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Reappraisal of preoperative bowel preparation in colorectal surgery

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ABSTRACT

For over a century, mechanical bowel preparation prior to elective colorectal surgery is a time – honored dogma. However, this dogma is based on experience and observation only. Challenges of this dogma began when surgeon started performing primary repair of colonic injury in trauma case with good results. This review aims to evaluate the evidence for and against the use of mechanical bowel preparation in elective colorectal surgery. A literature search was done on Pubmed and Medline in recent 10 years, and emphasis was put on randomized controlled trial and meta-analysis. It is concluded that there is no statistical evidence that patients significantly benefit from mechanical bowel preparation. Thus the routine use of mechanical bowel preparation in elective colorectal surgery should be reconsidered.

Key words: mechanical bowel preparation, colorectal surgery

INTRODUCTION

In the first half of 20th century, colorectal surgery was associated with a high mortality rate of >20%¹, which was mainly attributed to sepsis. The infective complications encountered after surgery include wound infection, intra-abdominal or pelvic abscess, and anastomotic leakage. These infective complications are mainly caused by endogenous colonic bacteria. It follows that reducing the fecal load and bacterial count in the colonic lumen might help reduce the rate of infection. As a result, for a long time, the combined usage of preoperative prophylactic antibiotics and mechanical bowel preparation (MBP) has remained the cornerstones of safe colorectal surgery².

Apart from decreasing postoperative infective complications, proponents of MBP claim that bowel cleansing also eliminates the proximal colonic stool column and help prevents the mechanical disruption of the anastomosis by well-formed stool. Additionally, MBP facilitates tumor localization by allowing palpation of the colon and, if required, peroperative colonoscopy; it also helps improve bowel handling by surgeons.

On the other hand, MBP is not without drawbacks. Nausea, vomiting and abdominal fullness are commonly reported by patients - 5 - 15% of patients cannot tolerate the entire preparation³⁻⁴. Electrolyte disturbance can happen especially in the elderly, and fatal complications have been reported⁵⁻⁷. Bowel prepara-



tion might also precipitate acute intestinal obstruction in patients with endoscopically obstructed tumors.

For more than a century, mechanical bowel preparation prior to elective colon and rectal surgery is a time - honored surgical dogma, and primary large bowel anastomosis is considered unsafe in unprepared colon. However, this dogma is based on clinical experience and observational studies only. Challenges to the use of MBP started in 1960s, when surgeons started performing primary repair of colonic injury in trauma cases with good results⁸⁻¹¹. There were also several studies suggesting that colo-colonic anastomosis was safe even in unprepared, obstructed colon¹²⁻¹⁵. This article aims to review the evidence in recent surgical literature on the efficacy of MBP in elective colorectal surgery.

MATERIAL AND METHOD

A literature search was undertaken to ascertain the evidence available regarding the use of MBP in elective colorectal surgery. This included a search of PubMed and Medline using the keywords “mechanical bowel preparation” and “colorectal surgery”. The search was restricted to randomized controlled trials and meta-

analysis studies carried out in the recent 10 years in order to give a balanced view of this topic.

RESULTS

Seven randomized controlled trials were identified in the literature regarding the use of MBP prior to elective colorectal surgery¹⁶⁻²². Anastomotic leakage and wound infection rate in these studies are summarized in Table 1. While overall anastomotic leakage and wound infection rates appeared to be similar or lower in patients without MBP when compared to those with MBP, all these randomized trials were underpowered in detecting significant difference in complication rates. Assuming an infective complication rate of 10% in patients with MBP, 770 patients in each group are required to detect a difference of 5% in a one-tailed statistical test assuming an alpha level of 0.05 and statistical power of 90%. It is almost impossible for a single institution to accrue such a large number of patients. While multi-centric studies help expedite patient accrual, the homogeneity of the operative and peri-operative techniques may be compromised, resulting in flawed studies.

Meta-analysis may provide answer in this scenario.

Table 1 – Randomized controlled trials on mechanical bowel preparation

MBP = mechanical bowel preparation; NS = not significant; S = significant

Study	Year	No of patients (MBP/ no MBP)	Anastomotic leakage rate % (MBP/no MBP)	Wound infection rate % (MBP/no MBP)
Zmora ¹⁶	2003	187/193	3.7/2.1 (NS)	6.4/5.7 (NS)
Fa-Si-Oen ¹⁷	2005	125/125	5.6/4.8 (NS)	7.2/5.6 (NS)
Bucher ¹⁸	2005	78/75	6/1 (NS)	13 /4 (NS)
Zmora ¹⁹	2006	120/129	4.2/2.3 (NS)	6.6/10 (S)
Jung ²⁰	2007	686/657	1.9/2.6 (NS)	7.9/6.4 (NS)
Pena- Soria ²¹	2007	48 /49	8.3/4.1 (NS)	12.5/12.2 (NS)
Contant ²²	2007	707/724	4.8/5.4 (NS)	13.4/14 (NS)



Table 2 – Meta-analysis studies on mechanical bowel preparation
 MBP = mechanical bowel preparation; NS = not significant; S = significant

