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Electrolyte Imbalance and Its Management in Gastrountestinal Surgery

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Abstract:
Background*: Emergency gastrointestinal surgery and electrolyte imbalance is very common association in surgical field. Sodium and potassium are most common of all for imbalance. Alternation of its level causes deterioration of general condition of patient. So it's very important to prevent alteration during and after gastrointestinal surgery, management of altered electrolyte levels after gastrointestinal surgery. Principally the sodium and potassium alterations have been taken into account along with special notice to other electrolytes such as bicarbonate ion, calcium ion and magnesium ion and various comparison between the*
Materials and Methods*: In this retrospective study, data from a large tertiary care teaching hospital was taken spanning over one year and including 50 cases operated for gastrointestinal tract surgeries, both elective and emergency, with complaints of drowsiness, fever, convulsions and abdominal distension were included. The haematological investigations, ultrasound and the diagnosis of electrolyte imbalance were compared and the various modalities used for the treatment of the same were discussed and compared.*
Results*: Almost 89 % of patient undergoing resection and anastomosis required correction of imbalance and 74 % with stoma required the same. However, those patients who underwent both resection as well as stoma almost always required correction of electrolyte.*
Conclusion: *From the study it could be concluded that the incidence of both hyponatremia and hypokalaemia occur more following stoma formation, especially ileostomy and resection and anastomosis of ileal segment. Further longer the segment, more was the incidence of electrolyte imbalance.*
Key Word*: Electrolyte imbalance; Hypokalaemia; Hyponatremia; gastrointestinal surgery;*

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I. Introduction

The various electrolytes present in body are essential for life and perform various functions such as nerve transmission, energy production, pH balance, muscle contraction, action potential, fluid balance and many others. They are extremely closely regulated by the body and following severe stress, such as surgeries, there occurs deregulation in the metabolic processes and manifests itself with various sign and symptoms. Normal electrolyte levels in body are mentioned below:
Serum sodium $Na^{+:}$135-145 mEq/L
K^{+} =3.5-5.5 mEq/L
CA^{++} =9 – 11 mg/dl
Mg^{++}= 1.4-2.2 mEq/L
Bicarbonate=22-26 mEq/L

Aims and objectives

- Study was carried out with the following aims and objectives:

1. To study various electrolyte imbalance post gastrointestinal surgeries,
2. To study ways to prevent the electrolyte imbalance in gastrointestinal surgeries.
3. To study clinical course of electrolyte imbalance in gastrointestinal surgeries.
4. To study treatment of electrolyte imbalance in gastrointestinal surgeries.

II. Materials And Methodology

- Study Settings: Department of General Surgery in a large teaching public health hospital.
- Study period: One year
- Sample Size: 50 Cases
- Study Type: Retrospective Study

Inclusion criteria:

- Patient presenting with

1. Patients having being operated for acute gastrointestinal conditions.
2. Complaints of
   - Drowsiness
   - Abdominal Distension
   - Fever
   - Convulsions

Exclusion Criteria:

As such there is no exclusion criteria.

METHOD:

1. All the patients fulfilling the inclusion criteria will be admitted.
2. Complain of

- Drowsiness
- Fever
- Abdominal Distension

Will be resorted to Ultrasonography (B Mode) for detecting free fluid and dilated bowel loops.

- Collection of blood for biochemical investigation will be done for estimating: haemoglobin, total and differential counts, serum bilirubin, SGPT, Alkaline phosphatases, serum blood urea nitrogen, serum total proteins, serum creatinine, and Coagulation profile
- X-Ray chest and abdomen, will be done in all cases and findings will be noted.

