

Clinical study on serum electrolyte level changes in operated cases of ileostomy

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Abstract

Background: In our study we estimate serum sodium (Na⁺) and potassium(K⁺) level in ileostomy patient. Regularly and follow up basis.

Methods- Hospital based prospective study was carried out at Government medical college and associated group of hospitals, Kota (Rajasthan). It included 50 cases in which ileostomy done from sept2017 to jan2020. The study aimed for serum sodium and potassium level changes in operated cases of ileostomy on post-operative day 3rd, 7th and 10th.

Results: Serum potassium level showed a significant decrease in patients with ileostomy, especially those having additional resection of small bowel segment in the postoperative period, on the 3rd post-operative day. The mean serum sodium level on the post-operative day 3 and post-operative day 7 when compared to post-operative day 10 value in the patients group having all ileostomy patients and patients having ileostomy with resection of small bowel was significantly low.

Conclusion: Patients undergoing ileostomy have average stoma output around 500-600 ml/day. All these patients show a fall in electrolyte value in early post-operative period. Patients, who underwent bowel resection in addition to ileostomy, had a significantly higher stoma output. The patients showed a significant fall in serum electrolyte levels. Serum sodium value fell below normal range by the post-operative day 3rd.

Keywords: Sodium, Potassium, Stoma.

Introduction

Maintenance of normal fluid electrolyte balance is desirable for maintenance of homeostasis. Electrolyte imbalance may be intra or extracellular among which serum electrolyte are readily measured.

Sodium is vital for homeostasis and the action potential in the body. -It is the predominant molecule that controls water movement in and out of the vascular system. Potassium is the main intracellular and sodium is the main extra cellular ion. Small changes in the serum reflect large intracellular changes that may cause significant morbidity and mortality.¹

Ileostomy is a surgically created opening in the anterior abdominal wall. The causes of ileostomy are to divert the feces away from the distal bowel loop in order or product anastomoses.²

Depending on the purpose for which the diversion has been necessary, an ileostomy may be temporary or permanent.³

Indications of ileostomy are intestinal obstruction due to benign and malignant disease, perforation with peritonitis, ulcerative colitis and crohn's disease and mesenteric ischemia.⁴

Complication of ileostomy are prolapse, retraction, paraileostomy hernia, stomal bleeding, stenosis of ileostomy orifice, skin reaction around stoma(Excoriation, erosion, sloughing), distal end gangrene, fluid and electrolyte imbalance and ileostomy diarrhea.⁵

In our study we estimate serum sodium (Na+)and potassium(K+) level in ileostomy patient. Regularly and follow up basis.

Materials and Methods

This randomized observational prospective cohort study has been carried out in 50 cases of operated cases in which ileostomy done, admitted to department of general surgery in Govt. medical college Kota and associated group of hospitals from Sept 2017 to till Jan 2020. All the patients were examined clinically and their history and examination were filled in pro forma.

Patients were selected according inclusion and exclusion criteria.

Inclusion Criteria

- All patients admitted to department of general surgery in Govt. medical college, Kota and associated group of hospitals in whom ileostomy done.

- All elective and emergency cases undergoing ileostomy construction and have follow up for 1-1½ months.

Exclusion Criteria

1. Patient with severe liver and renal disease.
2. Pediatric age group less than 12 years.
3. Patient who do not survive within respective study period.

Subjects

A total of 50 cases were included. After admission they underwent thorough ileostomy procedures as emergency/planned operative procedures.

Statistical Analysis

Statistical analysis was performed with the SPSS, version 21 for Windows statistical software package (SPSS inc., Chicago, IL, USA). The Categorical data were presented as numbers (percent) and were compared amongst groups using Chi square test. Probability was considered to be significant if less than 0.05

Results

This study was carried out at Government medical college and associated group of hospitals, Kota (Rajasthan).

It included 50 cases in which ileostomy done from sep2017 to jan2020.

Table 1: Case distribution according to age-

Age(years)	No. of patients
<25	9
25-49	29
50-80	12
Total	50

Table 1 reveals that the maximum number of patients were in 25-49 years age group, i.e., 29 (including 21 male and 8 female) and the youngest patient was 16 year old and the oldest one being 78 year old.(Average 34.93 for female and 38.28 for male patients).

