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Relationship between Cholesterol and Alkaline Phosphatase with Essential Hypertension

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Abstract

Hypertension (blood pressure) is one of the most commonly used clinical parameters, and its values are a key determinant of therapeutic decisions. In this study, 100 blood pressure samples were collected from male patients from the General Teaching Hospital in Mosul, where the concentration of some hormones and their relationship to blood pressure were measured. The results showed significant differences in the concentration of High-density lipoprotein (HDL) and low-density lipoprotein of cholesterol (LDL), as well as significant differences in the concentration of the serum ALP compared with the control group. Results also observed the significant differences in the concentration of hormones compared with the control group.

Keywords: Blood pressure, High-density lipoprotein (HDL), low-density lipoprotein (LDL), Serum ALP

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1. Introduction

Blood pressure is one of the most commonly used clinical parameters, and its values are a key determinant of therapeutic decisions. However, interpreting the physiological meaning of blood pressure in a given patient is not always easy. This paper reviews the physical basis and physiological determinants of arterial blood pressure (BP) and the relationship of BP to tissue perfusion. Some of these issues were covered in a previous review on blood pressure[1]. Blood pressure is defined as the force of blood pushing against the walls of blood vessels, through which it transports nutrients, water, oxygen, and enzymes to all the body's tissues and organs, known as circulatory system. Blood pressure is important for delivering oxygen and nutrients to the body's various tissues, as well as for transporting white blood cells for immunity. Circulation begins with the contraction of the heart muscle, which forcefully pushes all its contents of blood, which in turn travels from the heart to the aorta. When the heart beats, it pumps blood through the arteries to the rest of the body [2]. Hypertension(High blood pressure) is a chronic condition in which the blood pressure in the arteries is high. This high pressure requires the heart to work harder than usual to push blood through the vessels. Blood pressure consists of two numbers: systolic pressure and diastolic pressure. This number is based on the pressure exerted and measured during the contraction of the heart muscle (systole) or its relaxation between beats (diastole)[3]. Normal systolic blood pressure during cold temperature between 100-140 mm Hg remains in the high state but in the lower state to 60-90 is preferred blood pressure or if it is appropriate or indicates 140-90 mm Hg or high blood pressure is the most important factors that lead to stroke, heart attacks and heart failure and is one of the causes of disease[4]

2. Materials and Methods

100 blood pressure samples were collected from male patients from the General Teaching Hospital in Mosul, where the concentration of some hormones and their relationship to blood pressure were measured. The cholesterol is determined after enzymatic hydrolysis and oxidation. The indicator quinoneimine is formed from hydrogen peroxide and 4-aminoantipyrine in the presence of phenol and peroxidase

Cholesterol esterase

$$\text{Esters of cholesterol} + H_2O \rightarrow \text{Cholesterol} + \text{Fatty acids}$$

Cholesterol oxidase

$$\text{Cholesterol} + O_2 \rightarrow \text{Cholest-4-en-one} + H_2O_2$$

Peroxidase

$$H_2O + \text{Phenol} + \text{4Aminophenazone} \rightarrow \text{Quinonimine}$$

The quantity of this red dye quinoneimine formed is proportional to the cholesterol concentration

While Alkaline phosphatase (serum ALP) was

measured by Roch device (German-made) that is used for clinical chemistry tests. A blood sample is taken and diagnosed. It is placed in a tube and separated by a centrifuge. The serum is taken and the required amount for any test is placed in the aforementioned device. After that, a command is given to the aforementioned device to conduct the test. The test results are then shown to the patient if he has an increase or decrease in ALP and the extent of its impact on blood pressure.

3. Results and Discussion

The results showed significant differences ($p>0.05$) in cholesterol concentration among hypertensive patients, with the percentage reaching (224±24) among patients, compared to (95±13) among those without. Significant differences were also observed in the concentration of high-density lipoprotein (HDL), with the percentage reaching (125±15) compared to the control group (80±0.5)(fig - 1). Indeed, High cholesterol and high blood pressure have a complicated relationship. About 38% of all American adults have high cholesterol, or a total cholesterol number over 200 milligrams per deciliter (mg/dL). More than 43% have high blood pressure. High blood pressure means either your top number (systolic reading) is 140 or higher, or your bottom number (diastolic reading) is 90 or higher, or both[5]. More than 60% of people with high blood pressure also have high cholesterol. Both also threaten heart health because they're risk factors for cardiovascular disease. But you can get all your numbers under control with many of the same steps[6,7].

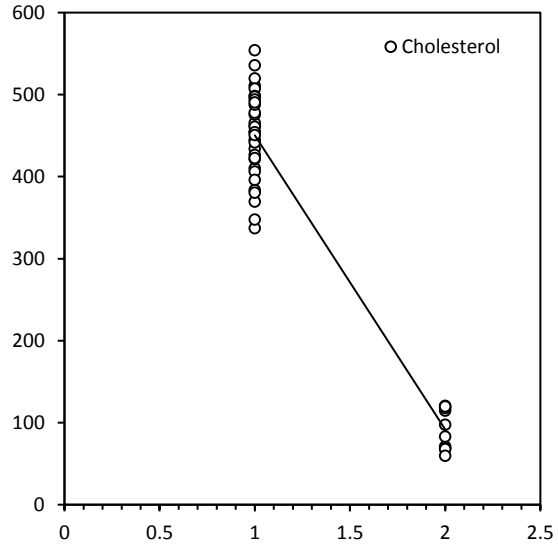

Fig. (1) Relationship between cholesterol and hypertension

Results showed that there are significant differences in the ALP enzyme in patients with high blood pressure compared to the control group, as the percentage reaches (100±15) compared to the control group (13±4)(fig 2). The reason for this enzyme being found in high proportions in heart and muscle cells is that high blood pressure leads to the release of high amounts of the ALP enzyme. Our findings demonstrate that serum ALP is associated with hypertension. A previous study of 4,155 men and women conducted by the United States National Health and Nutrition Examination Survey reported that ALP showed a significant association with higher frequency of hypertension (P = 0.01). Moreover, compared with the lowest quartiles of ALP, the adjusted OR associated with the highest quartiles was 1.6 (95% CI: 1.0 to 2.5)[8]. Another study of 79 South African men reported that 24-hour systolic blood pressure was positively associated (regression coefficient β= 0.289, P = 0.018) with serum ALP[9]. In conclusion, cholesterol and serum ALP is associated with hypertension. However, cholesterol more associated with hypertension than serum ALP.

