

An integrated multidisciplinary approach to implementation of a fast-track program for laparoscopic colorectal surgery

Une approche pluridisciplinaire intégrée visant la mise en œuvre d'un programme accéléré pour la chirurgie colorectale par laparoscopie

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Abstract

Background Enhanced perioperative care programs have been developed in order to attenuate the impact of surgical stress on organ dysfunction, thereby accelerating hospital discharge and reducing morbidity. The implementation of a fast-track program for laparoscopic colorectal surgery is reported.

Methods We report on a series of patients who entered a coordinated program based on preoperative patient education and counseling, a laparoscopic approach, provision of postoperative epidural analgesia, early food intake and mobilization, and structured surgical and nursing care practices. The program was introduced in September 2006 and adapted to our institutional needs. Outcome measures included length of hospital stay, return of bowel function, incidences of postoperative complications, and rate of readmission to hospital.

Results Twenty-five patients were selected by the surgeons for the accelerated laparoscopic colorectal pathway. The median duration of hospital stay was 3 (95% confidence

interval, 3–4) days. Sixteen patients (64%) were discharged from hospital on day 3. Nine patients failed the pathway for various reasons (social indications, poor pain relief, wound infection, anemia, urinary retention) and were discharged later (six patients on day 4, two patients on day 5, and one patient on day 6). Times to recover bowel function and to resume a full diet were all within the first 36 hr from time of surgery. There were two readmissions.

Conclusion This early clinical experience demonstrates the feasibility of a fast-track program for colonic surgery and the requirement for an integrated multidisciplinary approach to perioperative care.

Résumé

Contexte Des programmes de soins périopératoires améliorés ont été élaborés afin d'atténuer l'impact du stress chirurgical sur la défaillance systémique, ce qui a permis d'accélérer le congé de l'hôpital et de réduire la morbidité. La mise en œuvre d'un programme accéléré pour la chirurgie colorectale par laparoscopie est décrite ici.

Méthode Nous présentons une série de patients ayant participé à un programme coordonné et décrivons la formation et la consultation préopératoire des patients, l'approche par laparoscopie, la prestation d'une analgésie péridurale postopératoire, l'absorption de nourriture et la mobilisation précoce, et les pratiques structurées de soins chirurgicaux et infirmiers. Le programme a été mis en place en septembre 2006 et adapté pour répondre aux besoins de notre institution. Nous avons mesuré la durée du séjour à l'hôpital, la restauration de la fonction intestinale, l'incidence de complications postopératoires et le taux de réadmission à l'hôpital.

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Résultats *Vingt-cinq patients ont été sélectionnés par les chirurgiens pour subir une intervention accélérée par la voie colorectale par laparoscopie. La durée médiane du séjour à l'hôpital était de 3 jours (IC 95 %, 3-4). Seize patients (64 %) ont quitté l'hôpital au jour 3, la voie laparoscopique a échoué pour diverses raisons chez neuf patients (indications sociales, mauvais soulagement de la douleur, infection de plaie, anémie, rétention urinaire) qui ont reçu leur congé plus tard (six patients le quatrième jour, deux patients le cinquième jour, et un le sixième jour). La restauration de la fonction intestinale et le retour à un régime alimentaire normal ont eu lieu pour tous les patients dans les 36 premières heures suivant la chirurgie. Il y a eu deux réadmissions.*

Conclusion *Cette expérience clinique précoce démontre la faisabilité d'un programme accéléré pour la chirurgie du colon et le besoin d'une approche pluridisciplinaire intégrée aux soins périopératoires.*

Elective colorectal resection is associated with a complication rate of 20–30% despite major advances in surgical technique or the use of multimodal analgesia. Colorectal surgery is classically associated with a postoperative hospital stay of 8–10 days.¹ The introduction of thoracic epidural analgesia and the endoscopic approach to surgical resection.^{2,3} can accelerate the return of bowel function and decrease length of hospital stay with moderate success.

