Duodenal switch. A switch to the duodenal switch.

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ABSTRACT:

Background: The duodenal Switch (DS) combines a Sleeve-forming gastrectomy (SFG) and a bilio-pancreatic diversion (BPD).

Objectives: To report on 950 DS patients treated from 1994 to 2011.

Environment: Regional teaching hospital and private institution.

Methods: Prospective study of 950 consecutive patients treated with CD.

Results: There were 518 open DS (ODS) and 432 laparoscopic DS (LDS). Surgical mortality of 0.73% (1.6% in CDA and 0.47% in CDL), 4.84% incidence of leakage, two liver failure (0.2%) and protein calorie malnutrition (PCM) in 3.1%. At 5 years, the %EWL drops by 80% and the Expected BMI by 100%.

Conclusions: The CD is the most aggressive bariatric technique, with the best long-term weight loss. Operative complications and long-term follow-up guidelines are described. The aim is to change the bariatric techniques to accept the CD.

Keywords:
- Duodenal junction
- Bariatric surgery
- Vertical gastrectomy
- Bilio-pancreatic diversion
- Poliphenols.
**Introduction**

The Duodenal Switch (DS) is a mixed operation that consists of two techniques, a gastric surgery, the Sleeve-forming Vertical Gastrectomy (SFG) to reduce intake and also an intestinal surgery, the bilio-pancreatic diversion (BPD) that produces intestinal malabsorption (Fig.1). It is the most complex operation in Bariatric Surgery (BS).

Scopinaro published the results of BPD in 1980 [1]. Hess [2] describes it as: 1) VG eliminates major gastric curvature, reduces gastric volume, and intake and allows for normal emptying; 2) BPD derives post-pylorus intake from duodenum to ileum, and 3) 50% exclusion of the proximal bowel as DBP to cause malabsorption,

Hess [3] recommends measuring the entire small intestine, without tension, from Treitz to the ileocecal valve and uses 50% of its proximal length as a Bilio-Pancreatic Loop (BPL), 40% as a Alimentary Loop (AL) and 10% as a Common Loop (AC). Marceau [4,5] made standard BDP until 1991 and then switched to DS and is the first author to publish [6] in 1993 parietal gastrectomy plus BPD.


The DS [9-26] become standardized in the 1990s (Fig.1). Hess [9] sutures and invaginates the gastric division serosa to cover the staples of the VG and in the following 188 cases eliminated the leak in the staple line. Ren [27] publishes the first complete LDS in October 1999 and Baltasar [28] the 1st LDS in Europe in 10.5.2000 [29]. Paiva [30] in Brazil and Scopinaro [31] in Italy started the standard laparoscopic DBP in 2000.

**Material and method**

From 1994 to 2011, 950 MO patients, 518 open (ODS) and 432 laparoscopic (LDS) were operated on after full multidisciplinary preoperative evaluation and informed consent. 782 were women (82.3%) and 168 men (17.7%). The average age was 35 years (24-63). 474 were foreign citizens (350 Americans, 26 Canadians, 73 Norwegians and 25 English) were operated on in a private center by the same team.

The average Initial Body Mass Index (IMCI) (Kg/m2) was 49.23 (Women - 49.26 and Men - 49.07). Obesity range: a) Non-severe obesity grade 2 with comorbidities (IMCI <40), 110 patients (mean 37.66); b) Morbidly Obese (IMCI 40-50), 464 patients (mean 45.11); c) Super-obese - (SO) (BMI 50-60), 272 patients (mean 54.32) and d) patients with Triple Obesity (TO) and IMCI > 60, 104 patients (mean > 66.50). One patient had IMCI-100.

**Description of surgical techniques**

*Open DS (ODS) by transverse laparotomy*

The patient is in Trendelenburg position. A transverse supraumbilical incision is made between both costal margins (Fig.2 a-b). The round and falciform ligaments are divided. The gallbladder and appendix are removed.

The entire small intestine is measured from the ileocecal valve and 10% of the distal intestine (approx. 100 cm) is used as a Common Loop (AC) and marked with a clip. The most proximal 40% is the Alimentary Loop (AL) which is divided with a proximal linear stapler (approx. 200 cm). In total, 300 cm between AL plus AC. The Bilio-pancreatic loop (BPL) starts at D-1 and is the remaining 50% proximal.

