"ECHOCARDIOGRAPHIC ASSESSMENT IN PATIENTS OF THYROID DYSFUNCTION – A 1 YEAR CROSS-SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL"

BY

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REGISTRATION NO: BG0116007

Dissertation

Submitted to

KAHER, Belagavi, Karnataka

In partial fulfilment

of the requirements for the degree of

M .D.

IN

GENERAL MEDICINE

Under the Guidance of

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J. N. MEDICAL COLLEGE

BELAGAVI - 590010. KARNATAKA.

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Declaration by the Candidate

I hereby declare that this dissertation entitled**"ECHOCARDIOGRAPHIC ASSESSMENT IN PATIENTS OF THYROID DYSFUNCTION – A 1 YEAR CROSS-SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL"**is a bonafide and genuine research work carried out by me under the guidance of Dr.Arathi Darshan, Professor, Department of General Medicine, Jawaharlal Nehru Medical College, Nehru Nagar, Belagavi-590010.

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ABSTARCT

BACKGROUND & OBJECTIVES:

Thyroid diseases are, arguably, among the commonest endocrine disorders worldwide including India.The heart is an important target organ for thyroid hormone action and the molecular mechanisms that underlie the thyroid hormone based effects have been reviewed in the past. Thyroid hormone is an important regulator of cardiac function and cardiovascular hemodynamic. Hyperthyroidism and hypothyroidism are known to affect cardiovascular system in the number of ways.Cardiovascular adverse effect may start very early in the course of thyroid dysfunction and may remain undiagnosed, unless actively screened due to subclinical nature or non-specific presentation. So there is need to understand common cardiovascular manifestations of different thyroid disorders using appropriate investigations. In this background, the current study was conducted to evaluate the 2 D-EchoCardiography changes in thyroid disorders

MATERIALS & METHODS:

This study was a cross sectional study, conducted in the department of general medicine, DR.Prabhakar Kore hospital, KLE University, Belgaum. The study included 50 adults, aged above 18 years, with laboratory confirmation of various types of thyroid dysfunction by universal sampling.The data collection for the study was done between 1st January 2017 to 31st December 2107 for one year

Patients with Pre-existing heart diseases like Rheumatic heart disease, Ischemic heart disease, hypertensive heart disease and cardiomyopathy. Ischemic heart disease were excluded from the study. Patients who were taking medications that alter the thyroid function such as beta blockers, lithium, oral contraceptive pills, steroids, and alcohol were also excluded. Patients

with the chronic obstructive pulmonary disease, severe anaemia or any other endocrinal disorders were also excluded.

A detailed history was taken to evaluate symptoms and duration related to thyroid dysfunction. Special emphasis was taken to rule out cardiac dysfunction. A detailed examination was performed on every patient. All the patient were subjected to free T3, Free T4, Free TSH and two-dimensional Echocardiography.Transthoracic echocardiography was performed using a commercially available echocardiographic system (EPIQ), with gated ECG .4 chamber and M-Mode Doppler and tissue Doppler imaging images are digitally acquired by X5-1 Matrix probe. Comparison of volume of all four cardiac chambers by 2D and 3 D echocardiography in normal individual measurements were symmetrically performed by offline analysis with an independent reader, blinded to clinical data.

Descriptive analysis was carried out by the mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram and pie diagram. Since the study was only a descriptive study, no inferential statistical analysis was performed and no P values were reported. IBM SPSS version 22 was used for statistical analysis.

RESULTS:

The mean age of the subjects was 39.18 ± 14.32 years with higher female preponderance. The most common thyroid dysfunction was hyperthyroidism in 41.20% of the study population, followed by 15 % of subjects with primary hypothyroidism and 15% of subjects with subclinical hypothyroidism. Most common co-morbidities were anaemia in 23.50% participants, hypertension in 19.6% and diabetes mellitus in 9.8% of study population.The pulse, systolic and diastolic blood pressure were significantly higher among hyperthyroidism group, as compared to the other two groups.

Among 15 people with Primary hypothyroidism, sinus bradycardia was the most common ECG feature observed in 8 (53.3%) of the study population. The other common ECG features were low voltage criteria and right bundle branch block seen in 2 (13.33%) subjects each. One subject (6.67%) had prolonged QT interval. Among 21 people with hyperthyroidism, the most common ECG finding was sinus tachycardia seen in 12 (57.14%) of subjects. Atrial fibrillation was observed in 3(14.28%) subjects, and low voltage complexes were observed in 2 (9.52%) of people.Among 15 subjects with subclinical hypothyroidism, the only ECG abnormality was sinus bradycardia seen in 2 (13.33%) of the subjects.Among the people with hyperthyroidism, 8 (38.10%) participants each had normal and tachycardia. 4, (19.04%) participants had pulmonary artery hypertension, and 2 (9.52%) participants had dilated cardiomyopathy. Among the people with primary hypothyroidism, 11 (73.33%) participants had type 1 diastolic dysfunction, 4 (26.67%) participants had pericardial effusion, 3 (20%) participants had pulmonary artery hypertension, and 2 (13.33%) participants had normal. Among the people with subclinical hypothyroidism, 8 (53.33%) participants had type 1 diastolic dysfunction, 6 (40%) participants had normal, 4 (26.67%) participants had pulmonary artery hypertension.

CONCLUSIONS:

The study has highlighted the profile of cardiac dysfunction among different types of thyroid dysfunction. No statistical associations could be tested due to limited sample size. Hence large scale prospective studies on the subject are needed to guide clinical practice.

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Glossary	Abbreviations
AF	Atrial fibrillation
ATPase	Adenosine triphosphatase
BP	Blood pressure
CBC	Complete blood cell cound
CDMI	Colour Doppler myocardial imaging
CHD	Coronary heart disease
CLIA	Chemiluminescence immunoassay
CVDs	Cardiovascular diseases
ECG	Electrocardiography
EPIQ	Echocardiographic system
FT_3	Free triiodothyronine
FT_4	Free thyroxine
HDL	High-density lipoprotein
IBS	Integrated backscatter
IHD	Ischemic heart disease
IQR	Interquartile range
L-T4	L-thyroxine
LDL	Low-density lipoprotein
LFT	Liver function test
LV	Left ventricular
MHC	Alpha-myosin heavy chain
NIDDCP	National iodine deficiency diseases control programme
RFT	Renal function test
SCH	Subclinical hypothyroidism
STD	Subclinical thyroid dysfunction
T(3)	Triiodothyronine
T4	thyroxine
TDE	Tissue Doppler echocardiography

TRalpha	thyroid hormone receptor alpha
TRbeta	thyroid hormone receptor-beta
TSH	thyroid stimulating hormone
VD	video densitometry

INTRODUCTION

Thyroid diseases are arguably among the commonest endocrine disorders worldwide including India.[1]It affects as many as 9% to 15% of the adult female population and a smaller population of adult males. According to a projection from various studies on thyroid disease, it has been estimated that about 42 million people in India suffer from thyroid diseases.[2] In studies from the western literature, as many as 50% of people in the community have microscopic nodules, 3.5% have an occult papillary carcinoma, 15% have palpable goitres, 10% demonstrate an abnormal thyroid-stimulating hormone level, and 5% of women have overt hypothyroidism or hyperthyroidism.[3]Despite the coverage of National iodine deficiency diseases control programme (NIDDCP) in India, iodine deficiency is still prevalent in many parts of India.[4]

The heart is an important target organ for thyroid hormone action and the molecular mechanisms that underlie the thyroid hormone based effects have been reviewed in the past.Thyroid hormonesare an important regulator of cardiac function and cardiovascular hemodynamics. Triiodothyronine (T3), the physiologically active form of thyroid hormone, binds to nuclear receptor proteins and mediates the expression of several important cardiac genes, inducing transcription of the positively regulated genes including alpha-myosin heavy chain (MHC) and the sarcoplasmic reticulum calcium ATPase. T3 mediated effects on the systemic vasculature include relaxation of vascular smooth muscle resulting in decreased arterial resistance and diastolic blood pressure. In hyperthyroidism, cardiac contractility and cardiac output are enhanced and systemic vascular resistance is decreased, while in hypothyroidism the opposite is true.

Hyperthyroidism and hypothyroidism are known to affect cardiovascular system in a number of ways.[5]Increased or reduced the action of thyroid hormone on certain molecular pathways in the heart and vasculature cause the relevant cardiovascular derangements. It is well established that overt hyperthyroidism induces a hyperdynamic cardiovascular state (high cardiac output with low systemic vascular resistance), which is associated with a faster heart rate, enhanced left ventricular (LV) systolic and diastolic function and an increased prevalence of supraventricular tachyarrhythmias - namely, atrial fibrillation.Whereas overt hypothyroidism is characterized by the opposite changes. However, whether the changes in cardiac performance associated with overt thyroid dysfunction are mainly due to alterations of myocardial contractility or loading conditions remain unclear. Extensive evidence indicates that the cardiovascular system responds to minimal but persistent changes in circulating thyroid hormone levels, which are typical of individuals with subclinical thyroid dysfunction. Subclinical hyperthyroidism is associated with increased heart rate, atrial arrhythmias, increased LV mass, impaired ventricular relaxation, reduced exercise performance and increased risk of cardiovascular mortality. Subclinical hypothyroidism is associated with impaired LV diastolic function and subtle systolic dysfunction and enhanced risk for atherosclerosis and myocardial infarction. Because all cardiovascular abnormalities are reversed by restoration of euthyroidism ("subclinical hypothyroidism") or blunted by beta-blockade and L-thyroxine (L-T4) dose tailoring ("subclinical hyperthyroidism"), timely treatment is advisable in an attempt to avoid adverse cardiovascular effects. Interestingly, some data indicate that patients with acute and chronic cardiovascular disorders and those undergoing cardiac surgery may have altered peripheral thyroid hormone metabolism that inturn may contribute to altered cardiac function.

In hyperthyroidism, excessive thyroid hormone production, thyrotoxicosis and subclinical hyperthyroidism are associated with palpitations, tachycardia, exercise intolerance, dyspnea on exertion, widened pulse pressure and sometimes atrial fibrillation. Cardiac contractility is enhanced, and resting heart rate and cardiac output are increased. Cardiac output may be increased by 50%- 300% over that of the normal subjects as a result of combined effects of increased in resting heart rate, contractility, ejection fraction and blood volume with decrease in systemic vascular resistance.[6, 7] In hypothyroidism, cardiovascular signs and symptoms are diametrically opposite to those described for hyperthyroidism and may include bradycardia, mild hypertension (diastolic) narrowed pulse pressure, cold intolerance and fatigue.[8] Hypothyroidism is associated with increased systemic vascular resistance, decreased cardiac contractility, decreased cardiac output, accelerated atherosclerosis and coronary artery disease.[8, 9]

Subclinical hypothyroidism (SCH) is a common endocrine disorder characterised by increased levels of thyroid stimulating hormone (TSH) with normal levels of free thyroxine (T4) and free triiodothyronine (T3) in serum. The signs and symptoms of SCH are usually subtle as compared with those of overt hypothyroidism, so it is difficult to detect. Hence the diagnosis of SCH is a laboratory diagnosis.[10] The controversy about whether screening and treating SCH is warranted[11] because evidence concerning the risks is limited; randomized controlled trials on relevant outcomes have not been done.[12] SCH has been associated with an increased risk for atherosclerosis and meta-analyses have shown that it is also associated with an increased risk of coronary heart disease[13] and increased blood pressure. Several cross-sectional studies have suggested an association between SCH and left ventricular (LV) diastolic function. However, whether SCH is a risk factor for LV diastolic function is controversial.

Echocardiography is the best modality to assess cardiovascular abnormalities in thyroid diseases non-invasively. The use of 2 D echocardiography has shown that left atrial diameter, left atrial active emptying volume and fraction, left and right intra-atrial and interatrial electromechanical delay was significantly higher in hyperthyroid patients.[14, 15]Serum TSH and free T4 levels correlate with 2DE LV mass index 2DE longitudinal strain and 3DE LV area strain. TSH level and mitral Em / Am ratio were an independent predictor of atrial electromagnetic delay.[16]

Tissue Doppler echocardiography (TDE) is a new and powerful method used for the evaluation of regional and global diastolic ventricular function. TDE is used in this way because, compared to conventional Doppler echocardiography, it is minimally affected by alterations in afterload, valvular regurgitations, and changes in heart rate.[17, 18] In addition, abnormalities in LV diastolic relaxation can be observed with respect to physiological parameters in those aged >60 years.

Thyroid diseases are one of the silent epidemics of our time. They may get overlooked in the early stages because of their uncertain and ambiguous symptoms. However, they are different from other diseases in terms of their ease of diagnosis, accessibility of medical treatmentand the relative visibility in the form of a small swelling. Early diagnosis and treatment therefore remain the cornerstone of thyroid disease management.

AIMS AND OBJECTIVES:

The objective of the study:

- To evaluate the 2 D-Echo Cardiography changes in thyroid disorders

REVIEW OF LITERATURE:

GROWING BURDEN OF THYROID DISORDERS GLOBAL AND INDIA:

Thyroid hormones act on almost all nucleated cells and are essential for normal growth, and energy metabolism.[19] Thyroid dysfunction is common, readily identifiable and easily treatable, but if undiagnosed or untreated, it can have profound adverse effects.[20] Hypothyroidism and hyperthyroidism commonly arise from pathological processes within the thyroid gland (primary thyroid disease), although in rare cases, they can arise from disorders of the hypothalamus or pituitary (central hypothyroidism) or peripheral causes, such as strumaovarii, or functional thyroid cancer metastases.[21]

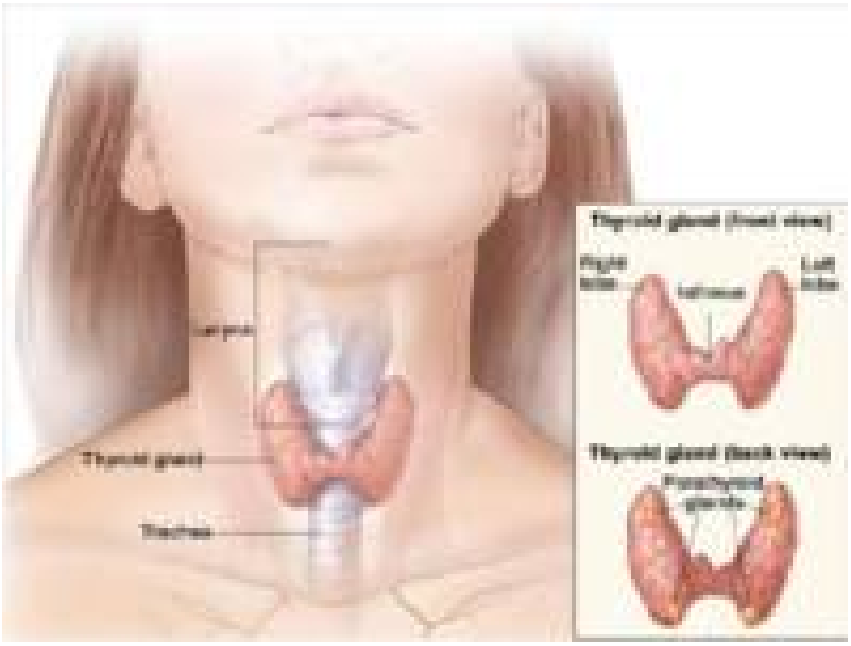
Thyroid diseases are arguably among the commonest endocrine disorders worldwide that have reached to alarming epidemic proportions. On a global scale, a staggering 200 million people have problems with their thyroid gland with over 50 per cent remaining undiagnosed.[22]

India too has a significant burden of thyroid diseases. According to the latest study, it is estimated that about 42 million people in India suffer from Thyroid diseases, Accounting for approximately 21 per cent of the global population suffering from such disorders.[23]Thyroid disease affects women seven times more than men, making it an important and understudied topic in women's health.Unnikrishnan et al,[23] in their eight cities study in India reported 54% prevalence among females, while Marwaha et al,[24] in their countrywide study found 63% prevalence of hypothyroidism .

In African-American populations, the frequency of hypothyroidism appears to be lower than in white individuals.[25] Careful reanalysis of data from the NHANES III

study indicates that non-Hispanic black individuals had a 54% lower risk of hypothyroidism than non-Hispanic white individuals, but non-Hispanic black individuals had over a threefold higher risk of hyperthyroidism.[26] Data from Brazil shows a similar pattern, with black individuals having the lowest prevalence of hypothyroidism and those of dual heritage and white individuals having a higher prevalence.[27]In India, striking regional variations in the prevalence of hypothyroidism have been reported[23, 24], which raises the need for the standardisation of assay methods and region-specific and population-specific reference ranges.

Figure 1: Anatomy of thyroid gland



Being the largest endocrine gland in the human body, this butterfly-shaped, bi-lobed gland produces hormones which influence almost all the metabolic processes in the body. The thyroid gland produces two hormones, namely- Triiodothyronine (T3) and its precursor Thyroxine (T4). Under normal conditions, the thyroid produces T3 and T4 at a 20% - 80% ratio.

Thyroid-stimulating hormone (TSH) is another important hormone that is secreted by the anterior pituitary cells in the brain, and its primary function is to increase the production of T3 and T4 by the thyroid gland.

The five common thyroid diseases in India are:

- Hypothyroidism,
- Hyperthyroidism,
- Goitre and iodine deficiency disorders,
- Hashimoto's thyroiditis, and
- Carcinoma Thyroid

The two most common forms of thyroid disease are hypothyroidism and hyperthyroidism.Underproduction of thyroid hormones slows down the body's metabolism, causing Hypothyroidism. Common symptoms of this condition are weight-gain despite eating sensibly, feeling cold, fatigue, depression and possibly increased blood pressure and cholesterol levels.

Hyperthyroidism occurs when an excess of T3 and T4 speeds up the body's metabolism and,if left untreated it can lead to complications such as severe weight-loss despite a healthy appetite, nervousness, staring eyes, accelerated heart rate and insomnia.

In both hypothyroidism and hyperthyroidism, there may be swelling of a part of the neck, which is also as Goitre.

The most useful marker of thyroid gland function in serum thyroid-stimulating hormone (TSH) levels. TSH levels are determined by a negative feedback system in which high levels of T3 and T4 suppress the production of TSH, and low levels of T3 and T4 increase the production of TSH. TSH levels are thus often used, as the first indicator of thyroid function.

- Elevated TSH levels can signify inadequate thyroid hormone production (hypothyroidism).
- Suppressed TSH levels can point to excessive thyroid hormone production (hyperthyroidism).

Table 1: Clinical reference values of thyroid function test

Test	***Range***
TSH	0.4-4.7mU/L
T3	0.92-2.78 nmol/L
FT3	0.22-6.78 pmol/L
T4	58-140 nmol/L
FT4	10.3-35 pmol/L

Thyroid disease has, in our time become a major public health concern worldwide, the multiple risks to thyroid function include not only the individual's genetic background but also environmental hazards such as inadequate iodine intake, polychlorinated biphenyls, radiation exposure from nuclear fallout and medical radiation, perchlorate in rocket fuel, cigarette smoking and others.

Hashimoto's thyroiditis is the most common cause of an underactive thyroid (hypothyroidism). In Europe and the United States, it variably affects 2-4 per cent of the population, while it occurs more often in women than in men.

Congenital hypothyroidism: 1 per 3,000 - 4,000 new-borns are affected by congenital hypothyroidism in North America, Europe, Japan and Australia, (Genetics Home Reference website).

