

Two-Year Outcomes of Sleeve Gastrectomy with Dual Pathways: A Single-Center Experience of B-TB and SASI Procedures

ming Tian

Baoji Hospital Affiliated to Xi'an Medical University

Huiqi Li

Baoji Hospital Affiliated to Xi'an Medical University

Taotao Wang

Baoji Hospital Affiliated to Xi'an Medical University

Mingguo Wang

Baoji Hospital Affiliated to Xi'an Medical University

Ping He

Baoji Hospital Affiliated to Xi'an Medical University

Haiying Li

Baoji Hospital Affiliated to Xi'an Medical University

Xiang Luo

Baoji Hospital Affiliated to Xi'an Medical University

Zhenxu Qiao

Baoji Hospital Affiliated to Xi'an Medical University

Jiangpeng Wei

weijiangpeng2015@163.com

xijing hospital

Research Article

Keywords: Bariaric and metabolic surgery, B-TB, SASI, Obesity

Posted Date: September 29th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10759714/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Objective

To compare the 2-year efficacy and safety of sleeve gastrectomy with Braun anastomosis transit bipartition (B-TB) and single anastomosis sleeve ileal (SASI) in the treatment of obesity and metabolic diseases.

Methods

A retrospective analysis was conducted on the clinical data of 234 patients with obesity who underwent either B-TB (n = 127) or SASI (n = 107) at our hospital between May 2021 and May 2023. Weight-related outcomes at 6, 12, and 24 months postoperatively, comorbidity remission rates, and perioperative and long-term complication rates were compared between the two groups.

Results

Both procedures achieved substantial weight loss at 6 and 12 months postoperatively, with outcomes plateauing after 12 months. At 12 months, the SASI group demonstrated significantly greater and percentage of total weight loss ($35.26 \pm 6.46\%$ vs. $31.12 \pm 7.36\%$, $P < 0.001$) and percentage of excess weight loss ($104.76 \pm 21.41\%$ vs. $93.72 \pm 22.46\%$, $P < 0.001$) compared with the B-TB group, and these differences remained significant after multiple correction ($P = 0.026$ and $P = 0.032$, respectively). However, at 24 months, no statistically significant differences were observed between the two groups in any weight-loss parameter. Regarding comorbidity resolution, both procedures achieved remission rates exceeding 90% for type 2 diabetes mellitus and over 77% for dyslipidemia, with no significant intergroup differences. SASI versus B-TB showed significantly higher complete remission (91.21% vs. 77.39%, adjusted $P = 0.031$) and lower improvement rates (22.61% vs. 8.79%, adjusted $P = 0.045$) for obstructive sleep apnea. In terms of safety, the overall complication rates were 11.02% in the B-TB group and 13.08% in the SASI group ($P = 0.623$), and early complication rates were 5.51% and 4.67% ($P = 0.770$). No severe adverse events occurred in either group.

Conclusion

Both B-TB and SASI are safe and effective metabolic and bariatric surgical procedures. The two procedures show comparable overall safety profiles and similar efficacy in resolving other comorbidities.

Clinical Trial Number: The study was approved by the Baoji Hospital Affiliated to Xi'an Medical University ethics committee (Approval No.: [2021] No. 32).

Background

Sleeve gastrectomy (SG) is the most widely performed bariatric procedure worldwide^[1]. However, it has inherent limitations, including weight regain in some patients during mid-to long-term follow-up and less

potent remission of type 2 diabetes mellitus compared with Roux-en-Y gastric bypass (RYGB)^[2-4]. These drawbacks have prompted surgeons to explore modified procedures that preserve the operational advantages of SG over RYGB while incorporating additional intestinal bypass maneuvers to enhance metabolic efficacy^[5, 6]. In this context, a variety of SG-based composite procedures have emerged.

The single anastomosis sleeve ileal (SASI) is performed by creating an end-to-side anastomosis between the ileum (approximately 300 cm proximal to the ileocecal valve) and the gastric staple line following SG^[7, 8]. This technique achieves partial food bypass and biliopancreatic diversion, combining the procedural simplicity of SG with the metabolic benefits of RYGB. On the other hand, sleeve gastrectomy with Braun anastomosis transit bipartition (B-TB) adds a Braun anastomosis and an ileo-ileal anastomosis to SG, establishing a bowel diversion pathway that resembles "transit bipartition."^[9, 10] This design aims to reduce nutrient absorption while preserving relatively intact gastrointestinal anatomical continuity.

Currently, clinical research on SASI and B-TB remains in its early stages, with the existing literature consisting primarily of case series and small-sample retrospective studies^[9, 11]. Direct head-to-head comparisons between the two procedures are lacking. Chen G et al^[12] reported the weight-loss outcomes of converting SG to various bypass procedures, but their study was limited by a small sample size and focused predominantly on conversion surgeries. Mahdy et al^[13] conducted a retrospective cohort study comparing SG, one-anastomosis gastric bypass, and SASI, however, B-TB was not included in their analysis. To date, no study has directly compared the 2-year clinical outcomes of B-TB and SASI.

Accordingly, this study aims to systematically compare the weight-loss efficacy, comorbidity resolution, and surgical safety between B-TB and SASI over a 2-year postoperative period, using retrospective data from 234 patients with obesity who underwent either procedure at our center. The findings are intended to provide evidence-based guidance for clinical decision-making regarding procedure selection.