The following data was collected about the patients

Proforma

1. Personal details:

- A. Name
- B. Age
- C. Sex
- D. Residence
- E. Occupation
- F. Indoor No
- G. Date of Admission
- H. Date of Discharge

2. CHIEF COMPLAINS:

Drowsiness
Anorexia
Headache
Nausea
Vomiting
Decrease urine output
Breathlessness
Stitch line bleeding
Bleeding from manipulating site
Generalized weakness

3. PAST HISTORY

Similar complains in past
Diabetes insipid us
Diabetes mellitus
Hypertension
Jaundice

Surgery

4. FAMILY HISTORY

5. PERSONAL HISTORY

DIET a) Vegetarian
b) Non vegetarian
c) Mixed

SLEEP a) Adequate
b) Inadequate

APETITE a) Normal
b) Decreased

BOWEL HABITS a) Regular
b) Altered

BLADDER HABITS

ADDICTION

6. OBSTRETIC HISTORY

7. MENSTRUAL HISTORY

Last menstrual period date

Menstrual complains

EXAMINATION FINDINGS

A) GENERAL EXAMINATION

Consciousness and orientation
Nourishment
Temperature
Pulse
Blood pressure
Respiratory Rate
Pallor +/-
Oedema +/-
Lymphadenopathy +/-
Icterus +/-
Cyanosis +/-
Clubbing +/-
Bone/joint/spine

B) SYSTEMIC EXAMINATION

a) Per abdominal examination-

1) Inspection-
Contour and shape
Bilateral symmetry
Umbilicus
Veins/arteries
Peristalsis
Respiratory movements
Any visible fullness or swelling

2) Palpation-
Temperature
Tenderness
Rigidity/guarding
Organomegaly- liver/spleen/kidney
Ascitis
hernial sites
External genitalia
Any other significant findings

