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Consensus survey on mini-gastric bypass and one-anastomosis gastric bypass

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Abstract

Introduction: An online questionnaire was filled out by pre-registered experienced attendees prior to the Annual *Mini-Gastric Bypass (MGB) – One-Anastomosis Gastric Bypass (OAGB)* Conference held at Naples, Italy, July 2017.

Methods: Data on the MGB and OAGB were compiled and analyzed, and the sequelae were tabulated. World literature was also reviewed.

Results: The reports of the 139 respondents indicated that the MGB and OAGB are favorable operations with respect to safety, resolution of co-morbidities (especially diabetes), short learning curve, and durable weight loss. We derived some guidelines from these results.

Conclusion: MGB and OAGB are favorable bariatric operations, but follow-up is required.

Keywords: Mini-Gastric bypass; One-Anastomosis gastric bypass; Morbid obesity; Bariatric surgery; Consensus survey; Post-Operative complications; Results on obesity-related co-morbidities; MGB-OAGB guidelines

Introduction

Mini-gastric Bypass (MGB or Malabsorptive Gastric Bypass) was devised by Rutledge in the USA in 1997. As a trauma surgeon, he was faced with an abdominal gun-shot wound, where duodenal exclusion with a Billroth II anastomosis was an appropriate reconstruction. This was the inspiration for the MGB, constructing a *long* lesser curvature channel which inhibits Gastro-Esophageal Reflux (GER) [1] (Figure 1).

Because of suspected GER, in 2002 a variant of the MGB, named One-Anastomosis Gastric Bypass (OAGB) or BAGUA (Bypass Gastrico de Una Anastomosis) originated in Spain by Carbajo and Garcia-Caballero [2] (Figure 2). Previously, they had performed the Roux-en-Y gastric bypass operation (RYGB) for >10 years.

The MGB and OAGB have been increasing throughout the world [3-9], and in 2015 became the third most common bariatric operation internationally [10].

Methods

Annual conferences on MGB and OAGB had been held in Paris, India, Montreal, Vienna and London, where the MGB-OAGB Club was formed [11].

A carefully designed questionnaire was posted on the Club website and also emailed to surgeons who had performed MGB

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or OAGB, and who had pre-registered for the MGB-OAGB Club Conference in Naples in 2017. A total of 139 surgeons from 31 countries who had performed 100 or more MGBs or OAGBs for one or more years were elgible and completed the survey. These surgeons kept accurate records, because the MGB-OAGB had met with some prejudice in early years. The survey compared the results of 37, O94 MGBs and the 9,203 OAGBs performed by the participants, which is the biggest report to date.

Of the 139 respondents, 128 had been performing the MGB or OAGB as their principal bariatric operation: 17 (12%) of respondents had performed >1,000 MGB-OAGB operations, 15 (11%) had performed 500–1000, and 107 (77%) had done 100–499 MGB-OAGBs. Data is reported as frequency, percentage, mean and standard deviation of valid responses. A p-value <0.05 using unpaired t-test was considered significant.

Figures

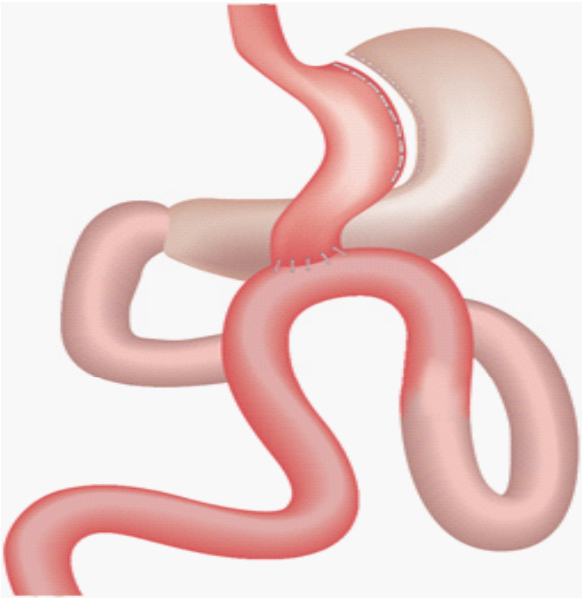

Figure 1: MGB created by horizontal division 2-3 cm *distal* to crow's foot, and then vertical stapler-division upwards (~18 cm), dividing to the left of the angle of His. A wide antecolic gastro-jejunostomy (GJ) is performed ~200 cm (varied with BMI) distal to Treitz' ligament, providing malabsorption.