Methods

1. Study Design and Patients

A retrospective analysis was conducted on data from patients with obesity who underwent B-TB and SASI procedures at our hospital from May 2021 to May 2023. Inclusion criteria were as follows: (1) Age between 17 and 69 years, regardless of sex; (2) body mass index (BMI) ≥ 32.5 kg/m², or BMI ≥ 27.5 kg/m² with at least two metabolic diseases ; (3) Underwent laparoscopic B-TB or SASI as a primary bariatric procedure; (4) Complete clinical data available, including preoperative baseline characteristics, operative records, and postoperative follow-up information. Exclusion criteria were as follows: (1) Revision surgery ; (2) Presence of severe dysfunction of vital organs that precluded tolerance to general anesthesia and surgery; (3) Concomitant malignant tumor or life expectancy < 1 year; (4) Pregnancy or lactation; (5) Presence of severe psychiatric disorders or cognitive impairment that prevented compliance with follow-

up; (6) Missing key variables in clinical data; (7) Postoperative follow-up duration < 3 months. All patients were informed of the surgical risks and signed informed consent forms. (Fig. 1)

2. Surgical Technique

2.1 Procedure Selection

The surgical procedure was determined through shared decision-making between the patient and a multidisciplinary team consisting of the surgeon, obesity physician, dietitian, and anesthesiologist. Key factors considered included baseline BMI, presence of type 2 diabetes mellitus (T2DM), and patient preference. During multidisciplinary discussions, patients were thoroughly informed of the differences between the two procedures: Super obesity (BMI ≥ 50 kg/m²): Patients were informed that B-TB might yield inferior weight loss outcomes compared with bypass procedures. T2DM: Patients were informed that SASI may offer better diabetes remission than B-TB. Gastroesophageal reflux disease (GERD): Patients were informed that B-TB may be less favorable due to its refluxogenic potential, whereas SASI provides better reflux control.

All patients undergoing either procedure were additionally informed of their experimental nature and the availability of only short-term outcome data. Schematic illustrations of both procedures were shown to the patients, highlighting potential benefits and complications based on the available literature.

2.2 Surgery

Following general anesthesia with endotracheal intubation, patients were positioned supine in reverse Trendelenburg. The surgeon stood on the right side. Step 1: A precise sleeve gastrectomy was performed, and the staple line was reinforced with 3 – 0 barbed suture via seromuscular embedding. Step 2: After sleeve gastrectomy, the total small bowel length was measured. The small intestine was transected 30 cm distal to the ligament of Treitz, and an enteroenterostomy was created at 40% of the total small bowel length distal to the transection site. The mesenteric defect was closed with non-absorbable suture, and the common limb length was maintained at no less than 3 meters. Step 3: A drain was placed at the angle of His based on intraoperative findings and was externalized and secured through the assistant's port. The specimen was retrieved from the main operating port, and the 12-mm port site was closed using a hernia hook needle. (Fig. 2)

3. Follow-Up

Preoperative baseline data, including age, sex, height, body weight, and obesity-related comorbidities, were routinely collected for all patients undergoing bariatric surgery at our center. Postoperative follow-ups were scheduled at 3, 6, 9, 12 and 24 months to assess weight loss outcomes: body weight, BMI, percentage of excess weight loss (%EWL), percentage of total weight loss (%TWL) and comorbidity improvement. Subsequently, annual follow-ups and health education were conducted by specialized nurses via WeChat, telephone, or outpatient visits, or hospitalization when necessary. Perioperative

complications occurring within 30 days after the B-TB or SASI were graded according to the Clavien-Dindo classification^[14].

Comorbidities were defined as follows: Dyslipidemia was identified by either a total cholesterol level exceeding 5.7 mmol/L, the current use of statins, a triglyceride concentration above 1.7 mmol/L, or treatment with fibrates. Obstructive sleep apnea (OSA) was defined based on patient-reported adherence to nocturnal continuous positive airway pressure (CPAP) therapy. Improvement in T2DM was determined by a decrease in glycated hemoglobin (HbA1c) levels, alongside a reduction in the dosage or number of oral hypoglycemic agents and/or insulin. Hypertension was considered controlled when patients maintained blood pressure below 140/90 mmHg without requiring ongoing antihypertensive pharmacotherapy.

4. Statistical Power Assessment for Sample Size

The primary endpoint of this study was the %TWL at 12 months postoperatively. Sample size and statistical power were calculated based on this endpoint, referencing the mean %TWL values reported in previous literature for each surgical procedure at the same time point (B-TB: $33.3 \pm 9.2^{[11]}$; SASI: $36.1 \pm 8.1^{[13]}$). Using the reported standard deviations (9.2 for B-TB and 8.1 for SASI), with a two-sided alpha of 0.05 and a power ($1-\beta$) of 0.90, the estimated required sample size was 202 patients per group. Given the retrospective nature and single-center design of this study, a total of 234 patients were ultimately enrolled. With this sample size, the minimum detectable difference in %TWL between the two groups was 3.67%, which exceeded the mean difference of 2.8% reported in the literature. Accordingly, the primary interpretation of our results will be based on effect size estimation with 95% confidence intervals, supplemented by hypothesis testing.

5. Statistical Analysis

Statistical analyses were performed using GraphPad Prism 11. Continuous variables following a normal distribution are presented as mean $\pm$ SD and were compared between groups using Welch's t-test. Categorical variables are expressed as frequencies and percentages and were compared using the χ^2 test, or Fisher's exact test when expected cell counts were < 5 .

To control for multiple comparisons, the step-down Bonferroni–Holm correction was applied across repeated measures within each outcome category. Both unadjusted and adjusted P values are reported. A two-tailed $P < 0.05$ was considered statistically significant.

For weight outcomes, between-group comparisons were performed at each time point using Welch's t-test, with Bonferroni-Holm correction applied across the 12 subitem tests. For comorbidity resolution, remission and improvement rates were compared using χ^2 or Fisher's exact test as appropriate, with Bonferroni-Holm correction applied within each comorbidity category. Absolute differences with 95% confidence intervals were calculated using the proportions test in R.

Results

Between May 2021 and May 2023, a total of 327 bariatric surgical procedures were performed at our center. After applying the exclusion criteria, 234 patients were ultimately enrolled in this study, including 81 males and 153 females, with a mean age of 32.53 years and a mean BMI of 39.42 kg/m². Demographic data for all groups are summarized in Table 1. No significant differences were observed between the BTB and SASI groups regarding age, sex, weight or BMI. Regarding preoperative comorbidities, the prevalence of T2DM (21.26% vs. 23.36%), dyslipidemia (76.38% vs. 83.18%), hypertension (53.54% vs. 65.42%), and OSA (90.55% vs. 85.05%) also did not differ significantly between groups. Overall, the two cohorts were well balanced in terms of baseline characteristics.

