

Original Article

# Incidence and Management of Iatrogenic Colonoscopic Perforations

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## Key Words

Colonoscopy;  
Perforation;  
Complication;  
Iatrogenic

**Purpose.** Although the incidence of iatrogenic colonoscopic perforation is low, it can result in severe complications and mortality. This study assessed the incidence and management of colonic perforations during an eleven year period at a medical center in southern Taiwan.

**Materials and Methods.** We reviewed all the medical records of patients receiving colonoscopies from January 1998 to June 2008. We collected the patient's demographic data, colonoscopic reports, and data regarding the location of perforations, their treatment and outcome.

**Results.** During the 11-year period, out of a total of 13442 colonoscopies, 17 cases (0.13%) involved colonoscopic perforations (15 men, 2 women). Of the 17 perforations, 11 (65%) occurred in the sigmoid colon. Eight (47%) of perforations were treated surgically and nine (53%) medically with intestinal rest and intravenous antibiotics. In the medically treated group, one patient failed conservative treatment and required surgical intervention. That patient underwent repair with proximal diversion. In the group treated surgically, four patients received primary repair with proximal diversion, two received colonic diversion, one resection with anastomosis, and one resection with end colostomy. One patient died from nosocomial pneumonia.

**Conclusion.** Iatrogenic colonoscopic perforation is a serious but rare complication. Its early recognition and treatment are essential. We found a perforation rate of 0.13%. Some patients with colonoscopic perforations may be safely treated nonoperatively, while others with large perforation or diffuse peritonitis may require surgery.

[J Soc Colon Rectal Surgeon (Taiwan) 2010;21:53-58]

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Colonoscopy is a common procedure for the diagnosis, treatment and follow-up of colorectal pathologies. However, this invasive procedure is performed with some risk of hemorrhage, perforation and even death.<sup>1,2</sup> The incidence of perforation is reported to range between 0.2% to 0.8% for diagnostic colonoscopy and from 0.15% to 3% for therapeutic colonoscopy.<sup>1,3-5</sup> With increasing numbers of colonoscopies being performed for screening purposes, this small

possibility of perforations can lead to a large number of clinical problems. Colonoscopic perforations may be managed medically or surgically, depending on the nature of the perforation. Knowing risk factors, recognizing early signs of perforations, and giving early and optimal treatment may reduce the probability of complications and death.<sup>6</sup> In this study, we report our experience with 17 consecutive colonoscopic perforations over an 11-year period.

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Received: June 2, 2009.

Accepted: October 26, 2009.

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## Patients and Methods

A total of 13442 colonoscopies were performed between January 1998 and June 2008 at Kaohsiung Veterans General Hospital, including 7840 diagnostic colonoscopies and 5602 therapeutic colonoscopies. All procedures were performed by colorectal surgery doctors. Data on patients undergoing colonoscopy were collected into a clinical database. The data we collected included demographic patient information and detailed colonoscopic reports. We reviewed the medical records of all patients reported to have colonoscopy-related colonic perforations. The following parameters were analyzed: patient age and sex, comorbidity, endoscopic indication, time interval from the procedure to the diagnosis of perforation, clinical presentation, location, type of treatment (operative vs. nonoperative), and outcome. Data regarding clinical characteristics, management, and outcome were analyzed descriptively.

## Results

Over the 11-year period (1998-2008), out of 13442 colonoscopies, we found 17 perforations (0.13%) in 15 men and 2 women (mean age of 63 years, range 36-83). The co-morbidities in each of the 17 patients appeared

in Table 1. Of these 17 patients, nine received endoscopies for polyps, three for diverticulosis/itis, four for health examinations, and one for lower gastrointestinal bleeding (Table 2). Five of perforations occurred during diagnostic procedures, and twelve during therapeutic procedures (11 polypectomies and 1 biopsy) performed during colonoscopies. The perforation rate for diagnostic procedure and therapeutic procedure were 0.06% and 0.21%, respectively.

