Original Article

Comparison of endoscopic radial incision and Savary-Gilliard's bougie dilation in efficacy on refractory esophagogastric anastomosis strictures

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Background: Among patients with a benign stricture in the upper gastrointestinal tract, those with esophagogastric anastomosis stricture (EAS) due to complications after esophagectomy for esophageal carcinoma comprise the majority. Dilation is the primary surgical treatment for EAS, but its short-term effect is not remarkable and its long-term effect is worse.

Methods: We compared endoscopic radial incision (ERI) and Savary-Gilliard's bougie dilation (SGBD) for patients with refractory EAS, and evaluated overall efficacy and complications. Stooler's scale was used to grade the patients' dysphagia before surgery. The two groups were compared for the number of dilations or incisions, the degree of dilation of the EAS after surgery and postoperative complications, such as intraoperative bleeding (arteriopalmus bleeding requiring endoscopic intervention), postoperative bleeding (hematemesis, bloody stool or black stool), postoperative perforation (fistula formation confirmed by gastrointestinal radiography), and postoperative infection (including postoperative fever).

Results: The Exp group had 15 markedly effectively treated patients, 7 effectively treated patients, and 3 ineffectively treated patients, while the numbers of these patients in the Obs group were 5, 6, and 10, respectively. Thus, the Exp group had a significantly higher total effective rate than the Obs group (88.0% *vs.* 52.4%, $P<0.05$). Patients treated by ERI had higher overall therapeutic effect, better swallowing symptom grade, and lower incidence of complications.

Conclusions: Thus, ERI is superior to SGBD in efficacy and safety for treating refractory EAS.

Keywords: Dysphagia symptoms; esophageal carcinoma (EC); radial incision; refractory esophagogastric anastomosis stricture (EAS); Savary-Gilliard's bougie dilation (SGBD)

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Introduction

Benign strictures in the upper gastrointestinal tract (UGT) are prevalent after esophageal and gastric surgeries (1), radiotherapy for UGT cancer (2), and chemical injury caused by mistakenly taking corrosive chemical substances such as acid and alkali (3). According to statistics, UGT shows a gradually increasing incidence in recent years (4). In most cases, benign esophageal strictures (ES) can be alleviated by a single balloon dilation, but some become intractable through ineffective repeated dilation or short-term recurrence (i.e., refractory ES) (5). Current surgical treatment is severe, with many complications and unsatisfactory efficacy (6). ES are primarily treated by endoscopic dilation [Savary-Gilliard's bougie dilation

(SGBD) (7), balloon dilation (8)] or endoscopic recyclable stent implantation (9). With each of these procedures, the dilation site is a weak part of the stricture and the site requiring the intervention the most (i.e., the site of fibrosis and thickening) is not dilated (10), so in terms of overall effect, most patients need to undergo multiple dilations to stabilize the size of the anastomotic stoma for smooth passage of an ordinary gastroscope (diameter >10 mm), and they face a big risk of intraoperative perforation (11,12). Reportedly, less than 30% of patients treated by traditional endoscopic dilation can eat solid food after surgery (13). Simmons and Barron (14) and Hordijk *et al.* (15) applied endoscopic fulguration for patients with benign esophageal anastomotic stricture who required second-line therapy, and found that it demonstrated no advantage, with a similar long-term effect to endoscopic balloon dilation.

Among patients with a benign stricture in the UGT, those with esophagogastric anastomosis stricture (EAS) after esophagectomy for esophageal carcinoma (EC) comprise the majority. Such patients have experienced EC, its radical operation, and resultant EAS. If the EAS leads to difficulty in eating, the patient is likely to suffer malnutrition and associated complications such as upper respiratory tract infection, and they may have poor life quality in severe cases and thus experience greatly shortened survival (16).

At present, EAS is a very common adverse complication after EC surgery, which seriously affects the prognosis, recovery and quality of life of patients. At present, my country still lacks reliable authoritative guidance for the treatment of EAS, and there is still considerable controversy regarding the choice of EAS treatment. Therefore, confirming the best treatment plan and use guidance of EAS as soon as possible is a hot and difficult problem that needs to be solved urgently in clinical practice.

Meizhou People's Hospital focuses exclusively on patients with AS after esophagectomy for EC. Since 2018 we have performed endoscopic radial incision (ERI) for EAS, with positive outcomes. In this study we compared the efficacy of ERI and SGBD for EAS. We present the following article in accordance with the STROBE reporting checklist (available at https://dx.doi.org/10.21037/apm-21-2648).

