

Isolated patent ductus arteriosus with right sided aortic arch: percutaneous closure with amplatzer device

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Abstract

Introduction: The association of a right aortic arch with an isolated patent ductus arteriosus is rare, especially when there are no other intracardiac anomalies. We report a case of successful transcatheter closure of PDA with right aortic arch. Due to anatomical variation PDA was crossed through aortic side and snared from pulmonary side and closed with Amplatzer duct occluder (ADO I). In this patient, full closure was confirmed in the catheterization laboratory and the patient was discharged with no complications. Percutaneous closure of an isolated patent ductus arteriosus associated with a right aortic arch is feasible, safe and effective.

Keywords: ductus arteriosus, percutaneous closure.

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INTRODUCTION

Patent ductus arteriosus is a common condition in pediatric cardiology, accounting for around 7% of all congenital heart diseases in this population¹. The association of a right aortic arch with a patent ductus arteriosus is rare, especially when there are no other intracardiac anomalies. Other anomalies are often found in this condition, such as atrial septal defect, ventricular septal defect, and absent or hypoplastic pulmonary arteries. Due to the rare occurrence of a right aortic arch and the variability in anatomic positioning of the head and neck vessels and the duct, it is important for

interventionalists to consider these factors before beginning any interventional procedure.

CASE REPORT

An 8 year old girl had a cardiac murmur since age of one month. She had been well except frequent episodes of respiratory tract infections. On examinations she was averagely built and nourished. Pulses were bounding. Blood pressure was 100/50 mmHg. The heart was not enlarged. The most striking cardiac findings were a continuous thrill over left upper portion of chest and grade 4/6 harsh machinery like continuous murmur loudest in left second intercostal space. A chest X-ray showed right sided aortic arch, normal size heart and slightly increased pulmonary vasculature. ECG was consistent with left ventricular hypertrophy. A transthoracic echocardiogram revealed a 3mm PDA with left to right shunt with peak gradient of 40mmHg. All chambers size were normal. Ejection fraction was normal. Patient's total blood counts and hemoglobin was normal. Complete blood coagulation profile was normal. Cardiac catheterization to close the defect by percutaneous techniques was planned. Patient was sedated with intravenous sedation midazolam and propofol. Amoxicillin clavulonic acid 25 mg/kg was administered intravenously 30 minutes before the procedure. A

Percutaneous femoral arterial and venous puncture was performed with the 5F femoral sheaths positioned in the arterial and venous pathways. After the arterial puncture, heparin was administered at a dose of 100 U/kg. With a 5F pigtail catheter positioned at the end of the aortic arch, angiography was performed using the left lateral view to determine the anatomy of the ductus arteriosus and to acquire measurements of the pulmonary extremity diameter as well as the aortic ampulla and its length (Fig1). Aortic and pulmonary trunk pressures were normal. The ductal type was determined according to Krichenko’s classifications it was type A². The ductal size was defined as the narrowest diameter of the ductus measured on the left lateral projection, using the catheter size as a reference; it was 7 x 3mm in size. 4 X 6 mm device was selected according to size PDA. After that, we tried to advance a multipurpose catheter from the pulmonary artery through the PDA to the descending aorta (Fig.2). A 0.035 inch guide wire was tried to cross PDA to enter into descending aorta but it was not crossed after several attempts. Then we removed pigtail and advanced JR3.5 catheter from aortic side. A double length 260cm terumo wire was advanced from JR catheter to cross PDA and entered into pulmonary artery (Fig 3). A snare was advanced from venous side to anchor terumo wire. With help of snare terumo wire was anchored in SVC and wire was taken out from venous side and JR catheter passed to distal IVC over terumo wire simultaneously (Fig 4, 5). By exchanging over a 0.035-inch guide wire, a long 180-degree angled delivery sheath was passed from venous side. By rail road technique delivery sheath was advanced to descending aorta and simultaneously JR catheter was removed from aorta (Fig.6). Then the device was advanced inside the long sheath to the descending aorta. After retraction of the long sheath, the retention disc was deployed in the descending aorta. After the device was gently pulled against the orifice, the sheath was further retracted and the conical part was deployed (Fig 7). Good ADO position was confirmed by a repeated aortogram, and then the device was released by counter clockwise rotation of the vise pin in the delivery cable. A repeat angiogram revealed no flow of contrast medium from the aorta into the pulmonary artery (Fig.8).



