

Early Surgical Treatment of Colonoscopic Perforations

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Abstract

Introduction: Colonoscopy is widely used for diagnostic and therapeutic purposes in colon, rectum, and anal canal diseases. Although colonoscopic perforations are rare, they can lead to serious morbidity and mortality. The aim of this study was to examine the diagnosis, treatment, and follow-up results of the patients operated for colonoscopic perforation in the light of the literature.

Methods: The results of the patients, who were operated in our clinic with the diagnosis of colonoscopic perforation between January 2015 and November 2019, were evaluated retrospectively. The patients' demographic characteristics, colonoscopy findings, disease diagnoses, time of surgery, and surgery performed and follow-up results were analyzed.

Results: A total of 7802 colonoscopy procedures were performed. Ten patients (0.12%) developed colonoscopic perforation. Of the patients, 6 (60%) were female and 4 (40%) were male. The mean age was 71.5 years. Perforation developed during the diagnostic procedure in 7 patients (70%) and during polypectomy in 3 patients (30%). Perforation localization was the sigmoid colon in seven patients, the rectosigmoid junction in two patients, and the right colon in one patient. All patients were operated within 6 h after the procedure. Six patients underwent primary repair, three patients underwent segmental colon resection + end-to-end anastomosis, and one patient underwent multiple surgeries. While two patients developed minor complications, one patient died on the 6th day after the procedure due to intra-abdominal sepsis.

Discussion and Conclusion: Although the incidence of colonoscopic perforation is low, it causes serious morbidity and mortality when it develops. Patients and their relatives should be informed in detail about possible complications before colonoscopy. Although there is no gold standard treatment, we believe that the diagnosis should be made as early as possible and appropriate treatment should be performed without delay.

Keywords: Colonoscopic perforation; colonoscopy; emergency surgical treatment.

Colonoscopy is a procedure performed for both diagnostic and therapeutic purposes. It is an effective screening tool for colon polyps, colorectal cancer, and cancer precursor lesions. Colonoscopies are relatively safe, and the risk of developing serious complications is about 8 in 10,000, most of which are colonic perforation^[1]. Colonoscopic perforations (CPs) may result in serious bleeding, peritonitis, and sepsis. Ideal management of CP is still controversial, and some progress has been made in developing minimally invasive approaches.

CP is a rare but a serious complication of colonoscopy. The incidence worldwide is estimated to be 0.16–8% for diagnostic colonoscopy and 0.02–8% for therapeutic colonoscopy^[2-10]. CPs occur by three different mechanisms, including mechanical trauma, pneumatic trauma, and post-therapeutic trauma. Colonic perforations after mechanical trauma usually occur due to uncontrolled advancement of the colonoscope. Especially in patients with a history of pelvic surgery or pelvic inflammatory disease, unnecessary strain occurs in the intestine after looping or

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during alpha maneuver, which creates longitudinal tears on the antimesenteric surface of the colon^[11,12]. Colonic perforations after mechanical trauma are common in the rectosigmoid colon or in the segment where a stricture is present, if there is a stricture. A second mechanism of colonoscopic perforation is perforation secondary to pneumatic trauma or barotrauma, and the cecum and right colon are the most susceptible colon segments for pneumatic perforations. Anatomically, pneumatical perforation that occurs during colonoscopy causes the rupture of the serosa and the development of mesenteric pneumatosis, and subsequent mucosal separation and transmural rupture. A third mechanism of colonoscopic perforation is the perforations that occur after a therapeutic procedure. Post-therapeutic CPs may be due to the perforation of the colon by a biopsy forceps, dilators, or brush used during colonoscopy, as well as due to the thermal damage arising during polypectomy. Apart from this, CPs occur after endoscopic mucosal resection and dissection, which have become more widespread in recent years, with rates reaching up to 5%^[13-15].

When performing a colonoscopy, 45–60% of perforations are detected by the endoscopist, but a significant number of perforations are not recognized immediately; they are suspected on the basis of clinical signs and symptoms that show up after colonoscopy. In this case, colonic perforations can lead to the development of secondary peritonitis, which is associated with significant morbidity and mortality^[6,16,17].

There are different treatment alternatives for CP, including conservative, endoscopic, and surgical approaches. In this study, we aimed to present the results of the patients who underwent emergency surgery with the diagnosis of colonoscopic perforation.

