

A Clinical Study of Cardiovascular Changes in Recently Detected Hypothyroid Patients

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Abstract

Thyroid hormone is very important for optimal functions of the body including the cardiovascular system. Hypothyroidism has significant adverse effects on the functions of the cardiovascular system. Overt and subclinical hypothyroidism is associated with increased risk of cardiovascular-related mortality and morbidity. Methods: This prospective cross-sectional study was done in the Department of General Medicine, Govt. Medical College, Mahaboobnagar. A total was n=47 with n=15 males and n=32 females were included based on inclusion and exclusion criteria. The patients with clinical symptoms of hypothyroidism were diagnosed and confirmed by chemiluminescence immunoassay (CLIA) method for TSH, FT₄ and FT₃ levels other investigations were CXR, ECG, and 2D echo. Results: Out of total n=47 patients there were n=15 male and n=32 females. The total number of cases with hypothyroidism in the male group were n=15 out of which n=6 showed cardiovascular involvement and n=9 did not show cardiovascular involvement. Bradycardia was found in n=2 male and n=9 females and decreased in heart sounds was found in n=6 male and n=7 females. Echo findings were Diastolic dysfunction was found in n=10 female and mild diastolic dysfunctions were found in n=6 female. One case each of IVS thickness and pericardial effusion was found in n=5 males and n=11 females. Conclusion: Hypothyroid patients can present with different symptoms which may be sometimes non-specific. High suspicion is the key for early diagnosis of hypothyroidism. The appearance of cardiovascular symptoms depends on the duration of hypothyroidism. Treatment with appropriate doses of L-thyroxine depending on the levels of TSH and proper patient compliance to the treatment will generally ensure the reversal of the cardiac abnormalities.

Keywords: Hypothyroidism, Cardiovascular changes.

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INTRODUCTION

Thyroid dysfunction is a common disorder encountered in general practice. The thyroid problems are on the rise in countries like India. It has been estimated that over 42 million people are suffering from one of the other forms of thyroid dysfunction [1]. Hypothyroidism is a clinical syndrome resulting from the deficiency of thyroid hormone levels resulting in a decrease in metabolism [2]. It is found to be 5-8 times more common in females as compared to male. The primary hypothyroidism accounts for 99.5% of cases which is due to failure of the thyroid gland. And only <0.5% of the cases are due to the disorder of pituitary gland or hypothalamus known as central hypothyroidism. Clinical cases of hypothyroidism always are represented with the elevation of TSH levels and decrease of serum-free T₄ below the reference range, while subclinical hypothyroidism is referred to in cases where TSH value is elevated and T₄ within the reference range. Since thyroid hormone affects several metabolic processes and all the tissues of the body are

generally affected with thyroid hormone deficiency. The cardiovascular system is particularly more sensitive to changes in thyroid hormone levels. Hypothyroidism is also associated with increased cardiovascular morbidity and mortality. The effects of hypothyroidism are bradycardia, mild hypertension (diastolic), narrowed pulse pressure, cold intolerance and fatigue [3, 4]. The important and consistent cardiovascular abnormality in hypothyroidism is impaired left ventricular diastolic functions. It is characterized by slow myocardial relaxation and impaired ventricular filling. Left ventricular functions are subnormal and decreased values of ejection fraction and stroke volume are found [5]. Due to the decrease in ejection fraction and stroke volume, the cardiac output is generally decreased by 30-50% [6]. There is increased capillary permeability due to hypothyroidism which leads to pericardial effusion and increased systemic vascular resistance [7]. The pericardial effusion has a direct relation to thyrotropin levels. Pericardial effusion is found to be present in 30-80% of the hypothyroid patients and

depends on the severity of the disease [8]. It is therefore important to find the clinical and subclinical cases of thyroid deficiency and timely detection of cases with effective treatment will strop cardiovascular damages. But it has been seen in all most all cases the cardiovascular changes are reversible with thyroid replacement therapy [4]. With this background, we in the present study tried to evaluate the cardiovascular involvement in patients with newly detected hypothyroidism.

MATERIAL AND METHODS

This prospective cross-sectional study was done in the Department of General Medicine, Govt. Medical College, Mahaboobnagar. Institutional Ethical committee permission was obtained for the study. Written consent was obtained from all the participants of the study. A total n=16 males and n=34 females were initially sorted out for inclusion in the study, however, n=1 male and n=2 females did not turned up for follow up visits the final total was n=47 with n=15 males and n=32 females were included. The patients with clinical symptoms of hypothyroidism were diagnosed and confirmed by chemiluminescence immunoassay (CLIA) method for TSH, FT₄ and FT₃ levels a combination of increased TSH concentration and low T₄ concentration have diagnostic value in cases of primary hypothyroidism CXR, ECG was recorded in 12 standard leads with a paper speed of 25mm/sec. PR interval of > 0.2 seconds was taken as prolonged, QRS complexes of less than 5mm in limb leads and less than 10mm in chest leads were taken as low voltage complexes. 2D Echocardiogram in all the patients in the study echocardiogram was done on Siemens G.

