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CASE REPORT
Coronary heart disease

Extensive coil embolization of a giant coronary artery aneurysm in an octogenarian: a case report

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Background Coronary artery aneurysms (CAA) are often diagnosed incidentally on coronary angiography or imaging modalities done for other reasons. 'Giant' CAA by definition exceeds 20 mm in diameter or four times the diameter of normal coronary artery. The management of patients with CAAs is challenging due to poorly understood mechanism, variable presentation, and lack of clear-cut societal recommendations. Though conservative management is preferred in asymptomatic patients, massive size or interval growth may make intervention necessary.

Case summary We describe a case of successful coil embolization of a giant coronary aneurysm in an elderly 84-year-old male. Patient, who presented for a follow-up computed tomography angiography to evaluate a previously repaired abdominal aortic aneurysm 2 years back, was found to have interval growth of right coronary artery aneurysm from 4 cm in diameter to 7 × 8 cm in its greatest dimensions. The rationale for treatment was to prevent sudden death from continued growth and eventual rupture of aneurysm in addition to potential risk of thromboembolism and compression of adjacent structures.

Discussion This case demonstrates the safe and successful use of extensive coil embolization technique to treat a 'giant' CAA in an elderly patient when surgical risks were prohibitive.

Keywords Coronary artery aneurysms (CAA) • Coil embolization • Computed tomography angiogram (CTA) • Case report

Learning points

- 'Giant' coronary artery aneurysms (CAA) (more than 20 mm or four times the diameter of normal coronary artery) along with interval increase in size warrant intervention to prevent sequelae including sudden death from rupture.
- Coil embolization is an effective treatment of 'giant' CAA when surgery is considered high risk due to patient's age and frailty.
- When aneurysmal size is massive to preclude stenting as an option, stentless coiling is a safe an effective strategy to occlude the aneurysm.
- Follow-up imaging such as computed tomography angiogram to ensure successful coiling should always be considered.

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Introduction

Coronary artery aneurysms (CAAs) are focal dilation of coronary arteries to 1.5 times the normal diameter while coronary artery ectasias (CAE) imply a more diffuse dilation. Coronary artery aneurysms are considered 'giant' when they exceed 20 mm in diameter or 4 times the diameter of normal coronary artery. True incident of CAEs is documented as 5% in all coronary angiography and 1% for CAAs.[1,2] Giant CAA are even rarer with a reported incident of 0.02–0.2%.[3] The management of patients with CAAs is challenging due to poorly understood mechanism, variable presentation, and lack of clear-cut societal recommendations. Treatment strategies are individually tailored to CAAs location and morphology, patient's characteristics, and clinical presentation. For giant, CAAs surgical approach is preferred though supporting data are scarce.[3] We describe an octogenarian male with giant right coronary artery (RCA) aneurysm, 7 × 8 cm in size and impinging on the right ventricular inflow tract that was successfully managed by stentless coil embolization.

Timeline

September 2017	Planned surgical repair of infrarenal abdominal aortic aneurysm (AAA). Also found to have incidental right coronary artery (RCA) aneurysm 4 cm in diameter.
8 October 2019	Elective imaging for AAA repair follow-up showed interval growth of partially thrombosed RCA aneurysm to 7 × 8 cm in diameter along with persistent endovascular leak from the previously repaired AAA. Patient was asymptomatic and admitted to hospital. Blood tests including cardiac troponin as well as electrocardiogram were unremarkable. Coronary angiogram confirmed massive RCA aneurysm with distal chronic total occlusion and diffuse aneurysmal coronary artery disease.
9 October 2019	Vascular surgery deemed the endoleak from AAA to be stable requiring no further intervention.
10 October 2019	Successful coiling of giant coronary artery aneurysm with seven coils due to concern for continued growth and rupture leading to sudden death as well as local compression and systemic thromboembolism.
11 October 2019	Good post-operative recovery with successful discharge to home.
14 November 2019	Follow-up computed tomography angiogram confirmed successful coil embolization of RCA aneurysm.

