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A Giant Left Anterior Descending Artery (LAD) Coronary Artery Aneurysm Treated by Covered Stent Angioplasty: A Case Report

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Conflict of interest: None declared

Patient: Male, 69-year-old
Final Diagnosis: Coronary aneurysm
Symptoms: Angina
Medication: —
Clinical Procedure: —
Specialty: Cardiology

Objective: Unusual setting of medical care

Background: Coronary artery aneurysm (CAA) is uncommon angiographic finding with unclear pathophysiology. Atherosclerosis is the main contributing risk factor in adults. To date, there are no standardized recommendations for the management of CAA. Therefore, this case report describes the effectiveness of PCI as therapeutic approach for giant CAA.

Case Report: We present the case of a 69-year-old male smoker brought to the Emergency Department (ED) due to the crescendo angina. Coronary angiography showed a giant saccular proximal left anterior descending coronary artery aneurysm, which was successfully treated with covered stent implantation, leading to good outcome.

Conclusions: The management of CAA is individualized and depends on several parameters such as aneurysm characteristics, technical challenges, and clinical situation. Future clinical trials investigating the role of PCI are needed.

MeSH Keywords: Acute Coronary Syndrome • Aneurysm • Case Reports • Drug-Eluting Stents

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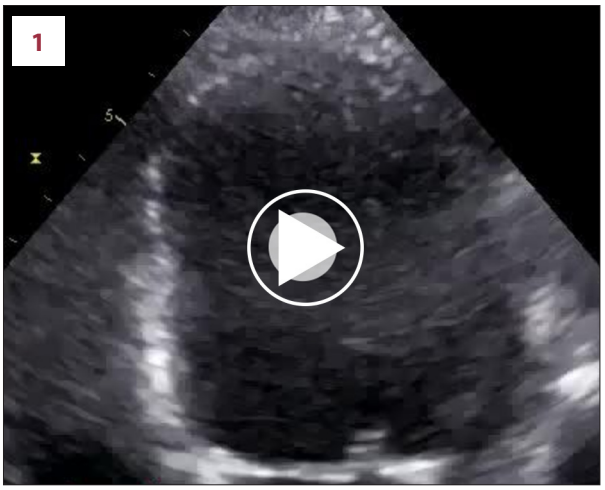
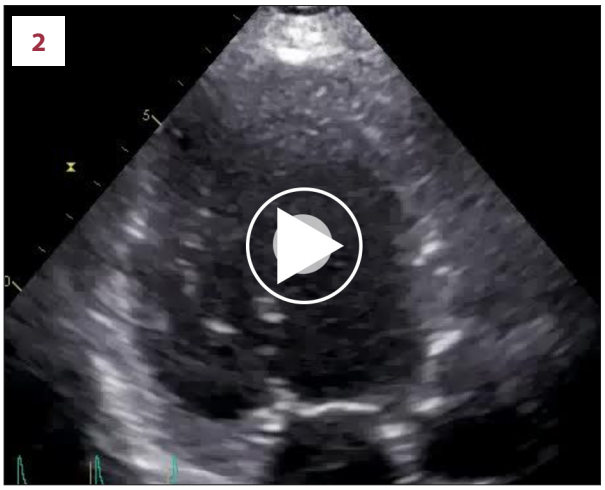
Background

Coronary artery aneurysm (CAA) is characterized by a focal dilation of the coronary artery more than 1.5-fold the diameter of an adjacent patent segment. It is an uncommon angiographic finding with a mean incidence of 1.65%, most often involving the right coronary artery [1]. A wide spectrum of clinical features, ranging from incidental discovering to acute coronary syndrome (ACS) and sudden death, are attributed to CAA. However, the management of CAA remains a potential challenge for physicians. Despite technical issues, the beneficial role of percutaneous coronary intervention as a therapeutic approach for CAA is uncertain. We describe a case of giant CAA successfully treated with covered stent implantation in a male patient presenting with unstable angina.

