Imaging of the Coronary Artery Fistula from Left Main Coronary Artery to Pulmonary Artery with Multidetector Computed Tomography

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Coronary artery fistulas (CAFs) are mostly congenital, but they have been reported to be acquired as complications of chest trauma or medical procedures. Most adults with CAFs are diagnosed incidentally, because they are initially asymptomatic. CAFs are usually discovered on routine coronary angiography or at autopsy. In this article, we present a 54-year-old male with an asymptomatic left main coronary artery to main pulmonary artery fistula in which the diagnosis was made by multidetector computed tomography (MDCT) and coronary angiography. Reconstructed images obtained on MDCT coronary angiography are illustrated with correlative angiographic images. It shows MDCT could be useful in diagnosis and in delineating the complex anatomy of a coronary artery fistula as well as for conventional coronary angiography.

Key Words: Coronary artery fistula • Multidetector row computed tomography • Coronary angiography

INTRODUCTION

The first pathological findings of coronary artery fistula (CAF) were described by Krause in 1865. Coronary artery fistulas are quite uncommon and have been reported in 0.27-0.4% of patients with congenital cardiac defects.1 More than 90% of CAFs drain into the right side of the heart, with 15% draining into the pulmonary circulation.2 Most patients with CAFs are asymptomatic and incidentally found in 0.3% to 0.8% of patients who undergo coronary angiography.3 Some individuals may present with fatigue, dyspnea, or angina. In this paper, we report a case of coronary artery to pulmonary artery fistula imaged by MDCT. Even though coronary angiography is the gold standard for imaging the coronary tree, the usage of MDCT in the diagnosis of CAFs is another, less invasive alternative.

CASE REPORT

A 54-year-old male patient presented for a health examination. He had had hypertriglyceremia for several years with medical control and denied any cardiac symptoms. The physical examination was grossly normal, with regular heart beats and no murmur. Twelve-lead ECG showed normal sinus rhythm without significant ST-T change. Thallium-201 myocardial tomographic imaging with treadmill exercise using Bruce protocol was performed under his health examination program. Treadmill ECG showed ST segment depression at leads II, III, aVF and V4 to V6. The initial and 4-hour delayed images showed partial reversible perfusion defects at the anterior (apical to mid), inferior (mostly mid to basal), and basal septal walls. Under the impression of possibly ischemic change, MDCT coronary angiography was performed with retrospective ECG-gated technique using a
16-slice CT scanner. Axial CT image showed a small tortuous vessel between the ascending aorta and pulmonary artery (Figure 1A). Three-dimensional reconstructed images from MDCT showed a coronary artery fistula arising from the left main coronary artery to the proximal portion of the main pulmonary artery (Figure 1B and C) and patent coronary arteries. For further confirmation of coronary artery status, cardiac catheterization with coronary angiography was performed and revealed the same findings (Figure 1D). Further treatment such as coil embolization was suggested to the patient, but he refused due to personal reason. This case demonstrates the capability of MDCT coronary angiography in delineating the complex anatomy of a coronary artery fistula.

**DISCUSSION**

CAF is difficult to detect because most patients with CAFs are asymptomatic, just like this patient. Adults with CAFs are usually asymptomatic, but some may present with symptoms of fatigue, dyspnea, orthopnea, angina, atrial arrhythmias, pulmonary hypertension, or endocarditis. Symptoms such as dyspnea on exertion, fatigue, and angina are more likely to develop in older patients (more than 20 years old) or those with a larger CAF. In this patient, ischemic finding was induced by treadmill examination. The most common finding of physical examination in CAFs is a continuous murmur, with the character of crescendo decrescendo in both systolic and diastolic phase. However, we did not find this kind of murmur in our patient. The specific character of image in CAFs is coronary artery dilation. A significantly enlarged coronary artery can be detected by 2-dimensional (2D) echocardiography. In this patient, MDCT coronary angiography examination was immediately arranged after treadmill examination under the impression of ischemic change. Therefore, no 2D echocardiography data was available for this patient. Even though echocardiography can identify the origin and insertion of CAFs, it does not provide as much information about the exit of the fistula or the extent of the shunt blood flow through the fistula as selective coronary angiography. Standard cardiac catheterization with coronary angiography is capable of precisely demonstrating the origin, the course, and the drainage site of the CAFs. Therefore, cardiac catheterization has been used as a standard reference technique for diagnosing CAFs. However, there is still limitation in cardiac catheterization. Cardiac catheterization has difficulty to measure abnormal tortuous blood vessels and to reveal the relation of CAFs to other structures, especially when the coronary arteries are with small dimensions during rapid and incessant cardiac cycle. Besides, cardiac catheterization is invasive and expensive. Recently, MDCT has been investigated as an alternative to conventional invasive cardiac catheterization. Compared with the cardiac catheterization, contrast-enhanced MDCT could provide more clear spatial (ability to distinguish between adjacent structures) and temporal (time needed to acquire one image) resolution for coronary imaging. With simultaneous recording of the patient’s ECG and reconstruction algorithms, MDCT angiography could accurately exclude significant coronary artery stenosis (> 50% luminal narrowing) with negative predictive values of 97%-100% and reliably assess the patency of grafts or
Furthermore, the image of CAFs by MDCT has rarely been reported in the literature. In the present case, CAF was incidentally found by MDCT coronary angiography. The MDCT coronary angiography revealed good correlation with the result of cardiac catheterization. The MDCT coronary angiography showed not only the vascular malformation and fistulous communications but also the 3D geometry relation of the CAF to the structures behind it. It provided valuable information about the tortuous configuration of the vascular malformation and spatial relations among the other cardiac structures. Most important of all, it is not invasive. Compared with magnetic resonance imaging (MRI), MDCT has the advantages of time efficiency, more availability and wider usage for those patients with pacemakers or defibrillator implantations.

Coronary artery anomalies such as CAFs have been described with greater frequency because of the increasing use of coronary image studies. Conventional cardiac angiography is invasive and might not delineate the potentially complex anatomy in full. This implies that MDCT, an emerging imaging technique in the evaluation of the cardiovascular system, could be considered as an alternative tool to conventional cardiac catheterization.

REFERENCES


從左主冠狀動脈到肺動脈的冠狀動脈瘻管
在多切面電腦斷層攝影的影像

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冠狀動脈瘻管是屬於先天性的疾病，但是也有可能會因為胸部創傷或者是特定醫療行為的併發症所產生。由於初期的冠狀動脈瘻管大多沒有臨床症狀，所以大多數的冠狀動脈瘻管都是在無意間被診斷出來的。比如說在例行性的心導管檢查，或者是在解剖的時候所發現到的。在這篇個案報告裡的五十四歲男性患者罹患了無症狀的左主冠狀動脈瘻管，而這個冠狀動脈瘻管經由冠狀動脈攝影，還有多切面電腦斷層攝影被診斷與肺動脈相連接。而且重組後的多切面電腦斷層攝影的影像跟冠狀動脈攝影所呈現的結果有不錯的吻合性。所以從這篇個案報告我們可以了解到，多切面電腦斷層攝影的呈像結果不遜於傳統的冠狀動脈攝影，甚至可以用來檢查與診斷具有複雜構造的冠狀動脈瘻管。

關鍵詞：冠狀動脈瘻管、多切面電腦斷層攝影、冠狀動脈攝影。