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Concept

The Duodenal Switch as an Increasing and Highly Effective Operation for Morbid Obesity

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Introduction

"Morbid Obesity" (ICD 278.01 / BMI >40) is an entity distinct from "obesity", the latter term encompassing the broad range of overweight. Available treatment modalities as well as outcomes differ substantially over the spectrum of higher BMI. Representative data for behavior modification, diet and exercise show at best an average weight loss of 4-7 kg at 2 years, with decreasing benefit in the longer term.[1-3]

The reported maximum of 7 kg is hardly significant for a morbidly obese individual who might be carrying an excess weight 45-75 kg or more. Those morbidly obese patients who do respond to non-surgical weight loss programs, generally fail to maintain the weight loss, with recidivism rates exceeding 95%.[4] Behavior modification, diet and exercise have been found to be ineffective on an intermediate and long-term basis for treatment of obesity, particularly morbid obesity. Regain of the lost weight is the rule, and more than the initial weight lost is commonly regained.[5,6]

Surgery is the only modality proven to be effective in the treatment of morbid obesity;[7] however, surgical treatment entails known finite risks influenced by clinical factors. To achieve a beneficial net reduction in morbidity and mortality, the risks from the excess weight must exceed the risks of surgery and anesthesia. It is interesting to note that published series show significant increases in the relative risk associated with obesity at a BMI of 27 kg/m^2, and exponential increases at a BMI of 32 kg/m^2 (the highest bracket reported)[8,9] – well below the 35 to 40 kg/m^2 often considered minimum for surgical intervention.

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Categorization of Bariatric Operations

1. Purely Malabsorptive Procedures

The most well-known and widely used purely malabsorptive procedure, jejuno-ileal bypass, involved bypassing all but 45 cm of small bowel.[10] It was associated with a mortality up to 8% from hepatic and renal failure, and has largely been abandoned.[11-14]

2. Purely Restrictive Operations

Laparoscopic adjustable gastric banding[15] and vertical banded gastroplasty[16] are purely restrictive procedures. As originally developed, the Roux-en-Y gastric bypass (RYGBP) is also primarily restrictive,[17] as weight loss results from constructing a very small (15-30 cc) proximal gastric pouch to limit the capacity of oral intake.[18] RYGBPs reliance on restriction alone has yielded inadequate long-term maintenance of weight loss in many surgeons' experience. Accordingly, surgeons who offer RYGBP operations have more recently included variable amounts of small-bowel bypass, and revi-

sionary surgery for RYGBP failure may include lengthening of the bypassed limb.[19-21] The latter procedures may be termed "distal" Roux-en-Y gastric bypass (DRYGBP).

3. Hybrid Procedures

Three commonly performed operations which incorporate both restriction and malabsorption may be classified as "hybrid": Distal Roux-en-y gastric bypass (DRYGBP), biliopancreatic diversion (BPD), and duodenal switch (DS).

- DRYGBP is constructed similar to RYGBP, with a shorter common limb and extended length of bypassed small bowel.
- BPD was developed in the 1970s by Nicola Scopinaro of Genoa, Italy.[22] Specific lengths of bypassed small bowel differ between BPD and DRYGBP. In BPD, the unused distal portion of the stomach is resected, whereas in the DRYGBP the distal stomach is stapled off but left in the abdomen. Food ingested traverses a similar route in DRYGBP and BPD.
- The operation known as duodenal switch (DS) was developed in 1988 by Doug Hess of Bowling Green, Ohio,[23] and was first published by Marceau et al[24] in 1993. Hess incorporated three main components into the DS: 1) Vertical gastrectomy with excision of the greater curvature significantly reduces gastric volume and thus provides *restriction*. 2) Division of the duodenum between the pyloric valve and the sphincter of Oddi allows for a normally functioning but smaller capacity stomach. Food empties into the small intestine under control of normal pyloric innervation and relaxation. 3) Bypass of proximal small bowel produces *malabsorption* and was derived after experience with the BPD. The first laparoscopic technique for performing DS was developed in 1999 in the authors' facility in San Francisco.[25]

