Advances in Endoscopic Bariatric and Metabolic Therapies

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KEYWORDS

• Endoscopic bariatric therapies • Endoscopy • Obesity • Metabolic health
• Minimally invasive procedures

KEY POINTS

- EBMTs offer less invasive alternatives to traditional bariatric surgery for weight management and metabolic improvement.
- Gastric and small-intestinal endoscopic interventions aim to replicate the mechanisms of surgical procedures through various techniques.
- Patient selection, training, and multidisciplinary care are crucial for optimizing the efficacy and safety of EBMTs.
- Integration with obesity management medications and combination therapies enhances the therapeutic potential of EBMTs in obesity management.

INTRODUCTION

The global obesity epidemic has driven the need for innovative and effective weight management strategies. Obesity is associated with cardiometabolic diseases which can lead to hypertension, dyslipidemia, type 2 diabetes (DM2), sleep apnea, and liver disease.[1] Moreover, it substantially elevates the risk of all-cause and cardiovascular mortality. This imposes a substantial health economic burden.[2] Bariatric surgery remains an important tool in the management paradigm, but its invasive nature can limit accessibility and adoption for some patients. Endoscopic bariatric and metabolic therapies (EBMTs) offer an organ-sparing approach, providing minimally invasive, adaptable solutions for weight loss and metabolic improvement.[3] This article reviews the emergence of EBMTs, exploring their diverse applications and potential to augment the landscape of obesity management.

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EVOLUTION AND SPECTRUM OF ENDOSCOPIC BARIATRIC AND METABOLIC THERAPIES

The development of EBMTs traces its origins to the early initiatives aimed at creating organ-preserving alternatives to conventional bariatric surgeries. With the advent of endoscopic techniques in the 20th century, a new pathway emerged for innovative interventions specifically targeting the gastrointestinal tract. Initial experiments involving the placement of gastric balloons during the 1980s established a groundwork for the evolution of endoscopic bariatric procedures. The value proposition of these interventions includes reduced recovery periods, preservation of anatomic integrity, reversibility, convertibility, decreased therapeutic burden, and the ability for customization for precision and personalized medicine.

The U.S Food and Drug Administration (FDA) has approved several endoscopic devices and procedures recently. EBMTs are used for the treatment of obesity in patients with a body mass index (BMI) of 30 kg/m^2 or higher, which could potentially address a well described treatment gap for patients with obesity class I and II and may be cost-effective for patients who are otherwise not candidates for bariatric surgery or do not wish to pursue it. FDA-approved EBMTs with indications for the treatment of obesity include several intragastric balloons (IGB), the transpyloric shuttle (TPS), aspiration therapy, and endoscopic sleeve gastroplasty by the Apollo Overstitch System (ESG). Presently, TPS and aspiration therapy are not commercially available.

Modern EBMTs comprise a diverse range of procedures aimed at inducing weight loss and enhancing metabolic health. Gastric EBMTs influence appetite regulation pathways by altering gastric emptying and accommodation. Small intestinal EBMTs modulate metabolic processes such as bile acid circulation, incretin signaling, inflammation, gut microbiome composition, and enteric nervous system signaling to target vital metabolic organs, including the pancreas, liver, adipose tissue, muscle, and the central nervous system. Consequently, the fundamental physiologic principle of EBMTs is to utilize the gastrointestinal tract as a therapeutic target for the modification and management of metabolic diseases.

Data suggests tailoring EBMTs based on factors like BMI, comorbidities, and patient goals yields superior outcomes compared to a "one-size-fits-all" approach. Several studies have demonstrated the superiority of personalized, patient-centric approaches to EBMTs compared to standardized protocols.[4] Similarly, research has demonstrated that patients with specific metabolic phenotypes respond better to weight loss techniques, highlighting the importance of individualized treatment strategies.[5]

Despite the promise of personalized EBMTs, several challenges must be addressed to optimize their implementation. These include the need for comprehensive patient assessment, accurate risk stratification, access to endoscopic facilities, and ongoing multidisciplinary support. Additionally, further research is needed to identify biomarkers, predictive algorithms, and other tools to guide treatment selection and optimize outcomes.

