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ORIGINAL ARTICLE

Ostomy in Nontraumatic Conditions: Our Experience and Review of the Literature

Kenan Büyükaşık[1] · Bünyamin Gürbulak[1,3,4] · Emre Özoran[1] · Yiğit Düzköylü[1] · Esin Kabul Gürbulak[2] · Aziz Arı[1] · Hasan Bektaş[1]

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Abstract A number of nontraumatic acute abdomen can result in peritonitis leading to sepsis. In emergent conditions, various procedures like segmentary colectomy and/or subtotal colectomy with anastomosis, Hartmann's procedure, transverse colectomy, and/or expandable metallic stent (SEMS) placement can be performed, considering the status of the patient and the facilitaties of the institution. In our study, we examined the cases diagnosed as acute abdomen without the history of trauma, which had lead to a procedure requiring colostomy. We retrospectively analysed 105 cases of nontraumatic acute abdomen, resulted in a procedure requiring colostomy. *American Society of Anesthesiologists* (ASA) scoring and *Mannheim Peritonitis Inde*x (MPI) were used in the evaluation of the risk of mortality and morbidity. There were colonic perforations of rectosigmoid tumor in 66 cases (62.8 %), sigmoid volvulus in 10 cases (9.5 %), colonic anastomotic leakage in 9 cases (8.5 %), intestinal adhesions in 8 cases (7.6 %), mesenteric ischemia in 5 cases (4.7 %), gynecological diseases in 3 cases (2.85 %), strangulated hernias in 3 (2.85 %), and Ogilvie syndrome in 1 case (0.95 %). Rate of morbidity was found to be 25.7 %, while mortality occurred in 2.8 % of the cases. Cases with mortality and morbidity had ASA scores above two and MPI scores above 23. Anastomotic leakage was the only reason of mortality. In nontraumatic occasions, the management and prognosis of cases with peritonitis, general status of the patients play major roles. The prognosis rates of morbidity and mortality can be highly predicted when ASA and MPI scores are evaluated together.

Keywords Colon perforation · Colostomy · Mannheim peritonitis index · Peritonitis

Introduction

A number of nontraumatic conditions can result in peritonitis leading to a series of organ failure with high rates of mortality and morbidity [1, 2].

This study has not been published elsewhere or has never been presented in any national or international symposia.

✉ Bünyamin Gürbulak
bgurbulak@gmail.com

Kenan Büyükaşık
op_dr_kenan@hotmail.com

Emre Özoran
ozoran@gmail.com

Yiğit Düzköylü
dryigit@gmail.com

Esin Kabul Gürbulak
ekabul@gmail.com

Aziz Arı
azizari02@hotmail.com

Hasan Bektaş
hasanbektas3417@hotmail.com

[1] Department of General Surgery, Istanbul Training and Research Hospital, Istanbul, Turkey

[2] Department of General Surgery, Şişli Hamidiye Etfal Training and Research Hospital, Istanbul, Turkey

[3] Istanbul Eğitim ve Araştırma Hastanesi, Kasap Ilyas mah. Org. Abdurrahman Nafiz Gürman Cd, Zip Code 34098 Fatih, Istanbul, Turkey

[4] Sakarya mah, Silahtaraga cad. No 150/10, Zip Code 34050 Eyup, Istanbul, Turkey

Tumoral obstructions in the colorectal and anal regions account for 60–70 % of this group. The remaining 30 % consist of diverticular disease, inflammatory bowel disease (IBD), pelvic malignancies, and pseudo-obstruction syndromes like Ogilvie syndrome [3]. Fifteen to twenty percent of colonic malignancies may present with acute obstruction [4].

In patients with acute colonic obstruction, especially in emergency conditions, various procedures like segmentary colectomy with primary anastomosis, subtotal colectomy with ileorectal anastomosis, Hartmann's procedure, transverse colectomy, and/or expandable metallic stent (SEMS) placement as a bridge to surgery and palliative treatment can be performed, considering the status of the patient and the facilities of the institution.

Independent from the etiology, malignancies of the left colon are associated with higher rates of morbidity and mortality.

General status of the patient, extent of peritonitis, and the treatment procedure are some of the factors affecting the course of clinical status [5]. Abdominal ultrasound and direct abdominal X-ray imaging can be inadequate in establishing the diagnosis. Computed tomography (CT) is a better diagnostic modality in cases with peritonitis [6].

