



Cohort Study

Intestinal obstruction in a tertiary care centre in India: Are the differences with the western experience becoming less?

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ABSTRACT

Background: Patients with intestinal obstruction consist of a major proportion of emergency room visits and the complication is associated with a significant morbidity and mortality. It has a diverse aetiology which varies from country to country. In developed countries it is mainly due to adhesions and in developing countries due to obstructed hernias. Although there are numerous studies from the western world on this subject there have been few recent publications from the developing world.

Patients and methods: We retrospectively analyzed all the patients admitted with intestinal obstruction to our department from January 1996 to December 2019. Their demographic data, duration of symptoms before presenting to the hospital and interval between admission and surgery were noted along with the cause and level of obstruction. The type of procedure, post-operative complications, mortality or whether re-exploration was done were also noted. Post-operative complications were graded according to the Clavien Dindo classification.

Results: A total of 986 patients presented with intestinal obstruction during this period out of which 743 patients underwent surgery. The commonest cause of obstruction was adhesions in 273 (36.7%) – the proportion increased significantly from 23% in 1996–2004 to 51.6% in 2013–2019. This was followed by carcinoma [130 (17.5%)], tuberculosis [111(14.9%)], strictures [94(12.7%)] and hernia (5.4%). Colorectal surgery was the most common previous procedure in the adhesions group [85(31.1%)]. The overall operative mortality was 41 (5.5%).

Conclusion: The aetiology of intestinal obstruction in our hospital is now mainly due to adhesions and is thus shifting towards the western pattern. But tuberculosis and obstructed inguinal hernias still constitute of a sizable proportion of our patients.

1. Introduction

Despite being one of the most common surgical emergencies, intestinal obstruction is often difficult to manage even today and is associated with a significant morbidity and mortality. Its aetiology differs not only between countries but also between different regions of a single country. Adhesive obstruction has been reported to be the most common reason for intestinal obstruction in Western countries since the end of the last century while obstructed hernias are continuing to be the most common cause in developing countries [1–4]. Due to advances in diagnostic and operative techniques along with postoperative intensive care, the mortality has now decreased from 60% to less than 10% over the last century but there is considerable variation in these with age and different aetiological diagnoses [5,6].

Although there have been numerous reports on intestinal obstruction from western countries there have been very few publications from the developing world. There are major differences not only in the aetiology of the condition but also the treatment and management resources between both regions [7–9]. Nevertheless, we opined that with the improvement in living standards and better access to health care facilities, previously reported causes and outcomes of intestinal obstruction from developing countries might be changing, particularly for patients admitted to tertiary care hospitals in larger cities which might now be more similar to the western pattern. Because of the emergent presentation and risk of bowel strangulation necessitating urgent surgery, an early establishment of the cause of obstruction is of importance to reduce major morbidity and mortality.

We therefore analyzed the details of all patients who presented with

; CT, Computed Tomography.

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Table 1
Aetiology of intestinal obstruction.

Aetiology	Number of patients (n = 743)	%
Adhesive obstruction	273	36.7
Carcinoma	130	17.5
Tuberculosis	111	14.9
Stricture of intestine	94	12.7
Hernia	40	5.4
Intussusception	15	2
Perforation of gut	13	1.7
Volvulus	12	1.6
Crohn's disease	7	0.9
Blind loop syndrome	3	0.4
Vascular disorders	12	1.6
Meckel's diverticulum	4	0.5
Faecolith	4	0.5
Ladd's band	5	0.7
Miscellaneous	20	2.67

intestinal obstruction to our hospital, a tertiary care centre in India, over the past 23 years (from July 1996 to December 2019), noted the changes in a aetiology over time and compared our results with those reported from western countries.