With an understanding of the pathophysiology of surgical stress, programs were designed to attenuate organ dysfunction, reduce morbidity, and shorten hospitalization. Postoperative programs proposed more than ten years ago challenged the traditional concepts of perioperative care and an evidence-based program was engendered.⁴ Following initial reports, several uncontrolled studies were undertaken to develop standardized programs comprehensive of preoperative education and discharge planning, early ambulation and early oral intake. The studies met with positive results.^{5,6} Recently, a randomized controlled trial and a systematic review showed benefits of fast-track colorectal surgery.^{7,8}

In 2005, a team comprised of surgeons, anesthesiologists, nurses, physiotherapists, nutritionists, and epidemiologists of the McGill University Health Centre (MUHC) developed a multidisciplinary approach to colon resection with the intent to implement a fast-track program in this institution. This team's objective was to improve clinical practice and to foster research in various aspects of surgical care. The team started to address the perioperative issues associated with colorectal surgery, and after several meetings during which various aspects of current clinical practice were analyzed, an accelerated colonic surgery pathway was proposed and subsequently implemented.

Following are the main elements of the fast-track protocol, as proposed by Kehlet *et al.*^{9,10}: preoperative patient education; appropriate discharge planning; limited disruption of fasting period; attenuation of the surgical stress response by minimizing surgical incision and thoracic epidural blockade^{11–15}; optimization of postoperative pain relief by using multimodal analgesia; avoidance or early removal of drains and tubes; and earlier oral feeding and enforced mobilization. These authors have reported a reduction of hospital stay to 2–3 days, low readmission rate, and low morbidity.

The present report documents our preliminary institutional experience with the implementation of an accelerated rehabilitation program in a selected group of patients who underwent laparoscopic colon resection in the context of a multidisciplinary perioperative program.

Methods

Patient selection

In September 2006, the accelerated colorectal pathway was implemented. Two surgeons (P.C. and B.S.) selected patients who were ASA I, II, and III with no preoperative chemotherapy or radiotherapy, no previous abdominal surgery, absence of metastatic colon tumor, no inflammatory bowel disease, and consent to participate in the accelerated colon pathway program. The MUHC Ethics Board approved the review of the medical records for this cohort study.

Components of the fast-track program

Preoperative education

One or two weeks prior to surgery, the patients, whom the surgeon identified as meeting the criteria to undergo the accelerated laparoscopic colorectal program, were screened by a nurse in the preoperative clinic. The patients were informed of all aspects of care, including milestone setting, multimodal analgesia, early postoperative oral intake and mobilization, and planned discharge of 3 days after surgery.

Anesthesia and analgesia

No premedication was administered. Before induction of general anesthesia, an epidural catheter was inserted in all patients between the eighth and tenth thoracic interspace. Following a test dose of 3 mL of lidocaine 2%, 10 mL of bupivacaine 0.5% was injected to produce a bilateral segmental (T4–L4) sensory block, which was assessed using an alcohol swab and sensation to pinprick before induction of anesthesia. The neuraxial blockade was maintained during

surgery with a continuous infusion of bupivacaine 0.25% infused at a rate of 3–10 mL · hr⁻¹. General anesthesia was induced with propofol 3 mg · kg⁻¹ *iv*, fentanyl 1.5 µg · kg *iv*, and rocuronium 0.8 mg · kg⁻¹, and was maintained with an end-tidal concentration of desflurane of 3–6%. Normal saline (0.9%) was infused at a rate of 6 mL · kg⁻¹ · hr⁻¹. One unit (500 mL) of pentastarch was also infused. Blood was transfused if blood loss exceeded 20% of the patient's estimated circulating volume. Intraoperative hypotension was treated with neosynephrine. A thermal blanket set at 40°C was positioned on the exposed upper part of the body to maintain perioperative normothermia (>36.0°C). All patients received prophylactic intravenous antiemetics for postoperative nausea and vomiting (PONV), including dexamethasone 8 mg *iv* and droperidol 0.625 mg *iv* or ondansetron 4 mg *iv*.

