

SMALL BOWEL OBSTRUCTION- CLINICAL FEATURES, BIOCHEMICAL PROFILE AND TREATMENT OUTCOME

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ABSTRACT

BACKGROUND

Small bowel obstruction is defined as failure in forward propulsion of the contents in the intestine either due to dynamic or adynamic cause. It is a common surgical emergency requiring early diagnosis and corrective surgery. It presents a challenge to the surgeon. Studies in the west have shown that bowel obstruction accounts for at least 20% of all admissions to the surgical service.

Aim: In view of varying aetiologies, intense study and clinical evaluation regarding trends and patterns of small bowel obstruction is worthwhile.

MATERIALS AND METHODS

The case series was conducted on 82 patients admitted in the Department of Surgery, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, from October 2013 to September 2015. Study was done through questionnaires and clinical examination, biochemical investigations including renal function tests, liver function tests, serum electrolytes, CT scan and CRP levels. Treatment modality was planned once the definitive diagnosis of bowel obstruction was made and data analysed using SPSS version 21.

RESULTS

63 (76.82%) cases were male, while 19 (23.17%) were female giving a ratio of 3.3: 1. The mean age was 37.50 years ranging from 13-94 years. Mechanical obstruction was the commonest type 92.68% followed by paralytic ileus in 6.1% cases. Abdominal distension was the commonest finding in 73%, abdominal tenderness in 68.5% and elevated bowel sounds in 59.2%. Previous abdominal scars were found in 32.4%, while reduced bowel sounds were recorded in 26.1%. Overall, adhesions and bands were the commonest cause of obstruction found in 56 (68.29%) patients followed by strangulated hernias in 13 (15.85%) patients and ileocaecal TB peritonitis in 8 (9.76%) patients was the main cause of paralytic ileus. 45.12% patients had hyponatraemia, 13 (15.85%) patients had hypokalaemia and 10 (12.20%) patients had hyperkalaemia.

CONCLUSION

21-40 years' age group accounted for more than half of the patients, the most common cause being adhesions from previous abdominal surgeries followed by strangulated hernias. Plain abdominal x-rays were diagnostic in more than 60% of cases. Operative management was the mainstay of treatment in more than 2/3rd of cases.

KEY WORDS

Small Bowel Obstruction, Laparotomy, Dynamic Obstruction, Paralytic Ileus.

HOW TO CITE THIS ARTICLE: Chinglensana L, Salam SS, Saluja P, et al. Small bowel obstruction- clinical features, biochemical profile and treatment outcome. J. Evolution Med. Dent. Sci. 2018;7(26):2972-2976, DOI: 10.14260/jemds/2018/670

BACKGROUND

Small bowel obstruction is a common surgical emergency that accounts for at least 20% of all admissions to a surgical service.¹ It is defined as failure in forward propulsion of the contents in the intestine either due to dynamic or adynamic cause.^{2,3} Dynamic obstruction is a type of mechanical obstruction to the bowel caused by a physical blockage, which can either be extraluminal (Extrinsic), mural (Intrinsic) or intraluminal.

Whereas adynamic obstruction (Functional) is due to paralysed bowel without any mechanical cause.⁴ Mechanical obstruction often requires appropriate surgical treatment unlike functional obstruction, which mainly relies on non-operative management.

Early diagnosis and immediate corrective measures usually bears a favourable prognosis. In the tropics patients are seen late with dehydration, circulatory collapse, biochemical derangements and sepsis due to poor healthcare facilities leading to considerable morbidity and mortality. The management of these patients therefore presents a serious challenge to the surgeon in a tropical environment.^{5,6} Depending on the site of obstruction, bowel obstruction can be of either small bowel obstruction or large bowel obstruction. Krebs HB et al⁷ studied the incidence of bowel obstruction and found that small bowel obstruction is far more common than the large bowel obstruction (77% vs. 23%) respectively.

'Financial or Other Competing Interest': None.
Submission 13-05-2018, Peer Review 09-06-2018,
Acceptance 14-06-2018, Published 25-06-2018.

