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CASE REPORT

End-to-End Resection for Neonatal Aortic Coarctation with Severe Left Ventricular Dysfunction and Large Ventricular Septal Defect: A Case Report in a 23-Day-Old Infant

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Abstract: Coarctation of the aorta (CoA) may occur alone or in association with other congenital heart defects, including ventricular septal defect (VSD). The coexistence of CoA with a large VSD and decreased left ventricular ejection fraction (LVEF) in neonates is uncommon and presents significant diagnostic and therapeutic challenges. We report the case of a 23-day-old female infant who presented with acute respiratory distress and was found to have CoA, a large membranous VSD, severe pulmonary hypertension, and markedly decreased LVEF. The patient underwent urgent surgical repair consisting of end-to-end CoA resection and pulmonary artery banding. Postoperatively, she demonstrated rapid hemodynamic improvement and recovery of ventricular function. This case highlights the importance of early recognition and timely surgical intervention in neonates presenting with complex CoA physiology and severe ventricular dysfunction.

Keywords: coarctation of aorta, ventricular septal defect, low ejection fraction

Introduction

Coarctation of the aorta is a prevalent condition observed in individuals with congenital heart disease.[1] It is characterized by a constriction at the isthmus of the aorta. The estimated global incidence of CoA is 3 cases per 10,000 live births.[1] Ventricular septal defect is the most frequently encountered anomaly, which can manifest as an isolated condition or co-occur with other malformations like tetralogy of Fallot, double outlet right ventricle, and common arterial trunk.[2] It is uncommon for CoA to be associated with a reduced left ventricular ejection fraction (LVEF) in neonates.[3] Severe CoA increases left ventricular afterload, while a large VSD causes excessive pulmonary over circulation; together, these mechanisms can rapidly depress ventricular function in early life.[2,3] The resulting decreased LVEF may obscure the hemodynamic contribution of each lesion, complicating clinical assessment and urgent decision-making.[4] Critical and complex congenital heart diseases should be diagnosed as early as possible, as timely emergency surgery is both effective and feasible.[5] Several surgical strategies have been described for managing neonatal coarctation, including single-stage repair, staged repair with pulmonary artery banding, or isolated coarctation repair with delayed closure of associated defects, with the choice depending on anatomical complexity and ventricular function.[4] What makes the present case unique is the severity of ventricular dysfunction at presentation and the decision to perform CoA repair combined with PAB in a 23-day-old neonate, a strategy typically reserved for older infants. This report highlights the clinical reasoning behind this approach and its favorable outcome.

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Case Presentation

A 23-day-old Syrian female neonate, with a birth weight of 2700g, was born at 37 weeks of gestation through a spontaneous vaginal delivery. The APGAR SCORE was 7 at the initial minute and remained 7 after a duration of 5 minutes. The patient exhibited signs of lethargy and feeding intolerance shortly after birth. She presented with acute respiratory distress for the first time. As a result, she was transferred to the emergency unit due to high-flow oxygen requirements.

During the physical examination, the patient exhibited tachypnea RR= 48 and apnea SPO2= 70, palpation revealed tachycardia HR= 170, and the femoral pulse was absent. Auscultation disclosed a grade 3/6 systolic ejection murmur at the left lower sternal border. Blood pressure measured in both upper limbs was 60\30 mmHg, while it was unmeasurable in both lower limbs. A chest X-ray showed cardiomegaly.

A two-dimensional echocardiogram demonstrated coarctation at the outlet of the descending thoracic aorta, after the left subclavian artery branching, the aortic diameter measured 2.5mm, and based on the Z-SCORE was calculated as −5 and severe left ventricular dysfunction, with an ejection fraction of 35%. Additionally, a large membranous VSD was identified, along with severe pulmonary hypertension and a closed ductus arteriosus (Figure 1). Computed tomography imaging demonstrated findings consistent with those observed on echocardiography (Figure 2). The diagnosis relied on the prior radiological findings.

