Fast-Tracking Colostomy Closures

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Abstract There have been very few studies on applying fast-track principles to colostomy closures. We believe that outcome may be significantly improved with multimodal interventions in the peri-operative care of patients undergoing this procedure. A retrospective study was carried out comparing patients who had undergone colostomy closures by the fast-track and traditional care protocols at our centre. We intended to analyse peri-operative period and recovery in colostomy closures to confirm that fast-track surgery principles improved outcomes. Twenty-six patients in the fast-track arm and 24 patients in the traditional care arm had undergone colostomy closures. Both groups were comparable in terms of their baseline parameters. Patients in the fast-track group were ambulatory and accepted oral feeding earlier. There was a significant reduction in the duration of stay (4.73 ± 1.43 days vs. 7.21 ± 1.38 days, $p=0.0000$). We did not observe a rise in complications or 30-day re-admissions. Fast-track surgery can safely be applied to colostomy closures. It shows earlier ambulation and reduction in length of hospital stay.

Keywords Colostomy closure · Fast track surgery · Early recovery after surgery · Multi-modal rehabilitation

Introduction

Multi-modal interventions implemented in the peri-operative period have been known to enhance recovery [1]. It has been

popularly called “Fast-track surgery” (FTS), “Enhanced recovery after Surgery” or “Multi-modal rehabilitation after surgery”. Starting from colorectal surgery, this methodology has gradually been adopted by various sub-specialties [2, 3]. In gastro-intestinal (GI) surgery, the FTS protocol has been mainly applied to major oncologic resections. Minimally invasive surgery (MIS) has played an instrumental role in the application of FTS to GI surgery. Some studies have shown that, if applied within FTS settings, the difference between open and MIS procedures may not be as substantial as once thought [4].

There have been very few reports studying the effect of FTS on colostomy closures. Our primary aim was to carry out this study to confirm whether the principles of FTS can be applied to this surgery. The reversal surgery at our centre was traditionally associated with a 7–10-day recovery period. There have been rapid advances in colorectal surgery. Emphasis on MIS and oncologic resections has led to the perception that colostomy surgeries are “easy”. It usually is performed without the fanfare that may accompany a laparoscopic colorectal resection. However, these surgeries are known to be associated with devastating complications [5]. On the other hand, when a patient comes in for a colostomy reversal he/she does not expect a repeat of the “major” surgery they had undergone to land up with a stoma in the first place. They expect a smooth peri-operative course and earlier return to productivity. It is because of the above reasons (especially the latter) that it might be in the interest of the surgeon to apply the FTS principles to colostomy closures.

Materials and Methods

A retrospective observational study was carried out covering a period of 4 years from May 2009 to April 2013 at a Municipal General Hospital in Mumbai, India. The approval of the institutional ethics committee was taken prior to the

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commencement of the study. Data were gathered regarding patients who underwent colostomy closure procedures under a single surgical unit over the given duration. The procedures considered under “Colostomy closure” were closure of a temporary loop colostomy including reversal of Hartmann’s procedure and reversal of ileo-colostomy. Ileo-colostomy was defined as a stoma where the ileum and the colon were brought out as either separate end stomas or a double-barrel stoma.

Our unit began implementing the “Fast-track” rehabilitation protocol to colostomy closure since April 2011. All the patients coming for this procedure since then have been managed by this protocol and were included in this study. Consecutive patients who underwent their surgery with conventional care methods over the previous 2 years were selected as historical controls. Data were gathered from medical records and charts available at the hospital. In case of lapses in information, the patient was interviewed over the telephone

or in person. Demographic data were recorded. A history of past events that led to the stoma creation was recorded. Basic biochemical and hematologic data considered were that obtained on testing immediately before surgery. The fast-track protocol (FTP) followed at our centre for colostomy closure is shown in Table 1. The differences in the conventional care protocol (CCP) are shown in the same table.

