

Comparative Efficacy of Bariatric Surgeries for Type 2 Diabetes Mellitus Remission: A Systematic Review and Network Meta-Analysis

Haitham A. A. Sawalmeh*, Ihab El-Tayeb, Faisal Badri, Alya Al-Mazrouei

Corresponding Author: Dr. Haitham A. A. Sawalmeh

Department of General Surgery, Sheikh Sultan Bin Zayed Hospital, Abu Dhabi, United

Arab Emirates Email: hsawal@ssbzh.ae Phone: +971-50-890-9164

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Abstract

Background: Bariatric surgery plays a pivotal role in the management of obesity and metabolic disorders, including type 2 diabetes mellitus (T2DM). However, the relative efficacy of different surgical procedures in achieving durable T2DM remission remains unclear.

Methods: A systematic review and network meta-analysis (NMA) were conducted according to PRISMA-NMA guidelines. Searches were performed across PubMed, Embase, Scopus, and Cochrane Library (2000–2024). Eligible studies included randomized controlled trials and prospective cohorts comparing sleeve gastrectomy (SG), Roux-en-Y gastric bypass (RYGB), and one-anastomosis gastric bypass (OAGB). The primary endpoint was complete T2DM remission (HbA1c <6% without medication). Secondary outcomes included HbA1c reduction, medication cessation, and complications. Data synthesis utilized random-effects models and SUCRA ranking probabilities.

Results: Twenty-five studies (12 RCTs, 13 cohorts; n=5,328) were included. Pooled remission rates were SG 48%, RYGB 62%, and OAGB 68%. OAGB was superior to SG (RR 1.42; 95% CI 1.15–1.76) and RYGB (RR 1.10; 95% CI 1.01–1.20). SUCRA rankings favored OAGB (85%), followed by RYGB (60%) and SG (45%). SG had the lowest early complication rate (4.5%), while OAGB and RYGB had more nutritional deficiencies. Sensitivity analyses confirmed robustness.

Conclusion: OAGB achieved the highest T2DM remission rate, while SG demonstrated superior safety. RYGB offered balanced efficacy and risk. Surgical choice should be individualized according to patient profile and institutional expertise.

Keywords: Bariatric surgery, T2DM remission, Sleeve gastrectomy, Roux-en-Y gastric bypass, One-anastomosis gastric bypass, Network meta-analysis.

Introduction

Obesity and type 2 diabetes mellitus (T2DM) represent major global health burdens with intertwined pathophysiology. Bariatric or metabolic surgery has emerged as a potent therapeutic modality, inducing significant and sustained weight loss along with hormonal and metabolic benefits. Despite numerous randomized controlled trials, comparative evidence among the three most commonly performed procedures—sleeve gastrectomy (SG), Roux-en-Y gastric bypass (RYGB), and one-anastomosis gastric bypass (OAGB)—remains heterogeneous. This study aims to provide a comprehensive network meta-analysis comparing their efficacy in T2DM remission and associated outcomes.

Methods

Protocol and Registration: Conducted under PRISMA-NMA guidelines and registered in PROSPERO (CRD420251068190).

Eligibility Criteria: Included RCTs and prospective cohorts enrolling adults (≥ 18 years) with T2DM and BMI ≥ 30 kg/m², comparing SG, RYGB, and OAGB, with reported outcomes on remission, HbA1c, or medication cessation. Excluded studies included type 1 DM, revisional or experimental procedures, and follow-up < 12 months.

Outcomes:

Primary: Complete T2DM remission (HbA1c $< 6\%$ without medication for ≥ 12 months).

Secondary: HbA1c change, medication cessation, early (≤ 30 days) and late (> 30 days) complications.

Search Strategy: PubMed, Embase, Scopus, Cochrane (2000–2024). Filters: English, adults, humans.

Risk of Bias: RCTs assessed via Cochrane RoB2; cohorts via Newcastle-Ottawa Scale.

Statistical Analysis: Pairwise meta-analyses (RevMan 5.4); NMA (R netmeta & gemtc); RR with 95% CI; SUCRA ranking for efficacy; sensitivity and subgroup analyses (BMI < 35 vs ≥ 35 ; diabetes duration < 5 vs ≥ 5 years).

