Serum Protein Profile in Patients with Acute Myocardial Infarction

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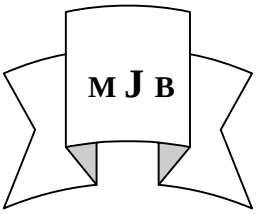

Abstract

Total serum protein, albumin, globulins concentrations, and albumin/globulins (A/G) ratio in the sera of patients with acute myocardial infarction (AMI) were assayed to investigate the expectant changes in protein profile.

Fifty five patients with AMI were subjected to present study, as well as fifty four healthy individuals as a control.

Total serum protein and serum albumin were determined colormetrically, serum globulins were calculated mathematically.

Total serum protein was found to decrease in the sera of patients when compared with healthy controls due to decrease in albumin. Globulins were elevated but not sufficient to substitute the depletion in albumin. Also A/G ratio decreased more than that of healthy controls.

In conclusion serum protein might be changed as a response to the presence of oxidative stress associated with AMI.

الخلاصة

لتقصي التغيرات المتوقعة في معالم بروتينات المصل فقد تم قياس تركيز كل من بروتينات المصل الكلية والألبومين والكلبيولينات ونسبة الألبومين /الكلبيولينات في خمسة وخمسين مريضا مصابا باحتشاء العضلة القلبية الحاد.

توصلت الدراسة الى وجود نقص معنوي في تركيز بروتينات المصل الكلية والألبومين ونسبة الألبومين /الكلبيولينات، في حين وجدت ارتفاعا معنويا في تركيز الكلبيولينات.

تستنتج الدراسة بأنه قد يكون هذا التغير ناتج عن وجود الإجهاد التاكسدي الذي يرافق احتشاء العضلة القلبية الحاد.

Introduction

Cardiovascular disease (CVD) remains the major cause of morbidity and death in developed countries[1-3],however researchers always seek a new risk index for CVD to aid in the diagnosis and disease management.

Although the protein in all fluid compartments plays a major physiological function, the plasma proteins are the most frequently analyzed. More than 500 plasma proteins have been identified[4].

Serum protein plays a crucial role in varied functions ranging from nutrition and control of body water distribution, to transporting and protection, as well as their central role as a hormones and enzymes[5]. Some proteins also act as antioxidants[6].

Total protein measurement is a fairly non-specific measurement as it can be influenced by many variables, and thus changes in one protein or group of proteins can be masked by opposite changes in other proteins. Total protein measurements can give an indication of gross changes brought about by a number of different disease states[7].

Albumin is the most abundant protein found in the plasma, making up 55-65% of the total protein[7,8]. Albumin, with a molecular weight of about 66 kDa, is synthesized by the liver and is the most important protein in maintaining the osmotic pressure of plasma. Another important role of this protein is that of a non-specific transport protein, as it binds many non-polar compounds such as bilirubin, long-chain fatty acids, phospholipids, metallic ions, amino acids, and a number of drugs. Albumin also functions as a reservoir for a number of hormones, particularly thyroid hormones[7-9].

Albumin is an important component of plasma antioxidant activity, primary by binding free fatty acid, divalent cations, HOCl and bilirubin and scavenging of $O2\cdot^-$ and $ONOO^-$ [6,8,10]. It acts as buffer in non-physiologic conditions, and the binding of albumin to endothelial membrane-associated glycoproteins increases capillary permeability to small protein[8].

The globulin group of serum proteins consists of α1, α2, β1, β2, and γ fraction. Each fraction consists of a number of different proteins with different functions. Globulins play a central role in the very varied function [7,8].

In the assay of total serum proteins, useful diagnostic information can be obtained by determining the albumin fraction and total globulins. A reversal or significant change in the ratio of albumin and total globulin (A/G) was first noticed in diseases of the kidney and liver. [4]

In the present study, we try to investigate the expectant changes in protein profile in the sera of patient with AMI.

