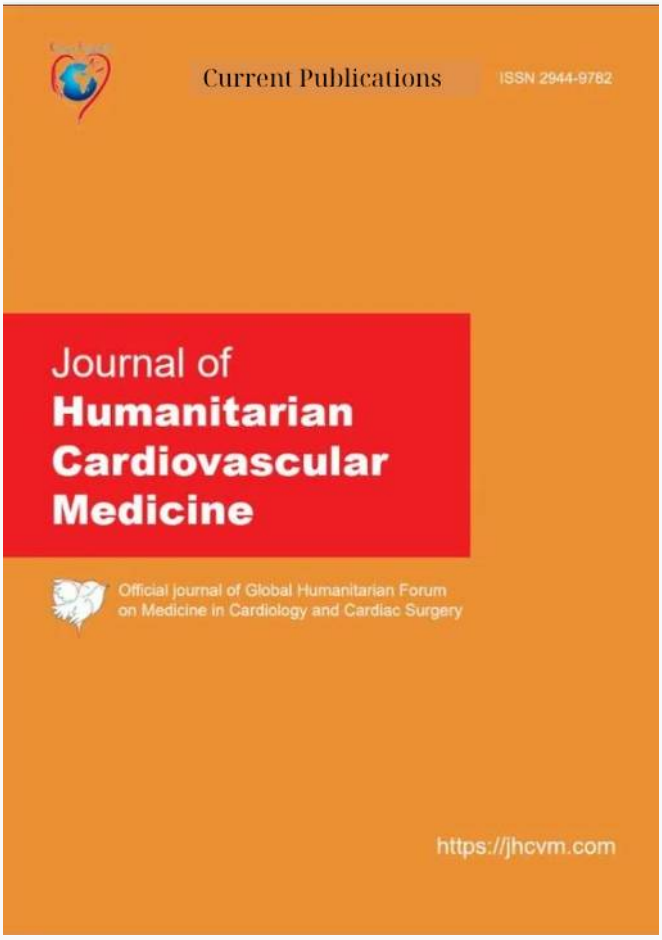
Journal of Humanitarian Cardiovascular Medicine

Vol 1, No 4 (2025)

Current Publications



Aortic Valve Replacement in a Patient With Right Coronary Artery Anomaly

Secil Cetin, Yilmaz Zorman, Doruk Yaylak, Afksendiyos Kalangos

doi: 10.12681/jhcvm.42310

To cite this article:

Cetin, S., Zorman, Y., Yaylak, D., & Kalangos, A. (2025). Aortic Valve Replacement in a Patient With Right Coronary Artery Anomaly. *Journal of Humanitarian Cardiovascular Medicine*, *1*(4). https://doi.org/10.12681/jhcvm.42310

Aortic Valve Replacement in a Patient With Right Coronary Artery Anomaly

Secil Cetin[1], Yilmaz Zorman[2], Doruk Yaylak[1], Afksendiyos Kalangos[2]

[1] Department of Anesthesia & Reanimation, Koc University Hospital, Turkey

[2] Department of Cardiovascular Surgery, Koc University Hospital, Turkey

Corresponding author
Doruk Yaylak, Koç Üniversitesi Hastanesi, Topkapı, Davutpaşa Cd. No:4, 34010 Zeytinburnu/İstanbul
Telephone: +905352445581
E-mail address: dorukyaylak@gmail.com

Keywords
Coronary artery anomaly, Aortic valve replacement, Intraoperative hemodynamic instability.

List of abbreviations
AVR Aortic valve replacement, CAA Coronary artery anomaly, RCA Right coronary artery, CABG Coronary artery bypass grafting, CPB Cardiopulmonary bypass, TEE Transesophageal Echocardiography, EF Ejection fraction, AVA Aortic valve area, CT Computed tomography, NIRS Near-infrared spectroscopy.

