

The importance of timely management: Large bowel obstruction - Aetiology and its outcomes

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ABSTRACT

Introduction: Large bowel obstruction (LBO) is one of the most frequent cases encountered by a surgeon in the emergency department. It accounts for 6.3% of all intestinal obstructions. In the acute setting, it often presents with abdominal distention, vomiting and constipation. This study aims to analyse clinical and aetiopathological features associated with large bowel obstruction and the outcome of various modalities of managing LBO. **Patients and Methods:** In this prospective study, patients above 18 years of age presenting to the emergency department of our hospital with features suggestive of dynamic intestinal obstruction were selected. After confirmation of the diagnosis and its underlying aetiology, they were managed either surgically or conservatively. The patient outcome in terms of complications and mortality were evaluated. **Results:** Out of 53 patients, 29 were males and 24 were females. The most common cause of large bowel obstruction was colonic malignancy in 27 patients (50.94%) followed by colonic volvulus in 15 patients (28.30%). Majority of patients (45) underwent surgery. The most common procedure done in our study was resection and anastomosis in 29 patients. 20% of the cases suffered from wound infection. Out of 53 cases in our study 27 patients had an uneventful post-operative period and 13 patients had delayed recovery. The total number of deaths in the study was 5 (12.5%). **Conclusion:** Prompt diagnosis and timely appropriate surgery in large bowel obstruction with available modern equipment and anaesthesia reduces morbidity, mortality, hospital stay and gives a satisfactory outcome.

Keywords: Obstruction, colonic malignancy, resection and anastomosis

1. INTRODUCTION

Large bowel obstruction is one of the commonest causes of a surgical emergency. A partial or complete blockage of the bowel results in the failure of intestinal obstruction contents passing through (Sinanan & Pellegrini, 1997). Acute obstruction of the large bowel is an important cause of emergency and the success in its treatment depends largely on initial diagnosis, skilful management and an appreciation of the importance of treating the

pathological effects of obstruction, just as much as the cause itself. It is disheartening to note that the great surgeon and teacher, Sir Hamilton Bailey had to succumb to surgical complications of acute large bowel obstruction due to carcinoma of colon (Eriksen et al., 1990).

Large bowel obstruction accounts for 6.3% of all intestinal obstructions. Acute LBO can occur due to mechanical causes (such as colorectal cancer, volvulus, diverticulitis etc) or motility disturbances, the latter being termed colonic pseudo-obstruction (Wangensteen, 1969). This is usually due to underlining carcinoma or occasionally diverticular disease and presents in an acute or chronic form. Colonic volvulus is responsible for approximately 5% of large bowel obstructions. Large bowel obstruction from all causes appears to affect males and females with equal frequency (Bruusgaard, 1947). In earlier days management of intestinal obstruction was predominantly surgical. But now, with a better understanding of pathophysiology, availability of vivid and accurate radiological techniques of diagnosis, improved understanding of the management of fluid and electrolyte abnormalities, potent antimicrobials and newer surgical principles such as the introduction of on-table lavage and resection and primary anastomosis replacing staged procedures, managing intestinal obstruction has been revolutionized (Sinnatamby, 2011).

Advancements in the field of anaesthesia and knowledge of intensive care have contributed to decreasing the injury and death associated with large bowel obstruction. However, in developing countries, the mortality associated with acute intestinal obstruction is higher and varies from 8-12% in recent times with the rate increasing to 16% with strangulation. The majority of mortalities occur in elderly individuals who present late to the hospital and have associated co-morbidities such as Chronic Obstructive Pulmonary Disease, Diabetes and Ischemic Heart Disease (Ganong, 1999).

The philosophy of 'never let the sun set or rise over a case of acute intestinal obstruction' has made early surgical intervention for acute intestinal obstruction a gold standard (Ramachandran, 1989). Therefore, with early diagnosis, proper principles of management, correct technique during surgery and adequate postoperative treatment, a gratifying result can be achieved. The study aims to analyse clinical features, aetiopathological features associated with large bowel obstruction and the outcome of modalities of management of large bowel obstruction.

