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THE RELATIONSHIP BETWEEN SERUM TOTAL TESTOSTERONE LEVELS AND CORONARY ARTERY DISEASE IN YOUNG: NOVEL APPROACH

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I. ABSTRACT

Background: In males, testosterone, an androgenic hormone, provides protection against multiple diseases including coronary artery disease (CAD). Evidence suggests a link between low serum testosterone and increased risk of CAD in the male population of varying ages. The main objective of the present study was to assess the relationship of serum testosterone level with coronary artery disease in young Indian men.

Methodology:A cross-sectional study was conducted on 75 male patients of age 44 years and below who were diagnosed with CAD on coronary angiography. The present study was conducted at the Departments of Cardiology at J.N Medical College, KAHER University, Belagavi, North Karnataka, India, during the period of May 2020 – January 2022. Venous blood samples were analyzed to collect biochemical parameters like testosterone, lipid profile, and troponin. Coronary angiography was performed to assess the frequency and severity of CAD. Collected data were analyzed using different statistical tools like chi-square and Pearson correlation tests on the SPSS software v24.0. A p-value below 0.05 was considered significant.

Results: Majority (36%) of patients were between 18-25 age group. Most of them had single-vessel disease (37.3%), and mild Lv dysfunction (62.7%). Serum testosterone levels showed insignificant association with comorbidities like hypertension ($\chi2 = 3.389$, $p > 0.05$), diabetes mellitus ($\chi2 = 31.705$, $p > 0.05$) and left ventricular ejection fraction ($\chi2 = 12.791$, $p > 0.05$). Serum testosterone level showed significant association with tobacco consumption / smoking ($\chi2 = 11.889$, $p = 0.008$). Low Serum testosterone level was significantly associated with severity of CAD ($\chi2 = 36.55$, $p < 0.05$). Results also showed a significant positive and linear relation between serum testosterone and HDL-c while a negative and insignificant correlation with LDL-c implying that testosterone levels can modulate HDL level thereby exerting anti-atherogenic effect.

ConclusionIn the present cross-sectional study, among 75 young Indian male patients the severity of coronary artery disease was inversely correlated with serum testosterone level. Serum testosterone level showed insignificant association with comorbidities such as hypertension and diabetes mellitus.The association of serum testosterone level with the severity of CAD and tobacco consumption / smoking was significant. The study also validates the correlation of testosterone with lipid profile and HDL-c, in particular.

Keywords Serum testosterone, CAD, coronary angiography

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II. Introduction

Cardiovascular diseases (CVD) contribute significantly to the worldwide demise rate and coronary course illnesses (CAD) are the most common among CVD. The unfriendly results of CVD (principally CAD and strokes) increment the death rate, no matter what the preventive measures and prescriptions being taken. The weight of CVD is powerfully extending, as the quantity of impacted individuals has multiplied during the last 10 years. Worldwide Burden Death,1assessed 18.6 million passing's caused because of CVD, among which 49.2% cases (9.14 million) were related to CAD.2The World Health Organization (WHO) expects 20 million passing's caused because of CHD by 2030.3Although the reasoning is yet to be investigated, androgens are seen to be answerable for the commonness of CADs more among men than among ladies.

Epidemiological investigations have evidenced CAD to be a major concern in males than females.[4,5] Framingham's study has found a significant association between male sex hormone testosterone and cardiovascular risk factors.[6] In contrast, a study showed that myocardial infarction associated with CAD was elevated in men undergoing testosterone replacement therapy (TRT) and risk factors, such as serum glucose levels and insulin resistance in men with diabetes, were found to be increased in TRT.[7] Premature coronary artery diseases (PCAD) less commonly occur young people when compared with middle aged and elderly individuals. A gradual decline in testosterone is initiated after puberty and it progresses along with increasing age. Evidence on low endogenous testosterone level has not conclusively addressed the enhancing mechanism of coronary risk in CAD patients. It is assumed that testosterone plays a role in the pathogenesis of CAD through genomic and non- genomic pathways.[8]

