ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 16, Issue 11, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

A PROSPECTIVE STUDY OF ELECTROLYTE IMBALANCE AND ITS MANAGEMENT IN GASTROINTESTINAL SURGERY

VIJAY KUMAR YADAV, MOHAMMED SALIM, SANJAY SHARMA, ROHAN KUMAR*

Department of General Surgery, Sardar Patel Medical College, Bikaner, Rajasthan, India.
***Corresponding author: Rohan Kumar; Email: rhnbijarnia@gmail.com**

Received: 02 May 2023, Revised* and *Accepted: 25 June 2023

ABSTRACT

Objective: The objective is to study electrolyte imbalance and its management in gastrointestinal (GI) surgery.

Methods: The present study was carried out in the Department of Surgery, S.P. Medical College and P.B.M Hospital, Bikaner. This is a prospective descriptive study and was carried out between December 2021 and November 2022 including 100 cases operated for GI tract surgeries (both elective and emergency).

Results: Out of 100 patients, 54% patient had electrolyte imbalance and required correction for same. 46% of patients had normal serum electrolytes post-operatively. The most common electrolyte imbalance observed is hyponatremia (30%) followed by both hypokalemia and hyponatremia (14%). We observed that the most common surgical interventions which had electrolyte imbalance were ileostomy patients (84%) followed by resection and anastomosis of bowel (70%).

Conclusion: Patients who had electrolyte imbalance were found to have more post-operative complications, longer hospital stay, and probably had an association with mortality. Early diagnosis, aggressive resuscitation, and timely definitive surgical treatment along with correction of electrolyte imbalance are essential to decrease the incidence of morbidity and mortality associated with electrolyte imbalance.

Keywords: Electrolyte imbalance, Hypokalemia, Hyponatremia, Gastrointestinal surgery.

 DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i11.48234. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

All surgical patients are at risk for fluid and electrolyte imbalance. This risk increases when a patient undergoes gastrointestinal (GI) surgery [1]. This understanding of pathophysiology of fluid and electrolyte imbalance in GI surgeries is of paramount importance because consequences if left unaddressed or poorly managed can be life threatening. Clinical spectrum of electrolyte imbalance depends on the type of electrolyte and level of imbalance, which can range from fever, disorientation, confusion, delirium, convulsions, edema, dyspnea, cardiac arrhythmias, oliguria, anuria, and death [2].

Aim

The aim is to study various electrolyte imbalances and its clinical course and prevention and management of electrolyte imbalance in GI surgeries.

METHODS

The present study was carried out in the Department of Surgery, S.P. Medical College and P.B.M Hospital, Bikaner. This is a prospective descriptive study and was carried out between December 2021 and November 2022. All patients presenting admitted in department of general surgery undergoing GI surgery (both emergency and elective) within the study duration and eligible as per inclusion criteria were included in the study.

All patients with a diagnosis of GI pathology who are subject to emergency or elective GI surgery and patients of ≥13 years of age irrespective of gender were included in the study. Patients below 13 years of age, not willing to participate in study, and discharged against medical advice were excluded from the study. The investigation was started after receiving ethical approval from the institute. Written informed consent was obtained from all the study subjects.

RESULTS

Almost all groups except ileostomy patients, there are lower mean serum sodium readings observed on day 3 and day 5 when compared to day 1 readings but not significant. In all ileostomy patients when post-operative day 3 reading was compared to post-operative day 5 reading, a significant lower reading was observed on post-operative day 5; however, there are lower values observed on day 3 when compared to day 1 readings but not significant (Table 1).

In almost all patients as mentioned in the above table when mean post-operative day 1 serum potassium reading was compared to post-operative day 3 and day 5 readings, lower reading was observed on post-operative day 3 and day 5 but all were in normal range (Table 2).

In our present study, the most common post-operative complication was surgical site infection (9%). 9 patients had sepsis in perioperative period. 5 patients had burst abdomen post-operatively. 3 patients had anastomotic leak and 3 patients had stoma complications (retraction and prolapse). Two patients had enterocutaneous fistula in post-operative period on long-term follow-up. Almost all patients having complications had electrolyte imbalances either sodium or potassium or both (Table 3).

Out of 100 patients, 54 patients required electrolyte correction. The most common electrolyte imbalance was hyponatremia (30%) followed by both hyponatremia and hypokalemia (14%) and hypokalemia alone (10%). We observed that the most common surgical intervention which had electrolyte imbalance was ileostomy patients (84%) followed by resection and anastomosis of bowel (70 %) (Table 4).

Mean hospital stay of patients in our study was 7.43 days. Patients with electrolyte imbalance had longer hospital stay (8.88 days) than patients with normal electrolytes (5.82 days) (Fig. 1).

