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NEW CONCEPT

Laparoscopic Gastroileal Bypass with Single Anastomosis: Analysis of the First 1512 Patients

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Abstract

Background Biliopancreatic diversion is perceived as the most effective operation for long-term treatment of massive obesity. The purpose of this study is to demonstrate that gastroileal bypass with single anastomosis is a safe and feasible procedure with similar results to the classic derivation, but reducing surgical time without decreasing the efficacy.

Methods Descriptive, observational, prospective study of patients undergoing gastroileal bypass with single anastomosis between April 2010 and December 2015. The postoperative follow-up was 24 months.

Results One thousand five hundred twelve patients underwent gastroileal bypass. The mean time of the procedure was 32 min; the average stay was 2.2 days. 30.1% of patients lost more than 100% of their excess weight, and 72.35% of patients lost more than 75% of their excess weight. 95.17% of patients dropped to a BMI < 35; 75.99% to a BMI < 30 and 30.15% to a BMI < 25.

Conclusions Gastroileal bypass with single anastomosis is a safe and fast procedure providing similar results to biliopancreatic diversion with respect to weight loss.

Keywords Gastroileal-bypass

Introduction

Between 1993 and 1997, we carried out a number of funded research projects developing different experimental models in pigs of multiple laparoscopic bariatric surgery techniques. Throughout the experimentation, biliopancreatic diversion without gastrectomy and gastroileal bypass were performed.

In 1994, Dr. Resa presented his doctoral thesis in medicine [1] analysing the results of vertical gastroplasty in humans and showing an experimental model of laparoscopic vertical gastroplasty in pigs. At this time, we began to notice the long-term failure of vertical gastroplasty, so we moved towards malabsorptive techniques.

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In 1998, Dr. Resa presented his doctoral thesis in veterinary medicine [2] showing different experimental models of laparoscopic bariatric surgery techniques in pigs.

In the 2000s, we began to perform laparoscopic biliopancreatic diversion with the Spopinaro procedure in humans and laparoscopic biliopancreatic diversion without gastrectomy [3–5].

In 2004, with our accumulated experience in biliopancreatic diversion, we decided to perform biliopancreatic diversion without gastrectomy in two stages on patients with high anaesthetic risk needing quick surgery. First, we would perform an anastomosis biliopancreatic diversion without gastrectomy, which we call a gastroileal bypass, a simple and ultra-rapid technique. In the second stage, once the patient weighed less and the vital risk had decreased, we would perform the second stage of the biliopancreatic diversion, the Roux-en-Y. No patient needed the second stage due to the good weight loss outcomes and resolution of comorbidities. After observing the evolution of these patients for some years, we decided to make the technique more widely available and offer it to other patients from 2010.

In January 2005, the Department of Health of Aragon regulated bariatric surgery under an order controlling the

hospitals, surgeons and techniques that can be performed. We were licenced to practice all the techniques and their variants by laparoscopy. For 6 years, 100% of the medical records of patients who had undergone the surgery in our region were reviewed by health inspectors to assess the quality of the treatment and the results. Additionally, all patients were consulted by the inspectors to assess the perceived quality of the treatment received.

An ethics committee of the ASISA insurance group, to which the Montpellier Clinic belongs, evaluated our protocols positively.

The Illustrious Medical Association of Zaragoza evaluated the information and the publicity presented to our patients.

Patients were aware that gastroileal bypass surgery is a new technique, a development of biliopancreatic diversion without gastrectomy.

In 2004, we began to apply the principles of patient-focused medicine, instead of the paternalistic model in the doctor-patient relationship, thus rejecting the notion that the patient must necessarily adapt to the technique imposed by us and seeking a new point of equilibrium characterised by decision-making based on patient autonomy. Once the different techniques, their effects, their benefits and drawbacks were presented, the patients chose the surgery to which they would best adapt. The patients who underwent gastroileal bypass were aware of how that operation worked, its benefits and its drawbacks.

All patients signed several informed consent forms: for the bariatric surgery technique which they were to undergo, for laparoscopic surgery, for general anaesthesia, for data protection law and scientific use of data. There was also a form specifying commitment to complying with the standards, recommendations and advised follow-up.

Biliopancreatic diversion (BPD) has been used satisfactorily as one of several surgical treatments against obesity in order to achieve long-term weight reduction [6, 7]. Scopinaro's operation has been perceived to be the most effective operation for long-term treatment of massive obesity [8]. Through our publication, we intend to show that gastroileal bypass (GIB), a hypoabsorptive modification of biliopancreatic diversion without gastrectomy, achieves excellent weight loss outcomes with a high level of safety and is easily reproducible.

This paper describes the technique and short-term results, 2 years, after a GIB. 97.89% of patients presented were followed up for at least 2 years.