Material and Method

Patients and Controls

Fifty five patients (35 males, 20 females) with AMI admitted to emergency unit in Merjian Teaching Hospital in Hilla city in 2007, have been subjected to the present study, as well as fifty four (28 males, 26 females) apparently healthy individuals as a control group, after having been asked about their health.

Total serum protein was measured by using commercially available kits (Randox Laboratories Ltd., UK) based on biuret method.

Serum albumin was measured by the use of commercially available kits (Randox Laboratories Ltd., UK), based on bromocresol green method.

To determine the albumin/globulins (A/G) ratio, it is common to determine total protein and albumin.

Globulins are calculated by subtracting the albumin from the total protein.

Total serum protein - serum albumin = serum globulins[4].

Statistical Analysis

All values were expressed as mean ± standard deviation (SD) . Student's t-test was used to estimate differences between the groups and these differences were considered significant when the probability was ($p < 0.05$).

Results

The results are given in figures 1,2,3, and 4.

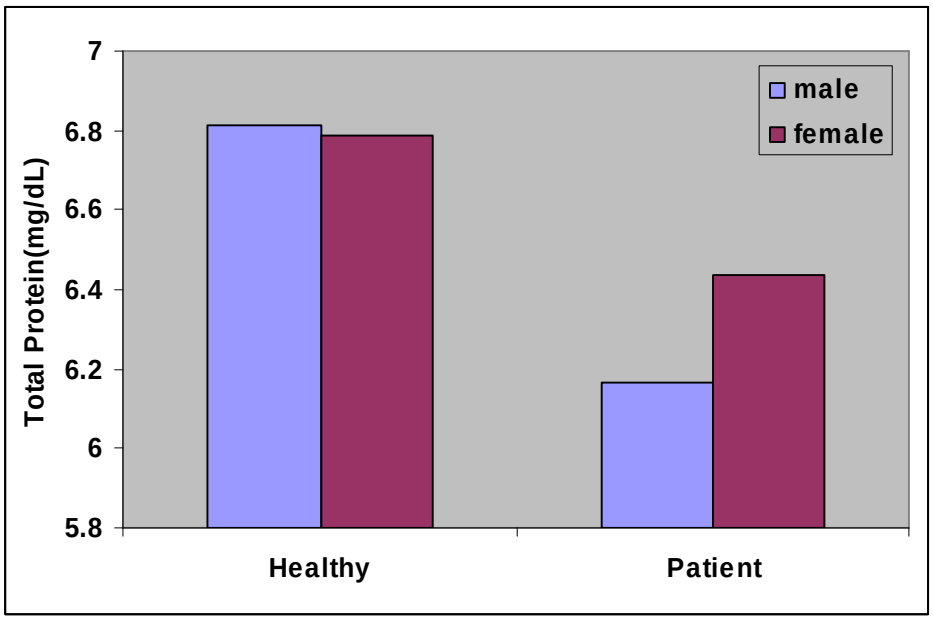

Figure 1 Total Protein Concentrations in the Sera of Patients and Healthy Controls.