3) Percussion

4) Auscultation

b) Rectal Examination Per rectal examination
Proctoscopy examination

c) Cardiovascular system

d) Respiratory system

e) Central Nervous System

INVESTIGATIONS

A) BLOOD INVESTIGATIONS-

1. Hb
2. TC
3. DC
4. ESR
5. RBS
6. S. Creatinine
7. Blood Urea
8. RVD testing
9. Hbs Ag
10. Liver Function Test-

S. Bilirubin- Total - increased/decreased
Direct - increased/decreased
Indirect - increased/decreased

S.G.P.T. - Increased/decreased

S. Alkaline Phosphatase - increased/decreased

Coagulation Profile-

PT
INR
APTT

11. S. electrolyte

B) RADIOLOGICAL INVESTIGATION

1. X-ray Chest
Abdomen
Standing
Lying
2. USG
Abdomen
3. CECT ABDOMEN

COMPLICATIONS

A. LOCAL

1. Acute fluid collection
2. Pleural effusion

B. SYSTEMIC

1. Cardiovascular

A) Shock
B) Arrhythmia

2. Pulmonary

A) ARDS

3. Renal failure
4. Haematological

A) DC

5. Metabolic

A) Hypocalcaemia
B) Hyperglycaemia
C) Hyperlipidaemia

6. Gastrointestinal

A) Ileus

7. Neurological

A) Visual disturbances
B) Confusion, irritability
C) Encephalopathy

8. Coma
9. Convulsion
10. Death

III. Results

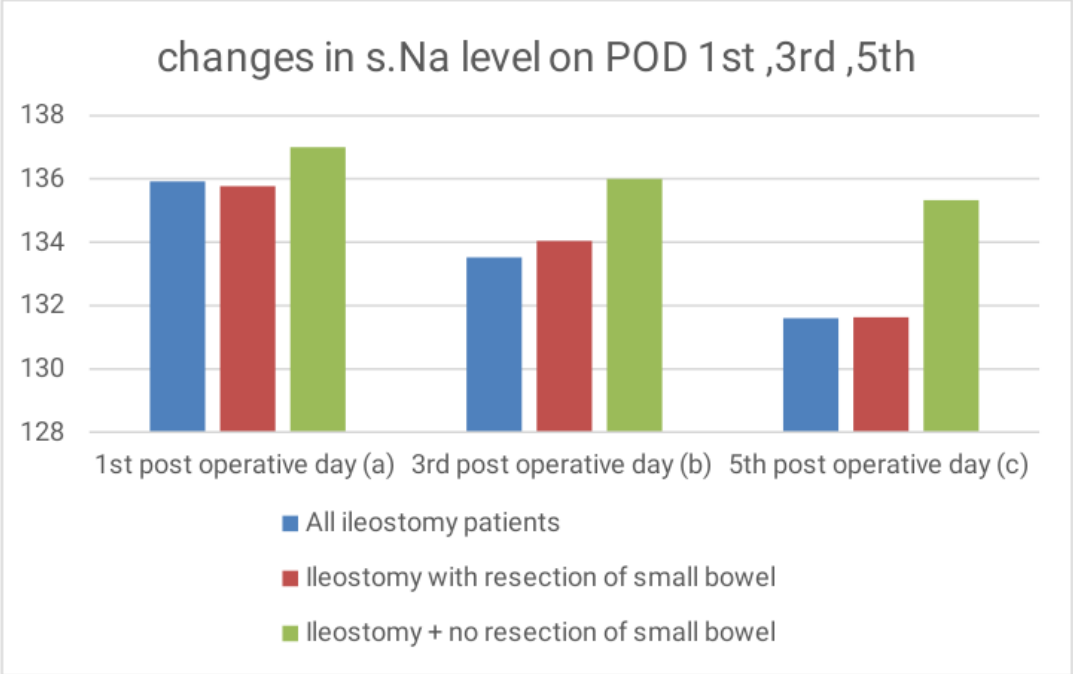
Patient undergoing GI surgeries that needed electrolyte correction

	NEEDED ELECTROLYTE CORRECTION	NOT IN NEED OF ELECTROLYE CORRECTION
RESECTION&ANASTOMOSIS	8	1
APPENDICECTOMY	1	3
GRAHAM'S PATCH	2	6
RESECTION&ANASTOMOSIS WITH STOMA	5	0
STOMA	11	4
TOTAL(41)	27	14

Out of 50 patients, 41 needed surgical management. Out of 29 Patients undergoing resection & anastomosis, stoma and stoma with resection & anastomosis, 24 needed electrolyte correction
Out of 12 patients who underwent grahams patch repair, only 3 needed electrolyte correction

Comparison of serum sodium (m mole/lit)

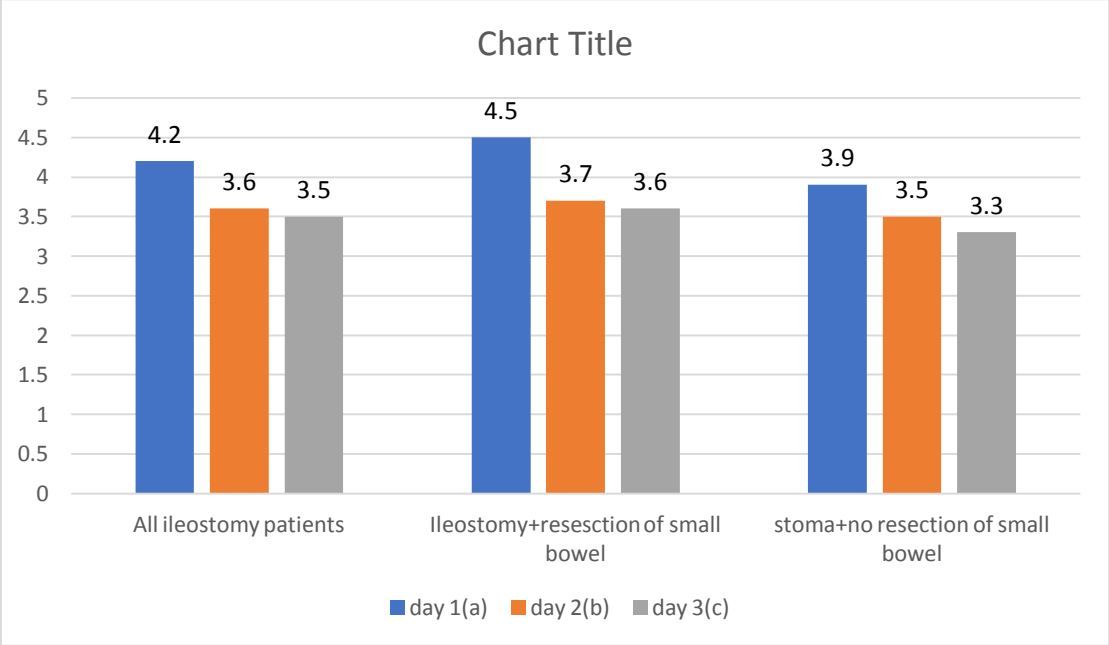
PATIENT GROUPS	1ST POST-OPERATIVE DAY(A)	3RD POST-OPERATIVE DAY(B)	5TH POST-OPERATIVE DAY(C)
All ileostomy patients	138.3	133.7	131.7
Ileostomy with resection of small bowel	137.8	133.08	131.4
Ileostomy + no resection Of small bowel	138.8	134.3	132