2. MATERIALS AND METHODS

In this prospective study, patients above 18 years of age attending the emergency clinic of our hospital with features suggestive of dynamic intestinal obstruction were selected with permission from the Institutional/University ethics committee (KLESKF/IEC/15/013). After confirmation of the diagnosis and its underlying aetiology, they were managed either surgically or conservatively. The patient outcome in terms of complications and mortality were evaluated. This study of large bowel obstruction was selected because it is most frequently encountered surgical disorder of the intestines and most common surgical emergencies. A careful clinical assessment is useful in diagnosing it and a surgeon needs to know the appropriate management to reduce the associated morbidity and mortality. This work comprises a detailed clinical study and management of 53 cases of large bowel obstruction including acute and sub-acute obstructions of different aetiologies. For this study, we selected patients above 18 years of age presenting to a tertiary care hospital with features suggestive of dynamic intestinal obstruction. Patients with a provisional diagnosis of large bowel obstruction were examined in detail as per the preform after admission. Investigation like Hb%, BT, CT, Blood group, RBS, Blood urea, S. Creatinine, Urine for albumin, sugar and microscopy, serum electrolytes and a Plain erect x-ray abdomen were done in all cases.

On arriving at a clinical diagnosis of large bowel obstruction, Soap water enema and rectal tube deflation were instituted in deserving cases. Cases which did not respond to conservative management were taken up for emergency laparotomy. During laparotomy, depending upon the intraoperative findings de-rotation/resection/colostomy/ileostomy/sigmoidopexy/caecopexy was done. In sick cases, only emergency life saving procedures were performed, along with a biopsy of the lesion where indicated. Postoperatively, colostomy care was provided and patency of the rectum was observed. Those patients requiring elective staged procedures were advised follow up accordingly. Post-operative follow-up was done at 6 months to 1 year and patients were taught about colostomy care, advised regarding chemotherapy regimens for underlying cancer and anti-tubercular treatment for TB patients.

3. RESULTS

In our study, 53 cases of large bowel obstruction were chosen from the patients presenting to tertiary care centre between 2015 to 2022. To make the study more focused, cases of paralytic ileus and of small bowel obstruction were excluded. A prospective descriptive study with 53 patients presenting to tertiary care centre with signs and symptoms of Large Bowel Obstruction (Figure 1) the majority of the patients in our study were males compared to females with male to female ratio of 2.3:1 (Table 1).

Table 1 Age Distribution & Sex Distribution.

Age in years	Number	%
18-20	3	5.66
21-30	8	15.09
31-40	20	37.73
41-50	9	16.98
51-60	7	13.20
>60	6	11.32
Male	29	54.71
Female	24	45.28
Total	53	100.0

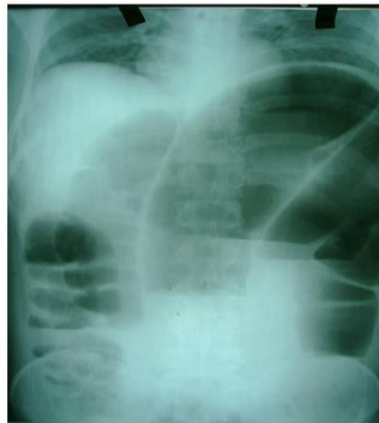


Figure 1 Erect abdomen X-ray showing large bowel obstruction.

Three patients had a history of previous surgery and among them, only 1 patient had postoperative adhesion. The most common cause of large bowel obstruction in our study was colonic malignancy accounting for 27 patients (50.94%). The next common cause was colonic volvulus in 15 patients (28.30%), followed by TB stricture, sliding hernia, anal stenosis, Hirschsprung’s disease, faecal impaction, Bands and metastasis (Ca Cervix) (Table 2).

Table 2 Diagnosis

Diagnosis	Number (n=53)	%
1.Colonic malignancy	27	50.94
2.Colonic volvulus	15	28.30
3.TB stricture	3	5.66
4.Sliding hernia	2	3.77
5.Anal stenosis	2	3.77
6.Hirschsprung’s disease	1	1.88
7.Faecal impaction	1	1.88
8.Bands	1	1.88
9.Metastatic (Ca Cervix)	1	1.88
Total	53	100.0

Among colonic malignancies causing large bowel obstruction, carcinoma of the sigmoid colon was the most common in 7 patients, followed by carcinoma rectum in 5 patients and then descending colon, ascending colon and caecum in that order (Table 3).

