Surgical treatment of morbid obesity with biliopancreatic diversion and gastric banding: report on an 8-year experience involving 235 cases


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ABSTRACT

Study aim: Developments have recently been made in bariatric surgery outside the USA. The aim of this retrospective non-randomized study was to report on our experience regarding biliopancreatic diversion (BPD) and non-adjustable gastric banding (GB) in a population of 235 obese patients.

Patients and methods: From March 1990 to March 1998, 235 obese patients were operated on, 142 by BDP and 93 by GB, via laparotomy after rigorous selection of the patient population.

Results: The mean duration of surgery was 2 h 50 minutes for BPD and 1 h for GB. One postoperative death occurred due to massive pulmonary embolism. Early major complications were frequent in the BPD group (n = 21) but rare in the GB group (n = 1). Mean duration of hospitalization was 16 days in the BPD group versus 9 days in the GB group. Mean percentage excess weight loss was 48% for the GB group and 60% for the BPD group after two years. Late mortality was limited to the BPD group (3.5%). Late complications were evenly distributed between the two groups, with a prevalence of malnutrition in the BPD group and outlet stenosis in the GB group. A high incidence of band removal was recorded related to this complication (17.2%). Incisional hernias were present in both groups.

Conclusions: GB and BPD are techniques which can induce weight loss and bring about subsequent health benefits. Nevertheless, in a few patients further intervention or adaptation of the approach due to clinical failure or to a high complication rate is required. Additional research is needed regarding determination of the surgical treatment that is best adapted to the case in question, i.e., taking into consideration both the restrictive and malabsorbative aspects. © 2000 Éditions scientifiques et médicales Elsevier SAS

bariatric surgery / biliopancreatic diversion / gastric banding

RÉSUMÉ

Traitement chirurgical de l’obésité massive par diversion biliopanкрéatique et gastroplastie : une étude de 235 cas réalisée sur une période de huit ans.

Objectif de l’étude : Le traitement chirurgical de l’obésité s’est récemment développé en dehors des États-Unis. Le but de cette étude rétrospective non randomisée était de rapporter notre expérience de la diversion biliopancréatique (DBP) et du cerclage gastrique (CG) non ajustable dans une population de 235 patients obèses.

Patients et méthodes : De mars 1990 à mars 1998, 235 patients obèses ont été opérés par laparotomie ; 142 ont eu une DBP et 93 un CG, après une sélection rigoureuse.

Résultats : La durée moyenne de l’opération était de 2 heures 50 minutes pour la DBP et de 1 heure pour le CG. Il y a eu un décès postopératoire à la suite d’une embolie pulmonaire massive. Des complications précoces ont été fréquemment observées dans le groupe DBP (n = 21), rarement dans le groupe CG (n = 1). La durée moyenne d’hospitalisation était de 16 jours dans le groupe DBP et de 9 jours dans le groupe CG. La perte de l’excès de poids a été en moyenne de 48 % dans le groupe CG et de 60 % dans le groupe DBP après deux ans. Il y a eu une mortalité tardive de 3,5 % dans le groupe DBP. Des complications tardives sont survenues dans les deux groupes, avec une prévalence de malnutrition dans le groupe DBP, et de sténose gastrique dans le groupe CG obligeant à retirer...
l’anneau dans 17,2 % des cas. De nombreuses événements sont survenues dans les deux groupes.

**Conclusions :** La diversion biliopancréatique et le cerclage gastrique peuvent entraîner une perte de poids avec tous les bénéfices qui en découlent. Néanmoins, chez quelques patients, il est nécessaire de réopérer, ou de transformer le montage en cas d’échec ou de survenue de complications. Il faut s’efforcer de déterminer pour chaque patient le traitement chirurgical le mieux adapté à son cas.

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Although bariatric surgery was first introduced in the 1950s, its development outside the USA and the setting up of an independent scientific organization (International Federation for the Surgery of Obesity, IFSO) are much more recent events.

The present group introduced bariatric surgery at the only specific treatment center in Sicily in 1990.

**PATIENTS AND METHODS**

Between March 1990 and March 1998, 235 morbidly obese patients were referred to the treatment center for surgical intervention. Two groups of patients were considered, consisting of 142 and 93 individuals, operated on during the years 1990–1995 and 1993-1998 respectively.

