

A Hidden Scar, A Visible Cure: Minimally Invasive Repair of ASD and Pulmonary Stenosis Without Femoral Bypass

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ABSTRACT

Introduction: Atrial septal defect (ASD) with concurrent pulmonary stenosis (PS) is a rare congenital cardiac anomaly that presents functional and cosmetic challenges, especially in young female patients. Traditional surgical approaches via median sternotomy, while effective, may result in significant scarring and longer recovery times. Minimally invasive techniques have emerged as a preferred alternative, offering reduced morbidity and improved aesthetic outcomes.

Case Presentation: A 20-year-old female presented with a large secundum ASD and severe valvular pulmonary stenosis. Due to her age and cosmetic concerns, she underwent surgical repair via a right anterolateral mini-thoracotomy using a 3-inch submammary incision. Cardiopulmonary bypass was established through conventional central aorto-caval cannulation, avoiding femoral access. The ASD was closed with a Dacron patch, and pulmonary valvotomy was performed through the right ventricular outflow tract and pulmonary artery. The procedure was completed without complications, and the patient had an uneventful recovery with excellent cosmetic and functional outcomes.

Conclusion: This case highlights the feasibility, safety, and advantages of combining central cannulation with a minimally invasive mini-thoracotomy approach in the surgical correction of complex congenital heart defects. It offers a resource-efficient, cosmetically superior alternative to sternotomy, especially suited for young female patients and low-resource settings.

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Introduction

Atrial septal defect (ASD) is one of the most common congenital heart diseases

encountered in adults, accounting for approximately 10% of all congenital cardiac anomalies. Secundum ASD is the

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predominant subtype and is frequently associated with left-to-right shunting, leading to right atrial and ventricular volume overload, pulmonary overcirculation, and eventual development of pulmonary hypertension if left untreated (1). Pulmonary stenosis (PS), although less commonly associated with ASD, presents a unique hemodynamic challenge by altering right ventricular loading conditions and complicating surgical management.

Surgical closure of ASD has evolved significantly since the first successful repairs in the early 1950s. Median sternotomy with cardiopulmonary bypass (CPB) using central aorto-caval cannulation has long been regarded as the gold standard, offering excellent exposure and reliable outcomes (1). However, despite its effectiveness, sternotomy is associated with drawbacks such as increased postoperative pain, longer recovery times, risk of sternal complications, and permanent visible scarring—issues that are particularly relevant in young female patients (2,3).

In response to these concerns, minimally invasive cardiac surgery (MICS) techniques have gained increasing acceptance over the past three decades. Right anterolateral thoracotomy (RALT) has emerged as a well-established alternative for ASD closure, providing comparable surgical outcomes while significantly improving cosmetic results and patient satisfaction (3,4). Several studies have demonstrated that RALT offers reduced surgical trauma, shorter hospital stay, and faster return to normal activities when compared with conventional sternotomy (3,4).

Most minimally invasive ASD repairs performed via thoracotomy rely on peripheral femoro-femoral cannulation to establish CPB. While effective, this approach is not without limitations, including risks of limb ischemia, vascular injury, lymphocele formation, and wound infection, as well as the need for additional surgical expertise and equipment (5,6,7). These limitations are particularly relevant in low-resource settings, where access to specialized cannulation devices and vascular closure systems may be restricted.

Conventional central cannulation, on the other hand, remains the most familiar and

reliable method for establishing CPB, ensuring optimal venous drainage and myocardial protection. Its application through a minimally invasive thoracotomy approach has been less frequently reported, especially in patients with combined intracardiac and outflow tract pathology such as ASD with severe pulmonary stenosis. Demonstrating the feasibility of central cannulation through a limited thoracotomy incision may help bridge the gap between traditional surgical principles and modern minimally invasive expectations.

In this report, we describe the successful repair of a large secundum ASD with concomitant severe valvular pulmonary stenosis using a right anterolateral mini-thoracotomy approach with conventional central aorto-caval cannulation. This case highlights a resource-efficient, cosmetically superior, and reproducible strategy that may be particularly advantageous for young female patients and centers operating in low- and middle-income settings.

Case Presentation

A 20-year-old female presented with progressive exertional dyspnea and easy fatigability. Transthoracic echocardiography revealed a large secundum ASD with a significant left-to-right shunt and severe valvular pulmonary stenosis. Cardiac catheterization confirmed normal coronary anatomy and gradient across the pulmonary valve (Figure 1).

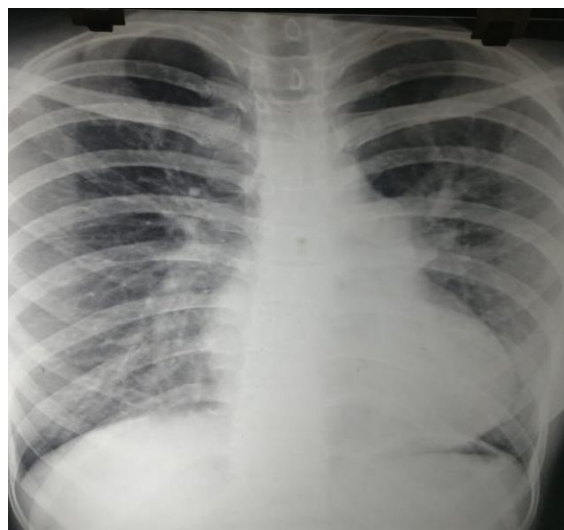


Figure 1. Pre-Operative X-ray Chest.

