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ORIGINAL CONTRIBUTIONS

Revision/Conversion Surgeries After One Anastomosis Gastric Bypass—An Experts' Modified Delphi Consensus

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Abstract

Purpose There is a lack of evidence for treatment of some conditions including complication management, suboptimal initial weight loss, recurrent weight gain, or worsening of a significant obesity complication after one anastomosis gastric bypass (OAGB). This study was designed to respond to the existing lack of agreement and to provide a valuable resource for clinicians by employing an expert-modified Delphi consensus method.

Key Points

- Elongation of the BPL is an acceptable option for recurrent weight gain or worsening of a significant obesity complication after OAGB.
- Preservation of at least 300–400 cm of common channel limb length is necessary to decrease nutritional deficiencies.
- Increasing the CC (shortening the BPL), conversion to RYGB with shorter BPL, or complete reversal of OAGB are acceptable options for severe nutritional complications resistant to nutritional supports.
- Conversion to Roux-en-Y gastric bypass (RYGB) with or without pouch downsizing is the only acceptable option for the treatment of persistent bile reflux after OAGB.

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Methods Forty-eight recognized bariatric surgeons from 28 countries participated in the modified Delphi consensus to vote on 64 statements in two rounds. An agreement/disagreement among ≥ 70.0% of the experts was regarded to indicate a consensus.

Results A consensus was achieved for 46 statements. For recurrent weight gain or worsening of a significant obesity complication after OAGB, more than 85% of experts reached a consensus that elongation of the biliopancreatic limb (BPL) is an acceptable option and the total bowel length measurement is mandatory during BPL elongation to preserve at least 300–400 cm of common channel limb length to avoid nutritional deficiencies. Also, more than 85% of experts reached a consensus on conversion to Roux-en-Y gastric bypass (RYGB) with or without pouch downsizing as an acceptable option for the treatment of persistent bile reflux after OAGB and recommend detecting and repairing any size of hiatal hernia during conversion to RYGB.

Conclusion While the experts reached a consensus on several aspects regarding revision/conversion surgeries after OAGB, there are still lingering areas of disagreement. This highlights the importance of conducting further studies in the future to address these unresolved issues.

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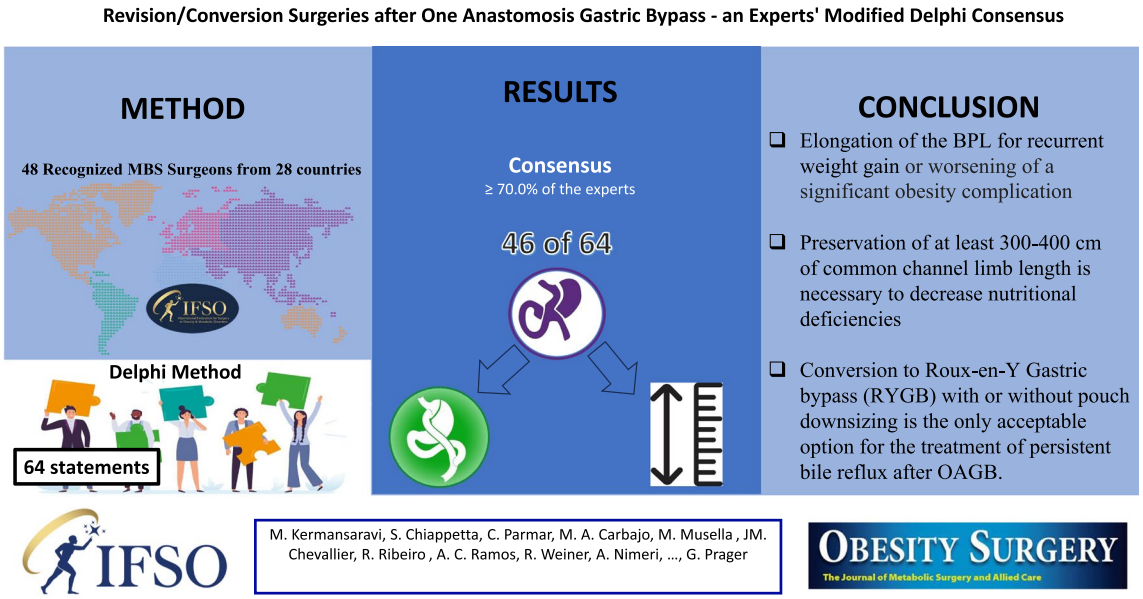
Graphical Abstract