The first group underwent biliopancreatic diversion (BPD), which consisted of gastric resection with a variable gastric stump of between 200–500 mL and restoration of the alimentary tract with a long Roux-en-Y bypass. The alimentary tract (from the gastric stump to the ileo-cecal valve) measured about 250 cm, the last 50 cm of which received the bilio-pancreatic secretion from the duodenal stump through the rest of the small bowel, according to the procedure of Scopinaro [1].

The second group underwent silicon non adjustable gastric banding (GB). The band was positioned just below the cardia, through an opening of the lesser sac and the gastrophrenic ligament above the short vessels. The band was calibrated over a 12 mm bougie with a 30 mL gastric pouch [2]. All interventions were performed via a median xipho-umbilical laparotomy.

The choice between the two surgical techniques was not randomized, but depended upon the enrolment period in this study. We first adopted a mixed technique (malabsorbitive and restrictive), and subsequently after a few years follow-up, due to certain severe nutritional complications, a less invasive gastric restrictive procedure. Intervention stratification per year has been reported in figure 1.

Demographic data on the patient population have been reported in table I. All patients were referred to surgical therapy after repetitive failure of dietary or medical treatments because of a BMI of over 40, or due to the presence in borderline patients (BMI 35–40) of obesity-related diseases which were not otherwise curable. Patients under 18 and over 65 years of age, or those subjects with a restricted life expectancy or suffering from a psychiatric disorder were excluded from surgical therapy. The most common comorbidities have been reported in table II.

After initial medical evaluation and agreement to follow-up requirements, all patients were studied by routine preoperative examination, including spirometry and arterial blood gas determination. When judged to be at risk of cardiac event, patients were

![Figure 1. Distribution of intervention per year.](image)

**Table I.** Demographic data on obese patients.

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Gender (M/F)</th>
<th>BMI</th>
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<tbody>
<tr>
<td>GB (93 patients)</td>
<td>35 (18–63)</td>
<td>25/68   48.7 (37–65.6)</td>
</tr>
<tr>
<td>BPD (142 patients)</td>
<td>36 (18–61)</td>
<td>40/101  50 (35–81)</td>
</tr>
<tr>
<td>Total No. (235 patients)</td>
<td>35.6</td>
<td>65/169  49.7 (35–81)</td>
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GB: gastric banding; BPD: biliopancreatic diversion.
screened for ventricular dyskinesia by echocardiography. Patients about to undergo GB were screened for hiatus hernia or gastroesophageal reflux disease by endoscopy, manometry and 24-h. phmetry. As regards BPD patients, 2 blood samples of about 300 cL were taken at 3-day intervals for hemodilution and autotransfusion purposes.

All patients were operated on according to the previously mentioned techniques. Antithrombotic prophylaxis was performed in all patients, consisting of applying a lower limb elastic bandage, early (3 h) postoperative mobilization, and for the BPD group, subcutaneous heparin administration. At induction 2 g i.v. cephalosporin were administered as antibiotic prophylaxis, and extended for 2 days postoperatively.

All patients received appropriate dietary indications, either hyperproteic with vitamin supplement or fluid hypocaloric according to the surgical procedure adopted. The wearing of an elastic abdominal external support was advised for 3 months in all patients; no particular restriction was imposed regarding standard physical activity.

RESULTS

The mean duration of surgical intervention was 2 h 50 min for the BDP group (1 h 50-5 h 15 min) and 60 min (42-120 min) for the GB group. The mean duration of hospitalization was 16 days for the BPD patients, versus 9 days for those submitted to GB. One postoperative death occurred in the whole series of 235 patients (0.4%), due to a massive pulmonary embolism (PE) occurring 15 days after surgery; this diagnosis was confirmed at autopsy in a male patient weighing 225 kg who underwent BPD, without previous clinical signs of postoperative deep venous thrombosis (DVT).