Table-2: Prevalence of hypertension as per JNC 8 criteria [9]

Prevalence of Hypertension	Male	Female	Total	Percentage
Normal <120/<80 mmHg	9	22	29	61.70
Pre-Hypertension 120-139 /80-89 mmHg	3	2	5	10.64
Hypertension I 140-159 /90-99 mmHg	2	4	7	14.89
Hypertension II >160 />100 mmHg	1	4	6	12.76

The total number of cases with hypothyroidism in the male group were n=15 out of which n=6 showed cardiovascular involvement and n=9 did not show cardiovascular involvement. Similarly, in

Sonoline G. 60 S ultrasound imaging system. Cardiac 2D-Mode, M-mode and Doppler each case was specifically screened for cardiovascular manifestations like pericardial effusion ventricular dysfunction. Exclusion criteria were patients already on treatment with thyroxine those on OCP's glucocorticoids, antineoplastic drugs, NSAIDs, diabetes, and pernicious anemia. All the obtained data were recorded in MS Excel spreadsheet and analyzed with SPSS version 17.

RESULTS

Out of total n=47 patients, there were n=15 male and n=32 females the mean age in male was 33.5 ± 2.5 years and female was 35.5 ± 3.0 years. In the females the maximum number was from age group 31-35 years and in male n=5 patients belong to age group 36-40 years shown in table 1.

Table-1: Age and sex-wise distribution of the cases in the study

Age Group	Male	Female	Total	Percentage
21 – 25	1	2	3	6.38
26 – 30	2	9	11	23.40
31 – 35	4	8	12	25.53
36 – 40	5	7	12	25.53
> 40	3	6	9	19.15
Total	15	32	47	100

Hypertension was classified as JNC 8 criteria in the present study out of n=9 male were with normal blood pressure, n=3 was pre-hypertension, n=2 were hypertension stage I and n=1 were with hypertension stage II. In female n=22 were normotensive and n=2 was pre-hypertension, n=4 were hypertension stage I and hypertension stage II (table 2).

the female group out of n=32 hypothyroid patients, n=19 showed cardiovascular involvement and n=13 were with non-cardiovascular involvement shown in table 3.

Table-3: The cardiovascular involvement in hypothyroid patients

Cases	Male	Female
No. of patients with hypothyroidism	9	13
No. of patients with cardiovascular involvement	6	19
Total No. of patients with hypothyroidism	15	32

The predominant symptoms related to cardiovascular system reported by the male patients included palpitations in n=3(20%), chest pain and breathlessness in n=2(13.33%) each. In females, breathlessness was a predominant symptom with n=7 (21.88%) patients reporting to the hospital with it and n=5(15.62%) were with chest pain and effort

intolerance was seen in n=2 (6.25%) patients shown in table 4.

Table-4: cardiovascular symptoms reported by the patients in the study

Cardiovascular symptoms	Male	Female
Chest Pain	2	5
Breathlessness	2	7
Swelling of feet	0	1
Effort intolerance	1	4
Palpitations	3	2

Note: Some patients reported with more than one symptom

The systemic examination of the cardiovascular system and the central nervous system was done in patients with hypothyroidism. Bradycardia was found in n=2 male and n=9 females and decreased in heart sounds was found in n=6 male and n=7 females. The CNS signs of delayed knee jerk were seen in n=12 female and n=4 male and other features are noted in table 5.

Table-5: Systemic examination of cardiovascular and CNS in hypothyroid patients

Systemic Examination	Male	Female
Cardiovascular Signs		
Bradycardia	2	9
Cardiomegaly	1	3
The decrease in heart sounds	6	7
CNS Signs		
Delayed relaxation of knee jerk	4	12
Hoarse voice	2	4

Note: some patients may have more than one signs

The Echo findings in the patients were done and normal Echo was found in n=9 male and n=13 females. Diastolic dysfunction was found in n=10 female and mild diastolic dysfunctions were found in n=6 female. One case each of IVS thickness and pericardial effusion was found in n=5 males and n=11 females and other features are shown in table 6.

Table-6: The Echocardiographic [ECG] findings of the cases in the study

Echo Findings	Male	Female
Normal	9	13
Systolic dysfunction	1	3
Diastolic dysfunction (Mild)	2	6
Diastolic dysfunction (Moderate)	1	10
Diastolic dysfunction (Severe)	2	1
IVS Thickness	0	1
Pericardial Effusion	5	11
Note: some patients may have more than one Echo findings		

The ECG findings of the patients were found to be normal n=9 and n=13 female and bradycardia were found in n=2 male and n=9 females. Low voltage complexes were found in n=7 females and n=2 males other observations are noted in table 7.