Methods

Patients

Patients with AS after esophagectomy for EC who underwent ERI or SGBD between June 2018 and August 2020 were enrolled and assigned to an observation group [Obs group (SGBD), n=21] or an experimental group [Exp group (ERI), n=25]. The inclusion criteria were: (I) confirmed EAS by gastroscopy and biopsy or barium meal of the UGT, (II) columnar stricture in the UGT (mainly including esophagus and esophagogastric anastomosis), and (III) received endoscopic therapy. The exclusion criteria were: (I) serious heart, lung or kidney insufficiency that prevented tolerate endoscopic examination and therapy, (II) blood coagulation dysfunction, and (III) preoperative examination revealed digestive tract perforation. All patients (or guardians) signed informed consent before surgery. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). Approval was given by the institutional ethics committee of Meizhou People's Hospital before implementation of the study and informed consent was taken from all the patients.

Surgical technique

Patients in the Obs group were treated by endoscopic-guided SGBD. Specifically, the pharynx of each patient was anesthetized with 2% lidocaine three times 15 min before surgery, and then the patient was required to orally take lidocaine mucilage. With a mouth gag in place, the patient was examined with a transoral ultrafine endoscope as follows. The endoscope was passed through the stricture, and then an ultra-hard guide wire was inserted (if the stricture prevented passage of the ultra-fine endoscope, the guide wire was inserted under fluoroscopic guidance). A Savary-Gilliard oesophageal dilator from the Cook Company (80 cm in length, 5–15 cm in end diameter, and 260 cm guide wire) was replaced with a 1.0–1.5 cm one according to the size of the stenos, and the dilator was let to stay for 3–5 min. The operation was repeated 2–3 times, and then the dilatation was confirmed by radiography. After surgery, the patient was required to strictly avoid food for 24 hours, and vital signs were routinely evaluated. Medical treatment comprised drugs for esophageal and gastric mucosa protection, drugs for edema relief and hemostasis drugs. If necessary, another dilation was performed according to the patient's ability to eat.

Patients in the Exp group were treated by ERI (*Figure 1*). Specifically, each patient was fasted for 6 h before operation. Then an incision was made in the site with obviously thickened scar tissue or the site where an ultrasonic probe was adopted for thickness probing, and the anastomotic