Following the diagnosis, treatment modality must be decided keeping the general status of the patient and extent of peritonitis in mind. In our study we examined the cases presenting with acute abdomen findings without the history of trauma, which had lead to a procedure requiring ostomy, and evaluated them by using the following parameters: *American Society of Anesthesiologists* (ASA) score, *Mannheim Peritonitis Index* (MPI), demographics of the patients, radiological and laboratory findings, etiology and localization, extent of peritonitis, type of the procedure, and rates of postoperative morbidity and mortality.

Patients and Methods

In our study, we retrospectively analysed 105 cases of acute abdomen following nontraumatic conditions between the years 2010 and 2014 which resulted in a procedure requiring ostomy. Demographics of the patients, radiological and laboratory findings, etiology and localization, extent of peritonitis, the type of procedure, and postoperative morbidity and mortality rates were obtained from the patient database. ASA scoring and MPI were used in the evaluation of the risk of mortality and morbidity. MPI is a scoring, designed by Wacha and Linder, consisting of 17 possible risk factors. Eight of these risk factors have impact in prognosis, which we used for our evaluation [7] (Tables 1, 2, and 3).

Table 1 Mannheim peritonitis index

Criteria	Score	Interpretation
Organ failure	7	1. Score 0–5: 0 % mortality
Diffuse peritonitis	6	2. Score 6–13: 20 % mortality
Age older than 50 years old	5	3. Score 14–21: 13 % mortality
Female gender	5	4. Score 22–29: 26 % mortality
Malignancy	4	5. Score 30–39: 64 % mortality
Non-colonic sepsis origin	4	
Preoperative duration of peritonitis	4	
Exudate: fecal cloudy or purulent clear	12	
	6	
	0	

Results

Fifty-nine of the cases were males and 46 were females. Mean age was found to be 64.8 (min 25—max 87). Colonic obstruction and perforation of a tumor in the rectosigmoid region were the leading causes of peritonitis, seen in 66 cases (62.8 %). The remaining reasons were sigmoid volvulus in 10 cases (9.5 %), anastomotic leakage originating from previous colonic resections in 9 cases (8.5 %), intestinal adhesions in 8 cases (7.6 %), mesenteric ischemia in 5 cases (4.7 %), gynecological diseases in 3 cases (2.85 %), strangulated hernias in 3 (2.85 %), and Ogilvie syndrome in 1 case (0.95 %) (Table 4). Pneumoperitoneum was detected in 93 (88.57 %), and intra-abdominal-free fluid was detected in 86 (81.9 %) of the cases with direct abdominal X-ray and CT, confirming intestinal perforation.

Rate of morbidity was found to be 25.7 % (27 cases), while mortality occurred in three (2.8 %) of the cases. Cases with mortality and morbidity had ASA scores above two and MPI scores above 23. Mean MPI scores in cases with complications without mortality were found to be 20.14 (9–24). Mean MPI scores in cases with mortality were 24 (range: 20–26). Anastomotic leakage was the only etiology observed in the mortality group (they all had MPI scores of 20 or higher).

Table 2 Definition of organ failure

Kidney failure	Creatinine >177 umol/L
Level of urea	>167 mmol/L
Oliguria	<20 ml/h
Lungs	PO2<50 mmHg
PCO2	>50 mmHg
Shock	Hypodynamic or hyperdynamic
Intestinal obstruction	Paralysis >24 h or complete mechanical obstruction

Table 3 ASA scoring

I	Patient is a completely healthy fit patient
II	Patient has mild systemic disease
III	Patient has severe systemic disease that is not incapacitating
IV	Patient has incapacitating disease that is a constant threat to life
V	A moribund patient who is not expected to live 24 h with or without surgery

Site of perforation and etiology, ASA score, and type of surgical procedure in patients with morbidity and mortality are shown in Table 5.

Discussion

A heterogeneous group of disease in nontraumatic occasions may present with acute abdomen and lead to peritonitis resulting in high rates of mortality, up to 15–30 % even with advanced surgical procedures and intensive care unit follow-up [9]. High mortality rates depend on patient factors, etiology specific factors, and diagnostic and therapeutic interventions. Thus, evaluating the extent of peritonitis, various scoring systems may help in foreseeing the cases which may result in high rates of mortality. In previous studies where MPI was used, mortality rate was 0–2.3 % when the score was lower than 21, 65 % when the score was between 21 and 29, and higher than 80 % with scores higher than 29 [8]. In our study, one case with mortality had a MPI of 20 and the remaining two cases had scores of 26, which is consistent with the literature. In our study, 20 was set as a cut-off point because we did not have any mortalities in cases with MPI lower than this score. All the patients with mortality had ASA scores of three. When those two scoring systems were used together mortality rates seem to rise with higher scores. Operative findings are also needed to score in MPI. The most restrictive disadvantage of MPI is not being able to foresee mortality preoperatively. Scoring is performed using both intraoperative and postoperative findings. Its advantage is its predictive ability without the use of laboratory findings. This can also lead to difficulties for the surgeon choosing between palliative and definitive surgical procedure and for the anesthesiologist during the postoperative follow-up period. All of our cases had presented with peritoneal free air and fluid. Thus, no difficulty was encountered during the decision period.

