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Laparoscopic Biliopancreatic Diversion: Technical Aspects and Results of our Protocol

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Background: Biliopancreatic diversion (BPD) has been an excellent operation for morbid obesity to achieve long-term weight reduction. We present our laparoscopic BPD protocol, which includes laparoscopic BPD with or without gastrectomy.

Methods: Our two interventions are: 1) BPD (Scopinaro) by laparoscopy in patients with findings on gastroscopy; 2) BPD by laparoscopy with proximal gastric division without resection in patients without findings on gastroscopy. Since October 2000, we performed 65 laparoscopic BPDs (45 women, 20 men).

Results: 4 cases were converted to open surgery, 3 in the first 10 cases. The average operating-time was 176 minutes (360-110). We detected 2 stenoses of the gastric anastomosis. 2 patients had to be re-operated during the immediate postoperative period because of a leak from the jejuno-ileal anastomosis and a hemoperitoneum.

Conclusion: BPD can be performed satisfactorily by laparoscopy. Avoiding the gastrectomy is an interesting option to reduce technical difficulties, the surgeon's stress, duration of the operation, the patient's stress, and, probably, postoperative morbidity and mortality. We consider an upper digestive endoscopy to be mandatory to determine, before operating, if the patient will need a gastrectomy, depending on its results.

Key words: Biliopancreatic diversion, laparoscopic approach, bariatric surgery, morbid obesity.

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Introduction

During the last 25 years, biliopancreatic diversion (BPD) has been an excellent operation for morbid obesity, to achieve long-term weight reduction.[1] Currently, Scopinaro's operation is perceived as the most effective operation for long-term weight loss.[1] Nevertheless, this procedure is not without postoperative complications, and these are perhaps excessive for patients with a BMI <45 kg/m^2.

We reasoned that the operation should be adjusted to the BMI. Thus, we developed a protocol, in which laparoscopic BPD is the standard operation for two reasons: 1) it results in good weight reduction; and 2) it permits good quality of life with regard to ingestion. In 1993, we began to develop several experimental models of bariatric surgical techniques with laparoscopy, culminating in the performance of laparoscopic BPD with distal gastric preservation in pigs.[2] Given this experimentation and the experience gained in advanced laparoscopic surgery, our goal was to perform this BPD laparoscopically in humans to improve the patients' postoperative recovery and to reduce early and late complications, especially those derived from the abdominal wall, while maintaining the weight reduction of the BPD. In addition, to reduce the laparoscopic difficulty of Scopinaro's technique and potential complications associated with the partial gastrectomy, we decided not to do the gastric resection unless we considered it indispensable. Therefore, in many of our patients, we performed a proximal gastric transection, pre-

served the distal stomach. With these concepts, we applied our laparoscopic BPD protocol.

Materials and Methods

Since October 2000, we have been performing the laparoscopic BPD with two different modalities, depending on the BMI and the presence or lack of gastric pathology. We preserve the distal stomach if upper digestive endoscopy with biopsy does not show signs of chronic gastritis, metaplasia, dysplasia, ulcer or resistance to medical treatment to eradicate *Helicobacter pylori*. Therefore, our two interventions are: 1) Scopinaro BPD by laparoscopy in patients with findings on gastroscopy; 2) laparoscopic BPD based on Scopinaro, but with gastric preservation in patients without findings on gastroscopy. Both techniques leave proximal gastric volume varying between 100 and 300 ml, an alimentary limb adapted to the patients' characteristics, with a length between 200 and 300 cm and a 60-cm common limb.

We performed Scopinaro's BPD by laparoscopy on 12 patients and BPD based on Scopinaro by laparoscopy but preserving the distal stomach on 53 patients. There have been 45 women and 20 men, with average age 45.3 years (22-61). The average preoperative BMI was 48.4 kg/m^2 (39.9-81.1). There was co-morbidity preoperatively in 100% of the patients. After minor technical modifications, we standardized the operative steps, the only difference being the intestinal measurement and, of course, the gastrectomy.