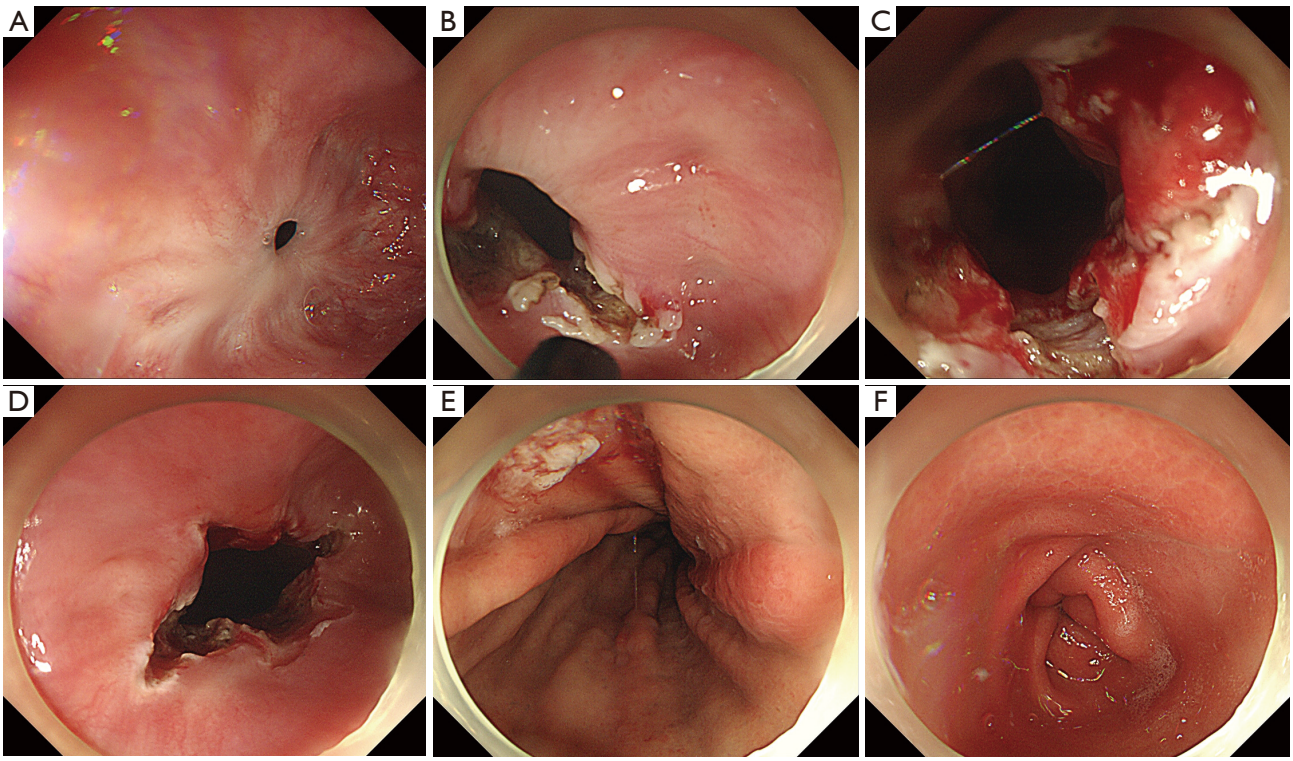

Figure 1 Operative technique of endoscopic radial incision (ERI). (A) Impassable stricture of esophagus about 22 mm caudal to the incisors, with an opening of approximate 0.2 cm; (B) surrounded by gray-white fibrous hyperplasia; (C) circular incision of stricture with the knife, incising to the muscular layer; (D) radial notch; (E) smooth mucosa of the remnant stomach, without erosion, ulcer or tumor; (F) favorable gastric antrum peristalsis and spotted mucosa, without ulcer or tumor.

stoma was rinsed under the direct vision of the gastroscope. The stenosis ring of the anastomotic stoma was cut longitudinally with a HOOK knife until it was consistent with the normal esophageal tangent position. Any suture or metal nail left at the anastomotic site should be removed or taken out. After operation, the wound surface was examined in detail to ensure that there was no active bleeding and perforation on the wound surface. In the case of active bleeding or perforation, electric cauterization should be taken as a symptomatic treatment to stop bleeding in the premise of avoiding excessive burning of surrounding scar tissue and normal tissue. After operation, the patient was routinely given treatments including hemostasis, infection prevention and nutritional support, and fasted for 24 hours.

Outcome measures

Stooler's scale was used to grade the patients' dysphagia before surgery (T0), and 2 weeks (T1) and 1 month after surgery (T2): grade 0: able to eat normally; grade I: unable to swallow some solid foods; grade II: only able to swallow semi-liquid food; grade II: only able to swallow liquid food; grade IV: unable to swallow liquid food.

The overall therapeutic effect in the two groups was evaluated as follows: Markedly effective: lumen diameter >1.2 cm, grade 0 dysphagia, and no recurrence during follow-up; Effective: Lumen diameter between 0.6 and 1.1 cm, grade I dysphagia, and no aggravation during follow-up; Ineffective: no change in lumen diameter, either no alleviation of dysphagia or aggravation of it.

The two groups were compared for the number of dilations or incisions, and the degree of dilation of the EAS after surgery.

Additionally, the two groups were compared for postoperative complications such as intraoperative bleeding (arteriopalmus bleeding requiring endoscopic intervention), postoperative bleeding (hematemesis, bloody stool or black stool), postoperative perforation (fistula formation confirmed by gastrointestinal radiography), and postoperative infection (including postoperative fever).

Table 1 Basic clinical data

Items	Obs group (n=21)	Exp group (n=25)	χ^2/t	P value
Sex			0.1869	0.6655
Male	13	17		
Female	8	8		
Age (years)	64.30±9.23	65.48±9.93	0.4145	0.6805
Operation site			0.0066	0.9354
Esophagus	17	20		
Esophagogastric junction	4	5		
Anastomosis diameter (mm)			0.022	0.9889
6–9	4	5		
3–5	9	11		
<3	8	9		
No of treatments before enrollment			1.0632	0.5976
0	8	11		
1–2	7	10		
≥3	6	4		

Table 2 Overall therapeutic effect

Items	Markedly effective	Effective	Ineffective	Total effective rate
Obs group (n=21)	5 (23.8)	6 (28.6)	10 (47.6)	11 (52.4)
Exp group (n=25)	15 (60.0)	7 (28.0)	3 (12.0)	22 (88.0)
χ^2/t				7.1421
P value				0.0075

Statistical analysis

We used SPSS20.0 for statistical analyses and GraphPad Prism 6 for illustrations. Measurement data are expressed as mean ± SD, and compared between groups by independent-samples *t*-test. Enumeration data are expressed as n (%), and compared between groups by the χ^2 test. A P value <0.05 denoted a significant difference.