Table 1
Baseline Demographic Characteristics^a

Characteristics	B-TB (n=127)	SASI (n=107)	/	P value
Age, mean ± SD, y	33.66 ± 7.93	32.11 ± 7.73	<i>t</i> = 1.492	0.1367
Sex			χ^2 = 0.070	0.791
Male	43 (33.86%)	38 (35.51%)		
Female	84 (66.14%)	69 (64.49%)		
Weight, mean ± SD, kg	113.40 ± 10.52	119.35 ± 9.46	<i>t</i> = 0.328 ^b	0.743
BMI, mean ± SD, Kg/m ²	38.33 ± 2.26	41.34 ± 3.52	<i>t</i> = 0.430 ^b	0.667
Type 2 diabetes	27 (21.26%)	25 (23.36%)	χ^2 = 0.149	0.700
Dyslipidemia	97 (76.38%)	89 (83.18%)	χ^2 = 1.647	0.199
Hypertension	68 (53.54%)	70 (65.42%)	χ^2 = 3.390	0.066
Obstructive sleep apnea	115 (90.55%)	91 (85.05%)	χ^2 = 1.670	0.196

^a Data are expressed as No. (%) of participants unless otherwise indicated.

^b Welch's t-test

BMI body mass index, B-TB sleeve ileal one-anastomosis transit bipartition with Braun's jejunoileostomy, SASI single anastomosis sleeve ileal

Weight loss outcomes

As shown in Table 2, significant weight loss was recorded in both surgical groups at 6 and 12 months postoperatively, manifested by a significant decrease in weight and BMI from baseline, along with a significant increase in %TWL and %EWL, with the data leveling off from 12 to 24 months. At 6 months postoperatively, there were no significant differences between the two groups in weight and BMI. Although the SASI group showed statistically significant differences in weight and BMI at 12 months, these differences did not remain significant after multiple correction testing. At 12 months, the SASI group demonstrated significantly higher %TWL and %EWL than the B-TB group, and the differences remained statistically significant after adjustment for multiple comparisons. At 24 months postoperatively, there were no statistically significant differences between the two groups in any weight loss parameters, although the SASI group showed slight advantages in weight and BMI. Overall, both procedures achieved substantial weight loss, but the SASI group exhibited more pronounced mid-term weight loss effects, while the long-term outcomes tended to be similar between the two groups.(Fig. 3)

Table 2
Mean weight,BMI, %EWL, and %TWL outcomes at BP, 6, 12, and 24 months

Variable	B-TB (n=127)	SASI (n=107)		P value Unadjusted	P Value Adjusted ^a
Mean weight at BP in Kg	113.40 ± 10.52	119.35 ± 9.46	t = 0.328 ^c	0.743	
Mean weight at 6 months in kg	80.45 ± 8.35	81.36 ± 7.42	t = 0.882	0.382	
Mean weight at 12 months in kg	75.50 ± 12.56	72.36 ± 10.52	t = -1.871	0.083	
Mean weight at 24 months in kg	74.41 ± 12.36	71.11 ± 13.58	t = -1.963	0.055	
BMI at BP	38.33 ± 2.26	41.34 ± 3.52	t = 0.430 ^c	0.667	
BMI 6 months	30.78 ± 7.36	32.59 ± 6.37	t = 1.001	0.067	
BMI 12 months	25.56 ± 3.43	25.42 ± 5.46	t = -0.242	0.813	
BMI 24 months	26.49 ± 3.76	25.13 ± 4.52	t = -0.522	0.416	
%EWLadditional 6 months	83.72 ± 16.49	85.65 ± 14.52	t = 0.951	0.342	
%EWLadditional 12 months	93.72 ± 22.46	104.76 ± 21.41	t = 3.853	< 0.001	0.032
%EWLadditional 24 months	95.36 ± 23.75	99.76 ± 21.56	t = 1.484	0.143	
%TWLindex 6 months	28.56 ± 6.43	29.78 ± 5.46	t = 1.565	0.125	
%TWLindex 12 months	31.12 ± 7.36	35.26 ± 6.46	t = 4.576	< 0.001	0.026
%TWLindex 24 months	33.39 ± 6.53	33.78 ± 7.36	t = 0.433	0.676	

^a Adjustment by step-down Bonferroni-Holm correction for multiple comparisons for the number of subitem tests.

BMI body mass index, %EWL percentage of excess weight loss, %TWL percentage of total body weight loss, BP bipartition procedure, B-TB sleeve ileal one-anastomosis transit bipartition with Braun's

Comorbidity resolution

Both procedures demonstrated favorable remission effects on T2DM, with remission rates exceeding 90% and improvement rates of approximately 8% in both groups. Regarding dyslipidemia, the remission rate was 77.32% in the B-TB group and 79.77% in the SASI group, with improvement rates of around 20% in both groups; however, no statistically significant differences were observed between the two groups. For hypertension, the remission rate was 72.05% in the B-TB group and 72.86% in the SASI group. In terms of improvement rate, the B-TB group showed a significantly higher rate than the SASI group (27.94% vs. 12.86%), but this difference did not remain significant after multiple correction. Notably, for OSA, the SASI group achieved a higher remission rate than the B-TB group (91.21% vs. 77.39%), while the B-TB group had a significantly higher improvement rate than the SASI group (22.61% vs. 8.79%). The differences between the two groups in both remission and improvement rates for OSA reached statistical significance even after adjustment for multiple comparisons, suggesting that the SASI procedure may confer superior outcomes for OSA. (Table 3)

