

# A novel reconstruction strategy in esophagectomy for megaesophagus



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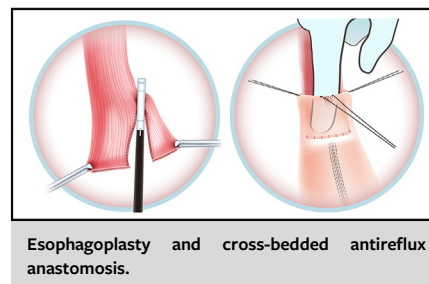
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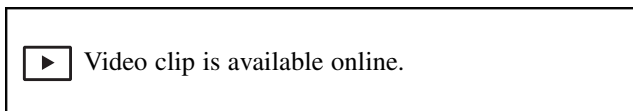
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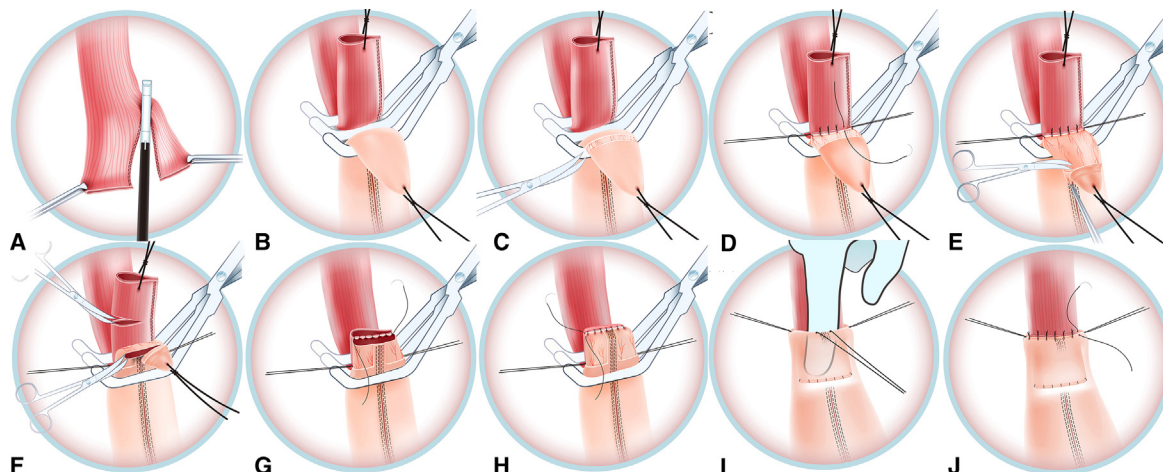


### CENTRAL MESSAGE

Esophagoplasty and cross-bedded antireflux anastomosis were applied in esophagectomy for megaesophagus.



Megaesophagus symbolizes the end stage of achalasia. Esophagectomy has been established as an initial treatment modality in patients with end-stage achalasia but challenges



**FIGURE 1.** Detailed steps of esophagoplasty and cross-bedded antireflux anastomosis. A, A linear cutting stapler was used to develop an esophagoplasty along the axis of esophagus. B, The gastric tube and shaped esophageal stump were clamped together with a 3-leaf clamp. C, The seromuscular layer of stomach was cut open circumferentially. D, A row of interrupted sutures was placed between the posterior seromuscular layer of stomach at the proximal cutting edge and the parallel muscular layer of esophagus to form the posterior outer layer of the anastomosis. E, The seromuscular layer and mucosa of distal gastric tube were divided stripping the seromuscular layer from mucosa. F, The redundant gastric mucosa and esophageal stump exceeding the clamp more than 2.5 cm were removed. G and H, The gastric mucosa and the whole layer of esophagus were sutured together with continuous sutures to form the inner layer of anastomosis. I, The inner layer of anastomosis was inserted into the gastric lumen. J, The anterior seromuscular layer of stomach and muscular layer of esophagus were sutured together with interrupted sutures to finish the anterior part of the outer layer of anastomosis. There are 2 critical points to optimize this procedure. First, this technique only fits for hand-sewn end-to-end anastomosis. Second, the diameter of gastric mucosa at the stoma should be larger than that of esophagus so that the mucosal layer of stomach wouldn't bind the esophagus inside it and induce dysphagia.

