



Laparoscopic colorectal resections with and without routine mechanical bowel preparation: A comparative study



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HIGHLIGHTS

- The evidence of omitting mechanical bowel preparation in laparoscopic colectomy is scarce in the literature.
- There is a concern that omission of mechanical bowel preparation in laparoscopic colectomy may affect surgical outcome adversely.
- This study showed that the clinical outcome, including operating time and postoperative complication rate was not adversely affected by omitting mechanical bowel preparation in laparoscopic colectomy.

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ABSTRACT

Background: The benefit of mechanical bowel preparation (MBP) in patients undergoing laparoscopic colorectal resections remains a question. This study aimed to evaluate the effect of omitting MBP on patients undergoing laparoscopic bowel resections.

Methods: The outcomes of patients who underwent elective colorectal resections for cancer of colon and upper rectum without MBP were compared to a retrospective cohort who had MBP.

Results: There were 97 patients in the No-MBP group and 159 patients in the MBP group. Their mean age, operative risk, tumor size and stage of disease were similar. There were no significant differences in operative time and estimated blood loss. The anastomotic leakage rate was 1.0% in the No-MBP group and 0.6% in the MBP group, ($p = 1.00$). Wound infection rate were 4.1% and 3.8% in the No-MBP group and the MBP group respectively ($p = 1.00$). Overall surgical morbidity rate was 11.3% in the No-MBP group and 8.2% in the MBP group ($p = 0.40$). Conversion rates were 5.2% in the No-MBP group and 6.9% in the MBP group, ($p = 0.57$).

Conclusion: The omission of mechanical bowel preparation does not increase surgical morbidities in patients undergoing laparoscopic bowel resections. It also has no effect on operating time and conversion rate.

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1. Background

Reducing anastomotic leakage rate and the incidence of surgical site infection remains a constant challenge to surgeons. It was previously believed that mechanical cleansing of the large bowel could reduce these complications as most were caused by endogenous colonic bacteria. Mechanical bowel preparation (MBP) by administration of oral laxatives has been practiced since the 1970s. Yet, as for today, the issue of whether MBP is beneficial in colon surgeries remains debatable.

Mahajna et al. showed that the liquid bowel content caused more spillage than solid stool and increased post-operative infective complications [1]. In 1972, Hughes conducted a randomized trial comparing pre-operative enema with preoperative mechanical bowel preparation, and found that vigorous bowel preparation could be safely omitted [2]. Bucher et al. published a meta-analysis which included seven randomized controlled trials of 1297 patients and concluded that MBP would not reduce septic complications and could even be harmful with respect to the incidence of anastomotic leak [3]. Likewise, there were several clinical trials and meta-analyses reaching similar conclusion [4–6]. But the verdict was not final and recent publication challenged this by showing reduced incidence of anastomotic leak and even postoperative paralytic ileus in patients having MBP [7].

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Many of the earlier studies did not include patients undergoing laparoscopic resections [8]. This study aimed to evaluate whether omitting MBP would result in increase in surgical complications in patients undergoing laparoscopic colorectal resections. The primary outcome is anastomotic leakage rate and surgical site infection. The secondary outcome is operative time and conversion rate.

2. Methods

Laparoscopic surgery has been widely applied in the authors' center since 2000 and has become the preferred approach of colorectal resection for patients in recent years. Open surgery was offered only when patients were considered not suitable for laparoscopic surgery and the common reasons included multiple previous abdominal operations and advanced local disease with invasion to other structures. Since October 2009, our unit adopted a policy of no MBP before colonic resection. There were limited cases which MBP was given due to the need of intraoperative colonoscopy to locate small tumors and were excluded from this study. Cases of mid and low rectal cancer were excluded from this study, as there was a potential need of diversion stoma. An unprepared colon will result in faecal matter distal to the diversion stoma and therefore defeat its purpose.

Consecutive patients who underwent laparoscopic colorectal resections from October 2009 to July 2011 formed the No-MBP group and a retrospective cohort of consecutive patients who had laparoscopic colorectal resections from January 2007 to September 2009 were chosen as control; the MBP group. Patients' demographics, operative details, pathology and operative outcomes were retrieved from a prospectively maintained database.

