

## Intestinal Segment Resection: Experience of a Tertiary Care Teaching Hospital in Southern India

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### Abstract:

**Background:** Intestinal segment resection is one of the major surgical procedures performed in elective and emergency settings. There are various etiological factors contributing to the intestinal pathologies wherein the patient might present with intestinal obstruction or peritonitis. However, there are very few published articles describing the type of intestinal resection and correlating it with etiological factors and post-operative HPE. Therefore, our study aims to include the above criteria and its relation with southern India and how it differs from other parts of India and the rest of the world.

**Methods:** We conducted a retrospective study of HPE reports of resected bowel segments which were collected from patient records who underwent intestinal resections. Data was subsequently analyzed, the factors beginning from the diagnosis to post-op recovery were evaluated.

**Results:** Of the 97 patients included in the study 30 presented with AIO (Acute Intestinal Obstruction) followed by 23 with SAIO (Subacute Intestinal Obstruction) and 21 with peritonitis. During laparotomy, the most common finding was tumor followed by stricture and perforation. Ileum was the most common anatomical location of pathology as well as the cause of morbidity and mortality. Patients with ileostomy had the highest rate of mortality.

**Conclusion:** The disease demographic is highly site and time-specific and surgeons should be ready to adapt and change their approach to management. In the setting of intestinal perforations, not all ileal perforations are due to typhoid and ileostomy doesn't always save lives. The leading cause of non-adhesive intestinal obstruction is a tumor and a general surgeon should be in a position to do a right hemicolectomy or at least an ileocecal resection in the emergency setting followed by an anastomosis to expect a reasonably good outcome in the patient population presenting to the general surgery department.

**Keywords:** Intestinal obstruction, Peritonitis, Anastomosis, Intestinal Perforation.

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### Introduction

Exploratory laparotomies contribute a significant percentage of major surgeries in any large teaching hospital and may result in considerable morbidity and mortality or drastic improvement in patient's condition depending on factors like age, comorbidities, nature of the disease, time of presentation to the hospital, type and timing of surgical intervention, capability of operating surgeon and peri-operative critical care facilities. While the human factors including technical expertise can't be objectively compared, certain parameters present themselves for critical evaluation thus helping the surgical team in better planning the surgical intervention and prognostication.

Worldwide intestinal resection and anastomosis are performed annually in over a million people with colorectal cancer, IBD, complicated diverticulitis

and morbid obesity [1]. It is a well-established fact that disease pattern varies demographically and temporarily, diseases common in north and western India might not be common in southern India like Crohn's and ulcerative colitis.

Though various studies have mentioned typhoid perforation to be one of the common causes of perforation peritonitis in India, but they have not mentioned any diagnostic evidence supporting their study [2,3,4]. In this part of the world, duodenal perforation is the most common cause of peritonitis [5,6] while few other studies show small bowel perforation to be more common [7,8]. IBD (Inflammatory bowel disease) is the most common cause of strictures in the Western world [9]. Prevalence of extrapulmonary TB was less than 10% three decades earlier, now make up more than 50%

of the disease burden with a significant number of patients having no evidence of pulmonary involvement [10] while another study conducted in India demonstrates a rising trend of IBD in India and the increasing incidence of Crohn's disease compared with intestinal TB [11].

The leading cause of Small bowel obstruction in industrialized nations is from extrinsic sources, with post-surgical adhesions being the most common. Significant adhesions can cause kinking of the bowel leading to obstruction [12,13]. The most common cause of large bowel obstruction is colorectal cancer followed by pseudo-obstruction and volvulus [14].

### Materials & Methods

A retrospective study was conducted from records over 4 years from January 2019 to December 2022. Medical Records of all patients who underwent laparotomy in the Department of General Surgery at Owaisi Hospital and Research Centre, Kanchanbagh, Hyderabad were collected and assessed.

A total of 97 cases were selected for the study after meeting the inclusion and exclusion criteria. As it is a retrospective study no ethical committee approval was required or taken.

### Inclusion Criteria

Patients who underwent intestinal segment resection and for whom a biopsy was sent for histopathological examination (HPE) were included in the study and were compared in terms of age, sex, pre-op diagnosis, anatomical location, intra-op diagnosis, pathology and operative procedure performed.

