Original Article

Bariatric surgery today: the good, the bad, and the ugly

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Background: Metabolic surgery has changed significantly over the last 70 years. While the field has evolved and the long-term data continues to be published, we are beginning to appreciate the full spectrum of the effects of bariatric surgery in addition to weight loss.

Methods: Here we review the literature from the 2015 and 2016 and present our perspective of the good, the bad, and the ugly side of bariatric surgery and how they have contributed to the field over the years.

Results: Weight loss and remission of comorbidities are the reasons for success in bariatric surgery. With a plethora of long-term data being published recently, the extent of benefit that bariatric surgery provides is growing. Contrary to the good, complications from surgery and endoscopic bariatric therapies continue to be detrimental to our patients, but remain the impetus for improvement.

Conclusions: We conclude by briefly touching on the physiologic and psychosocial aspects of bariatric surgery that are driving the future of the field, namely the biochemical changes created by bariatric surgery, predicting the population of patients who will fail their initial intervention, and how revisional surgery has become more commonplace in the long-term.

Keywords: Bariatric surgery; gastric bypass; sleeve gastrectomy (SG); gastric band (GB)

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Introduction

Metabolic surgery has made great strides over the past few decades. With a steady rise in obesity prevalence over the last 20 years, more than one third (36.5%) of US adults are obese today (1). The increase in obesity rates is associated with an increase in co-morbidities and health-care related costs (2). Obesity has become one of the most important public health conditions worldwide.

Treatment of obesity has changed considerably over the past 70 years, with the breakthrough of bariatric surgery. Conservative treatments, which include low-calorie balanced diets, exercise, anorectic drugs, and behavioral therapy, have been largely unsuccessful, particularly in the morbidly obese, with patients not being able to sustain long-term weight loss (3).

From a historic perspective, weight-loss as an effect of surgery was largely based on anecdote, initially seen in patients who underwent gastric resection for ulcer disease in the 1950's, as well as patients with short gut, which often lead to substantial weight loss, as well as rapid amelioration of diabetes (4).

The first surgical procedure intended for weight-loss, was in 1952, when Swedish surgeon, Dr. Henrikson resected 105 cm of small intestine from an obese female, who was unable to complete a weight-loss program (5). This did not catch on due to its irreversibility. In 1953, Dr. Varco, at the University of Minnesota, published about his experience with the first jejuno-ileal bypass (6). This procedure was abandoned due to its electrolyte imbalances, renal failure, cirrhosis, high morbidity and mortality. Next came jejuno-colonic shunts, which in 1963, had the largest series, and initially was meant to be reversible, but when patients began regaining significant weight, this became

optional (7). Results were similar to the jejuno-ileal bypass, and similarly due to the unacceptable rate of complications and mortalities, this procedure was deserted.

While these initial procedures were predominantly malabsorptive, it was the combination of malabsorption and caloric restriction that would drive the field forward. In the late 1960's, Dr. Edward Mason, out of the University of Iowa, developed the first modern gastric bypass procedure with loop gastroenterostomy (8). Dr. Alden and his team would take it one step farther and combine the loop gastric bypass with jejuno-ileal bypass. Some of his early patients developed early postoperative biliary emesis, which prompted the change to a Roux-en-Y gastric bypass (RNYGB) in 1977 (9).

Similarly, in 1970, Scopinaro and colleagues published a series of 18 patients who underwent biliopancreatic diversion, which included a partial gastrectomy anastomosed to a 250 cm roux limb, a biliopancreatic limb, and 50 cm common channel (10). This proved to be very effective in initial weight loss, sustaining weight loss, and reduction in comorbidities. However without very close follow-up, dangerous side effects were identified, including diarrhea, protein malnutrition, anemia, and effects due to vitamin and mineral deficiencies.

In 1998, Hess and Hess modified the biliopancreatic diversion with a duodenal switch, providing a longer common channel, and showing fewer incidences of liver failure, renal failure, and electrolyte abnormalities (11). While some surgeons were looking to improve on the malabsorptive/bypass model of bariatric surgery, others, using anecdotal data about weight loss from gastric resection with Billroth II anastomosis, were improving on this restrictive model.