2.1. Patient preparation

In the No-MBP group, patients were advised to have low fiber diet 3 days before the operation and they were put on fluid diet on the day before the operation. For patients undergoing left hemicolectomies and anterior resections, a rectal enema was given at 6 a.m. on the day of operation. In the MBP group, patients had the same dietary restriction and took 3–4 L of polyethylene glycol electrolyte solution in the evening before the operation. At the time of the study, there was only one alternative to polyethylene glycol: oral phospho-soda. Oral phospho-soda, although being less voluminous, has potential serious side effects including dehydration and acute kidney injury, and was therefore not routinely used.

All patients received prophylactic intravenous antibiotics (cefuroxime 1.5 g and metronidazole 500 mg) upon induction of anesthesia and were continued during the first 24 h after operation [10]. Cefuroxime was replaced by ciprofloxacin in patients with penicillin allergy. Povidone-iodine was used for disinfection of surgical site. Oral antibiotics for bowel preparation were not administered and routine preoperative hair clipping was not performed.

2.2. Method of bowel anastomosis and extraction of specimen

Extracorporeal anastomosis was performed, using handsewn or stapler in all right hemicolectomies, extended right hemicolectomies, left hemicolectomies and sigmoid colectomies. Intracorporeal double stapling technique was used in anterior resections. It is the practice of the unit to perform high anterior resections for the majority of tumors at the sigmoid colon. Intracorporeal suture anastomosis was not performed in patients involved in this study. Extraction of specimen was performed with the routine use of a wound protector (Alexis, USA).

2.3. Determination of outcomes

Anastomotic leakage and intra-abdominal collections were detected clinically and confirmed by imaging studies or subsequent re-operation. Surgical site infection was defined according to the definition set by the Centers for Disease Control and Prevention in 1992 [9]. Postoperative paralytic ileus is defined as inability to tolerate diet, absence of flatus and abdominal distension beyond postoperative day 4, in the absence of mechanical bowel obstruction. Intestinal obstruction is defined as presence of mechanical bowel obstruction as shown by imaging or subsequent operation. Conversion was defined as making an incision larger than that required for extraction of the specimen or making an incision prematurely to deal with difficulty in dissection, vascular control or intraoperative complications.

2.4. Statistical method

Statistical analysis was performed using SPSS ver. 11.5 (SPSS Inc, Chicago, IL). Continuous variables were compared with student *t*-test whereas categorical variables were compared by Chi-square test or Fisher's exact when appropriate. *P*-values <0.05 were considered as statistically significant.

3. Results

3.1. Patient characteristics and surgical outcomes

The study included 256 patients (97 patients in the No-MBP group and 159 patients in the MBP group). Patients' demographics, tumor characteristics and operation characteristics were shown in Table 1. The mean age was 70.7 years ($p = 0.988$). About 60% of patients in both groups had ASA (American Society of Anesthesiologists) class 2. The mean tumor size, cancer stage and types of operation were similar. The conversion rate, mean operative time, estimated blood loss of the No-MBP and the MBP group were 5.2% and 6.9%, 155.8 min and 165.0 min, 108.2 ml and 107.3 ml respectively.

3.2. Postoperative recovery

The mean hospital stay for the No-MBP group and the MBP group was 6.8 days and 5.6 days respectively (Table 2). The anastomotic leakage rates in the No-MBP group and the MBP were 1.0% and 0.6% respectively ($p = 1.00$). Two patients (one from each group) had anastomotic leakage and underwent reoperation with de-functioning stoma fashioned. Two patients (2.2%) from the No-MBP group and one patient (0.7%) in the MBP group had intra-abdominal collection, which required re-operation ($p = 0.56$). Six patients in the No-MBP group (6.2%) and four patients in the MBP group (2.5%) required reoperations ($p = 0.19$). The reasons for re-operation in the No-MBP group were intestinal obstruction for two patients, intra-abdominal collection for two patients, postoperative hemorrhage and anastomotic leakage in two patients. In the MBP group, four patients re-operated for acute cholecystitis, anastomotic leakage, ruptured liver metastasis and superior mesenteric vein thrombosis.

The wound infection rate was 4.1% and 3.8% in the No-MBP group and the MBP group respectively ($p = 1.00$). Total morbidity rate was 23.7% in the No-MBP group and 17.6% in the MBP group ($p = 0.24$). The 30-day mortality was zero in the No-MBP group and 0.6% (one patient died of pneumonia after right hemicolectomy) in the MBP group ($p = 1.00$).

