



# A Chinese survey of current practice patterns of preoperative bowel preparation in colorectal surgery

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**Background:** Bowel preparation has long been considered as the standard preoperative management for colorectal surgery. However, there are still controversies about bowel preparation and the importance of bowel preparation gradually declined.

**Methods:** An online 10-question anonymous survey was announced by posters to the active members who attended the 14<sup>th</sup> Chinese Academic Congress of Colorectal Surgery (CACCRS 2021) on October 15–17, 2021. The questionnaire sought information on each surgeon's current practice of preoperative bowel preparation.

**Results:** A total of 384 Chinese surgeons from 26 provincial administrative regions took part in this survey. The most common reason for choosing bowel preparation was preventing surgical site infection (SSI). Meanwhile, 74.2% Chinese surgeons believed bowel preparation could avoid anastomotic leakage. Only 33.9% thought that bowel preparation was considered to reduce risk of postoperative bleeding. In terms of bowel preparation methods, 56.5% Chinese surgeons preferred to choose laxatives alone. Regarding the choices of agents, Chinese surgeons were more likely to choose polyethylene glycol-electrolyte lavage solution (PEG-ELS).

**Conclusions:** Surgeons choose bowel preparation mostly to avoid SSI and anastomotic leakage, and they prefer using laxatives alone. Our study shows that surgeons do not have clear guidelines that can govern their clinical practice and there are still controversies about bowel preparation. Further study is required to provide strong evidences to inform clinical and policy decisions.

**Keywords:** Preoperative bowel preparation; colorectal surgery; survey

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## Introduction

Bowel preparation has long been considered as the standard preoperative management for colorectal surgery. A clean colon is thought to facilitate colorectal surgery manipulation, allowing the passage and firing of surgical

staplers. Inadequately prepared intestinal tract is considered to be an important factor leading to poor wound healing and postoperative infection, namely surgical site infection (SSI). Among all elective surgeries, colorectal surgery has the highest incidence of SSI, with a recent review showing

rates ranging from 5.4% to 23.2% (1).

The method and practice of bowel preparation including mechanical bowel preparation (MBP) and oral antibiotics preparation (OAP) vary differently. MBP refers to the use of oral laxatives and enema to reduce intestinal contents preoperatively, so as to provide a relatively clean intestinal cavity for the surgery, decrease intraluminal bacterial concentration and reduce postoperative infections. OAP refers to the prophylactic use of antibiotics before surgery for the reduction of the bacterial load of the whole body and intestines, so as to reduce the incidence of postoperative infections and other complications.

After the enhanced recovery after surgery (ERAS) concept was proposed, the importance of bowel preparation gradually declined. A multicenter randomized trial of 1,354 patients found that it was reasonable to safely perform colorectal surgery without MBP (2). Some meta-analyses concluded that MBP can be safely omitted in colon surgery (3), even increase the risk of SSI (4). On the other hand, the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) indicated that the combined use of MBP and OAP was associated with a significantly lower incidence of postoperative complications compared with the use of other bowel preparation strategies (5).

The view on whether the preoperative bowel preparation is necessary remains inconclusive, how surgeons manage bowel preparation in the real life clinical practice may be beneficial to the renewal of ideas. The aim of this study is to describe the current attitudes and practice patterns of preoperative bowel preparation among Chinese surgeons. We present the following article in accordance with the SURGE reporting checklist (available at <https://dmr.amegroups.com/article/view/10.21037/dmr-22-22/rc>).

