ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 6, Issue – 3, June - 2023, Page No. : 252 - 256

Left ventricular diastolic dysfunction in primary hypothyroid patients before and after l-thyroxine therapy

[1]Dr. Vikash Kumar, Junior Resident, Department of Medicine, Patna Medical College and Hospital, Patna.

[2]Dr. Kaushal Kishore, Professor and Head, Department of Medicine, Patna Medical College and Hospital, Patna.

[3]Dr. Devendra Kumar Sinha, Assistant Professor, Department of Medicine, Patna Medical College and Hospital, Patna.

[4]Dr. Rahul Shekhar, Senior Resident, Department of Medicine, Patna Medical College and Hospital, Patna.

Corresponding Author: Dr. Rahul Shekhar, Senior Resident, Department of Medicine, Patna Medical College and Hospital, Patna.

How to citation this article: Dr. Vikash Kumar, Dr. Kaushal Kishore, Dr. Devendra Kumar Sinha, Dr. Rahul Shekhar, "Left ventricular diastolic dysfunction in primary hypothyroid patients before and after l-thyroxine therapy", IJMACR- June - 2023, Volume – 6, Issue - 3, P. No. 252 – 256.

Open Access Article: © 2023, Dr. Rahul Shekhar, et al. This is an open access journal and article distributed under the terms of the creative commons attribution license (http://creativecommons.org/licenses/by/4.0). Which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: Thyroxine (T4) and triidiothyronine (T3), two related hormones produced by the thyroid gland. Thyrotoxicosis, a condition in which the thyroid gland produces too many thyroid hormones, or hormone shortage, which results from glandular damage (hypo thyroidism).

Objective: The objective of the study was to examine the effect of thyroid hormone replacement (L thyroxin) on left ventricular diastolic dysfunction in patients with overt hypothyroidism.

Materials and Methods: This study was conducted from April 2021 to November 2022.Patients with hypothyroidism were chosen from the OPD and IPD of the Department of General Medicine, PMCH, Patna.

Result: Serum TSH level showed a significant decrease in patients from 56.458m Iu/L (±13.032) to 17.932mIu/L (±11.040) after 3 months of L- thyroxine therapy. Serum T3 & T4 showed a significant rise in patients from 0.838 (±0.035) Nmol/L to 2.069 (±0.036) Nmol/L and 44.678 (±8.673) Nmol/L to 92.358 (±13.011) Nmol/L respectively after 3 months of treatment.

Conclusion: In conclusion, Patients with hypo thyroidism have aberrant diastolic dysfunction of the left ventricle, which is reversible with L-thyroxine medication. Doppler echocardiography is a trustworthy, easy-to-use, and affordable tool for determining diastolic dysfunction.

Keywords: left ventricular diastolic dysfunction, L-Thyroxine Therapy, Hypothyroid.

Introduction

Thyroxine (T4) and triidiothyronine (T3), two related hormones produced by the thyroid gland. Thyrotoxicosis, a condition in which the thyroid gland

produces too many thyroid hormones, or hormone shortage, which results from glandular damage (hypothyroidism)[1.] The most prevalent type of thyroid problem worldwide is hypothyroidism. It is a clinical condition brought on by inadequate thyroid hormone production as a result of anatomical and/or functional problems. Weight gain, aversion to cold intolerance, fatigue, dry skin, hair loss, menorrhagia, dyspnea, and hoarseness of voice are among the symptoms.

