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Case Report

Patent Ductus Arteriosus Device Closure with AMPLATZER Duct Occluder-II in a Low Birth Weight Preterm Neonate-First Experience in Pakistan

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ABSTRACT

We report a successful closure of large patent ductus arteriosus (PDA) in a low-birth weight preterm neonate using an ADO II device for the first time in AFIC/NIHD Rawalpindi. A hemodynamically significant PDA in a preterm neonate carries an increased risk of morbidity, including chronic lung disease, necrotizing enterocolitis and renal impairment. After the failure of medical therapy, successful, timely and safe transcatheter closure of PDA using appropriate equipment is a milestone in managing PDA in preterm neonates.

Keywords: Patent ductus arteriosus (PDA), Preterm, Transcatheter closure.

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INTRODUCTION

Preterm low birth weight neonates frequently present with patent ductus arteriosus (PDA). PDA incidence after day 4 is about 10% in late preterm and full-term neonates and 80% in extremely premature babies.[1]

Pharmacological treatment with indomethacin or ibuprofen is considered the first line for PDA closure. Paracetamol is also used as a safe and efficacious alternative in medical management. The surgical approach to PDA closure had previously been most commonly used, but it carries an increased risk of morbidity and mortality. Recently, many centres are closing PDAs in preterm low birth weight neonates by transcatheter approach. Timely closure of a hemodynamically significant PDA is important as it is associated with an increased risk of prolonged oxygen dependency/need for ventilation, chronic lung disease, necrotizing enterocolitis, renal impairment, and pulmonary and intraventricular haemorrhage in premature infants.[2,3]

Various cohort studies have reported positive outcomes of transcatheter PDA closure, using different devices for PDA closure in preterm low birth weight infants.[4,5] As a result, DA and CE have approved ADO II AS for PDA closure in preterm babies weighing more than 700 g and over three days old. This approval has been given after promising results of an ongoing trial.

Previously in our centre, we were not doing PDA device closures in preterm low birth weight infants. However, due to the non-availability of ADO II AS, we alternatively used ADO II for successful transcatheter PDA closure in a preterm low birth weight infant.

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CASE REPORT

A 20-day-old preterm neonate presented to us with a large Patent ductus Arteriosus. He was delivered via emergency LSCS at 34 weeks gestational age with a birth weight of 2.1kg. He remained admitted in NICU for seven days. The baby was referred to us from CMH Bahawalpur with failure to thrive and evaluation of continuous murmur at the left upper sternal area. Examination revealed a preterm baby weighing 2.2 kg with no dysmorphic features and a Grade 3/6 continuous murmur heard with maximum intensity at the left upper parasternal region. Echocardiography revealed a large Patent Ductus Arteriosus (PDA) shunting left to right with left-sided volume overload. He was given a therapeutic trial of oral ibuprofen with no response. Device closure of the defect was planned. After the pre-anaesthesia evaluation, the baby was taken to the cath lab.

Considering the baby's weight and the large duct size, device closure was planned with AMPLATZER Duct Occluder II. Right femoral vein accessed with 5 Fr sheath. PDA crossed with 5 Fr Judkins Right (JR) Catheter over 0.035" Radiofocus guidewire 150 cm (Terumo). JR replaced with 4 Fr pigtail catheter.

Aortograms in LAO 90θ and RAO 30θ showed long tubular PDA 5 mm in diameter (Krichenko Angiographic classification Type C) (Figure-1). Ini-tially, it was planned to do the procedure without arterial access. However, as we were using the device for the first time, an arterial line was taken for angiograms to

safely deploy the device without causing iatrogenic coarctation of the aorta. LFA accessed with 4 Fr sheath.[5] Fr delivery sheath entered from the venous side over 0.035' AMPLATZ exchange length wire 260 cm (MERIT MEDICAL) across the duct into the descending aorta. 6/6 mm AMPLATZER Duct Occluder II deployed across the duct under fluoroscopic and echocardiographic guidance (Figure-2).

