

## The Effect of Thyroid Gland Dysfunction and Its Treatment on Left Ventricular Function using Tissue Doppler and Speckle Tracking

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### Abstract

Thyroid hormones have a notable effect on the cardiovascular system and thyroid diseases have a prominent adverse effect on myocardial and vascular functions. Speckle tracking echocardiography is a more recent technique that provides a global approach to LV myocardial mechanics, giving information about the three spatial dimensions of cardiac deformation. With assess those impact about hypothyroidism & hyperthyroidism Furthermore their medication once myocardial work Toward utilizing tissue doppler echocardiography Also dot following. Patients were partitioned under two groups: one assembly 1: incorporated 25 patients for as of late diagnosed hyperthyroidism. Bunch 2: included 25 patients with as of late diagnosed hypothyroidism. The greater part patients were subjected to full historical backdrop taking, full clinical investigations, 12 lead ECG, lab evaluation as complete blood count, kidney functions, lipid profile Also thyroid work tests, What's more undergone dot following during presentation Furthermore took after up then afterward 3 months for medicine. Patients with hypothyroidism patients with hyperthyroidism required a few progressions over certain parameters that show inclusion of systolic and diastolic work of the left ventricle. In spite of those qualities of the parameters were in ordinary range, they were fundamentally different, and additionally of the gatherings previously, then after medication. Also, A percentage of the echocardiography got parameters were reversible following 3 months for medication.

**Keywords:** Thyroid Gland Dysfunction, Left Ventricular Function, Tissue Doppler, Speckle Tracking.

### 1. Introduction

Thyroid hormones need An outstanding impact on the cardiovascular framework Also thyroid ailments need a noticeable unfriendly impact for myocardial Also vascular capacities. Recurrence of thyroid brokenness builds with agincourt. Heart will be a significant focus organ to thyroid hormone activity. T3 may be the bioactive hormone that is known should influence tissue oxygen consumption, vascular resistance, blood volume, cardiovascular contractility Also heart rate.

Thyroid ailment need been connected with systolic What's more diastolic cardiovascular brokenness. [1]. For unmistakable hyperthyroidism, cardiovascular side effects Furthermore indications need aid normal in patients for hyperthyroidism [2], What's more On A percentage patients, these manifestations predominate. They include: Tachycardia, during rest, Throughout sleep, and misrepresented Throughout exercise, Palpitations, because of both tachycardia Furthermore that's only the tip of the iceberg Commanding cardiovascular contractility, Hyperdynamic precordium, demonstrative of the expand done cardiovascular contractility Furthermore cardiovascular workload ,Systolic hypertension with widened pulse weight [3]. Exertional dyspnea, which is expected that's only the tip of the iceberg to respiratory Also skeletal muscle shortcoming over cardiovascular brokenness ,Angina-like midsection pain, with electrocardiogram (ECG) progressions suggesting myocardial ischemia, build On left ventricular (LV) impostor list Furthermore lv hypertrophy, expanded ventricular irritability, particularly over former history for ventricular ectopy. [2]. Tolerant for unmistakable hypothyroidism bring bradycardia, diminished ventricular filling, diminished cardiovascular contractility, which prompt diminished heart yield [4]. Non obtrusive strategies for example, such that standard echocardiography by implication give

acceptable majority of the data over lv worldwide capacities. Standard echocardiography, In this way , gives constrained information regarding transforms from claiming lv capacity clinched alongside hypothyroidism. Those sway for thyroid sickness around lv diastolic Also systolic brokenness need been examined utilizing tissue doppler echocardiography in past investigations. Recently, new echocardiographic systems have been acquainted with assess myocardial mechanics. Strain and strain rate imaging will be An novel non obtrusive technique for evaluation about myocardial work. Spot following echocardiography may be a that's only the tip of the iceberg later system that gives a worldwide approach should lv myocardial mechanics, providing for data something like those three spatial measurements of cardiovascular deformity [5].

The point from claiming this consider will be will assess the impact about hypothyroidism & hyperthyroidism Also their medication with respect to myocardial work by utilizing tissue doppler echocardiography Furthermore spot following.