Signs include increased weight, swollen face, bradycardia, hypertension, carpal tunnel syndrome, and widespread baldness.[2-3]

Doppler Echocardiography and Hypothyroidism

In a study of 44 hypothyroid patients, Gupta A et al. found that the interventricular septal diameter and mean left ventricular posterior wall thickness were both significantly increased (p0.005). Concentric hypertrophy was seen.[4-5]

Zia Q Farookiet al studied Eleven children with hypothyroidism had asymmetric septal hypertrophy (ASH), such as the interventricular septal thickness: Left ventricular posterior wall diastolic thickness >1.3) seen in two children without left ventricular outflow tract blockage. Following thyroxine replacement, everything returned to normal.[6]

TK Mishra et al studied 32 individuals and patients with SH had normal LV systolic function. Compared to controls, there was a sizable amount of diastolic dysfunction in the SH patients. Increased A wave (0.63+0.6 m/sec vs. 0.54+0.05 m/sec), decreased E/A ratio, and extended deceleration above time (169+6.1 msec vs. 148.1+5.4 msec in controls, p 0.05). (0.7+0.09 vs. After taking hormone therapy for a year, echo cardio graphy showed that the left ventricle's diastolic function had significantly improved.[7]

Hypothyroidism is one of the most prevalent endocrine gland diseases. The combination of increased TSH levels and low or normal thyroid hormone concentrations is used to make the diagnosis of primary hypothyroidism.

Clinical symptoms such as signs of exhaustion, weakness, sluggishness, hoarseness, constipation, delayed tendon reflex relaxation, and irregularities of the skin are among the indicators. Additionally, a vast range of cardiovascular symptoms and effects exist.

Thyroid hormone has a significant effect on the cardiovascular system, leading to abnormalities in the left ventricle's (LV) size, function, and wall thickness as well as decreased or normal cardiac contractility, cardiac mass, and possibly dramatic changes in the heart's hemodynamics and contractility in mild thyroid failure and short-term hypothyroidism. Even hypothyroidism in the clinical or subclinical stages has shown these effects.

Positive associations between hypothyroidism and an increased risk of atherosclerosis and coronary artery disease (CAD) have been found.

Numerous investigations suggested that these effects are brought on by some form of microvascular endothelial dysfunction.

Numerous techniques, such as angiography, treadmill exercise testing, computed tomography angiography (CTA), the calcium score of the coronary arteries, and brachial artery ultrasound, have been utilised to examine the connection between hypothyroidism and CAD. Only a few studies make use of myocardial perfusion imaging (MPI), which is classified as functional imaging and uses single-photon emission computed tomography (SPECT). When diagnosing CAD, MPI SPECT has the advantage of using a unique hemodynamic patho physiological paradigm with microvascular perfusion assessment in comparison to traditional cardiac

©2023, IJMACR

structural imaging techniques like invasive coronary angiography and CTA.

Materials and methods

Study population

Cases

A total of 50 Patients visiting OPD or being admitted in Department of General Medicine ward having hypertension in PMCH, Patna were included as cases.

Controls

A total 50 apparently healthy subjects with age and sex matched were considered as the control group.

Type of study

This is a case-control study.

Study place

The study was done in Department of General Medicine at PMCH, Patna.

Study period

This study was conducted from April 2021 to November 2022.

Patients with hypothyroidism were chosen from the OPD and IPD of the Department of General Medicine, PMCH, Patna. The patient underwent tests for thyroid function, blood sugar, lipid profile, chest X-ray, and echocardiography (using 2D M Mode and Doppler technique). The study comprised 50 patients with high TSH (>10mlU/mL) and left ventricular diastolic dysfunction as determined by echocardiography.

- When the following conditions were met (Echo Doppler criteria)
- Emax (early diastolic filling velocity of the mitral valve) was lower than Amax (late diastolic filling velocity of the mitral valve), i.e., Emax Amax, and their ratio E/Amax is lower than one (E/A =1.7+/-0.6, normal range).
- Higher-than-normal values of mitral E wave decleration time (peak of E wave to end of E wave, i.e., DT) and isovolumic relaxation time (IVRT) showed diastolic dysfunction. (Normal range, DT=184+/-24 msec, IVRT=74+/-26msec).

Left ventricular end diastolic diameter (LVEDD), diastolic left ventricular posterior wall thickness (d-LVPET), and diastolic interventricular septal thickness (d-IVST) were all assessed

To determine whether Left Ventricular Diastolic Dysfunction is more common in hypothyroidism, 50 patients and age- and sex-matched controls were included in a comparative study.

