

## Laparoscopic repair of colonoscopic perforation: a new standard?

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### Abstract

**Background** Scientific evidence demonstrating interest in the laparoscopic approach for surgical repair of colonoscopic perforations is still lacking. The authors retrospectively reviewed the records of 43 patients who suffered from colonic perforations after colonoscopy between 1989 and 2008 in two tertiary centers in order to compare the results of the laparoscopic and the open approaches to repair.

**Methods** The patients' demographic data, perforation location, therapy, and outcome were recorded from the medical charts. Forty-two patients were managed operatively (19 laparoscopies and 23 laparotomies). In three patients who underwent explorative laparoscopy, the procedure had to be converted to laparotomy due to surgical difficulties. The patients who underwent laparotomy management had a longer period between the colonoscopy and the surgery ( $P = 0.056$ ) and more stercoral contaminations.

**Results** The mean hospital stay was shorter for the laparoscopy group ( $P = 0.02$ ), which had fewer postoperative complications ( $P = 0.01$ ) and no mortality (NS).

**Conclusion** This series demonstrates that early laparoscopic management of colonoscopic perforation is safe. Laparoscopic management may lead to reduced surgical and psychological stress for the patient because of its low morbidity and mortality rates and shorter hospital stay.

However, the procedure should be converted to a laparotomy if necessary.

**Keywords** Colonoscopy · Complications · Colonic perforation · Laparoscopy · Laparoscopic surgery

Colon perforation is a rare complication of diagnostic and therapeutic colonoscopy. The standard for treating colonoscopic perforation remains explorative laparotomy with primary perforation closure or bowel resection, with or without diverting stoma [1], despite some reports of the use of conservative management with antibiotics alone or with endoclipping [2, 3]. In the last decade, laparoscopy has been accepted as a valid surgical approach in colonic surgery, with low morbidity and shorter postoperative stay, even for complicated or cancerous disease [4–10]. Some case reports and small series of laparoscopic repair of colonoscopic perforations have been published, but strong scientific evidence demonstrating interest in this approach is still lacking.

In their growing clinical experience with laparoscopic colonic surgery, the authors gradually modified their approach to treating colonoscopic perforation, from systematic explorative laparotomy in the 1980s to laparoscopic management if possible, without systematic protection with diverting stoma, more recently. The aim of this report was to compare the outcome of patients who underwent open and laparoscopic surgical repair of colonoscopic perforations in order to evaluate the safety of the laparoscopic approach. We hypothesized that laparoscopic treatment of iatrogenic colonoscopic perforation may result in equal therapeutic efficacy, less perioperative morbidity, decreased length of stay, and overall better short-term outcome compared to open methods.

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## Patients and methods

The authors retrospectively reviewed the medical charts of 43 patients (22 males, 21 females, mean age = 66 years old) who suffered from colonoscopic perforation between 1989 and 2008 in two large tertiary centers. The patients' demographic data, perforation location, surgical characteristics, length of hospital stay, and outcome were recorded. The perioperative complications related to the secondary surgery necessary for stoma reintegration were not taken into account in this analysis.

Diagnosis of colon perforation was suspected on clinical grounds and confirmed by abdominal plain radiograph and/or computed tomography. The type of surgical approach and the surgical procedure itself (direct closure versus bowel resection, diverting stoma versus no stoma) was decided by the surgeon according to his/her experience with laparoscopy, the time between the colonoscopy and the diagnosis of perforation, and degree of peritoneal contamination. There was a clear tendency to favor the laparoscopic approach in the most recent years. In addition to the bowel repair, all patients underwent extensive peritoneal cleaning and rinsing, peritoneal drainage, and intravenous broad-spectrum antibiotics.

Among the 43 patients, one underwent conservative management, 23 immediate exploratory laparotomy, and 19 exploratory laparoscopy. Three of the 19 explorative laparoscopies were converted to laparotomies because of surgical difficulties closing the perforation because of the length of the colon (1 case) or colon tissue fragility (2 cases). These three cases were excluded from subsequent analysis in order to evaluate the safety of the "laparoscopy only" approach. In the 16 remaining patients, full laparoscopic management was performed. We compared the outcome of the 16 patients who underwent complete laparoscopy management (laparoscopy group,  $n = 16$ ) to the patients who underwent direct laparotomy (laparotomy group,  $n = 23$ ). These groups were similar with respect to age and sex ratio (Table 1).

