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The duration of postoperative ileus after elective colectomy is correlated to surgical specialization

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Abstract *Aim:* Postoperative ileus is an important factor of complications following gastrointestinal procedures. Its pathophysiology and the parameters, which may impact on its duration, remain unclear. The aim of this study was to measure the role of various clinical determinants on restoration of intestinal function after elective colorectal surgery. *Methods:* From July 2002 to September 2003, all patients who underwent laparotomy for colectomy (laparoscopic resections excluded) with either an ileotransverse, colocolic, or high colorectal anastomosis were entered in this prospective study. The intervals in hours between the end of the surgical procedure and passing of flatus (PG) and passing of stool (PS) were recorded by an independent investigator. PG and PS were eventually correlated with the following parameters: type of colectomy, early removal of nasogastric tube (NGT), mechanical bowel preparation (MBP), type of underlying disease, systemic administration of opiates, and surgical training (colorectal fellowship or other). *Results:* One hundred twenty-four patients were entered in this study. Four patients (3.2%) developed septic complications (3 anastomotic leaks

and 1 intraabdominal abscess) and were excluded from the analysis. Median age in this population was 68 (range 30–95) years. Mean duration of postoperative ileus was 70 ± 28 h (PG) and 99 ± 34 h (PS). The type of colectomy, underlying disease, MBP, and early NGT removal failed, in univariate analysis, to correlate with the duration of postoperative ileus. By contrast, time intervals PG and PS were statistically shorter in the group of patients treated by a colorectal surgeon [56 ± 23 vs 74 ± 28 h (PG); 82 ± 26 vs 103 ± 35 h (PS), $p=0.004$], as well as in patients who received systemic opiates for less than 2 days [64 ± 27 vs 75 ± 28 h (PG), $p=0.04$; 88 ± 32 vs 108 ± 33 h (PS), $p=0.001$]. *Conclusion:* Restoration of normal intestinal function after elective open colectomy takes 3 (PG) to 4 (PS) days. In our series, specialized training in colorectal surgery has a positive impact on the duration of postoperative ileus. Surgical specialization should be considered an important parameter in future clinical trials aiming to minimize postoperative ileus.

Keywords Colectomy · Surgery · Ileus · Specialization · Outcome

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Introduction

Postoperative ileus is an inevitable response to peritoneal irritation and is best defined as the uncomplicated ileus

occurring following surgery, which usually resolves spontaneously within 2 to 3 days [1]. Although its duration, due to the lack of objective endpoint, is somewhat difficult to determine, there is evidence that postoperative ileus

correlates with surgical trauma, and that it is most extensive after colonic surgery [2]. As a result, postoperative ileus is a significant medical problem after colorectal procedures, being simultaneously a factor of discomfort for the patient and of prolonged hospital stay [3].

After abdominal surgery, inhibition of small bowel motility is transient, and the stomach recovers within 24 to 48 h, whereas colonic function takes 2 to 3 days to return. Pathogenesis of postoperative ileus remains to date elusive and is probably multifactorial: Sympathetic spinal reflexes [4], inflammatory mediators released as part of stress response [5], and systemic opiates [6], all have an inhibitory effect on gastrointestinal motility and contribute to postoperative ileus.

Methods for preventing or for reducing the duration of postoperative ileus have recently attracted increased scrutiny [7]: Continuous thoracic epidural analgesia [8], early mobilization, and enteric nutrition [9], as well as a reduction in doses of systemic opiates [10] may all have a positive impact on recovery of bowel function after major abdominal surgery. By comparison, methods aiming for reducing surgical trauma have so far focused more on the role of the surgical approach (laparoscopic vs open) rather than on the role of the surgeon himself [11, 12].

We hypothesized that surgical specialization may have a significant impact on postoperative ileus in patients scheduled to undergo abdominal procedures. The aim of the study was therefore to prospectively correlate colorectal surgical training, as well as other clinical parameters, with the time to restoration of normal bowel function after elective, standardized colectomy.

Methods

From July 2002 to September 2003, all patients who underwent laparotomy for colectomy in the Department of Surgery at University Hospital Geneva were entered in this prospective study. This institution is a teaching center, with more than 400 colorectal procedures performed annually, a relatively high percentage of them (30%) on an emergent basis. Three senior consultants and 12 junior staff members routinely perform colorectal surgery with a general surgery background (10 years of experience at least). All of them have developed, during their training, a special interest for a specific area of digestive surgery (liver surgery, transplant, minimally invasive). However, one surgeon has received subspecialty training in a nationally approved colorectal surgery program overseas.

