Bangabandhu Sheikh Mujib Medical University Journal 2026;19(1):e82540
ISSN 2074-2908 | eISSN 2224-7750 |

CASE REPORT

Surgical correction of adult coarctation of aorta using extra-anatomic ascending-to-descending aortic bypass: A case report

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Abstract

Background: Coarctation of the aorta (CoA) is a congenital narrowing of the aortic lumen, usually diagnosed in childhood. Adult presentation is uncommon and often associated with hypertension, extensive collateral circulation, and complex vascular anatomy, making conventional repair challenging.

Case description and management: We report a 21-year-old man (body mass index, 21 kg/m^2) with a 6 -month history of headache and palpitations. He had severe hypertension, tachycardia, diminished femoral pulses, and a systolic murmur, but no hypertensive target-organ damage or secondary causes. Transthoracic echocardiography and computed tomography angiography confirmed severe CoA distal to the left subclavian artery, a patent ductus arteriosus, post-stenotic dilatation, and a bicuspid aortic valve. Preoperative antihypertensive therapy was initiated. The patient underwent off-pump extra-anatomic ascending-to-descending aortic bypass with patent ductus arteriosus ligation via median sternotomy and left anterior thoracotomy. Cardiopulmonary bypass was kept on standby, and distal perfusion was maintained throughout the procedure. Postoperatively, antihypertensive therapy was titrated according to upper-limb blood pressure, renal function, and lower-limb perfusion. Echocardiography at one-month follow-up confirmed a functioning graft, a peak gradient of 10 mmHg, and no residual shunt th follow-up echocardiography confirmed a functioning graft, peak gradient of 10 mmHg, and no residual shunt.

Conclusion: Extra-anatomic aortic bypass is a safe and effective alternative for adults with CoA and complex anatomy, minimising surgical risk while providing durable relief. This case highlights the feasibility of surgical correction and favourable outcomes in adults presenting with CoA.

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Publication history
Received: 26 June 2025
Accepted: 10 Jan 2026
Published online: 17 Feb 2026

Responsible editor
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E: Md. Fakhrul Islam Khaled
0000-0002-1003-6598
I: Mainul Mahmud
0009-0003-3502-2701

Keywords
coarctation of aorta, adult, extra-anatomic bypass

Ethical approval
Ethical approval was not sought because this is a case report. However, written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Funding
None

Trial registration number
Not applicable

Key messages

Untreated adult coarctation of the aorta is rare and often presents late with systemic hypertension or heart failure. Surgical correction using an extra-anatomic ascending-to- descending aortic bypass provides a safe and effective alternative when standard anatomical repair is not feasible. Timely diagnosis and tailored surgical planning are essential to ensure optimal outcomes.

Introduction

Coarctation of the aorta (CoA) is a congenital vascular anomaly characterised by narrowing of the aortic lumen, typically located near the ligamentum arteriosum, just distal to the left subclavian artery. It accounts for approximately 5–8% of all congenital heart diseases. While most cases of CoA are diagnosed in infancy or childhood, many remain undetected until adulthood, especially in resource-limited settings. In Bangladesh, adult CoA is often detected incidentally during evaluation for resistant hypertension or cardiovascular complications. Without treatment, most patients die before the age of 50, with an average survival of 35 years [1]. Hence, early repair of the anomaly is crucial to prevent irreversible vascular and cardiac changes [2].

Since the 1940s, surgical resection with end-to-end anastomosis has remained the standard in children and adolescents. In adults, long-standing hypertension often causes a thickened, rigid, calcified aorta with extensive collateral circulation and reduced mobility. In such cases, extra-anatomic bypass grafting is preferred [3]. Although endovascular stenting has emerged as an effective alternative, it may be unsuitable in cases with complex anatomy, associated patent ductus arteriosus (PDA), long-segment narrowing, or unfavourable landing zones.

Extra-anatomic bypass grafting diverts blood flow through the prosthetic conduit, minimising dissection of the diseased aorta and collaterals while providing durable relief of obstruction. In our patient, adult-onset coarctation with patent ductus arteriosus, long-standing hypertension, and unfavourable anatomy made anatomical repair and stenting unsuitable. Therefore, extra-anatomic bypass was the preferred surgical approach.

Case description and management

We report a 21-year-old man (body mass index, 21 kg/m^2) presenting with a 6-month history of headache and palpitations. He had hypertension (upper-limb blood pressure, 180/120 mmHg bilaterally), tachycardia (heart rate, 120 bpm), a grade 3/6 systolic murmur over the thoracic spine radiating to the subclavicular region, and absent femoral pulses. His renal function test was normal. He had no target-organ damage due to hypertension or any secondary causes of hypertension (as indicated by normal plasma renin, aldosterone, and thyroid function tests).

