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Study of Clinicobiochemical Changes in Patients with Small Bowel Obstruction

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Aims and objectives: To study the various clinical features and biochemical profile in small intestinal obstruction and to study the biochemical changes with outcome of treatment.

Materials and methods: Observational cross-sectional study was conducted in RIMS, Imphal, Manipur for two years with sample size of 82 patients of small intestinal obstruction getting admitted in the Department of Surgery.

Results: Total 82 patients were included out of which 63 were males and 19 were females presented with symptoms of pain abdomen, vomiting, constipation and abdominal distension. Mechanical obstruction was recorded in 76 (92.68%) cases, paralytic ileus in 5 (6.1%), while in 1 (1.21%) the type was not determined. Causes of intestinal obstruction were of obstruction followed by strangulated hernias (15.85%) and ileocaecal TB peritonitis (9.76%) was the main cause of paralytic ileus.

Conclusion: Most common cause of small intestinal obstruction was adhesions and bands and 52 patients managed by surgery and 30 students managed conservatively.

Keywords: *intestinal obstruction, paralytic ileus, hernias.*

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I. Introduction

Small intestinal obstruction is defined as failure in forward propulsion of the contents in the intestine either due to dynamic or adynamic cause.[1,2,3] Dynamic obstruction is a mechanical problem caused by a physical blockage which can either be extraluminal (extrinsic), mural (intrinsic) or intraluminal. Adynamic obstruction (functional) is due to paralysed bowel without any mechanical cause.[4,5]

Small intestinal obstruction is a universal problem with a wide geographical variation in the aetiological patterns. Even in same geographical location the aetiology varies with time.[6,7] In the tropics patients are seen late with dehydration, circulatory collapse, biochemical derangements and sepsis leading to considerable morbidity and mortality.[6] Depending on the site of obstruction, intestinal obstruction can be of either small intestinal obstruction or large intestinal obstruction. Krebs HB et al studied the incidence of intestinal obstruction and found that small intestinal obstruction is far more common than the large intestinal obstruction (77% versus 23%) respectively.[8]

In high small intestinal obstruction vomiting occurs early, is profuse and causes rapid dehydration with minimal distension and little evidence of dilated small intestinal loops on abdominal radiography. Whereas in low small intestinal obstruction, pain is predominant with central distension and multiple dilated small intestinal loops on abdominal radiography.[9]

In addition to all these signs and symptoms there is change in the internal milieu of the body also. This is mainly due to the improper absorption, repeated vomiting, constipation all leading to the biochemical changes in the body. These biochemical changes has severe adverse affects on the body so the timely correction of these changes can save the patient from grave consequences like seizures, cardiac arrhythmias, acute renal failure and even death also. The knowledge of these biochemical changes occurring in the body during small intestinal obstruction helps the surgeon to decide further management plan.[10,11]

RIMS, is the main referral and teaching hospital in Manipur. It receives emergencies from neighbouring states as well as other part of country. Some patients are finally seen at the hospital several days after onset of intestinal obstruction especially referrals. So the aim of this study was to find out the presentation, aetiological pattern, management and outcome of intestinal obstruction at the RIMS.

II. Aims and Objectives

1. To study the various clinical features and biochemical profile in small intestinal obstruction.
2. To study the biochemical changes with outcome of treatment.

III. Materials and Methods

a) Study design

Observational cross sectional study.

b) Study Period

October 2013 to September 2015 with minimum period of one month for follow up of last case.

c) Study population

The study will be done on all the patients attending RIMS OPD, casualty and emergency services

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with signs and symptoms of intestinal obstruction and requiring admission under the Department of General Surgery.

d) Inclusion criteria

Patients aged more than 12 years coming to hospital with signs and symptoms of intestinal obstruction and are willing for management in our hospital are included after taking informed written consent.

e) Exclusion Criteria

- Infants with intestinal obstruction due to congenital causes.
- Patients those who are treated on OPD basis/refused admission/terminally ill patients.

f) Sample size

82 patients of small intestinal obstruction getting admitted in the Department of Surgery within the study period who are willing to give valid consent and who fulfils the inclusion and exclusion criteria will be studied and included in study.

g) Study variables

Age, Sex, clinical presentation, biochemical parameters.