Table-7: ECG findings in the patients of the study

ECG Changes	Male	Female
Normal	9	13
Bradycardia	2	9
RBBB	1	2
LBBB	0	1
Low voltage complexes	2	7
ST-segment changes	1	0

DISCUSSION

We in the present study included n=47 cases of newly detected hypothyroidism. The patients were studied in detail concerning history, clinical examination, investigations. The mean age in our study in males was 33.5 ± 2.5 years and females it was 35.5 ± 3.0 years. In a similar study by BK Behera *et al*; [10] found the females with a mean age of 37.5 years and males were with the mean age of 47.5 years. The sex distribution in our study was 1: 2 were as Anil Kumar *et al*; [11] reported a sex ratio of 1.8: 1 and BK Behera *et al*; [10] reported a ratio of 1:3.2. In this study, 57.44% of patients reported with symptoms with a duration of fewer than 2 months. The mean duration of symptoms before the patients reported to the hospital was 1.5 months. The most common symptoms were related to facial puffiness, loss of hairs, cold intolerance and exertion dyspnoea. There was a history of weight gain in 63.83% of the patients, 12.76% of the patients had goitrous hypothyroidism. Bradycardia was found in n=2(13.33%) males and n=9 (28.13%) females and decreased in heart sounds were found in n=6 (40%) males and n=7 (21.88%) females. As per JNC 8 criteria Stage, I hypertension was seen in n=5 (10.64%), Stage II hypertension was n=7 (14.89%) and stage III hypertension was n=6 (12.76%). One of the interesting findings in our study was the incidence or severity of hypertension was increased as the age was increased. The finding suggests that a hypothyroid state accelerates the age-related increases in blood pressure. It has been seen that hypertensive subjects have a higher prevalence of high circulating TSH than normotensive subjects [12]. In the ECG findings, sinus bradycardia was the commonest both in male and females overall of n=11 (23.4%) were showing bradycardia. In other studies bradycardia has been reported by Shashikanth *et al* 30%, Kumar *et al* 14.3%, Crowley *et al* 13.7%, Ramesh *et al* 40% [4, 13-15]. The presence of low voltage complexes in this study was n=9(19.15%) in all patients. Ramesh *et al*; [15] have found 30% of patients with low voltage complexes and Rajasekhar *et al*; [16] have shown the presence in 24% of cases and S Shah *et al*; have found in 33% of cases [17]. ST-segment changes with the change of T waves were found only in one case (2.1%) in the present study. Satpathy *et al*; [18] have found ST depression from J point with T wave inversion as the common finding in 34% of the cases in their study. Garg *et al*; [19] have found ST changes in the form of the flat or inverted T wave in 14% of cases followed by sinus bradycardia in 4% of the cases. The Echo findings were

normal in n=22 (46.81%) of patients. Pericardial effusion was found n=16 (34.04%) of the cases in the study. Other studies by R Verma et al; [20] found the prevalence of effusion in 45% of cases and pericardial effusion have been reported from 30% to 80% of cases of hypothyroidism in agreement with the results of the present study. The next common finding was diastolic dysfunction found in the majority of the patients n=22(46.80%) while most of them were mild dysfunctions. R Verma *et al*; [20] found 27% of patients with hypothyroidism had diastolic dysfunction. The systolic dysfunction was found in n=4 (8.51%) of all cases R Verma et al; [20] have found systolic dysfunctions in only 7.5% of the cases closely matching with the results of the present study. Some studies have found that the presence of systolic dysfunction is very less or negligible in hypothyroid patients especially in the younger age group (20-40 years) [20-22]. IVS thickness was found only in one case in this study and we did not find any evidence of LVPW thickness in our study. The patients were treated with L thyroxine and followed up regularly for the progress of treatment and response to treatment was good in most of the cases of the study.

CONCLUSION

Hypothyroid patients can present with different symptoms which may be sometimes non-specific. High suspicion is the key for early diagnosis of hypothyroidism. The appearance of cardiovascular symptoms depends on the duration of hypothyroidism. Treatment with appropriate doses of L-thyroxine depending on the levels of TSH and proper patient compliance to the treatment will generally ensure the reversal of the cardiac abnormalities and prevent mortality and morbidity in the patients.