All the surgeries were performed by the same unit using the same surgical technique. The loops of involved intestine were mobilised by a peri-stomal or separate midline incision where required. A resection of stomal edges followed by double layer hand-sewn anastomosis was carried out. Non-absorbable sutures (3–0 mersilk) were used for all cases. The antibiotic policy over the study duration was uniform. A single pre-operative dose of a second-generation cephalosporin with metronidazole was given 30–60 min prior. Post-operative antibiotics were given only in case of an established infection. Analgesia was given (irrespective of the mode of

Table 1 Protocols applied to the study groups

	Fast-track protocol (FTP)	Conventional care protocol (CCP) (key differences only)
Pre-operative period	<ul style="list-style-type: none"> • Provide complete information about the protocol and take an informed consent • Advice given regarding exercise, smoking and alcohol cessation • Optimise any pre-existing co-morbidity • Minimal starvation (6 h for solids and 2 h for liquids) • 100 g oral carbohydrate drink • Avoid mechanical bowel preparation • Pre-operative antibiotic 	<ul style="list-style-type: none"> • Overnight starvation • No carbohydrate drink • Mechanical bowel preparation • Parenteral hydration (to compensate for bowel preparation)
Operative period	<ul style="list-style-type: none"> • Epidural anaesthesia (0.125 % bupivacaine, continuous infusion) along with spinal or general anaesthesia • Arterial/central lines inserted only if unavoidable • Strictly avoiding over-hydration • Maintain optimal oxygenation • Avoid hypothermia • Minimal tissue handling • Elective use of nasogastric tubes, abdominal drains and urinary catheters 	<ul style="list-style-type: none"> • Done under spinal or general anaesthesia • Routine use of nasogastric tubes, abdominal drain and urinary catheter • Liberal hydration
Post-operative period	<ul style="list-style-type: none"> • Maintain supplemental oxygen • Strict post-operative nausea and vomiting prophylaxis • Early enforced mobilisation • Early enteral nutrition • Removal of epidural catheter by day 2 • Ensuring adequate analgesia after epidural catheter removal • Early removal of all tubes, drains and catheters 	<ul style="list-style-type: none"> • No emphasis on PONV prophylaxis • No enforced mobilisation • Removal of nasogastric tube and abdominal drain delayed till markers of bowel motility are observed • Enteral nutrition given once bowel motility is restored
Post-discharge	<ul style="list-style-type: none"> • Ensure 30-day follow-up including <ul style="list-style-type: none"> Phone call at 48 h Seventh day clinic visit Any emergency visit 	<ul style="list-style-type: none"> • Patient follows up on day 7 in the clinic or else as and when required

administration) to achieve minimal or no pain. The WHO step ladder approach was used.

Outcomes of interest in the post-operative period were time to ambulation (considered as time taken to mobilise without help for 10 min out of bed), time to removal of all tubes, drains and catheter, time to passage of flatus and stool and the day of discharge. The discharge criteria used for all patients were uniform and are part of unit policy. Discharge was given when oral intake was adequate, pain was minimal or absent, patient could pass urine, at least flatus with or without stool, he/she was able to ambulate independently and the wound condition was satisfactory. A 30-day post-operative period was observed for any re-admission or complication. We intended to analyse the data to find out whether the fast-track methodology was superior to conventional care methodology in the management of patients undergoing colostomy closures.

Data Analysis

Continuous variables were summarised by group using summary statistics (number of observations, mean and standard deviation with range of minimum and maximum). Categorical data were summarised by treatment group using frequencies and percentages. Tests of significance employed compared categorical data using chi-square test. Continuous variables and other efficacy variables like mean period of discharge, return of motility, ambulation and mean period of removal of tubes, drains and catheters were compared by using Student's *t* test. All values reported were two-sided, and all the statistical tests were interpreted at 5 % level of significance.

Results

A total of 26 patients were found to have undergone colostomy closures under fast-track management, and 24 had their procedures done by conventional methods. The findings from 12 patients included in the study had been reported in a previous study [6]. The demographic data in the fast track group (called Group 1) and the conventional care group (called Group 2) are as shown in Table 2. The relevant antecedent histories with respect to the procedures performed are shown in Table 3. The baseline hematologic and biochemical parameters in the study population are shown in Table 4. The analysis revealed that the two groups were comparable in this respect. The American Society of Anesthesiologists (ASA) physical status classification was assigned to patients pre-operatively. Group 1 had 12 ASA-1 and 14 ASA-2 patients while Group 2 had 11 ASA-1 and 13 ASA-2. The groups were not significantly different in this aspect ($p=0.98$). Twenty-three (13 Group 1 and 10 Group 2) ileo-colostomy closures,