h) Method of Data Collection

1. Data will be collected from patients who are admitted in Surgical wards of RIMS, with a provisional diagnosis of small Intestinal obstruction.
2. Clinical study will be through questionnaires and clinical examination.
3. All patients will undergo routine biochemical and special investigations.
4. Treatment modality will be planned once the definitive diagnosis of intestinal obstruction is arrived at.
5. Post operative observation of patients for any complications.
6. Regular follow up and health education for the patients treated.

i) Statistical analysis

Statistical analysis will be done by using data based programme, descriptive statistics such as mean, proportion, percentage will be used. The result of the study will be interpreted using SPSS software 21 version. Chi square test will be used as a test of significance of the study. p-value <0.05 will be taken as significant.

j) Ethics

All the participants will be informed about the nature of the study and those agreed to participate will be asked to sign the informed consent formed. Participants are assumed that they could withdraw from the study at any time. The approval of the Institutional Ethics committee, Regional Institute of Medical Sciences (RIMS) will be taken. Confidentiality will be maintained.

IV. Results and Observation

a) Age distribution

The age range was between 13 years to 94 years. Most of the patients were between 21- 40 years accounting for 53.2% while the least group was above the age of 70 years (5.2%).

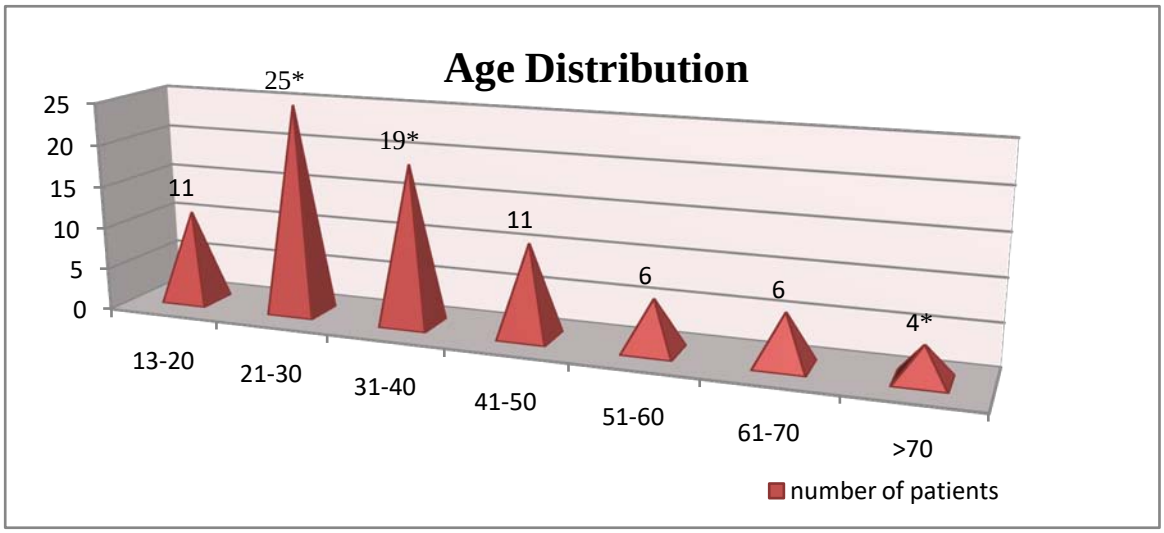

Figure 1: Age distribution of study population (n=82)

b) Sex distribution

There were 63 (77%) male patients and 19 (23%) female patients giving a male to female ratio of 3.2:1.

