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Long-Term Experience with Duodenal Switch in the Community Hospital

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Abstract

Background: Duodenal Switch (DS) is a procedure that combines a Sleeve Gastrectomy (SG) plus a biliopancreatic diversion (BPD)

Objectives: Report our experience with 950 consecutive DS in 950morbidly obese patients performed from 1994 to 2011 and 22 years follow up.

Setting: Mix of teaching and private institution in a community hospital of Spain.

Methods: Retrospective review of 950 consecutive morbidly obese patients treated by DS surgery.

Results: We performed 518 open and 432 laparoscopic DS. Operative mortality was 0.73% (1.6% in DS and 0.47% in LDS), 4.84% had a leak, two had hepatic failure (0.2%) and malnutrition was present in 3.1%. At 5 years, the percentage of BMI lost was 80%, and percentage of *expected* BMI loss was more than 100%.

Conclusions: DS is the most aggressive bariatric technique, but with the best long-term weight loss. We describe operative complications and long-term follow-up guidelines.

Keywords: Morbid obesity; Duodenal switch; Bariatric surgery; Gastrectomy and biliary pancreatic diversion; Weight loss

Introduction

Duodenal Switch (**DS**) surgery consists of two operations, SG (Sleeve Gastrectomy) plus Bilio-pancreatic diversion (**BPD**). It is the most complex technique in bariatric surgery (**BS**). DS combines restriction of food-intake and malabsorption in the small bowel. Scopinaro started the BPD in 1976 [1,2], published results in 1980 [3] and proposed it as the preferred bariatric operation [4]. DeMeester [5], in the 1980s, designed a procedure to prevent alkaline reflux into the esophagus in the gastrectomies to treat gastric ulcers and devised the DS to divert the first part of the digestive flow, from the duodenum (D1) to the jejunum as RY (Roux-en Yanastomosis), avoiding bile reflux.

Doug Hess [6] initiated the DS in 1988 and published the results in 1998. He incorporated the three main components: 1) SG to remove most of the stomach at the greater curvature, which reduces gastric volume but allows normal emptying; 2) Post pyloric division of the duodenum to empty into the small bowel thru a Duodenal ileal anastomosis (**DIA**). 3) The proximal small bowel diversion causes malabsorption as a BPD.

Hess [7] measures the entire small intestine, at low bowel tension, from ligament of Treitz to the ileocecal valve and used 50% of its length as BPL (Bilio-pancreatic Loop), 40% as AL (Alimentary Loop) and 10% as CC (Common Chanel). Marceau [8,9] used the standard BPD until 1991and one year later he changed to DS and he was the *first to publish it*[10] in 1993 as *parietalgastrectomy plus BPD***.** Lagacé [11] reported in1995 the first DS good results in 61 patients and Marceau in 1998 [12] compared 252 BPD with distal gastrectomy and 465 DS with an operative mortality of 1.7%.

Hess [13] and Baltasar [14-21] described the gastric part of the operation as a *Vertical Gastrectomy***.** An thone [22] and Almogy [23] called it *Longitudinal Gastrectomy* and Rabkin [24] as a *gastrectomy of the greater curvature***.**

The DS [25-30] became then a standard technique in the 90s (Figure1). Hess [13] modified the procedure by inverting and suturing the serosa on the following188 cases to reduce la incidence de stapler-lineleaks. Rabkin [31-33] performed the *1st LDS, with the DIA assisted by hand,* in September

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Figure 1: Duodenal Switch Sleeve Gastrectomy plus Bilio-pancreatic diversion.

1999. Ren & Gagner [34] made the *first full LDS* in October 1999. Baltasar [35-39] did the *first LDS in Europe* in 2000 [40]. Paiva [41] in Brazil and Scopinaro [42] in Italy in 2000 started the standard laparoscopic DBP.

Operative Technique

DS by laparotomy

Three surgeons perform the operation through asupra-umbilical transverse incision between both costal margins (Figure 2). Upon entering the abdomen, the round and falciform ligaments are sectioned. We remove the gallbladder and appendix. The patient is on a forced Trendelenburg position. The distal intestine, the CC, is measured75 cm proximal to the ileocecal valve, and marked with a clip. The measurement of AL is done proximally for another 225 cm. (in total 300 cm) and the intestine is divided with a linear stapler. We perform the end-to-side RY (Roux-en Yanastomosis), BPL to jejunum, with absorbable monoplane sutures. The mesenteric defect is closed with a non-absorbable suture.

