

Review article

The single anastomosis duodenal switch modifications: a review of the current literature on outcomes

Philippe Topart, M.D.^{*}, Guillaume Becouarn, M.D.

Société de Chirurgie Viscérale, Clinique de l'Anjou, Angers, France

Received December 20, 2016; accepted April 18, 2017

Abstract

Background: The single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S) was designed in 2007 to reduce the side effects of biliopancreatic diversion with duodenal switch (BPD-DS) by replacing the Roux-en-Y construction with a single duodeno-ileal anastomosis and combining the common channel with the alimentary limb. Several variants using different channel lengths were published. The objective of this study was to identify the published cases of SADI-S and variants and assess the results regarding potential benefits on side effects and revisions.

Methods: PubMed, ClinicalTrials.gov, and the databases of 3 relevant surgical journals were searched for any publication from 2007 to date.

Results: In all, 19 studies were analyzed. After identifying overlaps, 1,041 patients among 9 institutions were identified: 304 with SADI-S, 667 with stomach intestinal pylorus sparing surgery, and 70 with single anastomosis duodenojejunal bypass with sleeve gastrectomy. There were no postoperative deaths and the early complication rate was 7.3% (range 1.6–14%). The mean operative time was 100.8 minutes (range 69.9–181.7 min). The mean 1-year percentage of excess weight loss (%EWL) was 78.7% (range 61.6–87%) and percentage of total weight loss (%TWL) was 36.8% (range 32.7–41.1%). Two studies reported a 2-year %TWL of 38.7% and a single study reported a 5-year %TWL of 37%. A total of 50% of patients had biological data at 1 year. One retrospective study found no difference between BPD-DS and SIPS for vitamin deficiency at 2 years, but there was less severe diarrhea and malnutrition after SIPS. The revision rate increased from 2% to 7% after SADI-S between 2- and 5-year follow-up.

Conclusion: There are still limited long-term data available for single anastomosis duodenal switch. In the absence of published prospective randomized trials, no evidence exists in favor of this variant of the BPD-DS despite a possible trend in less malabsorption side effects. (Surg Obes Relat Dis 2017;13:1306–1312.) © 2017 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords:

Single anastomosis duodenal switch; SADI-S; SIPS; SADJB-SG; BPD-DS; Side effects; Malnutrition; Vitamin deficiency; Revision

Introduction

Since the description of the single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S) by Sánchez-Pernaute et al. in 2007 [1], several papers have been

published about this variant of the original biliopancreatic diversion with duodenal switch initially described by Hess et al. [2] and Marceau et al. [3] in the early 1990s. All these reports retained the sleeve gastrectomy as part of the original technique. However, with the objective of reducing side effects, in particular the risk of protein malnutrition and vitamin deficiencies, a 200-cm single loop combining the alimentary and common channels was designed with an end-to-side duodeno-ileal anastomosis. More recently,

^{*}Correspondence: Philippe Topart, M.D., Société de Chirurgie Viscérale, Clinique de l'Anjou, 142, avenue de Lattre de Tassigny, 49000 Angers, France.

E-mail: ptopart@gmail.com

significant interest in this new technique has been observed with numerous papers published since 2015. The aim of this work was to analyze the results of single anastomosis duodenal switch with respect to weight outcomes and nutritional and digestive side effects. A comparison to the results of the standard biliopancreatic duodenal switch (BPD-DS) was also assessed when available in the current literature.

Methods

The current review was based on a PubMed, Google Scholar, and ClinicalTrials.gov search from 2007 to date. In addition, we searched the online databases of 3 relevant high-impact journals: *Surgery for Obesity and Related Diseases*, *Obesity Surgery*, and *Surgical Endoscopy*. The following terms were used to perform the bibliographic search: single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S), stomach intestinal pylorus sparing surgery (SIPS), single anastomosis loop duodenal switch, modified duodenal switch (MDS), and loop/single anastomosis duodenojejunal bypass with sleeve gastrectomy (SADJB-DS and LDJB-SG). Original papers, reviews, case reports, and published abstracts were considered. Weight loss outcomes, side effects, and nutritional management were analyzed. When available, comparison to “standard” biliopancreatic diversion (BPD-DS) was discussed.