A Novel Reconstruction Strategy in Esophagectomy for Achalasia with Megaesophagus

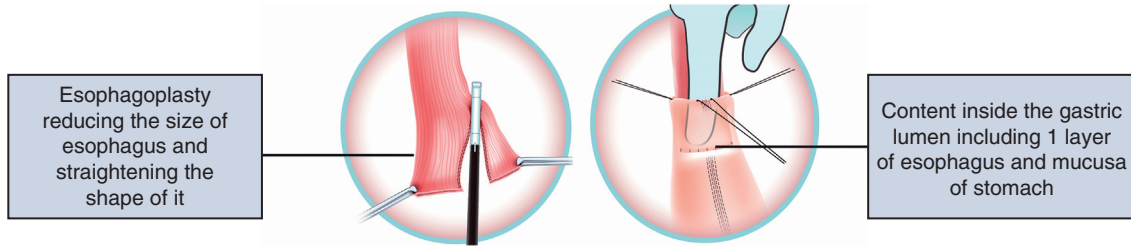


FIGURE 2. Summary of the technique.

remain due to the significantly dilated esophagus and long-term postoperative gastro-esophageal reflux after surgery.<sup>1</sup> A novel reconstruction strategy named cross-bedded antireflux (CAR) anastomosis combined with esophagoplasty was applied in esophagectomies for megaesophagus. The term *cross-bedded* refers to the gastric mucosa and the whole layer of esophagus were sutured together with continuous sutures to form the inner layer of anastomosis. It was inserted to gastric lumen ultimately.

### METHODS AND RESULTS

The institutional Review board number and date of approval was 612, May 19, 2022. Informed consent of all patients for publication of study data was obtained. [Figure 1](#) and [Video 1](#) summarize the procedures of esophagoplasty and formation of CAR anastomosis. This technique has been performed on 4 patients with megaesophagus who underwent thoracoscopic and laparoscopic 3-incision esophagectomy. At 6 months following surgery, no reflux was found. The results are presented in [Table E1](#).

### DISCUSSION

Among all achalasia patients, 5% to 25% would progress to end-stage disease despite various conservative

interventions.<sup>2</sup> Recurrent symptoms, including dysphagia, regurgitation, and respiratory complications are disabling or even life-threatening. Management of end-stage achalasia remains controversial. Esophagus preserving treatments such as redo myotomy, pneumatic dilation, and cardioplasty are associated with perforation, recurrent dysphagia, and reflux.<sup>3</sup> Esophagectomy has been effective to reestablish digestive tract patency and decrease the incidence of pulmonary aspiration and cancerization.<sup>4,5</sup> Nevertheless, postoperative recurrent dysphagia or nocturnal regurgitations have been frequently reported, which necessitates the refinement of reconstruction. In this strategy, esophagoplasty reduced the size of megaesophagus and straightened the shape facilitating the anastomosis whose safety could be supported by the tubulization of stomach.<sup>E1</sup> Previous studies have shown leakage and reflux can be well controlled by intussusception.<sup>E2,E3</sup> Possible mechanisms might be the adhesion between intussuscepted esophagus and stomach limited the potential intraluminal leakage anastomosis and the intussuscepted esophagus and gastric wall would functioned as a unidirectional valve to prevent reflux. Although endoscopy often rules out the existence of stricture, postoperative dysphagia could be caused by the anatomy that the double layers of the stomach might compress the esophagus, as [Figure E1](#) shows. This issue could be managed by removing the seromuscular layer of intussuscepted gastric wall to reduce the thickness of gastric wall covering the esophagus (2-1.5 layers) and avoid the bulge of gastric wall when intussusception was performed.

