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REVIEW ARTICLE

Is the Sleeve Gastrectomy Sufficient or Does it Require Additional Surgical Procedures?

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Laparoscopic sleeve gastrectomy is a relatively simple procedure and has become the most well-known bariatric surgical procedure in Korea and Western countries. However, this procedure has several disadvantages in terms of long-term weight loss and metabolic disease control. Laparoscopic sleeve gastrectomy and additional bypass (sleeve plus) procedures were recently introduced into bariatric surgery in order to combine the physiologic advantages of pyloric-saving reconstruction and the bypass effect. A sleeve gastrectomy was performed first, followed by a bypass procedure. This review describes sleeve plus procedures reported in the literature and compares their outcomes with the most frequently performed techniques.

Key Words: Laparoscopic sleeve gastrectomy, Sleeve plus, Weight loss, Metabolic disease

BACKGROUND

Obesity, one of the most common lifestyle diseases, has recently become worldwide pandemic [1] and is one of the most common causes of type 2 diabetes and other metabolic diseases. In many patients attempts to manage obesity by conventional methods such as diet and exercise have been unsuccessful [2]. Surgery can be an effective method to manage both obesity and its associated comorbidities. There are several types of bariatric surgeries are available, however no single procedure is suitable for addressing all patients with obesity [3]. Since westernized eating habits have become widespread in Korea, the prevalence of westernized diseases is also increasing, and obesity is a problem that has gradually emerged over time along with metabolic syndrome. Consequently, the Korean National Insurance System has covered surgical treatment for those with morbid obesity with a body mass index (BMI) >30 kg/m^2 with comorbidities or >35 kg/m^2 since 2019. The most common laparoscopic surgical options include sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGB), and laparoscopic sleeve gastrectomy is rarely performed in combination with bypass procedures. The procedure has shown excellent long-term weight loss and metabolic disease control, and few short or long-term complications, including weight loss failure. Laparoscopic sleeve gastrectomy and additional bypass (sleeve plus) procedures were recently introduced into bariatric surgery in order to combine the physiologic advantages of pyloric-saving reconstruction and the bypass effect. In this review, popular sleeve plus surgeries and their outcomes compared

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to metabolic and bariatric surgery were reviewed based on results presented in the literature reported to date.

PROBLEMS WITH SLEEVE GASTRECTOMY

1. High rates of weight loss failure compared to bypass surgery

Several studies have investigated long-term weight loss results after a sleeve gastrectomy [4-6]. Many of them have shown a significant linear decrease in BMI declines over the follow-up period, and some studies favor the results of the bypass operation [4,5,7-9]. Gradual dilation of the sleeve has also been reported to have a negative impact on weight loss [10]. With regards to undergoing second bariatric procedures due to insufficient weight loss, sleeve gastrectomy is more common than bypass surgery [6,8,11]. Although whether a secondary gastric bypass procedure yields outcomes comparable to those of primary bypass alone remains unclear, the operative risks for any second bariatric operation are undoubtedly higher [11].

2. Inferior results type 2 diabetes control

One of the most important advances in the field of bariatric surgery has been the publication of high-quality evidence regarding its effect on type 2 diabetes outcomes. A well-designed randomized study reported that the diabetes remission rate after bariatric surgery was significantly higher in the gastric-bypass group than in the sleeve-gastrectomy group [7,8,12]. A systematic review has also reported long-term outcomes of patients with type 2 diabetes after a sleeve gastrectomy.

Laparoscopic sleeve gastrectomy (LSG) is an effective long-term metabolic surgery for patients with T2DM, with a 5-year resolution rate of approximately 60%. However, recurrence of comorbidities following any restrictive bariatric surgery remains controversial, with 13% of patients still having diabetes at 5 years [13]

PROBLEMS WITH RY GASTRIC BYPASS

1. Early and late complications

RYGB has several short and long-term complications, such as loss of access to the remnant stomach, dumping syndrome, marginal ulcers, internal hernias, anemia, and vitamin deficiencies. Long-term complications are related to nutritional deficiencies requiring long-term vitamin and mineral supplementation [14,15]. Dumping syndrome symptoms can appear as early as 6 weeks postoperatively, and have been reported to affect up to 40% of patients according to large survey studies of individuals who have undergone bypass procedures [16,17].

2. Risk of remnant gastric cancer

Another concern regarding gastric bypass is the development of remnant gastric cancer. A review article found 17 patients with remnant gastric cancer after a gastric bypass surgery [18].