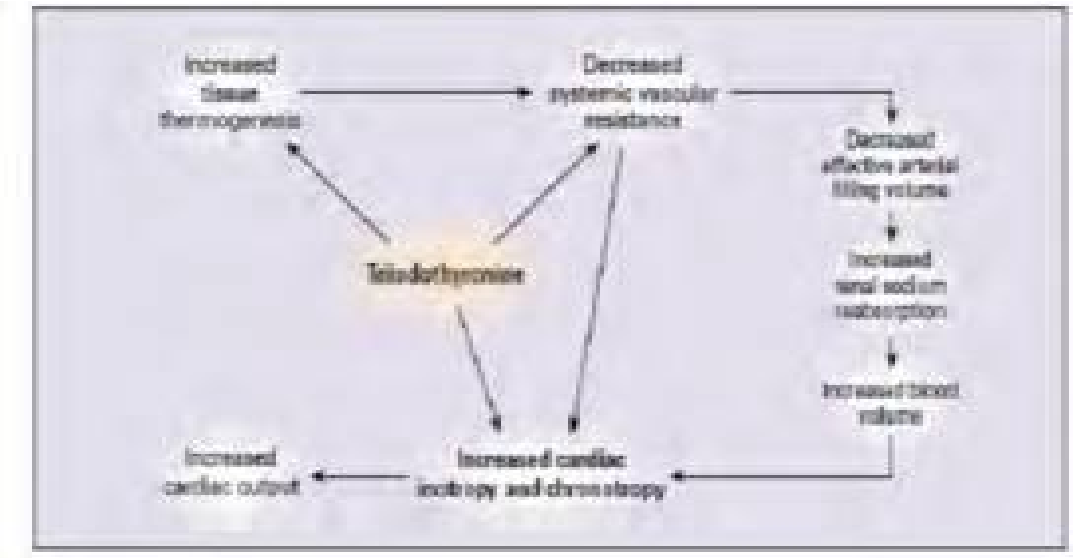
The relationship between Thyroid and heart

Thyroid hormone has many effects on the heart and vascular system.[28]Many of the clinical manifestations of hyperthyroidism are due to the ability of thyroid hormone to alter cardiovascular hemodynamics.The hemodynamic effects of hypothyroidism are opposite to those of hyperthyroidism, although the clinical manifestations are less obvious.[29]

Effects of Thyroid Hormone on Myocardial Contractility and Hemodynamics

The effects of triiodothyronine, the active cellular form of thyroid hormones on cardiovascular physiology are shown in Figure 2.And the effects of hyperthyroidism and hypothyroidism on various hemodynamic measures are listed in Table 2. It is clear from many invasive and noninvasive measurements in patients with thyroid disease that cardiac functions such as heart rate, cardiac output, systemic vascular resistance are closely linked to thyroid status. In addition to the well-recognized action of thyroid hormone to increase peripheral oxygen consumption and substrate requirements causing a secondary increase in cardiac contractility, the hormone also increases cardiac contractility directly.[29-31]Triiodothyronine decreases systemic vascular resistance by dilating the resistance arterioles of the peripheral circulation.[32]The vasodilation is due to a direct effect of triiodothyronine on vascular smooth muscle cells that promotes relaxation.[33]The clinical correlate of this finding is that a high dose of triiodothyronine decreases systemic vascular resistance and increases cardiac output within hours after coronary-artery bypass grafting.[34]

Figure 2. Effects of Thyroid Hormone on Cardiovascular Hemodynamics.



The diagram shows the way in which triiodothyronine increases cardiac output by affecting tissue oxygen consumption (thermo-genesis), vascular resistance, blood volume, cardiac contractility, and heart rate.

Table 2: Cardiovascular features

Physical examination	**Hemodynamic changes**	**ECG/X-ray/ ultrasound**
Hyperthyroidism		
Tachycardia at rest	↑ Cardiac output	↓ QT interval
↑ Pulse amplitude	↑ Myocardial contractility	↓ PR interval
Systolic murmur	↑ Systolic/diastolic function	ST-segment elevation
Mitral valve prolapse	↑ Systolic blood pressure	Atrial fibrillation
↑ First heart sound	↑ Blood volume	Wolff-Parkinson White Syndr

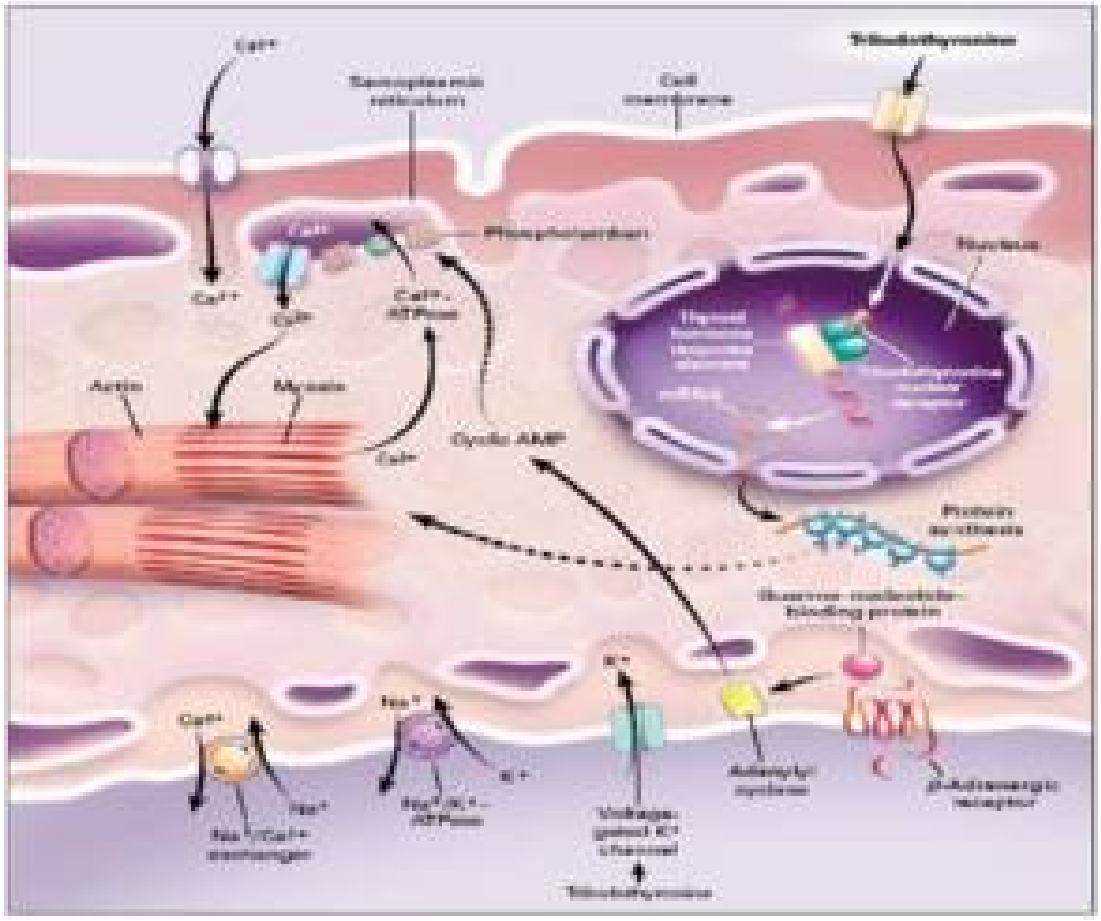
Possible third heart sound	↑ Venous resistance	↓ Contraction times
Ankle swelling	↓ Arterial resistance	Cardiac hypertrophy
Unspecific symptoms (palpitations, shortness of breath, chest pain)	↓ Diastolic blood pressure	Heart block
	↓↓ Circulation time	
Means-Learman "scratch."		
Hypothyroidism		
Bradycardia	↓ Cardiac output	↑ QT interval
Weak pulse	↓ Stroke volume	↑ Conduction abnormalities
Hypertension	↓ Myocardial contractility	T-wave inversion
Faint heart sounds	↓ Blood volume	Atrioventricular block
Quiet precordial findings	↑ Diastolic blood pressure	Pericardial/pleural effusions
↓ Exercise tolerance	↑ Peripheral vascular resistance	Cardiac tamponade (rare)
Dyspnea on exertion	↑ Circulation time	Ascites
Congestive heart failure	Signs of peripheral vasoconstriction	
Ankle swelling		

CELLULAR MECHANISMS OF THYROID HORMONE ACTION

The thyroid gland primarily secrets T_4 (=85%), which is converted to T_3 by 5-monodeiodination in the liver, kidney and skeletal muscle.[35, 36] The heart relies mainly on serum T_3 because no significant myocyte intracellular deiodinase activity takes place, and it appears that T_3 and not T_4, is transported into the myocyte.[37] Thyroid hormone effects on the cardiac myocyte are intimately associated with cardiac function via regulation of the expression of key structural and regulatory genes. The myosin heavy chain genes encode the two contractile protein isoforms of the thick filament in the cardiac myocyte. The sarcoplasmic reticulum Ca^{2+}-ATPase and its inhibitor, phospholamban, regulate intracellular calcium cycling. Together they are largely responsible for the enhanced contractile function and diastolic relaxation in the heart.[38, 39]

Figure 3. depicts the cellular mechanism of action of triiodothyronine on the cardiac myocyte. Triiodothyronine enters the cell, possibly by a specific transport mechanism and binds to nuclear triiodothyronine receptors. The complex then binds to thyroid hormone response elements of the genes for several cell constituents and regulates transcription of these genes, including those for Ca^{2+}-ATPase and phospholamban in the sarcoplasmic reticulum, myosin, b-adrenergic receptors, adenylyl cyclase, guanine-nucleotide–binding proteins, Na^+/Ca^{2+} exchanger, Na^+/K^+–ATPase, and voltage-gated potassium channels. Nonnuclear triiodothyronine actions on ion channels for sodium (Na^+), potassium (K^+) and calcium (Ca^{2+}) ions are indicated at the cell membrane. Dashed arrows indicate pathways with multiple steps, and mRNA denotes messenger RNA.

Figure 3. Sites of Action of Triiodothyronine on Cardiac Myocytes.



Thyroid hormone effects on the heart and peripheral vasculature include decreased systemic vascular resistance and increased resting heart rate, left ventricular contractility and blood volume. Thyroid hormones cause decreased resistance in peripheral arterioles through a direct effect on vascular smooth muscle cells and decreased mean arterial pressure which is sensed in the kidneys.

This activates the renin-angiotensin-aldosterone system and increases renal sodium absorption.

T3also increases erythropoietin synthesis which increases red cell mass. These changes combine to promote an increase in blood volume and preload.

Cardiac abnormalities in patients with thyroid disorders

Hyperthyroidism

Excess thyroid hormones causes palpitations, with some degree of exercise impairment and a widened pulse pressure, independent of the cause of the hyperthyroidism.[40, 41]The changes in heart rate results from both an increase in sympathetic tone and a decrease in parasympathetic tone.[42]Tachycardia, with heart rates greater than 90 beats per minute, is common at rest and during sleep; in addition, the normal increase in heart rate during exercise is exaggerated.[42]In a study of 880 patients of widely varying ages, resting tachycardia was second only to goitre as the most common sign of hyperthyroidism.[43]

In patients with hyperthyroidism, cardiac output is 50 to 300 per cent higher than in normal subjects. This increase is due to the combined effects of a decrease in systemic vascular resistance, an increase in resting heart rate, increase in left ventricular contractility and ejection fraction and an increase in blood volume.[44]The importance of the contribution of decreased systemic vascular resistance to the increase in systemic blood flow in patients with hyperthyroidism is evidenced by the results of studies in which the administration of arterial vasoconstrictors, atropine and phenylephrine, decreased peripheral blood flow and cardiac output by 34 per cent in patients with hyperthyroidism but had no effect in normal subjects.[45]

Patients with hyperthyroidism have increased left ventricular systolic and diastolic contractile function, a finding consistent with changes in the expression of contractile and calcium-regulatory proteins, as described previously.[39]The rate of increase in intraventricular pressure during systole, the left ventricular ejection fraction and the rate of blood flow across the aortic valve are all increased.[44]

Subclinical Hypothyroidism

Subclinical hypothyroidism (SCH) is defined as a condition characterised by elevated serum thyroid-stimulating hormone (TSH) concentrations (TSH: >4.5 mIU/L) while circulating thyroxine (T4) and tri-iodothyronine (T3) levels remain within the population reference range.[46] The incidence of SCH varies between 4 and 20 % depending upon the gender (females are more prone), age (older than 65) and population studied.[47] It may be caused by exogenous (L-thyroxine under-replacement in hypothyroid patients; medication with lithium, cytokines, iodine, antithyroid drugs, Iodine 131 therapy or thyroidectomy) or endogenous (Hashimoto thyroiditis and previous subacute or silent thyroiditis) factors.[37]

The argument against lowering the upper limit of normal for TSH values is that 22 to 28 million more Americans would be diagnosed with hypothyroidism without any clinical or therapeutic benefit from this diagnosis.[48] Our data also show that decreasing the upper limit of the TSH reference range to 3.0 mIU/L results in more than a 4-fold increase in diagnosis of hypothyroidism among patients without a history of thyroid disease seen in a tertiary medical centre.[49] No clear evidence supports a benefit for intervening at these levels of TSH.

Hypothyroidism

The hemodynamic changes typical of hypothyroidism are opposite to those of hyperthyroidism, but they are accompanied by fewer symptoms and signs.[5]The most common signs are bradycardia, mild hypertension, a narrowed pulse pressure and attenuated activity on the precordial examination. Other characteristic but nonspecific findings are high serum concentrations of cholesterol and creatine kinase (the skeletal-muscle MM isoform).[5, 33] Pericardial effusion and nonpitting edema

(myxedema) can occur in patients with severe, long-standing hypothyroidism.[5]The low cardiac output is caused by bradycardia, a decrease in ventricular filling and a decrease in cardiac contractility.[9]Systemic vascular resistance may increase by as much as 50 per cent[5, 33],and diastolic relaxation and filling are slowed.However, heart failure is rare, because the cardiac output is usually sufficient to meet the lowered demand for peripheral oxygen delivery.[50]Positron-emission tomographic studies of oxygen consumption in patients with hypothyroidism have revealed that myocardial work efficiency is lower than in normal subjects.[37]From 10 to 25 per cent of patients have diastolic hypertension, which combined with the increase in vascular resistance raises cardiac afterload and cardiac work.[5, 51]

Although atrial arrhythmias are common and ventricular ectopy is rare in patients with hyperthyroidism, the opposite is true of hypothyroidism.[5]Hypothyroidism prolongs the cardiac action potential and the QT interval.[52]This in turn predisposes the patient to ventricular irritability and, in rare cases acquired torsade de points.[53]These changes may arise at least in part from the regulatory effect of triiodothyronine on the expression of various ion channels in the heart.[52]

Subclinical Hyperthyroidism

Alterations in cardiac hemodynamics have been reported in some, but not all studies of patients with subclinical hyperthyroidism.[54, 55]The alterations include an increase in heart rate and left ventricular mass that improves in response to treatment with a beta-adrenergic–receptor antagonist, whereas the positive inotropic response persists.[56]

As noted above, patients with subclinical hyperthyroidism are at increased risk for atrial fibrillation.[56]These findings support the long-standing observation that elderly patients with few symptoms of hyperthyroidism may present with either cardiac-

rhythm disturbances or unexplained tachycardia.[29, 42, 57]Serum thyrotropin should be measured in all elderly patients with systolic hypertension, a widened pulse pressure, recent-onset angina, atrial fibrillation or an exacerbation of underlying ischemic heart disease.[29, 42, 57]

Relevant studies

Sonawale et al,[58](2018)evaluated the incidence of cardiovascular abnormalities in newly identified hyperthyroid patients and their outcome with anti-thyroid therapy. A total of 96 patients who were newly diagnosed to have hyperthyroid disease were screened and out of them, 40 patients who presented with cardiovascular symptoms and sign were included in the study (30 females, ten males). Hyperthyroid patients were re-evaluated after antithyroid therapy. Findings in patients were compared at presentation, and after 3 months of treatment. All had undergone a structured cardiovascular history and examination, including measurements of blood pressure (BP) and pulse rate. All had to rest 12-lead electrocardiogram and 2D ECHO. Cardiovascular symptoms and signs, as well as abnormal hemodynamic and dysrhythmias, especially supraventricular, were frequent among patients with hyperthyroidism. Palpitation and atrial fibrillation (AF) were more recurrent in overt hyperthyroid subjects. They opined that cardiovascular abnormalities were one of the most common presentations in patients with hyperthyroidism.

Kandan et al,[59] (2017) aimed to study the prevalence of various cardiac manifestations in overt and subclinical hyperthyroidism. A total of 50 patients of hyperthyroidism who visited general medicine department of Sri Ramachandra Medical College, Chennai, India were included in the study. Patients with other co-morbidities which

could contribute to cardiovascular manifestations were excluded from the study. All the patients underwent clinical evaluation, basic laboratory tests like CBC, RFT, LFT, serum electrolytes, fasting lipid profile (which included serum triglycerides, LDL, HDL, total cholesterol), FT_4, FT_3 and TSH and radiological variables were studied in these patients. ECG and 2D ECHO were performed in these patients to analyse the presence of any cardiac manifestations in these patients. The commonest cardiovascular signs were found to be tachycardia (82%), widened pulse pressure (50%) and pedal edema (12%). The commonest ECG finding was found to be Sinus tachycardia (46%) followed by atrial fibrillation (28%). Systolic dysfunction and chamber enlargement (18%) were the commonest echo findings. They concluded that cardiovascular manifestations were quite common and varied in hyperthyroidism which was to be looked for in the management.

Behera et al,[60](2017) wanted to study all the cardiovascular changes associated with the newly detected hypothyroidism and to know the cardiovascular involvement in sub-clinical hypothyroidism. Sixty newly detected hypothyroid patients, diagnosed by clinical evaluation and confirmed by thyroid hormone assay by chemiluminescence immunoassay (CLIA) method, were subjected to cardiovascular examination, electrocardiography, echocardiography and Treadmill test. It was a cross-sectional study design based on random sampling method which was conducted for two years in the department of General Medicine, MKCG Medical College Hospital, Berhampur, Odisha, India. The work was carried out after approval from the Institutional Ethics Committee of MKCG Medical College Hospital, Berhampur, Odisha. Patients were investigated before thyroid hormone replacement therapy. Statistical data analysis was made on the basis of deviation, standard error, t-test and

the proportion test. A p value of < 0.05 was considered statistically significant. It was concluded that hypothyroidism wass common in females, maximum in the between 17-47 years age group. Majority of the patients did not have any cardiovascular changes. Observed cardiovascular changes were ECG abnormalities, pericardial effusion, diastolic hypertension and diastolic dysfunction. A systematic study was done to know the early effects of hypothyroidism on the cardiovascular system.

Ramesh et al,[61](2016) investigated the cardiovascular involvement in hypothyroidism. The data for this study was collected from 40 hypothyroid patients by clinical examination and by performing ECG and Echocardiogram who came to Malla Reddy Medical College and Hospital, Hyderabad which included both outpatients and inpatients. Normal ECG was found in 30% of patients; Bradycardia was the most common finding seen in 16 patients counting for 40%. Low voltage complexes were seen in 35% of patients. Echo findings were normal in 32.5% cases. Pericardial effusion was the next common finding seen in 11 cases accounting for 27.5%. Diastolic dysfunction was seen in 27.5%, the majority of them being mild dysfunction. No cases were found to have severe diastolic dysfunction. IVS thickness was found only in 2 cases. Among 40 new cases of hypothyroidism, pericardial effusion was found in 27.5% patients. Diastolic dysfunction was seen in 27.5 % of patients. All the patients diagnosed with hypothyroidism are to be screened for pericardial effusion and other cardiac complications.

Shashikant et al,[62](2015) aimed at studying the cardiac dysfunction hypothyroidism by ECG and ECHO to assess the need for treatment even in the milder forms of the disease. A total of50 new patients of hypothyroidism who presented to Bapuji and

Chigateri government hospital from 1-10-2012 to 1-8-2014 were studied. They were clinically evaluated and underwent relevant investigations, including thyroid profile estimation, cardiac evaluation using ECG and 2D ECHO. Most cases fell in the age group of 31-40 yrs. There was an overall female preponderance with a mean age of 37.65yrs (76%). Bradycardia and hypertension were seen in 30% and 18 respectively. On examination, diminished heart sound is found in 22% of patients. Among 50 new cases of hypothyroidism, pericardial effusion was found in 18% of patients. Diastolic dysfunction was seen in 18% of patients. Thus, any unexplained pericardial effusion should be screened for hypothyroidism.