Abstract

Anomalous coronary arteries, though rare, may complicate cardiac surgery. We present a 75-year-old male scheduled for aortic valve replacement after incidental detection of severe aortic stenosis. Preoperative imaging revealed a right coronary artery originating from the left sinus of Valsalva, coursing between the aorta and pulmonary artery. Following implantation of a 23-mm prosthetic valve, the patient developed hypotension and right ventricular dysfunction during separation from cardiopulmonary bypass. Transesophageal echocardiography suggested prosthetic-induced coronary compression. The valve was downsized to 21 mm, and a prophylactic coronary artery bypass graft was placed. Hemodynamics stabilized, and the patient was successfully weaned from bypass and discharged uneventfully. This case highlights the critical role of preoperative imaging, intraoperative adaptability, and multidisciplinary collaboration in managing coronary anomalies during valve surgery.

Introduction

Coronary artery anomalies (CAAs) are congenital abnormalities, often incidental findings with a prevalence of up to 1% in the general population[1]. While some variants may predispose to sudden cardiac death[2], others remain benign but can present challenges during cardiac surgery[3]. No standardized protocols exist due to their rarity and variable clinical implications[4].

One critical concern is CAA in patients undergoing aortic valve replacement (AVR). Anomalous coronaries, especially those originating from the opposite sinus of Valsalva, may be compressed by the prosthetic valve, leading to intraoperative ischemia[3]. In such scenarios coronary artery bypass grafting (CABG), unroofing, or reimplantation might be necessary.

Here, we present a case of an anomalous right coronary artery (RCA) in a patient undergoing AVR, highlighting the importance of preoperative imaging and intraoperative management. Written informed consent for the procedure and publication was obtained from the patient.

Case Presentation

A 75-year-old hypertensive male, initially scheduled for robotic prostate surgery, was diagnosed with severe aortic stenosis during routine preoperative evaluation. He had no exercise intolerance and maintained an active lifestyle.

Transthoracic echocardiography (TTE) revealed preserved left ventricular ejection fraction (60%) and a critically stenotic aortic valve, with an area of 0.80 cm^2 (indexed 0.44 cm^2/m^2), and moderate regurgitation. Other valves were unremarkable. Laboratory values were within normal limits.

Coronary computed tomography angiography (CTA) demonstrated an anomalous RCA originating from the left sinus of Valsalva, adjacent to the left coronary ostium, and coursing between the aorta and pulmonary artery (Figure). This posed a potential risk for compression during AVR, requiring careful surgical planning.

On the day of surgery, anesthesia was induced with midazolam (0.1 mg/kg), fentanyl (3 mcg/kg), and rocuronium (0.9 mg/kg), followed by endotracheal intubation. Anesthesia maintenance was achieved using sevoflurane and remifentanil infusion. Bispectral index and Near-infrared spectroscopy (NIRS) monitoring were used to assess anesthetic depth and cerebral perfusion.

After systemic anticoagulation with heparin, cardiopulmonary bypass (CPB) was initiated. A 23-mm supra-annular bioprosthetic aortic valve was implanted. However, during weaning from CPB, systemic hypotension developed as the heart filled. Transesophageal echocardiography (TEE) revealed progressive right ventricular dysfunction. CPB was reinstituted, and similar hemodynamic instability recurred during two additional weaning attempts.

Inotropic and vasopressor support (norepinephrine 0.1–0.3 mcg/kg/min, epinephrine 0.05–0.3 mcg/kg/min, dobutamine 0.15–0.3 mcg/kg/min) was initiated to optimize cardiac output. It was suspected that the prosthetic valve was compressing the anomalous RCA. Although no intramural course or preoperative RCA stenosis was identified, coronary flow impairment at the ostium was considered likely due to the prosthesis. To avoid repeated cross-clamping and additional stress on the patient's condition, the surgical team elected to address both issues simultaneously. The 23-mm valve was replaced with a 21-mm prosthesis, and a prophylactic saphenous vein graft was performed to the RCA in the same intervention, despite the absence of significant stenosis.