The entire greater gastric curvature length is de-vascularized from 3 cm distal to the pylorus to the angle of His. A 12-mm gastric probe passes as a guide into the lesser curvature. The entire greater gastric curvature is divided with staplers from pylorus to His angle. A continuous inverting suture, including the separated omentum, covers the gastric staple-line to prevent leakage and torsion of the gastric tube. A retro-duodenal D1 tunnel, distal to the right gastric artery allows duodenal division with a linear stapler. An inverting running suture reinforces the duodenal stump.

The proximal AL passes retro-colic on the right, and end-to-end two-layer DIA Duodenal ileal anastomosis (**DIA**) is done. There are four suture lines (gastric reinforcement, DIA, RY and distal duodenal stump). Two drains are placed next to the gastric tube and the DIA.

The abdominal incision is closed in two layers with continuous Max on. After weight loss, the scar length reduces to one-third and that allows reaching the pubic area after a tummy tuck. We started our DS experience on 03.17.1994 and the mean operative time was 91 minutes after the first 25 cases. www.youtube.com/watch?v=h0nTzeUDI5o

Laparoscopic DS. (LDS)

Three surgeons also perform the LDS. Six ports are used. An optical trocar of Ethicon # 12 enters the abdomen at the lateral

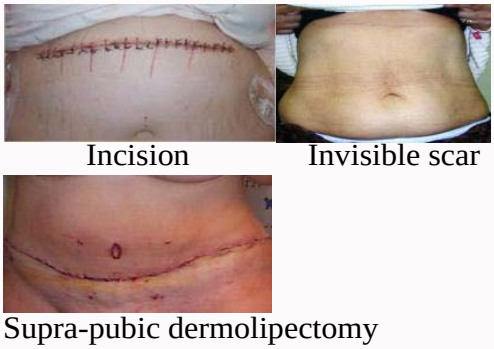

Figure 2: DS transverse incision.

border of the right rectus muscle, three finger breadths below the costal margin and is the *working port***.** The rest are Termaniantrocars that do not slip. A 10mm supra-umbilical port on the midline is for the camera. We place four 5 mm ports, two placed the right and left subcostal, one in the left hypochondria and the other in the epigastrium used to retract the liver. The rest of the procedure is like the open technique. All anastomoses are hand-sewn using the Serra-Baltasar *sliding first stitch* [43,44] and the Cuschieri knot to finish [45] the running monolayer suture. The bowel is measured with marked forceps 5 cm apart to avoid serosal tears. We extract the stomach without a protective bag. A Max on suture closes the 12 mm port. We initiated the LDS5.10.2000 [35]. The mean operative time was 155'after the first 50 cases. At discharge patients received prescriptions with multivitamin complex (Centrum Forte), vitamin A 20.000 IU, vitamin D 50.000 IU, calcium carbonate 1000 mg and ferrous sulfate 300 mg.

Methods and Material

950 consecutive MO patients had a DS (518 open and 432 lap) from 1994 to 2011, after a complete multi disciplinary pre-operative evaluation and legal informed consent. There were 782 women (82.3%) and 168 men (17.7%). The average age was 35 years (24-63). 474foreign citizens were operated (376 from the USA and Canada), 73 from Norway and 25 from England by the same surgical staff.

The mean *Initial* BMI (Body Mass Index = Kg/ m^2) was 49.23 Kg / m^2 (Women-49.26 and Men-49.07). *Obesity range*: a) *Severe obesity with comorbidities (*BMI <40)**,** 110 patients (mean 37.66); b) *MO patients (*BMI 40-50)**,** 464 patients (mean 45.11); c) *SO* – (Super Obese) *patients* (BMI of 50-60), 272 patients (mean 54.32) and d) *Triple Obesity patients (*BMI> 60),104 patients (mean> 66.50)and one patient had BMI-100.

Co-morbidities: 115 patients suffered from type II diabetes, 103 hypertension, 5 heart disease, 62 dyslipidemia, 19 SAOS, 16 osteoarthritis, 1 cerebral pseudo tumor.

Results

Major intraoperative complications

Three patients required an emergency tracheotomy [46,47] because oral intubation was impossible. In all cases severe desaturation ocurred, the tracheotomies were done without incidents and the operations ended normally.