Table 3 Colonic Malignancy

Part of the colon involved	Number (n=27)	%
Sigmoid	8	29.62
Rectum	7	25.92
Descending colon	5	18.51
Ascending colon	4	14.81
Caecum	3	11.11
Total	19	100

Among volvulus causing large bowel obstruction, the most common cause was sigmoid volvulus comprising of 73.33% of all volvulus cases and 27.5% of all large bowel obstructions. Ascending colon volvulus and transverse colon volvulus were noted in 2 patients respectively (Table 4).

Table 4 Colonic volvulus

Parts of the colon involved	Number (n=15)	%
Sigmoid	11	73.33
Ascending	2	13.33
Transverse	2	13.33
Total	15	100

The most common procedure done in our study was resection and anastomosis. It was done in the case of volvulus and colonic malignancies which were operable. It was done on 21 patients. The next common procedure was a temporary colostomy to cover distal colonic anastomosis. Permanent colostomy was done in carcinoma rectum cases and in a carcinoma cervix which had infiltrated the rectum, causing a stricture and obstruction. Ileotransverse anastomosis was done along with a right hemicolectomy in 2 cases of carcinoma ascending colon, in a case of carcinoma caecum, and as a palliative procedure in a case of carcinoma ascending colon with multiple meta stasis.

Diagnostic laparoscopy was done in 2 cases of carcinoma rectum where the obstruction was relieved by conservative techniques and both patients ended up with palliative permanent colostomy after being diagnosed to have multiple metastasis. Derotation was done in a case of ascending colon volvulus along with caecopexy to fix the mobile caecum and one sigmoid volvulus case along with sigmoidopexy. Anal dilation was done in case of anal stricture along with polypectomy of two rectal polyps which turned out to be benign on histopathological examination. Modified Duhamel’s procedure was done in a case of Hirschsprung’s disease who complained of on and off constipation since childhood. Adhesiolysis was done in a case who had postoperative adhesions after previous LSCS. Herniorrhaphy was done in a case of sliding hernia with sigmoid colon as a content-causing obstruction.

A proximal defunctioning loop ileostomy was done in a case of strangulated transverse colon volvulus after performing resection and anastomosis. APR was done in a case of carcinoma rectum along with a permanent colostomy. The most common comorbid factor resulting in delayed healing and prolonged hospital stay was hypoalbuminemia, followed by anaemia (Table 5).

Table 5 Comorbid factors

Comorbid factor	Number (n=53)	%
Hypoalbuminemia	10	18.86
Anaemia	9	16.98
CCF	3	5.66
Renal failure	3	5.66
MORBIDITY		
Burst abdomen	3	5.66
Chest infection	4	7.54
Faecal fistula	2	3.77
WOUND INFECTION		
Present	10	18.86

Absent	43	81.13
OUTCOME		
Recovery	35	66.03
Delayed recover	13	24.52
Death	5	9.43

Congestive cardiac failure and renal failure were noted in 2 cases each. In our study burst abdomen and chest infection were seen in 3 and 4 cases respectively a faecal fistula was seen in 2 patients. The majority of patients (35) underwent surgery. Only 5 patients were managed conservatively. Wound infection was the most important complication in our study with around 20% of the cases having wound infection. Out of 40 cases in our study 27 patients had an uneventful post-operative period and 8 patients had delayed recovery. The total number of deaths in the study was 5 amounting to 12.5%.

4. DISCUSSION

Intestinal obstruction is one of the commonest surgical emergencies all over the world even today. The mortality can be reduced significantly by instituting treatment at the earliest. Old age and other medical comorbidities are the factors that carry a considerable contribution to mortality (Naveed et al., 2020).