Razvi et al,[63](2010) evaluated incident IHD and mortality in participants in relation to their thyroid status. Data were reanalysed assessing incident IHD events and mortality during 20 yrs of follow-up in individuals with endogenous SCH (n = 97; TSH 6.0-15 mIU/ litre) vs the euthyroid group (n = 2279), who were IHD free at baseline. Incident IHD was significantly higher in the SCH group [adjusted hazard ratio 1.76 (95% confidence interval 1.15-2.71); P = 0.01]. It was concluded that in the Whickham Survey, there was an association between incident IHD events and IHD-related mortality with SCH over the 20 yr of follow-up. Furthermore, subsequent treatment of SCH with levothyroxine appeared to attenuate IHD-related morbidity and mortality, and this may explain why some other longitudinal studies of SCH had not shown such an association; properly designed controlled trials of treatment of SCH were required to answer this question definitively.

Di Bello et al,[17](2009)investigated the new echocardiographic techniques for the study of pathophysiological intramyocardial phenomena included video densitometry (VD), integrated backscatter (IBS), and colour Doppler myocardial imaging (CDMI). They presumed that being more independent from the cardiac load and from rotational and translational heart motion, these new sensors, non-invasive techniques such as CDMI and IBS show a real incremental value in comparison with conventional echocardiography and allow to detect subtle functional and textural abnormalities of the intramural myocardium, partially undetectable by conventional two-dimensional Doppler echocardiography. Subclinical thyroid dysfunction (STD), both in its hypo- and hyperthyroidism form, has a relatively high prevalence in general population (9-15% with a lower percentage of adult males), hence it could be very useful to study more deeply heart involvement in these pathophysiological conditions and understand the complex relationship between thyroid and heart. In subclinical hyperthyroidism, these new ultrasonic techniques permitted to discover more complex and different early cardiac abnormalities of both systolic and diastolic phases.

Fatourechi et al.[64] (2009) reviewed subclinical hypothyroidism as an update to primary physicians. Their literature showed that subclinical hypothyroidism (SCH), also called mild thyroid failure, is diagnosed when peripheral thyroid hormone levels are within normal reference laboratory range but serum thyroid-stimulating hormone (TSH) levels are mildly elevated. This condition occurred in 3% to 8% of the general population. It was more common in women than men, and its prevalence increased with age. Of patients with SCH, 80% had a serum TSH of less than ten mIU/L. The most important implication of SCH was a high likelihood of progression to clinical hypothyroidism. The possibility that it was a cardiovascular risk factor has been a

subject of debate. Large-scale randomised studies were needed for evidence-based recommendations regarding screening for mild thyroid failure and levothyroxine therapy for this condition. Currently, the practical approach was routine levothyroxine therapy for persons with a persistent serum TSH of more than 10.0 mIU/L and individualised therapy for those with a TSH of less than 10.0 mIU/L.

Biondi et al,[11](2008) reviewed on the clinical significance of subclinical thyroid function. The evidence showed that the clinical significance of subclinical thyroid dysfunction was much debated. Subclinical hyper- and hypothyroidism can have repercussions on the cardiovascular system and bone, as well as on other organs and systems. However, the treatment and management of SCTD and population screening are controversial despite the potential risk of progression to overt disease, and there is no consensus on the thyroid hormone and thyrotropin cut-off values at which treatment should be contemplated.

Singh et al,[13](2007) did a meta-analysis about the impact of subclinical thyroid disorders on CHD, CVS and all-cause mortality. A systemic search of the literature using Pubmed, Medline and Ovid online tool was performed to identify relevant studies. Amongst the clinical studies, crossectional study and studies with a follow-up period ranging between 4 and 20 yr were identified. They concluded that sub-clinical hypothyroidism is associated with both, a significant risk of CHD at baseline and follow-up. In addition, mortality from cardiovascular causes is significantly higher at follow-up. Subclinical hyperthyroidism is not associated with CHD or mortality from cardiovascular causes.

Wilson et al,[10](2005) in their review opined that the management of subclinical thyroid dysfunction is controversial. The prevalence of subclinical hypothyroidism is about 4 to 8.5 percent and may be as high as 20 per cent in women older than 60 years. Subclinical hyperthyroidism is found in approximately 2 per cent of the population. Most national organisations recommend against routine screening of asymptomatic patients, but screening is recommended for high-risk populations. There is good evidence that subclinical hypothyroidism is associated with progression to overt disease. Patients with a serum thyroid-stimulating hormone level greater than 10 microns per mL have a higher incidence of elevated serum low-density lipoprotein cholesterol concentrations; however, the evidence is lacking for other associations. There is little evidence that early treatment alters the clinical course.

Fazio et al,[65] (2004) reviewed the effect of thyroid hormone on the CVS. The evidence indicated that overt hyperthyroidism induces a hyperdynamic cardiovascular state (high cardiac output with low systemic vascular resistance), which is associated with a faster heart rate, enhanced left ventricular (LV) systolic and diastolic function, and increased prevalence of supraventricular tachyarrhythmias - namely, atrial fibrillation - whereas overt hypothyroidism is characterized by the opposite changes. Extensive evidence indicated that the cardiovascular system responds to the minimal but persistent changes in circulating thyroid hormone levels, which are typical of individuals with subclinical thyroid dysfunction. Interestingly, some data indicate that patients with acute and chronic cardiovascular disorders and those undergoing cardiac surgery may have altered peripheral thyroid hormone metabolism that, in turn, may contribute to altered cardiac function.

Danzi et al ,[66] (2004) reviewed thyroid hormone and the CVS. Thyroid hormone is an important regulator of cardiac function and cardiovascular hemodynamics. Triiodothyronine (T3), the physiologically active form of thyroid hormone, binds to nuclear receptor proteins and mediates the expression of several important cardiac genes, inducing transcription of the positively regulated genes including alpha-myosin heavy chain (MHC) and the sarcoplasmic reticulum calcium ATPase. Negatively regulated genes include beta-MHC and phospholamban, which are down-regulated in the presence of normal serum levels of thyroid hormone. Changes in serum T(3) levels in patients with chronic congestive heart failure are caused by alterations in thyroid hormone metabolism suggesting that patients may benefit from T(3) replacement in this setting.

Surks et al,[12] (2004) proposed to define subclinical thyroid disease, review its epidemiology, recommend an appropriate evaluation, explore the risks and benefits of treatment and consequences of nontreatment, and determine whether population-based screening is warranted. To define subclinical thyroid disease, review its epidemiology, recommend an appropriate evaluation, explore the risks and benefits of treatment and consequences of nontreatment, and determine whether population-based screening is warranted. A total of 195 English-language or translated papers were reviewed. Editorials, individual case studies, studies enrolling fewer than ten patients, and non-systematic reviews were excluded. They concluded that there was insufficient evidence to support population-based screening. Aggressive case finding is appropriate in pregnant women, women older than 60 years, and others at high risk for thyroid dysfunction.

Dillmannet al,[7](2002)reviewed the cellular action of thyroid on the heart. His literature review showed that changes in thyroid status markedly influence cardiac contractile and electrical activity. The predominant route by which triiodothyronine (T3) affects cardiac action is by exerting a direct effect in cardiac myocytes through binding to thyroid hormone nuclear receptor isoforms. In addition, T3 modifies cardiac action by alterations in the vascular system and decreases afterload of the left ventricle by subtle modification related to the sympathetic system. The importance of T3 nuclear receptor function has been further demonstrated by studies in null mutant mice in which thyroid hormone receptor alpha (TRalpha) and thyroid hormone receptor-beta (TRbeta) or both are deleted. The increased contractile performance induced by T3 is largely mediated by increased expression of the calcium adenosine triphosphatase (ATPase) of the sarcoplasmic reticulum and decreased expression of phospholamban and T3 increases the phosphorylation status of phospholamban.

The controversy about whether screening and treating SCH is warranted[11]because evidence concerning the risks is limited; randomized controlled trials on relevant outcomes have not been done.[12] SCH has been associated with an increased risk for atherosclerosis and meta-analyses have shown that it is also associated with an increased risk of coronary heart disease[13]and increased blood pressure. Several cross-sectional studies have suggested an association between SCH and left ventricular (LV) diastolic function. However, whether SCH is a risk factor for LV diastolic function is controversial.

There is certainly a contradiction between the epidemiological profile and the fact that thyroid conditions are one of the most prominent points of interest for clinicians. This discrepancy between the collective and individual approach probably arises because diagnosis, treatment, screening and prevention of thyroid diseases have been outstanding actions of both public health and medicine over the last two centuries. Nowadays, occurrences of patients with myxedematous facies and Graves disorder are less frequent because of the combination of awareness among physicians of the symptoms and signs of thyroid dysfunction, availability of thyroid tests and use of inexpensive medicines for thyroid replacement or for blocking hyperfunction of the thyroid gland.

David Cooper and Bernadette Biondi emphasised that the clinical significance of this mild degree of thyroid dysfunction is unknown. They point out existing disagreement among professional societies and experts about screening for subclinical thyroid disease. It is perhaps unsurprising that the benefits of treatment in subclinical thyroid disease are poorly characterised. They opined that large-scale randomised trials are urgently needed to inform future care for individuals with subclinical thyroid disease. The clinical significance of subclinical thyroid dysfunction, or of variations in thyroid hormones within the laboratory reference range, remains contentious·

Study Site: This study was conducted in the department of general medicine,Dr.Prabhakar Kore hospital& MRC, KAHER, Belgaum

Study Population: All the eligible patients in the OPD, diagnosed with thyroid dysfunction, as specified in inclusion criteria were considered as the study population.

Study Design: The current study was across-sectional observational study

Sample Size: All the eligible subjects presenting during the study period who satisfied the inclusion and exclusion criteria were included in the study by universal sampling.

A total of 50 subjects were available for final analysis.

Study Duration: The data collection for the study was done between 1stJanuary 2017 to 31stDecember 2107 for one year

Inclusion Criteria

- All patients aged 18 years and above
- Patients with deranged thyroid profile either hypothyroidism or hyperthyroidism. (subclinical hypothyroidism and hyperthyroidism are also included in the study)

Exclusion criteria:

- Pre-existing heart diseases like Rheumatic heart disease, Ischemic heart disease, hypertensive heart disease and cardiomyopathy.
- Patients taking medications that alter the thyroid function such as beta blockers, lithium, oral contraceptive pills, steroids and alcohol.
- Patients with the chronic obstructive pulmonary disease, severe anaemia or any other endocrine disorders.

Ethical considerations: Study was approved by the institutional human ethics committee. Informed written consent was obtained from all the study participants, and only those participants willing to sign the informed consent were included in the study. The risks and benefits involved in the study and voluntary nature of participation were explained to the participants before obtaining consent. Confidentiality of the study participants was maintained.

Data Collection Tools:

All the relevant parameters were documented in a structured study proforma.

Methodology:

Patients attending the OPD or those who were admitted who were diagnosed to have Thyroid disorders or those who are already on treatment will be enrolled in the study

A detailed history was taken to evaluate symptoms and duration related to thyroid dysfunction. Special carewas taken to rule out cardiac dysfunction.A detailed examination was performed on every patient. All the patientswere subjected to free T3, Free T4, Free TSH and two-dimensional Echocardiography.

Transthoracic echocardiography was performed using a commercially available echocardiographic system (EPIQ), with gated ECG .4 chamber and M-Mode Doppler and tissue Doppler imaging images were digitally acquired by X5-1 Matrix probe. Comparison of volume of all four cardiac chambers by 2D and 3 D echocardiography in normal individual measurements were symmetrically performed by offline analysis with an independent reader, blinded to clinical data.

Statistical Methods:

Descriptive analysis was carried out by the mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram and pie diagram. Since the study was only a descriptive study, no inferential statistical analysis was performed and no P values were reported. IBM SPSS version 22 was used for statistical analysis. [67]

RESULTS:

A total of 51 subjects were included in the final analysis.

Table 3: Descriptive analysis of age in the study population (N=51)

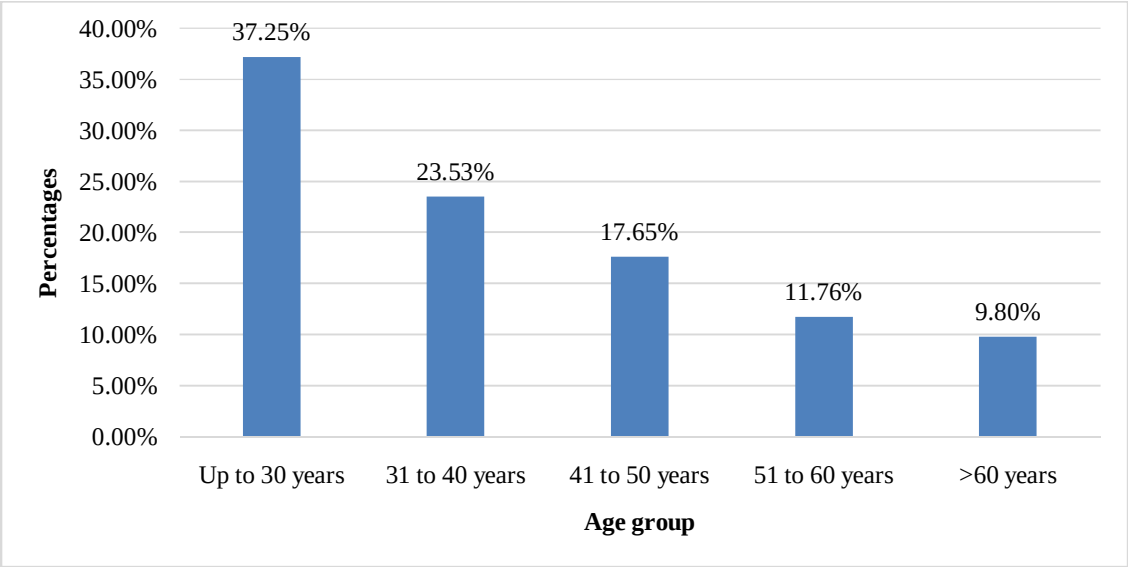
Parameter	Mean ± SD	Median	Min	Max	95% C.I	
					Lower	Upper
Age (in years)	39.18 ± 14.32	39.00	21.00	75.00	35.15	43.20

The mean age of the subjects was 39.18 ± 14.32 years with a range of 21 years to 75 years (95% CI 35.15 to 43.20). (Table 3)

Table4: Descriptive analysis of age group in the study population (N=51)

Age group	Frequency	Percentages
Up to 30 years	19	37.30%
31 to 40 years	12	23.50%
41 to 50 years	9	17.60%
51 to 60 years	6	11.80%
>60 years	5	9.80%

Figure 4: Bar chart of age group in study population (N=51)

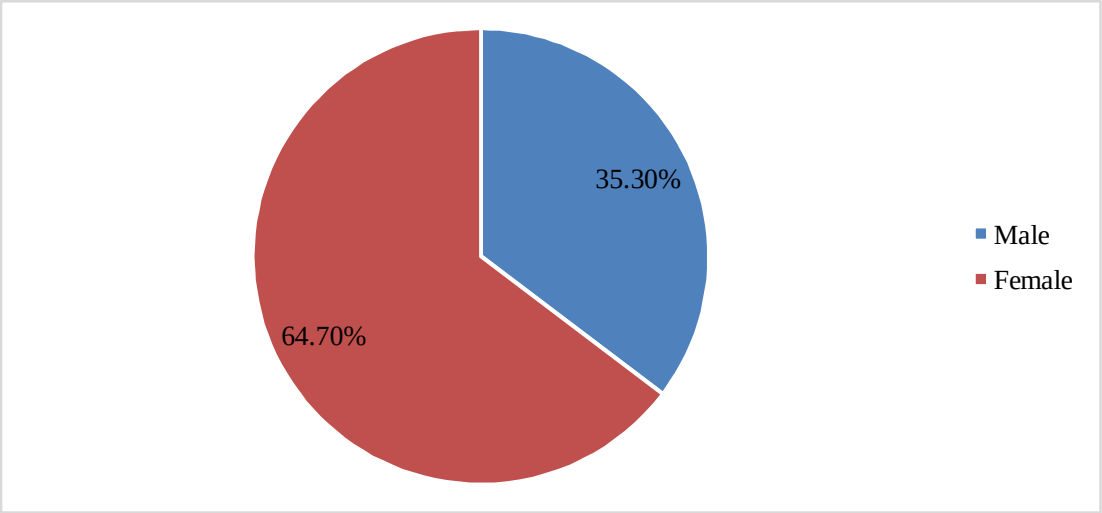


Among the study population, 19 (37.30%) participants were aged 30 years, 12 (23.50%) participants were aged between 31 to 40 years, 9 (17.60%) participants were aged between 41 to 50 years, 6 (11.80%) participants were aged between 51 to 60 years and 5 (9.80%) participants were aged >60 years and above. (Table 4& Figure 4)

Table 5: Descriptive analysis of gender in the study population (N=51)

Gender	Frequency	Percentages
Male	18	35.30%
Female	33	64.70%

Figure 5: Pie chart of gender in the study population (N=51)

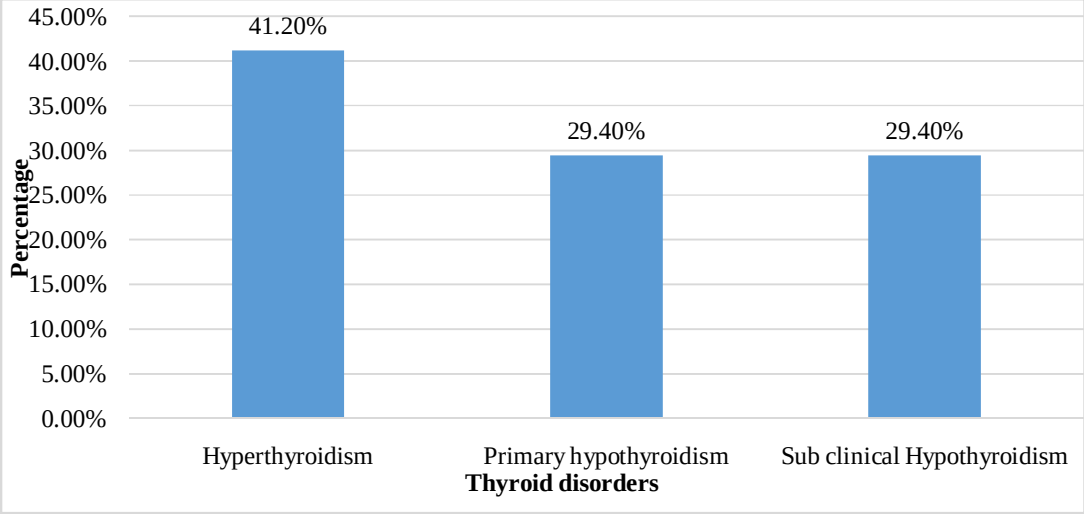


In the study population, male participants were 18 (35.30%) remaining 33 (64.70%) were female participants. (Table 5& Figure 5)

Table 6: Descriptive analysis of thyroid disorders in the study population (N=51)

Thyroid disorders	Frequency	Percentage
Hyperthyroidism	21	41.20%
Primary hypothyroidism	15	29.40%
Subclinical Hypothyroidism	15	29.40%

Figure 6: Bar chart of thyroid disorders in the study population (N=51)



In the study population, 21 (41.20%) participants had hyperthyroidism, 15 (29.40%) participants had primary hypothyroidism, and 15 (29.40%) participants had subclinical hypothyroidism. (Table 6& Figure 6).

