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REVIEW

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A novel intraoperative Esophagus-Sparing Anastomotic Narrowing Revision (ESANR) technique for patients who underwent esophagojejunostomy: three case reports and a review of the literature

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Abstract

Aim The aim of this study was to introduce the Esophagus-Sparing Anastomotic Narrowing Revision (ESANR) technique for the intraoperative management of anastomotic narrowing and to conduct a literature review to provide an algorithm for the management of narrowing and strictures that may develop secondary to esophagojejunostomy.

Methods Three patients with anastomotic narrowing during esophagojejunostomy were analyzed between September 2019 and June 2024. The anastomotic narrowing was detected by intraoperative gastroscopy after reconstruction. The ESANR technique was performed for the management of anastomotic narrowing. We conducted a systematic search of PubMed, Embase, and Web of Science databases for studies published up to June 2024 related to the treatment of anastomotic stricture. Data on the number of patients, sex, age, type of anastomosis, treatment, and outcomes were collected.

Results The ESANR technique proved effective for the management of anastomotic narrowing in patients who underwent esophagojejunostomy during gastric cancer surgery. No anastomotic stricture or leakage was found following ESANR, and all three patients recovered without complications. 12 studies with a total of 174 patients were analyzed. The management of anastomotic stricture, which included Balloon Dilation (BD), Endoscopic Incision Therapy (EIT), stent placement, Endoscopic combination therapy (Needle-Knife stricturotomy NKS, Balloon Dilation with Triamcinolone Injection TAC), and re-do laparoscopic esophagojejunostomy.

Conclusions In conclusion, the ESANR technique demonstrates potential advantages in addressing anastomotic narrowing in esophagojejunostomy. However, further clinical data and analyses are necessary to verify its effectiveness and establish robust statistical support.

Keywords Anastomotic narrowing, Gastric cancer, Esophagojejunostomy, Esophagus-sparing, Revision

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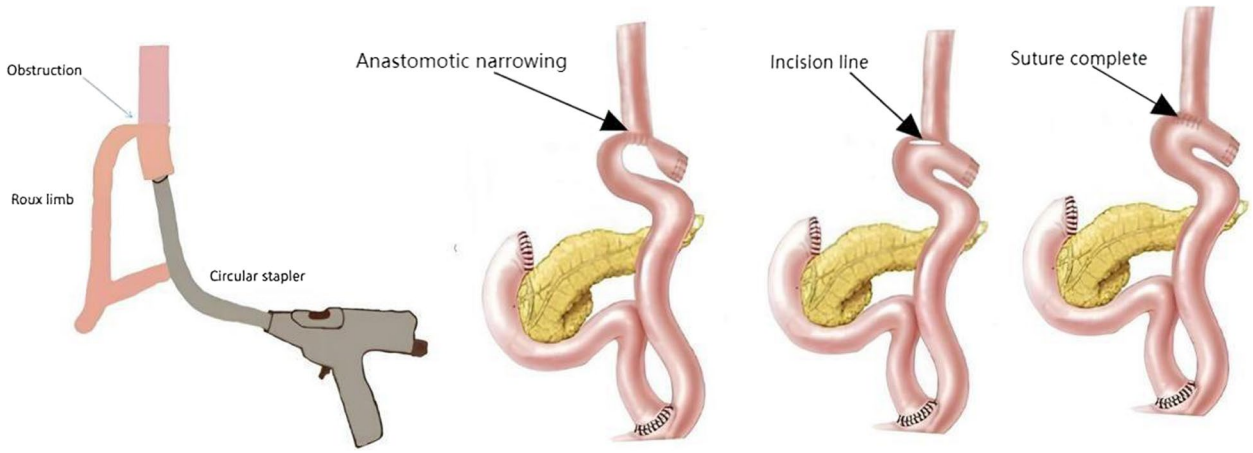

Fig. 1 Schematic of Intraoperative Esophagus-Sparing Anastomotic Narrowing Revision (ESANR)

Background

Gastric cancer is the fifth most common cancer and the fourth leading cause of cancer related mortality globally [1]. An estimated 20–40% of gastric cancers are now found in the upper portions of the stomach [2, 3]. For patients with proximal gastric cancer, a total gastrectomy with esophagojejunostomy reconstruction is often required to achieve the oncological goal of R0 resection [4].

Anastomotic stricture is one of the serious complications that may occur after reconstruction of esophagojejunostomy in gastric cancer surgery [5], with incidence rates from 0.6% to 8% [6–8]. The causes of anastomotic stricture include: 1) Selection of an inappropriately sized circular stapler [9]. 2) Improper stapler used during surgery, such as clamping the contralateral mucosa; 3) Suturing to the contralateral mucosa during manual suturing; and 4) Anastomotic ischemia, leakage, ulceration, or infection, which can lead to chronic inflammation and the formation of scar tissue at the anastomosis [10–14]. 5) Cancer recurrence in the anastomosis is also an important cause of anastomotic stricture [15–18].