2. Patients and Methods

Intestinal obstruction was diagnosed in patients who presented with colicky abdominal pain, distension, vomiting and obstipation with abdominal X-rays or CT (Contrast enhanced or Non-contrast) scans showing dilated bowel loops with a cut-off point. The data on these were extracted from an electronic database which has been maintained prospectively by our department since 1996 (the details of patients who were managed conservatively were excluded). The indications for operation were based on *absolute* and *relative* criteria. The *absolute* criteria were severe continuous abdominal pain and CT findings of closed loop obstruction, gangrene or impending gangrene and bowel perforation. The *relative* indications for operation were the other patients who failed conservative treatment. They were given a trial of nasogastric decompression, nothing orally and parenteral fluids and antibiotics for 4–6 days. If these patients did not improve surgery was usually performed. Patients with features of partial obstruction in the absence of a transition point on CT had a gastrograffin follow through examination and if the obstruction was not relieved they were taken up for surgery. Their demographic data, duration of symptoms before presenting to the hospital and hospital stay before surgery was noted along with the cause and level of obstruction. These were determined clinically, by abdominal X-rays and CT and confirmed intra-operatively. The type of procedure, any post-operative complications, mortality or re-exploration if any were also noted. Post-operative complications were graded according to the Clavien-Dindo classification. The data were examined for changes over time and also compared with those published from western countries as well as from India. This study has been reported in the line of STROCCS criteria [10] and registered with the research registry with the id-researchregistry6878.

3. Statistical analysis

Numeric continuous data were expressed as arithmetic means \pm standard deviations for symmetrical data and medians for asymmetrical data. The differences between means were tested using the unpaired Student t-test or Mann Whitney U test depending upon the distribution. Nominal data were expressed as frequencies or proportions. SPSS17 was used for analysis and a p value of <0.05 was considered to be significant.

4. Results

A total of 986 patients presented with intestinal obstruction during

Table 2
Changes in the aetiology over time.

Aetiology	1996–2004 (%)	2005–2012 (%)	2012–2019 (%)	p-value
Adhesive obstruction	23	35.6	51.6	0.03
Carcinoma	15.5	18.1	19	0.1
Tuberculosis	15.8	15	14.1	0.32
Stricture of intestine	13.1	12.3	12.6	0.5
Hernia	8	5.3	3.1	0.06
Intussusception	2.1	2.6	1.3	0.07
Perforation of gut	1.6	1.9	1.7	0.47
Volvulus	1.9	1.4	1.5	0.31
Crohn's disease	0.7	0.9	1	0.08
Blind loop syndrome	0.4	0.4	0.4	0.8
Vascular disorders	1.3	1.7	1.8	0.6
Meckeldiverticulum	0.4	0.5	0.6	0.71
Faecolith	0.6	0.5	0.4	0.43
Ladd's band	0.6	0.8	0.6	0.98
Miscellaneous	2.6	2.7	2.7	0.51

Table 3
Operations preceding adhesive intestinal obstruction.

No	Surgery	No. (%)
1.	Colorectal	85(31.1)
2.	Small bowel	43(15.8)
3.	Hepato-biliary	13(4.8)
4.	Upper GI	13(4.8)
5.	Gynaecological	11(4)
6.	Hernia repair	9(3.3)
7.	Liver transplant	4(1.5)
8.	Peritoneal disease	2(0.7)
9.	No previous surgery	93 (34)
	Total	273

Table 4
Sites of malignancy as primary cause for intestinal obstruction.

No.	Site of malignancy	No of patients(%)
1.	Colon	75(57.7)
	• Ileocaecal	• 25
	• Rectal	• 24
	• Sigmoid	• 16
	• Transverse colon	• 6
	• Descending colon	• 4
2.	Gynaecological	17(13.1)
3.	Stomach	12(9.2)
4.	Gall bladder	10(7.7)
5.	Peritoneum	10(7.7)
6.	Jejunum	6(4.6)
	Total	130

this period out of which 243 patients were managed conservatively and 743 patients underwent surgery. There were 429 (57.7%) males and 314 (42.3%) females who had a mean age of 50.1 years (range 11–96 years). The largest number of patients were in the age group of 41–60 years (133 of 380, 35%).

Abdominal adhesions were the most common cause in 273 (36.7%) followed by carcinoma in 130 (17.5%). Tuberculosis was present in 111 (14.9%) and 'non-specific' strictures of the intestine in 94 patients (12.7%). Hernia accounted for 5.4%. A few presented with intussusception, volvulus and vascular disorders (Table 1).