Table 7: Descriptive analysis of history in the study population (N=51)

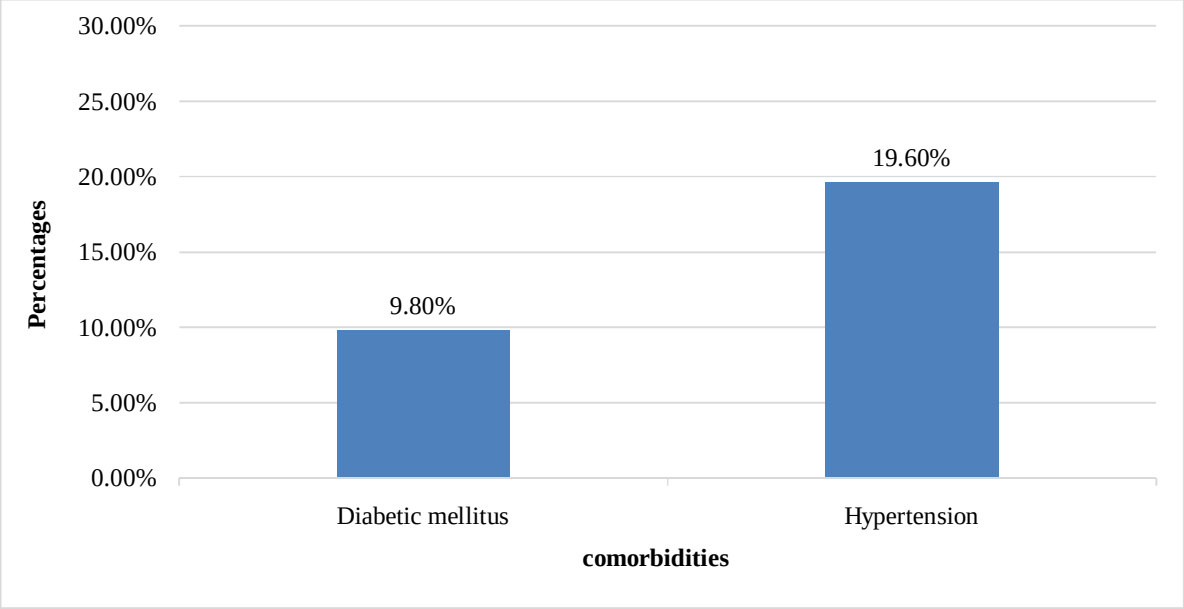
History	Frequency	Percentages
No	51	100.00%

None of them had a history of thyroid disorders. (Table 7)

Table 8: Descriptive analysis of Co-morbidities in the study population

Co-morbidities	Frequency	Percentages
Diabetic mellitus		
Yes	5	9.80%
No	46	90.20%
Hypertension		
Yes	10	19.60%
No	41	80.40%

Figure 7: Bar chart of Co-morbidities in the study population



In the study population, 5 (9.80%) people had diabetic mellitus, and 10 (19.60%) people had hypertension. (Table 8 & Figure 7).

Table 9: Descriptive analysis of the family history of thyroid disorder in the study population (N=51)

Family history	Frequency	Percentages
Not significant	51	100.00%

Table 10: Descriptive analysis of treatment history of thyroid disorders in the study population (N=51)

Treatment history	Frequency	Percentages
Negative	51	100.00%

Table 11: Descriptive analysis of physical examination (N=51)

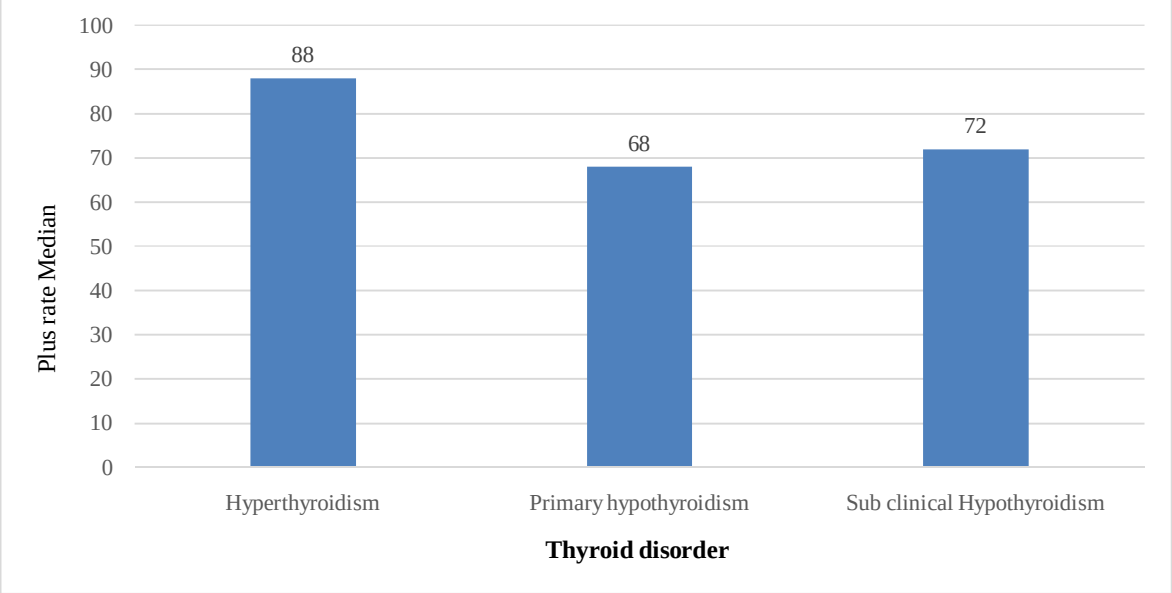
Parameter	Mean ± SD	Median	Min	Max	95% C.I	
					Lower	Upper
Pulse (Per Min)	75.98 ± 10.55	76.0	54.0	100.0	73.01	78.95
Respiratory rate (Per Min)	17.12 ± 1.74	18.0	14.0	24.0	16.63	17.61
Systolic blood pressure (mm/Hg)	120.28 ± 13.71	120.0	100.0	160.0	116.42	124.13
Diastolic blood pressure (mm/Hg)	76.16 ± 7.98	80.0	60.0	90.0	73.91	78.40

The mean pulse rate was 75.98 ± 10.55in the study population, range between 54 to 100 (95% CI 73.01to 78.95). The mean respiratory rate was 17.12 ± 1.74in the study population, range between 14 to 24 (95% CI 16.63to 17.61). The mean systolic blood pressure was 120.28 ± 13.71 mm/Hg in the study population, range between 100 to 160 (95% CI 116.42to 124.13). The mean diastolic blood pressure was 76.16 ± 7.98in the study population, range between 60 to 90 (95% CI 73.91to 78.40). (Table 11)

Table 12: Comparison of median pulse rate across different thyroid disorders(N=51)

Thyroid Disorders	pulse rate Median (IQR)(Per Minute)	Kruskal Wallis test (P value)
Hyperthyroidism	88 (82, 89)	<0.001
Primary hypothyroidism	68 (66, 70)	
Subclinical Hypothyroidism	72 (66, 78)	

Figure 8: Bar chart of median pulse rate across different thyroid disorders (N=51)

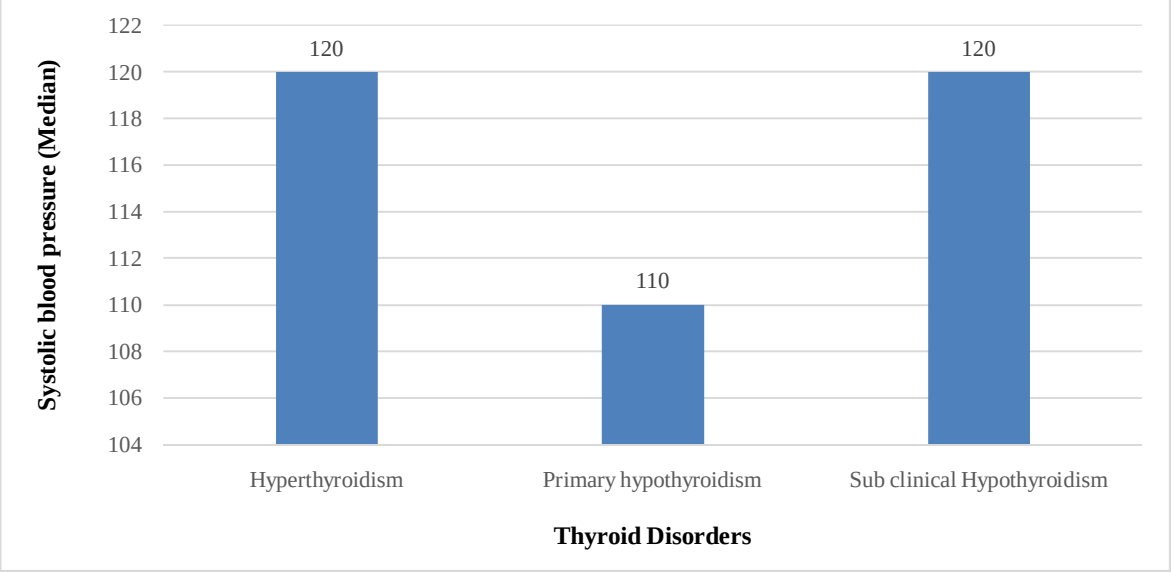


Among the people with hyperthyroidism, the median pulse rate was 88 (IQR 82 to 89). It was 68 (IQR 66, 70) and 72 (IQR 66, 78) among people with primary hypothyroidism and Subclinical Hypothyroidism. The difference in the pulse rate across thyroid disorders was statistically significant (P Value <0001). (Table 12& Figure 8)

Table 13: Comparison of median systolic blood pressure across different thyroid disorders (N=51)

Thyroid Disorders	Systolic blood pressure Median (IQR)(mm/Hg)	Kruskal Wallis test (P value)
Hyperthyroidism	120 (110, 130)	0.456
Primary hypothyroidism	110 (110, 130)	
Subclinical Hypothyroidism	120 (110, 130)	

Figure 9: Bar chart of median systolic blood pressure across different thyroid disorders (N=51)

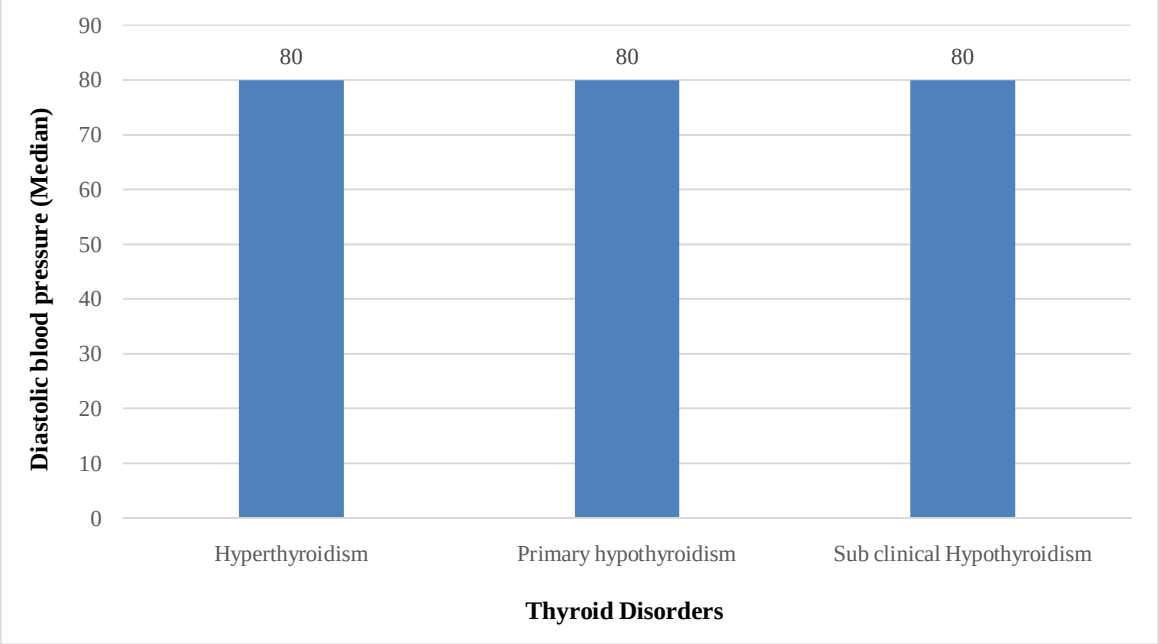


Among the people with hyperthyroidism, the median systolic blood pressure was 120 (IQR 110 to 130). It was 110 (IQR 110, 130) and 120 (IQR 110, 130) among people with primary hypothyroidism and Subclinical Hypothyroidism. The difference in the systolic blood pressure across thyroid disorders was statistically not significant (P Value 0.456). (Table 13& Figure 9)

Table 14: Comparison of median diastolic blood pressure across different thyroid disorders(N=51)

Thyroid Disorders	Diastolic blood pressure Median (IQR)(mm/Hg)	Kruskal Wallis test (P value)
Hyperthyroidism	80 (80, 80)	0.073
Primary hypothyroidism	80 (60, 80)	
Subclinical Hypothyroidism	80 (80, 80)	

Figure 10: Bar chart of median diastolic blood pressure across different thyroid disorders (N=51)

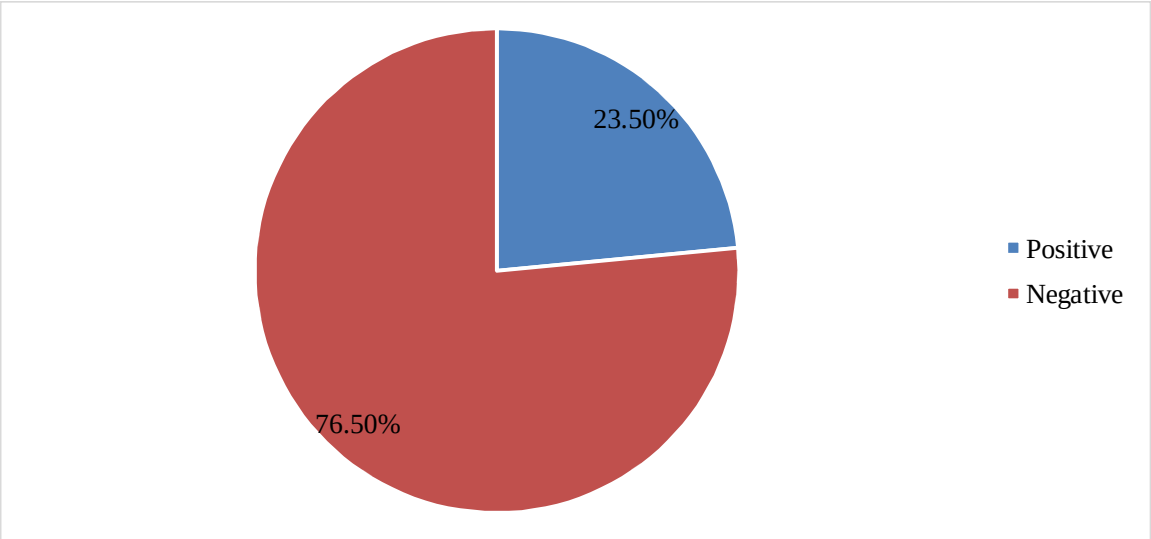


Among the people with hyperthyroidism, the median diastolic blood pressure was 80 (IQR 80 to 80). It was 80 (IQR 60, 80) among people with primary hypothyroidism and 80 (IQR 80 to 80) among people with Subclinical Hypothyroidism. The difference in the diastolic blood pressure across thyroid disorders was statistically not significant (P Value 0.073). (Table 14& Figure 10)

Table 15: Descriptive analysis of pallor in the study population (N=51)

Pallor	Frequency	Percentages
Positive	12	23.50%
Negative	39	76.50%

Figure 11: Pie chart of pallor in the study population (N=51)



Among the study population, 12 (23.50%) participants had anaemia. (Table 15& Figure 11)

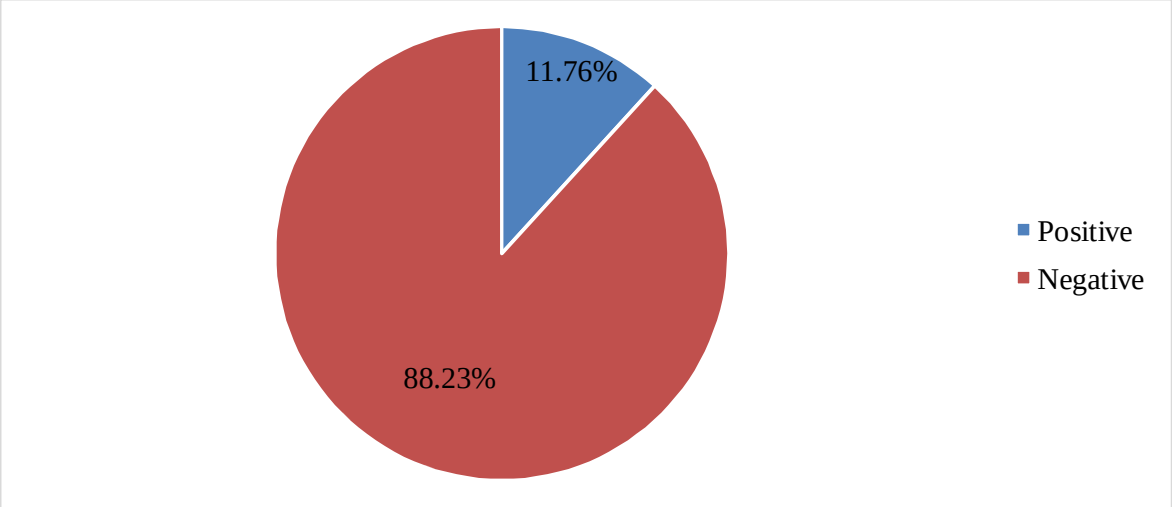
Table 16: Descriptive analysis of clubbing in the study population (N=51)

Clubbing	Frequency	Percentages
Negative	51	100.00%

Table 17: Descriptive analysis of edema in the study population (N=51)

Edema	Frequency	Percentages
Positive	6	11.76%
Negative	45	88.23%

Figure 12: Pie chart of edema in the study population (N=51)



Among the study population, 6(11.76%)participants had edema.(Table17& Figure 12)

Table 18: Descriptive analysis of goitre in the study population (N=51)

Goitre	Frequency	Percentages
Negative	51	100.00%

Table 19: Descriptive analysis of investigation in the study population (N=51)

Parameter	Mean ± SD	Min	Max
Hyperthyroidism			
T3	3.12 ± 1.68	1.40	6.60
T4	22.17 ± 27.7	1.25	139.88
TSH	0.04 ± 0.08	0.01	0.35
Primary hypothyroidism			
T3	0.99 ± 0.51	0.50	2.00
T4	4.43 ± 1.5	2.40	9.00
TSH	75.79 ± 110.03	7.24	360.90
Subclinical Hypothyroidism			