Case presentation

An 84-year-old male with past history of hypertension, aneurysmal coronary artery disease (CAD), abdominal aortic aneurysm (AAA) treated previously with endovascular repair 2 years ago presented for surveillance of his AAA repair. Computed tomography angiogram (CTA) revealed persistent endoleak from the repaired AAA. It also demonstrated interval growth of previously known right coronary artery (RCA) aneurysm from 4 cm to 7 × 8 cm in diameter (*Figure 1A and B*). Patient denied any symptoms including angina but was admitted to the hospital for further work-up. Vital signs at the time of admission revealed a blood pressure of 159/78 mmHg, heart rate of 65 beats/min, oxygen saturation (SpO2) of 95% on room air. Physical examination was otherwise unremarkable. At home, he was on low dose daily aspirin and high intensity rosuvastatin for known CAD and CAA. His electrocardiogram (EKG) showed inferior lead Q waves suggesting previous inferior infarction and occasional premature ventricular complexes (*Figure 2A*). Cardiac troponin was unremarkable. Transthoracic echocardiogram showed borderline left ventricle ejection fraction of 50% with inferolateral wall hypokenesis. It also revealed a large CAA containing partially thrombosed material and compressing the right ventricle inflow at the level of tricuspid valve, consistent with patient's previous history of RCA aneurysm (*Figure 2B*). A review of patient's myocardial perfusion scan performed 2 years back for pre-operative evaluation showed mixture of scar and ischaemia in the left circumflex coronary artery (LCx) territory. Coronary angiography (CA) was performed which showed diffuse aneurysmal and obstructive coronary artery disease with a giant partially thrombosed mid-vessel RCA aneurysm, 7 × 8 cm in its greatest dimensions with distal chronic total occlusion (*Figure 3A*). Retrograde collaterals from left circumflex (LCx) were seen filling the RCA. Diffuse small-sized multiple aneurysms of left anterior descending artery with multiple areas of complex 75% narrowing and mid-vessel LCx ectasia/small aneurysm with complex 50–70% stenosis were also seen on CA. Vascular surgery recommended no further intervention for the AAA as they deemed the endoleak to be stable after carefully reviewing the images. However, considering the massive size and rapid growth of the RCA aneurysm with impending risk of rupture and sudden death, percutaneous management with coil embolization was considered as the size of the aneurysm

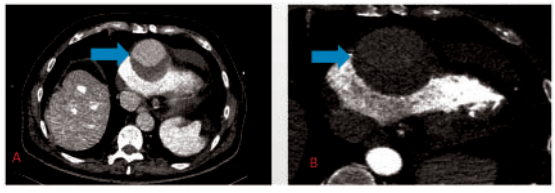

Figure 1 Computed tomography angiogram before coil embolization showing (*A*) (left): giant partially thrombosed right coronary artery aneurysm (blue arrow). (*B*) (right): compression of right ventricular inflow by giant right coronary artery aneurysm (blue arrow).