Data are presented as means  $\pm$  standard error of the mean (SEM). Means were compared using Student's  $t$  test or the Mann–Whitney test, and proportions were compared with Fischer's exact test. A value of  $P < 0.05$  was

considered significant. Data were analyzed using the Instat 3.0b and Prism 5 software for Macintosh (GraphPad Software, San Diego, CA).

## Results

The characteristics of the surgical procedures are presented in the Table 2. The time delay between the colonoscopy and the surgery was up to 24 h in 35% of the patients in the laparotomy group compared to 6% in the laparoscopy group ( $P = 0.056$ ). The majority of perforations occurred in the sigmoid colon in both groups. Numerically, there were more stercoral peritoneal contaminations and diverting stoma in the laparotomy group than in the laparoscopy group, despite the fact that the difference was not significant due to the small size of the series.

The postoperative course of both groups is presented in the Table 3. The mean hospital stay was shorter for the laparoscopy group ( $P = 0.02$ ). There was no mortality (NS) and fewer postoperative complications in the laparoscopy group ( $P = 0.01$ ). In the laparoscopy group, one patient presented a prolonged postoperative ileus that was treated conservatively, and one developed *Clostridium difficile* pseudomembranous colitis that was treated with medication. There was no reoperation in this group. In the laparotomy group, two patients died from multiorgan failure 8 and 11 days after the surgical procedure, and postoperative infection (parietal abscess,  $n = 3$ ; urinary tract infection,  $n = 1$ ; pulmonary infection,  $n = 2$ ) was the main cause of postoperative complications. One laparotomy patient needed early relaparotomy for residual peritoneal abscesses.

## Discussion

The analysis of this series demonstrated that colonoscopic perforation diagnosed early ( $<24$  h) may be managed safely laparoscopically, combining perforation suture, peritoneal rinsing, and drainage. In the absence of stercoral peritoneal contamination, diverting stoma may not be necessary. This policy may lead to reduced surgical and psychological stress for the patient, a very low rate of

**Table 1** Patients' characteristics

	Laparotomy ( $n = 23$ )	Laparoscopy ( $n = 16$ )	$P$	RR (95% CI)
Age (years) (mean $\pm$ SEM)	67.6 $\pm$ 2.7	62.6 $\pm$ 4	0.44	
Sex ratio (male/female)	11/12	9/7	0.74	0.87 (0.513–1.472)
Past history of abdominal surgery (yes/no)	7/16	3/13	0.47	1.269 (0.752–2.138)
Colonoscopy indication (diagnostic/therapeutic)	17/6	11/5	0.73	1.113 (0.6–2.062)

**Table 2** Surgical findings and surgical procedures

	Laparotomy ( <i>n</i> = 23)	Laparoscopy ( <i>n</i> = 16)	<i>P</i>	RR (95% CI)
Delay perforation/surgery (<24 h/>24 h)	15/8	15/1	0.056	0.562 (0.367–0.861)
Perforation site (sigmoid/other)	15/8	11/5	1	0.9375 (0.545–1 .611)
Peritoneal contamination				
None	8	6		
Fluid	8	8		
Sputum	4	1		
Stercoral	3	0		
Surgical procedure				
Raphy	7	14		
Resection	9	1		
Stoma/no stoma	7/16	1/15	0.11	1.695 (1.103–2.606)

**Table 3** Postoperative results

	Laparotomy ( <i>n</i> = 23)	Laparoscopy ( <i>n</i> = 16)	<i>P</i>	RR (95% CI)
Postoperative hospital stay (days) (mean ± SEM)	16.6 ± 1.6	10.1 ± 2.2	0.02	
Mortality	2	0	0.5	1.762 (1.330–2.334)
Overall morbidity	12	2	0.017	1.948 (1.192–3.184)

**Table 4** Published series of more than five patients managed by laparoscopy

Authors	Year	Exploratory laparoscopy ( <i>n</i> )	Full laparoscopic management ( <i>n</i> )	Morbidity (%)	Mortality (%)	Length of stay (days)
Wullstein	1999	7	5	0	0	7.4
Yamamoto	2001	NA	5	0	0	
Hansen	2007	11	7	28.4	0	7.6
Rumstadt	2008	NA	12	0	0	
Bleier	2008	NA	11	18	0	5.1
This series	2010	19	16	12.5	0	10

morbidity and mortality, and shorter hospital stay compared to the usual open approach. This finding is particularly important in the setting of this severe iatrogenic complication whose legal implications are evident.