Addressing technical issues intraoperatively is crucial to prevent the development of anastomotic stricture. No studies have previously focused on the intraoperative management of esophagojejunostomy anastomotic narrowing. The aim of this study was to introduce the ESANR technique for the intraoperative management of anastomotic narrowing and to conduct a literature review to provide an algorithm for the management of narrowing and strictures that develop as a result of esophagojejunostomy.

Materials and methods

We conducted a retrospective search of all patients who underwent total gastrectomy with esophagojejunostomy between September 2019 and June 2024. The data of patients who developed anastomotic narrowing of the esophagojejunostomy intraoperatively were analyzed. The Olympus gastroscope was used for intraoperative GAM procedure in the three patients (Olympus Medical Systems, Tokyo, Japan). GAM procedure was introduced previously [19, 20]. If the anastomosis was found to be completely occluded or if the gastroscope could not pass through the anastomosis, the ESANR technique was recommended.

The steps of the ESANR technique are as follows: First, an incision was made on the jejunal side of the Roux limb using an ultrasonic scalpel, creating an entry point to address the anastomotic narrowing while minimizing the risk of damage to the esophagus. The direction and length of the incision are determined by the surgeon, taking into account the severity and specific characteristics of the narrowing. Second, the anastomotic narrowing was opened and widened by releasing the sutured contralateral mucosa using the ultrasonic scalpel combined with an electrosurgical hook. A nasogastric or nasojejunal tube was then inserted as a guide or for the subsequent suture. Finally, the common entry of the jejunum and esophagus was closed with a V-lock running suture. The schematic of ESANR is illustrated in Fig. 1.

A systematic review encompassing intraoperative anastomotic narrowing and postoperative strictures was conducted. We systematically searched the PubMed, Embase, and Web of Science databases for published reports on the treatment of anastomotic stricture after total gastrectomy for gastric cancer up to June 2024. The search terms used included “esophagojejunostomy” “anastomotic stenosis” “anastomotic narrowing” “gastric cancer” and “anastomotic stricture”. Irrelevant and non-English-language articles were excluded based on titles and abstracts. Clinical data including number of patients,

sex, age, images, diagnosis, type of anastomotic stricture, treatment and outcome were collected.

Results

Three patients who underwent total gastrectomy with esophagojejunostomy complicated with intraoperative anastomotic narrowing. Specifically, portions of the counter-mesenteric mucosa or intestinal wall were inadvertently stapled into the anastomosis, leading to a narrowing of the lumen. After a literature search, we have not found any other reports related to the resolution of anastomotic narrowing during esophagojejunostomy. An algorithm for the management of narrowing and strictures that develop as a result of esophagojejunostomy was also provided (Fig. 7).

Case 1

An 82-year-old male patient was admitted to the hospital on November 6, 2019, after experiencing dysphagia for 2 months. The patient had developed dysphagia and belching, which were not alleviated by medication. Computed tomography (CT) revealed thickening of the upper stomach wall (Fig. 2A). Preoperative gastroscopic biopsy confirmed the diagnosis of gastric adenocarcinoma. The patient underwent total gastrectomy with esophagojejunostomy. However, intraoperative gastroscopy revealed narrowing at the anastomosis caused by the circular stapler (Fig. 3A, B). To address the anastomotic narrowing, the ESANR technique was employed (Fig. 3). The total operative duration was 600 min, with the ESANR technique taking 45 min. Postoperative upper gastrointestinal radiography showed no anastomotic stricture or leakage of contrast medium (Fig. 6A). The patient recovered well and was discharged without complications.

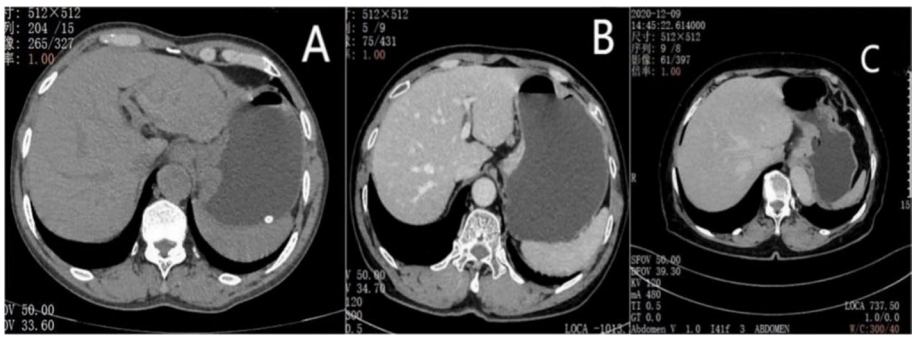

Fig. 2 Preoperative CT images of case 1–3. **A** Preoperative CT image of case 1; **B** Preoperative CT image of case 2. **C** Preoperative CT image of case 3