Table 3
Changes in Comorbidities at 2 Years

Comorbidities	B-TB (n=127)	SASI (n=107)	Absolute Difference, % (95% CI) ^a	P Value Unadjusted	P Value Adjusted ^a
Type 2 Diabetes					
Comorbidity present at baseline	27/127 (21.26%)	25/107 (23.36%)	-2.10% (- 12.9, 8.7)	0.700 ^d	
Remission	25 (92.59%)	23 (92.00%)	+ 0.59% (- 14.5, 15.7)	> 0.99 ^d	
Improved	2 (7.41%)	2 (8.00%)	-0.59% (- 15.7, 14.5)	> 0.99 ^e	
Dyslipidemia					
Comorbidity present at baseline	68/127 (53.54%)	89/107 (83.18%)	-6.80% (- 17.3, 3.9)	0.196 ^d	
Remission	75 (77.32%)	71 (79.77%)	-2.46% (- 14.8, 9.8)	0.682 ^d	
Improved	21 (21.65%)	18 (20.22%)	+ 1.43% (- 10.4, 13.2)	0.810 ^d	
Unchanged	1 (1.03%)	0	+ 1.03% (- 2.5, 5.3)	> 0.99 ^e	
Worsened	0	0	/	/	
Hypertension					
Comorbidity present at baseline	68/127 (53.54%)	70/107 (65.42%)	-11.88% (- 24.9, 1.8)	0.0656 ^d	0.085
Remission	49 (72.05%)	51 (72.86%)	-0.80% (- 15.7, 14.2)	0.916 ^d	
Improved	19 (27.94%)	9 (12.86%)	+ 15.08% +1.6, 27.5	0.033 ^d	0.178
Unchanged	0	7 (10.0%)	-10.0% (- 17.6, - 3.6)	0.013 ^e	0.065
Worsened	0	3 (4.29%)	-4.29% (- 10.4, 0.9)	0.244 ^e	
^a Remission: no symptoms and/or no medication; improvement: fewer					

Comorbidities	B-TB (n=127)	SASI (n=107)	Absolute Difference, % (95% CI) ^a	P Value Unadjusted	P Value Adjusted ^b
Obstructive Sleep Apnea					
Comorbidity present at baseline	115/127 (90.55%)	91/107 (85.05%)	+ 5.50% (- 3.3, 14.3)	0.189 ^d	
Remission	89 (77.39%)	83 (91.21%)	-13.82% (- 23.6, - 3.5)	0.0072 ^d	0.031
Improved	26 (22.61%)	8 (8.79%)	+ 13.82% (+3.5, 23.6)	0.0084 ^d	0.045
^a Remission: no symptoms and/or no medication; improvement: fewer					

symptoms and/or less medical treatment or medications; unchanged: same symptoms and equivalent therapy; worsened: more symptoms or increase in therapy. Remission of type 2 diabetes: hemoglobin A1c < 42 mmol/mol (6.0%), fasting glucose < 100 mg/dL, and at least 1 year with no active pharmacologic therapy.

^b Prop. test (R Project).

^c Adjustment by step-down Bonferroni-Holm correction for multiple

comparisons for the number of subitem tests.

^d χ^2 Test.

^e Fisher exact test.

B-TB sleeve ileal one-anastomosis transit bipartition with Braun's jejunioileostomy, SASI single anastomosis sleeve ileal

Complications

The total complication rate was 11.02% in the B-TB group and 13.08% in the SASI group, with no statistically significant difference between the two groups. Regarding short-term complications, the incidence was 5.51% in the B-TB group and 4.67% in the SASI group. One case of asymptomatic anastomotic leak occurred in the B-TB group, which was diagnosed as a radiographic leak by gastrointestinal contrast study and resolved after one month of conservative management. Intestinal obstruction occurred in 3 cases in the B-TB group and 4 cases in the SASI group, all of which were

managed conservatively and improved, with anastomotic edema considered as the possible cause. The 30-day readmission rates were 2.36% and 2.80%, respectively, both attributed to discomfort requiring hospitalization due to inadequate fluid intake. In terms of late complications, the incidence was 5.51% in the B-TB group and 8.41% in the SASI group, with no statistical significance. Gastroesophageal reflux occurred in 3 cases in the B-TB group and 4 cases in the SASI group, all graded as Grade B. Other complications, including diarrhea and constipation, were all resolved after conservative treatment. (Table 4)

Table 4
Complications and readmissions after the two procedures

Events	B- TB n=127	SASI n=107	Absolute Difference (95% CI) ^g	P Value Unadjusted ^h
Early morbidity (0–30 d)	7/127(5.51%)	5/107(4.67%)	+ 0.84%(– 4.7%, 6.4%)	0.770
Leak ^a	1	0	+ 0.79%(– 1.6%, 4.5%)	> 0.99
Obstruction ^b	3	2	+ 0.49%(– 3.3%, 4.4%)	> 0.99
Post-op 30-day readmission ^c	3	3	–0.44%(– 4.8%, 3.9%)	> 0.99
Late morbidity (1 month–2 year)	7/127 (5.51%)	9/107(4.67%)	–2.90%(– 10.2%, 4.3%)	0.385
Gastroesophageal reflux ^d	3	4	–1.38%(– 6.2%, 3.4%)	0.709
Diarrhea ^e	1	2	–1.08%(– 4.5%, 2.1%)	0.590
Constipation ^f	3	3	–0.44%(– 4.8%, 3.9%)	> 0.99
Total complication rate	14/127(11.02%)	14/107(13.08%)	–2.06%(– 10.3%, 6.1%)	0.623

^aReceived conservative treatment and recovered completely after 1 month.

^bReceived non-surgical treatment; symptoms were considered related to anastomotic edema. No internal hernia was detected on CT scan.

^cInsufficient water intake

^dGastroscopy performed 2 years postoperatively diagnosed gastroesophageal reflux of grade B or higher.

^eSymptoms improved after probiotic treatment.

^fSymptomatic treatment was administered, and symptoms improved after increased dietary fiber intake.

^gProp.test .

^hFisher exact test was used when the number of cases in any single group was less than 5; otherwise, the χ^2 test was adopted.

Discussion

In this study, body weight and BMI at 6 and 12 months postoperatively were significantly decreased compared with baseline, while %TWL and %EWL were significantly increased, which is consistent with the early weight loss effects of metabolic and bariatric surgery reported in previous literature.^[9, 11] At 12 months after surgery, the SASI group exhibited significantly greater %TWL and %EWL compared with the B-TB group, indicating that the SASI procedure may offer superior mid-term weight loss efficacy over the B-TB procedure.