Results

A total of 31 papers or published abstracts were found using the search criteria described above. Ten were not retained because they were case reports or addressed specific technical points or indications, such as gastroesophageal reflux disease and revisions, or reported very limited data [4–13]. Of the 21 selected papers, 6 were published abstracts [14–19] reporting enough data to be considered and 15 had been published in journals or books or on ClinicalTrials.gov [20–34]. Four studies included comparisons with other bariatric procedures: sleeve gastrectomy (SG) [26], Roux-en-Y gastric bypass (RYGB) [20,25], and BPD-DS [30]. One paper was an American Society for Metabolic and Bariatric Surgery statement on single-anastomosis duodenal switch [32]. Finally, a prospective randomized study was registered at ClinicalTrials.gov comparing SADI-S and standard BPD-DS [33]. After identifying any possible overlap between patients in the different published series, we found 1,041 patients. In practice, when considering a single center, only the most recent population census was considered for a specific procedure (e.g., differentiating single-stage and secondary-to-sleeve procedures). Of the 1,041 patients, 304 SADI-DS patients were at 3 different centers in Europe and Brazil, 667 had had SIPS in 4 centers in the United States, and 70 had SADJB-SG at 2 Asian centers.

Technique

The published studies were distributed among 3 procedures, which always included a sleeve gastrectomy and a single anastomosis duodenal switch (end-to-side duodeno-ileal anastomosis).

Loop or single anastomosis duodenojejunal bypass with sleeve gastrectomy

The procedure described by Huang et al. [20] used a 38 Fr bougie and a 200- to 300-cm biliopancreatic limb measured from the angle of Treitz without determining the length of the common channel. However, the procedure described by Lee et al. [21] used a 150-cm biliopancreatic limb or a 200-cm common channel according to the body mass index (BMI) of the patient.

Single anastomosis duodeno-ileal bypass with sleeve gastrectomy

Studies reported the use of 34–54 Fr bougie and a 200- to 300-cm common channel measured from the ileocecal valve.

Stomach intestinal pylorus sparing surgery also identified as modified duodenal switch and initially described as single anastomosis duodenal switch

These studies used 40 and 42 Fr bougie with a 300-cm common channel.

Except 2 papers [19,20] on LDJB-SG/SADJB-SG, which is closer to an omega loop–pylorus-preserving gastric bypass in concept, there was a significant overlap between the studies. Four centers published 5 papers on SADI-S [14,21–24]. As for SIPS/MDS, 4 centers reported their experience in 11 papers [15–19,25–30]; 3 of these reported the combined experience of 2 centers [16,17,28].

The characteristics of the series with reported data are summarized in Table 1. Two series exclusively comprised patients with type 2 diabetes [19,23].

Early results

Twelve studies reported 30-day outcomes, and 10 of them specifically indicated that revisions had been excluded (Table 2). Nine studies provided an overall complication rate ranging from 1.6% [30] to 14% [14]. Except in 1 study, which reported a 30-day reoperation rate of 11.6% [22], the other 9 series had 0 reoperations [19,25,30], or a rate < 1.6%. No series reported postoperative death.

Weight outcomes

Eleven series reported 1-year weight outcomes, 1 consisted of patients with an initial BMI < 35 kg/m² [20] (Table 3). Four series had follow-up of 2 years [19,23,27,30] and 2 had

Table 1
Single anastomosis patient characteristics

First author, yr	No. of patients	Type of surgery	Bougie	Common channel (cm)	M/F	Initial BMI (kg/m ²)	HT (%)	Diabetes type 2 (%)	OSAS (%)
Huang, 2014 [20]	20	LDJB-SG	38 Fr	200–300 [*]	13/7	27.9 ± 3.0	–	100	–
Lee, 2014 [21]	50	SADJB-SG	45 Fr	200–150 [*]	19/31	38.4 ± 6.0	–	–	–
Gebelli, 2016 [22]	67	SADI-S	36 Fr	300	21/46	53.5	49.2	26.8	26.8
Nelson, 2016 [23]	69 [‡]	SADI-S	34 Fr	250	21/48	58.4 ± 8.3	–	–	–
Sánchez-Pernaute, 2015 [24]	168 [†] subgroup of 97	SADI-S	54 Fr	200/250	45/52	44.3	–	100	–
Sánchez-Pernaute, 2016 [14]	100 [‡]	SADI-S	54 Fr	200/250	–	44.6	–	66	–
Cottam, 2016 [26]	54 [‡]	SIPS	40 Fr	300	16/38	47.6 ± 8.8	63	57	57
Cottam, 2016 [27]	61 [‡]	SIPS	40 Fr	300	23/38	50.1 ± 8.6	69	51	52
Enochs, 2015 [15]	150 [‡]	SIPS	40 Fr	300	35/115	48.6	–	–	–
Mitzman, 2016 [29]	123 [‡]	SIPS	42 Fr	300	55/78	49.4 ± 9.2	48	43.9	48
Neichoy, 2016 [18]	135 [‡]	SIPS	40 Fr	300	31/104	52.9 ± 9.5	74.8	42.2	60
Sabrudin, 2016 [16]	168 [‡]	SIPS	42 Fr	300	–	–	–	–	–
Surve, 2017 [31]	120	SIPS	40 Fr	300	42/78	49.5 ± 9.4	–	–	–
Zaveri, 2016 [19]	291 [‡]	SIPS	40 Fr	300	–	–	–	–	–