Table 1: Post-operative mean serum sodium levels (n=100)

S. No.	Surgical intervention group	Mean serum sodium level (mEq/L)		
		Post-operative day 1	Post-operative day 3	Post-operative day 5
1.	Primary repair of perforation (n=18)	137.75	136.53	136.04
2.	Adhesiolysis (n=9)	137.83	136.25	135.43
3.	Appendectomy (n=17)	137.8	137.3	137.7
4.	Gastrojejunostomy (n=8)	137.43	136.22	135.12
5.	Resection and anastomosis of bowel (n=17)	137.65	135.72	134.27
6.	All Ileostomy patients (n=25)	137.4	135.3	132.72
	Resection and anastomosis of bowel with ileostomy (n=16)	137.53	135.23	132.74
	Diversion ileostomy (n=9)	137.16	135.42	132.70
7.	Diversion colostomy (n=6)	138.35	137.66	136.36

Table 2: Post-operative mean Sr. potassium levels (n=100)

S. No.	Surgical intervention group	Mean Sr. potassium level (mEq/L)		
		Post-operative day 1	Post-operative day 3	Post-operative day 5
1.	Primary repair of perforation (n=18)	3.90	3.77	3.65
2.	Adhesiolysis (n=9)	3.83	3.64	3.49
3.	Appendectomy (n=17)	4.14	4.17	4.10
4.	Gastrojejunostomy (n=8)	4.11	3.96	3.79
5.	Resection and anastomosis of bowel (n=17)	3.77	3.60	3.53
6.	All ileostomy patients (n=25)	3.78	3.66	3.56
	Resection and anastomosis of bowel with ileostomy (n=16)	3.83	3.70	3.58
	Diversion ileostomy (n=9)	3.69	3.58	3.53
7.	Diversion colostomy (n=6)	3.81	3.66	3.58

Table 3: Post-operative complications (n=100)

S. No.	Post-operative complications	Number of patients with complications	Number of patients with electrolyte imbalance
1.	Anastomotic leak	3	3
2.	Surgical site infection	9	8
3.	Burst abdomen	5	4
4.	Enterocutaneous fistula	2	2
5.	Stoma complication(s)	3	3
6.	Sepsis	9	6

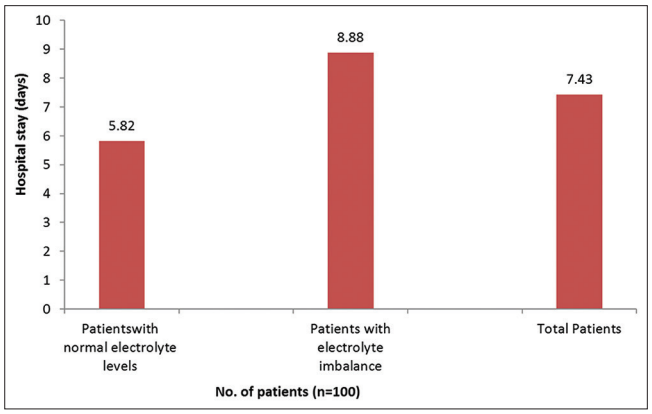

Fig. 1: Distribution of cases according to mean hospital stay (days) (n=100)

DISCUSSION

In our present study, 30% of patients required correction for hyponatremia, 10% of patients required correction for hypokalemia, and 14% of patients required correction for both hyponatremia and hypokalemia. These results are comparable with study conducted by Goswami *et al.* (n=50) [3] where 40% patients required correction for hyponatremia, 14% required correction for hypokalemia, and 18% required correction for both hyponatremia and hypokalemia.

In our study 46% patients had normal post-operative electrolytes and did not require correction, this is not comparable with study conducted by Goswami *et al.* (n=50) [3] Where 28% of patients had normal post-operative electrolytes and did not require correction. This is probably because of the fact that more patients underwent stoma creation (40%) in study by Goswami *et al.* (n=50) [3] in comparison to our study (31%).

In our present study, the mean ileostomy output in all ileostomy patients is 560 mL and 667.2 mL on day 3 and day 5, respectively. These results are comparable with study conducted by Goswami *et al.* (n=50) [3] where mean ileostomy output was 538 mL and 715 mL on day 3 and day 5, respectively, in the same group of patients as mean stoma output increased from day 3 to day 5. These results are also comparable with study conducted by Khunt *et al.* 2017 (n=25) [4] where mean ileostomy output was 414 and 568 on day 3 and day 5, respectively, which shows ileostomy output increased from day 3 to day 5 but the output of stoma was less in comparison to the present study and study by Goswami *et al.* (n=50) [3] which is most probably due to less patients underwent resection of bowel with ileostomy.

