

Aberrant Right Subclavian Artery as a Cause of Esophageal Traction Diverticula

AUTHORS:

Purrman KC, Anciano CJ, Oliver AL, Iannettoni MD, Speicher JE

CORRESPONDENCE AUTHOR:

James E. Speicher, MD
115 Heart Dr.
East Carolina University Brody School
of Medicine
Greenville, NC 27834
E-mail: speicherj15@ecu.edu

AUTHOR AFFILIATIONS:

Brody School of Medicine at East Carolina
University
Department of Cardiovascular Sciences
Greenville, NC 27834

Background	Esophageal diverticula are common problems associated with abnormal motility or extrinsic anatomic forces; presented within this case is an example of an aberrant right subclavian artery, one of the most common aortic arch anomalies that cause extrinsic pressure on the esophagus leading to the formation of a traction diverticulum.
Summary	A 59-year-old African American female presented to the emergency department with a history of dysphagia with intolerance to both solids and liquids. A CT Scan revealed a large upper esophageal diverticulum and a normal variant aberrant right subclavian artery coursing posterior to the esophagus near the neck of the diverticulum. After a course of nutritional support, the patient underwent ligation of the aberrant subclavian vessel and excision of the esophageal diverticula. She had an uncomplicated post-operative course with eventual resumption of oral intake and return to normal function.
Conclusion	The surgical team hypothesizes that the patient's congenital aberrant subclavian artery led to the formation of a traction diverticulum in the esophagus, and was the ultimate cause of her symptomatic profile. The incidence of this etiology of esophageal diverticula is unknown and this is the first published case report of such a phenomenon. Treatment of such a cause of esophageal diverticula uses the same principles required for all esophageal diverticular—removing the underlying etiology and, if necessary due to symptoms, resecting the diverticulum.
Keywords	Esophageal diverticulum, aberrant subclavian artery, Kommerell diverticulum, Dysphagia Lusoria.

MEETING PRESENTATION:

Eastern Cardiothoracic Surgical Society, St. Pete Beach, FL, October 2016

Case Description

Esophageal diverticula refer to abnormal outpouchings of the esophageal wall and are classified either by location, etiology (congenital, pulsion, or traction), or histology (true, false).¹ Congenital esophageal diverticula are false diverticula, present at birth, and located in the posterior esophagus.² Pulsion, or false, diverticula form as a result of high intraluminal pressure against a weakness in the esophageal wall (i.e. Zenker Diverticulum). These contain mucosa and submucosa, along with few muscle fibers. Traction, or true, diverticula are a consequence of pulling

To Cite: Purrman KC, Anciano CJ, Oliver AL, Iannettoni MD, Speicher JE. Aberrant Right Subclavian Artery as a Cause of Esophageal Traction Diverticula. *ACS Case Reviews in Surgery*. 2017;1(2):28-32.

forces external to the esophagus, usually from an inflammatory process (often inflamed mediastinal lymph nodes caused by Tuberculosis or Histoplasmosis).^{1,3,4} This leads to a tissue reaction that causes a full thickness outpouching of all three layers of the esophageal wall, muscle included, that results in a wide-mouthed diverticulum. Treatment of esophageal diverticula requires correcting the underlying etiology of the diverticulum with or without removal of the diverticulum itself.

The presence of an aberrant right subclavian artery is a known normal variant of the aortic arch anatomy, with a reported incidence of 0.2% to 4.4%.⁵ The aberrant vessel arises distal to the left subclavian and courses posterior to the esophagus in 80% of patients (15% between the esophagus and trachea and 5% anterior to the trachea). Aneurysmal dilatation of the takeoff of the vessel at the aorta is known as a Kommerell Diverticulum.⁶ Dysphagia lusoria is a common presentation of aberrant right subclavian artery, and is described as difficulty swallowing because of extrinsic compression on the posterior esophagus by the aberrant vessel.

This case report proposes a novel etiology for the development of traction esophageal diverticula. The patient presented has an aberrant right subclavian vessel that coincides with a large esophageal diverticulum. At time of surgery, it was noted that the vessel was not only coursing directly posterior to the neck of the diverticulum, but was also tightly-adhesed to the muscular wall of the esophagus. It is our hypothesis that the aberrant vessel caused significant traction on the esophageal wall leading to the development of the large esophageal diverticulum. With review of the current literature, the incidence of this etiology of esophageal diverticulum is unknown and this is the first published case report of such a phenomenon.

A 59-year-old African-American female presented to the emergency department reporting a history of dysphagia to solids progressing to liquids. Recently she has been unable to take liquids without coughing and had significant weight loss. Her past medical history included severe rheumatoid arthritis and COPD. Physical examination at the time of presentation revealed that the patient had a hoarse voice and signs of malnutrition (BMI= 16.6) but was otherwise unremarkable. Her prealbumin was determined to be <5 at this time. The patient had worked as a factory worker in the past but was now retired, and she had a 4 pack-year history of smoking. CT Scan of the chest with contrast revealed findings of a normal variant aberrant right subclavian artery with a Kommerell diverticulum proximally

that coursed posterior to the proximal esophagus, and a 5.0 x 2.5 cm proximal esophageal diverticulum at the level of the left thoracic inlet (Figure 1). At the time of presentation, the patient was unable to complete a barium esophagram or esophageal manometry due to aspiration and it was determined that data from these studies would not influence clinical decision-making.