BMI = body mass index; LDJB-SG = loop duodenojejunal bypass with sleeve gastrectomy; SADJB-SG = single anastomosis duodenojejunal bypass with sleeve gastrectomy = SADI-S: single anastomosis duodeno-ileal bypass with sleeve gastrectomy; SIPS = stomach intestinal pylorus sparing surgery; HT = hypertension; OSAS = obstructive sleep apnea.

^{*}Biliopancreatic limb length only, common channel length unknown.

[†]Twenty-five patients converted from sleeve, Roux-en-Y gastric bypass, or vertical banded gastroplasty.

[‡]Revisional cases excluded.

follow-up of 18 months [15,26]. One series provided results up to 3 years [31], and 1 specifically addressed 5-year outcomes [14].

Co-morbidity outcomes

Six series reported the evolution of preoperative co-morbidities [14,18,20,23,24,27] (Table 1). Between 6 months and 1 year after surgery, remission and improvement of type 2 diabetes was found in 60%–86% [18,20,23,24,27]. After 5-year follow-up, 70% of diabetic patients were off medication after SADI-S [14].

Hypertension was improved after 6 months to 1 year in 42.4%–96% of patients [18,20,23,24]. Finally, 2 series reported improvement or remission of obstructive sleep apnea in 60% (6 mo) [23] and 97.6% (12 mo) [18] of patients.

Nutritional status

Six series studied vitamin and nutritional status 1 year after surgery, except the study by Surve et al. [31], which assessed the blood check at 2 years (Table 4). The total number of patients for whom data were available at least

Table 2
Single anastomosis duodenal switch early postoperative outcomes

First author, yr	No. of patients	Type of surgery	Operative time (min)	Stay (d)	Early complications (%)	30-d reoperations (n)	Deaths (n)	Readmissions (n)
Huang, 2014 [20]	20	LDJB-SG	119 ± 46.9	3 ± 1.3	.5 major	0	0	–
Lee, 2014 [21]	50	SADJB-SG	181.7	3.8	6	0	0	–
Gebelli, 2016 [22]	67	SADI-S	115	–	12.8	–	0	–
Nelson, 2016 [23]	69 [‡]	SADI-S	–	4.3 ± 2.6	13	8	0	3
Sánchez-Pernaute, 2015 [24]	168 [†] subgroup of 97	SADI-S	–	–	3	2	0	–
Sánchez-Pernaute, 2016 [14]	100 [‡]	SADI-S	–	–	14	–	–	–
Cottam, 2016 [26]	54 [‡]	SIPS	–	–	3.7	0	0	–
Cottam, 2016 [27]	61 [‡]	SIPS	70 ± 14	–	18 ^a	1	0	–
Enochs, 2015 [15]	150 [‡]	SIPS	73	1.8	–	2	0	16
Mitzman, 2016 [29]	123 [‡]	SIPS	96	2 ± 0.9	4.8	1	0	2
Neichoy, 2016 [18]	135 [‡]	SIPS	83	1.7	6.6	2	0	3
Sabrudin, 2016 [16]	168 [‡]	SIPS	–	–	–	–	–	–
Surve, 2017 [31]	120 [‡]	SIPS	69.9 ± 15.8	2 ± 1	1.6	0	–	1

LDJB-SG = loop duodenojejunal bypass with sleeve gastrectomy; SADJB-SG = single anastomosis duodenojejunal bypass with sleeve gastrectomy; SADI-S = single anastomosis duodeno-ileal bypass with sleeve gastrectomy; SIPS = stomach intestinal pylorus sparing surgery.