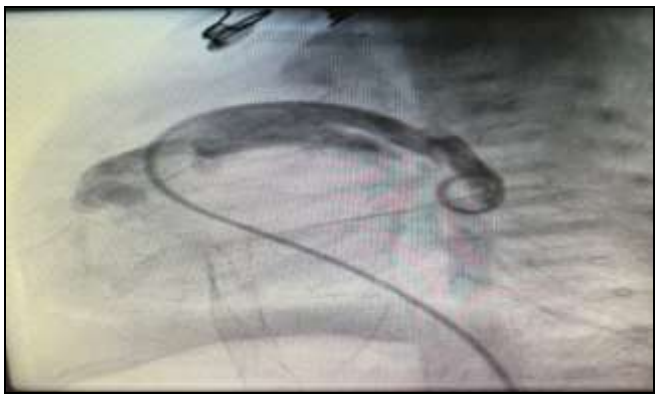

Figure-1 :Angiogram in LAO 90 showing Large Tubular PDA

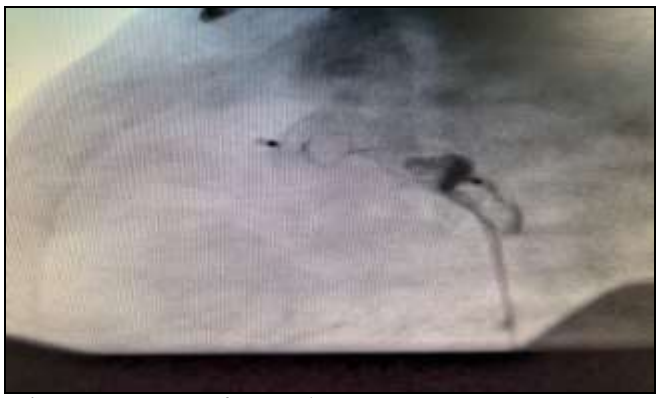

Figure-2 : ADO II after Deployment

Post-occlusion angiogram revealed a well-placed device with no residual leak. Post Procedure baby was managed in Paediatrics HDU. He took a relatively prolonged time to recover from general anaesthesia. Repeated episodes of apnea were managed successfully with intermittent stimulation and aminophylline. His peripheral pulses and lower limbs remained palpable post-procedure. Post-procedure echo revealed a well-placed device (Figures 3-5). The baby remained stable and was discharged from the hospital after 48 hours.

DISCUSSION

PDA device closure is one of the most common interventional procedures done in Cath Lab AFIC by the Structural and Congenital heart disease team. Worldwide, symptomatic PDA in low birthweight preterm neonates are being closed successfully and safely using various devices.[6-9] We have not been performing this procedure previously in preterm low birth weight neonates due to the non-availability of the required equipment in smaller possible sizes.

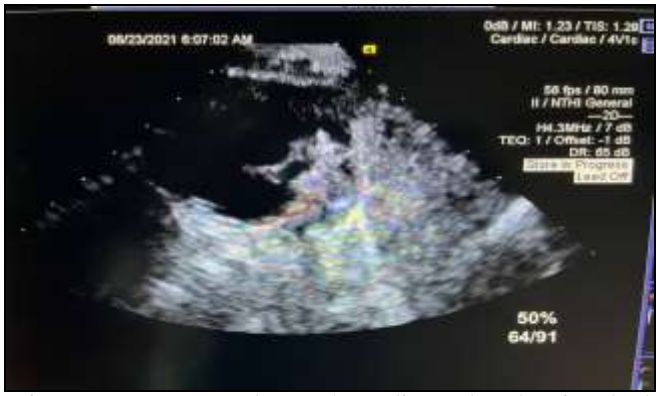

Figure-3 : Post procedure Echocardiography showing both Pulmonary and Aortic end of ADO-II

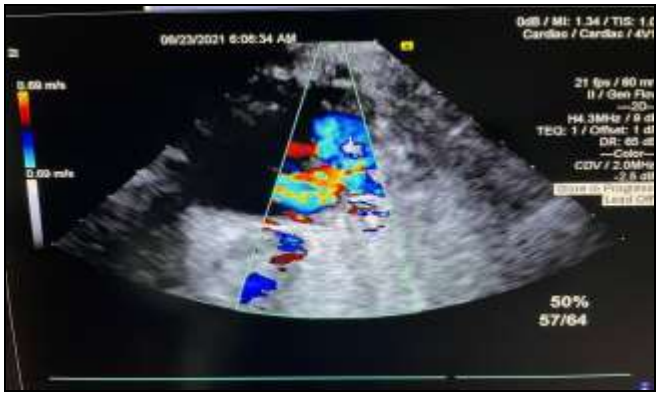

Figure-4: Color Doppler showing Good Flow in LPA

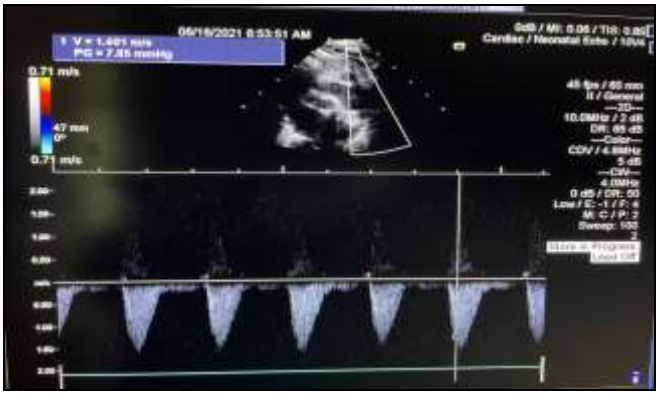

Figure-5 : Aortic end of device with CW Doppler Spectral Analysis showing no Coarctation

Moreover, previously we had vast experience in closing large-size tubular PDAs with VSD devices which were not suitable in this particular case as there

was the possibility of causing iatrogenic coarctation of aorta due to bulky retention discs and smaller length in this long PDA measuring approximately 11 mm in length. Considering these limitations, AMPLATZER Duct Occluder II was used for the first time in AFIC to close a large elongated PDA in a preterm low birth weight neonate. It is a soft self-expanding nitinol mesh device with a central waist and two retention discs. The central waist is meant to fill the ductus arteriosus, and the two retention discs should be deployed in the pulmonary artery and the aortic end of the PDA.