Scopinaro's BPD by Laparoscopy

Position of Patient, Surgeon, Assistant, and Monitor

A surgeon and an assistant perform the operation. The patient is placed in laparoscopic French position, with his or her legs spread. The surgeon is between the patient's legs, with the assistant on the patient's left side.

During the first part of the operation, while we work in the infra-mesocolic space and the assistant performs the measurement of the ileum from the ileocecal valve, sectioning the ileum at 260-360 cm, adapting the alimentary limb to the patients' BMI, the surgeon subsequently performs the enteroanastomosis at 60 cm with the patient in Trendelenburg (25°).

During the second part of the operation, while we work at the supra-mesocolic space, the patient is placed in reverse Trendelenburg (25°), while performing the gastrectomy and the gastro-jejunal anastomosis.

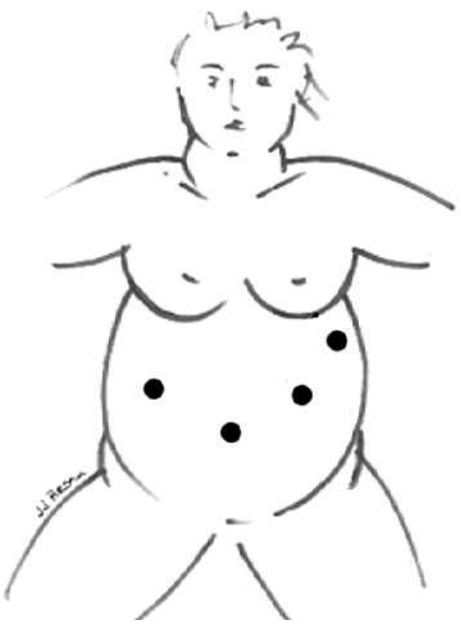
The monitor is at the head of the operating-table at all times, to the patient's right. We always use a 30° optic.

Position of the Trocars

We only use 4 or 5 trocars (Figure 1). We begin the operation by performing an umbilical opening with a Hasson cannula (10 mm) (Trocar 1), through which we introduce the laparoscope. Trocar 2 (12 mm) is placed in the right upper quadrant. Trocar 3 (12 mm) is placed in the left upper quadrant, symmetrical to the previous one. Trocar 4 (12 mm) is placed left lateral subcostal. A fifth Trocar (5 mm) can be useful at right subcostal.

Surgical Technique

Once the trocars have been placed under direct vision and the peritoneal cavity has been explored, the optic is changed from the umbilical trocar (Trocar 1) to the left upper quadrant trocar (Trocar 3). The assistant, from the patient's left side, intro-



Figur

duces with his right hand a clamp marked at 10 cm, and with his left hand introduces another clamp, in order to identify the ileocecal junction and perform the intestinal measurements. First, the assistant measures to 60 cm on the ileum proximal to the cecum, where he marks the spot with a dot, and 260 to 360 cm of ileum proximal to cecum (depending on the patient's BMI), where the intestinal division is done with a 60-mm Endo-GIA with 2.5-mm staples (AutoSuture, Tyco, Norwalk, CT, USA). The proximal end is taken to the 60 cm mark, performing the jejuno-ileal anastomosis with a 60-mm Endo-GIA with 2.5-mm staples.

Next, the surgeon between the patient's legs, closes the residual orifice left by the Endo-GIA. To do this, the optic is placed again in Trocar 1. This closure is done with continuous manual suture. The assistant tightens up the suture. Once an opening has been made in the mesocolon near the ligament of Treitz, the intestine can be pulled through it. Since the 30th case, we pass the intestinal loop in an antecolic fashion.

The gastrectomy starts with an opening in the greater omentum beside the stomach, in order to reach the retrogastric space. The gastric dissection continues with the Harmonic® scalpel (Ethicon Endo-Surgery) towards the duodenum, preserving the greater omentum. All possible retrogastric adhesions are divided, and the retroduodenal vessels are coagulated.

