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Single-Stage Extra-Anatomic Repair of Adult Aortic Coarctation With a Giant Right Subclavian Artery Aneurysm: A Case Report

Shivprasasd Shetty, Rajendra Umbarakar, Nigar khan,

Asmita Hegde Department of cardiovascular thoracic surgery bombay hospital 12, vitthaldas thackersay marg new marine lines 400020, Mumbai . E-mail:- dr.shiv13@gmail.com

Abstract

Background

Coarctation of the aorta is a congenital narrowing of the thoracic aorta accounting for approximately 5–8% of congenital heart defects. Although most patients are diagnosed during infancy or childhood, delayed presentation into adulthood is uncommon. The coexistence of untreated native aortic coarctation with a giant right subclavian artery aneurysm is exceptionally rare and presents significant diagnostic and surgical challenges.

Case Presentation

A 43-year-old male presented with progressive right-sided neck swelling, intermittent chest pain, and recurrent headaches. Transthoracic echocardiography demonstrated preserved left ventricular systolic function (LVEF 55%), mild concentric left ventricular hypertrophy, mild aortic regurgitation, and turbulent flow in the right subclavian artery with a peak Doppler gradient of 40 mmHg. Continuous flow within the abdominal aorta suggested extensive collateral circulation secondary to severe proximal aortic obstruction.

Computed tomography angiography demonstrated a short-segment severe coarctation located approximately 5 mm distal to the origin of the left common carotid artery near the origin of the left subclavian artery. In addition, a giant fusiform aneurysm of the right subclavian artery measuring approximately 4.5 cm in maximum diameter and extending for 3 cm was identified. Extensive collateral circulation through the right internal thoracic, thyrocervical, costocervical, and intercostal arteries was evident.

The patient underwent successful single-stage surgical correction through a median sternotomy under cardiopulmonary bypass. An ascending-to-descending thoracic aortic bypass was constructed using a 16-mm Dacron graft, followed by reconstruction of the right subclavian artery using an 8-mm Dacron graft after exclusion of the aneurysm. Left subclavian artery bypass grafting was done from primary graft to the proximal part of the subclavian artery. The postoperative course was uneventful.

Conclusion

Adult native aortic coarctation associated with a giant right subclavian artery aneurysm is an exceptionally rare vascular entity. Comprehensive multimodality imaging and individualized

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surgical planning allowed successful single-stage repair with satisfactory early clinical outcome.

Keywords: Coarctation of aorta, Subclavian artery aneurysm, Adult congenital heart disease, Dacron graft, Extra-anatomic bypass, Cardiothoracic surgery

Introduction

Coarctation of the aorta is a congenital narrowing of the thoracic aorta, accounting for approximately 5–8% of congenital heart defects. The lesion is typically located adjacent to the ductus arteriosus and is usually diagnosed during infancy or childhood. Untreated severe coarctation may lead to systemic hypertension, left ventricular hypertrophy, premature coronary artery disease, heart failure, intracranial aneurysms, and sudden cardiac death (1).

With advances in diagnosis and early intervention, adult presentation of untreated native coarctation has become increasingly uncommon (2). Survival into adulthood may be facilitated by the development of extensive collateral arterial circulation capable of maintaining distal systemic perfusion (3).

Subclavian artery aneurysms are rare vascular lesions and may cause serious compressive, thromboembolic, or rupture-related complications (4,5). Their association with native coarctation of the aorta is exceedingly uncommon and has only been sporadically reported, including rare right subclavian artery aneurysms (6,7). The coexistence of these lesions presents unique anatomical and surgical challenges requiring individualized operative planning.

We report a rare case of adult native aortic coarctation associated with a giant right subclavian artery aneurysm, successfully managed by single-stage ascending-to-descending thoracic aortic bypass with simultaneous subclavian arterial reconstruction.

Routine laboratory investigations were unremarkable.

Echocardiographic Findings

Transthoracic echocardiography demonstrated structurally normal cardiac chambers with preserved left ventricular systolic function (LVEF 55%). Mild concentric left ventricular hypertrophy was present. Mild aortic regurgitation with trivial mitral and tricuspid regurgitation was noted. Right ventricular function was normal, and no intracardiac shunt, thrombus, vegetation, or pericardial effusion was identified.

Color Doppler examination demonstrated turbulent flow within the right subclavian artery with a peak pressure gradient of 40 mmHg. The proximal descending thoracic aorta could not be visualized. Continuous non-pulsatile flow within the abdominal aorta suggested severe proximal thoracic aortic obstruction supplied predominantly through collateral circulation.