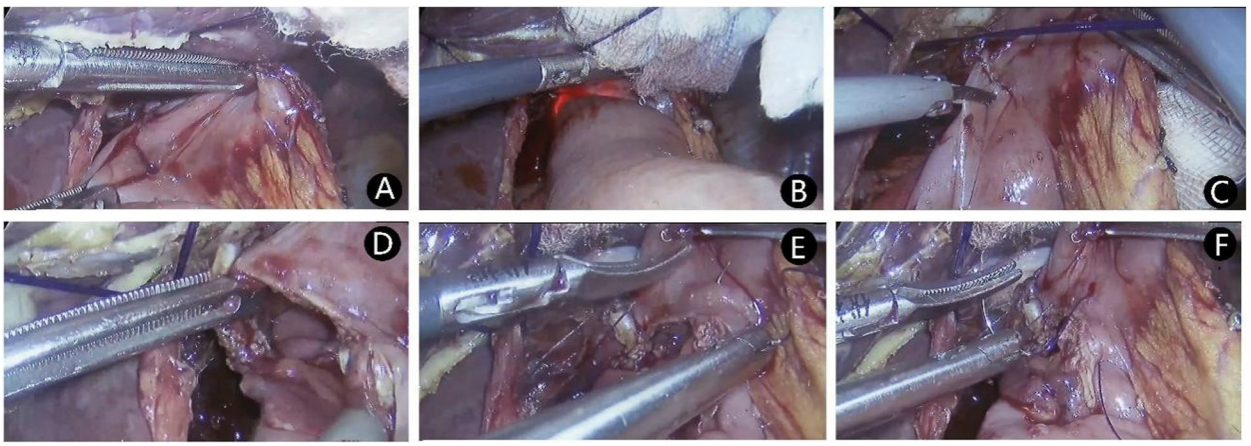

Fig. 3 Intra-operative images of CASE 1 patient. **A**, **B** Intraoperative gastroscopy revealed anastomotic narrowing. **C** An incision was made on the jejunum side of Roux limb using an ultrasonic scalpel. **D** The anastomotic narrowing was opened and widened by releasing the sutured contralateral mucosa with the ultrasonic scalpel combined with electrosurgical hook. **E**, **F** The common entry of jejunum and esophagus was closed with a V-lock running suture

Case 2

A 64-year-old male patient presented with a chief complaint of persistent abdominal distension for 6 months. Gastroscopy revealed an esophagogastric junction tumor, and pathology identified gastric adenocarcinoma. Computed tomography (CT) showed esophagogastric junction cancer close to the lesser curvature of the stomach. Preoperative staging indicated a T2N2M0 tumor (Fig. 2B). The patient underwent total gastrectomy with esophagojejunostomy. However, intraoperative gastroscopy during the procedure revealed an anastomotic narrowing caused by the circular stapler (Fig. 4A). To address the anastomotic narrowing, the ESANR technique was performed (Fig. 4). The total operative time was 370 min, with the ESANR technique taking 50 min. Postoperative upper gastrointestinal radiography showed no anastomotic stricture or leakage of contrast medium (Fig. 6B). The patient recovered well and was discharged without complications. No significant abnormalities were noted at postoperative follow-up.

Case 3

A 76-year-old female patient presented with a chief complaint of epigastric discomfort for more than 2 months. Gastroscopy revealed a tumor at the esophagogastric junction. Pathology confirmed the diagnosis of gastric adenocarcinoma. A computed tomography (CT) scan showed that the esophagogastric junction cancer was close to the lesser curvature of the stomach. Preoperative staging indicated a T3N0M0 tumor (Fig. 2C). The patient underwent total gastrectomy with esophagojejunostomy. However, intraoperative gastroscopy revealed anastomotic narrowing. The contralateral mucosa of the jejunum was clamped into the anastomosis by the circular stapler, resulting in anastomotic narrowing (Fig. 5A). To address the anastomotic narrowing, the ESANR technique was performed (Fig. 5). The total operative time was 330 min, with the ESANR technique taking 45 min. Postoperative upper gastrointestinal radiography showed no anastomotic stricture or leakage (Fig. 6C). The patient recovered uneventfully.

Literature review

A total of 12 studies on the management of narrowing and strictures that may develop secondary to esophagojejunostomy were included (Table 1). The included studies provided different treatments for anastomotic stricture after total gastrectomy and esophagojejunostomy for gastric cancer. Of the 12 studies, 7 were case reports, 4 were retrospective studies, and 1 was a prospective study. Only 6 studies described the type of stapler used in esophagojejunostomy, all of which were circular staplers. In 11 studies, anastomotic strictures were diagnosed postoperatively, while only our study diagnosed anastomotic narrowing intraoperatively. In total, 174 patients were included across the 12 studies, including 107 males and 67 females (Table 2). Among them, 140 patients had benign strictures/narrowing, and 34 had malignant strictures. Of the 140 patients with benign anastomotic strictures/narrowing, 93 were