GASTRIC-FOCUSED ENDOSCOPIC BARIATRIC AND METABOLIC THERAPIES

This section provides an overview of various gastric-focused EBMTs, highlighting their procedural details, efficacy, safety profiles, and impact on obesity-related complications.

A. Space-Occupying Devices

Intragastric Balloons (IGBs)

Intragastric balloons (IGBs) are non-surgical devices designed to occupy space within the stomach, altering appetite and reducing food intake (**Fig. 1**).[6] The first balloon was introduced to the US market in 1985 named the Garren-Edwards Gastric Bubble (GEGB). Two main types of IGBs exist: fluid-filled and gas-filled. Fluid-filled balloons, such as the Orbera balloon, consist of a silicone shell filled with saline solution, while gas-filled balloons, like the Obalon, are filled with gas. Studies has demonstrated that fluid-filled balloon have the potential to promote more weight loss compared to gas-filled balloons.[7] However, individual patient characteristics may influence response to treatment, highlighting the importance of personalized therapy selection.

Safety and Efficacy of Intragastric Balloons

Several studies have shown the effectiveness of intragastric balloons (IGBs) in promoting weight loss across diverse patient populations.[8–10] Research suggests that IGBs can lead to an average total body weight loss exceeding 10% after 6 months

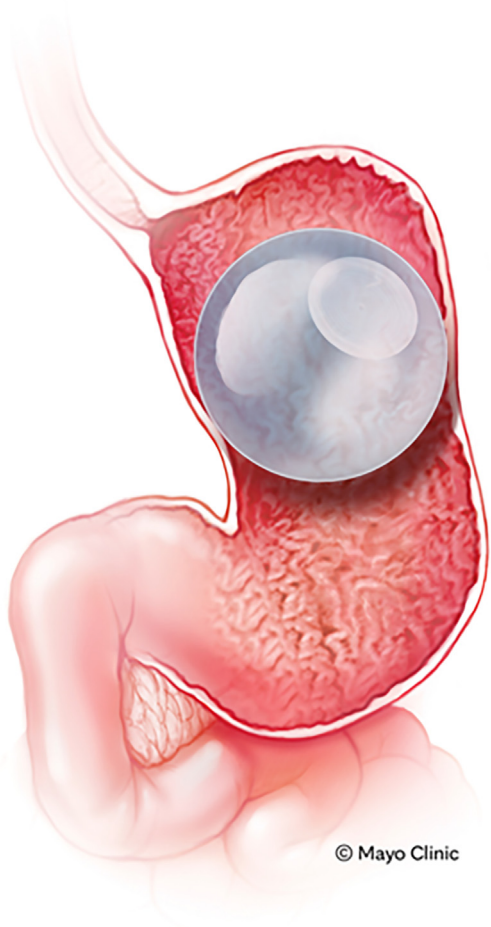

Fig. 1. Intragastric ballon in the stomach. Used with permission of Mayo Foundation for Medical Education and Research, all rights reserved.

of treatment. Additionally, IGBs have been associated with significant improvements in metabolic parameters, including reductions in HbA1c levels and improved lipid profiles.[11–13] Notably, the Spatz3 trial, a landmark study, demonstrated a 15% total body weight loss in the IGB group compared to only 3% in the control group.[14] However, the combination of IGBs with anti-obesity medications has yielded mixed results.[15,16] Early research suggests a promising role for glucagon-like-peptide 1 (GLP-1) agonists in promoting further weight loss after IGB removal.[15] IGBs have a good safety record, as evidenced by multiple randomized controlled trials and post-marketing studies. Nevertheless, careful patient selection, counseling, and monitoring are essential. Potential adverse events include IGB intolerance, gastric ulceration, balloon migration, hyperinflation syndrome, gastric perforation, and pancreatitis.[17] Patient selection is critical for successful IGB therapy, particularly in identifying motivated individuals committed to adopting healthy lifestyle practices after IGB removal to maintain weight loss. This multifaceted selection process necessitates a comprehensive evaluation that considers cost-effectiveness, safety, and efficacy profiles of specific IGBs in relation to weight loss outcomes and metabolic improvements, insertion modality, and alignment with individual patient needs and preferences.