Terminology has unfortunately not helped to clarify the anatomical or functional distinctions among DRYGBP, BPD and DS. Intake restriction is present in all three operations, based on the reduction in gastric volume, with BPD having the largest residual capacity (240 cc) and DRYGBP the smallest (15-30 cc). DS capacity is intermediate at approximately 120 cc. All three procedures use the Roux-en-Y construction to merge biliopancreatic outflow with the food stream. The quality of malabsorption differs among the procedures based on differing lengths of the various Roux limbs. Most important, only the DS preserves the pylorus and thereby affords normal gastric functioning. The DS does not rely on and is free of dumping, excess gastritis, and marginal ulceration with its frequently associated microscopic bleeding and secondary anemia.

Efficacy of DS for Morbid Obesity

Studies of RYGBP report an average excess weight loss in the 65% to 80% range.[26-29] However, RYGBP is not standardized among facilities, and configuration can differ even among surgeons at the same facility. Constructed via laparotomy or laparoscopy, the size and configuration of the RYGBP gastric pouch can vary significantly; small intestinal limb lengths and limb positioning also may differ. Technical variations include a prosthetic ring made of silicone rubber, polypropylene or Gore-tex® added to the underlying RYGBP structure.[30] Long-term outcomes of RYGBP differ widely because of these variations, confounding an accurate "apples to apples" comparison. Significant weight regain after RYGBP in some series can occur within 3 to 5 years.[31] Nonetheless, RYGBP offers significant resolution of co-morbidities, including non-insulin-dependent diabetes mellitus, hypertension, and sleep apnea.[32]

In contrast, performance of the DS is more uniform among DS surgeons. The authors' published series employing the laparoscopic D/S (LapDS) demonstrated an average of 91% excess weight loss at 2 years.[25] Published 10-year data with 93% follow-up demonstrate sustained average loss of 76% of excess weight.[33] This applies as well to the super-obese (BMI >50), while the RYGBP is documented to be less effective initially and longer term at that level. Multiple reports from others utilizing either conventional laparotomy or a laparoscopic approach to DS have confirmed Hess' long-term weight loss data,[34-37] although weight regain after 10 years is reported to be most pronounced in the super-obese.[38] Both short-term and long-term weight loss following DS exceeds that of any other operation,

with documented benefit for the metabolic syndrome,[39] pregnancy[40] and proportionate resolution of co-morbidities comparable to the RYGBP.

Increase in Surgeons Performing DS

DS usage continues to expand, based on patient demand and growing awareness of the advantages of established hybrid procedures. Currently RYGBP is the most widely used bariatric operation in the U.S.A.; however, the number of centers offering the DS is growing rapidly. The ASBS 2002 Membership Roster listed approximately 50 surgeons who offer the DS. The ASBS 2003 Membership Roster listed 104 surgeons offering the DS. Most bariatric surgeons already have substantial experience with RYGBP before beginning to perform DS, and the fact that the already large number of ASBS members offering DS doubled last year reflects widening recognition and acceptance of the superior weight loss and decreased morbidity of DS.

Increased Morbidity of RYGBP Compared with DS

In contrast to RYGBP and BPD, DS does not cause dumping. The DS anatomy is not associated with excess gastritis and marginal ulceration, and allows for a much more normal eating pattern, both with respect to quantity and variety of food choices. The RYGBP construction resembles the classical Mann-Williamson preparation used to study peptic ulcers in the laboratory. Because of the fragile mucosa at the gastrojejunostomy, gastric irritants such as aspirin and non-steroidal anti-inflammatory drugs (NSAIDs) are contraindicated in RYGBP and BPD. In contrast, DS patients have available a full range of food and medication choices.

Finally, RYGBP construction makes the large bypassed distal stomach inaccessible to standard non-invasive diagnostic modalities. Neither x-ray contrast studies nor endoscopy can assess this potentially important but hidden area.

