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ORIGINAL RESEARCH

A study on serum electrolyte changes in postoperative cases in abdomen surgeries

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Abstract

Background: In this study, we wanted to evaluate the serum electrolyte changes in postoperative cases (either elective or emergency), determine the serum electrolyte changes in postoperative patients, determine the common variety of electrolyte imbalance, and evaluate the electrolyte imbalance in postoperative patients with regard to incidence, type, day, associated clinical symptoms and ways to prevent it.

Materials and methods: This was a hospital-based study conducted among 82 patients who underwent surgery and whose serum electrolytes were evaluated. Clearance was obtained from the institutional ethics committee and written informed consent was obtained from the study participants.

Results: The significant difference in parameter estimates of pre-op and post-op. It was shown that paired t-test with a p-value less than 0.05 (with * mark) was set at a 5 percent level of significance. There is a significant difference seen in the parameter estimates among pre-op vs. first post-op and pre-op vs. fourth post-op (except output) with greater t-test values and p-value less than 0.05. Also, a significant difference has been seen in the value of the parameters serum sodium and serum potassium among first post-op vs. fourth post-op. It has been seen that about 51 percent of the sample population were under the age group between 51 and 60 years. About 30.5 percent of the sample population had undergone laparotomy. It has been seen that exactly 16 males and 9 females of the sample population underwent laparotomy which stands highest. It has been seen that exactly 10 respondents respectively under the age 25 to 30, 31 to 40, and 41 to 50 years who had undergone laparotomy procedure stand highest. It has been seen that exactly 18 male and 13 female respondents of the sample population did not have any associated clinical symptoms.

Conclusion: Electrolytes and water management in a patient is very important. It is ideal to bring the electrolytes and water levels in the body to normal levels during the preoperative period. Potassium supplements have to be added if the patient is on I.V. fluids only for more than 3 days following surgery. If the patient was started on an oral diet within the period, there is no necessity for giving additional potassium to the patient.

Keywords: Serum Electrolyte, Post-Operative Cases, Abdomen Surgeries

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Introduction

About a billion years ago, life began in the sea. The sea processed unique properties for the maintenance of life. For example, the water of the sea is a solvent for the electrolytes and the oxygen that are necessary for life. The sea is also a solvent for the carbon dioxide that accumulates during life's processes. Since carbon dioxide is volatile, it can be easily dissipated from the surface of the sea. In addition, the volume of the sea is so great that it can absorb a large amount of heat, or lose large amounts of heat, with only relatively small temperature changes. The volume of the sea is so great that significant changes in its composition occur over a period of hundreds of thousands of years. Finally, its dielectric constant, its surface tension and other physical properties are all important in maintaining and protecting life. As a result, the water that surrounds the cells of vertebrates and humans, namely, the extracellular water, still has an electrolyte composition similar to what the sea had in pre-recorded times despite all the counter changes in evolution that have occurred, over the eons the rivers of the world have eroded land and have washed elements into, the sea. This has caused the electrolytes of the sea to become more concentrated. Despite this, there is still a remarkable similarity between the proportional composition of electrolytes in seawater and extracellular water.[1] About 56 percent of the adult human body is fluid. Although most of this fluid is inside the cells and is called intracellular fluid, about one-third is in the spaces outside the cells and is called extracellular fluid. This extracellular fluid is a constant motion throughout the body. It is rapidly transported in the circulating blood and then mixed between the blood and the tissue fluids by diffusion through the capillary walls. In the extracellular fluid are the ions and nutrients needed by the cells for the maintenance of cellular life.[2] The extracellular fluid contains large amounts of sodium, chloride and bicarbonate ions, plus nutrients for the cells, such as oxygen, glucose fatty acids, and amino acids. It also contains carbon dioxide that is being transported from the cells to the lungs to be excreted and other cellular products that are being transported to the kidneys for excretion. The intracellular fluid differs significantly from the extracellular fluid; particularly it contains large amounts of potassium, magnesium, and phosphate ions.[3] Special mechanisms for transporting ions through the cell membranes maintain these differences. The surgical condition of the patient depends on the management of the body composition of fluid and electrolytes. Most diseases, many injuries and even operative trauma impose a great impact on the physiology of fluid and electrolytes within the body. These changes often exceed those brought about by acute lack of alimentation. Therefore, a thorough understanding of the metabolism of salt, water and electrolytes and certain metabolic responses is essential in the care of surgical patients.[4]

Aims and Objectives

- To study serum electrolyte changes in postoperative cases (either elective or emergency).
- To study which serum electrolyte is marked by a change in postoperative patients.
- To study the common variety of electrolyte imbalance
- Incidence of electrolyte imbalance in postoperative patients.
- When and what day it happens
- What type of disturbances seen
- Associated clinical symptoms.
- How to prevent it.

