Giant Left Main Coronary Artery Aneurysm and Atherosclerotic Coronary Tree: Additive Value of Coronary CT Angiography Over Conventional Angiography

Mehmet Onur Omaygenc,1,2 Ibrahim Oguz Karaca,1 Beytullah Cakal,1 Haci Murat Gunes,1 Arda Ozyukel,2 and Cengiz Erol3

1Cardiology Department, Istanbul Medipol University Hospital, Istanbul, Turkey
2Department of Cardiovascular Surgery, Istanbul Medipol University Hospital, Istanbul, Turkey
3Department of Radiology, Istanbul Medipol University Hospital, Istanbul, Turkey

Abstract

Introduction: Giant aneurysms are extremely rare anomalies of the coronary tree. Regarding the site of involvement, the left main coronary artery (LMCA) is the least encountered of all. Coronary angiography is invariably the diagnostic method of choice but infrequently, standard injections might be inadequate to clearly opacify the distal segments. In this particular state, coronary computed tomography angiography (CCTA) offers comprehensive imaging of the entire coronary tree and the contents of the aneurysm (calcification and thrombus). CCTA may also facilitate demonstrating the mass effect of the aneurysm, if it exists.

Case Presentation: A 44-year-old patient on routine dialysis treatment was suspected of having significant coronary artery disease due to typical exertional symptoms and abnormal stress test results in the course of evaluation for eligibility for renal transplantation. Coronary angiography was performed, and a giant aneurysm over 4 cm in diameter possibly emerging from the LMCA, was detected. The left anterior descending artery (LAD) could not be opacified in the left coronary injections, and the coronary segments adjacent to the origin of the aneurysm were not visualized either. Therefore, a CCTA was scheduled and it illustrated not only the LAD course but also 2 other intermediate arteries that were not recognized on coronary angiography, nature of the aneurysm, and atherosclerotic burden of the entire coronary tree. The patient was treated with surgery due to proven severe myocardial ischemia and to modify the risk of the upcoming transplantation procedure. The occlusion of the branches originating from the LMCA, sac shrinkage, and bypass grafting were the consecutive steps of the selected method of heart surgery.

Conclusions: Comprehensive imaging of a giant coronary aneurysm is a challenging issue and utilization of different modalities, including CCTA, is essential in the majority of cases. Due to the rarity of the situation, deciding on the necessity of intervention and the method of choice are also controversial. We sought to discuss these equivocal issues in light of the limited knowledge in the existing literature.

Keywords: Computed Tomography Angiography, Coronary Aneurysm, Coronary Angiography

1. Introduction

Coronary aneurysms are defined as a more than 1.5 fold increase at the luminal diameter of an artery with respect to the adjacent normal segment. Aneurysms are classified under the heading of coronary anomalies, and their prevalence ranges between 0.3% and 5% in various registries. Giant aneurysms are even rarer, but their prevalence varies because of the inconsistent definitions of the term "giant". Aneurysms measuring over 20 to 50 mm, triple or quadruple the size of the reference vessel, have been previously suggested for this purpose. Nevertheless, a frequency of 0.02% to 0.2% can be considered the approximate prevalence (1-3). The disease is male predominant, and atherosclerosis is primarily accused in the etiology for adulthood. In a non-atherosclerotic setting, medial degeneration commonly lies behind the pathophysiologic process. Kawasaki disease and congenital aneurysms lead the list of the causative factors in the absence of atherosclerosis (1, 4, 5). The left coronary system is less frequently affected than the right coronary artery, and the left main coronary artery (LMCA) is the least of all as the site of involvement (2, 5). Diagnosis usually necessitates an additional modality, mostly coronary computed tomography angiography (CCTA), coupled with conventional angiography, and the therapeutic approach remains controversial.

Here we present a case with a giant LMCA aneurysm, diagnosed with coronary angiography, fully identified with the help of CCTA, and treated with surgery.
2. Case Presentation

A 44-year-old male patient on dialysis, who was a candidate for renal transplantation, referred to our outpatient clinic for cardiac evaluation. He was obese, and he complained of exertional dyspnea even while performing routine daily activities. Cardiac physical examination and baseline ECG were normal. Echocardiographic examination revealed normal ejection fraction, moderate left ventricular hypertrophy, and mild diastolic dysfunction without significant valvular disease. Eventually, coronary angiography was scheduled due to abnormal treadmill stress test results. A giant aneurysm, measuring approximately 4 cm, was observed in the left coronary injections. The neck of the aneurysm seemed to originate from the distal LMCA, but the exact anatomy could not be identified in serial injections from various angles. Moreover, the left anterior descending artery (LAD) could not be clearly opacified (Figure 1 Videos 1, 2 in Supplementary File, right anterior oblique cranial and anteroposterior caudal views, respectively). Regarding the necessity of intervention for the giant aneurysm, which had led to ischemic symptoms and had the state of impending rupture, CCTA was planned to evaluate the left coronary tree precisely and come to a decision as to the treatment strategy. ECG-gated CT scan (Step and Shoot Cardiac acquisitions on a 256-slice multidetector CT scanner, Philips Brilliance iCT, Philips Healthcare, the Netherlands) was performed the day after, and images obtained with multiplanar reformation and 3D volume-rendering were assessed for a definite diagnosis (Figure 2). The aneurysm sac, involving scattered calcifications, measured $32 \times 32 \times 32$ mm in size and no image consistent with intraluminal thrombus formation was observed. It was located at the distal LMCA as was predicted. Additionally, the LAD, circumflex artery, 2 intermediate arteries arising from the LMCA, and dominant ectatic right coronary artery were explicitly visualized, and diffuse calcific atherosclerotic plaques resulting in mild-to-moderate stenosis in the entire coronary system were displayed (Figure 3). Meanwhile, diagnostic workup for possible relevant infective diseases, vasculitis, and other rheumatologic disorders was performed, which did not yield an abnormal result.

