啓明醫大學術誌 第29券 1號
Keimyung Med J
Vol. 29, No. 1, June, 2010

A Comparative Analysis of Treatment Methods for Colonic Perforation During Colonoscopy

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Abstract

Background/Aims: Successful managmemnt of colonoscopic perforation by nonoperative treatment has been reported but its management remains controversial. We compared operative and nonoperative managements and aimed to assess the prognostic factors and mortality due to colonoscopic perforations.

Methods: A large-scale, multicenter, retrospective analysis was conducted in the five tertiary hospitals in Daegu, Korea.

Results: Thirty-nine cases of colon perforations occurred out of 70,659 colonoscopic procedures in the five institutions and the overall incidence was 0.06%. Additional five cases were referred from primary practitioners. They were managed with (n=18) or without (n=16) surgical intervention. There were no statistically significant differences in age, sex, hospital stay and mortality rate between the two groups. Overall three cases of death occurred; one case (5.6%) in the operative group and two (7.7%) in the nonoperative group, but no statistically significant difference in mortality rate was observed (p=1.000). The status of completeness of bowel preparation was important factor for preventing patient mortality (p=0.001).

Conclusion: Colonic perforation during the colonoscopy can be successfully treated with either operative or nonoperative management in patients with adequate bowel preparation.

Key Words : Colonoscopic perforation

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Introduction

Colonoscopy is a basic procedure of the colon cancer screening. It has been reported that colonoscopic screening and polypectomy have substantially reduced the incidence of colorectal cancer [1, 2].

Colonoscopy is generally considered a safe procedure. The reported incidence of colonoscopic perforation was from 0.01 to 0.9% [3-6], it can lead to serious outcomes. Because of increasing use of colonoscopy, the number of case of colonoscopic perforation is likely to be increasing [6]. It remains controversial which procedure, operative or nonoperative method, can be proper treatment option for colonoscopic perforation.

Materials and Methods

Patients and data collection

We conducted a multicenter, retrospective study to evaluate the mortality and prognostic factors and compare the operative and nonoperative managements in treating colonoscopic perforations. We reviewed medical records of 44 colonoscopic perforation patients at five tertiary medical centers in Daegu, Korea between January 2000 and August 2006. Colonoscopic perforation was defined as 1) the observation of a macroscopic appearance of the perforation during colonoscopy or subsequent laparotomy, 2) presence of free or retroperitoneal air and/or fluid on plain radiography or computed tomography. We reviewed the medical records and analyzed the clinical data such as indication of colonoscopy, degree of difficulty related colonoscopic procedure, cause of perforation, location, the elapsed time between perforation and diagnosis, perforation size, experience of the colonoscopist, comorbid disease, the quality of bowel preparation, history of abdominal or pelvic surgery, operative and nonoperative management, length of hospitalization, and morbidity and mortality. We estimated the size of the perforation with the colonoscopic photograph by comparing it to that of an endoclip (HX-600-135 L, Olympus, Tokyo, Japan) or transparent cap from ligation unit (about 10-15mm). The completeness of bowel preparation was determined by the colonoscopist. It was classified as "excellent (nearly clean bowel lumen)", "good (containing small amounts of air bubbles)", "fair (containing small amounts of yellowish liquid)", or "poor (containing liquid or solid fecal material)". The "excellent", "good" and "fair" assessments were categorized as "adequate" and "poor" status was categorized as "inadequate". We evaluated several factors affected the morbidity and mortality of the patients and analyzed the outcomes between the operative and nonoperative groups.

Statistical analysis

Mortality was analyzed according to various risk factors, including comorbid disease, quality of bowel preparation, history of abdominal surgery, etiology and size of the perforation, and method of management. Chi-square tests were used a p-value <0.05 was deemed to be statistically significant.

Results

43 cases of colonoscopic perforation were reviewed. Of 43 cases, 27 were male and 17 were female. The mean age was 62.5 years. Eleven had a history of abdominal or pelvic surgery and thirty-four had comorbid diseases (Table 1).

Thirty-nine cases out of 70,659 colonoscopic procedures were performed at the five tertiary institutions and five cases were referred from primary practitioners. The incidence of perforation varied between 0.01 and 0.15%, according to the institution and the overall incidence was 0.06% (Table 2). The incidence of perforation was relatively higher in hospital A, because endoscopic submucosal dissections (ESD) were more frequently performed in hospital A.

Table 1. Demographic characteristics of patients with perforations (n=44)

Characteristic	Data
Number of perforations	44
Age, years, mean (range)	62.5 (32 ~ 86)
Gender (male:female)	27:17
Previous abdominal or pelvic surgery	11
Comorbid disease	34

The perforation site was listed in Table 3. Sigmoid colon was the most frequent site of perforation (26/44, 59.1%). However, there was no statistical significance of perforation site between two groups, sigmoid Vs. non-sigmoid colon (p=0.2278).