The exclusion criteria were as follows: nonelective procedures, laparoscopic or laparoscopically assisted operations, operations with associated resection of other intraabdominal organs, extended colectomies or atypical resections, low anterior resections and proctectomies, and the necessity to create a stoma either terminal or defunctioning. Basically the patients who were deemed eligible underwent electively

either a right or a left colectomy with an ileotransverse or a colocolic or high colorectal anastomosis, respectively. In our institution, bowel preparation is not used before right colectomies, and some of the patients in the present study were simultaneously enrolled in a prospective, randomized study on the role of bowel preparation before left-sided colorectal surgery.

The intervals in hours between the end of the surgical procedure and passing of flatus (PG) and passing of stool (PS) were recorded by a clinical research nurse who was blinded to of the tested clinical parameters and who visited the patients on a daily basis.

PG and PS were eventually correlated with the following parameters, which were considered potential important parameters affecting bowel function following colectomy: patients' demographics, type of colectomy (right or left), early removal of nasogastric tube (NGT) (less than or more than 24 h postoperatively), mechanical bowel preparation (MBP) prior to surgery (left colectomies only), type of underlying disease (cancer or other), systemic administration of opiates (less than or more than 48 h), and surgical training (colorectal fellowship or general surgery training).

Statistical analysis

Statistical analyses were undertaken by means of the software package STATGRAPH 3.0 software for Windows (Statgraph Software Inc., San Diego, CA). Quantitative data were expressed as mean±SD. Group comparisons were made using two-sided Fisher's exact test for categorical variables and two-sided Student's *t* test for continuous variables. Then a multivariate analysis was undertaken using the software GB-STAT (Dynamic Microsystems Inc., Silver Spring, MD, USA). Multiple strait regression models were used to test the relation of the identified independent factors to the dependant variable PG or PS with cutoff values of less than or at least 48 h. *P* values less than or equal to 0.05 were considered statistically significant.

Results

From July 2002 to September 2003, 124 patients who underwent laparotomy for an elective right or left colectomy with either an ileotransverse, colocolic, or high colorectal anastomosis were entered in this prospective study. Four patients (3.2%) developed septic complications (3 anastomotic leaks and 1 intraabdominal abscess) and were excluded from the analysis, leaving 120 patients who constitute the population studied herein. Median age in this group was 68 (range 30–95) years. There were 64 men and 56 women. The main indication for surgery was cancer (97 cases), diverticulosis, endometriosis, and Crohn's disease. Procedures performed included 50 right and 70 left colectomies; NGT was removed less than 24 h after surgery in 45 (37.5%)

Table 1 Comparison of clinical parameters according to surgeons

Variable	General surgeon, N=93	Colorectal surgeon, N=27	<i>p</i> value ^a
Age (median, range)	71 (31–95)	69 (30–84)	0.30
Gender			0.38
Male	52	12	
Female	41	15	
Underlying disease			0.01
Cancer	80	17	
Other	13	10	
Type of procedure			0.07
Right colectomy	43	7	
Left colectomy	50	20	
Bowel preparation			0.50
Yes	37	13	
No	56	14	
Systemic opioids			0.66
<48 h	42	14	
>48 h	51	13	
Early removal NGT			0.65
<24 h	36	9	
>24 h	57	18	

NGT nasogastric tube

^aUnpaired *t* test or Fisher's exact test when appropriate

cases. Seventy patients (58%) did not receive any bowel preparation.

A single colorectal surgeon performed 27 colectomies (22.5%). The comparison of patients operated by specialized vs general surgeons is summarized in Table 1. Patients operated by a colorectal surgeon were more likely to be operated on for conditions other than cancer, such as Crohn's disease and endometriosis, and showed a trend towards a higher proportion of left colectomies. The other demographics and surgical parameters were not significantly different between groups.

For the whole group, mean±SD duration of postoperative ileus was 70±28 h (PG) and 99±34 h (PS). The type of colectomy (*p*=0.78), underlying disease (*p*=0.73), MBP (*p*=0.15), and early NGT removal (*p*=0.22) were all parameters which failed, in univariate analysis, to correlate with the duration of postoperative ileus. By contrast, time intervals PG and PS were statistically shorter in the group of patients treated by a colorectal surgeon [56±23 vs 74±28 h (PG); 82±26 vs 103±35 h (PS), *p*=0.004]. Similarly, patients who received systemic opiates for less than 48 h had a shorter duration of ileus [64±27 vs 75±28 h (PG), *p*=0.04; 88±32 vs 108±33 h (PS), *p*=0.001]. The impact of various clinical parameters on the duration of postoperative ileus is summarized in Tables 2 and 3.

In multivariate analysis, the two factors (surgical specialization and systemic opiates for less than 48 h), previously identified, emerged again as significant predictors of shortened postoperative ileus. The results of the multivariate analysis are summarized in Tables 4 and 5. Surgical specialization was the only parameter which was consistently associated with a shortened postoperative ileus, whether it was measured by the time to PG or the time to PS.