According to Gururani et al.[9],low serum testosterone level among middle -aged Indian males was related to impaired brachial artery flow -mediated dilation, which increased the risk of CAD. Meanwhile, atherogenic lipid profile, mainly high -density lipoprotein level and diabetes, was linked to low serum testosterone level and pathogenesis of cardiac diseases among elderly males.[10]The association between CAD and serum testosterone level is a hot topic in cardiovascular medication

III. Coronary artery disease and diagnosis

CAD is caused either by a disturbance of blood flow dynamics. Ischemic damage to the myocardium increases the permeability of the endothelial layer towards low-density lipoprotein (LDL) cholesterol, leading to a build-up of cholesterol plaque in the innermost walls of arteries and a build -up of atherosclerosis plaque.[11] Over a period, CAD weakens the heart muscle and contributes to myocardial infarction (MI).

Physical examinations for comorbid conditions are compulsory to diagnose the risks for CAD.[12] Cardiologists suggest electrocardiography despite the reports of risk factors and biochemical tests being normal. Non-invasive techniques are appropriate for patients who are prone to risks involved with the invasive practice of coronary angiography.[13]Cassar et al.[12]reported the limitations and advantages of various non-invasive stress tests, namely, Electrocardiogram (ECG), 2D Echocardiogram, Treadmill Test (TMT), Dobutamine echocardiography, Adenosine positron emission tomography (APET), Coronary Angiography, and Adenosine magnetic resonance imaging, for symptomatic patients. The choice of test depends on the patient's condition and the laboratory expertise. Imaging techniques, such as nuclear imaging and computed tomography angiogram, are considered when variations occur in electrocardiography reports –both at rest and at stress. A new

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invasive technique called intravascular ultrasonography facilitates the cross-sectional examining of the artery and coronary atherosclerosis.

IV. Problem specification

Premature coronary artery disease (CAD) is a rapidly increasing phenomenon in the developing world. The insusceptibility of male sex hormones against atherosclerosis evidenced that age and sex are primary risk factors in elder patients with CVD.[23]Numerous studies have reported a negative association between androgen and severity of CVD in young people. Studies have found low levels of testosterone in elder people with CAD. Hereditary is a vital risk factor in middle-aged and young people.

However, some studies have accounted for controversial issues with patients aged less than 45 years. The high incidence of MI in elderly men compared to women of the same age and young men manifests that sex hormones have a prominent role in the pathogenesis of CVD and the risk for MI.[24]Dyslipidemia, obesity, and diabetes mellitusare the risk factors for MI. Low testosterone levels predicted acute myocardial infarction in patients suffering from Type 2 diabetes along with coronary heart diseases.[25]

V. Aim & Objectives:

- The aim of the study is to investigate the influence of serum testosterone level on coronary artery disease in young men.
- The objective is to find the correlation between coronary artery disease in young Indian males and their serum testosterone levels.

VI. REVIEW OF LITERATURE: ROL

A systematic literature review (SLR) identifies, selects and critically appraises research in order to answer a clearly formulated question (Dewey, A. &Drahota, A. 2016). The systematic review should follow a clearly defined protocol or plan where the criteria is clearly stated before the review is conducted. PRISMA stands for Preferred Reporting Items for Systematic Reviews and Meta-Analyses. It is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses.