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REFERENCES

- Unnikrishnan, A. G., & Menon, U. V. (2011). Thyroid disorders in India: An epidemiological perspective. *Indian journal of endocrinology and metabolism*, 15(Suppl2), S78.
- Longo, D. L., Fauci, A. S., Kasper, D. L., Hauser, S. L., Jameson, J. L., & Loscalzo, J. (2011). 341: disorders of the thyroid gland. *Harrison's principles of internal medicine*. (18th ed.). New York: McGraw-Hill.
- Demers, L. M., & Spencer, C. A. (2003). Laboratory medicine practice guidelines: laboratory support for the diagnosis and monitoring of thyroid disease. *Clinical endocrinology*, 58(2), 138-140.
- Crowley Jr, W. F., Ridgway, E. C., Bough, E. W., Francis, G. S., Daniels, G. H., Kourides, I. A., ... & Maloof, F. (1977). Noninvasive evaluation of cardiac function in hypothyroidism: response to gradual thyroxine replacement. *New England Journal of Medicine*, 296(1), 1-6.
- Karki, P., Pandey, I., Bhandary, S., Lamsal, M., & Shrestha, N. R. (2014). Echocardiographic Evaluation of Diastolic Dysfunction in Patients with Subclinical Hypothyroidism & the effect of L-Thyroxine treatment: A hospital based study. *Nepalese Heart Journal*, 11(1), 33-38.
- Klein, I., & Ojamaa, K. (2001). Thyroid hormone and the cardiovascular system. *New England Journal of Medicine*, 344(7), 501-509.
- Kochupillai, N. (2000). Clinical endocrinology in India. *Current science*, 79(8), 1061-1067.
- Demers, L. M., & Spencer, C. A. (2003). Laboratory medicine practice guidelines: laboratory support for the diagnosis and monitoring of thyroid disease. *Clinical endocrinology*, 58(2), 138-140.
- James, P. A., Oparil, S., Carter, B. L., Cushman, W. C., Dennison-Himmelfarb, C., Handler, J., ... & Smith, S. C. (2014). 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *Jama*, 311(5), 507-520.
- Behera, B.K., Satpathy, A., Samal, K. (2017). Cardiovascular changes in newly detected hypothyroid patients in Eastern India. *Int J Res Med Sci*, 5, 4302-6.
- KUMAR, A., BHANDARI, A. K., & RAHIMTOOLA, S. H. (1987). Torsade de pointes and marked QT prolongation in association with hypothyroidism. *Annals of internal medicine*, 106(5), 712-713.
- Nyrop, M., Bjørnholm, K. I., Nielsen, F. E., & Haedersdal, C. (1991). Cardiovascular manifestations of hypothyroidism. *Ugeskrift for laeger*, 153(26), 1849-1851.
- M Shashikanth. (2015). Study of cardiac dysfunction in hypothyroidism: Indian Journal of Basic and Applied Medical Research, 4, 111-116.
- KUMAR, A., BHANDARI, A. K., & RAHIMTOOLA, S. H. (1987). Torsade de pointes and marked QT prolongation in association with hypothyroidism. *Annals of internal medicine*, 106(5), 712-713.
- Ramesh, K., & Nayak, B. P. (2016). A study of cardiovascular involvement in Hypothyroidism. *IAIM*, 3(5), 7480.
- Putta, R, A. Sunitha., Gundrathi, V.V. (2015). Cross-Sectional Study of Cardiovascular Manifestations in Hypothyroidism; Indian Journal of Applied Research, 5:564-65.
- Shah, S. K. D., Kilari, M., & Shah, N. K. S. (2013). Cross sectional study of cardiovascular manifestations of hypothyroidism. *J Eval Med Dent Sci*, 2, 5021-9.
- Satpathy, P. K., Diggikar, P. M., Sachdeva, V., Laddha, M., Agarwal, A., & Singh, H. (2013). Lipid profile and electrocardiographic changes in

- thyroid dysfunction. *Medical Journal of Dr. DY Patil University*, 6(3), 250.
19. Garg, V. R., Solanki, D. B., Vasava, A. H., & Vadgama, J. N. (2016). A study on clinical, laboratory manifestation and effect on major organ system in hypothyroidism in tertiary care hospital of Surat city. *Chest*, 15, 30.
 20. Hamolsky, M. W., Kurland, G. S., & Freedberg, A. S. (1961). The heart in hypothyroidism. *Journal of chronic diseases*, 14(5), 558-569.
 21. Forfar, J. C., Muir, A. L., & Toft, A. D. (1982). Left ventricular function in hypothyroidism. Responses to exercise and beta adrenoceptor blockade. *Heart*, 48(3), 278-284.
 22. Yamada, H., Goh, P. P., Sun, J. P., Odabashian, J., Garcia, M. J., Thomas, J. D., & Klein, A. L. (2002). Prevalence of left ventricular diastolic dysfunction by Doppler echocardiography: clinical application of the Canadian consensus guidelines. *Journal of the American Society of Echocardiography*, 15(10), 1238-1244.