Table 2 Impact of variables on postoperative passing of stools

Variable	Ileus (h)	<i>p</i> value
Type of procedure		0.78
Right colectomy	98±35	
Left colectomy	99±33	
Indication for surgery		0.73
Cancer	101±43	
Other	98±32	
Bowel preparation		0.15
No	93±34	
Yes	102±34	
Early removal NGT		0.22
No	102±35	
Yes	94±32	
Surgical specialization		0.004
No	103±35	
Yes	82±26	
Systemic opioids		0.001
<48 h	88±32	
>48 h	108±33	

Table 3 Impact of variables on postoperative passing of gas

Variable	Ileus (h)	<i>p</i> value
Type of procedure		0.63
Right colectomy	68±27	
Left colectomy	71±29	
Indication for surgery		0.66
Cancer	69±26	
Other	72±37	
Bowel preparation		0.78
No	70±29	
Yes	69±27	
Early removal NGT		0.12
No	73±27	
Yes	65±29	
Surgical specialization		0.004
No	74±28	
Yes	56±23	
Systemic opioids		0.04
<48 h	64±27	
>48 h	75±28	

Table 4 Multivariate analysis of factors for passing of stools

Variable	<i>t</i> value	<i>p</i> value
Surgical specialization	3.13	0.002
NGT removal	0.57	0.57
Systemic opiates	2.62	0.01
Type of colectomy	1.31	0.19
Indication for surgery	1.93	0.055

Table 5 Multivariate analysis of factors for passing of gas

Variable	Ileus (h)	<i>p</i> value
Surgical specialization	3.32	0.001
NGT removal	0.34	0.73
Systemic opiates	1.02	0.31
Type of colectomy	0.68	0.49
Indication for surgery	1.4	0.16

Discussion

Restoration of normal intestinal function after elective open colectomy takes 3 (PG) to 4 (PS) days. The results presented here indicate that specialized training in colorectal surgery has a positive impact on the duration of postoperative ileus after elective colectomy; the other clinical parameter having a similar impact is the reduction in systemic administration of opiates. The other variables tested, such as the type of colectomy, the early removal of NGT, as well as the indication for surgery did not influence the duration of postoperative ileus.

Assessing postoperative ileus has proven difficult due to the lack of good objective endpoint, and bowel movements are certainly not a reliable indicator of the exact time of resolution of ileus; nevertheless, most clinicians would agree that it is probably the most objective measure and that, in combination with the passage of flatus [also known by the acronym of flatus and return of transit (FART); Read TE], can be considered a good estimate of the return of bowel function. In our series, postoperative ileus lasted 3–4 days, and colonic transit occurred 24 h after flatus, which is in accordance with most previously published series [13–15].

Surgeon-dependent differences in outcome are now well documented in patients with rectal [16–18] and breast [19] cancer; importantly, these differences seem to reflect the degree of specialization rather than case volume [20]. The colorectal surgeon working in our institution is mostly involved in pelvic surgery for rectal cancer or ulcerative colitis and did not perform more colectomies than other staff surgeons. However, the duration of postoperative ileus was strongly correlated with subspecialty training, with a reduction by nearly 24 h of postoperative ileus in comparison with patients operated on by general surgeons. This difference in magnitude is clinically relevant and is quantitatively similar to the impact of a reduced administration of systemic opiates.

An important limitation of our study is that the colorectal surgeon group is comprised of surgeries performed by only one surgeon, and that, accordingly, the effect of subspecialty training is confounded with the skills and experience of this surgeon. There is also a potential for patient selection bias, but very unlikely to favor the colorectal surgeon group, which included cases considered more difficult. Of note, there was a preponderance of cancers, and a trend toward right colectomies in the group operated by general surgeons; this also may have influenced our results. By contrast, pre- and postoperative management appeared relatively consistent between groups, with similar approaches regarding use of NGT and bowel preparation, as well as administration of opiates. Similarly, anesthetic techniques were distributed randomly between groups. Thus, most of the differences observed are likely to be related to the procedure itself.

In summary, the differences observed seem to be related, at least in part, to a reduction in surgical trauma by minimizing handling of the small bowel, shortening operating time, as well as conducting dissection in anatomical planes, with subsequent reduction in bleeding and need for postoperative transfusions. Unfortunately, in this study, these differences were not correlated with the duration of hospital stay, due to some specificities in the Swiss Health Insurance system, which make this parameter irrelevant for analysis. Our data demonstrate that specialized training in colorectal surgery has a positive impact on the duration of postoperative ileus after elective colectomy. Subspecialty training should be considered an important parameter in future clinical trials aiming to minimize postoperative ileus [14], [17].

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