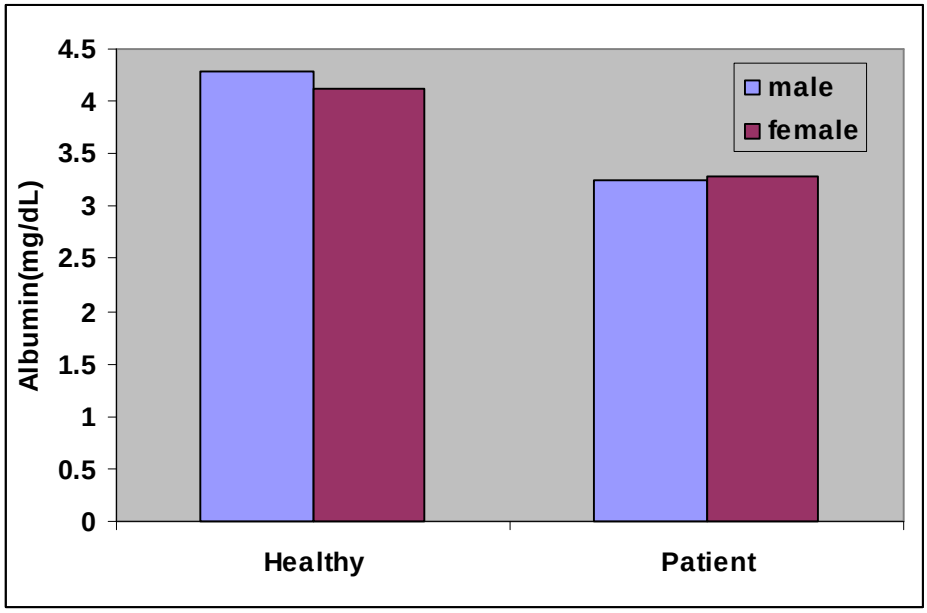

Figure 2 Albumin Concentrations in the Sera of Patients and Healthy Controls.

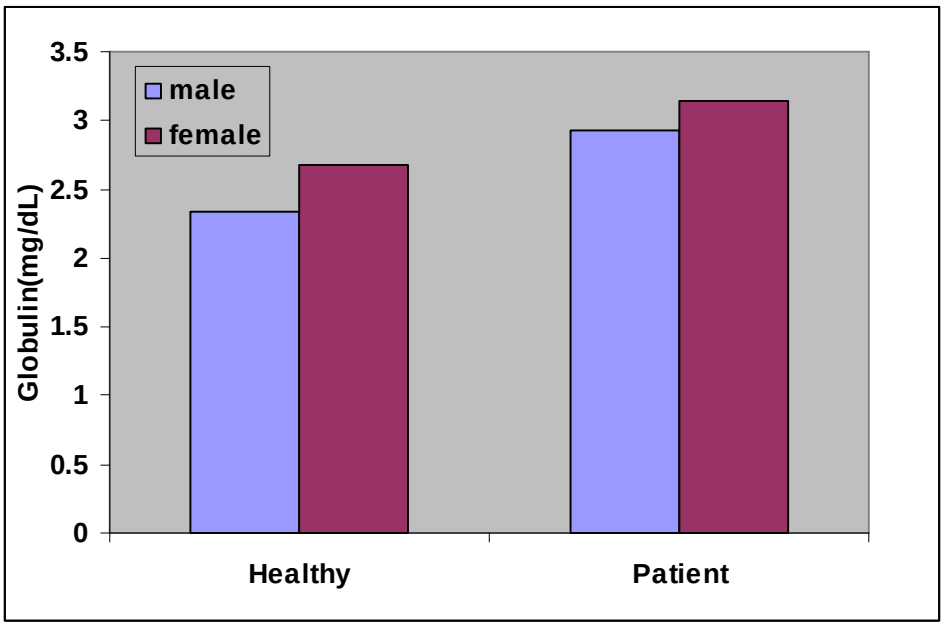

Figure 3 Globulins Concentrations in the Sera of Patients and Healthy Controls.