On three patients the gastric 12 mm probe would not pass thru the cardias and stapling of the stomach was done visually. Operative mortality within 30-days occurred in six DS patients (1.6%). The

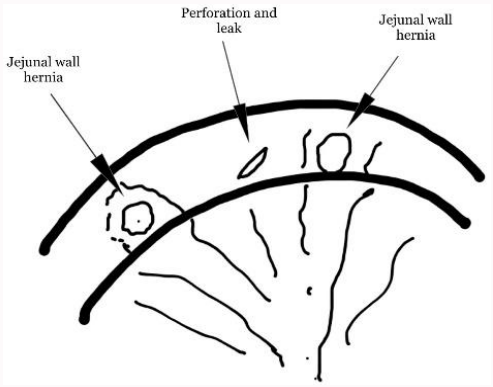

Figure 3: Small bowel wall hernias.

cause was: a) Leak at the *AL-BPL* anastomosis - 1, b) Rhabdomyolysis - 1, c) Pulmonary embolism - 2, d) Duodenal stump leak - 1, e) Leak in His angle - 1. Two LDS patients died (0.47%) of pulmonary emboli. Mean mortality for both groups was 0.73%.

Post-operative morbidity

1. **Leaks. There were 46 leaks for a total 4.84% leak rate.**

a) *Leaks at His angle*: 21 cases (2.3% incidence). They were treated with stents, drainage or laparotomies. One of them died. In IFSO 2000-Genoa, we presented [48] the use of a non-extractable *rigid endo-stent* in a leak in a re-operated patient after a previous VBG and then There after we successfully used extractable stents [49]. Nine patients required total gastrectomy for complications and all survived with very acceptable quality of life [50]. Three patients underwent a RY diversion [51,52] at the leak site and this technique, which we started in 2007, is today the treatment of choice of this complication when the extractable stent fails [53].

c) Duodenal stump leak. One patient had a duodenal stump leak and was repaired but died of sepsis. Since then, we protect all stapling the duodenal stump with an inverting suture and there were no more leaks. Nelson has also observed this complication [54].

b) *DIA leaks*: 24 cases (2.5% incidence). The DIA is the most difficult anastomose to perform. Nineteen of them were early leaks, successfully treated with drainage or re-do the anastomosis, five cases were late leaks (up to 2-14 years later), and they needed reoperation and redo the anastomosis. In one case, the leak occurred 3 years after the intervention, as a gastro-pleural fistula and was treated with total gastrectomy.

c) *Duodenal stump leak***.** One patient had a duodenal stump leak and was repaired but died of sepsis.

d) *Leak at the RY AL-BPL.* A patient had a small bowel diverticulum resected at 100 cm from the ileocecal valve and an open RY anastomose was done at the site without incidents. Radiological and diagnostic test did not clarify the cause of the leak, and with a late diagnosis the patient was re-explored but he died.

2. **Pulmonary emboli.** Two patients with Initial BMI-70and BMI-65 had emboli despite prophylactic therapy and died. Deep venous thrombosis in one case was successfully treated.

3. **Livera Liver disorders.** Twelve patients suffered early alterations in liver function [55] with significant bilirubin elevations (up to 15 and 29) that resolved with medical treatment.

Table 1: BMI drop and percentage of patient's follow-up - 50% at 1.5 year & 40% at 5 years.

Mes	IMC	% EIMCP	IMCE	% EIMCEP	Seguimiento
0	49,23	0,00	29,17	0,00	100
1	45,86	19,49	29,88	23,32	100
2	44,09	29,16	30,13	34,56	100
3	40,32	40,96	29,49	47,93	100
4	39,39	46,16	29,74	53,96	100
5	37,37	53,91	29,62	63,25	100
6	34,97	61,86	29,38	72,45	100
7	34,77	64,41	29,47	75,11	100
8	34,02	68,75	29,64	80,31	100
9	33,03	72,80	29,95	86,07	100
10	32,77	74,10	29,94	87,51	100
11	32,06	76,94	29,80	90,35	100
12	31,57	74,80	29,04	86,92	50,1
18	27,50	92,41	29,10	107,63	50,1
24	28,10	89,87	29,02	104,12	43,2
36	27,36	92,80	29,08	107,89	43,2
48	27,44	92,55	29,00	107,00	38,9
60	28,00	88,76	29,02	103,40	38,5
72	27,71	90,80	28,98	105,28	34,5
84	28,11	88,81	28,90	102,85	32,1
96	28,02	89,01	28,86	102,97	30,7
108	27,91	89,14	28,73	102,77	26,6
120	28,45	87,49	28,95	101,21	25,8
132	28,54	87,25	28,83	100,66	22,6
144	28,99	84,86	28,85	97,80	22
156	28,74	85,96	28,85	98,98	18,8
168	29,37	83,25	28,76	95,46	9,7
180	30,90	78,70	29,91	93,62	5,8
192	31,44	76,68	29,96	92,39	3,4
204	31,16	77,42	30,57	94,52	1,9
216	30,27	83,84	30,10	100,33	1,6
228	30,96	82,91	29,98	97,48	1,2
240	32,19	79,95	30,15	94,07	0,9
252	28,41	84,68	28,79	99,62	

