

Arteria lusoria in patients with a normal and a right-sided aortic arch diagnosed with multi-slice computed tomography: a report of two cases

E. Czekajska-Chehab¹, S. Uhlig¹, G. Staśkiewicz^{1, 2}, E. Mazur-Stążka³,
A. Torres², K. Gawęda⁴, A. Drop¹

¹1st Department of Radiology, Medical University, Lublin, Poland

²Department of Human Anatomy, Medical University, Lublin, Poland

³Department of Cardiology, Medical University, Lublin, Poland

⁴Department of Orthopaedics, Medical University, Lublin, Poland

[Received 8 September 2006; Revised 4 January 2007; Accepted 4 January 2007]

A retro-oesophageal course of the right subclavian artery is referred to as "arteria lusoria". It may be related to severe compression of the trachea and oesophagus, typically resulting in impaired swallowing. The paper presents two patients with arteria lusoria, which in one patient was an aberrant right subclavian artery and in the other an aberrant left subclavian artery, originating from the right-sided aortic arch. In both cases the diagnosis was made with multi-slice computed tomography. The embryology of the anomalies and clinical status of the patients is discussed. Arteria lusoria should be considered in differential diagnosis in patients with dyspnoea and dysphagia. Multi-slice computed tomography allows this anatomical variant to be reliably visualised.

Key words: subclavian artery, vascular anomalies, diagnostic imaging, cross-sectional anatomy

INTRODUCTION

An aberrant course of the right subclavian artery is referred to as "arteria lusoria", a term coined in 1794 by Bayford, who reported an adult patient who eventually died from malnutrition resulting from oesophageal compression by an aberrant retro-oesophageal right subclavian artery [2]. This is one of the causes of vascular ring formation, defined as an abnormal configuration of branches of the aortic arch encircling the mediastinal portions of the trachea and oesophagus. Vascular rings account for approximately 1% of congenital vascular anomalies [12]. The severity of symptoms related to this anomaly depends on the extent of the oesophageal and tracheal

entrapment, which may cause their partial obstruction. Possible symptoms include dyspnoea, recurrent pneumonia, bronchitis, stridor and dysphagia [18]. Aberrant right subclavian artery (RSCA) is the most common condition to result in formation of a vascular ring, with an incidence of 0.5–2% [4, 8].

A right-sided aortic arch (RAA) occurs in about 1/1000 of the adult population, carrying a high likelihood of vascular ring formation. After the double aortic arch, which is highly symptomatic, it is the second most common form of the symptomatic vascular ring requiring surgery [9]. In an RAA arteria lusoria is an aberrant left subclavian artery (LSCA), which may take a retro-oesophageal course.

Address for correspondence: E. Czekajska-Chehab, 1st Department of Radiology, Medical University of Lublin, Jaczewskiego 8, 20-090 Lublin, Poland, e-mail: czekajska@gazeta.pl

Diagnosis of these vascular anomalies is commonly made using angiographic examination [5], magnetic resonance [10] or computed tomography imaging [11]. The increased spatial and temporary resolution of multi-slice computed tomography (MSCT) allows detailed visualisation of even small vascular structures to be performed with great accuracy.

CASE 1

L.J., a 49 year-old female, who had been admitted to our institution because of unexplained chest pain and slight dysphagia, underwent an angiographic MSCT chest examination with a 64-row Light Speed VCT scanner (GE Medical Systems, Milwaukee, WI). The scanning range covered the thoracic cavity from the pulmonary apices to the diaphragmatic domes. The following parameters were used: collimation of 1.2 mm and a rotation time of 0.8 s, 120 kV, 350 mA. The examination was performed after administering an intravenous bolus of 120 ml of non-ionic contrast medium with an automatic syringe at a speed of 4 ml/s. The scanning delay was determined by the SmartPrep technique. Multi-planar and three-dimensional reconstructions were obtained using dedicated Advantage 4.2 workstations. The examination revealed an aberrant RSCA, with Kommerell's diverticulum deviating from the distal section of the aortic arch and a common origin of both common carotid arteries from the ascending aorta. The RSCA passing behind the mediastinal structures caused visible compression of the oesophagus (Figs. 1–3).