Dr. Mason developed the vertical banded gastroplasty in 1980, with a 50 mL pouch that was partitioned from the greater curvature with a stapler and the outlet wrapped with a silastic band (12). The operation proved to be less technically challenging, and avoided complications of dumping syndrome and marginal ulceration. Weight gain was not as great as the bypass procedures, and over time when the stapled partition began to breakdown, weight was regained.

Adjustable gastric bands (GB) were born out of a search for caloric restriction without disturbing the continuity of the gastrointestinal tract (13). The adjustable band could provide patients with a varying sized stoma, which could be changed, based on symptoms and was found to have better weight loss compared with non-adjustable bands. Around this time, in the early 1990's, laparoscopy was gaining ground, and this operation became less invasive, reversible, with a reduction in comorbidities, short-term weight loss, but with long-term complications that included band erosion, slippage, and foreign body infection (14).

Sleeve gastrectomy (SG) was developed in the late 1990's as a bridge to a definitive procedure in the super obese (15). It was soon found that short term 1 year weight loss was comparable to the adjustable GB, and this soon became a stand-alone operation, a less technically demanding operation, with far fewer complications.

In 2001, Dr. Rutledge published his experience with the laparoscopic mini-gastric bypass, first developed in 1997, a single anastomosis bypass that was a modification on Dr. Mason's original loop gastroenterostomy (16). A gastric sleeve is anastomosed to a segment of jejunum 200 cm distal to the ligament of Treitz for the purpose of a shorter operating time, while providing ideal weight loss, and easy to modify or reverse for inadequate weight loss, or weight regain.

In 2015, Cottam and colleagues presented a stomach intestinal pylorus sparing surgery, based on the duodenal switch procedure for obesity with a single anastomosis 300 cm retrograde from the ileocecal valve, in combination with fundoplication for the treatment of GERD in obese patients. They have been able to show similar weight loss to RNYGB with fewer 30-day and 18-month complications. In addition they showed that at 18 months patients had 30% greater weight loss compared to SG (17,18).

At this time, the SG is the most common primary bariatric procedure, followed by the RNYGB, and adjustable GB (19).

Methods

Articles published in 2015 and 2016 were analyzed and provide the framework for a review of the current literature pertaining to bariatric surgery presented as the good, the bad, and the ugly.

Results

The good

With the advent of laparoscopic surgery and adoption by the bariatric surgeon, the morbidity and mortality of the available procedures for treatment of obesity dropped to acceptable levels (20). As surgeon experience and supportive

long-term data continues to be published, the future of bariatric surgery appears to be necessary for the treatment of a variety of comorbidities.

Bariatric surgery induces significant weight loss for obese patients, especially in the short-term, which is well published, but long-term data (10 years+) until recently was unknown. In a large, multisite, clinical cohort of 1,787 veterans who underwent RNYGB, patients were found to have lost 28.6% of their baseline weight compared to 7.3% of nonsurgical matches (21). In another retrospective cohort study of 726 patients with 7-year follow-up, they found 22.5% weight loss after RNYGB (22). In the veteran cohort study, they were able to provide 4-year data comparing RNYGB to GS and adjustable GB. At 4 years, RNYGB patients lost 27.5% of their baseline weight, compared to 17.8% for GS and 10.6% for AGB. In general, patients undergoing RNYGB typically experience 60–70% EBWL, which is better than banding procedures, 45–50% EBWL, but less than biliopancreatic diversion with duodenal switch, 70–80% (23).

