

# Duodenal Switch: an Effective Therapy for Morbid Obesity—Intermediate Results

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**Background:**The duodenal switch (DS) is a variant of the biliopancreatic diversion (BPD), with a vertical subtotal gastrectomy and pylorus preservation.

**Methods:** DS was used to treat morbid obesity in 125 patients, with mean BMI 50, with 65% of the patients super obese (SO). Patients have been followed for an intermediate period.

**Results:** The percentage of excess weight loss (%EWL) was > 70% at 1 year, and reached 81.4% at 5 years when 97% of the patients had a %EWL > 50%. Comorbidities were cured or improved in all patients.

**Conclusion:** DS was very effective for the treatment of the morbid obesity in the SO patients.

**Key words:** Duodenal switch, morbid obesity, bariatric surgery, mixed bariatric techniques, hybrid bariatric techniques, biliopancreatic diversion

## Introduction

In the morbidly obese individual with a body mass index (BMI) > 40 kg/m<sup>2</sup> (35-40 with diabetes, hypertension, sleep apnea, dyslipemia, etc.), bariatric surgery is the only known effective therapy. Scopinaro<sup>1</sup> described in 1979 the biliopancreatic diversion (BPD), a mixed or hybrid surgery consisting of restrictive (partial gastrectomy) and

malabsorptive (functional shortening of the small intestine) components. In 1998, Hess modified the BPD with a vertical subtotal, pylorus-preserving, gastrectomy and added the duodenal switch (DS)<sup>2</sup> described by DeMeester<sup>3</sup> to prevent duodeno-gastric reflux. Marceau<sup>4</sup> published the largest experience. Baltasar<sup>5,6</sup> and Rabkin<sup>7</sup> described further experience with BPD-DS.

## Material and Methods

From 1994 to July 2000, 125 patients underwent BPD-DS. Mean age was 37 years (16-68), height 163 cm (147-194), initial weight 134 kg (96-236) and BMI 50 (39-100). In 102 patients, BPD-DS was a primary procedure and in 23 a conversion from a previous vertical banded gastroplasty (VBG). Of the patients, 77% were females, morbidly obese (BMI 40-50) 35% and super obese (BMI > 50) 65%. Only one patient, with BMI 100, had a concurrent abdominal and thighs dermolipectomy, to allow postoperative walking.

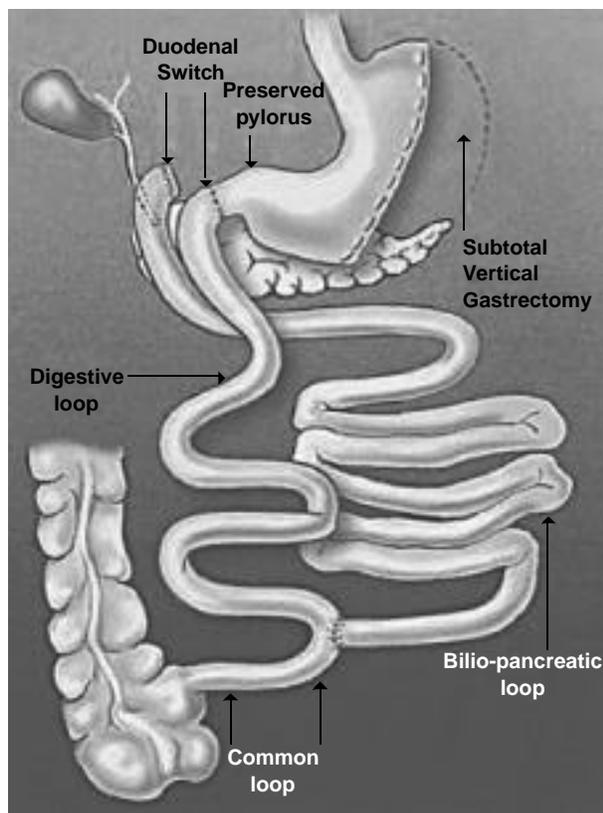
## Technique

The operation is shown in Figure 1, as previously described.<sup>5,8</sup> We perform the procedure through a transverse supraumbilical incision, to allow full exposure and to lessen postoperative pain. A subtotal vertical gastrectomy is made with staplers,

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**Figure 1.** Vertical subtotal gastrectomy / biliopancreatic diversion / duodenal switch.

which is oversown with a continuous running serosa-serosa suture, leaving a narrow gastric tube. The duodenum is divided 3 cm distal to the pylorus and the small bowel 250 cm proximal to the ileo-cecal valve. The distal ileum (alimentary or digestive loop) is brought up transmesocolic and anastomosed end-to-end to the duodenum with a monolayer continuous running suture of Prolene. The distal duodenum-proximal jejunum (biliopancreatic loop) is anastomosed end-to-side to the distal ileum, forming the common limb of ileum 75 cm from the ileo-cecal valve. The mesenteric rents are closed, and liver biopsy, cholecystectomy and appendectomy performed.