Table 4 Distribution of cases with perforation of the colon

Etiology	Number of cases (*n*)
Colon cancer	66
Sigmoid volvulus	10
Leakage of anastomosis	9
Intestinal adhesions	8
Mesenteric ischemia	5
Gynecological disease	3
Incarcerated hernia	3
Ogilvie syndrome	1
Total	105

The prolongation of the time between the onset of the symptoms and admission to the hospital can increase morbidity and mortality rates, because of septic complications [1, 2]. In their study with 165 cases, Iqbal et al. found the morbidity rate as 27 % in patients diagnosed in the first 24 h from the onset of the symptoms, while it was 44 % in patients who were diagnosed later [9]. Peritonitis persisting longer than 24 h is a criterion used in MPI scoring as a factor increasing mortality. In our study, 30 cases with morbidity and mortality had been diagnosed later than 24 h.

The sigmoid colon is the most common location for tumors, diverticulitis, and volvulus, and similarly the most common cause of peritonitis in the nontraumatic setting followed by rectum [1, 2]. Independent of the etiology, tumors of the colon distal to transverse segment have higher rates of morbidity and mortality, thus requiring temporary or permanent colostomy [10].

In our cases, the leading reason for peritonitis was tumors of these segments, which was consistent with the literature. Colonic perforations caused by diverticulitis frequently present with abscess formation. Free perforation and generalized peritonitis are rare presentations, but when they are observed, emergency surgery is required, with mortality rates as high as 20–25 % [11].

Perforation can be seen in 1.2–10 % of colorectal cancer patients. Mortality and morbidity rates in these cases are higher than other etiologies [12], which depends on the fact that perforation is usually seen in cases with advanced stages of cancer [1]. In our cases with morbidity and mortality, 22 cases out of 30 had colon cancer.

While single stage resection and anastomosis is the proposed therapeutic approach for right-sided colonic obstructions, treatment choices for left-sided obstructions are still controversial [11].

In emergency conditions, these patients either require intraoperative colonic irrigation or manual decompression followed by segmentary colectomy and primary anastomosis or subtotal colectomy and ileorectal anastomosis, if there is synchronous tumor or proximal bowel ischemia in the patients with low risk. Primary resection and end colostomy (Hartmann's procedure) or transverse colostomy and/or SEMS can be performed as a bridge to surgery or palliative treatment purposes [5].

Colostomy can be performed especially in left-sided obstructions as a bridge to definitive surgical procedure and in patients not suitable for surgery. It establishes colonic

Table 5 ASA and MPI scores of patients with complications

Case number	Etiology	Site of perforation	ASA score	MPI	Surgical procedure	Morbidity	Mortality
1	Cancer of the ascending colon	Anastomotic leakage	3	20	Ileostomy and transverse colostomy		+
2	Rectal cancer	Anastomotic leakage	3	21	Sigmoid colostomy	+	
3	Rectal cancer	Eventration	4	26	Sigmoid colostomy		+
4	Cancer of the sigmoid colon	Parastomal hernia	3	14	Repair of hernia	+	
5	Cancer of the rectosigmoid region	Anastomotic leakage	4	23	Sigmoid colostomy	+	
6	Rectal cancer	Anastomotic leakage	3	19	Colostomy	+	
7	Sigmoid volvulus	Sigmoid necrosis	3	9	Sigmoid resection and end colostomy	+	
8	Cancer of the sigmoid colon	Anastomotic leakage	4	24	Hartmann's colostomy	+	
9	Cancer of the sigmoid colon	Anastomotic leakage	3	19	Transverse colostomy and ileostomy	+	
10	Peritoneal carcinomatosis	Perforation of ileum	4	24	Transverse colostomy and ileostomy	+	
11	Cancer of the sigmoid colon	Anastomotic leakage	3	21	Sigmoid colostomy	+	
12	Necrotizing fasciitis	Necrosis of the stoma	4	24	Revision of the stoma	+	
13	Sigmoid volvulus	Anastomotic leakage	3	15	Sigmoid colostomy	+	
14	Peritoneal carcinomatosis	Ileocecal perforation	4	24	Subtotal colectomy and ileostomy	+	
15	Rectal cancer	Anastomotic leakage	3	26	Hartmann's colostomy		+
16	Rectal cancer	Necrosis of the stoma	4	21	Revision of the colostomy	+	
17	Rectal cancer	Anastomotic leakage	3	22	Hartmann's colostomy	+	
18	Cancer of the ascending colon	Anastomotic leakage	4	19	Ileostomy and cecostomy	+	
19	Cancer of the sigmoid colon	Anastomotic leakage	3	23	End colostomy	+	
20	Colovesical fistula	Anastomotic leakage	3	15	Sigmoid resection and end colostomy	+	
21	Cancer of the sigmoid colon	Anastomotic leakage	3	21	Sigmoid colostomy	+	
22	Strangulated umbilical hernia	Anastomotic leakage	3	18	Revision of anastomosis and ileostomy	+	
23	Cancer of the rectosigmoid region	Anastomotic leakage	4	22	Sigmoid colostomy	+	
24	Cancer of the sigmoid colon	Anastomotic leakage	3	21	Hartmann's colostomy	+	
25	Rectal cancer	Anastomotic leakage	3	22	Revision of anastomosis and ileostomy	+	
26	Sigmoid volvulus	Sigmoid necrosis	3	18	Sigmoid resection and end colostomy	+	
27	Rectal cancer	Anastomotic leakage	4	22	Hartmann's colostomy	+	
28	Cancer of the ascending colon	Anastomotic leakage	4	21	Ileostomy and revision of anastomosis	+	
29	Mesenteric ischemia	Perforation of ileum	4	20	Ileac resection and double barrel ileostomy	+	
30	Cancer of sigmoid colon	Anastomotic leakage	3	22	Sigmoid end colostomy	+	