The superior weight loss efficacy of the SASI procedure may be attributed to its more complete biliopancreatic diversion. Specifically, following the SASI procedure, bile and pancreatic secretions reflux into the stomach and subsequently pass retrogradely through the duodenum into the biliopancreatic intestinal limb, creating an "empty circulation" of biliopancreatic juices. This mechanism results in a more substantial delay in the mixing of ingested food with bile and pancreatic secretions, ultimately diminishing the absorption of nutrients.^[15–17] In contrast, although the B-TB procedure also achieves partial biliary and pancreatic diversion by incorporating an ileo-ileal anastomosis in addition to the Braun anastomosis, the extent of such diversion is comparatively milder. This may account for the observation that its mid-term weight loss outcomes are slightly less favorable than those of the SASI procedure.^[9–11]

Nevertheless, at 24 months post-surgery, no statistically significant differences were observed between the two groups across all weight loss metrics. This convergence of long-term efficacy may be associated with several factors. Firstly, with prolonged postoperative duration, the body may undergo compensatory adaptations via neuroendocrine regulatory pathways, manifesting as heightened appetite and diminished energy expenditure, which partially counteract the surgically induced anatomical alterations. Secondly, patients' dietary patterns and lifestyle modifications may gradually revert to their preoperative status during extended follow-up, thereby attenuating the intergroup differences. Additionally, despite the relatively modest degree of diversion in the B-TB procedure, its retention of a more intact gastrointestinal anatomical configuration may facilitate long-term nutritional homeostasis,

potentially accounting for the progressive narrowing of discrepancies in body weight and BMI between the two groups over time.

Both procedures demonstrated favorable efficacy in inducing remission of T2DM, with remission rates exceeding 90%. These results are in accordance with those reported in prior studies^[18, 19], suggesting that irrespective of the specific surgical approach, bariatric surgery facilitates effective diabetes control via multifaceted mechanisms, encompassing weight reduction, enhanced incretin secretion, and amelioration of insulin resistance .

The hypertension remission rates were similar between the two groups. Nevertheless, 7 patients in the SASI group exhibited no improvement in hypertension, and 3 showed deterioration, while no such events were observed in the B-TB group. These trends imply a potential superiority of the B-TB procedure in hypertension management; however, the underlying mechanisms are not yet elucidated. One possible explanation is that the more moderate intestinal reconstruction associated with the B-TB procedure leads to lesser activation of the renin-angiotensin-aldosterone system. Nonetheless, these findings warrant confirmation through studies with larger cohorts and extended follow-up periods.

OSA represents the most noteworthy comorbidity in the present study. The SASI group demonstrated a complete remission rate of OSA of 91.21%, which was significantly superior to the 77.39% observed in the B-TB group. Although the B-TB group exhibited a higher improvement rate of 22.61% compared with 8.79% in the SASI group, this discrepancy is likely a consequence of the substantially higher remission rate in the SASI group. The more favorable OSA resolution associated with the SASI procedure may be closely linked to its superior weight loss efficacy. Given that adipose tissue accumulation surrounding the upper airway constitutes a major risk factor for OSA, more substantial weight reduction facilitates the reduction of cervical fat deposits and pharyngeal soft tissue volume, thereby improving airway patency.^[20, 21] This observation is concordant with the significantly higher %EWL and %TWL in the SASI group at 12 months postoperatively in this study.

With regard to safety, both procedures exhibited favorable profiles, as no severe adverse events or mortalities were recorded in either group. Given that both surgical approaches entail the addition of gastrointestinal and enteroenteric anastomoses to standard sleeve gastrectomy—procedures that are routine in gastrointestinal surgery, they do not substantially extend operative duration, nor do they present concerns related to anastomotic tension or vascular perfusion. Consequently, they impose minimal physiological disruption on patients and are associated with low morbidity rates. Notably, although the B-TB procedure theoretically confers inferior postoperative reflux control compared with the SASI procedure owing to the preservation of an uninterrupted gastroduodenal-jejunal conduit, the incidence of reflux did not differ significantly between the two groups in the present study, a finding that may be attributed to the limited sample size.

Several limitations of this study should be acknowledged. First, the retrospective, single-center design may be subject to selection bias. Second, the allocation of surgical procedures was determined through

shared decision-making involving the multidisciplinary team and patients rather than by randomization; consequently, patient preferences and disparities in baseline comorbidity profiles may have confounded the results. Third, the follow-up duration of only 2 years is insufficient to assess long-term weight loss maintenance and the incidence of late complications associated with either procedure. Fourth, the diagnosis and remission of comorbidities may be subject to certain assessment biases. Fifth, although the sample size met the predetermined statistical requirements, it may lack adequate statistical power for certain subgroup analyses.

In summary, both the B-TB and SASI procedures achieved significant and safe weight reduction and comorbidity resolution within the 2-year postoperative period. The SASI procedure exhibited superior weight loss outcomes at 12 months compared with the B-TB procedure, along with a higher complete remission rate for OSA; nevertheless, these advantages diminished and became comparable at 24 months. The two procedures were equivalent with respect to safety profiles and the remission of other comorbidities. Considering that the relative merits of each procedure vary according to time points and specific comorbidities, the choice of surgical approach should be guided by individual patient characteristics to facilitate precision-based decision-making.

Abbreviations

BMI: body mass index;BP: bipartition procedure;

B-TB: sleeve gastrectomy with Braun anastomosis transit bipartition

CI: confidence interval;CPAP: continuous positive airway pressure

CT: computed tomography;GERD: gastroesophageal reflux disease

;HbA1c: glycated hemoglobin;OSA: obstructive sleep apnea;

RYGB: Roux-en-Y gastric bypass;SASI: single anastomosis sleeve ileal

SD: standard deviation;SG: sleeve gastrectomy;T2DM: type 2 diabetes mellitus;%EWL: percentage of excess weight loss;%TWL: percentage of total weight loss

Declarations

Ethics approval and consent to participate:

The study was approved by the Baoji Hospital Affiliated to Xi'an Medical University ethics committee (Approval No.: [2021] No. 32).This study was performed in accordance with the ethical principles of the Declaration of Helsinki and complied with all relevant national and institutional guidelines and

regulations for research involving human participants. All patients were informed of the surgical risks and provided written informed consent prior to participation.

Consent for publication:

Not applicable

Competing Interests:

I declare that the authors have no competing interests as defined by BMC, or other interests that might be perceived to influence the results and/or discussion reported in this paper.