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DOI: 10.14260/jemds/2018/670



In high small bowel obstruction vomiting occurs early, is profuse and causes rapid dehydration with minimal distension and little evidence of dilated small bowel loops on abdominal radiography. Whereas in low small bowel obstruction, pain is predominant with central distension and multiple dilated small bowel loops on abdominal radiography. These symptoms generally subside with good patient care, management and timely intervention, but it is also important to appreciate that consequences of small bowel obstruction can be life-threatening also sometimes if there is superimposed strangulation leading to ischaemic bowel.⁸ These cases with strangulation require intensive care management with timely intervention to save the life of the patient and to prevent any further complication.

In addition to 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 have severe adverse effects 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. The knowledge of these biochemical changes occurring in the body during small bowel obstruction helps the surgeon to decide further management plan. Small bowel obstruction is predisposed by varying underlying anomalies (Including congenital) and diseases. Among all the causes the most common causes of bowel obstruction include adhesions, neoplasm and herniation.⁹ Lower abdominal surgeries including appendectomies, colorectal surgery, gynaecologic procedures and hernia repairs confers a greater risk of adhesive small bowel obstruction.

In the first three or so decades of the 20th century, mortality from small bowel obstruction was very high.¹⁰ Although, the mortality due to acute small bowel obstruction is decreasing with better understanding of pathophysiology, improvement in diagnostic techniques, fluid and electrolyte correction, much potent anti-microbial and surgical management but still mortality ranges from 3% for simple obstruction to as much as 30% when there is vascular compromise or perforation of the obstructed bowel. This is further influenced by the clinical setting and related comorbidities.

Kloiber¹¹ of Germany (1919) emphasised the importance of x-ray in locating the level of obstruction. The presence of gas in the wall of the bowel is a highly significant sign of bowel necrosis. This was first demonstrated by Schorr¹² in 1963. Amongst all the dynamic or adynamic causes, post-operative adhesions stand as the most important cause. This was also reported by Brewer et al¹³ who analysed 1000 consecutive abdominal surgeries in 1976 and reported an incidence of post-surgical small bowel obstruction to be 2.5%, which are supposed to be due to post-surgical adhesions.

Miller G et al¹⁴ reported the recurrence of obstruction after abdominal operations and found that the likelihood of re-obstruction increases and the time to re-obstruction decreases with increasing number of previous episodes of obstruction.

Early diagnosis of small bowel obstruction, skilful operative management, proper technique during surgery and intensive postoperative treatment yield gratifying results.

Small bowel obstruction of any nature is a potential threat to life. Hence, the problem demands the best of clinical acumen of a surgeon. Being a common surgical problem confronted by general surgeons, small bowel obstruction forms a major surgery performed in surgical units. In view of plethora of aetiologies, small bowel obstruction needs an intense study and critical evaluation. In the management of small bowel obstruction, it was once said- "never let the sun rise and set in" in cases of small bowel obstruction, because about 5.5% of small bowel obstructions is ultimately fatal if treatment is delayed.

Regional Institute of Medical Sciences (RIMS), Imphal is the main referral and teaching hospital in Manipur and receives emergencies from neighbouring states as well as other parts of country. Patients presenting late have clinical and biochemical patterns, which may be different from other places where the patients have easy and fast access to the medical facilities. Clinical presentation, aetiological pattern, biochemical changes, management and outcome of small bowel obstruction patients requires detailed analysis.

Small bowel obstruction is associated with serious complications resulting in high morbidity and mortality unless promptly and properly managed. Studies done in the west have shown that bowel obstruction accounts for at least 20% of all admissions to a surgical service with more than 9000 deaths annually. The common causes in the west have been found to be adhesions, hernias and neoplasm. The trends and patterns of bowel obstruction have been shown to vary with time and therefore it was worthwhile to undertake this study.