^aTwenty-five patients converted from sleeve, Roux-en-Y gastric bypass, or vertical banded gastroplasty.

[†]Revisional cases excluded.

[‡]Total count of complications.

Table 3
Single anastomosis duodenal switch weight loss outcomes

First author, yr	No. of patients	Type	Patients with follow-up (n)					%EWL					%TWL					BMI (kg/m ²)		
			1 yr	2 yr	5 yr	1 yr	2 yr	5 yr	1 yr	2 yr	5 yr	1 yr	2 yr	5 yr	1 yr	2 yr	5 yr			
Huang, 2014 [20]	20	LDJB-SG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.5 ± 2.4	-	-
Lee, 2014 [21]	50	SADI-SG	-	-	-	80.3 ± 24.8	-	-	-	-	-	32.7	-	-	-	-	-	25.9 ± 4.6	-	-
Nelson, 2016 [23]	69 [†]	SADI-S	24	-	-	61.6 ± 12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sánchez-Pernaute, 2015 [24]	168 [‡] group of 97	SADI-S	86/90	74/80	25/32	91	92	98	-	-	-	-	-	-	-	-	-	-	-	-
Sánchez-Pernaute, 2016 [14]	100 [‡]	SADI-S	-	-	73/100	-	-	87	-	-	-	-	-	37	-	-	-	-	-	27
Cottam, 2016 [26]	54 [‡]	SIPS	-	-	-	-	-	-	-	-	-	36.3	41 [‡]	-	-	-	-	30.2	26.8 [‡]	-
Cottam, 2016 [27]	61 [‡]	SIPS	40/51	19/27	-	78.7 ± 19.2	83.7 ± 17.3	-	-	-	36 ± 8.5	38.7 ± 9.3	-	-	-	-	30.8 ± 6.1	29.1 ± 4.7	-	
Enochs, 2015 [15]	150 [‡]	SIPS	-	-	-	82.9	87.2 [‡]	-	-	-	-	-	-	-	-	-	-	-	-	-
Mitzman, 2016 [29]	123 [‡]	SIPS	64/102	-	-	72.3 ± 1.7	-	-	-	-	38.6 ± 0.7	-	-	-	-	-	-	-	-	-
Neichoy, 2016 [18]	135 [‡]	SIPS	33/54	-	-	68.9	-	-	-	-	41.1	-	-	-	-	-	22.5	-	-	-
Sabrudin, 2016 [16]	168 [‡]	SIPS	96	-	-	87	-	-	-	-	37	-	-	-	-	-	27	-	-	-
Surve, 2017 [31]	120	SIPS	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.3 [‡]	-	-
Zaveri, 2016 [19]	291 [‡]	SIPS	131	67	28 [¶]	86.1 ± 24.8	93.9 ± 28.8	93.3 ± 32.5 ^{¶¶}	86.1 ± 24.8	93.9 ± 28.8	93.3 ± 32.5 ^{¶¶}	35.9 ± 9.1	38.8 ± 11.6	39.9 ± 13.2 ^{¶¶}	29.3 ± 6.8	27.9 ± 8.4	28.5 ± 10 ^{¶¶}	-	-	-

BMI = body mass index; LDJB-SG = loop duodenojejunal bypass with sleeve gastrectomy; SADI-SG = single anastomosis duodenojejunal bypass with sleeve gastrectomy; SADI-S = single anastomosis duodeno-ileal bypass with sleeve gastrectomy; SIPS = stomach intestinal pylorus sparing surgery; %EWL = percentage of excess weight loss; %TWL = percentage of total weight loss.

[†] Twenty-five patients converted from sleeve, Roux-en-Y gastric bypass, or vertical banded gastroplasty.

[‡] Revisional cases excluded.

[§] Eighteen-month follow-up.

[¶] Points of body mass index lost.

^{¶¶} Three-year follow-up.