Seven patients had an unresectable tumor and underwent palliative chemotherapy (41%), and the disease-related mortality rate was 33.3%. Although an extremely small number of patients had remnant gastric cancer after a gastric bypass, upper endoscopy screening examinations should be performed in countries with high incidence of gastric cancer, including Korea. To date, no reports have investigated remnant gastric cancer after a gastric bypass in Korea.

ARE SLEEVE PLUS PROCEDURES NEEDED?

1. What is the role of sleeve plus procedure in metabolic and bariatric surgery?

The term "sleeve plus" for all such procedures was first introduced by Huang at the Taiwan Surgical Society of Gastroenterology meeting on October 24, 2015 [19]. Several types of sleeve plus procedures have been performed worldwide (Fig. 1). Theoretically, sleeve plus procedures can provide the physiologic advantages of pyloric-saving reconstruction and the bypass effect while overcoming concerns about sleeve alone and RYGB.

2. Sleeve plus procedures

1) Duodenojejunal bypass with sleeve gastrectomy (DJB-SG)

Two different techniques of sleeve-DJB have been used: the Roux-en-Y type, introduced by Kasama from Japan,

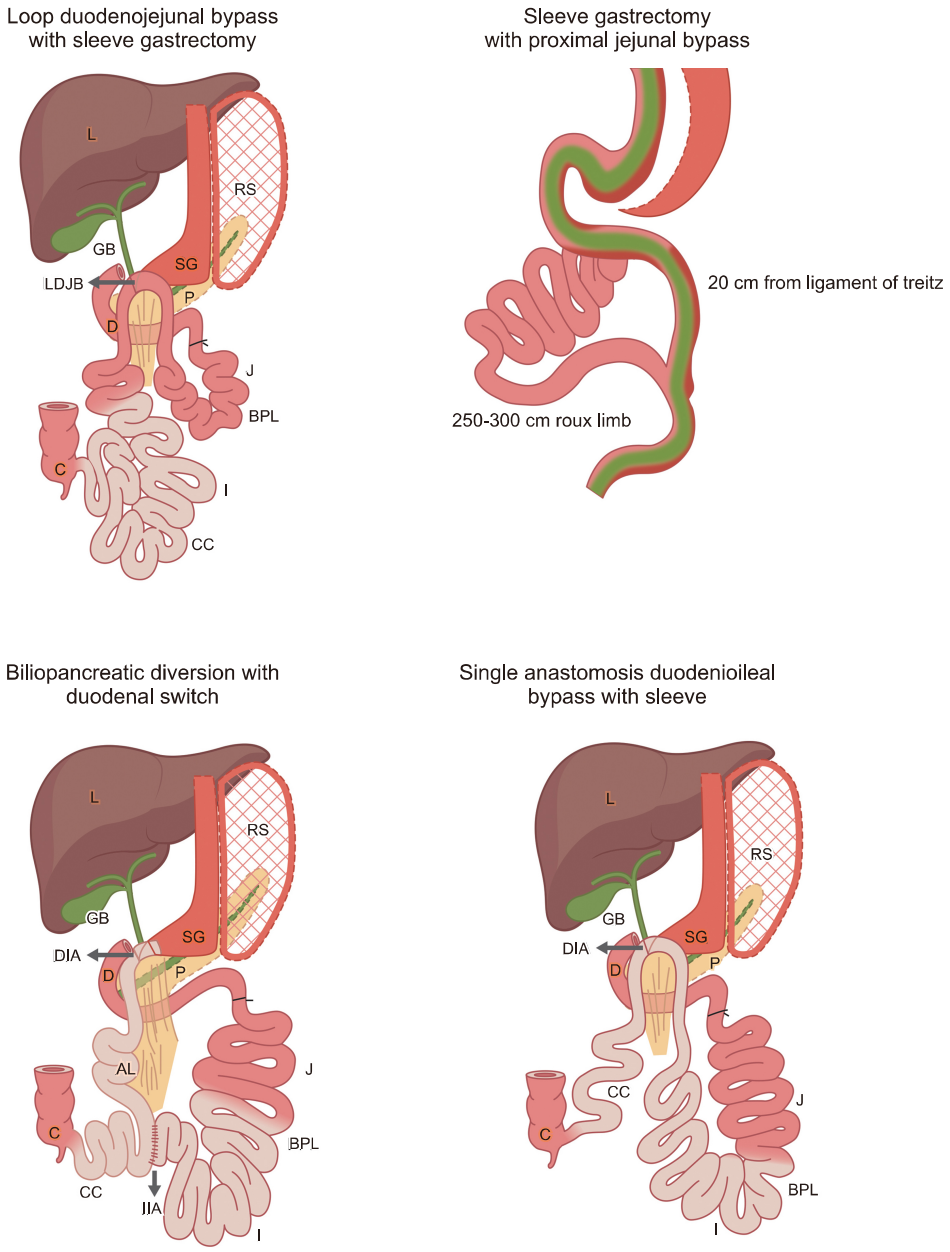

Fig. 1. Four different Sleeve plus procedures. AL = alimentary limb, BPL = biliopancreatic limb, C = cecum, CC = common channel, D = duodenum, DIA = duodenoileal anastomosis, GB = gall bladder, I = ileum, IIA = ileoileal anastomosis, J = jejunum, L = liver, LDJB = loop duodenojejunal bypass, P = pancreas, RS = resected stomach, S = stomach, SG = sleeve gastretomy.

