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Combined Surgical Approach to Multiple Giant Coronary Artery Aneurysms

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ABSTRACT

Multiple giant coronary artery aneurysms are rare but can develop in the presence of an underlying atherosclerotic vessel disease. Nevertheless, there is no consensus on the ideal surgical treatment or on operative procedures, including aneurysm resection, ligation, distal bypass, and graft interposition. We present the case of a 72-year-old woman with a history of multiple arterial aneurysms who was admitted to the emergency clinic with sudden-onset chest pain and dyspnea. The patient's diagnosis was ischemic heart disease and multiple giant coronary artery aneurysms involving the left anterior descending coronary artery and the proximal and distal segments of the right coronary artery. We present a combined surgical approach to multiple giant coronary artery aneurysms associated with atherosclerosis.

INTRODUCTION

Coronary artery aneurysm (CAA) is rare and is defined as coronary dilation that exceeds by 1.5 times the diameters of nonpathologic adjacent segments or the diameter of the patient's largest coronary vessel. A CAA is termed a giant aneurysm if its diameter is larger. In the literature, the diameters of giant CAAs in adults have varied from 50 mm to 150 mm. CAAs generally involve only a single coronary artery and are present in <5% of coronary angiographic series [Syed 1997; Li 2005]. The main causes of coronary artery aneurysm include atherosclerosis, Kawasaki disease, iatrogenic trauma of coronary angioplasty, and endocarditis [Syed 1997; Jha 2009]. In addition, the presence of aortic aneurysm is a significant risk factor for multivessel coronary artery disease [Hirose 2009]. Operative procedures include percutaneous stent-graft implantation, resection, reconstruction, or ligation and concomitant bypass grafting; however, there is no consensus on the ideal treatment [Firstenberg 2000]. We present a combined surgical approach to multiple giant CAAs.

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CASE REPORT

A 72-year-old woman was admitted to the emergency clinic with sudden-onset chest pain, dyspnea, and palpitation. The patient's diagnosis was acute inferior myocardial ischemia, and her symptoms improved after medical treatment. She also had a diagnosis of descending aortic aneurysm that had been followed-up for 4 years and had undergone tube graft interposition for an abdominal aortic aneurysm 10 years ago. A coronary angiogram showed multiple giant CAAs in the left anterior descending coronary artery (LAD) and the proximal segment of the right coronary artery (RCA). The distal segment of the RCA could not be visualized because of the increased size of the aneurysm and thrombus formation within. To evaluate the pathology properly, we performed a coronary computed tomographic (CT) angiogram and measured the diameter of the aneurysm in the proximal segment of the LAD as 6.9 cm, in the proximal segment of RCA as 6.6 cm, and in the distal segment of the right posterior descending (RPD) artery as 2.9 cm (Figure 1). Thus, an operation was performed to repair these multiple giant CAAs and associated morbidities, and to revascularize ischemic myocardium.

After median sternotomy and pericardiotomy, we encountered the multiple giant CAAs of the proximal LAD, the

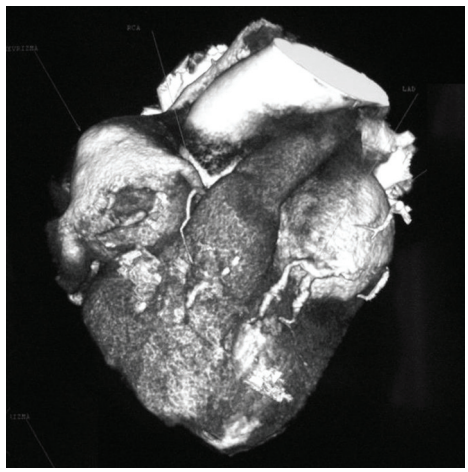

Figure 1. Preoperative coronary computed tomographic angiogram shows giant coronary artery aneurysms of the left anterior descending coronary artery and the right coronary artery.

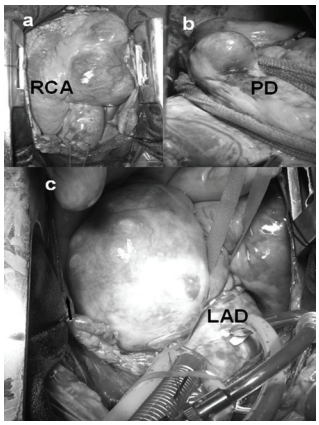

Figure 2. Perioperative view shows multiple giant aneurysms of the right coronary artery (RCA) (a), the right posterior descending artery (PD) (b), and the left anterior descending coronary artery (LAD) (c).