Materials and Methods

The files of the patients, who underwent emergency surgery with the diagnosis of perforation due to colonoscopy procedure in TR Ministry of Health Giresun University Prof Dr. A. İlhan Özdemir Training and Research Hospital Endoscopy Unit between January 2015 and November 2019, were retrospectively reviewed. In addition to the demographic characteristics of the patients who developed perforation, their endoscopic procedure, clinical and radiological findings after the procedure, time from the diagnosis of perforation to operation, surgical findings, surgical intervention, and post-operative follow-up information were analyzed. The patients who were op-

erated before 12 h were considered as early laparotomy, while those who were operated after a longer period were considered as late laparotomy. Necessary permissions were obtained for the study.

Results

Between January 2015 and November 2019, 7802 colonoscopy procedures were performed. A total of 10 patients (0.12%) developed perforation. As perforation rate is 0.001282 and $p < 0.001$ according to z-test of single mass ratio, it can be reached that the perforation rate can be below 1%. Descriptive statistics were used for other data. Of the patients, 6 (60%) were female and 4 (40%) were male. The mean age was 71.5 (range, 54–82) years. Perforation developed during the diagnostic procedure in seven patients and during the therapeutic procedure in three patients. One patient had perforation in the right colon, seven patients in the sigmoid colon, and two patients in the rectosigmoid junction localization. Eight patients were diagnosed by visualization of intra-abdominal structures during the procedure, and two patients were diagnosed as a result of abdominal pain and distention developed in the post-procedure follow-up and intraperitoneal free air visualized on contrast-enhanced CT (Figs. 1-4). The patients who were diagnosed with perforation during the procedure were operated within 2 h, while the patients who were diagnosed during the post-procedure follow-up were operated at the 4th and 6th h, respectively.



Figure 1. Free air of bottom of the diaphragm at the chest radiography.

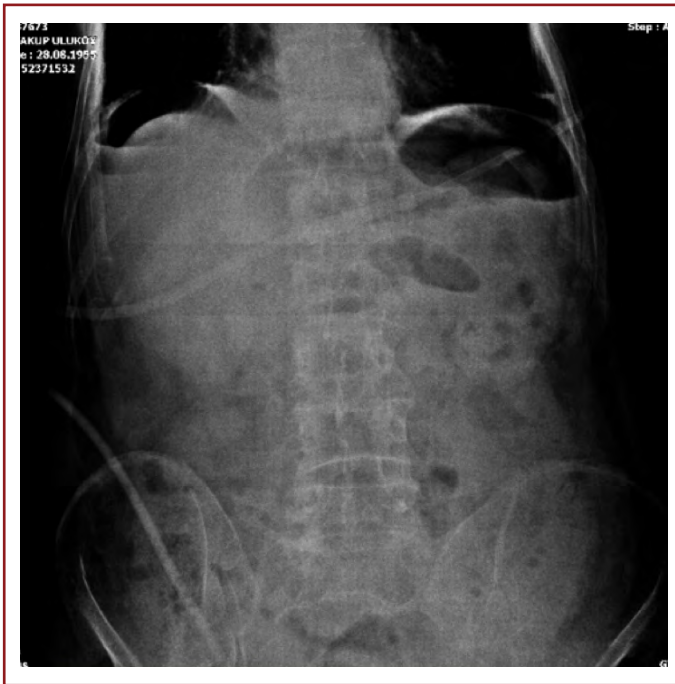


Figure 2. The image of bottom diaphragm free air on standing at the abdominal radiograph.

All patients were treated with early laparotomy. Primary repair was performed on six patients, segmented colon resection + end-to-end anastomosis was performed on three patients, and multiple surgeries were performed on one patient (Table 1). The surgical findings in perforations due to diagnostic procedures were as follows: Multiple diverticula in three patients, angulated sigmoid colon in two patients, and adhesion due to pelvic inflammatory

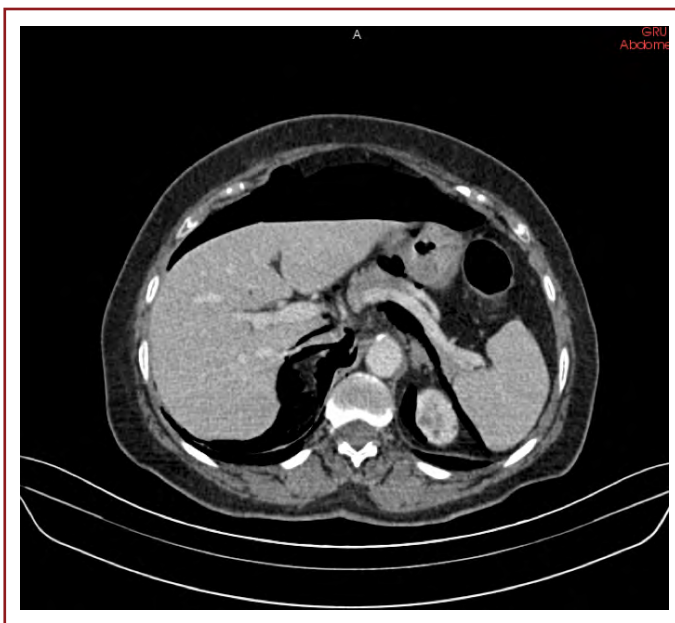


Figure 3. Diffuse free air on computer abdominal radiograph.

disease in one patient. One patient had no abnormal finding (Table 2). All therapeutic procedures were polypectomies.

