https://doi.org/10.48047/AFJBS.6.14.2024.5903-5910

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

A CROSS SECTIONAL STUDY TO EVALUATE THE SUBCLINICAL LEFT VENTRICULAR DYSFUNCTION IN CORRELATION WITH 2 DIMENSIONAL LONGITUDINAL SPECKLE TRACKING ECHOCARDIOGRAPHY AND THYROID FUNCTION TEST IN PATIENTS WITH HYPOTHYROIDISM WITH PRESERVED EJECTION FRACTION IN A TERTIARY CARE CENTER

Dr. G.Vinothini[1], Dr.Chevuri Mounika[2], Dr. V.R.Mohan Rao[3], Dr.Vengateswaragopinath[4], Dr.V.M. Jyotsnaa Grace [5], Dr.P. Tamilselvi [6]

[o1] Resident, Department of General Medicine, Chettinad Hospital and Research Institute, Kelambakkam, Chennai, India.
[2] Assistant Professor, Department of General Medicine, Chettinad Hospital and Research Institute, Kelambakkam, Chennai, India.
[3] Professor and Head, Department of General Medicine, Chettinad Hospital and Research Institute, Kelambakkam, Chennai, India.,
[4]Resident,Department of Anaesthesia and Critical care, Jawaharlal Nehru Institute of Medical Sciences, Imphal, Manipur,
[5]Fellow, Department of Immuno-Hematology & Transfusion Medicine, Dr. Rela Institute and Medical center, Chennai, India.
[6]Nursing Tutor, College of Nursing, Madras Medical College, Chennai, India.

Email: **[1]vinothiniguruthedoc93@yahoo.com**
[2]mouni.chevuri@gmail.com,[3]vrmohan_rao@yahoo.co.in, [4]dolphingopi77@gmail.com, [5]jyos6995@gmail.com,[6]selvimohan65@gmail.com

ORCID ID: [1]0009-0007-9240-3331, [2]0009-0000-2323-6823, [3]0009-0004-4973-0431, [4]0009-0005-7053-9700, [5]0009-0007-4761-9547,[6]0009-0001-0224-4768

Corresponding Author*: G.Vinothini[1]

Volume 6, Issue 14, Aug 2024

Received: 15 June 2024

Accepted: 25 July 2024

Published: 15 Aug 2024

doi: 10.48047/AFJBS.6.14.2024.5903-5910

ABSTRACT:

Background: A high level of suspicion for hypothyroidism should be given in conjunction with heart diseases, pericardial diseases, heart failure and/or heart arrhythmias. We expect to need assessment, risk stratification, and treatment of many more patients in the future.

Methods: This Cross – sectional study (prospective) was carried out from May 2024 to July 2024 in General Medicine department, at Chettinad Hospital and Research Institute,Kelambakkam, Chengalpattu Dt, on patients presenting to both OPD and inpatients with hypothyroidism. The data collected were subjected to statistical analysis to assess for correlation of myocardial strain with thyroid dysfunction in an asymptomatic population and LV ejection fraction (LVEF) ≥ 55%.

Results: In our study mean age was 44.74 ± 11.73 years, with 22(73.33%) females & 8 (26.66%) males. Correlation observed between 2D longitudinal speckle tracking echocardiography and hypothyroidism shows Positive correlation with Free T3 ($r = 0.37, p<0.05$), with Free T4 showed a negative correlation ($r=-0.09, p>0.05$), and positive correlation with TSH ($r=0.48, p<0.05$).

Conclusion: Ejection fraction assessed by 2D-longitudinal Speckle tracking echocardiography measuring global longitudinal strain pattern of left ventricle, revealed disparity comparing with conventional 2D- echocardiography. 2D-LSTE is a better investigation to assess small differences in LV performance of patients.

KEYWORDS

2D-longitudinal Speckle tracking echocardiography, global longitudinal strain, hypothyroidism, left ventricular dysfunction, ejection fraction.

INTRODUCTION

The thyroid hormone is ubiquitously present throughout the complete circulatory system, including the heart, the blood vessel and the blood cells, as definite by the Law of Flow of Blood, which ties these two organ systems together intimately[1]

Cardiovascular effects of thyroid hormone are significant. As a result of the loss of the hormone's inotropic and chronotropic effects, hypothyroidism reduces cardiac output at rest. The reduction of heart rate and stroke volume is caused by reduced volume and velocity of the heart[2]

Assessment of LV diastolic dysfunction permits more accurate estimation of LV filling pressure (LVFP), information that is crucial to optimal management of critically ill patients. Goal-directed therapy using intravenous fluids, diuretics, vasopressors, and vasodilators require knowledge of the LVFP. In clinical practice, echocardiography is the most effective method for evaluating LV diastolic function. In patients with and without LV systolic dysfunction, the American Society of Echocardiography (ASE) has issued recommendations outlining a step-by-step procedure for measuring LV diastolic performance and calculating LVFP or LA pressure[3]