Early major morbidity consisted of 6 cases of DVT (2.1%), two cases of non-lethal PE (0.8%), two cases of bleeding from stapled gastroenteric anastomosis (0.8%), two cases of gastric outlet obstruction (0.8%) in the BPD group, one case of abdominal wall disruption (0.4%), and one case of gastroenteric anastomosis asymptomatic leakage (0.4%). In four patients (1.6%), an emergency operation was required (two hemorrhages, one abdominal wall disruption, one gastric outlet obstruction); early complications mostly occurred in the BPD group (figure 2). Minor infections occurred involving the surgical wound (16%) or the urinary and respiratory tract (7%).

The follow-up was set at 1, 3, 6 and 12 months after surgery, and then at 1-year intervals. As the BPD procedure was adopted at an earlier period than GB, the follow-up covered 2-7 years for this group of patients; there was a 6-month to 2-year follow-up for the GB group. Fifteen patients were lost to follow-up. Data were available on 220 patients (93%), with only a 7% dropout rate.

Both surgical procedures proved to result in a consistent weight loss. Only two cases (2%) in the GB group did not achieve a satisfactory weight loss because of early band removal. Mean percentage excess weight loss (% EWL) was 48% at 2 years for the GB and 60% for the DBP group, remaining stable after 2 years (figure 3).

Late mortality was recorded in the BPD group. In two cases (1.3%), liver failure followed chronic
hepatopathy 2 and 3 years after surgery. Cardiac failure with subsequent pulmonary edema was the cause of mortality in a 54-year old male patient 15 months after surgery (0.7%). Another patient died of peritonitis following a small gut anastomotic leak (0.7%), occurring after BPD revisional surgery for common limb elongation. A male patient died 18 months after surgery after undergoing transverse colonic resection for Dukes D adenocarcinoma. Late mortality in the BPD group reached 3.5%. Both BPD and GB induced late morbidity. The main late complications in the BPD group were malnutrition syndromes (19%) for specific nutrients (vitamins, iron, and hypoproteinemia) or generalized disorders, requiring hospital admission for parenteral nutritional supplementation. GB group patients mostly showed functional gastric outlet stenosis (21.5%), requiring hospital admission and in most cases (16/20, 17.2% of the GB group) band removal. Among those patients with band removal, one case was associated with gastric wall erosion (1%), and one case with symptomatic gastroesophageal reflux (1%). All these patients refused to be treated by another type of bariatric surgery technique. An attempt to elongate the small bowel common limb (2%) was necessary in three patients for generalized malnutrition syndromes following BPD resulting, as already said, in a lethal postoperative complication. Chronic hepatopathy developed in 2 BPD group patients (1.4%), causing late mortality. Other common late complications in the BPD group involved proctologic disease. Six interventions (4.2%) were required during follow-up to correct anal fistulae, hemorrhoids or fissures. An emergency intervention was necessary at 8 months after BPD due to massive bleeding from a duodenal stump ulcer (0.7%). Gastric anastomotic ulcerations occurred in 2 cases (1.4%), and were successfully managed by medical therapy.

The only common complication in the two groups of patients was incisional hernia, which occurred in 24% of cases (35 patients) after BPD and in 15% of cases (14 patients) after GB. Five female patients at various time periods following BPD, underwent plastic surgery for persistence of the abdominal apron (3%). On the whole about 30% of patients required rehospitalization for various reasons. The number of hospital admittances varied for each patient between 1 and 12, with a marked prevalence of multiple admissions for the BPD group patients. Late complications have been summarized in table III.

Besides complications, the improvement recorded during follow-up for various parameters should be noted. A significant improvement was observed for symptomatology regarding patients affected by lower limb chronic venous incompetence (95% of cases). In 90% of cases, hypertensive patients were able to suspend medical therapy or reduce the drug dosage. Blood lipid levels were normalized at 1 year in 100% of patients. All diabetic patients suspended insulin administration at 1 year; only 21% remained on oral antidiabetic medication. All patients reported an increase in physical activity, either because of an improvement in osteoarthropathy, or cardiorespiratory performance. All patients with effort dyspnea reported an improvement in ambulatory autonomy, apart from one subject who died of pulmonary edema with persisting cardiac failure. Sleep apnea syndrome disappeared in all patients.