At the end of surgery, patients were transferred to the postoperative anesthesia care unit (PACU), and an epidural infusion of bupivacaine 0.1% with 3 µg · mL⁻¹ of fentanyl was started at a rate of 5–10 mL · hr⁻¹ and continued for up to 2–3 days postoperatively. A member for the acute pain service team assessed the segmental sensory block on a daily basis, and the infusion was adjusted to maintain a bilateral sensory block from T7 to L3 (area of surgical incision). Pain intensity was assessed using a visual analog scale (VAS; 0–10 cm, where 0 represents no pain and 10 cm represents the worse possible pain). If the VAS score at rest was greater than 3 cm, then the rate of epidural infusion was increased to a maximum of 15 mL · hr⁻¹. Patients received naproxen 500 mg twice daily, either orally or rectally for up to 5 days, and acetaminophen 1 g four times daily for up to 5 days. If pain still persisted, the epidural catheter was repositioned and the block was tested. On the morning of postoperative day 2, an epidural stop test was administered and, if successful (VAS at rest <3), the epidural infusion was discontinued. Until hospital discharge, slow-release oxycodone 10 mg twice daily and oxycodone 5–10 mg every 4 hr were provided as breakthrough medication.

Surgical management

Two surgeons who were well trained in laparoscopic surgery performed all of the procedures. All patients were admitted on the morning of surgery. Metronidazole 500 mg *iv* and cefazoline 2 g *iv* were administered 20 min before skin incision. One hour after insertion of the epidural catheter, all patients received a single dose of unfractionated heparin 5000 U subcutaneously, and antiembolic stockings were applied. Laparoscopy was achieved using a 12 mm untipped Hasson cannula inserted under direct vision into the peritoneal cavity through a small vertical infra-umbilical incision to establish the pneumoperitoneum, which was maintained

with carbon dioxide insufflation to a pressure of 12 mmHg. This incision was later extended to 4–5 cm to deliver the colon for resection and reanastomosis. Three additional 5-mm trocars were inserted under laparoscopic vision. For right hemicolectomy, the colon was completely mobilized laparoscopically. The resection and anastomosis was performed extracorporeally. For the left colon resection, the colon was mobilized laparoscopically. Blood vessels were divided intracorporeally. The colon was then divided intracorporeally. The anastomosis was completed intracorporeally or extracorporeally using the double-shaped end-to-end anastomotic circular stapling technique. A nasogastric tube and abdominal drains were not used.

In addition to incentive spirometry, postoperative orders included maintaining a heplock *iv* upon arrival to the surgical ward, clear fluids up to 1 L, and sitting in a chair for 20 min. On postoperative day 1, the patients were served a full diet and protein supplements for a total volume of 2 L · day⁻¹. They were encouraged out of bed for all meals and either walking or sitting for up to 8 hr per day. The bladder catheter was removed at 6:00 a.m. on postoperative day 1. Patients were visited daily by the surgical team for assessment of bowel function and progress of care. If, after postoperative day 3, patients did not meet the discharge criteria (full mobility without assistance, tolerance of semisolid and solid food without nausea and vomiting, absence of infection or pain, and passage of flatus), the reason was documented in the medical chart.

Nursing care on the surgical ward

During the preparatory phase leading to the implementation of the accelerated program, the nursing team of the surgical ward was actively involved in the reorganization of nursing care. The nurse manager and the educator introduced the program to the nurses and discussed the implications for their practice. A nursing worksheet/kardex was used for each patient in order to facilitate documentation. As patient care was pre-determined, the nurses created a pre-printed worksheet to eliminate having to hand-transcribe all the patient care orders.

Outcome measurements

A convenience sample of 25 subjects is reported in this case series. The primary outcome was the length of hospital stay, defined as time spent in the hospital from the day of admission to the day of hospital discharge. Secondary outcomes included quality of postoperative analgesia, as assessed by VAS scores at rest and while walking, and return of bowel function (time from surgery to passage of flatus and bowel movements).