## Methods

An online 10-question anonymous survey was announced by posters to the active members who attended the 14<sup>th</sup> Chinese Academic Congress of Colorectal Surgery (CACCRS 2021) on October 15–17, 2021 (Appendix 1). We distributed the questionnaire by Wenjuanxing web-application (<https://www.wjx.cn/>). The participants could complete the questionnaire during the meeting. No incentives were offered to obtain the survey results. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Medical Ethics Committee of The Seventh Affiliated Hospital of Sun Yat-sen University (No. KY-2020-024-01)

and individual consent for this cross-sectional survey was waived. The questionnaire sought information on each surgeon's current practice of preoperative bowel preparation. In the questionnaire, we collected demographic information, including gender, age, working experience, medical specialty, hospital setting, department volume and monthly number of operations. In terms of bowel preparation, we investigated the reasons for bowel preparation, the methods of preoperative bowel preparation and the choices of agents in the participants' practice. Among the reasons, we provided options such as preventing SSI, avoiding anastomotic leakage, and reducing risk of postoperative bleeding. Options of bowel preparation methods include using laxatives, enema, OAP and their combinations. We also asked for information on the choices of laxatives, regarding polyethylene glycol-electrolyte lavage solution (PEG-ELS), sodium phosphate (NaP), magnesium sulfate (MgSO<sub>4</sub>) and mannitol.

We analyzed the data statistically based on the responses obtained. All statistical analyses were performed using STATA version 12.0. Only P value <0.05 was considered statistically significant.

## Results

### Demographics

A total of 384 Chinese surgeons from 26 provincial administrative regions took part in this survey. The relevant demographic characteristics of the participants are presented in *Table 1*. Of the 384 participants, 311 (81.0%) were male surgeons. Most of them were between the ages of 40–50 (46.4%), had more than 20 years working experience (62.5%) and worked in general surgery (38.0%). Most of the hospitals were general hospitals (95.3%) and 52.6% department had less than 50 beds. Among the surgeons, 60.9% performed less than 100 operations per month.

### Bowel preparation reasons, methods and agents

*Table 2* shows bowel preparation reasons, methods and agents. The most common reason for choosing bowel preparation was preventing SSI (312/384, 81.3%). Meanwhile, 74.2% Chinese surgeons believed bowel preparation could avoid anastomotic leakage. Only 33.9% thought that bowel preparation was considered to reduce risk of postoperative bleeding (*Figure 1*).

In terms of bowel preparation methods, 56.5% (217/384)

**Table 1** Characteristics of surgeons

Characteristics	Number	Percent (%)
Gender		
Male	311	81.0
Female	73	19.0
Age		
<40 years	84	21.8
40–50 years	178	46.4
>50 years	122	31.8
Working experience		
<10 years	35	9.1
10–20 years	109	28.4
>20 years	240	62.5
Medical specialty		
Gastrointestinal surgery	110	28.7
Anorectal surgery	128	33.3
General surgery	146	38.0
Hospital setting		
General	366	95.3
Specialized	18	4.7
Department volume		
<50	202	52.6
50–100	142	37.0
101–150	22	5.7
>150	18	4.7
Operations per month		
<100	234	60.9
100–200	122	31.8
>200	28	7.3

Chinese surgeons preferred to choose laxatives alone; laxatives and oral antibiotics was used by 12.0%; laxatives and oral antibiotics combined with enema was used by 20.6%. Enema alone, oral antibiotics alone and other methods were only 7.8%, 0.5% and 2.6%, respectively (Figure 2).

Regarding the choices of agents, Chinese surgeons were more likely to choose PEG-ELS (349/387, 90.9%). Mannitol and NaP were prescribed by 6.3% and 6.8%,

**Table 2** Bowel preparation reasons, methods and agents

Answers	Number	Percent (%)
Reasons (multiple choice)		
Preventing SSI	312	81.3
Avoiding anastomotic leakage	285	74.2
Reducing risk of postoperative bleeding	130	33.9
Other	61	15.9
Methods (single choice)		
Laxatives	217	56.5
Laxatives and oral antibiotics	46	12.0
Laxatives, oral antibiotics and enema	79	20.6
Enema	30	7.8
Oral antibiotics	2	0.5
Other	10	2.6
Agents (multiple choice)		
PEG-ELS	349	90.9
Mannitol	24	6.3
NaP	26	6.8
MgSO <sub>4</sub>	11	2.9
Other	19	4.9

SSI, surgical site infection; PEG-ELS, polyethylene glycol-electrolyte lavage solution; NaP, sodium phosphate; MgSO<sub>4</sub>, magnesium sulfate.