The link between diabetes remission and bariatric surgery is not a new concept. Numerous observational studies have shown improvement after bariatric surgery in patients with type 2 diabetes, independent of weight gain, and for the majority of patients in the immediate post-operative period. There have been multiple prospective trials involving bariatric surgery in obese poorly controlled diabetics, where remission was defined as normoglycemia, being off oral hypoglycemic medications, and an HBA1c <6–7% (24). For patients who undergo RNYGB, diabetes resolves in 72–93% of patients with approximately another 15% of patients having improvement in their diabetes control at 2-year follow-up (25). Biliopancreatic diversion with duodenal switch has a rate of 85–98%, while SG and GB are 60–80% and 45–60% respectively. In 2012, a randomized and single center trial evaluated 150 patients and found that compared to intensive medical therapy (12%), a larger percentage of patients who underwent RNYGB and SG (42% and 37%) had an HBA1c <6.0% at 1-year follow-up (26). Mingrone and colleagues found at 2-year follow-up that the average HBA1c for their medical-therapy arm was 7.69 versus 6.35 for the RNYGB group and 4.95 for biliopancreatic diversion group (27). A 2016 retrospective study looked at 10-year follow up data and found complete remission of type II diabetes in 52% of patients undergoing RNYGB compared with 0% in the medical therapy. They went on to compare development of microvascular and macrovascular disease in both groups. They showed a significant decrease in the surgery group 11.5% *vs.* 46% for the medical therapy group for microvascular disease development and 5% versus 21% in the macrovascular disease development (28). The recent consensus statement from the 2nd Diabetes Surgery Summit states that there is now sufficient clinical evidence to support surgery among the anti-diabetic interventions for people with type II diabetes and obesity. They go on to add that RNYGB, among the four accepted operations for metabolic surgery, appears to have the most favorable risk-benefit profile for patients with type II diabetes (29).

In a similar fashion to diabetes, hypertension has been extensively studied as it relates to obesity and metabolic surgery. Both systolic and diastolic blood pressures have been shown to have a risk reduction of 45–50% in patients following bariatric surgery. Multiple randomized controlled trials and systematic reviews have shown improvements in postsurgical hypertension. Amongst the studies, hypertension resolved in 50–62% of cases with improvement seen in 63–86%. Biliopancreatic diversion with duodenal switch had the greatest percentage of resolution of hypertension in patients, followed by RNYGB, SG, and GB (25).

Hypertriglyceridemia and hypercholesterolemia follow similar trends to remission of diabetes and hypertension. All studies report improvement and/or resolution of dyslipidemia around the order of 70–80% of patients. The reported means of measurement varied among study, but included reduction in statin medication, changes to cholesterol, triglycerides, low-density lipoproteins, and/or high-density lipoproteins. Similarly to diabetes and hypertension, biliopancreatic diversion offered the highest remission of disease in patients, followed by RNYGB, SG, and GB (25).

With more available literature on long-term follow-up, bariatric surgery has been shown to improve a wide range of comorbidities related to obesity.

Polycystic ovary syndrome (PCOS), which is related to insulin resistance and hyperinsulinism have long been known to be exacerbated by obesity. In a recent 2016 meta-analysis, bariatric surgery was shown to decrease the pre-operative incidence of PCOS quoted as occurring in 45.6% of females to 6.8% at 12-month follow-up across 13 studies with 2,130 patients. Menstrual irregularity, hirsutism, and infertility were all significantly decreased post-operatively. PCOS females achieved similar weight loss and improvement in metabolic comorbidities compared to non-PCOS patients (30).

Fatty liver disease represents a spectrum of disease from

hepatic steatosis to nonalcoholic steatohepatitis (NASH) with potential progression to cirrhosis. A large review of 1,000 patients undergoing bariatric surgery revealed 80% of patients had non-alcoholic fatty liver disease (NAFLD). In a review of multiple retrospective and prospective cohort studies, bariatric surgery and weight loss has shown to improve and reverse the effects of NAFLD and NASH secondary to improvements in insulin resistance and inflammatory state associated with metabolic syndrome (31).

A population based cohort study from Denmark published in 2016 found that over a 15-year follow-up period gastric bypass was associated with a significantly reduced risk and improved prognosis of psoriasis and psoriatic arthritis, whereas gastric banding was not. It is postulated that these findings may be caused by postoperative differences in nutrient intake, as well as differences in secretion of hormones that potentially modulate inflammation (32).

