

Thyroid Panel and Modified Lipid Profile among Sudanese Patients with Coronary Heart Disease

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Abstract: *The analytical, comparative cross-sectional study was conducted to assess the thyroid profiles and modified lipid profiles levels among Sudanese patients with coronary heart disease performed on forty-one patients with coronary heart disease as test group collected from Sudan Heart Center, Al rabat teaching hospital and Al mawada hospital in Khartoum state, during the period between November 2017 and May 2018. Furthermore, the test group compared with forty-one apparently healthy volunteers as control group was selected with the same inclusion criteria.*

Spectrophotometric methods were used for measurement of lipid profile. Thyroid hormones (T3 &T4) and thyroid stimulating hormone were measured by using Sandwich Enzyme-Linked Immunosorbent Assay (ELISA). Moreover, statistical package for social science (SPSS version 23) computer software was used for data analysis.

The study clearly demonstrated that there was statistically significant decrease in T3, and significant increase in T4 levels in test group compared to control with (P. value 0.047) for T3, and (P. value 0.002) for T4. Nonetheless, the result of this study indicated a significant elevation in mean of total cholesterol, low density lipoprotein-cholesterol levels and significant decrease in high density lipoprotein –cholesterol in test group compared to control (P.value 0.000).

In conclusion Coronary heart diseases patients have significantly low Triiodothyronine, elevated Thyroxin, and normal Thyroid Stimulating Hormone levels, with significantly higher Total Cholesterol, Low Density Lipoprotein-Cholesterol concentrations, and lower HighDensity Lipoprotein-Cholesterol concentrations.

Keywords: Total cholesterol, High density lipoprotein cholesterol, Low density lipoprotein cholesterol, thyroid hormones (Triiodothyronine,Thyroxin).

1. INTRODUCTION

Coronary heart disease is believed to start with injury or damage to the inner layer of a coronary artery, this damage causes fatty plaque deposits on build up at the site of the injury, these deposits consist of cholesterol another cellular waste products, the accumulation is called atherosclerosis⁽¹⁾. Furthermore, this imbalance between the myocardial oxygen demand and the blood supply leading to reduction in the blood flow, this reduction may not produce any symptoms but as fatty deposits or plaques. Depending on the rate severity of coronary artery narrowing and myocardial response one of the four syndromes may develop includes angina (heart pain or discomfort) heart attack, heart failure and cardiac arrhythmias. Once the plaques have formed or rupture platelets will clump in the area, attempting to repair the blood vessels, this clump damaged the wall of the coronary artery that reducing or blocking blood flow, and leading to heart attack⁽²⁾.

Lipid profiles is the collective term given to the estimation of total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG). An extended lipid profile may include very low-density lipoprotein cholesterol (VLDL-C)⁽³⁾. However, this is used to identify dyslipidemia (various

disturbances of cholesterol and triglyceride levels); many forms of which are recognized as risk factors for cardiovascular disease and sometimes pancreatitis⁽³⁾.

A total cholesterol reading can be used to assess an individual's risk for heart disease; it should not be relied upon as the only indicator. The individual components that make up total cholesterol reading LDL, HDL, and VLDL are also important in measuring risk⁽³⁾.

Dyslipidemia are characterized by disorders in the levels of circulating lipids total cholesterol (TC) or triglycerides (TG), or low levels of high densitylipoprotein cholesterol (HDL-C), with or without repercussion of the vascular territory, associated to many clinical manifestations⁽³⁾.

They can be influenced by genetic and/or acquired disorders. Among the environmental variables involved in determining the lipid profile, smoking, sedentary lifestyle and diet are included. Excessive caloric ingestion, with high rate of fat and cholesterol, is associated to increased serum levels of total cholesterol (TC) and fraction cholesterol of low-density lipoprotein (LDL-C). Among adults, the increased concentration of TC and diminished fraction of high density lipoprotein (HDL-C) cholesterol, hypertension, smoking, diabetes and obesity are associated to advanced atherosclerosis lesions and a greater risk of clinical

manifestations of atherosclerotic disease. There are also other factors involved, but non-controllable; those are age, sex, race and heredity⁽³⁾.

Hyperlipidemia refers to elevated levels of lipids and cholesterol in the blood, and is also identified as dyslipidemia, to describe the manifestations of different disorders of lipoprotein metabolism. Although elevated low density lipoprotein cholesterol (LDL) is thought to be the best indicator of atherosclerosis risk⁽⁴⁾.