decompression with minimal surgical trauma, preventing the contamination with the colonic contents and allows multidisciplinary evaluation of the patient for definitive treatment. The disadvantage of the procedure is its multistep approach and longer hospital stay [13]. The complications caused by a stoma may vary from 21 up to 70 % [14]. In a single randomized controlled trial (RCT) comparing colostomy with resection, no difference was observed in mortality but duration of hospital stay was significantly lower in the resection group [15].

Colostomy is the preferred surgical option especially for palliation before neoadjuvant chemotherapy and high risk patients that are not suitable for elective surgery.

Although single stage resection and anastomosis is a better option than Hartmann's procedure for left-sided obstructions, it is not suitable for all the patients in this group. Depending on the patient's age, ASA score, MPI, tumor grade, and emergency status, Hartmann's procedure is generally performed for diseases of the sigmoid colon, but it can also be used in iatrogenic colonic perforation, diverticulitis, ischemic colitis, in high risk patients and advanced colonic distention. The advantage of Hartmann's procedure is not carrying the possible risks of anastomosis and its easy applicability even by an inexperienced surgeon. Its main disadvantage is the probability of not being able to close the stoma in 40–60 % of the patients, which affects the life quality adversely. Closure rates for stomas in Hartmann's procedure performed for cancer have been reported as 57 % [16].

Subtotal colectomy can be used in the presence of a synchronous tumor or proximal colonic injury and/or ischemia.

Segmentary or total colonic resection with primary anastomosis may be a better treatment option than Hartmann's procedure, but still remains as a controversial issue. Total or subtotal colectomy and ileorectal anastomosis prevents the risk of a synchronous tumor, which can be seen in 3–10 % of the

patients and future metachronous proximal colonic tumors, and spares the patient from a stoma. The main disadvantages are increase in the duration of operation, more functional intestinal disorders in the postoperative period, a more extensive surgical procedure, and diarrhea [17]. The most important risk factor is anastomotic leakage leading to local recurrence, surgical site infection, sepsis, reoperation necessity, and delay in adjuvant chemotherapy, shortening the disease-free period [18].

Thus, the treatment option should be decided in the light of parameters such as age, stage of the disease, ASA scores, MPI scores, and the etiology on the basis of the emergent situation of the patient. Majority of our cases had obstruction and perforation; thus, Hartman procedure was performed more commonly than resection with primary anastomosis.

Another controversial issue in the literature is intraoperative colonic irrigation (ICI) and manual decompression (MD). It was shown that mechanical bowel cleaning had no effect in preventing anastomotic leakage in elective colorectal surgery [19]. In cases without right colonic perforation or presence of a synchronous tumor, intraoperative ICI or MD can be performed before resection and primary anastomosis. ICI and MD can provide the advantage of shortening the colonic segment to be resected, preventing intestinal functional loss, leading to a safer anastomosis. Anastomotic leakage rates after ICI have been reported to vary from 4 to 10 %. The disadvantages of this method are duration of the operation and possible fecal spread and contamination [20].