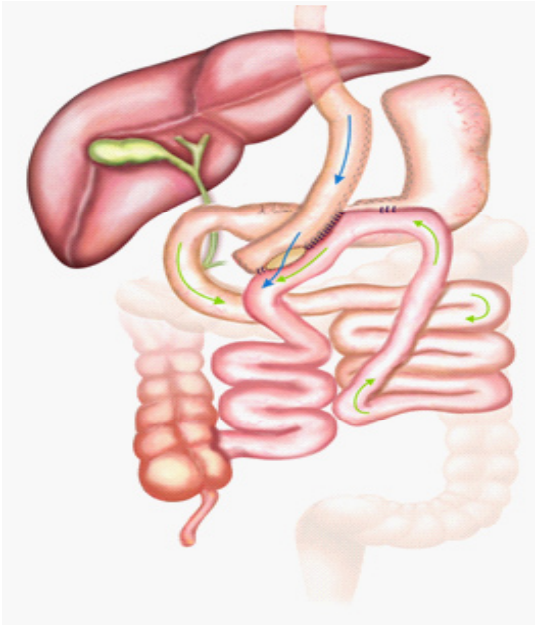

Figure 2: OAGB with a 15-18 cm gastric pouch and a 2.5 cm latero-lateral anastomosis between pouch and afferent jejunal loop which is suspended above the anastomosis by an initial continuous suture which secures the loop to the gastric pouch's staple-line, with final fixation of the loop's apex to the bypassed stomach. Biliopancreatic limb averages 250-350 cm (diagram by Dr. Arturo Valdes Alvarez of Saltillo, Mexico).

Results

In the reported 37,094 MGBs and 9,203 OAGBs, the mean pre-operative BMI was 45.2 kg/m^2 and 44.3 kg/m^{2}respectively, and the mean age was 43.5 and 44.2. Mean 30-day mortality rate was 0.03% and 0.01% in MGB and OAGB respectively. The leak rate in MGB and OAGB was 0.4 and 0.34% respectively. The survey data are shown in Table 1.

Post-operative changes are shown in Table 2, and found similar results between the two operations. At 5 years, 85.1% of patients who had undergone MGB had >50% Excess Weight Loss (EWL) using Metropolitan Life statistics [12]. At 5 years, 87.4% of patients who had undergone OAGB had >50% EWL.

Effect of gastric pouch length, diameter of Gastro-jejunostomy and bypass length on various parameters in MGB and OAGB

Of the 139 respondents, 91% reported that they begin the gastric pouch below the crow's foot, 6% at the crow's foot and 3% above the crow's foot. Of the 920 (0.02%) MGB revisions reported for intractable bile GE Reflux (GER), most were patients with a short pouch (starting at or above crow's foot). With the OAGB, surgeons reported no revisions for GER.

The gastric pouch was constructed loosely around a 32-42Fr bougie by 66%, but 19% constructed a tight pouch against the bougie (as in laparoscopic sleeve gastrectomy – LSG), and 12% a wide pouch (1-2 cm away from the bougie).

Regarding biliopancreatic limb-length (ie. bypass length), 53% chose 150-200 cm, 31% chose 201-250 cm, 10% chose 251-275 cm (mainly the OAGB surgeons), and 6% chose a tailored length depending on the BMI. At 1 year, in patients with >200 cm afferent limb, mean %EWL was 81.4%, and in patients with <200 cm afferent limb, %EWL was 77.5%. At 5 years, with either afferent limb lengths, EWL was similar: 75.2% in patients with the longer limb (>200 cm) and 74.0% in patients with the shorter limb.

For the MGB, the intended diameter of the Gastro-Jejunostomy (GJ) was 6 cm for 18%, 4-5 cm for 47%, and 3-4 cm for 35% of the respondents (Table 3). The OAGB surgeons reported an anastomotic diameter of 2.5-3cm.

In patients with pre-existing Hiatus Hernia (HH) and GERD, 72% of MGBs were performed without repairing the HH, because of data showing that MGB improves GE reflux [13,14]. However, with a significant HH and reflux, 18% recommended HH repair or RYGB at the time of MGB. Most OAGB surgeons repaired a HH if present.