Transpyloric Shuttle

The TransPyloric Shuttle (TPS) (BAROnova Inc, California, USA) is a minimally invasive weight loss device designed to impede gastric emptying. It achieves this by mechanically and intermittently obstructing the pylorus, the stomach's outlet, thereby promoting satiety and reducing food intake. The TPS consists of two silicone bulbs connected by a flexible tether: a larger one to prevent migration and a smaller one that extends into the duodenum, positioning the device across the pylorus. In 2019, the FDA approved the TPS for individuals with a body mass index (BMI) of 35.0 to 40.0 kg/m^2 or a BMI of 30.0 to 34.9 kg/m^2 with a qualifying obesity-related comorbidity. The mechanism of action involves creating a physical barrier at the pylorus, which slows the passage of chyme (partially digested food) from the stomach into the small intestine. This delayed gastric emptying prolongs satiety, leading to decreased caloric intake and promoting weight loss. Rothstein and colleagues (2019) conducted a randomized controlled trial demonstrating the TPS's safety and efficacy in improving cardiometabolic risk factors and quality of life in obese patients.[18] Gastric ulceration has been reported following TPS.[19] As of now, the device is not commercially available in the United States.

Oral Capsules

Oral capsules represent a unique approach to weight loss management through oral administration of non-systemic capsules composed of cellulose and citric acid. These capsules are designed to expand in the stomach, creating a hydrogel matrix that occupies space and increases satiety. The mechanism of action involves the hydrogel's ability to absorb water and expand, thereby filling a portion of the stomach and inducing feelings of fullness. As a result, individuals may consume fewer calories during meals, leading to weight loss over time. A 24-week study demonstrated a weight loss of 2.1% among patients with obesity compared to placebo.[20] Lu and colleagues (2024) conducted a randomized controlled trial assessing the safety and efficacy of these capsules in patients with overweight or obesity.[21] The study demonstrated that administering 2.24 g of capsules twice a day resulted in a significant decrease in body weight when compared to placebo among obese individuals, with a favorable safety profile.[21] Furthermore, participants reported improved satiety and reduced food cravings.

B. Gastric remodeling techniques

Endoscopic Sleeve Gastroplasty

Endoscopic sleeve gastroplasty (ESG) is an endoscopic procedure that involves placing full-thickness sutures through the gastric wall (Overstitch, Boston Scientific, Marlborough, MA) to remodel the stomach (Fig. 2). Abu Dayyeh and colleagues (2013) described the technique and its impact on gastric physiology and appetite regulation pathways affecting satiety and satiation.[22,23] ESG using the Overstitch device has been approved by the FDA for use in the management of obesity.

Safety and Efficacy of ESG

ESG has demonstrated significant efficacy in inducing weight loss and improving metabolic parameters in obese individuals. In a pivotal randomized controlled crossover trial, patients with a BMI of 30 to 40 kg/m^2 exhibited a 13.6% TBWL and a 49.2% excess weight loss at 52 weeks.[24] Additional studies have reported a TBWL of 15% to 20% over 12 to 24 months of follow-up.[25,26] Long-term studies have indicated the maintenance of weight loss in a significant percentage of patients for up to 5 years.[27,28] Furthermore, ESG is associated with a low rate of adverse events, underscoring its

