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Correlation between Serum Sodium and Potassium Levels With Altered Serum Lipid Profile Levels in Coronary Artery Disease

Dr. Tina Das[1], Dr. L. Shaini[1], Dr. Balary Nongtdu[1], Dr Yengkhom Upen Singh[1]
Dr. Bishnupriya Panda[1], Dr. Ursula Khwairakpam[1], Dr. Racheal S Marbaniang[1],
Dr. Maharabam Purnima Devi[1]
[1](*Department of Biochemistry, RIMS, Imphal)*
Corresponding Author: Dr. Tina Das

Abstract:
In more than 90% of cases, IHD is a consequence of reduced coronary blood flow secondary to obstructive atherosclerotic vascular disease. Abnormalities in plasma lipoproteins and derangements in lipid metabolism rank among the most firmly established and best understood risk factors for atherosclerosis. A diet high in sodium increases the risk of hypertension in people with sodium sensitivity, corresponding to an increase in health risks associated with hypertensions including cardiovascular disease. A decrease in serum potassium (K) level has been suggested to be a fairly common observation in patients with acute coronary syndrome (ACS), which has been shown to increase the risk of cardiac events, including lethal ventricular arrhythmias. The aim of this study was to see if there is any alteration of serum sodium and potassium levels with that of the altered lipid profile levels of the cases. This is a cross sectional study, conducted in the Department of Biochemistry in collaboration with the Department of Cardiology, RIMS. The study population consisted of 80 patients above 18 years suffering from coronary artery disease. The mean values of total cholesterol, HDL and LDL in the fasting state is minimally altered whereas the mean value of triglyceride was raised. There was no correlation between the raised serum triglyceride level and serum sodium and potassium levels. *It may be concluded that there is no significant correlation between serum sodium and potassium levels with the altered triglyceride levels in patients of coronary artery disease.*

Key Word*: Ischemic Heart Disease, lipid profile, High density lipoprotein(HDL), Low density lipoprotein(LDL), Serum Sodium and Potassium*

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I. Introduction

In more than 90% of cases, IHD is a consequence of reduced coronary blood flow secondary to obstructive atherosclerotic vascular disease.[1] Because coronary artery disease is an important manifestation of atherosclerosis, epidemiologic data related to atherosclerosis mortality typically reflect deaths caused by ischemic heart disease (IHD); indeed, myocardial infarction is responsible for almost one fourth of all deaths in the United States.[2] The major underlying cause of IHD is atherosclerosis; while myocardial infarctions can occur at virtually any age, the frequency rises progressively with increasing age and with increasing atherosclerotic risk factors.[3]

Abnormalities in plasma lipoproteins and derangements in lipid metabolism rank among the most firmly established and best understood risk factors for atherosclerosis. Hyponatremia is defined as serum sodium level < 136 mmol/L.[4,5] Normal potassium level considered in our study was 3.5-5.5 mmol/L. Hypokalemia is defined as serum potassium level <3.5mmol/L.[6] Different electrolytes such as potassium and sodium play an important role in the cell metabolism, electrical conduction and membrane excitability. Abnormalities of these electrolytes due to different causes can lead to a significant cardiac life threatening events.[7] Sodium and chloride serum levels are both carefully controlled by the kidneys, and acute and chronic excessive intake of both ions can cause adverse health effect. However, only serum sodium is thought to be strongly correlated to blood pressure levels and cardiovascular disease.[8] A diet high in sodium increases the risk of hypertension in people with sodium sensitivity, corresponding to an increase in health risks associated with hypertensions including cardiovascular disease.[9] A decrease in serum potassium (K) level has been suggested to be a fairly common observation in patients with acute coronary syndrome (ACS),[10.11.12.13] which has been shown to increase the risk of cardiac events, including lethal ventricular arrhythmias.[14,15,16] In addition, a decrease in K level generally induces vasoconstriction,[17] which leads to further ischemia, thereby producing a vicious cycle. The present

study was taken up to see if there is any alteration of serum sodium and potassium levels with that of the altered lipid profile of the cases.

II. Material And Methods

The study was a cross sectional study conducted in the Department of Biochemistry in collaboration with the Department of Cardiology, Regional Institute of Medical Sciences & Hospital, Imphal, Manipur for a period of 24 months from September 2016 to August 2018.

Study Design: A cross sectional study.

Study Location: This was a tertiary care teaching hospital based study done in Department of Biochemistry in collaboration with Department of Cardiology, RIMS, Imphal.

Study Duration: September 2016 to August 2018.

Sample size: 80 patients.