Seven perforations (41%) were identified during the examination or immediately thereafter, 9 (53%) within the first 24 hours, and 1 (6%) within 72 hours. In the last case, the patient was not alert enough and delayed to our hospital. The signs and symptoms at presentation included abdominal pain and distension, nausea, bleeding and fever (Table 3). Abdominal pain was the most common presenting symptom (76.5%). Plain abdominal x-ray showed pneumoperitoneum in 13 patients and retro-pneumoperitoneum in 3 patients. There was no evidence of free air on the initial film in

**Table 2. Indications for procedures in patients with colon perforations**

Indications	Numbers of Patients [n = 17]
Polyps	9
Diverticulosis/itis	3
Health examination	4
Lower GI bleeding	1

**Table 1. Co-morbidities of patients with perforations during colonoscopy**

Patient	Gender	Age	Hyper-tension	DM	COPD	Prior Abdominal Surgery	Hospital Stay (Days)	Mortality
1	M	66	●				9	
2	M	83	●		●		20	
3	F	79	●				9	
4	M	54					22	
5	M	81		●	●		46	●
6	F	60	●				16	
7	M	67	●	●			87	
8	M	51					15	
9	M	75	●				10	
10	M	64	●				9	
11	M	49					39	
12	M	79	●				4	
13	M	51					5	
14	M	51					7	
15	M	47					3	
16	M	36					5	
17	M	71	●				7	

M = Male. F = Female. DM = Diabetes Mellitus. COPD = Chronic Obstructive Pulmonary Disease

**Table 3. Clinical presentation in 17 patients with iatrogenic colonic perforation**

Symptom	Number of Patients (%)
Abdominal pain	13 (76.5)
Abdominal distension	10 (58.8)
Bleeding	4 (23.5)
Fever	3 (17.6)
Nausea/vomiting	2 (11.8)
Respiratory distress	1 (5.9)

one patient, but subsequently intraperitoneal air was detected as the clinical condition worsened. The most frequent site of perforation was the rectosigmoid region. (Table 4).

Nine of 17 patients (53%) were initially treated nonoperatively with intravenous antibiotics and intestinal rest. These patients were afebrile ( $\leq 37.5$  °C) and had localized abdominal tenderness. Three had received diagnostic procedures, and six received therapeutic procedures. The medical treatment for one patient who had received diagnostic colonoscopy failed, so he received further surgical intervention. After one week the patient had received medical treatment for his perforation, he developed diffuse peritonitis and increased leukocytosis. The patient underwent primary repair with proximal diversion. Eight of the 17 patients (47%) received surgical interventions as primary treatment of their perforations. Procedures included primary repair with proximal diversion in four patients, colonic diversion in two, resection with anastomosis in one, and resection with end colostomy in one.

There was one complication (treatment failure) in nine patients whose perforations were treated nonoperatively. Four (50%) of the 8 patients whose perforations were initially treated with surgery had postoperative complications including superficial wound infection ( $n = 1$ ), intra-abdominal abscess formation ( $n = 1$ ), prolonged ileus ( $n = 1$ ), and pneumonia ( $n = 1$ ).

**Table 4. Site of iatrogenic colonic perforation**

Site	Number of Patients [ $n = 17$ ] (%)
Rectosigmoid	11 (65)
Descending colon	3 (18)
Transverse colon	1 (6)
Ascending colon	2 (11)

There was one in-hospital death. That patient expired 2 weeks postsurgery due to nosocomial pneumonia. The mortality could be due to old age and co-morbidity of COPD. Those who received operative treatment had a mean length of stay of 27 days (median, 13 days; range 7-87 days) and those receiving medical treatment 11 days (median 9 days; range 5-46 days).