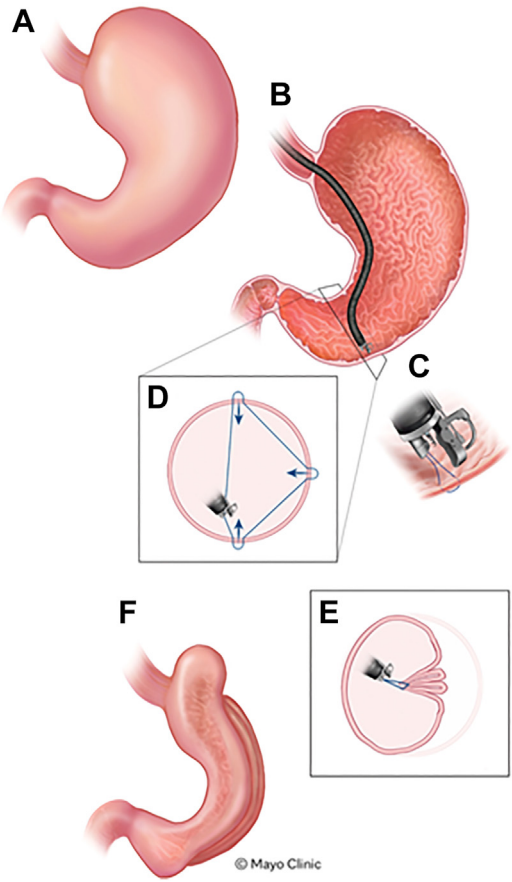

Fig. 2. Gastric remodeling with the overstitch™ device to create an endoscopic gastroplasty. Used with permission of Mayo Foundation for Medical Education and Research, all rights reserved.

safety and efficacy as an option for weight loss and metabolic improvement. It has also been linked to improvements in obesity-related comorbidities, including type 2 diabetes and hypertension. Vargas and colleagues (2023) found that ESG significantly improved gastric emptying, motility, and hormone levels, contributing to overall metabolic enhancements.[29] A smaller study reported remission of type 2 diabetes in 60% of patients with mild disease and 45.5% with moderate disease, based on the individualized metabolic surgery score.[30]

Primary Obesity Surgery Endoluminal Technique

The Primary Obesity Surgery Endoluminal (POSE) technique involves the placement of full-thickness sutures in the stomach wall using peroral incisionless operating platform (IOP) (USGI Medical, San Clemente, CA) to reduce gastric volume and restrict food intake. Modification of this technique yielded POSE 2.0 which works on the greater curvature of the stomach to reduce gastric volume compared to solely focusing on targeting the fundus[31–33] (**Fig. 3**).

Safety and Efficacy of Primary Obesity Surgery Endoluminal

POSE has been shown to induce significant weight loss and improve metabolic parameters in obese individuals. A study by Espinet-Coll et al. (2020) reported that POSE resulted in TBWL of 17% and EWL of 46% at 12 months post-procedure, with a low rate of adverse events.[34] Additionally, POSE 2.0 has been associated with improvements in metabolic parameters, such as insulin sensitivity, lipid profiles, and metabolic dysfunction-associated steatotic liver disease. For example, a study by Alkhatry and colleagues demonstrated an improvement in hepatic steatosis, weight loss, and insulin resistance in adults diagnosed with nonalcoholic fatty liver disease who underwent POSE 2.0 compared to controls at 12 months.[35] Additional studies by Jirapinyo and colleagues (2023) demonstrated reduction in portosystemic pressure gradient hepatic fibrosis.[36,37] A multicenter study by Lopez- Nava and colleagues (2023) of 44 patients reported a mean total body weight loss of 15.7% at 12 months along with improvements in hepatic steatosis which persisted for 24 months.[33] Ongoing randomized controlled trials are investigating POSE 2.0.

Endomina Gastric Plication

Endomina Gastric Plication (Endo Tools, Gosselies Belgium) is a novel endoscopic procedure that involves the placement of sutures via a 5-Fr needle in the gastric fundus to create folds, reducing gastric volume and promoting early satiety (**Fig. 4**).

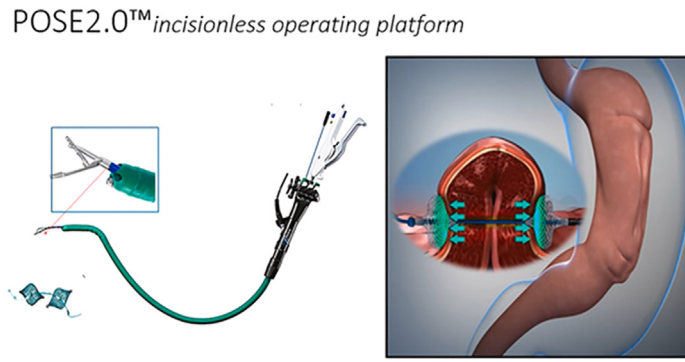

Fig. 3. Gastric remodeling using the peroral incisionless operating platform (IOP)