The mean perforation diameter was 3.7 cm (range, 2–6.3 cm). In three patients who underwent resection, the perforation diameter was 4 cm and above. Two patients developed minor complications (wound infection), a total of nine patients were discharged with recovery, and one patient died of intra-abdominal sepsis. Peritoneal carcinomatosis findings and irresectable tumor were detected during the laparotomy of the patient who developed perforation in the right colon, and loop ileostomy+primary repair was performed. As a result of identifying cecal necrosis during the exploration performed when acute abdomen developed during the intensive care follow-up, resection+end ileostomy+transverse colostomy was performed. The abdomen was closed up with a Bogota bag and abdominal irrigation was planned. The patient died of intra-abdominal sepsis.

Discussion

The rates of colonoscopic perforation vary depending on the procedures performed. The rate of developing colonoscopic perforation has been reported as 0.01–0.11% after diagnostic colonoscopy, 0–6% after dilatation of anastomotic stenoses, 0–18% after dilatation of stenoses associated with Crohn's disease, 4% after stent placement, 2% after colon decompression tube placement, and 0–5% after endoscopic mucosal resection and dissection in the colon^[17,18]. Perforations developing after diagnostic barotrauma are typically

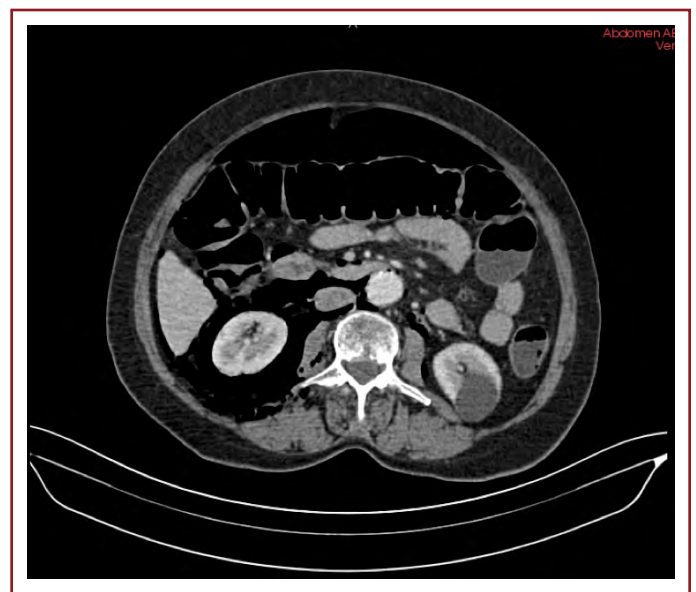


Figure 4. Diffuse free air on computer abdominal radiograph.

Table 1. Dermographic features, perforation localization, and surgical findings

The average age	71.5 (54–82%)
Female: male ratio	6:4
Localization of perforation	
Ascending colon	1 (10)
Sigmoid colon	7 (70)
Rectosigmoid	2 (20)
Diagnostic method	
During of colonoscopy	8 (80)
In service follow-up after colonoscopy	2 (20)
Average perforation diameter	3.7 cm (3–6.5)
Surgery type	
Primary repair	6 (60)
Segmental resection + end-to-end anastomosis	3 (30)
Multiple surgical treatment	1 (10)
Time between diagnosis and surgery (within the first 12 h, early laparotomy)	
Within the first 2 h	8 (80)
Between 2 and 6 h	2 (20)

Table 2. Surgical findings in perforations due to diagnostic colonoscopy

Colon diverticulum	(42.8%)
Angular sigmoid colon	(28.5%)
Adhesion due to pelvic inflammatory disease	(14.2%)
Normal findings	(14.2%)

large, while perforations developing after therapeutic procedures are usually small and occur at the therapeutic procedure site. The post-CP mortality rate varies between 0% and 0.65% and the risk factors for perforation include advanced age, multiple comorbidities, diverticulosis, obstruction, resection of polyps with a size >1 cm in the right colon, and other therapeutic procedures^[19,20]. In our study, the overall perforation rate was 0.12%, the perforation rate for diagnostic procedures was 0.084%, and the perforation rate for therapeutic procedures was 0.036%.