Colorectal surgery was the most common procedure preceding adhesive obstruction in 85(31.1%) patients followed by small bowel surgery in 43(15.7%) patients. A smaller number of patients had hepatobiliary, upper gastrointestinal and gynaecological surgery preceding adhesive obstruction (Table 3). 93 (34.1%) patients had not undergone any previous surgery.

Carcinoma as a cause of intestinal obstruction was seen in 130

Table 5
Surgical procedures.

No.	Procedure	No of patients
1.	Adhesiolysis	189
	• Adhesiolysis alone	• 88
	• Adhesiolysis with resection	• 81
	• Adhesiolysis with bypass	• 8
	• Adhesiolysis with stricturoplasty	• 3
	• Adhesiolysis with other intervention	• 9
2.	Ileal resection and anastomosis	108
	Ileal resection with ileostomy	48
	Ileostomy	40
3.	Jejunal resection and anastomosis	80
	Jejunostomy	41
	Jejunal resection with colectomy	1
4.	Right hemicolectomy	76
	Right hemicolectomy with ileostomy	23
	Left hemicolectomy	26
	Sigmoidectomy	40
	Anterior resection with ileostomy	31
5.	Miscellaneous	40
	Total	743

patients of whom 75(57.7%) had colonic cancer. Gynaecological malignancy led to obstruction in 17 cases and carcinoma of the stomach in 12 patients. Some patients had gall bladder and jejunal carcinoma (Table 4).

Strictures of the intestine were the cause for intestinal obstruction in 94 patients. These were possibly due to ischaemia in 26 patients (with equal numbers found in the jejunum and ileum), tuberculosis in 16 patients (14 in ileum and 2 in jejunum) and preceding abdominal trauma in 14 patients (6 of whom had a stricture in the ileum and 2 in the jejunum). Radiation and pancreatitis were responsible for stricture in 12 patients each being localized in the splenic flexure of transverse colon in all patients with pancreatitis. Other less common causes were diverticulitis and Crohn's disease. In 10 patients, the cause was not found.

Hernia was responsible for obstruction in 40 patients. 14 patients had obstructed ventral, 13 had incisional and 8 parastomal hernias. 5 patients had internal herniation with adhesions.

In 15 patients, intussusception was the aetiology with the ileo-caecal segment involved in 9 and ileo-ileal intussusception in 4 patients. The jejunum and transverse colon were involved in 1 patient each. 12 patients presented with volvulus with an ileal loop involved in 6 patients and the sigmoid colon and caecum in 3 patients each.

On analyzing the patients by dividing them into 8 year groups-1996–2004, 2005–2012 and 2013–2019 - considerable differences seen mainly in patients with adhesive obstruction. Between 1996 and 2004 23% of patients presented with adhesions and this increased to 51.6% between 2013 and 2019 (p- 0.03). Intestinal obstruction due to hernia and intussusception showed a major change over the years but without any statistical significance. Similarly the other causes did not show any significant differences (Table 2).

The ileum was the most common site of obstruction in 329 (44.3%) patients with the ileo-caecal region involved in 76 (10.3%). The jejunum was involved in 109 (14.7%) patients. Primary colonic involvement, apart from the ileo-caecal region, was present in 98 patients (13.2%). 70 patients had carcinomatosis with diffuse peritoneal and visceral involvement and 55 patients had diffuse adhesions.

The median time between the onset of the first symptoms and presentation to our hospital was 6 days (range 1–90) and the mean duration of stay in hospital before surgery was 3.5 days (range 0–28).

More patients underwent surgery for a benign compared to a malignant aetiology (78.5% vs 21.5%). In all patients with malignant causes, the diagnosis was established before surgery. Patients with malignancy had a higher mean age (53.4 vs. 49.1 years), longer duration of symptoms before admission (median 13 vs. 8 days) and a higher mortality (10.7% vs. 4.1%, p value 0.03) but their postoperative stay

Table 6
Mortality group vs. Survivors.