*Fig. 1. Duodenal Switch = SFVG + BPD*

The distal AL joins in an anastomosis jejunum-ileal end-to-side in Roux Y anastomosis (RYA) with continuous monoplane resorbable suture at the union of BPL and AC. The mesenteric defect is closed with a non-absorbable suture.

*Fig. 2. A) Incision; b) Invisible scar; c) Supra pubic dermolipectomy*

A 12 mm nasal-gastric tube is passed into the lesser curvature, which is used as a guide, for dividing and stapling the stomach lesser curvature starting at the pylorus to form the sleeve.

The entire major gastric curvature is de-vascularized starting 3 cm distal to the pylorus up to the angle of His. Both gastric walls, posterior and anterior to the staple-line, previously separated omentum, are joined with a continuous
inverting suture to avoid torsion of the gastric tube and leaks.

A retro duodenal tunnel is created at D1 level, distal to the right gastric artery, to divide the duodenum with a linear stapler before the Oddi sphincter. The distal duodenal stump is reinforced with continuous inverting suture.

The proximal AL passes retro-colic to the right and a continuous Duodeno-ileal Anastomosis (DIA) is performed. The operation has four suture lines (gastric reinforcement, ADI, RAY and the distal duodenal stump) and drains are placed, one next to the gastric tube and another in the ADI.

The abdomen is closed in two layers with continuous Maxon. After weight loss, the scar length shortens by one-third (Fig. 2b) and allows the upper transverse wound to descend to the pubic area in abdominoplasty at body contouring surgery (BCS) (Fig. 2c). We started CDA on 3.17.1994 and the average surgical time was 91 minutes.

https://www.youtube.com/watch?v=s2WI8Jf4Jqk [14]

Laparoscopic DS (LDS)

It’s also done by three surgeons, each one doing a manual anastomosis. Six ports are used [35-38]. The optical trocar, Ethicon #12’s "main working port" enters under direct view into the abdomen, at the lateral edge of the right rectus muscle, three finger traverses below the costal margin. To prevent slippage, we use ®) Termanian non-disposable trocars. The 10 mm central supraumbilical port is used for the midline camera.

Fig 3. Placement of trocars

Four other 5 mm ports are used, two sub-costal located on the right and left, one in the left hypochondrium and the other in the epigastrium used to retract the liver (Fig 3). The rest of the procedure is as in the open technique.

All are anastomosis are hand-sewn with a continuous monolayer suture [32,35]. They begin with the sliding and self-locking point of Serra-Baltasar [36-37] and end with the Cuschieri knot [38]. The intestine is measured with marked clamps 5 cm apart to avoid injury to the intestinal serosa. The mesenteric defect is closed with continuous non-absorbable suture. The stomach is removed without a protective pouch. A Maxon suture closes the 12 mm port fascia. We started the LDS in 5.10.2000 [35]. The average operating 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.

Results

Surgical mortality within 30 days occurred in ODS (1.6%). The causes were: a) Leakage in the DIA - 1, b) Bhabdomyolysis - 1, c) Pulmonary embolism - 2, d) Leak in the duodenal stump - 1, e) Leak in his angle of His - 1. Two patients with CDL died (0.47%) by pulmonary emboli. The average mortality for both groups was 0.73%.

Long-term mortality: Undiagnosed acute appendicitis at two years. Intestinal hernia necrosis at 3 years. There were other causes of death not related to the CD (cancer, melanoma, myocardial infarction, etc.).

Postoperative morbidity. Reporting morbidity is an essential part of the technique.

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

a) Esophageal-gastric junction leaks: 21 cases (2.3% incidence). One non-extractable stent [42] was treated with stent and the rest with extractables ones [43] and drainage. Nine patients required total gastrectomy for complications, and all survived with a very acceptable quality of life [44]. Three patients with chronic leakage underwent a Y-de-Roux shunt [45,46] in leakage and this technique, which we began in 2007, is the treatment of choice for this complication when the stent fails [47].

b) Leakage of the duodenal stump. A patient suffered a leak in the duodenal stump and was repaired but died of sepsis. Since then, we protect all stapling of the duodenal stump with an inverting suture and there were no further leaks.