## Results

There was no mortality in the 102 primary operated patients. Of the 23 patients converted from a previous VBG, two patients died—one from pulmonary

emboli and the second from multi-organ failure due to a thoracic esophageal rupture—an 8.7% mortality rate. The mortality rate for all 125 patients is 1.6%.

Seven patients suffered serious complications (two obstructions and five leaks) that required reoperations. The two patients who died and four of the five leaks occurred in patients converted from VBG. Mean hospital stay was 4.6 (2-12) days in the uncomplicated patients and 10.4 (8-65) days in the complicated ones.

One patient died 6 months after surgery due to hepatic failure, and a second patient (BMI 94) died 4 months after surgery possibly due to a refeeding syndrome while receiving total parenteral nutrition (TPN) for protein malnutrition.

No patient was lost to follow-up. Three patients required conversion of the small bowel bypass, (2.5% of the total 125 patients) due to liver failure from suicidal alcoholism in the first, diarrhea and anal leakage in the second, and protein malnutrition in the third. All these three patients now have a BMI under 32.

The percent of excess weight loss or %EWL (ie. [initial weight–actual weight/actual weight–ideal weight] x 100) is accepted as a good measure of end-results, and an %EWL > 50 is considered a success.

Mean weight changes are shown in Figure 2. The %EWL for all the operated patients at 1 year was 70.1 in 96 patients to this point, 75 at 2 years in the 75 patients, 75.0 at 3 years in 64 patients, 81.2 at 4 years in 54 patients, and 81.4 at 5 years in the 32 patients who have reached this point. The BMI dropped to 31.5 at 1 year, 29.7 at 2 years, 29.9 at 3 years, 28.0 at 4 years, and 28.0 in patients who have attained 5 years.

%EWL in the morbidly obese patients, (Figure 3) was 74.3 at 1 year, 78.6 at 2 years, 81.0 at 3 years, 83.9 at 4 years, and 90.7 at 5 years. BMI in the morbidly obese dropped from a mean of 43.1 to 28.2 at 1 year, 27.1 at 2 years, 26.7 at 3 years, 26.2 at 4 years and 24.2 at 5 years.

%EWL in the super obese patients (Figure 4) was 61.5 at 1 year, 71.5 at 2 years, 68.5 3 years, 77.2 at 4 years and 62.8 at 5 years. The mean BMI dropped from 60.8 to 37.1 1 year, 33.8 at 2 years, 34.8 at 3 years, 31.0 at 4 years and 35.6 at 5 years.

In the 107 patients (88.4%) operated upon > 6 months before the study, only 3 (2.8%) have a

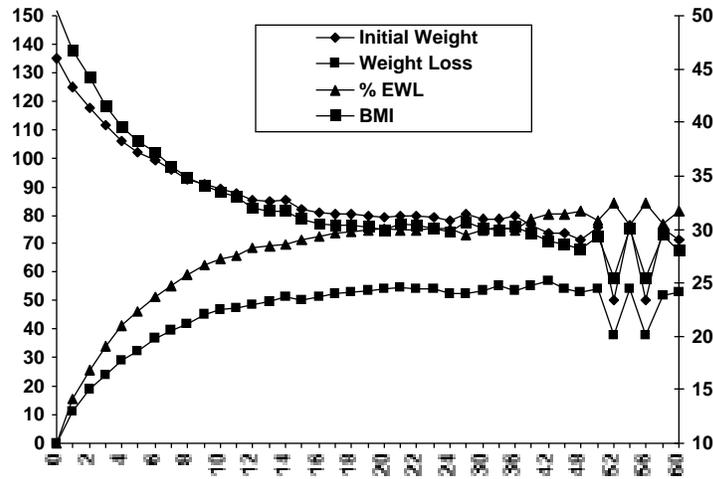


Figure 2. All BPD-DS patients. BMI on the right.

