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Dysmotility by mechanical bowel preparation using polyethylene glycol

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ARTICLE INFO

Article history:
Received 6 July 2013
Received in revised form
29 January 2014
Accepted 3 March 2014
Available online 11 March 2014

Keywords:
Mechanical bowel preparation (MBP)
Polyethylene glycol
Colon cancer
Enhanced recovery after surgery (ERAS)

ABSTRACT

Background: The effects of mechanical bowel preparation (MBP) on morbidity (e.g., anastomotic leakage and surgical site infection) have been evaluated. Its effect on early recovery after surgery has drawn renewed attention, and its use is discouraged in the postsurgical management of enhanced recovery. However, most surgeons in Japan prefer polyethylene glycol (PEG) for MBP. We investigated the effect of MBP with PEG on postoperative intestinal motility.

Materials and methods: We prospectively evaluated a consecutive series of 258 colon cancer patients who underwent colonic resection and primary anastomosis. We orally administered 2000 mL of PEG in the PEG group and did not administer PEG to patients in the no-PEG group. Postoperative gastrointestinal motility was assessed with radiopaque markers. All patients ingested radiopaque markers 2 h before surgery. Postoperative intestinal motility was radiologically assessed by counting the number of residual markers. Abdominal radiography was conducted on postoperative days 1, 3, and 5 to count residual markers in the large and small intestines.

Results: The total number of residual markers in the no-PEG group was less than that in the PEG group on day 5 ($P < 0.01$) but not on days 1 and 3. On all 3 d, the numbers of residual markers in the small intestine were significantly less in the no-PEG group than in the PEG group ($P < 0.001$). There were no differences in postoperative complications between the no-PEG and PEG groups.

Conclusions: PEG can negatively affect postoperative intestinal motility, and MBP using PEG is unnecessary in elective colon cancer surgery.

1. Introduction

The use of mechanical bowel preparation (MBP) for colorectal surgery is controversial. MBP has been expected to decrease the prevalence of surgical site infection (SSI). However, MBP has not been reported to influence the risk of SSI and anastomotic leakage in large clinical trials [1,2]. A meta-analysis also indicated that MBP does not decrease the prevalence of SSI and anastomotic leakage [3]. Nonetheless, many surgeons in Japan continue to undertake MBP with polyethylene glycol

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0022-4804/$ – see front matter © 2014 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jss.2014.03.001

(PEG) for colorectal surgery because they consider PEG to substantially decrease intestinal residues and help them to carry out the surgical procedure more easily.

In the past, the significance of MBP was discussed from the viewpoint of whether it could affect morbidity (e.g., anastomotic leakage, SSI). Considering that early recovery of intestinal motility may allow for early recovery of the general condition of the patient and early discharge from hospital, whether MBP affects postoperative intestinal motility is clinically important. In addition, there are technical reasons for MBP that are independent from the need to decrease the risk of SSI or leakage. These include a laparoscopic approach (bowel can be easier to handle) and the requirement for intraoperative localization (e.g., colonoscopy) of the lesion.

Fast-track surgery combines various methods used in the care of patients undergoing elective surgery. The methods used include epidural anesthesia, minimally invasive methods, optimal pain control, aggressive postoperative rehabilitation, and early oral nutrition. The combination of these approaches reduces the stress response and organ dysfunction, thereby greatly shortening the time required for full recovery. Particularly, in colon surgery, this concept is recognized widely as enhanced recovery after surgery (ERAS), which comprises 17 elements [4]. As a part of perioperative management, ERAS can reduce morbidity [5], and MBP is discouraged in ERAS management. However, in many ERAS studies, not all 17 elements were used, and MBP was not omitted in some studies [6,7].

Previously, we undertook a small, randomized controlled trial to evaluate the influence of PEG. We showed that PEG negatively affected postoperative intestinal motility in open colon surgery but not in laparoscopic surgery [8]. However, that trial involved only 79 patients and conclusive results could not be drawn. We considered conducting a randomized controlled trial of 300 patients, but many Japanese surgeons were concerned about the omission of PEG at that time. Therefore, we conducted an observational study to test the hypothesis that PEG can negatively affect postoperative intestinal motility and that omission of PEG may not increase the prevalence of postoperative complications.

2. Materials and methods

2.1. Patient selection

This was a single-center, prospective observational study. We evaluated a consecutive series of patients who underwent resection and primary anastomosis of the colon. All patients undergoing elective surgery for colon cancer (International Classification of Diseases, 10th revision, C18) between January 2010 and June 2012 were considered eligible for this study.

This study involved patients who underwent elective open or laparoscopic resection of the colon. Patients registered between January 2010 and June 2011 belonged to the PEG group. Those registered between July 2011 and June 2012 belonged to the no-PEG group. Patients in the PEG group were administered PEG. We prohibited the administration of PEG to patients in the no-PEG group. We permitted the administration of only 75 mg of sodium picosulfate hydrate (Laxoberon; Teijin Pharma Limited, Tokyo, Japan) if it was deemed necessary.

Inclusion criteria were patients (1) with a primary tumor located somewhere between the cecum and sigmoid colon, (2) who could undergo elective surgery, (3) who had an American Society of Anesthesiologists grades of 1–3, and (4) aged 20–85 y. Exclusion criteria were as follows: (1) $\geq$2 anastomoses, (2) intestinal obstruction, (3) having undergone colostomy or ileostomy, (4) having undergone any additional procedures, and (5) need for admission to the intensive care unit after surgery.

If we intended to carry out a colectomy with a colostomy or an ileostomy before the procedure, we excluded these patients before surgery. If we decided to create a stoma during the procedure for various reasons (e.g., edema of the colon or ileum, peritoneal dissemination), we excluded these patients after surgery.

This study was carried out in accordance with the Declaration of Helsinki. The study protocol was approved by the Ethics Review Committee of Nippon Medical School (Tokyo, Japan). The written informed consent was obtained from each patient.

2.2. Preoperative management

All patients began a low-residue diet 2 d before the procedure. They were prohibited from eating from the morning of the day before surgery. We administered 2000 mL of an oral agent consisting of PEG (Niflec; Ajinomoto, Tokyo, Japan) in the morning of the day before surgery to patients in the PEG group. All patients scheduled to undergo colorectal anastomoses received 120 mL of glycerin in the form of an enema.

2.3. Anesthesia and postoperative analgesia

General anesthesia and epidural anesthesia was induced in all participants. If the anesthetist judged that the risk of epidural anesthesia was high, patients underwent only general anesthesia.

Patients in whom epidural anesthesia was induced received continuous epidural analgesia containing fentanyl (0.4–1.2 mg every 2 d) and bupivacaine hydrochloride for postoperative analgesia. Patients in whom epidural analgesia was not induced received intravenous fentanyl (0.4–1.2 mg every 2 d).

2.4. Surgical procedure and postsurgical management

Open abdominal surgery was done through a midline laparotomy. For laparoscopic colon resection, the abdomen was entered via an incision of $\approx$4–6 cm in the appropriate area. D2 or D3 lymphadenectomy was conducted. Bowel reconstructions were undertaken by hand sewing or a functional end-to-end anastomosis in a right colectomy and by hand sewing or a double-stapled end-to-end anastomosis in a left colectomy. All procedures were undertaken by one of five staff surgeons in the Section of Colorectal Surgery at the Department of Digestive Surgery of Nippon Medical School.

We inserted suction drains in patients who had suffered large volumes of blood loss or intraoperative contamination.