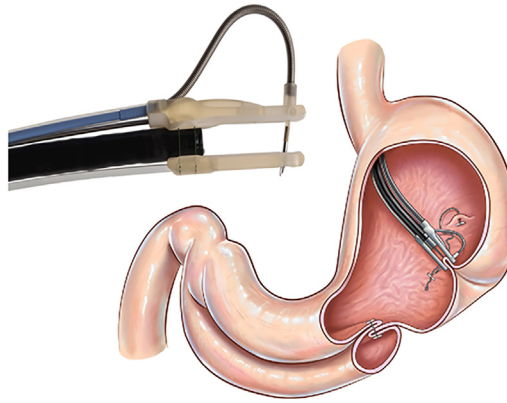

Fig. 4. Gastric remodeling using the Endomina™ plication devices

The process begins by securing stomach tissue between the device's two arms with forceps. A needle then penetrates through the layers of gastric tissue, securing a pre-tied knot to initiate the formation of a fold. After withdrawing the needle and releasing the tissue, a similar method is repeated to generate additional folds throughout the stomach, progressing from the lower to the upper regions.

Safety and Efficacy of Endomina Gastric Plication

Preliminary studies have demonstrated the efficacy and safety of Endomina Gastric Plication in inducing weight loss and improving metabolic parameters. A multicenter randomized controlled study by Huberty (2018) reported a %EWL of 29 and % TBWL of 7.4 at one year.[38] Moreover, Endomina has been hypothesized to improve obesity-related comorbidities, such as insulin resistance and fatty liver disease. However, larger-scale studies are needed to confirm these findings and assess the long-term outcomes of Endomina Gastric Plication.

Endozip - Automated Suturing Device

The Endozip procedure utilizes an automated suturing device to create gastric folds and reduce gastric volume, minimizing the need for extensive operator control (**Fig. 5**). Compared to manual suturing techniques, Endozip offers several potential advantages, including increased efficiency, reproducibility, and scalability.

Safety and Efficacy of Endozip

Research by Lopez-Nava and colleagues (2020) compared Endozip to manual suturing techniques and reported that Endozip resulted in comparable efficacy and safety profiles, with shorter procedure times and fewer technical challenges.[39] Additionally, Endozip has been associated with low rates of post-procedural complications, such as gastric perforation and bleeding.[40] Further prospective studies are ongoing to evaluate the outcomes of Endozip and its role as a gastric-focused EBMT.

AspireAssist - Aspiration Therapy

AspireAssist therapy (Aspire Bariatrics, King of Prussia Pennsylvania) involves the placement of a percutaneous gastrostomy tube (A-tube) connected to an external device, allowing patients to dispose of a portion of ingested food after meals. The tube is made of silicone and is inserted in a similar fashion to a percutaneous endoscopic

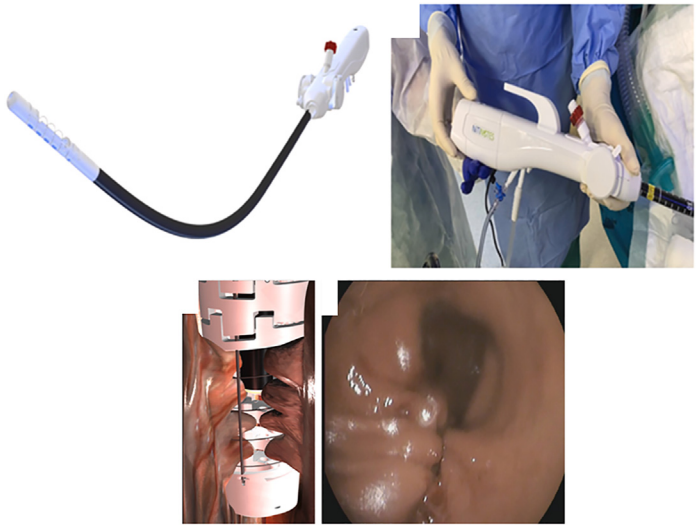

Fig. 5. Gastric remodeling using the Endozip™ automated suturing device

gastrectomy tube. Two weeks following insertion, the external portion of the tube is shortened and a skin port with the valve is attached to the skin. The device is then connected to the skin port to perform aspiration which takes roughly about 5 to 10 minutes to complete. By reducing caloric absorption, AspireAssist aims to promote weight loss and improve metabolic parameters. In 2016, the FDA approved the device for individuals with a BMI from 35 to 55 kg/m^2.