Funding

Not applicable

Author Contribution

Ming Tian contributed to study conceptualization, data collection, and figure preparation. Taotao Wang, Mingguo Wang, Ping He, and Haiying Li were responsible for data acquisition and patient follow-up. Xiang Luo and Zhenxu Qiao participated in figure preparation and visualization. Jiangpeng Wei and Huiqi Li contributed to study design, manuscript drafting and revision, data analysis, and overall supervision. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of this work.

Acknowledgements:

Not applicable

Availability of data and materials:

This manuscript does not report data generation or analysis.

References

1. Cheng Y, Xie Y, Sun W, et al. Sleeve gastrectomy versus roux-en-Y gastric bypass for remission of type 2 diabetes mellitus and obesity: systematic review and meta-analysis of randomized controlled trials. *Int J Surg.* 2026;112(2):4965–80.
2. Ben-Porat T, Mashin L, Kaluti D, et al. Weight Loss Outcomes and Lifestyle Patterns Following Sleeve Gastrectomy: an 8-Year Retrospective Study of 212 Patients. *Obes Surg.* 2021;31(11):4836–45.

3. Pan Q, Wang B, Zhao Y, et al. Sleeve Gastrectomy Versus Roux-en-Y Gastric Bypass in Terms of Hypertension Remission Rate After Surgery: A Meta-Analysis. *Obes Surg.* 2026;36(2):818–35.
4. Noel P, Cazerres C, Lutfi RE, Nocca D. 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. *J Laparoendosc Adv Surg Tech A.* 2026. 36(5): 350–355.
5. Alamo M, Sepúlveda M. The Sleeve Gastrectomy with Jejunal Bypass (Original Technique). *J Laparoendosc Adv Surg Tech A.* 2024;34(1):77–81.
6. Balamurugan G, Leo SJ, Sivagnanam ST, et al. Comparison of Efficacy and Safety Between Roux-en-Y Gastric Bypass (RYGB) vs One Anastomosis Gastric Bypass (OAGB) vs Single Anastomosis Duodeno-ileal Bypass with Sleeve Gastrectomy (SADI-S): a Systematic Review of Bariatric and Metabolic Surgery. *Obes Surg.* 2023;33(7):2194–209.
7. Balibrea JM, Vilallonga R, Hidalgo M, et al. Mid-Term Results and Responsiveness Predictors After Two-Step Single-Anastomosis Duodeno-Ileal Bypass with Sleeve Gastrectomy. *Obes Surg.* 2017;27(5):1302–8.
8. Salama T, Sabry K, Ghamrini YE. Single Anastomosis Sleeve Ileal Bypass: New Step in the Evolution of Bariatric Surgeries. *J Invest Surg.* 2017;30(5):291–6.
9. Widjaja J, Sun X, Chu Y, Hong J, Yao L, Zhu X. Sleeve Gastrectomy with Braun Anastomosis Transit Bipartition (B-TB): a Potential Midway Between Single Anastomosis and Roux-en-Y Transit Bipartition. *Obes Surg.* 2021;31(12):5500–3.
10. Chu Y, Widjaja J, Wang J, et al. Comparison of three different anastomotic methods of sleeve gastrectomy with transit bipartition using an obese rodent model. *Sci Rep.* 2023;13(1):21247.
11. Christogianni V, Rao A, Halter CJ, et al. Conversion of sleeve gastrectomy to different types of bipartitions: OATB, B-TB, and RYTB-a retrospective single-center study. *Updates Surg.* 2025;77(7):2007–14.
12. Chen G, Zhang GX, Peng BQ, Cheng Z, Du X, Roux-En. -Y Gastric Bypass Versus Sleeve Gastrectomy Plus Procedures for Treatment of Morbid Obesity: Systematic Review and Meta-Analysis. *Obes Surg.* 2021;31(7):3303–11.
13. Mahdy T, Gado W, Alwahidi A, Schou C, Emile SH. Sleeve Gastrectomy, One-Anastomosis Gastric Bypass (OAGB), and Single Anastomosis Sleeve Ileal (SASI) Bypass in Treatment of Morbid Obesity: a Retrospective Cohort Study. *Obes Surg.* 2021;31(4):1579–89.
14. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg.* 2004;240(2):205–13.
15. Dowgiałło-Gornowicz N, Waczyński K, Waczyńska K, Lech P. Single anastomosis sleeve ileal (SASI) bypass as a primary and revisional procedure: a single-centre experience. *Wideochir Inne Tech Maloinwazyjne.* 2023;18(3):510–5.
16. Ataya K, Patel N, Aljaafreh A, et al. Outcomes of Single Anastomosis Sleeve Ileal (SASI) Bypass as an Alternative Procedure in Treating Obesity: An Updated Systematic Review and Meta-Analysis. *Obes Surg.* 2024;34(9):3285–97.

17. Parkitna J, Jaworski P, Binda A, Barski K, Tarnowski W. Effect of SASI procedure (Single Anastomosis Sleeve Ileal) on the symptoms of gastroesophageal reflux disease in bariatric patients - a review of the literature. *Pol Przegl Chir.* 2023;96(0):60–4.
18. Queiroz S, Gadelha JG, Husain N, Gutu CS. Effect of Gastric Bypass vs Sleeve Gastrectomy on Remission of Type 2 Diabetes Mellitus Among Patients with Severe Obesity: A Meta-Analysis. *Obes Surg.* 2025;35(6):2296–302.
19. Sandoval DA, Patti ME. Glucose metabolism after bariatric surgery: implications for T2DM remission and hypoglycaemia. *Nat Rev Endocrinol.* 2023;19(3):164–76.
20. Cao P, Li J, Wang G, et al. Effects of sleeve gastrectomy on populations with obesity and obstructive sleep apnea: a meta-analysis. *Surg Obes Relat Dis.* 2025;21(3):288–300.
21. Wyszomirski K, Walędziak M, Róžańska-Walędziak A, Obesity. Bariatric Surgery and Obstructive Sleep Apnea-A Narrative Literature Review. *Med (Kaunas).* 2023. 59(7).