Surgical Strategy

Given the patient's young age, gender, and preference for a cosmetically hidden incision, we opted for a right anterolateral mini-thoracotomy with central cannulation—eschewing the more common femoro-femoral bypass.

Intraoperative Technique:

- **Positioning:** Supine with a 30–45° elevation of the right hemithorax.
- **Incision:** 3-inch submammary, right anterolateral thoracotomy through the third intercostal space.
- **Exposure:** Pericardiotomy 2 cm anterior to the right phrenic nerve; Superior Vena Cava (SVC), Inferior Vena Cava (IVC), and ascending aorta exposed and looped.
- **Cannulation:** Conventional aorto-caval cannulation using standard purse-string sutures and careful aortic handling.
- **Repair:**
 - Pulmonary valvotomy performed via pulmonary arteriotomy and Right Ventricular Outflow Tract approach. (Figure 2)

- ASD closure using a Dacron patch via right atriotomy. (Figure 3)

- **Bypass and Recovery:**

- Cross-clamp time: 38 minutes
- CPB time: 65 minutes
- Extubated 6 hours post-op
- Chest drainage: 100 mL
- Discharged on postoperative day 5

The patient had an uneventful postoperative course, no conduction disturbances, and a well-hidden cosmetic scar with high satisfaction.

Discussion

The surgical correction of ASD has evolved significantly since its inception in the early 1950s (1,4). Today, the emphasis has shifted towards minimally invasive methods that prioritize both outcomes and aesthetics, especially in young women (2,3,5).

Several studies have validated the safety of RALT in ASD closure (4,6). However, most rely on femoro-femoral bypass, which introduces risks such as limb ischemia, lymphocele, and infection (5,7). Our approach adapts standard aorto-caval cannulation to a minimally invasive setting, ensuring full myocardial protection and optimal exposure without additional risk or specialized equipment.



Figure 2. Intra operative Pulmonary valvotomy followed by hegar dilator for sizing in situ.

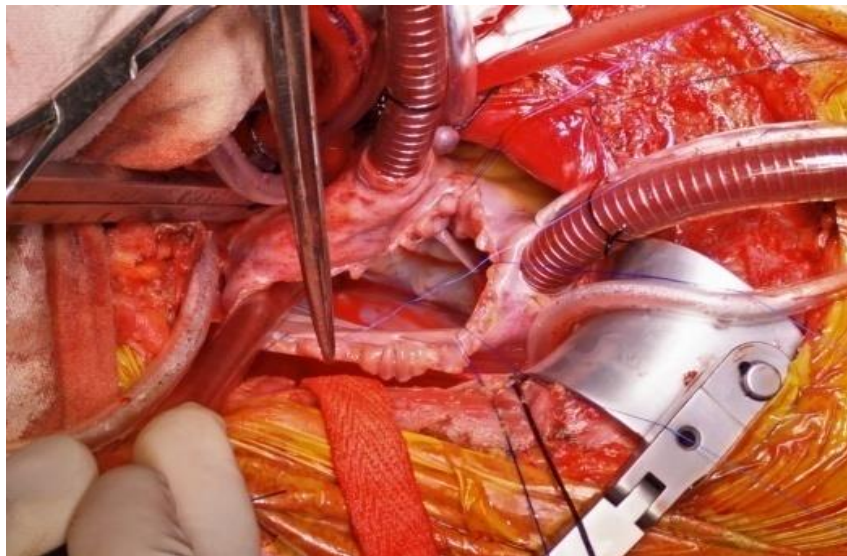


Figure 3. Intra operative ASD closure.

This strategy also eliminates the need for complex groin access or vascular closure devices, making it more accessible in resource-limited settings. Importantly, the small submammary incision offers superior cosmetic results and less postoperative discomfort (6,7).

Conclusion

This case underscores that minimally invasive intracardiac repair via right anterolateral thoracotomy using conventional central cannulation is not only feasible but also offers significant benefits:

- Avoids sternotomy and groin complications
- Offers rapid recovery and reduced hospitalization
- Provides excellent cosmetic outcomes

Such approaches bridge the gap between surgical tradition and modern expectations, providing functional correction without visible scars.

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Declaration

Ethical Approval and Informed Consent

The Institutional Review Board (IRB) or equivalent ethics committee of the GCS

Medical College, hospital and research centre, research approval not applicable as this is a case report/study.

Competing Interests

The author declared no potential competing interests with respect to the research, authorship, and/or publication of this article.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Patient Consent Information

The patient provided informed written consent for the publication of the study data.

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