Keywords OAGB · Revision · Conversion · Reversal · Correction · Revisional bariatric surgery

Introduction

One anastomosis gastric bypass (OAGB) is a recognized metabolic and bariatric surgical procedure (MBS) that is endorsed by the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) [1, 2] and the American Society for Metabolic & Bariatric Surgery (ASMBS) [3, 4]. It is now the 3rd most common MBS worldwide [5]. Despite its proven efficacy and safety as a primary or revisional MBS [6, 7], evidence for treatment pathways in certain conditions is missing. These conditions include complication management, suboptimal initial weight loss, recurrent weight gain, or worsening of a significant obesity complication [8, 9].

Long-term complications include mainly persistent bile reflux, persistent marginal ulcers, and nutritional complications. Even if these complications do not seem to be a frequent problem in the quantitative and qualitative studies analyzed in the updated IFSO-Statement 2021 [10], the incidence is reported to be 0.6–8% for anastomotic ulcers, 0.9–1.6% for biliary reflux, and 0.6–8% for excess weight loss and malnutrition [11].

This study was designed to respond to the existing lack of agreement [12] concerning the definition of situations warranting surgical intervention following OAGB and provide a valuable resource for clinicians by employing an expert-modified Delphi consensus method to address these concerns and assist healthcare professionals in their daily clinical practice when considering revision and conversion surgeries after OAGB.

Methods

Forty-eight worldwide recognized metabolic and bariatric surgeons from 28 different countries participated in this Delphi consensus study to develop a consensus on revisional MBS after OAGB as there is no strong evidence in most aspects of them.

The initial idea was raised by the Global Laparoscopy & Robotics (GLR) international group and then an international core team including 11 experts in OAGB designed the initial statements (Table 1). At the next step, well-known metabolic and bariatric surgeons including presidents of the IFSO, IFSO chapters/IFSO member societies, and recognized academic/private expert surgeons and opinion leaders in MBS were invited similar to other studies [14]. The selection of experts was meticulously carried out, considering their subject matter expertise, academic qualifications, and willingness to actively participate in the exercise. These criteria ensured that a diverse and knowledgeable group of individuals were chosen to contribute their valuable insights to the discussion. After discussion and exchange of opinions among the members, 64 statements were selected for the first round of voting (Table 2) using the modified Delphi consensus method using an online platform (Survey Monkey).

The link to the first round of consensus building (https://www.surveymonkey.com/r/OAGB-Conversion) was sent out on 5 October 2023 and was live until 17 October 2023. All invited experts voted on all 64 statements with only agree or disagree choices and an agreement/disagreement ≥ 70.0% was regarded as consensus (following previous Delphi consensuses in different aspects of MBS [4, 13–15]). Consensus was reached on 24 out of the 64 initial statements in the first round.

The core team diligently conducted a comprehensive review of the existing literature to gather additional evidence supporting or refuting each statement that did not reach a consensus. The results of the first round including some available evidence on 40 statements with < 70.0% consensus were shared with the experts, and they were invited to vote on the remaining 40 non-consensus statements during the second round of consensus building, which was live from 6 November 2023 to 23 November 2023 (https://www.surveymonkey.com/r/2nd-OAGB-Conversion).

Results

Forty-eight experts in MBS, from 28 countries voted on the 64 and 40 statements in the first and second rounds respectively. Table 2 summarizes the detailed results of the first and second round's votes on each of the 64 statements. A consensus of ≥ 70% was reached for 46 of 64 statements and experts did not achieve consensus on 18 statements after two rounds of online voting (Table 2).

Definitions for Statements

Weight gain of more than 30% of the initial surgical weight loss was a consensus on the "recurrent weight gain" definition and %total weight loss (%TWL) less than 20% within 2 years after surgery was the definition of "suboptimal initial weight loss" according to the consensuses reached by more than 85% of experts. These definitions apply to patients who have followed the dietary advice and lifestyle changes and shown compliance with the multi-disciplinary team and meet the eligibility criteria for revision/conversion MBS through a multi-disciplinary team. Similarly, detection of bile in the esophagus during endoscopy or bile scintigraphy, at least 6 months after OAGB without good response to lifestyle modification, nutrition, and medications, reached consensus for the definition of "Persistent Bile Reflux (BR)" by most of the experts.