According to the patient's medical status, emergency surgery was deemed necessary. The patient was admitted to the intensive care unit for preoperative preparation for surgery the following day. Prepared using Forsmaid and oxygen support. During the procedure, she positioned with her left side raised 60° from the table, and she underwent a single-stage surgery. During a left lateral incision, the descending thoracic aorta was accessed. The procedure was performed without the use of left ventricular bypass or circulation extracorporeal; therefore, a clamp was applied to the aorta. The CoA was repaired by resecting the stenosis and performing an end-to-end anastomosis with continuous stitches using 5–0 prolene suture. Subsequently, the pericardium was incised 1 cm in front of the phrenic nerve to expose the pulmonary trunk, and a pulmonary artery was banded with Dacron mesh to safeguard the pulmonary tree from elevated pulmonary

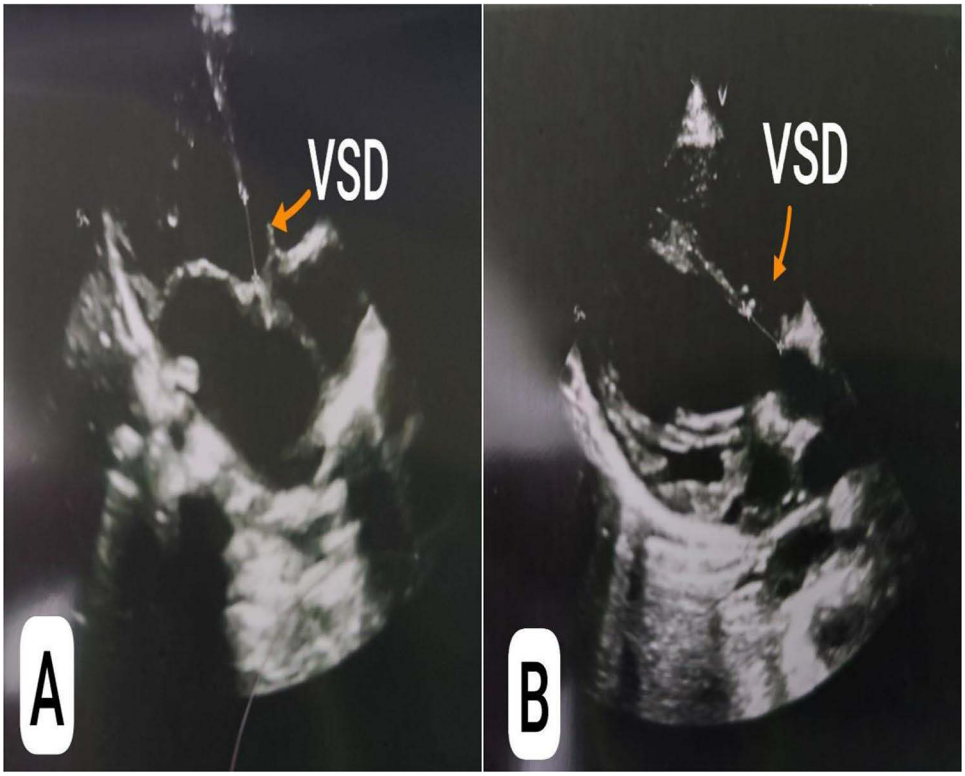

Figure 1 (**A** and **B**) A two-dimensional echocardiogram demonstrated a large membranous VSD, along with severe pulmonary hypertension and a closed ductus arteriosus.