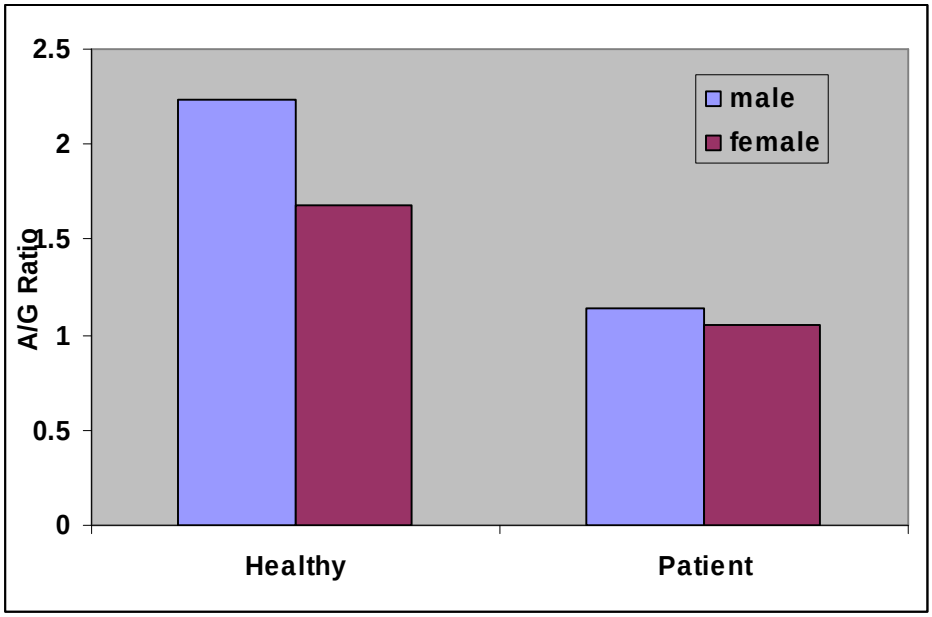

Figure 4 Albumin/Globulin Ratio in the Sera of Patients and Healthy Controls.

Discussion

Measurement of total serum protein concentration provides general information reflecting disease states in many organ systems.[4] Serum proteins play several roles in the human body. Some of them, such as albumin may be considered an important component of plasma antioxidant activity, primarily, binding free radicals, free fatty acid, divalent cations, HOCl and bilirubin.[6,8,11] For this reason, total serum proteins concentration may change under oxidative stress associated with AMI.

In the present study, we have found that the lower serum albumin concentration is associated with an increased risk for AMI in both genders. This finding has been supported the

suggestion that the relation between serum albumin and ischemic heart disease (IHD) may vary across sex, age, and level of serum cholesterol [12].

Another study found an association between serum albumin and IHD among older women but not older men[13]

Other studies were reported an increased risk of IHD and cerebral stroke increased with low serum albumin[14,15].

The effect of serum albumin on cardiovascular system is poorly understood, but some suggest that its effects on the blood viscosity and free fatty acid transport.

Hypoalbuminemia in AMI may be due to the combination of microalbuminuria; increased albumin leakage into extra vascular spaces and increased degradation plasma proteins by free oxygen radical, since protein sulfhydrals serve as sacrificial antioxidant, prevent plasma lipid peroxidation as well as being targets for oxidative damage. Hypoalbumine-mia leads to a reduction in the antioxidant scavenging capacity of plasma proteins and this in turn induces myocardial muscle damage by free oxygen radicals[16].

Low total serum protein levels can be found in cases of severe disease such as liver disease or severe malnutrition where the synthesis of protein is reduced. More commonly, low total protein levels are found in situation where there is dilution of the blood (haemodilution) caused by over-hydration. Total serum protein levels can also be affected by the absence of one of the major blood proteins, for example hypoalbuminaemia or hypogammaglobulinaemia.[7]

The results of the present study suggest that the decrease in total serum protein may be due to the involvement of albumin in the defense against oxidative stress associated with AMI. Globulins were elevated, but not sufficient to substitute the significant decrease in albumin.

Among several important functions of albumin, we restrict our interest to its ability to scavenge reactive oxygen radicals , where it is found to be an important antioxidant in plasma, by binding free fatty acid, divalent cations, HOCl and bilirubin and scavenging of $O2\cdot -$ and ONOO- by replace a highly free radical by a less reactive one.[6,8, 11]

Low levels of albumin have been reported in premature newborns with intrauterine growth retardation. These results were attributed to the scavenging property of albumin against oxidative stress.[17]

Useful diagnostic information can be obtained by determining the albumin/globulin ratio.[4]

Compared with healthy controls A/G ratio was found to significantly decrease in patients with AMI, in the present study.

In conclusion serum protein might be changed as a response to the presence of oxidative stress associated with AMI.

Acknowledgements

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