### 2. Patients and methods

This prospective study, might have been directed during Banha school Hospital, Throughout the time starting with might 2019 to december 2019, Furthermore incorporated fifty patients separated under two groups:. Gathering 1: included 25 patients with as of late diagnosed hyperthyroidism. Assembly 2: included 25 patients with as of late diagnosed hypothyroidism. Constantly on patients undergone spot following at presentation Furthermore accompanied dependent upon after 3 months about medicine.

#### Inclusion criteria

- Patients with recently diagnosed hyperthyroidism and hypothyroidism proved by laboratory investigation.

- In hypothyroidism, TSH assays are generally the most sensitive screening. Elevated TSH (usually 0.4 to 5.0 mU/L) with decreased T4(usually 4.6-12ug/dl) [6]
- In hyperthyroidism, Diagnosis is occurred when Suppressed TSH levels (usually 0.4 to 5.0 mU/L) and elevated T3(usually 80-180 ng/dl) and T4(usually 4.6-12ug/dl) [7]

**Exclusion criteria:**

- Patient refusal.
- Patients with Poor echogenicity.
- Patients with Impairment of LV systolic function (EF<50%) at presentation.
- Patients with Significant valvular heart disease.
- Patients with Cardiomyopathy.
- Patients with proven Coronary artery disease.

Before starting the research both informed participant consent and Banha university ethical committee approval were taken.

All patients were subjected to full history taking, full clinical investigations, 12 lead ECG, laboratory assessment as complete blood count, Kidney functions, Lipid profile and thyroid function tests, and undergone speckle tracking at presentation and followed up after 3 months of treatment.

**3. Results**

The mean age in hyperthyroidism group was 30.09±5.57 years and in hypothyroidism group was 39.71 ± 14.2 with female predominance in both groups (68% and 56%, respectively), and no statistical differences between groups regarding age or sex. Table (1).

**Table (1)** Demographic data of the studied groups

Variable	Group 1		Group 2		Test	p-value
	Hyperthyroidism N=25		Hypothyroidism N=25			
Age	Mean ± SD	30.09±5.57	39.71 ± 14.2	t=1.12	P=0.12	
	Range (years)	22-45	25-64			
Sex	Male	N	8	11	X=1.32	P=0.09
		%	32%	44%		
	Female	N	17	14		
		%	68%	56%		

t; student t test; X: Chi-Square test

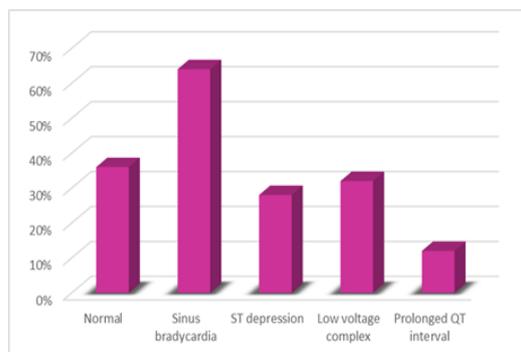
There was a statistical difference between hyperthyroidism and hypothyroidism groups regarding their BMI the mean BMI was 22.3 ± 3.12 in hyperthyroidism and 33.7 ± 5.1 in hypothyroidism, p<0.001. There was a statistical difference between hyperthyroidism and hypothyroidism groups regarding their heart rate (Mean heart rate was 105.28 ± 10.97 in hyperthyroidism and 70.11 ± 7.55 in hypothyroidism, p<0.001). While there was no statistical differences between groups regarding their systolic or diastolic

blood pressure, p=0.53 and p=0.67, respectively. There was a statistical differences between groups regarding TSH, Free T3 and Free T4. The mean TSH was 0.065 ± 0.74 in hyperthyroidism and 7.9 ± 2.11 in hypothyroidism, p<0.001. the mean free T3 was 11.6 ± 5.8 in hyperthyroidism and 4.5 ± 3.1 in hypothyroidism, p<0.001 and free T4 was 29.54 ± 10.54 in hyperthyroidism and 12.1 ± 2.7 in hypothyroidism, p<0.001. table 2

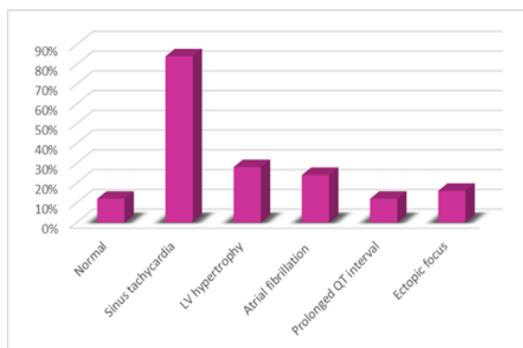
**Table (2)** Thyroid function tests in the studied groups

