

Evaluation of Serum Bilirubin and Magnesium in Cardiovascular Diseases

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Abstract: Objectives: objectives of this study were to assess the serum bilirubin and magnesium concentrations as markers for coronary artery disease (CAD). Background: Lipid oxidation and formation of oxygen radicals are important elements of arterial plaque formation and atherosclerosis, and are involved in the pathophysiology of coronary artery disease (CAD). Because bilirubin has antioxidant properties, it has been suggested that it may have a protective role in the atherosclerotic process. Magnesium, the fourth most abundant cation in the human body, is involved in several essential physiological, biochemical, and cellular processes regulating cardiovascular function. It play critical role in modulating vascular smooth muscle tone, atherosclerosis, and CAD. Together with bilirubin, magnesium has anti-inflammatory and anti-ischemic properties, it may have protective role in the CAD. Methodology: study was conducted on 50 known patient of CAD of age between 20-60 years were included in the study. Same numbers of healthy control subjects of the same range of age were selected from general population with no history of CAD, smoking, hypertension. The information about name, age, sex and duration of illness was recorded in a Performa. Patients of CAD with jaundice were excluded from study. Blood samples of patients and controls were drawn from vein for determination of serum bilirubin and magnesium level. Statistical analysis was done by using SPSS software. Results: The results had shown that the serum bilirubin and magnesium levels were lower in the cases when compared to the control group, the results were statistically significant. Conclusion: According to results, there was significant inverse relation between serum bilirubin and magnesium level and coronary artery disease. Higher serum bilirubin and magnesium levels played a protective role against CAD, even in the presence of other risk factor. Therefore bilirubin and magnesium level can be used as a predictor of CAD in the future.

Keywords: Bilirubin, Magnesium, Coronary artery disease, Atherosclerosis

1. Introduction

Bilirubin is known as toxic product of heme catabolism, but its role as potent physiological antioxidant is discovered recently, CAD is still the major prevailing cause of mortality among advanced countries. On the other hand, the number of victims is continuously increasing in developing countries. A various main risk factors have been identified for atherosclerosis, including hypertension, hyperlipidemia, diabetes mellitus, smoking, etc ^[1]. There are other factors, like plasma bilirubin level, with protective and preventive properties against coronary atherosclerosis ^{[2]-[8]}. The development of coronary atherosclerosis is associated with lipid oxidation and generation of free radicals ^{[1]-[9]}. Several mechanisms have been attributed to anti atherogenic property of bilirubin. The first protective effect of bilirubin relates to the antioxidant property of bilirubin, which prevents lipid oxidation, especially low-density lipoprotein (LDL), and inhibits free radical-induced damages ^{[10]-[15]}. Bilirubin has proven to be a potent antioxidant under physiological conditions by inhibiting lipid and protein oxidation ^[16]. As little as 10 nM of bilirubin is enough to protect cell against a 10000-fold higher concentration of oxidant ^[17]. The second protective effect relates to anti- inflammation properties of bilirubin, inflammation are fundamental to the arteriopathy ^{[18]-[20]}, bilirubin was proven to act against plaque formation and subsequent atherosclerosis ^[21].

Magnesium is the fourth most abundant cation in the human body and the second most abundant intracellular cation, and is an important cofactor for many enzymes, especially those involved in phosphate transfer reaction ^{[22]-[23]}. Magnesium is

therefore essential in the regulation of metabolism of other ions and cell function.

Magnesium deficiency has been shown to be associated with fatal cardiovascular disease, such as cardiac arrhythmia and coronary heart disease, as well as with risk factor for disease such as hypertension, hypercholesterolaemia and diabetes mellitus ^{[24]-[28]}.

2. Material and Methods

In this study, where 50 patients (aged between 20-60 years) with CAD were compared with a matched 50 healthy volunteers (aged between 20-60 years) as control group. On the other hand individuals with hepatocellular disorders, liver problem, kidney problem, malignant disease, erythrocyte disease, alcohol consumption and hemolyzed samples were excluded from study.

Total bilirubin level in the blood samples of all cases and controls were measured by diazo method (diazotized sulfanilic acid) and with colorimetric technique.

Serum magnesium level in the blood samples of all cases and controls were measured by Xylidyl Blue, Colorimetric Endpoint method.

First of all, the purpose of study was explained to the patients and their questions concerning the study were replied. The study had no additional cost to patients. The written consent of all patients was obtained and the study was confirmed by the ethics committee of the university. Data recording and analysis were performed using SPSS software.

3. Results

A total of 50 cases and 50 sex and age related controls were included in the study. It was seen that the mean age of patients and controls was 30 – 40 years. The mean level of serum bilirubin in controls was (1.002 mg/dl) the standard error of mean SEM (0.021), while the mean in cases was (0.462 mg/dl) with SEM of (0.022) these found to be statistically significantly lower than controls ($P < 0.001$).

Table 1- Mean \pm SEM of level of serum Bilirubin in controls and cases n= 100

Group	Serum bilirubin mg/dl
Controls (50)	1.002 \pm 0.021
Cases (50)	0.462 \pm 0.022

The mean level of serum magnesium in controls was (2.172 mg/dl) the standard error of mean SEM (0.031), while the mean in cases was (1.316 mg/dl) with SEM of (0.052) these found to be statistically significantly lower than controls ($P < 0.001$).

Table 2- Mean \pm SEM of level of serum magnesium in controls and cases n= 100

Group	Serum magnesium mg/dl
Controls (50)	2.172 \pm 0.031
Cases (50)	1.316 \pm 0.052

4. Discussion

Bilirubin level is usually used to assess abnormality in liver function. However latest study reports have shown that there is an inverse relationship between CAD and bilirubin and magnesium concentrations (within the reference range) [29]. The reference range of bilirubin is (0.2 – 1.2) mg/dl [30], and for magnesium, women (1.9-2.5) mg/dl, men (1.8-2.6) mg/dl [31].

In this study total serum bilirubin and serum magnesium were low in CAD patient as compared to control subjects.

Serum Total bilirubin level in CAD patients and control population were 0.462 \pm 0.022 and 1.002 \pm 0.021 respectively.

Serum magnesium level in CAD patients and control population were 1.316 \pm 0.052 and 2.172 \pm 0.031 respectively.

Low serum bilirubin level (up to 0.6 mg/dl) was observed in 44 patients from CAD group, showing an overall prevalence of 88%.

Similar lower levels were reported by earlier workers [32]-[34].

This study reported that antioxidant/antiatherogenic properties of bilirubin reduce lipid oxidation, and the anti-inflammatory, anti-ischemic properties of magnesium decrease the chance of atherosclerosis. Thus an inverse correlation was found between CAD and bilirubin and magnesium concentrations in serum [35]-[37].

5. Conclusion

The study suggested an inverse association between serum bilirubin and magnesium concentration and risk of CAD. Higher serum bilirubin and magnesium level have protective role against CAD, even in the presence of other risk factor. Therefore, Bilirubin and magnesium level can serve as predictive factor. If confirmed by future retrospective and prospective studies, bilirubin and magnesium concentrations in conjunction with traditional risk factor could help identify those at high or low risk of CAD.

Ethical Issues

Ethical consideration was considered in this study and all participants cannot be identified in any way by reader of the final report.

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