Table 2: Case distribution according to sex-

Sex	No. of patients
Male	35
Female	15
Total	50

Table 2 reveals that male patients (35) were more in number than female patients (15).

Table 3: Case distribution according to diagnosis

Diagnosis	No. of Cases	Percentage
1. Perforation peritonitis	29	58%
a) Enteric fever	20	40%
b) Tubercular perforation	2	4%
c) Acute appendicitis with ileal/cecal perforation	2	4%
d) Blunt trauma abdomen	1	2%
e) Non specific	4	8%
2. Intestinal obstruction	21	42%
a) Malignancy	5	10%
b) Sigmoid volvulus	3	6%
c) Tubercular stricture	3	6%
d) Adhesion	3	6%
e) Band	2	4%
f) Internal hernia	2	4%
g) Ileocecal volvulus	1	2%
h) Mesenteric ischemia	1	2%
i) Foreign body	1	2%

From table 3, the majority of patients who underwent stoma creation were of perforation peritonitis 29(58%) patients following enteric fever, tubercular or non-specific enteritis or blunt trauma abdomen or cecal and terminal ileum perforation in conjunction with acute appendicitis. 21 patients presented with intestinal obstruction, out of these 5 cases had malignancy, 3 cases had tubercular stricture and 3 had adhesion and 2 had band and 2 had internal hernia and 1 case of ileocecal volvulus and 1 case of mesenteric ischemia and 1 case of foreign body.

Table 4: Post-operative stoma output (in ml)

Post-operative day	All ileostomy patients	Ileostomy + No resection of bowel	Ileostomy + resection of bowel
3 rd day	444	389.28	513.63
7 th day	546.40	467.14	647.27

From table 4, the average daily quantity of stoma output in all patients on 3rd post-operative day was 444ml and on the 7th post-operative day the amount was 546.40ml. The average stoma output in patients having no resection of small bowel was 389.28 ml and 467.28 ml on the 3rd and 7th post-operative day respectively and that in patients having stoma with resection of small bowel was 513ml and 647.27ml on the 3rd and 7th post-operative days respectively.

Table 5: Distribution according to the stoma output (ml) and procedure done-

Operative Procedure	Day-3			Day-7		
	<500	500-1000	>1000	<500	500-1000	>1000
All ileostomy	32(64%)	18(36%)	0	24(48%)	26(52%)	0
Ileostomy with no resection of small bowel	22(44%)	6(12%)	0	20(40%)	8(16%)	0
Ileostomy with resection of small bowel	10(20%)	12(24%)	0	4(8%)	18(36%)	0

Table 6: Comparison of serum sodium (mmol/lit.) in ileostomy patient-

Patient group	3 rd post-operative day	7 th post-operative day	10 th post-operative day
All ileostomy patients	132.84	134.80	138.36
Ileostomy with resection of small bowel	129.18	132.27	135.36
Ileostomy + No resection of small bowel	135.71	136.78	140.71

Comparison of serum sodium (mmol/lit.) in ileostomy patient

1. In the group having all ileostomy patients, when post-operative day 3 reading was compared to post-operative day 7 and 10 reading, a significant lower reading was observed on post-operative day 3 and 7. When post-operative day 3 reading was compared to post-operative day 7 reading, a

significant lower reading was observed on post-operative day 3.

2. In the group having ileostomy with resection of small bowel, when post-operative day 3 reading was compared to post-operative day 7 and day 10 readings, a significant lower reading was observed in post-operative day 3 and day 7.
3. In the group having stoma with no resection of small bowel, when post-operative day 3 and day 7 reading was compared to day 10 reading, significant lower value was observed on post-operative day 3 and day 7 reading.

The value of serum sodium ranges 126-140mmol/L on post-operative day 3, 126-148mmol/l on post-operative day 7 and 127-149mmol/l on post-operative day 10.

Table7: Comparison of serum potassium (mmol/lit) in ileostomy patient-

Patient group	3 rd post-operative day	7 th post-operative day	10 th post-operative day
All ileostomy patient	3.26	3.36	3.38
Ileostomy with resection of small bowel	2.88	3.09	3.09
Ileostomy with no resection of small bowel	3.55	3.58	3.62

Comparison of serum potassium (mmol/lit) in ileostomy patient

1. In the group having all stoma patients, when post-operative day 7 reading was compared to post-operative day 10 readings, there was no observable significant change.
2. In the group having ileostomy with resection of small bowel, when post-operative day 3 reading was compared to post-operative day 7 and 10, a significant lower value was observed.