Testosterone is one the most prevalent androgens and is one of the central chemicals in the male regenerative framework. The essential capacity of this chemical is to control spermatogenesis, empower male conceptive organ development, and guide optional sexual qualities improvement. It is to a great extent combined by Leydig cells and is discharged in the adrenal cortex. The convergence of testosterone can go from 4-10 mg/day; the assessed typical plasma focus goes from 300-1000 ng/dl in ordinary adults.26,27

In blood around 1%-2% of the testosterone circles as free testosterone while the remainder of the testosterone chemical is bound to egg whites and SHBG (Sex steroid Hormone Binding Globulin).28 The testosterone impacts on cardiovascular frameworks are being impacted by plasma cells' intracellular pathway balance, cell digestion, and articulation of androgen receptors.29 A genomic system is related with the physiological impacts of androgen which is interceded by the receptor of androgens, be that as it may, non-genomic pathways have likewise been recognized in a few cases

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Coronary artery Disease

Coronary Artery Disease (CAD), one of the major diseases that cause death among humans in both developed and developing countries.[1] Worldwide, it is the third leading cause of death due to CAD that is about 17.8 million.[1,31,32,33] This disease is caused by the accumulation of plaque in the walls of blood vessels that carry oxygen to the heart. Plaque, a combination of components viz., fat, cholesterol, and deposits of calcium over years that narrows and hardens arteries, is a condition referred to as atherosclerosis that results in heart failure. Generally, the epidemiology of CAD varies according to their geographical locations, gender, and ethnicity (Go et al., 2014) and these studies provide information on the prevention and eradication of disease.[34] Moreover, young age people get affected by cardiovascular diseases in developing countries thereby workforce and economic productivity were negatively affected.[35].

Diagnosis and management of disease play an important role for the physicians to determine the mortality and morbidity associated with CAD. It is necessary to examine the patient's history such as hypertension, tobacco intake, smoking habits, and xanthelasma to determine the risk factors and benefits of treatment strategy.[39]Diagnosis of CAD depends on the following method.[40]

- Biochemical tests include Fasting Blood Glucose level, serum Creatinine, Total Cholesterol, Triglyceride, Low-Density Lipoprotein Cholesterol, High Lipoprotein Cholesterol, Lipoprotein, and Inflammatory biomarkers
- Cardiac biomarkers Troponin (T or I; cTnT or cTnI) and Creatine Kinase MB isoenzyme (CK-MB)
- Echocardiography
- Stress testsinclude exercise Electrocardiogram; Single Photon Emission Computed Tomography(SPECT); Adenosine Single Photon Emission Computed Tomography; Echocardiography; Dobutamine Echocardiography. Few studies involve imaging techniques and this method is recommended to the patients on depends on electrocardiography which has an effect due to stress. Patients whose history of coronary revascularization and having an insufficient report of electrocardiography shows the difficulty to assess in guiding. In case the patient is unable to exercise because of heart failure, acute aortic dissection, deconditioning, acute pulmonary embolus, frailty, orthopedic limitations, and 48hours before MI, a pharmacological imaging test is needed.[39]
- Cardiac Magnetic Resonance Imaging (CMR) indicates subsequent efficient recovery after surgical percutaneous revascularisation.
- A recent stress imaging technique is Magnetic Resonance Imaging (MRI) can be used for dobutamine wall motion imaging and adenosine perfusion. Among asymptomatic patients, the use of non-invasive testing is discouraged except for patients who express myocardial ischemia on electrocardiography or for the reports of coronary calcification.[39]Among cardiac death survived patients, the invasive coronary angiography technique can be used for diagnosis and for the patients who cannot perform non-invasive testing. Some patients who are not certain with a diagnosis on increased risk occupational testing, non-invasive testing, multiple hospitalizations, presence and/or absence of

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obstructive diseases, and patients who are suspected clinically for non-atherosclerotic causing ischemia and vasospasm with proactive testing are the other testing indications.[39]

- Coronary Angiography includes guidelines of American College Cardiology / American Heart Association for coronary angiography is based on symptomatic status and stratification risk related to non-invasive investigation outcome. For precise assessment of anatomical severity,invasivetechniquesare followed. Novel invasive techniques, such as Intravascular UltraSonography (IVUS) helps for cross-sectional analysis of CAD for enhanced diagnosis of the disease. Studies show that angiography is not enough for diagnosing CAD severity and hence, it must be proceeded along with Intravascular UltraSonography.

