

Original article:

Study of cardiac dysfunction in hypothyroidism

Dr. Shashikanth.M

Name of the Institute/college: Department of Medicine , JJM Medical College , Davangere , Karnataka , India

Corresponding author :Dr.Shashikanth.M

Abstract:

Introduction: Hypothyroidism is second most common endocrinopathy next to diabetes mellitus. Hypothyroidism is associated with increased cardiovascular mortality and morbidity¹. This study is aimed at studying the cardiac dysfunction in hypothyroidism by ECG and ECHO. Thus reiterating the need for treatment even in the milder forms of the disease.

Materials & Methods: 50 new patients of hypothyroidism who presented to Bapuji and Chigateri government hospital from 1-10-2012 to 1-8-2014 were studied. 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 yrs. There was an overall female preponderance with mean age of 37.65yrs (76%). Most common symptoms are of weight gain, lethargy, dry skin, and hoarseness of voice and bradycardia and hypertension seen in 30% and 18 respectively. On examination diminished heart sound is found in 22% patients. Lipid analysis showed increase of TC, LDL, VLDL, TGL and decrease of HDL.

Conclusion: Among 50 new cases of hypothyroidism, pericardial effusion was found in 18% patients. Diastolic dysfunction was seen in 18% patients. Thus any unexplained pericardial effusion should be screened for hypothyroidism.

Key words: Hypothyroidism, Cardiac Dysfunction, 2D ECHO

Introduction

Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones, which in turn results in a generalized slowing down of metabolic processes.¹ 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 thyroxine and triiodothyronine and mildly elevated levels of serum thyrotropin.^{2,3} The prevalence of hypothyroidism in the developed world is about 4-5%.^{4,5} The prevalence of subclinical hypothyroidism in the developed world is about 4-15%.^{4,6} Recent study by AG Unnikrishnan showed prevalence of hypothyroidism in Indian population was

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.

Thyroid hormones exert direct cellular effects on almost all tissues of the body. It causes multi organ dysfunction due to deranged metabolism. Cardiovascular complications⁸ are some of the most profound and reproducible clinical findings associated with thyroid disease. Hypothyroidism is associated with increased cardiovascular mortality and morbidity. The dysfunction ranges from functional systolic/diastolic dysfunction to overt failure and coronary artery disease. Systematic study was done to know the early effects of hypothyroidism on cardiovascular system. The identification of patients with

hypothyroidism is an important individual and public health issue. The completely reversible nature of these complications is well known. Hence, early detection and initiation of hormone replacement therapy can minimize associated cardiovascular changes. Thus the need of this study is to assess the CVS parameters in new hypothyroid patients by ECG and ECHO.

Methodology

50 Cases of hypothyroidism visiting Bapuji Hospital and Chigateri Hospital will be the subjects.

Sample Size :50 Cases of new hypothyroidism

Study duration : October 2012 to September 2014

Inclusion Criteria : Hypothyroid patients which include

- a) Newly diagnosed patients
- b) Detected hypothyroid patients not on treatment
- c) Patients on L-thyroxine for less than 4 months.

Exclusion criteria:

- a) Patients with known cardiac disease
- b) Patients with COPD, severe anemia, diabetes mellitus or any other endocrinal disorder.
- c) Patients taking medications that alter the thyroid function like beta blockers, lithium, OCP's, steroids & alcohol.

Investigations:

- T3, T4, TSH
- Hemoglobin, TC, DC, ESR
- RBS
- Urine routine – sugar, albumin microscopy
- Blood urea
- Serum creatinine

- Lipid profile
- A standard 12 lead ECG
- ECHO
- T3, T4 & TSH levels

3 ml of early morning fasting samples containing plain clotted blood are collected and sent for T3, T4, TSH estimation.

The hormone estimation is done by chemiluminescence assay.

Echocardiography: By using ECHO each case was specially screened for systolic and diastolic dysfunction and pericardial effusion. Diastolic dysfunction was assessed by means of the Canadian consensus criteria. Patients were grouped under the following 5 groups if at least 4 of the criteria have been met.⁹

Canadian consensus for diastolic dysfunction:

Systolic Dysfunction:

It is evaluated using the systolic time intervals as in other studies by workers like Edward W Bough¹⁰. PEP or the pre-ejection period is the time between the R wave on ECG and the opening of the aortic valve. It is the time interval between the electrical and mechanical activation of the heart. PEP is <105msec in males and <110msec in females. A value>0.76 is taken as the diagnosis of systolic dysfunction. Patients were categorized into two groups, either with or without systolic dysfunction.¹¹

Statistical Methods¹²:

1. Measures of central tendency
2. Measures of dispersion
3. Graphical representation of the data

Study design: A Cross sectional clinical study consisting of 50 new cases of hypothyroidism is undertaken to study the cardiac manifestations by ECG and ECHO

Results :

Table 1 : Lipid Profile And Hypothyroidism

Lipid parameters (mean ± SD)	Mild (n=20)	Moderate (n=25)	Severe (n=5)
Total cholesterol	150±15.04	172±19.01	195±17.34
HDL	34.05±4.5	33.36±4.5	30.06±5.2
LDL	124±6.5	127±9.4	142±4.472
VLDL	38.35±4.12	37.6±4.49	43.8±3.03
TGL	191.2±15	197.5±13	213±25.4

Lipid analysis showed increase of TC, LDL, VLDL, TGL and decrease of HDL in mild, moderate and severe cases.