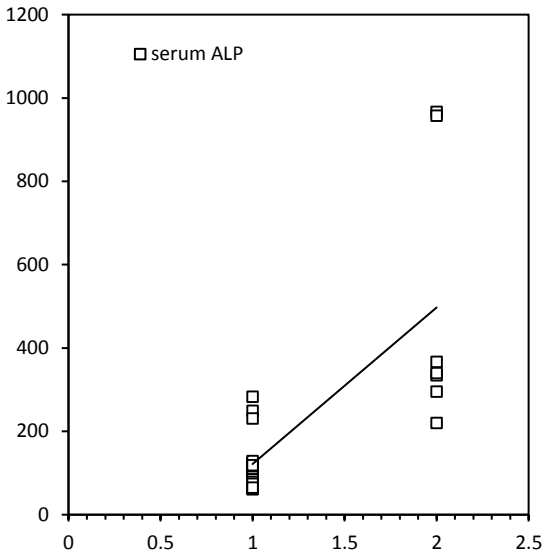

Fig. (2) Relationship between serum ALP and hypertension

High levels of the ALP enzyme lead to several diseases, including leukemia and hyperthyroidism. However, there is no pathological evidence of a low level of this enzyme. The enzyme level may be low in patients suffering from severe malnutrition.

For example, linear dose response relationships of serum ALP levels, even within the normal range, with risk of CVD in both men and women and with risk of total stroke, ischemic stroke, and hemorrhagic stroke in men as well. Further research with large sample size is needed to evaluate the normal limits and target levels of ALP for the prevention of CVD, especially for the middle aged and elderly adults15.

IALP is expressed and secreted by intestinal epithelial cells (especially in the duodenum), but is also biologically active in the serum91. The expression of IALP is regulated by various nutritional and inflammatory factors96. The effects of IALP activity in inflammatory conditions and in the metabolic syndrome is an emerging field of clinical research as

this ALP isozyme has important functions in gut mucosal defence. IALP maintains intestinal homeostasis by inactivating bacterial endotoxins such as lipopolysaccharide (LPS), regulating intestinal lipid absorption, eliminating toxic nucleotides and determining the composition of the intestinal microbiome16. ALP and, more specifically, BALP have been recognized as biomarkers of renal-osteodystrophy for decades17.

The use of BALP levels in clinical practice is less common than that of total ALP levels and data on the association of BALP levels with mortality in the general population are sparse. As mentioned above, a large North American observational study could not establish an association between BALP levels and mortality in the general population or in patients with mild CKD18. Finally, elevated hormone levels when blood pressure is recorded. Leads to hypothyroidism and hyperactivity of the adrenal cortex, also known as Cushing's syndrome and hyperaldosteronism, which is characterized by an increased level of aldosterone regulation.

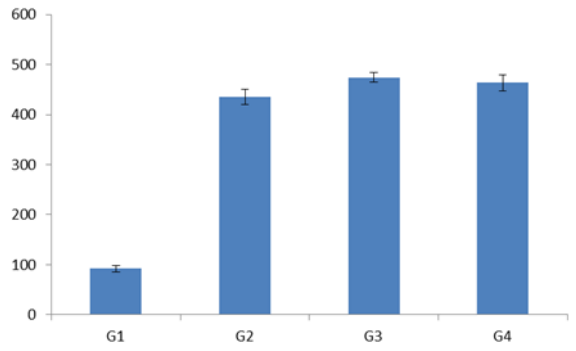

Fig. (3) The mean levels of cholesterol at samples of study (G1, control group,G2 , Patients aged 18-35, G3, Patients aged 36-50, G4, Patients aged ≥ 51)

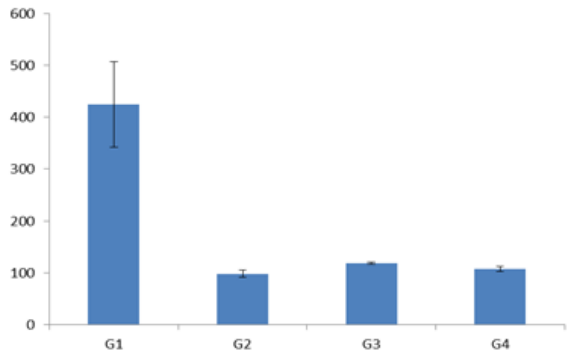

Fig. (4) The mean levels of ALP at samples of study (G1, control group, G2, Patients aged 18-35, G3, Patients aged 36-50, G4, Patients aged ≥ 51)

4. Conclusion

High blood pressure is one of the most common clinical parameters, and its values are a key factor in making treatment decisions. The results showed that cholesterol concentrations in patients with high blood pressure were higher than in people without the condition. Results showed that there are significant differences in the ALP enzyme in patients with high blood pressure compared to the control group. The results also noted significant differences in hormone concentrations compared to the control group.

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