Materials and methods

This was a hospital-based study conducted among 82 patients who underwent surgery and whose serum electrolytes were evaluated. Clearance was obtained from the institutional ethics committee and written informed consent was obtained from the study participants.

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Inclusion Criteria

1. Patients of both sexes
2. Except paediatric age groups.
3. Abdomen surgeries (elective as well as emergency).

Exclusion Criteria

1. Laparoscopic surgery
2. Known co- morbidities (renal or respiratory failure)
3. liver disease (end stage)
4. Mc Burney's incision
5. Inguinal hernia

Statistical Methods

Data was entered in MS Excel and analysed using SPSS software. Results were resented as tables.

Results

Age Group	Frequency	Percent	Valid Percent	Cumulative Percent
25-30	11	13.4	13.4	13.4
31-40	14	17.1	17.1	30.5
41-50	15	18.3	18.3	48.8
51-60	42	51.2	51.2	100.0
Total	82	100.0	100.0	
Age distribution				
Sex	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Male	51	62.2	62.2	62.2
Female	31	37.8	37.8	100.0
Total	82	100.0	100.0	
Sex distribution				

Table 1: Demographic Distribution

Diagnosis	Frequency	Percent	Valid Percent	Cumulative Percent
Appendicular Abscess	2	2.4	2.4	2.4
Appendicular Mass	3	3.7	3.7	6.1
Appendicular Perforation	7	8.5	8.5	14.6
Ca. Colon	2	2.4	2.4	17.1
Ca. Rectum Obstruction	1	1.2	1.2	18.3
Ca. Caecum	4	4.9	4.9	23.2
Ca. Descending Colon	6	7.3	7.3	30.5
Ca. Oesophagus + Dist. Obst.	3	3.7	3.7	34.1
Ca. Rectosigmoid Junct.	3	3.7	3.7	37.8
Ca. Rectum	3	3.7	3.7	41.5
Ca. Stomach	3	3.7	3.7	45.1
Duodenal perforation	20	24.4	24.4	69.5
Ca. Pancreas	3	3.7	3.7	73.2
Gastric Outlet Obstruction	2	2.4	2.4	75.6
Ileal Perforation	3	3.7	3.7	79.3
Recurrent Appendicitis	5	6.1	6.1	85.4
Sigmoid Diverticular	1	1.2	1.2	86.6

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Ventral Hernia with Obstruction	2	2.4	2.4	89.0
Ca. Pre-Pylonic Region	2	2.4	2.4	91.5
Ca. Hepatic Flexure Colon	1	1.2	1.2	92.7
Gastric Ulcer	1	1.2	1.2	93.9
GIST	1	1.2	1.2	95.1
Intestinal Obstruction	2	2.4	2.4	97.6
Jejunum Perforation	1	1.2	1.2	98.8
Sigmoid Volvulus	1	1.2	1.2	100.0
Total	82	100.0	100.0	
Procedure done	Frequency	Percent	Valid Percent	Cumulative Percent
Anterior GJ	1	1.2	1.2	1.2
Anterior Resection	5	6.1	6.1	7.3
Appendicectomy	6	7.3	7.3	14.6
Exploratory laparotomy	18	22.0	22.0	36.6
Colostomy	2	2.4	2.4	39.0
Diversion Ileostomy	1	1.2	1.2	40.2
Laparotomy	25	30.5	30.5	70.7
Left Hemicolectomy	7	8.5	8.5	79.3
Right Hemicolectomy	5	6.1	6.1	85.4
Left Hemicolectomy+colostomy	1	1.2	1.2	86.6
Part GJ + Bilioth II	2	2.4	2.4	89.0
Partial Gastrectomy	3	3.7	3.7	92.7
Radical Gastrectomy	1	1.2	1.2	93.9
Resection Anastomosis	2	2.4	2.4	96.3
Oesophagectomy	2	2.4	2.4	98.8
Triple Bypass	1	1.2	1.2	100.0
Total	82	100.0	100.0	

Table 2: distribution of the sample according to diagnosis & procedure done

It has been seen that about 51 percent of the sample population were under the age group of 51 to 60 years. It has been seen that about 62 percent of the sample population were males.

The distribution of the sample according to diagnosis has been seen that about 24 percent of the sample population diagnosed with Ch. Duo dental ulcer and are stands highest. It has been seen that about 30.5 percent of the sample population had undergone laparotomy.