Figure 1

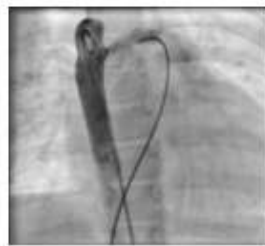


Figure 2

Figure 1: Aortogram in left lateral view shows a 3mm type A1 PDA
 Figure 2: Aortogram shows right sided aorta in anteroposterior view



Figure 3

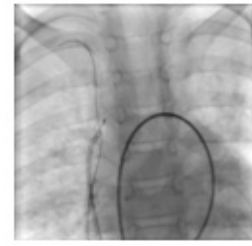


Figure 4

Figure 3: JR catheter with 0.035 inch guide wire

Figure 4: Guide wire was anchored across PDA from aortic side with snare in SVC

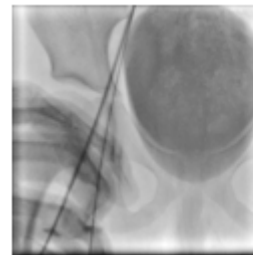


Figure 5



Figure 6

Figure 5: Guide wire was taken out from venous side with snare

Figure 6: Delivery sheath was passed to the descending aorta and JR catheter was removed from aorta simultaneously by rail road technique

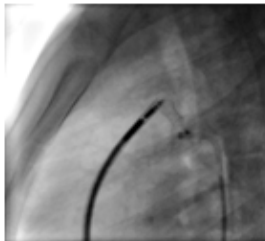


Figure 7

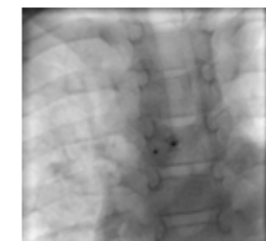


Figure 8

Figure 7: Aortic arch angiogram in left lateral view demonstrating

Figure 8: Final aortogram shows a complete closure of PDA. The position of the aortic disc and pulmonary end of the ADO (4X6 mm).

DISCUSSION

The reported incidence of right-sided aortic arch ranges from 0.04% to 0.14%³. This anomaly is determined by persistence of the right dorsal aorta with regression of the left dorsal aorta, and can present in association with patent ductus arteriosus in several variants, some of which can produce vascular rings with esophageal or tracheal compression. Even though the aortic arch is located at the right, the most frequent position of the ductus is at the left, arising from the left subclavian artery and connecting with the pulmonary artery on the same side. This modality is generally associated with

congenital cyanotic cardiac disease, in which ductus patency is favorable for the patient's survival. In children referred to major cardiac centers and in those with congenital heart disease, right aortic arch is more common than it is in the general pediatric population and is associated with tetralogy of Fallot, pulmonary atresia, and truncus arteriosus⁴. Many of these patients undergo surgical intervention and therefore are not routinely referred to the cardiac catheterization laboratory for PDA coil or device occlusion. Consequently, it is less likely that child who has right aortic arch variants will present for PDA transcatheter intervention, as evidenced by the relative paucity of case reports in the literature. We found difficulty in crossing PDA from pulmonary artery to descending aorta. So we crossed guidewire through PDA from aortic side with JR catheter and snared it from venous side. Finally Amplatzer duct occluder (ADO) device is placed antegradally. Among the devices used for percutaneous closure of the ductus arteriosus, the ADO has proven to be very safe and effective, with occlusion rates of 99.7%⁵. Moreover, the fact that the device can be recovered and repositioned makes it particularly useful in unusual anomalies, such as presented. Another percutaneous approach to close PDA with right sided aortic arch is retrograde with ADO II. ADO II has a flexible waist and low-profile discs that adapt to the lumen and orientation of the PDA, thereby avoiding protrusion and obstruction of the aorta or pulmonary artery and reduce the risk of embolization, even with high pulmonary artery pressures. Both feasibility and efficacy (96% to 100%) of the ADO II to occlude PDA with a minimum diameter >2 mm have been established⁶.

CONCLUSION

In summary, a right aortic arch is a rare phenomenon and may be accompanied by common or extremely rare variations in anatomy. In patients with a right arch who are referred to the cardiac catheterization laboratory for PDA occlusion, the anatomy of the arch must be clearly defined. From the results of our case and a review of the literature, it appears as though transcatheter occlusion of PDA variants from right aortic arches is a safe and effective procedure. Although that intervention was successful, the evidence for the safety of this approach is not conclusive.

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