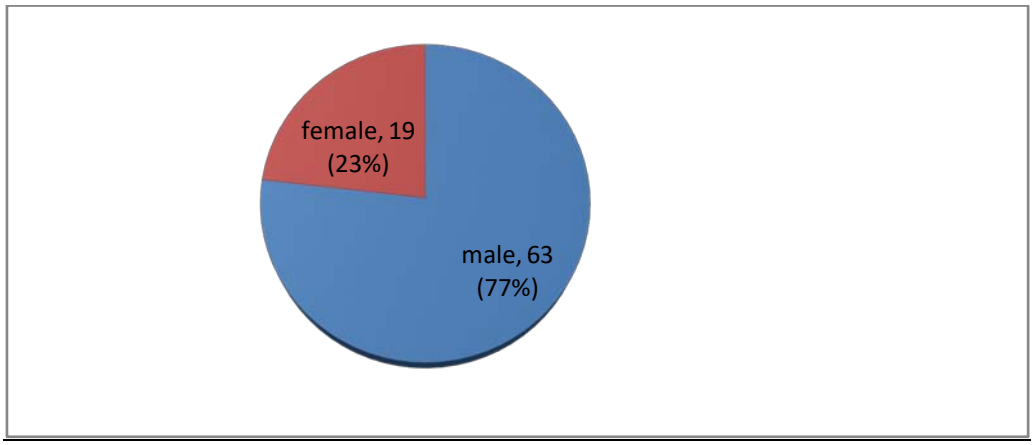

Figure 2: Bar diagram of gender distribution

c) Symptoms

The pattern of frequencies of the common presenting symptoms were as follows: abdominal pain (96.1%) vomiting (87.3%), constipation (77.3%) and abdominal distension (66.4%). None of the symptoms were found in isolation, they co-existed.

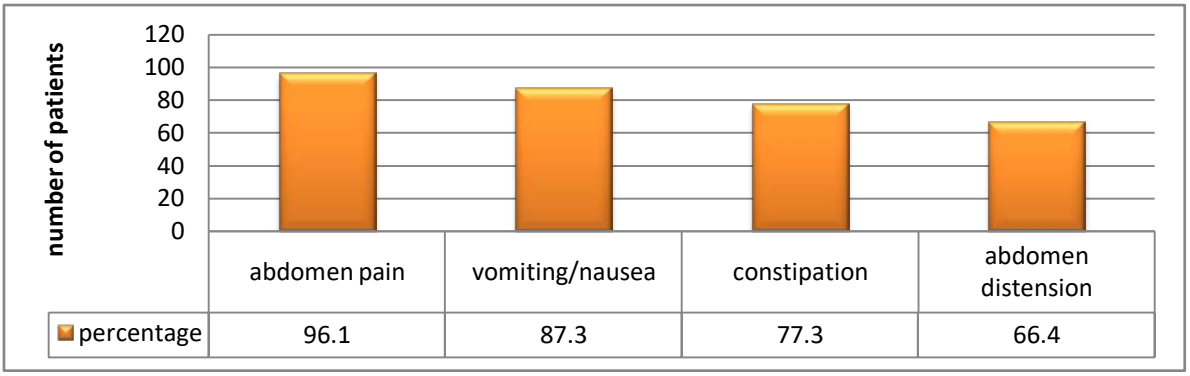

Figure 3: Distribution of symptoms in percentage

d) Duration of symptoms

The duration of symptoms was as shown in the table below. These were divided into intervals of 3 days for simplicity of presentation due to wide range. 46 (56.09%) patients were seen within the first three days of symptoms. The duration of symptoms was not documented in 1 (1.21%) patients.

Table 1: Duration of symptoms (n=82)

Duration of symptoms (Days)	Number of cases	Percentage
0-3	46	56.09%
4-6	16	19.51%
7-9	10	12.19%
>9	9	10.97%
unknown	1	1.21%
Total	82	100%

e) Physical signs

The frequencies of the main physical findings were as shown in the table below. No single finding was in isolation they co-existed.

Table 2: Physical findings

Findings	Total Number	Percentage (%)
Abdomen distension	60	73
Abdomen tenderness	56	68.5
Increased Bowel sounds	48	59.2
Abdomen scar	26	32.4
Decreased Bowel sounds	21	26.1
Hernia	17	20.4
Dehydration	13	15.4
Tachycardia	89	10.9
Visible Peristalsis	7	8.8
Hypotension	5	6.1
Abdomen mass	4	5.0
Fever	2	2.5

Abdominal distension was the commonest finding 73%, abdominal tenderness 68.5% and elevated bowel sounds 59.2%. Previous abdominal scars were found in 32.4%, while reduced bowel sounds were recorded in 26.1%. Other less frequent signs were as shown in the table.

f) Type of intestinal obstruction

Mechanical obstruction was recorded in 76 (92.68%) cases, paralytic ileus in 5 (6.1%), while in 1 (1.21%) the type was not determined.

