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Overcoming Double Trouble in Single-Sitting: A Case of an 8-Year-Old Boy with Coarctation of Aorta and Patent Ductus Arteriosus

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Abstract

There are very few reports on successful management of young children with coexistence of two congenital heart defects, coarctation of aorta and patent ductus arteriosus. These lesions can be treated either simultaneously or sequentially. Herein, we present the first successful report of simultaneous balloon angioplasty and Amplatzer duct occluder device implantation in a single-sitting in an 8-year-old boy with severe aortic coarctation and patent ductus arteriosus. The coarctation gradient decreased from 70 mmHg to 10 mmHg and a complete closure of the ductus arteriosus was achieved without any complication. Fellow interventional cardiologists may consider single-stage transcatheter treatment in young children with combination of these two lesions.

Keywords

Aortic Coarctation, Balloon Angioplasty, Congenital Heart Disease, Patent Ductus Arteriosus

1. Introduction

Reports of successful management of coexisting coarctation of aorta and patent ductus arteriosus (PDA) in infants and children are very limited [1]-[8]. Management options in such patients are decided after considering patient's age, anatomy of the coarctation, and size and type of the ductus arteriosus [1]. Surgery, balloon angioplasty, or stent implantation is the most widely used strategies for the management of coarctation of aorta. On the other hand, several types of coils and devices are used for PDA closure [2]. There are reports of both the lesions being treated successfully in cardiac catheterization laboratory, either simultaneously [1]-[5] in a single sitting or sequentially [5]-[8] in two different sittings. Here, we present a case of simultaneous management of

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coexisting aortic coarctation and patent ductus arteriosus in a young boy.

2. Case Report

An 8-year-old boy (weight: 15 kg) was admitted to our clinic with persistent complaints of shortness of breath for the past 3 - 4 years. His parents reported that the symptoms were aggravating during cold and cough. Patient's clinical and laboratory examinations were unremarkable. Two-dimensional echocardiography with color-doppler imaging revealed a 3 - 4 mm PDA with a left-to-right shunt. In addition, a severe coarctation of aorta was detected. Subsequently, angiography was performed via the right femoral vein/artery under general anesthesia and heparin (100 IU/kg). The angiogram confirmed the presence of a 4 mm PDA with good ampulla and a left-to-right shunt, and severe coarctation of aorta (**Figure 1**). The pressure gradient was 70 mmHg. After consulting patient's family, single-sitting management with coarctation balloon dilatation and PDA device closure was planned.

For coarctation balloon dilatation, the arch of the aorta was crossed with a 0.035 × 260 cm Terumo wire and 7Fr Jr Guiding catheter from the right femoral artery/vein access. Conventional angioplasty was performed with a 3.5 × 15 mm NC Sapphire balloon at 8 atms and again with an 8 × 16 mm Herculinik Renal balloon at 8 atms (**Figure 2**). The procedure was successful and the peak pressure gradient across the coarctation reduced to 10 mmHg. Subsequently, PDA device closure was performed.

For PDA device closure, the lesion was crossed from pulmonary artery side with a 5F MPA and 0.032 × 260 cm Straight-tip wire. Then, a 08/06 mm Amplatzer duct occluder device (AGA Medical Corporation, USA) was

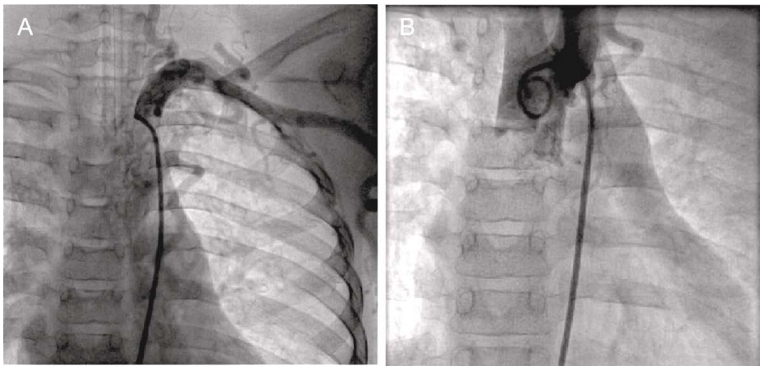

Figure 1. Angiogram revealing (A) severe coarctation of aorta and (B) patent ductus arteriosus.

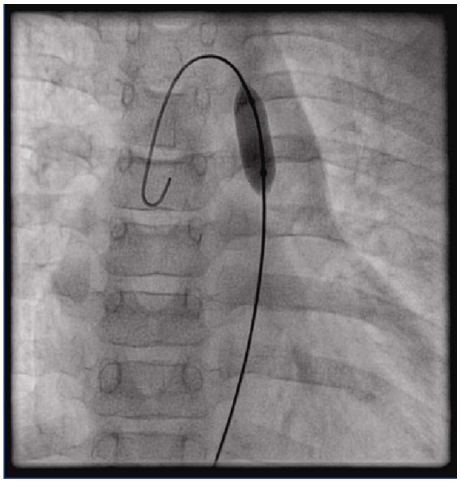

Figure 2. Balloon angioplasty for coarctation of aorta.

positioned in the ductus through 8F sheath using a 6F delivery cable. The position of the device was confirmed through a hand injection of contrast via the sheath. The device was deployed successfully (**Figure 3**). Check angio revealed complete PDA closure with no residual shunt. Subsequently, the catheters were pulled out, hemostasis was achieved, and the patient was allowed to recover overnight. The total procedure time was 60 minutes and the fluoroscopy time was 30 minutes.