Discussion

The MGB has two components: 1) a lesser-curvature *long* gastric pouch, serving as a slightly restrictive conduit, allowing adequate oral intake; 2) a180-200 cm jejunal bypass with a wide ante colic GJ anastomosis, which results in carbohydrate and

fat malabsorption [13]. A32-42 (mean 38) Fr bougie was passed by the anesthesiologist, and the stomach was stapler-divided cephalad, going ~1cm lateral to the angle of His; the cardia and left crus are not dissected, unlike in the LSG. Thus, in the MGB, a low-pressure gastric conduit is constructed [14], unlike the high-pressure conduit of the LSG [15].

In super-obese patients, 250 cm of proximal jejunum may be bypassed. In lower BMI with co-morbidities such as diabetes, 150 cm may be bypassed [13,16,17]. At the selected site, the tip or adjacent posterior wall of the gastric pouch is anastomosed ante colic to the jejunum, constructing a wide anastomosis under easy view. The GJ anastomosis should be at least 300 cm proximal to the ileocecal valve, to avoid protein malnutrition.

As stated, a HH was generally not repaired at the time of MGB. If needed (which was infrequent), HH repair was performed 12-18 months postoperatively [18]. However, for large HHs with adherence to gastric fundus, dissection and repair were performed at the time of MGB.

Patients avoid carbohydrate which could produce rapid dumping; thus, the food intake has mainly malabsorption of fat. The pouch in the MGB develops minimal dilatation, because there is no gastric outlet narrowing [14].

If ever necessary, the MGB can be modified by moving the GJ anastomosis distally or proximally [19]. The MGB can be easily reversed in rare cases of intractable hypoalbuminemia or excess weight loss by stapler-division along the GJ anastomosis (carefully inspecting the jejunal side), linear anastomosis of the gastric pouch to the matched bypassed stomach, and closing the defect at the bottom of the gastric pouch with running suture [18].

The OAGB variant of the MGB has a similar malabsorptive component [2,9]. In the OAGB, a side-to-side anastomosis of the afferent limb to the gastric pouch (rising on the remnant stomach), facilitates emptying of biliopancreatic juices toward the efferent limb, preventing GER. In >2,000 patients, Carbajo has not needed to revise any OAGB for reflux, as in our study.

The MGB, with the *long* gastric conduit, was found in our study to have a GER problem in 0.07%; if GER occurs, the patient should be questioned about smoking and taking non-steroidal-antiinflammatory drugs (which are prohibited), eating late at night, and lots of fried foods. It may be treated conservatively, or by Braun jejuno-jejunostomy or RYGB. The OAGB took slightly longer to perform (and is slightly more difficult to reverse) than the MGB. The OAGB represented 19.9% of the single anastomosis gastric bypasses in our study.

The rare leaks in our survey were usually at the GJ, and were far less than the troublesome proximal leaks following LSG [20]. Patients were usually ambulatory a few hours after surgery.

In USA, Hargroder had no operative deaths (i.e. within 30 days) in 1,450 patients over 13 years of MGB, and Peraglie had no operative deaths out of 1,800 MGBs over 13 years [21]. Furthermore, Peraglie found no deaths in his super-obese patients [22] and those age >60 [23].

GER resolved in the majority (>70%) after MGB (Table 2), explained by the decrease in gastro-esophageal pressure gradient after MGB [14].

It was noted after MGB-OAGB (as after RYGB) that alcohol is absorbed intestinally fairly rapidly. If persisting dyspepsia occurs post-operatively, *H. pylori* (HP) or pouch kinking should be ruled out. HP stool antigen or breath test was often checked pre-operatively and eradicated if positive. If there is indigestion or marginal ulcer, a proton pump inhibitor was prescribed (sometimes routinely).

After MGB-OAGB, supplements consisted of multi-vitamins, calcium (dairy or calcium citrate), yoghurt, vitamin D_3 1,000 IU 2-3 times daily, sublingual crystalline B_{12}, and an intestinally-absorbed iron supplement (Proferrin®–heme intestinal peptides). In 5% of menstruating women, iron deficiency was reported and required increased oral iron or rarely IM or IV iron [24].

Fruits and salads are well tolerated. Foods containing protein were important, eg. meats, seafood, nuts and dairy. No intractable hypoglycemia was reported. Fried and fatty foods caused cramps and diarrhea (steatorrhea) and are avoided. Vegetarians must take protein –legumes (lentils, beans, chick peas, peanuts, quinoa), yoghurt, milk, soy (tofu) or whey protein. In vegetarians and the elderly, it was advisable to bypass <200 cm of jejunum to avoid hypoalbuminemia [17].