"resistant marginal ulcer (MU)" was defined as persistent endoscopy-proven MU, despite 6-month medical therapy including the eradication of *H. Pylori* with the optimal dose of recommended eradicating regimen along with suspension/withdrawal of NSAIDs, aspirin, and smoking, according to 93.7% of experts' opinion.

Micro- and macro-nutrient deficiencies without good response to nutritional support and medical treatment were defined as "nutritional complications."

Most of the experts agreed to a trial of modern "obesity management medication" (OMM) (such as GLP-1 analog) as an option before deciding to do revisional/conversional surgery.

Eighty-one percent of participants reached a consensus on the fact that a C-peptide of more than 1 ng/ml makes the postoperative probability of diabetes remission more likely.

For recurrent weight gain or worsening of a significant obesity complication after OAGB, 89.5% of experts agreed that elongation of the biliopancreatic limb (BPL) is an acceptable option and the total bowel length (TBL) measurement is necessary during BPL elongation to preserve at least 300–400 cm of the common channel (CC) limb length to avoid nutritional deficiencies. The experts agreed that conversion of OAGB to other operations like BPD/DS, SADI-S, OATB/SASI, and SG/TB is not an acceptable option. They also agreed that adding a non-adjustable band on the gastric pouch is not acceptable.

For suboptimal weight loss after OAGB, 72.9% and 93.6% of experts agreed that surgical pouch resizing in case of an enlarged gastric pouch and elongation of BPL to preserve at least 300–400 cm of CC length are acceptable options, respectively.

For the treatment of persistent BR after OAGB, more than 85% of experts agree that conversion to Roux-en-Y Gastric bypass (RYGB) with or without pouch downsizing are acceptable option. In addition, detecting and repairing any size of hiatal hernia (HH) is necessary during conversion to RYGB.

In the presence of severe nutritional complications resistant to nutritional supports, the experts reached an agreement consensus on increasing the CC (shortening the BPL), conversion to RYGB with shorter BPL, or complete reversal of OAGB.

In patients with persistent marginal ulcer (MU), resection of gastro-jejunostomy (GJ) including the distal part of the pouch,

Table 1 The core team members

Name	Country
Miguel Angel Carbajo	Spain
Jean–Marc Chevallier	France
Sonja Chiappetta	Italy
Mohammad Kermansaravi	Iran
Mario Musella	Italy
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Gerhard Prager	Austria
Almino Ramos	Brazil
Rui Ribeiro	Portugal
Rudolf Weiner	Germany

