Seminars in Colon and Rectal Surgery 25 (2014) 85–89

Contents lists available at ScienceDirect

Seminars in Colon and Rectal Surgery

journal homepage: www.elsevier.com/locate/yscrs

The ideal bowel prep

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A B S T R A C T

The debate regarding optimal preparation of the patient for elective colon surgery spans numerous surgical generations. Mechanical bowel preparation prior to elective colorectal surgery has the observational benefit in reducing anastomotic leakage and infectious complications. Several newer studies have now questioned the need for any kind of mechanical bowel preparation and have certainly challenged these previous notions. Therefore, this article will evaluate the evidence and attempt to identify the ideal bowel prep and evaluate the role, if any, of reducing the incidence of anastomotic leak and surgical site infections.

Introduction

The concept of the ideal bowel prep has eluded colon and rectal surgeons for several surgical generations. Today, the issue of whether or not there is any benefit to mechanical bowel preparation is one of the most controversial topics in colon and rectal surgery. Over the last several years, many different authors have attempted to address this issue without achieving a clear consensus. For endoscopists, goals are clear and simple—the ideal bowel prep achieves optimal bowel clearance of feces while balancing patient tolerance and potential side effects. The safety and effectiveness of a colonoscopy in identifying important colonic pathology is directly impacted by the quality of the bowel preparation performed prior to the procedure. On the other hand, for colorectal surgeons, the safety and effectiveness of a surgery is determined by the minimization of complications, most importantly, anastomotic leakage.

Traditional dogma and "common sense" historically required pre-operative bowel purgatives to clear the operative site of stool and adjunctive antibiotics to attempt to minimize bacterial contamination.[1] However, in the last decade, we have seen a significant challenge to this decades-old dogma. Now, to some surgeons, the ideal bowel prep is *no* bowel prep. Not only have recent reports supported the safety of colorectal procedures without mechanical bowel preparation, some have even shown enhanced risks with their use. Nonetheless, despite this mounting evidence, 99% of surgeons in the United States reported the routine administration of MBP in a recent survey.[2] Understandably, there is hesitancy with letting go of previously established dogma. Ultimately, it comes down to the question: Is bowel prep necessary at all, and if so, what is the ideal bowel prep? As colorectal surgeons, it seems logical that our primary end point of concern would be anastomotic leakage and surgical site infections. Therefore, the goal of this article will be to provide a brief overview of the types of mechanical bowel preparations and to present the evidence that serves to evaluate the types and use of mechanical bowel preparations and the role, if any, of reducing the incidence of anastomotic leak and surgical site infections.

Mechanical bowel preparations—The basics

There are three basic types of mechanical bowel preparations (MBP): osmotic, stimulants, and a combination of both. An abbreviated version of the most common basic bowel preps are highlighted in Table 1. Osmotic preps function by pulling water into the colonic lumen to effect a mechanical purgative. These agents can be either absorbed or non-absorbed. Absorbable sodium phosphate (NaP) solutions can cause significant fluid and electrolyte shifts and should be used with caution when being administered to patients with renal compromise due to a possible nephrotoxic profile.[3] Caution should also be maintained in administering NaP preparations in the pediatric and elderly patients and in patients with bowel obstruction and other structural intestinal disorders, gut dysmotility, congestive heart failure, or liver failure.[4] On the other hand, non-absorbable polyethylene glycol (PEG)-based osmotic agents are well tolerated and avoid significant fluid and electrolyte shifts. Stimulants cause bowel wall contraction but are always used in conjunction with osmotic agents to achieve adequate bowel evacuation. Several variations to these basic bowel

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http://dx.doi.org/10.1053/j.scrs.2014.04.005
1043-1489/

Table 1
Common types of mechanical bowel preparations.

Agent	Preparation	Brand name	Recommended dosing
Osmotic—absorbable			
	Sodium phosphate tablets	Visicol, OsmoPrep (Salix pharmaceuticals, Morrisville, NC)	3 Tablets q 15 min up to 20 tablets; repeat in 10 h
	Sodium Phosphate liquid	Fleet (C.B. Fleet, VA)	30–45 mL with 32 oz. liquid; repeat in 10 h
Osmotic–non-absorbable			
	4 L PEG-ELS	GoLYTELY (Braintree Laboratories, Holbrook, MA)	240 mL q 10 min
	4 L SF-PEG	NuLYTELY (Braintree Laboratories, Holbrook, MA)	3 L; remaining 1 L 10 h later
Stimulant			
	Bisacodyl	Dulcolax (Boehringer Ingelheim Pharma, Ridgefield, CT)	2–4 (5–10 mg) tablets
Combination			
	2 L PEG-ELS + bisacodyl	HalfLytely (Braintree Laboratories, Holbrook, MA)	240 mL q 10 min to 1 L + 10-mg bisacodyl; repeat in 10 or 3 h before procedure
	2 L PEG + bisacodyl	Miralax (Schering-Plough, Kenilworth, NJ)	240 mL q 10 min to 1 L + 10-mg bisacodyl; repeat in 10 or 3 h before procedure