After RYGB, lap-band or LSG, carcinoma in the stomach and lower esophagus has been reported in 46 patients [25-27]. After LSG, Barrett's esophagus is frequent [28]. After MGB or OAGB, no carcinoma in the gastric pouch or esophagus has been reported. However, in the Far East (Taiwan) where the incidence of gastric carcinoma remains high, one carcinoma 9 years after MGB has been reported in the bypassed stomach (but not in the pouch) [29].

After LSG [20,30] and RYGB [31], significant weight regain has been found in the long-term. Comparative studies have documented more durable weight loss after the MGB [32-34]. Better quality of life has been found after MGB [35]. Diabetes, hypertension and lipid abnormalities have shown superior remission after MGB and OAGB [36,37]. Diabetes resolved in 79-94% after MGB [17,38-40]. Likewise, after OAGB, resolution of type 2 diabetes and other co-morbidities were found [41,42], including in the massively obese adolescent [43]. In diabetic patients with BMI <35, Kular found that HbA1c at 7 years after MGB was 5.7 ±1.8% [44].

Tables

Table 1: Survey data on MGB and OAGB.

	MGB	OAGB
Mean pre-op BMI (kg/m^2)	45.2	44.3
Mean operative time (mins.)	80.2	91.7*
Minimum O.R. time (mins.)	30.0	35.0
Mean bypass length (cm)	175	275*
Mean hospital stay (days)	2.6	2.2
Minimum stay (days)	1.0	1.0
Leaks	0.4%	0.34%
30-day mortality	0.03%	0.01%
Mean %EWL 1 yr	73.8	83.6
Mean %EWL 5 yr	72.9	79
Mean %EWL 10 yr	67.1	67.5

Total: 37,094 MGBs; 9,203 OAGBs.
%EWL = % Excess Weight Loss.
*p<0.05

Table 2: Post-operative changes reported after MGB and OAGB.

	MGB	OAGB[++]
Mean 1 yr post-op T2D resolution	85.9%	91.5%
Mean 5 yr T2D resolution	79.8%	90.1%
Resolution of sleep apnea – 1 yr	87.0%	95.4%
Resolution of sleep apnea – 5 yr	86.7%	93.2%
Resolution of hypertension – 1 yr	76.8%	80.6%
Resolution of hypertension – 5 yr	69.0%	78.6%
Resolved elevated cholesterol– 1 yr	82.1%	90.6%
Resolved elevated cholesterol– 5 yr	73.0%	84.9%
Mean pre-op GER	21.2%	22.0%
Mean post-op GER	0.07%	0%
Post-op nausea, vomiting & dyspepsia	8.0%	7.6%
Marginal ulcer	1.7%	1.4%
Diarrhea (>4 BMs / day)	2.3%±5.2	2.6%±4.4
Anemia	4.7%	6.3%
Severe anemia (<8 gm/dl)	1.1%±3.1	2.1%±2.2
Major low serum albumin	0.4%	0.8%
Major nutritional complications requiring hospitalization	0.6%	1.2%
No. of post-op internal hernias	8 (0.02%)	3 (0.03%)
Revisions+	334 (0.9%)	126 (1.4%)

Total: 37,094 MGBs and 9,203 OAGBs.
T2D: Type 2 Diabetes.
[+]After MGB, revisions included 150 patients for EWL and 80 patients for inadequate wt loss.
After OAGB, revisions included 82 patients for EWL and 19 patients for inadequate wt loss.
[++]No differences statistically between MGB and OAGB.

Table 3: Relationship between stated diameters used for Gastro-Jejunostomy (GJ) and %EWL at 1 and 5 years after the MGB.

% EWL	GJ Diameter	
	3-4 cm	4-6 cm
at 1 year	79.8 %EWL	74.1 %EWL
at 5 years	74.2 %EWL	72.0 %EWL

Conclusion

The survey has indicated that MGB and OAGB are rapid, and technically simple and relatively safe bariatric operations. The jejunal bypass length is modifiable with the degree of BMI. The MGB-OAGB show co-morbidity resolution and durable weight loss. The single non-obstructing ante-colic GJ constructed in easy view provides a technically easy option for revision or reversal. The MGB and OAGB patient should be monitored for possible development of hypoalbuminemia and iron deficiency.

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