No	Parameters	Mortality n = 41	Survivors n = 702
1	Mean age (years)	55.3	49.86
2	Malignant aetiology	17 (41.5%)	139 (19.8%)
3	Duration of symptoms before admission (median)	5.3 days	6 days
4	Comorbidities	7.9%	4.6%
5	Strangulation	7 (33.3%)	35 (9.7%)
6	Postoperative stay (mean)	13.85 days	8.6 days

Table 7
Univariate analysis of factors predicting mortality.

No	Mortality predictors	p value
1	Age >75	0.11
2	Age <75	
3	Strangulation/Viable bowel	0.01
4	Benign/Malignant	0.02
	Co-morbidity	0.21

was similar.

Two hundred twenty six (30.4%) patients had a comorbid illness. Hypertension, coronary artery disease and diabetes mellitus were the three most common comorbid conditions present. Compared to patients without any comorbidities, these patients had a higher mean age (59.6 vs. 47.4 years), higher postoperative complication rate (42.6% vs. 30.5%) and a higher mortality (7.9% vs. 4.6%, p value = 0.4).

Overall 411 patients underwent some form of resection and anastomosis procedure while 183 patients had a stoma created. Adhesiolysis was the most common surgical procedure performed in 189 patients (Table 5) being the only procedure done in 88 and accompanied by a resection procedure in 81 patients.

Post-operative complications were seen in 34.5% (257 of 743) patients. Grade I complications were seen in 137 (53.3%), grade II in 59 (22.9%) patients. Grade IIIa complications were seen in 27 (10.5%), while IIIb in 25 (9.7%) patients and grade IVa complications in 9 (3.5%) patients. Prolonged ileus was the most common in 42 patients followed by wound infection in 36 patients. 6 patients had a repeat episode of obstruction during the same admission. Acute renal failure, fever, intra-abdominal bleeding occurred in 18 patients each. 25 patients required re-exploration in the postoperative period 9 for recurrent obstruction, 9 for post-operative anastomotic leaks, 3 for intra-abdominal bleeding, enterocutaneous fistula, burst abdomen and stoma site obstruction in 1 patient each and 1 underwent pancreatic necrosectomy. 8 patients had new onset arrhythmia postoperatively. Patients who had complications had a higher mean age (51.7 vs. 47 years) and had a longer postoperative stay (11.8 days vs. 6.8 days) than those who did not.

The overall operative mortality was 5.51% (41 of 743) with sepsis and multi-organ failure being the most common cause. Patients who died were older with a mean age of 55.3 years and more likely to have malignancy, strangulation and perforation (Table 6), but only the differences in outcome of the groups with malignancy and strangulation reached statistical significance on univariate analysis (Table 7).

5. Discussion

Intestinal obstruction remains one of the commonest causes of acute abdominal pain worldwide amounting to 5% of emergency admissions. The pattern of intestinal obstruction varies from country to country and time to time within the same country. A steady rise in the number of major abdominal operations, together with earlier diagnosis and elective treatment of groin hernias and intra-abdominal malignancy, has resulted in a change in the causes of intestinal obstruction in Western and other developed countries over the past 50 years, when strangulated

hernias accounted for half of the total cases. In underdeveloped and developing countries the number of patients with intestinal obstruction due to gut volvulus and strangulated hernia still remains high. Over the recent past however there have been changes in the aetiology of intestinal obstruction in developing countries, and abdominal adhesions now tend to be the most common cause in the Western world, parts of Asia and the Middle East [11].

Our patients differ from the west in various ways. For instance their mean age was 50.1 years (range 11 weeks–96 years) compared with 66.8 year in the west, while most of our patients (35.7%) were aged between 40 and 60 (although they were slightly older than the patients in other reports from developing countries where the mean age was 39.6 years) [12–14].

Older studies, especially from the developing world, report a male predominance of the order of 2:110, possibly because the main cause of obstruction, hernia was more prevalent in males [11,15]. With adhesive obstruction now becoming more frequent, this gender difference has decreased. In our study, 57.6% of patients were males as compared to 42.4% females. Studies from other centres in this region have also shown similar trends with males outnumbering females [14,16]. However in the west, the male-female ratio is nearly equal with only isolated reports of a male predominance. Fevang et al. in their study have reported the proportion of females with intestinal obstruction increasing from 29% in 1960 to more than 40% in 1990 [9].

