Antecolic versus retrocolic alimentary limb in laparoscopic Roux-en-Y gastric bypass: a comparative study

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Abstract

Background: Laparoscopic Roux-en-Y gastric bypass (LRYGB) has become the most common surgical treatment for morbid obesity. Intestinal obstruction and internal hernias are complications more commonly observed after LRYGB than after open RYGB. The aim of this study was to evaluate the incidence of these complications in patients who had undergone LRYGB using an antecolic versus a retrocolic technique.

Methods: From August 2001 to August 2005, LRYGB was performed in 754 patients. The retrocolic and antecolic technique was used in 300 and 454 consecutive patients, respectively. The mean patient age was 37 ± 10 years, and 552 of the patients (73%) were women. The mean preoperative body mass index was 41.3 ± 5 kg/m². The median follow-up was 16 months.

Results: During follow-up, 36 patients (4.7%) underwent surgical exploration secondary to intestinal obstruction. This complication was observed in 28 (9.3%) and 8 (1.8%) patients in the retrocolic and antecolic technique groups, respectively (P < .001). In the retrocolic technique group, an internal hernia developed in 24 patients compared with 3 patients in the antecolic technique group. On multivariate analysis, the retrocolic technique was identified as a risk factor (P < .001).

Conclusion: A greater incidence of intestinal obstruction and internal hernia was observed in the retrocolic technique group than in the antecolic technique group undergoing LRYGB. The results of our study have shown that the use of the retrocolic technique is a risk factor for intestinal obstruction after LRYGB. (Surg Obes Relat Dis 2007;3:423–427.) © 2007 American Society for Bariatric Surgery. All rights reserved.

Keywords: Gastric bypass; Intestinal obstruction; Morbid obesity; Laparoscopy

Roux-en-Y gastric bypass (RYGB) has proved to be an effective surgical alternative for the treatment of morbid obesity. Today, RYGB is considered the reference standard for bariatric surgery because it provides excellent results in weight loss and the reduction of co-morbidities, such as type 2 diabetes, hypertension, dyslipidemia, and sleep apnea [1]. Since first described in 1994, laparoscopic RYGB (LRYGB) has received tremendous attention from surgeons and gained popularity among patients [2]. As a minimally invasive technique, it provides advantages compared with open surgery, such as less postoperative pain, a shorter hospital stay, a faster recovery, and better cosmetic results [3].

The introduction of a laparoscopic approach to gastric bypass has also led to a reduction in incision-related complications such as wound infection, incisional hernia, and in the incidence of postoperative small bowel obstruction re-
lated to adhesion formation. Nevertheless, with the development of LRYGB, certain complications, such as intestinal obstruction and internal hernias, have been shown to increase, with a 1.5–3.5% reported incidence [4,5]. Internal hernias after LRYGB can occur at the transverse mesocolon window, enterenterostomy mesentery defect, and Petersen’s space [6]. Patients who develop this postoperative complication may present only with intermittent abdominal pain or bowel obstruction, and the associated physical findings on examination can range from totally benign symptoms to signs of an acute abdomen. Computed tomography can reveal distension of the Roux limb alone, or together with distension of the bypassed stomach and small bowel loops, and mesentery whirling, which can be misinterpreted by an inexperienced radiologist [7].

The etiology described for the development of internal hernias after LRYGB include technical aspects such as a surgical learning curve, mesenteric defect closure, use of resorbable versus nonabsorbable sutures for defect closure, and the ascending route of the alimentary limb [8].

The aims of this study were to evaluate the frequency of intestinal obstruction and internal hernias in patients who underwent LRYGB, compare the incidence of these complications in patients who had undergone RYGB with the retrocolic versus the antecolic technique, and identify risk factors for the development of these complications.

Methods

From August 2001 to August 2005, 754 patients underwent LRYGB as surgical treatment of morbid obesity at our institution. The patient selection criteria followed the National Institutes of Health Consensus Statement 1991 guidelines for the surgical management of morbid obesity [9]. The patient characteristics, surgical results, and follow-up data were obtained from our prospective database. The mean patient age was 37 ± 10 years, and 552 (73%) were women. The mean preoperative body mass index was 41.3 ± 5 kg/m². Overall, 300 patients underwent LRYGB with retrocolic placement (from August 2001 to December 2003), and 454 patients underwent LRYGB with an antecolic alimentary limb (from January 2004 to August 2005). Patient age, mean body mass index, length of hospital stay, and morbidity were similar in patients who underwent LRYGB with the antecolic and retrocolic techniques. A greater number of women ($P = .001$), longer operative time ($P = .0003$), and greater rate of conversion to open surgery ($P = .001$) were observed in the retrocolic technique group (Table 1). The median follow-up was 16 months.