Table 2 Demographic data in study groups

Group Demographic variable	Group 1 (FTP)	Group 2 (CCP)	<i>p</i> value
Age (in years)			
Median	29	25	0.61
Mean±SD	32.46±11.19	34.46±15.5	(NS) ^a
Range	17–60	15–64	
Sex (%)			
Males	14 (53.85 %)	15 (62.5 %)	0.54
Females	12 (46.15 %)	9 (37.5 %)	(NS) ^b

NS not significant, SD standard deviation

^a Student's *t* test

^b Chi-square test

9 (4 group 1 and 5 group 2) transverse colostomy closures, 14 (7 group 1 and 7 group 2) sigmoid colostomy closures and 4 (2 group 1 and 2 group 2) reversal of Hartmann's procedures were performed.

The operative details have been summarised in Table 5. None of the patients in the study received blood or blood products in the peri-operative period. In none of the cases was post-operative ventilator support or inotropic support required. Urinary catheters were inserted routinely in the CCP group while only eight patients in FTP group were catheterized. It was electively removed on the first post-operative day in both groups. Re-catheterization was required in two patients in the CCP group and one patient in the FTP group due to retention. Nasogastric intubation was routine in the CCP group and performed only seven times in the FTP group. The nasogastric tube in the CCP group was taken out only when the patient passed flatus. This took an average of 3.87 ± 0.99 days. When inserted, the nasogastric tube was removed earlier in the FTP group (2.7 ± 1.1 days, $p=0.05$). Abdominal drains were deemed necessary in three patients in the CCP group and no patients in the FTP. Abdominal drains were removed when the drain output was <30 ml/day.

In the post-operative period, early enteral nutrition (on post-operative day 1) was tolerated in all but two patients in the FTP group. One patient had persistent nausea vomiting after feeding; therefore, feeding was suspended till day 3. After this, he tolerated feeds without consequence. The other patient did not tolerate feeds due to post-operative ileus which was later discovered to be due to anastomotic leakage. In the CCP group, enteral nutrition was given only when bowel motility had returned marked by the passage of flatus. On an average, enteral nutrition began on day 4 (3.83 ± 0.96) after surgery in the CCP group. Patients achieved 10 min out of bed independent mobilization earlier in the FTP group compared with the CCP group (1.15 ± 0.37 days vs. 1.7 ± 0.75 days, $p=0.002$). Return of bowel motility heralded by passage of flatus was observed earlier in the FTP group compared with

Table 3 Relevant antecedent history along with procedure performed

Relevant history	Peritonitis (perforation/anastomotic leak)		Tuberculosis		Malignancy		Perianal sepsis/trauma	
Procedure performed	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
Ileo-colostomy closure	3	2	8	7	2	1	0	0
Transverse loop colostomy closure	1	1	0	0	3	4	0	0
Sigmoid colostomy closure	2	3	0	0	2	2	3	2
Reversal of Hartmann's procedure	2	1	0	0	0	1	0	0

Group 1: fast-track protocol (FTP)

Group 2: conventional care protocol (CCP)

the CCP group (2.8 ± 0.7 days vs. 3.8 ± 0.9 days, $p=0.0001$). Patients passed stools earlier in the FTP group (3.9 ± 0.8 days vs. 6 ± 1.1 days, $p=0.0000$).

There was a single anastomotic leak noted in the fast-track group but none in the conventional care group. One patient

had ileus in the post-operative period in the FTP group. Three patients in the CCP group had ileus, but this did not reach statistical significance. The incidence of wound infection (1 in FTP vs. 2 in CCP) and wound dehiscence (1 in FTP vs. 0 in CCP) was not statistically different in either group. The final outcome measure was the day of discharge. Patients in the FTP group were discharged significantly earlier than patients in the CCP group (4.73 ± 1.43 days vs. 7.21 ± 1.38 days, $p=0.0000$). In the post-discharge follow-up period, we observed one re-admission due to wound infection in the FTP group. In the CCP group, there was one re-admission due to severe wound infection. No other complications were observed in either group. The overall incidence of complications was not significantly different in both groups ($p=0.49$).