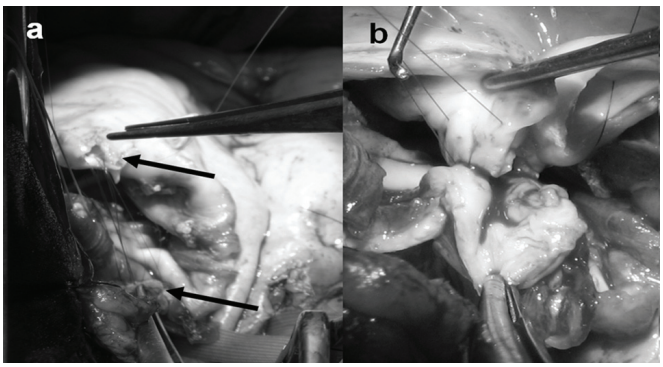

Figure 3. Perioperative view shows left anterior descending coronary artery after resection of a giant coronary artery aneurysm (a) and end-to-end anastomoses after approximation of both ends of the artery (b).

proximal RCA, and the RPD artery (Figure 2). Because the giant aneurysm of the RCA developed anteromedially over the right atrial appendage, disturbing the exposure for venous 2-stage cannulation, we used the right femoral vein for venous access.

The operation was performed with the patient under cardiac arrest and with moderate hypothermia. A longitudinal dissection of the giant CAA of the RCA revealed thrombosis and an underlying atherosclerotic vessel wall in the distal segment of the artery. After excision of the aneurysm, the proximal and distal ends of the RCA were ligated, and coronary bypass grafting to the RCA was performed with a saphenous vein graft. Conversely, the giant CAA involving the RPD artery was localized in a distal position. When this aneurysm was resected, this vessel was observed to be free of an underlying atherosclerotic process. Patch plasty with a piece of saphenous vein was done because of the distal location of the CAA as well as the presence of a bypass graft proximally.

After resection of the giant aneurysm along the proximal segment of the LAD, the proximal and distal ends of the native vessel were revealed and measured to be 4 mm in diameter (Figure 3A). At this point, we thought that use of the left internal thoracic artery (LITA) could lead to a size mismatch or early graft failure and that the use of saphenous vein might be associated with decreased patency. We therefore mobilized both ends of the middle segment of the LAD and anastomosed them end to end with 7-0 Prolene suture without traction (Figure 3B). We then approximated the epicardial tissue on both sides of the LAD to avoid an unexpected tension on the anastomoses. The patient's postoperative course was uneventful.

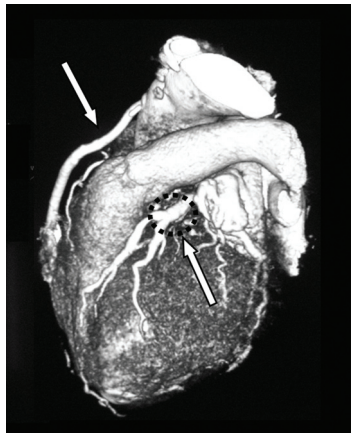

Figure 4. A coronary computed tomographic angiogram reveals the patency of end-to-end anastomoses of the left anterior descending coronary artery (lower white arrow and circle) and saphenous vein graft to the right coronary artery (upper white arrow).

The patient was discharged home on postoperative day 8 with a favorable outcome and is currently well. A coronary CT angiogram revealed all coronary arteries to be patent at 6 months after surgery (Figure 4).

COMMENT

CAAs can be associated with atherosclerosis in patients of advanced age, but multiple giant aneurysms are rarely present. In patients with aortic aneurysm, coronary disease presents with an incidence between 33% and 46% [Hirose 2009]. The incidence of CAAs is 0.15% to 4.9% of patients who undergo elective coronary angiography, whereas the incidence of multiple giant CAAs is not clear [Syed 1997]. CAA generally involves only a single coronary artery. Whereas the RCA is the most commonly involved coronary artery, followed by the LAD, multiple coronary aneurysms or involvement of the left main coronary artery is very uncommon.

