Original Research Article

Diastolic dysfunction among hypothyroidism patients

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Abstract

Background: Hypothyroidism has been reported as one of the most common forms of thyroid disorder worldwide. Studies claim that this clinical state is caused by deficiency of thyroid hormone due production to functional and/or structural abnormalities. Diastolic dysfunction is the abnormality of functioning of the diastolic elasticity, distensibility or relaxation of the left ventricle. This is active regardless of the normality of left ventricle ejection fraction or the symptomatic or asymptomatic of the patient. **Aims:** The aim of the study will be to examine the effects of diastolic dysfunction among patients of hypothyroidism. **Research questions:**1. What percentage of hypothyroid patients have left ventricle diastolic hypothyroidism?2.Can diastolic dysfunction be reversed by thyroxine treatments?3.Does any correlation exist between Doppler echocardiography findings and serum TSH regarding left ventricle diastolic dysfunction?**Materials:** In this study, 100 hypothyroidism patients were included. The sample was divided into two groups: the first group consisted of patients with normal levels of TSH, FT3 and FT4, the second group consisted of patients with normal TSH but lower than 10 mU/L with normal FT3 and FT4. Tests like Eliza, spirometry and echocardiography for left ventricular diastolic dysfunction assessment. **Results:** This study found that in group 1 there was lower TSH, FT3, E/A ratio with an increase of A wave velocity, reduction of E wave velocity, prolongated DT, inter-ventricular relaxation time, and low percentage of FVC, FEV1, FEF25-75. The results also showed a negative connection between TSH and E wave velocity and E/A ratio but a positive connection between the three pulmonary function indices and IVRT. **Conclusion:** Hypothyroid patients, mostly of subclinical hypothyroidism are prone to left ventricular diastolic dysfunction. As a result, they should be screened by Doppler echocardiography for early diagnosis.

Introduction

Hypothyroidism is a clinical condition resulting from the deficiency or low levels of the thyroid hormones viz-a-viz triiodothyronine (T3) and thyroxine (T4). This endocrine disorder is one of the most prevalent disorder as it has been encountered by primary care doctors from time to time. Lack of treatment could often lead to massive health issues like neuromuscular dysfunction,cognitive impairment, dyslipidemia,infertility,and hypertension [1]. The National Health and Nutrition examination Survey reveals that one out of every 300 people is a patient of hypothyroidism in the United States [2]. Studies show that this body disorder is highly prevalent in the Western world. It increases with age and even an impact of gender has also been found in its occurrence. Evidently, hypothyroidism occurs more in females as compared to cases in males. According to Bagchi, comparing the numbers of hypothyroidism between India with the UK and the US had revealed that in India, the numbers increase to about 11% while in the UK it is up to 2% and in the US it is up to 4-6% [3]. However, these stats of India had decreased since the year 1983 with the introduction of the universal salt iodization program. Despite the treatment of hypothyroidism being simple, many patients have only been suboptimally treated.

A study done by TK Mishra had shown significant diastolic dysfunction among SH participants selected for the study [4]. Among the subjects, echocardiography at the end of one year of hormone therapy had shown considerable improvement in diastolic functioning [4]. Farooki et al had found asymmetric septal hypertrophy which had returned to normal after thyroxine substitution [5]. Gupta and Sinha had found the rising of ventricular septal dimensions and significant increase of mean left ventricular posterior wall thickness [6]. This study will conduct a study to find out what influence thyroid hormone replacement has on left ventricular diastolic dysfunction of hypothyroidism patients.

Methodology

Study design

In this study, Doppler echocardiography was performed among 100 hypothyroidism patients. The patients had been clinically assessed and tests like Thyroid Function test, chest X-Ray, Blood Sugar, Echocardiography, Lipid profile and Doppler technique was done on the patients.

Sample

The patients who were symptomatic of hypothyroidism were selected initially for the sample of this study. However those patients who had shown an elevated TSH level and left ventricular diastolic dysfunction were selected for this study.