Around the turn of the century, adhesive obstruction became the most common cause of intestinal obstruction in the West with only a few isolated studies still showing obstructed hernia to be more common [13]. However in the developing world, though the incidence of adhesive obstruction has been showing a steady increase, most centres still report strangulated and obstructed hernias to be the most common cause of intestinal obstruction. Bjorg et al. in study of over 35 years have shown that the incidence of adhesions increased from 43% to 53% while that of incarcerated hernia decreased from 41% to 24% [9]. In India, a study from Chandigarh described adhesions to be the cause in 27% patients compared to obstructed hernia in 22%, while a study from Calcutta reported obstructed hernia to be more common (35.9%) and from Pondicherry, of 572 patients reported, external hernia was seen 38% as compared to adhesive obstruction in 32% [14,17].

Results from other developing countries have also shown variable results. Akgunet al from Turkey reported volvulus to be the most common cause in 28.6% patients followed by 25.3% for adhesions [22]. Two studies from Pakistan reported adhesions and tuberculosis as the most common causes [11,13]. Recent reports from Jordan and Turkey have shown adhesions to be the most common cause and the Nigerian and Ghanaian experience is that there has been a decrease in the proportion of obstructed hernias but they are still the most common cause of intestinal obstruction [15,18,19,22]. Advances in health care with more operations being performed electively for hernia have decreased the number of emergencies and hence the incidence of obstruction episodes.

However developed countries have uniformly reported adhesive obstruction to be the most common cause of intestinal obstruction, with the more recent studies reporting rates of 60–75% [1–4].

Colorectal operations were the most common procedures preceding adhesive obstruction in 85 patients followed by small bowel surgery in 43 patients out of a total number of 273. Barmarparaset al opined that the incidence of adhesive obstruction depended on the type of previous surgery [19]. Appendectomy and gynaecological procedures were reported to be the most common causes in analyses by Malik et al. (60%) and Cox et al. (23%) [9,13,20]. Similar to our study, most western institutions report colorectal surgery to be the most common surgery preceding adhesive obstruction [12,15].

The second most common cause in our patients was malignancy which was present in 130 (17.5%) patients. Developed countries have also reported carcinoma to be the second most common cause after adhesions with an incidence of approximately 20% [23]. Carcinoma causes obstruction via various mechanisms but carcinomatosis was the

most common cause in 70 patients with 35 patients having luminal growths and 35 having local recurrence with adjacent intestinal loops infiltrated or adherent. Yemlaz et al. also identified malignancy as the cause in 102 patients of which 85 were colorectal in origin [21]. Similarly Naseer et al. reported malignancy as the second most common cause and colon as the site in 33 of 44 patients with malignancy [11]. Karakoc et al. compared two groups of patient during different era and found the incidence of carcinomatosis to increase from 3.26% in 1980–1985 to 27.03% in 2000–2005 [24].

In our study tuberculosis was directly related to obstruction in 111 (14.9%) patients but was also present in 34 patients with other causes. The western literature reports very few cases of obstruction due to tuberculosis even with the resurgence of the disease after the increase in HIV infection. However tuberculosis continues to be an important cause in Asian population. Bhansali et al. in their study found tuberculosis as a cause in 15.5% cases [25]. 42 of 59 patients had disease localized to the ileocaecal region. Similarly in a study by Vij et al. the affected population was young with the disease localized mainly to the ileocaecal region [26].

94 (12.7%) patients were diagnosed with non-specific strictures of the intestine. Shaikhet al. reported these strictures in 8.3% of their patients with intestinal obstruction [27]. A recent study from India has reported these strictures to be the cause in 27.2% although the exact cause is not known ischaemia might be the most common etiology with most strictures localized to ileum and jejunum [28]. Lalwani et al. from our department have also shown the ileum to be the most common site in patients with post-traumatic strictures which probably develop after the segmental blood supply is compromised due to injury to the mesenteric vessels [29]. Since malignancy was a frequent cause, adjuvant radiation treatment was responsible for strictures in 12 patients. Pancreatitis was the preceding aetiology in 12 patients. Aldridge et al. reported pancreatitis as the cause for strictures, with 8 of the 10 strictures located in the splenic flexure and transverse colon [30].