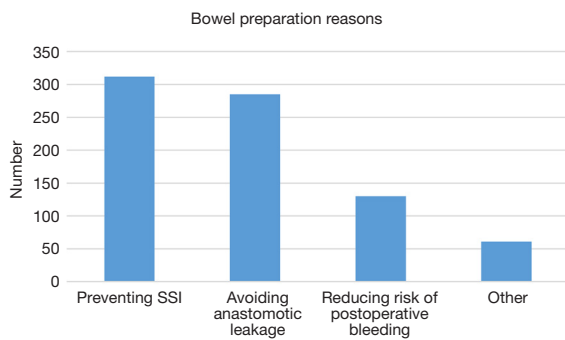
respectively. MgSO<sub>4</sub> and other agents were only 2.9% and 4.9% (Figure 3).

**Analysis of bowel preparation methods**

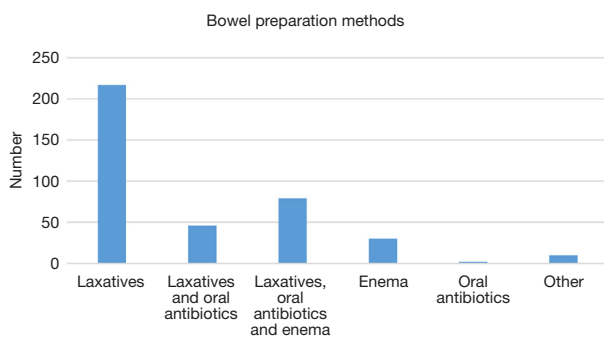
Analysis of bowel preparation methods is summarized in Table 3. The participants’ age and working experience did not show significant differences in the methods of bowel preparation (P value >0.05). In terms of hospitals’ characteristics, there were no significant differences in the use of bowel preparation. Department volume and number of operations also did not significantly affect choosing bowel preparation.

**Discussion**

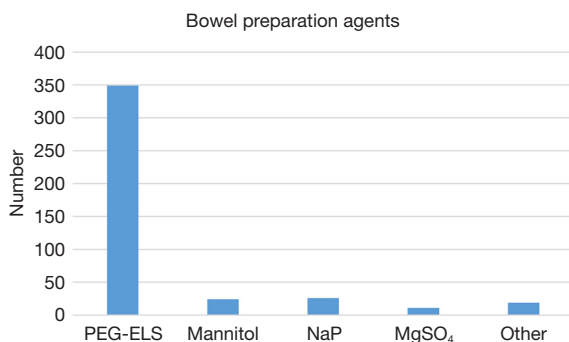
Bowel preparation has been controversial for many years, especially in necessity and methods. This survey involved



**Figure 1** Bowel preparation reasons. SSI, surgical site infection.



**Figure 2** Bowel preparation methods.



**Figure 3** Bowel preparation agents. PEG-ELS, polyethylene glycol-electrolyte lavage solution; NaP, sodium phosphate; MgSO<sub>4</sub>, magnesium sulfate.

currently the largest number of participants in China. In this study, the characteristics of demographic, hospital and department did not correlate with the methods of bowel preparation. Most of the reasons for bowel preparation were to prevent SSI and avoid anastomotic leakage. Surgeons preferred laxatives when it came to bowel preparation through the data we collected. In terms of laxatives

selection, PEG-ELS was mostly used.

Currently, there are only consensuses on bowel preparation before colonoscopy in China, but no guidelines on bowel preparation before colorectal surgery. Chinese surgeons make decisions on management of preoperative bowel preparation for patients based on their own clinical experience or guidelines from other countries. The American Society of Colon and Rectal Surgeons (ASCRS) and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) recommend a combination of MBP and OAP in both colonic and rectal surgery in the 2017 clinical practice guidelines (6). Likewise, the ERAS society guidelines recommended the same methods of bowel preparation (7). However, some countries did not recommend either MBP or MBP + OAP, especially with the spreading of ERAS all over the world. The Canadian guidelines, based on a systematic review of 14 randomized trials and 8 meta-analyses, concluded that it was acceptable to omit MBP as it provided no advantage and might trigger discomfort among patients (8). The British guidelines (updated in 2017 and based on Cochrane reviews) also indicated that stopping or reducing the routine use of MBP in patients undergoing elective colorectal surgery was likely to lead to improved quality of patient care, improved patient experience and productivity savings (9). Furthermore, the French ERAS guidelines did not recommend MBP whether in colonic (strong agreement) or in rectal surgery (weak agreement) (10).

