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Operative Decision-Making in Coronary Artery Aneurysms: A Case Series

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Ethics
This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Institutional review board approval was not required for this retrospective case series in accordance with local policy.

Patient Consent
Written informed consent was obtained from both patients for publication of their clinical details and accompanying imaging.

Conflict of Interest
No conflict of interest was declared by the authors.

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Abstract

Coronary artery aneurysms (CAAs) are uncommon, and management recommendations remain limited because of variability in underlying etiology and clinical presentation. This case series describes two patients with right coronary artery (RCA) aneurysms managed surgically within a 2-month period. The first patient was a 69-year-old man with RCA aneurysms and obstructive coronary artery disease who underwent off-pump coronary artery bypass grafting using a saphenous vein graft to the posterior descending artery with aneurysm ligation. The second patient was a 68-year-old man with large thrombotic RCA aneurysmal disease and a concurrent abdominal aortic aneurysm, raising concern for broader vascular involvement. He underwent off-pump coronary artery bypass grafting using saphenous vein grafts to the right ventricular, posterior descending, and posterolateral branches, along with aneurysm ligation. These cases emphasize the need for an individualized, anatomy-driven framework for CAA repair and long-term surveillance and provide a practical reference for operative planning.

Keywords: right coronary artery aneurysm, off-pump CABG, aneurysm ligation, aneurysmal vascular disease, postoperative surveillance

Introduction

Coronary artery aneurysms (CAAs) are uncommon, with a reported incidence ranging from 0.3% to 5% in angiographic studies [1]. They are defined as focal coronary dilations measuring at least 1.5 times the diameter of the adjacent normal vessel [2]. The right coronary artery is most frequently involved, and larger aneurysms carry increased risks of thrombosis, distal embolization, myocardial ischemia, and, rarely, rupture [3, 4].

In adults, atherosclerosis is the most common underlying cause, although inflammatory disorders, prior coronary intervention, trauma, and connective tissue disease may also contribute [5]. Despite increasing recognition, management remains challenging because CAAs are uncommon and evidence-based treatment recommendations are limited.

Medical therapy may reduce thrombotic risk but does not address progressive enlargement or future ischemic events. Percutaneous exclusion with covered stents may be limited by thrombus burden, inadequate landing zones, restenosis, or loss of branch vessels. Surgical treatment is therefore often favored for large or symptomatic aneurysms, particularly when reliable distal revascularization is required [6, 7].

In addition, preoperative screening of other vascular beds may identify multisite aneurysmal disease that can influence operative planning and long-term postoperative surveillance. Two cases of surgically managed RCA aneurysms are presented to demonstrate how aneurysm anatomy, distal myocardial territory at risk, and associated systemic aneurysmal disease may guide individualized operative decision-making.

Case presentation

Case 1

A 69-year-old man with a history of coronary artery disease, previous angioplasty and stenting of the circumflex and left anterior descending arteries, hyperlipidemia, morbid obesity, diabetes mellitus, and end-stage renal disease presented for surgical management of two right coronary artery (RCA) aneurysms and severe mid-RCA stenosis identified on angiography (Figure 1). Preoperative echocardiography demonstrated a left ventricular ejection fraction of 45%, concentric left ventricular hypertrophy, and no significant valvular abnormality.

At surgery, two large RCA aneurysms were noted, one proximally near the origin and one more distally near the bifurcation; both were heavily calcified. The posterior descending artery (PDA) measured 3 mm in diameter and was free of distal disease, providing a suitable target for grafting. The patient underwent single-vessel off-pump coronary artery bypass grafting (CABG) using a reverse saphenous vein graft from the right leg to the PDA, with ligation of the RCA aneurysms. Cardiopulmonary bypass was not used. The patient tolerated the procedure well and was transferred to the intensive care unit in stable condition. Postoperative management included standard hemodynamic monitoring, antiplatelet and statin therapy, glycemic control, and renal supportive care for end-stage renal disease. There were no intraoperative or postoperative complications. This case illustrates the feasibility of off-pump management of multiple calcified RCA aneurysms in a high-risk patient.