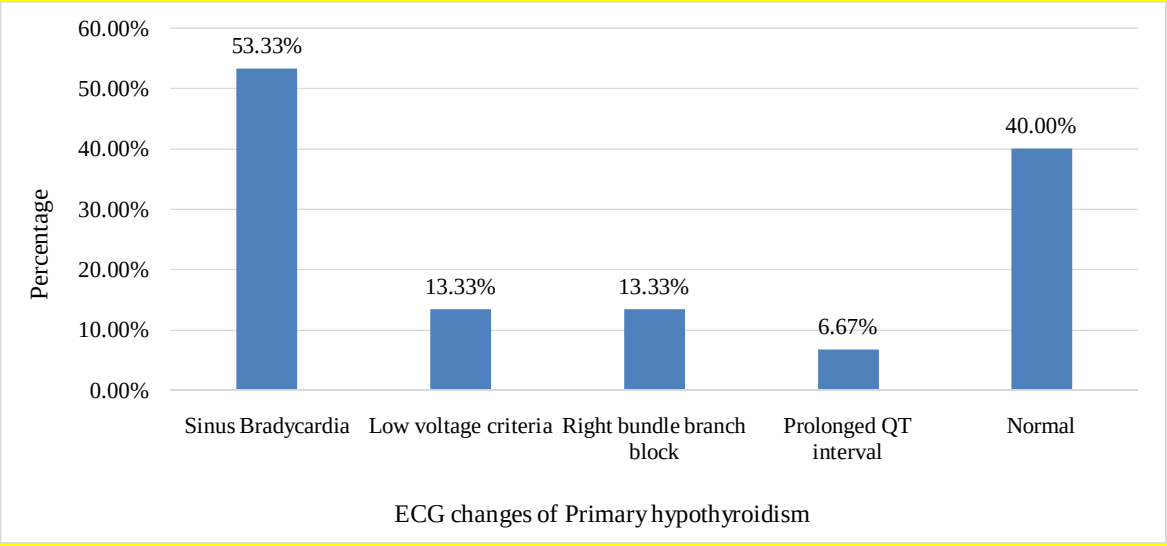
T3	1.24 ± 0.70	0.80	3.60
T4	6.94 ± 1.88	1.12	9.30
TSH	6.88 ± 1.3	5.17	9.22

Table 20: Descriptive analysis of ECG changes in the study population (N=51)

ECG changes	**Frequency**	**Per cent**
Primary hypothyroidism (N=15)		
Sinus Bradycardia	8	53.33%
Low voltage criteria	2	13.33%
Right bundle branch block	2	13.33%
Prolonged QT interval	1	6.67%
Normal	6	40.00%
Hyperthyroidism (N=21)		
Sinus tachycardia	12	57.14%
Atrial fibrillation	3	14.28%
Low voltage complexes	2	9.52%
Normal	6	28.57%
Subclinical hypothyroidism (N=15)		
Sinus Bradycardia	2	13.33%
Normal	13	86.67%

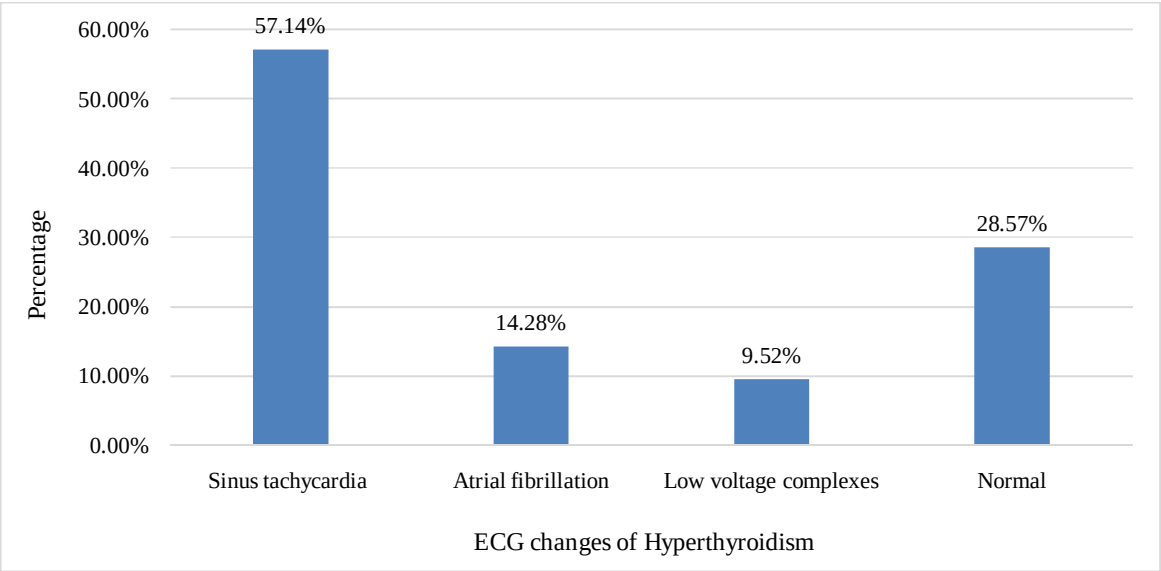
Note: many patients had more than 1 ECG finding. Hence the total percentage is beyond 100%

Figure 13: Bar chart of ECG changes of primary hypothyroidism in the study population



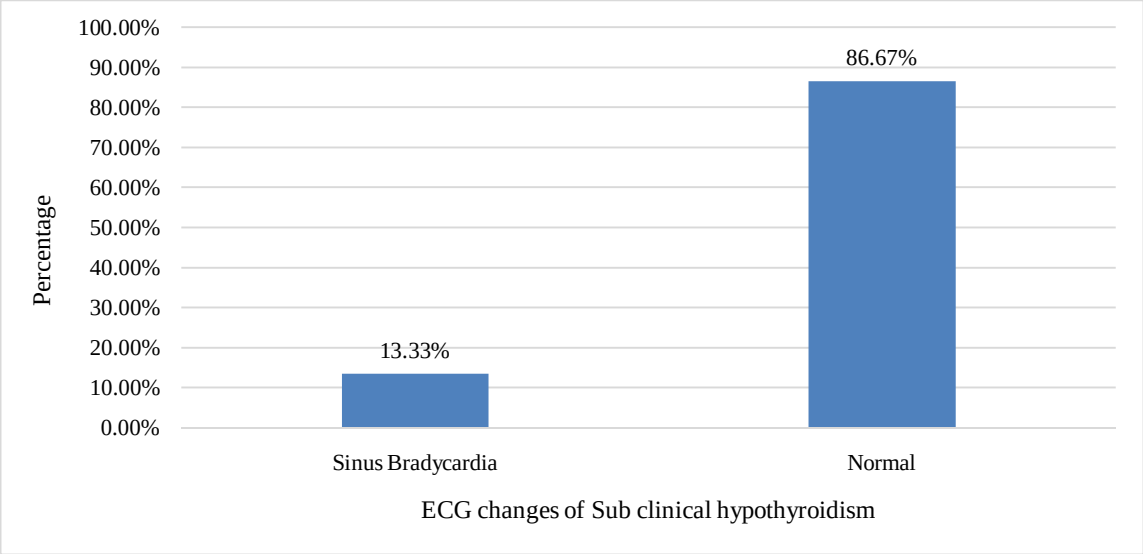
Among 15 people with Primary hypothyroidism, sinus bradycardia was the most common ECG feature observed in 8 (53.3%) of the study population. The other common ECG features were low voltage criteria and right bundle branch block seen in 2 (13.33%) subjects each. One subject (6.67%) had prolonged QT interval.(Table 20 & figure 13)

Figure 14: Bar chart of ECG changes of hyperthyroidism in the study population



Among 21 people with hyperthyroidism, the most common ECG finding was sinus tachycardia seen in 12 (57.14%) of subjects. Atrial fibrillation was observed in 3(14.28%) subjects, and low voltage complexes were observed in 2 (9.52%) of people. (Table 20 & figure 14)

Figure 15: Bar chart of ECG changes of subclinical hypothyroidism in the study population



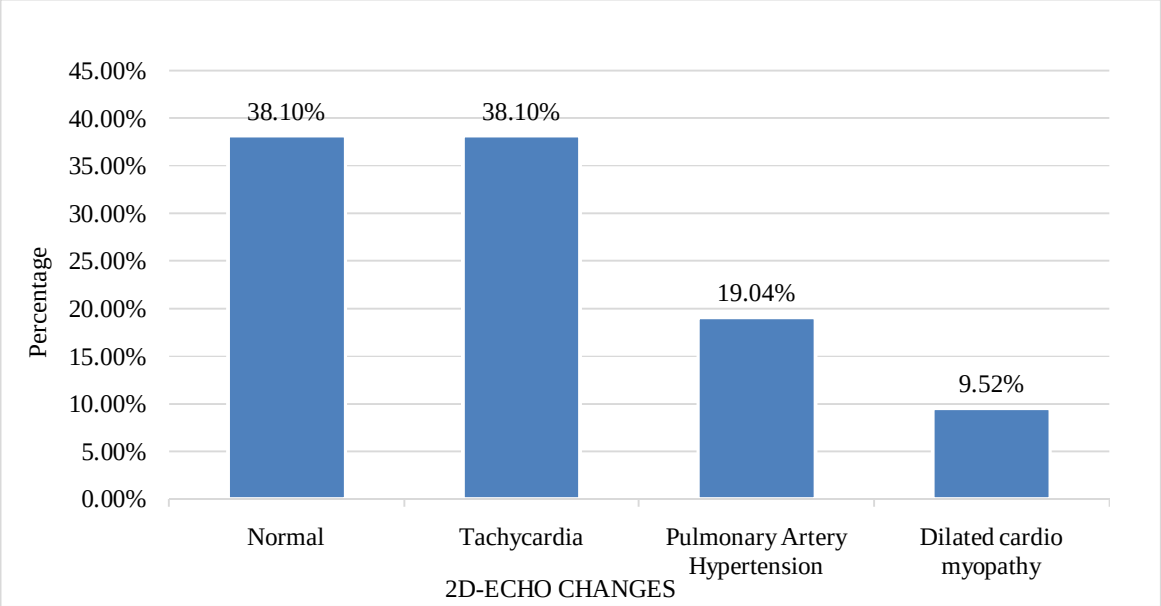
Among 15 subjects with subclinical hypothyroidism, the only ECG abnormality was sinus bradycardia seen in 2 (13.33%) of the subjects. (Table 20 & Figure 13,14,15).

Table 21: Descriptive analysis of 2D Echo in the study population (N=51)

2DEcho	Frequency	Per cent
Hyperthyroidism (N=21)		
Normal	8	38.10%
Tachycardia	8	38.10%
Pulmonary Artery Hypertension	4	19.04%
Dilated cardiomyopathy	2	9.52%
Primary hypothyroidism (N=15)		
Type 1 diastolic dysfunction	11	73.33%
Pericardial effusion	4	26.67%
Pulmonary artery hypertension	3	20.00%
Normal	2	13.33%
Subclinical hypothyroidism (N=15)		
Type 1 diastolic dysfunction	8	53.33%
Normal	6	40.00%
Pulmonary artery hypertension	4	26.67%

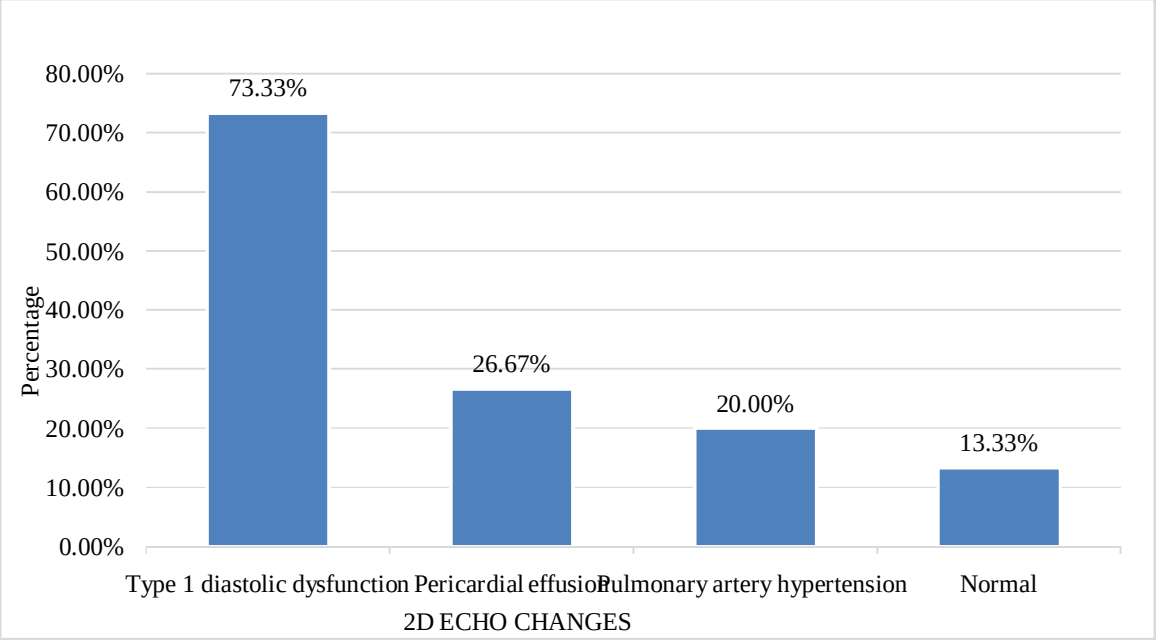
Note: many patients had more than one Echo finding. Hence the total percentage is beyond100%

Figure 16: Bar chart of 2D-Echo changes in people with hyperthyroidism



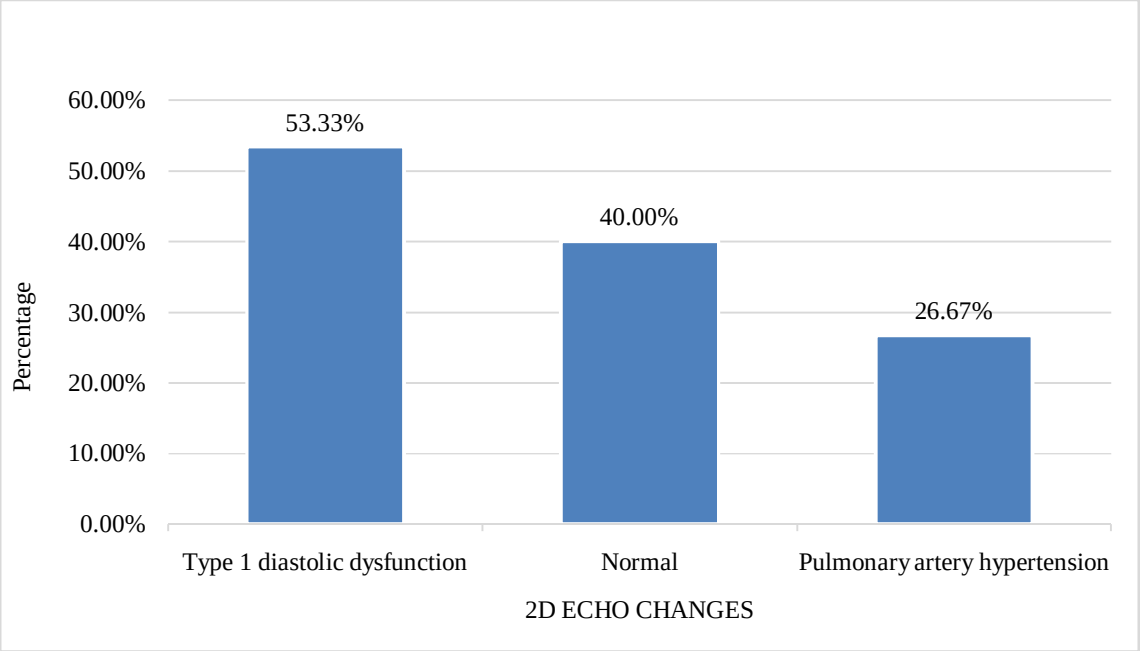
Among the people with hyperthyroidism, 8 (38.10%) participants each had normal and tachycardia. 4, (19.04%) participants had pulmonary artery hypertension, and 2 (9.52%) participants had dilated cardiomyopathy. (Table 21 & figure 16)

Figure 17: Bar chart of 2D-Echo changes in people with primary hypothyroidism



Among the people with primary hypothyroidism, 11 (73.33%) participants had type 1 diastolic dysfunction, 4 (26.67%) participants had pericardial effusion, 3 (20%) participants had pulmonary artery hypertension, and 2 (13.33%) participants had normal. (Table 21 & Figure 17)

Figure 18: Bar chart of 2D-Echo changes in people with subclinical hypothyroidism.



Among the people with subclinical hypothyroidism, 8 (53.33%) participants had type 1 diastolic dysfunction, 6 (40%) participants had normal, 4 (26.67%) participants had pulmonary artery hypertension. (Table 21 & Figure 18)

DISCUSSION:

Cardiovascular diseases (CVDs) are the most common cause of mortality, primarily affecting older adults. Heart disease causes nearly 700,000 deaths annually in the United States.[68]Although established risk factors explain most cardiac risks[69],significant attention has been focused on alternative biochemical markers to assist in identifying those at risk of a clinical cardiac event.[70]

The cardiovascular system is sensitive to the action of thyroid hormone. However, although a wide spectrum of cardiac abnormalities has long been recognised in patients with overt thyroid dysfunction, the question of cardiac involvement in patients with subclinical thyroid dysfunction has been investigated only in the last two to three decades. Previous studies have suggested that abnormal levels of thyroid-stimulating hormone (TSH) may represent a novel cardiac risk factor.[71-73]

In this study, the mean age of the subjects was 39.18 ± 14.32 years with a range of 21 years to 75 years. Similar findings of younger and narrow age range (21-60 years) were noted in the studies conducted by Shashikant et al,[62] who studied 50 patients with hypothyroidism and Ramesh et al.[61] who studied 40 patients with hypothyroidism in two tertiary hospitals.

In this study population, male participants were 18 (35.30%) remaining 33 (64.70%) participants were female. Shashikant et al,[62] found hypothyroidism thrice more commonly in females as compared to males, which is further corroborated by Behera et al.[60](3:1). Kandan et al,[59] noted female preponderance (60%) among hyperthyroidism cases, which is widely noted in many other studies.

Among the study population, 21 (41.20%) participants had hyperthyroidism, 15 (29.40%) participants had primary hypothyroidism, and 15 (29.40%) participants had subclinical hypothyroidism. The Cardiovascular Health Study[72], a large scale

prospective cohort study among 3233 US community-dwelling individuals, aged 65 years or older enrolled in 1989-90 found 82% of them had normal thyroid function. The prevalence of thyroid disorders in their study was as follows, 15% had subclinical hypothyroidism,1.6% had overt hypothyroidism while 15% had subclinical hyperthyroidism.[72]

In our study population, the mean pulse rate among the subjects with either of the three conditions was 75.98 ± 10.55(beats/min) with a range of 54 to 100 beats/min. Kandan et al,[59] noted a pulse rate of >100 among most of the subjects (82%). 18% of their study population is having a pulse rate of80-100 beats/min.

In our study population, 9.8% of people are found to have Type 2 diabetes mellitus. Vibha Uppal et al.[74] reported that 75.8 % of subjects diagnosed with abnormal thyroid profile had glycosylated haemoglobin of more than or equal to 8 % in their study population.

None of the patients in our study population had a goitre. Goitre was reported in 10% of patients with hypothyroidism in the study reported by Ramesh et al,[61]and Shashikant et al,[62] reported goitre in 6% of the cases.

In our study, 12 (23.50%) participants had Anemia. A higher prevalence (20%) of anaemia was noted by Shashikant et al.[62], and Kandan et al.[59]In their analysis of 50 hyperthyroidism patients anaemia was reported in 18% of cases.

In the present study,Edema was noted in 4 (11.76%) participants.Shashikant et al,[62]reported edema in 16% of the patients with hypothyroidism and Kandan et al,[59]reported edema among 12% of their study population.

In our study population, systolic blood pressure assessment revealed a median value of 120 mmHg among patients with hyperthyroidism. A median systolic blood pressure of 120 mmHg was noted in subclinical hypothyroidism group. While Among

the patients with primary hypothyroidism, the median systolic blood pressure was 110 mmHg. Behera et al.[60] reported the majority of their patients with hypothyroidism having pre-hypertension (120 – 139 mmHg). Kandan et al.,[59] noted systolic blood pressure of 120-139 among 46% of the cases while 30% of them had a systolic blood pressure of 140-159 mmHg among hyperthyroidism patients.

In our study group, diastolic blood pressure assessment revealed all the patients across the three groups having a value of 80 mmHg. Contrastingly Behera et al, [60] found that pre-hypertension (80-89 mmHg) (diastolic) was present in 46.7% among his study population and 13.3% among his study population had diastolic hypertension (90-99 mmHg). Kandan et al,[59] found majority of the cases of hyperthyroidism (50%) had a diastolic blood pressure of <80, with 30% of them having 80-89 mmHg.