Results

The patients' demographic characteristics and clinical data, including ASA classification, co-morbidities, surgical diagnosis, type and duration of surgery, and blood loss are presented in Table 1. No patient required conversion to an open procedure.

The median duration of hospital stay was 3 days (Table 2). Sixteen of the 25 (64%) patients met the clinical pathway expectations, i.e., one patient was discharged from hospital on day 2, and 15 patients were discharged on day 3. Nine patients stayed longer than 3 days and the reasons are presented in Table 3. Return of bowel function, as assessed by passage of flatus and return to full diet, occurred at median values of 24 and 32 hr, respectively. Two patients had intraoperative complications; one experienced blood loss >600 mL requiring blood transfusion, and two patients experienced a laceration of the spleen. Four postoperative complications were observed, including abdominal distension following accidental bowel perforation, fever following bowel obstruction, postoperative

Table 1 Demographic characteristics and clinical data

Variables	Accelerated program <i>N</i> = 25
Age (year)	61 ± 12
Body weight (kg)	76 ± 11
Body mass index (kg · m ⁻²)	25.0 (22.9–28.8)
Gender	
Male/Female	15/10
American Society of Anesthesiologists I/II/III	4/19/2
Co-morbidities	
Hypertension	6
Coronary artery disease	1
Asthma	0
Chronic obstructive pulmonary disease	1
Diabetes type 2	3
Hypothyroidism	1
Anemia	0
Diagnosis	
Cancer	15
Diverticulitis	6
Adenoma	4
Type of surgery	
Right hemicolectomy	14
Left hemicolectomy	3
Sigmoid resection	3
Total colectomy	1
Anterior resection	4
Duration of surgery (min)	223.68 ± 57.02
Blood loss (mL)	180 (125–650)

Table 2 Clinical data

Variables	Accelerated program <i>N</i> = 25
Length of hospital stay (days)	3 (3–4)
Time to passage of flatus (hours)	24 (24–47)
Time to bowel movements (hours)	65 (48–70)
Return to fluid diet (hours)	20 (18–21)
Return to full diet (hours)	32 (28–38)
Pain at rest (average of 4 days)	1 (0–2)
Pain on walking (average of 4 days)	1 (0–2)
Intraoperative complications	2
Postoperative complications	4

urinary retention, and an extended subcutaneous hematoma. The first two of these patients left hospital on postoperative day 3 but were readmitted on day 7 and day 6 for surgical observation and intervention.

Discussion

Our clinical experience indicates that it is feasible to implement a fast-track program to accelerate the clinical care of patients undergoing scheduled laparoscopic colorectal surgery. Over 60% of patients left the hospital on day 3, with two readmissions due to postoperative complications. Overall, these findings are comparable with other observational and controlled studies reported in the literature^{10,16} that show favorable results for length of stay, incidence of complications, analgesia, and the number of patients failing the pathway.

Over the years, the concept of fast-track surgery has evolved from the domain of ambulatory surgery to surgical care of patients scheduled for major surgery. Fast-tracking, also known as “accelerated recovery”, “accelerated rehabilitation”, “enhanced recovery” surgery involves the use of a coordinated multidisciplinary perioperative care plan to reduce complications, to facilitate earlier discharge from hospital, and to allow for faster recovery of daily activities.¹⁷ The approach stems from advancements in anesthetic techniques, improved knowledge of perioperative organ dysfunction, introduction of minimally invasive surgery, and revision of perioperative care.