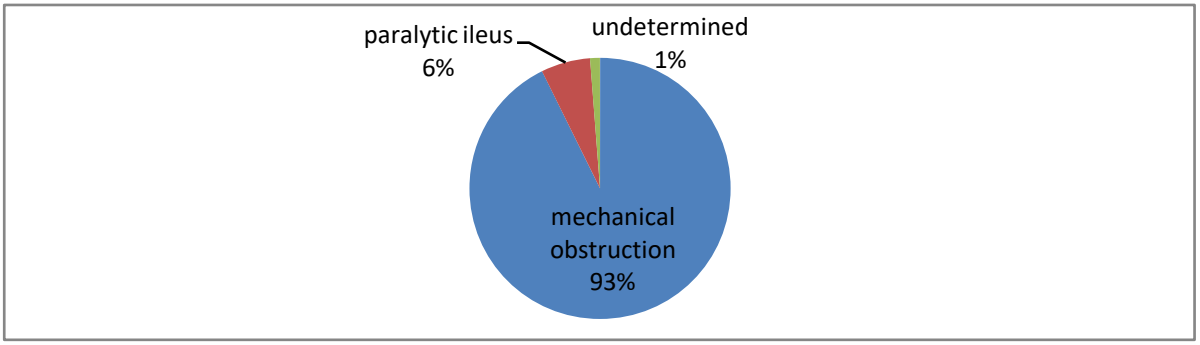

Figure 4: Type of intestinal obstruction

g) Causes

These are summarised in the table below for the different types of intestinal obstruction.

Table 3: Causes (n=82)

Cause of intestinal obstruction	Number of patients	Percentage
Adhesions	56	68.29%
Hernia	13	15.85%
Ileocaecal tuberculosis	8	9.76%
Intussusceptions	3	3.66%
Tumours	2	2.44%
Total	82	100%

Overall, adhesions and bands were the commonest (68.29%) cause of obstruction followed by strangulated hernias (15.85%) and ileocaecal TB peritonitis (9.76%) was the main cause of paralytic ileus.

h) Distribution

Distribution of hernias:

Table 3(a): Hernia distribution (n=13)

Type of hernia	Number	Percentage
Inguinal	11	84.62%
Umbilical	1	7.69%
Femoral	1	7.69%
Total	13	100%

Of all strangulated hernias, inguinal hernias were commonest 84.62%, umbilical and femoral hernia were very rare each accounted for around 7.69% overall.

i) Management

Overall, operative management was instituted in 52 (69.41%) patients while the rest 30 (30.53%) were managed conservatively.

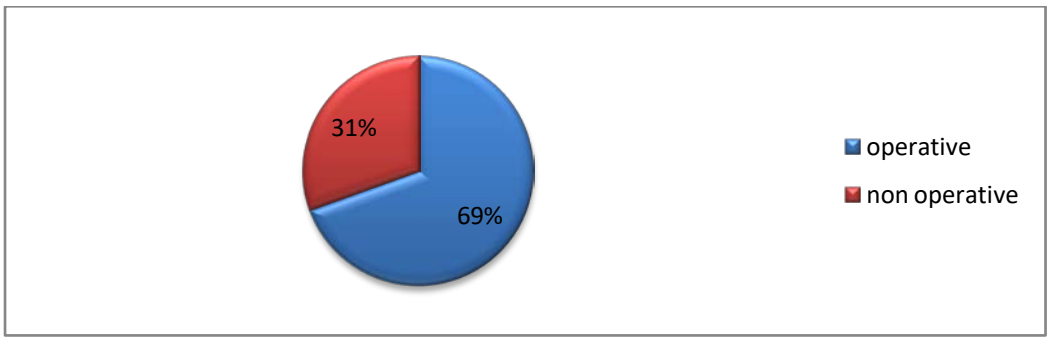

Figure 5: Management

Overall, surgery was performed in 69.47% of all the patients the type of which depended on cause and intra-operative findings. The rest of the patients, 30.53%, were managed conservatively.

j) Complications

Overall, 31 (37.80%) patients had complications while 51 (62.2%) had none. Complications were observed either pre-operatively or post-operatively as shown in the tables below. These did not occur in isolation since at least two could be found in one case.