Sample size calculation: Taking the standard deviation 34.1gm and standard error 8 of postprandial serum lipid profile the sample size has been calculated by using the formula, $\text{Sample size} = 4 \times \frac{S^2}{e^2}$, where, S (standard deviation) - 34.1gm, L (margin of error) – 16,e (standard error) – 8, precision – 95%

Subjects & selection method: The study population consisted of 80 patients above 18 years suffering from coronary artery disease and the patients were chosen from those admitted in the cardiology ward of RIMS, Imphal.

Inclusion criteria: 80 patients who were admitted within 12 hours after onset of symptoms in ICCU or Medicine Ward of RIMS Hospital having typical ischaemic symptoms, and whose test reports for CK-MB & Trop-I showed positive results were the study population.

Exclusion criteria: Patients suffering from chronic heart failure, hepatic and renal disease, malignancy and anaemia were excluded from the study.

Procedure methodology

5 ml of venous blood was collected, each in the fasting state by venipuncture from antecubital vein. The blood collected in the plain vial was centrifuged for 10 minutes within 30 minutes of collection and the serum was stored immediately at < -20 ℃. Other investigation parameters were collected from the documentation of routine investigations done in the hospital. Serum lipid profile estimation was done by Enzymatic Colorimetric Test with lipid clearing factor (LCF) by using kits marketed by Human Gesellschaft fur Biochemica und Diagnostica mbH through its Indian branch supply. Serum Sodium and potassium estimation was done by Enzymatic Colorimetric Test by using kits marketed by M/s Excel Diagnostics Pvt Ltd and also by using photocolorimeter machine**.** Approval of Research Ethics Board, RIMS, Imphal was taken. Informed consent was taken from the participants before the study and confidentiality were maintained.

Statistical analysis

The results available were analysed using SPSS version 20. Chi-square test was used to ascertain the significance of differences between mean values. The level $P < 0.05$ was considered as the cutoff value for significance.

III. Result

A. Socio demographic variables

Fig 1 : Bar diagram showing age distribution of cases.

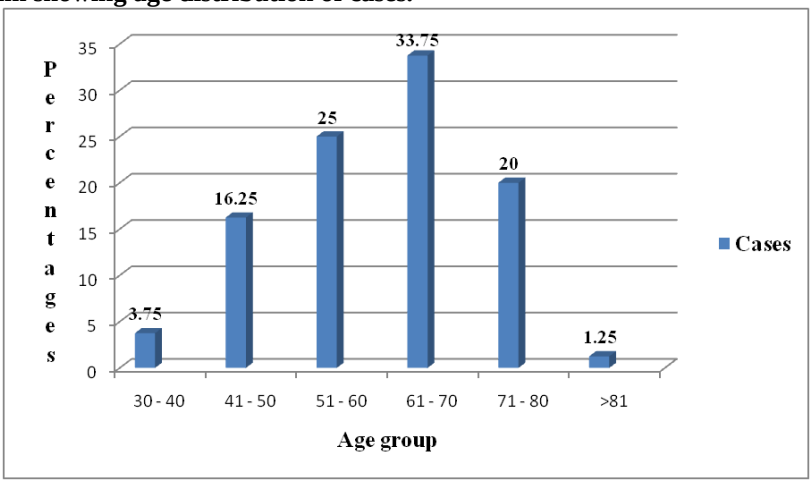

Figure 2: Pie chart showing distribution of cases by sex.