4. ***Hepatic failure.*** Two patients suffered liver failure (0.2% incidence). The first one occurred 6 months after surgery and was listed for liver transplant. She died due to a lack of donor. The second patient suffered liver failure three years postop. She underwent a successful liver transplant [56] with reversal of the BPD. She is alive and well 4 years later.

5. Protein caloric Malnutrition (PCM). Thirty-three patients (3.3%) developed PCM and 24 required CC lengthening [57,58]. 13 of them were done open without complications. In 11 cases, the CC was lengthened laparoscopically and on two of them the small bowel was injured by the dissecting forceps. They were diagnosed and repaired but they died later due to leaks [59]. The dissection forceps perforated easily due to the wall´s weakness (Figure 3). On both cases we found that there were mucosal hernias on a weak muscular wall

in between the mesentery vessels. This type of hernia had not been previously reported. Therefore, we do recommend laparotomy for bowel lengthening.

6. **Pancreatic-cutaneous fistula.** Burning at the skin level of the drains occurred after a pancreatic capsule injury [60]. The fistula and skin lesions healed spontaneously.

7. Hypoglycemia. Two patients had recurrent episodes of hypoglycemia that required BPD reversal.

8. Evisceration in four cases without consequences after adequate repair.

9. **Late Intestinal obstruction - 7 cases (0.73%incidence).** We treated two in our unit and the others were treated in other units with small bowel resection.

10. **Beriberi.** Three cases of vitamin B1 deficiency, with neurological symptoms, changes in gait and spontaneous fall, all successfully corrected. Aasheim [61] reports that this complication need surgent treatment.

11. Fractures due to poor absorption of Ca that required Vitamin D25 + Ca. Two cases occurred that are asymptomatic after appropriate care.

12. Toxic mega-colon due to pseudo-membranous colitis 16 years after surgery. The patient required a subtotal colectomy 22 cm from the anus with and end ileostomy and later on the ileum was attached to the rectum.

Miscellaneous: Pneumonia-4. Seroma-4, Wound infection-15. Hemorrhage-5 (3 requiring laparotomies). Catheter related sepsis -3

Long-term mortality**:** One undiagnosed acute appendicitis at two years, one intestinal necrosis due to internal hernia at 3 years. There were other causes of death unrelated to the DS (cancer, melanoma, myocardial infarction, etc.)

Weight-Loss Results

BMI was measured in 60% of 914 patients at 1 year and 30% at 8 years. Theme an Initial BMI of 49.3 dropped to a mean Final BMI of 30 (Table 1), and the percentage of BMI Loss (PBMIL) was 80% at 12 months.

In 2011, we described [62] the concept of Predicted BMI (**PBMI**) depending on the Initial BMI. The Predicted BMI was evaluated in on 7,410 patients. In this series, the mean Initial BMI was 49.23 and Final BMI was 29.6 and the PBMI-29.3. The*% of PBMI* exceeds 100%. So, weight lost have been excellent in the series and probably is better than with any BS operation.

Correction of Comorbidities

Diabetes (DMII)

DS is a very effective operation to treat diabetes; 98% of our patients have become normoglycemic with a normal glycosylated hemoglobin. Two non-diabetic patients suffered severe hypoglycemia and the BPD had to be reversed. In our first diabetic surgery the patient had a low Initial BMI-35 and we successfully performed an *LDS without SG* to treat diabetes [63]. Hypertension was corrected in 73% of cases and sleep apnea in 100%.