1) In the group having all ileostomy patients, when post-operative day 1 reading was compared to post-operative day 3 and 5 readings, a significant lower reading was observed on post-operative day 3 and day 5. 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.
2) In the group having ileostomy with resection of small bowel, when post-operative day1 reading was compared to post-operative day 3 and 5 readings, a significant lower value was observed on post-operative day 3 and day 5.
3) In the group having stoma with no resection of small intestine, no statistically significant change was observed with post-operative day 1 and day 3 readings when compared. However, a statistically significant lower reading was observed on post- operative day 5. Changes in the serum sodium level between post-operative day 3 and 5, were statistically significant

Comparison of serum potassium (mmol/lit)

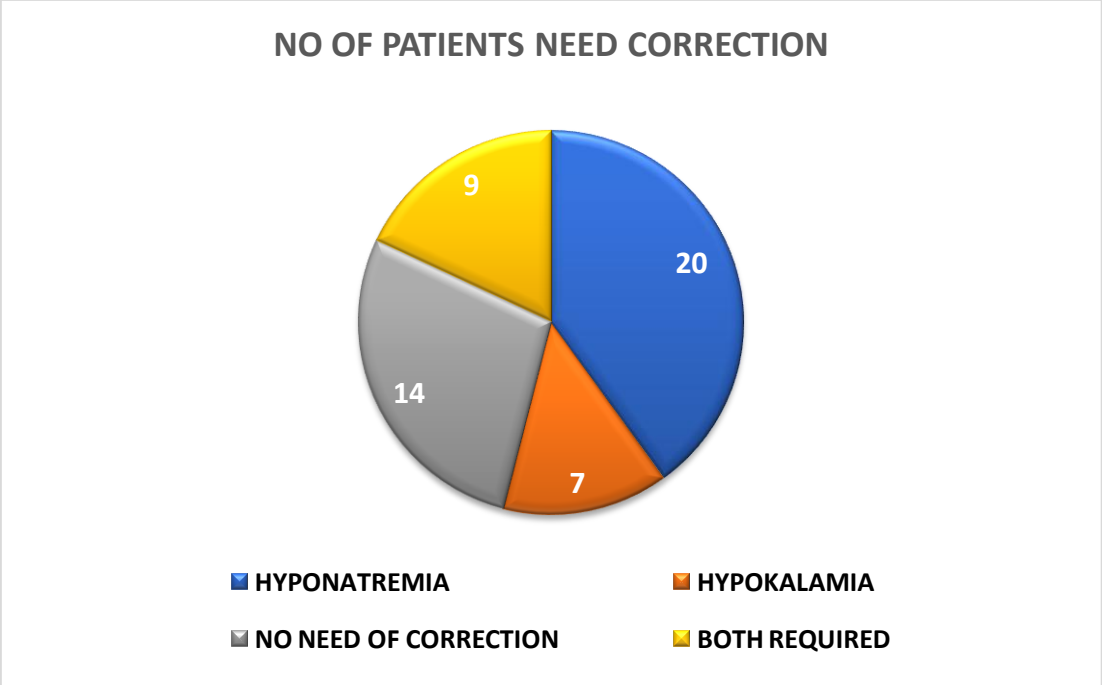
PATIENTS GROUPS	DAY1(A)	DAY3(B)	DAY5(C)
All ileostomy patients	4.2	3.6	3.5
Ileostomy +resection of small bowel	4.5	3.7	3.6
Stoma + no resection of small bowel	3.9	3.5	3.3