Table 2 Consensus statements voting results after two rounds

	Round 1	Round 2	Final result
A-Definitions for statements			
1. Recurrent weight gain: weight gain of more than 30% of the initial surgical weight loss	**Consensus (agree) 85.42%**	-	**Consensus**
2. Suboptimal initial weight loss: TWL (total weight loss) % less than 20% within 2 years after surgery	**Consensus (agree) 85.42%**	-	**Consensus**
3. Worsening of a significant obesity complication: recurrence or worsening of an obesity-associated medical disease that occurs after an initially adequate postoperative clinical response that was an indication for primary MBS (metabolic bariatric surgery) in BMI 30 kg/m^2 and more	**Consensus (agree) 89.58%**	-	**Consensus**
4. Persistent BR (bile reflux): detection of bile in the esophagus during endoscopy or bile scintigraphy, at least 6 months after OAGB without good response to lifestyle modification, nutrition, and medications	**Consensus (agree) 83.33%**	-	**Consensus**
5. Nutritional complications: micro and macro-nutrient deficiencies without good response to nutritional support and medical treatment	**Consensus (agree) 87.50%**	-	**Consensus**
6. Persistent MU (marginal ulcer): persistent endoscopy-proven MU, despite 6-month medical therapy including the eradication of *H. Pylori* with optimal dose along with suspension/withdrawal of NSAIDs, aspirin, and smoking	**Consensus (agree) 93.75%**	-	**Consensus**
7. Before deciding to do revisional/conversional MBS, a treatment with modern "obesity management medication" (OMM) (such as GLP-1 analog) can be offered	60.42% Agree	**Consensus (agree) 93.75%**	**Consensus**
8. In T2DM patients a C-peptide of more than 1 ng/ml makes the postoperative probability of diabetes remission more likely	50.00% Agree	**Consensus (agree) 81.25%**	**Consensus**
B-Recurrent weight gain/worsening of a significant obesity complication: after OAGB			
9. Surgical pouch resizing (stapled) in case of an enlarged gastric pouch is an acceptable option after OAGB	56.25% Agree	64.58% Agree	**No consensus**
10. Surgical stoma resizing (stapled) is an acceptable option after OAGB	62.5% Disagree	**Consensus (disagree) 77.08%**	**Consensus**
11. Endoscopic (intra-luminal) Pouch resizing, in case of an enlarged gastric pouch, is an acceptable option after OAGB	56.25% Disagree	62.50% Disagree	**No consensus**
12. Endoscopic (intra-luminal) stoma resizing is an acceptable option after OAGB	60.42% Disagree	**Consensus (disagree) 70.83%**	**Consensus**
13. Elongation of the BP limb (biliopancreatic limb: BPL) is an acceptable option after OAGB	Consensus (agree) 89.58%	-	**Consensus**
14. The total bowel length measurement is necessary before elongation of BPL	Consensus (agree) 97.92%	-	**Consensus**
15. The maximum BP limb elongation should be 30% of the total bowel length, but keeping a minimum of 300–400 cm of small bowel in the food stream	52.08% Disagree	52.08% Agree	**No consensus**
16. Conversion to single-anastomosis gastro-ileal (SAGI) bypass with a fixed common limb of 300–400 cm is an acceptable option after OAGB	54.17% Agree	54.17% Agree	**No consensus**
17. At least 300–400 cm common limb length is necessary to decrease the nutritional deficiencies	62.50% Agree	**Consensus (agree) 87.50%**	**Consensus**
18. Conversion to distal Roux-en Y gastric bypass with a total alimentary limb length (alimentary limb + common channel limb) of 400 cm is an acceptable option after OAGB (elongation of BP limb the Sugerman method)	50% Agree	52.08% Agree	**No consensus**
19. Convert to BPD/DS is an acceptable option after OAGB	50% Agree	58.33% Disagree	**No consensus**
20. Convert to SADI/S is an acceptable option after OAGB	52.08% Disagree	**Consensus (disagree) 72.92%**	**Consensus**
21. Non-adjustable band alone is an acceptable option after OAGB	68.75% Disagree	**Consensus (disagree) 85.42%**	**Consensus**
22. Adding a non-adjustable band to revision/conversion surgeries can increase the efficacy of the surgery	50% Agree	56.25% Disagree	**No consensus**
23. Conversion to one anastomosis transit bipartition (OATB/SASI) is an acceptable option after OAGB	62.50% Disagree	**Consensus (disagree) 85.42%**	**Consensus**

Table 2 (continued)