Figures

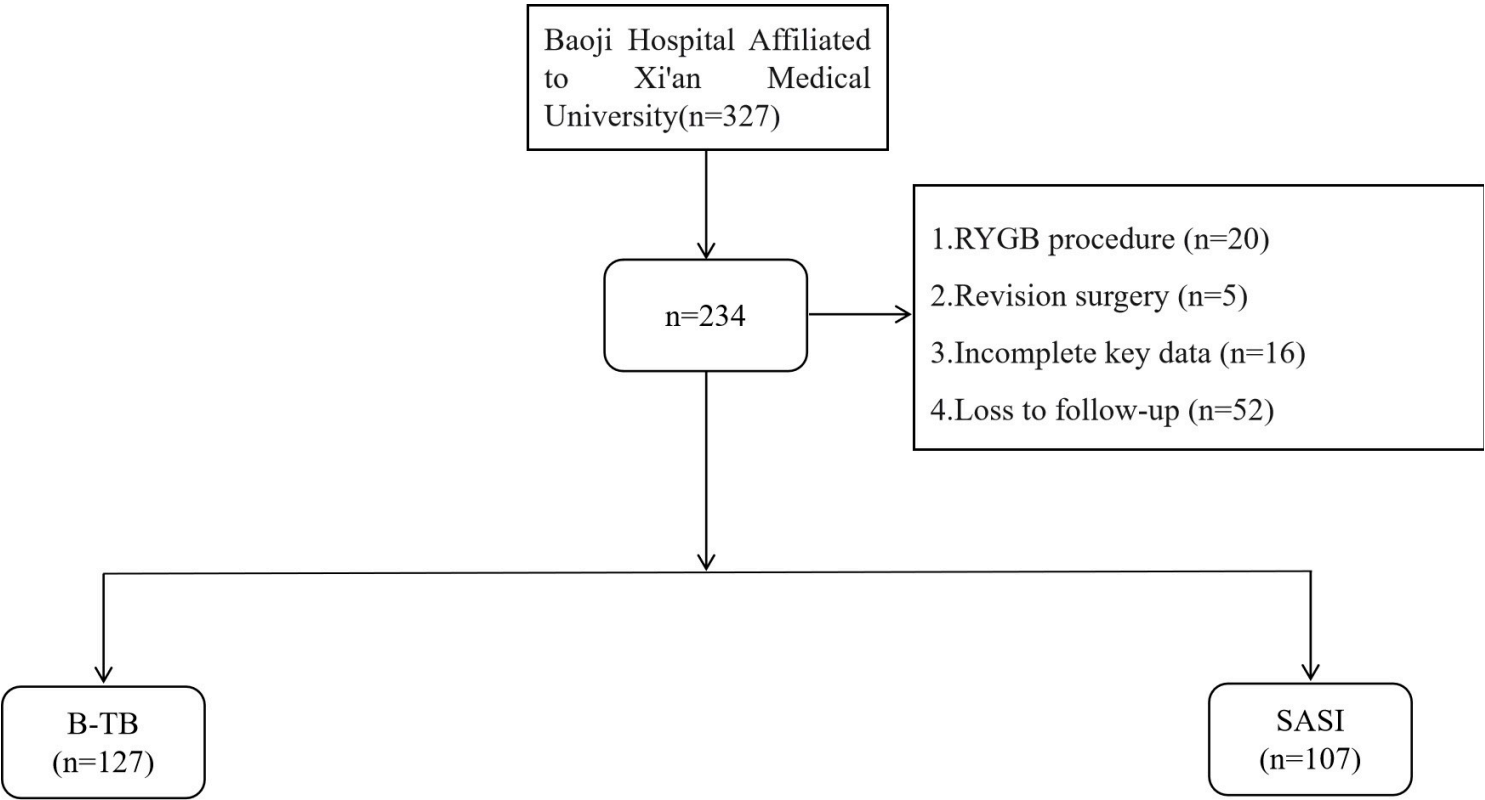


Figure 1

CONSORT flow diagram showing the process of patient enrollment in this retrospective clinical study.

