

Trans-catheter device closure of atrial septal defect in symptomatic children ≤ 10 kg: expanding the boundaries of percutaneous therapy

Abstract

Trans-catheter device closure of atrial septal defects (ASDs) has long been the treatment of choice in anatomically suitable children beyond early childhood. However, data on its feasibility and safety in infants and small children weighing ≤ 10 kg remain limited. This mini-review summarizes findings from a recent multicentric retrospective cohort study evaluating the outcomes of ASD device closure in symptomatic small children. The study highlights clinical indications, technical modifications, and midterm results. It demonstrates that percutaneous ASD closure is a safe and effective alternative to surgery in appropriately selected children below 10 kg, even in the presence of large defects and deficient septal rims.

Keywords: respiratory infections, pulmonary hypertension, rubella syndrome, anatomical assessment

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Introduction

Traditionally, trans-catheter closure of secundum ASDs has been delayed until a child reaches 15–18 kg to reduce the risk of complications and ensure adequate device anchorage. However, earlier intervention may be necessary in children who exhibit recurrent respiratory infections, symptoms of heart failure, failure to thrive, or early signs of pulmonary hypertension.^{1–5}

A major barrier to adopting ASD device closure in this lower weight group has been limited data and concerns about high device-to-weight ratios, floppy or deficient septal rims, and technical challenges. The study by Kamran et al. addresses these concerns by evaluating the safety, feasibility, and midterm outcomes of ASD closure in 85 symptomatic children weighing ≤ 10 kg across two high-volume tertiary cardiac centers in India.

Key study insights

Patient Profile

Mean age: 32 months

Mean weight: 9.17 kg

Gender distribution: 63% female

Comorbidities: Down syndrome, congenital rubella syndrome, Noonan's syndrome, Goldenhar syndrome, cerebral palsy

High-altitude residence: 13%^{6–9}

ASD characteristics

Mean ASD size: 14.9 mm

Mean Qp/Qs: 2.58

Mean pulmonary vascular resistance (PVR): 1.8 Wood units

Elevated pulmonary artery pressure: 18%

Deficient or floppy rims: Present in 76% of patients

Techniques used

LADED (Left Atrial Disc Engagement–Disengagement): 67%

Right Upper Pulmonary Vein (RUPV)-guided deployment: 15%

Conventional technique: 18%

Balloon- or catheter-assisted deployment: Not used in this cohort

Outcomes

Procedural success: 100%

Arrhythmias: 6 cases (5 SVTs responsive to adenosine, 1 complete heart block requiring pacemaker)

Average device-to-weight ratio: 1.9 (range up to 3.3 tolerated)

Device embolization or mortality: None

Catch-up growth and favorable cardiac remodeling: Observed in the majority at 1-year follow-up

Clinical relevance

This study adds to the growing body of evidence supporting the safety and effectiveness of trans-catheter ASD closure in children ≤ 10 kg with hemodynamically significant shunts. Key clinical implications include:

Device-to-weight ratios up to 3.3 can be well tolerated with appropriate case selection and modified deployment techniques.

Deficient rims are no longer absolute contraindications, especially when techniques such as LADED or RUPV-guided approaches are used.

Significant improvement in growth parameters and reduction in infection-related hospitalizations post-intervention.^{10–12} Transient arrhythmias, the most common complication, were generally manageable with medical therapy.

These results support the case for individualized treatment planning and reconsideration of rigid weight thresholds for ASD closure in infants.

Limitations & future directions

Retrospective design and absence of a control group limit definitive conclusions. Lack of long-term follow-up beyond one year restricts insights into device integrity and late complications. Standardized guidelines for device selection, especially regarding rim assessment and device sizing in small hearts, are needed.

Further prospective, multicenter studies with longer follow-up and larger sample sizes are essential to establish best practices in this evolving field.

Conclusion

Trans-catheter ASD closure in symptomatic children weighing ≤ 10 kg, once considered a high-risk endeavor, is emerging as a safe and effective therapeutic option when guided by meticulous anatomical assessment, individualized device sizing, and the use of refined deployment techniques. This approach could significantly reduce morbidity and hospitalization burden in this vulnerable population, especially in resource-limited settings.

Acknowledgement

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Conflict of interest

There is no conflict of interest.

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