

CASE REPORT

Starting Small: A Case Report on the First Percutaneous PDA Closure in a Preterm Neonate in Khyber Pakhtunkhwa.

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Abstract

Background: Patent ductus arteriosus (PDA) is a common cardiovascular condition in preterm infants, particularly those with extremely low birth weight (ELBW). If left untreated, a hemodynamically significant PDA (hsPDA) can lead to serious complications such as heart failure, respiratory distress, and poor weight gain. The Amplatzer Piccolo Occluder offers a minimally invasive transcatheter alternative to surgical ligation for infants weighing ≥ 700 g, reducing procedural risks and improving clinical outcomes.

Case Presentation: We report the case of a female infant born at 32 weeks of gestation with a birth weight of 1.2 kg, who developed symptoms of congestive heart failure, feeding difficulties, and failure to thrive. Echocardiography confirmed a hemodynamically significant PDA unresponsive to pharmacologic management. The infant was referred for transcatheter PDA closure.

Management and Results: A percutaneous closure was successfully performed on the 29th day of life using a 5×4 mm Amplatzer Piccolo Occluder via the femoral approach. The procedure was guided by fluoroscopy and echocardiography and conducted without the use of contrast due to impaired renal function. The intervention was uneventful, with no procedural complications. The infant was extubated on the sixth post-procedure day and exhibited significant clinical improvement, including adequate weight gain and resolution of apnea. At the one-month follow-up, the infant remained stable with no residual shunt or adverse effects.

Conclusion: This case highlights the safety, feasibility, and effectiveness of using the Amplatzer Piccolo Occluder for PDA closure in ELBW infants, even in resource-limited settings. To the best of our knowledge, this represents the first reported use of the device in Pakistan and at our institution, marking a significant advancement in neonatal cardiac care.

Keywords

Patent Ductus Arteriosus, Infant, Extremely Low Birth Weight, Heart Catheterization, Device Closure, Amplatzer Piccolo Occluder.

Introduction

Patent ductus arteriosus (PDA) refers to the persistent postnatal patency of the fetal ductus arteriosus, a vascular connection between the aorta and pulmonary artery. In preterm infants, this condition often results in a continuous left-to-right shunt, leading to significant morbidity. More than 80% of extremely low birth weight (ELBW) infants (<1,000 g) and up to 50% of premature infants retain PDA beyond the first week of life¹. The incidence of PDA is inversely proportional to gestational age: it persists in 90% of infants born at <24 weeks, 10% of those born between 25–28 weeks, and 10% of those born at 30–37 weeks gestation after four days of life^{2–4}. If left untreated, a hemodynamically significant PDA (hsPDA) may lead to serious complications including necrotizing enterocolitis, intraventricular hemorrhage, pulmonary hemorrhage, chronic lung disease, and even death^{5,6}.

Historically, treatment has involved pharmacological closure or surgical ligation, both of which carry inherent risks. In January 2019, the FDA approved the Amplatzer Piccolo Occluder for PDA closure in infants weighing ≥ 700 g⁷. This device allows a minimally invasive, transcatheter-based alternative to surgical ligation, offering a promising option for ELBW and preterm neonates.

Case Presentation

We report the case of a female preterm infant, one of dizygotic twins, born at 32 weeks of gestation via spontaneous vaginal delivery. Her birth weight was 1.2 kg. Unfortunately, the co-twin passed away on day four of life due to unrelated complications. The surviving infant was admitted to the Neonatal Intensive Care Unit (NICU) where she spent 28 days under observation and supportive care.

The patient was referred to our department with clinical features of congestive heart failure: poor weight gain, recurrent episodes of apnea, lethargy, respiratory distress, and feeding difficulties. On physical examination, the infant appeared tachypneic with a respiratory rate of 70 breaths/min, heart rate of 165 bpm, and oxygen saturation of 88% in room air. She was lethargic

and had a grade 2/6 continuous murmur best heard at the left upper sternal border.

Laboratory investigations revealed elevated renal parameters (urea: 68 mg/dL, creatinine: 1.4 mg/dL), though other hematologic and metabolic profiles were within normal limits. Chest radiograph showed cardiomegaly and pulmonary congestion. Transthoracic echocardiography revealed a large PDA measuring 3.5 mm with left-to-right shunting, causing left atrial and ventricular enlargement, confirming a hemodynamically significant PDA (hsPDA).

Despite receiving a full course of pharmacologic treatment with intravenous ibuprofen, the PDA remained symptomatic and significant. Surgical ligation was deemed high-risk due to low body weight and renal impairment. Therefore, transcatheter closure was considered the optimal intervention.