There is a direct correlative relationship between obesity and obstructive sleep apnea (OSA). Increased central adiposity around the pharynx increases collapsibility, through increased mechanical loading and reduced tracheal traction on the pharynx, particularly during sleep. Studies have shown that with sustained weight loss from bariatric surgery, resolution of OSA can be achieved. A recent meta-analysis reported resolution of sleep apnea more often after RNYGB than SG, but the difference was not statistically significant (33).

The risk of cancer has been linked to obesity. Esophageal, pancreatic, colorectal, post-menopausal breast, endometrial, kidney, thyroid, and gallbladder have all been implicated according to SEER data (34). Based on data from 2007, 4 percent (34,000 cases) of cancers in men and 7 percent (50,500 cases) in women were due to obesity. They found that as high as 40 percent of endometrial and esophageal adenocarcinomas were due to obesity. A recent review of the literature from Caixas *et al.* (35) found that bariatric surgery was successful in lowering the risk of cancer and decreasing cancer-related morbidity and mortality in all groups, except colorectal cancer. It seems likely that bariatric surgery could have a protective effect for overall cancer risk; however more research is necessary about specific cancers to make conclusions.

Similarly to the continued rise in obesity among adults, obese children and adolescents represent a substantial population with 1 in 6 American children being classified as obese. Based on a review of the literature weight loss, metabolic and quality of life improvement, reversal of comorbidities like OSA, insulin resistance, diabetes, hypertension, and dyslipidemia appear to be comparable to those seen in adults (36). Complication rates appear to be at an acceptable range and comparable to adults. As with adults, the long-term data continues to be lacking, but the utility of surgery for the treatment of obesity appears to be safe, effective, and reproducible in children and adolescents. Potential adverse effects on growth and development in pre-pubertal patients continue to be a concern for surgeons. In a recent retrospective review of children younger than 14 undergoing laparoscopic SG, children who had surgery experienced significantly higher growth, gaining 0.9 mm more per month on average (37). Compared with their adolescent peers who underwent surgery, they experienced significantly lower prevalence of comorbidities, similar resolution rates of comorbidities, and no difference in complication rate. In one systematic review focusing on the psychosocial outcomes of bariatric surgery, found that regardless of the procedure, patients experienced improvement in quality of life and depression post-operatively (38).

Another direct correlation exists between obesity and the acceleration of development of osteoarthritis through biomechanical and systemic inflammatory mechanisms. In a recent meta-analysis, arthritis resolved significantly more often in patients who underwent RNYGB compared to SG, which may be directly correlated with weight loss (25). There has been interest in bariatric surgery for patients requiring total knee arthroplasty. Interestingly, in a claim-based review of the entire Medicare database, researchers found a greater risk for patients undergoing total knee arthroplasty that had bariatric surgery, compared to obese and non-obese controls. This was postulated to be due to higher incidence of medical comorbidities, wound healing difficulties secondary to GI malabsorption, malnourishment secondary to catabolic state, and rapid weight loss before surgery (39). Alternatively, a national database study comparing 90-day postoperative complication rates found a reduction in the rates of major and minor complications in obese patients who underwent bariatric surgery prior to total knee arthroplasty compared with those that did not undergo bariatric surgery (40). This risk benefit for orthopedic surgery may be in the timing and patient selection.

There are a multitude of comorbidities that are improved with bariatric surgery that are not discussed here but exist in the literature, and as more long-term follow-up data is evaluated and researched, more will be discovered and understood about the harmful effects of obesity and the good behind bariatric surgery.

The bad

Bariatric surgery is not without its complicated dark side. Even in the most technically gifted hands, complications from bariatric surgery exist, and the knowledge and early recognition of these complications can be lifesaving. Laparoscopy, introduced in the 1990's to bariatric surgery, improved mean operative times, operative blood loss, length of intensive care stay, post-operative pain, in-hospital stay, faster recovery, and improved morbidity and mortality rates. For laparoscopic RNYGB 30-day mortality rates are 0.2–1.9%, with risk factors including BMI, male gender, age, and comorbidities (41). The majority of early complications leading to mortality include anastomotic leak with sepsis and pulmonary embolus. Perioperative morbidity rate is 23.6% and includes anastomotic leak, marginal ulceration, hemorrhage, wound infection, DVT/PE, and small bowel obstruction from trocar site hernia, anastomotic site intussusception, or internal hernia. Late complications include those listed under early perioperative complications plus anastomotic dilation or stricture, biliary tract pathology, gastric remnant fistula, weight regain, and metabolic/nutritional complications (42).

