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KIDNEY FUNCTION IN ARTHRITIS

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ABSTRACT: Arthritis is a chronic systemic autoimmune disease associated with potentially debilitating joint inflammation. Sixty-six blood samples were collected into plain bottles from arthritis patients (33 males and 33 females, aged 30-55yrs) and another sixty-six samples from non-arthritis subjects (33 males and 33 females, aged 30-55yrs) as controls. These samples were analysed for sodium, potassium, chloride, bicarbonate, urea and creatinine concentrations. The concentration of sodium was 138.5±7.5mmol/l for control and 132.5 ±4.5mmol/l for arthritis patients, potassium concentration was 3.75 ± 1.25mmol/l for controls and 4.25 ±1 .75mmol/l for arthritis patients, chloride concentration was 102 ± 6.0 mmol/l for control subjects and 100 ± 5.0mmol/l for arthritis patients, bicarbonate concentration was 24 ± 4.0mmol/l for controls and 22.5±3.5m mol/l for arthritis subjects. Urea concentration was 3.85 ± 2.35mmol/l for non-arthritis subjects and 11.85±4.55mmol/l for arthritis patients while creatinine concentration was 88.4 ± 442 μmol/l for non-arthritis subjects and 283 ± 115 μmol/l for arthritis subjects. These results show statistically significant ($p < 0.05$) increases in potassium, urea and creatinine concentrations and decreased levels of sodium, chloride and bicarbonate in arthritis. It is therefore recommended that kidney function assessment should be incorporated in the treatment and management profile of arthritis patients.

Keywords: kidney function, assessment, arthritis, alteration.

INTRODUCTION

Arthritis means joint inflammation. Inflammation is one of the body's natural reactions to disease or injury and includes swelling, pain and stiffness. Arthritis involves the wearing away of the cartilage that caps the bones in joints, the synovial membrane that protects and lubricates joints becomes inflamed, causing pain and swelling (Schnert *et al.*, 2011). Arthritis causes stress and elevated blood pressure by relating with chemical elements for different functions as the same as sodium and potassium. These elements are able to conduct an electrical current. These minerals are electrolytes which combine with water in maintaining fluid and electrolyte homeostasis, in generating and conducting electrical impulses across cell membranes in muscle function (Heanery, 2010; Sawka 2016).

The bones of a joint are covered with a smooth, spongy material called cartilage, which cushions the bones and allows the joint to move without pain. The joint is lined by the synovium. This synovium's lining produces a slippery fluid called synovial fluid that nourishes the joint and helps limit friction within. External to it is a strong fibrous casing called the joint capsule. Strong bands of tissue called ligaments connect the bones and help keep the joint stable. Muscles and tendons also support the joints and enable us to move. With arthritis, an area in or around a joint becomes inflamed, causing pain, stiffness and sometimes difficult moving. Arthritis can also affect other parts of the body, such as the skin and internal organs (David, 2017).

Cartilage is a firm but flexible connective tissue in the joints. It protects the joints by absorbing the pressure and shock created when we move and put stress on them. A reduction in the normal amount of this cartilage tissue causes some form of arthritis. Normal wear and tear cause arthritis. An infection or injury to the joints can exacerbate this natural breakdown of cartilage tissue. The risk of developing arthritis may be higher if there is a family history of the disease. Arthritis is an autoimmune disorder (Sigaux *et al.,* 2017). It occurs when the body's immune system attacks the tissues of the body. These attacks affect the synovium, a soft tissue in the joints that produces a fluid that nourishes the cartilage and lubricates the joints. It can eventually lead to the destruction of both bone and cartilage inside the joint (Nisha *et al.,* 2017) risk factors.