Table 4
Single anastomosis duodenal switch nutritional data

%	No. of patients with 1-yr follow-up	1-yr abnormal values (n patients with data)									
		Hb	Protein	Albumin	Vitamin B ₁₂	Ca	Vitamin D	Vitamin A	PTH	Zn	Se
Lec, 2014 [21]	34	13.1 ± 2.1 g/dL	8% (24)	4.3 ± 0.2 g/dL	0% (24)	8.7 ± 0 µg/dL	46% (24)	–	–	–	–
Nelson, 2016 [23]	24	25% (24)	8% (24)	13% (24)	0% (24)	13% (24)	23% (66)	54% (66)	33% (66)	28% (66)	–
Sánchez-Pernaute, 2015 [24]	72	–	29% (66)	12% (66)	8% (66)	–	8% (66)	–	–	–	–
Cottam, 2017 [28]	60	–	–	3% (39)	14 (37)	2 (39)	15 (37)	–	–	–	–
Enochs, 2015 [15]*	150	–	7.6% (131)	3.1% (130)	15.3% (130)	–	10.8% (120)	–	–	–	–
Mitzman, 2016 [29]†	64	–	–	39 ± 6 g/L (31)	1,011 ± 633 pg/mL (31)	–	38.1 ± 22 ng/mL (31)	–	–	–	–
Neichoy, 2016 [18]	54	–	13% (38)	12% (41)	10.4% (48)	18% (39)	29% (52)	–	–	–	–
Sabrudin, 2016 [17]	96	–	–	3.9 g/dL (45)	1,075 pg/mL (45)	–	32.2 ng/mL (45)	–	–	–	–
Surve, 2017 [31]	2-yr follow-up	–	8% (80)	8% (80)	0% (78)	6% (81)	34% (80)	–	–	–	–

Hb = hemoglobin; Ca = calcium; PTH = parathormone; Zn = zinc; Se = selenium.

Bold indicates mean values only for the whole group of patients.

*Abnormal values defined as protein <6.0 g/dL, albumin <3.5 g/dL, vitamin B₁₂ <211 pg/mL, vitamin D <20 ng/mL, vitamin A <38 µg/dL.

†Normal values defined as albumin 3.5–5.5 g/dL, vitamin B₁₂ 200–1100 pg/mL, vitamin D 30–100 ng/mL, vitamin A 38–98 µg/dL.

1 year from surgery was 465. Two other series [17,19] reported mean values only, with Mitzman et al. [29] indicating that various nutritional parameters were “close to normal.” Only 2 series specified laboratory normal ranges [15,17]. Protein and albumin deficiency was noted between 7.6% [15] and 29% [24] and 3.1% [15] and 13% [23] of patients, respectively. Except 1 series with a 37.8% deficiency rate [27], vitamin B₁₂ was found to be abnormal in <10% of cases. Hypocalcemia was reported by 4 series only, but vitamin D deficiency was assessed by all 6 series, with a 42%–46% deficiency in 2 of them [23,31]. Vitamin A deficiency was found by 2 series in 45%–53% of patients [15,24]. Finally, only 1 series reported 54% hyperparathyroidism and deficiencies in zinc and selenium [15]. Sabrudin et al. [17], in a subgroup of 24 of 60 patients with available biological data at 6-month follow-up, found a postoperative increase in vitamin D and iron, while vitamin A and albumin remained normal compared to preoperative values. Three series [20,23,25] reported some form of vitamin supplementation (multivitamins, 2,000 mg calcium/d, iron, and vitamin D), but there were no data on patient compliance.

Major side effects and revisions

Although protein malnutrition was not defined, it was reported in .8% [31], 1.4% (61% at 1-yr follow-up) [18], and 7% over 10 years [14]. Finally, Enochs [15] reported 11 “nutritional depletions” in a series of 150 patients with 1-year follow-up.

Diarrhea was encountered in 2 series, with an incidence of .8% [31] to 2.2% [18]. Sánchez-Pernaute et al. [24] reported a mean 2.5 bowel movements a day after SADI-S. The rate of revision with elongation of the common channel motivated by side effects was reported in .8% [31] and 1.5% [18] after SIPS. In the same group of patients, this rate increased over time from 2% to 7% [14] after SADI-S.