In this retrospective and nonrandomized study, a true comparison of postoperative complication rates between open and laparoscopic approaches cannot be performed because the two cohorts of patients are not identical. The delay in diagnosing the perforation was longer for the open group, leading to more frequent peritoneal stercoral contamination and to an increased rate of postoperative septic complications. Moreover, the laparoscopic approach for this situation was progressively favored with time and experience, and primary explorative laparoscopy has become the standard procedure in our departments for this rare indication. However, the complications showed low morbidity and mortality rates and a short postoperative stay in the laparoscopic group in this series.

Our series of 19 patients who underwent laparoscopy for colonoscopic perforations represents the largest reported study to date. Most of the published reports described one or two successful cases [11–21]. The publications on series of more than five patients [22–26] are presented in Table 4. These series confirmed the same excellent results of laparoscopic management of colonoscopic perforations that we experienced in our study. Should a randomized evaluation comparing the open approach with laparoscopy be performed in colonoscopic perforation? First, the low frequency of this complication of colonoscopy renders a prospective randomized study very difficult, even in a multicenter fashion. Furthermore, this prospective study would be ethically and medically unacceptable in our departments because we are convinced of the advantages of the laparoscopic approach. Such a study could be performed in centers where explorative laparotomy and stoma are still the standard method of managing colonoscopic perforation.

The laparoscopic management of colonoscopic perforation could also be compared to the recently described endoscopic repair using clips that may be efficient in small perforations, as described in some case reports.

The main message of our study is to advise surgeons with good laparoscopic experience to first perform an explorative laparoscopy in patients with early diagnosed colonoscopic perforation. Peritoneal contamination is usually very mild thanks to the colonoscopic bowel preparation that the patient performed. In the majority of cases, the perforation may be found in the sigmoid loop and can be safely closed by stitches or GIA staplers without a diverting stoma. However, the main objective of surgical treatment of colonoscopic perforation is, and should always remain, patient safety, and conversion to laparotomy and stoma after explorative laparoscopy should never be considered a failure or a mistake. The peritoneal cavity should also be thoroughly rinsed and drained, and the patient should receive broad-spectrum antibiotics. This minimally invasive approach to managing colonoscopy perforation, avoiding laparotomy and diverting stoma, has a low complication rate, decreases the hospital stay, and may render this severe iatrogenic complication of colonoscopy more acceptable to the patient. This may reduce the related legal issues related to this iatrogenic complication of colonoscopy. Therefore, from the literature review and from this study, we consider that a laparoscopic exploration and repair should be attempted in all patients with colonoscopic perforation as soon as this diagnosis is suspected.

