Cardiac Manifestation among Patients with Hypothyroidism - A Cross-Sectional Study in North Karnataka

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ABSTRACT

BACKGROUND

Hypothyroidism is the second most common endocrinopathy next to diabetes mellitus (DM). Hypothyroidism is associated with increased cardiovascular mortality and morbidity. Cardiovascular complications are some of the most profound, reproducible and reversible clinical findings associated with thyroid disease[1]. Hence this study was undertaken to assess the cardiac dysfunction among patients with hypothyroidism by electrocardiogram (ECG) and echocardiogram (ECHO) so as to provide a proper treatment guideline even among milder cases.

METHODS

This was a cross sectional study carried among 50 new patients of hypothyroidism who presented to Navodaya Hospital, Raichur during 2015 to 2017. They were clinically evaluated and underwent relevant investigations, including thyroid profile estimation, cardiac evaluation using ECG and 2D ECHO.

RESULTS

Most cases fell in the age group of 31 - 40 years. There was an overall female preponderance (76 %) over all age groups with mean age of 42.02 years. Goiter was found in 8 % of patients, bradycardia and hypertension was seen in 30 % and 22 % respectively. Central nervous system (CNS) examination revealed delayed ankle jerk in 40 % followed by hoarseness of voice in 38 % of patients. Lipid analysis showed increase of total cholesterol (TC), low density lipoprotein (LDL), very low-density lipoprotein (VLDL), triglycerides (TGL) and decrease of high-density lipoprotein (HDL). Normal ECG was found in 26 % of patients. Bradycardia was most common finding seen in 30 % (15) of patients. 24 % (12) of patients exhibited low voltage complexes. While, 46 % cases showed normal ECHO findings. 24 % of cases presented with pericardial effusion. 18 % cases presented with diastolic dysfunction among which majority were mild. None of the cases had severe diastolic dysfunction. Only a meagre 10 % cases showed intraventricular septum (IVS) thickness.

CONCLUSIONS

Pericardial effusion was seen among 24 % of patients while diastolic dysfunction was seen in 18 % patients. Thus, any unexplained pericardial effusion should be screened for hypothyroidism.

KEYWORDS

Hypothyroidism, Cardiac Dysfunction, 2D ECHO, ECG, Thyroid Stimulating Hormone (TSH)

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BACKGROUND

Globally, thyroid diseases are the most common endocrine disorders. Various researches have revealed that 42 million people in developing countries like India suffer from thyroid diseases which include both hypothyroidism and hyperthyroidism. Thyroid disease is easy to diagnose, even a tiny swelling of the thyroid guides the treating physician, and the accessibility of medical treatment differs the disease from other clinical conditions. Early diagnosis and treatment remain the cornerstone of management.[1] The most common functional disorder of the thyroid gland is hypothyroidism. Hypothyroidism is a cluster of clinical manifestations resulting from thyroid hormone deficiency or more rarely, from their impaired activity at tissuelevel.[2]

Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones, which in turn results in a generalized slowing down of metabolic processes.[3] Hypothyroidism is characterized by a broad clinical spectrum ranging from an overt state of myxedema, end-organ effects and multisystem failure to an asymptomatic or subclinical condition with normal levels of thyroxin (T4) and triiodo thyronine (T3) and mildly elevated levels of serumthyrotropin.[4,5]

The prevalence of hypothyroidism in the developed world is about 4 - 5 %.[6,7] The prevalence of subclinical hypothyroidism in the developed world is about 4 – 15 %.[6,8] Recent study by AG Unnikrishnan showed prevalence of hypothyroidism in Indian population to be 10.95 %, with significantly higher proportion of female vs male (15.86 % vs 5.02 %). Subclinical hypothyroidism (SCH) was observed in 8.02 % of the population.[9]

Objectives

To determine cardiac manifestations in newly diagnosed 50 hypothyroid patients by ECG and ECHO who were presented to Navodaya Hospital which includes both outpatients and in patient departments.

METHODS

This was a clinical cross-sectional study carried among 50 new cases of hypothyroidism which included both inpatients and outpatients visiting Department of General Medicine, Navodaya Hospital, Raichur from October 2015 to September 2017 to assess the cardiac manifestations by ECG and ECHO.

Inclusion Criteria

The patients confirmed with hypothyroidism by serum TSH, total T4 and T3 level in the age group of 18 to 60 years.

