

Less Invasive Bariatric/Metabolic Procedures for Weight Reduction and Glucose Control

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The prevalence of obesity has increased steadily in Korea as well as worldwide, and bariatric surgery is the most powerful treatment modality for morbid obesity. However, fear of invasive procedures means most patients prefer less invasive procedures. New treatment modalities for obesity are emerging, but in Korea, only one traditional gastric balloon is approved by the government. Although it is difficult to introduce new techniques in Korea because of the high entry barrier presented by the country's national health insurance system, it is important for physicians and surgeons to be aware of new obesity treatment modalities.

Key words: Obesity, Bariatric surgery, Gastroplasty, Therapeutic embolization, Gastric balloon

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INTRODUCTION

Bariatric and metabolic surgery has been covered by Korea's national insurance system since January 2019. As the number of bariatric and metabolic surgery cases continues to increase, many physicians and patients with obesity, as well as surgeons, are paying more attention to weight-loss surgery. The social stigma that morbid obesity is the individual's fault is also slowly weakening. Because of the high entry barrier posed by the national health insurance system, it is difficult to introduce new obesity treatment techniques in Korea. Bariatric surgery has been accepted as an important treatment modality for severe obesity since the late 2000s, and the methodology in less invasive procedures has also been evolving, making it necessary patients and physicians to be aware of new treatment modalities (Table 1).

PROCEDURELESS INTRAGASTRIC BALLOONS

Intragastric balloons are gastric volume-occupying devices that help satiate patients' hunger. A commercial intragastric balloon available in Korea is administered widely in local clinics. Intragastric balloons are usually placed endoscopically and can be filled with 400 to 800 mL of saline. The Eclipse (Allurion Technologies, Wellesley, MA, USA) is designed to be swallowed and inflated through a catheter without endoscopy. This balloon is filled with 550 mL of saline through a connected catheter that is then removed via the mouth. The Ellipse spontaneously empties the saline through a release valve approximately 3 months later and it is excreted with the stool. A pilot study demonstrated that the weight-loss effect of this procedureless gastric balloon was similar to that of an endoscopically placed balloon.¹ However, it is possible to regain

Table 1. Pros and cons of each procedure

Procedure	Weight loss/glucose control	Pros	Cons
Procedureless intragastric balloon ²	Percentage total weight loss, 10.9% at 6 months	Swallowable balloon and spontaneous removal	Questionable result of weight maintenance after balloon removal
Duodenal mucosal resurfacing ^{3,4}	Weight loss, -2.5 kg at 6 months/HbA1c reduction, 0.9% & fasting glucose reduction, 30.6 mg/dL at 6 months	Superior glucose control effect	Less weight loss Duodenal stenosis reported
Endoscopic sleeve gastropasty ⁵⁻⁷	Percentage total weight loss, 14.9%–19.5% at 6 months and 21.3% at 12 months	Favorable weight loss results	Difficulty in early diagnosis of gastric cancer after endoscopic gastropasty
Percutaneous endoscopic gastrostomy tube ^{8,9}	Percentage total weight loss, 12.1%–18.2% at 12 months	No limit to eating	Persistent fistula reported
Bariatric embolization ^{10,11}	Percentage excess weight loss, 12.8% at 6 months, and 11.5% at 12 months	No need to import new equipment or seek domestic approval	Reduced vascularity of stomach after embolization

HbA1c, glycosylated hemoglobin.

weight after the intragastric balloon is removed, and the long-term effects have not been fully demonstrated. Recently, a prospective single-arm trial showed favorable 1-year weight-reduction results with the use of a procedureless gastric balloon.² However, weight regain was observed 6 months after balloon removal, and longer-term results should be evaluated in the future.