Measurement of GLS has recently been incorporated in the clinical routine to recognize patients with mild systolic dysfunction that is not reflected as condensed EF. Because EF is mostly related to LV circumferential shortening, whereas GLS assesses longitudinal shortening, GLS has a higher sensitivity to identify moderate systolic dysfunction[4]

Furthermore, because the myofibers responsible for longitudinal shortening are mostly found in the susceptible subendocardium, a decrease in GLS frequently precedes a decrease in EF. In asymptomatic patients with aortic stenosis, GLS appears to be superior to EF as a parameter of systolic dysfunction and for risk stratification[5]

A high level of suspicion for thyroid dysfunction should be given in conjunction with heart diseases, pericardial diseases, heart failure and/or heart arrhythmias. . We insist the need for assessment, risk stratification, and treatment of many more patients in the future, especially to realise how easy it is to test for TSH. In order to make informed recommendations for patient care, physicians should understand the cardiovascular physiology and pathophysiology.

MATERIALS AND METHODS

This Cross – sectional study (prospective) was carried out from May 2024 to July 2024 in General Medicine department, at Chettinad Hospital and Research Institute, Kelambakkam ,Chengalpattu Dt, on patients presenting to both OPD and inpatients with hypothyroidism, after taking informed consent from patients.

Study Population

This study included 30 patients with hypothyroidism diagnosis, and with left ventricular ejection fraction (LVEF) ≥ 55%.

Ethical Statement

All patients above the age of 18 years of either sex diagnosed to have hypothyroidism and willing to participate in the study were included, while patients with any kind of comorbidity like CAD, hypertension, DM, alcoholic, liver disease, renal failure, other underlying heart diseases and Reduced LVEF were excluded from the study.

Data Collection

The study measured age, gender, clinical history and general examination, thyroid profile, electrocardiography, and 2D-echocardiography. LV Global longitudinal strain ejection fraction analysed by 2D longitudinal speckle tracking echocardiography at resting condition.

The data collected were subjected to statistical analysis to look for correlation of myocardial strain with hypothyroidism in an asymptomatic population and LV ejection fraction (LVEF) ≥ 55%.

RESULTS

In our study mean age was 44.74 ± 11.73 years, with 22(73.33%) females & 8(26.66%) males. Majority i.e. 36.66% belong to 41-50 years age group, 26.66% in 18-30 years age group, 13.33% both in 31-40 years and 51-60 years age group,10.00% in 61-70 years age group.

Free T3 values observed in patients with minimum 1.8 and maximum of 2.5 (pg/mL). Free T4 investigation values ranged 0.24 to 1.41 (ng/dL). As per thyroid profile TSH test ranges 6 to 11 (uIU/mL).In the present study, Mean Free T3 levels were 1.93± 0.83, mean Free T4 levels were 0.74 ±0.62, Mean TSH levels were 9.62 ±4.63.(Table 1)

Mean Ejection fraction % by conventional Echocardiography in the present study was in the range of 60.14 ± 3.83%. Global longitudinal strain EF% in the study with minimum value of 48% and maximum value of 72% obtained and a median of 58%. (Figure 1)

Correlation observed between EF by conventional Echocardiography and hypothyroidism shows with Free T3 Positive correlation (r=0.175,p>0.05), with Free T4 showed a negative correlation (r=-0.121,p>0.05), and positive correlation with TSH (r=0.145,p>0.05) (Table 2) The present study didn't observe statistically significant correlation between hypothyroidism and Ejection fraction in conventional echocardiography as the p value calculated to be >0.05.

Correlation observed between 2D longitudinal speckle tracking echocardiography and hypothyroidism shows Positive correlation with Free T3 (r = 0.372,p=0.023), with Free T4 showed a negative corelation (r=-0.09,p>0.05), and positive correlation with TSH (r=0.482,p=0.001). (Table 3) The present study observe statistically significant correlation between hypothyroidism and 2D longitudinal speckle tracking echocardiography as the p value calculated to be <0.05.

In the present study, a significant correlation was observed between EF% by 2D longitudinal speckle tracking echocardiography with Ejection fraction measured by conventional echocardiography as the p value calculated to be <0.05. (Table 4)

LIST OF TABLES AND FIGURES:

Table 1: Thyroid profile

	Minimum	**Maximum**	**Mean ± SD**
Free T3 (pg/mL)	1.8	2.5	1.93± 0.83
Free T4(ng/dL)	0.24	1.41	0.74 ±0.62
TSH(uIU/ml)	6	11	9.62 ±4.63

Table 2 : Correlation between EF % by conventional 2D echocardiography and Thyroid profile

		R value	**P value**

EF%	Free T3	0.175	0.157
	Free T4	-0.121	0.528
	TSH	0.145	0.515

Table 3: Correlation between 2D longitudinal speckle tracking echocardiography and Thyroid profile.