c) DIA leaks: 24 cases (2.5% incidence). ADI is the most difficult anastomosis to perform. There were 19 early leaks successfully treated with drainage or performed anastomosis again, 5 cases presented late leaks (up to 2-14 years later) and needed reoperation and redo anastomosis. In one case, he suffered one gastro-pleural fistula a year and was treated with total gastrectomy [48].

d) Leak at RYA. One patient had a small bowel diverticulum removed 100 cm from the ileocecal valve, and an open RNA was performed without incident. A leak occurred, radiological tests did not clarify the cause, and with a late diagnosis, the patient was re-explored, but died.
2. Pulmonary embolism. Two IMCI-70 and IMCI-65 patients had embolism despite prophylactic therapy and died. A deep vein thrombosis was successfully treated.

3. Liver: a) Liver disorders. Twelve patients suffered early alterations in their hepatic function [49] with significant elevations of bilirubin (up to 15 and 29) and resolved with medical treatment [50]. There is no evidence of prior publication of this complication.

b) Liver failure. Two patients suffered liver failure (incidence of 0.2%). The first occurred 6 months after surgery and was included in the urgent list of liver transplants but died due to lack of a donor. The second suffered liver failure three years after surgery, underwent a successful liver transplant [51] with reversal of BPD. And she's healthy 4 years later. Castillo [52] of Valldecilla Hospital in Santander described the first transplant worldwide after BPD and there are 10 memos published cases in the world [53] and two cases for gastric bypass (DG = gastric bypass) [54].

4. Protein Calorie Malnutrition (PCM)

Nutritional deficiencies such as protein malnutrition, liposoluble vitamins (A, D, E and K), iron, B1, B9, B12, selenium, folate and calcium may appear after the DS, which must be monitored prospectively. In 33 patients (3.3%) PCM appeared and 24 required AC lengthening [55,56] in the form of lateral-lateral “Kiss-X anastomosis”. In 13 of them, they were performed without complications by open surgery. In 11 patients, laparoscopic surgery was performed and in two of them, the small intestine was damaged by the dissection forceps. Both leaks were diagnosed and repaired during the operation, but escaped again and, although repaired the same day, died in the ICU [57] from sepsis.

We learned that hernias of the mucosa may occur through the weak muscular wall between the vessels of the mesentery. The dissection forceps easily injure this intestinal wall (Fig. 4) www.youtube.com/watch?v=Hw_aPYLjGXI.

We do not know of any previous report of this type of hernias. For this reason, at PCM, we recommend doing them by laparotomy.

d) Pancreatic-cutaneous fistula. The pancreatic capsule was injured with laparoscopic instruments and one patient had pancreatic fistulas and skin lesions (Fig. 5) that healed spontaneously [58].

![Fig. 5. Skin burns from two pancreatic fistulas](image)

e) Hypoglycemia: Two patients had recurrent episodes of hypoglycemia that required BPD reversal.

f) Evisceration in four cases without consequences after adequate repair.

g) Late intestinal obstruction: 7 cases (incidence of 0.73%). We treated two in our unit and the rest were treated in other units with resection of the small intestine.

h) Beriberi. Three cases of vitamin B1 deficiency, with neurological symptoms, gait changes and spontaneous fall, all successfully corrected. This complication needs urgent treatment.

10) Fractures due to malabsorption of Ca that required Vitamin D25 + Ca. Two cases were presented that are asymptomatic after adequate attention.

11) Toxic megacolon due to pseudo membranous colitis 16 years after surgery. The patient needed subtotal colectomy 22 cm from the anus with terminal ileostomy and then later the ileum was attached to the rectum and is asymptomatic.


Weight loss.

Final BMI (FBMI) was measured on 60% of 914 patients per year and 30% at 8 years. The mean IMCI of 49.3 fell to an average BMI of 30 (Fig. 6).
In 2011, we describe [59] the concept of % the Expected BMI drop (%PIMCEsp) which depends on the different IMCI grades. We evaluated %PIMCEsp in 7,410 patients. And if the %PIMCF was 29.3, then the %PIMCEsp of this series exceeded 100% and the PSP (% of Overweight lost) was 81% at 5 years. Molina [60] has corroborated this study of %PIMCEsp.