Results

Overall efficacy

The two groups were comparable for general clinical data (P<0.05) (*Table 1*). The Exp group had 15 markedly effectively treated patients, 7 effectively treated patients, and 3 ineffectively treated patients, while the numbers of these patients in the Obs group were 5, 6, and 10, respectively. Thus, the Exp group had a significantly higher total effective rate than the Obs group (88.0% *vs.* 52.4%, P<0.05) (*Table 2*).

Dysphagia grading

At T0, there were 0, 0, 12, 11, and 2 patients with grade 0–IV dysphagia in the Exp group, and 0, 0, 6, 11, and 4 patients respectively in the Obs group, so the two groups were not greatly differently before surgery (P>0.05). At T1, there were 20, 4, 1, 0, and 0 patients with grade 0–IV

Table 3 Dysphagia grading

Items	Class 0	Grade I	Grade II	Grade III	Grade IV	χ^2/t	P value
T0						2.3372	0.3109
Obs group	0	0	6	11	4		
Exp group	0	0	12	11	2		
T1						15.9130	0.0012
Obs group	5	8	4	4	0		
Exp group	20	4	1	0	0		
T2						10.0940	0.0389
Obs group	5	6	5	1	4		
Exp group	15	7	2	1	0		

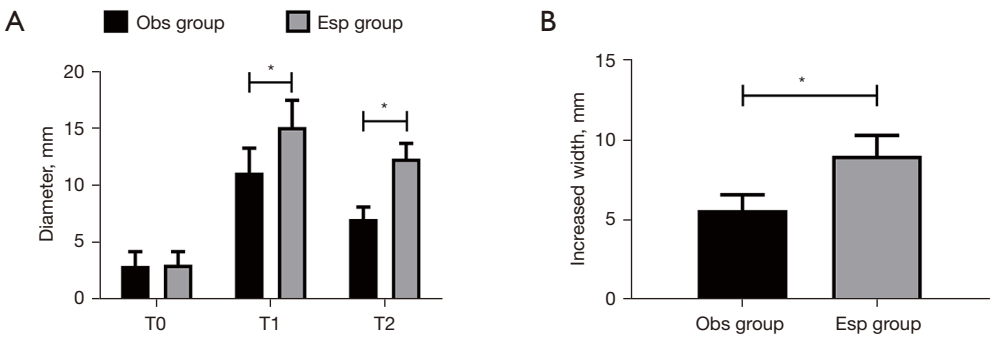

Figure 2 Degree of dilation of esophageal stricture. (A) Diameter of stricture before operation (T0) and 2 weeks (T1) and 1 month (T2) after operation. (B) Postoperative widening length in the two groups. *, P<0.001.

dysphagia in the Exp group, and 5, 8, 4, 4, and 0 patients respectively in the Obs group, and at T2, the respective numbers of patients were15, 7, 2, 1, and 0 patients in the Exp group, and 5, 6, 5, 1, and 4 patients in the Obs group. Thus, the two groups were significantly different for dysphagia grading at 2 and 4 weeks after surgery (both P<0.05) (*Table 3*).

Degree of dilation of EAS

At T0, there was no notable difference in the diameter of esophageal stenosis between the two groups (P>0.05). At T1 and T2, the diameter of esophageal stenosis in both groups increased, with a larger diameter of esophageal stenosis in the Exp group than that in the Obs group (*Figure 2*).

Incidence of complications

The Exp group had 11 patients with complications, which was a notably lower total incidence of complications than in the Obs group with 16 patients (44.0% *vs.* 76.2%, P<0.05) (*Table 4*).

Discussion

Long segmental strictures of the digestive tract, especially postoperative AS, have always been a therapy challenge. Patients with such disease often show tissue adhesion, disordered surgical field, and insufficient anastomotic distance, so their surgery is more difficult and they face a high incidence of complications. Thus, ultra-minimally

Table 4 Complications

Items	Intraoperative bleeding, n (%)	Postoperative bleeding, n (%)	Postoperative perforation, n (%)	Postoperative infection, n (%)	Total incidence, n (%)
Obs group (n=21)	2 (9.5)	2 (9.5)	8 (38.1)	4 (19.1)	16 (76.2)
Exp group (n=25)	0 (0)	2 (8.0)	7 (28.0)	2 (8.0)	11 (44.0)
χ^2/t					4.8781
P value					0.0272

invasive therapy by endoscope is a research focus (17). The most conventional therapy for AS is endoscopic dilation including guidewire-guided SGBD, balloon dilation under monitoring of endoscope, and self-expanding metal stent implantation, which is still under clinical study. Endoscopic dilation commonly requires repeated dilations and has complications such as bleeding and perforation, and its overall efficacy and long-term efficacy are both unfavorable (18). In the traditional anastomosis, although the teaching is more significant, due to the greater surgical trauma, the possibility of anastomotic leakage and gastroplegia after the operation is significantly increased, and the prognostic quality of life of the patient is significantly affected.

