" ASSESSMENT OF THYROID PROFILE IN PATIENTS WITH ACUTE CORONARY SYNDROME"

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Dissertation submitted to the

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IN

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Under The Guidance Of

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Dr. Meena Menon C

LIST OF ABBREVIATIONS

- T3 – triiodothyronine
- T4 – tetraiodothyronine
- TSH – thyroid stimulating hormone
- rT3 – reverse triiodothyronine
- FT3 – free triiodothyronine
- FT4 – free tetraiodothyronine
- AMI – acute myocardial infarction
- ACS – acute coronary syndrome
- STEMI – ST- segment elevation myocardial infarction
- CAD – coronary artery disease
- NT – Pro BNP – N- terminal pro B type natriuretic peptide
- HMG CoA – 3hydroxy 3methyl glutaryl co-enzyme A
- ECG – electrocardiography
- CBC – complete blood count
- IL – 6 – interleukin 6
- TRH – thyrotropin releasing hormone
- IGF – 1 – insulin like growth factor
- TGF – transforming growth factor
- BMR – basal metabolic rate
- LDL – low density lipoprotein
- TNF – tumor necrosis factor
- D1 – type1 deiodinase
- D2 – type 2 deiodinase
- D3 – type3 deiodinase
- GSH - glutathione
- MI – myocardial infarction
- UA – unstable angina

- LVOT – left ventricular outflow tract
- MR – mitral regurgitation
- ADMA – asymmetric dimethyl arginine
- NO – nitric oxide
- ROS – reactive oxygen species
- NADPH – nicotinamide adenine dinucleotide phosphate
- TBG – thyroid binding globulin
- CRP – c – reactive protein
- JVP – jugular venous pressure
- LBBB – left bundle branch block
- TnT – troponin- tropomyosin
- TnC - troponin calcium
- ACE – angiotensin converting enzyme
- EF – ejection fraction
- PCI – percutaneous coronary intervention
- ASA – acetyl salicylic acid
- UFH – unfractionated heparin
- CAG – coronary artery graft
- HDL – C – high density lipoprotein cholesterol
- LDL – C – low density lipoprotein cholesterol
- eNOS – endothelial nitric oxide synthase
- DM – diabetes mellitus

ABSTRACT

BACKGROUND:

Acute Coronary Syndrome is one of the leading causes of mortality and morbidity both in India and in the worldwide. The functioning of cardiovascular system and its haemodynamics are highly influenced by the thyroid hormones. Even a minor alteration in the functioning of the hormones can affect the ventricular function, heart rate and rhythm by increasing the serum cholesterol levels and thereby escalating the risk of coronary artery disease and cardiovascular mortality.

OBJECTIVES:

1. To estimate thyroid hormone levels in patients with Acute Coronary Syndrome.
2. To associate altered thyroid profile with outcome.

MATERIAL AND METHODS:

This was a hospital based cross - sectional study. It was conducted in patients who attended to the R.L.Jalappa Hospital and Narayana Hrudhayalaya, Kolar over a period of one and a half years. The study

population consisted of 80 patients who fulfilled the inclusion and exclusion criteria.

A detailed medical history which included demographic data, chief complaints, medical history, medications used and habits (smoking, alcohol consumption, chewing of betel nut and other forms of tobacco use) were obtained and were subjected to general physical examination. ECG, Cardiac enzymes and Thyroid profile were studied and thyroid profile was repeated on day 5 in these patients to assess the thyroid dysfunction, complications and its outcome in acute coronary syndromes.

RESULTS:

Out of the total 80 patients studied, thyroid dysfunction persisted in 16 patients (20%) on day 5 of the coronary event. Subclinical hypothyroidism was the most common form of thyroid dysfunction observed which was followed by low T3 syndrome in 8 (10%) and 4 (5%) patients respectively. The most common complication seen was heart failure in 2 patients (12.5%) followed by cardiogenic shock in 1 patient (6.2%). Both these complications were seen among the patients with low T3 syndrome.

CONCLUSION:

Our study brings to light that, low T3 in AMI is associated with a poor LV function during short term follow-up. Subclinical hypothyroidism and low T3 syndrome are more common in acute coronary syndrome. Patients with low T3 syndrome were found to have complications associated with thyroid dysfunction in acute coronary syndrome. Considering the major risk factors like diabetes, hypertension, smoking, alcohol consumption and age it did not have any correlation with the outcomes.

Keywords: thyroid, ACS, low T3syndrome

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INTRODUCTION

INTRODUCTION

Cardiovascular diseases have emerged as a global burden of diseases. World-wide deaths due to cardiovascular diseases contribute to around 30%. Interestingly, it has a greater prevalence in the industrialized countries, striking the younger populations[1]. Cardiovascular diseases represent a broad classification of illness that affects both the heart and the blood vessels.

The major cardiovascular diseases consist of coronary artery disease (angina, myocardial infarction) due to the narrowing of the coronaries, peripheral artery disease and stroke. Others include cardiac failure, arrhythmias, valvular heart diseases, congenital heart diseases, cardiomyopathy etc.

The primary cause for coronary artery disease, which manifest primarily as myocardial infarction is atherosclerosis[2]. Atherosclerosis is a condition where a plaque is formed in the arteries and over a period of time these plaques get hardened leading to narrowing of the vessel and hence reduction in the blood flow.

The plaque mainly comprises of fat, calcium, cholesterol, platelets and various other materials found in the blood. Reduction in blood flow to the cardiac muscle results in angina and myocardial infarction.

The functioning of cardiovascular system and its haemodynamics are highly influenced by the thyroid hormones[3,4]. Even a minor alteration in the

functioning of the hormones can affect the ventricular function, heart rate and rhythm by increasing the serum cholesterol levels and thereby escalating the risk of coronary artery disease and cardiovascular mortality[5].

Overt hyper/hypothyroidism, subclinical hypo/hyperthyroidism has been identified as independent risk factors affecting both the outcome as well as mortality among the cardiovascular diseases[6,7].

There is a rapid down regulation of thyroid homeostasis in the event of an acute coronary syndrome which is essential during acute ischemia. This alteration, most likely must have happened before the infarction process.

During acute myocardial infarction, a condition namely "low T3 syndrome" or "sick euthyroid syndrome" consisting of low total T3 and/or FT3, increased reverse T3 (rT3) and normal TSH, T4 and free T4 levels, was observed which extremely influenced the prognosis of the illness[8].

A majority of individuals who present with STEMI has been found to have an early reduction in their FT3 levels[9]. Reduced T3 levels serve as an independent marker of mortality among these population[10].

There are various studies in which the thyroid hormone levels have been evaluated in patients who presented with acute coronary events. This helps in determining the outcome of the hormone dysfunction on morbidity and

mortality in these individuals. There are also studies which have shown that there exist no association between thyroid and coronary artery disease[11].

Thyroid dysfunction can be considered as independent risk factor for various coronary events. Hence this study was undertaken to assess thyroid dysfunction in acute coronary syndrome and its outcome.

OBJECTIVES

OBJECTIVES OF THE STUDY

- To estimate thyroid hormone levels in patients with Acute Coronary Syndrome.

- To associate altered thyroid profile with outcome.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

It was in the year 1785 Caleb Parry observed that there existed an association between thyroid dysfunction and cardiovascular abnormalities. Subsequently many research works and studies were conducted in the field of thyroid and heart.

In India in the year 2000, with an estimated population of 1.03 billion, the overall prevalence of CAD was observed to be 3%. Interestingly there was a greater frequency observed among the younger population than among the older age groups.

Thyroid hormones have both direct and indirect effects on the cardiovascular system. When the hormones are produced in excess it leads to neurohumoral activation and sympathetic stimulation. Neurohumoral activation leads to release of biologically active substances like the NT-pro BNP which are considered as prognostic determinants of disease progression [12,13,14].

Sympathetic over activity brings in changes in cardiac rhythm. It can also lead to vascular stiffness which ultimately contributes to diastolic hypertension and enhance platelet plug formation which leads to CAD.

When there is a deficiency in the circulating thyroid hormones, TSH levels are elevated which has detrimental effects on the lipid levels. It has been

observed that the activity of HMG-CoA reductase, a key enzyme in the synthesis of cholesterol is reduced to a greater extent in hypothyroidism[15].

It has also been found that people with thyroid dysfunction are at a higher risk than those with a euthyroid state for developing complications in acute coronary syndromes[16].

During acute coronary syndrome, in the absence of a primary thyroid illness, the alteration in thyroid function consists of low T3 levels with normal T4 and TSH levels[17,18]. Sick euthyroid syndrome or low T3 syndrome observed in patients with ACS has been hypothesized to develop due to the inhibitory effects of the pleiotropic proinflammatory cytokine IL-6 on the thyroid gland.

Acute coronary syndrome:

Acute coronary syndrome (ACS), can be referred as a spectrum of clinical presentation that usually ranges from ST-elevation myocardial infarction (STEMI) to non ST-elevation myocardial infarction (NSTEMI) unstable angina (UA).

Most often it is due to the rupture of an atherosclerotic plaque and thrombosis of an artery leading on to infarction of that area supplied by the artery.

Sometimes in the absence of a plaque rupture or thrombosis an individual develops ACS when there is a physiologic stress on the heart. Acute myocardial infarction in this scenario has to be diagnosed by considering various factors. These include assessment of cardiac biomarkers, clinical symptoms, along with electrocardiographic and various imaging studies.

Pathogenesis:

The primary event is atherosclerosis that over a period of time progress and manifest as acute ischemia. There are various risk factors that enhance atherosclerosis like hypertension, diabetes mellitus, dyslipidemia and smoking[19,20].

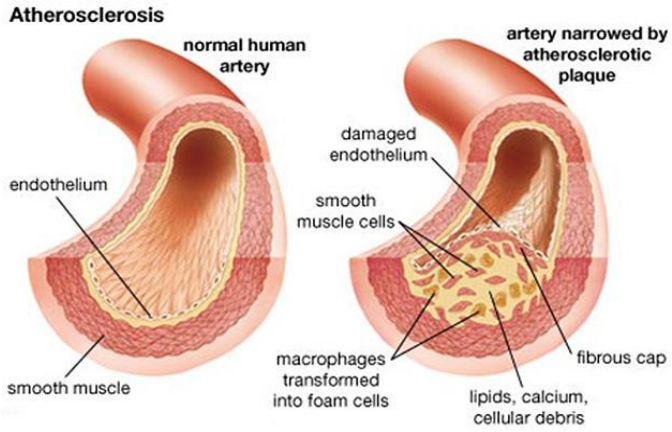


Fig 1. Atherosclerotic and a normal vessel. [20]

These risk factors contribute to endothelial dysfunction which is characterized by decreased levels of nitric oxide and increased production of endothelin 1, which causes impairment in the vascular homeostasis. Several locally active substances are released and they increase the thrombogenicty of blood[21].

Endothelial damage leads to migration of monocytes to the sub endothelium where they undergo differentiation and form macrophages. These macrophages digest the oxidized LDL and transforms into foam cells which form fatty streaks. Macrophages also release chemo-attractants and cytokines which continue the process[19].

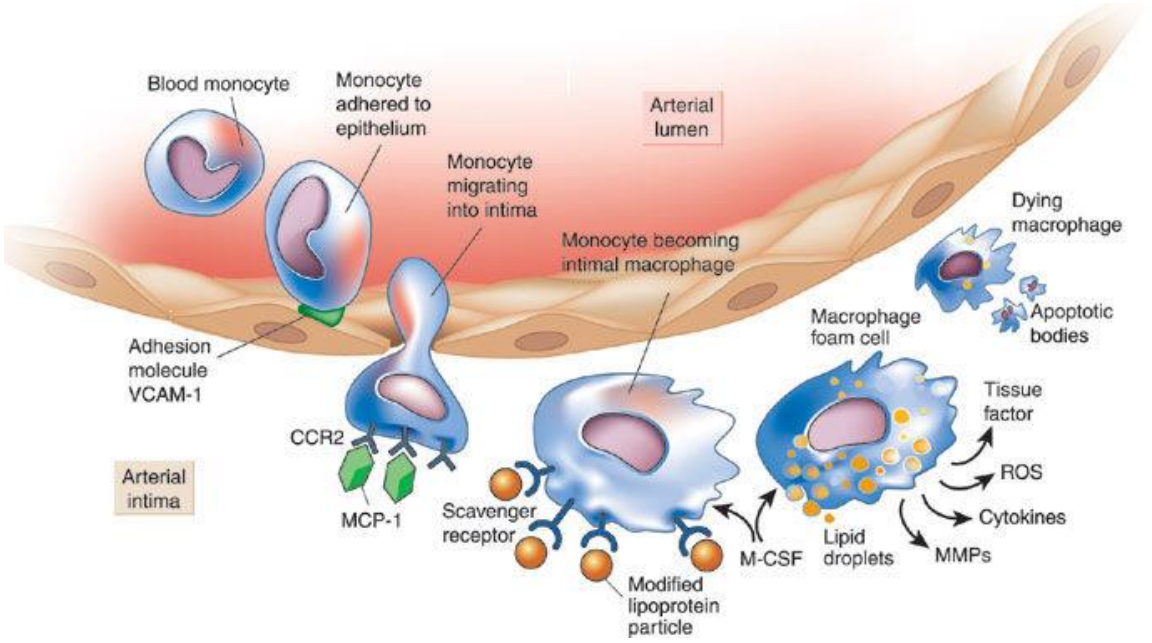


Fig 2. Macrophages and Formation of Foam cells[22]

These macrophages digest the extracellular matrix and leads to disruption of the plaque[19].