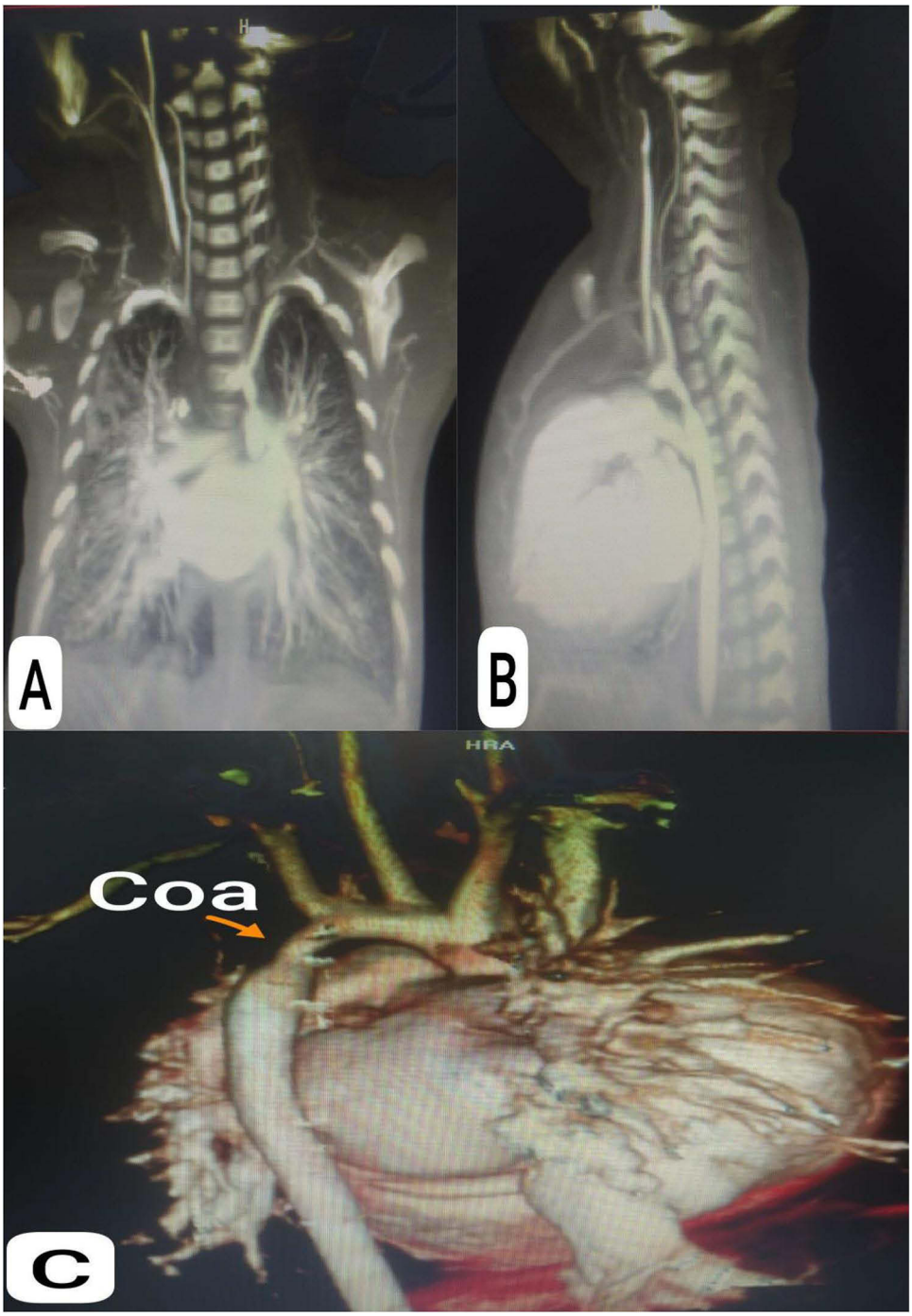

Figure 2 (**A** and **B**) Computed tomography angiography demonstrating a large membranous VSD and coarctation at the outlet of the descending thoracic aorta. (**C**) high-resolution MSCT images demonstrating a combination of congenital anomalies.

pressure. The decision to perform pulmonary artery banding (PAB) in addition to coarctation repair was based on the patient's severe pulmonary overcirculation, markedly decreased LVEF, and the need to avoid cardiopulmonary bypass in our resource-limited setting. Postoperatively, the patient remained hemodynamically stable and was discharged on the 6th postoperative day at the age of one month. Follow-up echocardiography performed one month after surgery demonstrated no residual coarctation, normalization of left ventricular function, and a significant reduction in pulmonary arterial pressure.

