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REVIEW ARTICLE

Reoperative Bariatric Surgery: a Systematic Review of the Reasons for Surgery, Medical and Weight Loss Outcomes, Relevant Behavioral Factors

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Abstract Reoperative surgery following the failure of primary bariatric surgery is increasing due to the significant rates of patients experiencing poor weight loss or medical complications. This literature review was conducted to organize the emerging, but scattered, literature regarding the reasons for undergoing surgery, the best available options, the predictors of success, and the psychological characteristics of patients submitted to reoperative surgeries. Reoperative procedures are technically challenging, but the possible benefits of reoperation supplant the increased risks associated with these procedures. The etiology of reasons for undergoing a second surgery includes medical (e.g., fistula, ulcer disease) and behavioral aspects. Factors that may compromise outcomes have not been much studied. Particular attention should be paid to candidates with a history of difficulties in engaging in healthy eating patterns.

Keywords Reoperative bariatric surgery · Reason for surgery · Outcomes · Eating behaviors · Depression and anxiety

Introduction

Obesity has become a pressing health problem worldwide and bariatric surgery is currently the treatment of choice for inducing substantial weight loss and long-term weight maintenance in severe obesity [1, 2]. Depending on the bariatric procedure, the percentage of excessive weight loss may range from 56.7 to 74.8% and is associated with the resolution of the common comorbidities of obesity and increased life expectancy [1]. Nonetheless, the variability of outcomes is considerable and research shows that about 20% of bariatric patients fail to achieve a significant amount of weight loss (above 50% of their preoperative excessive weight) [3], while others experience weight regain after initial successful weight loss [2]. With significant rates of patients presenting poor results and/or complications after primary surgery, a secondary surgical procedure may be required. The designation used to refer to such surgeries is not unanimous in literature. Many studies use the term reoperative bariatric surgery [3, 4], others apply the term revisional bariatric surgery [5, 6], and the term redo surgery is also used. For the purpose of this work, we decided to use the term "reoperative bariatric surgery," as proposed by the American Society for Metabolic and Bariatric Surgery (ASMBS).

According to the ASMBS, these procedures can be organized into the following categories: revisional, conversion, and reversal surgeries. In revisional procedures, the alterations performed do not modify the basic anatomy of the primary surgery (e.g., rebanding, resleeve). Normally, these procedures are performed due to chronic complications (e.g., gastro-gastric fistula, recurrent ulcers) from a previous primary operation [7–9]. They are also performed when weight regain occurs [7]. For cases with poor weight loss or weight regain, conversion procedures are the most common [3]. Such procedures represent a change in the structural anatomy of the primary operation into a different type of surgery [9]. Examples of conversion procedures comprise alteration from a purely restrictive surgery to a sleeve gastrectomy or a malabsorptive procedure. Finally, reversal procedures consist in undoing the primary procedure, usually with the restoration

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of the original anatomy (e.g., gastric band removal, restoration of anatomy after Roux-en-Y gastric bypass (RYGB)) [9]. Failure and complications of a primary bariatric procedure are the main reasons for performing the latter procedure. Although most of the bariatric surgery procedures can be reversed, such is not possible for surgeries that require permanent removal of organs (such as sleeve gastrectomy). Reversal procedures may also be an intermediate step towards conversion surgery [10].

The use of reoperative surgeries is increasing. Gagner and colleagues [11] estimated that up to 25% of bariatric patients underwent additional procedures related to problems with their primary bariatric operation over the last decade. The current global incidence of reoperations is estimated to be as high as 50% [7, 12], with restrictive procedures, such as adjustable gastric banding and vertical banded gastroplasty, showing the highest rates of reoperation (up to 60%) [12]. Worthy of note is the fact that procedures of reoperative bariatric surgery have a high level of complexity and are technically demanding [13].

There is little consistency in the literature regarding success and failure of revisional or conversion procedures, and little is known about the psychosocial variables that impact weight outcomes of such reoperative procedures. To date, five systematic reviews focused on reoperative bariatric surgery. Elnahas and colleagues [14] sought to determine the type of reoperative surgery that is more appropriate to improve weight loss following failed laparoscopic adjustable gastric band (LAGB) due to complications, insufficient weight loss, or weight regain. Another systematic review [15] has looked into the issues of morbidity, mortality, and results of gastric bypass and sleeve gastrectomy as reoperative procedures after gastric banding. Cheung and colleagues [16] focused on evaluating the efficacy of different reoperative surgical procedures following a failed primary sleeve procedure. Mahawar and colleagues [17] compared the outcomes from both reoperative sleeve gastrectomy and RYGB as primary procedures. Recently, Kuzminov and colleagues [10] conducted a systematic review that addressed short- and long-term complications after reoperative bariatric surgery and the possibility of a tertiary bariatric surgery.