![Figure 3. Excess weight loss (%).](image)

<table>
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<tr>
<th>Table III. Late complications.</th>
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<tr>
<td><strong>BPD (%)</strong></td>
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<tr>
<td>Mortality</td>
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<tr>
<td>Specific morbidity</td>
</tr>
<tr>
<td>Reoperations</td>
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<tr>
<td>Incisional hernias</td>
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DISCUSSION

In March 1991, the National Institute of Health (NIH) organized a Consensus Conference on Bariatric Surgery, in which it was determined that vertical band gastroplasty (VBG) and gastric bypass (GBP) because of their efficacy and low surgical risk, constituted the therapies of choice [3]. Since then, these procedures have been widely used, and several authors have reported favorably on them [4-11].

More recently, Brolin [12] criticized the criteria that led the NIH in 1991 to support the routine use of VBG and GBP, stressing the relative efficacy regarding long-term weight loss obtained with these procedures, and asked for a reassessment of the possible applications of BPD and other laparoscopic techniques.

These contradictory conclusions demonstrate that so far consensus has not been reached by the scientific community regarding the choice of surgical intervention.

Our experience is based upon two types of intervention representing the extremes of the surgical spectrum as regards visceral involvement, reversibility and weight loss mechanisms. The present investigation is a retrospective non-randomized study, but the similar demographic characteristics of the patients in the two groups and standardized medical care (80% of all cases were operated on by the first author, G.B.) provide a common overview.

Our data show that both GB and BPD are able to induce a consistent weight loss; BPD allows good maintenance of this result even at several years following surgery, while a longer follow-up is needed for GB. Regarding weight loss, our data are similar to those reported in the literature.

Concerning BPD, we refer to the findings of Scopinaro et al. [13], who in 1996 published with a 15-year follow-up a mean percentage EWL of over 70% in their 1976 patient group. Other authors with a shorter follow-up of 5 (14–16) and 2 years [17] report similar results.

More difficulty is encountered in comparing GB results in the literature. In fact, different techniques and materials have been used, smaller groups of patients incorporated per single study, and follow-up has usually been shorter. Forsell and Hellers [18] reported one of the longest follow-ups, showing a 68% EWL after 6-76 months, with a dropout rate of only 3%. Other studies [19-23] with a 6-month to 4-year follow-up are reported in Table IV. More recent series on GB report findings following laparoscopic procedures. Although this approach is gaining popularity among surgeons [24-27], its impact on bariatric surgery concerns only postoperative patient compliance and probably the incidence of incisional hernias, without any difference in effect on weight loss. More research is needed to establish the early postoperative complication rate after laparoscopic procedures.

The risk of complication is a factor of great concern in bariatric surgery. In our experience, early complications are practically confined to the BPD group, including the one mortality due to PE, and 4 early reinterventions; in the GB group a single case of postoperative DVT was recorded. This can be explained by the longer surgical exposure required by BPD, which implies visceral cutting and gastrointestinal anastomosis. Most of our early complications concern our initial experience; in particular the cases of postoperative gastric bleeding, which were due to incomplete hemostasis on the gastrointestinal stapled anastomosis line, as previously reported [1].

Thromboembolic complications, recorded throughout the literature for all types of interventions, are known to be the commonest cause of mortality in bariatric surgery [28, 29]. Recently [30] an increase in fibrin synthesis, interaction between fibrin and platelets, and platelets activity has been
demonstrated during the postoperative period in obese patients versus non obese control patients.

The only late common complication between the two groups was incisional hernia, occurring in 24% of patients who underwent BPD and in 15% of those treated by GB. These data emphasize the concept of obesity as a risk factor for incisional hernias and surgical incision infections, as previously reported [31]; no differences were encountered regarding suture technique of the abdominal wall or the presence of other possible common risk factors, as reported by other investigators [32-34]; the higher incidence in the BPD group can be explained by the longer follow-up period and by nutritional deficiencies that may have contributed to incomplete fascial healing.

Subcostal laparotomy has resulted in a lower incidence of incisional hernias [7, 35, 36]. This incision is best suited for gastric surgery and will be evaluated versus the laparoscopic approach. The laparoscopic approach reduces morbidity due to parietal disease, and results in a more comfortable postoperative course. It should be stated that in any case, following laparoscopic procedures no difference in weight loss is observed from the results following open surgery. A more consistent follow-up is needed to evaluate the specific complications associated with the laparoscopic approach.

