International Journal of Contemporary Pediatrics
Kapoor S et al. Int J Contemp Pediatr. 2023 Jun;10(6):966-968
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20231511

Case Report

Percutaneous patent ductus arteriosus closure in extremely low birth weight baby using Amplatzer Piccolo Occluder device

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Received: 15 April 2023
Accepted: 12 May 2023

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ABSTRACT

Hemodynamically significant patent ductus arteriosus (PDA) is one of major morbidities seen in preterm babies. It can be closed using conservative, surgical and percutaneous device occlusion techniques. Transcatheter Amplatzer Piccolo Occluder is 1st FDA approved device available in India for closure of PDA in very preterm babies with weight >700 gm. In India, insufficient data is available pertaining to this procedure in extremely low birth weight babies.

Keywords: PDA device closure, Preterm, Extremely low birth weight

INTRODUCTION

Patent ductus arteriosus (PDA) is one of the major morbidities in very preterm neonates. Decreased sensitivity of ductus arteriosus to oxygen, increased sensitivity to relaxing effect of prostaglandins and fewer contractile smooth muscles in preterm neonates primarily responsible for patency of ductus.[1] Incidence of PDA is inversely related to gestational age.[2] In 1/3rd very low birth weight and more than half extremely low birth neonates (ELBW) neonates ductus arteriosus will remain patent at 72 h after birth.[3,4] Presence of PDA is associated with increased risk of intraventricular haemorrhage, necrotizing enterocolitis, bronchopulmonary dysplasia, longer hospital stay and neonatal mortality.[5,6] PDA can be closed using medical management, surgical ligation and percutaneous device closure.

Percutaneous transcatheter closure of PDA using device is the standard of care in larger infants, children and adults.7 Transcatheter closure of PDA has not been performed routinely in very small infants (weight ≤ 2 kg). Recently, it has been seen that transcatheter closure of PDA can be performed safely and effectively in premature infants as small as 700 gm.[8-13]

The Amplatzer Piccolo Occluder received approval in Europe in 2011 for PDA closure in patients weighing ≥6 kg. The PDA morphology in extremely premature infants is typically long and tubular with a hockey stick configuration such that the Amplatzer Piccolo Occluder has favourable features (size, shape, delivery system) for closure of PDAs in premature neonates.[14] After clinical trials evaluating the safety and effectiveness of the Amplatzer Piccolo Occluder were conducted, this device was approved by the U.S. FDA for patients ≥700 gm. In India, insufficient data is available for use of this device in extremely low birth weight neonates.

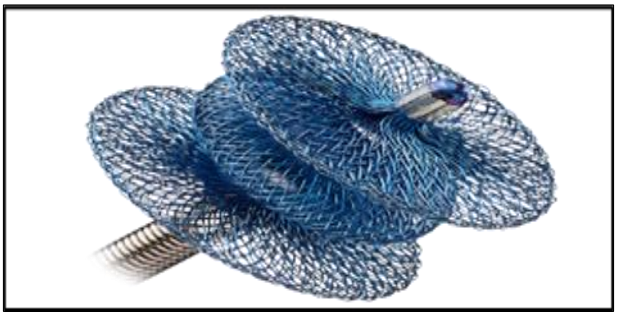

Figure 1: The Amplatzer Piccolo Occluder device.
Figure taken from www.abbott.com.

CASE REPORT

A 29 weeks preterm baby born to a primigravida mother with preterm caesarean section in view of severe pregnancy induced hypertension with pre-eclampsia with leaking per vagina. Baby weighed 900 grams at birth and had respiratory distress with hyaline membrane disease for which baby was given 1 dose of surfactant using INSURE technique. Baby was put on CPAP with FiO_2-25%, PEEP- 5 which was gradually weaned to FiO_2-21% and PEEP-4. Baby was given caffeine citrate for prevention of apnea of prematurity. Baby was started on intravenous antibiotics as per our unit policy in view of positive septic screen. Blood culture was sterile and CSF analysis was negative for meningitis. Feeds were started at 24 hours of life and were being gradually increased. 2D echocardiography on day 2 showed PDA which was not haemodynamically significant. Cranial ultrasound done on day 3 of life was normal. On day 10 of life baby had increased FiO2 requirement upto 60% and feed intolerance in form of abdominal distension (>3 cm) and increased gastric residuals (>50%). Septic screen showed rising C reactive protein and leucocytosis with neutrophilia for which antibiotics were upgraded to second line and repeat blood culture was sent. Feeds were withheld for 48 hours and reintroduced. 2D echocardiography showed 2.5 mm haemodynamically significant PDA. Baby was started on intravenous paracetamol as per our unit policy which was given for 5 days. Repeat 2D echo showed persistent haemodynamically significant PDA (hsPDA). A second course of paracetamol was again given along with fluid restriction for 5 days. Baby was not gaining weight in view of repeated episodes of feed intolerance and had persistent high FiO_2 requirement. 2D echo showed hsPDA 2.5 mm with length of 3 mm. Sepsis control was achieved with second line antibiotics. In view of clinical picture, decision was taken to go for percutaneous transcatheter closure of PDA. Necessary accommodations were made for transport from neonatal intensive care unit, ventilation, prevention of hypothermia and backup of blood products. The Amplatzer Piccolo Occluder device was used for closure of hsPDA. The procedure was performed using femoral approach under fluoroscopy guidance. The procedure was done with no complications during the course of procedure. Baby had post procedure hypertension (>90th centile) which was managed with sodium nitroprusside. Repeat echo was done to check for device, cardiac functioning, aortic and pulmonary blood flow. Gradually FiO2 requirement decreased by 48 hours and baby came to room air by day 3 post procedure. Feeds were increased and were tolerated well. Baby started to gain weight and was given routine preterm care as per our unit policy. Neurological examination was appropriate for age. Baby had retinopathy of prematurity for which laser treatment was done. Hearing assessment was done which was normal. Cranial ultrasound was done pre discharge which was normal for age. Baby was finally discharged on full spoon feeds at weight of 1600 gm. Baby was kept on regular follow up and repeat 2D echo showed closure of PDA with device in position, good cardiac function with good flows in pulmonary artery, aorta and no tricuspid regurgitation.