Materials and Methods

Patients and Study Design

We conducted a prospective case series of patients undergoing laparoscopic GIB from April 2010 to December 2015.

The patients had to be over 18 years of age, and the US National Institute of Health criteria for bariatric surgery were used for patient selection [9].

Peri and postoperative outcomes, including morbidity and mortality, were recorded prospectively and verified retrospectively using patient case notes, telephone and email contacts. In addition, an external observer, a quality control committee and a medical inspection by the local Aragonese government evaluated some patients retrospectively. They reviewed all their medical records and called patients by telephone to verify the quality of the treatment provided.

Operative Technique (Fig. 1)

The same surgical team performed all interventions; the main surgeon was always the same. The rest of the medical team consisted of a surgeon, an endocrinologist, a psychiatrist, a nutritionist, a haematologist and an anaesthetist who evaluated all patients preoperatively along with routine laboratory tests.

The patient was placed in the split-leg position. We used four trocars placed in the form of a V with the vertex at the navel, one left subcostal, one in the left nipple line, one supraumbilical and one in the right nipple line. On the left subcostal trocar, staples were inserted for the gastric section and anastomosis.

The technique consists of the horizontal section of the stomach at the second vessel of the lesser curvature with 2 or 3 60-mm blue linear stapler (Covidien®). To obtain the alimentary limb and common channel (in this technique, they are both the same as there is only a single anastomosis between the stomach and the intestine), at least 250 cm of ileum

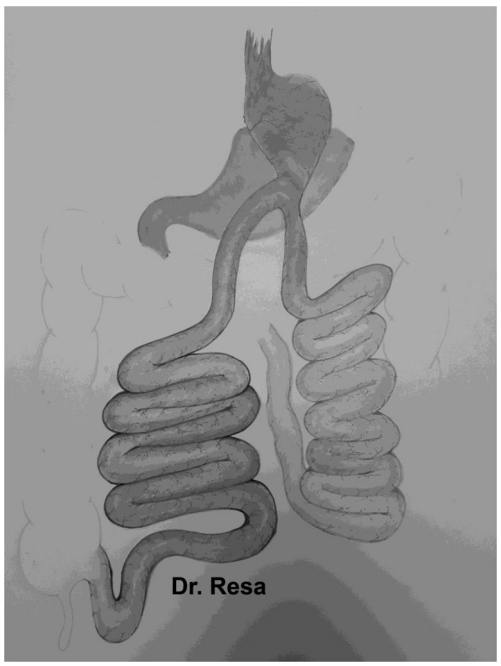

Fig. 1 Operative technique

measured from the ileocecal valve were used. This measure could be modified based on the slimming requirements of the patient.

The intestine was raised to the proximal stomach with a single anastomosis, not calibrated, which is made with a 60-mm blue linear stapler (Covidien®). The closure of the orifice of the Endo GIA used to make the anastomosis was performed by mechanical stitching inserted using the trocar from the right nipple line.

Aspiration drainage was used to close the anastomosis.

Patients started liquid tolerance on the first postoperative day. Discharge was allowed on the second postoperative day if no incidences were present.

Follow-Up

Patients were evaluated at week, 1, 3, 6, 9, 12, 15, 18 and 24 months after surgery and annually thereafter. This study only considers the first 2 years of follow-up. As the patients are from different regions and countries, follow-up should be provided for their different circumstances. All patients have telephone contact 365 days a year, 24 h a day, with several doctors (2 surgeons, 1 nutritionist, 1 internist, 1 psychiatrist, 1 anaesthetist) to ask questions or discuss concerns. Patients are notified by email of the need to undergo reviews in each follow-up period. When they make an appointment at our clinic, they can appear in person or the consultation can take place by telephone. The patients send the tests every 3 months by email and are answered daily 365 days a year. In each review period, the patient receives two replies on their progress, by mail and telephone or in person. Periodically, a member of our team, a specialist in coaching, calls all patients to encourage them with the follow-up, to find out about their progress and recover patients who have missed a review.

Early complications were defined as those occurring within 30 days of surgery.

Complete resolution of comorbid conditions was defined as requiring no active treatment for the disease.

All patients take one multivitamin every 24 h; 50,000 IU of vitamin A every 7 days; 400 IU of vitamin E every 7 days; 180,000 IU of vitamin D every 15 days and Omeprazole 20 mg every 24 h (first month 40 mg every 24 h).

Weight Loss

The weight loss assessments included: weight, weight loss, percentage of excess weight loss (%EWL) and changes in BMI in each review. Percentage of EWL was calculated using the weight corresponding to a BMI of 25 as the ideal body weight. All weight above this will be considered to be overweight.