Patients are generally asymptomatic, but a giant CAA can cause myocardial ischemia or infarction because of vasospasm, thrombus formation, and distal coronary embolization. It can rarely lead to mortality associated with fistulization and rupture into cardiac chambers or the pericardial space [Syed 1997; Iwai-Tanako 2007; Jha 2009]. The risk for occurrence of these morbidities increases when multiple giant CAAs develop simultaneously.

A giant CAA can be an incidental finding in coronary angiography or echocardiography; however, the patient may present with symptoms of ischemic heart disease and congestive heart failure, as well as sudden death, because of acute myocardial infarction, spontaneous rupture, or cardiac tamponade [Firstenberg 2000]. The differential diagnosis includes atherosclerosis, congenital malformations, iatrogenic trauma, cardiac tumor, infection, and Kawasaki disease. In addition, CAAs can be associated with aneurysm of the thoracic and abdominal aorta [Hinterauer 1985; Hirose 2009]. In cases with a previous diagnosis of aortic aneurysm, coronary artery disease should be in the differential diagnosis of associated comorbidities. Coronary angiography is the gold standard for the diagnosis of CAAs, but it has some limitations, including the inability to differentiate true aneurysm from pseudoaneurysm. Intravascular ultrasound is useful for differentiating these 2 pathologies and provides detailed and high-quality evaluation of such aneurysms [Eshtehardi 2008]. Nevertheless, coronary CT angiography allows a more detailed evaluation and demonstrates the extent and size of the pathology. This imaging modality also reveals the relationship of the aneurysm with the cardiac chambers and the distal coronary circulation.

Multiple CAAs are rare and are usually seen at an early age in patients with such autoimmune diseases as Kawasaki disease. CAAs in Kawasaki disease can present with a diffuse involvement of coronary arteries but are of a smaller size compared with giant CAAs [Sethi 2002]. In autoimmune diseases, surgical treatment is not usually considered as an initial treatment of choice because of the thrombosis and embolization risks associated with surgery, but surgery can be used to improve the quality of life and to prevent early mortality [Takahashi 1996]. In these patients, distal bypass grafting is usually preferred after resection of the aneurysm.

According to our literature review, co-occurrence of multiple giant CAAs with arterial aneurysm of the aorta has not been reported to date; however, an association between aortic aneurysms and coronary disease has already been well described [Hirose 2009]. This report also presents a combination of different surgical techniques in an individual case with multiple CAAs and considers alternative approaches. In the current case, the predisposing factors for CAA were advanced age, atherosclerosis, and concomitant aneurysms of the descending and abdominal aorta. This condition can be explained as due to a decrease in the quality of the elastic fibers in the media of vessel wall related to the patient's advanced age and atherosclerosis.

In isolated CAAs, percutaneous exclusion of the aneurysm with stent placement can be the treatment of choice [Eshtehardi 2008]; however, in multiple giant CAAs, surgical intervention is a more reasonable approach because of the morphologic variability and enlarged size of the aneurysms. The main purpose of surgical treatment in CAAs is to prevent their rupture and the patient's death, as well as to avoid thrombosis and related coronary embolization. Surgery allows excision of the aneurysmal sac and management of associated surgical conditions. There are different surgical approaches, including resection of the aneurysm, graft interposition, and bypass grafting distal to the aneurysm, with or without ligation [Hinterauer 1985; Agarwal 2007; Iwai-Tanako 2007; Jha 2009]. Nevertheless, there is no consensus as to the optimal surgical strategy for CAAs. In our case, we preferred end-to-end anastomoses for the LAD to the use of the LITA. Because the diameter of the LAD was 4 cm, use of the LITA could lead to a size mismatch and early graft failure. On the other hand, the saphenous vein was not used because of the better patency of end-to-end anastomoses. At this point, the most important problem is bleeding from the suture lines or coronary artery occlusion due to traction on the LAD. To avoid these morbidities, we mobilized the LAD sufficiently and checked for any resulting tension after the anastomoses. On the RCA, the distance between the 2 ends of the native vessel after resection of the aneurysm and arterial ligation was relatively long; therefore, we applied bypass grafting with saphenous vein. Patch plasty with the saphenous vein was performed for the RPD artery because of the distal location of the CAA and the presence of a bypass graft proximally.

In conclusion, end-to-end anastomosis is a safe and feasible procedure when a giant CAA requires surgical treatment. In sequential giant CAAs, patch plasty can be performed for a distal CAA if coronary revascularization is established after resection of the proximal aneurysm.

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