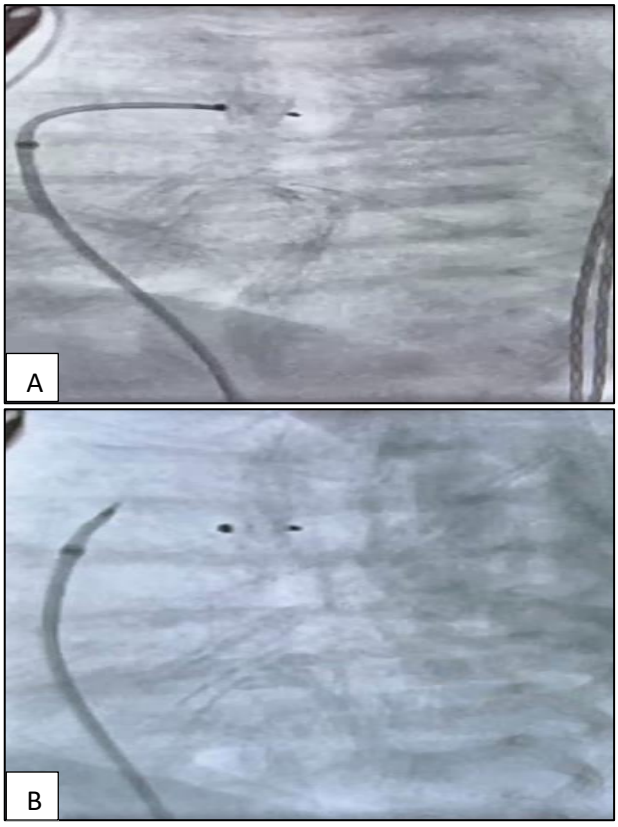

Figure 2 (A and B): Intra-procedure fluoroscopy. Device loaded catheter 2 and device in position within PDA.

DISCUSSION

The Amplatzer Piccolo Occluder is the first commercially available device for use in premature infants ≥700 g in India. Significant procedural complications can occur, especially with smaller babies despite the excellent outcomes in various studies.[9,11,15]

Potential adverse events that may occur during or after placing this device include air embolism, apnea, arrhythmia, hypertension, hypotension, bleeding, allergic dye reaction, valvular regurgitation, vascular access site injury, vascular occlusion, vessel perforation, device embolization, hematoma, infection, bacterial endocarditis, myocardial infarction, partial obstruction of aorta, partial obstruction of pulmonary artery , pericardial effusion, peripheral embolism, pleural effusion, ,cardiac tamponade ,pulmonary embolism to name some.

While most pediatric interventional cardiologists are familiar with the technique of percutaneous transcatheter PDA closure, incase of babies weighing ≤1 kg, several procedural modifications may be required to achieve success and reduce complication rates. In extremely low

birth weight babies attention must be paid for necessary accommodations during transportation from and to neonatal intensive care unit (NICU), ventilator support during the procedure, pain management during the procedure, maintenance of euthermia and backup for blood products.

Currently the contraindications for the usage of this occluder device are weight <700 gm at time of the procedure, age <3 days at time of procedure, coarctation of the aorta, left pulmonary artery stenosis, cardiac output that is dependent on right to left shunt through the PDA due to pulmonary hypertension, intra-cardiac thrombus that may interfere with the implant procedure, active infection requiring treatment at the time of implant, PDA length smaller than 3 mm, PDA diameter that is greater than 4 mm at the narrowest portion.

At present, there is no consensus on the ideal timing for PDA closure in premature infants.[16] Transcatheter PDA closure for ELBW and premature infants is a new therapy that could shift the treatment paradigm. Further studies are necessary to continue to answer important questions of which PDAs require closure and when to close the hsPDA in premature infants.

CONCLUSION

Percutaneous device closure of haemodynamically significant PDA in extremely low birth weight babies is challenging. Many administrative and procedural alterations may be required during the procedure. Piccolo device is the first FDA approved device for such small babies. Further studies are required in our population to see their outcomes, also to learn various administrative and procedural adaptations for these premises.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Kapoor S, Kaur R, Baidwan AS. Percutaneous patent ductus arteriosus closure in extremely low birth weight baby using Amplatzer Piccolo Occluder device. Int J Contemp Pediatr 2023;10:966-8.