The ileum was the most common site for intestinal obstruction in 329 (44.3%) with the colon involved in 98 (13.2%) patients. In our experience the small bowel was the more frequent site of obstruction as reported in other studies.

Patients with malignancy compared with those who had benign conditions had a higher mean age (53.4 vs. 49.1 years), equivalent male to female ratio, a longer interval between the onset of symptoms and presentation to hospital (13 vs. 8 days). Their mortality rates were also higher (10.7% vs. 4.1%. *p* value 0.03) but their postoperative stay was similar.

226 (30.4%) patients had associated comorbidities before surgery. The mean age of these patients was higher at 59.6 years compared to those who were free of other disease conditions (47.4). These patients with comorbidities had longer postoperative stays (9.6 days) compared to without (7.4 days). Fevanget al and Kapan et al. in their study on intestinal obstruction have reported the presence of preoperative comorbidities to be a predictor of death but in our study although their mortality was higher it was not statistically significant [9,15].

Postoperative complications occurred in 257 (34.5%) patients, which is similar to the study from Asbun et al. who also found complications in 31% [31]. The most common complication was postoperative ileus in 42 patients. 6 patients had a second episode of sub-acute intestinal obstruction. Wound infection was present in 36 patients. Most studies mention systemic complications and wound infection to be the most common complications. Re-exploration was required in 25 patients with 9 patients undergoing surgery for adhesions and one each for intra-abdominal bleeding, enterocutaneous fistula and pancreatic necrosis.

The mortality rate in our study was 5.51% which is comparable to other studies which have reported rates between 2.0 and 11% [32,33]. The patients who died were older, more likely to have malignancy and intestinal strangulation [34]. Bjorg et al. found old age, comorbidities, nonviable strangulation, and a treatment delay of more than 24 h

increased the death rate [9]. Ti and Yong also reported increasing age, gangrene and malignancy to be associated with higher mortality rates [35]. Strangulation and malignancy were the two most significant factors for mortality in our study with sepsis being the most common cause of death. 8 patients had new onset arrhythmia (6 had atrial fibrillation and 2 had supra-ventricular tachycardia). A recent study has shown that new onset AF in sepsis is associated with higher mortality [36].

The limitations of our study are its retrospective nature but the detailed and well maintained data base made the extrapolation of the data possible. The single centre experience of our study is another limitation as it does not represent a vast country like India but as our hospital is a referral centre with patients coming from all over the country, we decided to conduct this study to provide a kind of benchmark. It would be impossible to conduct a more representative study from India with its widely varying population indices and their unequal access to medical resources.

6. Conclusions

Compared to previous reports, post-operative adhesions have now become a common cause of intestinal obstruction in our tertiary care centre situated in a developing country. These were most commonly preceded by operations on the colon and rectum. Our overall mortality rate was comparable with those reported from the west. Old age, malignancy and strangulation were associated with a higher risk of mortality as has been the experience from other centres. However compared to Western reports our patient population was younger, males predominated and although the proportion of patients with adhesions is rising tuberculosis continues to be an important cause for intestinal obstruction.

Provenance and peer review

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Ethical approval and consent to participate

Ethical committee approval was not needed as per the regulations of the local committee.

Availability of data and materials

All the data and material is available with the author.

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Author contribution

1. Dr Suvendu Sekhar Jena - Data collection and analysis, writing full article. 2. Dr Ravi Chandra Reddy Obili – Data collection and analysis, writing and proofing of article. 3. Dr Sri Aurobindo Prasad Das and Dr Samrat Ray– Study conceptualization and designing, Article proofing. 4. Dr Amitabh Yadav, Dr Naimish N Mehta, Dr Samiran Nundy – Final proofing of article and final approval.

Conflicts of interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2021.103125>.

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