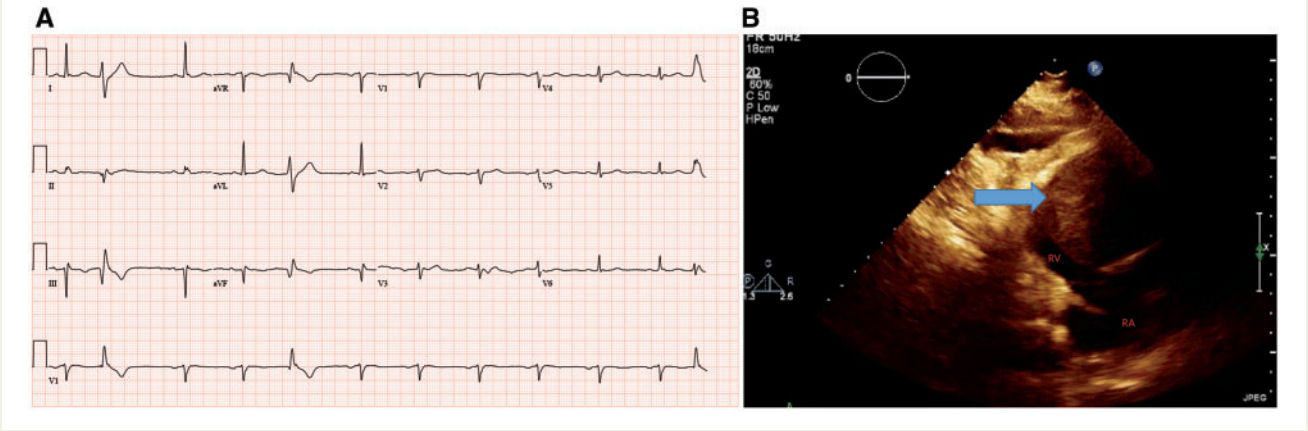

Figure 2 (*A*) Electrocardiogram with Q waves in inferior leads (II, III, and avF) suggesting prior inferior infarct and occasional premature ventricular complexes (PVCs). (*B*) Transthoracic echocardiogram (TTE) two-chamber view showing compression of right ventricle (RV) inflow by massive right coronary artery aneurysm at level of tricuspid valve (blue arrow).

precluded stenting as an option and patient's age, frailty, and comorbidities made surgery prohibitive. Patient underwent successful coiling of the aneurysm and proximal RCA using seven coils with good recovery. At discharge, patient's aspirin and statin were resumed.

The aim of coiling was to totally occlude the aneurysm. Due to paucity of reported data and previous experience with stentless coil embolization of CAA, it was decided to start with coiling the aneurysmal sac. In case of failure, it was agreed to perform coiling of non-aneurysmal proximal RCA feeding the aneurysm as a rescue measure.

A 7-Fr standard sheath was inserted into the right femoral artery to be used as an access site followed by insertion of a 7-Fr JR4 guide catheter that was used to engage the RCA. A 120 cm, 4-Fr Terumo angled glide catheter was then advanced to the mid-RCA over an exchange wire. As originally planned, in sequence 4 Terumo Azur 0.035″ (20 mm × 50 cm) coils were advanced into the aneurysmal sac. However, contrast was still seen flowing into the aneurysm. Therefore, as a rescue step, it was then decided to coil the proximal RCA feeding the aneurysm. The 4-Fr angled glide catheter was removed and a Terumo Progreat 2.8-Fr catheter was placed into the proximal non-aneurysmal RCA. An Azur 0.035″ (6 mm × 17 cm) coil was deployed in the proximal non-aneurysmal RCA to occlude the inflow of the aneurysm. Contrast was still seen entering freely into the aneurysm. This coil was then further packed with two 0.018″ (4 mm × 13 cm) coils. At the end of the procedure, no contrast was seen entering the sac. The JR4 guide catheter was removed. Though collaterals were seen filling the right posterior descending artery, no clear contrast was filling the aneurysmal sac at end of procedure (*Figure 3B–D*). A bolus of 7000 units of heparin was given during the procedure and periodic activated clotting time were performed in the lab to ensure adequate procedural anticoagulation.

Our patient had good post-op recovery and was discharged from hospital. Repeat CTA at almost 1-month interval showed totally occluded aneurysm with no residual filling (*Figure 4A–C*).

Discussion

Coronary artery aneurysms are rare findings detected on coronary angiography or computed tomography. They can be congenital or acquired.[3] The underlying pathophysiology in adults involves atherosclerosis, iatrogenic injury during coronary intervention, cocaine use, systemic infections, and underlying genetic tendencies while in children vasculitis (Kawasaki disease) is most common. Potential complications include *in situ* thrombosis with distal embolization leading to myocardial infarction, local compression of adjacent structure (pulmonary artery, tricuspid valve etc.), and eventual rupture leading to sudden death from massive tamponade.[4,5] For asymptomatic aneurysms, the most dreaded consequence is rupture and sudden death and is determined by aneurysmal size and interval growth.[6] Our patient did not have any anginal symptoms. There was EKG evidence of previous inferior wall myocardial infarct and coronary angiography (CA) also showed distal chronic total occlusion of RCA with collateral formation. The rationale of aneurysmal coiling in our case was to prevent further growth leading to sudden death from aneurysmal rupture. In patients with clinical and functional evidence of angina or those presenting with acute coronary syndrome, the treatment should be directed towards restoring coronary perfusion regardless of size or growth of the aneurysm.[3]

Management strategies for CAAs are individualized based on phenotype (CAA vs. CAE), clinical symptoms, and patient's characteristics. For asymptomatic patients, indication for percutaneous or surgical intervention include either massive size (described as more than 20 mm) or rapid interval growth.[7] Data on percutaneous intervention especially for asymptomatic and incidental CAA or CAE are