### Exclusion Criteria

1. Patients with gangrenous bowel due to strangulated hernia.
2. Resection due to blunt or penetrating abdominal injury.

3. Any patient where biopsy was not taken.

4. Complex Pathologies involving more than one part of the intestine like gallstone ileus and periampullary carcinoma

### Statistical Analysis

Data was collected from the medical records and entered into a spreadsheet. Data was subsequently analyzed, the factors beginning from the diagnosis to post-op recovery were tabulated against each other. The literature review pointed to differences in outcome between ileal resection and ileocecal resection, for which statistical significance was calculated by chi-square test. A p-value < 0.05 is considered significant. Statistical analysis was done using Jamovi (2.3.28) statistical software.

### Results

Of the 97 patients included in the study, 45 were males and 52 were females with M: F ratio of 1: 1.2.

The mean age of the patients was  $41.6 \pm 1.8$  years (95% CI) with a standard deviation of 17.54 years. The youngest patient was a 11 year old female and the oldest was 86 year old female and the range being 75 years. The age distribution is shown in [Figure 1]. The commonest age decade was 20-30 years.

The bimodal distribution of various pathologies resulted from the peaks for sigmoid volvulus, TB, Meckel's diverticulum occurring at an early age and GIST, non-specific inflammation, and adenocarcinoma occurring at a later age. As seen in [Figure 2]

The most common presentation was AIO (30), followed by SAIO (23), Peritonitis (21) and right iliac fossa (RIF) mass (9).

The majority of patients in the 3rd decade presented with SAIO (8/22) followed by peritonitis (6/22) while those in the 5th & 6th decade with AIO (7/19 & 8/18 respectively). Other presentations were almost evenly distributed in all age groups except in the 8th decade which had only 4 patients. [Table 1]

**Table 1: Age group of most common presentations**

Age Group	Most Common Presentations					Total
	AIO	SAIO	Peritonitis	RIF mass	Others	
10-20	4	2	4	-	Appendicitis-1, GOO-1	12
20-30	4	8	6	1	Appendicitis-2, Stomach growth-1	22
30-40	3	5	2	2	Radiologically detected tumor-1	13
40-50	7	2	4	3	3	19
50-60	8	1	2	3	4	18
60-70	2	4	2	-	Rectal growth-1	9
70-80	2	1	1	-	-	4
Total	30	23	21	9	14	97

Intra-operatively tumor was the most common reason for resection (33/97) followed by stricture (29/97) & perforation (22/97). Other indications were volvulus (4), diverticulitis (6) & idiopathic intestinal wall gangrene (1). [Table 2]

The most common pathology of AIO was tumor (13/30) followed by stricture, but for SAIO it was

stricture (15/23) followed by tumors (6/23). Peritonitis was the result of perforation in almost all of those patients (19/21) only exceptions being tumor (1) & idiopathic intestinal wall gangrene (1). RIF mass was due to tumors in majority of patients (6/9) [Table 2]

**Table 2: Correlation between pre-op diagnosis and Intra-op findings**

Pre-OP Diagnosis	Intra-OP Findings				
	Perforation	Stricture	Tumor	Others	Total
AIO	1	11	13	Diverticulum -1 Volvulus - 4	30
SAIO	-	15	6	Diverticulum - 2	23
Peritonitis	19	-	1	Wall Gangrene-1	21
RIF mass	1	-	6	Appendicular Phlegmon - 2	9
Others	Appendicular -1 Diverticular -1	GOO-3	7	Diverticulitis -2	14
Total	22	29	33	13	97

The most common site of pathology was ileum (33/97) followed by right colon & ileocecal region (30/97), left colon & sigmoid (16/97), stomach (6), and jejunum (6). There were 4 patients with

Meckel's diverticulum. Right colon was the most frequent site for tumors,(14/33) while for stricture & perforation it was ileum (14/29 & 17/22 respectively). [Table 3]

**Table 3: Correlation between Intra-op findings and Site of pathology**

Intra-OP Findings	Site of Pathology						
	Ileum	Ileocecal	Rt colon	Lt colon	p-value	Others	Total
Tumor	2	2	14	5	0.00077	10	33
Stricture	14	5	1	6	0.00336	Stomach-3	29
Perforation	17	2	1	1	0.00001	Jejunum-1	22
Others	-	Appendicular phlegmon-2 Wall gangrene-1	IBD-2	Volvulus-4		Meckel's-4	13
Total	33	12	18	16		18	97