The patient was weaned from CPB without complications and transferred to the intensive care unit (ICU) in stable condition without vasopressor support. NIRS values remained within normal limits throughout the case.

Postoperative recovery was uneventful. During follow-up, the patient reported no cardiac symptoms. Cardiac exam and echocardiography confirmed preserved ventricular function, normal prosthetic valve performance, and no regional wall motion abnormalities.

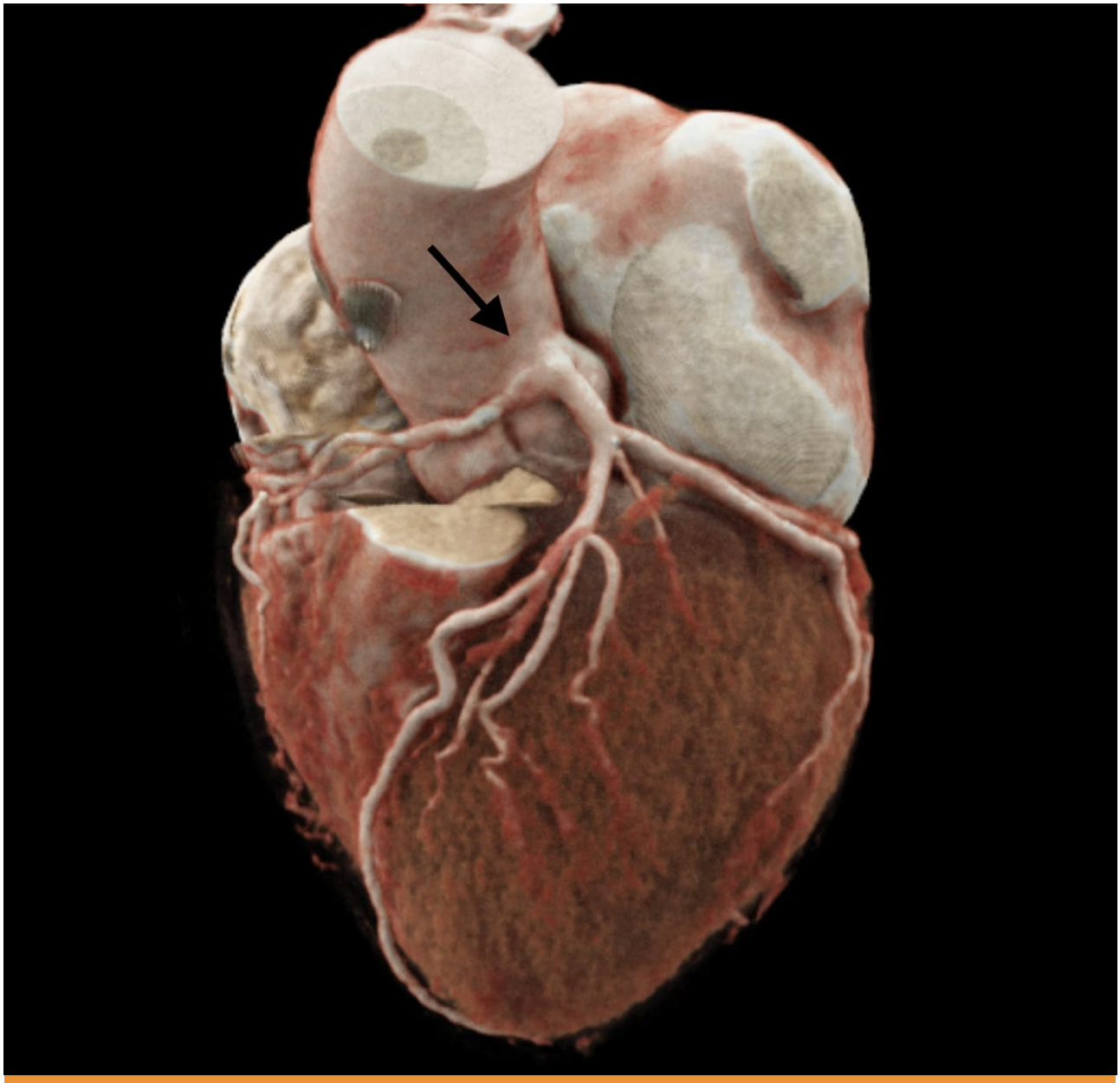


Figure legend: 3D image taken from coronary CT angiography showing anomalous origin and course of RCA.