DUODENAL MUCOSAL RESURFACING

Bariatric surgery is an effective option for controlling blood sugar levels, especially in patients with obesity and type 2 diabetes mellitus (T2DM), hence the name bariatric and metabolic surgery rather than weight-reduction surgery. Many weight-reduction-independent mechanisms are available for diabetes control in bariatric surgery. The foregut and hindgut theories are traditional explanations for the metabolic effects of bariatric surgery. The foregut theory posits that excluding the presentation of nutrients to the duodenum and proximal jejunum contributes to improvement in glycemic regulation after bariatric surgery.¹² Duodenal mucosal resurfacing (DMR) is an endoscopic intervention using specially designed catheters. It induces circumferential hydrothermal ablation of the duodenal mucosa and subsequent mucosal healing, resulting in an effect similar to foregut exclusion (Fig. 1).³ Investigators have conducted a prospective multicenter trial to evaluate the glycemic-control effect of DMR in people with T2DM ($n = 46$).⁴ In this trial, reductions of glycosylated hemoglobin of $0.9\% \pm 0.2\%$ were observed at 6 months compared with baseline values and this effect was preserved for up to 1 year. Fasting plasma glucose was reduced by 30.6 ± 9.0 mg/dL and 32.4 ± 9.0 mg/dL at 6 months and 12 months after DMR, re-

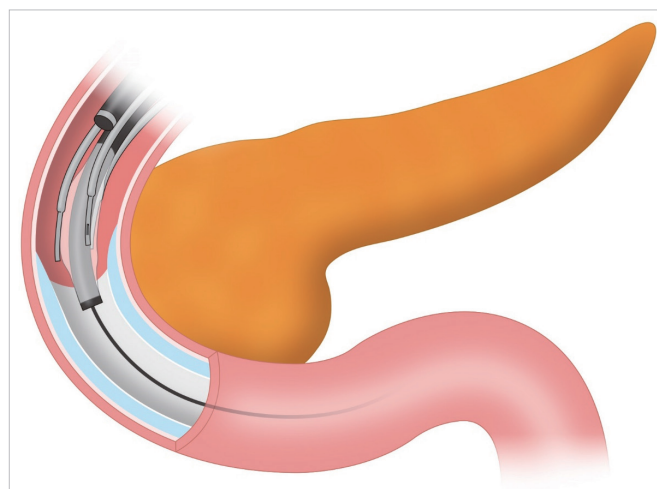


Figure 1. Schematic diagram of duodenal mucosal resurfacing. Circumferential ablation of the duodenal mucosa resulting in an effect similar to duodenal exclusion.

spectively.

ENDOSCOPIC SLEEVE GASTROPLASTY

Endoscopic sleeve gastropasty (ESG) is a volume-reduction procedure using endoscopic intragastric suturing to create multiple tissue plication in the stomach and reduce the stomach lumen (Fig. 2). Two prospective multicenter clinical trials reported total body weight loss of 15.2% and 14.9% at 6 months after ESG.^{5,6} Serious adverse events, including perigastric fluid collection, extra- and intra-gastric hemorrhage, pulmonary embolism, pneumoperitoneum, and pneumothorax occurred in 2%–2.7% of study participants. All cases recovered without surgical intervention. Recently, Fayad et al.⁷ published a retrospective single-center study comparing 1-year results

