The Heart Surgery Forum #2006-1170
10 (2), 2007 [Epub February 2007]
doi: 10.1532/HSF98.20061170

Online address: http://cardenjennings.metapress.com

Computed Tomography Angiography is an Excellent Tool for the Diagnosis of Congenital Coronary Artery Anomalies: A Report of 2 Cases

Dr. Rahmanian

Parwis B. Rahmanian, MD,[1] Javier G. Castillo, MD,[1] Sacha Salzberg, MD,[1] Javier Sanz, MD,[2] Farzan Filsoufi, MD[1]

[1]Department of Cardiothoracic Surgery and the [2]Cardiovascular Institute, Mount Sinai School of Medicine, New York, New York, USA

ABSTRACT

Congenital coronary artery anomalies are sporadically discovered in patients undergoing coronary angiography and in autopsy series. Although most anomalies are clinically insignificant, some may become causes of cardiovascular morbidities and mortality. Diagnosis is commonly made with conventional coronary artery angiography. The current development of modern cardiac computed tomography allows less invasive imaging of the coronary arteries and might provide additional anatomical and morphological information. Herein, we report our experience with computed tomography coronary angiography, describing 2 clinical cases of patients with symptomatic congenital coronary artery anomalies requiring cardiac surgery.

BACKGROUND

Congenital cardiac anomalies involving the coronary arteries present a rare subset of nonatherosclerotic coronary artery disease. The prevalence of coronary artery anomalies varies between 0.5% and 1.3% in patients undergoing coronary angiography and in autopsy series [Fernandes 1992; Angelini 2002]. The majority of coronary artery anomalies consist of variations of the aortic origin and subsequent coursing between the ascending aorta and the pulmonary artery and remain clinically insignificant [Cieslinski 1993]. However, in some cases, coronary artery anomalies may be complicated by syncope, arrhythmias, myocardial infarction, and even sudden death during or shortly after exercise due to abnormal myocardial perfusion with or without previous angina pectoris [Boulmier 2003; De Luca 2004]. Cardiac catheterization is the standard diagnostic tool for coronary artery disease. The development of modern imaging techniques, including cardiac computed tomography (CT) and magnetic resonance imaging, offers new insights into the cardiac anatomy. In this series, we report our experience with coronary CT for the diagnosis of coronary artery anomalies, and the resulting surgical management in 2 patients.

Received October 16, 2006; accepted December 13, 2006.

Correspondence: Farzan Filsoufi, MD, Associate Professor, Associate Chief of Cardiac Surgery, Department of Cardiothoracic Surgery, Mount Sinai Medical Center, 1190 Fifth Avenue, Box 1028, New York, NY 10028, USA; 1-212-659-6820; fax: 1-212-659-6818 (e-mail: farzan.filsoufi@mountsinai.org).

CASE REPORTS

Patient 1: Right Coronary Artery Arising from the Left Sinus of Valsalva

A 47-year-old man presented with a 3-month history of chest pain. He had previously undergone 2 unremarkable cardiac catheterizations (2001 and 2003) for similar symptoms. A recent positive stress test result led to hospital admission for further workup. During the hospitalization, a 12-channel electrocardiogram (ECG) was performed, showing sinus bradycardia and signs of a remote infero-posterior myocardial infarction. Cardiac enzymes (CPK, CPK-MB, and troponin I) were within normal range. A transthoracic echocardiogram revealed infero-posterior hypokinesia without any additional wall motion abnormalities. Because the results of the 2 previous cardiac catheterizations were inconclusive, a coronary CT angiography was performed and revealed the presence of an anomalous origin of the right coronary artery (RCA) from the left coronary sinus of Valsalva (Figure 1). The RCA crossed anteriorly between the aorta and the right ventricular outflow tract before reaching its normal anatomical path in the right atrioventricular groove. A conventional coronary angiogram was performed, ruling out any additional peripheral coronary artery disease. Because of these findings and considering the clinical symptoms, the patient was referred for surgical myocardial revascularization. An unremarkable coronary artery bypass grafting procedure using the right internal mammary artery as in situ graft to the RCA was performed. The postoperative course was uneventful, and the patient was discharged on postoperative day 4.