Results

We present 1512 patients who have undergone gastroileal bypass. They consist of 978 women and 534 men. The average age was 43.9 (SD 12.3) years of age. The preoperative average weight was 116.62 (SD 22.02) Kg and the preoperative average BMI was $42.36 +- 6.23$ Kg/m^2 (35–81.1). All patients had obesity-related comorbidities preoperatively. They included the following: 499 (33%) hypertension, 362 (23.94%) type 2 diabetes mellitus, 528 (34.92%) dyslipidemia, 225 (14.88%) hyperuricemia and 589 (38.95%) obstructive sleep apnoea.

All procedures were successfully completed laparoscopically. The average operating time was 32 min (between 25 and 43 min). The average postoperative stay was 2.2 days. Thirty day and in-hospital mortality was 0%.

Weight, weight loss, percentage of excess weight loss (%EWL) and changes in BMI following surgery are shown in Table 1.

30.1% of patients lost more than 100% of their excess weight, 72.35% of patients lost more than 75% of their excess weight and 96.1% of patients lost more than 50% of their excess weight. 95.17% of patients dropped to a BMI < 35; 75.99% to a BMI < 30 and 30.15% to a BMI < 25

Resolution of obesity-related comorbidities is shown in Table 2. Table 3 shows the evolution of some analytical parameters.

41 (2.71%) patients suffered early complications. Of these, there were 14 cases of postoperative haemoperitoneum (objectified bleeding in drainage plus analytical and haemodynamic repercussion) and 23 cases of gastrointestinal bleeding (haematemesis plus analytical and haemodynamic repercussion). Only one haemoperitoneum required re-surgery. The other cases were resolved with conservative treatment: observation and transfusion. None of these patients required admission to the ICU.

Four patients (0.26%) suffered an anastomotic leak and required re-surgery.

Late complications included 15 (0.99%) patients who suffered marginal ulcer, and anastomotic stenosis diagnosed by endoscopy, 8 (0.52%) required endoscopic dilation of the anastomosis, 4 (0.26%) dilation of the anastomosis surgically and 3 (0.19%) developed perforation and required laparoscopic surgery.

Only 13 patients (0.85%) suffered symptomatic bile reflux. No patients required conversion to Roux-en-Y; they were medically treated by endoscopic dilation of the anastomosis, omeprazole, sucralfate and prokinetics. Two patients required surgical revision for malnutrition, lengthening the alimentary loop. No patient suffered intestinal occlusion due to internal hernia.

Table 4 shows the evolution of some vitamins and parathormone (PTH).

Table 1 Weight, weight loss, percentage of excess weight loss and changes in BMI following surgery

Months	BMI	Weight	Weight loss	% weight loss
1	38.21 + − 5.96	105.9 + −20.34	10.5 + −3.77	21.37 + −8.85
3	34.84 + − 5.4	95.52 + − 18.31	19.41 + − 5.99	40.44 + − 13.12
6	31.96 + − 5.27	84.4 + − 17.4	26.66 + − 8.21	56.05 + − 17.41
9	30.13 + − 4.8	82.55 + − 16.1	31.18 + − 10.55	65.81 + − 19.8
12	28.88 + − 4.67	79.37 + − 15.9	34.22 + − 11.96	72.22 + − 21.14
15	28.07 + − 4.62	76.79 + − 16.17	36.18 + − 13.26	76.27 + − 21.42
18	27.49 + − 4.3	75.27 + − 16.17	36.94 + − 14.12	79.49 + − 21.71
24	27.11 + − 4.1	74.51 + −14.53	37.49 + − 15.24	81.51 + − 21.81

Discussion

We present a variation of the biliopancreatic diversion technique. Gastroileal bypass with single anastomosis is between the biliopancreatic bypass without gastrectomy and the one anastomosis or Omega Loop gastric Bypass.

The technique is simplified with a single anastomosis, which greatly diminishes the possibility of an internal intestinal hernia.

At the same time, we have control of the malabsorptive component when measuring the bowel from the ileocecal valve. We can leave more or less intestine for intestinal transit according to the weight and height of the patient and depending on their weight loss needs. In any case, the common intestine section in gastroileal bypass is much longer than in biliopancreatic diversion (> 250 cm versus 50–60 cm). Therefore, gastroileal bypass provides less steatorrhea and better absorption of fat-soluble vitamins than biliopancreatic diversion. We could say that the gastroileal bypass is a hypoabsorptive rather than a malabsorptive technique. In our opinion, all bypasses should measure the common intestine from the cecum to find out and understand the degree of hypoabsorption that we want to induce in the patient. Measuring the biliary intestine and alimentary intestine from the angle of Treitz only gives us indirect knowledge of absorption in the common intestine and absolute ignorance of its length, which is really the most important thing to understand. By definition, every bypass seeks to achieve a certain degree of malabsorption, but the only way to control this malabsorption is to know the length of the intestine in which the absorption will take place, the common intestine. Measuring the intestine from the cecum avoids leaving the common intestine too short or too long.