## Discussion

Perforation at the bowel wall is considered a major complication of colonoscopy.<sup>1,2</sup> Perforation risk is reported to range from 0.2% to 0.8% for diagnostic colonoscopy and from 0.15% to 3% for therapeutic colonoscopy.<sup>1,3-5</sup> Our data is 0.06% for diagnostic procedure and 0.21% for therapeutic procedures. These risk figures most likely are lower than estimates because they are based on documentation, which is sometimes less than precise. Factors thought to predispose to perforation during colonoscopy include inflammatory bowel disease, steroid use, malignancy, and preexisting partial tears or necrosis. Furthermore, loss of mobility of the colon or rectosigmoid due to previous surgery, infection, radiation, or adhesions may result in acute angulation of the bowel and increase the difficulty of colonoscopy procedure, which would also increase the possibility of perforation.<sup>9</sup>

Perforations during diagnostic colonoscopy result from a wide variety of procedures. Forceful instrument insertion and the "slide-by" technique in which the colonoscope is advanced along the mucosal surface without visualizing the bowel lumen can cause perforations.<sup>10,11</sup> Mechanical injuries can also occur by direct injury caused by the colonoscopic tip, such as inadvertent advancement of the tip through a diverticulum.<sup>12</sup> Barotrauma is another important factor associated with perforation during diagnostic colonoscopy. Excessive insufflation of the colon results in linear tears of the serosa that may progress to a full-thickness perforation.

Perforations during therapeutic colonoscopy may occur from similar mechanisms involved in diagnostic procedures as well as from thermal or electrical injury. Electrocautery, a coagulation technique, creates transmural injury when too much current is used.<sup>13</sup>

Typically, the perforations from thermal energy are small and are rapidly sealed by pericolonic fat or omentum. Postpolypectomy coagulation syndrome has been described as a transmural, thermal injury to colon wall without a definite perforation.

We found the most frequent site of perforation to be the sigmoid colon, as have other studies.<sup>7,14,15</sup> This may be explained by its anatomical characteristics, which may involve frequent redundancy or narrowing from diverticular disease or adhesions after previous pelvic operations.<sup>11</sup>

The signs and symptoms of perforation include abdominal pain, distension, nausea, fever, tachycardia, respiratory distress, and diffuse peritonitis. Similar to the findings of Farley and associates, we found abdominal pain and distension to be the most common presentation after colonoscopic perforation.<sup>14</sup> Radiographs were helpful adjuncts for identification of the perforation. An abdominal radiograph demonstrating free intraperitoneal air is a very good indicator of perforation. If the plain radiograph does not indicate pneumoperitoneum, a CT scan may demonstrate retroperitoneal air. With CT scan, one also has the ability to detect bowel wall thickening, unexplained peritoneal fluid, and extravasation of contrast. Thus, CT scan is a reasonable aid to clinical diagnosis.<sup>11</sup>

Colonoscopic perforations may be managed operatively or nonoperatively. Several large series have reported that many patients with perforations may be treated successfully without operations (Table 5). Conservative treatment includes bowel rest, intravenous fluids, and antibiotics to limit peritonitis and allow the perforation to seal. The indications for nonoperative treatment contain a well-prepared colon at

time of endoscopy, postpolypectomy coagulation syndrome, small perforation caused by transmural burn injury, no symptoms of diffuse peritonitis and relief of symptoms under conservative treatment within 24 hours without pain medication.<sup>18</sup> If there is no resolution of symptoms and signs, surgical intervention is warranted. The recognition of definite objective indicators of failure of conservative management requires experience, judgment, and close observation.

We choose conservative treatment initially for patients in colonoscopic perforation in recent 5 years (from 2004 to 2008). In medically treated group (nine patients), 8 were in this period interval. Seven patients treated successfully but one failed and then received further surgical intervention. The perforation size and location of this case was about 1cm at sigmoid colon (by operative finding). So the failed case might be due to large size of perforation. We select conservative treatment as first choice because of experience accumulated and review of related articles.