Laparoscopic GB placement is a relatively safe procedure with a 30-day mortality rate of 0.05%. Overall median morbidity rate is 11.3% (41). Early perioperative complications include gastric or esophageal perforation, VTE/PE, and wound infections. Open conversion is seen in less than 1% of cases. Cases of early obstruction have been predominantly eliminated due to improvements in technique and the band itself. Late complications were extremely high in early results. In a review of 19,221 laparoscopic GB cases across New York State, rate of revision or removal was as high as 20%, with 17% conversion to RNYGB or SG (43). With the advent of the pars flaccida technique and improvements in the band itself, prolapse rates are less than 5%, erosions fewer than 1%, port related complications in 2–6%, and band removal in response to complication in fewer than 3%.

Biliopancreatic diversion with duodenal switch has a 30-day mortality rate of 0–2.7%. Like RNYGB, early mortality is commonly due to pulmonary embolism, respiratory failure, and anastomotic leaks leading to sepsis (44). Perioperative morbidity is similar to RNYGB and includes anastomotic leak, wound related complications, and VTE. Long-term complications are also similar to RNYGB and include small bowel obstruction, and nutritional/metabolic complications.

Laparoscopic SG in comparison has relatively few complications and a 30-day mortality rate of 0.1%. In comparison to RNYGB, SG has a lower serious morbidity rate, reoperation rate, and wound complication rate. In an article from the German bariatric registry the leak rate has decreased from 6.5% in 2005 to 0.9% in 2013 owing to increased experience and recognition of risk factors for developing leak (45).

Laparoscopic mini-gastric bypass has a reported mortality rate of 0–0.9%. The majority of complications are similar to RNYGB, including postoperative gastrointestinal quality of life. The mini-gastric bypass has a long term complication rate 5.6% of dyspepsia and ulcers and 5% rate of iron-deficiency anemia owing to the single anastomosis (46).

With regard to GERD, multiple studies have found statistically greater resolution of GERD with RNYGB compared to SG. This is no surprise as a common complication of SG is GERD due to the anatomical changes, including decreasing the lower esophageal sphincter resting tone. In a data analysis study that reviewed the Bariatric Outcomes Longitudinal database, it was found that 84% of SG patients had GERD symptoms after their procedure, 9% had worsening GERD, and another 9% developed GERD post-procedure who did not have it pre-operatively (47). In a recent retrospective study, researchers found 100% improvement in GERD symptoms when SG was converted to RNYGB (48). Additionally, several small retrospective studies identified resolution of Barrett's esophagus in the obese patients who underwent gastric bypass, making it the recommended procedure for patients with GERD and Barrett's (49).

Although bariatric surgery in women of childbearing age reduces the risk of pregnancy complications associated with maternal obesity, effects on gestation and fetal development are adversely related. In a population based retrospective cohort study over the course of 33 years, with 10,296 individuals reviewed infants from post-operative mothers had a higher risk of prematurity, NICU admission, SGA status, and low APGAR score. This was further pronounced when the interval from operation to birth was less than 2 years (50).

Endoscopic procedures represent a new paradigm in the treatment of obesity and metabolic disease. Endoscopic therapies represent reversible, repeatable, less invasive, and low cost alternatives to surgery but are fraught with complications themselves that appear to more risk than benefit.

Multiple endoscopic gastroplasty systems have entered the market. They use a variety of full-thickness, partial-thickness plication and stapling technologies to create a gastric sleeve endoscopically without the use of incisions. To date, there is no long-term data, although in the short-term these products seem to reduce BMI with minimal adverse events. These endoscopic therapies are potentially less invasive, reversible, and lower cost, and may act as a bridge to bariatric surgery (51).