1) In the group having all stoma patients, when postoperative day 1 reading was compared to postoperative day 3 and day 5 readings, there was observable significant change.
2) In the group having all ileostomy patients, when postoperative day 1 reading was compared with day 5 reading, a significant lower value was observed on postoperative day 5.
3) In the group having ileostomy with resection of small intestine, when post- operative day 1 reading was compared to postoperative day 3 and day 5 readings, a significant lower value was observed on postoperative day3 and day 5.
4) In the group having stoma with no resection of small intestine, when postoperative day 1 reading was compared to postoperative day 3 and day 5 readings, no significant changes found.

Correction of electrolyte imbalance needed in emergency gastrointestinal surgeries

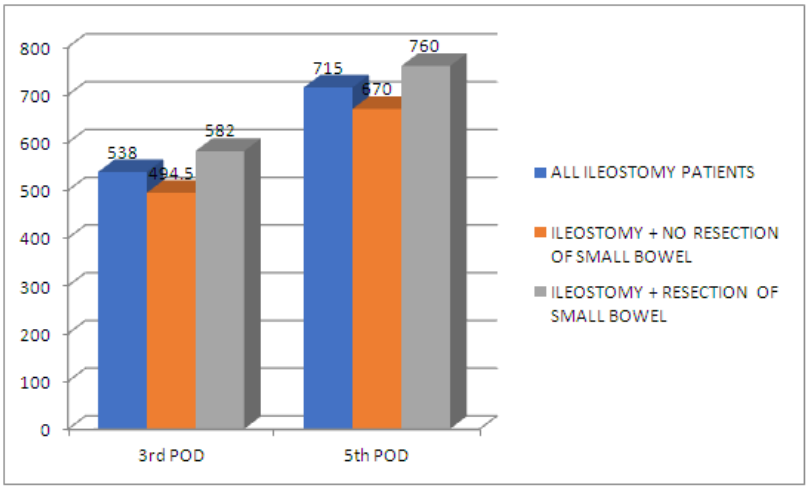
TYPE OF ELECTROLYTE IMBALANCE	NO OF PATIENTS NEED CORRECTION	PERCENTAGE
HYPONATREMIA	20	40
HYPOKALAMIA	07	14
NO NEED OF CORRECTION	14	28
BOTH REQUIRED	9	18
TOTAL	50	100



- According to this study most common type of electrolyte imbalance is hyponatremia after emergency gastrointestinal surgeries which need correction by using 0.9% NaCl pint. There is no need of using hypertonic saline infusion for correction of hyponatremia.
- Another type of electrolyte imbalance found during this study is hypokalemia which need correction by using KCl drip in 0.9% NaCl pint. During KCl drip patient should under observation as there is risk of hyperkalemia for that ECG monitoring required.