The %PIMCEsp was 80% at 12 months and remained or was higher even afterwards. Therefore, the weight lost with the DS has been excellent in the series and is probably superior to any other type of operation. The %EWL is a less reliable measurements because it puts MOs with BMIs of 35 on the same list as BMIs of 60 to 70.

Correction of comorbidities:

DS is a very effective operation to treat diabetes. 98% of our patients are normoglycemic with normal glycosylated hemoglobin. Two non-diabetic patients suffered severe hypoglycemia and the BPD had to be reversed. In our first diabetes surgery [61], the patient had a low BMI-35 and we successfully performed a LDS but without GV.

Hypertension was corrected in 73% of cases and sleep apnea in 100%.

The Horia-Ardelt Classification [62] was used on the BAROS scale to evaluate changes in patients’ quality of life. Changes after surgery included: self-esteem, physical activity, social activity, work activity plus sexual activity on a scale from -1 to +1. The average score was 2.03 out of a maximum of 3 points in 348 patients, which means a significant improvement in their quality of life.

Gastrointestinal symptoms were rated 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, stool type (from pasty to liquid): 2.2, frequency (no problem to intolerable) -1.8, stool odor - 3.35, abdominal swelling: 2.26. Therefore, the sum of all measurements was 12.14, for a total score of 5 (excellent) to 35 (poor). The worst side effect was the bad smell of feces with an average of 3.35.

Discussion

CD was never a popular therapy among surgeons; Hess [7] describes how after seeing a video of our technique in Seatle-1996 at the ASBS Meeting, he modified the procedure with an invaginated suture of the greater curvature and only had a leak in 188 cases. Very few surgeons continued performing the CD, and in fact, a subdivision named "The switchers" was created in the ASBS with its own logo. The CD remained unpopular, and we had to meet, for years, outside the congress venue as a separate group of 25-30 surgeons.

We have continued performing the intervention and many patients, even out of Spain, knew about its advantages and looked for this therapy. We have not hidden the difficulties of the operation and especially its complications. More than 72 bariatric surgeons visited us, and we have interacted live in several national and international congresses. A CDL video was second prize at IFSO 2002 in Sao-Paulo [29].

Three patients required an emergency tracheotomy [30,31]. In 2000, we used non-removable rigid stent [32], and then removable stent [33] to treat leaks. Nine patients required a total gastrectomy [34]. In three patients we used a Roux-en-Y derivation [35,36] and this technique is today the therapy of choice when the removable endoprosthesis fails [37]. We report liver disorders [38] and liver failure [39]. Caloric-protein malnutrition [40]. Leakage [41] due to laparoscopic lengthening. One patient suffered a pancreatic-cutaneous fistula [42].

In 2004, Buchwald [43] stated that in MO surgery should be considered for patients with obesity above class I (BMI 30-34.9 K /m2) and associated comorbidities. The morbidity and mortality should be low and obtain an optimal and sustained PSP with minimal side effects is needed. No DS is 100% successful or durable in all patients and there is no single standard procedure and probably will never be. In addition, DS cannot be the solution for the 1.7 billion with MO.
SG leaks are a cause of significant morbidity manifested in the specific meetings of Deitel and Gagner [44]. DS is a long and difficult procedure that requires experienced and experienced surgeons. Operative mortality should be <1% and morbidity <5%. Our mortality from CDL is low (0.38%). Since patients with DS have four suture lines, early detection of leakage is essential.

Mason [45] drew attention to tachycardia as the first warning sign of leakage and no patient should be discharged with this symptom. Duncan [46] gives an early discharge with an enhanced recovery program. Although our stay after DS is about 2-3 days; we instruct patients to introduce online the pulse and temperature, and they notify us of these parameters every four hours, for two weeks, to a telematic database [47, 48]. Patients with significant change in these parameters need immediate and urgent consultation.

DeMaria [49] reported that 450 institutions and 800 surgeons participated in the 2009 BSCOE program in two years (2007-9). Only 0.89% of the 57,918 patients received DS. Nelson [50], using BOLD data from 2007-2010, identified 78,951 patients undergoing gastric bypass (GBP) or CD. Of these patients, 98% had a BMI>52 Kg/m2 and only 2% with a BMI of 48 Kg/m2. DS was associated with a longer surgical time, blood loss and longer hospital stay. The rates of early reoperation were higher in the DS group (3.3% vs. 1.5%). The drop in BMI was significantly higher in DS in all follow-up intervals (P<0.05). In BMI> 50 Kg/m2 there was also a greater fall at 2 years (79% compared to 67%). The improvement of comorbidities (diabetes, hypertension and sleep apnea) was higher with DS (all P <0.05).