	Round 1	Round 2	Final result
24. Conversion to SG/TB is an acceptable option after OAGB	Consensus (disagree) 72.92%	-	**Consensus**
*C-Suboptimal weight loss			
25. Surgical pouch resizing (stapled) in case of an enlarged gastric pouch is an acceptable option after OAGB	68.09% Agree	**Consensus (agree) 72.92%**	**Consensus**
26. Surgical stoma resizing (stapled) is an acceptable option after OAGB	61.70% Disagree	**Consensus (disagree) 79.17%**	**Consensus**
27. Endoscopic (intra-luminal) Pouch resizing is in case of an enlarged gastric pouch an acceptable option after OAGB	51.06% Agree	56.25% Disagree	**No consensus**
28. Endoscopic (intra-luminal) stoma resizing is an acceptable option after OAGB	59.57% Disagree	**Consensus (disagree) 75.00%**	**Consensus**
29. Elongation of BP limb (BPL) is an acceptable option after OAGB	Consensus (agree) 93.62%	-	**Consensus**
30. The total bowel length measurement is necessary before elongation of BPL	Consensus (agree) 95.74%	-	**Consensus**
31. The maximum BP limb elongation should be 30% of the total bowel length, keeping a minimum of 300–400 cm of small bowel in the food stream	51.06% Agree	66.67% Agree	**No consensus**
32. Conversion to single-anastomosis gastro-ileal (SAGI) bypass with a fixed common limb of 300–400 cm is an acceptable option after OAGB	59.57% Agree	64.58% Agree	**No consensus**
33. At least 300–400 cm common limb length is necessary to decrease the nutritional deficiencies	63.83% Agree	**Consensus (agree) 89.58%**	**Consensus**
34. Conversion to distal Roux-en Y gastric bypass with a total alimentary limb length (alimentary limb + common limb) of 400 cm is an acceptable option after OAGB (elongation of BP limb the Sugerman method)	46.81% Agree	52.08% Disagree	**No consensus**
35. Convert to BPD/DS is an acceptable option after OAGB	51.06% Disagree	68.75% Disagree	**No consensus**
36. Convert to SADI/S is an acceptable option after OAGB	51.06% Disagree	**Consensus (disagree) 70.83%**	**Consensus**
37. Non-adjustable band alone is an acceptable option after OAGB	68.09% Disagree	**Consensus (disagree) 89.58%**	**Consensus**
38. Adding a non-adjustable band to revision/conversion surgeries can increase the efficacy of the surgery	55.32% Disagree	64.58% Disagree	**No consensus**
39. Conversion to one anastomosis transit bipartition (OATB/SASI) is an acceptable option after OAGB	Consensus (disagree) 70.21%	-	**Consensus**
40. Conversion to SG/TB is an acceptable option after OAGB	Consensus (disagree) 70.21%	-	**Consensus**
E-Persistent BR after OAGB			
41. Conversion to RYGB with the pouch downsizing is an acceptable option	Consensus (agree) 87.23%	-	**Consensus**
42. Conversion to RYGB without downsizing the pouch is an acceptable option	65.96% Agree	**Consensus (agree) 85.42%**	**Consensus**
43. Braun Jejuno–Jejunostomy is an acceptable option	63.83% Disagree	**Consensus (disagree) 81.25%**	**Consensus**
44. LINX is an acceptable option	Consensus (disagree) 76.60%	-	**Consensus**
45. Nissen-like fundoplication with gastric remnant (with hiatal repair if present) is an acceptable option	59.57% Disagree	**Consensus (disagree) 83.33%**	**Consensus**
46. Take down the GJ and refashion side-to-side GJ (Carbajo anti-reflux technique) is an acceptable option	68.09% Disagree	**Consensus (disagree) 93.75%**	**Consensus**
47. Ligamentum teres cardiopexy is an acceptable option	Consensus (disagree) 76.60%	-	**Consensus**
48. Detecting and repairing any size of hiatal hernia is necessary during the second operation for persistent BR after OAGB	Consensus (agree) 87.23%	-	**Consensus**

Table 2 (continued)

	Round 1	Round 2	Final result
F-Severe nutritional complications resistant to nutritional supports(refractory macro/micro deficiency-hypoalbuminemia-severe anemia)			
49. Complete reversal is an acceptable option	Consensus (agree) 91.49%	-	**Consensus**
50. Gastro-gastrostomy alone is an acceptable option	57.45% Disagree	62.50% Disagree	**No consensus**
51. Convert to SG is an acceptable option	57.45% Agree	64.58% Disagree	**No consensus**
52. Convert to RY with shorter BPL is an acceptable option	Consensus (agree) 70.21%	-	**Consensus**
53. Increasing the CC (shortening the BPL) is an acceptable option	Consensus (agree) 78.72%	-	**Consensus**
G-Persistent marginal ulcer			
54. Resection of GJ including the distal part of the pouch and conversion to RYGB is an acceptable option	Consensus (agree) 93.62%	-	**Consensus**
55. Reversal to normal anatomy is an acceptable option	Consensus (agree) 82.98%	-	**Consensus**
56. Conversion to SG is an acceptable option	59.57% Agree	64.58% Agree	**No consensus**
57. Simple repair of MU after debridement plus Truncal Vagotomy is an acceptable option	68.09% Disagree	**Consensus (disagree) 89.58%**	**Consensus**
58. Simple repair of MU after debridement plus life-long PPIs is an acceptable option	57.45% Disagree	**Consensus (disagree) 79.17%**	**Consensus**
59. Endoscopic oversewing of the MU is an acceptable option	68.09% Disagree	**Consensus (disagree) 83.33%**	**Consensus**
Severe dumping non-responsive to medical therapy and nutritional modifications			
60. Complete reversal is an acceptable option	Consensus (agree) 89.36%	-	**Consensus**
61. Gastro-gastrostomy alone is an acceptable option	63.83% Disagree	**Consensus (disagree) 78.72%**	**Consensus**
62. Conversion to SG is an acceptable option	Consensus (agree) 70.21%	-	**Consensus**
63. Surgical stoma downsizing is an acceptable option	51.06% Agree	55.32% Agree	**No consensus**
64. Endoscopic (intra-luminal) stoma downsizing is an acceptable option	57.45% Agree	68.09% Agree	**No consensus**

and conversion to RYGB or complete reversal to normal anatomy were the options that reached an agreement consensus.