Open Laparotomy vs Laparoscopy

Long conventional abdominal incisions have been superseded in many centers by small incisions, made possible by technical advances in video equipment and surgical instrumentation.[41,42] Patient preference for laparoscopic approaches is based on consistently decreased perioperative discomfort, shortened hospital stay and smaller scars. An important principle of laparoscopic surgery in that the procedure performed within the abdomen should remain identical whether conventional laparotomy or laparoscopy is used. A principle enunciated at the time that laparoscopy was adapted to Nissen fundoplication – that only the access route will differ – has remained a guiding tenet. Other than measures specific to the wound, intermediate and long-term indicators should be the same when comparing laparoscopic with open laparotomy groups. In the author's facility, OpenDS and LapDS technique are consistent with this tenet, using identical suture material, staplers, and volume and length measurements regardless of whether long midline or laparoscopic incisions are employed.[25]

Additional Comments

Common Limb Length in Roux-en-Y Gastric Bypass vs Hybrid Operations

For traditional versions of RYGBP, which is sometimes labeled "short-limb" or "proximal" RYGBP, the common limb is not measured whether the approach is via open laparotomy or laparoscopy. Based primarily on technical factors related to the mobility of the jejunal mesentery, a point within 100 cm of the ligament of Treitz is selected for dividing the small bowel when performing RYGBP. To create the enteric limb, the proximal cut end is anastomosed 40 to 80 cm distal to the point of transection. Because the common limb is not measured in RYGBP, there is no accepted standard for common limb length. In DRYGBP, the short common limb is calibrated to provide substantial malabsorption which assists long-term maintenance of weight loss.

Relationship of DS to BPD and RYGBP

DS was developed based on experience gained with the BPD. Nonetheless, the DS is not simply a variant of BPD. The distal RYGBP, a modification of RYGBP, is much closer to BPD in construction and in mechanism of weight loss. Serious side-effects accompanying RYGBP, DRYGBP and BPD include dumping and gastritis. These side-effects are not associated with DS.

DS is the Sole Clearly Established Alternative to RYGBP in Many Settings

Patients who have failed RYGBP or DRYGBP because of inadequate weight loss are candidates for takedown of the initial procedure and conversion to DS. Patients who have failed RYGBP or DRYGBP because of severe dumping also can be salvaged in this fashion. Patients who might anticipate long-term anticoagulation, or take aspirin, NSAIDs or other locally corrosive oral medication should not undergo DRYGBP-type procedures (including BPD) because of potential life-threatening complications of gastritis.

Conclusion

Increasing Acceptance and Prevalence

DS has been performed for >15 years and is increasing rapidly. Laparoscopic technique developed for performing DS has been used in >750 LapDS patients since 1999 in our center and is available in multiple centers worldwide having sufficient resources and experience. The number of surgeons offering DS as listed in the ASBS roster doubled between the 2002 and 2003 edition. Among the >100 ASBS members listed as offering DS, more than 10,000 patients are known to have had DS surgery.[43] Many U.S. insurance carriers approve reimbursement for DS, although in response to the increasing utilization of DS, some companies have *retroactively* labeled DS as "investigational" in order to restrict access, and now claim "randomized, double-blind" studies are needed to compare DS with RYGBP, without regard to evidence in the literature, to community practice, to patient preference or to medical ethics.[44]

Construction and Mechanism of Weight Loss

DS provides a normally functioning stomach and is not associated with dumping or excess gastritis. The long-term efficacy of DS exceeds that of other accepted procedures, and the morbidity is lower. In a significant number of surgical practices, DS is the procedure of choice for all bariatric patients. DS is generally acknowledged as superior to RYGBP for the super-obese patient (BMI >50), and for salvage in patients who have had a prior failed VBG / gastric band / RYGBP / DRYGBP due to lack of adequate weight loss or significant weight regain, and particularly for patients who require aspirin, NSAIDS, or chronic anticoagulation.

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