Figure 1. CT scan of the chest with contrast showing the aberrant right subclavian artery and its proximity to a large esophageal diverticulum.

An EGD was performed to further delineate the esophageal anatomy, and two separate diverticula were observed. A large, proximal, wide-mouthed diverticulum was noted with the entrance to the neck at 22 cm from the incisors and a neck extending for 3-4 cm distally (Figure 2). A smaller, distal, narrow-mouthed diverticulum with a 1 cm neck was noted at 26 cm from the incisors (Figure 3). The two diverticula did not appear to connect.



Figure 2. Image of the EGD that shows the inner surface of the large, proximal esophageal diverticulum with the lumen of the esophagus in the upper right corner.



Figure 3. Image of the EGD that shows the entrance to the smaller, distal diverticulum with the lumen of the esophagus in the background.

Given the patient's malnourished status, she underwent nutritional supplementation preoperatively. After her nutritional status stabilized, she underwent a right subclavian to carotid bypass with ligation of the aberrant subclavian vessel and placement of a descending aortic stent graft to cover the takeoff of the vessel and the Kommerell diverticulum. Her postoperative clinical course was unremarkable and one month later she presented for esophageal diverticulectomy.

A cervical incision was made along the anterior border of the sternocleidomastoid muscle. Dissection was carried down to the esophagus, and because of the degree of inflammation along with adhesion of the omohyoid to the diverticulum, the endoscope was placed into the esophagus and retroflexed into the diverticulum in order to more readily identify its borders. The superior aspect of the diverticulum was separated from surrounding structures and lifted out of the thoracic inlet (Figure 4).

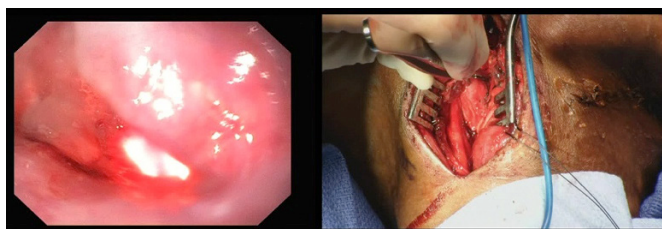


Figure 4. Intraoperative image showing dissection of the superior aspect of the diverticulum. The view on the left is through the endoscope which is retroflexed into the diverticulum, looking towards the apex. The view on the right shows the superior portion of the diverticulum being retracted away from the esophagus.

At this point the scope was repositioned to visualize the inferior aspect of the diverticulum and attempt was made to dissect to the distal edge of the diverticulum, however the cervical incision alone would not allow access to the inferior edge. A partial sternal split was performed, dividing the manubrium to the sternomanubrial junction. The upper thymus was divided and the innominate artery and vein were retracted inferiorly. At this point, the inferior aspect of the diverticulum was able to be separated from its fibrous attachments to surrounding structures (Figure 5).

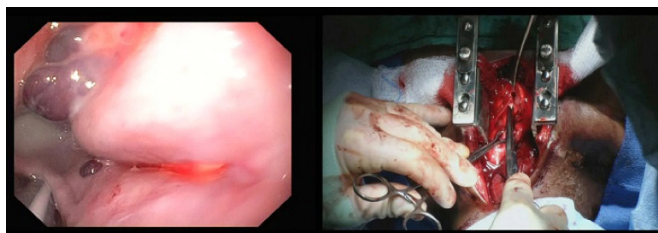


Figure 5. Intraoperative image showing dissection of the inferior aspect of the diverticulum. The view on the left is through the endoscope which is inserted into the diverticulum, showing the indentation of the wall of the diverticulum from external compression. The view on the right shows the inferior portion of the diverticulum being dissected away from the esophagus.

The mid-portion of the diverticulum was found to be tightly adhered posteriorly to the Kommerell diverticulum of the aberrant right subclavian artery. Tedious dissection freed the esophageal diverticulum from the Kommerell diverticulum. A myotomy was performed, circumferentially around the diverticulum (as the diverticulum appeared to be completely covered in muscle) and proximally and distally on the esophagus for several centimeters. The diverticulum was then stretched out away from the esophagus and a 42-French bougie was placed (Figure 6). Two firings of an Endo-GI Stapler with a tissue load were used to separate the diverticulum. The diverticulum was measured as being 7.2 cm in length with a 5 cm neck (Figure 7).

