IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 3 Ver.9 March. (2018), PP 24-27
www.iosrjournals.org

Serum magnesium, uric acid levels and lipid profile in ischemic heart disease

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Abstract: *Background: ischemic heart disease is one of the commonest mortality and morbidity in India and in the World. It is imbalance between oxygen supply and demand to the heart. Material and methods: In our study we had collected fasting samples from 50 cases and 50 age and sex matched controls. We have estimated serum magnesium and uric acid in ischemic heart disease patients and normal subjects. Results: All the parameters are significantly elevated when compared to controls which may be direct or indirect cause for the development of ischemic heart disease. Conclusion: Both the serum magnesium and uric acid levels are significantly elevated when compared to controls .Both the serum magnesium and uric acid should be evaluated further to establish its role in IHD.*

Keywords: *AMI: acute myocardial infarction, ACS: acute coronary syndrome, BMI: body mass index, CAD: coronary artery disease, CCS: chronic coronary syndrome, IHD: ischemic heart disease, LDL: low density lipoprotein, MI: myocardial infarction, ROS: reactive oxygen species,*

Date of Submission: 03-03-2018 Date of acceptance: 19-03-2018

I. Introduction

Cardiovascular disease is one of the major non communicable diseases in public health problem of developing countries. According to WHO report 2014, cardiovascular diseases will be the largest cause of deaths in India[1].

Ischemic heart disease is a condition of diverse aetiologies, all having common imbalance between oxygen supply and demand[2]. The most common risk factors are dietary patterns, lack of physical activity, alcohol intake, unusual sleep, stress, smoking, hypertension, family history of IHD and obesity.[3]. The clinical phenotype accompanying cardiac ischemia has traditionally been subdivided into the ACS and CCS. A sudden reduction in coronary blood flow increases myocardial oxygen demand is usually the mechanism of ACS. Atherosclerotic plaque injury such as rupture, erosion, haemorrhage are often superimposed on thrombosis or microembolism, endothelial dysfunction and heightened smooth muscle reactivity abruptly reducing the coronary blood flow and leading to acute ischemic myocyte injury.[4] By contrast, an abrupt increase in myocardial oxygen demand, in the setting of limited ability to increase myocardial oxygen supply, is usually the mechanism of ischemia in the CCS. Disorders of coagulation, endothelial and/or smooth muscle cell (SMC) function, as well as the myocardium also play a role.[5] When the coronary artery is narrowed the intramyocardial arterioles dilate in an effort to maintain total flow at a level that will avert myocardial ischemia at rest. Any increase work demands has been explained by a change in intravascular turbulence and arterial wall shear stress, inducing inflammatory processes in the arterial wall leading to atherosclerosis and leading to *development of ischemia*.[6]

Magnesium is an essential element which is required to regulate contractile proteins, modulates transmembrane transport of calcium, sodium, and potassium and also plays a pivotal role in control of cardiac excitability, neuromuscular transmission, vasomotor tone, and blood pressure, among other functions[7]. It is not an independent risk factor for mortality in heart patients. In many experimental studies showed that magnesium plays a role as protective against myocardial ischemia. It has been shown that magnesium reduces the intracellular calcium[8,9] which is a central mechanism in ischemic myocardial damage [10]. It dilates the coronary arteries and has good hemodynamic effects [11, 12] it reduces the total peripheral resistance [12, 13] and also inhibit platelet function, possibly by an effect on prostacyclin secretion [14, 15] Deficiency of magnesium causes elevation of triglycerides and decrease of HDL leading to atherosclerosis [16] .Elevation of serum Mg concentration is a protective factor for CV disease. Angkananard et al [17]suggested that it was associated with worse clinical outcomes in individuals with cardiovascular disorder. Mg is also said to be having an antiatherosclerotic effect; a recent meta-analysis [18, 19] found a significant inverse association between serum Mg concentrations and the risk of total CV events in general patients. This might be explained by Mg retarding arterial calcification.[20]

Uric acid is the end product of purine metabolism. Uric acid is an independent risk factor for cardiovascular disease[-21,22,23,24] In normal circumstances it is an antioxidant, becomes pro-oxidant in the atherosclerotic medium with ROS generation [25] The elevation of serum Uric acid has deleterious effects such as endothelial dysfunction, proliferation of vascular smooth muscle cells, increases platelet adhesiveness, oxidation of LDL- cholesterol and lipid peroxidation. All these pathological changes contribute to the pathogenesis of atherosclerosis and cardiovascular disease[26]‰

Atherosclerosis and its complications, such as cardiovascular diseases, have aroused extensive concern for public health in the international community because of their high prevalence worldwide, serious health consequences and substantial economic burden. Therefore, we conducted this hospital-based study to explore the associations between serum Magnesium, Uric acid and lipid profile in IHD patients.