To the best of our knowledge, no study has yet reviewed the literature that is proliferating regarding the reasons for undertaking reoperative bariatric surgery, medical, nutritional, and weight loss outcomes, and the behavioral or psychosocial variables associated with weight outcomes after reoperative bariatric surgery. This work aims to provide a literature review of these aspects.

Methods

The search for published scholarly articles that address reoperative bariatric surgery and similar constructs was conducted by a Ph.D. student, with a Master's degree in psychology, using Psych INFO, Pubmed, and Google Scholar databases, and any combination of the following key terms: revisional bariatric surgery, reoperative bariatric surgery, redo, reoperation, failure bariatric surgery, conversion, failed adjustable gastric banding, and re-sleeve. Reference lists of the obtained articles were also screened for potentially relevant papers. All fully available articles, published in English between 2002 and June 2016 were included in our review. Studies that had been published previously were not selected, as they reported results that have been replicated in recent years.

Results

A total of 2410 studies were identified and screened based on their titles and abstracts to identify 184 (7.63%) studies reporting on the variables of interest for this literature review. Of those, 77 (3.19%) were excluded because they deepened technical surgical/medical issues not addressing the topics focused on this literature or were merely focused on a highly specific and rare surgical technique (e.g., slisatic ring vertical gastroplasty, omega loop gastric bypass), 14 (0.58%) were excluded for not providing original data or statistical data (e.g., reviews, case reports, technical reports, editorials, comments), and 64 (2.66%) published replicate findings from more recent and methodologically sound studies. Twenty-nine (1.2%) published studies were included in this review. Table 1 describes those which were included in this literature review.

Reasons/Indications for Reoperative Bariatric Surgery

Reasons for reoperative surgery are varied in nature and are usually related to the primary surgical procedure [3]. Considering their etiology, reasons for reoperation can be categorized as medical complications related to surgical procedures or/and poor adjustment to lifestyle behaviors. Medical complications include surgical or anatomical problems such as fistula, severe reflux, ulcer disease, strictures, outlet obstruction, eroded gastric rings, and slippage [18]. Additionally, nutritional problems may also result in severe malnutrition and are mostly associated with malabsorptive procedures [19, 20]. Medical complications can also result in poor weight outcomes [21]. As for behavioral and lifestyle adjustment, the post-operative reemergence of maladaptive eating and lifestyle behaviors [39], difficulty in embracing the required lifestyle changes [40], and reappearance of depressive and anxious symptoms have been associated with failure of weight loss or weight regain after primary surgeries [41] (these aspects will be further developed elsewhere in this manuscript). It should be noticed that patients often present multiple reasons for receiving a reoperative surgery. Medical/anatomical factors co-occurring with behavioral problems are

Table 1 Summary of demographic and clinical aspects of studies with reoperative surgeries

