

ONLINE FIRST

This is a provisional PDF only. Copyedited and fully formatted version will be made available soon.



**ISSN:** 0015-5659

**e-ISSN:** 1644-3284

## **Aberrant right subclavian artery in a cadaver: a case report of an aortic arch anomaly**

**Authors:** M. A. Alghamdi, L. N. AL-Eitan, B. Elsy, A. M. Abdalla, H. Mutwakil Mohammed, A. G. E. Salih, S. Al Ghamdi

**DOI:** 10.5603/FM.a2020.0081

**Article type:** CASE REPORTS

**Submitted:** 2020-04-18

**Accepted:** 2020-07-25

**Published online:** 2020-07-29

This article has been peer reviewed and published immediately upon acceptance. It is an open access article, which means that it can be downloaded, printed, and distributed freely, provided the work is properly cited.

Articles in "Folia Morphologica" are listed in PubMed.

## **Aberrant right subclavian artery in a cadaver: a case report of an aortic arch anomaly**

Aberrant right subclavian artery: an important congenital anomaly of the aortic arch

**M.A. Alghamdi<sup>1,2</sup>, L.N. AL-Eitan<sup>3,4</sup>, B. Elsy<sup>1</sup>, A.M. Abdalla<sup>1</sup>, H. Mutwakil Mohammed<sup>1</sup>, A.G.E. Salih<sup>1</sup>, S. Al Ghamdi<sup>5</sup>**

<sup>1</sup>Department of Anatomy, College of Medicine, King Khalid University, Abha, Saudi Arabia

<sup>2</sup>Genomics and Personalized Medicine Unit, College of Medicine, King Khalid University, Abha, Saudi Arabia

<sup>3</sup>Department of Applied Biological Sciences, Jordan University of Science and Technology, Irbid, Jordan

<sup>4</sup>Department of Biotechnology and Genetic Engineering, Jordan University of Science and Technology, Irbid, Jordan

<sup>5</sup>Department of Surgery, College of Medicine, King Khalid University, Abha, Saudi Arabia

Address for correspondence: Dr. M.A. Alghamdi, King Khalid University PO Box 641, Abha, Asir Region, Postcode: 61421, Saudi Arabia, tel: 966 17 241 7866, Mobile: 966 505236044, e-mail: m.alghamdi@kku.edu.sa

*This work was conducted at the Anatomy Department of King Khalid University (KKU), Abha, Saudi Arabia.*

### **ABSTRACT**

In early embryogenesis, aortic anomalies occur as a consequence of disorders in the development of the primitive aortic arches system. Aberrant right subclavian artery (ARSA), also known as arteria lusoria, is one of the important congenital anomalies of the aortic arch, in which the right subclavian artery arises from the arch of aorta instead of the brachiocephalic trunk. During routine dissection of a female cadaver, we observed retroesophageal aberrant right subclavian artery arising as the fourth branch

from the aortic arch. In this case, the brachiocephalic trunk was absent. Early detection of aortic arch anomalies through diagnostic interventions is helpful to avoid complications during surgical procedures.

**Key words: anatomical variant, aortic arch, arteria lusoria, retroesophageal**

## **INTRODUCTION**

Anatomical variations in the human body do exist externally and internally where the latter may be presenting some pathological consequences or a life-threatening factor during surgical procedures. Aberrant right subclavian artery (ARSA) is the commonest congenital aortic arch anomaly with an incidence of 0.5% to 1.8% [1]. ARSA, or arteria lusoria, is a rare anatomical variation in the general population and has a female predominance [2,3]. Right subclavian artery (RSA) normally originates from the brachiocephalic trunk, but when this anomaly is present, the brachiocephalic trunk is absent. Therefore, four large arteries (i.e. right common carotid artery, left common carotid artery, left subclavian artery and right subclavian artery) arises from the aortic arch, in which the right subclavian artery has an aberrant origin arises from the most distal left side [2,4]. This anomaly is frequently asymptomatic, however; in some cases, it may be associated with clinical symptoms such as compression, dysphagia (dysphagia lusoria), cough, and chest pain [1,4-6]. According to Vučurević et al [7] aortic arch branching classification, type 4 pattern was found in this case report. Here, we report a case of a female cadaver with an aberrant right subclavian artery and reviewed the aortic arch branching variations, its embryological development and clinical significances.

## **CASE REPORT**

During a routine dissection at the Anatomy Department of King Khalid University (KKU), a female cadaver of unknown age was presented with a retroesophageal aberrant right subclavian artery. The branches were carefully dissected to identify their courses and photographed.