Variable	Group 1		Group 2		Test	p-value
	Hyperthyroidism		Hypothyroidism			
BMI (Kg/m <sup>2</sup> )	Mean±SD	22.3 ± 3.12	33.7 ± 5.1	t=5.43	P<0.001*	
Systolic bl.p	Mean±SD	119 ± 12.5	122.21 ± 14.1	t=0.98	P=0.53	
Diastolic bl.p	Mean±SD	73.16 ± 8.65	75.41 ± 9.07	t=0.77	P=0.67	
Heart rate	Mean±SD	105.28 ± 10.97	70.11 ± 7.55	t=8.53	P<0.001*	
TSH (mU/L)	Mean±SD	0.065 ± 0.74	7.9 ± 2.11	t=8.52	P<0.001*	
Free T3 (ng/dL)	Mean±SD	11.6 ± 5.8	4.5 ± 3.1	t=6.55	P<0.001*	
Free T4 (ng/dL)	Mean±SD	29.54 ± 10.54	12.1 ± 2.7	t=7.98	P<0.001*	

ECG findings in patients with hypothyroidism; 36% of cases showed a normal ECG study, 64% of patients had sinus bradycardia, 28% had ST depression, 32% had Low voltage complex and 12% had prolonged QT interval. ECG findings in patients with hyperthyroidism; 12% of patients had anormal ECG study, 84% had sinus tachycardia, 28% had LV hypertrophy, 24% had Atrial fibrillation, 12% had prolonged QT interval and 16% had ectopic focus. Fig 1and 2.



**Fig (1)** Various ECG findings in hypothyroidism



**Fig (1)** Various ECG findings in hyperthyroidism

Echocardiographic parameters of left ventricular function in patients with hypothyroidism at the start and after 3 months of treatment, there was a statistical difference between groups regarding EF, E/A, DT, E/e' sep and global strain. While there was no statistical

difference between groups regarding LA, LAVI, LVEDD, LVED vol, LVES vol, FS, IVS, PW, DT, E/e' lat, E/e' average, Ar-A, IVCT, IVRT, MPI, s/d and s/TDI. Table 3

**Table (3)** Echocardiographic parameters of left ventricular function in patients with hypothyroidism at the start and after 3 months of treatment.

		Base line	After 3 months	Test	P-value
LA (mm)	Mean±SD	31.3 ± 3.9	32.2 ± 3.3	pt=0.56	P=0.43
LAVI (ml/m <sup>2</sup> )	Mean±SD	21.9 ± 5.77	22.5 ± 4.56	pt=0.79	P=0.12
LVEDD (mm)	Mean±SD	48.4 ± 4.3	45.5 ± 3.3	pt=-1.2	P=0.09
LVED vol (ml)	Mean±SD	81.7 ± 18.4	80.9 ± 17.3	pt=-0.93	P=0.11
LVES vol (ml)	Mean±SD	31.6 ± 7.8	30.5 ± 6.5	pt=-0.97	P=0.12
EF (%)	Mean±SD	60.6 ± 4.4	63.9 ± 6.3	pt=2.87	P=0.003*
FS (%)	Mean±SD	34.30 ± 2.3	36.25 ± 3.6	pt=0.95	P=0.11
IVS (mm)	Mean±SD	10.8 ± 0.9	10.7 ± 0.9	pt=-0.11	P=0.87
PW (mm)	Mean±SD	8.1 ± 1.2	8.2 ± 1.1	pt=0.21	P=0.76
E/A (m/sec)	Mean±SD	1.32 ± 0.29	1.12 ± 0.21	pt=-2.34	P=0.04*
DT. (msec)	Mean±SD	167.9 ± 38.6	156.7 ± 34.6	pt=-1.67	P=0.06
E/e' sep (sm/s)	Mean±SD	7.62 ± 2.29	6.95 ± 2.11	pt=-2.98	P=0.01*
E/e' lat (sm/s)	Mean±SD	6.35 ± 1.62	6.03 ± 1.55	pt=-1.32	P=0.08
E/e' average (sm/s)	Mean±SD	6.98 ± 1.90	6.67 ± 1.72	pt=-1.33	P=0.08
Ar-A (ms)	Mean±SD	25.2 ± 4.12	23.5 ± 3.95	pt=-1.08	P=0.10
IVCT (msec)	Mean±SD	64.14 ± 13.41	60.95 ± 12.55	pt=-1.56	P=0.07
IVRT (msec)	Mean±SD	67.27 ± 6.7	66.95 ± 6.3	pt=-0.88	P=0.32
MPI	Mean±SD	0.47 ± 0.08	0.43 ± 0.07	pt=-1.2	P=0.09
s/d	Mean±SD	1.26 ± 0.16	1.25 ± 0.15	pt=-0.43	P=0.78
Global strain %	Mean±SD	-19.55 ± 2.3	-20.71 ± 2.3	pt=-2.7	P=0.03*
s/TDI (m/sec)	Mean±SD	0.077 ± 0.013	0.078 ± 0.012	pt=1.6	P=0.06