Table 4 Hematologic and biochemical parameters in study population

Parameter	Groups		<i>p</i> value
	Group 1(FTP)	Group 2(CCP)	
Hemoglobin (g/dl)			
Median	12.1	12.4	0.88
Mean±SD	12.43±1.57	12.37±1.27	(NS)
Leukocyte count (per mm ³)			
Median	9,300	7,250	0.09
Mean±SD	9,408±2,972	8,004±2,937	(NS)
Platelets (per mm ³)			
Median	256,000	243,500	0.96
Mean±SD	266,692±81,982	267,833±94,702	(NS)
Serum creatinine (mg/dl)			
Median	0.9	1	0.24
Mean±SD	0.9±0.16	0.96±0.2	(NS)
Total bilirubin (mg/dl)			
Median	0.8	0.8	0.48
Mean±SD	0.81±0.16	0.85±0.24	(NS)
Serum albumin (g/dl)			
Median	4	4.05	0.47
Mean±SD	4.07±0.32	4.13±0.32	(NS)
Fasting blood sugar (FBS)			
Post-prandial blood sugar (PPBS) (mg/dl)			
Median (FBS)	96	96	0.35
(PPBS)	108	102	(NS)
Mean±SD(FBS)	92.62±10.32	95.96±14.49	0.84
(PPBS)	105.69±9.45	105±14.49	(NS)

By Student's *t* test

SD standard deviation, FTP fast-track protocol, NS not significant, CCP Conventional care protocol

Table 5 Operative details in both groups

Parameter	Group		<i>p</i> value
	FTP	CCP	
Anaesthesia (no. of patients)			
General	8 ^a	10	
Spinal	18 ^a	14	
Incision (no. of patients)			
Midline	5	6	
Peri-stomal	21	18	
Operative time (min)			
Median	147.5	132.5	0.28
Mean±SD	151.7±39.3	140.4±35.3	(NS) ^b
Range	85–250	90–210	
Blood loss (ml)			
Median	170	160	0.47
Mean±SD	173.8±64.7	161±52.6	(NS) ^b
Range	75–300	80–350	

NS not significant, FTP fast-track protocol, CCP conventional care protocol

^a With epidural anaesthesia

^b By Student's *t* test

Discussion

The study is one of the very few to discuss the application of FTS principles to colostomy closure. In the study, we were able to demonstrate a clear benefit of FTS in terms of reducing length of hospital stay related to colostomy closures. There was no rise in complications or re-admissions when patients were discharged earlier. Similar results have been demonstrated by almost all studies involving major colorectal surgery [7].

Even though our study used historical controls, the two groups were found comparable in terms of demographic data like age and sex, baseline biochemical and hematologic parameters. The study population was relatively young and belonged to lower ASA classes. Not only has FTS demonstrated improved outcomes in such patients but also in elderly and patients with severe co-morbidities [8].

Studies dealing with FTS in colorectal surgery in the West have traditionally involved surgeries performed predominantly for malignancy. In a country like India, infectious and inflammatory bowel diseases still account for the majority of colorectal surgery. There is a lack of epidemiologic data that shows the various reasons for which stomas are created in India. However, our data suggest that, over a period of 4 years, only 15 out of 50 patients had a stoma created due to malignancy. Ileo-caecal tuberculosis, traumatic or pathologic perforations, anastomotic leak and peri-anal trauma/sepsis are still important reasons for stoma creation.

It has been conclusively proven that the simultaneous application of all the individual components of FTS yield maximum advantage [1]. However, in countries like India, we find it difficult to implement a few components of the program. We therefore tailored a protocol that would work best with the limited facilities available at our centre. It has been shown that FTS need not be a rigid protocol but can be flexible to suit individual patients and local institutional needs [9]. The approach involves engaging the patient early in the pre-operative period and continuing care well into the post-operative period. Pre-operative optimization is an integral part of FTS and has been shown to improve outcome [10]. Optimization may include smoking cessation, reducing alcohol intake, controlling any co-morbidity and advising an exercise regimen if appropriate. Interventions such as minimal starvation [11] and oral carbohydrate loading [12] have far-reaching benefits like reduced insulin resistance, reduced thirst and hunger in the peri-operative period and better whole body protein balance. Mechanical bowel preparation (MBP) in colostomy closures traditionally has been given using an osmotic purgative by mouth and distal stomal washes with an isotonic solution. We had eliminated MBP from our FTS protocol. It has been adequately demonstrated that is not required, and it has been suggested that it may even lead to a rise in complications [13, 14].