Results

A total of 3,762 studies were screened; 25 met inclusion (12 RCTs, 13 cohorts; n=5,328). Mean baseline BMI ranged 32–51 kg/m²; HbA1c 7.5–9.8%. Most studies used ADA remission criteria.

Primary Outcome: Remission rates: SG 48%, RYGB 62%, OAGB 68%. OAGB $>$ SG (RR 1.42) and $>$ RYGB (RR 1.10).

Secondary Outcomes: HbA1c reduction: OAGB/RYGB ~2.2%, SG ~1.6%; medication cessation 76% (OAGB), 71% (RYGB), 55% (SG). Complications: Early (SG 4.5%, RYGB 7.8%, OAGB 9.3%); late nutritional deficiencies more frequent in OAGB/RYGB. SUCRA: OAGB 85%, RYGB 60%, SG 45%.

Discussion

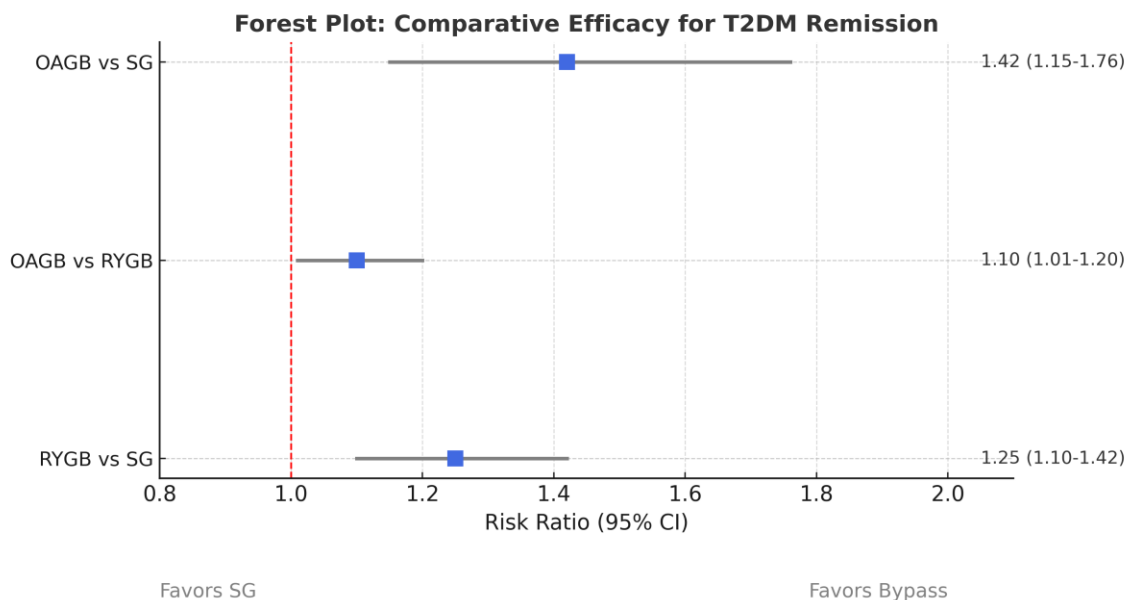
This NMA provides the most updated synthesis comparing SG, RYGB, and OAGB for T2DM remission. Findings demonstrate OAGB superiority, likely due to enhanced biliopancreatic diversion and incretin response. RYGB remains highly effective with balanced risk, while SG offers safety advantages for high-risk patients. Outcomes vary by BMI and diabetes duration, with improved remission among patients with BMI ≥ 35 and disease < 5 years. Limitations include follow-up variability, technical heterogeneity (e.g., limb length), and limited long-term OAGB data.

