Surgical Endoscopy (2022) 36:3136–3140
https://doi.org/10.1007/s00464-021-08616-6

"Relaparoscopy" to treat early complications following colorectal surgery

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Received: 13 October 2020 / Accepted: 14 June 2021 / Published online: 22 June 2021

Abstract

Background Laparoscopic surgery has shown clear benefits that could also be useful in the emergency setting such as early reoperations after colorectal surgery. The aim of this study was to evaluate the safety and feasibility of laparoscopic reintervention ("relaparoscopy") (RL) to manage postoperative complications after laparoscopic colorectal surgery.

Methods We performed a retrospective study based on a prospectively collected database from 2000 to 2019. Patients who required a reoperation after undergoing laparoscopic colorectal surgery were included. According to the approach used at the reoperation, the cohort was divided in laparoscopy (RL) and laparotomy (LPM). Demographics, hospital stay, morbidity, and mortality were analyzed.

Results A total of 159 patients underwent a reoperation after a laparoscopic colorectal surgery: 124 (78%) had RL and 35 (22%) LPM. Demographics were similar in both groups. Patients who underwent left colectomy were more frequently reoperated by laparoscopy (RL: 42.7% vs. LPM: 22.8%, *p*: 0.03). The most common finding at the reoperation was anastomotic leakage, which was treated more often by RL (RL: 67.7% vs. LPM: 25.7%, *p*: 0.0001), and the most common strategy was drainage and loop ileostomy (RL: 65.8% vs. LPM: 17.6%, *p*: 0.00001). Conversion was necessary in 12 patients (9.6%). Overall morbidity rate was 52.2%. Patients in the RL group had less postoperative severe complications (RL: 12.1% vs. LPM: 22.8, *p*: 0.01). Mortality rate was similar in both groups.

Conclusion Relaparoscopy is feasible and safe for treating early postoperative complications, particularly anastomotic leakage after left colectomy.

Keywords Colorectal surgery · Laparoscopy · Relaparoscopy · Morbidity · Mortality

Laparoscopy is increasingly becoming the standard of care for patients undergoing colorectal surgery for both benign and malignant diseases [1]. Many complications such as respiratory and wound infections and deep vein thrombosis have decreased with the use of laparoscopy in these patients [2, 3]. However, other complications such as anastomotic leakage and bleeding persist regardless of the minimally invasive approach used and are associated with significant morbidity and mortality if they are not promptly recognized and treated [4–8]. Many groups have gained great experience in minimally invasive colorectal surgery, allowing them to expand the use of laparoscopy. One of the most challenging indications that possibly require the greatest experience to treat postoperative complications is laparoscopic reintervention ("relaparoscopy") (RL) [9–13]. Although there are some publications on this subject [14–20], its application is neither widespread nor standardized.

Previous studies, including one of our groups, have demonstrated the feasibility of RL in this setting [14–20]. However, most of them have been limited by the low number of cases evaluated.

The aim of this study was to analyze the results obtained with the use of RL to treat early complications following laparoscopic colorectal surgery in a larger series of patients.

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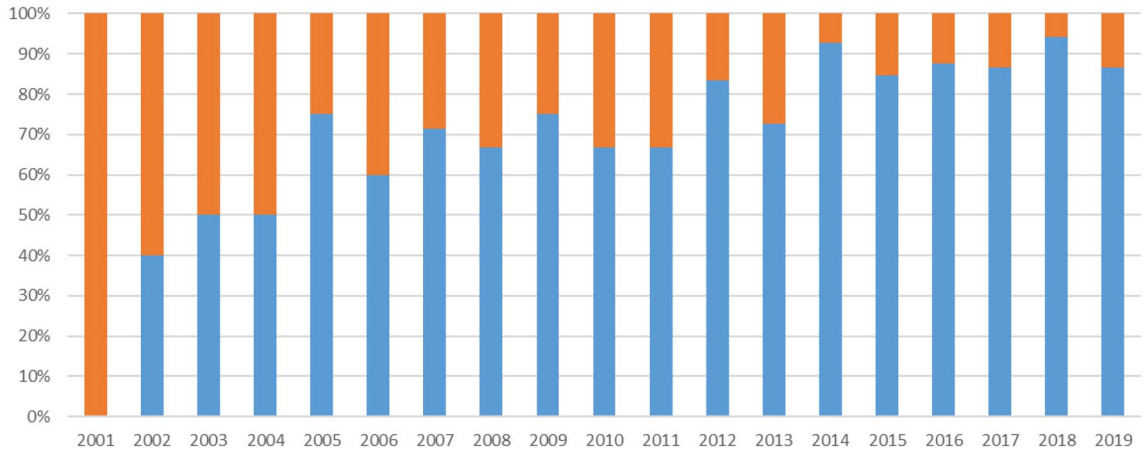