Treatment and management

Initial treatment is given according to the guidelines of the American College Cardiology / American Heart Association that includesthe following:[40] Management of the disease can be best achieved by proper diet, reduced smoking, exercise and by replacement of hormones such as estrogen and testosterone. Further treatment of hypertension, diabetes and dyslipidemia can also help to manage CAD. Secondary management procedures included intake of tablets like Aspirin, Clopidogrel, Beta Blockers, and Antioxidants. In addition, pharmacological management methods include nitrates, blocking agents of beta-adrenoceptor, calcium antagonists, ranolazine, nicorandil, ivabradine, and fasudil a rho kinase oral inhibitor.

CAD can also be managed by other related therapies such as stimulation of the spinal cord, external counterpulsation enhancer, and chelation. Also, the management of the CAD can be achieved by percutaneous coronary intervention, bypass surgery of the coronary artery.[40,41]

Coronary Artery Disease and Testosterone

Besides the traditional risk factors like smoking, obesity, hypertension, etc, recent reports imply that deficiency in the testosterone levels in men with progressing age contributes a possible role in raising the risk of heart attack and stroke[87], FDA, 2014). The effect of testosterone in cardiovascular physiology possessing various hormonal impacts on CVD is shown in Figure2.3.

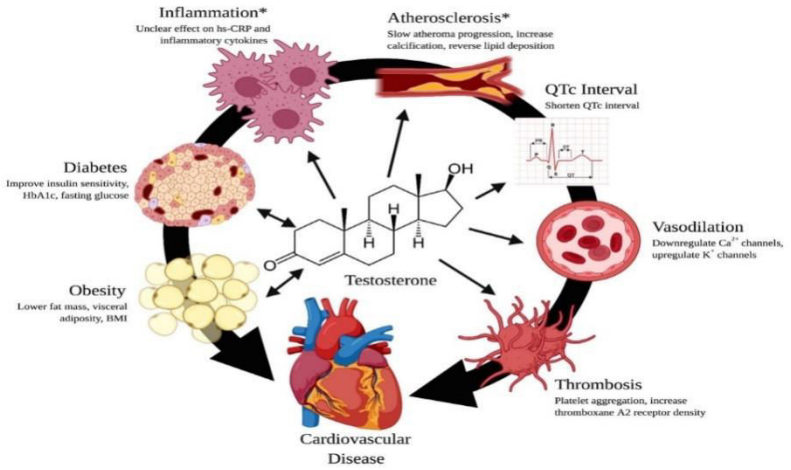

Figure 1: Mechanism action of testosterone on several risk factors of cardiovascular disease

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Besides testosterone, BMI-body mass index; Ca- calcium, HbA1c- hemoglobin A1c; hs-CRP- high-sensitivity, C-reactive protein, K-potassium, QTc interval- heart-rate−corrected QT interval is the undetermined research area with a possibility of a bidirectional relationship.[88]

VII. RESEARCH METHODLOGY:

All sequential patients satisfying the consideration measures will be remembered for the review. Further, they will be exposed to a point by point history and predesigned proforma. As per general meaning of MI/ACS, patients with normal chest uneasiness or other ischemic side effects who grew new ST-portion rises in at least 2 bordering leads and new group branch blocks with ischemic repolarization designs on a standard 12-lead electrocardiogram (ECG) were characterized as ST-raised myocardial dead tissue (STEMI) patients. Patients with high troponin levels yet without STEMI ECG rules were characterized as non-ST raised myocardial dead tissue (NSTEMI).

Venous Blood tests were gathered from the two sorts of patients ,the serum, and were shipped off the research facility. Serum levels of Testosterone, Lipid profile, Troponin I were assessed utilizing the standard techniques.

Complete testosterone is explicit for youthful patients with comorbidities like insulin opposition (metabolic disorder), and free testosterone is valuable for older patients and in patients with prostrate cancer.123

Testosterone under 8nmol/l is viewed as low and further partitioned into 6-8 (gentle), 4-6(moderate), <4(severe).

