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MODERN SURGICAL METHODS FOR THE TREATMENT OF METABOLIC SYNDROME: A COMPARATIVE ANALYSIS OF SADI-S, SASI-S, MINI GASTRIC BYPASS, AND ROUX-EN-Y GASTRIC BYPASS

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Abstract

Metabolic syndrome is one of the leading medical and social problems of modern medicine. Over the past decades, metabolic surgery has been considered the most effective method for achieving long-term remission in patients with obesity, type 2 diabetes mellitus (T2DM), and metabolic syndrome. The most commonly performed procedures include Roux-en-Y gastric bypass (RYGB), mini gastric bypass/one-anastomosis gastric bypass (MGB/OAGB), single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S), and single anastomosis sleeve ileal bypass (SASI-S).

The aim of this review is to provide a comparative analysis of the efficacy, metabolic outcomes, technical characteristics, and complications of these procedures in the treatment of T2DM. Analysis of current studies demonstrates that all methods produce significant antidiabetic effects; however, they differ in the degree of malabsorption, the risk of nutritional deficiencies, and the duration of diabetes remission. SADI-S

demonstrates the most pronounced metabolic effect, whereas RYGB remains the “gold standard” with the most extensively studied long-term outcomes.

Keywords: type 2 diabetes mellitus, metabolic surgery, SADI-S, SASI-S, mini gastric bypass, Roux-en-Y gastric bypass, diabetes remission, bariatric surgery.

Introduction

Type 2 diabetes mellitus (T2DM) and metabolic syndrome remain among the most important global healthcare challenges due to their rapidly increasing prevalence and association with severe cardiovascular and metabolic complications. Obesity, insulin resistance, dyslipidemia, and hypertension are key components of metabolic syndrome and significantly contribute to morbidity and mortality worldwide. Despite advances in pharmacological therapy and lifestyle interventions, long-term glycemic control and sustained weight reduction remain difficult to achieve in many patients with severe obesity and T2DM.

Over the last two decades, metabolic surgery has emerged as one of the most effective therapeutic strategies for achieving significant weight loss, improving glycemic control, and inducing long-term remission of T2DM. In addition to restrictive and malabsorptive mechanisms, bariatric procedures produce complex hormonal and metabolic changes involving incretin secretion, gut microbiota modulation, bile acid metabolism, and improved insulin sensitivity.

Currently, Roux-en-Y gastric bypass (RYGB), mini gastric bypass/one-anastomosis gastric bypass (MGB/OAGB), single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S), and single anastomosis sleeve ileal bypass (SASI-S) are among the most widely used metabolic procedures. However, these operations differ in technical complexity, metabolic efficacy, risk of nutritional deficiencies, and long-term outcomes. Therefore, comparative evaluation of these surgical approaches is essential for optimizing individualized treatment strategies in patients with obesity and T2DM.

Materials and Methods

This review was conducted using scientific publications obtained from PubMed, Scopus, Google Scholar, and other international medical databases. Articles published between 2020 and 2026 were analyzed. The search strategy included the following keywords:

"metabolic surgery," "type 2 diabetes mellitus," "RYGB," "MGB/OAGB," "SADI-S," "SASI-S," "bariatric surgery," and "diabetes remission."

The inclusion criteria consisted of systematic reviews, meta-analyses, randomized clinical trials, and observational studies evaluating metabolic outcomes, diabetes remission, weight loss, and postoperative complications after bariatric surgery. Studies with insufficient clinical data, duplicated publications, and articles unrelated to metabolic surgery were excluded from the analysis.

Roux-en-Y Gastric Bypass (RYGB)

Roux-en-Y gastric bypass involves the creation of a small gastric pouch with a volume of approximately 20–30 mL followed by the formation of a gastroenteric anastomosis and exclusion of part of the small intestine from food transit. The procedure combines restrictive and moderately malabsorptive components with a pronounced hormonal effect. RYGB is considered the most extensively studied metabolic operation and has long been regarded as the "gold standard." According to large clinical studies, remission of T2DM is achieved in 60–80% of patients during the first postoperative years. The main antidiabetic mechanisms include increased GLP-1 secretion, reduced ghrelin levels, accelerated food transit, and improved insulin sensitivity. The advantages of RYGB include well-studied long-term outcomes, high efficacy in gastroesophageal reflux disease (GERD), significant metabolic effects, and a relatively moderate risk of severe malabsorption. However, the procedure is technically complex and may be associated with internal hernias, dumping syndrome, and nutritional deficiencies such as iron, calcium, and vitamin B12 deficiency.