The sub endothelial matrix exposes tissue factor to the circulating blood which triggers an array of events. Initially there is platelet activation followed by it adhesion, aggregation and later on formation of thrombus.

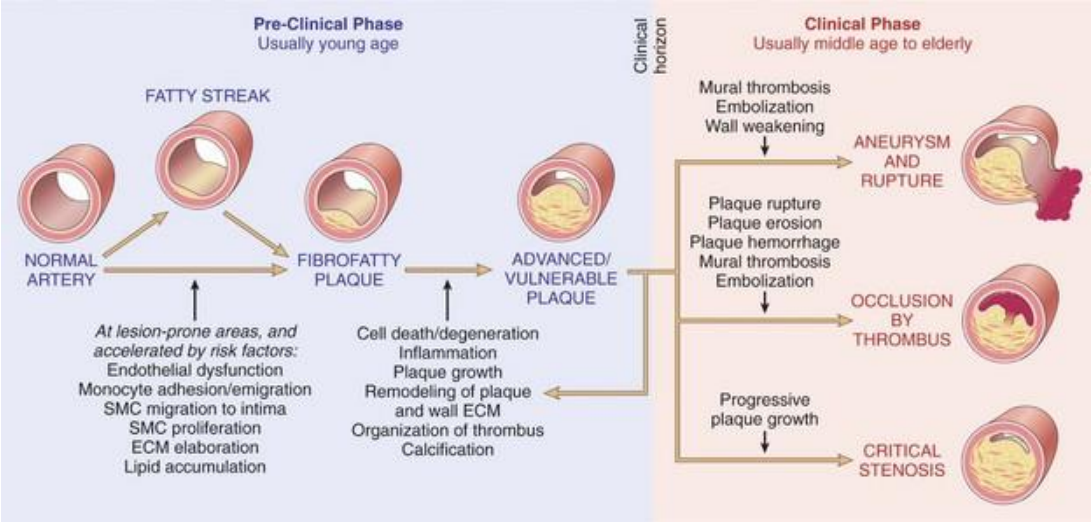


Fig 3. Clinical phase of a fatty streak[23]

The platelet rich clot or white clot causes only partial occlusion of the artery whereas the fibrin rich clot or red clot that is formed through the activation of the coagulation cascade causes complete occlusion of the artery[24,25,26].

A vulnerable plaque is defined as the thickness of fibrous cap in a lesion of less than 65µm and that is infiltrated with macrophages >25/hpf. Individuals

with reduced HDL-C and High levels of LDL-C are observed to have more vulnerable plaques[26].

Proliferation of the smooth muscles and collagen synthesis repairs the injury and stabilizes the plaque whereas; inflammation of the lipid layer in the plaque makes it more vulnerable and exposes the plaque for rupture[27].

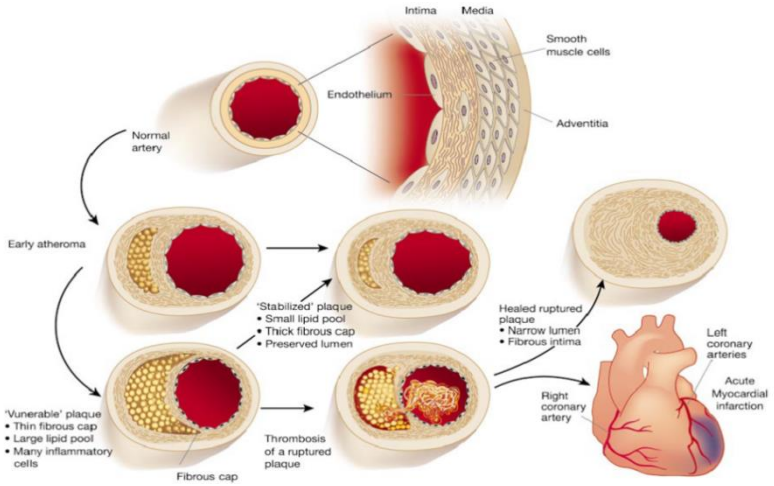


Fig 4. Stable and Vulnerable plaque[28]

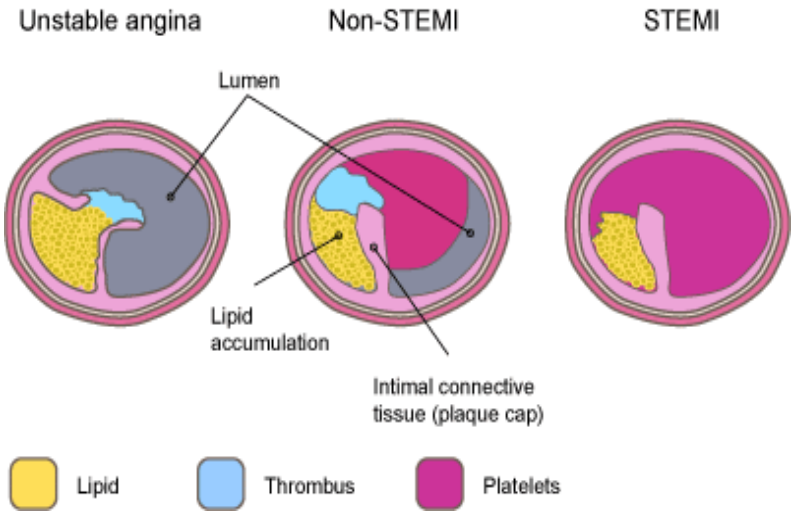


Fig 5. Atherosclerotic changes in different ACS:[29]

Clinical features:

Classical symptoms of STEMI, NSTEMI and UA are similar and hence it requires biochemical and other medical evaluation to differentiate between the three. The cardinal symptom is chest pain or angina (stable angina).

It is usually described as a pressure or heaviness in the central chest that typically gets intensified with exertion or other conditions that increase myocardial oxygen demand.

Nevertheless, not all patients complain of chest pain. In some and pain is usually present in the left arm, neck, jaw and epigastric discomfort. Diabetic and elderly patients most often do not experience pain.

They complain of palpitations, dyspnoea, fatigue, diaphoresis, light-headedness, nausea and vomiting. These are also called as angina equivalents[30].

In unstable angina patient experience angina equivalents especially during rest and are at increased risk of adverse cardiac events.

Physical examination reveals hypotension (ventricular dysfunction)/ hypertension (sympathomimetic stimulation), diaphoresis, pulmonary edema (other signs of left heart failure-pallor, oliguria, confusion), elevated JVP, cool extremities (in cardiogenic shock).

In addition there may be S3/S4 (inferior wall MI) and systolic murmur (dynamic obstruction to LVOT/ Apical infarct/ Secondary to MR).

Management of ACS:

Diagnosis:

When the demands on heart increases under physiologic stress, a stable CAD can lead on to ACS even in the absence of rupture of a plaque or thrombus. In this situation, ACS can be diagnosed by estimating the levels of cardiac biomarkers along with one of the following[31]:

A. Symptoms of ischemia

B. Pathologic Q waves on ECG

C. ST-T changes or New onset LBBB (ECG)

D. Imaging studies showing loss of viable myocardium/ regional wall motion abnormality.

E. Angiography showing intracoronary thrombus.

Cardiac biomarkers:

The important cardiac biomarkers are CK-MB and Troponins (TnI, TnT, TnC). Even though myoglobulin is levels are elevated during myocardial necrosis, they are not cardiac specific and hence not routinely used.

Troponin levels are found to be raised as early as 4 - 6 hrs of symptom onset and remains elevated for about 7 - 10 days following myocardial infarction. On the other hand CK - MB, peaks within 12-24 hrs and usually returns to normal within 24 - 48 hrs.

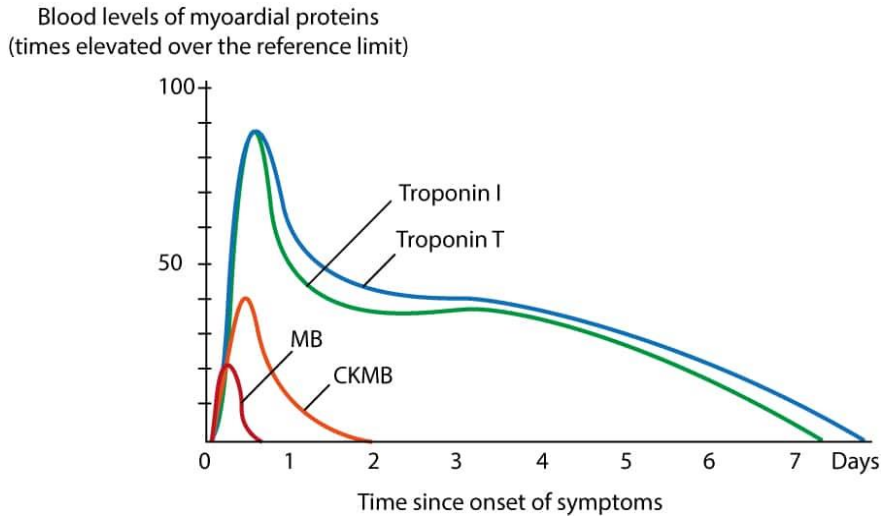


Fig 6. Timing of release of various Cardiac biomarkers after acute MI[32].

NSTEMI can be differentiated from UA by increased levels of cardiac biomarkers and enzymes (Troponin/CK-MB).

Electrocardiography:

During an episode of angina the following changes may be observed:

1. Transient elevation of ST segment.
2. Dynamic T wave changes-inversions, hyperacute or normalization changes.
3. ST depressions.

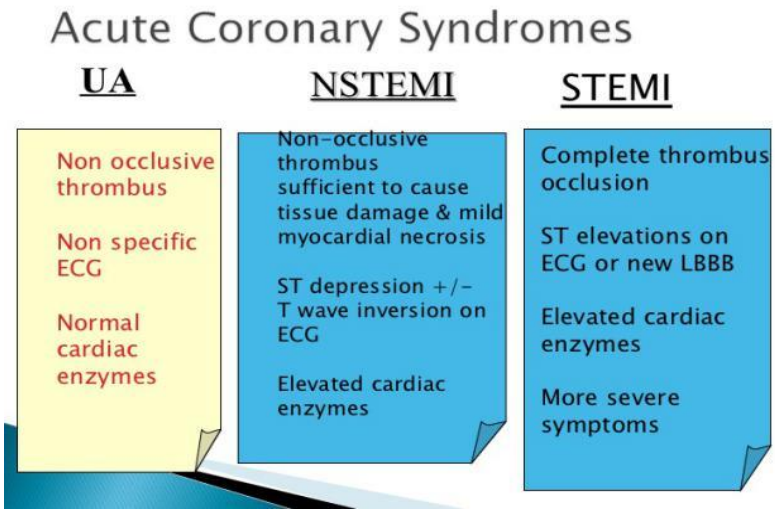


Fig 7. Types of Acute coronary syndromes[33].

Echocardiography:

Echocardiogram helps not only in evaluating the extent of myocardial injury, regional wall motion abnormalities but also in assessing the left ventricular and right ventricular function.

Various complications of MI like, chordal rupture, mitral regurgitation and pericardial effusion can also be detected.

Treatment:

The initial therapy targets to stabilize the patient which primarily includes relief of ischemic pain and antithrombotic therapy to prevent any further damage to the myocardium. Morphine, nitroglycerine, oxygen, aspirin and clopidogrel are the initial line of management.

Addition of calcium channel blockers brings in a reduction in the myocardial oxygen demand as it inhibits the myocardial contractility. It improves the blood flow to the myocardium by causing vasodilatation of the cardiac smooth muscles[31].

It is also recommended to give ACE inhibitors to patients with complications like pulmonary edema or to those with EF <40% within 24 hrs, as it found to reduce the mortality rates[34].

Percutaneous coronary intervention:

Coronary angioplasty or percutaneous coronary intervention is a procedure for treating ACS that includes STEMI, NSTEMI, UA and multivessal CADs.

For individuals presenting with STEMI, PCI is recommended as the immediate line of management. This is because a sudden disruption of the plaque causes coagulation and formation of platelet rich thrombi which can later evolve into a fibrin rich occlusive thrombi. Early reperfusion therapy is very critical in these patients to prevent the size of the infarct.

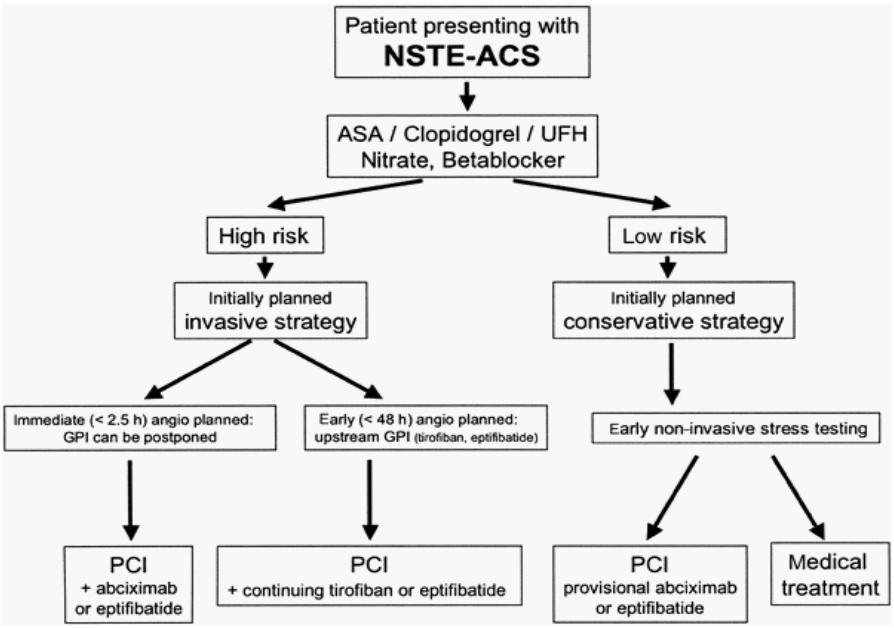


Fig 8. Approach to NSTEMI-ACS[35].