Testosterone estimation was finished by Chemiluminescence Immunoassay (CLIA) recognition utilizing microplate luminometers gives a delicate, high throughput, and practical option in contrast to regular colorimetric procedures, for example, Enzyme-connected immunosorbent measures (ELISA).

Coronary Angiography was finished to lay out the occurrence and seriousness of Coronary Artery Stenosis. Coronary angiography is a highest quality level method for the conclusion of CAD due to its capacity to give the seriousness of atherosclerosis and qualities of plaque.

The Coronary Angiography was performed to really look at the presence of CAD by a talented Interventional Cardiologist in the catheterization lab. Critical coronary stenosis and Coronary Artery Disease were characterized assuming that there was half or more stenosis on the lumen width in somewhere around one of the significant coronary veins. The patients with CAD were grouped into (I) Single vessel sickness (SVD): Stenosis happens in one of the left or right coronary vein (II) Double vessel illness (DVD): stenosis occurs in two coronary courses (III) Triple vessel illness (TVD): stenosis in three coronary corridors (IV) Left fundamental stenosis (LMS). stenosis in the left fundamental corridor no matter what the presence of stenosis in different courses. Among these vessel scores, TVD or potentially LMS (implies LAD) has been related with high-risk factors for atherosclerosis according to remedial rules.

VIII. RESULT ANALYSIS:

The gathered information were dissected involving the Statistical Package for Social Sciences (SPSS) programming adaptation 24.0. Expressive examination remembered portrayal of information for the type of recurrence, rate, mean and standard deviation. Relationship between's serum testosterone and

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different variables like age and lipid profile were directed utilizing Pearson's connection. Chi-square investigation were performed to concentrate on the relationship between straight out factors. Numerous relapse examination was utilized to know the connection among factors and CAD in young fellows.

1.1 Serum testosterone level

Table 4.5 exemplifies the serum testosterone level. Data shows that 27 (36%) patients had normal testosterone levels, 13 (17.3%) patients had mild testosterone levels, 22 (29.3%) patients had moderate testosterone levels and 13 (17.3%) patients had severe testosterone levels.

Table 4.5: Serum testosterone

	Frequency	Percent
Normal >8 nmol/L	27	36.0%
Mild deficiency (6-8 nmol/L)	13	17.3%
Moderate deficiency (4-6 nmol/L)	22	29.3%
Severe deficiency (<4 nmol/L)	13	17.3%
Total	75	100.0%

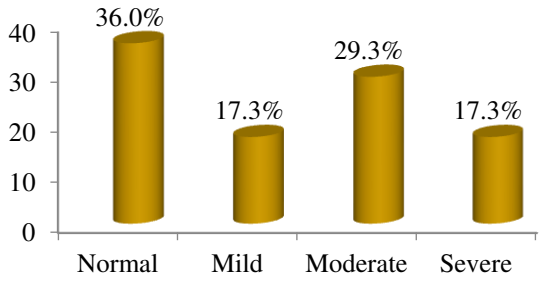

Figure 4.5: Serum testosterone

The relationship among hypertension and serum testosterone was viewed as unimportant (Chi-Square = 3.389, p > 0.335) (Table 4.7). Among 13 subjects with hypertension3patients (23.1%) were accounted for to have typical testosterone levels, 6 patients (46.2%) were accounted for to have moderate testosterone levels and 3 patients were accounted for to have serious testosterone levels. Along similar line 62 subjects without hypertension 12 patients (19.4%) were accounted for to have gentle testosterone levels, while 16 patients announced of moderate testosterone levels and 10 patients (16.1%) were accounted for to have serious testosterone levels. Be that as it may, 24 patients announced of having typical degrees of testosterone.