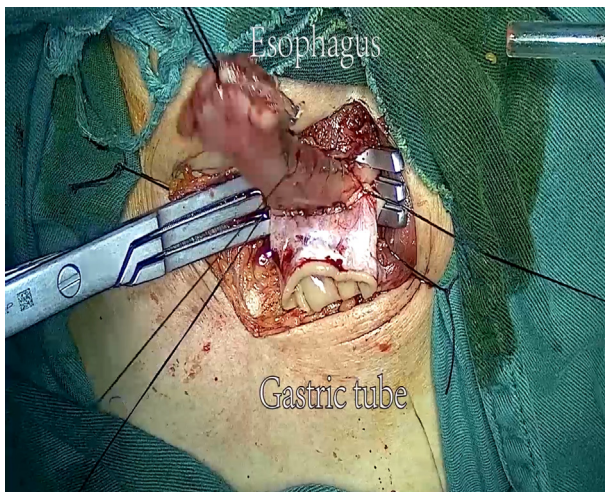
### CONCLUSIONS

Esophagoplasty and CAR anastomosis may elevate the status of esophagectomy in the treatment strategy of achalasia ([Figure 2](#)). Further validation of the good outcomes in more patients with megaesophagus and even malignancy is needed.

### Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling



VIDEO 1. Esophagoplasty and cross-bedded antireflux anastomosis in esophagectomy. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00359-0/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00359-0/fulltext).

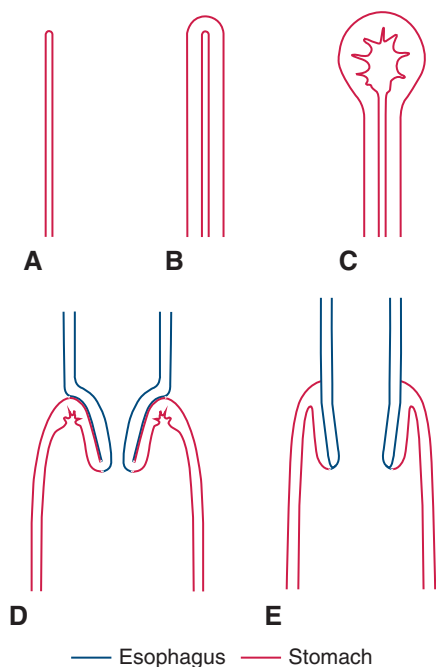
manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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**FIGURE E1.** Mechanism of how cross-bedded antireflux (CAR) anastomosis reduces postoperative dysphagia. The top row illustrates of the thickness of different tissues when they are folded. A, No bulge exists when a single-layer tissue is folded. B, No bulge exists when a double-layer tissue, with whose outer layer larger than inner layer is folded. C, Bulge appears when a double-layer tissue, with whose inner layer larger than outer layer, is folded. The inner layer piles up, together with the outer layer covering the inner layer, inducing a bulge at the site where the tissue bends. The bottom row illustrates the compression to esophagus induced by common intussuscepted anastomosis versus CAR anastomosis. D, The inner layer of stomach is larger than its outer layer. Bulge appears at the site where the gastric wall bends inside when intussusception is made in common intussusception anastomosis, which might lead to the intussuscepted gastric wall overly compress the esophagus below and cause postoperative dysphagia. E, With removing the seromuscular layer of the intussuscepted gastric wall, CAR anastomosis eliminates the bulge and reduces the thickness of gastric wall covering the esophagus.

**TABLE E1. Intraoperative and postoperative 6-month evaluation data of patients with megaesophagus undergoing esophagectomy combining esophagoplasty and cross-bedded antireflux anastomosis**

Case no.	1	2	3	4
Diameter of esophagus (cm)	6	7	7	6
Time for anastomosis (min)	23	25	25	24
Anastomotic leakage	Null	Null	Null	Null
Dysphagia score $\Delta$ *	0	0	1	0
Reflux score $\Delta$ *	0	0	0	0
DeMeester score	8.0	2.4	0.3	2.8

$\Delta$ , Change. \*The reflux score and dysphagia score were evaluated by visual analog scale ranging from 1 to 10.