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Off Pump Surgery for Giant Right Coronary Artery Aneurysms

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Abstract

Coronary artery aneurysms larger than 5 cm are exceedingly rare, and a standard treatment for them is lacking. We report 2 cases of giant right coronary artery aneurysms successfully treated by off pump resection of the aneurysm and bypass grafting. The controversy surrounding the proper management of such cases is discussed.

Introduction

Giant coronary artery aneurysms are very infrequent findings. They compromise coronary blood flow, and can rupture, dissect or create a fistula into adjacent structures (1, 2). As there are few cases of giant right coronary artery (RCA) aneurysms reported in the literature, the standard of care remains uncertain (3). The majority of reports describe surgical resection of the aneurysm with concomitant coronary artery bypass graft (CABG) as the most effective approach. We report our experience with 2 giant RCA aneurysms that were successfully treated off pump without cardiopulmonary bypass.

Case 1

Institutional review board approval was obtained for both cases. An 81-year-old male was diagnosed with a cystic structure adjacent to the right atrium discovered incidentally on routine cardiac imaging studies. The patient was status post CABG operation 16 years ago and was asymptomatic. The patient's past medical history was unremarkable except for chronic renal insufficiency (creatinine 2.9). Physical examination was unremarkable and the electrocardiogram showed first degree block and left bundle branch block.

Transthoracic echocardiography revealed a cystic mass lateral to the right atrium. This finding was confirmed by computed tomography angiography (CTA), which showed a giant RCA aneurysm containing thrombus, with moderate mass effect on right ventricular inflow. CTA images also confirmed the aneurysm to be in close proximity to the inner table of the sternum. Cardiac magnetic resonance imaging (MRI) characterized the mass to be 77 × 74 × 86 mm in size, circular, and adjacent to and compressing the right atrium, tricuspid annulus and right ventricle (Figure 1). Coronary angiography also demonstrated the aneurysm and

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showed patent saphenous vein and left internal mammary artery grafts to the circumflex, RCA (distal to the aneurysm) and left anterior descending arteries, respectively.

Given the location of the aneurysm and the risk of entry into the sac during resternotomy, the femoral artery and vein were exposed in the event cardiopulmonary bypass was needed. The sternum was reopened without difficulty. The RCA was identified and encircled with umbilical tape and clamped proximally and distally to isolate the aneurysm. Without instituting cardiopulmonary bypass, the aneurysmal sac was opened and laminated clot and debris were removed. The inlet and outlet of the aneurysm were then over sewn. The patent RCA graft was preserved. Intraoperative transesophageal echocardiography confirmed preservation of the biventricular function and removal of the aneurysm. The patient tolerated the procedure well and was discharged from the hospital on the fourth day postoperatively.

Case 2

A 70-year-old male with a history of hypertension and diabetes sought medical attention for recent onset of fatigue. He denied a past history of trauma, connective tissue disorders or cardiac diseases. Transthoracic echocardiography demonstrated a mass overlying the right atrium and ventricle. The mass was originally thought to be a pericardial cyst until the patient underwent cardiac MRI and coronary angiography which confirmed the diagnosis of giant RCA aneurysm, measuring $55 \times 55 \times 77$ mm in size (Figure 2). Coronary angiography did not show critical stenosis of any of the epicardial arteries. Given the size of the aneurysm and the mass effect on the adjacent structures, the patient was taken to the operating room with the plan of aneurysmectomy and a bypass graft to the RCA. After proximal and distal control of the aneurysm via vessel loops, the aneurysm sac was opened and the inlet and outlet over sewn. A RCA bypass was then performed using a saphenous vein graft off-pump. The patient tolerated the procedure well and was discharged on postoperative day 3.

Comment

Reports have defined coronary aneurysms with the greatest dimension exceeding 5 cm as giant. The importance of aneurysm size is primarily for deciding whether or not the patient needs urgent surgical intervention. There are reports in the literature describing rupture of aneurysms into the pericardium causing tamponade (4), or into adjacent chambers forming fistulas (5). Such patients usually warrant emergency surgical intervention. In addition, the mass effect of the aneurysm pressing over the adjacent cardiac and thoracic structures is another indication for surgical intervention. Kumar et al (6) reported a giant RCA aneurysm that presented as superior vena cava syndrome and required surgical excision.

The majority of coronary artery aneurysms are asymptomatic and found incidentally. However, for those symptomatic cases, chest pain and myocardial infarction are frequently the leading presentations. Even in the absence of severe coronary stenosis, a dilated coronary segment induces alterations in blood flow and is a source of emboli and predisposes patients to ischemia or infarction (7).

Despite the value of transthoracic echocardiography for the diagnosis of giant coronary artery aneurysms, coronary angiography is the gold standard for assessing coronary artery

anatomy. Computed tomography (CT) angiography and magnetic resonance (MR) imaging have recently been shown to be useful in the diagnosis of giant coronary aneurysms. These modalities may surpass angiography as they are not dependent on contrast opacification of the artery which can be difficult in a large coronary aneurysm (8).

Due to the rarity of giant coronary artery aneurysms, the optimal treatment for such patients is still somewhat controversial. Medical treatment (9), stent implantation (10) or bypass surgery (11) have been performed. However, aneurysm resection and concomitant coronary bypass is the standard of care (11) and aneurysms larger than 5 times the size of a normal coronary artery warrants surgical resection. Although atherosclerotic aneurysms are usually thick-walled and not prone to spontaneous rupture, in many cases, the underlying etiology of the aneurysm becomes evident only after surgical repair and histopathological studies are performed. As a result, the management should be individualized with focus on clinical symptoms, size of the aneurysm, the presence of coronary artery disease, and associated comorbidities.

A significant proportion of patients with coronary artery aneurysms may not have co-existing coronary artery disease. As a result, they usually require bypass of the single vessel affected by the aneurysm. Based on our successful experience, we propose that an off pump approach would be very safe for resection of the aneurysm and to perform bypass grafting if necessary. However, whether to establish an acceptable circulation to the coronary artery first or to resect the aneurysm should be individualized based on the degree of coronary stenosis and the existence of collateral circulation.

In conclusion, aneurysm resection and concomitant bypass surgery remains the standard therapeutic option for giant coronary aneurysms. We successfully treated 2 such cases of giant RCA aneurysms off pump with excellent outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Giant RCA aneurysm compressing the right atrioventricular groove. The cardiac MRI demonstrated laminated thrombus (arrow) on steady state free precession cine MRI, black blood turbo spin echo, and pre-contrast T1-weighted techniques. The heterogeneous signal intensity on the cine MRI and more prominently on the black blood TSE image is consistent with slow blood flow through the aneurysm.

Figure 2. Giant RCA aneurysm (arrow). Early contrast enhancement during 1st pass perfusion (lower left) is consistent with a vascular structure. The uniform enhancement of the aneurysm during later perfusion images and on delayed enhancement images confirms the vascular nature of the structure and excludes thrombus within the lumen.