Case 2

A 68-year-old man with a history of coronary artery disease, ST-elevation myocardial infarction, hypertension, dyslipidemia, cerebrovascular accident with residual facial numbness, and an infrarenal abdominal aortic aneurysm was evaluated for a newly identified right coronary artery aneurysm. He had previously been followed for right bundle branch block and cardiomyopathy and was asymptomatic at presentation. Preoperative computed tomography angiography of the chest, abdomen, and pelvis demonstrated marked aneurysmal dilation of the RCA, measuring up to 25 mm in outer diameter, with partial mural thrombus. Additional aneurysmal changes were noted in the mid left anterior descending artery (maximum diameter, 12 mm), infrarenal abdominal aorta (4.2 × 4.0 cm), and bilateral internal iliac arteries (right, 4.9 cm; left, 4.2 cm), consistent with multisite aneurysmal disease (Figures 2-4). Transthoracic echocardiography revealed a left ventricular ejection fraction of 30%, trace mitral regurgitation, and inferior hypokinesis.

The patient underwent off-pump CABG × 3 using left saphenous vein grafts to the right ventricular branch, posterior descending artery, and posterolateral artery, together with ligation of the RCA aneurysm and excision of a mediastinal lymph node. The aneurysmal RCA segment extended from just beyond the ostium to the bifurcation of the posterior descending and posterolateral arteries. After completion of the distal anastomoses, two proximal anastomoses were constructed at the aortic root to restore flow. Cardiopulmonary bypass was not used. The postoperative recovery was uneventful.

Figure 1. Coronary angiography demonstrating large aneurysmal dilation of the proximal and distal right coronary artery with single-vessel runoff in Case 1

Figure 2. Coronary angiography demonstrating diffuse aneurysmal dilation and ectasia of the right coronary artery extending into the distal branches

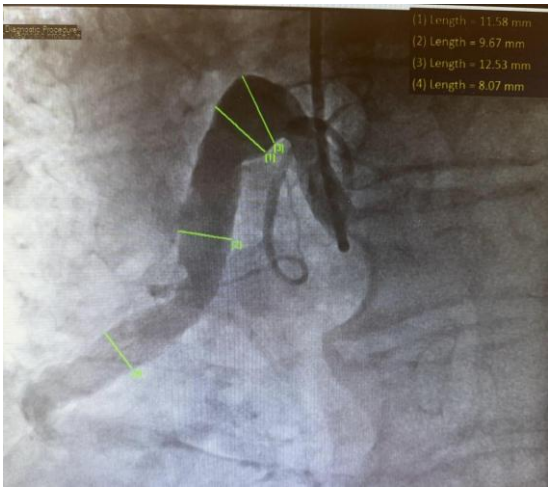
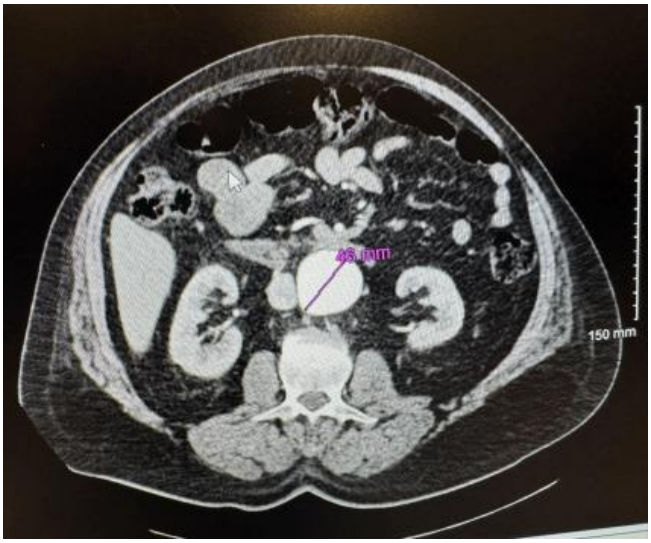


Figure 3. Cardiac computed tomography demonstrating aneurysmal dilation of the right coronary artery with additional aneurysmal involvement of the mid left anterior descending artery (maximum diameter, 12 mm), consistent with multisite coronary aneurysmal disease

Figure 4. Computed tomography of the abdomen demonstrating an infrarenal abdominal aortic aneurysm measuring approximately 4.2 × 4.0 cm, supporting the presence of systemic aneurysmal disease

