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## STATUS OF SERUM ELECTROLYTES IN CANCER PATIENTS

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### ABSTRACT

Cancer is the second largest killer disease. In India about more than 1 million new cases of cancer are diagnosed every year in a population of 1.2 billion. The various metabolic changes including electrolyte imbalance occur in cancer. The electrolyte imbalance in advanced cancer patients can be induced by various factors. The careful monitoring of the serum electrolytes plays very important role in prognosis of disease. Therefore it was aimed to study the electrolyte changes if any in post-operative cancer patients. 50 normal healthy controls and 104 operated cancer patients having age group 45 to 70 years from both genders were included in the present study. Serum electrolytes estimation was done on Easylyte plus Na/K/Cl electrolyte analyzer using solution pack kit by ion selective electrode (ISE) method. The statistical analysis was done by Student's *t*-test. In the present study serum sodium level in normal healthy controls was  $140.38 \pm 2.62$  mEq/L, whereas in cancer patients it was  $137.42 \pm 6.05$  mEq/L. The serum sodium level was mildly decreased but it was within the normal limits. Hyponatraemia is most often observed in hospitalized patients with the syndrome of inappropriate anti-diuretic hormone (SIADH) secretion which can be seen in malignancy or in the post-operative state due to a combination of non-osmotic stimuli for anti-diuretic hormone (ADH) release and administration of hypotonic fluids or may be due to effect of chemotherapeutic drugs. The serum potassium level in normal healthy controls was  $4.19 \pm 0.58$  mEq/L, whereas in cancer patients it was  $4.52 \pm 0.85$  mEq/L. The serum potassium levels in cancer patients was slightly higher than the normal but statistically significant ( $p < 0.05$ ) as compared to normal healthy controls. These slightly higher levels of serum potassium may be due to several reasons such as side effects of chemotherapeutic drugs, breakdown of tumor cells, hormones produced by certain types of tumors and extensive replacement of the adrenal glands by tumors can all result in high potassium blood levels or it may be non-specific. The electrolyte imbalance is additional risk factor for cancer patients. Thus electrolyte levels will help the clinicians for prognosis and proper monitoring of the cancer patients.

**Keywords:** *Cancer Patients, Ion Selective Electrode (ISE) Method, Hyponatraemia, Hyperkalemia, Syndrome of Inappropriate Antidiuretic Hormone (SIADH), Anti-diuretic Hormone*

### INTRODUCTION

Cancer is a major health problem not only in developed countries, but also in developing countries like India. It is the second largest killer disease. In India about more than 1 million new cases of cancer are diagnosed every year in a population of 1.2 billion (Mallath *et al.*, 2014). Cancer is characterized by loss of control of cellular growth and development leading to excessive proliferation and spread of cells. It is multi-factorial. The causative agents include physical, chemical, genetic and environmental factors (Satayanarayana and Chakrapani, 2013). The various factors like genetic, environment, drugs, chemicals, industrial pollution, radiation, diet, food additives, changed life style etc may contribute to the disease process. Almost all cancer deaths are due to avoidable factors such as tobacco, pollution, occupation, alcohol and diet. The environmental factors, diet and change of life style plays very important roles in cancer development. Because some individuals within the same environment develop cancer and others do not develop cancer.

Serum electrolyte concentrations are among the most commonly used laboratory tests by clinicians for assessment of a patient's clinical conditions and disease status. Sodium, potassium, and chloride are among the most commonly monitored electrolytes in clinical practice. Sodium is the most abundant cation in the extracellular fluid and Potassium is the primary cation in the intracellular fluid. The major

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physiological role of sodium is in controlling extracellular volume and potassium is in the regulation of muscle and nerve excitability. However, Chloride is the most abundant extracellular anion. The various metabolic changes occur in cancer. The electrolyte imbalance is one of them. The electrolyte imbalance in advanced cancer patients can be induced by various factors. The careful monitoring of the serum electrolytes plays very important role in prognosis of disease. Therefore it was aimed to study the electrolyte changes if any in post-operative cancer patients.

**MATERIALS AND METHODS**

The present study is retrospective study conducted in the department of Biochemistry, B.K.L. Walawalkar Rural Medical College, Sawarde, Dist – Ratnagiri, Maharashtra state, India. The present study includes 50 normal healthy controls and 104 operated cancer patients having age group 45 to 70 years from both genders. It is retrospective observational study. The normal healthy controls were free from diseases. All these subjects were considered healthy on the basis of physical and biochemical examinations. All these cancer patients and healthy controls were having normal renal function.

The random blood samples were collected in plain bulb without any anticoagulant and kept in tilted position for 30 minutes. After clotting at room temperature, the serum was separated from the clot by centrifugation at 3000 rpm for 10 minutes. The clear supernatant (Serum) was immediately transferred in another test tube and used for serum electrolyte estimation.

Serum electrolytes (Sodium, Potassium and Chloride) estimation was done on Easylyte plus Na/K/Cl electrolyte analyzer. By using this instrument the direct measurement of serum electrolytes were done by ion selective electrode (ISE) method. It was completely automated, microprocessor-controlled electrolyte system using solution pack kit by Transasia Bio-Medicals Ltd. The statistical analysis was done with the Excel 2007 software and the results were compared between normal healthy controls and cancer patients using the Student’s *t*-test.