There is a continuous debate on the role of bowel preparation in colorectal surgery. Opponents of MBP argue that it can damage the intestinal mucosal barrier and destroy the endogenous microbial barrier, thereby aggravating the damage of intestinal mucosa directly or indirectly (11). In addition, inadequate MBP caused a significantly higher incidence of peritoneal spillage and subsequent postoperative infectious complications (12). MBP might trigger discomfort among patients, including nausea, vomiting, abdominal pain and abdominal bloating (13).

Regardless of the fact that several studies have shown no benefit from MBP in colorectal surgery, the number of cases they studied was small. The largest and most well-documented study to date came from Kiran's study (14). They collected NSQIP-targeted colectomy data initiated in 2012 capture information on the use/type of bowel preparation and colorectal-specific complications. Of 8,442 patients, MBP with OAP was independently associated with reduced anastomotic leak [odds ratio (OR) =0.57, 95% confidence interval (CI): 0.35–0.94], SSI (OR =0.40, 95%

**Table 3** Analysis of bowel preparation methods

Characteristics	Laxatives	Laxatives and OA	Laxatives, OA and enema	Enema	OA	Other	P value
Age							0.326
<40 years	53	5	17	8	0	1	
40–50 years	91	25	41	16	1	4	
>50 years	73	16	21	6	1	5	
Working experience							0.686
<10 years	24	1	8	1	0	1	
10–20 years	59	13	25	10	1	2	
>20 years	134	32	46	19	1	7	
Medical specialty							0.791
Gastrointestinal surgery	57	15	23	12	1	2	
Anorectal surgery	77	13	28	6	0	4	
General surgery	83	18	28	12	1	4	
Hospital setting							0.308
General	209	44	75	26	2	10	
Specialized	8	2	4	4	0	0	
Department volume							0.220
<50	118	22	43	15	0	4	
50–100	81	18	27	10	1	5	
101–150	11	2	4	4	0	1	
>150	7	4	5	1	1	0	
Operations per month							0.662
<100	142	26	44	17	1	4	
100–200	60	17	28	11	1	5	
>200	15	3	7	2	0	1	

OA, oral antibiotics.

CI: 0.31–0.53), and postoperative ileus (OR =0.71, 95% CI: 0.56–0.90), compared with MBP alone and no bowel preparation. The findings of this study support the universal adoption of a simple preoperative bowel preparation regimen that combines MBP and oral antibiotics before elective colorectal resection. Bretagnol’s study, the first randomized trial focused on the postoperative results after sphincter-saving rectal resection for cancer, showed that the overall and infectious morbidity rates were significantly higher in no-MBP *vs.* MBP group, 44% *vs.* 27%, P=0.018, and 34% *vs.* 16%, P=0.005, respectively (15).

In our study, most of Chinese surgeons believed that bowel

preparation could prevent SSI (81.3%) and avoid anastomotic leakage (74.2%) by reducing the intraluminal bacterial counts and stool burden. In a retrospective study using data from ACS NSQIP Colectomy Targeted database from 2012 to 2015, combined MBP/OAP resulted in significantly lower rates of SSI (OR =0.56, P<0.001) and anastomotic leak (OR =0.53, P<0.001) than no preparation (16). Toh *et al.* included in their meta-analysis 38 RCTs and 8,458 patients (17). MBP + OAP was better in terms of SSI and wound infection compared to no preparation (OR =0.60, 95% CI: 0.45–0.79 and OR =0.67, 95% CI: 0.48–0.93, respectively), and in terms of SSI and wound infection compared to MBP alone (OR

=0.71, 95% CI: 0.57–0.88, and OR =0.62, 95% CI: 0.49–0.85, respectively). Nevertheless, the disruption of the host colonic microbiome and subsequent clostridium difficile infection remains a problem (18). Kim created a propensity-matched analysis of 957 paired cases (n=1,914) and compared patients receiving MBP + OAP with no bowel preparation (19). MBP + OAB group was less likely to develop postoperative clostridium difficile colitis than those who received no bowel preparation (0.5% vs. 1.8%, P=0.01). Bowel preparation should not be omitted considering the benefits above, especially in high-grade colorectal surgery.