Computed Tomography Angiography

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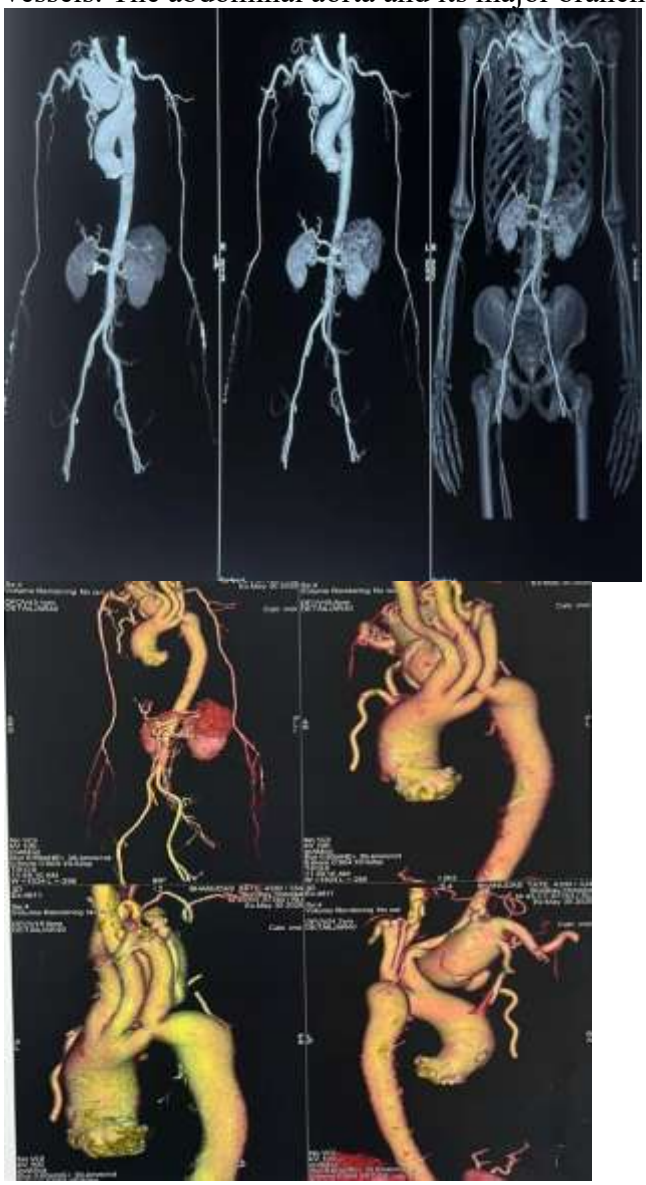
Computed tomography angiography demonstrated a short-segment severe narrowing of the aortic arch approximately 5 mm distal to the left common carotid artery near the origin of the left subclavian artery, consistent with native aortic coarctation.

The ascending aorta demonstrated mild fusiform dilatation.

A giant fusiform aneurysm of the right subclavian artery measuring approximately 4.5 cm in maximum diameter and extending over 3 cm was identified beyond its origin. A focal ulceration was present along the inferior aspect of the aneurysm without evidence of intraluminal thrombus.

The aneurysm produced significant mass effect with displacement of the trachea and mediastinal vascular structures.

Extensive collateral circulation was observed involving the right internal thoracic artery, thyrocervical trunk, costocervical trunk, upper intercostal arteries, and anterior chest wall vessels. The abdominal aorta and its major branches appeared normal.



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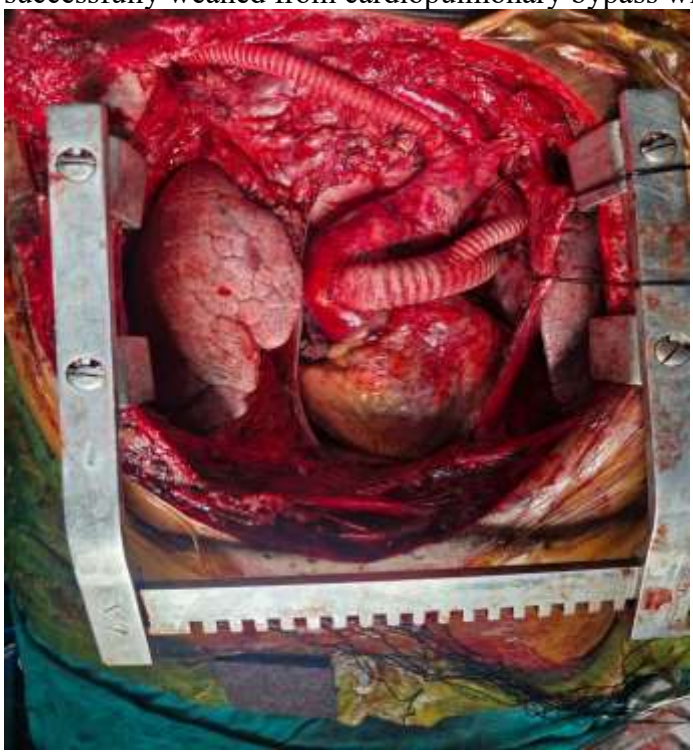
Surgical Technique

Following induction of general anaesthesia, a median sternotomy was performed.

