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Original article

Distal small bowel bypass for weight regain after gastric bypass: safety and efficacy threshold occurs at <70% bypass

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Abstract

Background: For patients with poor weight loss (WL) after Roux-en-Y gastric bypass (RYGB) there are few well-tolerated and effective surgical options. Revision to distal bypass by shortening of the common channel (CC) induces significant WL but often produces protein calorie malnutrition (PCM) and severe diarrhea.

Objective: The aim of this study was to identify a safe and effective threshold for distal small bowel bypass when done for revision of gastric bypass.

Setting: Academic Institution, United States.

Methods: We performed revision of RYGB for WL in 20 patients by shortening the CC to a new length of 120–300 cm. The Roux limb length was unchanged. WL and PCM were monitored. A threshold for percent of small bowel bypassed at which PCM was avoided was retrospectively determined. WL was then compared in patients above and below this threshold. Five patients completed a 250-kcal mixed meal challenge before and 3 months after revision to determine selected gut hormone responses.

Results: Bypassing ≥70% small bowel resulted in PCM in 4 of 10 patients but in none of 10 patients below that threshold. PCM was observed as late as 2 years after revision and necessitated rerevision by lengthening of the CC in 3 patients. Additionally, nocturnal diarrhea was more common and more intractable when ≥70% bypass was done. Both groups had significant excess body WL over 2 years, but it was greater in patients with ≥70% bypass (47 ± 19 versus 26 ± 17; $P < .05$). A favorable gut hormone response was observed with 3-hour decrease in glucose-dependent insulinotropic peptide (GIP) by 25% and increase in glucagon-like peptide-1 (GLP-1) by 25%, whereas fasting peptide-YY (PYY) increased by 71% ($P < .05$ for all).

Conclusions: Revision of RYGB to distal bypass when it is <70% of a patient's small bowel length results in an acceptable balance of WL and a positive safety profile. WL may be mediated through an enhanced gut hormone effect, an aversion to ingested fat, and possibly other mechanisms. (Surg Obes Relat Dis 2015;11:1248–1256.)

Keywords: Revision surgery; Poor weight loss; Gastric bypass; Gut hormones

Although Roux-en-Y gastric bypass (RYGB) produces durable weight loss (WL) in large numbers of patients, approximately 12%–15% have unsatisfactory WL or weight regain [1–3]. Numerous surgical strategies including revision of the gastric pouch, placement of a band over the

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pouch, conversion to long Roux limb gastric bypass, and narrowing the gastrojejunostomy have been used in an effort to augment the WL in these patients [4–7]. Results have been disappointing.

Several authors have reported accelerated WL by increasing the amount of bypassed small bowel with new common channel (CC) lengths of 50–300 cm [8–11]. However, there is an associated risk of protein calorie malnutrition (PCM) occurring in 7%–21% of patients reported, with a need for reversal or CC lengthening in 3%–14% [11].

We reviewed our experience with revision of RYGB by conversion to distal bypass with shortening of the CC. We also sought to understand the mechanisms by which WL occurs, including any effect on several gut hormones that have been implicated in the WL response to gastric bypass [12,13]. These are the foregut hormone, glucose-dependent insulinotropic peptide (GIP; secreted in the duodenum with a primary role at the adipocyte to enhance insulin action and inhibit lipolysis), and hindgut hormones, glucagon-like peptide-1 (GLP-1; increased first phase insulin secretion, suppression of glucagon secretion, and increased satiety) and peptide-YY (PYY; increased satiety and energy expenditure).

Methods

Patients

A retrospective review of our clinical practice of revision of RYGB by lengthening the biliopancreatic (BP) limb was conducted. Patients eligible for revision had prior proximal RYGB without demonstrable gastrogastric fistula on upper gastrointestinal series, <40% excess weight loss (EBWL), and a body mass index (BMI) >40 kg/m^2. Patients were excluded, if they smoked cigarettes.

Patients signed a detailed informed consent describing the potential risks and benefits of the procedure, including the possibility of little or no WL. All patients agreed to take a bariatric vitamin supplement and have laboratory studies at each follow-up visit. These tests were complete blood cell count, vitamin profile (B_1, B_{12}, D), iron profile (serum iron, total iron binding capacity, ferritin), and complete metabolic panel, which included total protein and serum albumin. Preoperative psychological evaluation, nutritional evaluation, and supporting documentation were sent to the patient's insurance carrier and authorization for open revision of gastric bypass (Current Procedural Terminology code 43848) was requested. Revision was accomplished according to then currently published standards for shortening of the common channel, which ranged from 50 cm to 300 cm [11]. For perceived safety reasons, a lower limit of 120 cm arbitrarily was chosen for our patients.

Patients 1, 4, and 11 developed PCM, defined as hypoalbuminemia with associated fatigue, impaired cognition, malaise, and pedal edema that was refractory to increased protein intake and required rerevision with lengthening of their common channels.

Surgical technique

All patients had open laparotomy through a small midline incision with measurement of the length of the small bowel from the ligament of Treitz to the cecum. The prerevision length of the CC (CC_{pre}) was 525 ± 165 cm but ranged from 330 to 780 cm in females and was 690 and 720 cm in 2 males. The Roux limb was detached at the previous jejunojejunostomy, taking as little mesentery as possible. The Roux limb was then brought distally, sweeping the now elongated BP limb to the left. A new jejunoileostomy was created with a functional end-to-side anastomosis formed with a tan load Tri-stapler (Covidien, New Haven, CT, USA). The length of the postrevision CC (CC_{post}) was measured directly from the cecum and varied from 120 to 300 cm.

Mixed meal challenge

A subset of 5 patients volunteered to be enrolled in a study to determine the effects of revision on certain gut hormones. Within 2 weeks before revision, patients received a 400-kcal 250 mL liquid mixed meal challenge consisting of 50% carbohydrates, 35% fat, and 15% protein. Venous blood was collected after an overnight fast and immediately after consumption of the meal challenge at 10 minutes, 20 minutes, 30 minutes, and 30-minute intervals thereafter, concluding at 3 hours. Plasma levels of GIP, GLP-1, and PYY were obtained at each time point. Total GIP, GLP-1, and PYY were analyzed using ELISA kits (EMD Millipore, Billerica, MA, USA). Plasma samples were collected and analyzed according to the manufacturer's instructions. All patients returned 3 months after revision with the identical protocol followed.

Outcome measures

Patients returned for follow up visits at 1-week, 6-week, and 3-month intervals. History of nocturnal diarrhea as well as WL and physical findings were documented. If PCM as defined above did not resolve with increased dietary protein intake, rerevision was done. Total parenteral nutrition was not considered as an option.

Statistical methods

The percent of small bowel bypassed in each patient was retrospectively determined from the surgical measurements (Fig. 1). Descriptive analysis included means for continuous variables and percentages for categorical data. An observational, clinical threshold for safety was sought. Patients were then stratified into 2 groups above and below the threshold for the analysis of WL. The *t* test or Mann-Whitney *U* test was used to evaluate the differences in mean