pt; Paired t-test; \*: significant; LA: left atrial systolic diameter; LAVI: left atrial volume index; LVEDD: end-diastolic diameters; LVESvol: left ventricular end-systolic volume; LVEDvol: left ventricular end-diastolic volume; EF: ejection fraction; FS: fractional shortening; IVS: interventricular septum thickness; PW: the left ventricular posterior wall; E/A: ratio between transmitral early and late diastolic peak flow velocities; DT: time between E velocity deceleration time to the baseline; S wave obtained by TDI, maximal systolic flow velocity;

Echocardiographic parameters of left ventricular function in patients with hyperthyroidism at the start and after 3 months of treatment, there was a statistical difference between groups regarding LA, LAVI, E/A, and global strain. While there was no statistical difference between groups regarding EF, LVEDD, LVED vol, LVES vol, FS, IVS, PW, DT, DT, E/e' sep, E/e' lat, E/e' average, Ar-A, IVCT, IVRT, MPI, s/d and s/TDI. Table (4).

**Table (4)** Echocardiographic parameters of left ventricular function in patients with hyperthyroidism at the start and after 3 months of treatment

		Base line	After 3 months	Test	P-value
LA (mm)	Mean±SD	39.22 ± 2.02	38.43 ± 2.25	pt=-2.31	P=0.05*
LAVI (ml/m <sup>2</sup> )	Mean±SD	37.47 ± 4.07	36.89 ± 4.19	pt=-2.25	P=0.04*
LVEDD (mm)	Mean±SD	53.5 ± 5.14	51.04 ± 4.5	pt=-1.32	P=0.07
LVED vol (ml)	Mean±SD	75.1 ± 9.91	76.5 ± 8.91	pt=1.08	P=0.11
LVES vol (ml)	Mean±SD	30.9 ± 7.05	31.9 ± 7.62	pt=1.10	P=0.11
EF (%)	Mean±SD	57.43 ± 6.7	58.55 ± 6.2	pt=1.34	P=0.10
FS(%)	Mean±SD	35.21 ± 3.45	34.88± 3.07	pt=-1.53	P=0.09
IVS (mm)	Mean±SD	9.23 ± 2.4	9.20 ± 1.01	pt=-1.33	P=0.13
PW (mm)	Mean±SD	8.95 ± 0.82	8.8 ± 0.82	pt=-0.93	P=0.32
E/A (m/sec)	Mean±SD	0.88 ± 0.1	0.9 ± 0.08	pt=2.67	P=0.04*
DT. (msec)	Mean±SD	190.53 ± 13.30	185.44 ± 12.64	pt=-0.99	P=0.27
E/e' sep (sm/s)	Mean±SD	8.62 ± 2.44	7.98 ± 2.21	pt=-2.32	P=0.06
E/e' lat (sm/s)	Mean±SD	6.73 ± 1.43	6.65 ± 1.07	pt=-1.21	P=0.15
E/e' average (sm/s)	Mean±SD	7.01 ± 1.61	6.98 ± 1.45	pt=-1.02	P=0.21
Ar-A (ms)	Mean±SD	22.09 ± 3.4	22.82 ± 3.5	pt=0.98	P=0.27
IVCT (msec)	Mean±SD	59.44 ± 9.43	60.42 ± 9.11	pt=0.92	P=0.31
IVRT (msec)	Mean±SD	65.9 ± 7.5	66.5 ± 7.1	pt=0.87	P=0.33
MPI	Mean±SD	0.41 ± 0.05	0.43 ± 0.07	pt=0.91	P=0.31
s/d	Mean±SD	1.22 ± 0.21	1.22 ± 0.23	pt=0.50	P=0.45
Global strain %	Mean±SD	-19.39 ± 1.1	-20.22 ± 1.3	pt=-1.92	P=0.04*
s/TDI (m/sec)	Mean±SD	0.098 ± 0.015	0.092 ± 0.014	pt=-0.76	P=0.37