3. In the group having stoma with no resection of small bowel, when post-operative day 3 reading was compared to post-operative day 7 and day 10, no significant changes was found.

The value of serum potassium ranged from 2.4-4.5mmol/L on post-operative day and 2.4-4.5 on post-operative day 7 and 2.9-4.1 on post-operative day 10.

Discussion

Creation of ileostomy is done to save the patient's life.

Indications of ileostomy are

- Perforation peritonitis (58%)-due to enteric, tubercular or other causes.
- Intestinal obstruction (42%)
- Malignancy (10%)

The character and the output of the stoma effluent depend on the site of the gastrointestinal tract where the stoma is created. It is a high output with bile and enzyme rich effluent in case of jejunostomy, ileostomy with resection of small bowel, ileostomy, and of much less output with semisolid or solid content in case of colostomy.

When the amount of stoma effluent is around or less than 500ml, it is low volume stoma, when the amount of stoma output is 1litre or more, it is high volume stoma. Patients with stoma output less than 1litre are seldom troubled. On the other hand, patients with high output stoma are prone to salt and water depletion.

especially when there is associated partial resection of ileum, resulting in unusual profuse ileostomy output.

Some of the observation and conclusion by A.O Wilson, Department of surgery, Post graduate medical school of London, is as follow: ⁵

- In the immediate post-operative period of terminal ileostomy, it may be difficult to maintain a satisfactory state of hydration.

- Sodium deficiency is very liable to develop, because the sodium content of ileostomy fluid is greater than that of chloride.
- Treatment by sodium citrate by mouth should be begun as soon as possible after operation. Large amount may be required, together with additional sodium chloride if ileostomy is very active. Much is now known about sodium and potassium metabolism and their effect on the body when these electrolytes are deficient. Their loss through skin, bowel and kidney has been studied.

But less is known about their excretion through artificially created stoma of the bowel. The earliest reliable study of the small intestinal contents in the human were reported by Abott W E (1963) who obtained specimen of the jejunum and ileum content from fasting human by means of specially devised tube.

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Fowler D I suggested that the amount of sodium required for replacement therapy during the first few post-operative days could be calculated by rule of thumb procedure in which, 300meq of sodium was given for each liter of ileostomy fluid loss. They thought that provided potassium deficiency is corrected before operation, potassium supplement were unnecessary after operation, unless enteritis developed.

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Kanaghinis T, Lubran M, Coghil N F pointed out that sodium concentration in ileostomy effluent as found by them were higher than those found by other worker. Subsequently they suggested that their high sodium figures were due oral administration on enteric coated salt tablet which might have escaped compete digestion.⁸

Administration of potassium chloride, which is efficiently absorbed but regard must be paid to the increase in sodium and water loss in the ileostomy effluent during potassium chloride administration. Resolution with sodium by orally administered sodium chloride may be much more difficult because of water loss induced by the load. Absorption of water and sodium in case of water and sodium depletion in ileostomy patients may be impaired by concurrent administration of codeine or opium. Information is not readily available about the management of fluid and electrolyte exchange in patients with recent ileostomy.⁹

Our experience shows that sodium administration is essential on occasion in after treatment of patients with ileostomy. The maximum volume of fluid lost from the ileostomy observed during any one 24 hours period was 3500ml, less than daily loss of 4000ml, which was observed by Carmicheal D et al, when abnormal losses occur at this rate, particular attention is required for their precise replacement. Failure to do so jeopardizes the chance of recovery. Fortunately, not all patients who have ileostomy have stoma output in such high amount. Adaptation of ileostomy usually develops after a period of several weeks of operation. With decrease in volume of fluid lost and in the concentration of sodium, potassium in it (Lockwood and Randall).¹⁰

We studied the serum sodium and serum potassium level changes in operated cases of ileostomy patients with or without small bowel resection.

In the previous studies the volume of daily ileostomy output was reported in the range of 200-500ml (Fowler DI 1959; Kanaghinis et al, 1963; Kaplan SA et al, 1962). Low volume ileostomy was defined as daily output around 500 ml and high volume ileostomy as a daily volume of a 1000ml or more, by Hill et al 1975.⁹

In our study the average stoma volume in all ileostomy patients was 444 ml on the 3rd day and 546.40 ml on the 7th postoperative day.