English [51], in ASMBS-2016, reports that obesity has increased alarmingly in the last 5 decades in the US, from 13.4% to 36.4%. In 2014, 215,666 operations were carried out in 795 accredited centers, LSG- 58.1%; only 1187 BPD, 0.6% DS and 26% of them LDS. The indirect costs of obesity and the overall economic impact are estimated at $1.42 trillion, 8.2% of the growth domestic product and more than double than in defense spending. Obesity is the fifth most important risk factor for mortality in the world and the reoperation rate is of 14%. Revisions, including conversions, can be overcome soon and suggest the need to develop a better evidence-based algorithm to minimize the use of new operations. More effective initial operations are needed.

Iannelli [52], in 110 patients with BMI> 50 Kg/m2, reached a reduction in the rate of postoperative complications when performing two-stage DS. When studying the procedure, only 39 patients (35.5%) required SG and DBP was avoided in 74.5% of the patients.

Biertho [53] operated to 1000 patients in 2006-2010. The conversion rate in the laparoscopy group was 2.6%. There was a postoperative death (0.1%) due to embolism. The mean hospital stay was shorter in the DSL group (6 to 6 days versus 7 to 9 days, P <0.01). The complication rates were 7.5%, without significant differences. No differences were found in abscesses or abdominal leaks.

Biertho [54] also treated 566 patients between 2011-2015 with LDS with BMI-49 and no mortality was reported at 90 days. The average stay in the hospital was 4.5 days. Major complications at 30 days occurred in 3% of patients, and minor complications in 2.5%. The EWL was 81% at 12 m, 88% at 24 m, and 83% at 36 months. Patients with HbA1C above 6%, decreased from 38% to 14%. The readmission was 3.5% and 0.5% of the patients needed a new operation. The rate of complications in the short and medium term of LDS is like other mixed bariatric procedures and with an excellent metabolic result.

Biron [55] studied the quality of life in 112 patients. The follow-up was 8.8 years. He observed a decrease in the quality of life at long term, after the initial changes that occurred 1-2 years after the surgery (so-called "honeymoon period"). DS improves the specific quality of life of the disease in the short and long term.

Prachand [56] observed an EWL of 54% at 2 years in 350 patients in 152 patients with GBP versus an EWL of 68% in 198 patients with DS with only one deceased (p not significant). The direct comparison of the EWL results at 3 years between DS = 68.9% was much higher than with GBP = 54.9% and showed that the DS was more effective. For Strain [57] DS provides a greater weight loss than GBP in patients with severe obesity (44.8 vs 31.2 %).

From 2002 to 2009 Topart [58] performed 83 DS and 97 GBP in patients with a BMI of 55Kg/m2. After 3 years of follow-up, the average of EWL was 63.7% for GBP and 84.0% for DS group (P> 0.0001).

Våge [59], from 2001 to 2008, treated 182 consecutive patients with DS without no case of mortality at 30 days. One patient needed surgery due to a leak, three patients due to bleeding and one patient due to a biliary leakage. Six patients (3.2%) underwent surgical revision, similar to our data (3.3%).

In summary, patients undergoing DS constantly reduce BMI more than patients with GBP. So, why are there so few patients with DS?

Angrisani [60] reports in the last survey that in 2018 there were 685,874 global bariatric operations; 92.6% primary and 7.4% revision. 96% surgical and 4% endoluminal. SG- 53.6%, GBP-30.1% and Bagua-4.8% and only 1.3% LDS. Is DBP a too complex operation or the results of DS are not so good? SG is irreversible but intestinal continuity can be restored to normality. LDS can be performed in two stages,
SG as the initial operation in high-risk patients with BMI>6.0 Kg/m2.

Rabin [61] reports that DS is not associated with major 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 necessary.

Keshishian [62] performed a preoperative percutaneous biopsy of the liver in 697 patients with DS. There was a transient worsening of the AST (13% of the reference value, P <.02) and ALT (130-160% of the reference levels, P <.0001) up to 6 months after DS. He also observed a progressive improvement of 3 degrees in the severity of NASH 3 years after DS.