Quality of life

We use the Horia-Ardelt Classification [64] of BAROS scale to evaluate the changes in the quality of life of the patients. The changes after surgery included: Self-esteem, Physical activity, Social activity, Work activity plus Sexual Activity on a scale from -1 to +1. The mean score was 2.03 out of maximum of 3 points in 348 patients, which means a significant improvement in their quality of life.

Gastro-intestinal symptoms were evaluated from a minimum of 1 as *excellent* to a maximum of 5 as *very bad*. In the 558 patients evaluated, food intake of all types was 1.4, vomiting -1.3, appetite -1.96, type of stools (from pasty to liquids) - 2.2, frequency (without problem to intolerable) -1.8, *smell of stools -3.35*, abdominal bloating-2.26. Therefore, the sum of all measurements was 12.14, for a total rating from 5 (*excellent)* to 35 (*poor)*. The worst side effect was foul odor of the stools with a mean of 3.35.

Discussion

Ideally, BS should have a low morbidity and mortality, while providing optimal and sustained BMI loss with minimal side effects. No type of BS technique is 100% successful or everlasting *in all patients*. There is no a single standard procedure for the treatment of MO in all the patients and probably never will be [65]. Furthermore, we cannot afford to treat all MO with BS. DS *is not a popular procedure among bariatric surgeons*.

SG leaks are a major cause of morbidity manifested in the specific World Sleeve meetings of Deitel and Gagner [66]. Before the 1990´s, this complication was rare and the DS surgeons (the "Switchers") were the first to communicate it. Sero-serosa inverting suture of the staple-line with omentum prevent twisting of the gastric tube and leaks [13].

Since DS patients have four suture-lines, early detection of leaks is essential. Mason [67] called attention to tachycardia as the first warning sign for leaks and no patient should be discharged with tachycardia.

Early discharge is done today by bariatric surgeons after ambulatory surgery [68].We train patients, at admission, to check their pulse and temperature digitally, and report them every four hours, as a warning system for two weeks, to a database by simple telematic medicine. Patients with any significant change in these parameters need immediate and urgent consultation. Buchwald [69] at the 2004 Consensus conferences tated that in MO, BS should be considered for patients with Class I obesity (BMI 30-34.9 Kg / m^2) and associated comorbid conditions. DS is along and difficult procedure that requires expert surgeons and adequate experience. It should have a <1% operative mortality and <5% morbidity. The intestinal continuity can be restored to normal, but the SG part is irreversible. LDS can be performed in two stages, with the SG as the initial operation, in high-risk patients and in patients with BMI > 60. Shortening of CC can improve the result in some patients who regain weight, but not all of them have good results.

DeMaria [70], using the longitudinal bariatric results database (BOLD) at two years (2007-2009), reported that 450 institutions and 800 American surgeons participated in the 2009 BSCOE program. Only 517 (0.89%) of the 57.918 patients operated for obesity had a BPD. Of these, 18 were DBPs and499 DS, 345 Open DS (66.7%), 9 open conversions and they were only 141 LDS (29.2%) - 4 assisted and 8 with robot.1328 patients (2.29%) had a SG and 95% were LSG. More than 4,000 patients received a SG on outpatient basis, with more than 2,000 from a single center [68,70].

The English [71] ASMBS-2016 reports that obesity has increased alarmingly in the last 5 decades - from13.4% to 36.4% in 2014. The indirect costs of obesity and overall economic impact is estimated at $ 1.42 trillion, which is equivalent to 8.2% of gross domestic product and more than double than spent on defense. Obesity is the fifth most important risk factor of mortality worldwide. Some 215, 666 bariatric operations were performed in 2016, among 795 accredited centers. The SG with 125,318 patients became the most frequent operation, accounting for 58.1% of all bariatric operations. Only 1187 BPD were DS (0.6%) and 26% of them were LDS.

Nelson [72] from 2007-2010, using the BOLD database, identified 78,951 patients undergoing Gastric Bypass (**RYGB)** or DS. Of these patients, 77,406 (98%) had a RYGB and BMI-52 and 1,545 (2%) underwent DS with BMI-48. The DS was associated with statistically significant longer surgical operating times, more blood loss and longer hospital stays. The rates of early re-operation were higher in the DS group (3.3% vs.1.5%). The drop in BMI was significantly higher in the DS cases at all follow-up intervals (P>0.05). In the SO (BMI > 50) there was also a fall, with DS at 2years of 79% versus 67% with GBP. The improvement of comorbidities - diabetes, hypertension and sleep apnea - were all superior with the DS (all P<0.05).