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## References

- Damore LJ 2nd, Rantis PC, Vernava AM 3rd, Longo WE (1996) Colonoscopic perforations. Etiology, diagnosis, and management. *Dis Colon Rectum* 39:1308–1314
- Albuquerque W, Moreira E, Arantes V, Bittencourt P, Queiroz F (2008) Endoscopic repair of a large colonoscopic perforation with clips. *Surg Endosc* 22:2072–2074
- Araghizadeh FY, Timmcke AE, Opelka FG, Hicks TC, Beck DE (2001) Colonoscopic perforations. *Dis Colon Rectum* 44:713–716
- Monson JR, Hill AD, Darzi A (1995) Laparoscopic colonic surgery. *Br J Surg* 82:150–157
- Kaba A, Laurent SR, Detroz BJ, Sessler DI, Durieux ME, Lamy ML, Joris JL (2007) Intravenous lidocaine infusion facilitates acute rehabilitation after laparoscopic colectomy. *Anesthesiology* 106:11–18
- Laurent SR, Detroz B, Detry O, Degauque C, Honore P, Meurisse M (2005) Laparoscopic sigmoidectomy for fistulized diverticulitis. *Dis Colon Rectum* 48:148–152
- Detry O, Defraigne JO, Chiche JD, Meurisse M, Joris J, Honore P, Jacquet N, Limet R (1996) Laparoscopic-assisted colectomy in heart transplant recipients. *Clin Transplant* 10:191–194
- Mendes da Costa P (2009) And now, can we operate colon cancers laparoscopically? *Acta Chir Belg* 109:432–435
- Lam HD, Tinton N, Cambier E, Navez B (2009) Laparoscopic treatment in acute complicated diverticulitis: a review of 11 cases. *Acta Chir Belg* 109:56–60
- Detry O, Honore P, Meurisse M, Jacquet N (1999) Diverticulosis and diverticulitis in the immunocompromised patients. *Acta Chir Belg* 99:100–102
- Mehdi A, Closset J, Gay F, Deviere J, Houben J, Lambilliotte J (1996) Laparoscopic treatment of a sigmoid perforation after colonoscopy. Case report and review of literature. *Surg Endosc* 10:666–667
- Busic Z, Lovric Z, Busic V, Cavka M, Lemac D (2007) Laparoscopic treatment of iatrogenic endoscopic sigmoid colon perforation: a case report and literature review. *J Laparoendosc Adv Surg Tech A* 17:324–325
- Alfonso-Ballester R, Lo Pez-Mozos F, Mart-Obiol R, Garcia-Botello SA, Lledo-Matoses S (2006) Laparoscopic treatment of endoscopic sigmoid colon perforation: a case report and literature review. *Surg Laparosc Endosc Percutan Tech* 16:44–46
- Velez MA, Riff DS, Mule JM (1997) Laparoscopic repair of a colonoscopic perforation. *Surg Endosc* 11:387–389
- Mattei P, Alonso M, Justinich C (2005) Laparoscopic repair of colon perforation after colonoscopy in children: report of 2 cases and review of the literature. *J Pediatr Surg* 40:1651–1653
- Kilic A, Kavic SM (2008) Laparoscopic colotomy repair following colonoscopic polypectomy. *JLS* 12:93–96
- Volpe A, Piccoli M, Colli G, Mecheri F, Melotti G (2007) Laparoscopic treatment of colonoscopic perforation: a case report. *Chir Ital* 59:587–590
- Hayashi K, Urata K, Munakata Y, Kawasaki S, Makuuchi M (1996) Laparoscopic closure for perforation of the sigmoid colon by endoscopic linear stapler. *Surg Laparosc Endosc* 6:411–413
- Miyahara M, Kitano S, Shimoda K, Bandoh T, Chikuba K, Maeo S, Kobayashi M (1996) Laparoscopic repair of a colonic perforation sustained during colonoscopy. *Surg Endosc* 10:352–353
- Agresta F, Michelet I, Mainente P, Bedin N (2000) Laparoscopic management of colonoscopic perforations. *Surg Endosc* 14:592–593
- Schlinkert RT, Rasmussen TE (1994) Laparoscopic repair of colonoscopic perforations of the colon. *J Laparoendosc Surg* 4:51–54
- Hansen AJ, Tessier DJ, Anderson ML, Schlinkert RT (2007) Laparoscopic repair of colonoscopic perforations: indications and guidelines. *J Gastrointest Surg* 11:655–659
- Rumstadt B, Schilling D, Sturm J (2008) The role of laparoscopy in the treatment of complications after colonoscopy. *Surg Laparosc Endosc Percutan Tech* 18:561–564
- Wullstein C, Koppen M, Gross E (1999) Laparoscopic treatment of colonic perforations related to colonoscopy. *Surg Endosc* 13:484–487
- Bleier JJ, Moon V, Feingold D, Whelan RL, Arnell T, Sonoda T, Milsom JW, Lee SW (2008) Initial repair of iatrogenic colon perforation using laparoscopic methods. *Surg Endosc* 22:646–649
- Yamamoto A, Ibusuki K, Koga K, Taniguchi S, Kawano M, Tanaka H (2001) Laparoscopic repair of colonic perforation associated with colonoscopy: use of passing sutures and endoscopic linear stapler. *Surg Laparosc Endosc Percutan Tech* 11:19–21