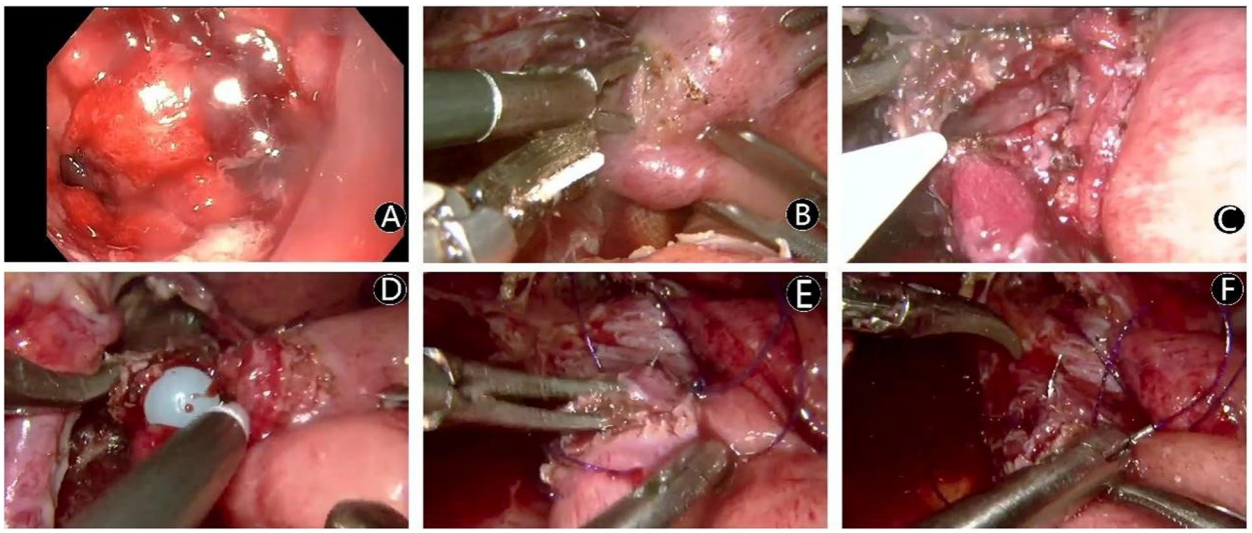

Fig. 4 Intra-operative images of CASE 2 patient. **A** Intraoperative gastroscopy revealed anastomotic narrowing. **C** An incision was made on the jejunum side of Roux limb using an ultrasonic scalpel. **D** The anastomotic narrowing was opened and widened by releasing the sutured contralateral mucosa with the ultrasonic scalpel combined with electrosurgical hook. **E**, **F** The common entry of jejunum and esophagus was closed with a V-lock running suture

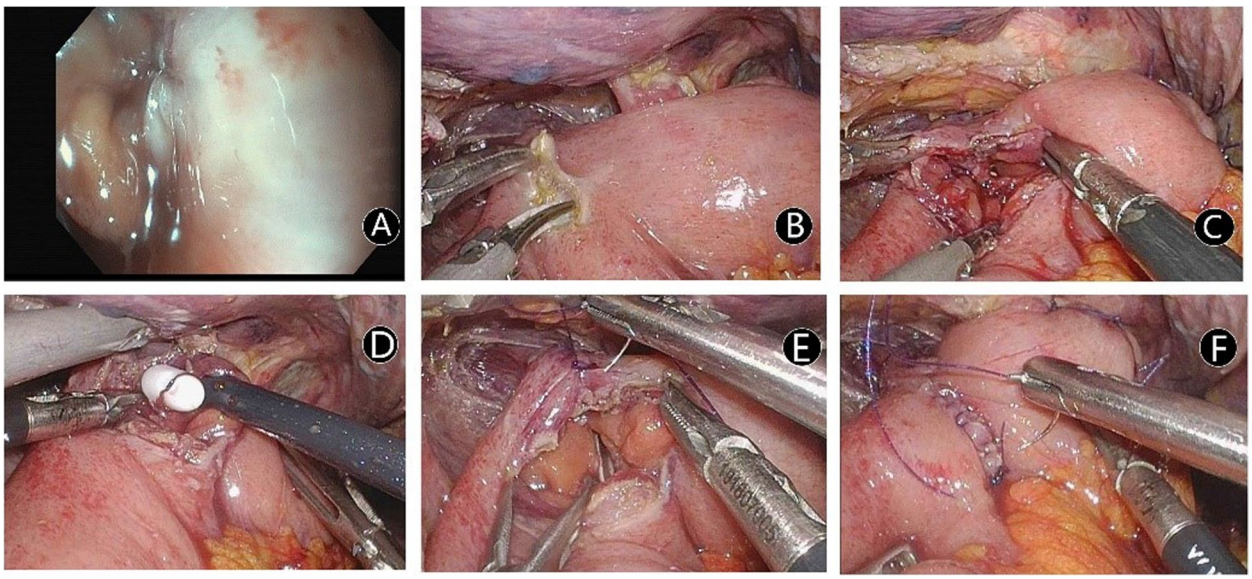

Fig. 5 Intra-operative images of CASE 3 patient. **A** Gastroscopy during esophagojejunostomy revealed only the blind end of the jejunum. **B**, **C** An incision was made on the jejunum side of Roux limb using an ultrasonic scalpel. **D** The anastomotic narrowing was opened and widened by releasing the sutured contralateral mucosa with the ultrasonic scalpel combined with electrosurgical hook. **E**, **F** The common entry of jejunum and esophagus was closed with a V-lock running suture

treated with BD, 39 with EIT or MEIT, 3 with re-do esophagojejunostomy, 3 with ESANR, 1 with SEMS, and 1 with endoscopic combination of NKS, BD with TAC. All 34 patients with malignant anastomotic strictures were treated with SEMS.