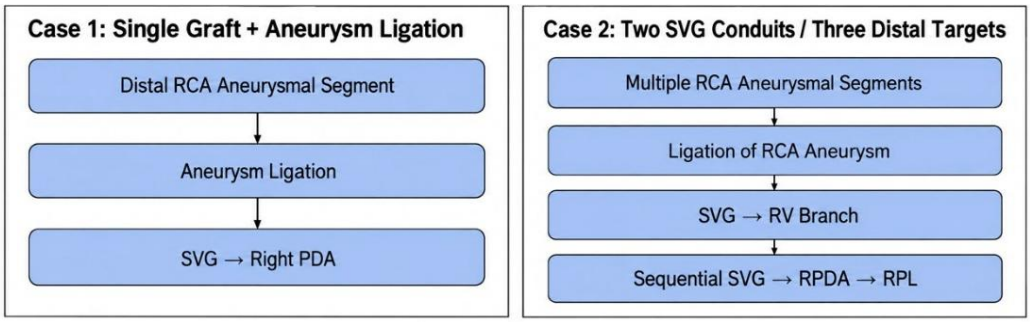


Discussion

In both patients, the operative strategy was guided by two principal objectives: exclusion of the aneurysmal coronary segment and preservation of reliable myocardial perfusion to distal coronary territories. The amount of myocardium at risk and the available distal runoff determined the number and configuration of bypass grafts required.

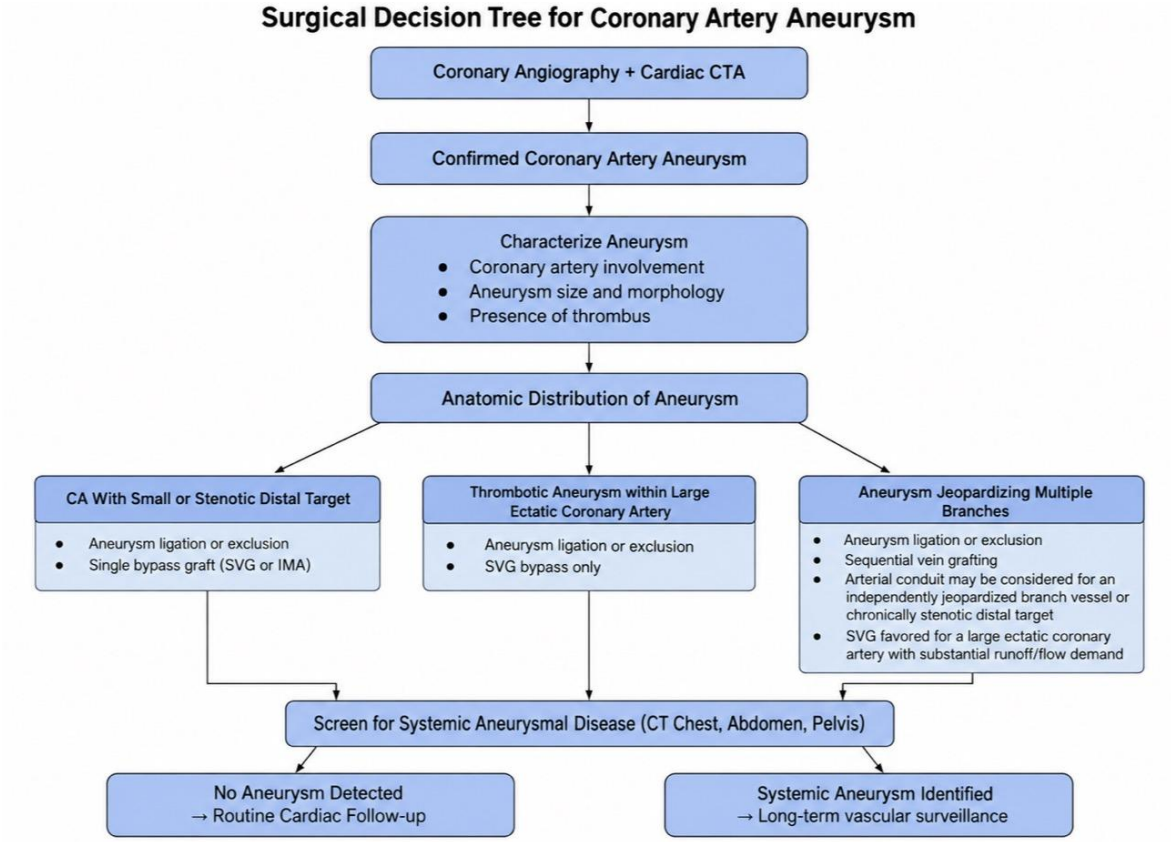
Although both patients had RCA aneurysms, the anatomic patterns differed substantially. In Case 1, preserved distal targets allowed aneurysm ligation with single-vessel bypass to the posterior descending artery. In Case 2, aneurysmal disease extended from the proximal RCA to the bifurcation of the posterior descending and posterolateral branches, requiring multivessel revascularization to maintain perfusion of multiple distal territories. These differing graft configurations, illustrated in Figure 5, demonstrate that aneurysm location alone does not determine operative strategy; distal branch involvement and the myocardial territory at risk are equally important considerations.