Duration of the study

Aug 2020- Nov 2020

Method

The selected patients were treated with levothyroxine and after a period of three month the echocardiography and the Thyroid profile will be repeated to assess whether left ventricular diastolic dysfunction had improved or not.

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Results

Table 1:Characteristics of the participants

	GROUP 1 (N=55)	GROUP 2 (N= 45)
AGE	47.93±6.42	48.46±6.12
SEX	M= 25, F= 29	M= 18, F= 27
BMI	31.35±2.93	31.51±2.79
DIASTOLIC BP	79.02±5.306	83.1±4.96
SYSTOLIC BP	131.42±10.06	136.96±5.58

Table 2. Gender differences among the participants

	GROUP 1		GROUP 2	
	Females	Males	Females	Males
TSH	3.01±0.88	2.505±0.75	6.54±1.74	6.09±1.32
A WAVE VELOCITY	54.47±10.40	55.27±3.79	67.89±4.18	66.46±5.13
E WAVE VELOCITY	71.43±4.08	71.43±3.17	57.15±10.67	58.05±12.76
E/A RATIO	1.71±2.28	1.30±0.11	0.85±0.17	0.87±0.20
DT	164.31±6.84	164.37±5.76	173.45±8.26	175.13±8.71
IVRT	70.18±5.07	70.35±3.51	120.32±4.03	118.38±5.38
FEV1%	84.31±3.77	85.05±5.97	82.21±6.67	81.10±5.87
FVC%	88.46±3.79	88.63±4.49	84.83±3.57	81.19±5.44
FEF25-75%	83.65±6.20	83.89±6.34	70.68±23.96	78.24±4.12

From table 2, it is evident that there is no gender differences between the variables except in FVC. FVC value was higher in group 2 in females than in males. TSH was also mildly high in case of females in group 1 than in males.

Table 3. Thyroid, pulmonary and echocardiography function measurements among participants

	GROUP 1	GROUP 2
TSH	2.79±0.85	6.35±1.58
T3	3.61±0.74	2.61±0.82
T4	12.68±1.74	12.55±1.81
PEAK A VELOCITY	54.81±8.22	67.30±4.61
PEAK E VELOCITY	71.43±3.69	57.53±11.48
E/A RATIO	1.54±1.73	0.85±0.18
IVRT	70.26±4.43	119.51±4.70
DT	164.34±6.34	174.18±8.41
DEV1%	84.6±5.71	81.74±6.30
FVC%	88.53±4.05	83.3±4.76
FEF25-75%	83.76±6.19	73.85±18.69

In Table 3, the value of TSH is higher in group 2. FT3 is in normal range yet it is lower in group 2 than in group 1. The echocardiographic measurements reveal diastolic dysfunction in group 2 where the peak A velocity was increased and the peak E velocity was decreased. E/A ratio is lower in group 2 than in group 1.

Table 4:Correlation between left ventricular diastolic function indices and pulmonary function

	A wave velocity		E wave velocity		E/A ratio		DT		IVRT	
	r	P	r	P	r	P	r	P	r	P
FEV%	-.112	0.240	.161	.119	.099	.342	-.112	0.281	-.218	0.034
FVC%	-.251	.014	.383	0.000	.092	.374	-.306	0.003	-.487	0.000
FEF25-75%	-.189	.067	.172	0.096	.089	.392	-.251	0.014	-.329	0.001

In table 4, it can be seen that the pulmonary function indices and the echocardiographic parameters of LV dysfunction were weak.

Discussion

A study of the findings of this work have shown that in comparison to the results of group 1, the echocardiographic measurements of group 2 have exhibited diastolic dysfunction where peak A was increased and peak E was decreased. In group 2, E/A ratio was found to be lower than 1 (0.85±0.18). Comparing the IVRT and DT of both groups showed that it was longer in group 2 than in group 1. These results were similar to the findings of the study conducted by Kosar et al, Biondi et al, Nag et al, Franzoni et al. [7,8,9,10]. Contrastive to this study, Biondi et al, Nag et al and Kosar et al, had found that there was no prolongation of E wave velocity. However by increasing LV preejection period, preejection period/LV ejection time ratio, and isovolumic relaxation time (IVRT), they had managed to diagnose diastolic dysfunction among their participants.

