

## Iatrogenic Perforations during Colonoscopy\*

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### Rezumat

#### *Perforațiile colonice iatrogene în timpul colonoscopiei*

În literatura medicală incidența perforațiilor iatrogene ale colonului este apreciată la valori cuprinse între 0,005 și 0,63%, majoritatea cazurilor necesitând rezolvare pe cale chirurgicală, prin laparotomie. Perforațiile în timpul colonoscopiei se pot produce printr-unul dintre următoarele mecanisme: acțiune mecanică a endoscopului, presiune crescută de insuflație, rezecție endoscopică involuntară sau ca o consecință a unei leziuni termice. Experiența noastră cuprinde 1953 colonoscopii, efectuate de către trei chirurghi, într-o perioadă de cinci ani, între 2008 și 2012. În acest interval au survenit patru perforații, ceea ce corespunde unei incidențe de 0,2%. Niciuna dintre aceste patru colonoscopii nu a fost terapeutică. Dintre cele patru leziuni, două au fost recunoscute în timpul procedurii, iar celelalte două - după 24 de ore. La toți pacienții s-a intervenit chirurgical, prin laparotomie; în trei cazuri s-au efectuat rezecții ale segmentelor de colon perforat, urmate de anastomoză primară (un caz) sau colostomie terminală (două cazuri). La cel de-al patrulea pacient, cu peritonită generalizată, a fost considerată oportună sutura perforației, protejată de o colostomie laterală în amonte. Colostomiile au fost desființate după 6 luni, când s-a practicat reîncadrarea colonului în

tranzit. Nu am înregistrat complicații post-operatorii majore sau decese. Am identificat ca factori de risc probabili asociați perforațiilor: vârsta peste 75 de ani, sexul feminin, indicele de masă corporală scăzut, morbiditățile asociate și diverticuloza colonică.

**Cuvinte cheie:** perforație colonică, colonoscopie

### Abstract

The incidence of iatrogenic colonic perforations in the medical literature ranges between 0.005% and 0.63% with the majority of patients requiring laparotomy for repair. Colonoscopic perforation may occur due to several mechanisms: blunt trauma to the colonic wall, barotrauma from air insufflation, unintentional endoscopic resection or excessive thermal injury. Our clinical experience includes 1,953 colonoscopies, performed by three surgeons over the course of five years, between 2008 and 2012. During this period of time, four colonic perforations occurred, which corresponds to an incidence of 0.2%. None of these four colonoscopies included therapeutic procedures. Two of the four lesions were diagnosed during the procedure, while the other two were diagnosed after 24 hours. All patients needed a laparotomy for repair. Segmental colonic resections were performed in three cases, followed by a primary anastomosis (one case) or by a terminal colostomy (two cases). In the fourth patient, in whom a generalized peritonitis had developed, the suture of the perforation protected by a lateral colostomy was thought to be a safer solution. Colostomies were removed six months after the first operation. No major post-operative morbidity or mortality were recorded. Age over 75 years, female gender,

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lower BMI, associated comorbidities and diverticulitis were identified as possible risk factors associated with these injuries.

**Key words:** colonic perforation, colonoscopy

## Introduction

Over the last decades, colonoscopy has become the gold standard for the diagnosis of colo-rectal lesions. Today, it is a safe standard procedure, which is widely accepted and performed all over the world, by gastroenterologists as well as by surgeons. Its well-known advantages are: the direct view of the lesion, the possibility of taking tissue samples for histo-pathological exams and, last but not least, the minimal invasive approach to a large amount of colo-rectal lesions.

However, minimal as it may be, this technique is still an invasive one and the risk of iatrogenic lesions cannot be avoided. We hereby present our clinical experience, which includes almost 2,000 procedures and the few cases in which complications have occurred. We tried to analyse which patients have a higher risk of colonic perforations and which are the most indicated methods of preventing them.