In our study, although all age groups of the adult population were included, the predominant age groups were 21-30 and 41-50 years with the maximum incidence being in the latter group (Hsu and Sevak, 2019). In the present study, out of 40 cases, 28 were seen in males and 12 in females, giving a sex ratio of 2.3:1. Out of 53 cases of large bowel obstruction, 27 cases were that of the primary malignancy. Thus, malignancy constitutes 47.5% of the large bowel obstruction whereas colonic volvulus (15 cases) contributed to 28.30% of all large bowel obstructions (Bass et al., 1997). According to a study, malignant bowel obstruction is an odious complication of numerous malignancies most notably gynaecological and colorectal cancer. Malignancy of the large bowel contributes to obstruction more frequently in the western world compared to a developing country, like ours. A study showed 26% of the study population had large bowel obstruction due to tumour (Nelson & Ellis, 1984). Singh et al., (1984) has shown that 19% of colorectal malignancies develop acute large bowel obstruction.

In our study carcinoma caecum was noted in 1 case, a female patient. Sigmoid growth was noted in 6 males and 1 female. Carcinoma rectum was found in 3 males and 2 females. Kapur, (2014) found that 75% of the malignant lesions of the large bowel occur in the rectum and that the sex distribution was equal. The age group in our study showed that the majority of the patients were over 30 years. Only 3 patients were less than 20 years. Our study includes 19 cases of malignancy- Sigmoid- 7, Rectum-5, Descending colon-3, Ascending colon- 3 and Caecum-1 reflecting the picture that in this area large bowel obstruction is more due to malignancy than colonic volvulus. In the colon, left-sided lesions are more obstructing than right-sided lesions. This is owed to the fact that left-side colon carcinoma is a constricting type of growth and the faecal matter is in a semisolid state as compared to that of the right side (Anderson & Lee, 1981). This explains the 15 cases of left-side lesion causing obstruction in this study showing statistics related to acute on chronic obstruction in lesions of the right colon 8%, left colon 21% and sigmoid 29% (Zaki et al., 2021).

In our study, a case with caecal growth underwent right hemicolectomy with Ileotransverse anastomosis. Our results are in concordance with the study that had 11 caecal obstructions in 136 patients and right hemicolectomy with Ileotransverse anastomosis was done in many patients. They observed a poor survival rate as the disease advanced. Out of 7 sigmoid lesions, 5 underwent resection with a 5 cm margin and an end-to-end anastomosis with a transverse colostomy (Hale & Solla, 1991). One patient had advanced-stage malignancy with multiple metastases and hence underwent only a colostomy. One patient had polyposis coli along with sigmoid growth, so he underwent total proctocolectomy with ileoanal anastomosis. Of the 5 rectal carcinomas, one underwent abdominoperineal resection and 2 patients had advanced disease, so underwent only colostomy. Two patients expired due to congestive cardiac failure, anaemia, and renal failure (Hale & Solla, 1991).

Another study highlighted that early-stage tumours are a rare cause of obstruction and that surgery was more often palliative in the obstructive type (45.8%). They also commented that the survival rate was less in the obstructive type (4.7% compared with 59.75% in the 1-year group and 17.6% compared to 31.1% in 5 years group) as compared to the non-obstructive type of tumours (Cirocchiet al., 2013). In a series, potentially curative resection was performed in 60% of patients. Surgical treatment was palliative in 34% of patients. Extended bowel resections were performed in 16% of patients and the postoperative morbidity rate was 31%. In this study single stage operation was done when the condition of the patients permitted, otherwise in critical cases emergency procedures with the planned staged procedures were performed (Goldblum et al., 2017).

Colonic Volvulus

In our study, 13 patients had colonic volvulus. Among them, 11 occurred in the sigmoid, one in the transverse colon and one in ascending colon. Sigmoid volvulus is an unusual emergency in Western Europe and North America (3.7% & 4.5%) (Gill & Eggleston, 1965)

The age group of sigmoid volvulus cases in this study showed that the majority were above the age of 40 years. Only 4 patients were less than 30 years. The sex ratio in our study was 11 males compared 2 females. In Anderson & Lees, (1981) series the sex ratio was equal and patients were over 60years. Patients with gangrenous changes had a history of vomiting and rebound tenderness on abdominal examination. Radiological diagnosis was made in almost all cases (omega sign, bent inner tube sign on erect x-ray abdomen), (Anderson & Welch, 1986).