Reasons/indications for reoperative bariatric surgery

Authors	Sample size (*N*)	Sex (F/M)	Mean age (years)	Type of reoperation	Type of initial surgery	Type of reoperative surgery
[3]	151	NR	NR	35 (23.2%) Conversional procedures; 109 (72.2%) revisional procedures; 7 (4.6%) reversals	26 (17.2%) VBG; 2 (1.3%) mini-gastric bypasses; 2 (1.3%) non-divided bypasses; 1 (0.7%) distal RYGB; 2 (1.3%) SG; 1 (0.7%) jejunoileal bypass; 1 (0.7%) biliopancreatic diversion; 3 (2%) RYGBP; 4 (2.6%) jejunoileal bypass; 3 (2%) pre-anastomotic rings; 11 (7.3%) pouch trimmings; 16 (10.6%) redo gastrojejunostomies; 5 (3.3%) redo jejunojejunostomies; 36 (23.8%) remnant gastrectomies; 2 (1.3%)	RYGB; SG
[4]	52	40/12	49.5	Conversion and revisional	7 LAGB; 4 VBG, 1 LSG; 40 RYGB	RYGB
[5]	102	NR	42 LAGB to LSG; 47.8 LAGB to RYGB; 55 fundoplication to bypass; 52 other	Conversion	48 LAGB; 29 fundoplication; 25 other	23 LSG; 25 RYGB; 29 bypass; 25 other
[6]	172	160/12	51.8	Conversion and revisional	62 (36%) VBG; 29 (17%) HGP; 18 (10%) open RYGB	RYGB
[8]	154	Group A: 88/18; group B: 38/10	Group A: 49.1; group B: 49.3	Conversion, revisional and reversal	53 RYGB; 45 VBG or HGP; 26 SG; 23 AGB, 2 JIB; 2 mini-gastric bypass; 2 BPD	Group A = 106 patients: 79 (74.5%) bypass; 27 (25.5%) SG. Group B = 48 patients: NR (79.2%) RYGB; NR (6.3%) SG; NR (8.3%) AGB; NR (6.3%) reversal
[11]	27	26|1	40.3	Conversion	12 VBG; 9 gastric banding; 6 GBP	RYGB
[13]	30	23|7	41.1	Conversion	24 AGB; 5 VBG; 1 both	LRYGB
[18]	47	30/17	42.5	Conversion	LAGB	RYGB
[19]	218	83%; 17%	48	Conversion and revisional	Group 1 = 97: NR (66%) gastroplasty; NR (13%) RYGB; NR (13%) loop gastric bypass; group 2 = 95: 57 (NR) VBG; 7 (NR) other gastroplasties; 18 (NR) RYGB 18; group 3 = 26 (NR)	204 RYGB; 13 VBG; 1 JIB reversal
[20]	56	NR	39.6	Conversion and revisional	Group 1 = 22 (56.4%) VBG; 1 (2.6%) HGP; 13 (33.3%) gastric banding; 3 (7.7%) RYGBP; group 2: 15 BPD-RYGBP; group 3: 2 RYGBP.	35 (62.5%) BPD-RYGBP; 3 (5.4%) RYGBP (STD-RYGBP); 3 (5.4%) partial gastrectomy with BPD; 15 (26.7%) BPD
[21]	72	61/11	41 (female)/42.5 (male)	Conversion and revisional	28 banding; 19 VBG; 6 LSG; 3 RYGB 16 biliopancreatic diversion with duodenal switch	RYGB
[22]	5	2|3	38.8	Conversion	RYGB	SG
[23]	100	79/21	NR	NR	16 LAGB, 2 VBG, 19 RYGB, 14 LSG, 4 BPD	NR

Table 1 (continued)

Reasons/indications for reoperative bariatric surgery

Authors	Sample size (*N*)	Sex (F/M)	Mean age (years)	Type of reoperation	Type of initial surgery	Type of reoperative surgery
[24]	37	33/4	50	Revisional	RYGB	RYGB
[25]	*N* = 66: 54 PR; 12 MR	NR	PR: 46.9; MR:47.1	Conversion and revisional	12 NAGB; 57 VBG; 6 HGP; 1 BPD; 7 RYGB; 1 loop GBP	RYGB
[26]	233	NR	NR	Conversion	220 LAGB; 13 SG	RYGB
[27]	95	r-SG: 36/6; r-RYGB: 46/7	r-SG: 35.6; r-RYGB: 39	Revisional	42 SG; 53 RYGB	42 r-SG; 53 r-RYGB
[28]	77	65/12	47	Conversion and revisional	Group 1: 42 band; 10 LSG; 7 R-SG group 2: 5 VBG; 4 LSG; 4 gastric band; 1 gastric plication; 1 LAP-BAND; 1 gastric bypass ring; 1 refashioning of gastrojejunostomy	Group 1: 59 LSG; group 2: 18 RYGBP
[29]	61	53/8	38.5	Revisional	RYGB	RYGB
[30]	55	49/6	43	Conversion	LAGB	RYGB
[31]	47	The female to male ratio was 9:1	47.3	Conversion	16 VBG; 26 RYGBP; 5 both	DS
[32]	66	CG: 42/5; RG: 17/2	CG: 42.3; RG: 42.6	Conversion and revisional	LAGB	CG: 47 RYGB; RG: 19 LAGB
[33]	163	150/13	43	Revisional	LAGB	LAGB
[34]	151	125/26	NR	Conversion and revisional	14 JIB; 39 HGP; 22 VBG; 10 gastric banding; 58 RYGB; 8 loop GBP	82 RYGB; 1 VBG; 56 D-RY; 12 T-RY
[35]	25	25/0	42	Revisional	RYGB	GJ
	11	7|4	46.1	Conversion	RYGB	LAGB
[36]	23	NR	NR	Conversion	VBG	RYGB
[37]	45	30/15	40.3	Conversion	38 LAGB; 7 NAGB	18 LSG; 18 RYGB; 7 BD-DS; 2 BPD
[38]	12	12/0	48.8	Conversion	AGB	LSG