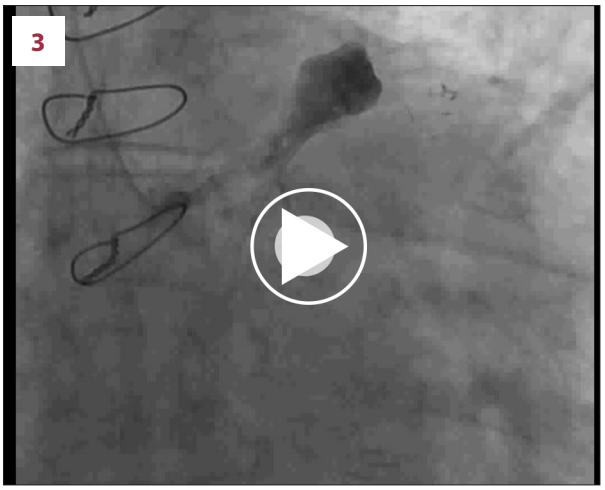
Case Report

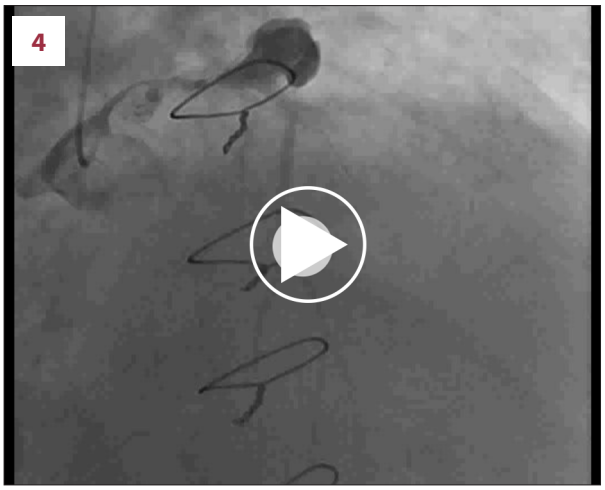
A 69-year-old male smoker known to have dyslipidemia and type 2 diabetes mellitus was brought to the ED for angina. His past medical history included an abdominal aortic aneurysm, bilateral endarterectomy, heart failure with reduced ejection fraction (38% in 2015), and coronary artery disease treated by stent angioplasty in 2000 followed by left anterior descending and diagonal coronary artery bypass graft in 2007. He noted the appearance of crescendo angina for 1 month ago. A physical exam was unremarkable for cardiopulmonary findings. ECG (electrocardiogram) showed sinus rhythm and old left bundle branch block. Laboratory studies revealed normal renal function, elevated stable troponin at 67 ng/l (<14 ng/l), D-Dimer at 1150 (<500), and NT-pro-BNP at 2990 pg/ml (300 pg/ml). Transthoracic echocardiography (TTE) showed an altered left ventricle ejection fraction at 25% with inferior and infero-lateral walls akinesia (Videos 1, 2). Then, he was referred for coronary angiography, which showed severe calcified stenosis of





Videos 1, 2. TTE showing an altered left ventricle ejection fraction at 25% with inferior and infero-lateral walls akinesia.





Videos 3, 4. 2019. Left coronary angiogram showing the LAD aneurysm expanded in size.

