Multidetector-row Computed Tomography in Diagnosis of a Large Right Coronary Artery Aneurysm Resulting from Arteriovenous Fistula

Kun-Eng Lim, Kuei-Ton Tsai and Yu-Lin Ko

Coronary artery aneurysm with arteriovenous fistula is an uncommon condition. We report a 52-year-old male with a large right coronary artery aneurysm resulting from a coronary artery-to-right ventricle fistula. The aneurysm and the fistula were demonstrated by an electrocardiography-gated multidetector-row computed tomography coronary angiography. Three months after surgery, the computed tomography coronary angiography showed no fistula, and the distal right coronary artery was bypassed with a saphenous graft. Thus, we concluded that in some instance multidetector-row computed tomography coronary angiography may be helpful for diagnosis and demarcation of coronary artery aneurysm with arteriovenous fistula.

Key Words: Coronary arteriovenous fistula • Computed tomography

INTRODUCTION

Coronary artery aneurysm is an uncommon disease. Coronary artery aneurysm is defined as coronary dilatation that exceeds the diameter of normal adjacent segment or the diameter of the patient’s largest coronary vessel by 1.5-2 times. The incidence of this anomaly is between 1.4% and 5%. Coronary artery aneurysm caused by coronary arteriovenous fistula is an even more uncommon condition. Currently, multidetector-row computed tomography (MDCT) coronary angiography has become a valuable method for evaluation of coronary artery disease and the heart. Herein, we report MDCT coronary angiography is helpful for demonstrating a large right coronary aneurysm resulting from a coronary artery-to-right ventricle (RV) fistula.

CASE REPORT

A 52-year-old male suffered from effort-related chest tightness and palpitation for about 2 weeks. He had cardiac murmur and had been told he had heart disease by her family physician a long time before. He family history was unremarkable. He had a history of hyperlipidemia (at admission, triglyceride measured 211 mg/dl) and peptic ulcer for many years. On physical examination, the patient appeared essentially well. However, a harsh grade 2-3/6 continuous murmur was audible over the left lower parasternal border. Chest radiography showed widening of the right mediastinum. Electrocardiography (ECG) showed left atrial enlargement and right bundle branch block. Transthoracic 2-dimensional and color-Doppler echocardiography showed mildly dilated left ventricle and aortic root, thick interventricular septum, mild mitral and tricuspid regurgitations, and moderate aortic regurgitation. Furthermore, there was a large right coronary artery (RCA) orifice due to a suspected coronary arterio-venous fistula. Transesophageal echo-

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cardiography showed a dilated aortic root and a large RCA from the right coronary sinus along the RV free wall. In addition, the large RCA also compressed the RV inflow tract and drained into the RV near the tricuspid valve level. Yet, the left ventricular systolic function was preserved. Invasive coronary angiography demonstrated a large RCA aneurysm about 3.3 cm in diameter originating from the ostium of the RCA, with the draining site of arteriovenous fistula not being able to be identified. The left main coronary trunk and its tributaries were patent, and left ventricular ejection was about 66%. For further evaluation of any additional findings as preoperative work-up, an ECG-gated enhanced MDCT was acquired with a 64-slice scanner (Light Speed VCT, General Electric, Milwaukee, Wisconsin). Contrast agent transit time was determined using a 20-ml bolus injection of contrast agent (Ultravist 370 mg/dl, Schering, Berlin, Germany), followed by a 40-ml saline chaser. For acquisition of the volume data set, the patient received a total of 65 ml contrast agent via antecubital vein at a rate of 5 ml/s, followed by a 40-ml saline chaser. The scan parameters were: 64 × 0.625-mm collimation, caudocranial scan direction, 350-ms rotation time, 120-kV tube voltage, and 600-mA tube current. Images were reconstructed with ECG gating to obtain optimal motion-free image quality. All reconstructed images were transferred to dedicated workstation for postprocessing and evaluation (Advantage 4.2, General Electric, Milwaukee, Wisconsin). Volume-rendered images of MDCT coronary angiography showed a large RCA aneurysm, without any luminal stenosis (Figures 1A and 1B). There was no evidence of wall calcification of the RCA aneurysm. The distal portion of RCA aneurysm draining directly into the posterior wall of the RV was demonstrated on thick-slab maximum intensity projection image (Figure 2).