Reasons/indications for reoperative bariatric surgery

Authors	Mean BMI at revision (kg/m^2)	Mean BMI post-revision (kg/m^2)	Medical complications	Inadequate weight loss/weight regain	Complications (%)	% excess weight loss after reoperative bariatric surgery	Mortality (%)
[3]	Range from 18 to 80 kg/m^2	NR	97 (64.2%)	54 (35.8%)	21.9	NR	2%
[4]	42.9	NR	100%	NR	20 (38.5)	NR	0%
[5]	39.7 LAGB to LSG; 40 LAGB to RYGB; 34 fundoplication to bypass; 42.5 other	NR	34%	66%	3 (18%) LAGB to LSG; 4 (20%) LAGB to RYGB; 5 (25%) other revision; 10 (40%) fundoplication to bypass	NR	0%
[6]	47.9	NR	27%	58%	94 (55%)	27%	1%
[8]	Group A: 51.6; group B: 47	Group A: 37.5; group B: 38.9	NR	NR	33 (48.5%) open revision; 121 (24.8%) laparoscopic revision	Group A: 53.7%; group B: 37.6%	1 (3%) open revision; 0 (0%) laparoscopic revision
[11]	42.7	35.9	*n* = 3	*n* = 24	6 (22%)	NR	0%

Table 1 (continued)

Reasons/indications for reoperative bariatric surgery

Authors	Mean BMI at revision (kg/m^2)	Mean BMI post-revision (kg/m^2)	Medical complications	Inadequate weight loss/weight regain	Complications (%)	% excess weight loss after reoperative bariatric surgery	Mortality (%)
[13]	40.0	27.6	*n* = 7	23	*n* = 5	28.5%	*n* = 1
[18]	45.8	37.7	18 (38%)	29 (62%)	8 (17%)	56.5%	0 (0%)
[19]	Group 1: 51 (only reported group 1)	Group 1: 38; group 2: NR; group3: 34	*n* = 121	*n* = 97	54 (52%)	Group 1: 46%; group 2: NR; group3: NR	2 (2.6%)
[20]	Group1: 55.4; group 2: 29.5; group 3: 45.2	*n* = 35	17 (30.4%)	39 (69.6%)	57.1%	68.9%	0%
[21]	37.7 (female); 43.6 (male)	NR	43 (59.7%)	29 (40.3%)	30.55%	NR	0%
[22]	46.6	NR	NR	NR	0%	36.8%	NR
[23]	43	33	*n* = 62	*n* = 55	NR	NR	0%
[24]	46	35.3	NR	NR	27%	46.5	0%
[25]	PR: 45.2; MR: 46.2	NR	48 (57.1%)	50 (59.5%)	PR: 9.3%; MR: 16.7%	PR: 60.6%; MR: 54.3%	0%
[26]	NR	NR	NR	NR	23.5%	58.1%	NR
[27]	r-SG: 38.5; r-RYGB: 43.2	r-SG: 32.3; r-RYGB: 34.7	r-SG: 3 (7.2%) r-RYGB: 2 (3.8%)	r-SG: 39 (92.9%); R-RYGB: 51 (96.2%)	r-SG: 7.1%; r-RYGB: 20.8%	r-SG: 47.4; r-RYGB: 45.6	0%
[28]	40.9	31.9	35 (45.5%)	42 (54.5%)	10.4%	58%	0%
[29]	39.5	29.7	*n* = 6	*n* = 55	14 (23.0%)	60.7%	0%
[30]	47.7	35.6	10 (18.2%)	45 (78.6%)	20 (30.9%)	NR	0%
[31]	47.3	29.2	49 (37%)	22 (46%)	4 (8.5%)	69%	0%
[32]	CG: 44.1; RG: 44.5	NR	CG: 15.8%; RG: 100%	CG: 84.2%; RG: 0%	CG: 10.5%; RG: 4.3%;	CG: 48.2%; RG: 47.4%	NR
[33]	33.7	0 (0%)	163 (100%)	0 (0%)	13.7%	50.55%	0%
[34]	13 JIB: 36 kg/m^2; 63 gastric restrictive (63) (HGP, VBG, GB): 36 kg/m^2; 59 gastric bypass (59); 35 loop RYGB	NR	NR	76%	33 (21.8%)	D-RY: 48%; T-RY: 51%; RYGB: 58.8%	2 (1.3%)
[35]	41.0	44.2	NR	NR	8%	64.1%	0%
	43.4	37.1	0%	100%	*N* = 1	59%	0%
[36]	52.7	28.6	*n* = 10	*n* = 19	1 (4.3%)	73.5	0%
[37]	LSG: 40; RYGB: 41.6; BPD-DS: 46.9; BPD: 37.7	LSG: 31; RYGB: 31.8; LBPD-DS: 30.8; LBPD: 30	35 (77.7)	10 (22.2)	LSG:13.2%; RYGB: 6.6%; BPD-DS and BPD: 11%	LSG:69.7; RYGB: 52; LBPD-DS: 81.85; BPD: 76.9	0%
[38]	37.9	31.0	NR	NR	NR	44.3	NR