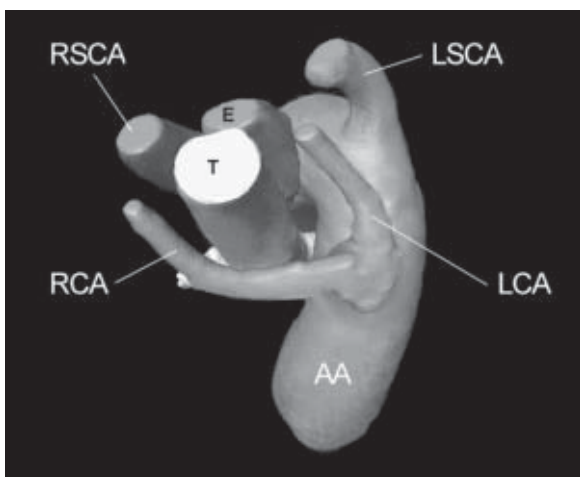


Figure 1. Case 1. Anterosuperior view of mediastinal structures — drawing based on three-dimensional reformations. Common origin of carotid arteries (RCA — right, LCA — left) from the ascending aorta (AA). The trachea (T) and oesophagus (E) are encircled by the right subclavian artery (RSCA). The left subclavian artery (LSCA) originates from the aortic arch.

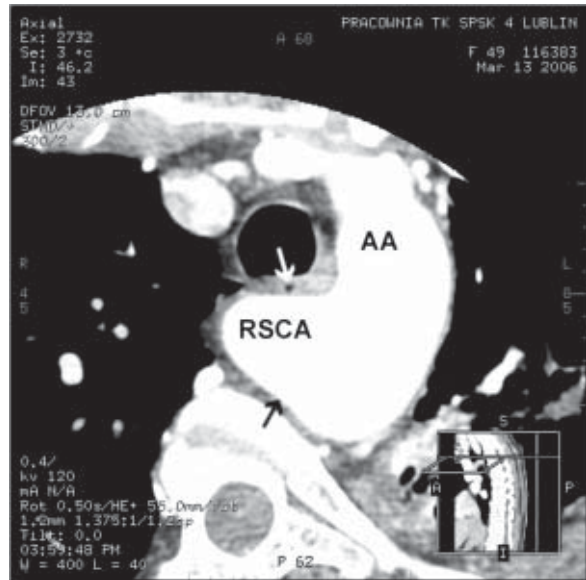


Figure 2. Case 1. Axial CT scan after intravenous administration of contrast medium. Significant widening (black arrow) of aorta in the origin of the right subclavian artery (RSCA) identified as Kommerell's diverticulum. White arrow — compression of the oesophagus, AA — ascending aorta.

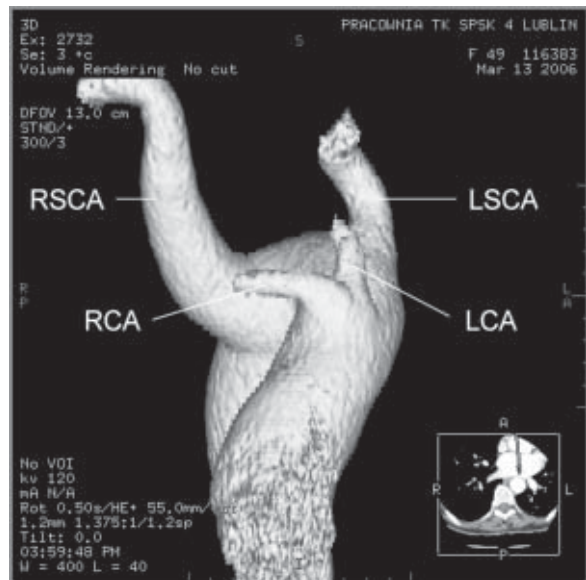


Figure 3. Case 1. Volume rendering anterior view of arterial branches. RSCA — right subclavian artery, LSCA — left subclavian artery, RCA — right common carotid artery, LCA — left common carotid artery.

CASE 2

P.A., a 30 year-old female, underwent an MSCT examination of the chest. On admission her main complaints were difficulty in breathing and swallowing. A computer tomography examination of the chest was performed with the same protocol as in Case 1. The major finding in the patient was a right-sided

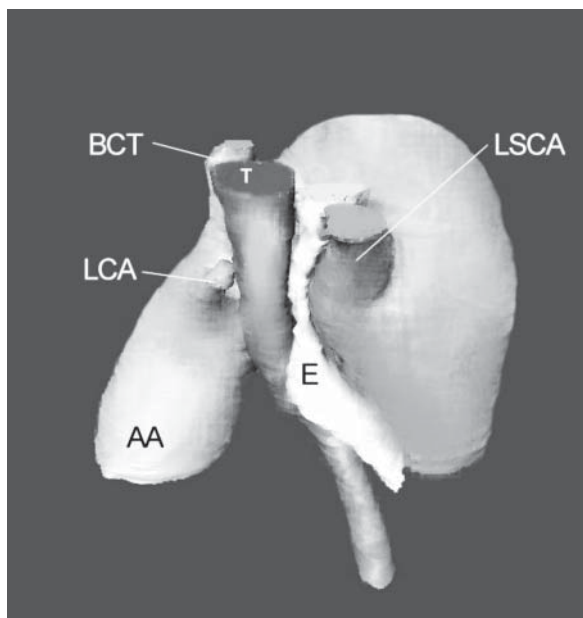


Figure 4. Case 2. Left lateral view of mediastinal structures — drawing based on three-dimensional reformations. Obvious compression of the oesophagus (E) and trachea (T) by Kommerell's diverticulum in the origin of the left subclavian artery (LSCA). AA — ascending aorta, LCA — left carotid artery, BCT — brachiocephalic trunk.