The EndoBarrier duodenal-jejunal bypass liner is a 60 cm polymer sleeve that prevents food from contacting the mucosa of the jejunum, while allowing biliopancreatic secretions to move along outside the sleeve. This device is placed endoscopically and verified fluoroscopically. In an open-label trial of 42 patients, 1 year data revealed an average weight loss of 22 kg, although adverse events were as high as 20% and included bleeding, migration, and obstruction (52).

Space occupying devices or gastric balloons displace volume and induce gastric distension, alter GI motility, and nutrient transit. The gastric balloon has found a role as a bridge to bariatric surgery. There are currently 5 balloons on the market in the United States: the Orbera Intragastric Balloon, Heliosphere BAG, Reshape Duo Intragastric Balloon, Obalon Intragastric Ballon and Spatz Intragastric Balloon. Each of these is a slightly different variant of a saline or air filled space occupying device that is used for a limited amount of time, with trial proven weight loss in the short-term. Complications include nausea, vomiting, gastric erosions/ulcers, spontaneous deflation, and rarely gastric peroration (51).

The AspireAssist is a modified percutaneous endoscopic gastrostomy with an external accessory capable of aspirating a portion of ingested caloric intake. A randomized control trial of 18 patients revealed weight loss of 18.6% of total body weight in the AspireAssist group at 1-year (53). Complications include pain at the tube site, infections, and persistent gastrocutaneous fistulas. Long term follow-up and a larger patient sample size will be required to prove durable weight loss efficacy, as well as demonstrate that certain long term physiologic sequelae such as electrolyte imbalance will not result from daily post-prandial gastric aspiration.

The ugly

The ugly side of bariatric surgery has more to do with the psychosocial effects of obesity and failure of bariatric surgery as it relates to nutritional and metabolic improvement. This is categorized as ineffective weight loss, or weight regain, and this unknown aspect of the effects of bariatric surgery is what is driving the field into the next era. Revisional surgery is a hot topic, as well as understanding the changing microbiome, and the behavioral aspects of obesity, like grazing.

More recently, the topic of the intestinal microbiota has been implicated as a key factor in the weight loss and maintenance of weight loss in the bariatric surgery patient. Changes in nutrient absorption after bariatric surgery can have major effects on the intestinal microbiota, which leads to the changes seen in obese patients after bariatric surgery (54). Early studies with mice found different intestinal microbiota in obese mice compared to controls. This was further studied in humans, with similar results when comparing obese individuals to lean controls. This went further with fecal transplantation from obese mice to lean mice causing increased adiposity. Similarly in human fecal transplant from a lean patient to an obese patient showed increased insulin sensitivity after 6 weeks.

Additionally, eating habits, exercise, intestinal hormones, bile acids, and mood and affect may also play key roles in the makeup of our intestinal microbiota and how it relates to obesity and weight loss. The current data on microbiota of patients who have undergone bariatric surgery is relatively limited. There is still a plethora of research required to substantiate these claims, and understand how the micro biome truly affects the bariatric surgical patients. Can the composition of intestinal microbiota in a pre-surgery candidate predict their ability to lose weight and maintain that weight loss? For patients who regain their weight, are there novel approaches through the microbiome to increase efficacy of the bariatric procedure? These questions are important for future research and potential success of bariatric surgery.

One of the technical unknowns in bariatric surgery is standardization of limb length in RNYGB. Lack of standardization poses problems of interpretation and comparison of the scientific literature. Even when deciding between various lengths of alimentary limbs or biliopancreatic limbs in the malabsorptive procedures, measuring length intra-operatively becomes operator dependent, and may vary significantly between operators. Further, recent data shows that limb length did not make a huge contribution to weight loss when compared among different lengths, and that weight loss was achieved with small bowel bypass length as little as 100–200 cm from

the ligament of Treitz (55). This is in contrast to the SIPS procedure, which measures a common channel that is 300 cm retrograde from the ileocecal valve, which does not take into account the bypassed segment. To date there are no objective measures of small intestinal length, the closest being a patent for a device that runs the bowel between clamps, which houses a rotary distance measuring system as the small bowel is moves through the clamps (56).

