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Laparoscopic Versus Open Restorative Proctocolectomy for Familial Adenomatous Polyposis

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Abstract

Purpose: This study compared outcomes after laparoscopic (LAP) or conventional (open) total proctocolectomy with outcomes after ileal J-pouch anal anastomosis (IPAA) at a single institution.
Methods: Charts from 133 familial adenomatous polyposis patients (1997–2013) were reviewed. Demographic data (age, sex, color, American Society of Anesthesiologists [ASA] status, previous surgery, and body mass index) and surgical outcomes (length of stay, early and late morbidity, reoperation, and mortality rates) were compared among 63 patients undergoing IPAA.
Results: Demographic features were similar among patients (25 open and 38 LAP). Conversely, colorectal cancer at diagnosis prevailed in the open group (60% versus 31.6%; $P = .02$). Tumor stages ($P = .65$) and previous surgery index (20% versus 10.5%; $P = .46$) were similar. Surgical length was longer for LAP (374 versus 281 minutes, $P = .003$). Short-term complication rates (28% versus 28.9%), hospital stay (10.9 versus 8.9 days), and total long-term reoperations (28% versus 21%) were not statistically different. However, major late morbidity (16% versus 2.6%; $P < .001$) and late reoperation rates (16% versus 5.2%; $P < .05$) were greater among open patients. Both groups did not differ regarding pouch failure rates (8% versus 5.2%). There was no operative mortality in the present series.
Conclusions: (1) LAP IPAA is a safe procedure associated with a low conversion rate, (2) short-term results showed no clear advantages for both approaches, and (3) a greater risk of major late complications and late reoperations should be expected after open procedures.

Keywords: familial adenomatous polyposis, ileal pouch anal anastomosis, postoperative complications, restorative proctocolectomy, laparoscopy

Introduction

Familial adenomatous polyposis (FAP) is a hereditary genetic disease characterized by the development of multiple adenomatous polyps at a young age. Prophylactic surgery in FAP is usually indicated before colorectal cancer (CRC) development, with the aim to improve survival. Established surgical options include total abdominal colectomy with ileorectal anastomosis, restorative proctocolectomy (RPC) with ileal J-pouch anal anastomosis (IPAA), and total proctocolectomy (TPC) with ileostomy. The decision-making process to choose the best option should take into account several factors either related to the patient, to the disease, or even to the surgeon's experience.[1]

IPAA is considered the procedure of choice for the treatment of FAP once it removes all the colorectal mucosa at risk and leads to good functional results, besides the involved morbidity risk. Nevertheless, there are several controversies regarding this procedure, mainly when it is indicated to manage FAP. These include the performance of mucosectomy (and handsewn anastomosis) versus no mucosectomy (with stapled anastomosis), the indication of a diverting ileostomy and the surgical approach (laparotomy versus laparoscopy, LAP).

Today, a broad spectrum of operations including RPC may be adequately performed laparoscopically. In a young population such as FAP patients, a minimally invasive approach is considered a very attractive option.[2,3] Taking into account the refinements and increasing adoption of LAP techniques, their proposed advantages need to be systematically evaluated, regardless the higher costs involved.

For this reason, we reviewed the patients treated in our institution over the past decades. Thus, the aim of this work

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was to compare short- and long-term outcomes of LAP and conventional proctocolectomy with IPAA.

Materials and Methods

This study was approved by the Gastroenterology Department. Charts from FAP patients undergoing surgery from 1997 to 2015 were reviewed. Prophylactic colectomy was performed at the Colorectal Unit in Hospital das Clínicas (University of São Paulo Medical School, Brazil). All operations were performed by Brazilian Board-certified colorectal surgeons.

Surgical approach (open or LAP) was determined by surgeons' choice according to the period the patient was treated, individual experience, and patient's clinical features. Patients were placed in a modified lithotomy position in padded stirrups (with arms extended by the body side in the LAP group). Dissection progressed from the right colon to the rectum in all patients. After proctocolectomy, the IPAA was planned in a standardized double stapling technique using a circular stapler under LAP control to avoid torsion of the root of the mesentery and to ensure a tension-free anastomosis. After completion of the anastomosis, drains were routinely placed around the anastomosis. All but 1 patient had a covering loop ileostomy at the right quadrant.