Thyroid hormones are essential for normal development, growth and metabolic balance; it also plays an important role in carbohydrate metabolism and protein synthesis, and they increase calorogenesis and oxygen consumption in most tissues⁽⁵⁾.

Thyroid hormones may lead to increase in heart rate and cardiac output; due to its ability to increase the sensitivity of the cardiovascular and nervous system to catecholamine's⁽⁵⁾.

Thyroid hormones play a major role in regulating lipid metabolism, thus thyroid dysfunctions can result in lipid abnormalities and increase the risk to develop hypertension, endothelial dysfunction and cardiovascular disease⁽⁶⁾.

Furthermore, the relationship between thyroid hormones and lipid metabolism is clearly displayed in patients suffering from thyroid dysfunctions. Overt hypothyroid patients show elevated cholesterol and triglyceride (TG) levels while overt hyperthyroid patients show reduced lipid levels. These observations have been shown to extend into the subclinical hypo/hyperthyroid range, suggesting that apart from thyroid hormones, thyroid-stimulating hormone (TSH) exerts independent effects on lipid metabolism. Moreover, thyroid hormones have been shown to induce the expressions of 3-hydroxy-3-methyl-glutaryl-CoA reductase (HMG-CoA) reductase (responsible for cholesterol synthesis), low density lipoprotein receptor (LDLR) via sterol regulatory element-binding protein-2 (SREBP-2) (responsible for the uptake of cholesterol), lipoprotein lipase (responsible for catabolizing TG-rich lipoprotein), cholesteryl ester transfer protein (responsible for high density lipoprotein (HDL) metabolism) and apolipoprotein AV (which reduces the production of hepatic very low density lipoprotein (VLDL)-TG). Thyroid-stimulating hormone has also been shown to induce adipogenesis, lipolysis and increase the activity of HMG-CoA⁽⁷⁾. Nonetheless, the lipid profile changes are reversible with the thyroid hormone replacement⁽⁷⁾.

The most common cause of CHD is narrowing of the lumen of the coronary arteries by atherosclerosis. Initially, an area of atheromatous plaque forms in the coronary artery. The mechanism for plaque formation is unclear, although the predominant view is that lipid accumulates under the lining of the coronary artery. Because the lipid infiltrate is a foreign matter, white blood cells called macrophages engulf it, and create foam cells. Smooth muscle cells then invade the area, which enlarges the plaque and obstructs more than 50% of the lumen of the coronary artery that the flow of blood to the heart muscle, the myocardium, is reduced;⁽⁸⁾

while resting, or undertaking a minimal activity, the blood supply to the heart is adequate. However, when the heart requires a greater supply of oxygen, as occurs during exercise or emotional episodes, the blood supply cannot increase sufficiently and the person will experience chest discomfort. This is referred to as angina pectoris. Once plaque has formed, the wall of the coronary artery is damaged and irregular in shape and platelets cluster around the obstruction. This reduces the size of the lumen still further and consequently the blood supply is also reduced⁽⁸⁾.

Long term hypothyroidism is associated with severe cardiovascular manifestation including increased systemic vascular resistance, reduced contractility and cardiac oxygen consumption and raised diastolic hypertension⁽⁹⁾.

The association of thyroid dysfunctions with hypercholesterolemia and hypertension makes the thyroid dysfunctions patients more predispose to accelerated atherosclerosis and coronary heart disease than others⁽⁹⁾.

Prevalence of coronary heart disease (CHD) is increased in Sudan. Dyslipidemia is most common risk factor for the development of CHD. Nonetheless, Thyroid hormones has role in lipid metabolism, hence that TSH regulates the key enzyme in cholesterol synthesis and has a role in maintaining lipid homeostasis.

The study was aimed to assess the thyroid hormones, modified lipid profile levels in Sudanese patients with CHD in comparison with healthy control group.

The objectives of this research were;

-To measure serum TSH, T3, T4, Total cholesterol, HDL-C, LDL-C levels in CHD patients and control group.

-To compare serum TSH, T3, T4, Total cholesterol, HDL-C, LDL-C levels among Sudanese patients with CHD with healthy control group.

2. MATERIALS AND METHODS

This is an analytical, comparative cross-sectional, hospital based study. It was conducted in Sudan Heart Center, Al Rebat teaching hospital and Al Mawada hospital in Khartoum state, during the period from 2017 to 2018.