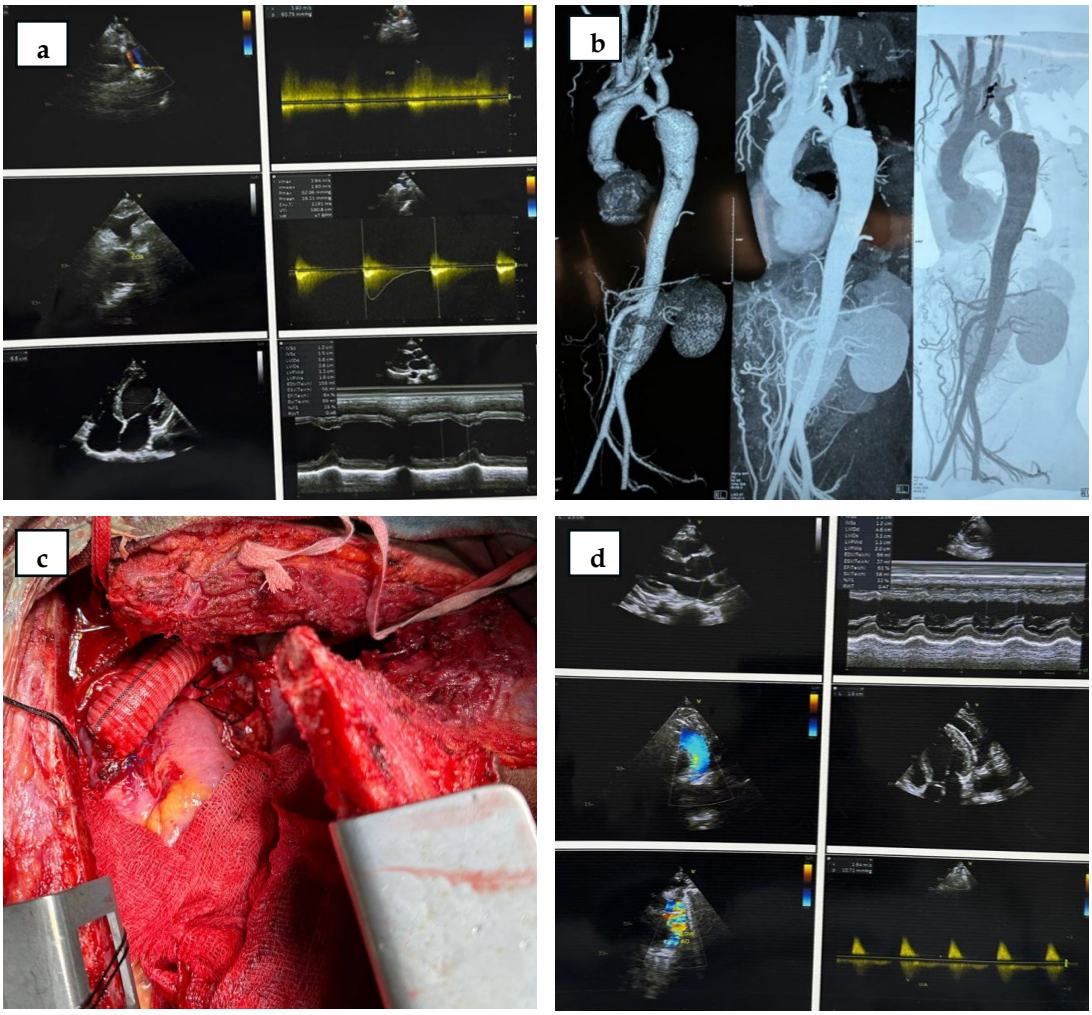

Figure 1 a) Preoperative transthoracic echocardiogram showing severe coarctation of the aorta distal to the left subclavian artery with a peak gradient of 62 mmHg and a mean gradient of 16.3 mmHg, b) Preoperative computed tomography angiogram revealed post-stenotic dilatation of the descending thoracic aorta (4.1 cm * 3.8 cm) without thrombus, c) Extra-anatomic ascending-to-descending aortic bypass using polytetrafluoroethylene vascular graft, d) Postoperative transthoracic echocardiogram showing a functioning graft with a peak gradient of 10 mmHg and successful patent ductus arteriosus ligation with no residual shunt.

Transthoracic echocardiography showed severe CoA distal to the left subclavian artery with a peak gradient of 62 mmHg and a mean gradient of 16.3 mmHg. Patent ductus arteriosus with continuous left-to-right shunt was noted, alongside a bicuspid aortic valve, mild left ventricular hypertrophy, and pulmonary artery systolic pressure of 35 mmHg (Figure 1a). Computed tomography angiogram revealed post-stenotic dilatation of the descending thoracic aorta (4.1 cm ´ 3.8 cm) without thrombus. The abdominal aorta measured 19.1 mm in diameter, with its branches normal in course and calibre (Figure 1b). The patient was managed preoperatively with metoprolol 50 mg twice daily and prazosin 2 mg thrice daily to maintain systolic blood pressure below 140 mmHg.