		R value	**P value**
2D longitudinal speckle tracking echocardiography	Free T3	0.372	0.023
	Free T4	-0.09	0.558
	TSH	0.482	0.001

Table 4: Correlation between EF and Global longitudinal strain by 2D longitudinal speckle tracking echocardiography

	EF%	R value	P value
2D longitudinal speckle tracking echocardiography	EF	0.83	<0.0001*

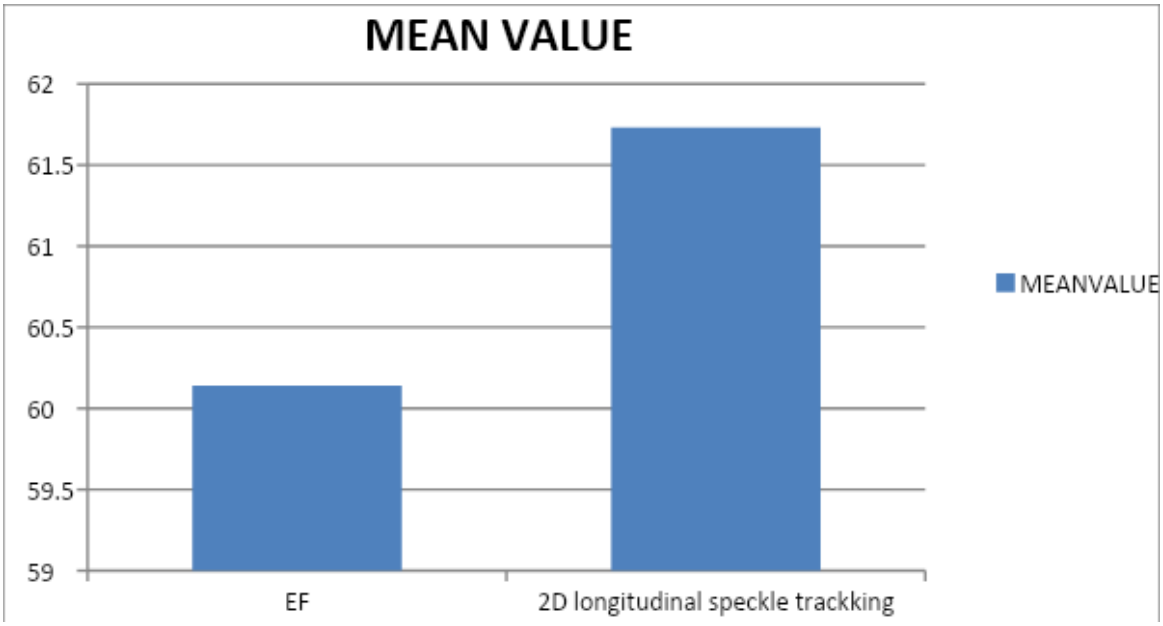

Figure 1: Bar diagram showing mean values for both EF% by conventional echocardiography & EF% by 2D – longitudinal speckle tracking echocardiography.

DISCUSSION :

The study included 30 patients with diagnosed hypothyroidism condition. The overall average age of the study participants was observed to be 44.74 ± 11.73 years. As per literature statements onset of hypothyroidism increases with aging, but in our study participants this discrepancy was not observed.

Majority of the study participants were females 73.33% and 26.66% of males were participated in our study period. Thyroid illness is quite prevalent, affecting up to 15% of adult females and a lower proportion of males.

Patients expressing free T3 diverse levels between 1.8 to 2.5 (pg/mL) had been observed. Estimated concentrations of free T4 in the study consisted from 0.24 to 1.41 (ng/dL).TSH values varied between 6 to 14 (uIU/mL) depend on the thyroid profile. Mean Free T3 levels were 1.93± 0.83, mean Free T4 levels were 0.74 ±0.62, Mean TSH levels were 9.62 ±4.63

Electrocardiography (ECG) was performed on patients who agreed to participate in our study and the results were analysed; individuals with standard electrocardiography findings were the only ones included in the study. Following electrocardiograms, patients underwent traditional echocardiogram to estimate their ejection fraction as a percentage. The most used technique for determining left ventricular systolic function is traditional echocardiography. The mean Ejection Fraction Percentage spanned as 60.14±3.83 %. Considering Free T3, there seems to be a relationship across EF by 2D ECHO and thyroid profile, Positive correlation was detected (r=0.175,p=>0.05), while negative correlation was observed (r=-0.121,p=>0.05) with Free T4 and positive correlation beings observed (r=0.145,p=>0.05) for TSH.