Discussion

Anastomotic stricture is one of the serious complications of esophagojejunostomy. It can lead to dysphagia and significantly impact the quality of life of patients, requiring treatment with multiple methods and even re-operation [21, 22]. Prevention plays a crucial role in reducing the incidence of anastomotic stricture following esophagojejunostomy. Therefore, it is important to prevent serious postoperative complications by taking the necessary steps to address intraoperative anastomotic narrowing. Intraoperative anastomotic narrowing can be encountered in esophagojejunostomy. Surgeons often resort to re-do anastomosis when such narrowing occurs. Here, we present a novel ESANR technique that effectively addresses anastomotic narrowing during esophagojejunostomy.

ESANR is a technique employed during esophagojejunostomy to revise anastomotic narrowing, providing the benefit of avoiding the need to re-do the entire anastomosis, thereby preserving valuable esophageal length/tissue. However, this technique is not intended for the treatment of long-term chronic strictures. We included both intraoperative anastomotic narrowing and postoperative stricture in this study for the following reasons: 1) Intraoperative anastomotic narrowing is thought to contribute to the development of postoperative strictures and

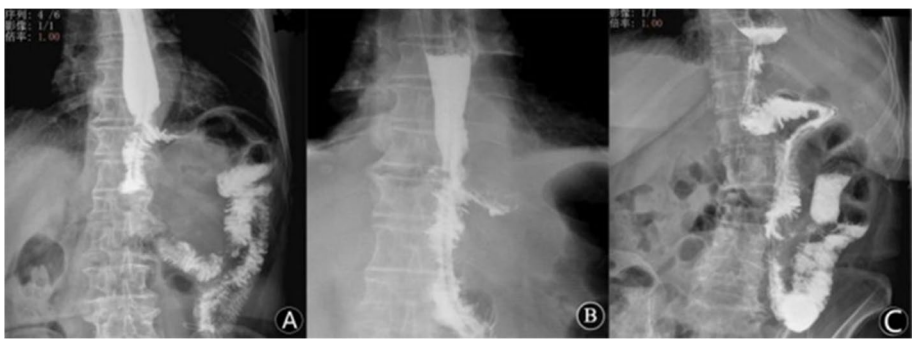

Fig. 6 Postoperative upper gastrointestinal contrast imaging. **A** Postoperative upper gastrointestinal contrast imaging of case 1. **B** Postoperative upper gastrointestinal contrast imaging of case 2. **C** Postoperative upper gastrointestinal contrast imaging of case 3

Table 1 The clinical characteristics of included studies

Author	Year	Area	Journal	Article type	No. of patients	Age (years)	Sex (male/female)	Stapler type	Time of diagnosis	Benign/ Malignant	Treatment	Post treatment follow-up
Dai Manaka [21]	2022	Japan	Langenbecks Arch Surg	Case report	3	58/61/77	(3/0)	Circular	Postoperative	Benign	RD	No recurrence of stricture at one-year follow-up after surgery
Gyu Young Pih [22]	2020	Korea	Journal of Gastrointestinal Surgery	Retrospective	21	Average67.5	BD: (10/2) EIT: (3/6)	No described	Postoperative	Benign	BD12/EIT9	No recurrence of stricture was observed in the EIT group during a median follow-up of 582 days In the BD group, 5 patients developed recurrence of stricture after a median of 63 days
Chan Gyoo Kim [23]	2008	Korea	Surg Endosc	Retrospective	58	ND	(28/30)	Circular	Postoperative	Benign	BD	Recurrence of stricture requiring re-dilation occurred in only 3 of the 58 patients
Our case	2024	China		Case report and review	3	82/65//76	(2/1)	Circular	Intraoperative	Benign	ESANR	No recurrence of stricture was seen in 2 patients at follow-up to date.1patient died two years after
Jad Farha [24]	2020	USA	Am J Gastroenterol	Case report	1	34	(1/0)	No described	Postoperative	Benign	NKS&BD&TAC	No recurrence of stricture one year after surgery
Yücel Üstündag˘a [25]	2001	Turkey	Digestive surgery	Case report	1	73	(1/0)	Circular	Postoperative	Benign	SEMS	Hospital stay after stent insertion was 3 days. His oral intake of a modified diet including especially soft materials returned to near normal levels

Table 1 (continued)