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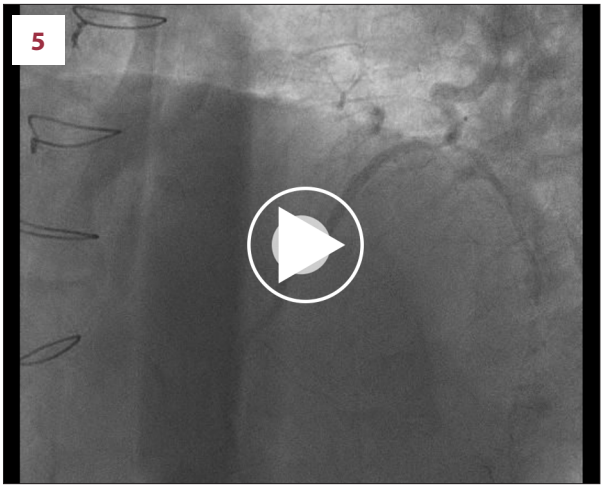
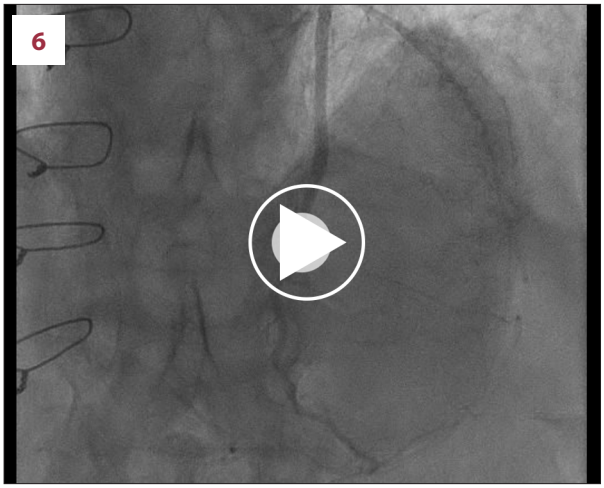
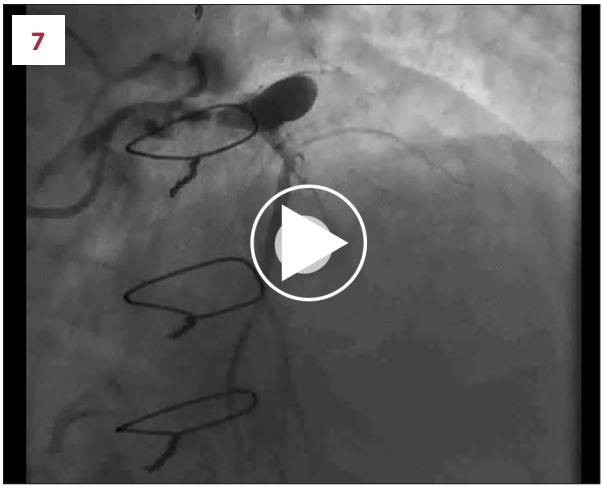
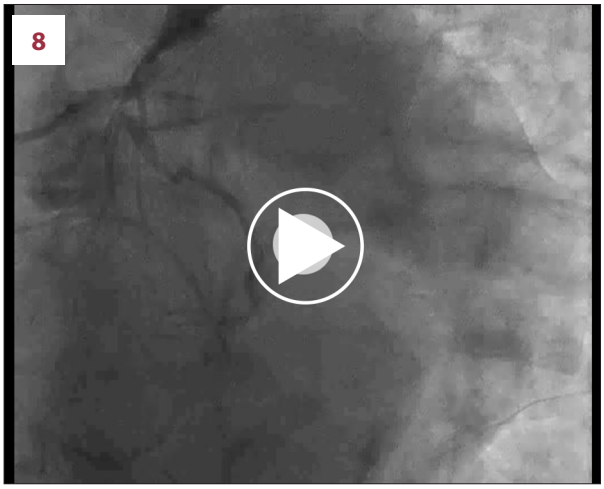




Videos 5, 6. 2019. Coronary angiogram showing patent LIMA graft to middle LAD and diagonal coronary artery.