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Discussion

CoA is rarely associated with a decreased left ventricular ejection fraction (LVEF). Recent studies have examined a cohort of 180 children under the age of 6 months were diagnosed with CoA, revealing that only 11% of these cases displayed an EF below 40%.[3] In an evaluation study of 1448 patients with VSD, CoA was found in only 1.5%.[6] Therefore, the combination of CoA, VSD, and decreased LVEF is rare.[3,6] Rarely, CoA presents symptomatically if the patent ductus arteriosus does not close, as it has been reported that the afterload mismatch is the etiology of decreased LVEF.[7] If CoA is present alongside a decreased LVEF, it is crucial for the patient to undergo an emergency surgical procedure. Postponing the intervention may lead to develop complications that can negatively impact the ventricle's ability to regain its normal function and size.[8] The coexistence of CoA, a large VSD, and markedly decreased LVEF has been described only in a limited number of recent reports, underscoring the rarity of this presentation. Maeda et al reported a premature infant with CoA and VSD who required a staged hybrid approach, illustrating how anatomical variability, ventricular function, and institutional resources influence decision-making.[9] Compared with their case, our patient presented at an earlier age with more profound ventricular dysfunction, necessitating urgent intervention to prevent irreversible myocardial injury. Multiple surgical strategies have been proposed for managing CoA associated with VSD, including single-stage repair, staged repair with pulmonary artery banding (PAB), hybrid interventions, and isolated CoA repair followed by delayed VSD closure. Recent analyses emphasize that the optimal approach should be individualized based on ventricular function, the size of the VSD, and the availability of cardiopulmonary bypass.[10,11] Current guidelines similarly highlight the importance of tailoring the surgical plan to the patient's hemodynamic stability and the capabilities of the treating center.[12] In resource-limited settings where cardiopulmonary bypass is not readily available, staged repair with PAB remains a practical and effective option. This strategy reduces pulmonary over-circulation, stabilizes hemodynamics, and allows time for ventricular recovery before definitive VSD closure.[4] Our decision to perform CoA repair combined with PAB in a 23-day-old neonate aligns with these principles and reflects an individualized approach adapted to both the patient's condition and the institutional context. The rapid postoperative improvement in ventricular function observed in our patient is consistent with recent evidence demonstrating that early surgical intervention can facilitate myocardial recovery and reduce postoperative morbidity in neonates with CoA and ventricular dysfunction.[3,10] This case adds to the growing body of literature supporting timely CoA repair with PAB as a safe and effective strategy when immediate VSD closure is not feasible. What sets our case apart is that we performed PAB on a newborn at the age of 23 days, although it is more common to do this between 2 and 3 months of age.[13] According to the latest recommendations, PAB has shown great benefit in cardiac malformations with the risk of premature mortality due to unstable pulmonary vascular resistance in newborns.[14]

Conclusion

This case illustrates that early recognition of coarctation of the aorta with a large ventricular septal defect and severe left ventricular dysfunction is essential for preventing irreversible myocardial injury. Our patient underwent surgical repair within hours of presentation, and the rapid postoperative recovery demonstrates that timely intervention can restore ventricular function even in critically ill neonates. These findings support the importance of prompt evaluation and immediate surgical decision-making in similar complex presentations.

Abbreviations

CHD, Congenital heart disease; CoA, Coarctation of the aorta; CTA, Computed tomography angiography; ICU, Intensive care unit; LVEF, Left ventricular ejection fraction; MSCT, Multislice computed tomography; PAB, Pulmonary artery banding; $SatO_2$, Oxygen saturation; VSD, Ventricular septal defect.

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

This study is exempt from ethical approval in our institution.

Consent for Publication

Written informed consent was obtained from the parents for publication of this case report and accompanying images.

Disclosure

The authors declare that they have no conflicts of interest to disclose for this work.

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