We measured the diameters of the arch of aorta and its branches with a caliper. The diameter of the aortic arch was measured prior to the origin of the right common carotid artery. The descending aorta diameter was performed after 1 cm from the origin of the branching of aberrant right subclavian artery. The diameters of the right common carotid, left common carotid, and left subclavian and aberrant right subclavian were measured after 1 cm of their origins (Table 1).

In the present case, we observed absences of brachiocephalic trunk and presences of four branches namely, right common carotid, left common carotid, left subclavian and aberrant right subclavian arteries from right to left side of the aortic arch (Figure 1).

## **DISCUSSION**

Normally during embryological development, the distal right dorsal aorta degenerates in the double aortic arches system. Right subclavian artery develops from the right 4<sup>th</sup> aortic arch and 7<sup>th</sup> cervical intersegmental artery. In the case of aberrant right subclavian artery, the right 4<sup>th</sup> aortic arch, 7<sup>th</sup> intersegmental artery, proximal and persistent distal right dorsal aorta involve in the formation of this cardiac malformation [1,5,8]. When aberrant, the right subclavian artery arises from the aortic arch distal to the left subclavian artery and crosses the midline causing compression [1,9].

Despite that the aberrant right subclavian artery is a common aortic developmental anomaly; it is relatively a rare aberration in the general population with a female predominance [10]. The occurrence was more common in female (55.3%) than male cases (44.7%) [2], which is consistent with other reported studies [11,3]. The current case, aberrant right subclavian artery arises from the left side of the aortic arch as the last branch and passes behind the oesophagus.

This anomaly is mostly having a retroesophageal course (dorsal to the oesophagus) in the reported cases (80%), passes between the trachea and the oesophagus (15%), or anterior to the trachea in 5% of the cases [9,12]. Although most of the patients (60-70%) were asymptomatic throughout their lives [6,13], they frequently diagnosed by incidental evaluations obtained for other reasons (i.e. imaging and aortic dissection) [6,14,15]. If symptomatic, in the adult usually produces dysphagia (dysphagia lusoria),

cough, chest pain, shortness of breath and weight loss due to the compressive effect of the nearby structures [2,9]. An aneurysmal aortic dilatation, Kommerell's diverticulum occurs at the origin of the aberrant right subclavian artery [8, 16]. Increased frequency of pulmonary infections is common in infants than the adult; this is due to the absence of tracheal stiffness, in combination with dysphagia and aspiration of food particles [17].

In our case the aberrant right subclavian artery was 16mm in diameter; same finding had been reported in another study [18]. Caliber of the aortic arch branches depends on the position of their origin. There is an association between the origin of the branches and the diameter of the aortic arch [19].

In right transradial approach for coronary angiography and angioplasty procedures, the presences of the aberrant right subclavian artery increase the number of catheters and prolong angiography time. Before proceeding the techniques, the operator requires a sound knowledge of the anatomical variations thereby decrease the complication rate. [20,21].

Many studies [22-24] reported the correlation between fetal aberrant right subclavian artery, intracardiac malformations and chromosomal abnormalities such as trisomy 21, 22q11 deletion of the long arm of the chromosome and turner syndrome. Prenatal diagnosis of the aberrant right subclavian artery is a useful marker for the ultrasonographic detection of fetal chromosomal abnormalities. In such cases, prenatal cytogenetic analysis is strongly recommended.

Treatment options such as conservative measures and surgical intervention mainly depend on the severity of the patient's symptoms and the presence of aneurysms [25]. Conservative measures are non-invasive treatments including dietary and lifestyle modifications often used for patients with mild to moderate symptoms [9,25]. This includes reducing or avoiding exacerbating foods, eating small bites of the food at a slower rate with adequate chewing, and having more liquids [25].

Several non-invasive angiography methods such as multislice and multidetector computed tomography, Doppler sonography, transthoracic echocardiography and the magnetic resonance imaging are essential for preoperative diagnosis of the aberrant right subclavian artery. These methods help to avoid unintentional injury of this artery during surgical procedures. [26-28]. Patients with severe symptoms, consideration for

surgery should be taken as a variety of safe and effective surgical approaches have been proposed [2, 25].

## CONCLUSIONS

Conclusively, anatomical variations are frequent, and the aberrant right subclavian artery is a well-known anomalous with or without pathological consequences. Prenatal diagnosis of the aberrant right subclavian artery through non-invasive angiography methods help to detect the fetal chromosomal abnormalities. Sound knowledge of the course and relations of the aberrant right subclavian artery is helpful to reduce the risk and complications in surgical procedures.

**Funding resource:** The authors would like to extend their appreciation to the Deanship of Scientific Research at King Khalid University for funding this project through general research program under grant number (G.R.P. 220/41).