Videos 7, 8. 2015. Left coronary angiogram showing initial size of LAD aneurysm.

distal left main bifurcation, post-stenotic saccular giant aneurysm (15×12 mm) in the proximal part of the left anterior descending artery (LAD) (Videos 3, 4), chronic occlusion of the middle LAD, distal circumflex and right coronary arteries, and patent left internal mammary artery bypass graft to the LAD and diagonal coronary artery (Videos 5, 6). Comparing coronary angiography results with the previous angiogram performed in 2015, we found stable coronary artery lesions except for the LAD aneurysm, which was significantly increased in size (10×8 mm in 2015) (Videos 7, 8, Figure 1A, 1B). The hypothesis of coronary steal syndrome provoked by this large aneurysm compromising blood flow to the distally located marginal branches on top of the potential risk of future aneurysmal rupture due to the progressive increasing in size were the reasons to intervene. After a multidisciplinary expert discussion, we decided to perform a percutaneous approach to exclude the CAA in view the complexity of a second cardiac intervention, the patency of coronary graft, and the chronicity of the coronary lesions. Then, we proceeded with rotablator atherectomy of the left main and proximal LAD. A BeGraft (Bentley InnoMed, Hechingen, Germany) covered stent was successfully implanted, excluding the giant aneurysm; thus, the stent was post-dilated with a non-compliant balloon in view the inadequate stent expansion. However, a moderate residual stenosis was noted (Figure 1C). The patient was discharged on dual antiplatelet therapy (clopidogrel+aspirin), 80 mg atorvastatin, 80 mg furosemide, 5 mg ramipril, and 5 mg bisoprolol. After 6 months, there was no chest pain, he had better physical performance, and LVEF improvement at 35% were noted (Videos 9, 10). Follow-up coronary angiography at 1 year after hospital discharge performed for non-cardiac pre-operative work-up showed a stable angiographic outcome (Video 10, Figure 1D).

Discussion

The widespread use of new coronary imaging modalities and the increased referrals to coronary angiography in ACS have

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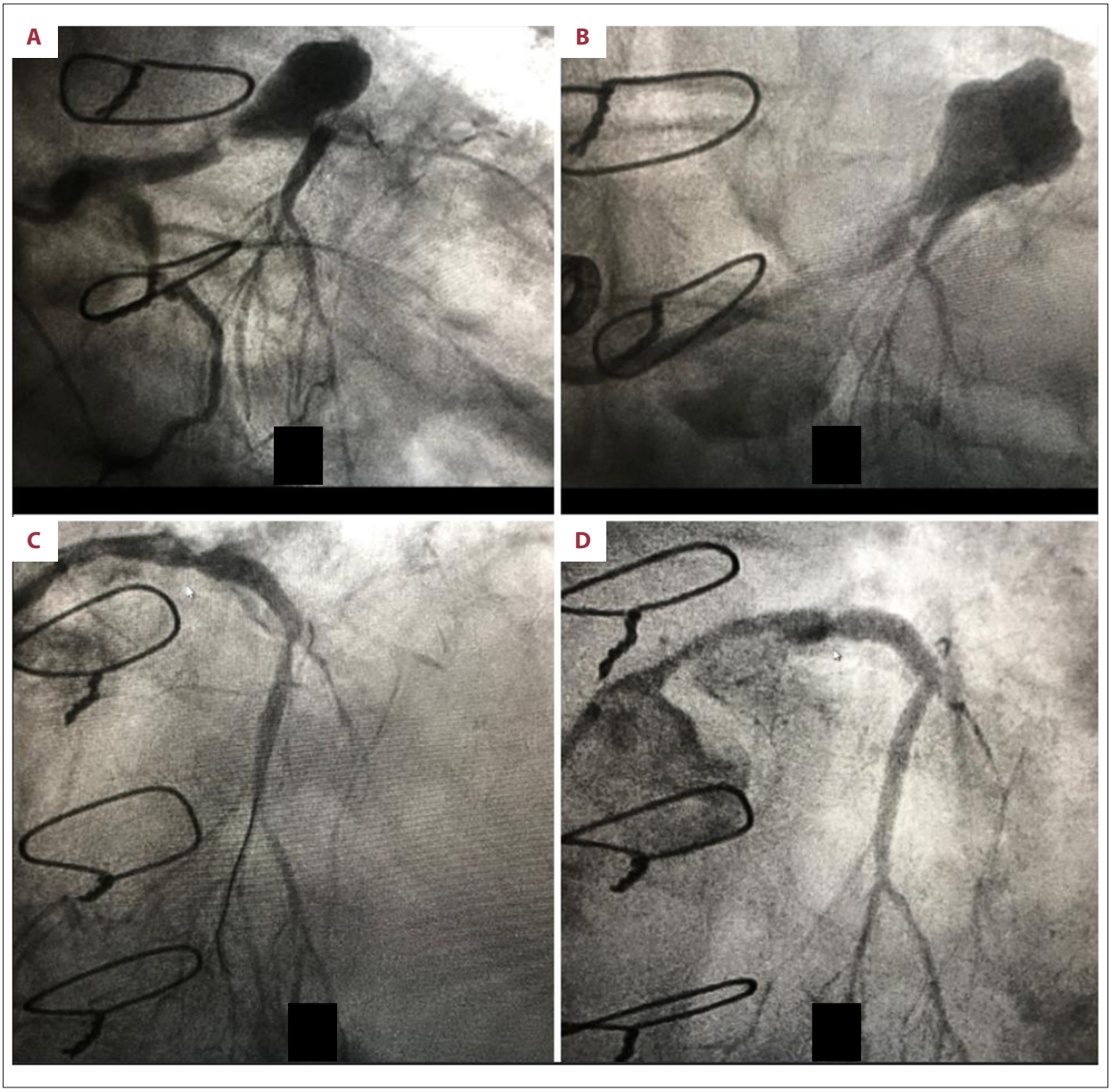