Levothyroxine was administered to these 50 patients. To see whether left ventricular diastolic dysfunction improves with it, thyroid profile and echocardiography were redone after three months.

Study design

The inclusion criteria

- Between the ages of 15 and 70.
- possessing a favourable clinical history of increased TSH LEVELS.

The exclusion criteria

- Arrhythmias like persistent atrial fibrillation or flutter;
- significant valvular abnormalities;
- congenital heart disease;
- hypertrophic cardiomyopathy;
- pericardial disease;
- ischemic heart disease;
- left ventricular hypertrophy;
- systemic diseases like diabetes mellitus;
- patients who refuse to give their consent.

©2023, IJMACR

Result and discussion

- In present study, patients were assessed clinically as well as echocardiography, including the 2D M Mode and Doppler method. For the study, 50 patients with elevated TSH (>10 mU/mL) and left ventricular diastolic dysfunction on echocardiography were evaluated.
- In present study, results showed that L-thyroxine therapy lasted for three months, and the Emax value significantly increased throughout that time, associated with a considerable decline from baseline in A max value. As a result, following three months of L-thyroxine medication, the E/A max ratio increased dramatically from 0.773 (0.042) to 1.254 (0.128), showing that the left ventricle's diastolic dysfunction had normalised in the hypothyroid patients.
- There was a concomitant significant decrease in IVRT from three months into treatment from 96.314 msec (±3.010) to 83.454msec (±4.684). At the conclusion of the three-month research, a significant drop in d-IVST was also noted from 12.540 (±0.907) to 8.600 (±0.907), indicating that the study group's left ventricular diastolic performance has improved overall. Virtanen and co. [163] found that when taking thyroxine, Emax tended to rise.
- A considerable reduction in left ventricular dimensions was seen in the tests d-IVST, & LVPET; the d-IVST decrease was seen at the conclusion of the three-month research from 12.540 (±0.907) to 8.600 (±0.907), in d-LVPET was decrease at the conclusion of a three-month research from 10.643 (±0.910) to 8.343 (±0.907). Similarly, At the conclusion of the three-month research, a significant reduction in LVEDD was also noted from 46.284 (±3.026) to 42.272 (±3.020).
- Patients' serum TSH levels significantly decreased from 56.458m Iu/L (±13.032) to 17.932mIu/L (±11.040) after taking L-thyroxine for three months. Patients from exhibited a significant increase in serum T3 and T4 from 0.838 (±0.035) Nmol/L to 2.069 (±0.036) Nmol/L and 44.678 (±8.673) Nmol/L to 92.358 (±13.011) Nmol/L respectively after 3 months of treatment.
- 41% of hypothyroid patients had left ventricular diastolic dysfunction. This discovery is in line with that made by R. Verma et al. [163], who made the finding that 27.27% of individuals with overt hypothyroidism had diastolic impairment.
- In the 32 individuals that TK Mishra et al. [164] examined, the LV's systolic function was normal. Compared to controls, there was a sizable amount of diastolic dysfunction in the SH patients. The isovolumic relaxation time was also prolonged (89.1+7.3 vs. 79.4+5.9 msec, p 0.05), as did the acceleration above time (169+6.1 vs. 148.1+5.4 in controls). After a year of hormone therapy, echocardiography showed a significant improvement in the LV's diastolic performance.

Conclusion

In conclusion, Patients with hypothyroidism have aberrant diastolic dysfunction of the left ventricle, which is reversible with L-thyroxine medication. Doppler echocardiography is a trustworthy, easy-to-use, and affordable tool for determining diastolic dysfunction. However, in this regard, a long-term follow-up utilising 2D echocardiography is necessary. At first, it was believed that the improvement of left ventricular diastolic dysfunction was caused by L-thyroxine stimulating calcium ATPase in the sarcoplasmic reticulum of myocardial cells. The following improvement in the left ventricle's total diastolic function may have been caused by ongoing biochemical

©2023, IJMACR

alterations and corresponding anatomical changes in the myocardium.