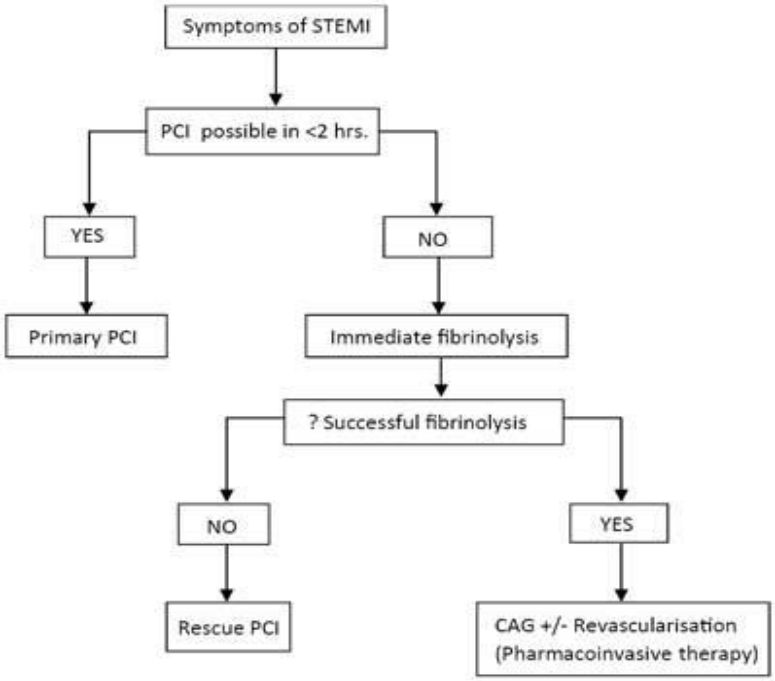


Fig 9. Approach to STEMI[36].

Statins should be initiated in all patients irrespective of their LDL values and if there are no contraindications.

The secondary prevention includes management of the risk factors. The modifiable risk factors like smoking, diabetes, hypertension and obesity needs to be managed as it can prevent further episodes of ischemia and also the morbidity and mortality related to the illness.

Assessment of Prognosis:

Killip Classification for Patients with STEMI:

Class I	No evidence of heart failure.
Class II	Findings consistent with mild to moderate heart failure. S3 gallop, Rales and Jugular venous distention.
Class III	Pulmonary edema
Class IV	Cardiogenic shock

Table 1. Killips Classification [37].

It has been observed in various studies that people falling into the class 3 and 4 were at a higher risk of mortality both at 30 days and 6 months.

Timi risk score for UA/NSTEMI:

History	Score
Age > 65yrs	1
> 3 risk factors - CAD (DM, HT, FHx, Dyslipidemia, Smoking)	1
Known CAD >50% stenosis	1
Recent Use of Aspirin (in the past 7 days)	1
Presentation	
Severe angina <24hrs	1
Elevated cardiac biomarkers	1
ST- deviation > 0.5mm	1
Risk Score 0-7 points	

Table 2. TIMI risk score[38]

Thyroid Gland:

The thyroid gland occupies the thyroid bone and laryngeal cartilage. It develops from the thyroglossal duct. It is an endocrine gland which consists of two lobes connected by an isthmus.

It is a highly vascular gland and is innervated by the autonomic nervous system. The parasympathetic fibers are derived from the vagus nerve and the sympathetic fibers from superior middle and inferior ganglia of sympathetic trunk.

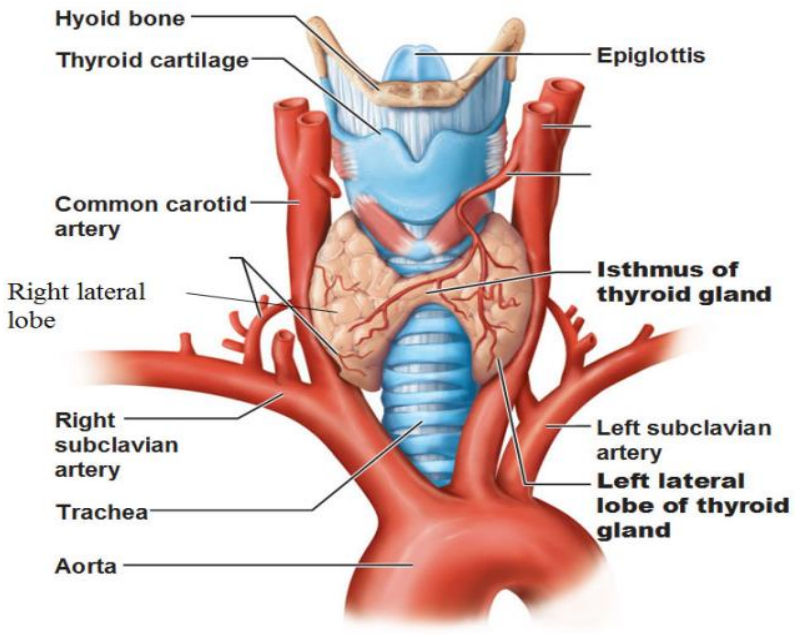


Fig 10. Anatomy of Thyroid Gland[39]

Physiology of thyroid hormones.

The thyroid gland via its hormones plays a crucial role in tissue metabolism and its development. Hence it has a great influence on various organ systems. Thyroid hormones regulate cell differentiation during development and helps in maintaining the thermogenic and metabolic homeostasis in an adult.

The primary hormones produced by the gland are triiodothyronine (T3) and Thyroxine (T4). They are synthesized in thyroid cells by oxidizing iodide to iodine with the help of the enzyme thyroid peroxidase. It is then bound to tyrosine. These monoiodotyrosine molecules are then again iodinated to diiodotyrosine molecules.

A Diiodotyrosine molecule in turn undergoes oxidative condensation and gets stored in thyroglobulin. The enzyme protease releases the hormones into cytoplasm. TRH from the hypothalamus signals pituitary to release TSH which regulates the production of T3 and T4.

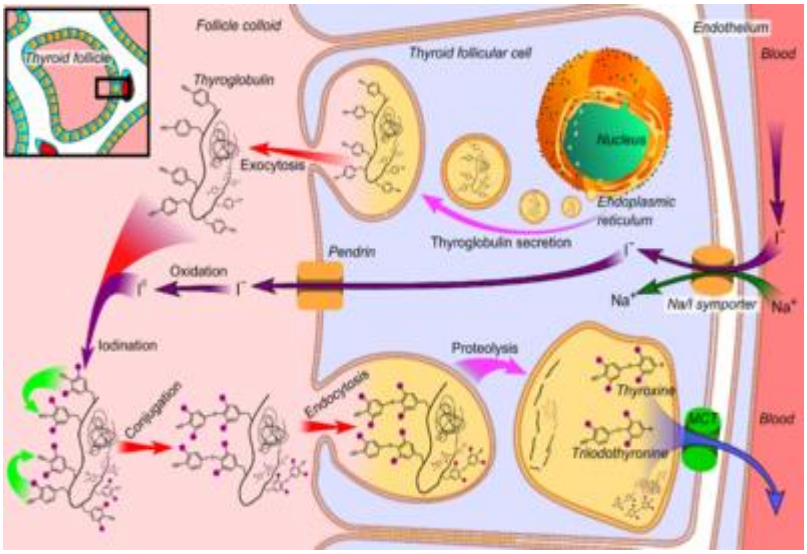


Fig 11. Physiology of Thyroid Hormones[40]

Regulation of Thyroid Hormones:

Thyroid hormones, its levels in the serum, release and functions are mainly regulated by the Hypothalamic-pituitary-thyroid axis. This is a classic illustration of the endocrine feedback control.

TRH secreted by the hypothalamus releases TSH from anterior pituitary which in turn stimulates the thyroid gland for the formation and release of

the hormones. Thyroid gland releases T4 which undergoes peripheral conversion to T3 which is the biological active form of the hormone.

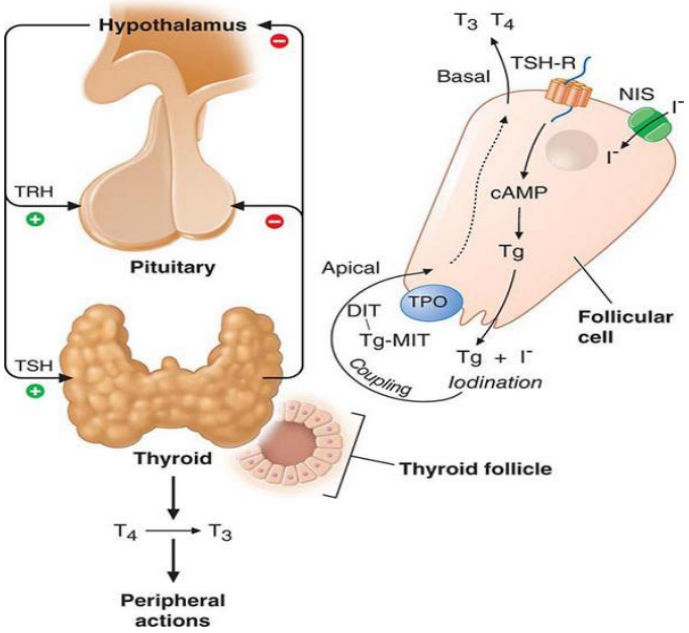


Fig 12. Regulation of Thyroid Gland[41].

Once the levels of these hormones are maintained in circulation, T3 exert an inhibitory effect on the pituitary and the hypothalamus leading to reduction in the formation and release of TSH and TRH. Hence the Hypothalamic-pituitary-thyroid axis is well established.

Apart from TSH thyroid gland is also influenced by various other growth factors like IGF-1 (Insulin like growth factor-1), epidermal growth factor, transforming growth factor (TGF), endothelins and various cytokines.

Thyroid hormones reference values are as follows:

Thyroid Hormones	Values
Free T3	2.0 - 4.4 Pg/ml
Free T4	0.9 - 1.7 ng/dl
TSH	0.27 - 4.2 µIU/ml

Table 3. Reference range for Thyroid Hormones [42]**.**

Functions of thyroid gland on various organ systems are as follows:

Heart	↑ heart rate and cardiac output
Lungs	↑ the rate of ventilation
Glucose metabolism	↑ glucose absorption from intestine and hepatic glucose production
Lipid metabolism	↑cholesterol clearance from plasma
Metabolism	↑ BMR, normal growth, maturation and cartilage and bone formation.
Brain	Promotes normal brain development.
Muscle	↑ Protein breakdown.
Adipose tissue	Stimulates lipolysis.
Lipoprotein	Stimulates LDL receptors.

Table 4. Functions of Thyroid Gland on organ systems [43]**.**

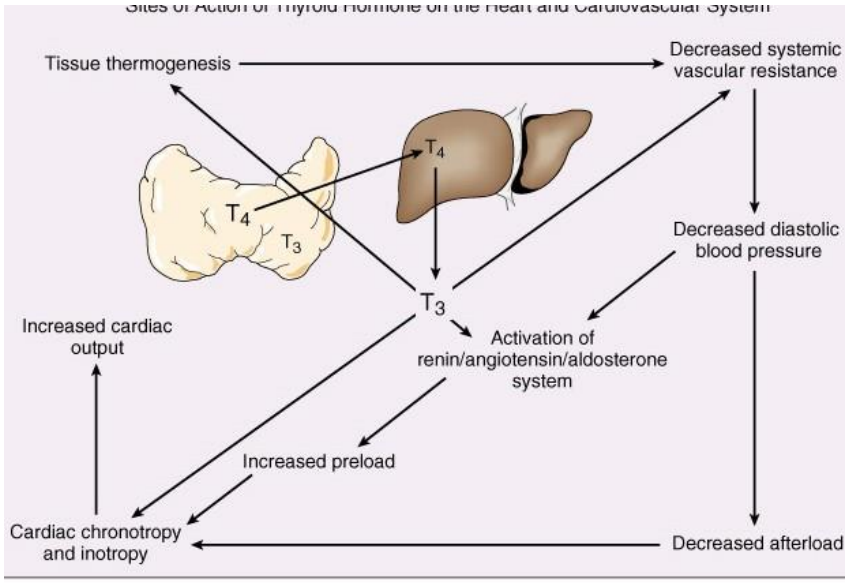


Fig 13. Mechanism of action -Thyroid Hormones on Cardiovascular system[44].

The most important test for diagnosing thyroid dysfunction is by measuring the levels of TSH.