The mean length of stay was shorter in conservative treatment group. It could be owing to lighter clinical severity in this group. However, there were no significant differences in the mean length of stay and mortality rate between medical treatment group and surgical treatment group. It might be due to limited case numbers of both groups (9 cases in medical treatment group and 8 cases in surgical treatment group).

Operative treatment is most often necessary in patients with generalized peritonitis, large injuries, or failed conservative treatment.<sup>11</sup> The specific operative procedures used will depend on the size of perforation, the degree of peritoneal soilage, the presence of associated colonic pathology, the stability of the pa-

**Table 5. Reported colonoscopic perforation rates and management**

Author (Year)	No. of Colonoscopies	No. of Perforation (%)	Operative Management (% mortality)	Nonoperative Management (% mortality)
Anderson <i>et al</i> <sup>16</sup> (2000)	10486	20 (0.19)	19 (5)	1 (100)
Farley <i>et al</i> <sup>14</sup> (1997)	57028	45 (0.075)	42 (0)	3 (0)
Christie <i>et al</i> <sup>17</sup> (1991)	4784	7 (0.15)	2 (0)	5 (0)
Hall <i>et al</i> <sup>15</sup> (1991)	17500	15 (0.09)	14 (0)	1 (0)
Jentschura <i>et al</i> <sup>18</sup> (1994)	29695	31 (0.1)	24 (8.3)	7 (0)
Lo <i>et al</i> <sup>19</sup> (1994)	26708	12 (0.04)	6 (16)	6 (0)
Dafnis <i>et al</i> <sup>20</sup> (2001)	6066	8 (0.1)	8 (0)	0 (0)
Tulchinsky <i>et al</i> <sup>21</sup> (2006)	12067	7 (0.058)	6 (0)	1 (0)
Current study (2009)	13442	17 (0.13)	8 (12.5)	9 (0)

tient and the overall underlying condition of the patient.<sup>14,18,19</sup> Primary repair of the colon is reserved for limited injury with no coexisting pathology. Surgical resection with primary anastomosis should be attempted if abdominal contamination or concomitant pathology is present. Bowel resection and colostomy are used in patients with extensive fecal contamination, operative delay, and multiple comorbidities. Finally, if there is significant peritoneal soilage or if patient's operative course is tenuous, a colectomy without anastomosis should be performed.<sup>11</sup>

## Conclusion

Although iatrogenic colonoscopic perforation is rare, it is a serious complication and its early recognition and treatment are essential. The sigmoid colon is the area at greatest risk for perforation. Although some colonoscopic perforations may be treated safely nonoperatively, they require constant observation. Surgery should be undertaken if the patient does not improve. For patients with large perforations or diffuse peritonitis, surgery is indicated.