In our study, two patients out of 11 sigmoid volvulus cases were managed conservatively with flatus tube decompression, soapy water enema, IV fluids and nasogastric tube insertion. 9 of the cases underwent a laparotomy where in derotation of the sigmoid was done and one patient underwent on-table decompression via flatus tube with sigmoidopexy. 3 cases with gangrenous sigmoid colon had resection and anastomosis and the other 6 cases had a redundant sigmoid with short mesentery and underwent sigmoid colectomy with end-to-end anastomosis with a transverse colostomy (Rao et al., 1982). History of similar complaints was found in 3 patients which subsided with local treatment. In the majority of cases, earlier history of constipation and borborygmi was present. In our study 2 patients previously operated on with sigmoidopexy presented with recurrent sigmoid volvulus (after 2-5 years) (Figure 2).

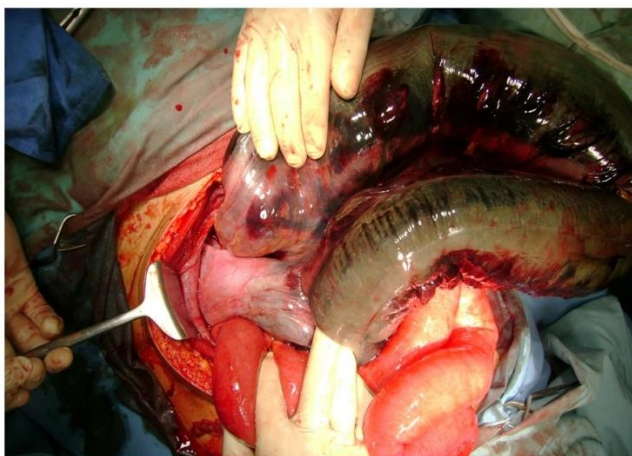


Figure 2 Sigmoid volvulus

Shepherd, (1968) observed high recurrences after sigmoidopexy. Caecal volvulus is a rare entity in India. According to Groove et al., (1973) accounts for less than 1% of all cases of intestinal obstruction Anderson and Lees, (1980) study showed caecal volvulus at 22.5%, sigmoid volvulus-73.6% and transverse colon volvulus at 3.9% (Anderson & Welch, 1986).

The transverse colon volvulus case in our study was a 30-year-old male patient. For him, we did a resection and anastomosis. Anderson et al., (1981) noted that 3.9% of the incidence of transverse colon volvulus with predominance in women ages ranged from 10-89 years and was associated with mental dementia. In this case, the initial clinical diagnosis was sigmoid volvulus and it was correctly diagnosed at laparotomy. In Anderson and Lee, (1980) study none of the seven patients was correctly diagnosed preoperatively, had done transverse colonopexy in 4 of his cases and three subsequently had recurrences (Anderson and Lee, 1980).

Other

In one case of carcinoma cervix invading the rectum and causing obstruction underwent a sigmoid colostomy to relieve the obstruction. Tuberculosis is one of the commonest medical problems in developing countries like India (Rao et al., 1982). In the era of HIV, this gains particular significance as extrapulmonary manifestations are on the rise, abdominal tuberculosis being the most common among them. Tuberculosis lesions presenting as acute large bowel obstruction is rare. In our study, we had 2 cases with TB abdomen with a solitary rectal stricture who presented with large bowel obstruction. Sigmoid colostomy was done in both and ATT was started postoperatively, Kelly et al., (2008) commented that tuberculosis should be kept in mind when dealing with patients with large bowel obstruction of unknown origin and with suspected findings of pulmonary Koch's on chest X-ray.

The study series of Zakiet al., (2021), shows that 5% of the cases of abdominal tuberculosis present with intestinal obstruction. We had one patient with faecal impaction who was treated with the manual evacuation of stools and enemas (Holt & Wagner, 1984). Adhesions are common in small bowel and rare in the large bowel. The obstruction of the colon is rarely caused by adhesions. However, a review of a number of series of large bowel obstructions reveals that obstruction due to adhesions is less, but significant in the transverse colon. In our study, it was kinked due to a band which was released thus relieving the obstruction. The patient had a history of previous LSCS. In our study we had a patient with a sliding inguinal hernia with a sigmoid colon as the content who presented with features of acute large bowel obstruction (Figure 3).