**Acknowledgments:** The authors would like to express their gratitude to King Khalid University, Saudi Arabia, for providing administrative and technical support.

## References

1. Saraceni C, Kwan W, Joshi T, et al. Aberrant Right Subclavian Artery: A Rare Cause of Dysphagia. *Am J Gastroenterol.* 2018; 113: S982-S983. URL: [https://journals.lww.com/ajg/Fulltext/2018/10001/Aberrant\\_Right\\_Subclavian\\_Artery\\_A\\_Rare\\_Cause\\_of.1720.aspx](https://journals.lww.com/ajg/Fulltext/2018/10001/Aberrant_Right_Subclavian_Artery_A_Rare_Cause_of.1720.aspx).
2. Polgaj M, Chrzanowski Ł, Kasprzak JD, et al. 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; 1-6. URL: <https://www.hindawi.com/journals/tswj/2014/292734/>.
3. Jain KK, Braze AJ, Shapiro MA, et al. Aberrant right subclavian artery-esophageal fistula and severe gastrointestinal bleeding after surgical correction of scimitar syndrome. *Tex Heart Inst J.* 2012; 39(4): 571-574. URL: <https://www.ncbi.nlm.nih.gov/pubmed/22949782>.
4. Mahmodlou R, Sepehrvand N, Hatami S. Aberrant Right Subclavian Artery: A Life-threatening Anomaly that should be considered during Esophagectomy. *J Surg Tech Case Rep.* 2014; 6(2): 61-63. URL: <https://www.ncbi.nlm.nih.gov/pubmed/25598945>.
5. Aslan S, Elmalı M. An unusual Cause of Late-Onset Dysphagia: Aberrant Right Subclavian Artery. *South Clin Ist Euras.* 2019; 30(3): 277-279. URL: [https://www.journalagent.com/scie/pdfs/SCIE-44127-CASE\\_REPORT-ASLAN.pdf](https://www.journalagent.com/scie/pdfs/SCIE-44127-CASE_REPORT-ASLAN.pdf).

6. Rosa P, Gillespie DL, Goff JM, et al. Aberrant right subclavian artery syndrome: a case of chronic cough. *J Vasc Surg.* 2003; 37(6): 1318-1321. URL: [https://doi.org/10.1016/S0741-5214\(02\)75464-5](https://doi.org/10.1016/S0741-5214(02)75464-5).
7. Vučurević G, Marinković S, Puškaš L, et al. Anatomy and Radiology of the Variations of Aortic Arch Branches in 1,266 Patients. *Folia Morphol (Warsz).* 2013;72(2):113-22. URL: <https://doi:10.5603/fm.2013.0019>.
8. van Son JA, Konstantinov IE, Burckhard F, Kommerell and Kommerell's diverticulum. *Tex Heart Inst J.* 2002; 29(2): 109-112. URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC116736>.
9. Naqvi SEH, Beg MH, Thingam SKS, et al. Aberrant right subclavian artery presenting as tracheoesophageal fistula in a 50-year-old lady: Case report of a rare presentation of a common arch anomaly. *Ann Pediatr Cardiol.* 2017; 10(2): 190-193. URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5431032>.
10. Natsis K, Didagelos M, Gkiouliava A, et al. The aberrant right subclavian artery: cadaveric study and literature review. *Surg Radiol Anat.* 2017; 39(5): 559-565. URL: <https://www.ncbi.nlm.nih.gov/pubmed/27999944>.
11. Molz G, Burri B. Aberrant subclavian artery (arteria lusoria): sex differences in the prevalence of various forms of the malformation. *Virchows Archiv A.* 1978; 380(4): 303-315. URL: <https://link.springer.com/article/10.1007/BF00431315>.
12. Domínguez EF, Corredera BM. Anomalies associated with aberrant right subclavian arteries. A case report. *Eur J Anat.* 2009; 13(1): 43-46. URL: <https://eurjanat.com/web/paper.php?id=09010043>.
13. Janssen M, Baggen MG, Veen HF, et al. Dysphagia lusoria: clinical aspects, manometric findings, diagnosis, and therapy. *Am J Gastroenterol.* 2000; 95(6): 1411-1416. URL: <https://www.ncbi.nlm.nih.gov/pubmed/10894572>.
14. Battaloglu B, Secici S, Colak C, et al. Aberrant right subclavian artery and axillary artery cannulation in type A aortic dissection repair. *Ann Thorac Surg.* 2013; 96(1): e1-2. URL: <https://www.ncbi.nlm.nih.gov/pubmed/23816108>.
15. Fernando RJ, Altman JM, Farmer B, et al. Aberrant Right Subclavian Artery An Important Variant of the Aortic Arch. *Anesthesiology.* 2019; 130(4): 615-616. URL: <https://anesthesiology.pubs.asahq.org/article.aspx?articleid=2723776>
16. Cinà CS, Althani H, Pasenau J, et al. Kommerell's diverticulum and right-sided aortic arch: a cohort study and review of the literature. *J Vasc Surg.* 2004 ;39: 131-9. URL:<https://doi.org/10.1016/j.jvs.2003.07.021>.
17. Atay Y, Engin C, Posacioglu H, et al. Surgical Approaches to the Aberrant Right Subclavian Artery. *Texas Heart Institute Journal.* 2006; 33( 4), 477-481. URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1764953>.
18. Natsis K, Didagelos M, Manoli SM, et al. A bicarotid trunk in association with an aberrant right subclavian artery. Report of two cases, clinical impact, and review of the literature. *Folia Morphol (Warsz).* 2011;70( 2): 68-73. URL: <https://www.ncbi.nlm.nih.gov/PMID21630225>.
19. Manole AM, Iliescu DM, Rusali A, et al. Morphometry of the aortic arch and its Branches *ARS Medica Tomitana.* 2013; 3(74): 154-159. URL: [https:// DOI: 10.2478/arism-2013-0027](https://DOI:10.2478/arism-2013-0027).