About 89.4% and 70.2% of experts agreed that complete reversal or conversion to SG are acceptable choices in patients with severe dumping that is non-responsive to medical therapy and nutritional modifications, respectively.

No consensus was achieved for 18 statements, as shown in Table 2.

Discussion

OAGB is the third most performed MBS up to date; however, evidence is still missing regarding revisional bariatric surgery after OAGB. Therefore, this Delphi consensus might help clinicians to indicate the right treatment pathway in certain circumstances.

Since the definition of statements is the basis for creating homogeneity in future clinical studies, the first six statements, which all got consensus, include the definition of the most important clinical symptoms and complications, which are correlated with obesity treatment and especially are correlated to OAGB.

Recurrent weight gain, suboptimal initial weight loss, worsening of a significant obesity complication on the one hand, and persistent BR, nutritional complications, and resistant MU on the other hand are clinical issues to deal with in the long-term after OAGB [11].

In the current literature, BR, nutritional complications, and resistant MU have a wide range of prevalence with numbers dealing from 7.8 to 55.5% for BR [16] after OAGB based on how it is identified, and 0.1–1.3% for excessive weight loss and malnutrition and 0.6–8% for MU [11].

Recurrent Weight Gain/Suboptimal Weight Loss and Worsening of a Significant Obesity Complication After OAGB

In this Delphi Survey weight gain of more than 30% of the initial surgical weight loss was a consensus on the "recurrent weight gain" definition and %total weight loss (%TWL) less

than 20% within 2 years after surgery was the definition of "suboptimal initial weight loss" according to the consensuses reached by more than 85% of experts. Furthermore, the consensus was achieved for the worsening of a significant obesity complication, which means recurrence or worsening occurs after an initially adequate clinical response post primary MBS [17]. In the current literature, many definitions exist for weight regain and insufficient weight loss resulting in inconsistencies in the reported prevalence of these two conditions [18], and therefore, this Delphi consensus included the definition of these statements.

The experts agree that OMM (such as GLP-1 receptor agonists) is an option before deciding to perform revisional/conversional surgery. Ninety-four percent of the experts agreed that the treatment pathway in recurrent weight regain/suboptimal clinical response might start with pharmacotherapy. Revisional/conversional bariatric surgery has an increased risk of perioperative complications [19] and pharmacologic therapy demonstrated further weight loss in clinical studies [20, 21]. Whether a life-long therapy is feasible and whether pharmacologic therapy is a long-term therapeutic option has still to be demonstrated in large-scale randomized clinical trials [21].

The survey included the role of measuring the C-peptide value to evaluate type 2 diabetes mellitus (T2DM) remission. More than 80% (81.25%) of the experts agree that a C-peptide of more than 1 ng/ml makes the postoperative probability of T2DM remission more likely. This opinion is in line with the current literature. One systematic review and meta-analysis showed that preoperative fasting plasma C-peptide was associated with increased T2DM remission after MBS [22], and another one demonstrated that fasting C-peptide values were significantly associated with increased remission (C-peptide, 95% CI = 0.2–1.0), whereas T2DM duration, patient age, preoperative insulin use, preoperative fasting blood glucose values, and preoperative glycosylated hemoglobin values were significantly associated with reduced remission (T2DM duration, 95% CI = − 1.2 to − 0.7; age, 95% CI = − 0.5 to − 0.1; percentage of preoperative insulin users, odd ratio = 0.10, 95% CI = 0.07–0.15; preoperative fasting blood glucose, 95% CI = − 0.9 to − 0.5; preoperative glycosylated hemoglobin, 95% CI = − 1.1 to − 0.4) [23].