Exclusion Criteria

Patients with cardiac diseases, severe anaemia, chronic obstructive pulmonary disease (COPD), diabetes mellitus or any endocrine disorders. Patients on medications like beta blockers, lithium, oral contraceptive pills (OCPs), steroids and alcohol that alter the thyroid function.

Ethical clearance (Ref: Med / DOME / 118) was taken from the institution prior to the commencement of the study. The patients included in the study were examined in detail and necessary investigations were conducted and data recorded in the proforma after obtaining the written informed consent.

Investigations

The following investigations were done to diagnose hypothyroidism and associated cardiac profile. haemoglobin (Hb), complete blood count (CBC), random blood sugar (RBS), urine routine which consists of sugar and albumin microscopy, serum creatine, lipid profile, chest x-ray, T3, T4 and TSH levels, ECHO. 3 ml of early morning fasting samples were collected and sent in a plain tube for T3, T4, TSH estimation. The hormone estimation was done by chemiluminescence assay.

Electrocardiogram (ECG)

ECG was recorded in all patients at a paper speed of 25 mm per sec at normal standardization more than 0.2 sec of PR interval was taken as prolonged. Low voltage complexes were taken when QRS complexes were less than 5 mm in limb leads and less than 10 mm in chest leads.

Echocardiography

2D Echocardiograph with Color Doppler, continuous wave doppler having a transducer of 2.5 MHz with VCR, printer, ECG gating facility of Hewlett Packard was used. Various modes used in ECHO are the following: M-Mode ECHO, Two-dimensional ECHO, Doppler ECHO, Pulse wave, Continuous doppler, Color doppler. By using ECHO, each case was specially screened for systolic and diastolic dysfunction and pericardial effusion.

Statistical Methods

The data for the purpose of the study was collected in a predesigned and pretested proforma. About 50 cases were selected on the basis of simple random sampling method. A descriptive analysis was carried out using statistical package for social sciences (SPSS) 18 while Microsoft word and Microsoft excel were used to generate graphs and tables. Results were presented as mean, SD and frequency.

RESULTS

Our study included a total of 50 subjects. The various parameters were evaluated and then compiled. The results were then analysed using the SPSS v 16.0 software at Department of Social and Preventive Medicine. 50 subjects participated in the study of which 37 were females and 13 were males. This has been depicted in the tables and graphs below. Majority of the cases were in the age group of 31 - 40 years. Females were predominant than male with the mean age of 40.43 years. The mean age of the cases were 42.02 years. The female population constituted about 37 of total 50 cases accounting to 74% of the total. (Table No.1)

Most common symptoms were of lethargy found in 40 patients (80 %), weight gain found in 27 patients (54 %), cold intolerance in 23 patients (46 %), constipation in 20 patients (40 %), dry skin in 19 patients (38 %), hoarseness of voice in 19 patients (38 %), dyspnoea in 17 patients (34 %) and menstrual symptoms in 15 female patients accounting to 30 % of total patients. On general examination, most common findings are increased body mass index (BMI) found in 31 of 50 patients accounting to 62 % of the total, dry skin found in 19 patients (38 %), pallor was present in 13 patients (26 %), bradycardia was found in 14 patients (28 %), BP above 140 / 90 mmHg in 11 patients (22 %), oedema in 09 patients and goiter was found in 4 patients accounting 18 % and 8 % respectively.

On systemic examination diminished heart sound was found in 10 patients accounting to 20 % patients. CNS examination revealed delayed ankle jerk in 20 followed by hoarseness of voice in 19 patients accounting to 40 % and 38 % respectively. The TSH level > 10 µIU/ml with low T3 and T4 is diagnostic of overt hypothyroidism. The TSH level between 4.5 – 10 µIU/ml with normal T3 and T4 levels indicates subclinical hypothyroidism.[4] Out of 50 patients, overt hypothyroidism was found in 47 patients accounting to 94 % and subclinical hypothyroidism was seen in 3 patients accounting to 6 % of patients.

Lipid analysis showed increase of TC, LDL, VLDL, TGL and decrease of HDL in hypothyroid cases**.** (Table no.2) Normal ECG was found in 13 patients accounting to 26 % of patients. Out of 50 patients 08 patients had bradycardia accounting to 16 %, 07 patients had low voltage complex accounting to14 %, 04 patients had bradycardia with low voltage accounting to 08 %, 05 patients had left bundle branch block (LBBB) accounting to 10 %, 04 patients had right bundle branch block (RBBB), 06 patients had ST segment changes and 03 patients had bradycardia with ST segment changes accounting to 08 %, 12 % and 06 % respectively.