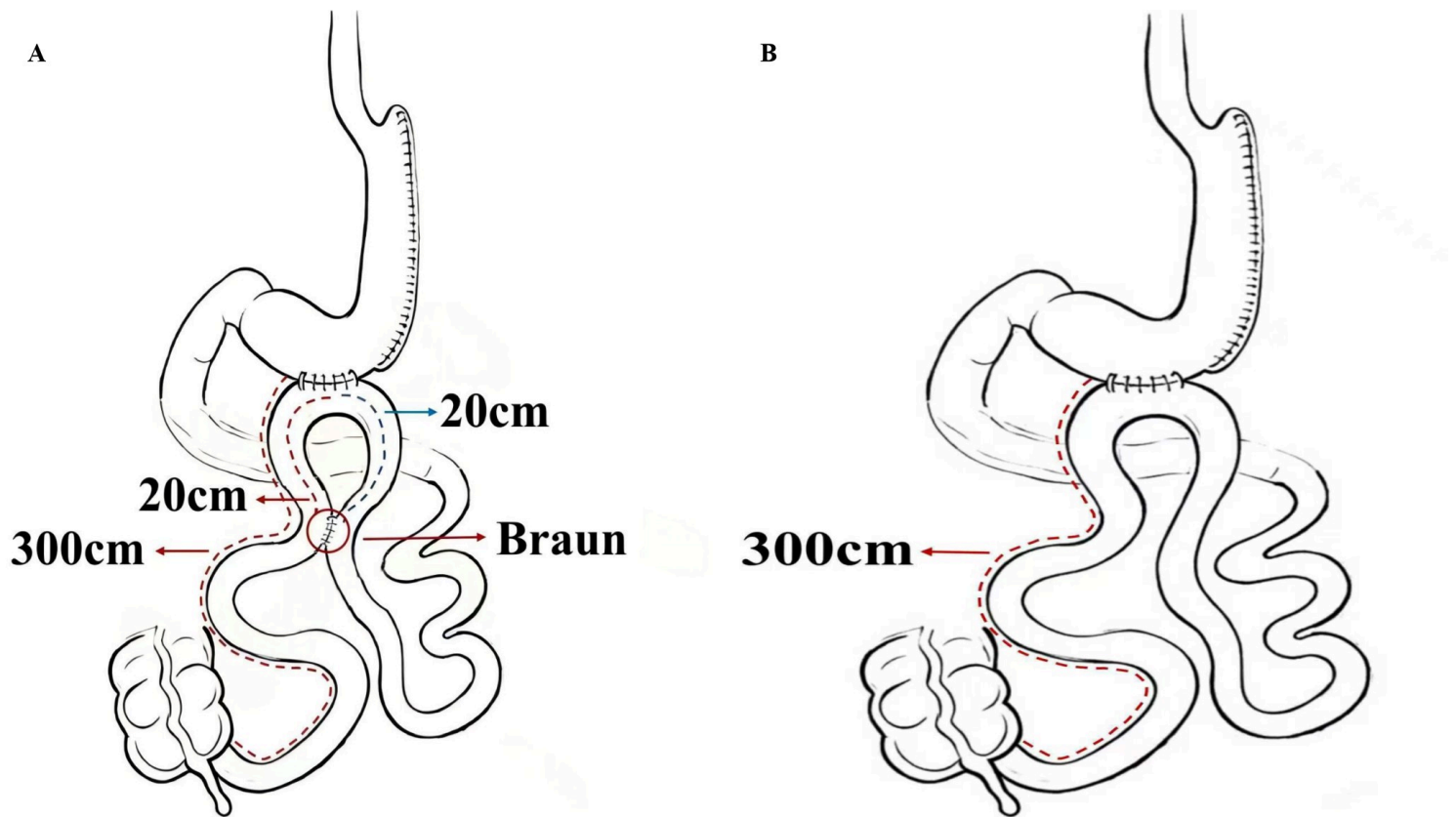


Figure 2

Graphical illustration for (a) Single Anastomosis Sleeve Ileal (SASI) and (b) sleeve gastrectomy with Braun anastomosis transit bipartition (B-TB)

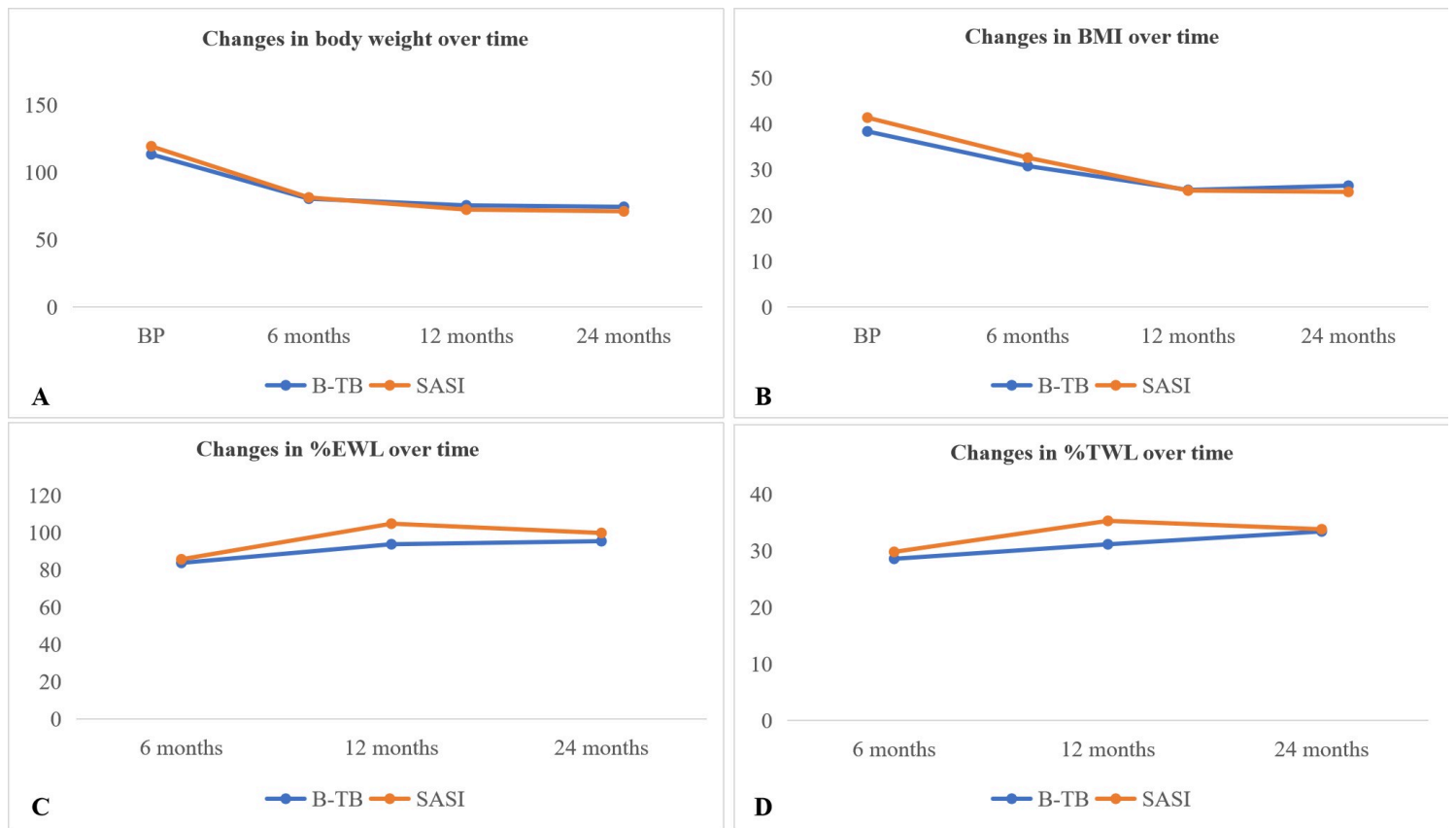


Figure 3

Changes in (A)body weight,(B)BMI,(C)%EWL,(D)%TWL over time. %TWL percentage of total body weight loss, BP bipartition procedure, BMI body mass index,%EWLpercentage of excess weight loss