The relationship between diabetic mellitus and serum testosterone level was viewed as inconsequential (Chi-Square = 1.705, p > 0.636). Among 9 subjects with diabetes 2 patients (22.2%) were accounted for to have typical testosterone levels, 4 patients (44.4%) were accounted for to have moderate testosterone levels, while 2 patients had extreme testosterone levels. Along similar line 66

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subjects without diabetes 12 patients (18.2%) were accounted for to have gentle testosterone levels and 11 patients (16.7%) were accounted for to have extreme testosterone levels (Table 4.7).

From Table 4.7, a relationship of testosterone level with tobacco utilization/smoking was viewed as measurably critical (Chi Square= 11.889, p = 0.008). Among 19 subjects with tobacco utilization/smoking, 5 subjects (26.3%) were accounted for to have ordinary testosterone levels and 8 patients (42.1%) were accounted for to have serious testosterone levels. Among the excess 56 subjects without tobacco utilization/smoking 12 patients (21.4%) were accounted for to have gentle testosterone levels and 17 patients (30.4%).

Table 4.7: Association between different variables and serum testosterone

	Normal	Mild	Moderate	Severe	Total	**Chi square**	**p value**
Hypertension							
Yes	3 (23.1%)	1 (7.7%)	6 (46.2%)	3 (23.1%)	13	3.389	0.335
No	24 (38.7%)	12 (19.4%)	16 (25.8%)	10 (16.1%)	62		
Diabetes Mellitus							
Yes	2 (22.2%)	1 (11.1%)	4 (44.4%)	2 (22.2%)	9	1.705	0.636
No	25 (37.9%)	12 (18.2%)	18 (27.3%)	11 (16.7%)	66		
Tobacco Consumption / smoking							
Yes	5 (26.3%)	1 (5.3%)	5 (26.3%)	8 (42.1%)	19	11.889	0.008
No	22 (39.3%)	12 (21.4%)	17 (30.4%)	5 (8.9%)	56		

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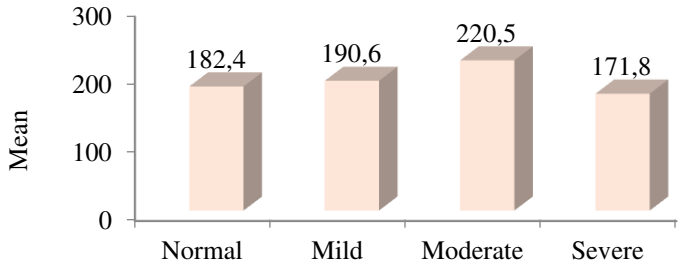

Figure 4.7: Total Cholesterol

Table 4.9: Association between coronary artery angiography and serum testosterone

	Normal	**Mild**	**Moderate**	**Severe**	**Total**	**Chi square**	**p value**
Single vessel disease (SVD)							
LAD	5 (27.8%)	5 (27.8%)	3 (16.7%)	5 (27.8%)	18		
RCA	0 (0%)	3 (42.9%)	4 (57.1%)	0 (0%)	7		
LCX	0 (0%)	0 (0%)	2 (66.7%)	1 (33.3%)	3		
Double vessel disease (DVD)							
LAD and RCA	3 (30%)	3 (30%)	3 (30%)	1 (10%)	10	36.555	0.019
LAD and LCX	4 (33.3%)	2 (16.7%)	6 (50%)	0 (0%)	12		
RCA and LCX	2 (100%)	0 (0%)	0 (0%)	0 (0%)	2		
Triple vessel disease (TVD)	8 (72.7%)	0 (0%)	0 (0%)	3 (27.3%)	11		
Recanalized Coronary artery	5 (41.7%)	0 (0%)	4 (33.3%)	3 (25%)	12		

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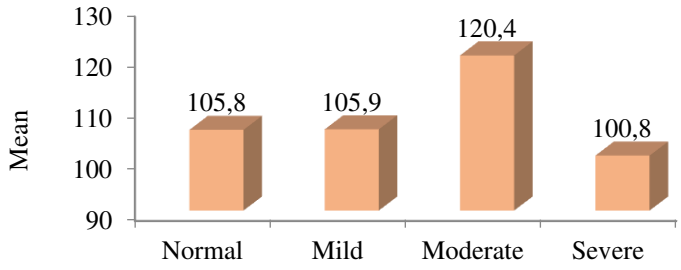