Hormones	Hypothyroidism	Hyperthyroidism	Euthyroid sick syndrome
T3	N/LOW	HIGH	LOW
T4	LOW	HIGH	N/LOW
TSH	HIGH	LOW	N/LOW

Table 5. Interpretation of thyroid hormones[45]:

Sick Euthyroid Syndrome or "Low T3 syndrome":

Sick euthyroid syndrome or low T3 syndrome by definition implies to low total T3and/or free T3, increased reverse T3 (rT3), and normal TSH, T4 and free T4 levels in the event of an acute myocardial infarction which invariably affects the prognosis [46].

In the absence of a preexisting thyroid gland dysfunction, the levels of thyroid hormones in circulation are altered as a result of adaptation to the acute illness. There is deregulation of the hypothalamic-pituitary-thyroid axis which is reflected as a dysfunctioning of the peripheral type 1 deiodinase activity.

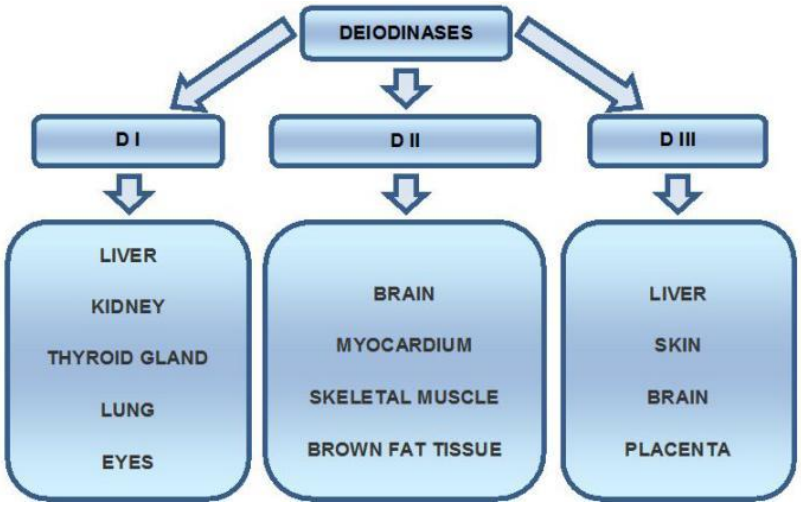


Fig 14. Types of deioninases [47]

Hence there occurs an adjustment at the hypothalamus to maintain the thyroid homeostasis[48]. Moreover the illness and the drugs are believed to

interact with the protein binding properties of the hormones[49]. This leads to a transient elevation of the free hormones while there is a reduction in the levels of total hormones.

Cytokines particularly IL-6, TNF-α, and interferon beta released during an acute illness has an inhibitory effect on the H-P-T axis. It inhibits the production of TSH, TRH, thyroglobulin, T3 and thyroid binding globulins. They also reduce the activity of type 1 deiodinase and binding capacity of T3 receptors thereby down regulate various steps and processes involved in the hormone synthesis[50].

Deiodination:

The peripheral deiodination of T4 to T3 is catalyzed by type 1 deiodinase. Type 1 deiodinase is largely seen in the plasma membranes of liver, kidney, thyroid and pituitary. It is believed that formation of T3 (reduced during illness) and clearance of rT3 (increased during illness) is brought about by D1[51].

D1 catalytic activity requires co-factor glutathione (GSH). During an acute illness the glutathione levels and D1 activity can be suppressed by IL-6[52]. As D1 is a selenoprotein, selenium deficiency which is very common during acute illness can lead to inactivity of D1.

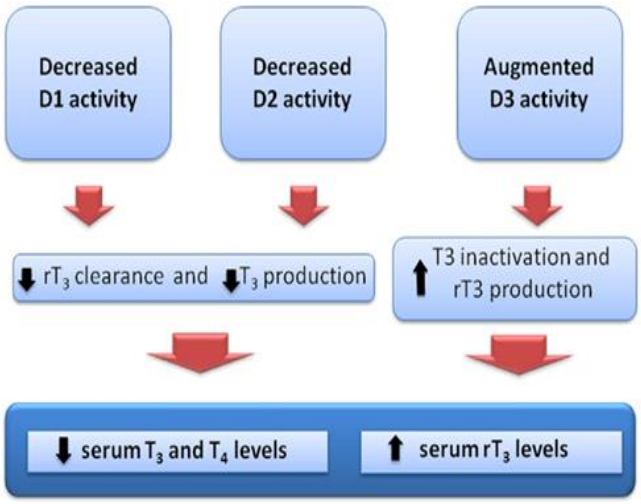


Fig 15. Effects of deiodinases on Thyroid hormones[53].

Sick euthyroid syndrome Stages:

Sick euthyroid syndrome has been classified into the 4 stages.

1. *Low T3 state:*

Most important change observed is low serum T3 which is due to the impairment in the peripheral conversion of T4 to T3. It usually occurs as early as early as 24 hours of onset of the illness[54,55]. These patients are clinically euthyroid but in some there is mild prolongation of the Achilles tendon reflex[56].

Most common phenomenon observed in those with congestive heart failure and acute cardiac injury. Hence in these patients it is serves as a negative prognostic factor i.e.; a patient with low T3 level has a worse prognosis[57].

2. High T4 state:

This is typically seen in the elderly population who has underlying psychiatric illness[58,59]. It occurs due to acute inhibition of deiodinase or due to increase in TBG levels.

3. *Low T4 state:*

As the severity and duration of the illness progress significant changes in TSH and T4 levels are observed[60]. The levels of T4 reach a subnormal value as the binding of T4 to TBG is affected. Reductions in the T4 levels are unlikely due to hormone deficiency. Therefore it serves as marker for multisystem failure in critically ill individuals.

4. Recovery state:

As the patient recovers from the illness these hormonal changes observed tend to normalize gradually. TSH values remain elevated for sometime as the recovery period prolongs in some individuals.

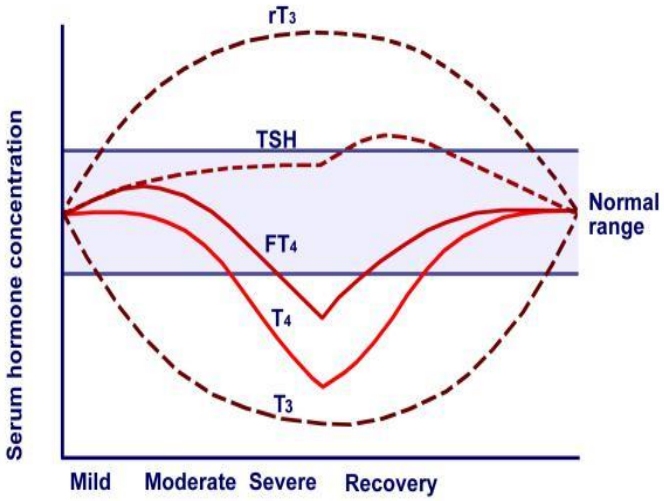


Fig 16. Stages of Sick euthyroid syndrome[61].

Clinical Considerations:

Low T3 syndrome or sick euthyroid syndrome has also been seen in various other conditions. A few examples are:

- Sepsis
- Gastrointestinal diseases
- Pulmonary illnesses
- Renal disorders
- Neoplasias
- Bone marrow transplantation

Low T3 syndrome and ACS:

One of the major target systems for thyroid hormones is the cardiovascular system[62]. The most common alteration in thyroid hormones noted in patients with myocardial infarction, cardiac failure and adults and children who has undergone cardiopulmonary bypass is low levels of circulating T3[63].

The mortality rate in those with acute myocardial infarction with low T3 levels has been found to be higher. Within the first 24 hours of infarction circulating T3 levels fall and by around third day of the insult reaches the highest degree.

During acute myocardial infarction, there is excessive release of cortisol, circulating free fatty acids, free radicals and cytokines which significantly inhibit the enzyme deiodinase. Ischemia triggers the myocytes to produce cytokines particularly interlukin-6.

Reperfusion further increases its production and hence it exert a great influence on the left ventricular ejection fraction. Various other inflammatory markers like TNF-α have also been found to be higher in acute myocardial infarction[64].

Hypothyroidism and CAD:

Clinical hypothyroidism is believed to have detrimental effects on cardiovascular risk factors and hence raises the risk of cardiovascular

diseases. It brings in various lipid abnormalities. It accelerates oxidation of LDL and thereby increases LDL-C and triglycerides[65]. It also increases the plasma levels of homocysteine and CRP[66-69].

Hypofunctioning of the thyroid gland causes activation of adrenergic and sympathetic system and leads to increased vascular stiffness contributing to diastolic hypertension[70-73].

Endothelial dysfunction has been commonly observed in patients with hypothyroidism leading to hyperuricemia and hyperphosphatemia[74,75].

Studies on the effects of hypothyroidism on the natural course of CAD have shown that atherosclerosis was a common occurrence among those with hypothyroidism than those with a normal thyroid function[76].

Hyperthyroidism and CAD:

Hyperthyroidism can lead to myocardial infarction even in the absence of carotid stenosis[77]. Excess thyroid hormones can stimulate the renin-angiotensin-aldosterone system and also it elevates von Willibrand factor which enhances platelet function and thus stimulate platelet plug formation[78,79].

All these changes are reflected as necrosis of the cardiac myocytes, areas of fibrosis and round cell infiltration of the heart[80].

Subclinical hypothyroidism and CAD:

Subclinical hypothyroidism, coronary artery disease and atherosclerosis can be interconnected and the association between them has always been an area of special interest. It is a condition where the TSH values are elevated with a normal T3 and T4 value.

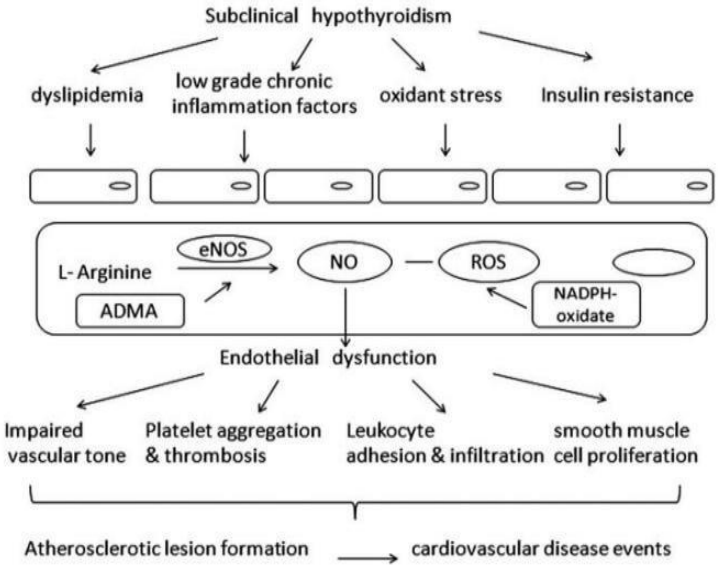


Fig 17. Effects of Subclinical hypothyroidism on Cardiovascular system[81].

Especially in the older individuals it carries a greater risk of atherosclerosis leading to coronary artery disease[82]. Majority of patients with subclinical hypothyroidism ultimately progress to hypothyroidism while in some it normalizes[83].

The chances for it to happen depend on a greater elevation of TSH and presence of detectable antithyroid antibodies in circulation. Subclinical hypothyroidism is considered as an early phase of evolving hypothyroidism.

Subclinical hypothyroidism occurs due to the similar causes as that of clinical hypothyroidism. Unlike in a patient with clinical hypothyroidism, where there is raised cholesterol, triglycerides and LDL-C levels, surprisingly these changes observed are less marked and less consistent.

However these changes are beyond any doubt risk factors for the development of atherosclerotic cardiovascular diseases[12,13].

Thyroid and Atherosclerosis:

Both hypothyroidism and hyperthyroidism can lead to coronary artery diseases. It has also been evident in the recent studies that hypothyroidism exhibit a strong association between atherosclerosis and ischemic heart disease[84].

Endothelial dysfunction marks the early step in atherosclerosis. Patients with hypothyroidism have reduced levels of nitric oxide. The expression of genes that are involved in the metabolism of homocysteine could highly be regulated by thyroid hormones.

Hyperhomocysteinemia intensifies atherosclerosis, impairs the endothelial function and induce thrombus formation[85].

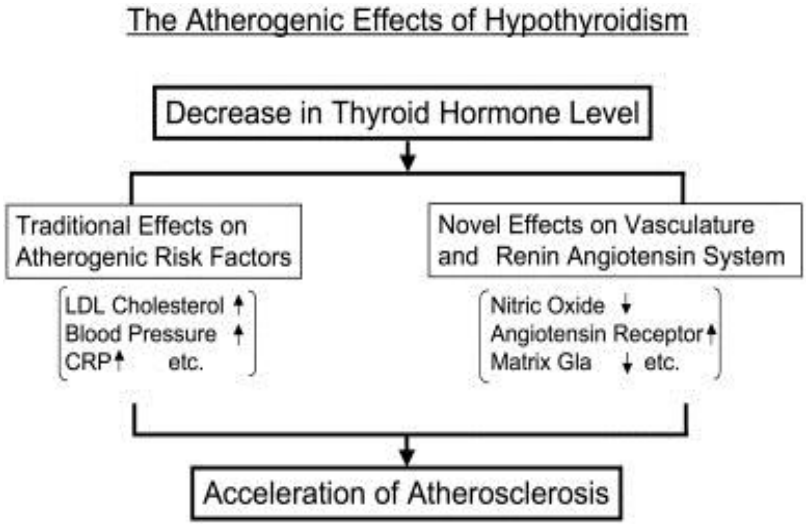


Fig 18. Atherogenic effects of Hypothyroidism[86]

Another interesting fact about thyroid hormones are that they can enhance angiogenesis. It occurs at the capillary level which is dependent on the fibroblast growth factor upregulation[87].