Table 4(a): Pre-operative complications

Complications	Number of patients	% of total patients
Dehydration	12	14.43%
Peritonitis	11	13.41%
Gangrene	9	10.97%
Electrolyte imbalance	4	4.88%
Sepsis	4	4.88%
Gut perforation	2	2.44%
Renal failure	1	1.22%

Table 4(b): Post-operative complications

Complications	Number	% of total patients
Recurrence	3	3.66%
Wound infection	2	2.44%
Fistula formation	1	1.22%
Burst abdomen	1	1.22%
DVT	1	1.22%
Total	8	9.76%

Complications were relatively fewer post-operatively (9.76%). There was however a significant association between pre-operative peritonitis, pre-operative guts gangrene and post-operative wound infection and fistula formation.

k) Hospital stay

The figure below shows the number of days taken in hospital with a mean hospital stay of 7.39 days. Majority 51 (62.19%) were discharged within the first one week, 24 (29.27%) were discharged within the second week while 7 (8.54%) stayed in hospital for more than two weeks.

Table 5: Duration of hospital stay (n=82)

Hospital stay (days)	Number	Percentage
1-7	51	62.19%
8-14	24	29.27%
15-21	3	3.66%
>21	4	4.88%
Total	82	100%

l) Mortality

The mortality rate was 8.53% (7) patients of the 82 cases.

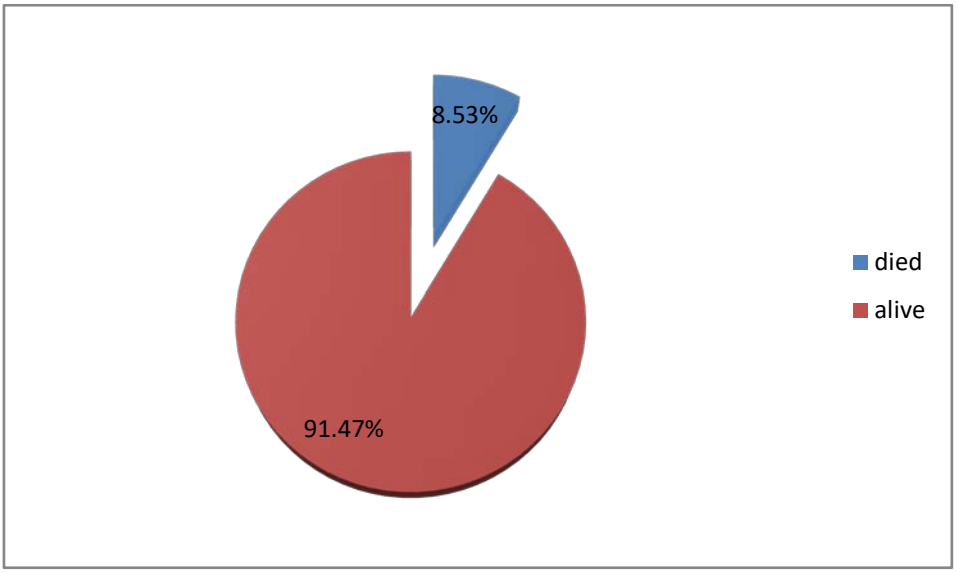

Figure 8: Mortality rate in percentage

Mortality/duration of symptoms

The mortality rate increased with increased duration of symptoms as shown in the tables below.

Table 6: Overall mortality/duration of symptoms (n=7)

Duration(days)	Number	Percentage
1-2	1	14.29%
3-4	2	28.57%
>5	3	42.86%
Unknown	1	14.29%
Total	7	100%

m) Association

Table 6(a): Mortality versus duration of symptoms

		Mortality		Total
		Yes	No	
Duration of symptoms	1-2	1(2.17%)	45(97.82%)	46
	3-4	2(12.5%)	14(87.50%)	16
	>5	4(20.0%)	16(80%)	20
Total		7	75	82

Level of significance p < 0.05. Pearson Chi-square=0.000. This shows a significant association between duration of symptoms and mortality. There was an increase in mortality rate compared to increase in duration of symptoms.

n) Electrolyte profile

Table 7(a): Sodium profile

Electrolyte conc. Na^+(meq/l)	Number of patients	Percentage of patients
120-125	5	6.10%
125.1-130	18	21.95%
130.1-135	20	24.40%
135.1-140	19	23.17%
140.1-145	15	18.30%
145.1-150	5	6.10%
>150	0	0%
Total	82	100%