Late follow-up showed a 3.5% mortality in the BPD group. Complications leading to death (colonic adenocarcinoma, cardiac failure) were not in any instance linked to nutritional deficiencies, but specific nutritional requirements resulted in particular problems regarding the therapeutical approach toward these patients. A larger overview shows that 19% of BPD patients develop postoperative anemia, multivitamin shortage, hypoproteinemia, and various degrees of hepatic dysfunction sufficient to require hospitalization for nutritional support, and in three cases a surgical attempt to elongate the intestinal common limb. Patients were readmitted for nutritional deficiency when this proved to be chronic at clinical or laboratory analysis (Hb < 8 g/dL, hemeralopy, mucosal phlogosis, relapsing infections, PT < 35%, persistent leg edema or an anasarctic condition, severe bone demineralization, proteinemia < 4 g/dL, albumin < 40%). Apart from incisional hernia, BPD resulted in 11% reinterventions and 30% further hospitalizations. Comparison with Scopinaro’s findings [13] shows that our data are similar regarding the incidence of malnutrition and reintervention rate for common limb elongation (21 versus 17%). Differences are observed in the incidence of stomal ulcers (1.4 versus 15%) and proctologic diseases (4.2 versus < 1%).

A particularly disappointing experience in our study was that of two cases of late mortality due to hepatic failure. Scopinaro et al. [13] reported three cases of liver cirrhosis with fatal evolution (0.1%), determined by the authors to be the result of alcoholic abuse; however, in our series no link was found with alcohol or with disease of viral etiology.

Recent reports [37] have demonstrated that patients who have undergone VBG show, after consistent weight loss, reduction of liver steatosis, but an increase in lobular phlogistic response. The cases progressing to cirrhosis required liver transplantation, which was successfully performed in patients submitted to jejunoo-ileal bypass (JIB) [38].

Given the above, in 1993 we adopted a gastric restriction procedure, selecting non-adjustable laparotomic GB for its simplicity and reversibility. This intervention confirmed the high incidence of incisional hernias (15%), but follow-up showed a single common specific complication: the outlet syndrome (OS) (21.5%). The OS had already been described by Granstrom and Backman in 1987 [39] as a functional status differing from that of organic stenosis; i.e., it is due to gastric pouch dilatation and its delayed emptying, because of slippage of the gastric fundus below the neostomal level, as easily demonstrated by radiographic postoperative controls. All the removed bands showed a patent stoma at endoscopy, and an intraoperative finding of various degrees of pouch dilatation. In 17.2% of cases, this complication led to band removal; most removals (63%) were performed between the first and second postoperative year; the remaining 37% of removals were carried out during the first postoperative year. In two cases, an early removal (before the third postoperative month) was necessary. After removal, most of the patients showed low compliance toward postoperative dietary restrictions, reporting frequent food abuse and autoprovoked vomiting: these mechanisms may have favored gastric pouch dilatation. The same reaction has been proposed by Kuzmak and Burak [40], to explain gastric pouch dilatation. The increasing incidence of band removal may
reduce the long-term efficacy of GB, as these patients are expected to regain some weight. The use of an adjustable GB has recently lowered the incidence of OS to 4-6% [18, 41-43]. As OS is commonly reported in all GB series as a means of overcoming this problem, we recently adopted the procedure of vertical banded divided gastroplasty (according to McLean); the preliminary results will soon become available.

CONCLUSION

Our findings lead us to conclude that the techniques adopted in this series are successful in bringing about adequate weight loss. The same conclusion has been reached in the international literature on VBG and GBP [4, 5, 7, 44].

Despite these conclusions, each study shows that there is a variable group of patients in which the technique utilized is unsuccessful due to an insufficient weight loss or a high complication rate.

Given our findings, even if the complication rate regarding percentage is similar in the two groups, the severity of most of the ensuing BPD complications has led us to more selectively consider the use of this approach. We are of the opinion that BPD (according to McLean); the preliminary results will soon become available.

REFERENCES