While bariatric surgery does provide an effective treatment for morbidly obese patients, long-term follow-up data does show that a portion of patients do re-gain weight post-operatively. Studies have been able to identify multifactorial influences ranging from metabolic alterations, anatomic failures, mental health issues, nutritional non-compliance, and physical inactivity (57). The percentage of revisional surgery increases yearly accounting for 13.6% of cases in 2015, the third most common procedure that year (19). Currently RNYGB appears to be the revisional procedure of choice for patients who have failed GB and SG. According to one systematic review from 2016, several procedures have had successful weight loss following revision for failed gastric bypass, including placement of an adjustable GB, distal RNYGB, and revision to biliopancreatic diversion with duodenal switch (58).

To date there are no guidelines or recommendations for the type of revisional procedure. Bariatricians need to take a systematic patient specific approach based on the procedure-specific failure. As the number of patients who return long-term with weight plateau or regain, revisional bariatric surgery has become more commonplace.

Psychiatric disorders in bariatric surgical candidates are gaining more attention as long-term data is being published. Upwards of 40% of all bariatric surgery patients have at least one psychiatric disorder, with depressive disorders, anxiety disorders, and eating disorder making up for the majority of diagnoses (59). Identification of these disorders improves perioperative managements and is a predictor of weight loss after bariatric surgery. Mood disorders, and the presence of 2 or more psychiatric disorders is directly related to weight loss cessation and weight regain at the 1 year mark. Binge-eating disorders are also adversely related to predicted weight loss following bariatric surgery.

Substance use disorder like alcohol abuse is another ugly feature of post-operative bariatric surgery. Candidates have a greater lifetime risk of alcohol use disorders and a greater propensity to alcohol intoxication after bariatric surgery. Based on accelerated alcohol absorption, higher maximum alcohol concentrations in the body, and longer elimination times after gastric bypass, alcohol use disorder is a contraindication to bariatric surgery (60,61).

Suicide attempts and risk of completed suicide among bariatric surgery patients is also a major concern. Bariatric surgery patients have higher suicide attempt rates preoperatively. In a 10-year follow-up study, bariatric surgery patients as a group had excessive suicides compared with their age and sex-matched counterparts. A later meta-analysis provided evidence that the suicide rate was lower after surgery, but highlights the fact that suicide risk remains high and warrants long-term supervision (62). While psychiatric disorders are a marker for worse post-operative outcomes in terms of weight loss compared to their bariatric surgery peers without psychiatric disorders, with appropriate post-operative follow up with pharmacotherapy and psychotherapy, surgical outcomes and psychiatric disorders are improved in the long-term (59).Additionally, obesity is independently associated with cognitive impairment and an increased risk of dementia. Bariatric surgery is effective in combating obesity and there are some findings that suggest it improves cognitive function and reduces the risk of Alzheimer's disease, although further research is required to substantiate these early findings (63).

Behavioral failures can often been frustrating for the surgeon. Grazing has been implicated as a direct cause of failure of bariatric surgery. In one single detection analysis study, 274 post-gastric bypass patients were evaluated based on 5 pre- and post-surgical behavioral variables. Overwhelmingly, 93% of patients had successful weight loss who reported adherence to the bariatric diet and grazed no more than once per day (defined as nibbling, snacking, or eating small amounts of food in an unplanned and repetitious way over an extended period of time) (64). In a self-reporting survey study of 497 post laparoscopic or open RNYGB patients, frequency of binge eating, a loss of control of eating, and grazing were all significantly correlated with greater weight regain and led to poorer health-related quality of life (65).

Conclusions

The field of bariatric surgery has made great strides in the past 70 years. As more long-term data is published and as technique, morbidity, and mortality improve with experience, we can provide our patients with better health and quality of life. The future lies in understanding the physiologic changes that happen as a result of these malabsorptive and restrictive

procedures and tease out those patients who have a risk for metabolic or psychosocial failure and provide them options for success. While bariatric surgery may have its good, bad, and ugly, the data is clear about its utility to treat the effects of obesity and related comorbidities.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037//ales.2017.02.26). The authors have no conflicts of interest to declare.

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