The patient underwent surgical intervention with closure of the fistula using a hemashield patch; the RCA aneurysm was excluded from the right coronary circulation to avoid late rupture and thromboembolism complication by closure of both the proximal and distal ends of this lesion. Direct aneurysmorhaphy was done, and the distal RCA was bypassed with a saphenous vein graft. Post operation recovery was uneventful, and the patient was discharged from hospital 18 days after operation. Post-operative echocardiography revealed thickened posterior left ventricular wall, abnormal septal wall motion, adequate left ventricle and RV systolic function, and dilated aortic root with mild to moderate aortic regurgitation. Three months after surgery, the computed tomography coronary angiography showed no fistula, and the distal right coronary was bypassed with a patent saphenous graft (Figure 3).
Coronary artery aneurysm is a rare coronary artery disease in adult patients.\textsuperscript{1-3} It may be a congenital anomaly, or secondary to other diseases, such as atherosclerosis, post coronary intervention, infection, Kawasaki’s disease, trauma, systemic degenerative disease, or other inflammatory diseases.\textsuperscript{1,2,10,11} In our patient, no aforementioned causes were found, so we thought this patient might suffer from a congenital fistula. The majority of fistulae terminate in the right side of the heart. The most frequent sites of termination, in descending order, are the RV, right atrium, coronary sinus, pulmonary trunk, left ventricle, and superior vena cava.

Coronary angiography, currently the reference standard for imaging of coronary artery disease and anatomy, is an invasive procedure that requires highly trained personnel, with significant cost and low, but not negligible, procedure-related morbidity and mortality.\textsuperscript{12} In addition, there is a radiation dose to the operator. Owing to the complex three-dimensional nature of coronary artery fistula combined with a large coronary artery aneurysm, invasive angiography usually cannot fully delineate the complete outline of the large coronary artery aneurysm, side branches, and the fistula, as in our case.

Magnetic resonance (MR) imaging is a suitable non-invasive imaging tool for evaluation of coronary artery anomalies and their courses, yet it requires longer time, is more expensive, and is limited with regard to determination of the distal coronary arterial course.\textsuperscript{13} Also, the spatial resolution achieved with this imaging is marginal for coronary artery imaging. MR imaging is used for evaluation of coronary artery anomalies only when the patient has contraindication for CT because of a severe allergic reaction to iodinated contrast agent or due to impaired renal function (creatinine level of $> 1.5$ mg/dl).

MDCT coronary angiography is a faster, safer, more convenient, and non-invasive diagnostic modality to detect the presence of coronary artery anomalies.\textsuperscript{9,14} In this case, the entire examination was completed within 5 minutes and was performed as an outpatient procedure. MDCT combines the advantages of coronary angiography and intravascular ultrasound in one noninvasive modality, which allows full demonstration of the course of the coronary artery aneurysm, side branches, and other important information like diameter, lumen, and wall of the coronary artery, any presence or absence of calcification, and the myocardium.\textsuperscript{6,9} In addition, MDCT also can identify other significant non-cardiac findings during the same examination. All these data are crucial.

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in planning possible surgical or therapeutic interventions. In this case, the morphological findings of fistula and the RCA aneurysm were adequately provided by MDCT. Although MDCT has many aforementioned advantages when assessing coronary artery anomalies, radiation exposures are relatively high in using this technique, ranging from 5-18 mSV, as compared to those for invasive coronary angiography (5-7 mSv). Therefore, appropriate use of this technique is needed, especially for pediatric patients.

In contrast, transesophageal echocardiography is a practical and diagnostic test for assessing the coronary artery anomalies; yet it is not totally non-invasive, is operator-dependent, and may fail to completely delineate the complex anatomy of the coronary anomalies. Furthermore, this test requires full cooperation of the patient. As MDCT is a fast, accurate, and non-invasive technique that can delineate the complex coronary anomalies and extracardiac findings, we advocate that MDCT may be very helpful in some instances for investigating the adult patients suspected of having coronary anomalies.

In summary, we have reported a large coronary artery aneurysm resulting from coronary artery fistula to the RV, which was demonstrated by MDCT coronary angiography. When patient refuses coronary angiography or for whatever reasons coronary angiography cannot be performed, MDCT angiography may serve as an alternative diagnostic tool for assessing coronary artery anomalies.

REFERENCES