Discussion and Conclusions

CAAs can complicate AVR, particularly when the anomalous vessel courses between the great arteries. Compression by the implanted valve can lead to myocardial ischemia and hemodynamic instability. Alameddine et al. reported a series of eight patients with CAA undergoing AVR, where three experienced coronary compression, requiring intraoperative CABG or postoperative percutaneous intervention[5].

Recognising a CAA before the surgery has an importance not just to be well prepared but also enables the team to develop strategies for coronary injuries. While a coronary angiogram is considered the gold standard, less invasive imaging methods can be utilised as well[1].

Intraoperative monitoring should be optimized to detect myocardial ischemia and hemodynamic deterioration early. Continuous electrocardiographic monitoring and TEE can be utilized when appropriate. To mitigate compression and ensure adequate coronary flow, the appropriate intervention must be determined promptly. When

deemed necessary, performing a coronary bypass is of critical importance.

Although our surgical plan did not proceed exactly as planned, we successfully managed to ensure adequate perfusion. This case underscores the importance of anticipating complications in patients with CAAs undergoing valve surgery.

In conclusion the coexistence of CAA and severe aortic stenosis significantly increases the complexity of AVR. Risk of coronary compression requires detailed preoperative imaging, vigilant intraoperative monitoring, and prompt intervention when ischemia is suspected. Multidisciplinary collaboration is key to optimizing outcomes and minimizing complications in these high-risk patients.

References

1. Agarwal PP, Dennie C, Pena E, et al. Anomalous Coronary Arteries That Need Intervention: Review of Pre- and Postoperative Imaging Appearances. Radiographics. 2017;37(3):740-757.
2. Yamanaka O, Hobbs RE. Coronary artery anomalies in 126,595 patients undergoing coronary arteriography. Cathet Cardiovasc Diagn. 1990;21(1):28-40
3. Papakonstantinou NA, Leontiadis E, Katsaridis SD, et al. Anomalous circumflex artery: a benign variant generating a malignant potential after valve surgery. Coron Artery Dis. 2023;34(5):364-371
4. Gaudino M, Di Franco A, Arbustini E, et al. Management of Adults With Anomalous Aortic Origin of the Coronary Arteries: State-of-the-Art Review. J Am Coll Cardiol. 2023;82(21):2034-2053
8. Alameddine AK, Binnall BJ, Conlin FT, Broderick PJ. Aortic Valve Replacement in 8 Adults with Anomalous Aortic Origin of Coronary Artery. Tex Heart Inst J. 2019;46(3):189-194. Published 2019 Jun 1

Contributions: All authors contributed equally to this work.

Funding: The authors received no specific funding for this work.

Conflict of interests: The authors declare that they have no competing interests.

Revision notes:

Revised parts are highlighted by color blue.

Reviewer A:

We sincerely thank the reviewer for the positive evaluation of our manuscript and the supportive comments.

Reviewer B:

We thank the reviewer for the thoughtful and constructive feedback. The concern regarding the surgical decision making process was highly valuable. As noted, preoperative coronary angiography demonstrated no stenosis in the right coronary artery. After implantation of the prosthesis, however, compression at the RCA ostium was suspected. In order to avoid repeated cross-clamping and additional stress on the patient's condition, we elected to perform both prosthesis downsizing and prophylactic RCA bypass in a single intervention. This approach minimized intraoperative risk while ensuring long-term myocardial perfusion.

Accordingly, we have revised the related section to clarify this rationale. The updated sentences have been highlighted in blue in the revised manuscript.