Mini Gastric Bypass (MGB/OAGB)

Mini gastric bypass is a simplified variation of gastric bypass involving the creation of a long gastric pouch and a single gastroenteric anastomosis. Compared with RYGB, the procedure is technically simpler and associated with shorter operative time. Numerous studies demonstrate that MGB/OAGB provides comparable or even greater weight loss and T2DM remission rates compared with RYGB. The procedure offers several advantages, including shorter operative duration, lower technical complexity, high remission rates of T2DM, and high efficacy in patients with BMI >50 kg/m^2. Nevertheless, the major limitation of the procedure is biliary reflux. In addition,

excessive biliopancreatic limb length may increase the risk of hypoproteinemia, iron-deficiency anemia, and fat-soluble vitamin deficiencies.

SADI-S (Single Anastomosis Duodeno-Ileal Bypass with Sleeve Gastrectomy)

SADI-S combines sleeve gastrectomy with duodenoileal anastomosis and is considered a modification of biliopancreatic diversion with duodenal switch (BPD-DS), although it involves only one anastomosis. The operation includes sleeve gastrectomy, preservation of the pylorus, and a pronounced malabsorptive component. Among contemporary bariatric procedures, SADI-S demonstrates one of the strongest antidiabetic effects, with T2DM remission rates reaching 80–90% in several studies. The procedure is associated with maximal HbA1c reduction, durable metabolic outcomes, and a lower probability of diabetes relapse. A 2025 meta-analysis demonstrated the superiority of SADI-S over RYGB in terms of weight reduction and glycemic control. The advantages of SADI-S include the most pronounced metabolic effect, high efficacy in super obesity, preservation of the pylorus, and a lower incidence of dumping syndrome. However, the procedure is associated with a high risk of nutritional deficiencies, hypoproteinemia, steatorrhea, and the need for lifelong monitoring. In addition, long-term evidence remains limited compared with RYGB.

SASI-S (Single Anastomosis Sleeve Ileal Bypass)

SASI-S is a relatively new technique combining sleeve gastrectomy with an additional ileal anastomosis. The distinctive feature of this operation is the preservation of physiological food passage through the duodenum while simultaneously creating an alternative accelerated pathway to the distal small intestine. Current studies demonstrate that SASI-S provides effective weight reduction, improved glycemic control, and high remission rates of T2DM. Furthermore, the procedure produces a strong incretin effect with a lower incidence of severe malabsorption compared with SADI-S. The advantages of SASI-S include preservation of physiological digestion, lower frequency of severe nutritional deficiencies, significant antidiabetic efficacy, and relative technical simplicity. However, the procedure still lacks sufficient long-term evidence and standardization of limb lengths, while the potential risk of biliary reflux remains a concern.

Comparative Analysis of Surgical Procedures

Parameter	RYGB	MGB/OAGB	SADI-S	SASI-S
Number of anastomoses	2	1	1	1
Technical complexity	High	Moderate	Moderate	Moderate
Weight loss	High	High	Very high	High
T2DM remission	60–80%	70–85%	80–90%	70–85%
Risk of malabsorption	Moderate	Moderate/High	High	Moderate
Risk of biliary reflux	Low	Higher	Low	Possible
Vitamin deficiencies	Moderate	Moderate	Pronounced	Moderate
Dumping syndrome	Possible	Possible	Rare	Rare
Long-term outcomes	Well studied	Well studied	Limited	Limited