Patient 2: Left Anterior Descending Artery Arising from the Right Sinus of Valsalva

A 38-year-old man was admitted to our hospital with sudden onset of atypical chest discomfort. The ECG showed normal sinus rhythm and T-wave inversion on the precordial

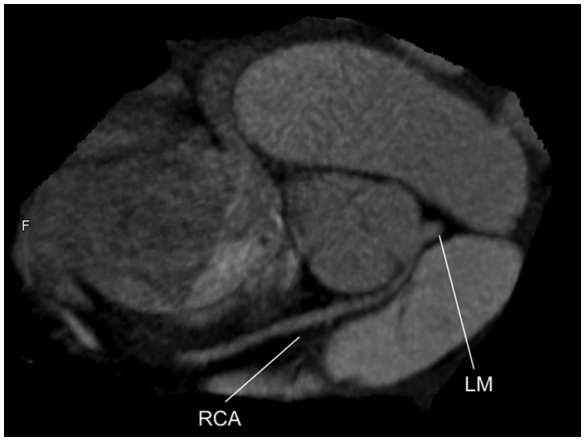

Figure 1. Preoperative cardiac computed tomography angiogram showing the right coronary artery (RCA) originating from the left sinus of Valsalva. LM indicates left main coronary artery.

leads. Cardiac enzymes were in the normal range on admission and during the first 24 hours of hospitalization. A CT angiogram (Figure 2) was performed and revealed an abnormal origin of the left coronary artery with a concomitant myocardial bridge. This finding was later confirmed by a conventional coronary angiogram (Figure 3A). The left coronary descending artery (LAD) originated from the right sinus of Valsalva, coursed between the aorta and the right ventricular outflow tract and the pulmonary trunk, and resumed its normal path in the interventricular groove. The coronary angiogram revealed no significant luminal narrowing; however, it did confirm the presence of a myocardial bridge, which was precisely located in the mid-LAD portion. The patient was taken to the operating room for myocardial revascularization. He underwent single-vessel coronary artery bypass grafting with a LIMA-to-LAD anastomosis. The mid portion of the LAD was found to be intramyocardial and covered by a 1.5-cm layer of muscle. The postoperative course was uneventful, and the patient was discharged on postoperative day 4. A follow-up cardiac catheterization at 1 month demonstrated a patent LIMA-to-LAD anastomosis (Figure 3B).

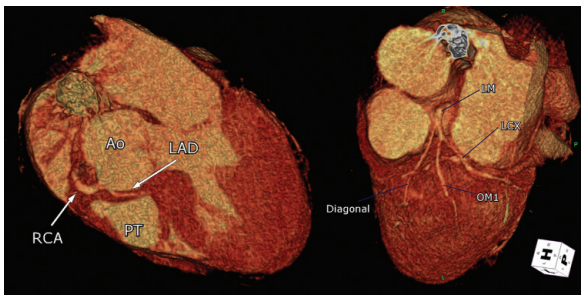

Figure 2. Preoperative computed tomography angiogram showing the left anterior descending artery (LAD) originating from the right sinus of Valsalva. RCA indicates right coronary artery; Ao, aorta; PT, pulmonary trunk; LM, left main coronary artery; LCX, left circumflex coronary artery; OM1, first obtuse marginal artery.

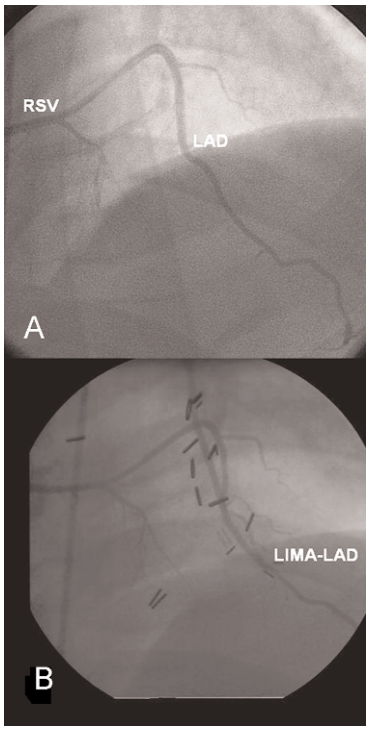

Figure 3. A, Cardiac catheterization shows an anomalous origin of the left anterior descending artery (LAD) from the right sinus of Valsalva (RSV). The LAD arose from the RSV, ran between the aorta and the pulmonary trunk, and then took a normal course in the anterior interventricular groove. B, Postoperative follow-up cardiac angiogram shows a patent left internal mammary artery (LIMA) bypass to the LAD.