Collateral formation is highly beneficial for the ischemic myocardium, but neovascularization in the atherosclerotic plaque can destabilize the plaque. This can predispose the plaque to rupture and form thrombus[88].

Hence it is evident that thyroid possesses anti-atherosclerotic effects and hypothyroidism can intensify atherogenesis. Therefore maintaining a euthyroid state is very important to prevent the progression of atherosclerosis and various cardiac events.

Treatment of thyroid dysfunction:

Treating thyroid dysfunction is a slow process. Sometimes it takes to a year or even more for the thyroid function to get stabilized. For an underactive thyroid gland or hypothyroidism is treated mainly by Levothyroxine which replaces thyroid hormones.

Hyperthyroidism is a condition where the thyroid gland or the hormone production has to be suppressed. This is usually attained by radioactive iodine treatment, antithyroid medications or surgery.

MATERIALS & METHODS

MATERIALS AND METHODS

Source of Data:

This study was conducted in patients who attended to the General Medicine department of R.L.Jalappa Hospital and Cardiology department of Narayana Hrudhayalaya, Kolar over a period of one and a half years. Institute Human Ethics Committee clearance was obtained and the study proceeded. It was a hospital based cross sectional study consisting of 80 patients who were admitted to the Medical and Cardiology wards.

Those who fulfilled the inclusion and exclusion criteria were only included in the study. After a detailed medical history and general physical examination, those diagnosed with ACS were subjected to thyroid profile studies on day 0 and day 5 to assess the thyroid dysfunction, complications and its outcome in acute coronary syndromes.

Study design:

A cross - sectional study.

Inclusion Criteria:

- Patients with clinical symptoms and signs and laboratory findings suggestive of acute coronary syndrome.

Exclusion Criteria:

- Known case of thyroid dysfunction.
- Sepsis.
- Patients on corticosteroids.
- Patients who have received iodinated contrast agent in the previous two weeks.

Study Parameters:

The following investigations were done in the patients to confirm ACS and assess thyroid dysfunction:

- CBC.
- ECG.
- Cardiac enzymes – CK-MB, Tn-I.
- 2D-ECHO
- FT3, FT4, TSH.

Collection of Data:

The study procedure was explained and after obtaining the written informed consent from the patient in their own language, all of them were thoroughly examined with a detailed medical history and physical examination. These patients were then subjected to appropriate investigations as per the

proforma. Thyroid function tests done on day 0 were repeated on day 5 and both these results were compared.

Estimation of T3, T4 and TSH:

Thyroid hormone profile was estimated using the Electro Chemiluminescence Immunoassay "ECLIA". The test principle for T3 and T4 comprises of the Competition principle. The results are determined through a 2-point calibration and a master curve that is provided through the reagent barcode. The reagents used are M Streptavidin-coated micro particles, R1 Anti-T3-Ab and Anti-T4-Ab~Ru(bpy) and R2 T3 biotin and T4 biotin.

The test principle for TSH comprises of Sandwich principle. The reagents used were M Streptavidin-coated micro particles, R1 Anti-TSH-Ab~biotin and R2 Anti-TSH-Ab~Ru (bpy).

Diagnosis of ACS:

ACS was diagnosed by appropriate medical history suggestive of clinical symptoms and signs. These patients underwent ECG and 2D ECHO and were categorized into STEMI, NSTEMI and UA.

Calculation of the Sample size:

Sample size was estimated by using the 25% proportion of abnormal Thyroid Profile in MI subjects from the study by Saurabh Potdar et al[89]. Sample size was estimated by using the formula:

$N = Z^2pq/ d^2$ where p=25% (0.25)

$= (1.98)^2 \times 0.25 \times 0.75 / (0.1)^2$ q (1-p)= 0.75

= 73

At 10% absolute error and 95% Confidence interval sample size of 73 was obtained. Considering 10% non-response rate Sample size of **73 + 7.3 ≈ 80** MI cases will be evaluated for Thyroid profile in the study.

Statistical analysis:

Collected data will be entered into an excel sheet. Quantitative data will be represented in the form of mean and standard deviation, qualitative data will be represented in the form proportions and chi square will be test of significance. $P<0.05$ will be considered statistically significant.

RESULTS

RESULTS

This was a hospital based cross sectional study, which involved 80 patients who were diagnosed with ACS. Thyroid dysfunction was studied in them on day 0 and the test was repeated on day 5.

Table 6:- Distribution of subjects according to thyroid function on Day 0

Type of Thyroid Dysfunction	Frequency	Percent
Normal	53	66.3
Hyperthyroidism	2	2.5
Hypothyroidism	2	2.5
Low T3 Syndrome	4	5.0
Subclinical hypothyroidism	19	23.8
Total	**80**	**100.0**

Out of the total 80 patients diagnosed with ACS on day 0, thyroid dysfunction was observed in 27 patients and the rest 53 (66.3%) were euthyroid. The different forms of thyroid dysfunction observed were hyperthyroidism, hypothyroidism, subclinical hypothyroidism and low T3 syndrome.

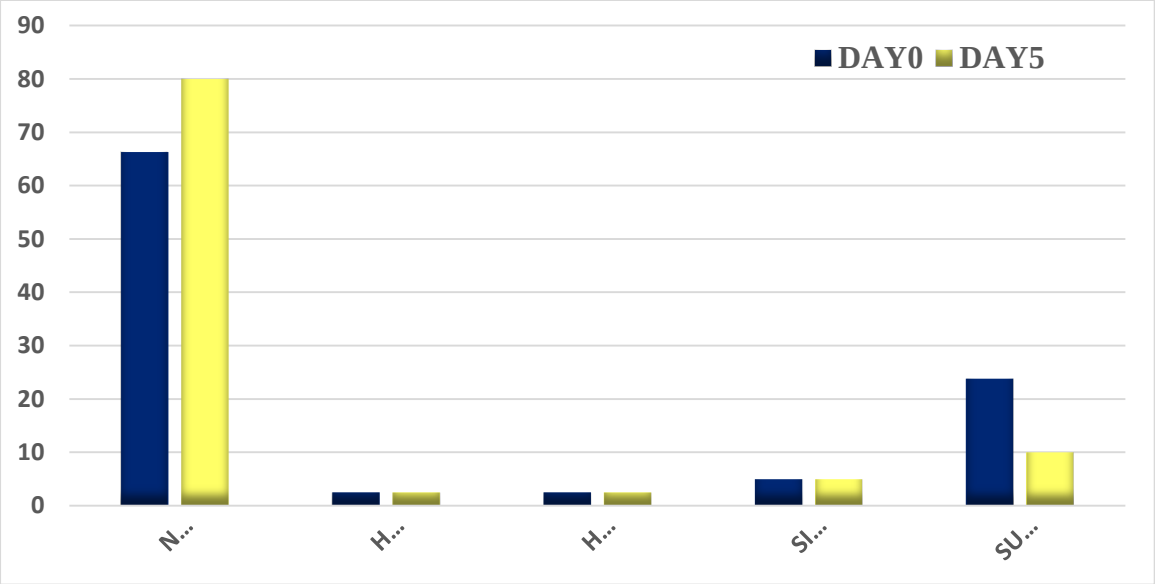
Hyperthyroidism and hypothyroidism were observed in 2 patients each, 2.5% and 2.5% respectively. Majority of them were found to have subclinical hypothyroidism. The frequency of subclinical hypothyroidism was observed in 19 patients (23.8%). Low T3 syndrome was observed only in 4 patients (5.0%).

Table 7:- Distribution of subjects according to thyroid function on Day 5

Type of Thyroid dysfunction	Frequency	Percent
Normal	64	80.0
Hyperthyroidism	2	2.5
Hypothyroidism	2	2.5
Low T3 syndrome	4	5.0
Subclinical hypothyroidism	8	10.0
Total	**80**	**100.0**

It was observed on day 5 that thyroid dysfunction returned to normal in majority (64 patients, 80%) of these patients. When hypothyroidism, hyperthyroidism and low T3 syndrome persisted, the incidence of subclinical hypothyroidism had significantly come down to10%.

Only 8 patients were having subclinical hypothyroidism. The incidence had come down to 10% from 23.8%.



graph 1:- Graph showing Distribution of subject according thyroid function on Day 0 and Day5

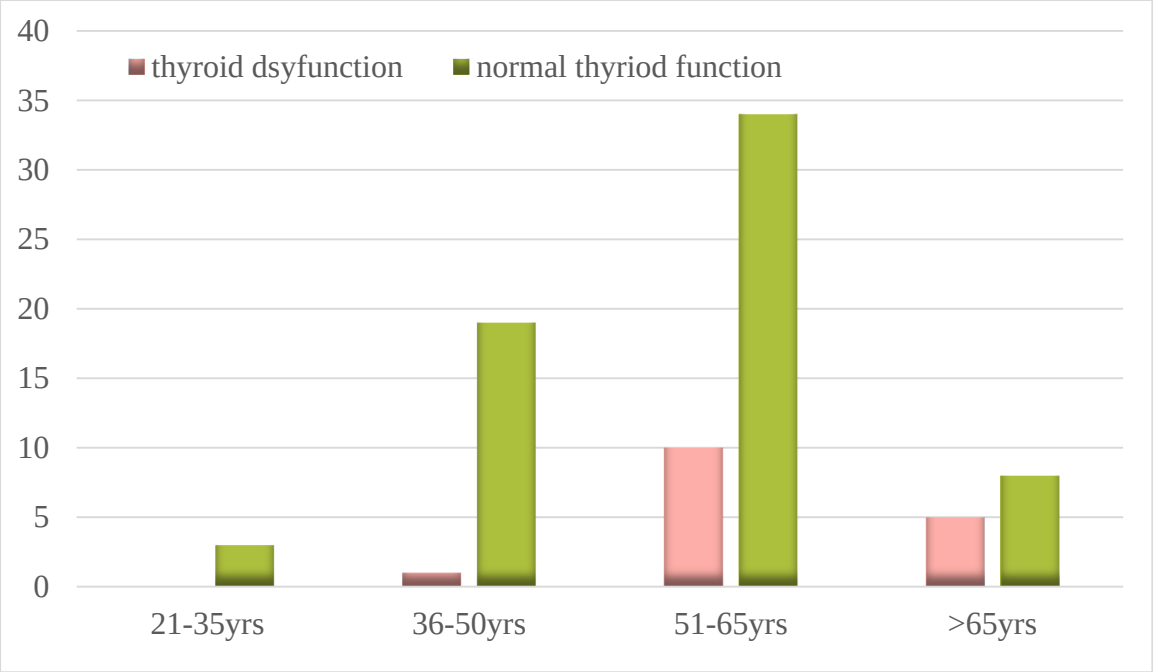
Table 8:- Distribution of subject according to thyroid function and Age group

Age group	Thyroid function		Total	P value
	Abnormal	*Normal*		
21-35	0	3	3	**0.088**
	0.0%	4.7%	3.8%	
36-50	1	19	20	
	6.3%	29.7%	25.0%	
51-65	10	34	44	
	62.5%	53.1%	55.0%	
>65	5	8	13	
	31.3%	12.5%	16.3%	
Total	16	64	80	
	100.0%	100.0%	100.0%	

Table 3 describes distribution of patients with thyroid dysfunction belonging to various age groups. Thyroid dysfunction was most commonly noted in the age group 51 - 65 years. The incidence was found to be 62.5%. The incidence among those more than 65 years was 31.3%. The incidence was least found in the age group 36 - 60yrs (6.3%).

Interestingly none of the patients belonging to the age group 21 - 35 were diagnosed with thyroid dysfunction. Hence there were no statistically any

significant differences observed between the age group and thyroid dysfunction.