The average stoma output in patients having no resection of small bowel was 389.28 ml and 467.28 ml on the 3rd and 7th post-operative day respectively

The ileostomy output tended to be unusually profuse if additional resection of ileum had to be performed (Hill et al 1975). In our study the ileostomy patients in which resection of ileum was done, the mean output on the 3rd postoperative day was 513.63ml and on the 7th day was 647.27ml and was significantly higher than patients having stomas with no resection of the ileum($p<0.05$).

New ileostomy may produce diarrhoea of 1-2 lit/day as reported by A.O. Wilson et al, in our study there were no such patient.

The present study revealed a significant decrease in serum sodium concentration postoperatively in patients who underwent stoma creation.

Ileostomy patients having resection of small intestine had significantly lower serum sodium level compared to stoma patients with no resection of small bowel on the 3rd, 7th and 10th postoperative days($p<0.05$).

The mean value of serum sodium level on post-operative day 3rd and 7th day is below normal level and in normal range on post-operative day 10th in the group having all ileostomy patients.

In the group having all ileostomy patients, when post-operative day 3 reading was compared to post-operative day 7 and day 10 reading, a significant ($p<0.05$) lower reading was observed on post-operative day 3 and day 7 compared to day 10 reading. When post-operative day 3 reading was compared to post-operative day 7

reading, a significant ($p<0.05$) lower reading was observed on post-operative day 3.

In the group having ileostomy with resection of small bowel, when post-operative day 3 reading was compared to post-operative day 7 and day 10 readings, a significant lower reading was observed in post-operative day 3 and day 7. In the group having ileostomy with resection of small intestine, mean value of serum sodium on day 3 and day 7 were below normal range and post-operative day 10 reading was within normal range. The difference between post-operative day 3 and post-operative day 7 reading was significant ($p<0.05$). The difference between post-operative day 3 and post-operative day 7 and post-operative day 10 reading was also significant.

In the group having stoma with no resection of small bowel, when post-operative day 3 and day 7 reading was compared to day 10 reading, a significant ($p<0.05$) lower value was observed on post-operative day 3 and day 7 reading. Mean value of serum sodium level on day 3 and day 7 and day 10 lies within normal range in group having ileostomy with no resection of small bowel.

The value of serum sodium ranges 126-140mmol/L on post-operative day 3, 126-148mmol/l on post-operative day 7 and 127-149mmol/l on post-operative day 10 in group having all ileostomy patients.

The above finding compared to the works of Hill GL et al, (1974), Gallagher et al, (1962) who also observed decrease in serum level in post-operative period in patients with ileostomy. Hill et al, 1975 also observed the resection of ileum with ileostomy increases stoma output and electrolyte losses.¹⁰

In the group having all stoma patients, when post-operative day 7 reading was compared to post-operative

day 10 readings, there was no observable significant change.

In the group having ileostomy with resection of small bowel, when post-operative day 3 reading was compared to postoperative day 7 and 10, a significant ($p < 0.05$) lower value was observed.

In the group having stoma with no resection of small bowel, when post-operative day 3 reading was compared to post-operative day 7 and day 10, no significant changes was found.

The value of serum potassium ranged from 2.4-4.5mmol/L on post-operative day 3 and 2.4-4.5mmol/L on post-operative day 7 and 2.9-4.1mmol/L on post-operative day 10. This is in agreement with the result documented by various authors. Golighar JC, (1975), Elkinton JR et al, (1944), who observed a slight decrease in serum potassium levels in ileostomy patients, but no sign of potassium depletion in patients with ileostomy. However, some other authors had observed an increase in serum potassium level in patients with ileostomy N.D Gallagher et al, (1962), No such increase was noted in this study¹¹

Conclusion

Patients undergoing ileostomy have average stoma output around 500-600 ml/day. All these patients show a fall in electrolyte value in early post-operative period. Patients, who underwent bowel resection in addition to ileostomy, had a significantly higher stoma output. The patients showed a significant fall in serum electrolyte levels. Serum sodium value fell below normal range by the post-operative day 3rd.

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