As a result, we are now unable to accurately capture the association between hypothyroidism and ejection fraction by conventional 2D echocardiography in our study. From 2D-ECHO ejection fraction

results were measured and renowned. Patients who's left ventricular ejection fractions>55% were selected and underwent with 2D-LSTE without age, gender and thyroid function tests dissimilarity, evaluated the GLS ejection fraction (%).The p value observed in our study is <0.05 demonstrating that there was statistically significant association between hypothyroidism and 2-dimensional longitudinal speckle tracking echocardiography.

In 2010, Abdulrahman et al l[6] A total of 25 patients suffering with thyroid carcinoma on treatment with levothyroxine tablets, divided in to 2 groups 1)low TSH group & 2)high TSH group both are compared with 40 patients who are euthyroid as controls. They stated that 2D-STE is a more sensitive technique for detecting even minor changes in these individuals LV function.

In 2021, Abdel razk et al[7] female participants were selected who are suffering with SCH with a 30 normal population group who are healthy individuals willing to participate in study, They had standard echocardiography, color Doppler, and two-dimensional STE as part of the echocardiographic assessment. In individuals with SCH, the left atrium volume index, isovolumetric relaxation time, and mitral E/A percentage were all significantly lower. We also found in our research that in individuals with hypothyroidism, 2D-LSTE is more effective than conventional echocardiography at identifying LV failure early on.

In 2013, Sunbul et al[8] According to a study, untreated SH is linked to LV longitudinal myocardial function deterioration. Early identification of LV dysfunction in patients with SH and recording of improvements in myocardial twist parameter with speckle tracking echocardiography appear to be helpful with treatment. We studied subclinical hypothyroid patients who are on already thyroid treatment to check LV dysfunction with GLS BY 2D-LSTE & we observed the usefulness of the technique to detect early LV myocardial dysfunction.

CONCLUSION

Ejection fraction assessed by 2D-longitudinal Speckle tracking echocardiography measuring global longitudinal strain pattern of left ventricle, revealed disparity comparing with conventional 2D-echocardiography, should be used to identify subclinical cardiovascular disease in patients with hypothyroidism. 2D-LSTE is a better investigation to assess small differences in LV performance of patients.

REFERENCES

1. Klein I. Chapter 86: Endocrine disorders and cardiovascular disease In Braunwald's. In: Bonow RO, Mann DL, Zipes DP, Libby P, editors. Heart Disease. Ninth. Vol. 2. Elsevier; Saunders: 2012. pp. 1833–1841.
2. Klein I. Thyroid Hormone and the cardiovascular system. Am J Med. 1990;88(6):631-7.
3. Symons C. Thyroid heart disease. Br Heart J. 1979;41:257-62.
4. Aurigemma GP, Silver KH, Priest MA, Gaasch WH. Geometric changes allow normal ejection fraction despite depressed myocardial shortening in hypertensive left ventricular hypertrophy. Journal of the American College of Cardiology. 1995 Jul;26(1):195-202.
5. Magne J, Cosyns B, Popescu BA, Carstensen HG, Dahl J, Desai MY, Kearney L, Lancellotti P, Marwick TH, Sato K, Takeuchi M. Distribution and prognostic significance of left ventricular global longitudinal strain in asymptomatic significant aortic stenosis: an individual participant data meta-analysis. JACC: Cardiovascular Imaging. 2019 Jan;12(1):84-92.

6. Abdulrahman RM, Delgado V, Ng AC, Ewe SH, Bertini M, Holman ER, Hovens GC, Pereira AM, Romijn JA, Bax JJ, Smit JW. Abnormal cardiac contractility in long-term exogenous subclinical hyperthyroid patients as demonstrated by two-dimensional echocardiography speckle tracking imaging. European journal of endocrinology. 2010 Sep 1;163(3):435.
7. Abdelrazk RR, El-Sehrawy AA, Ghoniem MG, Amer MZ. Speckle tracking echocardiographic assessment of left ventricular longitudinal strain in female patients with subclinical hyperthyroidism. Cardiovascular Endocrinology & Metabolism. 2021 Sep;10(3):182.
8. Sunbul M, Durmus E, Kivrak T, Yildiz H, Kanar BG, Ozben B, Sari I, Mutlu B. Left ventricular strain and strain rate by two-dimensional speckle tracking echocardiography in patients with subclinical hypothyroidism. European review for medical and pharmacological sciences. 2013 Dec 1;17(24):3323-8.