Figure 1. (**A**) 2015 left coronary angiogram showing a saccular aneurysm (10×8 mm) of the proximal LAD. (**B**) 2019 left coronary angiogram showing the aneurysm increased in size (15×12 mm). (**C**) 2019 left coronary angiogram showing covered stent implantation after rotablator atherectomy with significant residual stenosis. (**D**) 2020 left coronary angiogram showing a good aneurysm exclusion with stent recoil and stable in-stent restenosis.

increased the frequency of rare angiographic findings such as CAA. Aneurysmal dilation of coronary artery diameter greater than 8 mm, as described in our case, define a giant CAA [2]. The right coronary artery and the proximal coronary segments are most commonly involved. To date, the pathophysiology of CAA is not well understood. However, atherosclerosis is the main contributing factor in adults, while Kawasaki disease is the major predisposing factor in children [3]. The main complications are CAA rupture resulting in cardiac tamponade, local thrombus formation, and subsequent distal embolization leading to myocardial infarction.

In the absence of available guidelines, the therapeutic approach to CAA is individualized and depends on several parameters, including aneurysm characteristics (shape, size, location), clinical presentation (silent versus ACS) and co-existence of atherosclerosis. Both medical and invasive strategies have been described in the literature. The role of anticoagulation therapy in CAA is controversial and debatable, especially for those discovered incidentally [2]. Some studies report no advantage for anticoagulation therapy in CAA, whereas others show the opposite result [2]. There are limited data supporting

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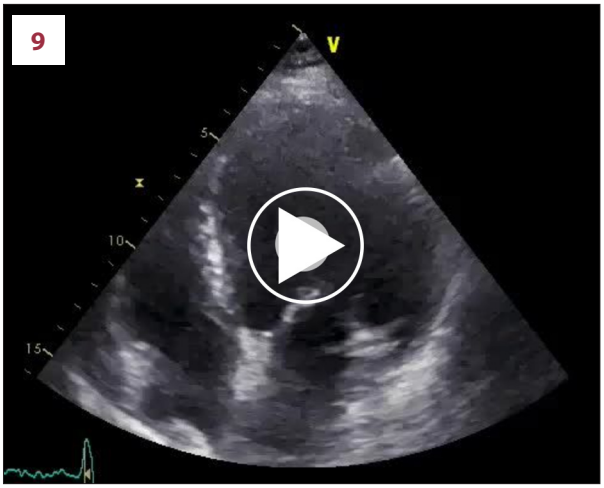