According to this Delphi consensus, surgical approach in recurrent weight gain or worsening of a significant obesity complication might include only elongation of the BPL, including TBL measurement. Surgical pouch resizing had agreement consensus only in case of suboptimal initial weight loss and not recurrent weight gain. The ideal gastric pouch size and width of gastroenterostomy have been recommended in the IFSO consensus conference statement on OAGB and included that "surgeons should aim to construct a long and narrow pouch over a 36–38 Fr tube (90% of voters)" and that "the ideal width of the gastroenterostomy should be 3–5 cm (85% of voters) [1]. However, in a study by Ferro et al., 11 patients underwent laparoscopic pouch resizing (LPR) for recurrent weight gain that showed good results in weight loss outcomes and improvement and resolution of obesity-associated medical problems, with an acceptable complication rate and operative time. The weight and BMI before and after resizing at the last follow-up visit were statistically significant [24]. Another retrospective study on consecutive patients who underwent a gastric pouch resizing [25] for suboptimal weight loss after OAGB showed acceptable results during a 2-year follow-up [26].

Endoscopic and surgical stoma resizing are well-discussed revisional bariatric surgery options after RYGB since it is well-known that increased gastrojejunal stoma diameter is a risk factor for recurrent weight gain after RYGB [27] and that endoscopic revision of the gastric outlet results in meaningful weight loss and comorbidity resolution in select patients experiencing recurrent weight gain [28]. Since OAGB is not seen as a restrictive procedure and since no evidence exists regarding stoma resizing, it is understandable that no consensus was achieved regarding these revisional bariatric surgical options. On the other hand, an increased pouch width might lead to an increased food intake, and therefore, pouch resizing might be helpful.

Elongation of the BPL as a revisional bariatric surgery might be acceptable since a systematic review and meta-analysis showed that considering a 200-cm BPL when performing OAGB delivers a better weight loss outcome than a 150-cm BPL [29]. Since tailoring the limb length based on TBL is an important issue and evidence is still lacking, we hopefully will have new insights into the effect of different BP-limb lengths, when the results of the TAILOR study will be published [30]. A common channel of at least 300–400 cm might be necessary to decrease nutritional deficiencies in the long term [31].

Soong et al. conducted a cohort study comparing two groups of patients who underwent OAGB The first group had unknown lengths of the small bowel and common channel, while the second group had measured lengths of the small bowel and a common channel ranging from 400 to 600 cm. The study found that the second group, with the measured lengths, had significantly lower rates of anemia, secondary hyperparathyroidism, and hypoalbuminemia compared to the first group. The researchers emphasized the importance of measuring the entire length of the small bowel to achieve a common channel length greater than 400 cm, to decrease the rates of hypoalbuminemia and malnutrition [32].

Kassir et al. in a study showed that a primary single-anastomosis gastro-ileal bypass (SAGI) with preservation of a 300-cm common limb had no albumin deficiency during a

3-year follow-up [33]. SAGI bypass has shown good results in weight loss outcomes as a primary MBS in short-term follow-up [34]. Although there is no published data for SAGI as revision surgery after OAGB.

In the Italian Multi-Institutional Study, BPL elongation and gastric pouch resizing were represented with 9.4% and 4.5% as revisional procedures after OAGB [35]. No standard treatment pathway for recurrent weight gain or suboptimal clinical response however does exist.

The experts agreed that the banded pouch and conversion to SADI-S, One anastomosis transit bipartition (OATB/SASI), and SG/TB are not acceptable options for revision.

A prospective randomized trial comparing OAGB ($n=17$) and banded-OAGB ($n=16$) showed no differences regarding weight loss and vomiting 1 year after surgery [36]. Although another RCT on 20 patients showed that banded-OAGB led to a higher early weight loss (3 months) than the standard technique [37], no evidence exists of whether conversion from OAGB to banded-OAGB might have good results. Furthermore, there were no available publications in English during our literature search regarding the conversions of OAGB to SADI-S, One anastomosis transit bipartition (OATB/SASI), and SG/TB.

Persistent Bile Reflux

Bile reflux (BR) after OAGB and its long-term concerns are constantly debated topics after OAGB [38, 39]. The experts agreed with the definition of BR as "detection of bile in the esophagus during endoscopy or bile scintigraphy, at least 6 months after OAGB without good response to lifestyle modification, nutrition, and medications." Different options were given to the experts to resolve BR. Consensus (more than 85%) was achieved that conversion to RYGB with or without pouch downsizing is an acceptable option. In a retrospective study, a total of 32 patients who underwent conversion from OAGB to RYGB without pouch downsizing due to persistent BR found that the conversion to RYGB successfully alleviated symptoms of BR in 93.8% of patients [40]. Another similar study showed that conversion of OAGB to RYGB without downsizing the pouch with the creation of an alimentary limb of 75 cm can lead to good results in remission of persistent GERD [41]. RYGB has been considered a good option for patients with BR even in the long term [42, 43]. Nearly 87% (87.32%) of experts also agreed in the first round that identifying and addressing a symptomatic HH is necessary during the revisional procedure for treating BR after OAGB [42].