Rationale of Study

Arthritis is an autoimmune condition in which the immune system of affected individuals attacks and destroys their own joint tissue. Untreated arthritis is associated with significant morbidity and mortality (Case, 2014). Many patients with arthritis are untreated because they do not know they have the condition or they fail to seek treatment (Pattison and Harrison, 2014). Arthritis occurs in males and females, adults and youths. The disease may also affect other parts of the body such as swelling around the lungs and swelling around the heart. Arthritis causes stress by relating with chemical elements of different functions. This study focused on the blood concentrations of electrolytes, urea and creatinine in arthritis.

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MATERIALS

Venous blood samples were collected into plain bottles from 66 arthritis patients (33 males and 33 females, aged 30-55years) and 66 healthy individuals as controls (33 males of 33 females, aged 30-55years). The samples were allowed to clot for one hour at room temperature, centrifuged for 5mins at 3000 revolution per minutes (Centrifuge 8040, Zurich) and serum samples transferred with pasteur pipette into labeled plain bottles. These samples were analysed within 24hours for sodium, potassium, chloride, bicarbonate, urea and creatinine concentration.

METHODS

Sodium, potassium, chloride, bicarbonate concentrations were analysed with TECO kits (CA 92 807, Teco Diagnostics, Anaheim) while urea and creatinine concentrations were determined with Randox kits (BT29 4QY, United Kingdom). Results were obtained with Chemwell Autoanalyser (Chemwell, USA).

RESULTS

Table 1: Mean values of control subjects and Arthritis patients

	Sodium (mmol/l)	Potassium (mmol/l)	Chloride (mmol/l)	Bicarbonate (mmol/l)	Urea (mmol/l)	Creatinine (umol/l)
Controls	138.5 ± 7.5 (131-146)	3.75 ± 1.25 (2.6-5.0)	102±6 (96-108)	24±4 (20-28)	3.85 ± 2.35 (1.5-62)	88.4 ± 44.2 (44.2-132.6)
Arthritis patients	132.5±4.5 (128-137)	4.25±1.75 (2.5-6.0)	100±5.0 (95-105)	22.5± 3.5 (19-26)	11.85±4.55 (7.3-16.4)	283±115 (168-398)

Table 2: **Mean values of female Arthritis patients**

	Sodium (mmol/l)	Potassium (mmol/l)	Chloride (mmol/l)	Bicarbonate (mmol/l)	Urea (mmol/l)	Creatinine (umol/l)
Controls	138.5 ± 7.5 (131-1460	3.75 ± 1.25 (2.5-5.0)	102±6 (96-108)	24±4 (20-28) (1.5-6.2)	3.85±2.35 (44.2-132.6)	88.4±44.2
Arthritis patients	131.5±3.5 (128-135)	3.75±75 (3.0-4.5)	100±5 (95-105)	22.5±3.5 (19-26)	11.85±4.55 (7.3-164)	181±13 (168-194)

Table 3: **Mean values of male Arthritis patients**

	Sodium (mmol/l)	Potassium (mmol/l)	Chloride (mmol/l)	Bicarbonate (mmol/l)	Urea (mmol/l)	Creatinine (mmol/l)	Creatinine (umol/l)
Control	138.5±7.5 (131-146)	3.75±1.25 (2.5-5.0)	102± 6 (96-108)	4± 43.8 5±2.35 (20-28)		88.4±44.2 (1.5-6.2)	(44.2-132.6)
Arthritis patients	133±4.0 (129-137)	4±2.0 (2.0-6.0)	100.5±4.5 (96-105)	22.5±2.5 (20-25)	15.05±1.35 (13.7-16.4)	295.5± 101.5 (194.6-19.7)	

DISCUSSION

Arthritis is a condition associated with swelling and inflammation of the joints which results in pains and restriction of movements. This study was on the serum concentrations of sodium, potassium, chloride, bicarbonate, urea and creatinine in patients suffering from arthritis. We observed increases in the serum concentrations of potassium, urea and creatinine while sodium, chloride and bicarbonate decreased (Table 1). The decrease in sodium concentration was more in females than in males (Table 2). Sodium is the major positive ion (cation) in fluid outside of cells, the chemical notation is $Na^{+.}$ When combined with chloride, the resulting substance is table salt. Sodium regulates the total amount of water in the body and the transmission of sodium into and out of individual cells plays a role in critical body functions (Koivuniemi and Leirisalo 2013). Many processes in the body, especially in the brain, nervous system and muscle require electrical signals for communication.