Intraoperative finding of tumor turned out to be adenocarcinoma in the majority of patients (20/33) followed by mesenchymal tumors (GIST-Gastro intestinal stromal tumor: 7, NET-Neuro endocrine tumor: 2, lipoma: 2, NHL- Non-Hodgkin's lymphoma: 1). One patient suspected to have tumor intraoperatively turned out to be due to ulcerative

colitis on post-op HPE. Stricture & perforation was due to non-specific inflammation in the majority of patients (16/29 & 13/22 respectively) followed by TB (9/29) & IBD (3/29) in the case of stricture while TB (2/22) & IBD (4/22) in case of perforation. [Table 4]

**Table 4: Correlation between Intra-op findings and Post-op HPE**

Intra-OP Findings	Post-OP HPE					Total
	Adenocarcinoma	Non Specific Inflammation	Tuberculosis	Chron's/ Ulcerative colitis	Others	
Tumor	20	-	-	1	Mesenchymal tumors-12	33
Stricture	1	16	9	3	-	29
Perforation	1	13	2	3+1	Appendicular-1 Diverticular-1	22
Others	-	Diverticulitis-2 Meckel's-4	-	-	7	13
Total	22	35	11	8		97

Ileum was the most frequent site for non-specific inflammatory pathology (22/35) as well as for TB (5/11) & IBD (4/8) while for adenocarcinoma it was right colon (14/22) followed by left colon (5/22). TB & IBD were significantly more frequently found in

Ileum (5/11 & 4/8) & ileocecal region (4/11 & 2/8) than in other parts of GIT.

Mesenchymal tumors were more frequent in jejunum (GIST-3, Lipoma-2) compared to stomach (GIST-1, NET-1), ileum (GIST-2) & right colon (GIST-1). [Table 5]

**Table 5: Correlation between most frequent site of pathology and post-op HPE**

Most frequent site of Pathology	Post-OP HPE					Total
	Adenocarcinoma	Non-Specific Inflammation	Tuberculosis	Chron's/Ulcerative colitis	Others	
Ileum	-	22	5	4	GIST-2	33
Ileocecal Region	-	Appendicular-3	4	2	3	12
Rt colon	14	-	1	2	GIST-1	18
Lt colon	5	3	-	-	Volvulus-4 Diverticular-4	16
Others	Stomach-1 Rectum-2	Stomach-3 Meckel's-4	Jejunum-1	-	7	18
Total	22	35	11	8	21	97

Ileal segment resection was the most performed resection (37/97) followed by ileocecal resection/right hemicolectomy (32/97) [Table 6].

**Table 6: Correlation between Post-op HPE and Type of resection**

Post-op HPE	Type of Resection						Total
	Ileal Segmental Resection	Ileocecal Resection/ Rt Hemicolectomy	Lt Hemicolectomy/ Anterior Resection	Sigmoid Resection	Distal Gastrectomy	Others	
Adenocarcinoma	-	14	5	2	1	-	22
Non-specific inflammation	22	5	4	1	3	-	35
Tuberculosis	5	5	-	-	-	Jejunum-1	11
Crohn's/Ulcerative colitis	4	4	-	-	-	-	8
Others	NET-2 Meckel's-4	4	-	Volvulus-4	GIST-1	6	21
Total	37	32	9	7	5	7	97

**Table 7: Correlation between Type of resection and final outcome**

Type Of Resection	Outcome				Total
	Recovered	Delayed Recovery	Expired	p-value	
Distal Gastrectomy & others	10	1	1	0.00001	12
Ileal Segmental Resection	19	13	5	0.01822	37
Ileocecal Resection / Rt Hemicolectomy	27	2	3	0.00001	32
Lt Hemicolectomy / Anterior Resection / Sigmoid Resection	9	6	1	0.0471	16
Total	65	22	10		97