Post-procedure period was uneventful. Patient was discharged from the hospital two days after the successful simultaneous interventions of PDA device closure and balloon angioplasty for coarctation of aorta. He was prescribed with aspirin 75 mg once daily for 3 months, cefixime 200 mg twice daily for 3 days, and acetaminophen 325 mg twice daily. At about 10 days follow-up, the patient was stable and remained asymptomatic. Follow-up echocardiography revealed in-situ PDA device with no residual shunt, no signs of pulmonary embolism, normal biventricular function, and no indications of recoarctation with 20 mmHg pressure gradient at the site of coarctation balloon dilatation.

3. Discussion

The ductus arteriosus is an essential fetal structure. A failure of constriction of smooth muscle within the wall of this ductus in postnatal period leads to PDA. It is the second most common form of congenital heart defect, accounting for about 5% - 10% of all congenital heart disease, with a reported incidence of nearly 1 in 2000 births [9]. On the other hand, coarctation of aorta is the fifth most common form of congenital heart defect, accounting for about 6% - 8% of all congenital heart disease, with an estimated incidence of nearly 1 in 2500 births [10]. There are few cases in which both conditions, PDA and coarctation of the aorta, may coexist [1]-[8].

Surgery is usually suggested in patients with PDA and coarctation of aorta. Surgical repair of aortic coarctation is performed via a left lateral thoracotomy and involves clamping the aorta above and below the coarctation. The conventional approaches include subclavian patch angioplasty, resection with end-to-end anastomosis, and subclavian flap repair [10]. On the other hand, the surgical approaches for PDA include PDA closure by clip (single or double), PDA ligation, and PDA ligation and division [11]. Although the recommended treatment for the combination of aortic coarctation and PDA in infants and children is surgery, transcatheter treatment approaches can be effectively applied as a non-surgical option. The major benefits of transcatheter interventions are avoidance of thoracic surgery, thoracotomy scar, and prolonged hospitalization associated with it [1] [2]. Several reports suggest that both lesions can be treated successfully, either simultaneously or sequentially, using transcatheter treatment approach [1]-[8]. The sequential approach avoids catheter and wire manipulation, and reduces the risk of aortic dissection and device malpositioning. However, this approach is associated with high cost and a need for second hospitalization and intervention, which are unpleasant for the child and family [1]. Hence, an effort should be made to treat both the conditions simultaneously, when possible [2] [3]. With this view, we opted for a single-sitting transcatheter management in our patient.

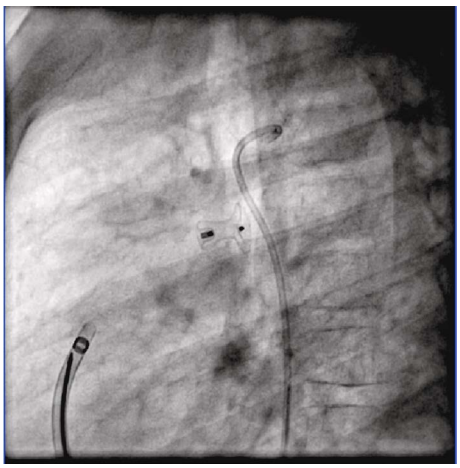

Figure 3. Implantation of Amplatzer duct occluder device for patent ductus arteriosus closure.

Balloon angioplasty is the most widely used non-surgical approach to manage coarctation of aorta. Mid-term outcomes with balloon angioplasty have shown favorable results in the management of patients with aortic coarctation [10]. Although the use of covered stent was another valuable option for single-sitting management of aortic coarctation and PDA [2], we did not opt for it due to lack of clinical evidences in infants and small children. Furthermore, stent implantation in such cases is associated with significant risk of spinal artery occlusion, causing paraplegia and paraparesis [1]. Hence, we preferred balloon angioplasty over stenting in our case.

For PDA closure, coils have been the most widely accepted device because of its low cost, ease in delivery, low catheter profile, and attainment of high complete occlusion rate during follow-up. However, there have been concerns regarding use of coils in PDA due to the reports of high failure rate and high risk of distal embolization. Recently, Amplatzer duct occluder device, a self-expandable nitinol device with round flat retention disks, has been emerging as a valuable option. It is usually indicated for transcatheter closure of moderate-to-large size PDA [12]. Studies suggest that PDA closure with Amplatzer duct occluder device is safe and effective, with complete closure rate in nearly all patients [3] [12]. Further, the outcomes with Amplatzer duct occluder devices are superior to those of coils [12]. Therefore, we chose Amplatzer duct occluder device over coils for the closure of PDA in our patient. For successful repositioning, the size of Amplatzer duct occluder device we selected was 1.5 - 2 times larger than the PDA diameter. In our case of single-sitting intervention for two congenital heart defects, balloon dilation of coarctation was carried out first, followed by PDA device closure. The patient remained asymptomatic at 10-day follow-up and was scheduled for regular follow-up. We strongly believe that a longer-term follow-up will provide further insights regarding the treatment effect in this patient.

Earlier, there have been few reported cases of simultaneous management of PDA and coarctation of aorta in the literature with similar context [1]-[5]. Celebi *et al*. have reported a case of simultaneous management of coarctation of aorta and PDA with balloon angioplasty and PDA coil embolization [1]. In another report, Hakim *et al*. have reported simultaneous implantation of a stent and Amplatzer duct occluder device in a patient with coarctation of aorta and PDA [3]. In the milieu of availability of various devices and modalities of treatment, our case is the first successful report of simultaneous balloon angioplasty and Amplatzer duct occluder device implantation in a single-sitting management of patient with severe coarctation of aorta and PDA, to the best of our knowledge. We suggest fellow interventional cardiologists to opt for a single-stage transcatheter treatment in young children with a combination of these two lesions.

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