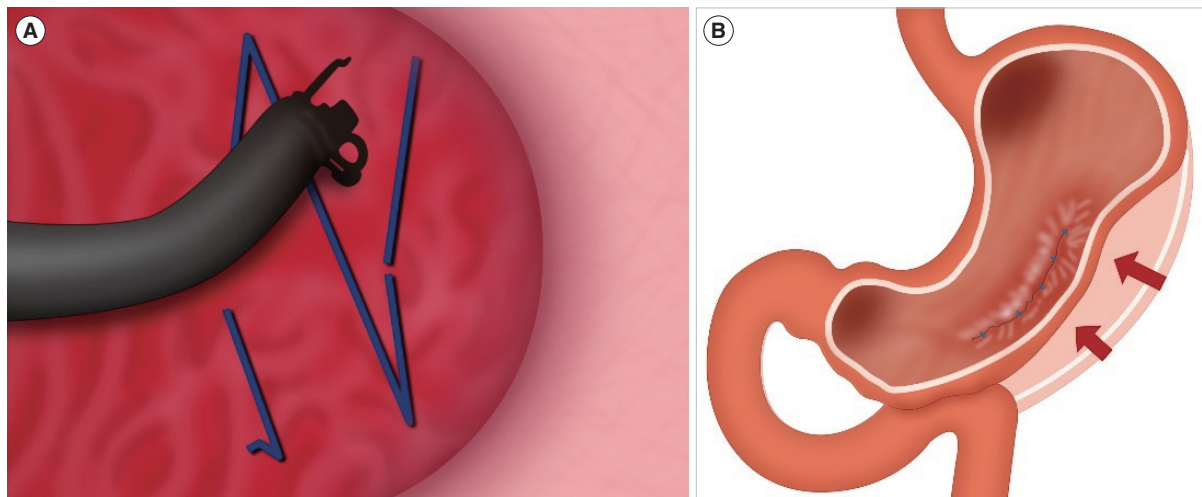


Figure 2. Procedures of endoscopic sleeve gastropasty. (A) Endoscopic view: endoscopic suturing device. (B) Overall appearance: gastric volume reduction.

of ESGs and intragastric balloons. ESG demonstrated a superior weight-reduction outcome (21.3% vs. 13.9% at 1 year) and a lower complication rate (5.2% vs. 17%) compared with intragastric balloons during the year after intervention.

PERCUTANEOUS ENDOSCOPIC GASTROSTOMY TUBES

Aspiration therapy uses a percutaneous gastrostomy tube to partially drain the gastric contents after a meal (Fig. 3). The aspiration process involves flushing food out of the stomach through the tube and infusing water into the stomach and then reversing the flow to allow the remaining gastric contents to drain out of the stomach. This technique is reminiscent of the habits of Roman nobility, who were said to chew and spit without swallowing food in order to enjoy large meals. The effectiveness of the procedure has been verified in a pilot study,¹³ a randomized controlled trial,⁸ and a 4-year observational study.⁹ However, the proportion of patients on long-term maintenance of the device was low, and the longer a patient maintained the device, the greater the chance of persistent fistulas. These shortcomings represent obstacles to popularization of aspiration therapy.

BARIATRIC EMBOLIZATION

Transarterial embolization of the left gastric artery was designed

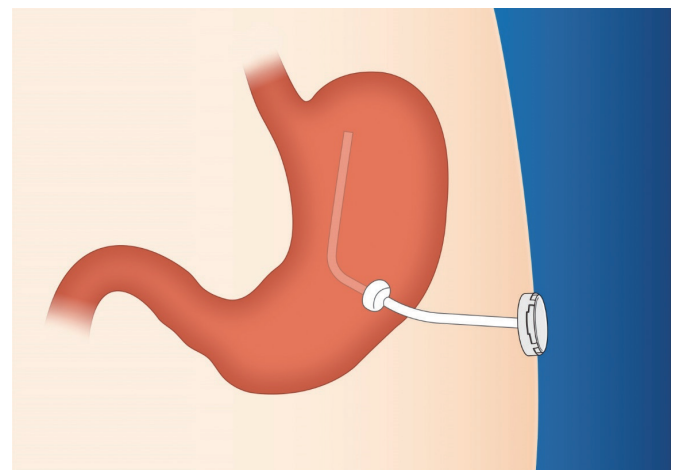


Figure 3. Percutaneous endoscopic gastrostomy tube. Endoscopically placed gastrostomy tube and skin port.

to reduce ghrelin secretion and the sense of hunger by altering the endocrine function of the gastric fundus.¹⁰ Bariatric embolization produced a significant weight loss effect that lasted for 1 year in a prospective trial (mean excess weight loss 12.8% at 6 months and 11.5% at 12 months).¹¹ Evidence for the precise mechanism of this therapy is still lacking, but the effect is reliable. One drawback of bariatric embolization is that reduced vascularity from left gastric artery embolization can cause ischemia of the remnant stomach, which could be an issue if bariatric surgery is performed to non-responders of this therapy.

CONCLUSION

Four procedures, excluding bariatric embolization, require not only importing equipment into Korea but also government approval. It is unknown whether the techniques can be used in the near future in Korea because it is not easy for domestic companies to import such products into the country's relatively small market. On the other hand, bariatric embolization does not require any new products. It can be used for research purposes if the researcher obtains the approval of the institutional review board (Table 1). Although new methods for the treatment of obesity are difficult to develop or import to small markets, all researchers and clinicians should be apprised of the new methods and continue to consider which techniques are practical.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Drafting of the manuscript: YSP; critical revision of the manuscript: SHA, and study supervision: YSS and HHK.

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