Author	Year	Area	Journal	Article type	No. of patients	Age (years)	Sex (male/female)	Stapler type	Time of diagnosis	Benign/ Malignant	Treatment	Post treatment follow-up
Young Kwon Cho [26]	2005	Korea	AJR Am J roentgenol	Retrospective	23	Average 59.3	(14/9)	No described	Postoperative	Benign	BD	Eighteen patients did not experience recurrence of stricture during the mean follow-up period of 27.5 months, and five patients experienced recurrence of stricture
Hiroyoshi Iguchi [15]	1993	Japan	Cardiovasc Intervent Radio	Case report	1	42	(0/1)	No described	Postoperative	Malignant	SEMS	Died of widespread metastases and renal failure 80 days after stent placement
Toshiko Iwasaki [16],	1993	Japan	Cardiovasc Intervent Radi	Case report	1	66	(1/0)	No described	Postoperative	Malignant	SEMS	Died of cachexia four months after the stent was placed
Jin Hyoung Kim [27]	2007	Korea	J Vasc Interv Radiol	Retrospective	32	Average 54.5	(21/11)	No described	Postoperative	Malignant	SEMS	The median survival and stent patency period were 87 and 140 days, respectively
G. Brandimarte [28]	2002	Italy	Endoscopy	Case report	6	Average 68.3	(4/2)	Circular	Postoperative	Benign	EIT	No recurrence of stricture was demonstrated during a mean 24-month follow-up

Table 1 (continued)

Author	Year	Area	Journal	Article type	No. of patients	Age (years)	Sex (male/female)	Stapler type	Time of diagnosis	Benign/ Malignant	Treatment	Post treatment follow-up
Tae Hoon Lee [29]	2009	Korea	Gastrointest Endoscopy	Prospective outcome study	24	Average55.9	(19/5)	Circular	Postoperative	Benign	MEIT	During the 24-month follow-up observation, 21 did not develop recurrence of stricture Three patients developed recurrence of stricture after an average of 1.6 months

RD Re-do laparoscopic esophagojejunostomy, *BD* Balloon dilatation, *EIT* Endoscopic incisional therapy, *SEMS* Self-expandable metallic stent, *NKS&BD&TAC* Needle-knife stricturotomy triamcinolone Injection, *MEIT* Modified method endoscopic incision

Table 2 Basic information on included patients receiving each management method

	Patients	Sex(male/female)	Type of stricture/narrowing	Time of stricture/narrowing diagnosis confirmed	Initial success rate
BD	93	52/41	93 benign	Postoperative	78.4%
EIT/MEIT	39	26/13	39 benign	Postoperative	100%
Combination of NKS, BD with TAC	1	1/0	1 benign	Postoperative	100%
Stent	35	23/12	1 benign, 34 malignant	Postoperative	94%
surgery	3	3/0	3 benign	Postoperative	100%
ESANR	3	2/1	3 benign	Intraoperative	100%

may represent a risk factor. 2) Including ESANR alongside postoperative anastomotic strictures allowed us to develop a more comprehensive algorithm for managing the narrowing and strictures associated with esophagojejunostomy (Fig. 7). 3) The absence of published data specifically addressing intraoperative anastomotic narrowing made it challenging to focus the literature review exclusively on this topic.

Prevention of anastomotic stricture

Several methods have been reported for the prevention of anastomotic stricture: 1) Selecting the appropriate stapler intraoperatively based on the diameter of the esophagus and jejunum can effectively prevent anastomotic stricture [9]. It is crucial to avoid excessive compression of the anastomotic tissue and to ensure proper mucosal alignment, maintaining a single-layer intestinal wall within the stapler. 2) Performing intracorporeal esophagojejunostomy using linear staplers (overlap method) during laparoscopy may reduce complications such as anastomotic bleeding and stricture [30]. 3) Fujimoto et al. introduced the "hybrid anastomosis," in which end-to-side anastomosis was performed using a circular stapler followed by side-to-side anastomosis by a linear stapler. This approach compensates for the limitations of the circular stapler method in esophagojejunostomy and effectively prevents strictures [31]. 4) For manual anastomosis, using absorbable sutures can reduce the incidence of postoperative anastomotic inflammation [32]. 5) After completing the anastomosis, checking its patency and integrity is essential. Gao et al. described a comprehensive leak detection procedure involving gastroscopy, air, and methylene blue (GAM) for assessing the anastomosis post esophagojejunostomy. This method could effectively prevent anastomotic complications resulting from technical deficiencies in patients undergoing total gastrectomy for gastric cancer [20]. 6) Postoperative complications such as leakage, fistulas, infection, and edema lead to an inflammatory reaction and scar tissue proliferation, causing anastomotic stricture [11, 12], therefore active treatment of complications is also important to prevent stricture.

Management of anastomotic narrowing and strictures

Management of narrowing and strictures that develop because of esophagojejunostomy require consideration of its etiology and severity. Currently, no standardized treatment exists for the management of anastomotic narrowing and strictures. Therefore, developing an algorithm, is crucial for guiding the management of narrowing and strictures that develop as a result of esophagojejunostomy.