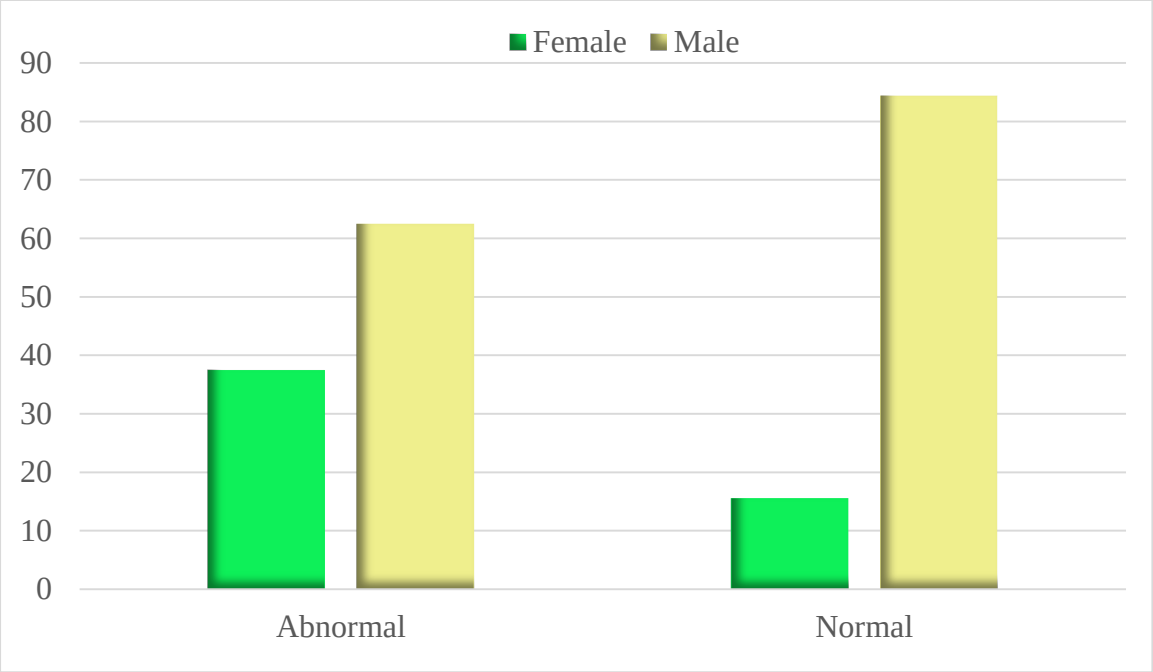
graph 2:- Graph showing Distribution of subjects according to thyroid function and Age group

Table 9:- Distribution of subjects according to thyroid function and sex

Sex	Thyroid function		Total	P value
	Abnormal	***Normal***		
Female	6	10	16	**0.136**
	37.5%	15.6%	20.0%	
Male	10	54	64	
	62.5%	84.4%	80%	
Total	16	64	80	
	100.0%	100.0%	100.0%	

In our study, there was a male predominance with 62.5% being diagnosed to have thyroid dysfunction. Out of the 80 patients, 64 were males and only 16 were females. Of the 64 males, 10 were found to have abnormal thyroid profile.

Females contributed only to 37.5%. Majority of the females were euthyroid and only 6 were found to have thyroid dysfunction. It was very evident in our study that there was no statistical significance between gender and thyroid dysfunction.



Graph 3:- Graph showing Distribution of subjects according to thyroid function and sex

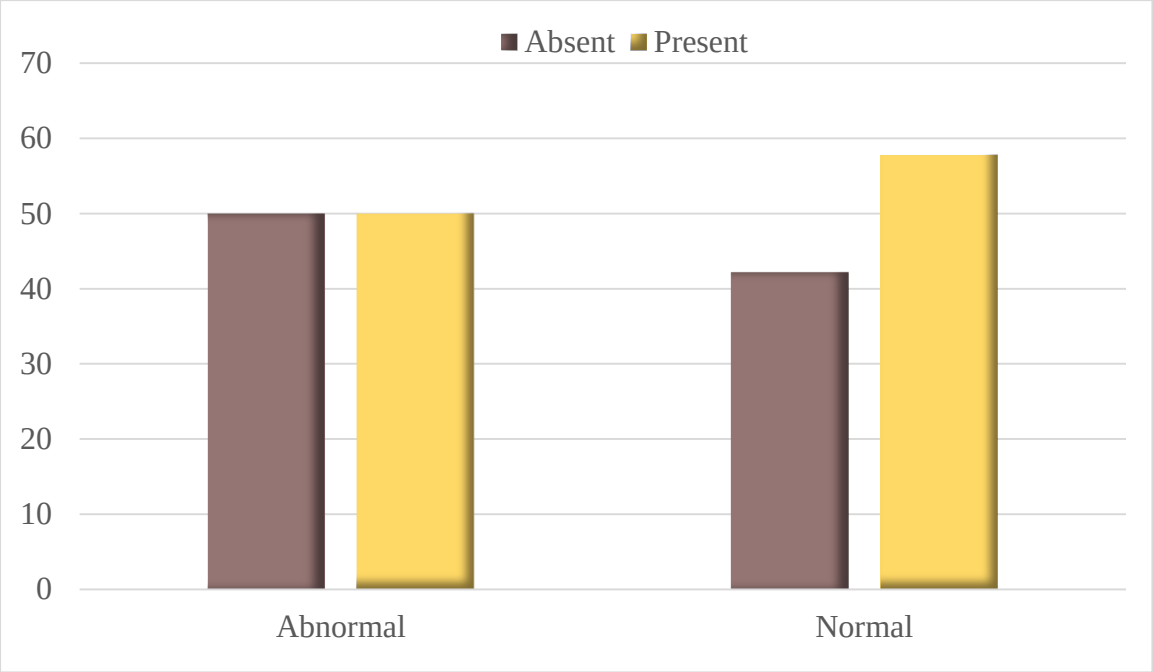
Table 10:- Distribution of subjects according to thyroid function and Smoking

Smoking	Thyroid function		Total	P value
	Abnormal	***Normal***		
Absent	8	27	35	**0.721**
	50.0%	42.2%	43.7%	
Present	8	37	45	
	50.0%	57.8%	56.3%	
Total	16	64	80	
	100.0%	100.0%	100.0%	

In the present study, thyroid dysfunction was observed in equal no: of patients with the risk factor smoking. That is, we had 45 smokers among whom only a minority was diagnosed to have thyroid abnormality. Only 8 patients (50%) had thyroid derangement.

In the non-smoking group, there were a total of 35 patients with only 8 patients (50%) diagnosed to have derangement in their thyroid profile. Majority who smoked (57.8%) did not have any form of thyroid abnormalities.

Thus there was no statistically any significance observed between smoking and thyroid dysfunction.



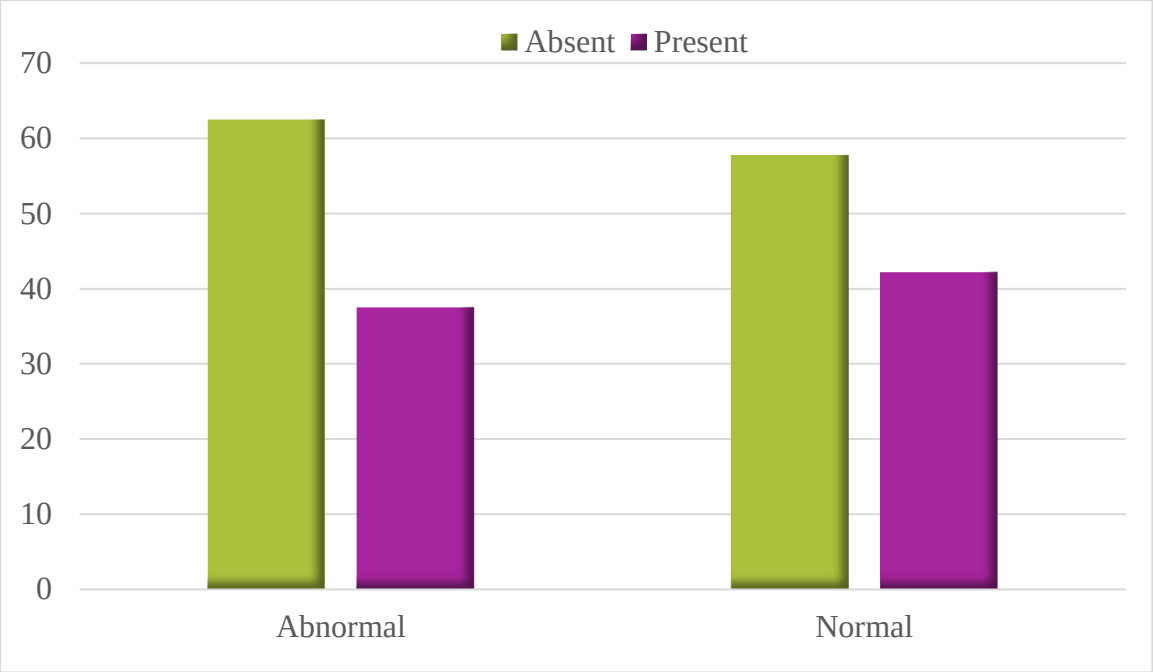
Graph 4:- Graph showing Distribution of subjects according to thyroid function and smoking

Table 11:- Distribution of subjects according to thyroid function and Alcohol

Alcohol	Thyroid function		Total	P value
	Abnormal	***Normal***		
Absent	10	37	47	**0.817**
	62.5%	57.8%	58.7%	
Present	6	27	33	
	37.5%	42.2%	41.3%	
Total	16	64	80	
	100.0%	100.0%	100.0%	

There were a total of 33 patients (41.3%) who consumed alcohol. Out of which only a minority, 6 patients (37.5%) were diagnosed to have abnormality with thyroid. Remaining 27 (42.2%) were euthyroid.

Similarly in the nonalcoholics too only 10 patients (62.5%) were found to have thyroid abnormality. Hence like the other risk factors like age, gender and smoking, alcohol consumption too did not have any strong association with thyroid dysfunction.



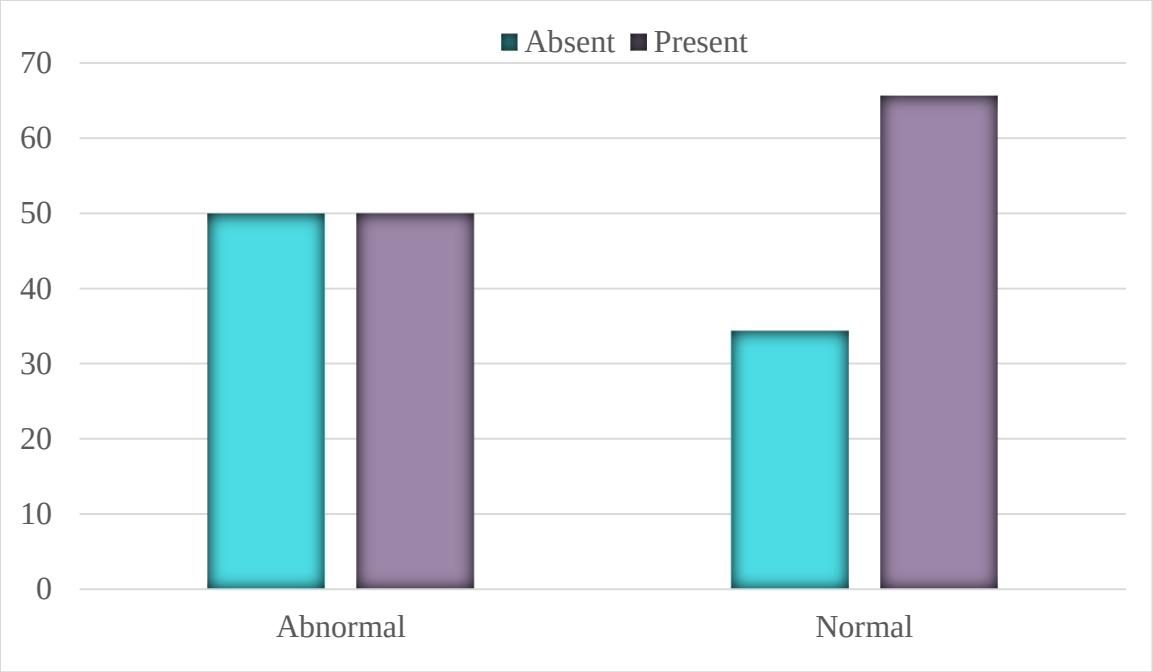
Graph 5:- Graph showing Distribution of subject according thyroid function and alcohol

Table 12:- Distribution of subjects according to thyroid function and DM

DM	Thyroid function		Total	P value
	Abnormal	***Normal***		
Absent	8	22	30	**0.248**
	50.0%	34.4%	37.5%	
Present	8	42	50	
	50.0%	65.6%	62.5%	
Total	16	64	80	
	100.0%	100.0%	100.0%	

Majority of the patients were diabetics in our study. Out of the 80 patients 50 of them (62.5%) were found to have high blood sugar values. Among them majority did not have thyroid derangement, only 50% (8 patients) had abnormality in thyroid function.

Rest of the 30 patients were euglycemic and among them only 8 (50%) had thyroid dysfunction. Here also we did no observe any clinical significance between one of the major risk factor Diabetes mellitus and thyroid dysfunction.



