Published online 2023 October 29.

Endovascular Management for an Aberrant Right Subclavian Aneurysm

El Hadhri Saif El Hak^{1,*}, Chaouch Nazih¹, Jenni Haifa¹, Boughanmi Khawla¹ and Ahed Fallouh¹

¹Department of Vascular and Thoracic Surgery, Rene Dubos Hospital, Pontoise, France

^{*}Corresponding author: Department of Vascular and Thoracic Surgery, Rene Dubos Hospital, Pontoise, France. Email: hadhri.saif@gmail.com

Received 2023 February 26; Accepted 2023 August 28.

Abstract

Introduction: Aberrant right subclavian artery (ARSA) aneurysm repair is usually performed surgically. Case Presentation: We report the case of an endovascular exclusion of ARSA aneurysm using a degressive covered endograft via axillary access. This technique can avoid classical complications of an open surgical repair and the complexity of hybrid techniques, especially in patients of advanced age with multiple comorbidities.

Keywords: Thoracic Endovascular Aortic Repair, Kommerell Diverticulum, Aberrant Right Subclavian Artery

1. Introduction

The aberrant right subclavian artery, clinically known as Arteria Lusoria, is the most common embryologic abnormality of the aortic arch (1). It was first described in 1735 by Hunauld (2). It is considered to be caused by an abnormality of the right fourth pharyngeal arch that is responsible for the development of the innominate artery and the persistence of the seventh intersegmental artery (3).

Symptomatology is essentially related to aneurysmal disease development that mostly occurs at the level of its origin. It occurs in 60% of aberrant right subclavian artery cases, known as the Kommerell diverticulum (4, 5).

The natural history of aberrant right subclavian artery aneurysms is similar to aneurysms in other locations, with continuous expansion and risk of rupture and death (6).

Open surgical repair of these aneurysms is usually performed under a thoracotomy and requires aortic clamping, which can be a source of increased morbi-mortality in high-risk patients. Endovascular repair of ARSA aneurysms has been reported and represents a less invasive approach (7, 8).

We present the case of endovascular repair of an aberrant right subclavian artery aneurysm.

2. Case Presentation

A 75-year-old female treated for COPD consulted a pneumologist for increasing dyspnea for several months. A CT scan showed a retro-esophageal aberrant right subclavian artery aneurysm, and the patient was transferred to our unit for further examination and eventual treatment. Physical examination was perfectly normal; there was no palpable cervical nor thoracic mass, and blood pressure was normal and symmetrical in both arms.

Dedicated CT angiography was made and showed that the ARSA arose a few centimeters after emerging from the aorta. It passed through the posterior mediastinum to attend to the right arm, slightly compressing the esophagus (Figure 1).

Vertebral and mammary arteries were issued from subclavian arteries and spared from aneurysm dilation. The maximum aneurysm diameter was 46 mm, the proximal neck diameter was 23.6 mm, and the distal neck diameter was 9.8 mm (Figure 2).

Even though no alarming symptoms concerning aneurysm size drove us to treat the patient using an endovascular approach, it was done after a deep discussion with the patient about the risks, benefits, and alternatives, such as open surgery. The procedure took place under local anesthesia with light sedation.

Copyright © 2023, Multidisciplinary Cardiovascular Annals. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0) (https://creativecommons.org/licenses/by-nc/4.0/) which permits copy and redistribute the material just in noncommercial usages, provided the original work is properly cited.



Figure 1. longitudinal CT slice showing trachea compression by the aneurysm



Figure 2. Aneurysm anatomical characteristics

The vascular access was provided by a 16 French sheath introduced after a surgical control of the axillary artery in the armpit. After catheterizing the aneurysm, we deployed a Cook degressive endograft 28 - 12/60 mm with good angiographic control at the end of the procedure (Figure 3).

The patient was discharged on day 2 and was seen at 01 and 06 months with a satisfying CT angiography control at 01 months (Figure 4).

3. Discussion

An aberrant subclavian artery represents the most common anomaly of the aortic arch, with an

Incidence of around 1 to 2% (9). It is associated with a higher incidence of trisomy 21 (19 - 35%) and other congenital syndromes (10). In 60% of cases, it originates from a saccular dilation of the aorta, known as "Kommerell's diverticulum" (11). Ninety percent of



Figure 3. Final angiographic control after endograft deployment



Figure 4. 3D CT reconstruction at 01 month

patients are asymptomatic, but compression of the esophagus or the trachea can cause symptoms like dysphagia (71%), dyspnea (19%), or coughing (8%) (12).

In 1956, 20 years after Kommerell's first description of the vessel's diverticulum, McCallen described an aneurysmal aberrant right subclavian artery (13). Ninety percent of these aneurysms are secondary to atherosclerosis, and 25% are associated with other locations of aneurysms, most frequently in the aorta (6).

Although the natural history of an aberrant right subclavian artery aneurysm is not precisely known because of its rarity, rupture and dissection have been reported. Austin and Wolfe, in their publication, reported a rupture rate of 19% among 32 patients (6). Cinà and his team observed a rupture or dissection rate of 53% among 32 patients with aberrant subclavian artery and right aortic arch (5).