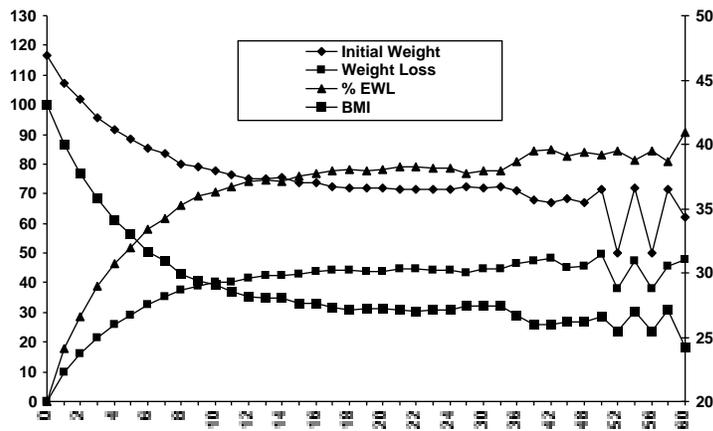


Figure 3. Only morbidly obese with BMI < 50.

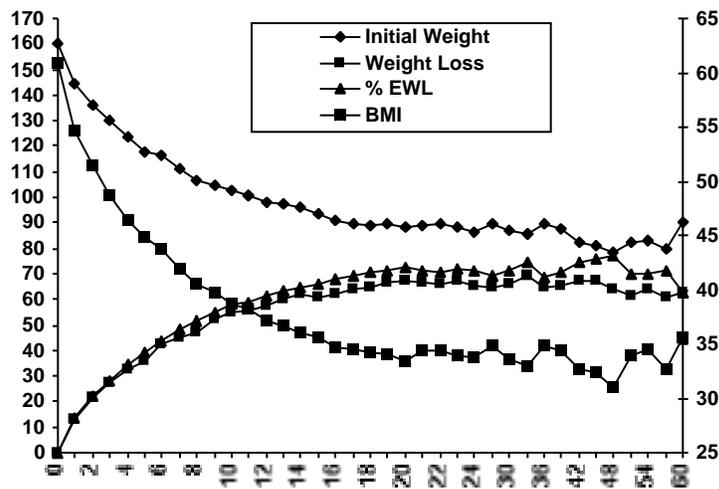


Figure 4. Only super obese with BMI > 50.

%EWL < 50. By the BAROS classification,<sup>9</sup> 45% have excellent results, 40% very good, 12% good, 3% fair, and there were no failures.

By using Marceau's evaluation of the secondary GI symptoms (type of intake, vomiting, frequency and odor of the stools, and gas bloat syndrome) in a scale from 1 to 5 (1 ideal and 5 worst results),<sup>4</sup> the mean was 1.7.

Serum triglycerides and more-so cholesterol dropped to very low levels (130-140) in our patients. Seven diabetic patients who had required insulin were cured. Nine hypertensive patients out of 10 were cured and one improved. Sleep apnea syndrome disappeared in the 7 patients affected, and gastroesophageal reflux resolved in all 7 symptomatic patients.

Conversion may be required because of secondary side-effects. We had to convert the small bowel to its normal position in three patients. The first patient had diarrheas and cumbersome anal leakage, and the digestive loop and common limb were extended at two surgeries. Her initial weight was 105 kg, 46 kg at conversion, and 3 years later 54 kg. The second patient, who had been converted from a VBG to a BPD-DS, dropped his weight from 210 kg to 100 kg, when all his liver enzymes were disturbed by a suicidal alcoholic hepatitis; after reversal, his enzymes returned to normal and his weight appears to be staying at 128 kg. The third patient, also converted from a VBG, with initial weight of 105 kg and BMI of 44 had weight fall to 44 kg; over 2 years, she developed severe hypocalcemia, protein malnutrition, severe anemia and renal failure. Once she was reversed, her hemostasis improved, and her weight is 56 kg.

There was one evisceration, 0.8%. Seven patients developed hernias, 5.8%. Gastrointestinal bleeding occurred in two patients and was controlled with H<sub>2</sub>-blocking agents. Oral iron intake was insufficient in 10% of our female patients, who require additional parenteral iron. Patients were also prescribed oral calcium. Calcium metabolism is monitored by the calcium, alkaline phosphatase and PTH serum levels. Liposoluble vitamins (A, carotene, D,K) should be monitored, but so far none of our patients have presented deficits.

