Successful Percutaneous Device Closure of a Large 16mm Patent Ductus Arteriosus in a 12 Year Old Male — A Case Report

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Abstract

Patent Ductus arteriosus (PDA) is one of the common congenital cardiac anomalies found in neonate & children which require closure unless pulmonary circulation is dependent on it. Symptoms and time of presentation depends upon the size of the PDA. Large PDAs can cause left heart failure in infants, Eisenmenger syndrome in adults. Surgical closure of large PDA has long been established but nonsurgical device closure of this defect is also emerged as the first choice. Large PDAs leads to development of pulmonary vascular disease. In a patient with significant pulmonary vascular disease and high pulmonary vascular resistance, closure of PDA is contraindicated. In addition, another risk associated with percutaneous closure for these patients is the embolism of the device into aorta. We report a case of 12 year old male, diagnosed to have 16 mm PDA. After checking reversibility of pulmonary vascular bed, this PDA was closed percutaneously with a 20/18 mm PDA device. Patient is asymptomatic at 8 weeks follow-up.

ABBREVIATIONS

PDA: Patent Ductus Arteriosus; PVR: Pulmonary Vascular Resistance; Qp/Qs: Pulmonary Flow/ Systemic Flow Ratio; PH: Pulmonary Hypertension

INTRODUCTION

Isolated Patent Ductus arteriosus is one of the common congenital cardiac anomalies found in neonate & children with estimated incidence of 1:2000 to 1:5000 live births which is about 10 to 12 percent of all varieties of congenital heart disease [1]. Symptoms and time of presentation depends upon the size of the PDA. Most of the PDAs are diagnosed during childhood. Clinical presentation range from asymptomatic patient in whom PDA was diagnosed incidentally, recurrent lower respiratory infections due to Left ventricular failure and Eisenmenger syndrome in adults [2]. For symptomatic patients, transcatheter percutaneous PDA device closure and open surgical ligation are modalities to treat PDA. In the past due to unavailability of large devices surgery was the only option for management of large PDAs. If left untreated large PDAs lead to development of pulmonary vascular disease and Eisenmenger syndrome. We report a case of 12 year old male, diagnosed to have 16 mm PDA.

After checking reversibility of pulmonary vascular bed, this PDA was closed percutaneously on same day with a 20/18 mm PDA device. Patient is asymptomatic at 8 weeks follow-up.

CASE PRESENTATION

12 year old male patient admitted with history of effort intolerance since 6 months. There was no significant antenatal, perinatal and post natal history. On examination pulse was 84 beats per minute; blood pressure was 110/40 mmHg. There was no cyanosis and digital clubbing. Oxygen saturation was 96%. On Auscultation P2 was loud, a murmur was heard in left first and second intercostal space which had a holosystolic component and continued through the timing of the second heart sound but faded well before the subsequent first heart sound. His chest X-ray showed cardiomegaly, prominent pulmonary conus and increased pulmonary vascularity (Figure A). ECG showed biventricular hypertrophy (Figure B). Routine blood investigations were normal. Echocardiography showed dilated left ventricle, large PDA with left to right shunt (Figure C, D).

Cardiac catheterization was done under sedation with 6F right femoral artery, left femoral artery and right femoral venous access. Right & left heart catheterization was performed...
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anterior oblique views was performed with 6F pigtail catheter. Maximum size of PDA measured was 16 mm in right anterior oblique view (Figure F). Hence it was decided to close the PDA with 18/16 mm COCOON device. This device was not holding the aortic end and slipped into pulmonary artery hence it was decided to take bigger device. Then 20/18 COCOON device was deployed across the PDA without releasing. Patient was started on oxygen 100% and pulmonary artery and aortic pressure was monitored simultaneously with 6F MPA and 6F pigtail catheters respectively. After 30 minutes mean pulmonary artery pressure decreased to 39 mmHg (Figure G). Aortogram in left lateral view was performed with 6F pigtail catheter, showed no flow across PDA and no obstruction to the aortic flow (Figure H). Device was released under fluoroscopy. Position of device after releasing is shown in Figure I. Patient was monitored in catheterization laboratory for further 30 minutes and shifted to intensive care unit. Echocardiography was done just after the procedure and at 24 hours and at 48 hours. Echocardiography showed decrease in left ventricular internal diameter in diastole (LVIDD) from 54 to 51 mm and mean pulmonary artery pressure of 39 mmHg (Figure J, K). There was no flow across PDA. There was no gradient in
descending aorta across this device. Patient was discharged on
single antiplatelet (aspirin) and enalapril after 48 hours of the
procedure. The patient is asymptomatic at 8 weeks follow up.