BMI body mass index, *RYGB* Roux-en-Y gastric bypass, *VBG* vertical banded gastroplasty, *NAGB* non-adjustable gastric banding, *SG* sleeve gastrectomy, *AGB* adjustable gastric banding, *LAGB* laparoscopic adjustable gastric banding, *HGP* horizontal gastroplasty, *JIB* jejunoileal bypass, *BPD* biliopancreatic diversion, *GJ* gastrojejunostomy, *PR* primary revision, *MR* multiple revision operations, *LSG* laparoscopic sleeve gastrectomy, *r-SG* revisional sleeve gastrectomy, *r-RYGB* revisional Roux-en-Y gastric bypass, *loop GBP* loop gastric bypass, *DS* duodenal switch, *BPD* biliopancreatic diversion, *BPD-DS* biliopancreatic diversion with duodenal switch, *BPD-RYGBP* biliopancreatic diversion with Roux-en-Y gastric bypass, *RG* revision group, *CG* conversion group, *T-RY* transected RYGB, *D-RY* distal RYGB, *NR* not reported

likely to result in weight regain or insufficient/inadequate long-term weight loss [21, 22]. In most cases, unsuccessful initial or sustained weight loss and weight regain are the most frequent reasons for reoperative bariatric surgery [19–21, 23].

Outcomes After Reoperative Bariatric Surgery

Medical Complications After Reoperative Surgery

The mortality rate is estimated to be about 2%, showing higher values when compared to those estimated for primary procedures, which is expected to range between 0.1 and 1.1% [3, 19, 21]. Little is known about short- and long-term medical complications, such as leaks, intra-abdominal hematomas, bowel necrosis, pulmonary embolism, and even death after reoperative procedures. The literature suggests that reoperative surgeries have higher complication rates compared to primary procedures [6, 9, 24–28, 39]. As for laparoscopic revisional surgeries, complication rates range from 0 to 39.3% and rates for conversion surgery from 0 to 47.6% [8, 21, 29].

A low risk of post-operative complications has been reported for revisional procedures of gastric banding. However, this type of procedure results in higher re-reoperation rates [10]. Gastric banding and sleeve gastrectomy present lower complication rates when compared to other types of reoperative procedures [27, 42]. In regard to malabsorptive conversion surgical procedures, complication rates reported in the literature range from 10 to 78.6% [30, 32]. Conversion to RYGB involves greater risk of complications than in patients undergoing a first-time operation [13, 39]. On the other hand, revisional RYGB has been shown to be a safe procedure with post-operative complication rates comparable to the primary RYGB [4, 19, 21, 29, 30]. Keshishian and colleagues [31] indicated that conversion to duodenal switch brings an increased risk of complications. Nevertheless, research is still limited regarding this type of conversion surgery.

In conclusion, complication rates are higher for conversion than for revisional procedures, owing to the fact that they are technically demanding surgeries [32]. Despite the high rates of medical complications associated with reoperative surgeries when compared to primary surgeries, the risk-benefit relationship favors the decision of a second surgery [13]. Nevertheless, it should be noted that the aftermath of short- and long-term complications on post-operative effects has not been extensively explored yet [26, 28].