In our study, the group having all ileostomy patients, when post-operative day 1 mean serum sodium levels (137.4 mmol/L) compared to post-operative day 3 (135.3 mmol/L) and day 5 (132.72 mmol/L) readings, a lower reading was observed on post-operative day 3 and day 5. When post-operative day 3 readings were compared to post-operative day 5 readings, a lower reading was observed on post-operative day 5.

In the group having ileostomy with resection of small bowel, when post-operative day 1 mean sodium levels (135.53 mmol/L) were compared to post-operative day 3 (135.23 mmol/L) and day 5 (132.74 mmol/L) readings, a lower values were observed on post-operative day 3 and day 5.

In the group having stoma creation with no resection of intestine, when post-operative day 1 mean sodium levels (137.16 mmol/L) compared

Table 4: Surgical intervention-wise distribution of cases who needed correction of electrolyte imbalance (n=100)

S. No.	Type of Surgical intervention	Number of patients needed correction	Number of patients did not Need correction	Total
1.	Primary repair of perforation	9	9	18
2.	Adhesiolysis	3	6	9
3.	Appendectomy	5	12	17
4.	Gastrojejunostomy	3	5	8
5.	Resection and anastomosis of bowel	12	5	17
6.	All ileostomy patients	21	4	25
	Resection and anastomosis of bowel with ileostomy	14	2	16
	Diversion ileostomy	7	2	9
7.	Diversion colostomy (n=6)	1	5	6
Total		54	46	100

with day 3 (135.42 mmol/L) and day 5 (132.7 mmol/L) reading, lower readings were observed on post-operative 3 and day 5.

The results of our study are comparable with Khunt *et al*. 2017 (n=25) [4] (where mean sodium levels were 136.38, 135.02, and 133.48 on day 1, day 3, and day 5, respectively, in all ileostomy patients) and Goswami *et al*. 2021 (n=50) [3] (where mean sodium levels were 138.3, 133.7, and 131.7 on day 1, day 3, and day 5, respectively, in all ileostomy patients) and Songra *et al*. 2018 [5] (n=100) (where mean sodium levels were 139.23, 137.09, and 135.45 on day 1, day 3, and day 5, respectively, in all ileostomy patients). Lower mean sodium values are observed on day 3 and day 5 in comparison to day 1 in all of these studies.

In our present study, the group having all ileostomy patients, when post-operative serum potassium level on day 1 (3.78 mmol/L) was compared to post-operative day 3 (3.66 mmol/L) and day 5 (3.56 mmol/L) readings, lower reading were observed on post-operative day 3 and day 5. When post-operative day 3 reading was compared to post-operative day 5 reading, lower reading was observed on post-operative day 5.

The results of our study are comparable with study by Khunt *et al*. 2017 (n=25) [4] (where in all ileostomy patients mean serum potassium on day 1, day 3, and day 5 were 4.06, 3.93, and 3.9, respectively) and study by Songra *et al*. 2018 (n=100) [5] (where in all ileostomy patients mean serum potassium on day 1, day 3, and day 5 were 3.98, 3.65, and 3.79, respectively).

The results are also comparable with study by Goswami *et al*. 2021 (n=50) [3] where post-operative day 1 readings were compared to post-operative day 3 and day 5 readings, lower reading was observed on post-operative day 3 and day 5 (in all ileostomy patients, mean serum potassium on day 1, day 3, and day 5 were 4.2, 3.6, and 3.5, respectively).

In our present (n=100) study, mortality rate was 8%. These results are comparable with study by Kumar *et al*. 2021 (n=35) [6] where mortality rate was 8.5% and the most common cause of mortality was septic shock.

CONCLUSION

Electrolyte imbalance is common in most of the GI surgeries. Among these surgeries, patients undergoing emergency GI surgery other than resection and anastomosis, stoma (appendicectomy, Graham's patch, etc.,) most of them does not need any electrolyte correction in the post-operative period. Patient having electrolyte imbalance had complications in post-operative period, and most of them need correction. Overall, mortality was 8 out of 100, among these patients, 6 had electrolyte imbalances, so it can be concluded that electrolyte imbalances can be a contributing factor in mortality. Early diagnosis, aggressive resuscitation, and timely definitive surgical treatment along with correction of electrolyte imbalance are essential to decrease the incidence of them morbidity and mortality associated with electrolyte imbalance in GI pathologies. Electrolyte imbalance, malnutrition, old age of the patients, delayed presentation of patient to the hospital leading to delayed diagnosis and treatment, and associated systemic co-morbid conditions adversely affect the final surgical outcome of the patients with GI pathologies.

ACKNOWLEDGMENT

We owe a debt of gratitude to the Sardar Patel Medical College, Bikaner, for assistance during the course of the research.

AUTHORS' CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHOR'S FUNDING

The authors hereby state that they did not get any financial assistance for their research, writing, or publication of this paper.

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