Type 2 diabetes
Buchwald [63] reports that DS and BPD have a diabetes resolution rates that exceed 90%. In comparison, the GBP rate is approximately 70%. Tsoli [64] showed that SG was comparable to DBP in the resolution of T2DM but lower in dyslipidemia and blood pressure. In our first diabetes surgery [65], the patient had a low BMI-35 and we successfully performed a LDS without SG with excellent results.

Väge [66] thinks that DS is effective in T2DM, hypertension and hyperlipidemia; the duration of diabetes and the age of the patients are the most important preoperative predictors.

DS by stages
What part of the operation should be done first? DBP or SG? Most surgeons recommend SG. However, Marceau [67] from 2001 to 2009 treated 1,762 patients all scheduled for DS. The procedures of the first stage were 4B BPD isolated without SG and 53 cases with only SG. The conclusions were that SG and BPD contribute independently to the beneficial metabolic results. Long-term results in terms of weight loss and resolution of metabolic abnormalities were better with isolated DBP than with isolated SG. The results of DS in one stage were better than those of two stages.

Moustarah [68] treated 49 OS patients with BPD without OS. The initial weight was 144 Kg and IMCI-52.54 and the drop in the BMI of 14.5 Kg / m2 was very significant (p <0.001).

DBP without SG is rare as the alone weight loss procedure; but in patients whose clinical indications justify the omission of SG, isolated DBP has better weight loss results. In this series, weight loss at 2 years compares favorably with other commonly performed bariatric operations.

We believe that BPD without SG is totally reversible and is an advantage, since SG can be added later if is needed. The infra duodenal surgery of BPD is easier in OS patient than the infra diaphragmatic surgery of the SG.

The biggest problem with DS patient follow-up is that other professionals may not understand how to prevent or treat their long-term complications. The follow-up of patients with DS is very important. We inform to the patient with a detailed technical explanation of the operation, possible complications and their correction, and an extensive explanatory sheet of laboratory analyzes necessary for life.

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

In addition to leakage, the most serious long-term complication of DS is DCP. Surgical correction is simple using a jejunal-jejunal anastomosis to length CA, preferably by laparotomy.

Today we are privileged with endocrinology units, compared to 15 years ago when they did not believe in surgery and their support was limited. The support of bariatric nursing and nutritionists is very important. We provide to patients with the digitized videos of the entire operation, because if a new operation is necessary, the surgeon should know all the details of the original technique. It is necessary to emphasize the significant contribution that the Spanish authors from the 90s made about BPD such as Larrad A [69,70], Solano J [71], Ballesteros M [72], Hoyuela [73] in DBP, as well as Sánchez-Pernaute A [74] with the now popular LDS with a single anastomosis (SADI).

A switch to the Duodenal Switch? How to change to the DS. A call!

DS has not yet said its last word as Halawani [75] says; one third (34.9%) of American adults are obese. DS number in the US is less than 1% for the years 2011-2015. DS must be added to the practice of the "Center of Excellence in Obesity" (CEO). DS is better than the GBP and offers a higher PSP and a lower rate of weight recovery. It conserves the pylorus and produces a slower gastric emptying. With adjustments to the length of the AC and the size of the gastric tube, any obese patient may be a candidate for DS.

Patients with a BMI <50 kg/m2 may also be candidates. DS is a viable option due to its flexibility. The surgeon can adjust the impact of the restriction. The length of AC can be variable.

DS is good for chronic patients, with non-steroidal anti-inflammatory and steroids. The highest rate of early mortality compared to the LSG (0.28%) is slightly higher.
(0.43%) although it is still considered a complex high-risk procedure and the results should be analyzed with caution.

DS is very versatile and can offer an integral management of obesity and its metabolic comorbidities. With dedication, adequate training and a comprehensive education, DS can be implemented in daily clinical practice.

**Conclusions**

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

**Ethical approval**

All the procedures that were carried out in the studies cited in this document are in accordance with the ethical standards of the national and institutional research committees and with the Declaration of Helsinki and the amendments.

**Informed consent**

The informed consent was obtained from all the individual participants included in the cited studies.

**Conflict of interests**

None of the authors has any conflicts of interest to disclose.

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