In the literature, in a RCT comparing manual decompression with ICI, MD was reported to be performed in a shorter time and segmentary colonic resection had the same mortality and morbidity rates with ICI, thus it can be used safely [21].

Colonic stenting is a successful method used in the recent years for bridging and palliative purposes. Even though technical success rates are conflicting when moving proximal to sigmoid colon, overall and clinical success rates are 88 and 92 %, respectively [22]. In a prospective RCT stent group, success of anastomosis rates was higher and preventing the requirement for a colostomy, the technique provides low postoperative complications and shorter hospital stay [23]. The complications associated with stenting are perforation, tumor migration, and restenosis. Decompression with colonic stent placement for acute obstructions followed by definitive surgical intervention is the best treatment modality in the appropriate circumstances.

Fifteen percent of patients with colorectal cancer present with obstruction or perforation requiring emergent surgical intervention. In these cases, colonic resections have 10–20 % mortality and 30–50 % morbidity rates depending on the general status of the patient and the comorbidities [24].

In cases with perforation, limited segmental resection of the affected bowel area followed by primary anastomosis or placement of a stoma is a choice that had to be made depending on the extent of abdominal contamination and the general status of the patient [12].

In our study, out of the 105 cases analysed for acute abdomen, all the cases with mortality had ASA scores higher than two and MPI scores higher than 23. The use of these criteria in the selection of the treatment modality and the type of surgical procedure are important for postoperative morbidity and mortality.

Ischemic colitis is commonly seen in the descending and the sigmoid colon. Factors like thrombosis, emboli, decreased cardiac output, drug use, and shock may play a role in the etiology [25]. In our study, morbidity occurred in a patient with mesenteric ischemia, in whom ileal resection and anastomosis had been performed. Following anastomotic leakage, intestinal contents came from the drain on the fifth postoperative day. Double barrel ileostomy procedure was used and the stoma was closed later on.

Colonic volvulus is the third most common reason for obstruction after cancer and diverticulitis. Early diagnosis and decompression are gold standard in treatment. In our study, there were three cases with sigmoid volvulus resulting in morbidity as a result of colonic perforation. The Hartmann colostomy procedure was used in those patients. We had encountered two cases with necrosis in the stoma. The first one was observed in a case with peritoneal carcinomatosis and the latter was a patient with necrotizing fasciitis. The necrosis of the stomas is mostly seen in the emergency setting rather than elective operations. Both cases had deterioration of general status and the ASA scores were higher than three with MPI scores higher than 23. Anastomotic leakage was encountered in the case of the stoma closure, which had been previously performed for colovesical fistula, and a sigmoid colostomy was performed.

Currently, there is a limited number of studies analyzing the prognostic factors affecting the morbidity and mortality in cases of peritonitis in the nontraumatic setting. Guloglu et al. [26] reported morbidity rates as 44 % and mortality rates as 31 %, while Ertekin et al. [2] reported morbidity rates as 42 % and mortality rates as 33 % in their studies. Shinkawa et al. [1] reported a mortality rate of 17.5 %. In our study, the rates of morbidity and mortality were 25.7 and 2.8 %, respectively. The rates of morbidity and mortality are significantly higher in cases with higher ASA and MPI scores [27]. Park et al. reported the mortality of 57.1 % for patients with a MPI score of more than 25 [28]. On the other hand, Yaman et al. reported that the morbidity rate was 30 % in the patients with a MPI <21 and 66.7 % with a MPI >21, despite the developing conditions in postoperative intensive care units [29].

Colonic stenting is the best choice as a bridge to surgery and/or palliation. It decreases morbidity, mortality, and need for colostomy.

The patients in our study had advanced stages with obstructive and/or perforated tumors, thus many of them had required

a stoma. Although our institution has the opportunity of colonic stenting the advanced presentation of the cases and the presence of perforation prohibited its use.

Conclusion

In nontraumatic occasions, the management and prognosis of cases with peritonitis, age, etiology and stage of the disease, ASA and MPI scores play major roles. Mortality and morbidity rates are still reported to be high despite the advances in intensive care. In this group of patients, anastomotic leakage is the main complication leading to mortality. Especially, in patients with generalized peritonitis with ASA score >2 and MPI >20, morbidity and mortality rates are increased.

The prognosis rates of morbidity and mortality can be highly predicted when ASA and MPI scores are evaluated together.

If the circumstances are appropriate, SEMS should be placed first followed with elective surgery. The Hartmann procedure should be reserved for patients with high risk. Subtotal colectomy can be performed in the presence of a synchronous tumor. Colostomy should be reserved as a last choice for patients with high morbidity and unfit for surgery.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

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