BOLD results showed 30,777 *re-interventions*; a*14% reintervention rate.* Revisions, including conversions, may soon exceed the number of primary BS procedures suggesting the need to develop better evidence-based algorithms to minimize the use of re-operations. It is evident that the number of failures is very high and effective initial operations are needed.

Marceau [73] described the" negative aliesticity" test to measure satiety and found that with DS it was three times faster than in normal subjects. Paradis [74] repeated the test two years after the surgery and satiety appeared at 12.7 min in operated patients compared to 26.7 min before surgery.

Hess [13] in 2005 described the running suture to reinforce the gastric staple line and reported 1,150 patients with BMI-50.9 treated with DS. In 15 years, there were 8 reversals (0.61%) and 37 revisions (3.7%). Diabetic cure occurred in 98% of patients. The 19 adolescents (14-18 years of age) improved and, in his opinion, it is the best operation for adolescents. One problem is that other physicians and surgeons may not understand the DS follow-up and prevent or treat the long-term complications in these patients. He concluded that DS is a safe and effective operation for the treatment of morbid obesity.

Iannelli [75] in 110 patients with BMI > 50 could reduce the rate of postoperative complications performing a two-stage DS. By staging the procedure, only 39 patients (35.5%) required BPD and biliopancreatic diversion was avoided in 74.5% of patients.

Biertho [76] surveyed 1000 patients with CD from2006-2010. The conversion rate in the laparoscopy group was 2.6%. There was one postoperative death (0.1%) due to embolism. The mean hospital stay was shorter in the LDS group (6 to 6days versus 7 to 9 days, P <0 .01). Complication rates were 75%, without significant differences. No differences were found in abdominal abscesses or leaks.

Biertho [77] also treated 566 patients between2011-2015 with LDS with BMI-49 and without 90-day mortality. Mean hospital stay was 4.5 days. Major complications at 30 days occurred in 3.0% of patients and minor complications in 2.5%. The percentage EWL was 81% at 12 m, 88% at 24 m, and 83% at 36 months. Patients with HbA1C above 6% decreased from 38% to 1.4%. Read mission were 3.5% and 0.5% of patients needed reoperation. He found that the current rate of complications in the short and medium term of LDS is like other mixed bariatric procedures with excellent metabolic results.

Biron [78] studied quality of life of 112 patients. Follow-up was 8.8 years. He observed some decrease in quality of life over time after the initial changes that occurred 1-2 years after surgery, during the so-called "honeymoon period". The improvements in quality of life was directly related to surgery. This study confirms that BS with DS improves the specific quality of life of the disease in the short and long term.

Prachand [79] observed %EWL at 2 years in 350patients. %EWL was 54% in 152 patients with GBP vs. 68% in 198 patients with DS with only 1death (P= not significant). The direct comparison of %EWL results at 3 years between DS = 68.9% was much higher than GBP = 54.9% and showed that DS was more effective. Strain [80] also obtained BMI reduction of 23.8% with DS compared to 16.5% with GBP.

To part [81,82] on 2002-2009 performed 83 DS and 97 GBP, with BMI-55 with unsatisfactory results in 20% of the cases. The levels of vitamins and micronutrients remained stable over time. However, there was a trend towards an increase in PTH levels and difficulties in maintaining a normal level of vitamin D despite updated vitamin supplements. After 3 years of follow-up, the average % EWL was 63.7% after GBP and 84.0% after DS (P> 0.0001). 83.5% of GBP and 98.7 of DS were successful (P<0.0005). In conclusion, although patients recovered 10% of the weight lost after the first postoperative year, the results were significantly better with DS than with GBP.

Våge [83] treated 182 consecutive DS patients from2001-2008, without 30-day mortality. One patient needed surgery due to leak; three patients due to bleeding and one due to bile leakage. Six patients underwent surgical revision for PCM.

Despite starting with a significantly higher BMI, patients undergoing DS constantly reduce BMI more than GBP patients do? So, why are there so few patients receiving a DS? Is DBP a too complex operation or DS results are not so good?

Søvik [84] showed greater weight loss results after DS than with GBP in patients with severe obesity; however, comparative data on changes in gastrointestinal symptoms, bowel function, eating behavior, dietary intake and psychosocial functioning are limited. The average weight decreased 31.2% after the RY-GBP and 44.8% after the DS.