Fig. 1 Progression of the use of the RL during the period of time analyzed. In orange LPM (laparotomy), in blue RL (laparoscopy)

Methods

Study design and population

A retrospective study based on a prospectively collected database was performed. Patients who underwent laparoscopic colorectal surgery and required a reoperation between June 2000 and December 2019 were included. Patients in whom the laparoscopy was converted during the primary resection were excluded.

The cohort of patients subject to reoperation was divided into two groups according to the approach: laparoscopy (RL) and laparotomy (LPM). Early complication was considered when the reoperation was performed in the period of 30 days after primary surgery. The use of laparoscopy at the reoperation was determined according to the surgeon's preference. All reoperations were performed by senior national board-certified colorectal surgeons. Patients who underwent RL but converted to open procedure were placed in the RL group based on intention-to-treat analysis.

Variables and outcomes

Demographics, intraoperative complications, and conversion rate at the second surgery were analyzed. Recovery parameters such as length of hospital stay (LOS) before and after reoperation, intensive care unit (ICU) admission, morbidity scored as Clavien–Dindo classification, and mortality rate were also considered for analysis. Severe complications were considered for those included in Clavien–Dindo ≥ 3b. The RL technique was performed as described previously [14].

Statistical analyses

The Student's t-test was used to compare continuous variables, whereas the $\chi 2$ and Fisher test were used for categorical variables. A multivariate logistic regression model was used to identify potential variables associated with the use of laparoscopy for reoperation.

A p value < 0.05 was considered statistically significant for all tests.

The institutional review board (IRB) of our institution approved this study. Written informed consent was waived by the IRB owing to the study's retrospective nature.

Results

Relaparoscopy was possible in 78% ($n = 124$) of the overall cohort of 159 of 1843 who required reoperation after laparoscopic colorectal surgery. Figure 1 shows the progression of the use of the RL during the analyzed period of time.

Demographics were similar in both groups. (Table 1).

Patients in whom the primary procedure was longer were more likely to be included in the LPM group. Conversely,

Table 1 Demographic characteristics

	RL (124)	LPM (35)	P
Age (average)	60.1	63.2	0.34
Age > 65	43.5%	61.7%	0.06
Gender (Male)	60.4%	57.1%	0.73
Pathology (Malignant)	61.3%	65.7%	0.63
Previous abdominal surgeries	32.5%	40.8%	0.8
BMI (average)	26.33	25.91	0.67
ASA grade			
I	16.5%	9.1%	0.41
II	65.7%	58.6%	0.44
III	15.9%	28.3%	0.09
IV	1.9%	0%	0.5

Table 2 Type of surgery at the first operation

	RL (124)	LPM (35)	P
Right colectomy	24%	33.7%	0.7
Left colectomy/sigmoidectomy	**42.7%**	**22.8%**	**0.03**
AR	12.9%	8.5%	0.48
AR + loop ileostomy	0.8%	5.7%	0.06
Proctocolectomy	12.1%	14.3%	0.73
Operative time (minutes)	**173.6**	**208.8**	**0.01**

Bold determines varaibles statistically significant

Table 3 Complications identified at re-operative surgery

	RL (124)	LPM (35)	P
Anastomotic leakage	**67.7%**	**25.7%**	**0.0001**
AL + ischemia	**0.8%**	**11.42%**	**0.0013**
Small bowel perforation	**1.6%**	**8.5%**	**0.03**
Internal hernia	4%	5.7%	0.67
Abdominal abscess	16%	0%	0.4
Negative finding	8%	0%	0.08

Bold determines varaibles statistically significant

patients who underwent left colectomy/sigmoidectomy were more frequently included in the RL group (Table 2).