Table 7(b): Potassium profile

K^+(meq/l)	Number of patients	Percentage (%)
3-3.5	9	10.97%
3.51-4.0	12	14.63%
4.01-4.5	20	24.40%
4.51-5.0	30	36.59%
5.01-5.5	8	9.76%
5.51-6.0	3	3.66%
Total	82	100%

Table 7(c): Chloride profile

Chloride conc.	Number	Percentage (%)
90-95	31	37.80%
95.1-100	27	32.92%
100.1-105	20	24.40%
>105	4	4.88%

Table 8(a): Effect of duration of symptoms on serum sodium levels in patients with small bowel obstruction

Sodium levels	Duration of symptoms	Number of patients	Percentage of patients
Hyponatremia	5	37	45.12%
Normonatremia	2	45	54.88%

The study shows that 45.12% patients had hyponatremia with delayed presentation of around 5 days whereas those patients with early presentation don't have significant changes in the sodium levels. No patients with small bowel obstruction had hypernatremia. The p value was <0.0001.

Table 8(b): Effect of duration of symptoms on potassium levels in patients with small bowel obstruction

Potassium levels	Duration of symptoms	Number of patients	Percentage of total patients
Hypokalemia	4	13	15.85%
Normokalemia	2	59	71.955
Hyperkalemia	6	10	12.20%

Of the total 82 patients with small bowel obstruction 13 patients had hypokalemia with an average time of presentation around 4 days, 10 patients had hyperkalemia with more delayed presentation of around 6 days of symptoms. Around 59 patients with early presentation had normal potassium levels. The p value was 0.020.

Table 8(c): Effect of duration of symptoms on serum chloride levels in patients with small bowel obstruction

Serum chloride levels	Duration of symptoms	Number of patients	Percentage of patients
Hypochloremia	5	24	29.26%
Normochloremia	2	52	63.41%
Hyperchloremia	3	6	7.32%

Of the total 82 patients with small bowel obstruction 24 patients with delayed presentation of around 5 days had low chloride levels where as 6 patients had high chloride levels. 52 patients with early presentation had normal potassium levels. The p values was 0.036.

V. Discussion

In this study, 63 (76.82%) cases were male while 19 (23.17%) were female giving a male: female ratio of 3.3:1 which showed a male preponderance (figure 2). This compares to an earlier study by Ngugi J[36] intestinal obstruction from adhesions where the ratio was 3:1. The mean age was 37.50 years with a range of 13-94 years (figure 1). The peak age group was in the third and fourth decades accounting for 53.2% compared to the fifth decade in the United Kingdom.[41]

In this study, Mechanical small bowel obstruction (SBO) was the commonest type, 92.68%, followed by paralytic ileus found in 6.1% of the cases. Mechanical SBO occurrence is more frequent since the main causes of mechanical obstruction (adhesive obstruction and hernia strangulation) mainly occur at the level of small bowel (table 3).

The pattern of intestinal obstruction at RIMS compares to that in the western advanced countries which contrasts earlier reports by McAdam W. J[32] and Paul Ivo Garrido[33] where strangulated hernias were found to be the commonest cause in developing countries. The main cause of intestinal obstruction at RIMS is due to adhesions and bands, mainly associated with previous laparatomies. A small group may occur due to peritoneal infections or inflammatory conditions for which laparatomy has not been done.[36] This pattern differs with other developing countries contrary to literature.[8]

Akcakaya A[42] in Turkey noted that the most frequent cause of intestinal obstruction in the developed countries is adhesions while strangulated hernias are more common in developing countries, which does not appear to be the case at RIMS. In India, Tamijmarare et al[43] k. showed that in a study of 572 patients admitted with Small intestinal obstruction between 1984 and 1992, 219 patients had obstructed external hernias as the leading cause while adhesive obstruction was second in 176 patients.

India is a developing country but the pattern of intestinal obstruction compares to that of developed countries due to the fact that the health delivery in urban centres tends to simulate that of developed countries.[36] With hernias being electively repaired and obstructive hernias becoming less common, adhesive obstruction has emerged as the leading cause of intestinal obstruction in the west[43] which could possibly to be the case at RIMS.