Table 2: Severity of hypothyroidism according to TSH levels

Severity of hypothyroidism	TSH levels (mU/L)	No.of cases
Mild	0.5 – 20	20
Moderate	20-50	25
Severe	>50	5

Table 3 : ECG findings

ECG	No.of cases	Percentage
Normal	18	35
Bradycardia	15	30
Low voltage complexes	15	30
STT changes	10	20
LBBB	2	4
RBBB	7	14

Normal ECG is found in 35% of patients. Bradycardia is most common finding seen in 15 patients counting for 30%. Low voltage complexes is seen in 30% patients.

Table 4 :ECHO findings

Echo findings	No.of cases	Percentage
Normal	25	50
Systolic dysfunction	2	4
Pericardial effusion	9	18
Diastolic dysfunction		
Mild	7	14
Moderate	2	4
Severe	Nil	0
IVS thickness	5	10

Echo findings are normal in 50% cases. Pericardial effusion is next common finding seen in 9 cases accounting to 18%. Diastolic dysfunction seen in 18%, majority of them being mild dysfunction. No cases found to have severe diastolic dysfunction. IVS thickness found in only in 5 cases

Discussion:

The present study included 50 newly detected hypothyroid patient and it was conducted in J.J.M. Medical College, between October 2012 to September 2014, data analysis done and discussed here in comparison with previous trials. The age range of the study is between 21-60 years. Most patients belonged to the age groups of 31-40. There were an overall female preponderance over all age groups. The female population constituted about 76% of the total with female : male ratio 3:1. Similar demographic profile was mentioned in most of medicine text books including Harrison text book of internal medicine. On general examination most common findings are dry skin and weight gain in around 70% and 68% of patients respectively. Bradycardia seen in 30% of patients, hypertension is seen in 18% of the patients, other less common findings includes goiter, edema, pallor, which accounts for 6%, 16%, and 20% respectively. Delayed relaxation of the ankle jerk is the most common finding present in 26 patients which constitutes 52% of the patients, which correlates well with the description in most standard textbooks of endocrinology¹ and in various studies by Lambert¹⁵ and Underdahl. On cardiovascular examination cardiomegaly is found in 2 patients which accounts for 4% of the patients, diminished heart sound in 11 patients accounting for 22% of the total indicating probability of pericardial effusion.

Reported pericardial effusion to occur in 30% to 80% of patients with hypothyroidism.

There is increase of total cholesterol, LDL, VLDL, triglycerides and decrease of HDL. Alka M. Kanaya et al in 2002, showed increase of total cholesterol. This is also in agreement with the literature given in Williams text book of endocrinology.¹⁶

ECG is normal in 18 patients (35%). Among abnormal ECG which constitutes 65% of the patients, low voltage complexes and bradycardia seen in upto 30% of the patients. LBBB & RBBB found in 4% & 14% respectively. This finding is consistent with other studies like by R. Varma¹⁷ except conduction disturbances. MH Nikoo¹⁸, M.D. SUMS 2002 also documented sinus tachycardia QT prolongation and also ventricular tachycardia which are not found in our study.

The cardiac complications of long standing hypothyroidism are serious if not diagnosed properly earlier. As a non-invasive method echocardiography can play important role in recognizing the cardiac pathology as well as to follow up the effect of the therapy. In the present study, echocardiography findings are normal in 25 patients that accounts for 50% of cases.

Pericardial effusion is the next common finding seen in 9 cases i.e. in 18% of cases. Earlier study by R. Verma in 1995 showed that prevalence of pericardial effusion to be 45%.

Rawat B and Satyal A,⁸ reported pericardial effusion upto 30-80% 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. Nevertheless, in a patient with undiagnosed pericardial effusion, hypothyroidism should be ruled out.

In our study diastolic dysfunction seen in 18%, majority of them being mild dysfunction 7 among 9 patients. In a study by R.Verma in 1995 it was seen that 27% of patients had diastolic dysfunction. Systolic dysfunction seen in 4% of patients. Forfaret al¹⁹. (1982) and others have described low systolic function indices in hypothyroid patients. However Smallridge et al. (1987) have argued that this could be related to relatively elderly patients included in the above studies. They found no such alteration in systolic function in their younger patients (aged 20- 48 years). This was further supported by Fournon et al. (1982), Grossman et al. (1994) and Verma et al. (1995) who did not find any evidence of systolic dysfunction in hypothyroid patients. Rawat B, and Satyal A, et al⁸ showed no systolic dysfunction.