Figure 3 Dilated large bowel.

He underwent Herniorrhaphy. External hernias rarely cause large bowel obstruction. Only 3 cases of ipsilateral inguinal hernias containing sigmoid colon or caecum have been associated with large bowel obstruction. While this condition is rare, 1 report highlighted the increased potential for malignancies of the colon in patients with colonic incarceration within an inguinal hernia (Kulah et al., 2005). This suggests that this patient population should undergo a thorough evaluation for colonic malignancy. In our study, we had a 22-year-old patient who presented with on & off constipation and was diagnosed to have Hirschsprung's disease. He underwent modified Duhamel's procedure. Another patient had anal stenosis with rectal polyps he underwent anal dilation with polypectomy which was benign on histopathological examination (Holt & Wagner, 1984).

Complications, morbidity and mortality

The major complication seen in our study was wound infection, which was present in 8 patients amounting to 20%. The majority of cases developing wound infection were those complicated by strangulation, perforation, malignancy or following resections (Holt & Wagner, 1984). The case of obstructed inguinal hernia developed scrotal oedema post-operatively, followed by wound infection. Burst abdomen was seen in two cases both following bowel resections (Sircar et al., 1996). Faecal fistulas were seen in two cases after resection for colonic malignancy. Chest infection was seen in three patients. Renal failure, CCF, hypoalbuminemia and anaemia were the other significant co morbid factors which added to the delayed recovery of patients (Wig et al., 1978). Majority of the complications were seen following strangulated obstructions, resections of the bowel and malignancies. All the above factors led to a delayed recovery in 8 cases of the study (20%) and 5 deaths (12.5%). Most of them occurred soon after admission, with two cases succumbing to the disease before evaluation, with co morbidities like CCF and renal failure (Rabinovici et al., 1990; Singh et al., 1984).

5. CONCLUSION

Large bowel obstruction contributes to one of the important causes of acute obstruction presenting to the emergency. All age groups are involved; however, the aetiology differs within the groups, more commonly seen in males compared to females. The presenting complaints are abdominal pain and distension, constipation, vomiting and shock in case of later stages which have strangulation. The importance of a clinical examination of the abdomen, evaluating the vitals, a rectal examination is indisputable. In our series, colonic malignancy was the commonest followed by colonic volvulus. Also, conservative management to optimize the patient in the emergency department followed by a well-planned elective surgery is a better approach for obstruction, unless emergency surgery is necessary to avoid complications and morbidity. To conclude prompt diagnosis and timely precise surgery in

large bowel obstruction with available modern equipment and anaesthesia reduces morbidity, mortality and hospital stay and gives a satisfactory outcome.

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Author Contributions

Mahesh Kalloli: Conceptualise the study, drafted, edited, revised and approved the manuscript.

Rahul Kenawadkar & Mahesh Kalloli: Performed the study and approved the manuscript.

Priyanka Gadvi: Collected the data and approved the manuscript.

Rhea Sarkari: Statistical analysis and approved the manuscript.

Ethical approval

The study was approved by the Medical Ethics Committee of KLESKF/IEC/15/013.