BD

Since London et al. reported successful treatment of esophageal strictures with a Gruentzig-type balloon catheter in 1981 [33], BD has become a widely used method for treating anastomotic strictures globally. Common methods of guidance for BD include endoscopic and fluoroscopic guidance [26]. Endoscopic BD has been recognized as highly effective for benign anastomotic stricture after radical surgery for gastric cancer and should be considered as a primary intervention before reoperation [34]. Two critical factors in BD are the number of sessions required and the diameter of dilation. One reported suggests that BD to 15 mm in a single session for benign anastomotic strictures after Roux-en-Y gastric bypass surgery is safe and effective [23]. Another study suggested that BD to 20 mm appears to be optimal for prevention of recurrent symptoms with the fewest complications [26]. Regarding the number of sessions of dilation, several previous studies focusing on the BD procedure have found that more than 40% of cases require at least three additional dilations to achieve an optimal outcome. The success rate reported in the literature ranges from 70 to 90% [12, 14, 35]. The success rate of the articles we included was

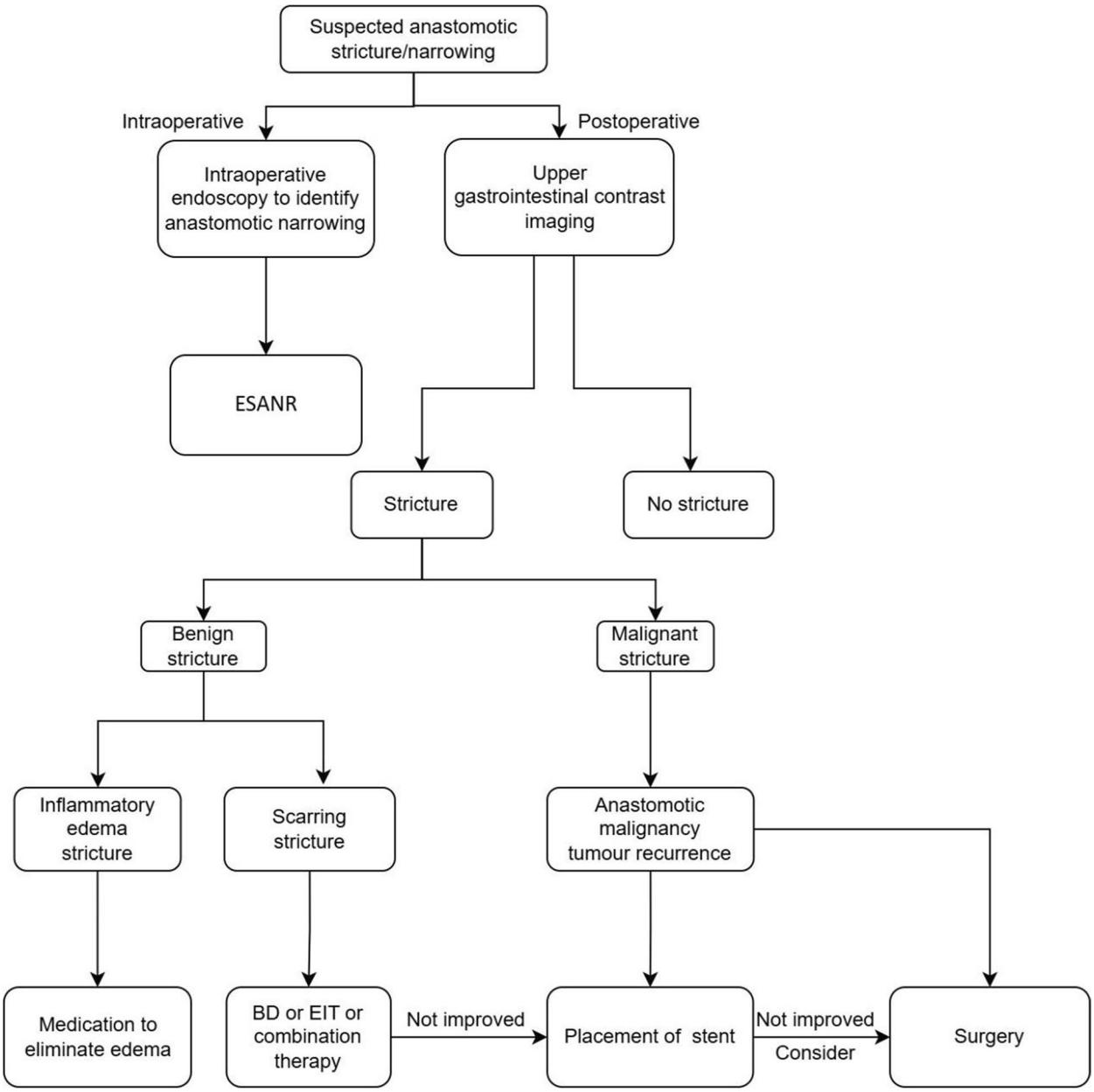

Fig. 7 Algorithm for the management of anastomotic narrowing and strictures. ESANR: Esophagus-Sparing Anastomotic Narrowing Revision. BD: Balloon Dilatation. EIT: Endoscopic Incisional Therapy

approximately 78.4%, which is comparable to what has been previously reported in the literature [22, 23, 26].