A higher level of TSH was found in the study subjects (75.79 ± 110.03mIU/L) with hypothyroidism.A study conducted by Shashikant et al,[62] categorised TSH levels in relation to the severity of hypothyroidism. They reported TSH values of 0.5 – 20, 20-50 and >50 mIU/L respectively among patients with mild, moderate and severe hypothyroidism. A study conducted by Ramesh et al,[61] reported that patients with higher serum TSH levels (severe hypothyroidism) had a higher cardiovascular involvement (40%).

ECG changes

Hyperthyroidism (N=21)

In our study population, the ECG assessment among patients with hyperthyroidism revealed normal findings in 28.57% of cases. However, the majority of them (57.14%) had sinus tachycardia. Comparatively Kandan et al,[59] found 46% of the cases with hyperthyroidism having sinus tachycardia.

In our study,14.28% of the cases had atrial fibrillation, which could be a risk factor for systolic dysfunction. Comparatively, Forst L et al,[75] reported 8.3% of the cases with hyperthyroidism hadatrial fibrillation.Kandan et al,[59] also reported atrial fibrillation in the majority of the patients (45%) with hyperthyroidism.As per review by Jayaprasad N.et al,[76]atrial fibrillation occurs in 10 - 15% of patients with hyperthyroidism. In their study, the reviewers have reported that, low serum thyrotropin concentration as an independent risk factor for atrial fibrillation. Thyroid hormone contributes to arrhythmogenic activity by altering the electrophysiological characteristics of atrial myocytes by shortening the action potential duration, enhancing automaticity and triggered activity in the pulmonary vein cardiomyocytes. Even subclinical levels of hyperthyroidism were proposed to be a risk factor for atrial fibrillation by Auer J et al.[77] In their study; atrial fibrillation was present in 2.3% of people with normal values for serum thyrotropin, 13.8% of people with overt hyperthyroidism, and 12.7% of people with subclinical hyperthyroidism. In their study, the authors concluded that low serum thyrotropin concentration is associated with a >5-fold higher likelihood for the presence of atrial fibrillation with no significant difference between subclinical and overt hyperthyroidism. The prevalence of atrial fibrillation reported by Auer J et al.[77]study among hyperthyroid subjects is very close to the proportion recorded by us.

Primary hypothyroidism (N=15)

In the present study, normal ECG was noted in 40% of the patients with hypothyroidism.

A study was done by Shashikant et al,[62] reported normal ECG in 35% of patients among the study population, while Ramesh et al,[61]reported normal ECG in 30% of patients among their study population.

In our study, 53.33% of patients with hypothyroidism had sinus bradycardia. Contrastingly many of the Indian studies which exclusively analysed patients with hypothyroidism reported the far lesser prevalence of sinus bradycardia. Ramesh et al,[61] found 40% of the study population had bradycardia. While Shashikant et al,[62] reported 30% of the participants having sinus bradycardia. Contrastingly Behera et al,[60]reported sinus bradycardia in 7% among 60 patients with hypothyroidism.

In our study, among the participants with Hypothyroidism 13.3% of participants had low voltage complexes. While Shashikant et al,[62] found low voltage complexes in 30% of patients. Ramesh et al,[61] observedlow voltage complexes in 35% of patients while Behera et al,[60] noted 40% of their patients had low voltage complexes.

In our study population, Right bundle branch block is seen in 13.3% among the participants with primary hypothyroidism.Shrivastava et al,[78] reported right bundle branch block in 4.4% among their study population.

In our study population, QTc prolongation was seen in one patient. Shrivatsava et al,[78] reported QTc prolongation in 2.2% of their study population.

2D Echo changes

Hyperthyroidism (N=21)

The 2D echocardiography analysis of patients with hyperthyroidism showed normal study among 38.10% of participants. An equal proportion of them (38.10%) however

had sinus tachycardia.19% of them had pulmonary hypertension, and9.52% of them had dilated cardiomyopathy.

Unlike these findings, Kandan et al,[59]reported 18% of the patients with hyperthyroidism had systolic dysfunction, 12% had diastolic dysfunction, 18% had chamber enlargement, 6% had a regurgitant lesion, and 4% had pulmonary hypertension.

Hypothyroidism

The present study revealed normal echocardiographic findings only in 13.33% of the cases of hypothyroidism. Contrastingly, Ramesh et al,[61] reportednormal 2D echocardiography in 32.5% of patients.

Alarmingly in our study,73.33% of the study patients had type 1 diastolic dysfunction. Much of the literature has reported a lower prevalence. Varma et al,[79]reported Type I diastolic dysfunction in 27% of the subjects while Shashikant et al,[62]reported Type I diastolic dysfunction in18% of their study population. In our study,patients did not have any systolic dysfunction. Contrastingly, some studies have reported systolic dysfunction. Shashikant et al,[62] reported systolic dysfunctions in 4% of patients. Forfare et al,[80] have described low systolic function indices in hypothyroid patients. However, Smallridge et al,[81] have argued that this could be related to relatively elderly patients included in the above studies.This was further supported by Grossman et al,[82] Verma et al[79] and Rawat et al.[83] who did not find any evidence of systolic dysfunction in hypothyroid patients.

About 26.67% of the subjects with hypothyroidism in our study population had pericardial effusion. A lower prevalence (18%) was noted by Shashikant et al.[62]While

Vermal et al,[79] reported 45%; Rawat et al,[83] reported 30-80%of their patients had pericardial effusion.

A relatively low incidence of pericardial effusion in our study may be due to earlier detection of hypothyroidism in the present days as a result of the routine use of thyroid function tests. Nevertheless, in a patient with undiagnosed pericardial effusion, hypothyroidism should be ruled out.

In our study population, Pulmonary arterial hypertension is found in 20% of participants with Primary Hypothyroidism. While Shashikanth et al,[62]reported pulmonary arterial hypertension in 18% of patients with hypothyroidism. In a study done by Curnock AL et al,[84]Nine out of 40 patients, i.e.,(22.5%) had evidence of Pulmonary arterial hypertension.

Subclinical hypothyroidism (N=15)

The present study found a normal 2D echo in 40% of subjects with subclinical hypothyroidism.

In the present study,53.33% of patients with subclinical hypothyroidism had type 1 diastolic dysfunction. Zoncu et al,[85]found impairment in both systolic and diastolic function in subclinical hypothyroidism and Behera et al,[60] found diastolic dysfunction as the major manifestation of echocardiography in patients with subclinical hypothyroidism.

In our study population, Pulmonary artery hypertension was reported in 26.67% of patients with Subclinical Hypothyroidism. Yu Sato et al,[86] reported higher mean pulmonary arterial pressure in subclinical hypothyroidism group than the euthyroid group in their study population.

CONCLUSIONS:

- The mean age of the subjects was 39.18 ± 14.32 years with higher female preponderance.
- The most common thyroid dysfunction was hyperthyroidism in 41.20% of the study population, followed by15 % of subjects with primary hypothyroidism and 15% of subjects with subclinical hypothyroidism.
- Most common co-morbidities were anaemia in 23.50% participants, hypertension in 19.6% and diabetes mellitus in 9.8% of study population.
- The pulse, systolic and diastolic blood pressure were significantly higher among hyperthyroidism group, as compared to the other two groups.
- Among patients with primary hypothyroidism, sinus bradycardia was the most common ECG feature. The other common ECG features were low voltage criteria and right bundle branch block. One subject (6.67%) had prolonged QT interval.
- Among the people with primary hypothyroidism, type 1 diastolic dysfunction was the most common 2D echo finding observed in about three-fourths of study subjects. The other common Echo findings were pericardial effusion and pulmonary artery hypertension.
- Among patients with hyperthyroidism, the most common ECG finding was sinus tachycardia. Atrial fibrillation and low voltage complexes were the other common ECG findings. Among the subjects with hyperthyroidism tachycardia was the most common echo finding. Pulmonary artery hypertension and dilated cardiomyopathy were the other features.
- Among patients with subclinical hypothyroidism, the only ECG abnormality was sinus bradycardia. Among the people with subclinical hypothyroidism,

more than half of participants had type 1 diastolic dysfunction in echo evaluation. About one-fourth of subjects had pulmonary artery hypertension.

LIMITATIONS:

1. A limited sample size of the study did not permit us to perform any inferential analysis to identify high-risk factors associated with cardiac dysfunction in the study population.
2. Since the study was conducted in a single institution, with a limited catchment area, the general ability of study findings is very limited.

RECOMMENDATIONS:

1. There is a need to conduct further large-scale studies on the subject of evaluating the cardiovascular manifestations among people with different types of thyroid dysfunction.
2. Efforts should be made to identify a subgroup of patients with thyroid dysfunction, who are at high risk of cardiovascular dysfunction. This may facilitate timely referral of these patients for appropriate evaluation by 12 lead ECG, 2D-Echocardiography and definitive diagnosis of cardiac dysfunction and its early management.

SUMMARY:

Considering the strong association reported by earlier studies between thyroid dysfunction and it's cardiovascular effects, a cross-sectional study was conducted to assess the 2d-echocardiographic changes among people with thyroid dysfunction. The study was conducted on 50 people diagnosed with various types of thyroid disorders, who were evaluated by 12 lead ECG and 2d echocardiography. The mean age of the subjects was 39.18 ± 14.32 years with high female preponderance. The most common thyroid dysfunction was hyperthyroidism in 41.20% of the study population, followed by primary hypothyroidism and subclinical hypothyroidism among 15% of the subjects each. Most common co-morbidities were anaemia in 23.50% participants, hypertension in 19.6 % and diabetes mellitus in 9.8% of the study population. The pulse, systolic and diastolic blood pressure were significantly higher among hyperthyroidism group, as compared to the other two groups. Among subjects with primary hypothyroidism, sinus bradycardia was the most common ECG feature. The other common ECG features were low voltage criteria and right bundle branch block. One subject (6.67%) had prolonged QT interval .Among the subjects with primary hypothyroidism, type 1 diastolic dysfunction was the most common 2D echo finding, observed in about three-fourths of study subjects. The other common Echo findings were pericardial effusion and pulmonary artery hypertension. Among subjects with hyperthyroidism, the most common ECG finding was sinus tachycardia. Atrial fibrillation and low voltage complexes were the other common ECG findings. Among the subjects with hyperthyroidism, tachycardia was the most common echo finding. Pulmonary artery hypertension and dilated cardiomyopathy were the other features. Among subjects with subclinical hypothyroidism, the only ECG abnormality was sinus bradycardia. Among the subjects with subclinical hypothyroidism, more than

half of participants had type 1 diastolic dysfunction in echo evaluation. About one-fourth of subjects had pulmonary artery hypertension.

REFERENCES

1. Kochupillai N. Clinical endocrinology in India. Curr Sci. 2000;79(8):1061-7.
2. Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective. Indian J Endocrinol Metab. 2011;15(Suppl2):S78-81.
3. Wang C, Crapo LM. The epidemiology of thyroid disease and implications for screening. Endocrinol Metab Clin North Am. 1997;26(1):189-218.
4. Vir SC. Current status of iodine deficiency disorders (IDD) and strategy for its control in India. Indian J Pediatr. 2002;69(7):589-96.
5. Klein I, Ojamaa K. Thyroid hormone and the cardiovascular system. N Engl J Med. 2001;344(7):501-9.
6. Biondi B, Palmieri EA, Lombardi G, Fazio S. Effects of thyroid hormone on cardiac function-the relative importance of heart rate, loading conditions, and myocardial contractility in the regulation of cardiac performance in human hyperthyroidism. J Clin Endocrinol Metab. 2002;87(3):968-74.
7. Dillmann W. Cellular action of thyroid hormone on the heart. Thyroid. 2002;12(6):447-52.
8. Prisant LM, Gujral JS, Mulloy AL. Hyperthyroidism: a secondary cause of isolated systolic hypertension. J Clin Hypertens (Greenwich). 2006;8(8):596-9.
9. Crowley Jr WF, Ridgway EC, Bough EW, Francis GS, Daniels GH, Kourides IA, et al. Noninvasive evaluation of cardiac function in hypothyroidism: response to gradual thyroxine replacement. N Engl J Med. 1977;296(1):1-6.
10. Wilson GR, Curry RW, Jr. Subclinical thyroid disease. Am Fam Physician. 2005;72(8):1517-24.
11. Biondi B, Cooper DS. The clinical significance of subclinical thyroid dysfunction. Endocr Rev. 2008;29(1):76-131.
12. Surks MI, Ortiz E, Daniels GH, Sawin CT, Col NF, Cobin RH, et al. Subclinical thyroid disease: scientific review and guidelines for diagnosis and management. JAMA. 2004;291(2):228-38.
13. Singh S, Duggal J, Molnar J, Maldonado F, Barsano CP, Arora R. Impact of subclinical thyroid disorders on coronary heart disease, cardiovascular and all-cause mortality: a meta-analysis. Int J Cardiol. 2008;125(1):41-8.
14. Tadic M, Celic V, Cuspidi C, Ilic S, Zivanovic V, Marjanovic T. How Does Subclinical Hyperthyroidism Affect Right Heart Function and Mechanics? J Ultrasound Med. 2016;35(2):287-95.
15. Tadic M, Ilic S, Cuspidi C, Marjanovic T, Celic V. Subclinical hyperthyroidism impacts left ventricular deformation: 2D and 3D echocardiographic study. Scand Cardiovasc J. 2015;49(2):74-81.
16. Sokmen A, Acar G, Sokmen G, Akcay A, Akkoyun M, Koroglu S, et al. Evaluation of atrial electromechanical delay and diastolic functions in patients with hyperthyroidism. Echocardiography. 2013;30(10):1194-201.
17. Di Bello V, Talini E, Delle Donne MG, Aghini-Lombardi F, Monzani F, La Carrubba S, et al. New echocardiographic techniques in the evaluation of left ventricular mechanics in subclinical thyroid dysfunction. Echocardiography. 2009;26(6):711-9.
18. Van de Veire N, De Sutter J, Bax JJ, Roelandt JR. Technological advances tissue doppler imaging echocardiography. Heart. 2008.
19. Yen PM. Physiological and molecular basis of thyroid hormone action. Physiol Rev. 2001;81(3):1097-142.
20. Maenhaut C, Christophe D, Vassart G, Dumont J, Roger PP, Opitz R. Ontogeny, Anatomy, Metabolism and Physiology of the Thyroid. In: De Groot LJ, Chrousos G, Dungan K, Feingold KR, Grossman A, Hershman JM, et al., editors. Endotext. South Dartmouth (MA): MDText.com, Inc.; 2000.
21. Bahn Chair RS, Burch HB, Cooper DS, Garber JR, Greenlee MC, Klein I, et al. American Association of Clinical Endocrinologists Hyperthyroidism Other Causes of Thyrotoxicosis. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the

American Thyroid Association and American Association of Clinical Endocrinologists. Thyroid. 2011;21(6):593-646.

22. Taylor PN, Albrecht D, Scholz A, Gutierrez-Buey G, Lazarus JH, Dayan CM, et al. Global epidemiology of hyperthyroidism and hypothyroidism. Nat Rev Endocrinol. 2018;14(5):301-16.
23. Unnikrishnan AG, Kalra S, Sahay RK, Bantwal G, John M, Tewari N. Prevalence of hypothyroidism in adults: An epidemiological study in eight cities of India. Indian J Endocrinol Metab. 2013;17(4):647-52.
24. Marwaha RK, Tandon N, Desai AK, Kanwar R, Aggarwal R, Sastry A, et al. Reference range of thyroid hormones in healthy school-age children: Country-wide data from India. Clin Biochem. 2010;43(1-2):51-6.
25. Hollowell JG, Staehling NW, Flanders WD, Hannon WH, Gunter EW, Spencer CA, et al. Serum TSH, T4, and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). J Clin Endocrinol Metab 2002;87(2):489-99.
26. Aoki Y, Belin RM, Clickner R, Jeffries R, Phillips L, Mahaffey KR. Serum TSH and total T4 in the United States population and their association with participant characteristics: National Health and Nutrition Examination Survey (NHANES 1999–2002). Thyroid. 2007;17(12):1211- 23.
27. Sichieri R, Baima J, Marante T, De Vasconcellos MTL, Moura AS, Vaisman M. Low prevalence of hypothyroidism among black and Mulatto people in a population-based study of Brazilian women. Clin Endocrinol (Oxf). 2007;66(6):803-7.
28. Graves RJ. Newly observed affection of the thyroid gland in females. London Med & Surg Jour. 1835;7:516-7.
29. Klein I. Thyroid hormone and the cardiovascular system. Am J Med. 1990;88(6):631-7.
30. Dillmann WH. Biochemical basis of thyroid hormone action in the heart. Am J Med. 1990;88(6):626-30.
31. Polikar R, Burger AG, Scherrer U, Nicod P. The thyroid and the heart. Circulation. 1993;87(5):1435-41.
32. Park KW, Dai HB, Ojamaa K, Lowenstein E, Klein I, Sellke FW. The direct vasomotor effect of thyroid hormones on rat skeletal muscle resistance arteries. Anesth Analg. 1997;85(4):734-8.
33. Ojamaa K, Klemperer JD, Klein I. Acute effects of thyroid hormone on vascular smooth muscle. Thyroid. 1996;6(5):505-12.
34. Klemperer JD, Klein I, Gomez M, Helm RE, Ojamaa K, Thomas SJ, et al. Thyroid hormone treatment after coronary-artery bypass surgery. N Engl J Med. 1995;333(23):1522-7.
35. Bianco AC, Salvatore D, Gereben B, Berry MJ, Larsen PR. Biochemistry, cellular and molecular biology, and physiological roles of the iodothyronine selenodeiodinases. Endocr Rev. 2002;23(1):38-89.
36. Maia AL, Kim BW, Huang SA, Harney JW, Larsen PR. Type 2 iodothyronine deiodinase is the major source of plasma T 3 in euthyroid humans. J Clin Invest. 2005;115(9):2524-33.
37. Everts ME, Verhoeven FA, Bezstarosti K, Moerings E, Hennemann G, Visser TJ, et al. Uptake of thyroid hormones in neonatal rat cardiac myocytes. Endocrinology. 1996;137(10):4235- 42.
38. Hartong R, Wang N, Kurokawa R, Lazar MA, Glass CK, Apriletti JW, et al. Delineation of three different thyroid hormone-response elements in promoter of rat sarcoplasmic reticulum Ca2+ ATPase gene. Demonstration that retinoid X receptor binds 5'to thyroid hormone receptor in response element 1. J Biol Chem. 1994;269(17):13021-9.
39. Kiss E, Jakab G, Kranias EG, Edes I. Thyroid hormone-induced alterations in phospholamban protein expression. Regulatory effects on sarcoplasmic reticulum Ca2+ transport and myocardial relaxation. Circ Res. 1994;75(2):245-51.
40. Graettinger JS, Muenster JJ, Selverstone LA, Campbell JA. A correlation of clinical and hemodynamic studies in patients with hyperthyroidism with and without congestive heart failure. J Clin Invest. 1959;38(8):1316-27.