Figure 5. Graft configuration strategies in the surgical repair of right coronary artery aneurysms. Left: Case 1, in which a discrete distal target allowed single-vessel saphenous vein grafting after aneurysm ligation. Right: Case 2, in which two saphenous vein graft conduits provided revascularization to three distal coronary targets: one SVG to the right ventricular branch and a second sequential SVG to the right posterior descending and right posterolateral branches following RCA aneurysm ligation



Abbreviations: RCA: right coronary artery, RV: right ventricular, PDA/RPDA: (right) posterior descending artery, RPL: right posterolateral branch, SVG: saphenous vein graft.

Figure 6. Operative decision pathway for coronary artery aneurysm repair. The algorithm outlines surgical management according to aneurysm characteristics and the number of distal coronary branches at risk, guiding selection between single bypass grafting for isolated distal targets and sequential saphenous vein grafting for aneurysms jeopardizing multiple branches. The pathway also emphasizes screening for systemic aneurysmal disease to inform long-term vascular surveillance



Abbreviations: CA: coronary artery, CTA: computed tomography angiography, IMA: internal mammary artery, SVG: saphenous vein graft.

Both procedures were performed without cardiopulmonary bypass to reduce perioperative hemodynamic stress in patients with impaired ventricular function. Off-pump coronary artery bypass may be performed safely in selected patients with reduced ejection fraction when graft targets are accessible and intraoperative monitoring is carefully maintained [8]. Following completion of grafting, figure-of-eight 4-0 polypropylene sutures were placed proximally and distally around the aneurysmal segment and temporarily tightened with snares while electrocardiographic (ECG) and transesophageal echocardiographic monitoring were used to assess for ischemic change. The sutures were maintained under temporary occlusion for approximately 10 minutes. In the absence of new ischemic ECG changes, deterioration in myocardial function, or hemodynamic compromise, definitive ligation was completed. If acute ischemic ECG changes or deterioration in myocardial function were observed, the sutures would be released and the aneurysm left unligated to thrombose over time. This approach permits functional confirmation of adequate graft-dependent myocardial perfusion before permanent aneurysm exclusion and supports performing the procedure on a beating heart to allow real-time assessment.

Conduit selection also requires consideration of anticipated flow demand. In large ectatic coronary arteries with substantial runoff requirements, an internal mammary artery (IMA) graft alone may provide insufficient early flow after aneurysm ligation. In such settings, saphenous vein grafts (SVGs) may offer greater immediate conduit capacity, whereas arterial conduits may remain appropriate for independently jeopardized branch vessels or chronically stenotic distal targets.

The presence of abdominal and iliac aneurysmal disease in Case 2 highlights that coronary artery aneurysms may, in some patients, reflect broader systemic arteriopathy. Identification of aneurysmal disease in other vascular beds may influence operative planning and supports consideration of postoperative vascular surveillance. Based on this experience, the authors recommend that preoperative evaluation include computed tomography angiography of the chest, abdomen, and pelvis to assess for aneurysms in other vascular beds. Taken together, these cases support an individualized operative approach based on aneurysm anatomy, distal myocardial territory at risk, conduit flow requirements, and evidence of multisite aneurysmal disease. A simplified decision pathway derived from these operative principles is summarized in Figure 6.

In conclusion, coronary artery aneurysms lack standardized management and require individualized operative judgment. These cases suggest that off-pump aneurysm ligation with tailored saphenous vein grafting may provide an adaptable approach across differing anatomic and systemic contexts. This strategy is intended to preserve distal perfusion while limiting the need for cardiopulmonary bypass; however, broader evidence is required before its safety or generalizability can be established.

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