EIT

EIT is a straightforward technique where an endoscopic knife cuts in the fibrotic tissue of a stricture under direct vision. G. Brandimarte et al. first reported its use in 2002 for the treatment of esophagojejunostomy anastomotic strictures after total gastrectomy [28]. Since then, EIT has increasingly been adopted in the management of strictures, primarily as a second-line treatment for patients in which strictures recur or are refractory [36]. Studies have indicated that EIT can also serve as a safe and effective primary treatment for esophagojejunostomy anastomotic strictures after total gastrectomy, showing significantly lower recurrence of stricture rates compared to BD [22]. A modified method of incisional therapy (MEIT) proposed by Lee et al. was the use of a transparent hood attached to the scope tip for better visualization of the work field. Their research suggested that MEIT

was safe and feasible as a primary treatment, potentially maintaining patency longer in benign anastomotic strictures of esophagus [29]. The recurrence free rate of EIT as a primary treatment was between 80.6%and 93% in 6–24 months follow-up [29, 37, 38]. The success rate of the literature we included that used either EIT or MEIT was 100% [22, 28, 29].

Stent placement

The types of stents include self-expanding plastic stents (SEPS), self-expanding metal stents (SEMS), and biodegradable stents [39, 40]. Toshiko Iwasaki and Hiroyoshi Iguchi first reported two cases of recurrent malignant anastomotic stricture, that self-expanding metallic stents were placed in 1993. Unfortunately, both patients died shortly after stent placement: one due to cachexia and the other due to widespread metastases and renal failure [15, 16]. Currently, SEMS is more commonly used for esophagojejunostomy anastomotic stricture, particularly when malignant strictures or prior treatments like BD or EIT have not provided sufficient improvement. Studies have demonstrated that stent placement effectively treated anastomotic leakage, stricture, and obstruction following gastrectomy, thereby improving nutrition and reducing the morbidity and mortality risks associated with reoperation [15, 16, 25, 41–43]. The success rate of the literature using SEMS that we included was approximately 94% [27]. SEMS has proven particularly beneficial for patients with anastomotic stricture caused by tumor recurrence after curative surgery, offering a safe and non-surgical therapeutic option [17, 18].

Endoscopic combination of NKS, BD with TAC

Endoscopic treatment modalities can involve single methods or combinations thereof. Jad Farha et al. reported the successful use of a combination of BD, triamcinolone (TAC) injection following needle-knife stricturotomy approach for the treatment of esophagojejunostomy anastomotic strictures. This approach was recommended for patients whose strictures have progressed despite repeated BD treatments with minimal improvement and persistent dysphagia [24]. However, safety and efficacy still need to be explored due to limited data available, especially in regards to stapled anastomotic strictures.

Re-do laparoscopic esophagojejunostomy

Surgical intervention becomes necessary for patients experiencing severe obstruction, such as complete blockage, strangulation, necrosis, or perforation, which cannot be managed by the previously mentioned treatment methods. However, performing laparoscopic re-do esophagojejunostomy is technically demanding. Dai Manaka et al. reported on repeat laparoscopic esophagojejunostomy for anastomotic stricture after esophagojejunostomy. The surgery was successful in all three patients, and they concluded that this approach should be considered only for patients who are resistant to non-surgical treatments [21]. Importantly, reoperation should be conducted by a surgeon with extensive surgical experience.

Limitations

Our study has several limitations. First, with only three cases included, the findings may not adequately represent the entire target population and are subject to sampling bias. Second, the efficacy and safety of the ESANR technique require further investigation and validation. Third, the literature review was constrained by the lack of high-quality studies, with more than half of the references included being case reports.

Conclusion

In conclusion, the ESANR technique demonstrates potential advantages in addressing anastomotic narrowing in esophagojejunostomy. However, further clinical data and analyses are necessary to verify its effectiveness and establish robust statistical support.

Abbreviations

ESANR	Esophagus-sparing anastomotic narrowing revision
BD	Balloon dilation
EIT	Endoscopic incision therapy
NKS	Needle-knife stricturotomy
TAC	Triamcinolone injection
GAM	Air, and methylene blue
SEMS	Self-expandable metallic stent
MEIT	Modified method endoscopic incision
RD	Re-do laparoscopic esophagojejunostomy

Authors' contributions

Y.T, J. Z and Z. W have made substantial contributions to the design of the work. J. Z, G. C and F.S. P performed literature searches and data analysis. Y. L, M. C drew the schematic. X.Q, Z. L, L.G provide surgical images. Y. T and D. B, have drafted the work or substantively revised it. All authors read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

All procedures followed were in accordance with the ethical standards of the ethics committee of Nanchong Central Hospital and with the Helsinki Declaration of 1964 and later versions. Informed consent to be included in the study, or the equivalent, was obtained from all patients.

Consent for publication
Written informed consents were obtained from the patients for publication of the three case reports and any accompanying images. Three copies of the written consents are available for review by the Editor of this journal.

Competing interests
The authors declare no competing interests.

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