Our results showed that Chinese surgeons preferred PEG-ELS as their first laxatives choice (90.9%). PEG-ELS has been widely used for colorectal surgery since 1980. Because of its isotonic and electrolyte-balanced feature, the patient's electrolytes and internal environment don't change much, and it has been shown to be highly effective and well tolerated, especially patients with renal insufficiency, congestive heart failure, and advanced liver disease (20). In spite of its safe and adequate cleansing, large volumes of liquid required and unpleasant taste remain troubling patients (21). Modified regimen (a lower-volume PEG formulation, for instance) and improved taste (PEG-ELS-II, for instance) enhance patients' tolerance with the progress of technology (22,23). Mannitol and NaP are both hyperosmotic cleansing agents which not only can't be absorbed from the gastrointestinal tract, but also can attract fluid into the bowel. The disadvantage of mannitol is that it can explode by the catabolism of *Escherichia coli* (24). The preference for NaP has reduced owing to phosphate-induced renal disease (25).

This survey had some limitations. Firstly, the questionnaire did not ask about bowel preparation in colon surgery and rectal surgery separately, which could lead to further findings. In recent years, bowel preparation for colon surgery has often been omitted. This can influence the accuracy of the survey results. Moreover, questionnaire's options should be more classified in detail. If responders chose 'other' on the multiple choice question, they should give a specific description. Finally, there is no discrimination of open or laparoscopic procedures. The questionnaire should include elective and emergency procedures.

## Conclusions

In summary, this present survey describes the current attitudes and practice patterns of preoperative bowel preparation among Chinese surgeons. Our study shows that

surgeons choose bowel preparation mostly to avoid SSI and anastomotic leakage, and they prefer using laxatives alone. Surgeons do not have clear guidelines that can govern their clinical practice and there are still controversies about bowel preparation. Further study is required to provide strong evidences to inform clinical and policy decisions.

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## Footnote

*Reporting Checklist:* The authors have completed the SURGE reporting checklist. Available at <https://dmr.amegroups.com/article/view/10.21037/dmr-22-22/rc>

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*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Medical Ethics Committee of The Seventh Affiliated



Hospital of Sun Yat-sen University (No. KY-2020-024-01) and individual consent for this cross-sectional survey was waived.

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**A survey of current practice patterns of preoperative bowel preparation in colorectal surgery**

1. What is your gender?
  - Male
  - Female
2. What is your age?
  - <40 years
  - 40–50 years
  - >50 years
3. How many years of your work experience?
  - <10 years
  - 10–20 years
  - >20 years
4. Your medical specialty?
  - Gastrointestinal surgery
  - Anorectal surgery
  - General surgery
5. What's your hospital setting?
  - General
  - Specialized
6. What's your department volume?
  - <50
  - 50–100
  - 101–150
  - >150
7. Number of operations you perform per month?
  - <100
  - 100–200
  - >200
8. Which of the following reasons do you think bowel preparation is necessary? (Multiple choice)
  - Preventing SSI
  - Avoiding anastomotic leakage
  - Reducing risk of postoperative bleeding
  - Other
9. Which of the following methods do you choose?
  - Laxatives
  - Laxatives and oral antibiotics
  - Laxatives, oral antibiotics and enema
  - Enema
  - Oral antibiotics
  - Other
10. Which of the following agents do you often choose? (Multiple choice)
  - PEG-ELS
  - Mannitol
  - NaP
  - MgSO<sub>4</sub>
  - Other