Discussion

Metabolic surgery is currently considered the most effective method for achieving T2DM remission in patients with obesity. The choice of surgical procedure should be individualized and depend on body mass index, duration of diabetes, C-peptide levels, the presence of gastroesophageal reflux disease, eating behavior, and patient adherence to lifelong follow-up. RYGB remains the most extensively studied procedure with predictable outcomes and a high safety profile. MGB/OAGB represents a technically simpler alternative with favorable metabolic outcomes, although caution is required because of the risk of biliary reflux. SADI-S provides the strongest antidiabetic effect, particularly in patients with morbid obesity and severe T2DM, but is associated with a higher risk of nutritional complications. SASI-S appears to be a promising approach that combines efficacy with more physiological digestion; however, further investigation is required.

Clinical Implications

The selection of metabolic surgical procedures should be based on individualized patient characteristics and metabolic goals. RYGB remains preferable in patients with

severe gastroesophageal reflux disease due to its anti-reflux effect and extensive long-term evidence. MGB/OAGB may be considered in patients requiring technically less complex procedures with significant metabolic efficacy, although careful postoperative monitoring for biliary reflux is necessary. SADI-S appears particularly effective in patients with super obesity and poorly controlled T2DM because of its strong metabolic impact, while SASI-S may represent a balanced option combining metabolic efficacy with preservation of more physiological nutrient passage. Multidisciplinary follow-up involving surgeons, endocrinologists, dietitians, and nutrition specialists is essential for long-term success and prevention of nutritional complications.

Limitations

Several limitations should be considered in the interpretation of this review. First, the available studies demonstrate heterogeneity in patient populations, follow-up duration, and surgical techniques. Second, long-term evidence for newer procedures such as SADI-S and SASI-S remains limited compared with RYGB. Third, the number of randomized controlled trials directly comparing these procedures is still insufficient. Therefore, further large-scale prospective studies are necessary to establish standardized recommendations regarding the optimal surgical approach for patients with metabolic syndrome and T2DM.

Conclusion

Metabolic surgery has become a cornerstone in the modern treatment of obesity-associated type 2 diabetes mellitus. RYGB remains the reference standard because of its well-established long-term efficacy and safety profile. MGB/OAGB provides comparable metabolic outcomes with lower technical complexity, whereas SADI-S demonstrates the most powerful antidiabetic and weight-loss effects among contemporary procedures. SASI-S represents an emerging physiological approach with promising short- and mid-term outcomes. Nevertheless, the optimal choice of procedure should be individualized according to patient-specific metabolic characteristics, obesity severity, comorbidities, and the ability to maintain lifelong nutritional surveillance. Future multicenter randomized studies with extended follow-up are required to further clarify the comparative effectiveness and safety of these procedures.

References:

1. Patrick Noel et al. A Comprehensive Review of Sleeve Gastrectomy, Roux-en-Y Gastric Bypass, One-Anastomosis Gastric Bypass, Duodenal Switch, and SADI-S: Very Long-Term Outcomes at 10 Years and Beyond, 2026.
2. Lucas Sabatella et al. Comparison Between SADI-S and Roux-En-Y Gastric Bypass: A Systematic Review with Meta-Analysis, 2025.
3. Balasubaramaniam V., Pouwels S. Remission of Type 2 Diabetes Mellitus after Sleeve Gastrectomy, OAGB and RYGB: A Systematic Review, 2023.
4. Efficacy and safety of single-anastomosis gastric bypass variants versus sleeve gastrectomy or RYGB: systematic review and meta-analysis, 2025.
5. Arterburn D.E. et al. Benefits and risks of bariatric surgery in adults. JAMA. 2020;324(9):879–887.
6. Rubino F. et al. Metabolic Surgery in the Treatment Algorithm for Type 2 Diabetes: A Joint Statement by International Diabetes Organizations. Diabetes Care. 2022.
7. Schauer P.R. et al. Bariatric Surgery versus Intensive Medical Therapy for Diabetes — Long-Term Outcomes. New England Journal of Medicine. 2021.
8. Angrisani L. et al. IFSO Worldwide Survey of Bariatric and Metabolic Procedures Performed in 2024. Obesity Surgery. 2025.