## Patients and Methods

We have retrospectively analysed a series of 1,953 consecutive colonoscopies in patients admitted in the Surgical Clinic "Prof. I. Juvara" of the Clinical Hospital "Dr. I. Cantacuzino" from Bucharest over five years, between 2008 and 2012. These procedures have been performed by three surgeons, all of them board-certified in diagnostic and therapeutic endoscopy. A number of four colonic perforations have occurred, which constitutes an incidence of 0.2%. Each of the two surgeons having the largest experience was responsible for two perforations.

We believe it might be useful to briefly present the main features of each of these four clinical cases:

### *Case report 1*

A 72 year-old male patient suffered from constipation for an extended period of time (several years). He specifically denied any bleeding, diarrhea, presence of mucus, anemia or loss of body weight. One may notice, in the light of the outcome, that the indication of a colonoscopy in this case was not very well sustained. The procedure was performed without any apparent difficulty; few images of rectal and sigmoid diverticuli were noticed. However, 1 hour after the procedure the patient presented with severe abdominal pain in the lower quadrants; the symptoms decreased after conservative treatment with common analgesics and did not reappear over the next 24 hours. The clinical examination performed the day after the procedure showed no clinical sign of peritonitis; white blood cell count:

5,100 leukocytes/mm<sup>3</sup>. Still, abdominal ultrasonography identified accumulation of fluid within the peritoneal cavity, mainly in the pelvis and among the intestinal loops.

An emergency laparotomy was decided on. The intra-operative diagnosis was generalized peritonitis, caused by a 1/0.5 cm perforation of a diverticulum on the anterior wall of the sigmoid, just near the upper part of the rectum. We deemed that the safest technique was the suture of the perforation, protected by a lateral colostomy; drainage of the peritoneal cavity was associated. The lateral colostomy was removed after six months. Barotrauma from air insufflation was the pathogenic mechanism involved.

### *Case report 2*

An 82 year-old female patient, with cardiac and vascular comorbidities (NYHA III cardiac insufficiency, high blood pressure) presented with constipation, pain in the right iliac fossa, anemia and loss of body weight. The colonoscopy was unusually difficult and many parts of the colon were not visible during the intubation. Unexpectedly, the perforation became apparent, when intra-abdominal viscera (the liver and the gallbladder) were directly visible.

The laparotomy led to the diagnosis of a 2/1.5 cm perforation of the sigmoid colon; the surgical repair consisted of a segmental resection of the perforated loop, followed by an end-to-end anastomosis, with a favourable post-operative course. The perforation mechanism was represented by mechanical forces of the endoscope.

### *Case report 3*

A 72 year-old female patient was admitted for pain in the right iliac fossa and body weight loss. The intubation proved to be very difficult; while the endoscope was approaching the hepatic flexure of the colon, a perforation occurred and typical clinical signs of pneumoperitoneum were noticed. The accident was due to the mechanical forces of the endoscope. A laparotomy was immediately decided on and led to the identification of a large (4/3 cm) perforation of the sigmoid loop, which was resected, followed by a temporary colostomy. The post-operative course was favourable, with the removal of the stoma after six months.

### *Case report 4*

A 75 year-old female patient complained of non-specific abdominal pain and diarrhea for several weeks before admission. The intubation was possible only up to the level of the splenic flexure and the findings were only moderate pallor and edema of the colonic mucosa. Unexpectedly, clinical and radiologic signs of peritonitis occurred 24 hours after the procedure; consequently, a laparotomy was performed. The transverse and sigmoid colon had multiple areas of segmental necrosis and about 15-20 diverticuli. The peritonitis was caused by three perforations, each of them 1 cm in size: two of them were located on the sigmoid colon and the third one- on the transverse colon. The surgical technique which permitted the resection of all the lesions was a left hemicolectomy, followed by a temporary colostomy. Histo-pathological

examination found non-specific inflammatory features. The pathogenic mechanism of the perforation seemed to be barotrauma from air insufflation, but the primary lesion remains unknown. Some possible explanations could be: several acute diverticulitis episodes, an idiopathic inflammatory bowel disease or chronic ischemia of the colonic mucosa. Post-operative course did not include any complications and the removal of the stoma was thus possible.

## Results

In the aforementioned four cases, no major post-operative complications or mortality occurred. Although our series of clinical cases is not very large (fortunately!), we were able to identify some of their characteristic features.