MATERIALS AND METHODS

This is a case series conducted in the Department of Surgery, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, from October 2013 to September 2015 on patients aged more than 12 years, admitted in the surgical wards of RIMS, Imphal with the diagnosis of small bowel obstruction. Study population was chosen by Convenience Sampling and 82 patients of small bowel obstruction were admitted within the study period. Approval of the Institutional Ethics Committee, Regional Institute of Medical Sciences, Imphal was obtained and confidentiality was maintained. There was no conflict of interest.

The patients with the diagnosis of small bowel obstruction underwent routine biochemical investigations like renal function tests, liver function tests, serum electrolytes, CT scan and CRP levels. Post-operative observation of patients was carefully done to see for any complications. Regular follow-up of the treated patients was done. The result of the study was interpreted using SPSS software 21 version.

All cases of small bowel obstruction fulfilling the inclusion criteria were studied and recorded in the prescribed proforma for data collection with prior written consent from the patients in case of adults and parents or guardians in case of minor. A detailed history with reference to the duration of onset and associated symptoms was taken. A detailed physical examination was undertaken, and relevant laboratory investigations were performed during the initial clinical encounter. All necessary investigations like CBC (Complete Blood Count), Urine RE, Blood Sugar, LFT (Liver Function Test), KFT (Kidney Function Test), serum

electrolytes, ultrasonography and x-ray were done. Total number of surgical procedures performed on patients with small bowel obstruction in General Surgery Department during this period was 52, while rest 30 patients were managed conservatively.

RESULTS

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%). The youngest patient was 13 years old boy, whereas the oldest was 94 years old male patient. There were 63 (76%) male patients and 19 (24%) female patients giving a male-to-female ratio of 3.2: 1.

The most common presenting symptoms were abdominal pain in 96.1%, vomiting in 87.3%, constipation in 77.3% and abdominal distension in 66.4% of the cases. The main physical findings included abdominal distension in 73%, abdominal tenderness in 68.5%, increased bowel sounds in 59.2% and previous abdominal surgical scars in 32.4% of cases. Other signs included decreased bowel sounds in 26.1% of cases, dehydration recorded in 15.4%, while tachycardia and visible peristaltic movements were recorded in 10.9% and 8.8% of cases respectively. Digital rectal examination was performed in 50.8% of the cases.

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%. 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.

The most commonly used investigation was plain abdominal x-rays with a diagnostic value of more than 60%. Mechanical obstruction accounted for 92.68% as mechanical SBO. Paralytic ileus was found in 6.1% of the cases, while the type of obstruction was not determined in 1.6% of the cases. Overall, postoperative adhesions and bands (68.29%) was the leading cause of small bowel mechanical obstruction followed by strangulated hernias in 15.85% of the cases. The main cause of paralytic ileus was tuberculous peritonitis in 9.76% of the cases. Operative management was performed in 52 (69.41%) patients depending on requirement, while 30 (30.53%) patients were managed conservatively. Overall, adhesions and bands were the commonest cause of obstruction found in 56 (68.29%) patients followed by strangulated hernias in 13 (15.85%) patients and ileocaecal TB peritonitis in 8 (9.76%) patients was the main cause of paralytic ileus.

Of all strangulated hernias inguinal hernias were commonest 84.62%, umbilical and femoral hernias were very rare, each accounting for around 7.69%. Overall, operative management was instituted in 52 (69.41%) patients, while the rest 30 (30.53%) patients were managed conservatively. The main complications recorded were peritonitis in 11 (13.41%), bowel gangrene in 9 (10.97%) and septicemia in 4 (4.88%) cases. Less common complications included gut perforation in 2 cases, enterocutaneous fistula in one, burst abdomen in one and deep venous thrombosis (DVT) of the calf in one patient. The study shows 45.12% patients had hyponatraemia, 15.85% had hypokalaemia and hyperkalaemia in 12.20% of cases which was more in cases

with strangulated hernia. Hypochloroemia was present in 29.26% of cases, whereas hyperchloroemia was present in 7.32% of cases. The overall mortality rate was 8.53% (7) of the 82 cases. This was higher in patients who presented late.