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

REFERENCES AND NOTES

- Anderson JR, Lee D. The management of acute sigmoid volvulus. *Br J Surg* 1981; 68(2):117-20.
- Anderson JR, Welch GH. Acute volvulus of the right colon: An analysis of 69 patients. *World J Surg* 1986; 10(2):336-41.
- Bass KN, Jones B, Bulkley GB. Current management of small-bowel obstruction. *Adv Surg* 1997; 31:1-34.
- Bruusgaard C. Volvulus of the sigmoid colon and its treatment. *Surgery* 1947; 22(3):466-78.
- Cirocchi R, Farinella E, Trastulli S, Desiderio J, Listorti C, Boselli C, Parisi A, Noya G, Sagar J. Safety and efficacy of endoscopic colonic stenting as a bridge to surgery in the management of intestinal obstruction due to left colon and rectal cancer: A systematic review and meta-analysis. *Surg Oncol* 2013; 22(1):14-21.
- Ericksen AS, Krasna MJ, Mast BA, Noshier JL, Brodin RE. Use of gastrointestinal contrast studies in obstruction of the small and large bowel. *Dis Colon Rectum* 1990; 33(1):56-64.
- Ganong WF. Regulation of gastrointestinal function, Ch 26. *Review of medical physiology*. Philadelphia, USA: Appleton and Lance 1999; 483.
- Gill SS, Eggleston FC. Acute intestinal obstruction. *Arch Surg* 1965; 91(4):589-91.
- Goldblum JR, Lamps LW, McKenney J, Myers JL. Rosai and Ackerman's Surgical Pathology E-Book. Elsevier sci 2017.
- Hale DA, Solla JA. Complete colonic obstruction caused by a sigmoid colon cancer incarcerated in an inguinal hernia sac. *South Med J* 1991; 84(10):1280-1281.
- Holt RW, Wagner RC. Adhesional obstruction of the colon. *Dis Colon Rectum* 1984; 27(5):314-5.
- Hsu J, Sevak S. Management of malignant large-bowel obstruction. *Dis Colon Rectum* 2019; 62(9):1028-30.
- Kapur RP. Intestinal motor disorders. In *Pathology of paediatric gastrointestinal and liver disease*. Springer, Berlin, Heidelberg 2014; 249-316.
- Kelly MD, Bunni J, Pullyblank AM. Laparoscopic assisted right hemicolectomy for caecal volvulus. *World J Emerg Surg* 2008; 3(1):1-3.
- Kulah B, Ozmen MM, Ozer MV, Oruç MT, Coskun F. Outcomes of emergency surgical treatment in malignant

- bowel obstructions. *Hepatogastroenterology* 2005; 52(64):11-22-7.
16. Naveed M, Jamil LH, Fujii-Lau LL, Al-Haddad M, Buxbaum JL, Fishman DS, Jue TL, Law JK, Lee JK, Qumseya BJ, Sawhney MS. American Society for Gastrointestinal Endoscopy guideline on the role of endoscopy in the management of acute colonic pseudo-obstruction and colonic volvulus. *Gastrointest Endosc* 2020; 91(2):228-35.
 17. Nelson IW, Ellis H. The spectrum of intestinal obstruction today. *Br J Clin Pract* 1984; 38(7-8):249-51.
 18. Rabinovici R, Simansky DA, Kaplan O, Mavor E, Manny J. Cecal volvulus. *Dis Colon Rectum* 1990; 33(9):765-9.
 19. Ramachandran CS. Intestinal volvulus. *Int J Surg* 1989; 66-70.
 20. Rao KP, Grover YK, Mitra AK. Acute intestinal obstruction in Kumaon hill. *Int J Surg* 1982; 699-704.
 21. Rousseau P. Management of malignant bowel obstruction in advanced cancer: A brief review. *J Palliat Med* 1998; 1(1):65-72.
 22. Sinanan MN, Pellegrini CA. Large bowel obstruction. *Maingot's Abdominal Operations*. 10th ed. Stanford, CT: Appleton and Lange 1997; 1391.
 23. Singh I. *An Introduction to Human Embryology for Medical Students*. Macmillan Press 1978.
 24. Singh JP, Maini VK, Bhatnagar A. Large-bowel malignancy. *Dis Colon Rectum* 1984; 27(1):10-5.
 25. Sinnatamby CS. *Last's Anatomy e-Book: Regional and Applied*. Elsevier sci 2011.
 26. Sircar S, Taneja VA, Kansra U. Epidemiology and clinical presentation of abdominal tuberculosis--A retrospective study. *J Indian Med Assoc* 1996; 94(9):342-4.
 27. Wangenstein OH. Historical aspects of the management of acute intestinal obstruction. *Surgery* 1969; 65(2):363-83.
 28. Wig JD, Bose SM, Kaushik SP. Volvulus obstruction of the small and large bowels. *J Postgrad Med* 1978; 24(2):117.
 29. Zaki HA, Shaban EE, Zahran A, Bashir K, Elmoheen A. A Rare Presentation of Small Bowel Obstruction Due to Obstructed Indirect Inguinal Hernia. *Cureus* 2021; 13(12).