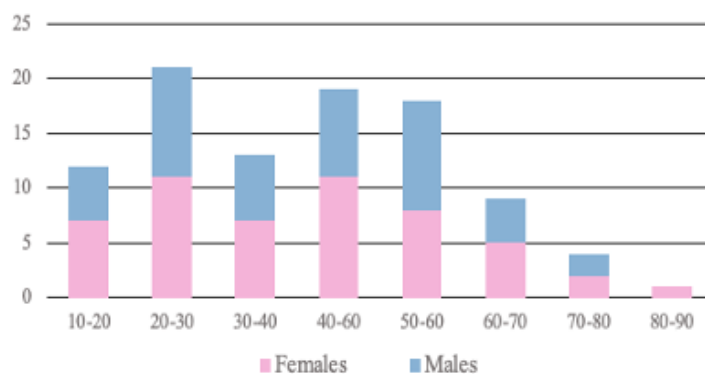


Figure 1. Age Distribution

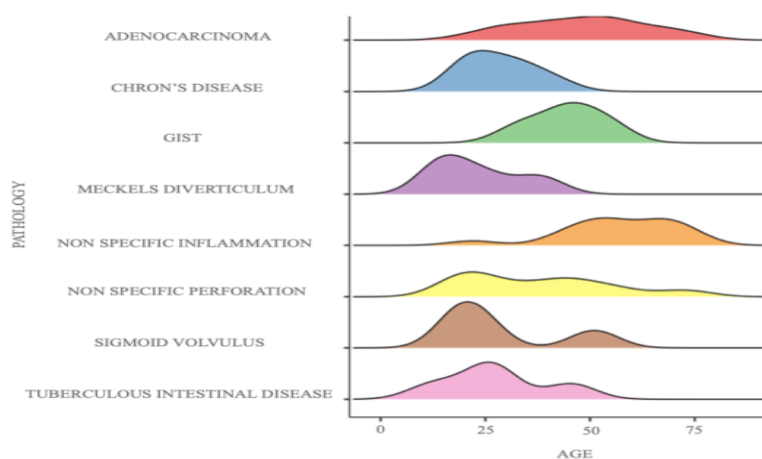


Figure 2. Different Pathologies cumulating to a bimodal distribution

Ileal segment resection was combined with ileostomy in 17 patients of whom 4 expired, and one patient was found to have autoimmune enteropathy in the post-op period who died due to unrelenting progress of the disease.

Right hemicolectomy/ ileocecal resection was followed by primary anastomosis in all the patients but resulted in the death of 3 patients – 2 due to sepsis and 1 due to myocardial infarction in the post-op period. 4 patients who underwent left hemicolectomy, one each of anterior resection & sigmoid resection had colostomy performed and one patient with left hemicolectomy developed post-op sepsis following anastomotic dehiscence resulting in death [Table 7]. None of the patients with jejunal segment resection developed any significant post-operative complication. The only mortality in that group was distal gastrectomy done for adenocarcinoma.

Procedure-wise ileocecal resection/ right hemicolectomy had significantly better outcomes in both mortality & morbidity compared to ileal segment resection & left colonic resection surgery (p-value 0.023).

## Discussion

Resection and anastomosis of the bowel is one of the surgical procedures which has the potential to bring out extreme anxiety in the surgeon and be a cause of morbidity in the patient, sometimes resulting in death. Healing of anastomosis depends on various factors both local and systemic, including vascularity of edges, suturing technique, type of pathology, hypoproteinemia, Jaundice and systemic inflammatory disorders [15]. This is one of the constants in the ever-changing world of surgery even after technological innovation has given us staplers and robots. No wonder that quite a few surgeons, even those who are not in their early stages of career, prefer doing a diversion procedure instead of primary anastomosis in the emergency setting [16].

Tumors were the most common pathology found in patients operated for AIO while non-specific inflammatory perforation of ileum was the most common cause in patients with peritonitis(14/22). These findings were significant on two counts: First, they point out to us the dangers of labelling a disease based on only clinical history and non-specific investigations without rigorously verifying the claims of previous clinicians as shown in the etiology of ileal perforations. Most of the studies

originating from India assumed the ileal perforations to be caused by typhoid fever based on clinical features and precedent teachings [2,3,4,17,18]. In our study, HPE of resected ileal segments failed to reveal the typical features of mononuclear infiltration and erythrophagocytosis in any of the patients and hence they were categorized into non-specific perforations.