Table 1
Patient demographics, tumor characteristics and operative characteristics.

	No-MBP group (n = 97)	MBP group (n = 159)	p
Patient demographics			
Sex			0.70
Male	55 (56.7%)	85 (53.5%)	
Female	42 (43.3%)	74 (46.5%)	
Mean age (years)	70.73 ± 10.09	70.71 ± 11.68	0.99
ASA ^a			
1	17 (17.5%)	16 (10.1%)	
2	59 (60.8%)	101 (63.9%)	
3	21 (21.6%)	41 (25.9%)	0.21
Neoadjuvant chemoradiation	0%	0%	
Tumour characteristics			
Location			0.17
Caecum & ascending colon	15 (15.4%)	36 (22.6%)	
Hepatic flexure	16 (16.5%)	11 (6.9%)	
Transverse colon	10 (10.3%)	13 (8.2%)	
Splenic flexure	6 (6.2%)	5 (3.1%)	
Descending colon	8 (8.2%)	21 (13.2%)	
Sigmoid colon	28 (28.9%)	48 (30.2%)	
Upper rectum & rectosigmoid junction	14 (14.4%)	25 (15.7%)	
Mean tumor size (cm)	4.3 ± 2.1	4.5 ± 1.8	0.35
Cancer stage ^b			
Early (Stage 0–II)	55 (56.7%)	88 (55.0%)	
Advanced (Stage III–IV)	42 (43.3%)	72 (45.0%)	0.79
Operation characteristics			
Duration (min)	155.8 ± 44.4	165.0 ± 45.0	0.11
Blood loss, estimated (ml)	108.2 ± 123.0	107.3 ± 115.0	0.96
Type			0.70
Right hemicolectomy	37 (38.1%)	53 (33.3%)	
Extended right hemicolectomy	4 (4.1%)	6 (3.8%)	
Left hemicolectomy	11 (11.3%)	28 (17.6%)	
Sigmoid colectomy	4 (4.1%)	5 (3.1%)	
Anterior resection	41 (42.3%)	67 (42.1%)	
Diversion Stoma	0%	0%	
Conversion	5 (5.2%)	11 (6.9%)	0.57

^a American Society of Anesthesiologists.

^b Cancer of Colon Staging using American Joint Committee on Cancer 7th revision.

Table 2
Comparison of postoperative outcome.

	No-MBP group (n = 97)	MBP group (n = 159)	p
Mean length of stay (days)	6.8 ± 7.3	5.6 ± 7.1	0.22
Total morbidity	23 (23.7%)	28 (17.6%)	0.24
Leakage	1 (1.0%)	1 (0.6%)	1.00
Intra-abdominal collections	2 (2.2%)	1 (0.7%)	0.56
Hemorrhage	3 (3.1%)	1 (0.6%)	0.15
Wound infections	4 (4.1%)	6 (3.8%)	1.00
Intestinal obstruction	4 (4.1%)	1 (0.6%)	0.07
Paralytic ileus	7 (7.2%)	4 (2.5%)	0.11
Cardiac complications	3 (3.1%)	6 (3.8%)	1.00
Pulmonary complications	3 (3.1%)	9 (5.7%)	0.54
Urinary tract infections	2 (2.2%)	4 (2.5%)	1.00
Deep vein thrombosis	1 (1.0%)	1 (0.6%)	1.00
Re-operations	6 (6.2%)	4 (2.5%)	0.19
30-day mortality	0	1 (0.6%)	1.00

3.3. Subgroup analysis

A subgroup analysis was performed according to the type of anastomosis performed: ileocolic, colocolic and colorectal anastomoses (Table 3). There were no differences in terms of superficial surgical site infection, deep organ space infection, postoperative paralytic ileus and reoperation rate in the various subgroups. Overall complication rate was comparable.

4. Discussion

Despite numerous studies on the subject, the benefit of MBP

remains to be a question. Many prior studies, which negate the benefit of MBP, were done in the era of open surgery. One could logically expect that this could be extrapolated into laparoscopic colectomy. The widely adopted Enhanced Recovery After Surgery (ERAS) guidelines recommended MBP should not be routinely used for colonic surgery [10]. However, this was yet again challenged by a recent large scale retrospective study, in which the use of MBP was associated with lower anastomotic leakage rate, surgical site infection rate and incidence of paralytic ileus [7]. This is further complicated by the use of oral antibiotics in addition to MBP. The use of MBP, which is an essential decision that general surgeons could not escape from, seems to be an ever-changing dogma.