## Discussion

The definition of results has been defined as preliminary (<2 years), intermediate (2-5 years), long-term (5-10 years), and very long-term (> 10 years). The ideal technique in bariatric surgery should have: a) low mortality, b) low morbidity; c) effectiveness %EWL > 50% in > 75% of the patients for at least 5 years; d) reproducibility, with a good learning curve; e) low reoperation rate (< 2% per year); f) good quality of life, eg lack of vomiting, diarrhea etc.; g) few side-effects on the homeostasis (Fe, Ca, vitamins, proteins, etc); h) be reversible.

The BPD-DS operation is a "complex" operation with at least 4 suture-lines. Mortality rates range from 0.5 to 2%, most commonly due to pulmonary embolism, respiratory failure and GI leaks. Our mortality in primary cases was fortunately nil. The operative mortality of two cases, 1.6%, occurred in converted patients. The operative deaths and the serious complications occurred in patients converted from one (or two) previous VBGs.

The duodenal-jejunal is the most complex anastomosis. It is done with a Valtrac absorbable device by Hess<sup>2</sup> and Biron<sup>3</sup> and with a circular stapler by Marceau.<sup>3</sup> We perform it by a single continuous running vascular suture of 2-0 Prolene.

The vertical gastrectomy is done by several applications of a linear cutter. The gastric tube should not be constructed too narrow, since a stenosis of the tube can cause a suture-line leak proximally. We use a 40-Fr nasogastric tube during the stapling to prevent narrowing. The application of the last, upper stapler should be lateral to the fat pad on the angle of His. Hess covers the suture-line of staples with a running sero-serosa stitch,<sup>2</sup> as we do.<sup>5</sup> Methylene blue is used to test for leaks at surgery.

BPD-DS is the most effective operation to lose weight. Hess had a %EWL of 80 at 2 years and 70 at 8 years.<sup>2</sup> Marceau<sup>4</sup> had a 73% EWL at 4.5 years, and 87% of his patients had a %EWL > 50; 81% of his patients had a BMI < 35 and only 6% had a BMI > 40. In our *intermediate* experience, %EWL exceeded the 70% throughout the years, and only 3 patients did not reach 50% EWL.

Comparing morbid and super obesity, %EWL

was superior in the morbidly obese but the fall in BMI was greater in the super obese. The mean fall in BMI was 37% in the morbidly obese and 43% in the super obese.

Marceau found the nadir of weight loss at  $53 \pm 20$  kg, and the weight gain was 7 kg after several years.<sup>4</sup> We have had no conversions in our patients thus far due to poor weight loss.

Elevations of the hepatic enzymes SGOT and SGPT were frequently up to 50 and 60 levels in the first few months after surgery; this may be related to malabsorption and should be treated with pancreatic enzymes (Kreon<sup>®</sup>) and Flagyl.<sup>11,12</sup> Liver failure is rarely reported (as in one of our patients); BPD-DS should not be done in patients with cirrhosis or viral hepatitis types B and C. Marceau<sup>4</sup> reported two cases in 770 patients. If severe elevation of enzymes and bilirubin occur, the patient should be placed on TPN and if there is no improvement, the patient's small bowel should be returned to its normal position.

Frequency of stool was not a major problem. Most patients have 1-2 stools very early in the morning and 1-2 throughout the rest of the day. Foul odor of the stool was a common side-effect. Marceau<sup>4</sup> reported 32% minor, 18% major and 16% very serious foul odor. No treatment for the malodorous stool has been effective, although there is improvement with time. Fat intake should be reduced to a minimum.

A major benefit of this operation is quality of life. More than 90% of the patients eat any kind of food, and vomiting is extremely rare. Gastric emptying was normal in 81.3% of our studied patients.<sup>13</sup> Patients with a previous VBG have again the pleasure of eating with minimal or no restrictions.

BPD-DS is being performed also by laparoscopy. Gagner's group<sup>14</sup> at New York Mount Sinai Hospital did the first laparoscopic BPD-DS operations in 1999 and Jossart et al<sup>15</sup> have also done over 40 cases with a lap-assisted technique. The BPD-DS as a hybrid procedure has grown in popularity both with surgeons and with patients. Over 30 centers, equally divided between university and non-academic practices, regularly perform the operation.<sup>15</sup>

## Conclusion

BPD-DS has proved in our hands to be a very effective procedure to control weight in the morbid and super obese patients in an intermediate period. The quality of life of the patients is very satisfactory. Protein malnutrition is rare, as are conversions due to failure to lose weight. Laparoscopy offers a less invasive alternative.

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