41. Mintz G, Pizzarello R, KLEIN I. Enhanced left ventricular diastolic function in hyperthyroidism: noninvasive assessment and response to treatment. J Clin Endocrinol Metab. 1991;73(1):146-50.
42. Cacciatori V, Bellavere F, Pezzarossa A, Dellera A, Gemma ML, Thomaseth K, et al. Power spectral analysis of heart rate in hyperthyroidism. J Clin Endocrinol Metab. 1996;81(8):2828-35.
43. Nordyke RA, Gilbert FI, Harada AS. Graves' disease: influence of age on clinical findings. Arch Intern Med. 1988;148(3):626-31.
44. Feldman T, Borow KM, Sarne DH, Neumann A, Lang RM. Myocardial mechanics in hyperthyroidism: importance of left ventricular loading conditions, heart rate and contractile state. J Am Coll Cardiol. 1986;7(5):967-74.
45. Kontos HA, Shapiro W, Mauck HP, Richardson DW, Patterson JL, Sharpe AR. Mechanism of certain abnormalities of the circulation to the limbs in thyrotoxicosis. J Clin Invest. 1965;44(6):947-56.
46. Pearce SH, Brabant G, Duntas LH, Monzani F, Peeters RP, Razvi S, et al. 2013 ETA guideline: management of subclinical hypothyroidism. Eur Thyroid J. 2013;2(4):215-28.
47. Vanderpump M, Tunbrldge W, French J, Appleton D, Bates D, Clark F, et al. The incidence of thyroid disorders in the community: a twenty-year follow-up of the Whickham Survey. Clin Endocrinol (Oxf). 1995;43(1):55-68.
48. Surks MI, Goswami G, Daniels GH. The thyrotropin reference range should remain unchanged. J Clin Endocrinol Metab 2005;90(9):5489-96.
49. Fatourechi V, Klee GG, Grebe SK, Bahn RS, Brennan MD, Hay ID, et al. Effects of reducing the upper limit of normal TSH values. JAMA. 2003;290(24):3195-6.
50. Ladenson PW, Sherman SI, Baughman KL, Ray PE, Feldman AM. Reversible alterations in myocardial gene expression in a young man with dilated cardiomyopathy and hypothyroidism. Proc Natl Acad Sci USA. 1992;89(12):5251-5.
51. Bengel FM, Nekolla SG, Ibrahim T, Weniger C, Ziegler SI, Schwaiger M. Effect of thyroid hormones on cardiac function, geometry, and oxidative metabolism assessed noninvasively by positron emission tomography and magnetic resonance imaging. J Clin Endocrinol Metab. 2000;85(5):1822-7.
52. Ojamaa K, Sabet A, Kenessey A, Shenoy R, Klein I. Regulation of rat cardiac Kv1. 5 gene expression by thyroid hormone is rapid and chamber specific. Endocrinology. 1999;140(7):3170-6.
53. Fredlund BO, Olsson SB. Long QT interval and ventricular tachycardia of “torsade de pointe” type in hypothyroidism. Acta Med Scand. 1983;213(3):231-5.
54. Padayatty S. Concerning minimal cardiac effects in asymptomatic athyreotic patients treated with thyrotropin-suppressive doses of L-thyroxine. J Clin Endocrinol Metab. 1998;83(7):2607.
55. Mercuro G, Panzuto MG, Bina A, Leo M, Cabula R, Petrini L, et al. Cardiac function, physical exercise capacity, and quality of life during long-term thyrotropin-suppressive therapy with levothyroxine: effect of individual dose tailoring. J Clin Endocrinol Metab. 2000;85(1):159-64.
56. Biondi B, Fazio S, Carella C, Sabatini D, Amato G, Cittadini A, et al. Control of adrenergic overactivity by beta-blockade improves the quality of life in patients receiving long term suppressive therapy with levothyroxine. J Clin Endocrinol Metab. 1994;78(5):1028-33.
57. Klein I. Thyroid and the heart: the intimacy is strained. Thyroid. 2011;21(5):469-70.
58. Sonawale A, Chichkhede A. Cardiovascular Manifestations in Newly Diagnosed Hyperthyroid Patients and their Outcome with Anti-Thyroid Treatment. J Assoc Physicians India. 2018;66:22.
59. Kandan V, Sathyamurthy P, Rajkumar M, Narayanan L. Cardiovascular manifestations in hyperthyroidism. International Journal of Research in Medical Sciences. 2017;4(7):3032-8.
60. Behera BK, Satpathy A, Samal K. Cardiovascular changes in newly detected hypothyroid patients in Eastern India. International Journal of Research in Medical Sciences. 2017;5(10):4302-6.

61. Ramesh K, Nayak BP. A study of cardiovascular involvement in Hypothyroidism. IAIM. 2016;3(5):7480.
62. Shashikant M. Study of cardiac dysfunction in hypothyroidism. Indian J Basic Appl Med Res. 2015;4:111-6.
63. Razvi S, Weaver JU, Vanderpump MP, Pearce SH. The incidence of ischemic heart disease and mortality in people with subclinical hypothyroidism: reanalysis of the Whickham Survey cohort. J Clin Endocrinol Metab. 2010;95(4):1734-40.
64. Fatourechi V, editor Subclinical hypothyroidism: an update for primary care physicians. Mayo Clinic Proceedings, Elsevier; 2009.
65. Fazio S, Palmieri EA, Lombardi G, Biondi B. Effects of thyroid hormone on the cardiovascular system. Recent Prog Horm Res. 2004;59(1):31-50.
66. Danzi S, Klein I. Thyroid hormone and the cardiovascular system. Minerva Endocrinol. 2004;29(3):139-50.
67. IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.
68. Hoyert DL, Kung H-C, Smith BL. Deaths: preliminary data for 2003. Natl Vital Stat Rep. 2005;53(15):1-48.
69. Magnus P, Beaglehole R. The real contribution of the major risk factors to the coronary epidemics: time to end the only-50% myth. Arch Intern Med. 2001;161(22):2657-60.
70. Pahor M, Elam MB, Garrison RJ, Kritchevsky SB, Applegate WB. Emerging noninvasive biochemical measures to predict cardiovascular risk. Arch Intern Med. 1999;159(3):237-45.
71. Cappola AR, Ladenson PW. Hypothyroidism and Atherosclerosis. J Clin Endocrinol Metab. 2003;88(6):2438-44.
72. Cappola AR, Fried LP, Arnold AM, Danese MD, Kuller LH, Burke GL, et al. Thyroid status, cardiovascular risk, and mortality in older adults. JAMA. 2006;295(9):1033-41.
73. Biondi B, Palmieri EA, Lombardi G, Fazio S. Subclinical hypothyroidism and cardiac function. Thyroid. 2002;12(6):505-10.
74. Uppal V, Vij C, Bedi GK, Vij A, Banerjee BD. Thyroid Disorders in Patients of Type 2 Diabetes Mellitus. Indian J Clin Biochem. 2013;28(4):336-41.
75. Frost L, Vestergaard P, Mosekilde L. Hyperthyroidism and risk of atrial fibrillation or flutter: a population-based study. Arch Intern Med. 2004;164(15):1675-8.
76. N J, Francis J. Atrial fibrillation and hyperthyroidism. Indian Pacing Electrophysiol J. 2005;5(4):305-11.
77. Auer J, Scheibner P, Mische T, Langsteger W, Eber O, Eber B. Subclinical hyperthyroidism as a risk factor for atrial fibrillation. Am Heart J. 2001;142(5):838-42.
78. Shrivastava P, Tiwari A. ECG & Echocardiographic Changes in Newly Diagnosed Primary Hypothyroidism.
79. Varma R, Jain A, Ghose T. Heart in hypothyroidism--an echocardiographic study. J Assoc Physicians India. 1996;44(6):390-2.
80. Forfar J, Muir A, Toft A. Left ventricular function in hypothyroidism. Responses to exercise and beta adrenoceptor blockade. Br Heart J. 1982;48(3):278-84.
81. Smallridge RC, Goldman MH, Raines K, Jones S, Van Nostrand D. Rest and exercise left ventricular ejection fraction before and after therapy in young adults with hyperthyroidism and hypothyroidism. Am J Cardiol. 1987;60(10):929-31.
82. Grossman A, West S, Williams J, Evans J, Rees L, Besser G. The role of opiate peptides in the control of prolactin in the puerperium, and TSH in primary hypothyroidism. Clin Endocrinol (Oxf). 1982;16(3):317-20.
83. Rawat B, Satyal A. An echocardiographic study of cardiac changes in hypothyroidism and the response to treatment. Kathmandu University medical journal (KUMJ). 2004;2(3):182-7.
84. Curnock AL, Dweik RD, Higgins BH, Saadi HF, Arroliga AC. High prevalence of hypothyroidism in patients with primary pulmonary hypertension. Am J Med Sci. 1999;318(5):289-92.
85. Zoncu S, Pigliaru F, Putzu C, Pisano L, Vargiu S, Deidda M, et al. Cardiac function in borderline hypothyroidism: a study by pulsed wave tissue Doppler imaging. Eur J Endocrinol. 2005;152(4):527-33.

86. Sato Y, Yoshihisa A, Kimishima Y, Kiko T, Watanabe S, Kanno Y, et al. Subclinical Hypothyroidism Is Associated With Adverse Prognosis in Heart Failure Patients. Can J Cardiol. 2018;34(1):80-7.

PROFORMA

"ECHOCARDIOGRAPHIC ASSESSMENT IN PATIENTS OF THYROID DYSFUNCTION – A 1 YEAR CROSS-SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL"

CASE NO:

NAME:

AGE/SEX:

IP NO.:

ADDRESS:

OCCUPATION:

COMPLAINTS AT PRESENTATION: YES/NO

1.Duration of thyroid dysfunction

2.History of any previous heart disease

3.Diabetes

4.Hypertension

Family history

Personal history

Treatment history

History of any drug intake that alters thyroid hormone levels

PHYSICAL EXAMINATION:

TEMPERATURE
PULSE
RESPIRATORY RATE
BLOOD PRESSURE
PALLOR
EDEMA
GOITRE
CLUBBING

SYSTEMIC EXAMINATION:

R. S.:

C.V.S.:

P.A.:

C.N.S.:

Diagnosis:

Complications:

INVESTIGATION:

SERUM TSH
T3
T4
ECG
2D ECHO

INFORMED CONSENT

Title Of Research Study: " ECHOCARDIOGRAPHIC ASSESSMENT IN PATIENTS OF THYROID DYSFUNCTION – A 1 YEAR CROSS-SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL "

Principal Investigator:-

Dr.Dandamudi Kushal Dheeraj,
Post Graduate Student,
Department Of General Medicine,
JNMC, Belgaum.

Guide:-

Dr.Arathi Darshan
Professor & Head of Unit,
Department of General Medicine,
JNMC, Belgaum.

Introduction and Purpose:-

This research is intended to study 2D Echocardiography changes in patients with thyroid dysfunction. The principle investigator of study is Dr.Dandamudi Kushal Dheeraj under the guidance of Dr.Arathi Darshan.

Procedure:

If you agree to be part of the research study, you will be asked the relevant history and will be subjected to relevant clinical examination and investigations. You will also have to give blood samples for the necessary investigations.

Risk and Benefits:

The only risk and possible discomfort you might get is while taking blood from your arm for the investigations. It may cause swelling, pain, redness (rarely happens) at the site from where the blood is drawn.You may not be benefitted by these investigations but you will be part of this study which is going to be useful to others in the future.

Alternatives:

Taking part in this study is voluntary. You may choose not to take part in this study.

If you decide to take part you can later change your mind and withdraw from the study. Your decision will not change the present or future health care or other services that you receive.

The study doctor or sponsor may stop your participation in this study at any time. If you choose not to take part in the study, you will receive the standard treatment for patients with your condition.

Privacy and Confidentiality:

All information collected about you during the course of this study will be kept confidential to the extent permitted by law. The code numbers will identify you in this research record. Information from this study may be published but your identity will be confidential in any publication.

Institution / Sponsor's policy:

Does not apply to this research

Financial incentives for participation:

You will not be paid / offered any gifts /incentives for participating in the study.

Authorization to publish the results:

The results of the study would be forwarded to the KLE University, Belgaum as part of requirement towards the completion of MD degree, review and publishing.

In case of the queries during study or in future you may contact following persons:

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On Human Subjects Research,

JNMC, Belgaum.

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ತಿಳುವಳಿಕೆ ಒಪ್ಪಿಗೆ ಪತ್ರ

ಸಂಶೋಧನೆಯ ಶೀರ್ಷಿಕೆ : "ಎಸೊಸಾರ್ಡಿಯೋಗ್ರಾಫಿಯ ಅನಿಷ್ಟಮಂಡಲ ಇನ್ ಎ ಪೇಷಂಟ್ಸ್ ಆಫ್ ಸ್ಟೈರಾಯ್ಡ್ ರಿಸಪ್ಟಿವ್" – ಎ ಒನ್ ಇಯರ್ ರ್ಯಾಸ್ಪೆಕ್ಟಿವ್ ಸ್ಟಡಿ ಇನ್ ಎ ಟೆರ್ಷಿಯರಿ ಕೇರ್ ಹಾಸ್ಪಿಟಲ್.

ಮುಖ್ಯ ಸಂಶೋಧಕರು:-

ಡಾ. ದಂಡಪ್ಪನವರ ಕುಶಲ ಧೀರಜ

ಸ್ನಾತಕೋತ್ತರ ವೈದ್ಯಕೀಯ ವಿದ್ಯಾರ್ಥಿ

ಜನರಲ್ ಮೆಡಿಸಿನ್ ವಿಭಾಗ

ಜೆ.ಎನ್.ಎಮ್.ಸಿ, ಬೆಳಗಾವಿ

ಮಾರ್ಗದರ್ಶಕರು:-

ಡಾ. ಆರತಿ ದರ್ಶನ

ಸಹಪ್ರಾಧ್ಯಾಪಕರು ಮತ್ತು ಘಟಕದ ಮುಖ್ಯಸ್ಥರು

ಜನರಲ್ ಮೆಡಿಸಿನ್ ವಿಭಾಗ

ಜೆ.ಎನ್.ಎಮ್.ಸಿ, ಬೆಳಗಾವಿ

ಸಂಶೋಧನೆಯ ಪರಿಚಯ ಮತ್ತು ಉದ್ದೇಶ :-

ಹೃದಯ ಸಂಬಂಧಿ ತೊಂದರೆಗಳು ಥೈರಾಯ್ಡ್ ಸರಿಯಾಗಿ ಕಾರ್ಯನಿರ್ವಹಿಸಿದಲ್ಲಿ ಮತ್ತು ಕಡಿಮೆ ಅಥವಾ ಅಧಿಕ ಪ್ರಮಾಣದಲ್ಲಿ ಕಾರ್ಯನಿರ್ವಹಿಸುವುದರಿಂದ ಬರುತ್ತವೆ ಮತ್ತು ಒಂದಕ್ಕೊಂದು ಸಂಬಂಧಿಸಿವೆ.

ಎಕೋಕಾರ್ಡಿಯೋಗ್ರಾಫಿಯಿಂದ ಹೃದಯ ಸಂಬಂಧಿ ರೋಗಲಕ್ಷಣಗಳನ್ನು ಪತ್ತೆಹಚ್ಚಿ ಅವುಗಳ ಪರಿಣಾಮಕಾರಿ ಚಿಕಿತ್ಸೆಗೆ ಸಹಕಾರಿಯಾಗುತ್ತದೆ.

[illegible]

[illegible] ಈ ಸಂವಿಧಾನದಿಂದ ಭಾರತದಲ್ಲಿ ಒಕ್ಕೂಟವಾದ ಸಂಸದೀಯ ಸಾರ್ವಭೌಮ ಪ್ರಜಾಸತ್ತಾತ್ಮಕ ಜನವಾಡ ಗಣರಾಜ್ಯವನ್ನು ಸ್ಥಾಪಿಸಲಾಗಿದೆ. ಇದು ಮೊದಲ ಗಣರಾಜ್ಯ ದಿನವನ್ನು ಸಂಕೇತಿಸುತ್ತದೆ.

ಸಂವಿಧಾನದ ಪ್ರಮುಖ ಲಕ್ಷಣಗಳು :-

ಈ ಸಂವಿಧಾನದಲ್ಲಿ ಸಮಾಜವಾದಿ ಜಾತ್ಯತೀತ ಪದಗಳನ್ನು ಸೇರಿಸಲಾಗಿದೆ. ಸಂವಿಧಾನದ ಪ್ರಸ್ತಾವನೆಯಲ್ಲಿ ಸಮಾನತೆ, ಸಹೋದರತ್ವ, ಸಮಗ್ರತೆ ಮತ್ತು ಘನತೆಯ ಪರಿಕಲ್ಪನೆಗಳನ್ನು ಸೇರಿಸಲಾಗಿದೆ.

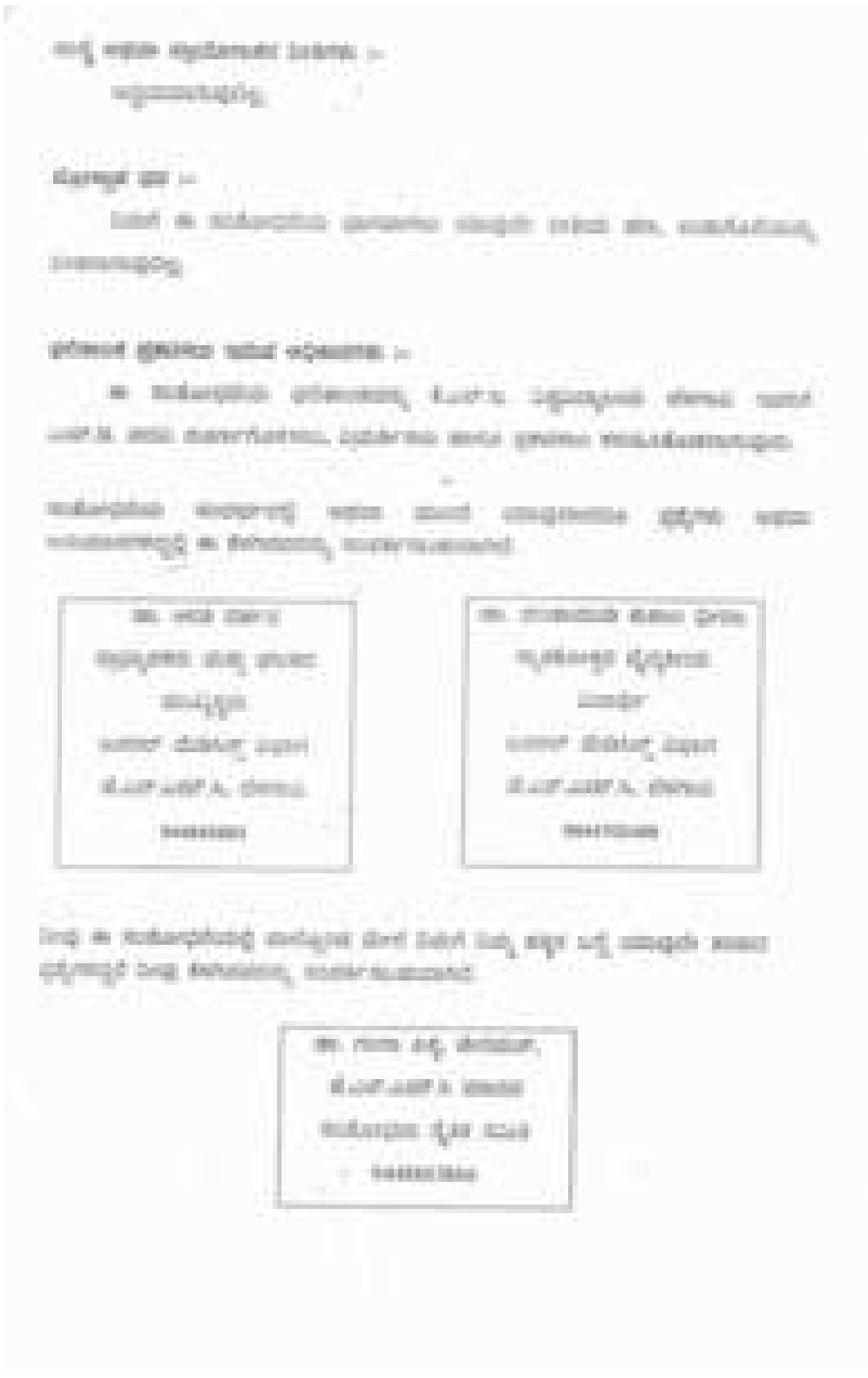
ಸಂವಿಧಾನದ ಪ್ರಸ್ತಾವನೆಯು ಭಾರತದ ಜನರು ತಮ್ಮ ಸಂವಿಧಾನದ ಮೂಲವೆಂದು ಘೋಷಿಸುತ್ತದೆ. ಇದು ಸಂವಿಧಾನದ ಉದ್ದೇಶಗಳನ್ನು ಮತ್ತು ಗುರಿಗಳನ್ನು ಸಹ ಸೂಚಿಸುತ್ತದೆ.

