60. And about 14 patients had above 60 (Table 8). Among the 50 patients 2 males (4%) had loud P2. 3 females and 3 males (12%) had cardiomegaly. 3

females and 11 males (28%) had varying heart sounds with a highly significant P Value suggestive of these patients are more prone for arrhythmia (Table 9).

In this present study the commonest ECG findings were found to be Sinus tachycardia (46%), atrial fibrillation (28%), non-specific ST-T changes (8%), RV hypertrophy

(10%), left ventricular hypertrophy (8%) and RBBB (10%) (Table 10). In this study, echocardiographic evaluation showed systolic dysfunction in 18% of patients and chamber enlargement in 18% of patients, followed by diastolic dysfunction in 12%, regurgitant lesion in 6% and pulmonary hypertension in 4% of patients (Table 11).

Table 11: Echocardiography findings of hyperthyroid patients.

Echo findings	Absent			Present			Total	P value
	F	M	T	F	M	T		
Systolic dysfunction	27 (90%)	14 (70%)	41 (82%)	3 (10%)	6 (30%)	9 (18%)	50	0.071
Diastolic dysfunction	27 (90%)	17 (85%)	44 (88%)	3 (10%)	3 (15%)	6 (12%)	50	0.594
Chamber enlargement	27 (90%)	14 (70%)	41 (82%)	3 (10%)	6 (30%)	9 (18%)	50	0.071
Regurgitant lesion	28 (93.3%)	19 (95%)	47 (94%)	2 (6.7%)	1 (5%)	3 (6%)	50	0.808
Pulmonary hypertension	30 (100%)	18 (90%)	48 (96%)	0 (0%)	2 (10%)	2 (4%)	50	0.077

Table 12: Descriptive statistics of hyperthyroid patients.

	N	Minimum	Maximum	Mean	Std. deviation
Age	50	19	68	42.02	12.631
BMI	50	15.84	25.00	20.9230	2.00146
Pulse	50	90	160	112.96	13.479
SBP	50	90	160	130.12	15.797
DBP	50	60	90	76.48	8.276
Pulse pressure	50	30	80	53.56	12.395
EF	50	30	65	56.92	9.134
Hb	50	7.9	16.0	12.036	2.0922
Cholestrol	50	104	224	154.38	24.686
Se. Tri	50	90	258	129.42	38.907
HDL	50	34	58	44.84	6.488
LDL	50	68	125	87.14	13.217
FT3	50	4.02	4.97	4.5442	0.27681
FT4	50	1.65	2.82	2.1508	0.27101
TSH	50	0.00	0.40	0.0961	0.11345
Valid N (listwise)	50				

DISCUSSION

In this current study 50 patients with hyperthyroidism who consulted Sri Ramachandra Medical College Hospital, Chennai, India during the study period were included. The age of the patients in this present study ranged between 19-68 years. In this present study, peak incidence was observed among the age group of 41-60 years (50%), followed by the age group of about 20-40 years (44%).

In this study Females (60%) were more than males (40%). This female preponderance in hyperthyroidism is well known in many other studies as well. In the present study, the commonest symptoms were found to be weight loss, easy fatigue, excessive sweating, tremors, decreased

sleep, and increased appetite. In the present study the commonest cardio vascular symptoms were palpitation (78%), followed by dyspnoea (26%) and chest pain (4%). This also goes with the fact that palpitation and dyspnoea are the commonest symptoms of hyperthyroidism patients irrespective of the cause.

Hence in congruent with earlier studies, this study also had majority of patients presenting with palpitation, dyspnoea and chest pain.^{9,10} In this present study the commonest cardio vascular signs were found to be tachycardia (82%), widened pulse pressure (50%) and pedal edema (12%). Tachycardia was particularly common in the elderly age group. Increased pulse pressure is also seen in these patients. In this study 82% of the patients had tachycardia, as comparable with the Zargar et al.¹⁰ In the current study 50% of the patients

had widened pulse pressure where as in Klein et al, it is 30%. 12% had pedal edema in present study where as in Klein et al it is 5%.⁸

In this study sinus tachycardia was found in 46% patients which was 63.5% patients in the study by Zarger et al, however it was mentioned that sinus tachycardia, that is heart rate exceeding 100 beats/min was observed in 40% of patients with hyperthyroidism, occurring more frequently in the younger age group patients, which is comparable with the current study.¹⁰ In hyperthyroid patients the prevalence of atrial fibrillation varies between 2% and 20%.^{1,11} In the study by Barsela S et al 21% of patients had atrial fibrillation, while 8.9% in that of Zarg 28% patients in this study had atrial fibrillation et al and 6% of that of Osman et al.^{9,10,12} In our study 28% patients in this study had atrial fibrillation which is slightly higher than others.

Intraventricular conduction disturbances like RBBB occur more commonly in about 11% of patients with hyperthyroidism without any associated heart disease of other etiology as mentioned in Zarger et al.¹⁰ In comparison, 10% of patients in this study had RBBB. In this present study systolic dysfunction was seen in 18% of the patients, where as in Mercé et al, it was present in 3% of the patients.¹³

As the current study had more number of patients with atrial fibrillation, it might be the reason for higher systolic dysfunction. In this study pulmonary hypertension was present in about 8.7% of patients however in Sui et al, patients with hyperthyroidism and normal LV systolic function, up to 47% of the patients had PHT.¹⁴ Inadequate sample size may be the reason for this difference. The prevalence of diastolic dysfunction increases as the age increased, from 17.9% in patients who are less than 40 years to 100% in those who are all above 60 years.^{15,16} Present study had diastolic dysfunction in about 12% of patients. Regurgitant lesions were seen in 23% of the patients in the study by Merce et al while in the present study 6% of the patients had the same.¹³ Over all the cardiovascular manifestations dominated the picture of hyperthyroidism though the frequency is slightly different from the earlier studies. Early identification and management of them is very important since many of them can contribute to serious mortality and morbidity.

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