Operative technique

Surgery was performed using four 10–12-mm ports and one 5-mm port located as shown in Fig. 1. In all patients, a 10–15 cm³ gastric pouch was created, with a complete stomach section, 20–30-cm biliopancreatic limb, and a 150-cm alimentary limb. A double-layer, hand-sewn gastrojejunostomy was performed using running absorbable suture (Vicryl 3-0, Johnson & Johnson, S.J. Campos, São Paulo, Brazil). The gastrojejunostomy was performed over a 34F tube.

In patients who underwent surgery from August 2001 to December 2003, the alimentary limb was constructed and mobilized using a transmesocolic and antegastric route. In those who underwent surgery from January 2004 to August 2005, the alimentary limb was located antecolic and antegastric. In the latter patients, the greater omentum was completely transected vertically to create a window to mo-

Table 1

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Retrocolic technique (n = 300)</th>
<th>Antecolic technique (n = 454)</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>37.1 ± 10</td>
<td>37.7 ± 10</td>
<td>.44</td>
</tr>
<tr>
<td>Gender (n)</td>
<td></td>
<td></td>
<td>.001</td>
</tr>
<tr>
<td>Male</td>
<td>56 (19)</td>
<td>131 (29)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>244 (81)</td>
<td>323 (71)</td>
<td></td>
</tr>
<tr>
<td>Preoperative BMI (kg/m²)</td>
<td>41.2 ± 5.4</td>
<td>41.3 ± 5.1</td>
<td>.62</td>
</tr>
<tr>
<td>Operative time (min)</td>
<td>123 ± 47</td>
<td>111 ± 43.6</td>
<td>.0003</td>
</tr>
<tr>
<td>Conversion to open surgery (n)</td>
<td>9 (3)</td>
<td>1 (0.2)</td>
<td>.001</td>
</tr>
<tr>
<td>Hospital stay (d)</td>
<td>4.03 ± 4.35</td>
<td>4.25 ± 3.11</td>
<td>.49</td>
</tr>
<tr>
<td>Postoperative complications (n)</td>
<td>24 (8)</td>
<td>44 (9.6)</td>
<td>.43</td>
</tr>
</tbody>
</table>

BMI = body mass index.

Data presented as mean ± standard deviation or numbers of patients, with percentages in parentheses.
bilibize the alimentary limb anterior to the transverse colon and placed antecolic and antegastric. Initially, the mesenteric defect, Petersen’s space, and mesocolon defect were closed with absorbable suture (Vicryl 3-0, Johnson & Johnson). This technique was later modified to closure with 2-0 silk running suture in all patients (silk 2-0, Johnson & Johnson).

Statistical analysis

The results are reported as the mean ± SD. Student’s t test and the chi-square test were used for data analysis. The Kaplan-Meier method was used for the follow-up analysis, and the groups were compared with the log-rank test. Univariate and multivariate analyses were used to define the risk factors. P <0.05 was considered statistically significant.

Results

During follow-up, 36 patients (4.7%) underwent surgery secondary to intestinal obstruction. An open and laparoscopic procedure was performed in 2 (5.5%) and 34 (94.4%) patients, respectively. Conversion to open surgery was necessary in 6 patients (17.6%). Bowel resection was performed in 2 open or laparoscopic-converted procedures. No patient died.

In patients who underwent LRYGB with the antecolic versus retrocolic technique, intestinal obstruction was observed in 28 (9.3%) versus 8 (1.8%) patients, respectively (P <.001). In the retrocolic technique group, an internal hernia and adhesions were diagnosed in 25 (86%) and 3 (11%), respectively. In 1 patient (3%) in this group, mesocolon defect stenosis was observed 3 months after intestinal obstruction secondary to a repaired mesocolon defect hernia. This patient underwent laparoscopic conversion to an antecolic alimentary limb. In the antecolic technique group, an internal hernia, adhesions, and enteroenterostomy stenosis in 3 (38%), 4 (50%), and 1 patient (12%) developed. The location of the internal hernias is detailed in Table 2.