II. Methods and materials

In the present study we have collected fasting venous blood samples from 100 subjects in which 50 samples were from CAD patients and equal number of age and sex matched healthy subjects. None of them were diabetics. All subjects agreed to provide their personal information regarding the purpose and the procedures of our study. This study was conducted in department of biochemistry, Rangaraya Medical College, Kakinada. The study was approved by Institutional Ethical Committee (IEC). Written Informed consent of participants was taken prior to study. The observed values were compared with controls. Our study include both sexes of age 35 to 65years who are suffering from IHD.

Serum uric acid was estimated by the uricase method, serum Magnesium is estimated by xylidyl blue , Total cholesterol by CHOD-PAP, Triglycerides by glycerol phosphate oxidase, HDL by direct method, by using standard enzymatic methods by Randox Daytona autoanalyser .LDL calaculated by using Fried Wald's formula .The results were tabulated in table NO:1. The statistical analysis was done by using graph pad prism version 6.0 software and results were expressed as mean ± SD. p value < 0.05 was considered as statistically significant.

III. Results and discussion

Table1: showing the comparison of Mean (±SD) values of studied parameters among Controls and IHD subjects

	PARAMETERS	CONTROLS Mean±SD (n=50)	CASES Mean±SD (n=50)	p VALUE
1	Serum Total cholesterol (mg/dl)	132.62 ± 35.61	185.14 ± 87.87	< 0.0001
2	Serum Triglycerides (mg/dl)	107.44 ±69.48	175.08± 113.59	< 0.0002
3	Serum HDL(mg/dl)	40.88 ±12.55	31.23 ±13.24	< 0.0001
4	Serum LDL (mg/dl)	89.46 ± 27.01	131.80± 79.11	<0.0003
5	Serum uric acid (S.UA) (mg/dl)	4.919 ±1.425	9.896 ± 1.739	< 0.0001
6	Serum Magnesium (mg/dl)	1.785 ± 0.438	2.686 ± 0.856	< 0.0001

Nowadays, atherosclerosis and its complications, such as cardiovascular diseases, have aroused extensive concern for public health in the international community because of their high prevalence worldwide, serious health consequences and substantial economic burden. Therefore, we conducted this hospital-based study to explore the associations between serum Magnesium, Uric acid and lipid profile in IHD patients. Results of this study confirmed the strong association between serum Uric Acid, Magnesium levels and lipid profile in IHD patients.

In our study total cholesterol levels were statistically significantly increased ($p<0.0001$) in IHD subjects compared to controls. In our study triglycerides levels were statistically significantly increased ($p<0.0002$) in IHD subjects compared to controls. In our study HDL cholesterol levels were statistically significantly decreased ($p<0.0003$) in IHD subjects compared to controls. The present study is correlated with Serum Lipid Profile in Ischemic Heart Disease. Dyslipidemia is major risk factor for IHD cause in patients and increased levels of LDL proved an association with the risk of atherosclerosis.[27] There is a strong inverse association between low levels of high-density lipoprotein cholesterol (HDLc) and increased risk of IHD

In our study uric acid levels were statistically significantly increased ($p<0.0001$) in IHD subjects compared to controls. The present study correlated with Sunny Chopra et al who showed that there is increased platelet aggregation and plays an important role in endothelial dysfunction and its activation thereby increasing the risk of coronary thrombosis.[28] Uric acid acts as an antioxidant when it enters cells including vascular smooth muscles and adipocytes[29]. Hyperuricemia may predict the development of cardiovascular disorders[30], hypertension[31] and diabetes mellitus[32].

In our study serum magnesium levels were statistically significantly increased ($p<0.0001$) in IHD subjects compared to controls. The present study correlated with the data of National Health and Nutrition Examination Survey Epidemiologic Follow up study (NHEFS). This study suggests that decreased serum magnesium levels are inversely proportional to risk of IHD. Increase magnesium gets accumulated in heart tissues as infarction progresses. This magnesium leakage from cardiac cells into the serum causes significant increase in IHD patients.[33]

IV. Conclusion

In conclusion serum magnesium, uric acid is strongly associated with IHD and it should be further evaluated.

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