Diagnosis	**Sex**		**Total**
	Male	**Female**	
Appendicular Abscess	0	2	2
Appendicular Mass	1	2	3
Appendicular Perforation	4	3	7
Ca. Colon	2	0	2
Ca. Rectum Obstruction	1	0	1
Ca. Caecum	2	2	4
Ca. Descending Colon	2	4	6
Ca. Oesophagus + Dist. Obst.	2	1	3
Ca. Rectosigmoid Junct.	2	1	3
Ca. Rectum	0	3	3
Ca. Stomach	2	1	3
Duodenal perforation	15	5	20

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Ca. Pancreas	3	0	3
Gastric Outlet Obstruction	1	1	2
Ileal Perforation	3	0	3
Recurrent Appendicitis	3	2	5
Sigmoid Diverticular	0	1	1
Ventral Hernia with Obstruction	2	0	2
Ca. Pre-Pylonic Region	2	0	2
Ca. Hepatic Flexure Colon	1	0	1
Gastric Ulcer	1	0	1
GIST	0	1	1
Intestinal Obstruction	2	0	2
Jejunum Perforation	0	1	1
Sigmoid Volvulus	0	1	1
Total	52	31	82

Table 3: The distribution of the sample according to diagnosis and gender

It has been seen that exactly 3 females and 1 male of the sample population were diagnosed with duodenal perforation and stand highest. The distribution of the sample according to procedure is done and gender. It has been seen that exactly 16 males and 9 females of the sample population underwent laparotomy and stand high.

Procedure done	**Sex**		**Total**
	Male	**Female**	
Anterior GJ	0	1	1
Anterior Recection	2	3	5
Appendicectomy	4	2	6
Exploratory laparotomy	13	5	18
Colostomy	0	2	2
Diversion Ileostomy	1	0	1
Laparotomy	16	9	25
Left Hemicolectomy	4	3	7
Right Hemicolectomy	3	2	5
Left Hemicol + Scolost	0	1	1
Part GJ + Bilioth II	1	1	2
Partial Gastrectomy	3	0	3
Radical Gastrectomy	0	1	1
Resection Anastomosis	1	1	2
Oesophagectomy	2	0	2
Triple Bypass	1	0	1
Total	**51**	**31**	**82**

Procedure done	**Age Group**				**Total**
	25-30	**31-40**	**41-50**	**51-60**	
Anterior GJ	0	0	1	0	1
Anterior Resection	0	1	0	4	5
Appendicectomy	0	1	1	4	6
Exploratory laparotomy	3	2	5	8	18
Colostomy	0	0	1	1	2
Diversion Ileostomy	0	0	1	0	1
Laparotomy	6	4	5	10	25

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Left Hemicolectomy	1	0	1	5	7
Right Hemicolectomy	0	2	0	3	5
Left Hemicol + Scolost	0	0	0	1	1
Part GJ + Bilioth II	1	0	0	1	2
Partial Gastrectomy	0	0	0	3	3
Radical Gastrectomy	0	1	0	0	1
Resection Anastomosis	0	2	0	0	2
Oesophagectomy	0	1	0	1	2
Triple Bypass	0	0	0	1	1
Total	**11**	**14**	**15**	**42**	**82**

Table 4: The distribution of the sample according to diagnosis and age group

It has been seen that exactly 10 respondents of the sample population were diagnosed with Ch. Duodenal Ulcer under the age of 51 to 60 years stands the highest. The distribution of the sample according to procedure and age group was done. It has been seen that exactly 10 respondents respectively under the age group of 25 to 30, 31 to 40, and 41 to 50 years who had gone with laparotomy procedure and stand highest.

Associated clinical Symptoms	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Chills & Rigors	22	26.8	26.8	26.8
Drowsiness & Skin wrinkling	3	3.7	3.7	30.5
Drowsiness & Weakness	5	6.1	6.1	36.6
Drowsiness & Confusion	4	4.9	4.9	41.5
Drowsiness, Muscle Twitching	1	1.2	1.2	42.7
Dryness of Tongue & Hills	5	6.1	6.1	48.8
Nausea & Vomiting	9	11.0	11.0	59.8
Weakness	2	2.4	2.4	62.2
Nil	31	37.8	37.8	100.0
Total	**82**	**100.0**	**100.0**	

Associated clinical Symptoms	**Sex**		**Total**
	Male	**Female**	
Chills & Rigors	16	6	22
Drowsiness & Skin wrinkling	1	2	3
Drowsiness & Weakness	4	1	5
Drowsiness & Confusion	2	2	4
Drowsiness, Muscle Twitching	0	1	1
Dryness of Tongue & Hills	4	1	5
Nausea & Vomiting	4	5	9
Weakness	2	0	2
Nil	18	13	31
Total	**51**	**31**	**82**

Table 5: The distribution of the sample according to associated clinical symptoms

It confirms that exactly 22 respondents were associated with chills and rigours symptoms and were stands highest. The tallest bar shows the same. The distribution of the sample according to associated clinical symptoms and gender. It has been seen that exactly 18 male and 13 female respondents of the sample population did not have any associated clinical symptoms.