We noticed that all the perforations occurred in colonoscopies performed by experienced surgeons, who had completed more than 500 procedures at that time. Three of the four patients were female and all of them were older than 72. In patients over 70, in which a diverticular disease is known or even supposed, colonoscopies seem to have a higher risk of perforation. A barium enema may be a wiser choice for them.

The diagnosis of perforation was delayed in both cases in which barotrauma from air insufflation was involved. Consequently, we suggest that the patients in which colonoscopy was more difficult should be followed up for at least 24 hours, thus enabling an early diagnosis of a possible peritonitis.

## Discussion

The incidence of colonic perforation ranges from 0.005% to 0.63%, depending on the literature source (1-3). Increasing colonoscopy use has also elevated the total number of iatrogenic colon lesions. However, an encouraging finding is that a gradual decline in the incidence of colonic perforation has been noticed, which has reached a plateau in the last years (4). Still, differences in the incidence rates may possibly be attributed to the way the different studies have been conducted- some of them included older patients, with higher rate of complications (5,6).

Colonoscopic perforation may occur due to several mechanisms: blunt trauma to the colonic wall, barotrauma from air insufflation, unintentional endoscopic resection or excessive thermal injury. Both perforations from blunt trauma occurred in the rectosigmoid area, where such usually develop when the colonoscope is pushed without resolution of looping of the rectosigmoid colon (7).

A large amount of predictive or risk factors for colonic perforation have been analysed in different studies. It seems that the statistically significant factors associated with this complication are: age over 70, female gender, lower BMI, lower albumin level, ICU patients, inpatient setting as well as abdominal pain and Crohn's disease as indications for colonoscopy (4,8).

Most of the studies are in congruence and show that age greater than 65 years is a significant predictor for perforation

(3,9,10). Many of these patients have colonic diverticulosis and some of them have a history of multiple episodes of acute diverticulitis, which predispose to iatrogenic lesions (11). Female gender seems to be an independent predictive factor for perforation, as well (3,6).

Lower BMI is another statistically significant risk factor. Furthermore, it is a predictor for pain and difficult colonic intubation during colonoscopy. An explanation could be that these patients may have sharp angles of the sigmoid colon, which increase the likelihood of mechanical injury during colonoscopy (12).

Hypoalbuminemia is a well-documented marker of morbidity and is a strong predictor of mortality in elderly patients (13,14). Low albumin has been shown to be a predictor for failure to complete colonoscopy, apart from being associated with a higher risk for perforation. The poor health and nutritional status of these patients as well as the decreased tensile strength of the colonic wall may be the main involved pathogenic factors (4).

Among patient features, colonoscopies performed in inpatients and particularly the ICU setting seem to have substantially greater risk of perforation. Increased number of comorbidities is directly associated to this risk (5,10). The indication of the procedure is also important, as there is evidence that colonoscopies indicated for abdominal pain or Crohn's disease result in a higher incidence of colonic perforation.

A number of factors that were supposed to increase the risk of iatrogenic perforations proved to be non-involved in the pathogeny of these lesions. Firstly, no significant difference in the rate of perforation between colonoscopies performed by gastroenterologists or surgeons has been noticed, so we may conclude that colonoscopies performed by surgeons are safe, with low morbidity and mortality (15). Quite surprisingly, the performance of biopsy, polypectomy or other therapeutic procedures are not significant risk factors for perforation.

The diagnosis of perforation may be sometimes suggested during the procedure by an unexpected bleeding from the colonic wall, or made obvious by the direct view of intra-abdominal viscera or fat tissue through the mural defect. After the procedure, pneumoperitoneum shown on a simple abdominal X-ray and clinical/biological/imaging signs of peritonitis should be carefully considered.

Operative management of iatrogenic colonoscopic perforation is diverse. Most of these patients require a laparotomy for repair. However, a recently published Chinese study, based on almost 90,000 patients, presented the experience in treating diagnostic colonoscopy-associated bowel perforation by laparoscopic direct suturing (16). The endoscopic management of colon perforation up to 30 mm in size should be furthermore considered (7,17).