Patient charts from open and LAP groups were reviewed to retrieve demographic and surgical data that had been prospectively collected. Patient features such as age, sex, race, body mass index (BMI), clinical status (American Society of Anesthesiologists [ASA] score), previous surgery, and association with CRC were analyzed.

To verify whether LAP RPC is associated with meaningful advantages over the conventional approach, we included the following study endpoints: intraoperative complications, need for blood transfusion, length of surgery, reasons for conversion to open approach, length of hospital stay, reoperation, 30-day morbidity, and mortality rates. Conversion was defined as an unplanned abdominal incision to control intraoperative complication or to perform segments of the operation. Hospital discharge was decided individually as patients recovered from surgery.

Postoperative clinical morbidity was categorized as major or minor. Postoperative major complications were defined as life threatening or requiring reoperations (peritoneal infections, cardiopulmonary or thromboembolic events, renal failure, etc.); all other complications were regarded as minor (surgical site or urinary infections). Complication and reoperation rates as well other outcomes were finally compared between groups.

For statistical analysis, Student's *t*-test or Kruskal-Wallis tests were used for continuous measures (age, BMI, etc.). For other variables (sex, color), Pearson's chi-square or Fisher's tests were used. Significance was attested for $P < .05$.

Results

From 1997 to 2015, 63 FAP patients were subjected to TPC and IPAA. Thus, 25 patients underwent laparotomy from 1997 to 2012 (open group) and 38 patients were treated by LAP from 2003 to 2015 (LAP group). Since we started to perform LAP total colectomies in 2003, only 4 patients were treated through laparotomy, mainly due to previous open surgery or obesity, at a time when we had not achieved the learning curve for a complex procedure.

Table 1. Demographics of 63 Familial Adenomatous Polyposis Patients Treated Through Laparotomy or Laparoscopy

Variable	*25 Open*	*38 LAP*	P
Mean age (SD)	31.2 (11.9)	28.2 (12.1)	.3323[a]
Range (years)	15–64	14–56	
Male, *n* (%)	8 (32%)	14 (36.8%)	.6933[b]
Female	17 (68%)	24 (63.2%)	
Sex ratio (male:female)	0.47	0.58	
Caucasian	20 (80%)	33 (86.8%)	.4996[c]
Non-Caucasian	5 (20%)	5 (13.1%)	
Associated CRC	15 (60%)	12 (31.6%)	.0257[b]
No cancer	10 (40%)	26 (68.4%)	
Stage I	7 (46.6%)	5 (41.6%)	.6590[c]
Stage II	3 (35%)	1 (8.3%)	
Stage III	4 (26.6%)	6 (50%)	
ASA I	21 (84%)	32 (84.2%)	1.0000[c]
ASA II	4 (16%)	6 (15.8%)	
Previous surgery	5 (20%)	4 (10.5%)	.4634[b]
BMI mean (SD)	24.2 (6.1)	23.0 (4.1)	.6099[a]
BMI range	(18.3–24.8)	(16.8–33.6)	

[a]Student's *t*-test.
[b]Chi-square test.
[c]Fisher exact test.
ASA, American Society of Anesthesiologists; BMI, body mass index; CRC, colorectal cancer; LAP, laparoscopic; open, conventional (laparotomy); SD, standard deviation.

Patients' demographics are presented in Table 1. Nearly all patients' data (mean age, sex, color, ASA status, previous surgery, and BMI) were statistically similar. However, the presence of CRC at diagnosis was the only feature to distinguish both groups (60% in the open versus 31.6% in the LAP group; *P*-value .02). Besides that, oncological stages were similar ($P = .65$), even noticing a greater rate of Stage III patients in the LAP group (50% versus 26.6%). In general, previous surgery was also a more frequent event among open patients (20% versus 10.5%), but this difference was not significant ($P = .46$).