DISCUSSION

A large isolated PDA leads to increased pulmonary flow and
produces a volume load with consequent dilation of the chambers
and vessels, through which the flow passes: the pulmonary
vasculature, left atrium, and left ventricle. This chamber
enlargement is a function not only of shunt volume but also of
time, and therefore is progressive. Symptoms of congestive heart
failure and pulmonary edema may also develop. In addition,
such a high-volume, high-pressure shunt over time can lead
to irreversible pulmonary vascular disease (Eisenmenger
syndrome). The presentation of PDA depends upon patient age
and the size of the PDA [3]. Most PDAs are diagnosed and closed
during childhood.
Closure of a PDA either percutaneously or surgically is indicated if Left atrial and Left Ventricle are enlarged or signs of congestive heart failure are present or in presence of pulmonary hypertension (PH) with net left-to-right shunting. Surgical repair is recommended when the PDA is too large for device closure [4]. With the availability of large sized devices even larger PDAs are successfully closed percutaneously.

Treatment of the large PDA in the setting of PH is challenging. This situation arises when PDA is diagnosed in older children and adults. In neonates and infants, PH is most often reversible, but in older patients the resolution of PH is variable depending on the reversibility of PVR. In these patients, cardiac catheterization is necessary to calculate net left to right shunt and PVR prior to consideration of PDA closure [5]. Assessment of PVR after administering 100% oxygen and after nitric oxide has several limitations in these patients. In the case of PDA, the exact site of sampling distal to the shunt remains controversial since the precise streaming of the ductal flow is not universal.

Temporary occlusion of PDA with device or balloon has been in use to decide on contribution of left to right shunt and PVR to PH. Use of device is simple, convenient, reliable and saves time but is an expensive proposition in case the pulmonary artery pressure does not fall or actually rises. Device is released if there is fall in pulmonary artery pressure with no decrease in aortic pressure. If the pulmonary artery pressure does not fall or rises, it indicates irreversible PH and the device closure in this situation is not advised. Closure of PDA in this situation has adverse outcome [6-8].

With the availability of large sized devices even larger PDAs are successfully closed percutaneously. Most commonly used devices for large PDAs are COCOON duct occluder (Vascular) with size upto 20/18 mm [9] and CERA (Lifetech) PDA occluder with size upto 24/22 mm. Maximum size available with AMPLATZER duct occlude device is 12/10 mm hence it cannot be used in PDAs larger than 8 mm. Another device, OCCLUTECH PDA occluder is available upto the size of 18/14 mm [10-12]. These devices and their sizes are not widely available. Other nontraditional devices used for closure of large PDAs are AMPLATZER septal occluder and AMPLATZER Muscular VSD devices [13]. In our patient COCOON 20/18 mm device was used. Transcatheter PDA closure is a very safe and effective procedure. Mortality is rare and, while residual shunt is often demonstrated immediately after device placement by angiography, complete closure of the PDA is almost universal by 1 year [14].

CONCLUSION

Large PDAs diagnosed in older children and adults are associated with pulmonary hypertension. Management of these patients is challenging. Cardiac catheterization is necessary to check for reversibility of PH. Test device occlusion is reliable method to decide regarding reversibility. Percutaneous closure of large PDAs is very safe and effective procedure due to the availability of various large PDA occluder devices.

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