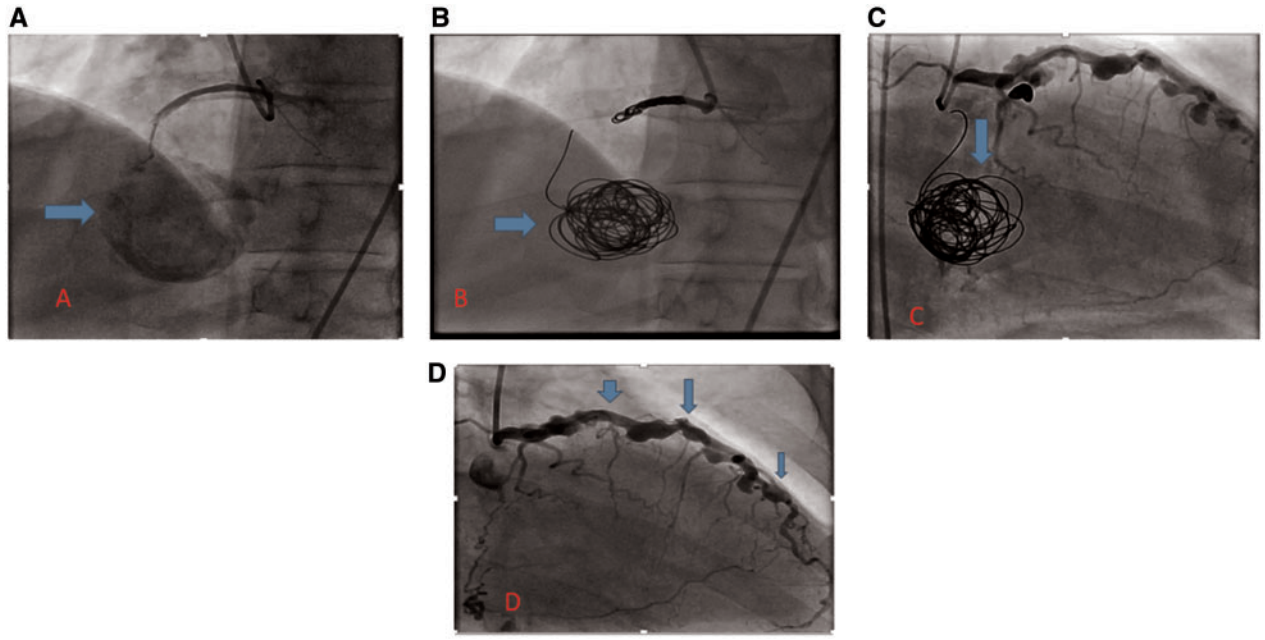

Figure 3 Coronary angiography showing (*A*) (top left): giant right coronary artery aneurysm on diagnostic angiogram (blue arrow). (*B*) (top middle): right coronary artery aneurysm with minimal residual filling after antegrade occlusion (blue arrow). (*C*) (top right): total occlusion of aneurysm with seven coils and no retrograde filling (blue arrow). (*D*) (bottom): diffuse aneurysmal coronary artery disease involving other coronary arteries (blue arrows).