20. Allen D, Bews H, Vo M. et al. Arteria Lusoria: An Anomalous Finding during Right Transradial Coronary Intervention. *Case Reports in Cardiology*. 2016;1-3. URL: <https://dx.doi.org/10.1155/2016/8079856>.
21. Abhaichand RK, Louvard Y, Gobeil JF, et al. The problem of arteria lusoria in right transradial coronary angiography and angioplasty. *Catheterization and Cardiovascular Interventions*. 2001; 54, (2): 196-201. URL: <https://doi:10.1002/ccd.1266>.
22. Borenstein M, Minekawa R, Zidere V, et al. Aberrant Right Subclavian Artery at 16 to 23 + 6 Weeks of Gestation: A Marker for Chromosomal Abnormality. *Ultrasound Obstet Gynecol*. 2010;36(5):548-52. URL: <https://doi:10.1002/uog.7683>.
23. Chaoui R, Thiel G, Heling KS. Prevalence of an aberrant right subclavian artery (ARSA) in fetuses with chromosomal aberrations. *Ultrasound Obstet Gynecol*. 2006;28:414-415. URL: <https://doi.org/10.1002/uog.3047>.
24. Lee SH, Jung JM, Song MS, Choi Sj, et al. Evaluation of cardiovascular anomalies in patients with asymptomatic turner syndrome using multidetector computed tomography. *J Korean Med Sci*. 2013;28(8):1169-73. URL: <https://doi:10.3346/jkms.2013.28.8.1169>.
25. Nik Qisti F, Shahrin Niza AS, Razrim R. Dysphagia Lusoria: A Case Report. *Dysphagia*. 16;15(2):7376. URL: [https://iiuimedic.net/imjm/v1/download/Volume % 2015% 20No% 202/IMJM-Vol-15-No-2-Pg-073-076.pdf](https://iiuimedic.net/imjm/v1/download/Volume%2015%20No%202/IMJM-Vol-15-No-2-Pg-073-076.pdf).
26. Yang M, Mo X, Jin J, et al. Diagnostic value of 64 multislice CT in typing of congenital aortic anomaly in neonates and infants. *Zhonghua Yi Xue Za Zhi*. 2010; 90,(31): 2167-2171. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC21029654>.
27. Chen X, Qu YJ, Peng ZY, et al. Diagnosis of congenital aortic arch anomalies in Chinese children by multi-detector computed tomography angiography. *J Huazhong Univ Sci Technolog Med Sci*. 2013; 33(3): 447-451. URL: <https://doi:10.1007/s11596-013-1140-9/PMC23771676>.
28. Hart PA, Kamath PS. Dysphagia lusoria. *Mayo Clin Proc*. 2012; 87(3): e17. URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3497995>.

**Table 1.** Diameter measurements of the Aortic arch and its branches in millimeters

AA	DA	LCCA	RCCA	LSA	ARSA
28	22	8	8	9	16

AA: Aortic Arch; DA: Descending Aorta; LCCA: Left Common Carotid Artery; RCCA: Right Common Carotid Artery; LSA: Left Subclavian Artery; ARSA: Aberrant Right Subclavian Artery

**Figure 1.** Right common carotid artery (A), aortic arch (B), retroesophageal aberrant right subclavian artery (C), left common carotid artery (D) and left subclavian artery (E).