The intestinal obstruction rate at 24 months was 8.9% in

Table 2

<table>
<thead>
<tr>
<th>Cause</th>
<th>Retrocolic technique (n = 300)</th>
<th>Antecolic technique (n = 454)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal hernia</td>
<td>25 (86)</td>
<td>3 (38)</td>
<td></td>
</tr>
<tr>
<td>Transverse mesocolon</td>
<td>17*</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Enteroenterostomy defect</td>
<td>7</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Petersen’s space</td>
<td>1</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>Adhesions</td>
<td>3 (11)</td>
<td>4 (50)</td>
<td>—</td>
</tr>
<tr>
<td>Jejunoojejunostomy stenosis</td>
<td>—</td>
<td>1 (12)</td>
<td>—</td>
</tr>
<tr>
<td>Mesocolon defect stenosis</td>
<td>1 (3)*</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>28 (9.3)</td>
<td>8 (1.8)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Data presented as numbers of patients, with percentages in parentheses. * Patient with mesocolon defect stenosis 3 months after intestinal obstruction secondary to mesocolon defect hernia.

Fig. 2. Intestinal obstruction rate after LRYGB stratified by retrocolic and antecolic technique (log-rank test).
the retrocolic technique group and 2.9% in the antecolic technique group ($P = .004$; Fig. 2).

On univariate and multivariate analyses, the retrocolic technique for the alimentary limb was identified as a risk factor for intestinal obstruction (odds ratio 3.66, 95% confidence interval 2.43–6.2, $P < .001$; Table 3).

### Discussion

LRYGB results in a lower incidence of abdominal wall postoperative complications, such as wound infection and incisional hernia [10,11]. Nevertheless, the evolution from the open to the laparoscopic approach in RYGB has led to an increasing incidence of other postoperative events, mainly intestinal obstruction secondary to internal hernia [12].

Internal hernia as a complication of LRYGB has been previously reported and have not been limited to bariatric studies [13]. In open bariatric surgery, internal hernia was rarely described. Jones [14] reported an incidence of internal hernia of the biliopancreatic limb of <35% in 1174 open RYGB procedures. With the increasing development of LRYGB, many studies have reported the increasing incidence of internal hernia.

In this series, the incidence of intestinal obstruction was 4.7% at 16 months of follow-up. This rate is similar to that described in other series. As has been reported, the rate of intestinal obstruction was greater in patients who underwent LRYGB using a retrocolic technique than in those with the antecolic technique [15]. This was a retrospective study. One bias was that those patients who underwent the retrocolic technique were the first patients to undergo LRYGB at our institution. Therefore, this group included patients in the learning curve of our experience for whom a longer operative time and greater conversion rate have been observed [16]. Another bias was related to the longer follow-up period for patients who had undergone LRYGB with the retrocolic technique. Nevertheless, the Kaplan-Meier analysis showed that the intestinal obstruction rate at 24 months was significantly greater for the patients who had undergone the retrocolic technique. On multivariate analysis, which included the learning curve outcomes such as operative time and hospital stay, the retrocolic technique was a risk factor for intestinal obstruction. These findings suggest that the retrocolic technique for alimentary limb reconstruction is associated with a greater incidence of intestinal obstruction. These results must be evaluated with long-term follow-up data.

In the retrocolic group, internal hernias were the main cause of intestinal obstruction (86%). In contrast, in the antecolic group, adhesions constituted the main cause of bowel obstruction, with a lower incidence of internal hernias (34%).

Technical aspects such as mesenteric defect closure, the use of nonabsorbable suture for closure, and the orientation and route of the alimentary limb have been suggested as significant factors in the incidence of internal hernia [17]. The orientation of the limbs before the creation of the distal anastomosis has also been shown to facilitate these defects. A right-positioned biliopancreatic limb with a left Roux limb has been shown to favor internal herniation, in that the biliopancreatic limb would tend to return to its normal position on the left side of the abdomen [12]. Potential sites for internal hernias after RYGB are the enteroenterostomy defect and Peterson’s space in all patients and the transverse mesocolic defect in patients who underwent RYGB with the retrocolic technique. Probably the most important factor related to the greater incidence of intestinal obstruction in the retrocolic group was related to the greater potential site for hernia development. The retrocolic mesenteric defect has been reported as the most frequent site of internal hernia in other series [6,8,15].

### Conclusion

In this series, the retrocolic technique for LRYGB was associated with a greater incidence of intestinal obstruction because of the greater rate of internal hernias in this group. On the basis of these findings, the antecolic technique is recommended for LRYGB, although prospective randomized studies should continue to evaluate it.

### Disclosures

The authors have no commercial associations that might be a conflict of interest in relation to this article.

### References