In the operative period, anaesthetic techniques are tailored to reduce the impact of surgical stress. Epidural anaesthesia

with a local anaesthetic has been shown to not only reduce pain but also work to reduce ileus, preserve peri-operative nutritional profile, improve exercise capacity, lead to better quality-of-life scores and facilitate early discharge [15]. There has been a shift from the strategy of liberal fluid therapy to goal-directed fluid therapy (GDFT). It has been shown to reduce length of hospital stay [16]. We did not have the technology available at other leading FTS centres like transesophageal Doppler, etc., to monitor GDFT. The costs involved have been prohibitive at governmental organization like ours. The cost-benefit ratio of GDFT for low-risk surgery in low-risk patients has been a matter of debate. We emphasised on restricting over-hydration and under-hydration. Sub-optimal end-points like urine output and blood pressure were used. Elective use of drains, tubes and catheter compared with their routine use after surgery is advised in FTS. The basis of this may be that drains do not contribute to early detection of anastomotic leaks [17]; they impede ambulation [18] and may contribute to increased wound infection [17]. There has been a shift towards minimising the use of nasogastric tubes. It has been shown that it does not hasten reversal of ileus, increases pulmonary complications and is uncomfortable [19]. We believe that its routine use in colostomy closures should be abandoned.

In the post-operative period, we observed a higher compliance with early ambulation in the FTS group. This has been observed in almost all studies across the world. Early ambulation promotes a sense of well being and has also been shown to predict early discharge and return to productivity [20]. Early enteral nutrition was accepted by majority of the patients in the FTS group. It has been shown to be safe and effective in reducing post-operative catabolic response [21]. Maintaining a relatively pain-free state in the post-operative period reduces the surgical stress by suppressing sympathetic stimulation as well as helps promote ambulation [6]. In our study, the FTS group demonstrated an earlier recovery of bowel function. There is sufficient evidence to suggest that the multiple interventions in a FTS protocol have a positive impact on bowel function [22]. We were able to demonstrate a significantly shorter length of hospital stay (reduction of approximately 34 %) in the FTS group. This was not accompanied by a rise in complications or re-admissions. We did not observe a significant difference between the two groups in terms of any specific or overall complications. Around the world, larger studies have actually shown a reduction in complications in FTS groups [23]. The small sample size and non-prospective nature of this study may have been one reason why we did not make similar observations.

A small sample size and a retrospective nature are some of the major limitations of our study. We still believe we had made some important observations. It can be safely concluded that surgeries like colostomy closures may be performed under the umbrella of a fast-track surgery program. It may be

suggested that fast-track surgery can improve outcome in surgeries that do not involve minimal access/laparoscopy. This should lead to the application of these principles to open surgical procedures, even if at times facilities at the disposal of the surgeon may be limited. Such surgeries may not enjoy the attention awarded to other major colorectal/laparoscopic surgeries. The implementation of an enhanced recovery program may eliminate this surgeon-based bias and give the patient an opportunity to have the best outcome possible.