We compared SGBD and ERI for patients with AS after esophagectomy for EC. The group treated by ERI had significantly better efficacy and fewer dilations (incisions) than the group undergoing SGBD. In ERI, direct gastroscopic vision enables targeted incising of the stricture, compared with the blind approach using balloon or bougie dilation, and thus can have a good expansion effect (19). Different strictures have different levels of fibrosis or thicknesses of the circular muscle. For those with light fibrosis or a thin muscular layer, a small force is enough to achieve tearing and dilation, whereas for those with obvious scar fibrosis or thick muscular layer, a larger external force is need to achieve the same result (20). Appropriate incision depth under endoscopic vision is the premise of the safety and reliability of ERI (21). Theoretically, the final depth of incision of the stricture is the superficial muscularis propria, but there are no clear layers at the anastomosis, so distinguishing the submucosa from the muscularis propria can be difficult after fibrous hyperplasia. Comparatively speaking, ERI under direct vision can target the muscular layer in the unbalanced anastomotic fibrosis for uniform dilation (22). Short segmental EAS is often less than 1 cm and after the scar is cut open during ERI, the stricture is released under tension of the esophageal muscle layer, and the dilation effect is thus maximized (23). Bougie dilation tears the stricture uniformly, but its effect is limited, and multiple dilations are required to achieve fixation of the diameter of the stoma. At 2 and 4 weeks after operation, the patients undergoing ERI had significantly better grade of postoperative dysphagia and widening of a longer section of stricture than the group undergoing dilation. For patients not receiving radiotherapy and consolidation therapy after EC radical operation, multiple bougie dilations are required to attain satisfactory results, and most patients are graded as 1–3 for swallowing symptoms. However, only one session of ERI is enough to reach grade 0 swallowing symptoms. The patients undergoing ERI also had a lower incidence of complications such as bleeding, perforation and late recurrence (24,25). During ERI, the incision is made carefully and hierarchically in the direction of the mucosal layer to reduce the risk of perforation. Additionally, the serosa is often reinforced with suturing at the surgical anastomotic site, and the hyperplastic tissue is protected during the healing process of the anastomosis. Even if there is a small focal absence of the intrinsic muscular layer, there will be no perforation causing clinical symptoms. In addition, triamcinolone acetonide is a synthetic corticosteroid used to treat various skin diseases, relieve discomfort caused by mouth ulcers and is used in the treatment of eye and retinal diseases, to effectively improve the recovery of patients (26,27). In recent years, it has gradually been used in the treatment of submucosal dissection of the esophagus. Studies have shown that during esophageal surgery, the balance between the surrounding granulation tissue and the original tissue is disrupted due to peeling and damage of the esophageal mucosa. Therefore, the esophageal tissue is prone to fibrosis and hyperplasia, which further promotes the occurrence of esophageal stenosis (28,29). On the one hand, triamcinolone acetonide can inhibit the activity of inflammatory factors and exert

an anti-inflammatory effect. On the other hand, it can inhibit the synthesis of collagen and reduce the abnormal proliferation of new cells (30). This can effectively improve the process of tissue fibrosis after esophageal surgery and further improve the patient's recovery. Since October 2020, we have also gradually implemented triamcinolone acetonide injection treatment during esophageal surgery, but due to the small number of cases currently collected, it was not included in this study. In the future, we will conduct experimental analysis of the application of triamcinolone acetonide in refractory EAS as soon as possible to further improve the treatment options of the disease.

Conclusions

To sum up, with its greater ability to dilate the EAS and fewer complication, ERI is superior to SGBD in treating refractory EAS. However, because of the small sample size and relatively short follow-up, the long-term advantages of ERI were not clarified, so further studies with larger sample size and extended follow-up observation are required.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://dx.doi.org/10.21037/apm-21-2648

Data Sharing Statement: Available at https://dx.doi.org/10.21037/apm-21-2648

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://dx.doi.org/10.21037/apm-21-2648). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the institutional ethics committee of Meizhou People's Hospital and informed consent was taken from all the patients.

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