References

1. Shahid MA, Ashraf MA, Sharma S. Physiology, thyroid hormone. Stat Pearls [Internet]. 2020.
2. Yen PM. Physiological and molecular basis of thyroid hormone action. Physiological reviews. 2001;81(3):1097-142.
3. Pearce EN, Yang Q, Benjamin EJ, Aragam J, Vasan RS. Thyroid function and left ventricular structure and function in the Framingham Heart Study. Thyroid. 2010;20(4):369-73.
4. Gupta R, Munyak J, Haydock T, Gernsheimer J. Hypothyroidism presenting as acute cardiac tamponade with viral pericarditis. The American journal of emergency medicine. 1999;17(2):176-8.
5. Gupta A, Sinha R. Echocardiographic changes and alterations in lipid profile in cases of subclinical and overt hypothyroidism. The Journal of the Association of Physicians of India. 1996;44(8):546, 51-3.
6. Farooki ZQ, Hoffman WH, Perry BL, Green EW. Myocardial dysfunction in hypothyroid children. American journal of diseases of children. 1983; 137 (1): 65-8.
7. Mishra T, Routray S, Das S, Behera M. Left ventricular dysfunction in patients with subclinical hypothyroidism and its reversibility after hormone therapy. Japi. 2005; 53:943-6.
8. Scholte AJ, Roos CJ, van Werkhoven JM. Function and anatomy: SPECT-MPI and MSCT coronary angio graphy. Euro Intervention. 2010 May;6 Suppl G: G94-G100. PMID: 20542836.
9. Varma R, Jain AK et al. Heart in hypothyroidism–An echocardiographic study. J Assoc Physicians India 1996, 44(6): 390-2
10. Mishra, T. K., Routray, S. N., Das, S., & Behera, M. (2005). Left ventricular dysfunction in patients with subclinical hypothyroidism and its reversibility after hormone therapy. Japi, 53, 943-946.
11. Virtanen, V. K., Saha, H. H. T., Groundstroem, K. W. E., Salmi, J., & Pasternack, A. I. (2001). Thyroid hormone substitution therapy rapidly enhances left-ventricular diastolic function in hypothyroid patients. Cardiology, 96(2), 59-64.

Legend Tables

Table 1: Comparison of Emax, Amax, E/Amax and E wave findings in patients before and after 3 months treatment

		Baseline	After 3 months	P-value
Emax	Mean	58.606	76.050	<0.001 (Significant)
	Std. Deviation	3.619	3.401	
Amax	Mean	76.006	61.103	<0.001 (Significant)
	Std. Deviation	5.545	5.543	
E/Amax	Mean	0.773	1.254	<0.001 (Significant)
	Std. Deviation	0.042	0.128	
E wave	Mean	236.514	222.114	<0.001 (Significant)
	Std. Deviation	3.011	3.010	

Table 2: Comparison of IVRT, d-IVST and d-LVPET findings in patients before and after 3 months treatment

		Baseline	After 3 months	P-value
IVRT	Mean	96.314	83.454	<0.001 (Significant)
	Std. Deviation	3.010	4.684	
d-IVST	Mean	12.540	8.600	<0.001 (Significant)
	Std. Deviation	0.907	0.907	
d-LVPET	Mean	10.643	8.343	<0.001 (Significant)
	Std. Deviation	0.910	0.907	
LVEDD	Mean	46.284	42.272	<0.001 (Significant)
	Std. Deviation	3.026	3.020	

Table 3: Comparison of T3, T4 and TSH in patients before and after 3 months treatment

		Baseline	After 3 months	P-value
T3	Mean	0.838	2.069	<0.001 (Significant)
	Std. Deviation	0.035	0.036	
T4	Mean	44.678	92.358	<0.001 (Significant)
	Std. Deviation	8.673	13.011	
TSH	Mean	56.458	17.932	<0.001 (Significant)
	Std. Deviation	13.032	11.040	

©2023, IJMACR