Table 3
Subgroup analysis according to the type of anastomosis performed.

	Ileocolic anastomosis ^a			Colocolic anastomosis ^b			Colorectal anastomosis ^c		
	No-MBP	MBP	p	No-MBP	MBP	p	No-MBP	MBP	p
Superficial SSI ^d	2 (4.9%)	2 (3.4%)	1.00	1 (6.7%)	1 (3.0%)	0.53	1 (2.4%)	3 (4.5%)	1.00
Deep organ space infection ^e	2 (4.9%)	1 (21.7%)	0.57	0 (0%)	0 (0%)	/	2 (4.9%)	1 (1.5%)	0.56
Paralytic ileus	5 (12.2%)	2 (3.4%)	0.12	0 (0%)	2 (6.1%)	1.00	2 (4.9%)	0 (0%)	0.14
All complications	11 (26.8%)	15 (25.4%)	1.00	3 (20.0%)	5 (15.2%)	0.69	9 (22.0%)	7 (10.4%)	0.16
Reoperation	3 (7.3%)	3 (5.1%)	0.69	1 (6.7%)	0 (0%)	0.31	2 (4.9%)	1 (1.5%)	0.56

^a Ileocolic anastomoses were performed in right hemicolectomies and extended right hemicolectomies.

^b Colocolic anastomoses were performed in left hemicolectomies and sigmoid colectomies.

^c Colorectal anastomoses were performed in anterior resections.

^d SSI: surgical site infection.

^e Deep organ space infection includes anastomotic leakage and intra-abdominal abscess.

The results of this study echoes with some of the study conducted on patients undergoing laparoscopic colonic resections. Zmora et al. [11] compared the outcomes of 68 laparoscopic colectomies with MBP to 132 laparoscopic colectomies without MBP in a retrospective review and observed similar complication rate. The anastomotic leakage rate was 4% and 3% and wound infection rate was 12% and 17% respectively. The group without MBP has higher conversion rate, which was caused by difficulty in tumor localization. Bertani et al. published a randomized control trial comparing the use of MBP plus glycerine enema and glycerine enema alone in patients undergoing laparoscopic colonic resections. There was no significant difference in terms of surgical site infection and anastomotic leakage rate observed between the two groups [12].

Apart from incidence of infectious complications, whether the use of MPB would affect the efficiency of laparoscopic colectomy was also of interest. Would MPB result in less impacted bowel and hence better handling? The use of MBP might improve the operative space by cleansing the bowel content [13]. A randomized control trial showed better surgical view in patients with MBP undergoing laparoscopic operations [14]. However, in the presence of an obstructing tumor, this might in turn causes decrease in operative space as proximal bowel distends. The operating time and conversion rate served as surrogates for operative difficulty in this study. Omission of MBP did not positively or adversely affect these two parameters.

With the evidence in the literature, the use MPB is largely up to individual surgeon's preference, and it is widely preferred according to surveys [15–17]. Many consider MBP rather harmless but some study suggested otherwise. A meta-analysis which included 5000 patients showed significantly more cardiac events in patients who had MBP (4.0% VS 2.5% respectively; $p = 0.04$) [18]. Indeed more evidence is welcomed to support the use of MBP or its omission.

The present study was limited by its small sample size and retrospective nature. It demonstrated that with the change of policy and omitting mechanical bowel preparation, the outcome of laparoscopic colectomy was not inferior to those who had bowel preparation prior to the study period. However, failure to detect a difference due to small sample size could not be ruled out.

5. Conclusion

The omission of mechanical bowel preparation does not increase surgical morbidities in patients undergoing laparoscopic colectomy. It also has no effect on operating time and conversion rate.

Conflicts of interest

The authors declare no conflicts of interest.

Sources of funding

This study was not funded by any organisations.

Ethical approval

Ethical approval was not sought.

Author contribution

MY Chan contributed to writing the manuscripts and analyzing data.

CC Foo contributed to writing the manuscripts and conception and design of study.

J Poon contributed to conception and design of study.

WL Law contributed to conception and design of study and final approval of study.

Guarantor

The Guarantor is the one or more people who accept full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

CC Foo accepts full responsibility for the work and conduct of the study.

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