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

Majority of 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.

There is a significant association between duration of symptoms and mortality. There is an increase in mortality with increase in duration of symptoms.

The study shows that 45.12% patients had hyponatraemia with delayed presentation of around 5 days, whereas those patients with early presentation do not have significant changes in the sodium levels. No patients with small bowel obstruction had hypernatraemia. Of the total 82 patients with small bowel obstruction 13 patients had hypokalaemia with an average time of presentation around 4 days, 10 patients had hyperkalaemia with more delayed presentation of around 6 days of symptoms. Around 59 patients with early presentation had normal potassium levels. Patients with delayed presentation of around 5 days had low chloride levels, whereas 6 patients had high chloride levels. 52 patients with early presentation had normal potassium levels.

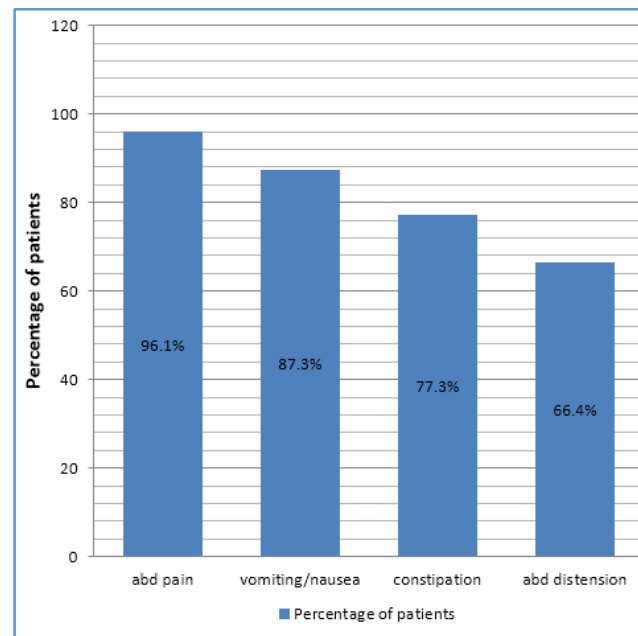


Figure 1. Symptoms

Finding	No. of Patients	% of Total Patients
Abdominal distension	60	73%
Abdominal tenderness	56	68.5%
Inc. Bowel sounds	48	59.2%
Abdominal scar	26	32.4%
Decreased bowel sounds	21	26.1%
Hernia	17	20.4%
Dehydration	13	15.4%

Tachycardia	9	10.9%
Visible peristalsis	7	8.8%
Hypotension	5	6.1%
Abd. mass	4	5.0%
Fever	2	2.5%

Table 1. Physical Findings

Cause of Bowel Obstruction	Number of Patients	Percentage of Total Patients
Adhesions	56	68.29%
Hernia	13	15.85%
Ileocaecal TB	8	9.76%
Intussusceptions	3	3.66%
Tumours	2	2.44%
Total	82	100%

Table 2. Various Causes of Small Bowel Obstruction (n=82)

Complication	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 3. Pre-Operative Complications

Complication	Number of Patients	% of Total Patients
Recurrence	3	3.66%
Wound infection	2	2.44%
Fistula formation	1	1.22%
Burst abdomen	1	1.22%
Deep vein thrombosis	1	1.22%
Total	8	9.76%

Table 4. Post-Operative Complications

DISCUSSION

Small bowel obstruction is an important cause of acute abdomen and according to previous studies it accounts for at least 20% of all admissions to a surgical service.¹ 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 and it is comparable to an earlier study by Ngugi JK et al,¹⁵ where the sex ratio was found to be 3: 1 in cases of bowel obstruction secondary to adhesions. The mean age was 37.50 years with a range of 13 - 94 years. The peak age group was in the third and fourth decades accounting for 53.2% compared to the fifth decade in the United Kingdom.¹⁶ This group comprises the most productive work force of any country.