Safety and Efficacy of AspireAssist

A study by Thompson and colleagues (2017) demonstrated that AspireAssist therapy resulted in significant weight loss and improvements in metabolic parameters in obese individuals, with an average TBWL of 15% to 20% at 12 months of therapy.[41] A meta-analysis conducted by Jirapinyo and colleagues (2020) of 590 patients demonstrated improvement of obesity-related comorbidities such as blood pressure (SBP: −7.8 mm Hg, DPB: −5.1 mm Hg), triglycerides: −15.8 mg/dL, hemoglobin A1C: −1.3% at 1 year.[42] The most common adverse events included abdominal pain, peristomal granulation tissue, and peristomal irritation.[42] However, concerns have been raised regarding the potential for disordered eating behaviors and the psychological impact of AspireAssist therapy, highlighting the importance of careful patient selection and monitoring. Unfortunately, AspireAssist was withdrawn from the market recently due to financial concerns.

In conclusion, gastric-focused EBMTs offer promising options for the management of obesity and metabolic disorders. While each intervention has unique characteristics and mechanisms of action, they share a common goal of promoting weight loss and improving metabolic health in obese individuals by altering appetite regulation pathways. Continued research and innovation in this field are essential to optimize outcomes and expand treatment options for patients with obesity.

Small Intestinal Endoscopic Bariatric and Metabolic Therapies

Small intestinal endoscopic bariatric and metabolic therapies encompass a range of minimally invasive procedures targeting specific regions of the small intestines to induce metabolic benefits. These therapies leverage the complex interplay between

nutrient absorption, gut hormones, gut immunity, the gut microbiome, and neuronal signaling pathways to modulate metabolic processes. Unlike gastric-focused therapies, small intestinal EBMTs influence metabolic pathways in a weight loss-dependent and independent manner, thereby benefiting metabolic disorders such as type 2 diabetes.

The metabolic benefits of small intestinal EBMTs are mediated by several mechanisms, including alterations in gut hormone secretion, changes in nutrient absorption, and modifications in gut microbiota composition. Gut hormones such as glucagon-like peptide-1 (GLP-1), peptide YY (PYY), and oxyntomodulin play crucial roles in regulating appetite, food intake, and glucose metabolism.[43–45] Therapies that target the small intestines can modulate the secretion of these hormones in a paracrine fashion, leading to increased satiety, reduced food intake, and improved glycemic control. Furthermore, by bypassing or modifying specific segments of the small intestines, these therapies can limit the absorption of nutrients such as glucose and fatty acids, thereby reducing postprandial hyperglycemia and lipid levels. Additionally, the small intestine is home to a diverse array of microbial species that play essential roles in nutrient metabolism, energy homeostasis, and inflammation.[46] Thus, regenerative small intestinal therapies that alter the luminal environment of the small intestine may impact gut microbiota composition and inflammation, leading to metabolic benefits.

One such therapy is endoscopic duodenal mucosal resurfacing (DMR), which involves the ablation of the duodenal mucosa using heated liquid to destroy the superficial mucosal layer and stimulate regrowth of normal mucosal tissue (Revita DMR system, Lexington Massachusetts). Mucosal remodeling may reset duodenal enteroendocrine cells that have become diseased thus restoring signaling that can improve diabetes control through improvement of the incretin effect. The device is a catheter capable of circumferential saline lift to protect the submucosa, followed by inflation of a 2-cm-long balloon filled with fluid heated to 90° C. By disrupting nutrient sensing and signaling pathways in the duodenum, DMR is believed to enhance insulin sensitivity and promote weight loss. Studies have shown that DMR leads to improvements in glycemic control and reductions in body weight in patients with type 2 diabetes. A multicenter study by van Baar and colleagues (2020) reported a reduction in HbA1c post DMR (−0.9%) compared to baseline at 24 weeks.[47]