If the reoperation was done within the first 5 days, the chances of performing a RL were significantly higher (RL: 40.3% vs. LPM: 62.8%, *p*: 0.017). Length of stay after reoperative surgery (RL: 10.2 days vs. 12 days, *p*: 0.29) and total length of stay (11.3 days vs. 14.2 days, *p*: 0.10) were similar in both groups.

The most common finding at reoperation was anastomotic leak, which was diagnosed in 93 (58.5%) patients (Table 3). This complication was mostly treated by RL (RL: 67.7% vs. LPM: 25.7%, *p*: 0.0001). Treatment of this complication was mainly by peritoneal lavage, drain placement near the anastomosis, and performance of a protective loop ileostomy (RL: 65.8% vs. LPM: 17.6%, *p*: 0.00001). Although RL was useful to treat other complications, the majority of these complications were treated by LPM (Table 4). Conversion was necessary in 12 (9.6%) patients owing to absence of surgical field (58.3%), generalized fecal peritonitis (33.3%), and massive colonic ischemia (8.3%). Eight percent of patients had negative RL. The operative time was shorter in the RL group (Table 4). After reoperation, there were no differences in the use of ICU and LOS.

However, overall morbidity was similar in both groups (RL: 46.8% vs. LPM: 72.6%, *p*: 0.8). Severe complications were less frequent after RL (RL: 14.2% vs. LPM: 33.4%, *p*: 0.01). Mortality occurred in 11 (6.9%) patients (RL: 5.6%, vs. LPM: 11.4%, *p*: 0.23) due to septic shock, cardiovascular, and pulmonary complications (Table 5).

Table 4 Type of surgery at reoperation

	RL (124)	LPM (35)	P
Drainage, loop ileostomy	**65.8%**	**17.6%**	**0.00001**
Hartmann´s surgery	**2.4%**	**11.7%**	**0.019**
Resection, redo anastomosis	**1.6%**	**23.5%**	**0.0001**
Drainage	**16.2%**	**2.9%**	**0.04**
Small bowel repair	0.8%	5.8%	0.05
Operative time (minutes)	**85.4**	**109.4**	**0.01**

Bold determines varaibles statistically significant

Table 5 Reoperative surgery outcome

	RL (124)	LPM (35)	P
Postoperative ICU	20.16%	28.5%	0.29
Requirement of additional surgeries	12.1%	22.8%	0.11
Complications			
Clavien 1–2	35 (28.2%)	12 (34.3%)	0.4
Clavien 3a	8 (9.9%)	1 (2.8%)	0.35
Subtotal (1–2–3a)	**43 (38.1%)**	**13 (37.1%)**	**0.4**
Clavien 3b	5 (6.2%)	5 (14%)	0.09
Clavien 4a–4b	3 (2.4%)	3 (8%)	0.07
Clavien 5	7 (5.6%)	4 (11.4%)	0.23
Subtotal (3b-4–5)	**15 (14.2%)**	**12 (33.4%)**	**0.01**
Total	**58 (52.3%)**	**25 (70.5%)**	**0.8**
Wound hernia	12.9%	17.1%	0.52

Multivariate analysis showed that patients undergoing resection with redo anastomosis were significantly less likely to be reoperated by laparoscopy (OR 0.09, 95% CI 0.01–0.88, $p = 0.04$) (Table 6).

Discussion

The aim of this study was to evaluate the safety and feasibility of relaparoscopy to manage postoperative complications after laparoscopic colorectal surgery. We found that (a) the success rate of RL is high; (b) anastomotic leak after left colectomy was the complication more suitable to be treated by this approach; and (c) severe complications after the use of RL were significantly lower compared with the LPM outcome.