The pattern of small bowel obstruction at RIMS compares to that in the western advanced countries, which contrasts earlier reports by McAdam WJ¹⁷ and Garrido PI where strangulated hernias were found to be the commonest cause in developing countries. The main cause of bowel obstruction at RIMS is due to adhesions and bands, mainly associated with previous abdominal surgeries. A small group may occur due to peritoneal infections or inflammatory conditions, for which laparotomy has not been done.¹⁸ This pattern differs with other developing countries contrary to literature.⁸ McEntrie et al¹⁹ found that the commonest cause of bowel

obstruction in United Kingdom was adhesions followed by neoplasms, strangulated hernias, volvulus and faecal impaction in that order. Akcakaya in Turkey noted that the most frequent cause of bowel 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 al²⁰ showed that in a study of 572 patients admitted with small bowel 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 bowel 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.¹⁸

Hyponatraemia was largely dependent on the duration of symptoms, which could be due to high concentration of Na⁺ in gastro-bowel secretions.²¹ On an average in the first 3 days of obstruction the patient had normal Na⁺ levels and after 4 days patient had hyponatraemia. Na⁺ levels were either normal or below normal. There was no patient with hypernatraemia. Normal Na⁺ levels existed among patients who presented within the first 3 days.²²

Patients with bowel obstruction lose K⁺ both in secretions and urine. As the distal convoluted tubule respond to aldosterone in the shock-like state of bowel obstruction it reabsorbs 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 hypokalaemia. K⁺ is also lost to the bowel 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⁺ levels go 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 hypovolaemia that occurs in bowel obstruction.²³

Patients with a short duration of small bowel obstruction presented with normochloroemia followed by hyperchloroemia and then hypochloroemia. This tie up with scientific explanation that most patients are assumed to have had normal levels before bowel obstruction, hyperchloroemic and then hypochloroemia. Patients followed initial hypochloroemia could be explained by the initial reabsorption of Na⁺. This is effected by the proximal convoluted tubule. This is more effective before aldosterone levels rise. The Na⁺ is followed by Cl⁻ for electroneutrality in the proximal convoluted tubule, thus Cl⁻ levels rise initially.²⁴

Later hypochloroemia could be explained by as hypovolaemia develops, aldosterone levels rise. This favours Na⁺ reabsorption in the distal convoluted tubules. In the distal convoluted tubules, Na⁺ reabsorption is in exchange for K⁺ and H⁺. Hypochloroemia existed in patients presenting after 6 days of obstruction. Thus, the Na⁺ reabsorbed in the distal convoluted tubules in the presence of aldosterone is exchanged for H⁺ instead of K⁺. Thus, Cl⁻ ions will be lost in the form of paradoxical aciduria and even when the transient hypokalaemia shifts to hyperkalaemia 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 hypochloreaemia.²⁵

CONCLUSION

The study was conducted on 82 patients admitted with the diagnosis of small bowel obstruction during the 2-year period of October 2013 to September 2015 in the surgical wards of Regional Institute of Medical Sciences (RIMS), Imphal and from the above study, following conclusions were reached- The commonly affected age group is 21 - 40 years accounting for more than half of the patients and is predominantly present in the males with a male-to-female ratio of 3.2: 1. The most common cause being adhesions from previous abdominal surgeries followed by strangulated hernias. Plain abdominal x-ray is the main imaging investigation carried out and found out to be diagnostic in more than 60% of cases. Dehydration was present in most of the patients and resuscitation was essential in all cases of small bowel obstruction. Operative management was the mainstay of treatment in more than two-thirds of cases and rest of the cases were managed non-operatively. Duration of obstruction influenced serum electrolyte levels and site of obstruction had minimum influence over the serum potassium levels, but site of obstruction does have effect over the serum sodium and chloride levels until unless time has not been controlled. Strangulation influences serum potassium levels but does not seem to influence serum sodium, chloride and bicarbonate levels. Hospital stay and mortality rate were higher in patients who presented late.

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