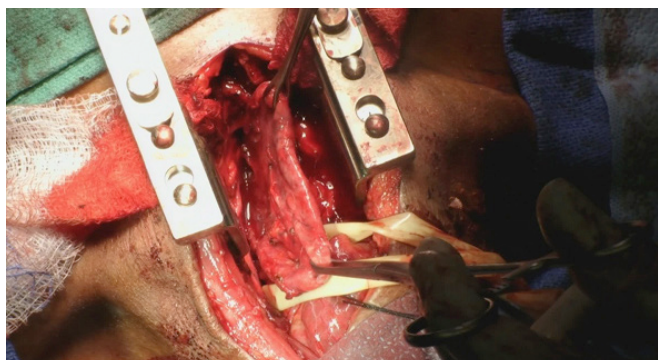


Figure 6. Intraoperative image showing the entire diverticulum after completion of dissection and myotomy.



Figure 7. The resected diverticulum, measuring 7.2cm in length.

Once the diverticulum was separated from the esophagus, the muscle layers were reapproximated over the staple line. The more distal 1cm diverticulum could not be accessed through the extended cervical incision and would have required a thoroscopic procedure for resection. Because of the likely asymptomatic nature of the smaller diverticulum and the patient's deconditioned status and severe respiratory compromise at baseline, it was elected to not remove the second diverticulum unless it became necessary at a later time. A JP drain was placed into the mediastinum over the esophagus. The sternum was closed and the incisions were closed in layers. The patient had a somewhat protracted postoperative course, mainly due to her overall level of malnutrition and deconditioning. She was discharged on postoperative day 13. Her swallowing function returned to normal with speech therapy and she is able to tolerate all oral intake with minimal dysphagia. She has undergone one dilation for a focal stricture at the proximal staple line since her original surgery. At her 6-month follow-up appointment, the patient is noted to be gaining weight and is continuing to tolerate all oral intake without difficulty at this time.

Conclusion

The presentation of a normal variant aberrant right subclavian vessel and the presence of large, symptomatic esophageal traction diverticula in this patient is not an identified phenomenon. It is hypothesized that the aberrant vessel created a desmoplastic reaction with the muscular wall of the esophagus, causing traction on the esophageal wall and leading to the formation of the large, symptomatic esophageal diverticulum in this patient. The patient's main pre-

senting symptom was dysphagia, which is commonly seen in patients with an aberrant right subclavian artery and Kommerell diverticulum, often referred to as dysphagia lusoria. In this case, however, the patient's extreme dysphagia and actual intolerance of oral intake was thought to be more likely related to the compression of her upper esophagus by the large esophageal diverticulum rather than through the mechanism of dysphagia lusoria.

Importantly, this case report highlights aberrant subclavian vessels as a unique cause of traction diverticula. The incidence of such a phenomenon is not known and this is the first case report published that details the concurrent presence of these two factors. Heightened clinical suspicion is important in patients who present with aberrant right subclavian vessels with dysphagia and/or esophageal diverticula. Optimal therapy necessitates removal of the inciting etiology of the diverticulum and diverticular resection if the diverticulum causes significant symptoms of dysphagia and compression/obstruction.

Lesson Learned

In this report, we present a case of an aberrant right subclavian artery as a rare cause of a symptomatic traction esophageal diverticulum. Heightened clinical suspicion for this etiology of esophageal diverticulum is important in patients that present with concomitant aberrant right subclavian vessels and dysphagia and/or esophageal diverticula. Optimal therapy in these cases involves removal of the inciting etiology as well as the esophageal diverticulum itself for resolution of symptoms.

References

1. Smith CD. Esophageal strictures and diverticula. *Surg Clin North Am.* 2015 Jun;95(3):669-81. Doi 10.1016/j.suc.2015.02.017 PMID: 26843913
2. Lingholm EB, et al. Congenital esophageal diverticulum – a case report and review of the literature. *J Pediatr Surg.* 2013 Mar;48(3):665-8. doi:10.1016/j.jpedsurg.2012.12.037 PMID: 23480930
3. Bagheri, R., Maddah, G., & Mashhadi, M. (2014). Esophageal diverticula: Analysis of 25 cases. *Asian Cardiovascular and Thoracic Annals*, 22(5), 583-587. doi:10.1177/0218492313515251 PMID: 24867034
4. Ballehaninna, U., Shaw, J., & Brichkov, I. (2012). Traction esophageal diverticula: a rare cause of gastrointestinal bleeding. *SpringerPlus*, 1(50). doi:10.1186/2193-1801-1-50 PMID: 23626926

5. Natsis K, et al. The aberrant right subclavian artery: cadaveric study and literature review. *Surg Radiol Anat*, 2016 Dec 20. Doi:10.1007/s00276-016-1796-5 PMID: 2799994
6. Van Bogerijen GHW, et al. Evolution in the management of aberrant subclavian arteries and related Kommerell diverticulum. *Ann Thorac Surg*. 2015 Jul;100(1):47-53. doi:10.1016/j.athoracsur.2015.02.027 PMID: 25912743