In this study, TSH was found to be positively correlated to the DT and the TVRT and negatively correlated to the E wave velocity. T3 was correlated to A wave velocity. Even though the FEF25-75%, FVC% and FEV% were in the normal range, they were higher in group 1 with negative correlation between TSH and FVC. But in IVRT and FVC, a slight negative correlation was found. Similar to the study by Cakmak et al, where the finding were low FEF25-75%, FEV1, FVC and the diffusing capacity of lung for carbon monoxide among subclinical hypothyroidism patients [11]. Another study had shown similar findings where it was suggested that the cause for reduced respiratory function is decreased inspiratory muscle strength, hypercapnia, hypoventilation and is related to the duration and degree of the thyroid disorders in hypothyroidism [12, 13]. In our study 25-75% was found to have weakly correlated to cardiac diastolic dysfunction parameters and thyroid hormones.

Conclusion

Hypothyroidism patients are prone to left ventricular diastolic dysfunction. So these patients need to be screened by doppler echocardiography for early diagnosis and management. Even though pulmonary function is mild, it should not be ignored. Future studies

need to be conducted after deciding if these changes are enough for establishing thyroxine replacement therapy.

References

1. Gaitonde, D. Y. Hypothyroidism: an update. South African Family Practice, 2012;54(5):384-390.
2. Hollowell, J. G., Staehling, N. W., Flanders, W. D., Hannon, W. H., Gunter, E. W., Spencer, C. A., & Braverman, L. E. (2002). Serum TSH, T4, and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). The Journal of Clinical Endocrinology & Metabolism, 87(2), 489-499.
3. Bagcchi, S.Hypothyroidism in India: more to be done. The lancet diabetes & endocrinology,2014; 2(10), 778.
4. Mishra, T. K., Routray, S. N., Das, S. Left ventricular dysfunction in patients with subclinical hypothyroidism and its reversibility after hormone therapy. Japi,2005; 53:943-946.
5. Farooki, Z. Q., Hoffman, W. H., Perry, B. L., & Green, E. W. Myocardial dysfunction in hypothyroid children. American journal of diseases of children, 1983;137(1): 65-68.
6. Gupta, A. 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), 546-551.
7. Kosar, F., Taskapan, C. Evaluation of right and left ventricular function using pulsed-wave tissue Doppler echocardiography in patients with subclinical hypothyroidism. Journal of endocrine-ological investigation, 2005;28(10): 704-710.
8. Biondi, B.,Carella, C., Panza, N., Cittadini. Left ventricular diastolic dysfunction in patients with subclinical hypothyroidism. The Journal of Clinical Endocrinology & Metabolism,1999; 84(6), 2064-2067.
9. Nag, C., Seth, B. C., &Haldar, S. K. Diastolic dysfunction in subclinical hypothyroid patients in rural India: A case–control study. Nigerian Journal of Cardiology, 2016;13(1): 23.
10. Franzoni, F., Galetta, F., Fallahi, P., Tocchini, L., Merico, & Santoro, G. Effect of L-thyroxine treatment on left ventricular function in subclinical hypothyroidism. Biomedicine & pharmacotherapy,2006; 60(8):431-436.
11. Cakmak, G., Saler, T., Saglam, Z. A., Yenigun, M., & Demir, T. (2007). Spirometry in patients with clinical and subclinical hypothyroidism. TuberkToraks,2007; 55(3):266-70.
12. Valjevac, S.,Valjevac, A., Kucukalic-Selimovic, E., &Lepara, O. Assessment of lung dysfunction with spirometry in patients with thyroid disorders. Acta Informatica Medica, 2011;19(1):16.
13. Roel, S., Punyabati, O., Prasad, L., Salam, R., Ningshen, K., Shimray, A. J., & Devi, A. N. Assessment of functional lung impairment in hypothyroidism. IOSR J. Dental Med. Sci.(IOSR-JDMS), 2014; 13(9), 4-7.

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