Comparison of operative results is presented in Table 2. LAP patients clearly demonstrated a greater length of surgery (374 versus 281 minutes, $P = .003$). Short-term outcomes were also not statistically different among groups, as we compare early complication rates (28% versus 28.9%) and hospital stay (10.9 versus 8.9 days). In contrast, the open group exhibited a greater risk of late complications (16% versus 10.5%), but without significant difference. And although total major and minor early morbidity rates did not distinguish both groups, major late morbidity was much greater after laparotomy (16% versus 2.6%; $P < .001$). Moreover, long-term reoperations index was also statistically similar between groups (28% versus 21%), with the open group showing a greater percentage of late reoperations (16% versus 5.2%).

Pouch failure (including permanent stoma) occurred in 4 patients (6.3%), occurring in 2 patients in the LAP group (5.2%) and 2 in the open (8.0%) group. There was no 30-day mortality in the present series.

Discussion

RPC is considered the standard surgical procedure for ulcerative colitis (UC) and FAP.[4] LAP RPC has been gradually

Table 2. Operative Time, Short- and Long-Term Results After Conventional or Laparoscopic Ileal-Pouch Anal Anastomosis

Data	*25 Open*	*38 LAP*	P
Operating time (minutes)	281.4 (240–390)	374.5 (240–700)	.0034[a]
SD	63.1	110.8	
Early complications, *n* (%)	7 (28)	11 (28.9)	.9351[b]
Major	4 (16.0)	8 (21.0)	.25[c]
Minor	3 (12.0)	3 (7.9)	.35[c]
Late complications, *n* (%)	4 (16)	4 (10.5)	.7019[c]
Major	4 (16.0)	1 (2.6)	.001[c]
Minor	0 (0)	3 (7.9)	.05[c]
Pouch failure, *n* (%)	2 (8.0)	2 (5.2)	.68[a]
Reoperations (total), *n* (%)	7 (28.0)	8 (21.0)	.5580[c]
Early	2 (8)	5 (13)	.4686[c]
Late	4 (16)	2 (5.2)	.05[b]
After ileostomy closure	1 (4)	1 (2.6)	.92[b]
Hospital stay (days)	10.9 (7–21)	8.9 (5–20)	.1083[a]
Follow-up (months)	122.2 (5–328)	43.3 (5–122)	.0054[a]
SD	92.3	31.9	

[a]Kruskal-Wallis test.
[b]Chi-square test.
[c]Fisher's exact test.
Numbers in parens denote minimal and maximum values.
LAP, laparoscopic; open, conventional (laparotomy); SD, standard deviation.

accepted as an alternative to conventional techniques and, despite the increasing adoption of LAP techniques during the past decades, there is no clear evidence supporting LAP approach superiority when performing colorectal extended resections.[5,6] The present single-center series presents our experience on the treatment of 63 FAP patients operated with open (25) or LAP approaches (38).

Tables 3 and 4 present early outcomes and conversion rates of LAP pouch surgery reported in the recent literature. One may easily note that there is a prevalence of retrospective studies including both FAP and UC patients. Operative duration in the LAP approach has been constantly longer, both in the randomized clinical trial (RCT) and in the meta-analysis of non-RCTs.[7,8] This is generally attributed to the complex nature of a technically demanding procedure that requires a long learning curve.[9] Another common feature is the less need for intraoperative blood transfusion.[8–10]

Results regarding complication rates have not always favored laparoscopy. Moreover, many comparative studies, RCTs, reviews, and meta-analysis failed to demonstrate this and other supposed advantages such as reoperations rates. One of the few RCTs concluded that the hand-assisted LAP technique was longer (210 versus 133 minutes) and more costly (16,728 versus 13,406 dollars), but associated with the same

Table 3. Comparative Results Between Open and Laparoscopic Restorative Proctocolectomy Published in the Literature