Causes and the size of perforations

The sizes of perforations were variable. Less than 10 mm sized perforation occurred in thirty patients (68%) and those larger than 10 mm were found in eleven patients (18%). Three cases of perforation were not identified the size, diagnosed by imaging studies alone (7%). Twenty-one (48%) perforations occurred during diagnostic examinations and twenty-three (52%) during therapeutic procedures (9 polypectomies, 14 ESD) (Table 2).

Table 2. Details of procedures and perforations in each of the five tertiary hospitals and primary practitioners

Hospital	No. of Colonoscopy	No. of Perforation	Cause of Perforation (diagnostic/therapeutic)	Incidence (%)
A	12,981	20	7/13 (polypectomy 3, ESD* 10)	0.15
B	15,332	5	3/2 (polypectomy 2)	0.03
C	7,843	5	4/1 (polypectomy 1)	0.06
D	19,705	2	1/1 (polypectomy 1)	0.01
E	14,798	7	3/4 (ESD 4)	0.05
Subtotal	70,659	39	18/21 (polypectomy 7, ESD 14)	0.06
Referred case	unknown	5	3/2 (Polypectomy 2)	
Total		44	21/23 (polypectomy 9, ESD 14)	

* ESD: endoscopic submucosal dissection

Table 3. Site of perforation

Site	N (%)
Sigmoid colon	26 (59.1)
Ascending colon	6 (13.6)
Transverse colon	5 (11.4)
Hepatic flexure	3 (6.8)
Descending colon	2 (4.5)
Splenic flexure	1 (2.3)
Cecum	1 (2.3)

Clinical presentation

Forty patients (91%) presented with abdominal pain/distension. Thirty-one patients (70%) underwent abdominal CT scans: five had retroperitoneal free air, twenty-three had intraperitoneal free air. Twenty-nine cases (66%) of perforation were recognized at the time of colonoscopy. Additional thirteen cases (29%) were diagnosed within 24 hours and two patients (5%) were diagnosed 24 hours after colonoscopy.

Operative versus nonoperative management

Eighteen patients (41%) were treated with surgical intervention, such as primary closure with/without colostomy or resection with anastomosis; eleven patients underwent open surgery and seven received laparoscopic surgery. Twenty-six (59%) patients were managed nonoperatively; five patients with bowel rest only, systemic antibiotics and 21 patients with additional endoscopic repair using endoclips. Among them, the number of endoclips were identified only in eighteen patients. Median number of used endoclips was 4.5 (1-11). Six patients (14%) underwent endoscopic repair initially and then surgery. No significant difference was observed between the operative and nonoperative groups in terms of gender, age, completeness of bowel preparation, size of the perforation, elapsed time after perforation and type of the procedure (Table 4). The mean length of hospital stay in the operative management group was longer than in the nonoperative arm, there was no statistically significant difference (9.6 versus 14.3 days, p=0.065). Mortality was similar between two groups (2/26 vs.1/18, p=0.482).

Status of bowel preparation

Thirty-nine patients (89%) had adequate bowel preparation status (excellent, good, fair), and no death occurred. However, in the five (11%) with inadequate bowel preparation (poor), three cases of deaths took place. Thus, mortality was related to the quality of bowel preparation (adequate 0/39; inadequate 3/5, p=0.001) (Table 5).

Deaths

Of 44 cases of perforation, three deaths (6.8%) occurred. The first death took place in an 80-year-old male with previous abdominal surgery, but no comorbid disease. During the cancer screening colonoscopy, a perforation was detected at the transverse colon. Even with immediate laparoscopic surgery, he died 3 days later due to sepsis. The second death occurred in a 76-year-old female with hypertension and chronic renal failure, who was taking clopidogrel for cerebral infarction. She underwent a diagnostic colonoscopy because of diarrhea. The perforation was found at a wide-based diverticulum at the rectosigmoid junction during the procedure. An endoscopic repair

Table 4. Operative versus nonoperative management of colonoscopic perforation

Management		Nonoperative (n=26)	Operative (n=18)	*p*-value
Gender	Male	17	10	0.545
	Female	9	8	
Age (years)	< 60	9	8	0.480
	> 60	17	10	
Comorbidity	None	4	6	0.273
	Present	22	12	
Bowel preparation	Adequate	23	16	1.000
	Inadequate	3	2	
Size	< 10 mm	20	10	
	≥10 mm	4	7	0.209
	Unknown	2	1	
Detection time	< 24 hours	25	17	1.000
	≥24 hours	1	1	
Type of procedure	Diagnostic	11	10	0.541
	Therapeutic	15	8	
Length of hospitalization (mean, days)		9.7	14.3	0.065
Mortality	Alive	9	9	1.000
	Dead	2	1	

using clip was performed. She refused operative management and died after 10 days. The third death occurred in a 58-year-old female with adult respiratory distress syndrome. The colonoscopy was undertaken for hematochezia and the perforation was found at an ulcer in transverse colon. She was treated nonoperatively and died 2 days later.