Weight Loss After Reoperative Bariatric Surgery

Generally, conversion to RYGB after failed adjustable gastric band has superior results in achieving weight loss compared to rebanding or conversion to vertical banded gastroplasty [18, 30, 39]. Some authors sustain that revisional gastric banding does not result in more weight loss but represents a good strategy to maintain long-term weight loss [18, 33]. As expected, malabsorptive procedures as a second surgical procedure are associated with increased weight loss when compared to restrictive procedures [19, 34].

Similarly to primary surgery, a few studies have shown that most of the weight loss occurs within the first 12 months after reoperative bariatric surgery [29, 35, 42]. Nonetheless, the amount of weight loss is generally higher in primary bariatric surgery than in reoperative procedures. Still, it should be noted that reoperative surgeries result in additional weight loss and greater final weight loss [19]. For instance, conversion to gastric bypass presents a mean % excess weight loss (% EWL) ranging from 46 to 70% [19, 33, 34]. Moreover, Gobble and colleagues [40] showed that after LAGB for failed RYGBP, the mean % EWL was 20.8% and the mean total % EWL in both surgeries was 58.8%. On the other hand, Roller and colleagues suggested that patients who undergo multiple procedures tend to lose less weight as the number of procedures increases [39], probably due to the weight loss benefitted from previous surgeries [29].

Nutritional Problems After Reoperative Bariatric Surgery

To the best of our knowledge, no study has compared primary and reoperative surgeries in terms of nutritional deficiencies. However, the risk of nutritional deficiencies has been reported in primary surgeries and it is suggested that they depend not only on the percentage of weight loss but also on the type of surgical procedure performed [19, 43].

Despite the lack of studies about the nutritional deficiencies after the reoperative bariatric surgeries, some studies have shown that nutritional deficiencies in patients undergoing revisional surgeries are similar to those reported in studies on primary bariatric procedures. These surgeries produce significant changes in the gastrointestinal anatomy and physiology, inducing a substantial change in the quantity and quality of diet, which may result in nutritional deficiencies [43]. Increased risk of metabolic/nutritional complications occurs particularly in malabsorptive surgeries (e.g., RYGB, biliopancreatic diversion with a duodenal switch) [43], as these procedures modify the functional anatomy of the gastrointestinal tract and the absorption of nutrients. Research has suggested that approximately 20% of patients submitted to distal RYGB reoperation develop nutritional complications [19], including low levels of vitamin B12, after conversion to RYGB [36], and also after conversion to biliopancreatic diversion with a duodenal switch [37]. The decrease in iron levels [36], as well as protein deficits, after conversion to RYGB have also been reported. Further research is needed to investigate if nutritional complications after reoperative surgeries are similar or increase when compared to primary interventions, particularly considering the expected accentuated weight loss and the more invasive procedures.

Behavioral and Psychosocial Variables in Reoperative Bariatric Surgery

An emerging body of research has shown that behavioral and psychosocial variables are relevant in primary bariatric surgery outcomes. However, information on behaviors or psychological aspects following reoperation is sparse, and there is no data to support their role in weight outcomes following reoperative bariatric surgeries. So far, only Kafri and colleagues [37] have compared the psycho-behavioral outcomes between patients undergoing second and primary bariatric surgery. Patients who underwent reoperation reported more non-normative eating patterns (including binge eating, loss of control eating, and grazing), vomiting, lower rates of physical activity, reduced levels of healthy eating, less weight loss, and a higher level of psychological distress [37]. Findings suggest that these patients do not adopt critical behavioral changes necessary for long-term success [40].