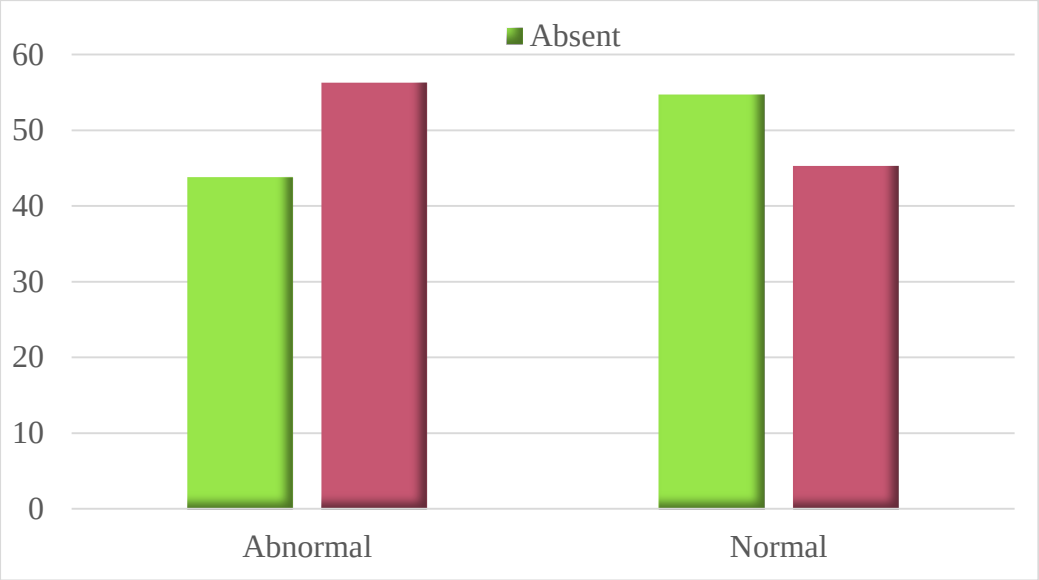
Graph 6:- Graph showing Distribution of subjects according to thyroid function and DM

Table 13:- Distribution of subjects according to thyroid function and HTN

HTN	Thyroid function		Total	P value
	Abnormal	***Normal***		
Absent	7	35	42	**0.577**
	43.8%	54.7%	52.5%	
Present	9	29	38	
	56.3%	45.3%	47.5%	
Total	16	64	80	
	100.0%	100.0%	100.0%	

One of the major risk factor hypertension too was observed in 38 patients with ACS. Among them only 9 patients (56.3%) with hypertension as a major risk factor had thyroid abnormality.

Remaining 35 patients (54.7%) of a total 42 patients did not have hypertension or thyroid abnormality. Among them only 7 (43.8%) were found to have abnormal thyroid levels. Again here also we could not find any clinical significance with hypertension and thyroid abnormality.



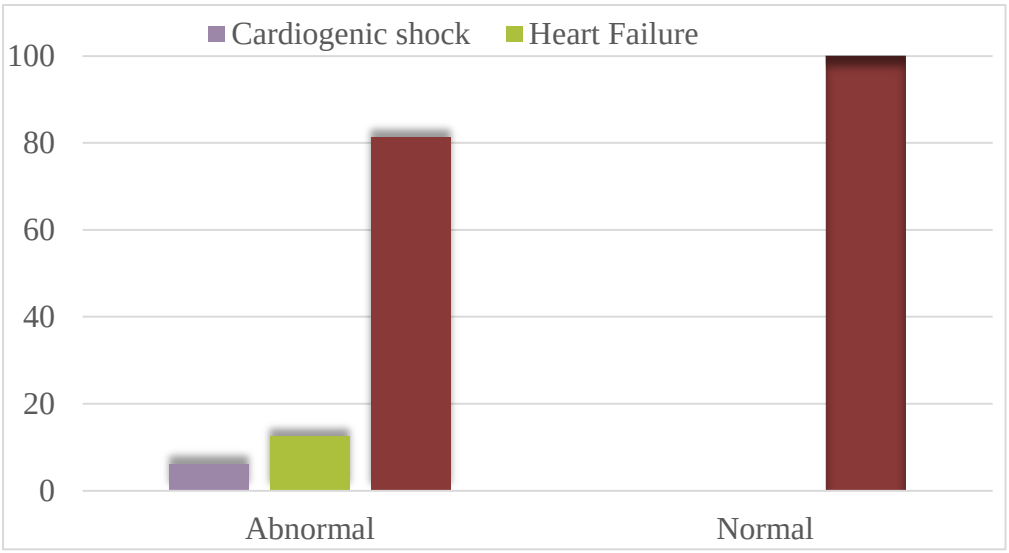
Graph 7:- Graph showing Distribution of subjects according to thyroid function and alcohol

Table 14:- Distribution of subjects according to thyroid function and complication

Complications	**Thyroid function**		**Total**	**P value**
	Abnormal	***Normal***		
Cardiogenic shock	1	0	1	**0.006**
	6.2%	0.0%	1.2%	
Heart failure	2	0	2	
	12.5%	0.0%	2.6%	
NIL	13	64	77	
	81.3%	100.0%	96.3%	
Total	16	64	80	
	100.0%	100.0%	100.0%	

Complications observed in our study were cardiogenic shock and heart failure. Majority of them did not develop any complications. Only 3 of them were found to develop complications of which 2 (12.5%) of them had heart failure and only 1 (6.2%) had cardiogenic shock.

The complications were seen in those with low T3 syndrome.



Graph 8:- Graph showing Distribution of subjects according to thyroid function and complication

DISCUSSION

DISCUSSION

Acute Coronary Syndrome is one of the leading causes of mortality and morbidity both in India and in the worldwide.[90] Thyroid hormonal changes could result in the functional derangement of the cellular metabolism and affecting almost all the organs including the heart. This study was carried out with the aim of assessing the prevalence of thyroid dysfunction its outcomes.

This study titled "Association of thyroid profile in Acute coronary syndrome" was carried out in the Department of Medicine and in the Department of cardiology, RL JALAPPA hospital and Narayana Hrudhayalaya, Kolar. It was a Cross sectional study and was conducted over a period of one and a half years.

Incidence of thyroid dysfunction:

In the present study, majority (53 patients) were found to be euthyroid. On day 0 when thyroid function tests were performed 27 (33.8%) of them were found to have various forms of thyroid abnormalities. It was observed to be hypothyroidism, hyperthyroidism, subclinical hypothyroidism and low T3 syndrome.

Out of these 27, 23.8% were diagnosed with subclinical hypothyroidism. Hypothyroidism and hyperthyroidism were present in 2 patients each. Rest of the 4 (5%) were found to have low T3 syndrome. These 4 patients were later found to develop complications due to ACS.

On the 5th day when the thyroid profile was repeated, there was a significant reduction in the number of patients with thyroid dysfunction. Number of patients with subclinical hypothyroidism had come down to 8 (10%) from 19. Low T3 syndrome was still observed in the 4 patients while thyroid dysfunction still persisted in the remaining 4 patients (5%).

In our study the most common form of thyroid dysfunction noted was subclinical hypothyroidism (5%). Similar observations were also seen in study conducted by Osama A et al[91]. The prevalence of subclinical hypothyroidism predominated in their study with a frequency of 5.6%.

In the study conducted by Faiza A Q[92] even though he observed subclinical hypothyroidism as the major form of thyroid dysfunction, however the prevalence was only 2.7% of the total patients. The prevalence of subclinical hypothyroidism was observed to be even as high as 10.76% of the patients in the study conducted by Okuyan Ertugrul et al[93].

Even though our study had only 4 patients (5%) who demonstrated low T3 syndrome, there are still higher incidences of low T3 syndromes observed in various studies conducted by Rodrigo et al, Osama A et al and Faiza A Q[92]. The values are 18%, 15% and 10% respectively.

Association of thyroid dysfunction and complications

Significant number of complications and mortality has been reported because of thyroid dysfunction in acute coronary syndrome.

Majority of them in our study that is a total of 77 patients (96.3%) were found to be free of any complications from ACS. But among this 77, thyroid function tests were deranged in 13 patients (81.3%). Remaining 64 of them were euthyroid and also were free of any complications. These 13 patients although had thyroid dysfunction, they too did not develop any complications.

Nonetheless thyroid dysfunction was significantly associated with complications like heart failure (12.5%) and Cardiogenic shock (6.2%) in our study. Interestingly, only in those with low T3 syndrome, these complications were present. Two of them developed heart failure and 1 of them went into cardiogenic shock. Fortunately other complications described were not observed in our study population.

Our study was comparable with the study conducted by Osama A et al[91], who also observed that the risk of occurrence of shock (6.04%), arrhythmia (2.05%) and re-infarction (1.67%) increased with thyroid dysfunction than the euthyroid cases, in acute coronary syndrome.

There was a significant statistical correlation observed between low T3 and left ventricular dysfunction, poor LVEF and cardiogenic shock in the study conducted by Shilpa Deoke and Ujwala Walvi[94].

There was a strong association between thyroid dysfunction and the development of complications in our study. The level of clinical significance is as evidenced by a p value <0.006.

Thus, it can be concluded that low T3 in AMI is associated with a poor LV function during short term follow-up. It is evident from the observations made in our study.

Alteration of thyroid dysfunction on day 0 and day 5

Thyroid function tests were performed on the day of admission that is; day 0 and it was repeated on day 5 in the study population of 80 patients. The test was repeated to compare the results on these two days to assess thyroid dysfunction in ACS.

We observed that thyroid dysfunction was present in 27 patients (33.8%) out of the total 80 patients in the study on day 0. Interestingly on day 5 when the test was repeated, majority (64 patients, 80%) of them returned to normal. This could probably be due to the acute stress releasing various inflammatory markers and its contribution.

On day 0, majority of them among these 53 were found to have subclinical hypothyroidism. A total of 27 patients were diagnosed with different forms of thyroid dysfunction. About 19 (23.8%) of them had subclinical hypothyroidism. Around 4 (5%) were found to have low T3 syndrome. Hyperthyroidism and hypothyroidism were observed in 2 patients each 2.5% and 2.5% respectively.

On day 5, the number of patients with subclinical hypothyroidism had significantly come down to 10% (8 patients). While hypothyroidism and hyperthyroidism still persisted in those 4 patients (5%), low T3 syndrome was observed in only 4 patients (5%).

Our study was hence comparable with that of Portar S et al[89]. Among the total 30 patients in their study, 20% were found to have thyroid dysfunction on day 0. Among this 20%, 21.6% showed evidence of low T3 syndrome with a significant p value {$p<0.05$}.

Like in our study, subclinical hypothyroidism was found to be the major form of thyroid dysfunction observed Porter S et al study[89]. About 14.28% were found to have subclinical hypothyroidism of the total 30 patients.

Hence our study showed persistence of thyroid dysfunction in 16 patients (20%) with predominance of subclinical hypothyroidism in 8 patients (10%).

Association of thyroid dysfunction with Age

In our study there was a higher incidence of thyroid dysfunction to be observed in patients belonging to the age group51-65 years (62.5%). Lesser incidence in those above 65 years (31.3%). None of the patients belonging to the age group 21 - 35 years were diagnosed to have thyroid abnormality.

Our findings could be comparable to the study conducted by Vijay K S, Satyam P, Kohli S C[95] where 62 of them (62%) were above 60 years and 32 of them (32%) belonged to age group 40-60 years.

Association of thyroid dysfunction and sex

Our study showed a male predominance than females. It was observed that 64 of them were males and only 16 of them were females. Among this 64, 10 patients (62.5%) were diagnosed with thyroid dysfunction whereas only 6 among the females had thyroid abnormality.

This was again similar to the observations noted by Vijay K S, Satyam P, Kohli S C[95]. In their study there were 58 male patients (58%) and 42 female patients (42%) who had thyroid dysfunction.

Association of risk factors and thyroid dysfunction

The incidence of thyroid abnormality in diabetics in our study was 50% (8 patients). Similar to our observations, in the studies conducted by Primental et al[96], and Vijay K S, Satyam P, Kohli S C[95], also noticed 13 patients (18.6%) and 5 patients respectively showed thyroid dysfunction along with diabetes mellitus.

In our study risk factors like hypertension, alcoholism and smoking was observed in 9 patients (56.3%), 6 patients (37.5%) and 8 patients (50%) respectively. This was statistically insignificant as the p value was >0.01.

Hence hypertension, alcohol and smoking did not influence the prevalence of thyroid dysfunction.

CONCLUSION

CONCLUSION

Thus, it is evident from the observations in our study that low T3 in AMI is associated with a poor LV function during short term follow-up.

- Subclinical hypothyroidism and low T3 syndrome are common in acute coronary syndrome.

- Low T3 syndrome was associated with the complications associated with thyroid dysfunction in acute coronary syndrome.

- Diabetes, hypertension, smoking, alcohol consumption and age did not have correlation with the outcomes.

Concisely, the changes that happen with thyroid hormones and its regulations seem to be an adaptive response of the endocrine system to an acute illness. Most of the times it is difficult to explain thyroid profile in a critically ill patient, as there could also be an intrinsic thyroid dysfunction. Therefore it is very important to assess the patient clinically and also to determine the duration and severity of the illness.

Most of these patients do not require any thyroid hormone replacement therapy. It is advisable to evaluate a patient for thyroid dysfunction until he has fully recovered from the acute illness.

SUMMARY

SUMMARY

This was a hospital based cross sectional study, which consisted of 80 patients who attended to the Department of General Medicine at R.L.Jalappa Hospital Kolar and to the Cardiology department of Narayana Hrudhayalaya. The study was conducted over a period of one and a half years from January 2016 to June 2017. 80 patients who fulfilled the inclusion and exclusion criteria were selected for the study.

These patients were then evaluated in detail with medical history, physical examination and biochemical investigations. This study aimed at finding the prevalence of thyroid dysfunction among patients with acute coronary syndromes and its relation with the outcome.

Hence the major investigations were ECG to diagnose ACS and thyroid function tests to detect thyroid abnormality. Various other investigations were also performed.

Thyroid profile was repeated on the 5^{th} day of admission to assess the association between thyroid dysfunction and ACS.

- In the present study, thyroid function tests were performed on day 0 and on day 5 of admission. It was observed that majority of the patients did not have any form of thyroid abnormality.
- Out of the 80 patients on day 0 only 27 (33.8%) were diagnosed with thyroid dysfunction.