Figure 4.8: Low-density lipoproteins

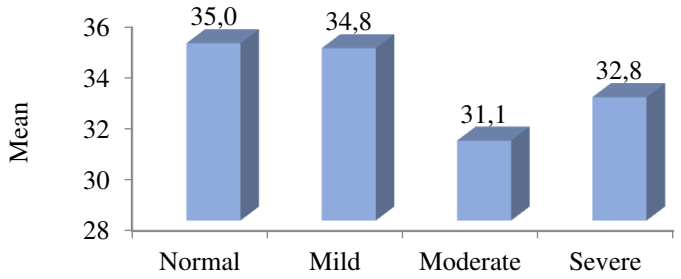

Figure 4.9: High-density lipoproteins

The plaque develop in the blood vessel dividers upsets the blood supply to the heart prompting a condition for the most part alluded to as coronary course sickness. Older guys are inclined to a higher gamble of coronary course sickness, and a potential low bioavailability of testosterone is related with an expanded gamble of CAD. In the current review, the low serum testosterone level was related with seriousness of CAD. From the information it tends to be derived that in young fellows the bioavailability of testosterone levels can influence cardiovascular circumstances.

IX. DISCUSSION

In males, testosterone, a sex hormone, is known to produce male secondary characteristics like body hair and also promote reproductive system development including sperm production, etc. Besides this, the impact of testosterone on men's health is also noted. Low levels of testosterone are known to contribute to bone loss, increased incidences of cardiovascular events, mortality, etc.Testosterone was found to have beneficial effects in men with cardiac disease.

The main objective of the present study was to assess the relationship of serum testosterone level with coronary artery disease in young Indian men. Low testosterone level is considered as a risk factor for CAD in male population.

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There is clinical evidence indicating a relationship between serum testosterone and coronary artery disease in male population of elderly age, middle-age [1] and young age. The lowering of serum testosterone is attributed to the normal physiological process of aging. However, there is clinical evidence of low testosterone in the presence of chronic illnesses like diabetes mellitus, pulmonary disease, CAD, etc.

The present cross-sectional study showed association between coronary artery disease and serum testosterone level in men. In a case-control study, authors found no correlation between the severity of coronary artery disease and serum testosterone level as low as 3.51 ± 1.39 ng/ml (approximately 8.7 ± 3.4 nmol/l); accumulated evidence showed low serum testosterone levels in middle-aged men (40-59 years)[131] as well as low serum total, free and bioavailable testosterone in male (54 ± 6 years) with CAD [134]which was in contrast to the present findings. Likewise, Bashyal state that reported no association between testosterone level (12.01 ± 6.1 nmol/l) and CAD among elderly men aged 60.4 ± 11.1 years. However, findings similar to the present study are reported in literature.

In the present study, CAD was categorized into single-vessel disease (SVD), double-vessel disease (SVD), triple-vessel disease (TVD), and recanalized vessel. In the present study, the association between serum testosterone level and the number of affected vessels was found to be significant. Studies citing the association between serum testosterone level and affected vessels are available in literature. With an increase in the severity of CAD (one to three-vessel disease), a significant drop in both serum testosterone level was observed in CAD patients.[139]

The authors did not address the possible physiological mechanism for this observation. On the contrary, a meta-analysis of four RCTs showed no significant effect of testosterone replacement therapy on LVEF in patients with congestive heart failure.[141]In a male rat model, administration of low doses of testosterone was able to restore the reduced LVEF following MI thereby indicating a possible positive role of testosterone in normal heart function. Yet, from the available data it can be inferred that more clinical studies on the relationship of serum testosterone level with left ventricular function and LVEF in CAD patients are required to draw a conclusion.