DISCUSSION

The incidence of coronary artery anomalies varies between 0.5% and 1.3% [Yamanaka 1990; Fernandes 1992; Angelini 2002]. Yamanaka et al described a series of 1686 patients with coronary artery anomalies. The authors reported anomalous origin or distribution of the coronary arteries in 87% of cases, whereas 13% had coronary artery fistulas. The most common anomalies were separated LAD and left circumflex artery origin from the left coronary sinus or left circumflex artery origin from the right coronary sinus. An origin of the LAD from the right coronary sinus was present in only 2.6% of patients with coronary artery anomalies. Among the congenital coronary malformations, coronary artery origin from the wrong aortic sinus (coursing between aorta and pulmonary trunk) is most commonly associated with sudden death, particularly in younger patients during exercise [Basso 2000]. Due to the lack of typical symptoms, these anomalies are rarely suspected or identified during a person's lifetime and are usually first recognized at autopsy. Previous reports have also shown that normal ECG and negative stress test results do not exclude the presence of abnormal coronary artery origins and their potential life-threatening complications such as sudden cardiac death due to ventricular arrhythmia [Kumpf 2006].

Traditionally, cardiac catheterization has been the gold standard for detecting coronary anomalies. However, this technique has a lower sensitivity in this particular group of patients. New noninvasive approaches such as contrast-enhanced multidetector CT have become powerful diagnostic tools to identify patients with anomalous coronary arteries [Khouzam 2003]. In addition, 3-dimensional CT reconstruction may be a useful adjunct to determine the optimal treatment strategy in patients with coronary artery malformation [Ou 2006]. In our series, the patients initially underwent CT angiography, which confirmed the diagnosis of congenital coronary artery abnormalities and provided important additional anatomical and morphological information, leading to an elective and uneventful surgical treatment.

In conclusion, CT coronary angiogram is a noninvasive and more precise imaging tool for 3-dimensional imaging and representation of the various common coronary artery anomalies than the conventional invasive coronary angiogram. CT angiography should be considered in patients suspected of having abnormal coronary arteries. Once identified, these patients should undergo surgical therapy at the appropriate time, particularly those with an interarterial course of the LAD or those unresponsive to medical treatment.

REFERENCES

Angelini P, Velasco JA, Flamm S. 2002. Coronary anomalies: incidence, pathophysiology, and clinical relevance. Circulation 105:2449-54.

Basso C, Maron BJ, Corrado D, et al. 2000. Clinical profile of congenital coronary artery anomalies with origin from the wrong aortic sinus leading to sudden death in young competitive athletes. J Am Coll Cardiol 356:1493-501.

Boulmier D, Langanay T, Clerc JM, et al. 2003. Sudden death disclosing abnormal origin of the left coronary vessel from the pulmonary artery trunk. Arch Mal Coeur Vaiss 962:135-9.

Cieslinski G, Rapprich B, Kober G. 1993. Coronary anomalies: incidence and importance. Clin Cardiol 1610:711-5.

De Luca L, Bovenzi F, de Luca I. 2004. Congenital coronary artery anomaly simulating an acute aortic dissection. Heart 903:e11.

Fernandes ED, Kadivar H, Hallman GL, et al. 1992. Congenital malformations of the coronary arteries: the Texas Heart Institute experience. Ann Thorac Surg 544:732-40.

Khouzam R, Marshall T, Lowell D, et al. 2003. Left coronary artery originating from right sinus of Valsalva with diagnosis confirmed by CT—a case report. Angiology 544:499-502.

Kumpf M, Sieverding L, Gass M, et al. 2006. Anomalous origin of left coronary artery in young athletes with syncope. BMJ 332:1139-41.

Ou P, Iserin F, Vouhe P, et al. 2006. Anomalous origin of the left coronary artery from the right aortic sinus: surgery based on diagnosis by 64 slice CT. Eur J Cardiothorac Surg 294:610.

Yamanaka O, Hobbs RE. 1990. Coronary artery anomalies in 126,595 patients undergoing coronary arteriography. Cathet Cardiovasc Diagn 211:28-40.