After deciding the upper level of the gastrectomy, it is best to perform the gastric section with two or three 60-mm Endo-GIA with 3.5-mm staples before performing the duodenal division. This allows us to pull the stomach towards Trocar 2 and dissect the lesser gastric curvature with the Harmonic scalpel or using a 60-mm Endo-GIA with 2.5-mm staples. The stomach, fixed only by the duodenum, can be easily sectioned with another cartridge of 60-mm Endo-GIA with 2.5-mm staples. The sectioned stomach is kept over the right hepatic lobe.

To proceed with the gastro-jejunal anastomosis, the jejunum is fixed to the gastric reservoir with a stitch. Then the anastomosis is performed with a 60-mm Endo-GIA with 3.5-mm staples. We usually perform an anastomosis of 3 or 4 cm in length.

We complete the operation by extracting the gastrectomy portion through the umbilical wound.

Laparoscopic BPD of Scopinaro Preserving the Distal Stomach

Preservation of the distal stomach greatly simplifies this operation. The procedure is the same, up to the point of performing the gastrectomy. Once the site of division of the stomach is determined, approximately 5 cm from the angle of His, an opening is made between the stomach and the greater omentum. The 60-mm Endo-GIA with 3.5-mm staples is introduced through this opening to transect the stomach and preserve the distal stomach. The remainder of the operation is the same.

Results

We performed 65 laparoscopic BPDs, with four cases converted to open surgery, three in the first 10 patients.

The average operating-time was 176 minutes (360 to 110 minutes). For the first 10 patients, the average operating-time was 242 (360-180) minutes and for the last 10 patients, 145.5 (210-90) minutes. The operations with gastrectomy took about 25 minutes longer than those without gastrectomy.

Because of our initial lack of experience with laparoscopic BPD, the patient's postoperative course was monitored with more care than usual, and the average postoperative stay was 7.8 days (4 to 41 days). At present, hospital stay is 4 or 5 days. An esophago-gastro-jejunal study was carried out in the first 30 patients using barium diluted to 50%, to verify the size of the gastric pouch and the proper functioning of the gastro-jejunal anastomosis. We detected two stenoses of this anastomosis. The first one, due to edema, resolved with medical treatment. The second one, due to a probable displacement of the Endo-GIA stapler in closing the orifice, required surgical treatment after 8 months of weight loss. In this case, the initial gastro-jejunal anastomosis had been performed with a 45-mm Endo-GIA. This same patient had to be re-operated immediately postoperatively for a leak from the jejuno-ileal anastomosis. Up to that point in our experience, we divided and anastomosed the intestine with an Endo-GIA with 3.5-mm staples, and afterwards we used 2.5-mm staples here.

Our mortality consists of one patient, a female

who had a bronchial aspiration caused by vomitus. All the major complications described above occurred in the first six patients. Throughout the remaining series, there were two cases of postoperative hemoperitoneum; the first was resolved with conservative treatment, and the second was re-operated laparoscopically.

The percentage of excess weight lost (%EWL) and decrease in BMI are shown in Table 1.

Discussion

It has been confirmed that the BPD can be performed satisfactorily using laparoscopy.[3-7] Our experience also shows that these operations can be performed with four trocars. A fifth trocar can be useful if a hepatic separator or a new opening for suturing is needed. Through laparoscopic mini-invasion, large incisions and their problematic consequences can be avoided, at the same time achieving a better postoperative recovery with less pain, better respiratory dynamics, and an earlier discharge home.

Avoiding the subtotal gastrectomy is an interesting option to reduce technical difficulties, duration, and probably postoperative morbidity and mortality. However, preserving the distal stomach by performing an upper horizontal division may cause an increase in stomal ulcers, making it necessary to leave a small gastric pouch with a transection at less than 5 cm from the angle of His. We do not believe that the risk of gastric cancer in the preserved distal stomach could justify performing a gastrectomy. Such a risk is minimal.[8] We note that some surgeons who perform gastric bypass had to perform a gastrectomy after obtaining certain results on endoscopy.[9,10] We thus use a gastric bypass protocol without and with a gastrectomy. Thus, we consider an upper digestive tract endoscopy mandatory before operating to determine if the patient will need a gastrectomy, depending on the results of this examination.