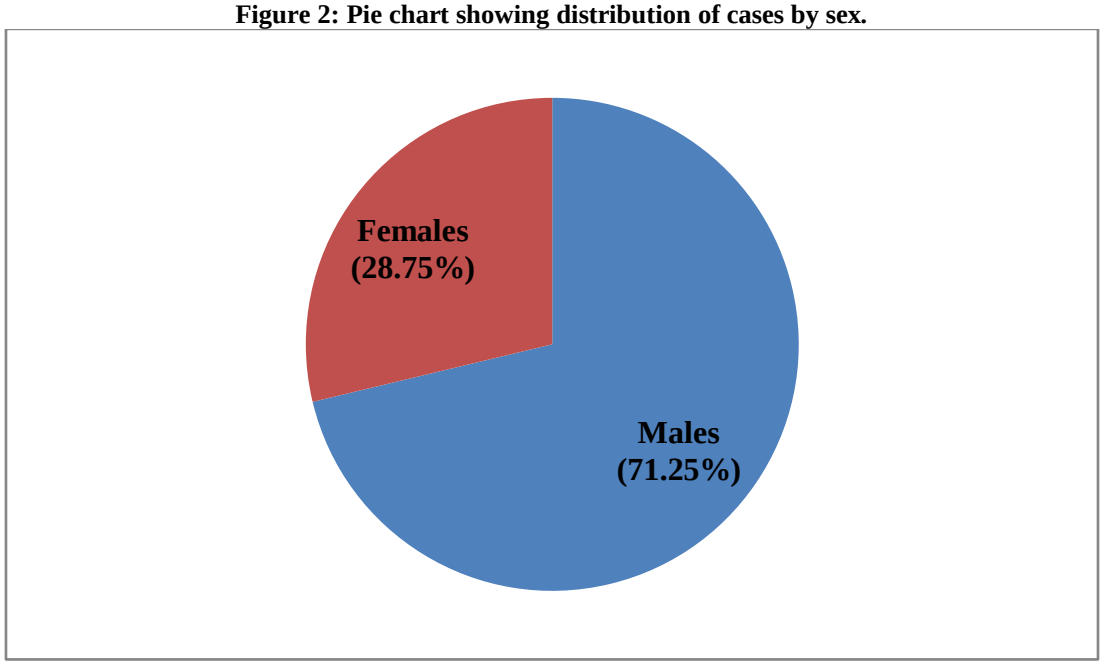

Table 1 : Mean and standard deviation values of lipid profile.

In table 1, the mean and the standard deviation values of lipid profile are shown.

Lipid profile	(Mean ± SD)
Cholesterol	169.61 ± 42.863
Triglyceride	187.23 ± 86.940
HDL	36.73 ± 11.173
LDL	95.30 ± 34.614

Table 2 : Correlation between triglyceride and serum sodium levels in cases.

		Sodium		p-value
Triglycerides		<145meq/l	>145meq/l	0.112
	<150mg/dl	46	4	
	>150mg/dl	30	0	

Table 2, shows the correlation between the triglyceride and serum sodium level. The correlation was done by chi-square test. There was no correlation between the triglyceride level and serum sodium, and this finding was statistically insignificant (p=0.112).

Table 3 : Correlation between serum triglyceride and serum potassium levels in cases.

		Potassium		p-value
Fasting Triglycerides		<5.0meq/l	>5.0meq/l	0.879
	<150mg/dl	47	3	
	>150mg/dl	28	2	

Table 3, shows the correlation between the triglyceride and serum potassium level. The correlation was done by chi-square test. There was no correlation between the fasting triglyceride level and serum potassium, and this finding was statistically insignificant (p=0.879).

IV. Discussion

Serum lipid profile is one of the major risk factor for coronary heart disease. This study was carried out to estimate both the fasting lipid profile level along with serum sodium and potassium levels in coronary artery disease patients and to compare the findings of fasting and non-fasting lipid profile.

In this study, most of the cases were elderly males. This is evident from table 1, which shows that maximum number of cases i.e. 33.75% were in the age group between 61 – 70 years followed by 25% in 51 – 60 age group, 20% in 71 – 80 age group, 16.25% in 41 – 50 age group, 3.75% in 30 – 40 age group and 1.25% in >80 years age group. Mean age of cases was 61.7 years. Table 2 shows that most of the cases constituted of male population i.e. 71.25% and the rest 28.75% were females. These findings were consistent with the observation of a study done by Goulart AC et al[18], in which the mean age was 62.7years and 58.5% were men.

With aging, there is an incremental acquisition of several CVD risk factors in an individual's lifespan. When these risk factors are incorporated in a multivariable regression model, age still remains an independent risk factor. The burden of CVD risk associated with rising age can be reduced partly by the modification of traditional coexisting CVD risk factors.[19]

It is seen from Table 5, that the mean values of total cholesterol, HDL and LDL in the fasting state is minimally altered whereas the mean value of triglyceride was raised. The mean values of total cholesterol, triglyceride, HDL and LDL was 169.61mg/dl, 187.23mg/dl, 36.73mg/dl and 95.30mg/dl respectively.

Increase in serum sodium level is associated with increased risk of coronary artery disease. But in this present study most of the cases had normal serum sodium level (<145mEq/L) and this was contradictory to the findings of the study done by Gao S et al[20]**.** In the present study there was no correlation between serum triglyceride levels and serum sodium levels and the finding was statistically insignificant.

Both low and high potassium levels is detrimental for cardiac function. Most of the cases in the present study have normal serum potassium levels and this finding was contradictory to the findings of the study done by Zhao GX et al[21], who demonstrated that elevated levels of serum potassium are closely associated with the severity of coronary artery lesions and the number of disease vessels in coronary artery disease patients. No association was found between serum triglyceride levels and potassium levels according to this study.

V. Conclusion

The results of this study shows that the levels of serum triglyceride, which is more atherogenic, was raised in the cases. There was not much alteration in the serum cholesterol, HDL and LDL levels. This study could not demonstrate any association of serum sodium and potassium with the altered serum triglyceride levels among the cases.

This is the first study in Indian Manipuri population with coronary artery disease to compare the lipid profile levels with the serum sodium and potassium levels. This study concludes that as compared to the altered serum triglyceride levels there is not much alteration in the serum sodium and potassium levels in coronary artery diseased patients.

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