The limit to considering whether the diverticulum at the vessel's origin is normal or aneurysmal was not clear until 1989 when Felson established a classification containing three groups: The normal diverticulum, aneurysmal dilatation of the diverticulum, and aneurysm of the distal vessel separated from the diverticulum or aorta by a normal segment of the subclavian artery (14).

For aberrant subclavian artery aneurysm management, the threshold size above which aneurysm repair should be indicated in asymptomatic or mildly symptomatic patients is not precisely determined. Cinà et al. recommended surgical repair for 3 cm aneurysms or above (5). However, Ota and his team recommended treatment for symptomatic aneurysms of 5 cm or greater (15). Other series recommended early intervention (16, 17).

The gold standard treatment had been open surgery until endovascular and hybrid techniques emerged (18, 19). Nevertheless, surgical management for this pathology requires thoracotomy or sternotomy and even circulatory arrest in some cases, which is responsible for a high rate of mortality (18 - 25%) (6, 20).

Yang et al. in their study (21), compared surgical and endovascular techniques and found that in endovascular/ hybrid techniques groups, the mortality rate was (6.5%) and was significantly lower than reported by Kieffer et al. (18) (P = 0.043) and Austin and Wolfe (6) (P = 0.030), so was the complication rate (17.9%) compared to Austin and Wolfe (6) (P = 0.032) and Esposito et al. (20) (P = 0.001) and concluded that endovascular approach might be a good choice, especially for older patients with multiple comorbidities.

Davidian et al. (22) were the first to report an endovascular repair for an aberrant right subclavian artery aneurysm using a 24/13/110 mm PTFE-covered stent graft with a successful result; studies began then to emerge to report cases with hybrid techniques such as carotid-subclavian bypass associated with TEVAR and in some cases fenestrated fully percutaneous procedures (21, 23).

3.1. Conclusions

The presented case shows that aberrant right subclavian artery aneurysm repair with the appropriate anatomy can be successfully treated with an endovascular approach using a covered stent, which allows avoiding invasive surgery and subsequent high mortality and morbidity rates.

Footnotes

Authors' Contribution: Study concept and design, Acquisition of data: El Hadhri Saif El Hak. Analysis and interpretation of data: Chaouch Nazih. Drafting of the manuscript: Jeni Haifa. Administrative, technical, and material support: Boughanmi Khaoula. Study supervision: Ahed Fallouh

Conflict of Interests: The authors declare that they have no conflict of interest.

Funding/Support: This study was not funded by any other organism.

Informed Consent: The patient was informed about the study and accepted the publication anonymously.

References

- Molz G, Burri B. Aberrant subclavian artery (arteria lusoria): Sex differences in the prevalence of various forms of the malformation. Evaluation of 1378 observations. *Virchows Arch A Pathol Anat Histol.* 1978;**380**(4):303-15. [PubMed ID:153045]. https://doi.org/10.1007/BF00431315.
- Polguj M, Chrzanowski L, Kasprzak JD, Stefanczyk L, Topol M, Majos A. The aberrant right subclavian artery (arteria lusoria): The morphological and clinical aspects of one of the most important variations-a systematic study of 141 reports. *Sci World* J. 2014;2014:292734. [PubMed ID: 25105156]. [PubMed Central ID: PMC4102086]. https://doi.org/10.1155/2014/292734.
- Vucemilo I, Harlock JA, Qadura M, Guirgis M, Gowing RN, Tittley JG. Hybrid repair of symptomatic aberrant right subclavian artery and Kommerell's diverticulum. *Ann Vasc Surg.* 2014;28(2):411–20. [PubMed ID: 24200134]. https://doi.org/10.1016/j.avsg.2013.04.016.
- Van Son JA, Konstantinov IE. Burckhard F. Kommerell and Kommerell's diverticulum. *Texas Heart Institute J.* 2002;29(2):109.
- Cina CS, Althani H, Pasenau J, Abouzahr L. Kommerell's diverticulum and right-sided aortic arch: A cohort study and review of the literature. J Vasc Surg. 2004;39(1):131-9. [PubMed ID: 14718830]. https: //doi.org/10.1016/j.jvs.2003.07.021.
- Austin EH, Wolfe WG. Aneurysm of aberrant subclavian artery with a review of the literature. J Vasc Surg. 1985;2(4):571-7. [PubMed ID: 3892054]. https://doi.org/10.1067/mva.1985.avs0020571.
- Kedora J, Grimsley B, Pearl G. Endovascular treatment of an aberrant right subclavian artery aneurysm with use of the Zenith iliac plug. *Proc (Bayl Univ Med Cent)*. 2009;**22**(2):144–5. [PubMed ID:19381317]. [PubMed Central ID: PMC2666862]. https://doi.org/10.1080/08998280. 2009.11928496.
- Corral JS, Zuniga CG, Sanchez JB, Guaita JO, Basail AM, Gimeno CC. Treatment of aberrant right subclavian artery aneurysm with endovascular exclusion and adjunctive surgical bypass. *J Vasc Interv Radiol.* 2003;14(6):789–92. [PubMed ID: 12817048]. https://doi.org/10. 1097/01.rvi.0000079990.80153.fe.
- Natsis K, Didagelos M, Gkiouliava A, Lazaridis N, Vyzas V, Piagkou M. The aberrant right subclavian artery: Cadaveric study and literature review. Surg Radiol Anat. 2017;39(5):559–65. [PubMed ID: 27999944]. https://doi.org/10.1007/s00276-016-1796-5.
- Chaoui R, Heling KS, Sarioglu N, Schwabe M, Dankof A, Bollmann R. Aberrant right subclavian artery as a new cardiac sign in second-