The option of Braun jejuno-jejunostomy (JJ) for treating BR reflux after OAGB was not regarded as an acceptable option by 81% of experts. This is understandable as there is hardly any published evidence to support this. The argument is that bile could still reach the stomach after Brauns JJ. [4, 44]. However, in a study involving 14 patients who underwent the Braun procedure due to persistent BR after OAGB, the results showed that 85% of patients reported a very good clinical response, with complete resolution of their BR symptoms [45]. We would encourage surgeons to publish their results with Brauns anastomosis so that it can help build an evidence base for the future. Similarly, in view of the lack of published evidence, there was no consensus that using LINX or using ligamentum teres cardiopexy can be used as an option for treating PBR. Although the novel concept of trying the gastric remnant to construct a Nissen-like fundoplication to treat this also was disagreed by the experts. A study reported the remission of refractory BR after OAGB in 11 of 12 patients who underwent excluded stomach fundoplication [46]. In a randomized controlled trial, the study found that incorporating a modified fundoplication technique using the excluded stomach during OAGB had significant benefits in a greater reduction in acid levels and effectively prevented bile reflux esophagitis compared to standard OAGB [47].

Furthermore, 94% of experts agreed that it is not advisable taking down the GJ and refashion side-to-side GJ as described by Carbajo as an anti-reflux mechanism [4, 12].

Severe Nutritional Complications

Studies have shown nutritional complications can occur with this operation depending on the BPL [44, 48]. Experts agree that complete reversal is an option in case of refractory cases of hypoalbuminemia or anemia which fail to be managed with conservative management. There was no consensus that anastomosis of the gastric pouch with the remnant (gastro-gastrostomy) or conversion to sleeve gastrectomy [4] is a feasible option after thorough work up [15, 49]. The only consensus was with the option of conversion to RYGB with either a shorter BPL or lengthening of the CC.

Persistent Marginal Ulcer

Marginal ulcer can occur in OAGB which in the majority of cases is managed successfully by conservative management [50]. However, in case of failure of conservative management, the experts agreed that resection of the GJ including the distal part of the gastric pouch and conversion to RYGB or complete reversal to normal anatomy are acceptable options. There was no consensus that in such a scenario conversion to SG should be done. The experts agreed that simple repair of MU after debridement plus truncal vagotomy or addition of life-long PPI or endoscopic oversewing of the MU is not advisable for resistant MU [51].

Severe Dumping

Severe dumping is infrequent after OAGB [52, 53] with the incidence reported to be 2.2–42.9% [52, 54–57]. Experts agreed that conversion to SG or complete reversal is advisable in rare cases where severe dumping non-responsive to medical management is persistent. They disagreed that gastro-gastrostomy alone was a feasible option. There was no consensus that stoma downsizing either surgically or endoscopically would solve this problem despite the recent literature published about the role of endoscopy in such scenarios after RYGB [58].

There are limitations related to the Delphi study. It is an expert opinion and hence level 4 evidence. The surgeons who perform this operation routinely can provide bias at voting during the study. To balance this, MBS experts who are performing routinely all kinds of metabolic and bariatric procedures were invited. This wide group of experts' selection is a strength of the study. This is the first reported Delphi study on this topic and would make an evidence base for future studies on this subject.

Conclusion

The topic of revision/conversion surgeries following OAGB remains a subject of debate among specialists in the field of MBS. This study sought to gather the viewpoints of 48 well-known metabolic and bariatric surgeons from 28 different countries through a modified Delphi consensus. The experts reached a consensus on various aspects concerning revision/conversion surgeries after OAGB. However, it is important to note that there are still areas of disagreement, underscoring the necessity for further research in the future.

Data Availability The data that support the findings of this study are available on request from the corresponding authors, [SC, MK].

Declarations

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

Informed Consent Informed consent does not apply.

Conflict of Interest The authors declare no competing interests.

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