ಸಂವಿಧಾನದ ಮೂಲಗಳು :-

ಈ ಸಂವಿಧಾನವು ಅನೇಕ ಮೂಲಗಳಿಂದ ಪ್ರಭಾವಿತವಾಗಿದೆ. ಅವುಗಳಲ್ಲಿ ಕೆಲವು ಪ್ರಮುಖವಾದವುಗಳನ್ನು ಕೆಳಗೆ ನೀಡಲಾಗಿದೆ. ಇದು ಈ ಸಂವಿಧಾನದ ಕೆಲವು ಪ್ರಮುಖ ಅಂಶಗಳ ಮೂಲವನ್ನು ಸಹ ಸೂಚಿಸುತ್ತದೆ.

ಗಮನಿಸಿ :-

ಸಂವಿಧಾನದಿಂದ ಸಂವಿಧಾನದಲ್ಲಿ ಅನೇಕ ಪರಿಷ್ಕರಣೆಗಳನ್ನು ಕಾಲಕಾಲಕ್ಕೆ ಮಾಡಲಾಗಿದೆ. ಎಲ್ಲಿಯವರೆಗೆ ಇದು ಮೂಲ ಪ್ರಜಾಸತ್ತಾತ್ಮಕ ಸ್ವರೂಪವನ್ನು ಉಳಿಸಿಕೊಳ್ಳುತ್ತದೆ. ಮೂಲಭೂತ ರಚನೆಯ ಸಿದ್ಧಾಂತವು ಈ ಸಂವಿಧಾನದ ಪ್ರಮುಖ ಲಕ್ಷಣವಾಗಿದೆ.



जानकारी हासिल होने के बाद दी गई सम्मति

संशोधन अभ्यासक्रम का नाम : **"रोगीयों के कंठग्रंथीयोंमें पैदा होनेवाले दोषोंका हृदय के स्पंदन की जानकारी हासिल करके अनुमान लगाना।"** हॉस्पीटल में पूरी बाते ध्यान में रखकर किया हुआ एक साल का अभ्यासक्रम।

प्रमुख संशोधक :
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मार्गदर्शक :
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❊ प्रस्तावना और हेतु:

कंठग्रंथी के कार्यों में पैदा हुए दोष, इसका मतलब कंठग्रंथीसे कम या ज्यादा कार्य करनेकी क्षमता (स्राव पैदा करने की क्षमता का) का वैद्यकिय हिसाब से हृदयकी स्पंदनों की मदत से किया हुआ अभ्यास है।

हृदय की स्पंदनोंकी (ठोकों की) संख्या ध्यान में लेकर, कोई भी शस्त्रक्रिया न करके, हृदयरोग पहचानना और औषधोपचार करके रोगोंका निवारण करने का यह अभ्यास है।

❊ पध्दती :

यदी आप इस संशोधन अभ्यास में सम्मिलित होना चाहते हो तो, आपको आपका कौटुंबिक पूर्व इतिहास पुछा जायेगा और आपकी वैद्यकिय तपासणी और अन्य जाँच करने हेतु, लिए गये रक्त और मुत्र का परीक्षण करने के लिए आपका उस समय नमूने लिए जाएंगे।

❊ आपत्ती और फायदे :

आप के रक्त की जाँच करने हेतु आप के बाहों में से रक्त लिया जाएगा। और उस वक्त आपको वेदना होगी, यही आपको धोका है। जिस जगह से रक्त लिया जाएगा वहा सूजन आयेगी और वेदनाएँ होगी और वह हिस्सा रक्त रंग का (कभी होगा या न होगा) होगा। आपको इस रक्त जाँच से कोई भी फायदा नही होगा। लेकिन भविष्य में आपके द्वारा यह किये हुए अभ्यास का फायदा भविष्य में अन्य कोई व्यक्तियों को होगा।

❊ पर्याय :

इस अभ्यासक्रम में आप खुद शामिल हो सकते हो। इस अभ्यासक्रम में आप हिस्सा नही भी ले सकते है। आप इस अभ्यासक्रम में हिस्सा लिया है तो, आप इसमें से आपका नाम किसी भी समय कम कर सकते हो। आपने इस अभ्यासक्रम में हिस्सा लिया तो भी आपको इस वक्त या भविष्य में मिलनेवाली सब वैद्यकिय सेवा आपको यहाँसे प्राप्त होगी। अभ्यास करनेवाले डॉक्टर या इस कार्यक्रमका आयोजन करनेवाले, आपका इसमें मिलनेवाला सहयोग किसीभी वक्त बंद कर सकते है। यदी आपने इस संशोधन अभ्यासक्रम में हिस्सा नही लिया, तो भी आपको यहाँपर रोगी होने के नातेसे मिलनेवाली पूरी सुविधायें मिलेगी।

❊ गोपनियता :

इस अभ्यासक्रम में आपके द्वारा प्राप्त की हुई जानकारियाँ कायदे के दायरे के अनुसार गुप्त रखी जायेगी। इस अभ्यासक्रम के दौरान आपकी पहचान यह आपको दिए हुए कोड नंबर द्वारा की जायेगी। इस अभ्यास क्रम में मिली हुई जानकारियाँ प्रकाशित की जायेगी लेकिन आपकी पहचान इस प्रसिध्दी में गुप्त रखी जायेगी।

❊ संस्था या कार्यक्रम जाहीर करनेवालों की :

यह इस संशोधन अभ्यास को लागू नही है।

❊ कार्यक्रम में सम्मिलित होने से मिलनेवाली आर्थिक सहायता :

इस अभ्यासक्रम में हिस्सा लेने से आपको किसी भी प्रकार की आर्थिक सहायता नही मिलेगी ना ही आपको कोई वस्तु भेट दी जायेगी।

❋ निष्कर्ष प्रकाशित करनेका अधिकार :

इस संशोधक अभ्यासक्रम में निष्कर्ष के, एल ई, युनिव्हर्सिटी बेलगाम इनको जांच के लिए एवं प्रकाशन के लिए भेजे जायेंगे और यह एक एम डी, पदवी पूरी करनेका अपना एक हिस्सा है।

❋ यदि आपको इस संशोधन अभ्यासक्रम के बारे में इस वक्त या भविष्य में कोई प्रश्न हो तो आप निम्नलिखित व्यक्तिसे संपर्क कर सकते हो।

डॉ. दंडगुडी कुशल धीरज
संशोधक
पोस्ट ग्रॅज्युएट विद्यार्थी,
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प्रोफेसर विभाग प्रमुख,
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❋ यदि आप को आपके कोई हक संबंधी शंका हो तो आप निम्नलिखित व्यक्तिसे संपर्क कर सकते है।

डॉ. गंगा पिछी, चेअरमन
मानव संशोधन इथिक्स कमिटी, जे.एन.एम.सी. आणि
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CONSENT FORM

I voluntarily agree to take part in this study by signing below. I may withdraw at any time. I am not giving up any of my legal rights by signing this form. My signature below indicates that I have read this consent form, or it has been read to me and has been explained to me in my vernacular language and all my questions have been answered. I will be given a copy of this consent form.

Signature / Left Thumb print of the Participant or legally authorized representative

Participant's name :……...

Signature / Left thumb impression of the participant :……...

Name of the legally authorized representative / guardian :……...

Signature / Left thumb impression :……...

Witness' name :……...

Signature / Left thumb impression :……...

Investigator's name and signature :……...

Date:

Place:

SNo	Op no	Age	Gender	Past history	Duration of thyroid's function	H/o of previous heart disease	DM	HTN	Family history	Personal history	Treatment history	Temp	Pulse Permin	Respiratory rate/min	Systolic blood pressure (mmHg)	Diastolic blood pressure (mm Hg)	Pallor	Cyanosis
1	2725577	67	Male	No	No	No	Yes	Yes	Not significant	No habits	Negative	39°	62	24	150	80	Negative	Negative
2	4844877	30	Male	No	No	No	No	No	Not significant	No habits	Negative	39°	64	22	134	74	Negative	Negative
3	4355610	25	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	72	18	110	80	Negative	Negative
4	4207282	52	Female	No	No	No	Yes	No	Not significant	No habits	Negative	39°	68	18	100	60	Positive	Negative
5	1909722	27	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	70	18	110	70	Negative	Negative
6	813103	50	Female	No	No	No	No	Yes	Not significant	No habits	Negative	39°	90	19	120	80	Negative	Negative
7	4361613	40	Male	No	No	No	No	No	Not significant	No habits	Negative	39°	70	18	110	60	Negative	Negative
8	3693868	68	Male	No	No	No	Yes	Yes	Not significant	No habits	Negative	39°	72	18	120	80	Positive	Negative
9	2697138	35	Male	No	No	No	No	No	Not significant	No habits	Negative	39°	72	18	120	80	Negative	Negative
10	3650607	48	Male	No	No	No	No	No	Not significant	No habits	Negative	39°	78	18	130	80	Negative	Negative
11	2748037	25	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	64	18	130	80	Negative	Negative
12	4426861	36	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	62	18	110	60	Positive	Negative
13	3195425	25	Male	No	No	No	No	No	Not significant	No habits	Negative	39°	60	18	110	60	Positive	Negative
14	4162175	67	Female	No	No	No	No	Yes	Not significant	No habits	Negative	39°	66	16	130	70	Negative	Negative
15	4364798	42	Male	No	No	No	No	No	Not significant	No habits	Negative	39°	88	18	110	70	Negative	Negative
16	611729	23	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	76	18	120	80	Negative	Negative
17	1491001	29	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	80	18	100	60	Positive	Negative
18	3294294	40	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	88	16	120	80	Negative	Negative
19	4370812	40	Male	No	No	No	No	No	Not significant	No habits	Negative	39°	78	16	120	80	Negative	Negative
20	4611719	26	Male	No	No	No	No	No	Not significant	No habits	Negative	39°	90	16	110	80	Negative	Negative
21	4677133	54	Male	No	No	No	Yes	Yes	Not significant	No habits	Negative	39°	86	16	110	80	Negative	Negative

22	4676132	40	Male	No	No	No	No	No	Not significant	No habits	Negative	39°	88	16	110	80	Negative	Negative
23	4261139	52	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	86	15	130	80	Negative	Negative
24	4256217	57	Female	No	Yes	No	No	Yes	Not significant	No habits	Negative	39°	88	16	130	80	Negative	Negative
25	4169670	56	Female	No	No	No	Yes	No	Not significant	No habits	Negative	39°	86	16	140	90	Positive	Negative
26	4609671	42	Male	No	No	No	No	Yes	Not significant	No habits	Negative	39°	88	14	150	90	Positive	Negative
27	4250501	39	Male	No	No	No	No	No	Not significant	No habits	Negative	39°	84	16	130	80	Negative	Negative
28	3827131	43	Male	No	Yes	No	No	No	Not significant	No habits	Negative	39°	80	16	130	80	Negative	Negative
29	4579971	31	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	100	18	100	60	Negative	Negative
30	4790936	24	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	80	14	110	70	Positive	Negative
31	3718441	39	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	90	16	100	60	Negative	Negative
32	1809904	27	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	70	16	110	70	Negative	Negative
33	4263413	28	Female	No	No	No	No	No	Not significant	No habits	Negative	39°	92	16	120	80	Negative	Negative
34	4324821	24	Male	No	Yes	No	No	No	Not significant	No habits	Negative	39°	66	14	110	80	Negative	Negative
35	4146017	55	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	74	18	130	80	Positive	Negative
36	3704583	21	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	72	16	100	60	Positive	Negative
37	3676698	75	Female	No	Yes	No	No	Yes	Not significant	No habits	Negative	39°	68	18	160	80	Negative	Negative
38	3241383	32	Male	No	Yes	No	No	Yes	Not significant	No habits	Negative	39°	54	18	130	80	Negative	Negative
39	4234042	45	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	58	16	110	80	Negative	Negative
40	4306437	22	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	78	18	110	80	Negative	Negative
41	4285229	24	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	66	18	110	80	Negative	Negative
42	4349510	25	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	70	17	140	80	Negative	Negative
43	3444129	47	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	88	18	120	80	Negative	Negative
44	4309360	44	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	78	18	120	80	Negative	Negative
45	4397839	25	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	80	16	120	80	Positive	Negative
46	4418261	26	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	88	16	140	80	Negative	Negative
47	3304686	69	Male	No	Yes	No	No	Yes	Not significant	No habits	Negative	39°	67	16	130	80	Negative	Negative
48	4431352	25	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	68	16	120	80	Negative	Negative
49	4431356	42	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	78	18	120	80	Negative	Negative
50	3458878	32	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	66	16	110	80	Positive	Negative
51	3994856	38	Female	No	Yes	No	No	No	Not significant	No habits	Negative	39°	68	18	120	80	Negative	Negative

SNo	Lymphadenopathy	Icterus	Clubbing	Edema	Goitre	RS	CVS	PA	CNS	T3	T4	TSH	2D Echo				
													Tachycardia	Pulmonary Artery Hypertension	Dilated cardiomyopathy	Type1 diastolic dysfunction	Pericardial effusion
1	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.98	7.14	7.06	No	No	No	Yes	No
2	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.00	7.90	5.43	No	No	No	Yes	No
3	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.40	6.60	9.10	No	No	No	No	No
4	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.50	4.90	9.67	No	No	No	Yes	No
5	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.50	3.80	34.77	No	No	No	Yes	No
6	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	2.00	18.00	0.01	No	No	No	No	No
7	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	2.00	3.80	360.90	No	Yes	No	No	No
8	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.90	7.30	9.22	No	No	No	Yes	No
9	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.90	6.00	6.13	No	Yes	No	No	No
10	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.20	6.30	5.63	No	No	No	Yes	No
11	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.60	11.80	0.01	Yes	No	No	No	No
12	Negative	Negative	Negative	Positive	Negative	NAD	S1,S2+	NAD	NAD	0.60	3.80	290.00	No	No	No	Yes	Yes
13	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.50	2.40	99.00	No	No	No	No	No
14	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.20	6.20	7.03	No	Yes	No	No	No
15	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	2.00	18.00	0.01	No	Yes	No	No	No
16	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.80	7.65	5.93	No	No	No	No	No
17	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.80	8.00	8.73	No	Yes	No	Yes	No
18	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.60	10.30	0.04	Yes	No	No	No	No
19	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.20	7.00	6.64	No	No	No	No	No
20	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	2.90	16.00	0.01	No	Yes	No	No	No
21	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.76	16.20	0.01	No	No	Yes	No	No
22	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	3.90	17.50	0.01	Yes	No	No	No	No
23	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	4.00	16.80	0.01	No	Yes	No	No	No

24	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	3.60	16.10	0.01	No	No	No	No	No
25	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	2.90	16.80	0.01	No	No	Yes	No	No
26	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	6.50	24.90	0.01	Yes	No	No	No	No
27	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	2.10	13.10	0.01	No	Yes	No	No	No
28	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	2.03	12.40	0.04	Yes	No	No	No	No
29	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	3.00	139.88	0.01	No	No	No	No	No
30	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	6.50	24.69	0.01	Yes	No	No	No	No
31	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.40	11.50	0.04	Yes	No	No	No	No
32	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.40	3.90	7.24	No	No	No	Yes	No
33	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	4.20	24.90	0.01	No	No	No	No	No
34	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.50	9.00	10.00	No	Yes	No	Yes	Yes
35	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.40	9.00	0.35	Yes	No	No	No	No
36	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	2.00	3.80	136.80	No	No	No	No	No
37	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.80	4.80	19.02	No	No	No	Yes	No
38	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.90	2.90	100.00	No	No	No	No	No
39	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.90	9.30	5.17	No	No	No	Yes	No
40	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.80	9.00	7.19	No	Yes	No	Yes	No
41	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.90	7.90	7.20	No	No	No	No	No
42	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.70	4.60	15.31	No	No	No	Yes	No
43	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	6.60	30.00	0.01	No	No	No	No	No
44	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	3.60	1.12	5.70	No	No	No	Yes	No
45	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	2.00	16.50	0.03	No	No	No	No	No
46	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	3.48	1.25	0.18	No	No	No	No	No
47	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.70	5.20	12.84	No	No	No	Yes	Yes
48	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.10	5.40	10.31	No	No	No	Yes	No
49	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	1.00	6.70	7.03	No	No	No	No	No
50	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.90	4.20	16.21	No	No	No	Yes	No
51	Negative	Negative	Negative	Negative	Negative	NAD	S1,S2+	NAD	NAD	0.80	4.00	14.83	No	Yes	No	Yes	Yes

S No	Thyroid Disorders	ECG changes						
		Sinus Bradycardia	Low voltage criteria	Right bundle branch block	Prolonged QT interval	Sinus tachycardia	Atrial fibrillation	Low voltage complexes
1	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
2	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
3	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
4	Primary hypothyroidism	Yes	No	No	No	No	No	No
5	Primary hypothyroidism	No	No	No	Yes	No	No	No
6	Hyperthyroidism	No	No	No	No	Yes	No	No
7	Primary hypothyroidism	Yes	No	No	No	No	No	No
8	Sub clinical Hypothyroidism	Yes	No	No	No	No	No	No
9	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
10	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
11	Hyperthyroidism	No	No	No	No	Yes	No	No
12	Primary hypothyroidism	No	No	Yes	No	No	No	No
13	Primary hypothyroidism	No	No	No	No	No	No	No
14	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
15	Hyperthyroidism	No	No	No	No	No	No	No
16	Sub clinical Hypothyroidism	Yes	No	No	No	No	No	No
17	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
18	Hyperthyroidism	No	No	No	No	No	No	No
19	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
20	Hyperthyroidism	No	No	No	No	No	No	Yes
21	Hyperthyroidism	No	No	No	No	No	No	No
22	Hyperthyroidism	No	No	No	No	Yes	Yes	No
23	Hyperthyroidism	No	No	No	No	Yes	No	No
24	Hyperthyroidism	No	No	No	No	Yes	No	No
25	Hyperthyroidism	No	No	No	No	No	Yes	No

26	Hyperthyroidism	No	No	No	No	Yes	No	Yes
27	Hyperthyroidism	No	No	No	No	No	No	No
28	Hyperthyroidism	No	No	No	No	No	No	No
29	Hyperthyroidism	No	No	No	No	Yes	No	No
30	Hyperthyroidism	No	No	No	No	Yes	No	No
31	Hyperthyroidism	No	No	No	No	No	Yes	No
32	Primary hypothyroidism	Yes	No	No	No	No	No	No
33	Hyperthyroidism	No	No	No	No	Yes	No	No
34	Primary hypothyroidism	Yes	No	No	No	No	No	No
35	Hyperthyroidism	No	No	No	No	Yes	No	No
36	Primary hypothyroidism	No	Yes	No	No	No	No	No
37	Primary hypothyroidism	Yes	No	No	No	No	No	No
38	Primary hypothyroidism	Yes	No	No	No	No	No	No
39	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
40	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
41	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
42	Primary hypothyroidism	No	No	Yes	No	No	No	No
43	Hyperthyroidism	No	No	No	No	Yes	No	No
44	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
45	Hyperthyroidism	No	No	No	No	No	No	No
46	Hyperthyroidism	No	No	No	No	Yes	No	No
47	Primary hypothyroidism	No	Yes	No	No	No	No	No
48	Primary hypothyroidism	Yes	No	No	No	No	No	No
49	Sub clinical Hypothyroidism	No	No	No	No	No	No	No
50	Primary hypothyroidism	No	No	No	No	No	No	No
51	Primary hypothyroidism	Yes	No	No	No	No	No	No