The other point of significance is the change of incidence rates with time, while there were 19 patients with intestinal TB in a period of 4 years between 2015-2018 in a study conducted in the same institute [10], the number came down to 11 in the present study period of same duration between 2019-2022. Similar is the observation of authors G.MC Entee et al who have noticed a change in the spectrum of intestinal obstruction over 50 years from strangulated hernias to adhesive obstructions and intra-abdominal malignancies [19]. Even in our series, tumors (13/30) and of them adenocarcinoma (9/13) have turned out to be the most common cause of AIO. Another unexpected finding was the number of patients with Crohn's disease (6.19%) which was slightly less than that for intestinal TB (9.28%) Table 4. This was in line with a multi-centric study which showed a significant majority of patients with Crohn's disease were diagnosed following a non-response or a relapse after a trial of ATT [11]. This observation is closely parallel to our study where 2 patients, clinically and radiologically diagnosed as ileocecal Koch's, failed to respond to ATT even after 1 year and 3 patients with suspected typhoid ileal perforations, turned out to have Crohn's etiology on HPE. This shows the conventional wisdom of 1939 still holds true. "It is better to look and see than to wait and see." It is much better to operate without a diagnosis and prevent death than to wait for the correct diagnosis and have a funeral [20]

Easy availability of imaging investigation in this part of the country as compared to more economically developed countries plays a part in early diagnosis of intestinal tumors as is evident in our study where 2 patients were diagnosed – one with jejunal GIST & another NHL of ileocecal region, on routine imaging investigation ordered for non-specific abdominal complaints [21]

The increased incidence of small bowel tumors and specifically gut mesenchymal tumors like gastrointestinal stromal tumors (GIST), neuroendocrine tumor and non-Hodgkin's lymphoma (NHL) - a hospital-based study from Eastern India (Sengupta et al.) reporting the highest incidence in small-bowel and most common presenting symptom to be abdominal lump [22]. A similar higher incidence of mesenchymal tumors in the small bowel compared to the stomach and colon was found in another study conducted in our institute [23] which contrasts with the study conducted in

Cancer Institute, Chennai reporting stomach as the most common site [24]. This discrepancy between studies conducted in a general hospital and a speciality Cancer Hospital is in focus again with regard to colorectal cancers. In our study right colon being the most common site both for Adenocarcinoma(14/33) and NHL. This finding contrasts with those from speciality Cancer Institute reporting rectum as the most common site for Adenocarcinoma[25,26] and stomach for NHL[27,28], the probable cause for this discrepancy lies in the presentation- while patients with right colonic tumors present to surgery department with features of intestinal obstruction or abdominal lump either as an emergency or electively and malignancy gets detected post-operatively on histology of resected specimens[29] (NHL, GIST and a majority of Adenocarcinomas in our study). Most of the patients with gastric and rectal malignancies present in an inoperable stage and hence are referred to specialized cancer centers for chemotherapy/radiotherapy or complicated surgical procedures, a similar observation was inferred by the authors of the study from Cancer Institute in Bangalore, India [25] and another study from Buffalo, New York, USA[26].

Ileal segment resection was the most performed surgery(37) followed by right hemicolectomy/ ileocecal resection(32). Right hemicolectomy/ ileocecal resection (32) group had significantly better recovery than patients who underwent ileal segment resection(p-value 0.023). Most of the mortality was in patients on whom ileostomy was performed post resection instead of primary anastomosis. This interesting finding could be due to the poor general condition of the patient following advanced stage of septicemia going into multi-organ failure due to late presentation to the hospital, where the type of procedure performed or the age of the patient has a limited bearing on the outcome. This flies in the face of conventional wisdom advocating routine loop ileostomy in all patients with non-traumatic ileal perforation [3,17] and reported a higher incidence of anastomotic dehiscence in right colonic resections compared to left colonic resections reported in Western literature[30].

This brings us to the main drawback of this study, being a retrospective study the presenting complaints, their duration and the condition of the patient at the time of presentation to the hospital are not meticulously documented in case of emergency admissions thus confounding the outcome against ileal pathology patients as there were significantly greater number of patients with ileal pathology admitted as an emergency compared to patients having colonic pathology (p<0.008).

The way forward is prospective studies comparing disorders involving different sites of GIT controlling the other confounding factors like the disease's

duration and patient presentation, to better gauge the effectiveness of any surgical intervention.

### Conclusion

In the setting of intestinal perforations, not all ileal perforations are due to typhoid, ileostomy doesn't always save lives. The most common cause of non-adhesive intestinal obstruction is tumors and a general surgeon should be in a position to do a right hemicolectomy or at least an ileocecal resection in the emergency setting followed by an anastomosis to expect a reasonably good outcome in the patient population presenting to the general surgery department.

Disease incidence & demographics change with time and the surgeon has to be ready to adapt appropriately to the changes.

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