RL has been demonstrated to be a successful approach for the treatment of early complications after laparoscopic colorectal procedures when it is adequately indicated and performed by experienced surgeons [21]. In our study, a large proportion of patients with postoperative complications were managed safely with RL approach. Although demographics and comorbidities were similar in patients undergoing laparoscopy and laparotomy, there was a trend

Table 6 Multivariate analysis evaluating variables associated with the use of laparoscopy in the reoperation

	OR	95% CI	p
Left colectomy	2.32	0.63–8.47	0.2
Anastomotic leak	0.99	0.11–8.65	0.99
AL+ischemia	0.13	0.01–3.6	0.23
Small bowel perforation	0.34	0.03–3.91	0.39
Ostomy, drainage	3.32	0.26–41.65	0.35
Hartmann procedure	0.26	0.01–5.46	0.38
Resection + **redo anastomosis**	**0.09**	**0.01–0.88**	**0.04**
Drainage	3.54	0.29–42.11	0.32

toward younger and healthier patients in the relaparoscopy group. Surgeons' confidence and training in minimally surgery might have also contributed to an unconscious selection bias in our study. Overall, we still believe that patients' characteristics, severity of the complication, and experience of the surgeon should all be considered before deciding the approach of the reoperation.

The most frequent severe complication in colorectal surgery is anastomotic leakage, with a prevalence that can vary between 1 and 30 percent with optimum values between 2% and 5% [4, 6]. In the present series, anastomotic dehiscence was the most frequent postoperative complication requiring reoperation. If a minor defect with vital anastomotic ends is found during reoperation, the standard procedure is to perform a peritoneal lavage, drain placement near the anastomosis, and a protective loop ileostomy. All of these steps can be performed laparoscopically using the same port sites of the initial operation. RL was more useful for some complications after certain surgeries. For instance, left colectomies with dehiscence were more likely to be resolved by this approach, as well as was demonstrated in other studies [9]. In the present series, patients with previous abdominal operations had a higher likelihood of undergoing a reoperation with an open approach (LPM). However, since all these patients had the initial operation done by laparoscopy, we believe that this difference at reoperation was a fact of chance with no clinical significance.

Although patient's clinical presentation determines the timing of reoperation, an early laparoscopic procedure is more likely to be technically feasible before ileus develops, the contamination is limited, and the adhesions are soft. In fact, in the present series, the time elapsed before performing the reoperation was shorter in the RL group.

Unlike in previous studies [16], we found no differences in postoperative outcome in terms of recovery and length of stay. However, severe complications (Clavien 3b) were significantly lower in the RL group. This is possibly the most relevant finding of our study. A recent meta-analysis tried to determine the feasibility of laparoscopic reoperation for early postoperative complications following colorectal surgery and concluded that the number of studies available is still low [21]. In addition, all the publications included were retrospective cohort studies with an overall low quality and internal validity [21].

Limitations of this study include its retrospective design, which is the main limiting factor. In addition, selection bias might have affected the chosen surgical approach, which was at the surgeon's discretion at the time of the reoperation. However, the main strength of this study is that, to our knowledge, it is one of the largest institutional series regarding this topic to date.

Conclusion

Relaparoscopy used to treat early complications after colorectal surgery is feasible and safe in experienced centers. Anastomotic leak seems to be the complication with the highest chance to be resolved by this approach. A decreased rate of severe postoperative complications could be one of its main benefits. Prospective studies are needed to confirm our findings and determine which patients will benefit the most from relaparoscopy.

Declarations

Disclosures Nicolás A. Rotholtz, MD, Mariano Laporte, MD, Mariana Matzner, MD, Francisco Schlottmann, MD, MPH, and Maximiliano E. Bun, MD have no conflicts of interest or financial ties to disclose.