## References

1. Rogers BH, Silvis SE, Nebel OT, Sugawa C, Mandelstam P. Complications of flexible fiberoptic colonoscopy and polypectomy. *Gastrointest Endosc* 1975;22:73-7.
2. Smith LE. Fiberoptic colonoscopy: complications of colonoscopy and polypectomy. *Dis Colon Rectum* 1976;19:407-12.
3. Shahmir M, Schuman BM. Complications of fiberoptic endoscopy. *Gastrointest Endosc* 1980;26:86-91.
4. Muhldorfer SM, Kekos G, Hahn EG, Ell C. Complications of therapeutic gastrointestinal endoscopy. *Endoscopy* 1992;24:276-83.
5. Wullstien CH, Köppen MO, Gross E. Laparoscopic treatment of colonic perforations related to colonoscopy. *Surg Endosc* 1999;13:484-7.
6. Lüning TH, Keemers-Gels ME, Barendregt WB. Colonoscopic perforations: a review of 30366 patients. *Surg Endosc* 2007;21:994-7.
7. Garbay JR, Suc B, Rotman N, Fournanier G, Escat J. Multicentre study of surgical complications of colonoscopy. *Br J Surg* 1996;83:42-4.
8. Gatto NM, Frucht H, Sundararajan V, Jacobson JS, Grann VR, Neugut AI. Risk of perforation after colonoscopy and sigmoidoscopy: a population-based study. *J Natl Cancer Inst* 2003;95:230-6.
9. Gelfand DW. Complications of gastrointestinal radiologic procedures: complications of routine fluoroscopic studies. *Gastrointest Radial* 1980;5:293-315.
10. Waye JD. Colonoscopy: a clinical review. *Mt Sinai J Med* 1975;42:1-34.
11. Damore LJ II, Rantis PC, Vemava AM III, Longo WE. Colonoscopic perforations: etiology, diagnosis, and management. *Dis Colon Rectum* 1996;39:1308-14.
12. Williams CB, Lane RH, Sakai Y. Colonoscopy. *Gut* 1973;14:990-1003.
13. Ghazi A, Grossman M. Complications of colonoscopy and polypectomy. *Surg Clin North Am* 1982;62:889-96.
14. Farley DR, Bannon MP, Zietlow SP, Pemberton JH, Ilstrup DM, Larson DR. Management of colonoscopic perforations. *Mayo Clin Proc* 1997;72:729-33.
15. Hall C, Dorricott NJ, Donovan IA, Neoptolemos JP. Colon perforation during colonoscopy: surgical versus conservative management. *Br J Surg* 1991;78:542-4.
16. Anderson ML, Pasha TM, Leighton JA. Endoscopic perforation of the colon: lessons from a 10-year study. *Am J Gastroenterol* 2000;95:3418-22.
17. Christie JP, Marrazzo J III. "Mini-perforation" of the colon - not all postpolypectomy perforations require laparotomy. *Dis Colon Rectum* 1991;34:132-5.
18. Jentschura D, Raute M, Winter J, Henkel T, Kraus M, Mane-gold BC. Complications in endoscopy of the lower gastrointestinal tract. Therapy and prognosis. *Surg Endosc* 1994;8:672-6.
19. Lo AY, Beaton HL. Selective management of colonoscopic perforations. *J Am Coll Surg* 1994;179:333-7.
20. Dafnis G, Ekbohm A, Pahlman L, Blomqvist P. Complications of diagnostic and therapeutic colonoscopy within a defined population in Sweden. *Gastrointest Endosc* 2001;54:302-9.
21. Tulchinsky H, Madhala-Givon O, Wasserberg N, Lelcuk S, Niv Y. Incidence and management of colonoscopic perforations: 8 years' experience. *World J Gastroenterol* 2006;12:4211-3.

原 著

## 大腸鏡造成之醫源性大腸破裂的 發生率及處理

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**目的** 雖然大腸鏡造成醫源性大腸破裂的機率不高，但有可能會引起嚴重的併發症，甚至導致病人死亡。本篇研究在於討論本院大腸鏡造成大腸破裂的發生率及處理之相關經驗。

**方法** 此篇是回溯性的研究文章。收集本院從 1998 年 1 月至 2008 年 12 月發生大腸鏡造成大腸破裂的病人數共 17 人；分析病人相關基本資料、造成大腸破裂的原因、處置及預後。

**結果** 從 1998 年 1 月至 2008 年 12 月本院為 13442 位患者執行大腸鏡檢查或治療。總共有 17 位病患發生大腸破裂，發生率為 0.13%。9 位病人是給予保守性治療，包括禁食、靜脈輸液給予及抗生素治療；其中 1 位患者術後於住院期間因院內感染而導致死亡。破裂位置最常見是在乙狀結腸。

**結論** 大腸鏡造成之醫源性大腸破裂是少見但相對嚴重的併發症，早期發現及治療對於病人的預後相當重要。保守性治療適用於經過審慎篩選的病患。對於那些破洞比較大、生命徵象相對不穩定或是已有廣泛性腹膜炎的病人，手術治療是比較合適的。

**關鍵詞** 併發症、大腸鏡、醫源性大腸破裂。