The movement of sodium is critical in the generation of these electrical signals. Too much or too little sodium can cause cells to malfunction and extremes in the blood sodium levels can be fatal. A decreased sodium concentration occurs whenever there is a relative increase in the amount of body water relative to sodium. This happens with some diseases of the kidney and liver (Adrogue, 2011; Hilbran *et al.*, 2012). Serum potassium concentration decreased by 11.8% in arthritis patients compared to healthy individuals (Table 1). Potassium is a major positive ion (cation) found inside of cells and proper level is essential for normal cell function. Among the many functions of potassium in the body are the regulation of the heartbeat and the function of the muscles (Sawka and Montain, 2013). An abnormal increase in potassium (hyperkalemia) or decrease in potassium (hypokalamia) can profoundly affect the nervous system and increases the chance of irregular heartbeats which can be fatal. Potassium is normally excreted by

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the kidney, so disorders that increase the excretory function of the kidneys can result in decreased potassium levels in the blood (Musso *et al,* 2011).

The decrease in chloride concentration was insignificant in both male and female arthritis patients while the percentage decrease (6%) in the concentration of bicarbonate was the same in both sexes. Chloride and bicarbonate levels are important in metabolic regulation (Hart *et al.,* 2013). A marked increased was observed in urea and creatinine concentrations. Serum urea level was elevated by 67.5% while creatinine level moved up by 68%. These are statistically significant ($P < 0.05$). Serum urea increased more in males than in females. Urea is a nitrogen containing substance normally cleared from the blood by the kidney into the urine. Diseases that compromise the function of the kidney lead to increased blood levels of urea (Macias-Nunez and Lopez-Novoa, 2011). Urea is a major metabolic product of mammalian biopathways containing ammonia, which is toxic to the body. It must be quickly filtered from the blood by the kidneys. Its transport plays a vital role in nitrogen elimination and osmotic homeostasis. The skin releases waste products including water, salts and urea formed when amino acids are used for energy (Zhou *et al.,* 2012). Urea is transported via the blood to the kidneys for excretion and is integrated to the urinary concentration mechanism in the kidney. It is generally considered that urea is passively transported across biological membranes by diffusion. Lately, specific transporters for urea have been identified in the renal medulla that urea is transported actively (Toh and Miossec, 2013).

Creatinine is a chemical waste molecule generated from muscle metabolism. It is produced from creatine, a molecule of major importance for energy production in muscles. Creatinine is transported through the blood stream to the kidneys. The kidneys filter out most of the creatinine and dispose it in the urine (Vadde, 2013). We found a 68% increase in the concentration of creatinine in arthritis patients when compared with healthy subjects. This increase was more in males (68%) than in female (51%) due to muscle mass. If kidney function falls, the creatinine level will rise. It is normally generated by skeletal muscle through the breakdown of creatine phosphate for energy. Body fluids contain charged organic molecules. Only a small percentage of molecules in fluids are non-electrolytes: glucose, urea and creatinine (Willian *et al.,* 2012). A specific and saturable Na^+ and Cl^- dependent creatinine transporter responsible for creatinine uptake across the plasma membrance

has been described for skeletal, heart and smooth muscles. This finding suggests the possibility of coupling between ion and water fluxes at the protein level as cellular water transport. The human Na^+-glucose co-transporter is a molecular water pump (Musso and Macais-Nunez, 2014). In summary, individuals with arthritis have a chance of developing kidney disease. Amyloid proteins get deposited and cause kidney failure, therefore patient with arthritis require regular kidney function assessment.

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