Eventually, therapeutic options were discussed by the heart team and the patient himself. As a result, surgery was planned due to proven severe myocardial ischemia and to modify the risk of the upcoming transplantation procedure. At the operating room, the aneurysmatic segment was exposed and dissected (Figure 4). The coronary ostia were separately sealed, the sac was shrunk via over-and-over suturing, and bypass grafting to each branch was performed thereafter. The patient was discharged uneventfully at the end of the 1st week.

3. Discussion

Coronary aneurysms were first described at the beginning of the 19th century. In the last 20 years, several case reports and registries have been published about this topic in parallel with the widespread utilization and evolvement of such imaging modalities as coronary angiography and CCTA (1, 2). Traditionally, atherosclerosis is the leading cause of aneurysm formation. Intimal injury, consecutive weakening of the media, and loss of elasticity culminate with the local rise of intraluminal pressure and the dilation of the vessel. Apropos of the non-atherosclerotic context, an inherent medial degenerative process most likely lies behind the incidence. More recently, percutaneous coronary intervention has emerged as a distinct risk factor, possibly via a mechanism based on endothelial dysfunction (1, 2, 6). In our case, atherosclerosis seemed to be the reason for the aneurysmal dilation.

Coronary artery aneurysms are mostly asymptomatic, but infrequently patients may present with distinct clinical scenarios like stable angina pectoris, acute coronary syndromes (thrombus formation in the sac with and without embolization), sudden cardiac death (myocardial infarction, rupture, etc.), and heart failure. Cardiac tamponade, fistula formation, and compression of the adjacent structures have also been reported. Further, superior vena cava syndrome and possible misdiagnosis of mediastinal masses are medical conditions that could be particularly attributed to the existence of giant aneurysms (2, 4, 7, 8).

Coronary angiography is invariably the diagnostic method of choice to detect coronary aneurysms but occasionally, selective injections might be inadequate to clearly opacify the distal segments. In this particular state, additional modalities should be used for further evaluation. Intravascular ultrasound (IVUS) is one of them, and it is especially helpful for discriminating between true and false aneurysms (2). In our case, we could not use IVUS because a clear distal luminography is required for the insertion of the guide wire on which the probe is advanced. Moreover, since the contents of the aneurysm vis-a-vis whether or not there was an unorganized thrombus and the origination of the coronary ostia were unclear, it was not reasonable to navigate the guide wire in the sac in a blinded manner. Even so, the aneurysm was supposed to be a true aneurysm, given that almost all of the coronary pseudoaneurysms having been reported so far had resulted from a previous percutaneous coronary intervention (2). CCTA does not have these limitations of coronary angiography and IVUS and offers comprehensive imaging of both the entire coronary tree and the aneurysm sac. Evaluating the contents
Figure 1. Coronary Angiography, Right Anterior Oblique Cranial (A) and Anteroposterior Caudal (B) Views. Note That the Exact Origination of the Aneurysm and the LAD Course Could Not Be Visualized

Aneurysm (*): Cx, Circumflex artery; LAD, Left anterior descending artery; LMCA, Left main coronary artery.

Figure 2. CCTA Imaging of the Left Coronary System After 3D Reconstruction and Subtraction of the Adjacent Tissues. (A) CCTA Imaging of the Left Coronary System in the Left Anterior Oblique View. Adjacent Cardiac Anatomic Structures Were Also Displayed. (B)

Aneurysm (*): CCTA, Coronary computed tomography angiography; Cx, Circumflex artery; IMA, Intermediate artery; LAD, Left anterior descending artery; LMCA, Left main coronary artery.

of the aneurysm (calcification and thrombus) yields fundamental information about prognosis. CCTA may also facilitate demonstrating the mass effect of the aneurysm, if it exists. Consequently, these features make CCTA perfectly suitable for routine utilization in diagnostic workup (3, 9).

Choosing the appropriate treatment strategy for a coronary aneurysm is controversial. In addition to symptom severity, the localization, size, and contents of the aneurysm should also be taken into consideration when trying to arrive at a decision concerning the necessity of intervention. Several reports favoring conservative (antiplatelet and/or anticoagulant) treatment, surgery, and covered stent implantation have been published so far but sufficient data do not exist for establishing algorithms (1, 2). Regarding this fact and the breadth of the clinical spectrum, the therapeutic approach should be individualized. Once the anatomy is precisely identified, extensive size with a potential risk of rupture and thromboembolism as well as the compression of the adjacent structures might raise the necessity of surgical treatment for large aneurysms as was the case in our patient (2, 8, 10, 11).

3.1. Conclusions

Dealing with giant coronary artery aneurysms is a challenging issue due to the presence of various unanswered questions regarding the definition, diagnosis, and treatment. In our opinion, the rarity of the situation necessitates that every single striking case be reported. We sought not only to declare to what extent an aneurysm can extend but also to emphasize the additive diagnostic value of CCTA over coronary angiography in clarifying the precise anatomy and directing the management strategy.

Supplementary Material

Supplementary material(s) is available here.

Footnotes

Conflict of Interests: None
Financial Disclosure: None.

References