References

1. Keller DS, Ibarra S, Haas EM (2015) Minimally invasive colorectal surgery: status and technical specifications. Minerva Chir 70(5):373–380
2. Aly EH (2009) Laparoscopic colorectal surgery: summary of the current evidence. Ann R Coll Surg Engl 91(7):541–544
3. Feo LJ, Jrebi N, Asgeirsson T et al (2014) Anastomotic leaks: technique and timing of detection. Am J Surg 207(3):371–374
4. Blumetti J, Chaudhry V, Cintron JR et al (2014) Management of anastomotic leak: lessons learned from a large colon and rectal surgery training program. World J Surg 38(4):985–991
5. Boyce SA, Harris C, Stevenson A, Lumley J, Clark D (2017) Management of low colorectal anastomotic leakage in the laparoscopic era: more than a decade of experience. Dis Colon Rectum 60(8):807–814
6. Chadi SA, Fingerhut A, Berho M et al (2016) Emerging trends in the etiology, prevention, and treatment of gastrointestinal anastomotic leakage. J Gastrointest Surg 20(12):2035–2051
7. Kwak JM, Kim SH, Son DN et al (2011) The role of laparoscopic approach for anastomotic leakage after minimally invasive surgery for colorectal cancer. J Laparoendosc Adv Surg Tech A 21(1):29–33

8. Ricciardi R, Roberts PL, Read TE, Marcello PW, Hall JF, Schoetz DJ (2012) How often do patients return to the operating room after colorectal resections? Colorectal Dis 14(4):515–521
9. Chang KH, Bourke MG, Kavanagh DO, Neary PC, O'Riordan JM (2016) A systematic review of the role of re-laparoscopy in the management of complications following laparoscopic colorectal surgery. Surgeon 14(5):287–293
10. Cimitan A, Contardo T, Molaro R, Morpurgo E (2016) The role of laparoscopy in the treatment of anastomotic leaks after minimally invasive colorectal resections for cancer. Surg Laparosc Endosc Percutan Tech 26(4):e80–e84
11. Gilshtein H, Yellinek S, Setton I, Wexner SD (2019) What are the results of laparoscopic re-operative rectal surgery? Am J Surg. https://doi.org/10.1016/j.amjsurg.2019.12.003
12. Marano A, Giuffrida MC, Giraudo G, Pellegrino L, Borghi F (2017) Management of peritonitis after minimally invasive colorectal surgery: can we stick to laparoscopy? J Laparoendosc Adv Surg Tech A 27(4):342–434
13. Yellinek S, Gilshtein H, Krizzuk D, Wexner SD (2020) Re-operation surgery following IPAA: is there a role for laparoscopy? Surg Endosc. https://doi.org/10.1007/s00464-020-07537-0
14. Rotholtz NA, Laporte M, Lencinas SM, Bun ME, Aued ML, Mezzadri NA (2009) Is a laparoscopic approach useful for treating complications after primary laparoscopic colorectal surgery? Dis Colon Rectum 52(2):275–279
15. Cuccurullo D, Pirozzi F, Sciuto A et al (2015) Relaparoscopy for management of postoperative complications following colorectal surgery: ten years experience in a single center. Surg Endosc 29(7):1795–1803
16. Ibáñez N, Abrisqueta J, Luján J et al (2018) Reoperation after laparoscopic colorectal surgery. Does the laparoscopic approach have any advantages? Cir Esp. 96(2):109–116
17. Lee CM, Huh JW, Yun SH et al (2015) Laparoscopic versus open reintervention for anastomotic leakage following minimally invasive colorectal surgery. Surg Endosc 29(4):931–936
18. O'Riordan JM, Larkin JO, Mehigan BJ, McCormick PH (2013) Re-laparoscopy in the diagnosis and treatment of postoperative complications following laparoscopic colorectal surgery. Surgeon 4:183–186
19. Vennix S, Abegg R, Bakker OJ et al (2013) Surgical re-interventions following colorectal surgery: open versus laparoscopic management of anastomotic leakage. Laparoendosc Adv Surg Tech A 9:739–744
20. Wind J, Koopman AG, van Berge Henegouwen MI, Slors JF, Gouma DJ, Bemelman WA (2007) Laparoscopic reintervention for anastomotic leakage after primary laparoscopic colorectal surgery. Br J Surg 94(12):1562–1566
21. Wright DB, Koh CE, Solomon MJ (2017) Systematic review of the feasibility of laparoscopic reoperation for early postoperative complications following colorectal surgery. Br J Surg 104(4):337–346