Zoncu et al,²⁰ found impairment in both systolic and diastolic function in subclinical hypothyroidism. In the recent re-

analysis of the Whickham survey²¹ – An association was found between incident ischaemic heart disease (IHD) events and IHD – related mortality with subclinical hypothyroidism over the 20 years follow up.

IVS thickness found in only in 5 cases in our study and above studies shows increased numbers in both subclinical and overt hypothyroidism. There is no evidence of LVPW thickness in our cases. Rawat B and Satyal A et al reported LVPW to occur. Bennet et al. (1983), Lee et al. (1990) and Bernstein et al. (1995) did not find similar incidences.

Conclusion :

50 new cases of hypothyroid patients presented with an abundance of features suggestive of increased cardiovascular morbidity in the form of deranged lipid profile, bradycardia, diastolic dysfunction and low voltage complex are the most common abnormal finding in ECG. Pericardial effusion is most common abnormal finding in ECHO. Any unexplained pericardial effusion should be screened for hypothyroidism and all hypothyroid patients should be screened for cardiac dysfunction.

References:

1. Disorders of thyroid gland J.Larry Jameson Anthony P. Weetman, 18th edition Harrison's internal medicine-2011.341:2911-2939.
2. Cooper DS. Clinical practice.Subclinical hypothyroidism. N Engl J Med. 2001;345:260–5.
3. Roberts CG, Ladenson PW. Hypothyroidism.Lancet. 2004;363:793–803.
4. Hollowell JG, Staehling NW, Flanders WD, Hannon WH, Gunter EW, Spencer CA, et al. Serum TSH, T (4), and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III) J ClinEndocrinolMetab. 2002;87:489–99.
5. Hoogendoorn EH, Hermus AR, de Vegt F, Ross HA, Verbeek AL, Kiemency LA, et al. Thyroid function and prevalence of anti-thyropoxidase antibodies in a population with borderline sufficient iodine intake: Influences of age and sex. Clin Chem. 2006;52:104–11.

6. Bembem DA, Hamm RM, Morgan L, Winn P, Davis A, Barton E. Thyroid disease in the elderly. Part 2. Predictability of subclinical hypothyroidism. *J Fam Pract.* 1994;38:583–8.
7. Indian journal of endocrinol Metab. 2013 jul-Aug 17(4): 647-652.
8. Rawat B1 and Satyal A2, an echocardiographic study of cardiac changes in hypothyroidism and the response to treatment, *Kathmandu University Medical Journal* (2003) Vol. 2, No. 3, Issue 7, 182- 187
9. Yamada H, et al. Prevalence of Left Ventricular Diastolic Dysfunction by Doppler Echocardiography: Clinical applications of the Canadian Consensus Guidelines. *J Am Soc Echocardiography* 2002; 15: 1238-44.
10. Edward W Bough, MD; William F Crowley, M.D: myocardial function in hypothyroidism. *Arch Intern Med* 1978 Oct;138.
11. Indian journal of endocrinol Metabolism 2012;16:204-213.
12. Bio-statistics, Park text book of preventive and social medicine, 18th edition, 2004; 604-608.
13. Klein I, Levey GS. New perspective on thyroid hormones, catecholamines and the heart. *Am J Med* 1984;76:167-172
14. Kral, J, Hradec, J, Limanova, J; heart in thyroid disease *corvasa* .1992 34(2) 108-14.
15. Lambert, E. H., Underdahl, L. O., Beckett, S., and Mederos, L. O. A study of the ankle jerk in myxedema. *J. clin. Endocr.* 1951, 11, 1186.
16. Bough EW, Crowley WF, Ridgway C, Walker H, Maloof F, Myers GS, Daniels GH. Myocardial function in hypothyroidism. Relation to disease severity and response to treatment. *Arch Intern Med* 1978;138:1476-1480.
17. R. Verma, Heart in hypothyroidism. *JAPI* 1996, 44:390-393.
18. M.H Nikoo MD. Department of Internal Medicine, SUMS, cardiovascular manifestations hypothyroidism, *SEMJ* vol2.42.
19. Forfar JC, Muir AL, Toff AD. Left ventricular function in hypothyroidism. *Br Heart J* 1982;48:278-284.
20. Zoncu S., Pigliaru F., Putzu C. et al. Cardiac function in borderline hypothyroidism: a study by pulsed wave tissue Doppler imaging. *Eur. J. Endocrinol.* 2005;152;527-533.
21. S. Razvi, J. U. Weaver, M. P. Vanderpump, and S. H. S. Pearce, "The incidence of ischemic heart disease and mortality in people with subclinical hypothyroidism: reanalysis of the Whickham survey cohort," *Journal of Clinical Endocrinology and Metabolism*, vol. 95, no. 4, pp. 1734–1740, 2010.