- Our study showed a persistence of thyroid dysfunction in 16 patients (20%) on day 5 with predominance of subclinical hypothyroidism.
- Subclinical hypothyroidism was the major form of thyroid dysfunction observed. It was 23.8% on day 0 which had reduced to 10% on day 5.
- Low T3 syndrome was observed in 4 patients (5%) both day 0 and day 5.
- There was a strong association between thyroid dysfunction and the development of complications in our study. The level of clinical significance is as evidenced by a p value <0.006.
- Most common complication observed was heart failure occurring in 2 patients (12.5%) when compared to other complications.
- Only 1 patient (6.2%) went into cardiogenic shock.
- The major risk factors of ACS, its relation with thyroid dysfunction were also studied. The major risk factors were smoking, alcohol consumption, diabetes and hypertension.
- Considering the age group, thyroid dysfunction was more prevalent in the age group 51 - 65 years (62.5%). Above 65 years of age 31.3% had thyroid derangement.
- Out of the 80 patients, 64 (80%) were males and 16 (20%) were females.
- There were 45 smokers in the study and thyroid abnormality was detected in only 8 (50%) of them.
- Only a few 37.5%, among those who consumed alcohol were found to have thyroid abnormality.

- Only a minority, 50% among the diabetic population and 56.3% with hypertension had thyroid abnormality.
- Therefore we did not observe any clinical significance between these risk factors and thyroid abnormality.

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ANNEXURES

PROFORMA

SL. No:
Date:

Name:

Age:

Occupation:

Address:

OP/ IP No:

CHIEF COMPLAINTS:

HISTORY OF PRESENT ILLNESS:

Onset

Duration

Progression

Drugs - OCP's

Chronic illness- Diabetes Mellitus, Hypertension, Smoking.

PAST HISTORY:

FAMILY HISTORY:

ON EXAMINATION:

GENERAL PHYSICAL EXAMINATION:

- BULIT AND NOURISHMENT- BMI
- PALLOR / ICTERUS / CLUBBING / CYANOSIS / PEDAL OEDEMA / LYMPHADENOPATHY/ SKIN TAGS/ XANTHOLESMA
- VITALS :
    - TEMPERATURE –
    - PULSE RATE- RATE/ RHYTHM -
    - RESPIRATORY RATE -
    - BLOOD PRESSURE –

SYSTEMIC EXAMINATION:

- CARDIOVASCULAR SYSTEM
- RESPIRATORY SYSTEM
- ABDOMEN
- CNS

INVESTIGATIONS:

1. ECG
2. THYROID PROFILE

	F T3	F T4	TSH
Day 0			
Day 4			

3. COMPLETE HAEMOGRAM

4. CK-MB

5.Trop-I

6. 2D ECHO

PROVISIONAL DIAGNOSIS:

CONSENT FORM

Study title: ASSESSMENT OF THYROID PROFILE IN PATIENTS WITH ACUTE CORONARY SYNDROME

PG guide's name: Dr. P.N.VENKATARATHNAMMA

Principal investigator: DR. MEENA MENON. C

Name of the subject:

Age :

Address :

a. I have been informed in my own vernacular language the purpose of the study, the necessity of relevant investigations to be carried out and photographs to be taken.
b. I understand that the medical information produced by this study will become part of institutional record and will be kept confidential by the said institute.
c. I understand that my participation is voluntary and may refuse to participate or may withdraw my consent and discontinue

participation at any time without prejudice to my present or future care at this institution.

d. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).
e. I confirm that _____ (name of PG guide) has explained to me the purpose of research and the study procedure that I will undergo and the possible risks and discomforts that I may experience, in my own language. I hereby agree to give valid consent to participate as a subject in this research project.

Participant's signature

Signature of the witness: Date:

I have explained to _____ (subject) the purpose of the research, the possible risk and benefits to the best of my ability.

Guide signature Date:

KEY TO MASTER CHART

- H no – hospital number
- F – female
- M – male
- FT3 – free triiodothyronine
- FT4 – free tetraiodothyronine
- TSH – thyroid stimulating hormone
- DM – diabetes mellitus
- HTN – hypertension
- CK – MB – creatinine kinase MB
- Trop – I - Troponin I

H.no	age	gender	FT3 Day 0	FT3 Day 5	FT4 Day 0	FT4 Day 5	TSH Day 0	TSH Day 5	DM	HTN	CK-MB	TROP-i	smoking	ALCOHOL	COMPLICATIONS
305331	45	m	4.62	4.05	11.8	11.8	0.9	0.88	present	–	5	1	present	present	–
25802	75	F	3.75	3.77	19.11	15.09	6.87	6.56	present	present	5.76	2.3	–	–	–
334961	67	F	6.65	6.99	14.23	17	3.2	3.54	–	–	8	2.6	–	–	–
242661	55	M	4.33	4.35	21	21.9	0.94	0.81	present	present	4.87	1.8	–	present	–
333804	60	M	5.8	6	20.2	21	6.43	4.8	present	present	6	6	present	present	–
305339	54	M	3.9	3.87	18.7	19	1.6	1.5	present	–	6.45	4.3	present	present	–
335773	55	M	4.2	4.35	16	14.3	1.9	2.04	–	–	5.78	2	present	present	–
335599	45	M	5.2	5.26	13.6	13.6	3.88	3.62	–	present	7.2	3.88	present	–	–
335728	58	M	5.9	6.01	13	17.66	3.6	4	present	present	6.23	4	–		–
335697	37	M	5.68	5.78	16.2	15.4	2.66	2.46	present	–	7.56	5.4	present	–	–
305357	51	F	4.7	4	12.8	12.5	8.66	7.2	–	present	8.12	2.5	–	–	–
337092	63	M	6.5	8.35	20	18.4	0.33	0.255	present	present	5.9	6	–	present	–
306301	65	F	4.2	4.44	15	14.6	5.8	5.97	present	present	7.34	2.78	–	–	–
333965	56	M	3.9	3.89	13.9	13.6	3.26	3.22	–	–	6.22	1.5	present	present	–
334711	65	M	5.22	5.62	17.09	16.89	3.6	3.5	–	–	12	1	present	–	–
344127	68	M	3.66	3.7	17.45	17.28	3.6	3.4	–	present	7.98	2.65	present	–	–
343021	32	M	5.78	5.65	14.69	14.56	2.6	2.3	present	present	5.8	3.6	–	present	–
376146	41	M	3.32	3.4	13.78	13.55	1.67	1.54	present	–	4.96	4	–	–	–
370859	62	F	2.65	2.4	15	15.16	2.57	2.6	–	–	5.28	2	–	–	heart failure
376984	24	M	5.4	5	18.67	18.45	3.8	3.5	present	–	8.3	3.7		–	–
340480	60	M	4.78	4.6	16.4	16.26	2.5	2.01	present	–	6.97	1.56	present	present	–
376942	45	M	4.34	4.2	13.56	13.37	5.45	4.12	–	–	7.9	2.44	–	present	–
340716	56	M	3.67	3.8	15.67	15.46	2.35	2.1	–	–	6	6.1	present	–	–
377027	61	M	2.88	2.9	11.05	11.6	9.1	8.6	–	present	8.88	4	present	–	–
341455	53	M	4.6	4.54	14.78	14.48	3.54	3.4	present	present	9.4	1.66	present	–	–
343701	68	M	3.88	3.87	17.03	16.9	2.6	2.3	present	present	6	3	present	present	–
379793	68	M	6.1	6.22	13.56	14.12	3	3	present	–	8.78	4	present	present	–
340596	68	M	4.8	4.97	16.25	16.12	5.66	4.15	present	–	6	1.8	present	present	–
375713	48	M	5.63	5.66	15.27	15.11	1.01	1.05	–	present	5.66	2.76	present	present	–
333965	56	M	4.34	4.5	16.32	16.22	6.22	4.16	present	present	8	5	present	–	–
334711	65	M	3.76	3.9	14.29	14.38	3.6	3.4	–	–	7.67	2.6	present	present	–
375650	78	M	5.78	5.66	13.12	13.04	8.78	8.06	–	–	6.89	3.5	–	–	–
400319	52	M	5.84	5.77	17.26	17.11	3	3	–	present	9	3	–	present	–
393669	42	M	4.66	4.5	14.28	14.27	1.46	1.34	present	present	6.7	8	present		–
398622	65	M	3.98	4.02	13.57	13.45	2.52	2.4	present	present	8.2	4.3	present	present	–
402076	60	M	5.76	5.65	13.8	13.63	3.7	3.5	–	–	7.7	2	present	–	–
389046	60	F	4.66	4.43	14	14	2	2	present	–	6.89	1.8	–	–	–
384263	38	M	5.01	5.4	14.2	14.4	1.8	1.75	present	present	6.2	5	present	present	–
390013	63	M	4.34	4.22	13.4	13	7.36	4.2	present	present	7	1.45	present	–	–
484118	50	M	5.11	5.2	16.43	16.34	3	3	–	present	4.98	1	present	–	–
392514	66	M	4.66	4.87	14	14.2	7.35	7.11	present	–	6.7	2.8	present	present	–
476755	55	F	3.99	4.11	13.22	13.25	3.5	3.33	present	present	6.9	4.5	–	present	–

384522	68	M	3.79	3.98	18.43	18.32	2.4	2.4	present	–	7.9	7.6	present	present	–
400076	60	M	2.44	2.25	16.44	16.08	3.56	3.6	–	–	5.2	3	present	–	–
335728	58	M	5.22	5.61	18.5	18.1	1.53	1.47	present	present	5.33	5	present	present	–
403465	56	M	4.21	4.45	14.2	14.5	2	2	present	–	8.6	4.8	present	–	–
399088	30	M	5.39	5.7	15.7	15.3	5	4	–	–	9.56	3.66	present	–	–
389993	55	M	4.85	4.9	15	15	1.52	1.28	present	present	8.22	1.78	–	–	–
387473	60	M	4.66	4.7	17	17.8	10.01	9.77	present	present	5.9	2.66	present	present	–
399106	45	M	5.34	5.2	13	13	2.52	2.44	present	–	6.7	4	–	present	–
414152	64	F	3.75	3.9	16	16	6.4	4.15	present	–	9	3.9	–	–	–
414863	64	M	5	4.88	14.57	14.47	3.6	3.3	present	–	5.8	2.43	–	present	–
412295	45	M	5.3	5.66	16	16	3	3	–	present	6.22	7	present	–	–
414546	60	F	4.71	4.6	13	13	7.9	4.18	present	present	6.7	1.35	–	–	–
413792	51	M	5.23	5.3	17.8	17.4	2.45	2.32	–	–	6	2	present	–	–
414940	60	M	4.55	4.8	13	13	1	1.06	present	–	7.9	2.45	–	present	–
414842	36	M	2.9	2.76	14.88	15.2	2.67	2.78	present	present	5.8	1.23	present	–	diogenic sh
279912	76	M	6.1	5.9	17	17	1	0.89	–	present	9	3	present	–	–
414602	58	M	3.88	3.67	18.3	18.1	1	1	present	present	6.8	1.16	–	present	–
413686	45	F	5.7	5.55	14.78	14.64	1.34	1.22	present	–	7.8	0.98	–	–	–
414966	40	F	4.9	4.78	14.62	14.5	5.02	4.2	present	–	8	2.9	–	–	–
414179	65	M	2.87	2.7	10	10.02	10	10.01	present	present	4.99	4	present	present	–
429131	44	F	4.32	4.1	17.05	17.1	1.09	0.99	–	–	7.9	5	–	–	–
460540	47	M	6.2	5.9	16.48	16.45	3	3	present	–	6.98	3.1	present	–	–
423259	62	M	3.88	4.2	13.5	13.46	1.48	1.35	present	–	7.89	4.6	present	–	–
460014	45	M	5.1	5.03	18.66	18.5	6.11		present	–	6.77	2	–	–	–
426624	81	F	3.99	3.78	17.57	17.45	2	1.95	present	present	9	3.33	–	–	–
426604	85	F	2.12	2.05	17.8	17.66	2.78	2.67	–	–	5.8	2	–	–	heat failure
455628	54	M	4.06	3.98	12.99	12.78	2.6	2.43	present	present	5	1.8	present	present	–
429591	55	M	5.11	4.98	15.25	15.17	2.46	2.53	present	present	6.8	5.23	–	present	–
457269	60	M	5.11	4.87	13.8	13.67	2	2	–	–	7.12	4.32	present	–	–
419241	70	F	7.66	7.8	22.09	22.11	0.37	0.33	–	–	9.06	5	–	–	–
458956	45	M	5.4	5.26	14.87	14.67	1.46	1.34	–	–	5.76	10.6	–	–	–
485998	56	M	3.77	3.9	16.12	16.1	3.66	3.74	–	present	8.66	6.2	present	–	–
480200	44	M	4.78	4.66	13.89	13.67	4.23	4.15	present	–	7.67	3.78	–	present	–
485484	60	M	5.12	5.07	16.33	16.25	3.9	3.8	present	present	6.45	4	present		–
215538	53	M	3.96	3.77	18.6	18.54	6.14	4.2	–	present	8.97	1.6	–	–	–
479911	55	F	5.8	5.67	13.02	12.9	3.2	3	present	present	6	0.9	–	–	–
478935	50	F	4.6	4.23	15.66	15.45	5.34	4.09	present	–	7.98	2.5	present	present	–
492224	58	M	4.65	4.7	13.34	13.2	8.56	8.22	–	–	5.87	1	present	present	–