aorta, with the left subclavian artery (LSCA) originating as its last branch and following a retro-oesophageal course. The proximal LSCA was significantly widened, with signs of Kommerell's diverticulum. Significant compression of both the trachea and oesophagus was observed (Figs. 4–6).

DISCUSSION

An aberrant RSCA, *arteria lusoria*, is one of the most common variants of the aortic arch, reported to occur in up to 1.8% of the population [14]. The defect may be associated with other vascular anomalies, including Kommerell's diverticulum, which typically coexists with *arteria lusoria* [17]. Klinkhamer analysed examinations of 295 patients with aberrant RSCA and found this defect to coexist with a common origin of the carotid arteries (COCA) in 29% of cases [6]. Multiple anatomical variants of the origins of the vertebral arteries are also possible [15]. COCA, however, is described as a predisposing factor for dysphagia in patients with aberrant RSCA, as in Case 1, as it forms an incomplete vascular ring around the trachea and oesophagus.

The aberrant RSCA is an effect of abnormal embryogenesis of the aortic arch, defined as an involution of the right fourth vascular arch and the proximal right dorsal aorta, which, as a result, leaves the

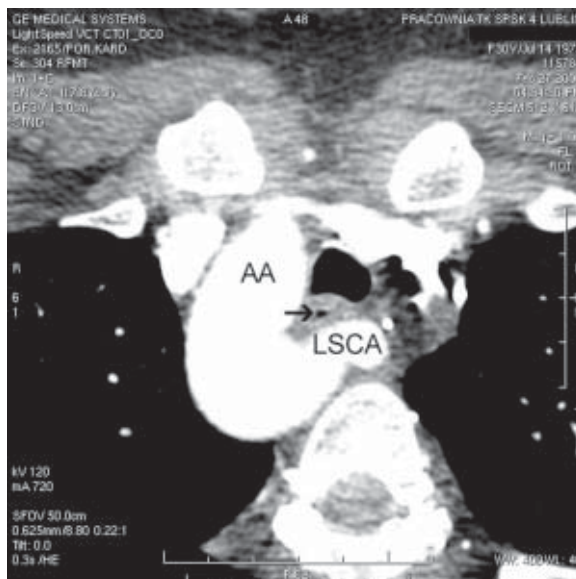


Figure 5. Case 2. Axial CT scan after intravenous administration of contrast medium. Black arrow indicates the lumen of the oesophagus. AA — ascending aorta, LSCA — left subclavian artery.

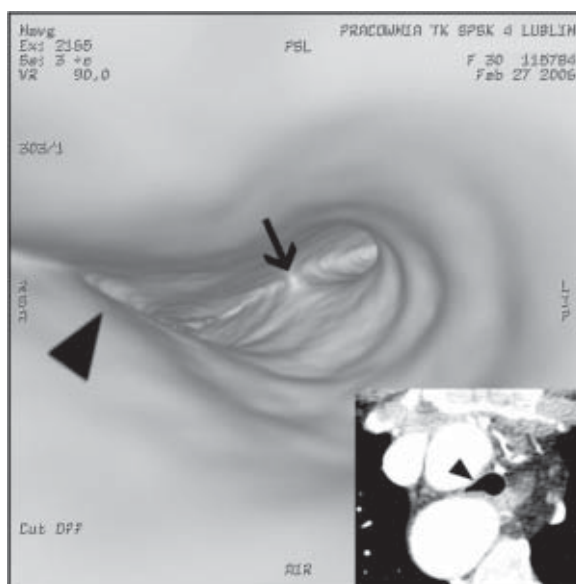


Figure 6. Case 2. Virtual bronchoscopy visualisation of patient's trachea — superior view. Insert reveals corresponding axial CT scan. Arrow shows the tracheal carina and arrowheads indicate significant compression of tracheal wall.

right seventh intersegmental artery (RSCA) originating from the left dorsal aorta [11, 13]. COCA results from a persistence of the foetal common carotid trunk [13].

In the majority of cases an aberrant RSCA remains asymptomatic, while about 10% of adult patients

develop symptoms such as dysphagia [3, 10] or dyspnoea [16]. In some cases arteria lusoria may be implicated in serious clinical consequences such as rupture of its proximal aneurysmatic part or distal embolisation [4].