Discussion

Modern resuscitation of the acutely ill began during the conflicts which occurred in the early and middle parts of the 20th century. Walter. B. Canon, professor of physiology at Harvard

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introduced the term "homeostasis" to describe the "coordinated physiological processes" that maintain a steady state for most systems. He could well be called the father of critical care.[5]
In this study of serum electrolytes in postoperative patients, attention was paid to the changes in serum sodium and potassium levels in gastrointestinal surgeries. In 98% of the cases studied, a fall in the serum sodium level was noticed in the first postoperative day sample. In the remaining 2% of the cases, there was no significant change. The serum sodium level on the fourth postoperative day showed a return towards the preoperative level in 60% of the cases. In the other 40% of the cases, the serum sodium levels increased from the first postoperative day but were significantly lower than the preoperative values. In 2 cases, the serum sodium on the fourth postoperative day was higher than the preoperative values, which could be because of an excess in the input of sodium. This result correlates with the normal physiologic response of the body to surgical trauma, where there is a fall in the serum sodium level 24-48 hours following the trauma.[6-9]
Increased secretion of aldosterone occurs partly due to stimulation of the adrenals by ACTH, it also occurs as a result of decreased circulating blood volume or loss of extracellular fluids that are often present after a major operation. In this study, there is an increase in serum sodium level from the first to the fourth postoperative day but the values on the fourth postoperative day are significantly lower than the preoperative values in most of the cases because gastrointestinal secretions contain a large number of electrolytes which are lost considerably in gastrointestinal surgeries due to continuous nasogastric aspiration, improper supplementation and various other factors. Stomach secretions compose of sodium about 60 mEq/1t, duodenum 140 mEq/1t, ileum 140 mEq/1t and colon 50 mEq/1t. In this study, twenty-five patients had mild clinical symptoms like hypotension and nausea and about 4 patients had neurological manifestations of hyponatremia. 90% of the cases showed a decrease in serum potassium level on the first postoperative day. In about 5% of the cases, the values were significantly less than the preoperative level which could be because of the absence of the input. In this study, about ten patients developed symptoms of potassium deficit like weakness and diminished tendon reflexes. The renal excretion of potassium may be small when compared with the amount of potassium that may be lost in gastrointestinal secretions. Stomach secretions consist of potassium 10 mEq/lt, duodenum 5 mEq/lt, ileum 5 mEq/lt and colon 30 mEq/lt. It is noticed that potassium is excreted in exchange for sodium (due to aldosterone). So great are the body's reserves of potassium that, unless the patient was severely depleted at the time of operation, the therapeutic administration of potassium does not arise until the fourth day. All the cases studied in this series showed a fall in the 24-hour urine output on the first postoperative day. 60% of the cases showed a return toward the preoperative urine output volume. In the remaining 40% of the cases, the fall in the urine output volume on the fourth postoperative day was due to the release of ADH, which increases the re-absorption of water in the distal tubules and collection ducts. In 98% of the cases which showed a fall in urine output on the first postoperative day, there was a fall in serum sodium level because of the dilution factor. Only in 2% of the cases, there was no change in the sodium level. A majority of the patients studied in this series showed a normal body response to major surgical trauma.

Conclusion

Fluid management-related complications postoperatively in emergency surgeries were more than elective due to a lack of time for adequate correction of blood parameters and nutritional status. Patients undergoing colostomy had low stoma output i.e., below 500 ml/day; they did not develop fluid or electrolyte derangement in the early postoperative period and needed no monitoring. The patients showed a significant fall in serum electrolyte levels, especially sodium and potassium. Serum sodium values fell below the normal range by the 5th

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postoperative day. Retention of water was also noticed as is evident by the decreased urine output in the immediate postoperative period. This shows that electrolytes and water management in a patient are very important. It is ideal to bring the electrolytes and water levels in the body to normal levels during the preoperative period. Potassium supplements have to be added if the patient is on IV fluids only for more than 3 days following surgery. If the patient has started on an oral diet within the period, there is no necessity for giving additional potassium to the patient.

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