Diagnostic Assessment

- Clinical Signs: Apnea, poor feeding, lethargy, respiratory distress.
- Laboratory Findings: Elevated urea and creatinine; otherwise, unremarkable.
- Radiologic Imaging: Chest X-ray showed cardiomegaly and pulmonary edema.
- Echocardiography: Revealed a 3.5 mm PDA with left-to-right shunt, LA/LV dilation, no pulmonary hypertension or other structural cardiac anomalies.

Therapeutic Intervention

On the 29th day of life, the patient underwent percutaneous transcatheter closure of the PDA using the Amplatzer Piccolo Occluder. The procedure was performed under general anesthesia via the right femoral venous approach using a 4 French delivery system.

Due to the patient's renal status, the procedure was conducted without the use of contrast. Real-time fluoroscopic and echocardiographic guidance ensured precise deployment. A 5×4 mm Piccolo device was chosen based on ductus morphology.

Successful device deployment was confirmed intra-procedurally without evidence of obstruction to

adjacent structures. There were no intraoperative or immediate post-procedural complications

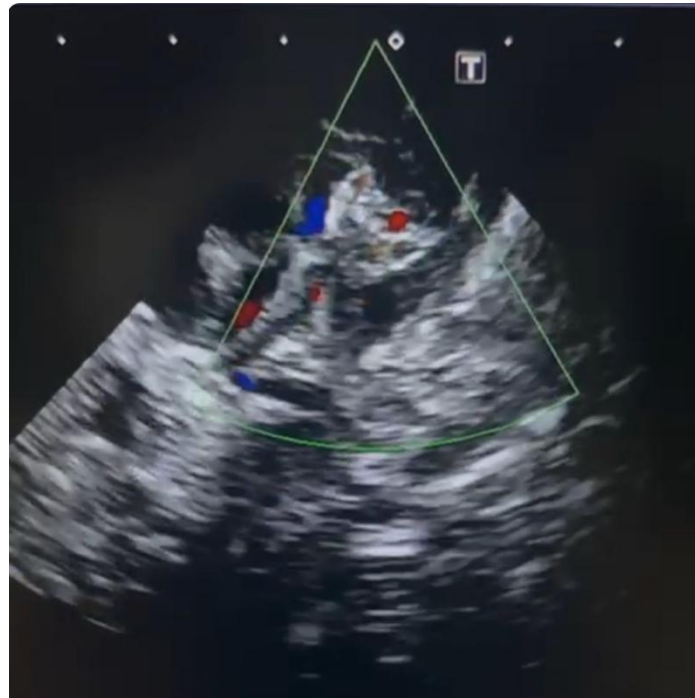


Figure 1: Echocardiogram showing successful deployment of the Piccolo PDA Occluder.

Follow-up and Outcome

The patient exhibited significant clinical improvement post-procedure. She was extubated on day 6 post-intervention with no recurrence of apnea or respiratory distress. Feeding tolerance improved, and weight gain was consistent. She was discharged 12 days post-procedure, weighing 1.4 kg, maintaining oxygen saturation >95% in room air. At the 1-month follow-up, the infant was thriving, with appropriate weight gain and normal developmental milestones. Echocardiography confirmed complete closure of the PDA with no residual shunt or device-related complications.

Discussion

PDA accounts for 5–10% of congenital heart diseases in term neonates and has a much higher incidence in preterm infants, particularly those <1,200 g⁸. Risk factors include prematurity, female sex (2:1 ratio), respiratory distress syndrome, high-altitude births, and maternal rubella infection.

Conservative approaches including fluid restriction and PEEP can facilitate spontaneous closure, especially in late preterm infants. Medical therapy with indomethacin, ibuprofen, or acetaminophen is generally effective but may fail in ELBW infants⁹. In such cases, surgical ligation or transcatheter closure becomes necessary.

A number of devices are available for PDA closure including Amplatzer Duct Occluders I/II and the KONAR-MFO^{10,11}. The Amplatzer Piccolo Occluder, specifically designed for use in infants ≥700 g, was FDA-approved in 2019. It enables transcatheter closure using a small (4 Fr) sheath and avoids nephrotoxic contrast in renal-compromised neonates⁷. Clinical studies show 95.5–99% success rates in PDA closure with very few complications^{12–15}.

In this case, the patient had a symptomatic hsPDA unresponsive to medical therapy. Due to renal concerns and surgical risk, the Piccolo device was

an ideal solution. The device's minimally invasive delivery, size suitability, and high success rate contributed to the excellent clinical outcome.

Conclusion

This case illustrates the successful use of the Amplatzer Piccolo Occluder for PDA closure in a premature infant weighing 1.2 kg. The procedure was performed safely without contrast and led to significant clinical improvement. This is the first documented case in our tertiary care center—and to our knowledge, in Pakistan of using the Piccolo device in such a setting. Our experience supports its safety, feasibility, and efficacy, making it a valuable addition to PDA management in resource-limited settings.

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