Study	Year	No of patients (MBP/no MBP)	Anastomotic leakage rate % (MBP/no MBP)	Wound infection rate % (MBP/no MBP)
Pascal ²³	2004	642/655	5.6/2.8 (S)	7.5/5.5 (NS)
K. Slim ²⁴	2004	720/734	5.6/3.2 (S)	7.4/5.7 (NS)
P. Wille ²⁵	2005	789/803	6 /3.2 (S)	7.4/5.4 (NS)
G. Gravante ²⁶	2008	2463/2456	4.1/3.4 (NS)	9.6/8.7 (NS)
Pineda ²⁷	2008	2304/2297	4.2/3.5 (NS)	9.9/8.8 (NS)
K. Slim ²⁸	2009	2452/2407	4.02/3.44 (NS)	9.5/8.3 (NS)
Guenaga ²⁹	2009	2390/2387	4.2/3.4 (NS)	9.6/8.3 (NS)

There are 7 meta-analysis studies identified in the literature assessing the role of MBP in preventing infective complications following colorectal surgery²³⁻²⁹ (Table 2). Of these 7 studies, three confirmed a significantly higher anastomotic leakage rate after receiving MBP²³⁻²⁵. The other 4 more recent and larger scale studies also reached the conclusion that MBP results in increased anastomotic leakage rate, but the difference is not statistically significant²⁶⁻²⁹. Wound infection rate is increased in patients receiving MBP but again the difference did not reach statistical significance.

DISCUSSION

The existing evidence does not support the conventional wisdom that MBP helps decrease the bacterial load and reduce faecal spillage into operative field, thereby reducing septic complications. Investigators have tried to explain why MBP could not reduce septic complications. There are several postulations:

1. MBP was introduced in parallel with prophylactic antibiotics in the history of surgery. The intervention that affects changes in bacterial flora is the use of antibiotics, not the bowel preparation³⁰. It has been

shown that when MBP is performed alone, the bacterial load does not decrease significantly in the lumen or in the bowel wall³¹⁻³³. Mucosal-associated bacteria are still found within the bowel wall with an increasing gradient from the distal rectum to the proximal colon after MBP³⁴.

2. The reduction in the risk of faecal spillage into the operative field by MBP is questionable. Mahajna *et al.* reported a spillage rate of 17% in patients undergoing colorectal surgery with MBP as compared to 12% in patients without MBP group (p=0.21)³⁵. Not only MBP does not completely empty the bowel content, but the remaining liquid stool is also more difficult to handle and might lead to an increased chance of spillage during operation.

3. Bowel cleansing alters the microcirculation in the bowel wall and leads to relative ischemia. The resultant ischaemia might enhance the bacterial translocation through the bowel wall and increase infective complications³⁶.

Different types of anastomosis exist in colorectal surgery, including ileo-colic, colo-colonic and colorectal anastomosis, with different risks of anastomotic leakage. Majority of the studies mentioned above focused on colo-colonic and colorectal anastomosis, and



reported overall anastomotic leakage and infection rate without stratification. Only Guenaga *et al* did the subgroup analysis for low anterior resection and colonic surgery²⁹. He reported increased leakage rate for both low anterior resection (10% versus 6.6%) and colonic surgery (2.9% versus 2.5%) in patients with MBP, though the differences are not statistically significant. Further studies in future should stratify the patients into different subgroups, including types of anastomosis as well as surgical indications (for example benign versus malignant); in this way more meaningful conclusions can be drawn on the indications of MBP in different clinical settings.

Majority of the afore-mentioned studies on MBP were carried out on patients undergoing elective open colectomy. There are limited data in the literature focusing on the use of preoperative mechanical bowel preparation in laparoscopic surgery, one of the most significant developments in surgery over the last 2 decades. Theoretically, as anastomotic techniques are generally performed in the same fashion as in open surgery, infective complication rates should be similar. Zomora *et al* had done a retrospective review on 200 patients undergoing laparoscopic colectomy in 2005³⁷, and found no difference in the postoperative complication rates between patients with MBP and patients without MBP. Specifically, anastomotic leak occurred in 3 (4%) patients with MBP, compared to 4 (3%) without MBP. Although laparoscopic colectomy

may be safe to perform in the absence of mechanical bowel preparation, adequate patient selection is imperative. Pre-operative bowel cleansing is definitely recommended in patients with small lesion, in whom peroperative colonoscopy might prove necessary for intra-operative tumor localization. This is especially important for patients undergoing laparoscopic surgery, where the surgeon's ability to palpate the colon is limited.

CONCLUSION

Current data in the literature is limited by the heterogeneity and methodological inadequacies of the studies. Having said that, overall there is no convincing evidence that mechanical bowel preparation is associated with reduced rates of anastomotic leakage after elective colorectal surgery. On the contrary, the use of MBP may be associated with increased rates of anastomotic leakage and wound infection. Perhaps liquid stool in a prepared colon is worse than solid lumps of fecal matter in an unprepared colon. Thus, before further powerful evidence from literature, the dogma that mechanical bowel preparation is necessary before elective colorectal surgery should be reconsidered. More large-scale prospective trials are required to evaluate the utility of mechanical bowel preparation in laparoscopic colectomy.

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