

Anomalous Subaortic Position of the Brachiocephalic Vein Associated with Tetralogy of Fallot

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The left brachiocephalic vein is found in an anomalous position less frequently than the superior vena cava or azygous channels in thoracic venous systems. We experienced a rare case of anomalous left brachiocephalic vein which was clearly demonstrated by spiral computed tomography (3D-CT). Although the malformation in itself seems to be of no functional importance, we assessed its importance in terms of associated conditions and its relevance to subsequent operations. (Ann Thorac Cardiovasc Surg 2001; 7: 106–8)

Key words: anomalous left brachiocephalic vein, tetralogy of Fallot, spiral computed tomography (3D-CT)

Introduction

Usually the left brachiocephalic (or innominate) vein extends from the junction of the left internal jugular and left subclavian veins to the junction of the right brachiocephalic (or innominate) vein and the superior vena cava (SVC). The normal course is obliquely downwards and to the right, passing in front of the left subclavian, left common carotid, and brachiocephalic arteries, beneath the aortic arch. Rarely, this vein follows an anomalous course, passing from left to right below the arch of the aorta, to enter the SVC below the orifice of the azygos vein.¹⁻⁵⁾ We experienced such a rare case of anomalous left brachiocephalic vein (ALBCV) which was clearly demonstrated by spiral computed tomography (3D-CT). Although the malformation in itself seems to be of no functional importance, we assessed its importance in terms of associated conditions and its relevance to subsequent operations.

Case Report

An eight-month-old male infant with tetralogy of Fallot

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was referred to us for definitive surgical repair. Preoperative angiography and ultrasonography revealed the typical findings of tetralogy of Fallot. The ALBCV was clearly demonstrated by 3D-CT (Fig.). The aortic arch was right sided and its branches were a mirror image of the normal arrangement.

The patient underwent a total correction using conotruncal repair.⁶⁾ Operative findings showed the ALBCV passed behind the ascending aorta and below the aortic arch before entering the lower portion of the SVC between the entry of the azygos vein and the junction with the right atrium. The site of the arterial duct was not apparent. During the operation, while taking care not to injure the ALBCV nor the sinus atrial node, the SVC was encircled just below the ALBCV and the SVC cannulation was performed just above its junction with the right atrium. After the initiation of total bypass using extracorporeal circulation, the infundibular septum was totally resected, the perimembranous outlet ventricular defect was closed using a membranous flap, and the outflow reconstruction of the right ventricle was made by a wide monocusp patch. Weaning from cardiopulmonary bypass and the postoperative course were uneventful.

Discussion

The ALBCV position is less common than anomalous positions of the SVC or azygous channels in thoracic venous systems.¹⁻⁵⁾ Embryologically the brachiocephalic vein and SVC originate from the right and left



Fig. Preoperative spiral computed tomography (3D-CT). Upper: right upper posterior view. Lower: posterior view. The ALBCV (arrow) passed behind the ascending aorta and below the aortic arch (open arrow) before entering the lower portion of the SVC (double arrow). The aortic arch was right sided and its branches were a mirror image of the normal arrangement.

precardinal veins. Each precardinal vein joins its ipsilateral posterior cardinal vein and forms the common cardinal vein that flows into the venous sinus. In the 8th week of fetal development the precardinal anastomosis appears between both precardinal veins, after which the left precardinal vein disappears. This anastomosis develops into the left cephalic vein. If the lower portion of the left anterior cardinal vein atrophies while the usual transverse anastomosis fails to develop, survival will depend on the opening up of an alternative anastomotic pathway within the capillary plexus of that region.¹⁾ The ALBCV is frequently associated with conotruncal anomalies, such as tetralogy of Fallot and ventricular septal defect with pulmonary atresia.^{1,2)} In addition, a right aortic arch is more common in patients presenting a venous anomaly than in those who do not present it.²⁾ The embryological origins of the anomalous vein have been reviewed but the relation between the abnormal position of the brachiocephalic vein, conotruncal cardiac anomalies, and the right aortic arch has yet to be established. The incidence among patients with congenital heart disease is from 0.015% by autopsy to 0.98% by ultrasonography.³⁾ The incidence found in the necropsy series may have been lower because tetralogy of Fallot and ventricular septal defect associated with pulmonary atresia, both conditions in which the venous anomaly is common, do not have a high mortality rate. Therefore, these two cardiac malfor-

mations were probably less common in the necropsy series. Furthermore, this lesion might be missed during routine necropsy examinations.

The ALBCV itself is asymptomatic. Therefore, its radiological evaluation is not significant until a surgical procedure is planned for an associated cardiovascular disease. However, the ALBCV must be distinguished from other major vessels especially in a preoperative examination.^{2,4)} Because the postaoortic left subclavian vein passes adjacent to the pulmonary artery and the ductus arteriosus, the surgical view may be limited during ductus ligation.^{1,4)} Also, attention must be paid in the case of SVC-pulmonary artery shunting operation.¹⁾ Venous injury should be avoided when taping the SVC, because the postaoortic left brachiocephalic vein enters the SVC in a more caudal and deeper fashion than usual.⁴⁾ In another unique case, Baba et al.²⁾ reported a case of superiorinferior ventricles with ALBCV, in which this anomalous vein was used for a right atrial-pulmonary shunting. Thus, demonstrating a postaoortic left brachiocephalic vein may have practical importance when planning an operation.

This case report demonstrates the usefulness of 3D-CT for a noninvasive diagnosis of ALBCV. Smallhorn et al.⁵⁾ described the ultrasonography findings associated with ALBCV and cautioned that the ALBCV might be confused with the central pulmonary arteries in the presence of pul-

monary atresia or a venous confluence in anomalous pulmonary venous connection. 3D-CT clearly demonstrated the relationship of the ALBCV to the other major vessels.

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