Low serum testosterone level is known to increase the stiffness in arterial blood vessels thereby increasing the risk of hypertension.However, in the present study, association of serum testosterone with hypertension was found to be insignificant.

Further, in the present study, the lipid profile was not significantly different amongnormal, mild, moderate and severe serum testosterone levels. Lipid parameters such as HDL-c, triglycerides, LDL and total cholesterol were found to be lower in CAD patients with low serum testosterone level. Evidence indicates association between serum testosterone level and lipid profile.[148] The association of Testosterone in Older Men with Mobility Limitations (TOM) trials reported higher triglycerides and lower HDL with low testosterone. High triglycerides and low HDL-c is associate with an increased risk of CAD. A proatherogenic lipid profile is associated with low testosterone level. Wickramatilake described that posited that low testosterone level creates an atherogenic (plaque formation in arteries) lipid profile, a primary cause for the pathogenesis of CAD.

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Besides, the author showed a significant positive and linear relation between serum testosterone and HDL-c while a negative and insignificant correlation with LDL-c implying that testosterone levels can modulate HDL level thereby exerting anti-atherogenic effect. In concordance with the present findings Helaly found that the low levels of free testosterone and low HDL-c in elderly patients presented with CAD. Authors found this unique to CAD implying contribution of low free testosterone to the increased risk of CAD. Durukanfound that a positive correlation of serum testosterone level with total cholesterol and low-density lipoprotein. Overall, it can be concluded that association of serum testosterone with lipid profile has been heterogeneous and may need further investigation.

The heterogeneity in the findings related to serum testosterone and CAD in male patients could be attributed to the study design, selection of patient population with different manifestations of CAD and of varying age, the estimation of type of testosterone, the number of times the estimation of testosterone level was performed during the course of study and the follow-up period. To summarize, the association between serum testosterone and CAD in terms of severity of CAD.. Thus, it can be postulated that low serum testosterone level can contribute to CAD by affecting blood pressure level, HDL-c and ventricular dysfunction.

X. CONCLUSON AND FUTURE SCOPE:

This review was led to find the relationship be-tween's serum testosterone levels and seriousness of coronary course sickness, and significant discoveries are

- In the current cross-sectional review, among 75 youthful Indian male patients the seriousness of coronary supply route sickness was conversely corresponded with serum testosterone level.
- Serum testosterone level showed immaterial relationship with comorbidities, for example, hypertension and diabetes mellitus.
- The relationship of serum testosterone level with the seriousness of CAD and tobacco utilization/smoking was critical.
- The concentrate likewise approves the relationship of testosterone with lipid profile and HDL-c, specifically.

XI . LMITATONS:

The review was restricted to a little measure male populace who were owned up to the Department of Cardiology, J.N Medical school, KAHERS University Belagavi, Karnataka. Taking into account there are expanded occurrences of CAD among the Indian populace, little example size and from a solitary region or focus/clinic unit could highlight choice predisposition and furthermore limit the speculation of the discoveries to a bigger Indian populace as well regarding the populace past geological limits of India.

This cross-sectional review showed the relationship of serum testosterone level with CAD, not the causation. Consequently, extrapolation of the discoveries to the causal connection between testosterone levels and results in CAD patients ought to be performed with alert. Free testosterone wasn't possible at our middle and complete testosterone was taken for this review.

In future, study ought to be led from multi-focus and on a bigger male populace with a wide age range including male patients as long as 80 years or above. A planned report with a more drawn out follow-up period will address the causal connection among testosterone and CAD. The relationship of serum testosterone with different variables like future cardiovascular occasions like MI, cardiovascular breakdown or stroke and all-cause mortality ought to be directed. Further, assessment of relationship utilizing Gensini score could give a more exact

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relationship of testosterone level with the seriousness of CAD. A more definite and relative examination utilizing all out serum, free and bioavailable testosterone ought to be performed to help the relationship of testosterone with CAD.

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