Authors	*Study design*	*Number*	*Ileus (days)*	*OR time (minutes)*	*Blood loss (mL)*	*Morbidity (%)*	*LOS (days)*
White et al.[20]	Retrospective	LAP 76 Open 131	NR	285 > 208	NR	51% = 61.5%	6 < 8
Schiessling et al.[5]	Prospective, randomized	LAP 21 Open 21	Similar	LAP longer	261 = 228	Similar	Similar
Fleming et al.[9]	Retrospective, multicentric	LAP 339 Open 21	NR	124 > 46	3.9% <8.0%	LAP < open	7.3 = 7.9
Kelly et al.[3]	Retrospective	LAP 10 Open 10	LAP better	NR	NR	NR	LAP smaller
Ahmed et al.[7]	Retrospective, review	LAP 253 Open 354	NR	LAP > open	NR	Similar	Similar
El-Gazzaz et al.[10]	Case-matched	LAP 119 Open 238	NR	272 > 163	250 < 338	23.1 = 21.5	5 < 6
Zhang et al.[6]	Case-matched	LAP 21 Open 25	2<4	325 > 220	115 < 240	23.8 = 28.0	9 < 11

LAP, laparoscopic; LOS, length of stay; NR, not reported; open, conventional (laparotomy); OR, operative room.
Symbols < or > indicate statistical difference; = indicates no statistical difference.

Table 4. Conversion Rates After Laparoscopic Ileal-Pouch Anal Anastomosis in Literature Series

Study, year	*No. of patients*	*Conversion rate*
Schiessling et al., 2013	42 (21 LAP) UC and FAP	23.8%
Zhang et al., 2007	23 UC and FAP	0
Cotte et al., 2011	66 IBD and 53 other	13.6%
White et al., 2014	76 FAP and UC	9%

LAP, laparoscopic; FAP, familial adenomatous polyposis; IBD, inflammatory bowel disease; UC, ulcerative colitis.

morbidity (20% versus 17%) and length of stay (10 versus 11 days) when compared with laparotomy.[11] In a single-center, randomized, and controlled trial (LapConPouch Trial), Schiessling et al.[5] compared the effectiveness of LAP IPAA in 21 FAP and 21 UC patients. Similarly, they observed no difference in the amount of blood loss (261.5 ± 195.4 mL versus 228.1 ± 119.5 mL), length of hospital stay, postoperative pain, bowel function, and quality of life. The conversion rate to open approach was 23.8%. The most obvious advantage of the minimal invasive technique was the improved cosmesis.

Similar results were derived from two meta-analyses and reviews that reported a significantly longer operative time, less blood loss, and a smaller postoperative stay.[7,8,12] Also, there was no significant difference in postoperative adverse events, mortality, long-term functional results, reoperation, and pouch failure rates.

The absence of significant advantages when confronting LAP and open techniques may have several reasons. First of all, LAP requires a high level of technical expertise, mainly in patients with previous operations or in those with high BMI. Thus, the learning curve is long and may reflect some of the published results. Furthermore, most series include inflammatory bowel disease (IBD) and FAP patients together.

It is well known that postoperative outcomes (specially anastomotic leak rates) are generally better in FAP than in IBD.[13–15] At diagnosis, patients with polyposis usually present few symptoms and good general conditions, a different picture from those suffering from UC.[16] Also, they do not exhibit inflammatory alterations (adhesions, masses, friable tissues, thickened mesentery) or clinical alterations such as malnutrition and effects from medical therapy that could potentially affect operative outcomes.[17] Besides this, even cases with severe inflammation may benefit from a minimally invasive approach.[18,19]

As experience grows, certain patient groups such as FAP patients turn to be excellent candidates for minimally invasive approaches, because they are usually young, motivated, and desire a cosmetic procedure. Moreover, they are under risk for more than one surgical procedure during lifetime. Besides retrospective, our series demonstrates the experience of one university center whose members have performed LAP colorectal surgery since the 1990s, and now present our results in a series contemplating only FAP patients.

Better results concerning operative morbidity after LAP have been eventually described. In a recent study from the St. Mark's Hospital,[20] 207 consecutive patients (131 open and 76 LAP) with similar demographics were evaluated from 2006 to 2011. The LAP group had a smaller rate of minor complications (33% versus $50 \cdot 4\%$), shorter length of stay (6 versus 8 days), and similar anastomotic leakage, major morbidity, 30-day readmission, reoperation, and stoma closure rates. Otherwise, only 3 patients died, all in the open surgery group. The authors concluded that LAP RPC is feasible with some short-term advantages.