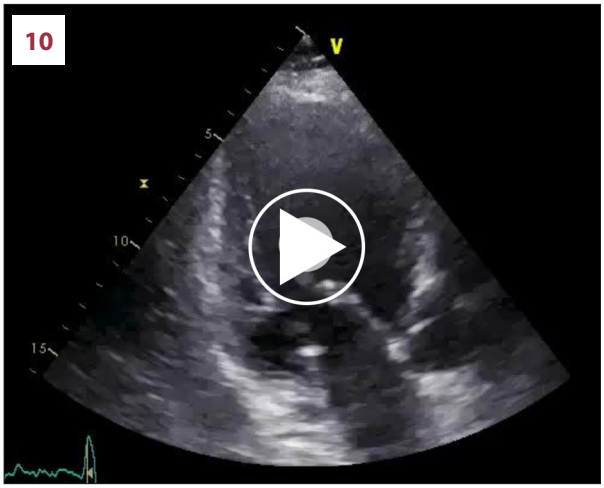

Videos 9, 10. TTE showing an improved LVEF at 35%.

the beneficial role of anticoagulation therapy in CAA patients presenting for ACS [3].

To date, there is limited evidence supporting PCI outcomes in CAA, especially in asymptomatic patients, where data are based on clinical series. As a result, the management of incidentally discovered CAA is more complex. Aneurysm morphological features (size, saccular *vs.* fusiform, localized *vs.* diffused), concomitant coronary artery disease, clinical situation (silent *vs.* symptomatic), technical feasibility, risk of future complications, aneurysm extension, and progression are the main determinants of therapeutic decision-making. In our case, diffuse atherosclerotic disease was the culprit contributing factor for CAA. Also, the concept of coronary steal syndrome or the theory that blood flow turbulence in a giant aneurysm can act hemodynamically in a similar way to that of significant coronary stenosis could explain the improvement in LVEF after excluding CAA. However, the hypothesis of coronary steal and flow dynamics remains debatable. The study by Murakami et al. found that giant CAA was associated with a decline in FFR but not CFR [4], whereas the study by Hamaoka et al. showed that CAAs of intermediate-to-large size were associated with a reduction in CFR and abnormal flow dynamics [5].

It is worth noting that the rarity of giant CAA necessitating a medical intervention makes it difficult to standardized treatment or to develop firm guidelines supporting optimal management. Insights from the literature suggest a primarily surgical approach for giant CAA (>20 mm or >4×coronary reference diameter), multiple CAA, CAA involving the saphenous graft [2], and for those that are not suitable for percutaneous intervention [1]. The expansion in size (passing from 10 to up to 15 mm) of the CAA was the major determinant to intervene in order to prevent future life-threatening complications. Carino et al. reported the feasibility of surgical ligation followed by CABG for aneurysms involving 2 vessels [6]. Moreover, Chen et al. supported the endovascular treatment with coil embolization for giant aneurysms [7]. The PCI strategy was preferred over a surgical approach due to the patency of left mammary graft to the LAD and diagonal coronary arteries, which overcome the effect of potential future restenosis, the complexity of second cardiac intervention, and the technical feasibility of covered stent implantation.

Yip et al. and Bogana Shanmugam et al. assessed the PCI outcomes in aneurysmal infarcted coronary arteries [8,9]. A higher rate of no-reflow and distal embolization while performing the procedure was reported. Furthermore, an increased risk of stent thrombosis or restenosis was observed [8,9]. The use of covered stents and some practical issues may explain the last finding. Proper landing site assessment, covered stent delivery, appropriate stent apposition, and side branch preservation are the potential technical challenges.

Conclusions

Giant CAA is a rare angiographic feature that can be associated with life-threatening complications. To date, there are no standardized recommendations for the management of giant CAA. We report a case of giant CAA successfully treated with covered stent implantation leading to a good outcome. Further future clinical trials assessing the role of PCI in the management of CAA are needed.

Conflict of interest

None.

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