Andersen [85] performed DS on 51 patients and the paid work increased from 28 (54.9%) to 34 (66.7%). Aasprang [86] obtained significant physical and mental improvement but the degree of anxiety did not improve, and Hernández [87] found that preoperative sexual dysfunction improved significantly 6 months after DS in obese women and continued to improve up to 12 months later. Hedberg [88] found that levels of Magnesium were elevated after the intervention.

Rabkin [89] reports that the DS is not associated with extensive nutritional deficiencies. Annual laboratory studies, which are required after any type of bariatric operation, appear to be sufficient to identify unfavorable trends. In selected patients, additional iron and calcium supplements are indicated.

Keshishian [90] performed a pre-operative need leliver biopsy

on 697 DS patients. A transient worsening of the AST (13% of the reference value, P <.02) and ALT (130-160% of the reference levels, P <.0001) appeared up to 6 months after the DS. He observed a progressive improvement of approximately 3 degrees in the severity of NASH and a 60% improvement in hepatic steatosis at 3years after the DS.

Diabetes (DMII)

Buchwald [91] reports that DS and BPD have resolution rates that exceed 90%. In comparison, the rate for the GBP is approximately 70%. Tsoli [92] showed that SG was comparable to BPD in resolution of DMII but lower in the improvement of dyslipidemia and blood pressure.

Våge [93] thinks that DS is effective in DMII**,** hypertension and hyperlipidemia. Duration of diabetes and age of patients are the most important preoperative predictors for DMII remission and hypertension.

Refractory hyperinsulinemic hypoglycemia after surgery is very rare [94] and its pathophysiology not yet fully elucidated. Partial pancreatectomy is associated with significant potential morbidity, including new onset diabetes and should not be recommended. Bypass reversal, if needed, is the best and simpler operation.

What part of the DS operation is better to stage? The BPD or the SG? Most surgeons advocate making the SG first. However, Marceau [95] from 2001-2009, treated 1,762 patients all programmed to have DS. First stage procedures were 48 *Isolated BPD without SG* and 53 cases *SGwithout BDP*. The conclusions were that the SG and BPD contribute independently to the beneficial metabolic results. Long-term results in term of weight loss and resolution of metabolic abnormalities were better with *the isolated BPD than with isolated SG*. One stage DS results were superior to those done in two stages. With these results in mind, we should start staging by doing the BPD first since it is fully reversible procedure and not more difficult than the SG.

Moustarah [96] treated 49 SO patients with *BPD without SG*. The initial weight was 144 Kg. and BMI-52.54 and the fall in the BMI of 14.5 Kg / m^2 was very significant (p <0.001).

The *BPD without SG* is rare as a *single* weight loss procedure; but in patients, whose clinical indications justify the omission of the SG, BPD alone has equal or better good weight loss results. In this series, weight loss at 2 years compares favorably with other commonly performed bariatric operations. *BPD without SG* is reversible and is another advantage since the SG can be added anytime thereafter.

Follow-up of DS patients is a very important. We provide at discharge a detailed technical explanation of the operation with an explanatory sheet of each one of the possible complications and their correction and the necessary postoperative labs. As we tape all the LDS operations we also provide the patient with the digitized taped images of the entire operation so in case the patient needs re-operations, the surgeon knows all the technical details of the original one.

The most important long-term data to detect CPM is serum albumin. Labs of PTH and vitamin D25 (to detect absorption and deficits of calcium and protect bone pathology), blood count to correct deficits of Fe with intravenous therapy and deficits in all trace elements such as Mg, Cu, etc.

We are privilege today with endocrinology units, compared to 15 years ago when they did not believe in BS and their support was very limited. So is the support of nutritionists and bariatric nursing.

Apart from leaks, the most serious long-term complication of DS is the CPM. Surgical correction is simple by using the "Kissing-X" as a Jejuno-jejunal anastomosis to lengthen the CC, preferably by laparotomy.

We all recognize with To part [96,97] the invaluable contribution of Marceau and his team at Quebec City on the long-term assessment of DS at 20 years, with an effective follow-up program of more than 90%, the positive impact of the DS on childbearing-age women on their offspring and accepting the idea that MO is a disease rather than a behavioral disorder.

Conclusions

DS techniques are not common for the management of MO. DS is the most complex BS and its learning curve is longer than other operations. To standardize the technique took us at least 25 cases in DS and 50 in LDS. The DS is safe and the most effective in terms of long term weight loss results.

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