We report an asymptomatic 48-year-old woman presenting with a right aortic arch (RAA) with mirror-image branching, combined an aortic diverticulum and engorged azygos vein. Chest X-ray (CXR) showed soft tissue opacity over the right paratracheal region with absence of a left aortic notch. Computer tomography (CT) was performed for further evaluation. Three-dimensional CT angiography reconstruction portrayed the above mentioned findings. When a right aortic arch with mirror-image branching was found, it usually is associated with severe congenital heart disease. Here, we report this case with an atypical clinical presentation and image findings demonstrated by three-dimensional CT angiography.

Right aortic arch (RAA) is not uncommon in complex congenital heart disease, especially the tetralogy of Fallot [1]. However, it occurs only in about 0.1% in adults [2]. RAA can be classified as 3 major types: (1) with an aberrant left subclavian artery; (2) with mirror-image branching of the major arteries; and (3) with the left subclavian artery isolated from the arch. In adults the type-1 was most common; the other two types are very rarely reported, especially in asymptomatic adults [3].

Computer tomography (CT) angiography by 64-detector CT (64-DCT) is a vascular imaging technique made clinically feasible by the combination of high resolution isotropic, fast rotation time, and wide scan coverage to provide a volume image during single breath hold, which allows high-quality postprocessing of three-dimensional (3-D) image [4, 5]. The technique allows rapid acquisition of volumetric CT data during the arterial phase after intravenous bolus administration of contrast materials. Computerized reconstruction of the data generates 2- and 3-D images of vessels and adjacent structures. This technique is nowadays commonly used for evaluation of cardiovascular diseases [4, 5].

We reported the 64-DCT findings of RAA with mirror-image branching in an asymptomatic adult. CT angiography was proved to be useful for the classification of RAA type, depicting associated anomaly which will guide the clinical management.

CASE REPORT

A 48-year-old woman came to our clinical outpatient department for a CXR in health screening and we incidentally found that there was a soft-tissue opacity over the right para-tracheal region and absence of a left aortic knob (Fig. 1). On physical
examination, there was no murmur of heart sound, no hypertension, equal blood pressure on bilateral arms and no cyanosis. This patient had no complaints of dysphagia or other particular symptom in the past medical history.

A CT angiography of the chest was performed post intravenous contrast medium through power injector to check for the possibility of congenital anomalies or tumor growth. It was performed by a 64-DCT with ECG gating due to suspicious vascular lesion (collimator = 0.5 mm, rotation time = 0.40 sec, Aquilion 64, Toshiba). We performed the postprocessing reconstruction on a dedicated 3-D workstation. A RAA was noted. In addition, the first

Figure 1. On the PA view of the chest X-ray (CXR), the right-sided arch indents the right lateral wall of the trachea or pushes the trachea slightly to the left. The upper descending aorta can usually be seen through the mediastinal tissues to the right of the spinal column.

Figure 2. Computer tomography (CT) with three-dimensional reconstruction angiography shows right aortic arch with mirror-image branching.

Figure 3. a. The axial view of the CT scan shows an aortic diverticulum form at the right side descending aorta with mild indentation of the esophagus. b. The left lateral oblique view of the 3-D CT angiography shows a diverticulum off the proximal descending aorta.
branch was the left innominate artery, followed by the right carotid and right subclavian arteries as in normal arrangement. Therefore, a RAA with mirror-image branching (Fig. 2) was considered. An aortic diverticulum (Fig. 3a, 3b) at the distal aortic arch and engorgement of the azygos vein (Fig. 4) were also noted. Since the patient didn’t have any clinical symptoms, no treatment was given.

**DISCUSSION**

According to Edwards’ hypothetical scheme of aortic arch development, the RAA with mirror-image branching results from regression between the descending aorta and left subclavian artery during embryologic development of the aortic segment [6] (Fig. 5).

In the RAA with mirror-image branching, the aortic arch passes over the right main stem bronchus and joins a right-sided proximal descending aorta. The first branch is the left innominate artery, and is followed in turn by the right carotid and the right subclavian arteries. Commonly, this interruption in the left arch is between the ductus arteriosus and the descending aorta, with a left duct arteriosus connecting the subclavian portion of the innominate artery to the left pulmonary artery. Since there is no retroesophageal component, the esophagus is not compressed from behind on an esophagogram. This type of anomaly is usually associated with cyanotic congenital heart disease, especially tetralogy of Fallot and truncus arteriosus [6, 7, 8].

The interruption in the left arch rarely occurs between the left subclavian artery and the left ductus arteriosus [6]. In the case of left arch interruption,

![Figure 5](image)

**Figure 5.** Right aortic arch can be classified as 3 major types: a. with an aberrant left subclavian artery; b. with mirror-image branching of the major arteries; and c. with the left subclavian artery isolated from the arch. A, aorta; LCCA, left common carotid artery; LD, left ductus arteriosus; LSA, left subclavian artery; PT, pulmonary trunk; RCCA, right common carotid artery; RSA, right subclavian artery.
the left ductus arteriosus connects the left pulmonary artery to the upper descending aorta, producing a vascular ring, and a lateral esophagogram would be expected to show a posterior indentation or filling defect of the esophagus. Only a few cases of this arterial anomaly have been reported [3].

An abnormality of the aortic arch and its major branches is often associated with severe congenital heart disease. In most of the patients, the aberrant vessels usually form vascular rings and produce clinical symptoms caused by tracheal or esophageal compression [9, 10]. Here we present an incidentally disclosed asymptomatic adult patient.

The distal portion of the left arch may persist as an enlarged aortic diverticulum, the so-called diverticulum of Kommerell [8]. This diverticulum could extend to the left wall of the esophagus, resulting in an indentation on the esophagus [11]. An aortic diverticulum is commonly found with the RAA having an aberrant left subclavian artery, but is rarely noted in a RAA with mirror-image branching of the great vessels [3].

Dilatation of the azygos vein may occur due to increased right heart pressure or increased collateral venous return [12]. In our case, the compression of left brachiocephalic vein by the sternum and RAA leads to increased collateral venous return to the azygos system. As a result, an engorgement of the azygos notch could be seen on CXR and CT.

The 64-DCT data acquisition provides an isotropic, high resolution volume images during single breath hold [5]. These features enhance the ability of 2 and 3-D image reconstruction, providing angio-gram-like images in multiple projections. The contrast-enhanced 64-DCT scan can easily provide the diagnostic information regarding the arch anomaly and the relationship with other anatomy. The existence of a RAA with mirror-image branching in an asymptomatic adult by 64-DCT was rarely reported. We report this unusual case that can be well demonstrated by 64-DCT reconstruction images.

REFERENCES

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成年人少見無症狀之鏡像分支型右主動脈弓在 64 排電腦斷層影像表現

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我們報告一位以右主動脈弓及鏡像分支，合併表現降主動脈憩室和膨脹的奇靜脈的 48 歲的女性。此病人到目前為止都是沒有臨床症狀，體檢發現胸部 X 光右側靠近氣管區發現增加軟組織密度及左側缺乏主動脈弓。電腦斷層（CT）檢查安排做為更進一步的評估時，發現是很少出現在無症狀的成年人的右主動脈弓及鏡像分支。立體（3-D）電腦斷層血管重組檢查顯示是一右主動脈弓合併降主動脈憩室及膨脹的奇靜脈。右主動脈弓及鏡像分支是稀有但非罕見，但經常與嚴重的先天性心臟病相關。我們以 3-D 電腦斷層血管重組影像報告此名病患非典型的臨床表現和影像。