An aberrant LSCA in patients with a right-sided aortic arch occurs in about 1/1000 of the general population [9]. However, until 2004 only 32 cases had been published of symptomatic aberrant LSCA in the adult population [9]. Embryologically this results from an involution of the fourth vascular ring, along with the right dorsal aorta, leaving the seventh intersegmental artery attached to the descending part of the aorta. This follows a retro-oesophageal localisation in its course into the arm [1]. The most common symptoms in patients with arteria lusoria originating from a RAA are dysphagia, dyspnoea and other respiratory disorders [7].

The development of MRI and MSCT and their increasing availability has led to a simplification in the diagnosis of arteria lusoria and concomitant pathologies. The application of three-dimensional and multi-planar reconstructions enables the anatomical relations of the mediastinum and compression of the trachea or oesophagus to be properly visualised and a contingent surgical procedure to be planned.

REFERENCES

- Adkins RB, Maples MD, Graham BS, Witt TT, Davies J (1986) Dysphagia associated with aortic arch anomaly in adults. *Am Surg*, 52: 238–245.
- Bayford D (1794) An account of a singular case of obstructed deglutition. *Memoirs Med Soc London*, 2: 275–286.
- Delap TG, Jones SE, Johnson DR (2000) Aneurysm of an aberrant right subclavian artery presenting as dysphagia lusoria. *Ann Otol Rhinol Laryngol*, 109: 231–234.
- Epstein DA, Debord JR (2002) Abnormalities associated with aberrant right subclavian arteries — a case report. *Vasc Endovascular Surg*, 36: 297–303.
- Fineschi M, Iadanza A, Sinicropi G, Pierli C (2002) Images in cardiology: Angiographic evidence of aberrant right subclavian artery associated with common carotid trunk. *Heart*, 88: 158.
- Klinkhamer AC (1966) Aberrant right subclavian artery. Clinical and roentgenologic aspects. *Am J Roentgenol Radium Ther Nucl Med*, 97: 438–446.
- Koullias GJ, Korkolis DP, Iams WB, Elefteriades JA (2005) Late-onset dysphagia lusoria assessed by 3-dimensional computed tomography of an aortic arch abnormality. *Dis Esophagus*, 18: 60–63.
- Loukas M, Louis RG Jr, Gaspard J, Fudalej M, Tubbs RS, Merbs W (2006) A retrotracheal right subclavian artery in association with a vertebral artery and thyroid gland. *Folia Morphol (Warsz)*, 65: 236–241.
- McNally PR, Rak KM (1992) Dysphagia lusoria caused by persistent right aortic arch with aberrant left subclavian artery and diverticulum of Kommerell. *Dig Dis Sci*, 37: 144–149.
- Ozates M, Nazaroglu H, Uyar A (2000) MR angiography in diagnosis of aberrant right subclavian artery associated with common carotid trunk. *Eur Radiol*, 10: 1503.
- Panebianco V, Anzidei M, Catalano C, Passariello R (2006) Dysphagia lusoria in combination with multiple congenital anomalies of the aortic arch. *Eur J Cardiothorac Surg*, 29: 105.
- Park MK (2002) Vascular rings. In: Park MK (ed.) *Pediatric cardiology for practitioners*. 4th Ed. St. Louis, Mosby.
- Poultides GA, Lolis ED, Vasquez J, Drezner AD, Venieratos D (2004) Common origins of carotid and subclavian arterial systems: report of a rare aortic arch variant. *Ann Vasc Surg*, 18: 597–600.
- Richardson JV, Doty DB, Rossi NP, Ehrenhaft JL (1981) Operation for aortic arch anomalies. *Ann Thorac Surg*, 31: 426–432.
- Saito T, Tamatsukuri Y, Hitosugi T, Miyakawa K, Shimizu T, Oi Y, Yoshimoto M, Yamamoto Y, Spanel-Browski K, Steinke H (2005) Three cases of retroesophageal right subclavian artery. *J Nippon Med Sch*, 72: 375–382.
- Stork T, Gareis R, Krumholz K, Eichstadt H (2001) Aberrant right subclavian artery (arteria lusoria) as a rare cause of dysphagia and dyspnea in a 79-year old woman with right mediastinal and retrotracheal mass, and co-existing coronary artery disease. *Vasa*, 30: 225–228.
- van Son JA, Konstantinov IE, Burckhard F (2002) Kommerell and Kommerell's diverticulum. *Tex Heart Inst J*, 29: 109–112.
- Wychulis AR, Kincaid OW, Weidman WH, Danielson GK (1971) Congenital vascular ring: surgical considerations and results of operation. *Mayo Clin Proc*, 46: 182–188.