Research has shown that psychological and behavioral factors impact the results of weight loss after primary surgery, which may also be expected after reoperative bariatric surgery. Among behavioral aspects, problematic eating behaviors such as loss of control eating, grazing, night eating syndrome (NES), and emotional eating have been associated with poorer weight loss and weight regain [44]. Some authors suggested that problematic eating may resurface or develop over the long term (usually in the second year of surgery), affecting weight loss outcomes in primary surgery [45]. Since binge eating is physically impossible after stomach reduction, different forms of disordered eating may reemerge (such as grazing or feelings of loss of control) [46]. Increased awareness has been raised regarding grazing behavior due to its association with weight outcomes. Some authors have reported that this type of behavior results in excessive caloric intake, especially in the long term after primary surgeries [47], but no study has investigated its role after revisional procedures. Research also suggested that some patients may develop NES post-operatively which is associated with poor weight outcomes after primary surgeries, but there is no data regarding reoperative surgeries [48]. In addition, some authors have shown an association between pre-operative or post-operative emotional eating and long-term weight loss [49]. Mathus-Vliegen [50] suggested that post-operatively, emotional eating has an impact on weight loss and that weight variation is inversely related to emotional eating after primary surgeries. However, additional studies are still needed in order to understand the impact of emotional eating after a second, usually malabsorptive, surgical intervention. Finally, eating disorders, which are serious psychological conditions, have been described following primary bariatric procedure but there is no data regarding such problems after secondary surgeries [51].

Other psychological aspects such as anxiety [52], depression [53], and impulsivity [54] also seem to have a role in the control over eating and weight outcomes following primary bariatric surgery. Generally, a post-operative decrease in depression and anxiety symptoms is observed [55]. However, anxiety and depression may reoccur, resulting in a greater impact on the course of weight than pre-surgery diagnoses [41]. Similarly, high impulsivity levels also seem to contribute to the reduced success of bariatric surgery [54].

Nutritional and lifestyle compliance is a critical factor in maintaining long-term weight loss [56], and research has shown that poor weight outcomes have been associated with non-compliance with post-operative nutritional requirements [2, 40]. Hence, it is important that healthcare professionals are aware of the psychological variables that may compromise the necessary behavioral modification and compliance with medical prescriptions.

Despite the importance of these aspects, there is at the present no data regarding their role after reoperative bariatric surgeries. Further studies are needed to explore altered eating behaviors in this population, and to better characterize the psycho-behavioral background of reoperative bariatric surgery.

With the purpose of increasing the success rates of reoperation surgeries, a comprehensive pre-operative assessment is crucial [7]. The primary aim should focus on identifying behavioral or psychological aspects associated with failure of primary surgery, as they may compromise further weight loss and therefore should be targeted and treated [7].

The role of the multidisciplinary team is crucial, and enhancing adherence to post-operative dietary protocols and regular follow-up monitoring sessions is necessary to optimize weight outcomes [57]. Additionally, computer and internet-based interventions, or other weight management programs, can serve as complementary tools to provide the patient with an educational component and promote compliance with post-bariatric surgery nutritional requirements [40, 56, 58].

The limitation of this review includes the fact that there is a great heterogeneity of surgical techniques and studies which inconsistently describe the reasons for undergoing reoperative surgery or assess behavioral factors that may influence outcomes.

Reoperative bariatric surgeries comprehend different procedures that vary in indications and outcomes. These reoperative procedures are technically challenging and associated with a higher morbidity and mortality compared to primary procedures, stressing the need for careful patient selection and surgeon expertise. Even so, the possible benefits of reoperation seem to be more significant than the risks for patients. Despite the mixed literature, emerging studies demonstrate that reoperative bariatric procedures are effective for weight loss and improvement in overall health [9]. The etiology of reasons for undergoing a second surgery includes medical (e.g., fistula, ulcer disease) and behavioral aspects. Unsuccessful weight loss and weight

regain are the most common reasons for reoperative bariatric surgery and may stem from medical complications and/or inadequate lifestyle behaviors.

Despite the benefits that reoperation offers, there is a subgroup of bariatric patients that may present additional concerns due to the increased risk of poor weight loss after the second surgery, and the factors that may compromise these outcomes have not been much studied. It is important to note that the weight history of candidates for reoperative surgery should be taken into account, since patients may achieve good results in comorbidity control despite poor weight loss maintenance. Professionals should ponder if such minimal benefits justify the increased risk that can result from this demanding and complex surgery. Particular attention should be paid to the nutritional deficiencies that may require specific recommendations for reoperative surgeries, which are usually more invasive when compared to primary surgeries. Moreover, candidates with a history of difficulties in engaging in healthy eating patterns should be of concern owing to their increased risk of poor weight outcomes. Research into these aspects is timely considering that the post-operative support of patients undergoing reoperative surgeries may require specificities that have been neglected.

Compliance with Ethical Standards

Conflict of Interest The authors declare that there is no conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed Consent Does not apply.

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