Discussion

From a technical standpoint, and although an American Society for Metabolic and Bariatric Surgery position statement [32] recently considered these single anastomosis duodenal switch techniques as “investigational,” there is very little difference compared to the standard BPD-DS. At least combining an alimentary limb with a common channel of at least 250 cm, SADI-S and SIPS would theoretically result in less nutritional and digestive side effects that until now have prevented global adoption of biliopancreatic diversion [34]. While the results of the prospective randomized trial comparing SADI-S and BPD-DS conducted by Torres [33] are still pending, only 2 retrospective studies from the same institution are available [28,31]. In the series published by Surve et al. [31], the results of 62 BPD-DS (150 cm alimentary limb and 150 cm common channel) and

120 SIPS were compared and a total of 99 patients (DS and SIPS not separately identified) had 2-year follow-up. There were significantly fewer early complications (1.6% and 20.9%) after SIPS and shorter operative time (69.9 ± 15.8 and 136.9 ± 35.5 minutes) for the procedure. However, there might be an effect of the learning curve, the BPD-DS series being older than SIPS. Although no statistical calculation was specifically available for these 2 items, the rate of severe diarrhea and malnutrition was much less frequent after SIPS (0.8% each) than after BPD-DS (11.2% and 8%, respectively), and 1 liver failure was reported in the BPD-DS series. However, patients' laboratory values exhibited similar changes after surgery, and no difference was found between the 2 procedures in terms of vitamin levels. Vitamin D deficiency and hypocalcemia were found in 19 and 4 of 34 patients, respectively, after BPD-DS and 34 and 6 of 80 patients after SIPS. No information was available on vitamin A or parathormone levels, and there were no definitions for "severe diarrhea" and "malnutrition." Revision with lengthening of the common channel was reported in 1 patient in each group. In a series of 100 SADI-S patients with at least 5-year follow-up, the rate of revision was 7% [14], while an earlier report on the same group with a shorter (2-yr) follow-up for half of the patients reported a 2% revision rate [25], suggesting that the risk of revision increases overtime. In the most recent article by Sánchez-Pernaute et al. [14], it is unknown whether the initial 200 cm alimentary/common channel used in the 50 first patients was responsible for the increased rate of revision. After BPD-DS, the reported rate of revision with channel elongation for severe side effects ranges from 2% to 5% [35] and up to 10% in a recent report on 10-year follow-up [36]. In terms of weight loss, SIPS led to a slightly lower 24-month %TWL, with a difference of 15% in favor of BPD-DS [31]. The same observation was made regarding %EWL (94.9% for BPD-DS and 87.1% for SIPS). However, the end BMIs were close (25.6 versus 26.9 kg/m²), this time to SIPS's advantage. Overall, SADI-S and SIPS yielded significant weight loss, with %EWL $\geq 70\%$ at 1 year, and even at 5 years (Table 3), with %TWL $\geq 35\%$ at 1, 2, and 5 years after surgery.

Except for 1 study with 5-year data in 100 SADI-S patients [14], follow-up remains limited to 1 year for most of the publications. In addition, there is significant overlap with series reporting outcomes in the same population or even combining the experience of 2 centers. Overall, there is little information available in the literature on vitamin supplementation.

Conclusion

Single anastomosis duodenal switch appears to be a variant of the standard BPD-DS. Given the available literature, it is still premature to conclude that this modification of the original BPD-DS can significantly reduce

the risk of major side effects of the malabsorptive surgery, although it seems to allow for significant and sustained weight loss at 2 to 5 years of follow-up. More long-term studies and the still to be released prospective randomized study are required to support the use of SADI-DS/SIPS as a valid alternative to standard BPD-DS.

Disclosures

The authors have received honoraria for teaching from Baxter, Ethicon, and Medtronic not in relation to this work.

