

Robotic, Hybrid and Endovascular Approaches to Facilitate Management of Vascular Rings

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Background

Vascular rings result from aberrant development of the aorta or subclavian arteries. Although typically asymptomatic, they may result in dyspnea, stridor, and dysphagia lusoria.

Although historically treated via thoracotomy, appropriately selected patients may benefit from minimally invasive approaches. We describe the successful management of four patients with symptomatic vascular rings by robot-assisted division or resection of aberrant vessels.

Methods

Workup

- Cross sectional imaging, bronchoscopy, and esophagogastroduodenoscopy (EGD) confirmed compression of aerodigestive structures resulting in dysphagia lusoria
- All patients satisfied anatomic criteria for a robot-assisted hybrid approach (at least 6cm from mediastinum to lateral chest wall and 6-8cm between robot thoroscopic ports).

Management

- Robot-assisted division of the aberrant subclavian artery and ligamentum arteriosum (n=2)
- Staged hybrid approach with robot-assisted double arch division followed by endovascular repair (TEVAR) for residual aneurysm (n=1)
- TEVAR with subclavian arterial Amplatz embolization of large Kommerell diverticulum followed by robot-assisted resection of aberrant subclavian artery (n=1)

Monitoring

- Intraoperative pre- and post-procedural bronchoscopy and EGD showed resolution or improvement in compressions.
- All patients were successfully extubated in the operating room.

Results

Patients were on average age 22 years old (SD 7.4), 75% female, with mean weight of 68.25 kg (SD 19.7), and mean height 26.72 cm (SD 5.0).

Table 1. Surgical indications.

Surgical indications, n=4	Value
ASA-PS: 3, % of patients	100%
Surgical indication and comorbidities:	
Dysphagia, % of patients	100%
Dyspnea, % of patients	100%
Stridor, % of patients	25%
Chest Pain, % of patients	25%
Anatomy:	
Right-sided aortic arch, left ligamentum arteriosum with anomalous retroesophageal left subclavian arteries, and Kommerell diverticulum, % of patients	50%
Double aortic arch, % of patients	25%
Right-sided aortic arch and Kommerell diverticulum, % of patients	25%

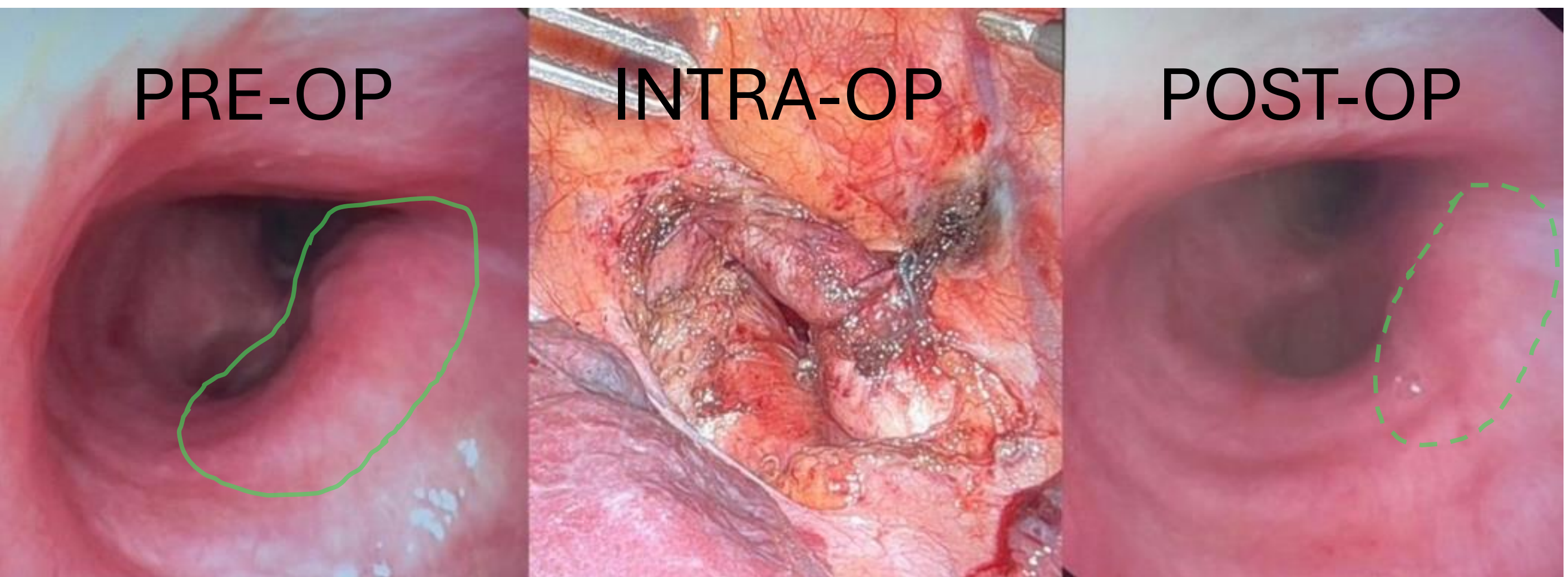


Figure 1. Preoperative EGD demonstrating esophageal compression (solid green line, left), intraoperative view of the vascular ring (middle), and postoperative EGD demonstrating resolution of compression (dashed green line, right).

Table 2. Clinical outcomes.

Outcomes, n=4	Value
Hospital length of stay in days, robotic surgery alone, n=3, mean (SD)	2.67 (0.6)
Hospital length of stay in days, TEVAR alone, n=1	4
Hospital length of stay in days, robotic surgery and TEVAR, n=1	8
Resolution or significant improvement in symptoms during hospitalization, % of patients	100%
Post operative number of days at most recent follow up, median (IQR)	75 (31-320)
Resolution or significant improvement in symptoms at most recent follow up, % of patients	100%
Freedom from reintervention, % of patients	100%

Following robotic division:

- All patients resumed normal diet on postoperative day 1 without nausea or emesis
- One patient had a small left pneumothorax on imaging on postoperative day 1, resolved with chest tube placement

Conclusion

These cases describe the safety and viability of using minimally invasive techniques to manage vascular rings in appropriately selected patients.