Clinical diagnosis depends on the size of the perforation, segment of the perforated colon, development mechanism of perforation, peritoneal contamination, underlying colon pathology, and clinical condition of the patient. At the time of perforation, the endoscopist can see mesenteric vascular formations, submucosal adipose tissue, or other colon segments. Sudden-onset pain and failure to achieve adequate distention in the lumen despite ventilation with colonoscopy may be suggestive of perforation. When patients are suspected of having perforation, immediate erect direct abdominal X-ray or abdominal X-ray in the left lateral decubitus position, and chest graphy should

be obtained, and subdiaphragmatic air, retroperitoneal air, pneumomediastinum, pneumothorax, or subcutaneous emphysema should be investigated. If the suspicion of perforation is strong and the X-rays are normal, water-soluble contrast-enhanced abdominal computed tomography (CT) should be performed. In our study, the diagnosis of perforation was made during the procedure when intestinal structures were visualized in seven patients and during the ward follow-up, when intraperitoneal free air was visualized on CT.

Retrospective studies with large patient series have stated that 20–24% of CP were noted during the procedure, 60–70% were noted within 24 h after the procedure, and the remaining 6–20% were noted more than 24 h after the procedure. Most of the perforations detected after 24 h are perforations that develop after therapeutic colonoscopy^[11,12]. In our study, three diagnoses of perforation were made during the procedure in seven patients and in the first 4 h after the procedure in three patients. Conservative treatment was not deemed appropriate for any patient. This may be due to the preference of physicians and the fact that patients had advanced age.

Conservative approach consists of bed rest, discontinuation of oral intake, broad-spectrum antibiotic therapy, erect direct abdominal X-ray and/or abdominal CT, and close follow-up. It is recommended to have surgical consultation from the first moment when perforation is detected and to follow up the patient together with general surgery. Conservative treatment can be used for perforations developing after therapeutic colonoscopy, small perforations, those with

no evidence of peritonitis, no underlying morbidity such as cancer, stricture, and inflammatory bowel disease, patients whose bowel cleaning is well done, stable patients without findings of peritonitis, and patients who do not have colonic stricture or morbidities such as colon cancer^[21,22]. In our study, all patients were consulted with general surgery and a decision for emergency surgery was made.

Conventional endoscopic clip and over-the-scope clip (OTSC) can be used for closing the perforation site in eligible patients. Conventional endoclips can only cover the mucosal layer in cases of CP. With the OTSC clip system, the closure that will provide tissue approximation in accordance with surgical principles can be provided at least from the sub-mucosal layer (preferably full thickness). Endoscopic treatment can be used for patients with good bowel cleaning, perforations detected during diagnostic and therapeutic colonoscopy, stable patients without peritonitis findings, and patients without colon strictures or colon cancer-like diseases^[23,24]. The closure with the endoscopic clip method is more successful in perforations smaller than 1 cm^[25]. Endoscopic clips and OTSC were not used on any of our patients due to technical impossibility and lack of experience.

Surgical treatment of CPs should be performed on patients diagnosed with early perforation, for large perforations developing after diagnostic colonoscopy, on patients with peritonitis findings, patients whose general conditions have deteriorated on conservative treatment, patients with stenosis in the distal part of the perforation, patients on whom endoscopic clips cannot be used, and patients with contrast material leak on abdominal tomography after endoscopic clip procedure. Surgical treatment options can vary depending on the patient's clinical picture, diameter of the perforation, underlying colon pathology, degree of intestinal cleanness, the time from perforation to diagnosis, and surgeon's preference. Primary repair or bowel resection is used as a treatment option. In our study, early emergency laparotomy was performed on all patients; primary repair was performed on six patients, segmental resection+end-to-end anastomosis was performed on three patients, and multiple surgical procedures were performed on one patient.

Conclusion

Although the incidence of colonoscopic perforation is observed low, it causes serious morbidity and mortality when it develops. Colonoscopic perforation treatment varies depending on the underlying diseases, development mechanism of the perforation, treatment method to be used, and

experience of the treating physicians. Particular attention should be paid during therapeutic colonoscopy, especially in elderly patients and/or in patients with comorbidity. Patients and their relatives should be informed in detail about possible complications before colonoscopy. Although there is no gold standard treatment, we believe that the diagnosis should be made as early as possible and appropriate treatment should be performed without delay.

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