After systemic heparinization, cardiopulmonary bypass was established using ascending aortic cannulation and two-stage venous cannulation. An extra-anatomic ascending-to-descending thoracic aortic bypass was constructed using a 16-mm Dacron graft. The proximal anastomosis was fashioned to the ascending aorta using continuous 4-0 polypropylene suture, while the distal anastomosis was completed beyond the coarctation segment on the descending thoracic aorta. Subsequently, an 8-mm Dacron graft was anastomosed from the primary bypass graft to reconstruct the left subclavian artery.

The right subclavian artery proximally was ligated and the aneurysm was opened, decompressed, and excluded from the circulation by ligating the distal part of subclavian artery. Reconstruction of the proximal part by end to end anastomosis, 8mm dacron graft using continuous 7-0 Prolene sutures and distal right subclavian artery end to side anastomosis was done using continuous 7-0 polypropylene sutures. The patient was successfully weaned from cardiopulmonary bypass with satisfactory hemodynamic stability.



Discussion

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Adult presentation of untreated native coarctation remains an uncommon clinical entity (2). Long-term survival in severe coarctation may depend substantially on the development of extensive collateral circulation capable of maintaining distal perfusion despite anatomical obstruction (3,8).

The present patient demonstrated remarkable enlargement of the internal thoracic, thyrocervical, costocervical, and intercostal arteries, producing extensive collateral perfusion. The continuous Doppler flow within the abdominal aorta observed on echocardiography further reflected long-standing collateral-dependent distal circulation.

The coexistence of a giant right subclavian artery aneurysm represents an exceptionally rare vascular abnormality in patients with coarctation (6). Chronic exposure to elevated proximal arterial pressure together with abnormal flow dynamics may contribute to progressive aneurysmal degeneration (9). Such aneurysms carry clinically important risks, including rupture, thromboembolism, and compression of adjacent structures (4,5). Surgical management of complex adult coarctation can employ an extra-anatomic bypass strategy, particularly when direct repair is difficult or concomitant cardiovascular pathology requires treatment (10-13). In our case, an ascending-to-descending aortic bypass combined with subclavian reconstruction permitted treatment of the obstructive aortic lesion and exclusion of the aneurysm in a single operation. Single-stage strategies have also been described for adult coarctation associated with other major cardiovascular lesions (14,15). Contemporary reports support individualized surgical planning for complex and late-presenting coarctation (16,17). Long-term surveillance remains important because late complications can occur in extra-anatomic aortic grafts (18).

Although catheter-based treatment has an established role in selected adult patients with coarctation(1), thecomplex anatomy in this patient favored open surgical repair. The combination of severe native coarctation, giant aneurysmal degeneration, and extensive collateral circulation made single-stage extra-anatomic reconstruction an attractive strategy.

Ascending-to-descending thoracic aortic bypass through a median sternotomy provides an alternative to direct repair in selected adults with complex coarctation and can facilitate concomitant procedures (10-13). In the present case, subclavian arterial reconstruction maintained upper-limb perfusion while the aneurysm was excluded from the circulation.

This case highlights the importance of comprehensive preoperative imaging, multidisciplinary planning, and individualized surgical management in rare adult congenital vascular disorders. Multimodality imaging is central to defining coarctation anatomy, collateral vessels, associated aneurysms, and subsequent surveillance requirements (19,20).

Conclusion

Adult native preductal coarctation associated with a giant right subclavian artery aneurysm is an exceptionally rare vascular anomaly. Comprehensive echocardiography and computed tomography angiography were essential in defining the complex anatomy and planning surgical intervention. Single-stage ascending-to-descending thoracic aortic bypass with simultaneous right subclavian artery reconstruction provided effective treatment with satisfactory early outcome. This case emphasizes that carefully planned open surgical reconstruction remains an excellent option in selected patients with complex adult congenital aortic pathology.

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Learning Points

- Adult presentation of untreated native aortic coarctation is uncommon, and extensive collateral circulation may permit survival into adulthood (2,3).
- Right subclavian artery aneurysm is a rare but clinically significant association with coarctation of the aorta (6).
- Multimodality imaging is indispensable for defining anatomy and planning operative strategy (19,20).
- Single-stage extra-anatomic repair is a useful surgical option in selected adults with complex coarctation and associated cardiovascular lesions (10-15).

Conflict of Interest

The authors declare no conflict of interest.

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Author Contributions

All authors contributed to patient management, manuscript preparation, critical revision of the manuscript, and approval of the final version.

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