pt; Paired t-test; \*: significant; LA: left atrial systolic diameter; LAVI: left atrial volume index; LVEDD: end-diastolic diameters; LVESvol: left ventricular end-systolic volume; LVEDvol: left ventricular end-diastolic volume; EF: ejection fraction; FS: fractional shortening; IVS: interventricular septum thickness; PW: the left ventricular posterior wall; E/A: ratio between transmitral early and late diastolic peak flow velocities; DT: time between E velocity deceleration time to the baseline; S wave obtained by TDI, maximal systolic flow velocity.

#### 4. Discussion

In this study, ecg discoveries Previously, patients with hypothyroidism; 36% of cases indicated an ordinary ecg study, 64% about patients needed sinus bradycardia, 28% needed ST depression, 32% required low voltage complex What's more 12% needed prolonged QT interim. This might have been done consent with An investigation by Goyal [8], the predominant abnormality found with respect to electrocardiography On hypothyroid situations might have been sinus bradycardia(61. 5%), heart rate differed starting with 46 will 98/min, the opposite as a relatable point electrocardiographic abnormalities watched were ST-T transforms and low voltage complexes. ST-T transforms in the structure for t wave reversal alternately ST fragment dejection Also flattening might have been introduce Previously, 7 instances (26. 9%). T wave abnormalities were recognized not best over subpar heads as well as done precordial heads. Low voltage complexes were discovered in 4 cases (15. 3%). QT interim might be prolonged On you quit offering on that one tolerant. Over [9], ecg might have been typical to 12

patients (30%). Around abnormal ecg which constitutes 70% of the patients, low voltage complexes available over 35% of patients. Ahead ECG, the The greater part basic discoveries were sinus bradycardia, introduce in 40% of instances. LBBB Also RBBB found to 5% Also 7. 5% individually.

In this study, ecg discoveries in patients for hyperthyroidism; 12% about patients required anormal ecg study, 84% needed sinus tachycardia, 28% required lv hypertrophy, 24% required atrial fibrillation, 12% required prolonged QT interim and 16% required ectopic center. For An investigation Toward Goyal [8], the frequency from claiming sinus tachycardia might have been 79. 2%, cleared out ventricular hypertrophy might have been found for 4 patients (16. 7%) What's more atrial fibrillation might have been found for 3 (12. 5%). Furthermore for [10], 60. 7% from claiming patients required sinus tachycardia, 42. 8% required lv hypertrophy, 28. 5% required prolonged QT interval, 21. 4% required lv stain, 21. 4% required atrial fibrillation Also 10% required ectopic center.

In this study, echocardiographic parameters for cleared out ventricular capacity to patients with hypothyroidism at the begin Furthermore following 3months of treatment, there might have been a measurable distinction between gatherings viewing EF, E/A, DT, E/e' sep and worldwide stain. Same time there might have been no measurable distinction the middle of gatherings in regards LA, LAVI, LVEDD, LVED vol, LVES vol, FS, IVS, PW, DT, E/e' lat , E/e' average, Ar-A, IVCT , IVRT, MPI, s/d Also s/TDI.

Similarly, in [11] contemplate something like those impact about levothyroxine medication with respect to left ventricular capacity for subclinical hypothyroidism,

after five months of levothyroxine help statistically altogether expanded the EF. Also in the consider from claiming Ilic What's more cols. [12], you quit offering on that one quite a while help with levothyroxine demonstrated comparative comes about.

Those parameter What's more, the lion's share of Corps parts don't stay in their starting work areas once their comm inferred from TDI, which will be An parameter will assess systolic capacity of LV, might have been statistically fundamentally bring down in the hypothyroidism bunch contrasted with hyperthyroidism one assembly. This turns out those abnormal longitudinal systolic capacity about lv in hypothyroidism, which may be primary influenced in lv systolic brokenness [13]. The parameter S/TDI didn't recuperate then afterward medication. [11] needed a comparable perception for tolerant for subclinical hypothyroidism.