and third-trimester fetuses with Down syndrome. *Am J Obstet Gynecol*. 2005;**192**(1):257-63. [PubMed ID: 15672034]. https://doi.org/10. 1016/j.ajog.2004.06.080.

- Kommerell B. Verlagerung des oesophagus durch eine abnorm veranfende arteria subclavia dextra (arteria lusoria). Fortschr Geb Roentgenstr. 1936;54:590–5.
- Delap TG, Jones SE, Johnson DR. Aneurysm of an aberrant right subclavian artery presenting as dysphagia lusoria. Ann Otol Rhinol Laryngol. 2000;109(2):231-4. [PubMed ID: 10685579]. https://doi.org/ 10.1177/000348940010900221.
- McCallen AM, Schaff B. Aneurysm of an anomalous right subclavian artery. Radiology. 1956;66(4):561–3. [PubMed ID: 13323296]. https://doi. org/10.1148/66.4.561.
- Felson B. Ruptured anomalous right subclavian artery: Aneurysm or diverticulum? Semin Roentgenol. 1989;24(2):121–6. [PubMed ID: 2499050]. https://doi.org/10.1016/0037-198x(89)90033-3.
- Ota T, Okada K, Takanashi S, Yamamoto S, Okita Y. Surgical treatment for Kommerell's diverticulum. J Thorac Cardiovasc Surg. 2006;131(3):574–8. [PubMed ID: 16515907]. https://doi.org/10.1016/j. jtcvs.2005.10.012.
- Kouchoukos NT, Masetti P. Aberrant subclavian artery and Kommerell aneurysm: Surgical treatment with a standard approach. *J Thorac Cardiovasc Surg.* 2007;**133**(4):888–92. [PubMed ID: 17382621]. https://doi.org/10.1016/j.jtcvs.2006.12.005.
- Kamiya H, Knobloch K, Lotz J, Bog A, Lichtenberg A, Hagl C, et al. Surgical treatment of aberrant right subclavian artery (arteria lusoria) aneurysm using three different methods.

Ann Thorac Surg. 2006;**82**(1):187-90. [PubMed ID: 16798212]. https://doi.org/10.1016/j.athoracsur.2006.02.080.

- Kieffer E, Bahnini A, Koskas F. Aberrant subclavian artery: Surgical treatment in thirty-three adult patients. *J Vasc Surg.* 1994;**19**(1):100–9. discussion 110-1. [PubMed ID: 8301723]. https://doi.org/10.1016/s0741-5214(94)70125-3.
- Kopp R, Wizgall I, Kreuzer E, Meimarakis G, Weidenhagen R, Kuhnl A, et al. Surgical and endovascular treatment of symptomatic aberrant right subclavian artery (arteria lusoria). *Vascular*. 2007;**15**(2):84–91. [PubMed ID: 17481369]. https://doi.org/10.2310/6670.2007.00018.
- Esposito RA, Khalil I, Galloway AC, Spencer FC. Surgical treatment for aneurysm of aberrant subclavian artery based on a case report and a review of the literature. *J Thorac Cardiovasc Surg.* 1988;**95**(5):888–91. [PubMed ID: 3283462].
- Yang C, Shu C, Li M, Li Q, Kopp R. Aberrant subclavian artery pathologies and Kommerell's diverticulum: A review and analysis of published endovascular/hybrid treatment options. *J Endovasc Ther.* 2012;19(3):373–82. [PubMed ID: 22788890]. https://doi.org/10.1583/11-3673MR.1.
- Davidian M, Kee ST, Kato N, Semba CP, Razavi MK, Mitchell RS, et al. Aneurysm of an aberrant right subclavian artery: Treatment with PTFE covered stentgraft. J Vasc Surg. 1998;28(2):335-9. [PubMed ID: 9719329]. https://doi.org/10.1016/s0741-5214(98)70169-7.
- Gafoor S, Stelter W, Bertog S, Sievert H. Fully percutaneous treatment of an aberrant right subclavian artery and thoracic aortic aneurysm. *Vasc Med.* 2013;18(3):139–44. [PubMed ID: 23720037]. https://doi.org/10. 1177/1358863X13485985.