References

- [1] Sánchez-Pernaute A, Rubio Herrera MA, Pérez-Aguirre E, et al. Proximal duodenal-ileal end-to-side bypass with sleeve gastrectomy: proposed technique. *Obes Surg* 2007;17(12):1614–8.
- [2] Hess DS, Hess DW, Oakley RS. The biliopancreatic diversion with the duodenal switch: results beyond 10 years. *Obes Surg* 2005;15(3):408–16.
- [3] Marceau P, Biron S, Bourque RA, Potvin M, Hould FS, Simard S. Biliopancreatic diversion with a new type of gastrectomy. *Obes Surg* 1993;3(1):29–35.
- [4] Ng P, Sharp L, Bermudez D. Omega loop duodenal switch with linear stapled duodenoileostomy. *Surg Obes Relat Dis* 2015;12(7):S35.
- [5] Sabrudin S, Pearlstein S, Lamoureux D, Brownlee A, Roslin M. Outcomes after laparoscopic conversion of failed adjustable gastric banding to vertical sleeve gastrectomy (VSG) or modified duodenal switch (MDS) with single anastomosis. *Surg Obes Relat Dis* 2016;12(7):S42.
- [6] Sánchez-Pernaute A, Herrera MA, Pérez-Aguirre ME, et al. Single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S). One- to three-year follow-up. *Obes Surg* 2010;20(12):1720–6.
- [7] Sánchez-Pernaute A, del Cid EA, Herrera MÁR, et al. Prospective non-randomized comparison between single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S) and gastric bypass, for the treatment of morbid obesity. *Surg Obes Relat Dis* 2016;12(7):S22–3.
- [8] Sánchez-Pernaute A, Rubio MÁ, Conde M, Arrue E, Pérez-Aguirre E, Torres A. Single-anastomosis duodenoileal bypass as a second step after sleeve gastrectomy. *Surg Obes Relat Dis* 2015;11(2):351–5.
- [9] Surve A, Zaveri H, Cottam D, Richards C, Medlin W, Cottam A. Laparoscopic stomach intestinal pylorus sparing surgery in a patient with morbid obesity and situs inversus: first video case report. *Surg Obes Relat Dis* 2017;13(1):122–4.
- [10] Surve A, Zaveri H, Cottam D. Retrograde filling of the afferent limb as a cause of chronic nausea after single anastomosis loop duodenal switch. *Surg Obes Relat Dis* 2016;12(4):e39–42.
- [11] Zaveri H, Surve A, Cottam D, et al. A comparison of outcomes of bariatric surgery in patient greater than 70 with 18 month of follow up. *Springerplus* 2016;5(1):1740.
- [12] Zaveri H, Surve A, Cottam D, et al. Stomach intestinal pylorus sparing surgery (SIPS) with laparoscopic fundoplication (LF): a new approach to gastroesophageal reflux disease (GERD) in the setting of morbid obesity. *Springerplus* 2015;4:596.
- [13] Lee WJ, Zachariah PJ, Tsou JJ, Lee YC, Chen JC, Ser KH. Single-anastomosis duodenal-jejunal bypass with sleeve gastrectomy (SADJB-SG) versus RY gastric bypass: mixed meal study. *Surg Obes Relat Dis* 2015;11(6):S210.
- [14] Sánchez-Pernaute A, Rubio Herrera MA, Martín Antona E, Matía P, Pérez Aguirre E, Torres A. Single-anastomosis duodeno-ileal bypass