PEG, polyethylene glycol; SF-PEG, sulfate-free polyethylene glycol. *Source*: Adapted with permission from Beck DE. Bowel preparation for colonoscopy. *Clin Colon Rectal Surg*. 2010; 23:1; 10–13.

preps have evolved over the years, including high- vs. low-volume lavage, combination bowel preps, and the addition of flavoring or carbohydrate–electrolyte solutions (Gatorade). As it can be seen from the most recent ASCRS practice parameters regarding pre-operative bowel preparation, despite an exhaustive review of the literature, with regard to the success to mechanical bowel cleansing, there is very little difference in the efficacy of either base prep.[5] Furthermore, to truly evaluate the efficacy of bowel preparation, one must assess the relatively subjective appearance of the prepared colonic mucosa to a relatively objective parameter. Toward that end, several preps have been proposed; however, no single prep seems ideal in all situations.[6] Interestingly, when comparing these preps in the context of elective colorectal surgery with an outcome measure of surgical site infection (SSI), sodium phosphate-based MBP may have superiority over PEG-based MBP. To the best of our knowledge, in the only published literature to evaluate this, Itani and Kim[7] conducted a prospective randomized control trial to evaluate the effect of PEG ($n = 303$) and sodium phosphate (NaP) ($n = 367$) MBPs on SSI. As expected, no superiority was identified in the quality of MBP; however, a higher rate of SSI was observed in the PEG (34%) than NaP (24%) group (difference = 10%; 95% confidence interval: 3.4–17.2). However, it should be noted that this study was a post hoc analysis of a prospective randomized controlled antibiotic prophylaxis trial (ertapenem vs. cefotetan), and further multivariate analysis showed no significant difference between the two MBPs.

Patients favor preparations that are low in volume, are palatable, have easy to complete regimens, and are either reimbursed by health insurance or inexpensive. Physicians are advised to select a preparation that is safe to administer in light of existing comorbid conditions and those that will not interact with previously prescribed medications. In addition, surgeons have to temper their intraoperative expectations with the adequacy of the bowel prep. For instance, a fully prepped colon may not be as necessary for right-sided procedures as for left-sided procedures requiring a low pelvic anastomosis. Ultimately, the ideal bowel prep has to balance the intraoperative expectations of the surgeon with the safety profile and comfort to the patient. Finally, once the ideal mechanical bowel prep has been chosen, one must now determine the utility of adding oral non-absorbable antibiotics prior to elective surgery.

Role of oral antibiotics

More than 250,000 colectomies are performed each year in the US and the rate of surgical site infection (SSI) is higher than in any other elective operation. This is likely due to the high bacterial load present within the colon lumen.[8] The presumed benefit of the addition of oral non-absorbable antibiotics to a pre-operative mechanical bowel preparation is to reduce infectious complications following colon surgery by killing the native gut flora. Studies have shown that mechanical bowel preparation alone does not reduce mucosa-associated flora.[9] In an effort to sterilize the luminal contents and theoretically decrease surgical site infections and anastomotic leakage during spillage, the Nichols et al.[1] prep was introduced in 1971 and included three doses of oral neomycin and erythromycin and became the gold standard of mechanical bowel preparation until the 1990s. In addition, the combination of oral non-absorbable antibiotics and intravenous antibiotics provides the greatest mucosa-associated reduction in colony-forming units (1.8×10^2 compared to 3.4×10^7).[10] Two studies, from the late 1980s through the early 1990s supported the importance of both oral and intravenous antibiotics prior to elective colon surgery.[11,12] Yet, despite the apparent benefit of oral antibiotics, a 2005 survey showed that only 75% of colon and rectal surgeons routinely used oral antibiotics.[2] Factors leading to such low adoption rates included patient dislike for the side effects of oral antibiotics and a concern about predisposition to *Clostridium difficile* colitis.[13]

Recently, the efforts to reduce SSI have included the implementation of the Surgical Care Improvement Project (SCIP) guidelines and the push to incorporate standardized prophylactic pre-operative parenteral antibiotic measures. The correct and timely administration of antibiotics has now become a performance measure for quality improvement projects nationwide. The role of an appropriate parenteral antibiotic before incision is well established in reducing SSI, and administration of pre-operative parenteral antibiotics is standard in current day studies examining intestinal surgery.[14] However, the role of oral antibiotics in conjunction with pre-operative mechanical bowel prep has been recently questioned. Despite the current trends amongst surgeons to omit oral non-absorbable antibiotics, the data suggests that this omission may be premature.