and the "loop" type, introduced by Huang from Taiwan [20,21]. The reported rates of diabetes remission at 1 year with sleeve–DJB and sleeve–loop DJB were 86% and 62%, respectively; however, these procedures require meticulous surgical techniques [19]. According to recent data, %EWL was 95.77% and 83.84% and %TWL was 34.64% and 30.32% at the 1–year and 3–year follow–ups respectively [22]. Diabetes remission reached a maximum of >90% of patients at the 1–year follow–up in patients with $HbA1_C$ levels of <6.5%. Even at the 3–year follow–up, remission was >90%, indicating that diabetes remission was sustainable after sleeve gastrectomy loop duodenojejunal bypass (SG LDJB). A Korean study suggested that sleeve DJB can be a feasible and safe procedure for Korean bariatric patients [23]. Another Korean study showed excellent weight loss results with %TWL of 27.5% and a discontinuation rate of diabetic medication of 91% at 6 months postoperatively [24]. However, the Korean the studies included only a small number of patients and had a retrospective design.

2) LSG with proximal jejunal bypass (LSG-JB)

Sleeve gastrectomy with jejunal bypass (LSG-JB) was developed by Alamo in 2004 and was later modified in 2006 to exclude the bypassed portion of the jejunum. In this technique, after a sleeve gastrectomy, the ligament of Trietz is identified, and the jejunum is divided at 20 cm. Distally, the jejunum is measured at a distance of 250-300 cm and anastomosed to the proximal biliopancreatic jejunal limb. SG with jejunal bypass is technically simple and reversible with effective weight loss and diabetes remission in patients with BMI <35 kg/m^2 [25,26] and BMI >35 kg/m^2 [27]

3) Biliopancreatic diversion with duodenal switch (BPD-DS)

Biliopancreatic diversion was first developed by Scopinaro et al. [28] in 1979 and combined with a horizontal gastric resection with closure of a duodenal stump, gastroileal anastomosis, and ileoileal anastomosis to create a 50-cm common channel and a 250-cm alimentary channel [29]. The duodenal switch evolved into the creation of an alimentary limb of 200 to 250 cm in length [30]. Sustained weight loss (90% EWL), even up to 5 years, was observed due to the stronger incretin response and continued malabsorptive effect of DS. In a group-matched study by Hess and Hess [30] in which patients had a mean BMI of 50 kg/m^2, the rate of diabetic remission after BPD-DS was significantly higher than that after RYGB (82% vs. 64%). Protein-calorie malnutrition is mostly observed during the first year, with an incidence of 3-5%, which gradually decreases to 1-3.7% in the second year [4].

4) Single anastomosis duodenoileal bypass with sleeve (SADI-S)

Single-anastomosis duodenoileal bypass with sleeve gastrectomy/one anastomosis duodenal switch (SADI-S/OADS) was first described by Sánchez-Pernaute et al. [31] in 2007 as a modification of the standard biliopancreatic diversion with duodenal switch (BPD/DS). This consists of a biliopancreatic diversion in which a sleeve gastrectomy is followed by an end-to-side duodenoileal diversion with an omega loop of the ileum at 200 cm proximal to the ileocecal valve. In a recent systematic review, outcomes at 24 months after SADI-S showed mean TBW, EBW, and EBMI losses ranging from 25.8% to 46.3%, 44.3% to 86.0%, and 19.5% to 80.8%, respectively [32]. This method is considered a revision surgery after a sleeve gastrectomy. Nutritional complications can occur if the common channel is <300 cm.

CONCLUSION

Carrying out only restrictive procedures for the treatment of metabolic and bariatric diseases may be insufficient, and laparoscopic RYGB carries a potential risk of gastrojenunostomy-related complications and although rare, remnant gastric cancer especially in Northeast Asia. Combined malabsorptive and restrictive bariatric operation with pylorus preservation, which prevents marginal ulcers at anastomosis and dumping syndrome after meals has essential benefits. Randomized controlled trials with long-term follow-up are needed to ensure consistency in high-quality outcomes reported to date.

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