Conflict of Interest None to declare

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References

- Kehlet H, Wilmore DW (2002) Multimodal strategies to improve surgical outcome. *Am J Surg* 183(6):630–641
- Kiessling AH, Huneke P, Reyher C, Bingold T, Zierer A, Moritz A (2013) Risk factor analysis for fast track protocol failure. *J Cardiothorac Surg* 8:47
- Kehlet H, Soballe K (2010) Fast-track hip and knee replacement—what are the issues? *Acta Orthop* 81:271–272
- Basse L, Jakobsen DH, Bardram L, Billesbølle P, Lund C, Mogensen T, Rosenberg J, Kehlet H (2005) Functional recovery after open versus laparoscopic colonic resection: a randomized, blinded study. *Ann Surg* 241:416–423
- Herwig Pokorny MD, Harald Herkner MD, Raimund Jakesz MD, Friedrich Herbst MD (2005) Mortality and complications after stoma closure. *Arch Surg* 140:956–960
- Nanavati AJ, Prabhakar S (2014) A comparative study of ‘fast-track’ versus traditional peri-operative care protocols in gastrointestinal surgeries. *J Gastrointest Surg* 18:757–767
- Wind J, Polle SW, Fung Kon Jin PHP, Dejong CH, von Meyenfeldt MF, Ubbink DT, Gouma DJ, Bemelman WA, Laparoscopy and/or Fast Track Multimodal Management Versus Standard Care (LAFA) Study Group; Enhanced Recovery after Surgery (ERAS) Group (2006) Systematic review of enhanced recovery programmes in colonic surgery. *Br J Surg* 93:800–809
- Schwenk W, Günther N, Wendling P, Schmid M, Probst W, Kipfmüller K, Rumstadt B, Walz MK, Engemann R, Junghans T, “Fast-track” Colon II Quality Assurance Group (2008) “Fast-track” rehabilitation for elective colonic surgery in Germany—prospective observational data from a multi-centre quality assurance programme. *Int J Colorectal Dis* 23:93–99
- Lyon A, Payne C, McKay G (2012) Enhanced recovery programme in colorectal surgery: does one size fit all? *World J Gastroenterol* 18: 5661–5663
- Jenkins JT, Burch JL (2012) Preoperative optimisation and conditioning of expectations. In: Francis N (ed) *Manual of fast track recovery for colorectal surgery*. Springer-Verlag London Limited, London, pp 15–35
- Aguilar-Nascimento EJ, Dock-Nascimento BD (2010) Reducing pre-operative fasting time: a trend based on evidence. *World J Gastrointest Surg* 2(3):57–60
- Jones C, Badger SA, Hannon R (2011) The role of carbohydrate drinks in preoperative nutrition for elective colorectal surgery. *Ann R Coll Surg Engl* 93(7):504–507
- Güenaga KF, Matos D, Wille-Jørgensen P (2011) Mechanical bowel preparation for elective colorectal surgery. *Cochrane Database Syst Rev* 9, CD001544
- Serrurier K, Liu J, Breckler F, Khozeimeh N, Billmire D, Gingalewski C, Gollin G (2012) A multicenter evaluation of the role of mechanical bowel preparation in pediatric colostomy takedown. *J Pediatr Surg* 47(1):190–193
- Carli F, Kehlet H, Baldini G, Steel A, McRae K, Slinger P, Hemmerling T, Salinas F, Neal JM (2011) Evidence basis for regional anesthesia in multidisciplinary fast-track surgical care pathways. *Reg Anesth Pain Med* 36(1):63–72
- Feldheiser A, Conroy P, Bonomo T, Cox B, Garces TR, Spies C, Anaesthesia Working Group of the Enhanced Recovery After Surgery (ERAS®) Society; Enhanced Recovery After Surgery Society (2012) Development and feasibility study of an algorithm for intraoperative goal directed haemodynamic management in non-cardiac surgery. *J Int Med Res* 40(4):1227–1241
- Puleo FJ, Mishra N, Hall JF (2013) Use of intra-abdominal drains. *Clin Colon Rectal Surg* 26(3):174–177
- Browning L, Denehy L, Scholes RL (2007) The quantity of early upright mobilisation performed following upper abdominal surgery is low: an observational study. *Aust J Physiother* 53:47–52
- Bauer VP (2013) The evidence against prophylactic nasogastric intubation and oral restriction. *Clin Colon Rectal Surg* 26(3):182–185
- Henriksen MG, Hansen HV, Hesselø I (2002) Early oral nutrition after elective colorectal surgery: influence of balanced analgesia and enforced mobilization. *Nutrition* 18:263–267
- Wang ZH, Zhong B, Xiang JY, Zhou YB, Wang DS (2013) Effect of early oral enteral nutrition on clinical outcomes after colorectal cancer surgery. *Zhonghua Wei Chang Wai Ke Za Zhi* 16(8):735–738
- Yang D, He W, Zhang S, Chen H, Zhang C, He Y (2012) Fast-track surgery improves postoperative clinical recovery and immunity after elective surgery for colorectal carcinoma: randomized controlled clinical trial. *World J Surg* 36(8):1874–1880
- Zargar-Shoshtari K, Connolly AB, Israel LH, Hill AG (2008) Fast-track surgery may reduce complications following major colonic surgery. *Dis Colon Rectum* 51(11):1633–1640