- with sleeve gastrectomy (SADI-S). Absolute results at 5 years. *Surg Obes Relat Dis* 2016;12(7):S70–1.
- [15] Enochs P. The laparoscopic stomach, intestinal and pylorus sparing (SIPS) procedure: a single center analysis of our first 100 patients. *Surg Obes Relat Dis* 2015;11(6):S165–6.
- [16] Sabrudin S, Goriparthi R, Lamoureux D, Cottam D, Roslin M. Modified duodenal switch (MDS) or SIPS (stomach intestine pyloric sparing) results and significance. *Surg Obes Relat Dis* 2016;12(7):S75.
- [17] Sabrudin S, Pearlstein S, Lamoureux D, Roslin M. Pre and post operative comparison of comprehensive metabolic profile with vitamin levels in patients undergoing modified duodenal switch (MDS). *Surg Obes Relat Dis* 2016;12(7):S173.
- [18] Neichoy B, Schniederjan B, Cottam D, Zaveri H, Surve A, Cottam A. The Texas experience of stomach intestinal pylorus sparing surgery (SIPS) at one year. *Surg Obes Relat Dis* 2016;12(7):S21–2.
- [19] Zaveri H, Surve A, Cottam D, et al. Weight loss outcomes in patients with stomach intestinal pylorus sparing surgery at 3 years. *Surg Obes Relat Dis* 2016;12(7):S42.
- [20] Huang CK, Ahluwalia JS, Garg A, et al. Novel metabolic/bariatric surgery — loop duodenojejunal bypass with sleeve gastrectomy (LDJB-SG). In: Chih-Kun Huang, editor, *Essentials and controversies in bariatric surgery*. Rijeka, Croatia: InTech; 2014. p. 133–44.
- [21] Lee WJ, Lee KT, Kasama K, et al. Laparoscopic single-anastomosis duodenal-jejunal bypass with sleeve gastrectomy (SADJB-SG): short-term result and comparison with gastric bypass. *Obes Surg* 2014;24(1):109–13.
- [22] Gebelli JP, Gordejuela AG, Ramos AC, et al. SADI-S with right gastric artery ligation: technical systematization and early results. *Arq Bras Cir Dig* 2016;29(Suppl 1):85–90.
- [23] Nelson L, Moon RC, Teixeira AF, Galvão M, Ramos A, Jawad MA. Safety and effectiveness of single anastomosis duodenal switch procedure: preliminary results from a single institution. *Arq Bras Cir Dig* 2016;29(Suppl 1):80–4.
- [24] Sánchez-Pernaute A, Rubio MÁ, Cabrerizo L, Ramos-Levi A, Pérez-Aguirre E, Torres A. Single-anastomosis duodenoileal bypass with sleeve gastrectomy (SADI-S) for obese diabetic patients. *Surg Obes Relat Dis* 2015;11(5):1092–8.
- [25] Sánchez-Pernaute A, Rubio MÁ, Pérez Aguirre E, Barabash A, Cabrerizo L, Torres A. Single-anastomosis duodenoileal bypass with sleeve gastrectomy: metabolic improvement and weight loss in first 100 patients. *Surg Obes Relat Dis* 2013;9(5):731–5.
- [26] Cottam A, Cottam D, Medlin W, et al. A matched cohort analysis of single anastomosis loop duodenal switch versus Roux-en-Y gastric bypass with 18-month follow-up. *Surg Endosc* 2016;30(9):3958–64.
- [27] Cottam A, Cottam D, Roslin M, et al. A matched cohort analysis of sleeve gastrectomy with and without 300 cm loop duodenal switch with 18-month follow-up. *Obes Surg* 2016;26(10):2363–9.
- [28] Cottam A, Cottam D, Portenier D, et al. A matched cohort analysis of stomach intestinal pylorus saving (SIPS) surgery versus biliopancreatic diversion with duodenal switch with two-year follow-up. *Obes Surg* 2017;27(2):454–61.
- [29] Mitzman B, Cottam D, Goriparthi R, et al. Stomach intestinal pylorus sparing (SIPS) surgery for morbid obesity: retrospective analyses of our preliminary experience. *Obes Surg* 2016;26(9):2098–104.
- [30] Surve A, Zaveri H, Cottam D. A step-by-step surgical technique video with two reported cases of common channel lengthening in patients with previous stomach intestinal pylorus sparing surgery to treat chronic diarrhea. *Surg Obes Relat Dis* 2017;13(4):706–9.
- [31] Surve A, Zaveri H, Cottam D, Belnap L, Cottam A, Cottam S. A retrospective comparison of biliopancreatic diversion with duodenal switch with single anastomosis duodenal switch (SIPS, stomach intestinal pylorus sparing surgery) at a single institution with two year follow up. *Surg Obes Relat Dis* 2017;13(3):415–22.
- [32] Kim J, American Society for Metabolic and Bariatric Surgery Clinical Issues Committee. American Society for Metabolic and Bariatric Surgery statement on single-anastomosis duodenal switch. *Surg Obes Relat Dis* 2016;12(5):944–5.
- [33] Torres A. Single anastomosis duodenoileal bypass vs standard duodenal switch as a second step after sleeve gastrectomy in the super morbid obese patient (SADI vs CD). *ClinicalTrials* NCT01685177 2009 Sept. <https://clinicaltrials.gov/ct2/show/NCT01685177> [cited].
- [34] Buchwald H, Oien DM. Metabolic/bariatric surgery worldwide 2011. *Obes Surg* 2013;23(4):427–36.
- [35] Topart PA, Becouarn G. Revision and reversal after biliopancreatic diversion for excessive side effects or ineffective weight loss: a review of the current literature on indications and procedures. *Surg Obes Relat Dis* 2015;11(4):965–72.
- [36] Bolckmans R, Himpens J. Long-term (>10 yrs) outcome of the laparoscopic biliopancreatic diversion with duodenal switch. *Ann Surg* 2016;264(6):1029–37.