## Conclusions

The increased risk of perforation during colonoscopy among elderly patients is obvious. It is advisable to restrict inexperienced practitioners from performing in these cases.

Patients over 80 years of age in whom a diagnostic colonoscopy has been indicated should also be informed of their increased risk of perforation.

The final target is to reduce the number of iatrogenic lesions. The methods to accomplish it should be: understanding that some patients are at greater risk for colonoscopic perforation, considering available alternatives for them, such as the classic barium enema and carefully adjusting patient selection criteria for this procedure. As many of us have already found out, it is better to be safe than sorry.

## References

1. Araghzadeh FY, Timmcke AE, Opelka FG, Hicks TC, Beck DE. Colonoscopic perforations. *Dis Colon Rectum*. 2001;44(5):713-6.
2. Iqbal CW, Chun YS, Farley DR. Colonoscopic perforations: a retrospective review. *J Gastrointest Surg*. 2005;9(9):1229-35: discussion 1236.
3. Korman LY, Overholt BF, Box T, Winker CK. Perforation during colonoscopy in endoscopic ambulatory surgical centers. *Gastrointest Endosc*. 2003;58(4):554-7.
4. Hamdani U, Naem R, Haider F, Bansal P, Komar M, Diehl DL, et al. Risk factors for colonoscopic perforation: a population-based study of 80118 cases. *World J Gastroenterol*. 2013;19(23):3596-601.
5. 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(3):230-6.
6. Anderson ML, Pasha TM, Leighton JA. Endoscopic perforation of the colon: lessons from a 10-year study. *Am J Gastroenterol*. 2000;95(12):3418-22.
7. Byeon JS. Colonic perforation: can we manage it endoscopically? *Clin Endosc*. 2013;46(5):495-9.
8. Raju GS, Saito Y, Matsuda T, Kaltenbach T, Soetikno R. Endoscopic management of colonoscopic perforations (with videos). *Gastrointest Endosc*. 2011;74(6):1380-8.
9. Levin TR, Zhao W, Conell C, Seeff LC, Manninen DL, Shapiro JA, et al. Complications of colonoscopy in an integrated health care delivery system. *Ann Intern Med*. 2006;145(12):880-6.
10. Arora G, Mannalithara A, Singh G, Gerson LB, Triadafilopoulos G. Risk of perforation from a colonoscopy in adults: a large population-based study. *Gastrointest Endosc*. 2009;69(3 Pt 2):654-64.
11. Patraşcu T, Doran H, Catrina E, Mihalache O. Therapeutical options in sigmoid diverticulitis. When should we operate? *Chirurgia (Bucur)*. 2012;107(6):715-21.
12. Takahashi Y, Tanaka H, Kinjo M, Sakumoto K. Prospective evaluation of factors predicting difficulty and pain during sedation-free colonoscopy. *Dis Colon Rectum*. 2005;48(6):1295-300.
13. Greenberg BM, Atmar RL, Stager CE, Greenberg SB. Bacteraemia in the elderly: predictors of outcome in an urban teaching hospital. *J Infect*. 2005;50(4):288-95.
14. Elahi MM, McMillan DC, McArdle CS, Angerson WJ, Sattar N. Score based on hypoalbuminemia and elevated C-reactive protein predicts survival in patients with advanced gastrointestinal cancer. *Nutr Cancer*. 2004;48(2):171-3.
15. Wexner SD, Garbus JE, Singh JJ. A prospective analysis of 13,580 colonoscopies. Reevaluation of credentialing guidelines. *Surg Endosc*. 2001;15(3):251-61. Epub 2001 Feb 6.
16. Zhang YQ, Lu W, Yao LQ, Qin XY, Xu MD, Zhong YS, et al. Laparoscopic direct suture of perforation after diagnostic colonoscopy. *Int J Colorectal Dis*. 2013;28(11):1505-9. Epub 2013 Jul 24.
17. Gubler C, Bauerfeind P. Endoscopic closure of iatrogenic gastrointestinal tract perforations with the over-the-scope clip. *Digestion*. 2012;85(4):302-7. Epub 2012 May 17.