Echo findings were normal in 23 of 50 cases accounting to 46 %. Pericardial effusion was seen among 24 % (12) of cases. Diastolic dysfunction was seen among 9 patients while majority were mild and no cases were severe. IVS thickness was seen in 5 cases accounting to 18 %. (Table no. 3) Out of 12 patients with hypothyroidism 08 patients had mild pericardial effusion, 03 patients had moderate pericardial effusion and 01 patient had severe pericardial effusion. (Graph No. 1)

Age (years)	Male N	Male %	Female N	Female %	Total N	Total %
21 - 30	-	-	07	18.9	07	14
31 - 40	05	38.5	15	40.5	20	40
41 - 50	05	38.5	10	27	15	30
51 - 60	03	23.1	05	13.5	08	16
Total	13	100	37	100	50	100
Mean ± SD	46.53 ± 7.46		40.43 ± 10.48		42.02 ± 10.08	

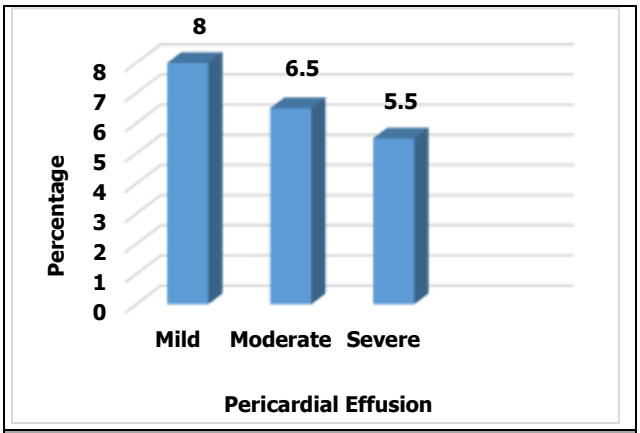
Table 1. Distribution of Study Participants Based on Demographics

Lipid Parameters	n	Range	Mean ± SD
Total cholesterol	50	180 - 251	211 ± 17.17
HDL	50	22 - 55	34.06 ± 5.32
LDL	50	93 - 182	123.64 ± 13.97
VLDL	50	31 - 81	42.10 ± 10.40
Triglycerides	50	101 - 408	191 ± 39.74

Table 2. Lipid Parameters among Study Subjects

ECG	No. of Cases	Percentage
Normal	13	26
Bradycardia	8	16
LVC	7	14
LVC with bradycardia	4	8
LBBB	5	10
RBBB	4	8
STT	6	12
STT with bradycardia	3	6
ECHO		
Normal	23	46
Systolic dysfunction	04	08
Pericardial effusion	12	24
1. Mild	08	66.67
2. Moderate	03	25
3. Severe	01	8.33
Diastolic dysfunction	09	18
IVS thickness	05	10

Table 3. ECG and ECHO Findings



Graph 1. Pericardial Effusion in 12 Patients with Hypothyroidism

DISCUSSION

50 newly detected hypothyroid patients visiting Navodaya Medical College and hospital, Raichur between October 2015 to September 2017 were included in the study and data analysis was done. The same is discussed here in comparison with previous trials.

Age and Sex Distribution

The study population belonged to age group of 20 - 60 years. Female were predominant (74%) with the majority belonging to 31 - 40 years. Similar demographic profile was seen in Harrison's text book of internal medicine.

ECG Changes and Hypothyroidism

Normal ECG was found in 13 patients accounting to 26 % of the patients. Among abnormal ECG changes bradycardia was the most common finding seen in 15 patients accounting for 30 %, low voltage complexes was seen in 11 patients accounting to 22 %, LBBB, RBBB and ST segment changes were seen in 05, 04 and 09 patients accounting to 10%, 08% and 18% of patients respectively. (Table No. 3)

This finding is consistent with other studies conducted by R. Varma[10] Except conduction disturbances. MH Nikoo[11] also documented sinus tachycardia QT prolongation and also ventricular tachycardia which were not found in our study.