Table 1. Percentage of excess weight lost (%EWL) and BMI after laparoscopic BPD

Time (months)	%EWL	BMI (kg/m^2)
1	18.5 (6-35.2)	43.33 (35.3-72.7)
3	35.01 (16.36-70)	38.38 (28.2-60.8)
6	50.59 (27.7-96.2)	34.96 (24.2-48.9)
9	60.73 (33.93-105)	32.51 (22.9-41.4)
12	70.68 (42.8-125)	30.23 (19.8-34.6)
18	73.52 (47.27-122.5)	29.41 (20.2-35.5)
24	77.3 (47.27-12.0)	28.29 (20.6-35.5)
30	82.05 (50-120)	27.4 (20.6-35.2)
36	81.82 (50-120)	27.5 (20.6-35.2)

In our protocol, the site of division of the small bowel proximal to the ileocecal valve depends on BMI: BMI 40-45, 335-360 cm; BMI 45-50, 310-335 cm; BMI 50-55, 285-310 cm; and BMI >55, 260-285 cm. The shorter length for super-obese individuals is intended to result in greater weight loss with surveillance for metabolic and nutritional alterations,[1,11,12] and the longer length for morbidly obese patients is aimed at good results with few metabolic complications.[13]

From a technical and planning perspective, we believe that we are approaching the end of our learning curve, while anticipating changes to our protocol for two reasons: first, for the purpose of determining precisely at what point the gastrectomy is indicated and, second, because we would like to reach a consensus concerning our measurements with other groups of surgeons.

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Invited Commentary: Limb Lengths in BPD

As a preliminary comment, and contrary to the concerns that I had expressed in the past, I agree with the Authors and the Editor (Ref. 8 in the above paper) that, considering the large number of gastric bypass operations performed in the last 25 years, an increased risk of gastric cancer following this operation now appears to be very unlikely.

I have one favorable and one unfavorable comment about this paper. First, I want to thank the Authors for supporting my view that the name of bariatric operations, like all other functional operations, should refer to the surgically-created anatomic change which causes the functional alteration aimed at obtaining the specific goal of the operation, which, in the case of obesity surgery, is weight loss. In simpler words, bariatric operations should be named according to their mechanism of action. In fact, the Authors, when preserving the distal stomach in their operation, do not forget that the mechanism of action remains exactly the same, and call their operation *"BPD with preservation of the distal stomach"*, which is the equivalent of *"BPD with GBP"* in my short chapter on semantics in obesity surgery.[1] On the contrary, the article quoted by the Authors as Ref. 10, where the term "gastric bypass" is used in spite of the absence of any bypassed stomach, symbolizes the extent to which this name is used today, especially in the USA, irrespective of the anatomo-functional reality of the operation. Some years ago I made the same comment on a very similar presentation at the ASBS Annual Meeting, and I was told that this is done because of insurance requirements. I understand this. Still, at least in the scientific meetings and journals, we should all try to speak the same language.

The unfavorable comment regards the length of the alimentary limb inversely proportional to the initial BMI. We have demonstrated that the digestive-absorptive apparatus in BPD causes a maximum absorption capacity for fat and starch,[2] the former being absorbed only in the common limb while the latter is absorbed in the entire small bowel between the gastroenterostomy and the ileocecal valve. This means that, theoretically, equal limb lengths should cause equal stabilization weight, while to shorten the alimentary limb should result not in greater weight loss but in lower stabilization weight. In reality, we found that, intestinal limb lengths being equal, the stabilization weight is higher for men and is directly proportional to height and initial weight. The obvious conclusion is that the intestinal absorption capacity for energy per unit of intestinal length is higher in men and is the higher the taller and the heavier the operated patient. Therefore, leaving a shorter alimentary limb in the heavier patients would oppose this natural mechanism, causing a higher weight of stabilization in the shorter and the less obese patients, who are generally women, and vice versa. We also found a direct correlation between stabilization weight and total small bowel length, meaning that intestinal absorption capacity for energy per unit of intestinal length is also higher in patients with longer small bowel. Thus, to make intestinal limb lengths directly proportional to total bowel length would go in the opposite wrong direction.

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