Discussion

The incidence of iatrogenic perforation during colonoscopy ranges from 0.02 to 0.19% [3,4,7-9], and reported mortality has been very variable, from 0 to 8.3% [3,4,7,9,10]. In our study, the incidence of perforation from each tertiary hospital was 0.01-0.15%, the overall incidence was 0.06%, and the overall mortality was 6.8%.

Factors predispose to colonoscopic perforation include colonoscopist experience, diverticuli, loss of mobility of the colon due to cancer, radiation or previous abdominal surgery and etc [4,6,11,12].

We found 26 cases of perforation at the sigmoid colon or the junction of the sigmoid colon and descending colon. In this and previous reports, the most frequent site of perforation was the sigmoid colon because it is a difficult area to deal with and is the commonest site for polypectomy [3,9,13].

Table 5. Clinical characteristics of the patients with colonoscopic perforation

Factors	N (death)	*p*-value
Combined disease		
present	34 (2)	0.548
absent	10 (1)	
Concurrent medication		
present	25 (2)	0.604
absent	19 (1)	
Quality of bowel preparation		
adequate	39 (0)	0.001
inadequate	5 (3)	
Previous abdominal or pelvic surgery	11 (1)	1.000
present	33 (2)	
absent		
Type of procedure	21 (3)	1.000
diagnostic	23 (0)	
therapeutic		
Diagnosis of perforation following procedure		
Within 24 hours	22 (95.5%)	1.000
After 24 hours	2 (4.5%)	
Size of perforation		
< 10 mm	30 (68%)	0.220
≥10 mm	11 (18%)	
Unknown	3 (7%)	
Treatment		
Nonoperative	26 (2)	1.000
Operative	18 (1)	

In most cases, the perforation was detected during the colonoscopy. It has been reported that early recognition of perforation is related to improved outcome [6]. For rapid recognition of colonoscopic perforation, the endoscopist should be alert to the occurrence of perforations, especially if great discomfort is indicated by the patient, air insufflation into the lumen is difficult to maintain or bloody fluid is seen in the lumen upon withdrawal of the endoscope [13,14]. Abdominal pain or distention after colonoscopy should not be ignored; furthermore, such complaints can be obscured in unconscious patients or deeply premedicated patients. Thus careful physical examination and radiographic evaluation should be considered in patients with continuous abdominal pain or distension after

colonoscopy.

In the literature, it has been hypothesized that perforations from diagnostic colonoscopies usually result in large defects, requiring immediate surgical management, while those from therapeutic colonoscopies frequently result in smaller defects and nonsurgical treatment can be attempted [15,16]. However, there are two important changes in colonoscopic procedure. First, the number of ESD has increased. So, even a therapeutic colonoscopy can cause a large perforation. In this study, perforations larger than 10mm in size were found in 11 cases and four of them occurred in ESD; four of the eleven cases were managed nonoperatively. Second change is the improvement of endoscopic devices. Endoscopic repair of perforations using clipping was introduced in 1997 [17,18], and it has two advantages; First, it can minimize the amount of peritoneal soilage immediately and second, it can help us to detect the site of perforation.

It has been reported that poor prognostic factors are delayed recognition of the perforation, extensive peritoneal contamination, patients using anticoagulation drugs, past history of medical disease, and the size of the perforation[3,13]. In our experience, the overall mortality rate was 6.8% and the most significant prognostic factor was the completeness of bowel preparation (p=0.001). Other factors, such as surgical or nonsurgical management, were not statistically significant prognostic factors. The adequacy of bowel preparation seemed to be associated with the degree of peritoneal contamination.

The choice of treatment for colonoscopic perforation seems to depend on various factors such as the mechanism and size of the lesion, adequacy of the bowel preparation, underlying pathologic process, general health of the patient, degree of peritonitis, and the elapsed time between perforation and recognition [10,15,19]. It has been argued that the size of perforation is larger during diagnostic colonoscopy than during therapeutic colonoscopy. Therefore, it has been justified that operative management is appropriate for diagnostic colonoscopy-related perforation and nonoperative management for therapeutic colonoscopy-related perforation [8,15]. In our experience, 11 patients out of 21 diagnostic procedure-related perforations were managed nonoperatively and two deaths occurred. No statistically significant difference was detected (p=1.000) (Table 5). Overall, 18 patients underwent operative management, while 26 were managed nonoperatively. In the operative group, the median hospital stay was longer than in the nonoperative group, but the difference was not statistically significant (p=0.065). In this study, operative or nonoperative management had no significant difference on mortality rate (7.7 versus 5.56%, p=1.000).

Because this is a retrospective multicenter study, there are some limitations. (1) The incidence of perforation was relatively higher in hospital A, because ESD was more frequently performed in hospital A. (2) There was no standard for decision-making about operative or nonoperative management of the perforations. (3) We cannot know the overall numbers of the diagnostic or therapeutic colonoscopies and the numbers of colonoscopies by less experienced or more experienced colonoscopists.

Conclusion

The clinician should note that adequate bowel preparation may be closely related with mortality. Even an experienced endoscopist can cause colonic perforations during diagnostic procedures. No prognostic difference was identified between operative and nonoperative management.

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