Colorectal surgery has been adopted as a study model by our multidisciplinary group of clinical investigators, and all aspects of clinical care provided in this institution were examined and critically reviewed in light of results from evidence-based programs of enhanced perioperative care.¹⁷

A minimally invasive approach to colon resection, initially used for benign colorectal disease, became more accepted as a less invasive alternative to conventional open resection for colorectal cancer.¹⁸ The laparoscopic approach is reported to cause less inflammatory response and to be

Table 3 Reasons for hospital discharge beyond postoperative day 3

Patient	Age (years)	ASA	Type surgery	Reason for delayed discharge	LOS (days)
1	67	2	Left hemicolectomy	Social reasons	4
2	74	3	Anterior resection	Postoperative urinary retention	4
3	60	2	Sigmoid resection	Social reasons	4
4	71	2	Anterior resection	Anemia, subcutaneous hematoma	4
5	73	3	Sigmoid resection	Continue epidural for pain	4
6	31	2	Right hemicolectomy	Failed epidural stop test	4
7	53	2	Anterior resection	Non ambulating and eating well	5
8	80	2	Right hemicolectomy	Pain poorly controlled with epidural, changed to PCA	5
9	55	2	Anterior resection	Wound infection	6

ASA American Society of Anesthesiologists' physical status classification; LOS length of stay

associated with less pain, early feeding, and less wound infection without compromising the adequacy of the oncological resection.^{19,20}

Thoracic epidural anesthesia and analgesia with local anesthetics has been shown to facilitate the early return of bowel function and to provide superior pain relief with no motor blockade, thus facilitating oral feeding and minimizing immobility.²¹

Therefore, it would make sense to take advantage of these two interventions to accelerate the postoperative recovery. While strong evidence of the effectiveness of epidural analgesia on the recovery of bowel function with open colectomy has been demonstrated, a few studies using laparoscopy and epidural analgesia produced contrasting results.^{11,12,22} This discrepancy was probably due to the fact that the perioperative care differed in each of the studies.²³ In two recent studies, a laparoscopic approach to colon resection, together with thoracic epidural local anesthetics, contributed to accelerate the return of bowel function and dietary intake.^{14,15} This physiological benefit, however, did not translate into faster hospital discharge (median of 5 days). Such findings prompted us to consider the need to revise surgical and nursing management and allocation of resources.¹⁰

The MUHC multidisciplinary group decided to send one senior nurse to visit the Surgical Gastroenterology Unit of the Hvidovre Hospital in Denmark where work on the fast-track colon surgery program was pioneered. Some challenges were identified with the implementation of the accelerated program at the MUHC. The surgeons involved in this program were highly cautious in selecting suitable candidates. In fact, only 25 of the 61 patients who underwent laparoscopic colon resection throughout the 18-month study period were enrolled in this program. This fact could prompt some criticism regarding selection bias and could also suggest some difficulty in generalizing the findings. Social factors ($n = 2$) and poor quality of pain relief ($n = 3$) were the most common reasons for hospital discharge beyond day 3 (20%),

implying that preoperative education and postoperative optimization of analgesia are prerequisites for a successful fast-track surgical program.²⁴ Another limitation of this report is the relatively small number of subjects. Furthermore, as we did not attempt to undertake a randomized controlled trial at this stage of program implementation, the strength of evidence is somewhat more limited. Finally, although nursing resources were not addressed in this preliminary report, there was a perception that some aspects of accelerated care would require more nursing time, for instance, attending to patients while they began mobilizing, providing nutritional supplementation, and monitoring vital signs with greater frequency.

Several important lessons were learned from this early clinical experience. The first lesson was identifying the need for a more integrated multidisciplinary team approach. While there was a strong motivation to follow a set care protocol, occasionally communication was weak between the stakeholders involved in the clinical program. Another lesson was identifying the need to establish outcome measures in addition to length of stay that would be meaningful to patients.²⁵

In summary, an accelerated program of colon resection can be implemented with the collaboration of surgeons, anesthesiologists, nurses, and patients and their families where the anesthesiologist plays an active role as a perioperative physician.²⁶ In our small series, over 60% of the patients were discharged from hospital 3 days after surgery. However, our experience highlights the need for further work in order to optimize the recovery process and to reinforce the components that could facilitate a more widespread application of fast-track programs.

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Conflicts of interest None declared.

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