The second challenge was to avoid complications related to vascular access in a low birth weight neonate. 4 Fr is the smallest possible sheath size available to us. We initially used a 4 Fr sheath for venous access. However, after failing to enter the right ventricle with a 4 Fr JR catheter, we had to replace the sheath with a 5 Fr. Initially, it was planned to do the procedure without arterial access because of the high risk of vascular thrombosis and limb ischemia.[10] However, as we were using the device for the first time, the arterial line was taken in the middle of the procedure for angiograms in order to safely deploy the device without causing iatrogenic coarctation of the aorta. 4 Fr sheath in the artery was kept for the minimum possible time and removed immediately after the procedure, thus helping us to avoid anticipated dreadful vascular complications.

Another problem faced during the device deployment was the proper positioning of the aortic disc due to the large diameter of the aortic end of the PDA. As a result, the device was recaptured and repositioned twice for a stable device position and satisfactory duct occlusion.

Conflict of Interest: None.

Author's Contributon

Following authors have made substantial contributions to the manuscript as under:

SI & KA& AM: Conception, drafting the manuscript, critical review, approval of the final version to be published. Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Weinberg JG, Evans FJ, Burns KM, Pearson GD, Kaltman JR. Surgical ligation of patent ductus arteriosus in premature infants: trends and practice variation. Cardiol Young 2016 ; 26(6): 1107-1114. doi: 10.1017/S1047951115001869.
2. El-Khuffash A, Levy PT, Gorenflo M, Frantz ID 3rd. The definition of a hemodynamically significant ductus arteriosus. Pediatr Res 2019; 85(6): 740-741. doi: 10.1038/s41390-019-0342-7.
3. Bischoff AR, Giesinger RE, Bell EF, McNamara PJ. Precision medicine in neonatal hemodynamics: need for prioritization of mechanism of illness and defining population of interest. J Perinatol 2020 ; 40(9): 1446-1449. doi: 10.1038/s41372-020-0741-y.
4. Zahn EM, Nevin P, Simmons C, Garg R. A novel technique for transcatheter patent ductus arteriosus closure in extremely preterm infants using commercially available technology. Catheter Cardiovasc Interv 2015; 85(2): 240-248. doi: 10.1002/ccd.25534.
5. Narin N, Pamukcu O, Baykan A, Sunkak S, Ulgey A, Uzum K. Percutaneous PDA Closure in Extremely Low Birth Weight Babies. J Interv Cardiol 2016; 29(6): 654-660. doi: 10.1111/joic.12352.
6. Sathanandam S, Justino H, Waller BR 3rd, Radtke W, Qureshi AM. Initial clinical experience with the Medtronic Micro Vascular Plug™ in transcatheter occlusion of PDAs in extremely premature infants. Catheter Cardiovasc Interv 2017; 89(6): 1051-1058. doi: 10.1002/ccd.26878.
7. Wang-Giuffre EW, Breinholt JP. Novel use of the medtronic micro vascular plug for PDA closure in preterm infants. Catheter Cardiovasc Interv 2017 ; 89(6): 1059-1065. doi: 10.1002/ccd.26855.
8. Rodriguez Ogando A, Planelles Asensio I, de la Blanca ARS, Ballesteros Tejerizo F, Sanchez M, Gil Jaurena JM, et al. Surgical Ligation Versus Percutaneous Closure of Patent Ductus Arteriosus in Very Low-Weight Preterm Infants: Which are the Real Benefits of the Percutaneous Approach? Pediatr Cardiol 2018 ; 39(2): 398-410. doi: 10.1007/s00246-017-1768-5.
9. Sathanandam S, Balduf K, Chilakala S, Washington K, Allen K, Knott-Craig C, *et al*. Role of Transcatheter patent ductus arteriosus closure in extremely low birth weight infants. Catheter Cardiovasc Interv 2019; 93(1): 89-96. doi: 10.1002/ccd.27808.
10. Alexander J, Yohannan T, Abutineh I, Agrawal V, Lloyd H, Zurakowski D, et al. Ultrasound-guided femoral arterial access in pediatric cardiac catheterizations: A prospective evaluation of the prevalence, risk factors, and mechanism for acute loss of arterial pulse. Catheter Cardiovasc Interv 2016; 88(7): 1098-1107. doi:10.1002/ccd.2670