Another therapy is endoscopic duodenal-jejunal bypass liner (DJBL), which is an ultrathin sleeve of Teflon anchored in the duodenal bulb by a nitinol crown (EndoBarrier, GI Dynamics, Lexington, Massachusetts). By blocking nutrient interaction with the small-bowel mucosa, DJBL reduces nutrient absorption and alters gut hormone secretion, leading to metabolic improvements. Clinical trials have demonstrated that DJBL results in significant weight loss and improvements in glycemic control in patients with type 2 diabetes.[48–50] A meta-analysis performed by Jirapinyo and colleagues (2018) demonstrated a HbA1c improvement of 0.9% after DJBL compared to control patients. In addition, GIP decreased, whereas GLP-1, PYY and ghrelin increased.[51]

Endoscopic Re-Cellularization via Electroporation Therapy (ReCET) (**Fig. 6**) represents a promising new frontier in the management of metabolic disorders, developed by Endogenex (Plymouth, MN). This therapy involves the delivery of a pulsed electric field to the duodenum via a specialized catheter, which regenerates duodenal signaling without the use of heat or the requirement for a submucosal lift. Given its non-thermal nature, this technology aims to stimulate the regeneration of healthy stem cells in the duodenum, restore sensing and signaling pathways in the mucosal and submucosal layers, reverse duodenal inflammation, and improve the body's

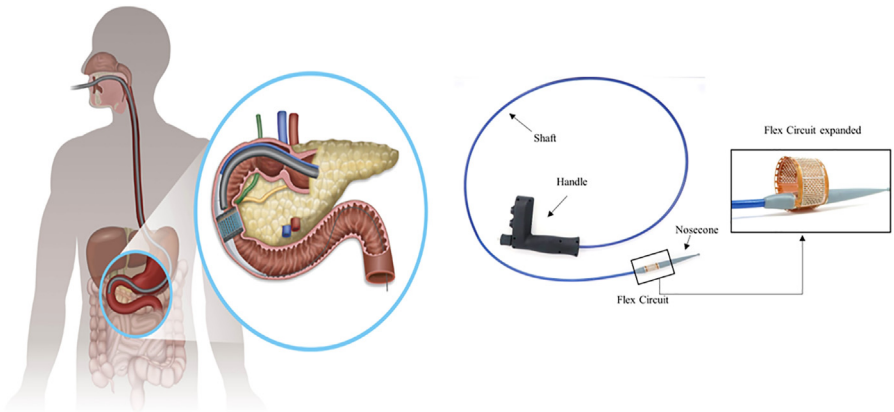

Fig. 6. Endoscopic re-cellularization electroporation therapy (ReCET).

innate mechanisms for blood sugar control by improving insulin resistance and β-cell function. While the therapy is relatively new, several pilot studies have provided promising insights into its efficacy and safety profile. One of the first-in-human studies evaluated the safety and feasibility of ReCET in 30 adult patients with type 2 diabetes.[52] No device or procedure-related serious adverse events were reported. Additionally, a significant reduction in HbA1c levels was observed at 24 weeks post-treatment in both single-energy and double-energy applications, with a clear dose-response curve.[52] Currently, several clinical trials are underway to evaluate the safety and efficacy of ReCET in T2DM patients, including a large multicenter randomized pivotal trial. The REGENT-1 US trial is a prospective multicenter study designed to assess the safety, feasibility, and efficacy of ReCET.[53] Preliminary findings from 10 participants demonstrated a 100% success rate, with 4 out of 5 participants achieving an HbA1c $\leq$ 7% at 24 weeks post-treatment. Moreover, participants experienced a mean weight loss of 5.0% at 24 weeks.[53] In a proof-of-concept study, ReCET combined with a GLP-1 receptor agonist eliminated the need for exogenous insulin in 86% of patients at 12 months[54]

Lastly, the incisionless magnetic anastomosis system (GI Windows, Bridgewater Massachusetts) is another novel endoscopic therapy that entails deployment of self-assembling magnets in the duodenum or proximal jejunum and ileum under fluoroscopic guidance. The proposed mechanism of this procedure is that nutrient and bile delivery to the distal small bowel will induce an ileal break phenomenon resulting in decreased food intake and improved metabolic control. Initial preliminary research has demonstrated success of device placement with a good safety profile.[55] For example, a study by Machytka and colleagues (2017) demonstrated a significant reduction in HbA1c level in diabetics (1.9%) and prediabetic (1.0%) patients at 12 months following placement of the incisionless magnetic anastomosis system.[56]