In evaluation of the patients, the most useful guide to diagnosis was plain abdominal X-rays, where in combination with history and physical findings, distended bowel loops with air-fluid levels was diagnostic. The severity of obstruction can be determined from the number of air-fluid levels as it increases with the number of levels. It should however, be noted that in adults, two inconstant fluid levels may be regarded as normal one at the duodenal cap and the other in the terminal ileum.[15] The laboratory evaluation included haemogram and biochemistry including serum, electrolyte profile.

The development of hyponatremia was largely dependent on the duration of symptoms as suggested by very low p-value which was less than 0.001. This could be due to high concentration of Na^+ in gastrointestinal secretions.[44,45] On an average, in the first 3 days of obstruction, the patient had normal Na^+ levels, and after 4 days, patient had hyponatremia. Na^+ levels were either normal or below normal. There was no patient with hypernatremia. Normal Na^+ levels existed among patients who presented within first 3 days.[46]

On an average 2 days elapsed before K^+ levels changed, becoming hypokalemic and later hyperkalemic. Patients with intestinal obstruction lose K^+ both in secretions and urine. As the distal convulated tubule respond to aldosterone in the shock like state of intestinal obstruction. They reabsorb Na^+ ions. The reabsorbed Na^+ is exchanged for H^+ and K^+. In small bowel obstruction low H^+ exist due to vomiting. Since H^+ is also low in early obstruction, K^+ is lost to the tubular lumen instead. That may explain the early hypokalemia. K^+ is also lost to the intestinal lumen. Later on, serum H^+ is increased due to anaerobic metabolism and lactic acid production. The increased H^+ is excreted instead of K^+. Thus K^+ level goes up. Also on acidosis H^+ is pumped into the cell in exchange for Na^+ instead of K^+. This is accentuated by high aldosterone levels that are in consonance with hypovolemia that occurs in intestinal obstruction.[47] The p value was 0.020, which was statistically significant. Thus the general trend was as expected physiologically.

The trend of serum chloride concentration in patients presenting after a short duration of small intestinal obstruction was normochloremia followed by hyperchloremia then hypochloremia, patients had a statistically significant p value of 0.036. This tie up with scientific explanation that most patients are assumed to have had normal levels before intestinal obstruction, hyperchloremic then hypochloremia. Patients followed initial hypochloremia could be explained by the initial reabsorption of Na^+. This is effected by the proximal convulated tubule. This is more effective before aldosterone levels rise. The Na^+ is followed by Cl^- for electroneutrallity in the proximal convulated tubule thus Cl^- levels rise initially.[48]

Later hypochloremia could be explained by; as hypovolemia develops, aldosterone levels rise. This favours Na^+ reabsorption in the distal convulated tubules. In the distal convulated tubules, Na^+ reabsorption is in exchange for K^+ and H^+. A transient hypokalemia seems to occur on average in patients presenting after 4 days, whereas hypochloremia existed in patients presenting after 6 days. Thus, the Na^+ reabsorbed in the distal convulated tubules in the presence of aldosterone is exchange for H^+ instead of K^+. Thus Cl^- ions will be lost in the form of paradoxical aciduria[48] and even when the transient hypokalemia shifts to hyperkalemia hypovolaemic shock exists. Thus there is anaerobic respiration and lactic acidosis. The H^+ excreted is still followed by Cl^- thus favouring Cl^- ion loss in urine further with consequent hypochloremia.[49]

Majority (62.19%) of the patients were discharged from hospital within the first week (figure 7). Hospital stay was determined by severity and outcome. The mean duration was 7.39 days. Most of the patients were followed up at the surgical outpatient clinic, Patients' follow up was determined by the cause and outcome. Patients managed operatively were booked for follow up. Some patients booked for follow up did not attend the clinic for reasons that could not be established in this study.

VI. Conclusion

Commonest physical findings in this study was abdominal distension (73%) followed by abdominal tenderness (68.5%). The type of obstruction most common was mechanical obstruction (92.68%) and most common cause of obstruction was adhesions and bands (68.29%) followed by hernia (15.85%). Inguinal hernia was most common. 52 patients were managed by surgery and 30 patients by conservatively.

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possible. The third author Dr. Rumi Debbarma has done the statistical analysis, provided the help in developed concept and designs the intellectual content, innovations. Fourth author, Dr. Amit Kumar has provided scientific advice, guidance and mentorship in scientific writing.

Authors' Contribution

I declare that this work was done by the author named in this article.

Conflicts of Interest

No conflicts of interest are associated with this work.

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