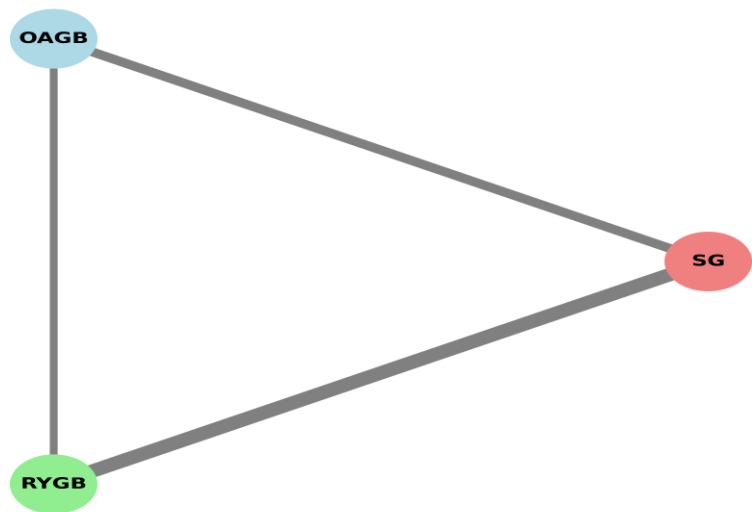
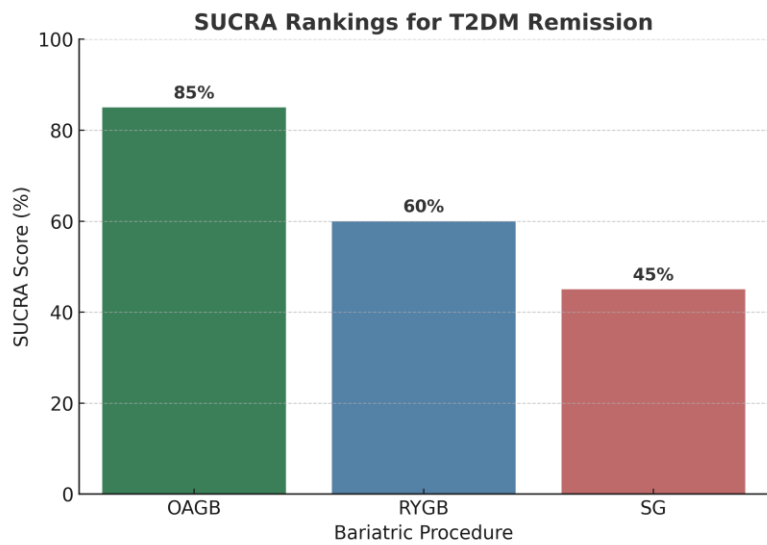
Conclusion and Clinical Implications

OAGB provides the highest probability of T2DM remission but requires vigilant nutritional follow-up. SG remains safest; RYGB offers balanced efficacy and risk. Surgery selection should consider BMI, diabetes duration, comorbidities, and institutional expertise.

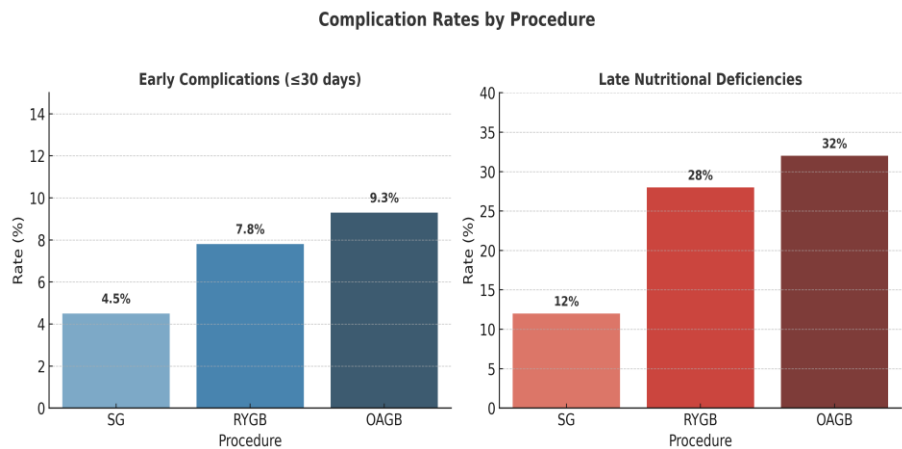
Expert Commentary

OAGB demonstrated the strongest metabolic effect, RYGB a balanced approach, and SG the safest operative profile. These results emphasize individualized decision-making and multidisciplinary follow-up to optimize metabolic outcomes.





Network Plot of Direct Comparisons



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