A total of Forty-one patients with coronary heart disease (Test group) were included in the study, compared with Forty-one apparently healthy controls matched for age and sex. Patients with History of diabetes mellitus, autoimmune disease and familial dyslipidemia were excluded from the study.

The permission of this study was obtained from Nile college academic affair. The objectives of the study were explained to all individuals participated in the study. Oral consent was obtained from each participant in the study.

After taken an oral consent and used alcohol swab (70% ethanol) as antiseptic for skin, a sample of venous blood (3 ml) was collected from each participant in this study, using disposable plastic syringe. The blood was collected from the arm directly in lithium heparin container.

The containers were then centrifuged at 3000 rpm for

3minutes and obtained plasma. The plasma prepared was stored at-25⁰ c until used.

Spectrophotometric methods were used for measurement of total cholesterol, HDL-C, and LDL-C levels. Thyroid hormones (T3 &T4) and thyroid stimulating hormone were measured by using Sandwich Enzyme-Linked Immunosorbent Assay (ELISA). The precision and accuracy of all methods used in this study were checked each time; a batch was analyzed by including commercially prepared control sera. Statistical Package for Social Science (SPSS version 23) computer software was used for data analysis (Significance levels were set at P≤0.05). Independent t-test

was used to compare between test group and healthy control group.

3. RESULTS:

In the present study, total of 82 subjects were divided into two groups, 41 healthy controls and 41cases (CHD patients), were included.

It was evident that T3 and T4 levels were decreased in cases as compared to controls with p value 0.047for T3, and 0.002 for T4(**Table1**).

It was evident that TC, LDL-C, and HDL-C levels were increased in cases as compared to controls with P value 0.000 (**Table1**).

Table (1): Comparison of T3, T4, TSH and Lipid Profile between CHD patients and healthy controls:

Parameters	Case(N=41) Mean ± SD	Control(N=41) Mean ± SD	P- value
TSH (μIU/ml)	1.48 ± 0.68	1.47 ± 0.63	0.950
T3 (ng/ml)	2.12 ± 0.94	2.45 ± 0.35	0.047
T4 (μg/dl)	11.26 ± 2.27	9.75 ± 2.08	0.002
Cholesterol (mg/dl)	250 ± 49	155 ± 25	0.000
LDL-C (mg/dl)	177 ± 28	91 ± 24.4	0.000
HDL-C (mg/dl)	31 ± 7.5	70 ± 17.6	0.000

-The table shows the mean ±SD. deviation and probability value (p-value).

- Independent t-test was used for comparison.

- P value ≤ 0.05 is considered significant.

4. DISCUSSION:

Prevalence of coronary heart disease (CHD) is increased in Sudan, high mortality rate.Arteriosclerosis is not clinically evident until middle age or later, when the arterial lesions precipitate the organ injury⁽¹⁰⁾. The association of thyroid dysfunctions with hypercholesterolemia and hypertension makes the thyroid dysfunctions patients more predispose to accelerated atherosclerosis and coronary heart disease than others.

Our study was found that most of the CHD patients have TSH level within normal range no statistically significant difference between case and control values (p value 0.950), another study reported that CHD patient had high levels of TSH, hypothyroidism is associated with dyslipidemia having raise in all lipid parameters, which may increase the risk of

cardiovascular diseases. This finding was reported by BandiA⁽¹¹⁾.This difference from the current study may be due to small sample size used limited period and therefore the results inferred may not be considered as the reflection of larger population.

In our study, there was a weakly significant difference between case and control values ofT3 (p value 0.047) similar findings were observed by Singh PA⁽¹²⁾.Who found that the (T3) levels significantly decreased when compared to control, and highly significant difference between case and control values of T4(p value 0.002).

Furthermore, the current study showedthat CHD patient has high levels of TC, LDL-C, and HDL-C, compared with controls (p value 0.000). Similar findings were observed by Al-Hakeim HK⁽¹³⁾and Archana Prakash⁽¹⁴⁾.

5. CONCLUSION:

In conclusion coronary heart diseases patients have significantly lower Triiodothyronine, increased Thyroxin, and normal Thyroid Stimulating Hormone levels, with

significantly higher Total Cholesterol, Low Density Lipoprotein-Cholesterol concentrations, and lower High Density Lipoprotein-Cholesterol concentrations.

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