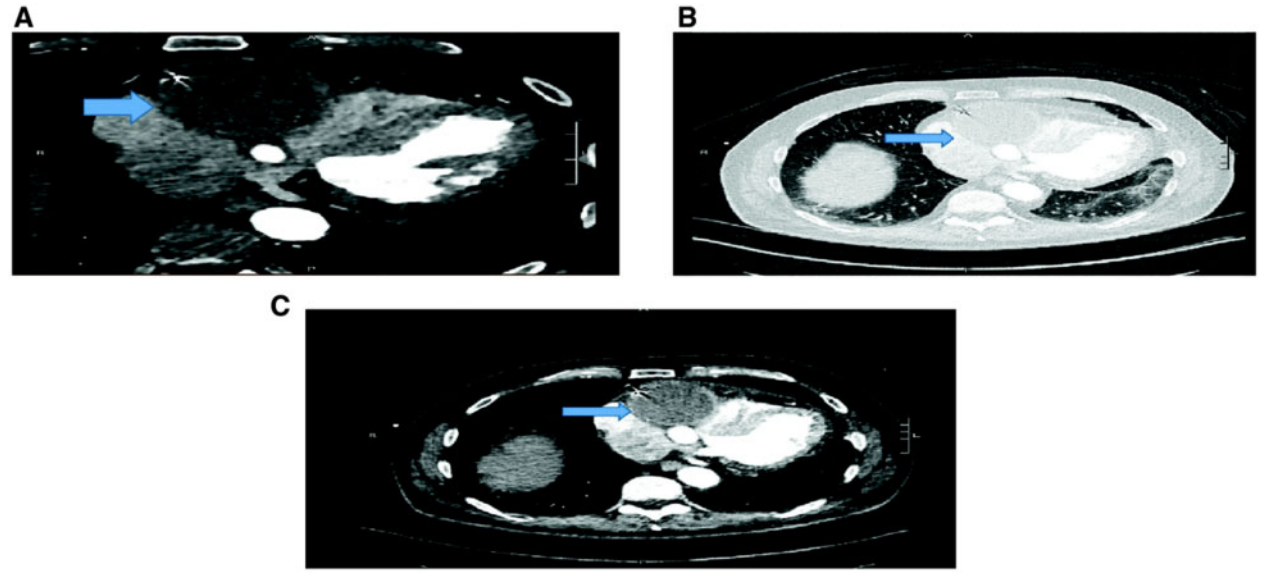

Figure 4 Follow-up computed tomography angiogram after coil embolization showing (*A*) (top left): no residual filling of the aneurysm (blue arrow). (*B*) (top right): totally occluded aneurysm using seven coils (blue arrow). (*C*) (bottom): totally occluded aneurysm with no residual aneurysmal filling with contrast.

sparse and limited to small series.[8] Various strategies including covered stents for small aneurysms involving major branch vessels, stent-based coiling for large and diffuse CAA involving major branch vessels have been reported.[9] Coil embolization of aneurysms leads to occlusion of the aneurysm with formation of organized thrombus, fibrosis, and eventual endothelialization. Previous studies have reported coil embolization of CAAs in the setting of stent-assisted deployment as well as stentless coiling.[10]

Various indications for surgery include aneurysms involving left main coronary artery, giant CAA, and rapidly growing saphenous venous

graft CAA with preferred surgical method being proximal and distal ligation of aneurysm with bypass grafting. The natural progression of giant, asymptomatic CAA is not exactly known. With time, however, they tend to grow and in about one-half of the cases such aneurysms become obstructed and are associated with myocardial infarction, arrhythmias, and sudden death from aneurysmal rupture. Most 'giant' CAA therefore require medical management with antiplatelets and antithrombotics to prevent their growth when first diagnosed.[11] In our patient, despite being on antiplatelets the interval growth of aneurysm was quite significant hence requiring intervention. The frailty of patient with multiple comorbidities made surgery prohibitive while massive size of aneurysm precluded stenting as an option. It was decided to proceed with coiling of the aneurysm without stenting. The initial rationale was to occlude the aneurysmal sac itself using coils and in case of failure, coiling the proximal non-aneurysmal RCA as a rescue step. This strategy was based on the available data regarding stent-assisted and stentless coiling of CAA.[3] An alternative approach would have been to coil the proximal non-aneurysmal RCA alone to occlude the aneurysm without coiling the aneurysmal sac itself. In our case, the massive aneurysmal size required a percutaneous strategy including extensive coiling of the aneurysm as well as the proximal non-aneurysmal portion of RCA as a rescue step. This not only ensured successful coiling at the procedure end but also on follow-up CTA images 1-month later.

Conclusions

Though medical management should be first line for asymptomatic CAAs, interval growth and concerning size warrant intervention to avoid complications including sudden death from rupture of aneurysm. Percutaneous extensive coiling without stenting for giant aneurysms is a less invasive and promising technique in patients who are at high surgical risk.

Informed consent

Appropriate informed consent has been obtained from the patient.

Lead author biography

Dr Talha Ahmed graduated from King Edward University in Pakistan and is now doing his internal medicine residency at the University of Maryland Midtown Campus. He is a current chief resident at his training program and aims to be a fellow in cardiology in the near future.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidelines.

Conflict of interest: none declared.

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