ELECTROLYTES CONCENTRATION IN PATIENTS WITH HEART DISEASE

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Abstract: The purpose of study was to examine possible changes in electrolytes level of patients with heart disease. Serum electrolytes were determined by using appropriate techniques in fifty patients and controls. The result showed a significant elevation in the levels of sodium whereas, decreased concentration of serum calcium and potassium in patients compared to those of controls. Further investigations will clarify the scope of changes in these electrolytes, which may reliable diagnostic aid in heart disease.
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Key Words: Electrolytes, Serum, Heart diseases, Flame photometer

Introduction

Electrolytes play important roles in cellular metabolism, energy transformation, and in the regulation of cellular membrane potentials, particularly those of muscle and nerve cells. Decreases of these electrolytes can induce a wide range of clinical disorders, with neuromuscular dysfunction and severe arrhythmias. The risk for these disorders increases significantly when more than one electrolyte is deficient, and increases still further in the presence of heart disease **(1).** Electrolytes have been subjected to several investigations concerning their role in the etiology of heart disease. Although there is not necessarily a direct cause–effect relationship between the development of heart disease and electrolytes status, it is generally believed that some of them are heart disease risk factors **(2).** Thus, it has been suggested that deficiency, lack of homeostatic control, or excess intakes of some electrolytes might lead to cardiovascular mortality **(3).** Patients with heart diseases commonly exhibit acid-base and electrolyte disturbances mainly due to the activation of several neurohumoral mechanisms as well as to drugs regularly used in this population. It was reported that heart disease patients exhibited electrolytes abnormalities such as hypokalemia, hypocalcemia and hypophasphatemia **(4).**

Electrolyte imbalance can cause serious problems such as dehydration, nausea, vomiting and fever. Over the long term, an electrolyte imbalance can contribute to heart disease, kidney failure, eating disorders and disorders of the endocrine system.

Alterations in electrolyte balance have been claimed to play a role in the pathophysiology of coronary heart disease; however, the relationship between the electrolyte pattern and other clinical variables immediately after an acute vascular event is unclear **(5).** Sodium is a vital electrolyte in the fluid that carries nutrients to cell tissue and helps regulate blood pressure. Sodium levels can directly influence potassium and chloride levels in the body. Because of this, sodium levels are a good indicator of overall electrolyte balance **(6).** Potassium maintains pressure in body fluids and regulates pH balance, kidney function and enzyme activity. Blood potassium levels become high following a heart attack because excess amounts are released into the blood, the relations between serum calcium concentration and the cardiovascular risk factors like hypertension, hyperglycaemia and hyperlipidaemia **(7)**. However calcium plays a vital role in a number of biological processes related to the pathogenesis of atherosclerosis, the relationship of serum calcium and severs stenosis observed on angiography **(8).**

Material and Method

Fifty blood samples (10ml) of both the groups each from patients and control subjects were collected into sample tubes without the addition of anticoagulant. The blood samples were centrifuged at 1500 rpm for 20 minutes; the serum was separated and immediately used for the determination of the electrolytes, sodium, potassium and calcium was analyzed using flame photometer (M-410 CORNING).

All the chemicals and reagents obtain were of analytical grade obtained from Merck.

Determination of serum potassium

The principal reaction is based on measuring; at alkaline pH potassium ions and (TPB) form a turbid emulation, the formation of which can be measured quantitatively in a photometer at 578 nm. The increase of the absorbance (A) is directly proportional to the concentration of potassium in the sample 1000µl of reagent sodium hydroxide, TPB-Na (R1) followed by reagent kalium (R2) in a 5ml sample tube containing 10µl blood serum were mixed and allowed to stand for 10 minutes to complete the reaction.

Determination of serum sodium

The principle reaction is based on measuring at sodium magnesium uranyl acetate. The excess of uranium was reacted with Ferrocyanide to produce a chromophore, the formation of which can be measured quantitatively in a photometer at wavelength at 550nm. The increase of the absorbance (A) is directly proportional to the concentration of sodium in the sample.

Determination of serum calcium

1000µl of reagent mercuric (ii) thiocynate, mercuric (ii) calcium (R1) followed by reagent Ferric (iii) Nitrate Nitric Acid (R2) in a 5ml sample tube containing 10µl blood serum were mixed and allowed to stand for 10 minutes to complete the reaction.

Results

Table 1 show the blood serum concentration of electrolytes in patients with heart disease and controls.

Electrolytes	Patients	Controls
Sodium	**2.30±0.73**	**1.43±0.28**
Potassium	**1.41±0.22**	**2.39±044**
Calcium	**1.52±0.58**	**2.48±0.39**

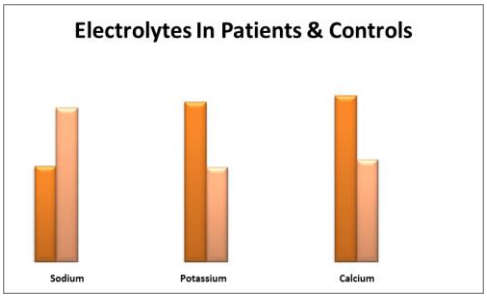

Fig: 1 Shows the increased concentration of serum sodium and decreases concentration of potassium and calcium in patients as compared with control subjects.

Discussion

Heart diseases accounts for the majority of morbidity. It involves the vascular changes in the coronary circulation leading to angina pectoris and myocardial infarction. It is previously suggested that higher sodium concentration in essential hypertensive patients is related to an elevated blood pressure and an inappropriately high secretion of aldosterone because aldosterone is a potent salt retaining hormone. Results showed that sodium was significantly increased in patients (Fig. 1) whereas calcium and potassium, decreases as compared to control subjects. Results showed a complete picture of electrolyte disturbances. Sodium can cause cardiac arrhythmias, neuromuscular irritability, hypertension and vasoconstriction (including constriction of coronary arteries), as well as metabolic effects **(9)**, all of which are extremely undesirable, especially in patients who have undergone cardiac surgery. Low levels of other electrolytes such as potassium and calcium can also have highly undesirable effects in patients with heart disease. Clinical symptoms include muscle weakness, respiratory failure, and increased risk for respiratory infections, impaired myocardial function and a decrease in cardiac output **(9)**. Low serum calcium levels can also induce arrhythmias. Hypocalcaemia can lead to severe cardiovascular depression **(10)** and congestive heart failure that is unresponsive to inotropic agents, especially in patients with underlying cardiomyopathies **(11).** These cardiovascular effects may occur in the absence of specific electrocardiographic changes. Thus, low electrolyte levels can have severe adverse effects on the clinical course of patients with heart disease. Furthermore, when more than one electrolyte is deficient the effects may be cumulative, specifically in the case of potassium deficiencies. These impacts of electrolyte disorders may be more pronounced in patients undergoing cardiac surgery, who are already at increased risk for tachyarrhythmia and other complications during the perioperative and postoperative periods, preventing electrolyte disorders is thus an important goal of therapy in this category of patients **(12, 13).**.

Conclusion

It was concluded that the pathogenesis of some heart diseases has been connected with changes in the constancy of electrolytes in patients as compared to controls. Deficiency of electrolytes like potassium and calcium may increase the risk of heart diseases. Whereas, an increase level of sodium could induce the deficiency. Further investigations will clarify the scope of changes in these electrolytes, which may reliable diagnostic aid in heart disease.

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