On the other hand, sectioning the stomach horizontally, avoiding the crossroads of the oesophagus, spleen and liver, make it easier, safer and more reproducible than any other. Making a single anastomosis, especially if performed with mechanical sutures, is simple and safe.

72.35% of patients with weight loss of more than 75% of their excess weight. These results are similar to those presented by different authors by using biliopancreatic diversion [5, 8, 10, 11].

Improvement in hypercholesterolemia, type 2 diabetes mellitus and obstructive sleep apnoea, was observed in over 90% of patients within 2 years of surgery. This is compared with other series of mini-gastric bypass (MGBP), Roux-en-Y gastric bypass (RYGBP) or biliopancreatic diversion (BPD) [5, 6, 10–13]. The improvement in hypertension was less marked as is normal with all techniques.

The use of a longer gastric pouch in gastroileal bypass and biliopancreatic diversion may be expected to produce a greater incidence of stomach ulceration than RYGBP and MGBP.

Table 2 Resolution of obesity-related comorbidities (2 years)

Comorbidity	Cases improved, *n* (%)
Hypertension 499 (33%) Blood pressure > 140/90 mm/hg	284 (56.91%)
Type 2 diabetes mellitus 362 (23.94%) Glycemia > 126 mg/dl	325 (89.77%)
HbA1c > 6.1%	
Dyslipemia 528 (34.92%) Cholesterol > 200 mg/dl	500 (94.68%)
Triglycerides > 150 mg/dl	
Hyperuricemia 225 (14.88%) Uric acid > 7 mg/100 ml	217 (96.44%)
Obstructive sleep apnoea 589 (38.95%) 5 apnoea/hour	576 (97.79%)

Table 3 Evolution of some analytical parameters

Months	Glycemia	HB A1C	Cholesterol	Triglycerides	Uric acid
PreS	112.16	6.6	198.14	154.22	5.83
1	102.15	6.26	164.48	146.11	6.17
3	98.36	5.74	162.68	139.97	4.96
6	88.47	5.2	153.68	121.09	4.73
9	86.75	5.04	149.59	107.78	4.49
12	86.84	5.02	147.28	102.63	4.47
15	85.71	5	146.89	96.17	4.26
18	86.9	5.12	144.55	93.74	4.18
24	87.65	4.92	148.31	88.64	4.16

Following MGBP and RYGBP, the reported incidence is around 4–5% and 0.6% respectively [12, 14], similar to ours. Perhaps, our true incidence could be higher as some may be asymptomatic and will increase over time in a longer follow-up. The possibility of marginal ulcer perforation, although scarce in this series in the first two postoperative years (0.19%), is our greatest concern, as it can grow with long-term follow-up. In our cases, perforations have always been related to treatment with anti-inflammatories, and we must pay special attention to their prevention by taking IBP.

One questionable issue with this technique is anastomosis, similar to Billroth II. Minigastric bypass has been previously criticised due to perceived higher incidence of oesophagitis and bile reflux compared to Roux-en-Y gastric bypass [15, 16]. In the present study, 0.86% of patients reported clinical reflux; however, none of the patients required conversion to Roux-en-Y. Long-term results should be analysed. However, we think that when we reach our anastomosis, it has passed through an important part of the intestine and some of its salts have been reabsorbed. It could be that the bile composition in our case is different and less aggressive.

The risk of malnutrition is low; the risk of failure in weight loss is greater, which suggests that the technique is not as malabsorptive as it might seem in principle.

Table 4 Evolution of some vitamins and parathormone (PTH)

Months	B1	B6	B9	B12	A	D	PTH
PreS	6.55	10.3	6.16	409.31	28	22.33	71.04
1	6	29	5.94	587.49	31	37.57	58.33
3	5.69	76.64	6.64	445.68	33.37	58.16	56.6
6	7.65	66.45	14.78	480.03	34.13	68.36	55.07
9	6.31	34	8.91	478.86	34.05	70.74	56.52
12	6.78	52.15	7.62	480.79	41.06	62.14	59.19
15	10.17	53.18	9.66	454.89	39.62	61.18	63.19
18	8.09	42.14	8.7	518.86	39.99	59.31	67.07
24	8.08	56.08	8.32	525.23	38.04	59.38	73.09

Only fat-soluble vitamins require exhaustive follow-up, in particular vitamins A and D and the relationship of the latter with PTH. We will never see deficiencies in water-soluble vitamins.

Conclusion

Laparoscopic gastroileal bypass is a safe and fast technique that can achieve excellent excess weight loss in the medium term, with effective comorbidity resolution and low complications and mortality.

A longer follow-up is necessary to verify the stabilisation of weight loss and comorbidities as well as to detect long-term complications.

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflict of Interest The authors declare that they have no conflict of interest.

Informed consent was obtained from all individual participants included in the study.

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