Worldwide longitudinal strain is acknowledged a greater amount delicate over EF over surveying lv worldwide systolic function, particularly At those EF will be normal, done support for subclinical lv brokenness. GLS altogether moved forward then afterward the levothyroxine help  $p=0.03$ . Additionally past investigations indicated comparable effects. [11, 12 and 14].

The effects from doppler transmitral stream What's more velocities assessed by TDI demonstrated transforms Previously, a few parameters which would characterized Likewise parameters for diastolic work evaluation. Over [11] study, in spite of the fact that those values from claiming A percentage parameters were in the typical range, there may be An statistically noteworthy distinction the middle of those qualities of the control What's more ScH aggregations. There might have been statistically altogether more level E/A ratio, Furthermore higher E/e' sep. Proportion in the ScH one assembly contrasted with those control one assembly. Then afterward 5 months about euthyroid state, the E/A proportion didn't increment essentially.

On An investigation Eventually Tom's perusing [15], those E/A proportion might have been statistically essentially bring down over patients for ScH contrasted with those control one assembly. In the same study, those proportion expanded altogether then afterward 6 months about euthyroid state Also begun and Johnson had proceeded should expand after 12 months of euthyroid state.

In this study, echocardiographic parameters from claiming exited ventricular work clinched alongside patients with hyperthyroidism at the begin and then afterward 3months of treatment, there might have been An Factual Contrast between bunches in regards LA, LAVI, E/A, What's more worldwide stain. Same time there might have been no Factual distinction between aggregations viewing EF, LVEDD, LVED vol, LVES vol, FS, IVS, PW, DT, DT, E/e' sep , E/e' lat , E/e' average, Ar-A, IVCT , IVRT, MPI, s/d What's more s/TDI.

Similarly, done An investigation Toward [16], regarding progressions in cardiovascular work What's

more structure for recently diagnosed Graves' infection. At benchmark at measured echocardiographic parameters were inside the reference ranges On the whole examined subjects. Furthermore, lv dimensions, divider thickness and lv impostor list were expanded in the tolerant one assembly compared with controls. In regards the rwanda work TAPSE Also dp/dt were altogether decreased contrasted with the controls. LVEF might have been fundamentally easier in the tolerant contrasted with those control assembly yet the Contrast lost hugeness following changing for heart rate. With respect to those diastolic work those tolerant gathering indicated essentially bring down values for e Also a wave for a opposite E/A proportion Also fundamentally deferred E-wave DT What's more IVRT, which demonstrate impeded lv unwinding. Similarly, the tissue doppler investigation demonstrated a opposite E'/A' proportion. At last 2D-STE in particular lv radial, boundary What's more longitudinal strains Also SRIVRT were tantamount between the two gatherings What's more were inside typical values as stated by those meta-analysis about typical ranges about left ventricular strain.

In the same study, [16], echocardiography examine in In 6 months about accepting those thyrostatic treatment, those Graves' malady patients exhibited An huge decline in LVEDD, lv impostor index, la volume list Also la breadth inasmuch as lv launch portion (LVEF) didn't progress altogether Throughout the course for help. There might have been a change of lv diastolic capacity including An diminishment over An wave, A' wave and E/A proportion yet the reversal for E/A proportion stayed.

There are some confinements in this contemplate. The configuration will be not that of a Visually impaired or twofold unseeing study which incorporates medication versus placebo. Secondly, we emulated the parameters for systolic and diastolic function, Anyhow we didn't straightforwardly see cardiovascular horribleness Also mortality, which obliges precise long haul following of patients. Thirdly, lake from claiming controls Furthermore little example extent in this consider which might assistance to a preferred examination.

## 5. Conclusion

Patients with hypothyroidism patients with hyperthyroidism needed a portion transforms done certain parameters that show inclusion from claiming systolic Furthermore diastolic capacity of the left ventricle. In spite of those qualities of the parameters were clinched alongside ordinary range, they were altogether different, and in addition of the bunches previously, then then afterward medicine. Also, some of the echocardiography acquired parameters were reversible after 3 months from claiming medication.

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