**RESULTS AND DISCUSSION**

**Results**

**Table 1: Serum electrolytes in normal healthy controls and cancer patients**

Sr. No.	Statistical details	Serum Sodium levels in mEq/ L		Serum Potassium levels in mEq/ L		Serum Chlorides levels in mEq/ L	
		Normal healthy controls (N=50)	Cancer patients (N=104)	Normal healthy controls (N=50)	Cancer patients (N=104)	Normal healthy controls (N=50)	Cancer patient (N=104)
1.	Mean ± SD	140.38±2.62	137.42±6.05	4.19±0.58	4.52±0.85	102.41±3.16	103.77±5.78
2.	Maximum Level	148.20	145.60	5.41	7.08	108.6	112.3
3.	Minimum Level	133.7	121.10	3.28	3.0	91.0	83.0
4.	Statistical Significance	YES (P < 0.05)		YES (p < 0.05)		NO (p > 0.05)	

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**Table 2: Distribution of cancer patients included in the study**

Sr. No.	Cancer	No. of Patients	Percentage (%)
1.	Annal Canal	02	1.92
2.	Bladder	02	1.92
3.	Oral (Buccal Mucosa, Tongue, Hemipalate,)	28	26.92
4.	Breast	20	19.23
5.	Cervix	12	11.53
6.	Colon	06	5.76
7.	Melanoma	02	1.92
8.	Oesophagus	06	5.76
9.	Ovary	16	15.38
10.	Rectum	10	9.61
TOTAL		104	100%

**Discussion**

Berghmans *et al.*, (2000) have done prospective study on hyponatraemia in medical cancer patients and observed the hyponatremia in cancer patients. Simit *et al.*, (2012) studied hyponatremia in hospitalized cancer patients and its impact on clinical outcomes. In their study they observed hyponatremia in hospitalized cancer patients. Thompson (Thompson, 2010) explained Hyponatraemia is the commonest electrolyte abnormality in clinical practice. Alea *et al.*, (2013) estimated serum electrolytes using flame atomic absorption photometry in leukemia patients before and after chemotherapy. They found that Serum levels of Na, K, Ca and Cl were significantly decreased in patients before chemotherapy in comparasion with that of control group. Kultigin *et al.*, (2010) studied alterations in serum biochemical parameters of patients with lung cancer exposed to radiotherapy. They have evaluated biochemical parameters before and after radiotherapy and found significantly decreased sodium and increased potassium levels in cancer patients following radiotherapy. George *et al.*, (1977) studied the effect of cancer on nitrogen, electrolyte, and mineral metabolism. Yadav *et al.*, (1997) studied serum electrolytes in normal healthy controls and diabetes mellitus patients. Our results were comparable in most of the previous researchers.

The present study includes 104 various types of cancer patients. Out of total cases it was found that 26.92% patients (28/104) were having oral cancer and 1.92% patients (2/104) were having melanoma, annal canal bladder cancer (Table 2). In the present study serum sodium level in normal healthy controls was  $140.38 \pm 2.62$  mEq/L, whereas in cancer patients it was  $137.42 \pm 6.05$  mEq/L. The serum sodium level was mildly decreased but it was within the normal limits. This serum sodium level was significantly decreased ( $P < 0.05$ ) in cancer patients as compared to normal healthy controls (Table 1). Maintenance of normal extracellular fluid volume and sodium concentration requires a balance between sodium excretion and sodium intake. There were several reasons for mild decrease of serum sodium levels in cancer patients. This decrease of serum sodium level may be due to hyponatraemia usually develops when there are underlying conditions that impair the kidney's ability to excrete free water. Hyponatraemia is most often observed in hospitalized patients with the syndrome of inappropriate antidiuretic hormone (SIADH) secretion which can be seen in malignancy or in the post-operative state due to a combination of non-osmotic stimuli for anti-diuretic hormone (ADH) release and administration of hypotonic fluids or may be due to effect of chemotherapeutic drugs.

The serum potassium level in normal healthy controls was  $4.19 \pm 0.58$  mEq/L, whereas in cancer patients it was  $4.52 \pm 0.85$  mEq/L. The serum potassium levels in cancer patients was slightly higher than the normal but statistically significant ( $p < 0.05$ ) as compared to normal healthy controls (Table 1). Hyperkalemia is a common clinical problem. Potassium enters the body via oral intake or intravenous infusion, is largely stored in the cells, and is then excreted in the urine. The major causes of hyperkalemia are increased potassium release from the cells and, most often, reduced urinary potassium excretion. These slightly

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higher levels of serum potassium may be due to several reasons such as side effects of chemotherapeutic drugs, breakdown of tumor cells, hormones produced by certain types of tumors and extensive replacement of the adrenal glands by tumors can all result in high potassium blood levels or it may be non-specific.

The serum chloride level in normal healthy controls was  $102.41 \pm 3.16$  mEq/L, whereas in cancer patients it was  $103.77 \pm 5.78$  mEq/L. The statistical significant difference was not observed in serum chloride levels in cancer patients as compared to normal healthy controls. The electrolyte imbalance is additional risk factor for cancer patients. Thus electrolyte levels will help the clinicians for prognosis and proper monitoring of the cancer patients.

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