The procedure was performed via median sternotomy combined with a left anterior thoracotomy at the second intercostal space. The left internal mammary artery was divided to improve exposure. A tight 2 cm coarctation was observed just distal to the left subclavian artery, with thinning and post-stenotic dilatation of the descending aorta. The patent ductus arteriosus was initially ligated with number 1 silk.

After systemic heparinisation, the descending thoracic aorta was partially clamped with a satinsky side clamp to ensure distal perfusion. A longitudinal aortotomy was performed, and a 16 mm polytetrafluoroethylene vascular graft was anastomosed end-to-side to the descending aorta using a running 4-0 polypropylene suture. Subsequently, the ascending aorta was incised on its anterior wall after application of a side clamp, and the graft was anastomosed end-to-side (Figure 1c). Hemostasis was ensured, and the graft was de-aired before completion. Cardiopulmonary bypass was kept on standby, and distal perfusion pressure monitoring was not required as distal flow was maintained.

Postoperatively, antihypertensive therapy was guided by upper-limb blood pressure, renal function, and lower-limb perfusion. Metoprolol was tapered, and prazosin and other vasodilators were gradually adjusted to avoid hypotension and rebound hypertension. Echocardiography at one-month follow-up confirmed a functioning graft with a peak gradient of 10 mmHg and successful patent ductus arteriosus ligation without residual shunt (Figure 1d).

Discussion

Late presentation of CoA in adulthood is uncommon, often due to missed childhood diagnoses or residual lesions post-intervention [4]. Adults may develop extensive collateral circulation, which obscures classic signs and delays diagnosis. CoA is often identified during the evaluation of systemic hypertension, particularly when there is a pulse or blood pressure discrepancy between the upper and lower limbs. While some patients remain asymptomatic, others may report headaches, leg fatigue, or claudication. Physical findings—such as diminished femoral pulses or inter-limb blood pressure differences—should prompt further evaluation. Computed tomography or magnetic resonance imaging is essential for diagnosis and treatment planning.

According to the 2020 European Society of Cardiology guidelines [5] intervention is indicated in hypertensive patients with a non-invasive pressure gradient>20 mmHg, confirmed invasively, or in asymptomatic individuals with persistent hypertension, abnormal exercise response, or significant left ventricular hypertrophy. Surgical options include resection with end-to-end anastomosis, commonly used in infants, or extended anastomosis for arch hypoplasia. Subclavian flap aortoplasty, though less commonly used because of higher risks of recoarctation and limb ischaemia, remains an option. Interposition grafting is suitable when direct anastomosis is not feasible. Patch aortoplasty has fallen out of favour due to the risk of late aneurysm [6].

Endovascular stenting was avoided because of the interrupted aortic arch anatomy and unfavourable landing zones. In adults with complex or calcified vessels, off-pump extra-anatomic aortic bypass is a safe alternative that minimises dissection and cardiopulmonary bypass, maintains distal perfusion, and reduces spinal or renal ischaemia. Favourable postoperative outcomes, low mortality, significant reduction in blood pressure, and low rates of graft-related complications have been reported in adults undergoing this procedure [7, 8].

Although mortality is generally low, potential complications include postoperative hypertension, nerve injuries (recurrent laryngeal or phrenic), subclavian steal syndrome, spinal cord ischaemia, and late aortic dissection. Closure of the patent ductus arteriosus is essential to prevent left-to-right shunting and pulmonary hypertension. Lifelong follow-up is recommended to monitor for late complications and ensure optimal long-term outcomes [9].

This case highlights the successful surgical management of adult CoA with an extra-anatomic ascending-to-descending aortic bypass. Given the challenges of late presentation and complex anatomy, this technique offers a safe and effective alternative to conventional repair. Given the limited literature on this approach, this case provides valuable insight into its feasibility and outcomes.

Acknowledgements

We acknowledge the contributions of the entire operating team, whose coordination and expertise were instrumental in the successful management of this case. We also sincerely thank the patient and their family for their trust and consent to share this case for academic purposes.

Author contributions

Manuscript drafting and revising it critically: SB, OSK, RH. *Approval of the final version of the manuscript:* SB, OSK, RH, SH, MNI. *Guarantor accuracy and integrity of the work*: SB, OSK, RH, SH, MNI .

Conflict of interest

We do not have any conflict of interest.

Data availability statement

We confirm that the data supporting the findings of the study will be shared upon reasonable request.

AI disclosure

None

Supplementary file

None

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