ECG Findings	K. Ramesh et al[12]	Present Study
Normal	30 %	26 %
Low voltage	35 %	24 %
Bradycardia	40 %	30 %
LBBB	05 %	10 %
RBBB	7.5 %	08 %

Table 3. Comparative Study of ECG Findings

ECHO Findings and Hypothyroidism

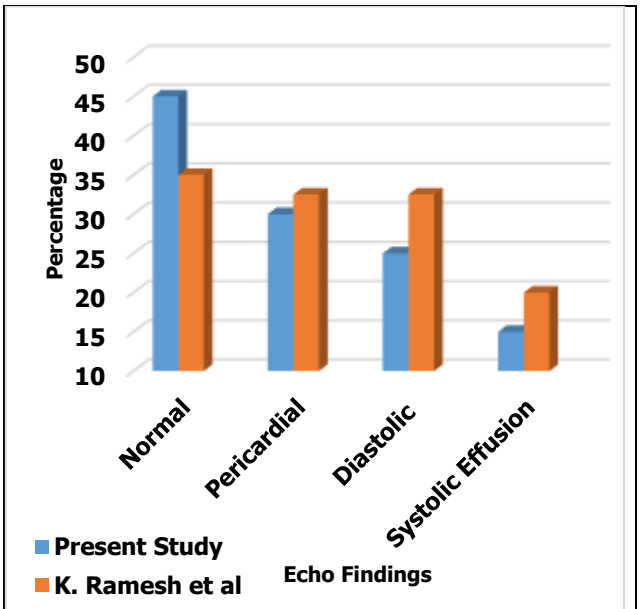
Echocardiography plays a vital role in recognizing the cardiac pathology and to assess the effect of therapy. There are chances of serious cardiac complication due to long standing hypothyroidism if not diagnosed at early stage. Our study revealed that 46 % (23) of cases had normal ECHO findings. Pericardial effusion was the most common findings seen in 24 % of cases accounting to 24 %. Diastolic dysfunction was seen in 9 cases which were mild with no severe diastolic dysfunction. IVS thickness was seen in 18 % (5) of cases. Earlier study by K. Ramesh et al. showed prevalence of pericardial effusion in 27.5 % of hypothyroid patients which correlates with our study.[12] (Figure No.1)

Rawat B and Satyal A,[13] also reported pericardial effusion up to 30% of patients with hypothyroidism. A relatively low incidence of pericardial effusion in our study may be due to earlier detection of hypothyroidism in the present days as result of routine use of thyroid function tests. Hypothyroidism should be ruled out among patients with undiagnosed pericardial effusion. Our study revealed majority of mild diastolic dysfunction which was seen in 18 % of the cases. The observations were similar with the finding of R Verma in 1995 which showed 27 % patients with diastolic dysfunction.[10]

Systolic dysfunction was seen in 8 % of patients. A study carried out by Forfaret et al. in 1982 revealed that low systolic function indices among hypothyroid patients.[14] However Small ridge et al. (1987) had argued that this could be related to relatively elderly patients included in the above studies.[15] They found no such alteration in systolic function in their younger patients (aged 20- 48 years). This was further supported by Fouron et al. (1982)[16] Grossman et al. (1994)[17] and Verma et al. (1995)[10] who did not find any evidence of systolic dysfunction in hypothyroid patients. Rawat B and Satyal A et al.[13] showed no systolic dysfunction.

Zoncu et al.[18] found impairment in both systolic and diastolic function in subclinical hypothyroidism. In the recent re-analysis of the Whickham survey[19] an association was found between ischaemic heart disease (IHD) events and IHD–related mortality with subclinical hypothyroidism over the 20 years follow up.

Our study revealed that IVS thickness was seen only in 5 cases and showed increased number of both subclinical and over hypothyroidism. Literature shows high incidence of asymmetric septal hypertrophy. It was seen that most of the patients were relatively old and showed a normal age related IVS thickening, whereas Bennet et al. (1983),[20] Lee et al. (1990),[21] and Bernstein et al. (1995)[22] did not find similar incidences in younger patients.



Graph 2. Comparative Study of 2D Echo Findings

CONCLUSIONS

Thyroid dysfunction can present with various cardiovascular changes. A very high index of suspicion is required for early diagnosis of hypothyroidism. The severity and duration of elevated TSH levels decide the involvement of cardiovascular system in hypothyroid patients. Our study consisting of 50 patients had significant cardiovascular manifestations; most of the patients had features suggestive of increased cardiovascular morbidity in the form of bradycardia, abnormal low voltage complex on ECG, and deranged lipid profile. The most common abnormal finding on the echocardiography was pericardial effusion and diastolic dysfunction. Echocardiography is an easily available, non-invasive, sensitive diagnostic tool to assess cardiac status of the patients with thyroid disorders. Physicians need to be sensitized to early detection of hypothyroidism to prevent development of significant systemic manifestations with appropriate thyroxine therapy.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
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