Beyond these early results, the use of minimally invasive procedures to manage FAP may provide other important long-term benefits. In our series, the total rates of early (28% versus 28.9%) and late (16% versus 10.5%) complications were similar in both groups. However, the risk of late major morbidity was much greater after laparotomy (16% versus 2.6%; $P < .001$). Certainly, this is another important point to be raised during the decision-making process.

Furthermore, it is known that RPC may affect tubal infertility due to pelvic adhesions. In a meta-analysis and systematic review evaluating UC and FAP patients, infertility rates rose from 20% to 63% after IPAA.[21] Consequently, the impact of this information should help surgeons and patients to discuss timing and choice of surgery.

As there is evidence that LAP generates fewer adhesions even after lengthy colorectal procedures, another potential important advantage of the LAP approach would be a higher pregnancy rate, thus turning LAP into the best option when dealing with young women. In an attempt to assess adhesions development in UC patients, Hull et al.[22] performed a diagnostic LAP at the time of ileostomy closure after LAP (28) or open (12) IPAA. They found that LAP pouch surgery was associated with significantly fewer incisional, abdominal, and adnexal adhesions. Similarly, a questionnaire sent to 160 women treated in three university hospitals in Europe addressed fertility history after IPAA for FAP, UC, and colonic inertia.[23] Using a Kaplan-Meier survival function, they reported a higher pregnancy rate after LAP IPAA, a finding corroborated by another important European center.[24]

Although not supported by high-grade evidence, the idea that LAP leads to fewer adhesions with decreased abdominal reoperation rates is well accepted.[25,26] Among our patients, reoperation due to intestinal adhesions was necessary in 1 patient in the LAP and open groups (2.6% and 4.0%, respectively). Other important advantages are related to quality of life and body image.[10,27]

Still, there is scant data concerning this presumed benefits and also about the potential reduction in incisional hernia rates after LAP IPAA. A retrospective cohort study of 238 open and 110 LAP IPAA revealed similar incidences of incisional hernia (8.4% versus 5.9%; $P = .4$) and small bowel obstruction requiring hospital admission (26.1% versus 29.4%; $P = .5$) or surgery (8.4% versus 11.8%; $P = .31$).[28] As some of the anticipated long-term benefits of LAP IPAA are not regularly demonstrated, this issue should also be discussed with patients when proposing the LAP approach.

Another controversial question is the discussion about advantages and complications of anastomosis diversion after RPC, as ileostomy omission may be acceptable for selected situations.[16] Despite FAP being an independent factor favoring ileostomy omission, we consider that ileostomy omission should not be considered in FAP due to the risk of desmoid disease associated with reoperations, even though an ileostomy may have a great impact on young patients.[29,30]

Fortunately, loop ileostomy closure after LAP surgery presents a significantly shorter operative time and hospital

stay, as well as a lower rate of postoperative complications.[31] Besides that, complication rates after ileostomy closure were similar (4% versus 2.6%) among our patients, probably related to the small sample.

Finally, the data discussed here suggest that LAP RPC is safe, effective, and may confer specific advantages when performed in a routine basis for FAP patients. Moreover, patients should be conscious that short-term advantages of LAP are limited, mainly represented by cosmesis and a faster clinical recovery in the absence of postoperative complications.

In a long-term perspective, one may expect a higher rate of pregnancy and a smaller risk of abdominal adhesions, major complications, and reoperations. These potential advantages should be raised and discussed, mainly when dealing with young patients. In a context of high-quality medical management, the LAP approach should be the preferable option for skilled surgeons working in high-volume centers.

As a perspective, future comparative studies should focus on establishing rates of specific complications, quality of life, and costs in a prospective and randomized setting.

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Ethical guidelines were followed and this work was approved by the Department Ethics Committee.

Authors' Contributions

F.G.C. and C.A.R.M. designed and wrote the study; M.G.M.d.C. and D.M.C. performed the research, analyzed the data, and searched for references; and S.C.N and I.C. revised the article text.

Disclosure Statement

No competing financial interests exist.

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