The advent of small intestinal EBMTs holds significant promise for treating diabetes and other metabolic disorders. By targeting the small intestines, these minimally invasive therapies improve glycemic control and metabolic health, potentially modifying disease pathophysiology. In type 2 diabetes patients, these therapies have been shown to reduce HbA1c levels, improve insulin sensitivity and beta cell function, and decrease medication requirements, often resulting in sustained weight loss. This contributes to metabolic improvements and reduces the risk of obesity-related complications. Beyond diabetes, small intestinal EBMTs may benefit individuals with obesity,

metabolic syndrome, cardiovascular comorbidities, and metabolic liver disease by promoting weight loss, improving glycemic control, altering gut dysbiosis and inflammation, improving lipid profiles, and reducing hepatic steatosis. Understanding gastrointestinal dynamics is essential for optimizing these therapies, as the small intestine's complex motility patterns, nutrient sensing mechanisms, and interactions with the enteric nervous system play crucial roles in nutrient absorption, gut hormone secretion, and satiety and metabolic signaling. Advancements in imaging modalities and diagnostic techniques, such as high-resolution manometry, dynamic MRI, artificial intelligence, and spacial transcriptomics allow for detailed, non-invasive assessments of foregut physiology. Integrating these insights into the development of small intestinal EBMTs enables clinicians to tailor interventions to individual patient needs and maximize therapeutic efficacy.

Combination Therapies

Advancements in obesity medication management now offer effective options for selected patients. The value proposition and comparative effectiveness of ESG compared to, or in addition to, obesity management medications are an active area of investigation. Observational studies have demonstrated the benefits of combining or sequencing ESG with medications, particularly in enhancing the durability of the response.[57,58] In addition, early work has demonstrated the feasibility of combining EBMTs with distinct mechanism of actions such as combining a gastric with small intestinal endoscopic intervention.[59,60] However, given the limited follow-up in the existing literature—typically extending to 5 years or less—additional data is required to better understand the different archetypes of response to EBMTs and medications. This data will also help in defining optimal personalized approaches to maximize the durability of the response and improve long-term health outcomes.

SUMMARY AND DISCUSSION

The integration of endoscopic bariatric and metabolic therapies into clinical practice marks a significant advancement in managing obesity and related metabolic disorders. These therapies offer tailored solutions for patients across the obesity spectrum. They are effective in promoting weight loss and improving metabolic parameters such as glycemic control, lipid profiles, and cardiovascular health. Despite their promise, challenges such as limited awareness among healthcare providers, insurance coverage issues, and the need for specialized training hinder widespread adoption. Addressing these challenges through research, policy measures, comprehensive training programs, and a multidisciplinary approach can optimize patient outcomes. Embracing innovation, fostering collaboration, and advocating for research and policy initiatives will harness EBMTs' full potential to improve patient outcomes and reduce the burden of obesity.

CLINICS CARE POINTS

- EBMTs can be considered in patients with a BMI of 30-40 kg/m2 who do not qualify for or wish to avoid invasive bariatric surgery.
- EBMTs can provide significant weight loss and improvements in obesity-related comorbidities like type 2 diabetes, hypertension, and dyslipidemia.
- When choosing among the various EBMTs, personalized therapy selection based on patient characteristics such as BMI, comorbidities, and weight loss goals is critical.

DISCLOSURE

B.K. Abu Dayyeh: co-inventor of Endogenex (licensed technology by Mayo Clinic to Endogenex). Consultant for Endo-TAGSS, BFKW, USGI, Olympus, Medtronic, Spatz Medical, and Boston Scientific, and received research grants from USGI, Apollo Endosurgery, Boston Scientific, Medtronic, and EndoGastric Solutions. Co-inventor of Endogenex. Consultant for Endo-TAGSS, BFKW, USGI, Olympus, Medtronic, Spatz Medical, and Boston Scientific USA. Received research grants from USGI, Apollo Endosurgery, Boston Scientific, Medtronic, and EndoGastric Solutions.

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