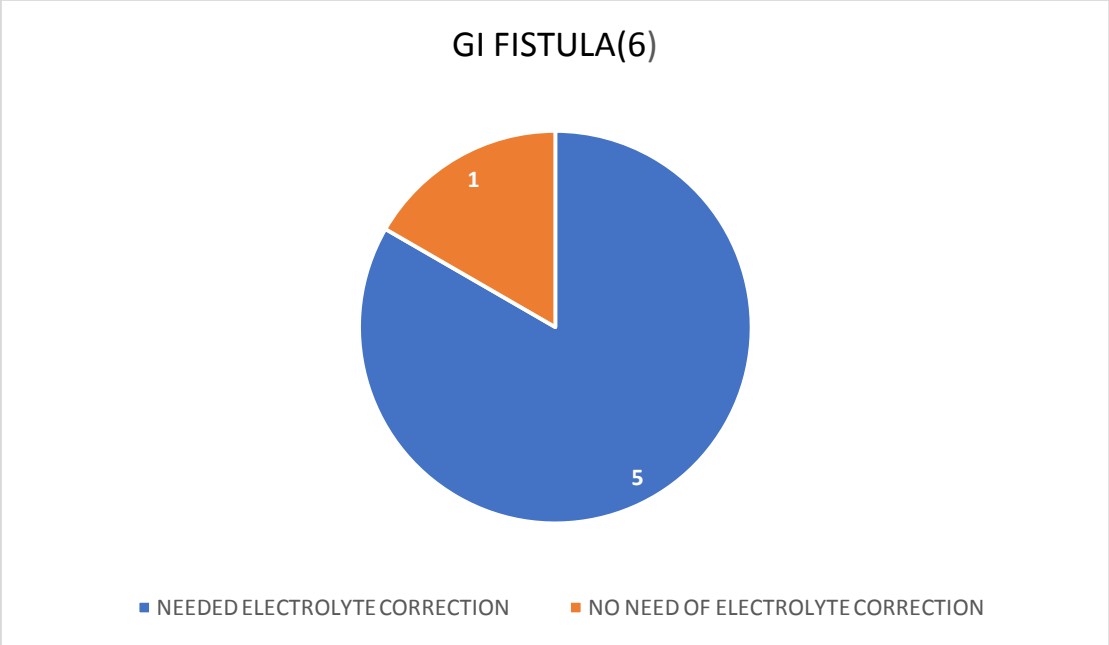
Distribution according to the stoma output on 3rd POD and 5th POD and procedure done

OPERATIVE PROCEDURE	AVERAGE STOMA OUTPUT ON 3rd POD (ml)	AVERAGE STOMA OUTPUT ON 5th POD (ml)
All ileostomy patients	538	715
Ileostomy + no resection of small bowel	494.5	670
Ileostomy + Resection of small bowel	582	760



Complication (Gi Fistula) In Emergency Surgery Having Electrolye Imbalance

COMPLICATION	NEEDED ELECTROLYTE CORRECTION	NO NEED OF ELECTROLYTE CORRECTION
GI FISTULA(6)	5	1



Out of 50 Patient, 41 needed surgical intervention Out of 41, 6 developed GI fistula
Out of 6 gi fistula patients, 5 needed electrolyte correction and 1 doesn't needed any electrolyte corrections

IV. Conclusion

Clinical study on electrolyte imbalance and its management in emergency gastrointestinal surgeries done at M. P. Shah medical college, Jamnagar, Gujarat, India. It included 50 cases of emergency gastrointestinal surgeries from July 2018 to October 2020. The study concludes as follows:

- Electrolyte imbalance occur in most of the emergency gastrointestinal surgeries among these surgeries most common surgery performed was ileostomy, small bowel resection.
- The stoma output was found to be higher in patients having ileostomy and was significantly higher in patients who had additional ileal segment resection done.
- Serum potassium level showed a significant decrease in patients with ileostomy, especially those having additional resection of ileal segment in the postoperative period, on the 5th postoperative day.
- The mean serum sodium level remained within the normal range on post-operative day 1, day 3 and day 5 in all, except in patients having ileostomy with additional resection of ileal segment, in which serum sodium level decreased below the normal range by 5th post-operative day.
- According to this study hyponatremia correction done only using 0.9% NaCl pint according to its severity and clinical bases. There is no need of giving hypertonic saline.
- According to this study hypokalaemia correction done using KCl drip in 0.9% NaCl pint.

From the study, it can be concluded that:

(1) Patients undergoing ileostomy have average stoma output .and all these patients showed a fall in electrolyte value in early post-operative period, but the mean values tend to remain in normal range.

(2) Patients, who underwent ileal resection in addition to ileostomy, had a significantly higher stoma output. The patients showed a significant fall in serum electrolyte levels, especially sodium, potassium. Needs correction

(3) Patient is having post of complication like GI fistula is also having electrolyte imbalance. Most of them needs correction

(4) Patient undergoing emergency GI surgery other than resection& anastomosis, stoma (appendicectomy, graham's patch Etc.,) most of them doesn't need any electrolyte correction in the postop period

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