A Refined Coronary Computed Tomography Procedure Reveals an Anomalous Origin of the Left Coronary Artery from the Pulmonary Artery, Including the Collateral Artery

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Anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA), which has also been termed Bland-White-Garland syndrome, is a rare congenital anomaly of the coronary artery that accounts for 0.25–0.5% of all congenital cardiac malformations. Although computed tomographic coronary angiography allows for the evaluation of the connection and anatomy of ALCAPA, procedural details have not yet been reported. This case report describes how the appropriate dose and duration of contrast medium administration were determined, as well as the optimal direction of image acquisition to allow the most detailed anatomical visualization of the ALCAPA.

Key words  ALCAPA · Bland-White-Garland syndrome · Computed tomography angiography.

INTRODUCTION

Anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA) is a rare congenital cardiac malformation in which the coronary artery arises from the pulmonary artery (PA) [1]. Although multi-detector computed tomographic coronary angiography (CTCA) is used to assess ALCAPA [2], detailed methods for the procedure have not yet been reported. The development of increasingly high-speed multi-slice X-ray computed tomography (CT) scanners has led to shorter imaging duration and the need to determine the best timing for imaging.

CASE REPORT

A 74-year-old female was admitted due to exertional dyspnea and underwent electrocardiography (ECG) and transthoracic echocardiography; the findings were suggestive of coronary artery disease with concomitant coronary fistula. Coronary angiography (CAG) revealed a giant right coronary artery (RCA) channeling directly to the left coronary artery (LCA) without significant stenosis (Fig. 1, Movie 1 in the online-only Data Supplement) and coursing off the LCA into the PA without pulmonary hypertension (mean PA pressure: 15 mm Hg).

We performed an ECG-gated CTCA using a 256-slice multi-detector CT unit (Brilliance iCT, version 3.2.5, Philips, Best, the Netherlands) and made volume-rendering images on the portal workstation (IntelliSpace Portal, version 8, Best, the Netherlands). The baseline heart rate was 77 beats per minute (bpm), so intravenous Landiolol (Ono Pharmaceutical Co., Ltd., Osaka, Japan) was administered at a dosage of 0.125 mg/kg body weight into the antecubital vein; image acquisition was started with a heart rate of 63 bpm. In addition, 0.3 mg of sublingual nitroglycerin (Toa Eiyo Ltd., Tokyo, Japan) was given to the patient prior to imaging.

The standard protocol of contrast medium (iopamidol-370, Bayer Yakuhin Ltd., Osaka, Japan) administration for patients with a body weight of less than 50 kg calls for the injection of iodinated contrast at 20 mg/kg/second for 14 seconds followed by 30 mL of saline; the patient had a body weight of 44 kg.
CTCA Procedure of the ALCAPA

The direction of coronary artery flow requires a higher density of contrast medium in the LCA than in the PA. Therefore, a prolonged contrast administration equalizes the density of the LCA and PA and prohibits detection of the direction of flow.

A total of 43 mL of non-ionic iodinated contrast was administered intravenously, followed by 30 mL of saline at a rate of 2.8 mL/s to obtain images with sufficient enhancement of both arteries that allowed acquisition of volume-rendering images and visualization of blood flow. These volume-rendering images identified the source of flow as originating from the RCA to the left anterior descending artery and to the main PA (Fig. 2), which was later confirmed by transesophageal echocardiography. It also revealed that the ostium of the LCA arose behind the main PA just above the pulmonary valve. Coronary flow was in the direction from the LCA to the PA.

**DISCUSSION**

In our protocol, we set the time duration of contrast medium administration to four seconds and the imaging direction from the side of the cardiac apex towards the patient’s head. The four-second duration was based on performing a CTCA with chronic total occlusion (CTO) of the coronary artery, wherein the duration of contrast medium administration was two sec-
onds longer than usual when imaging a typical coronary artery. The intuitive decision to prolong the contrast administration time for two more seconds compared to imaging a CTO was made in anticipation of the slower coronary flow through the anomaly. This imaging protocol was used by the authors in a previously encountered case of ALCAPA in whom CAG was not performed, and this method proved to be successful in detailing the coronary artery malformation. We compared this past injection protocol with our current patient using the timing information from the CAG and were able to validate the four-second duration of contrast administration and deem it as appropriate. It is therefore our impression that clear imaging of the coronary artery anatomy of an ALCAPA can be performed using this CTCA protocol.

This case presented CTCA images that clearly depicted ALCAPA in an elderly patient without pulmonary hypertension. Planning the dose and duration of administration of contrast medium and determining the appropriate direction for CTCA acquisition are important to achieve superior visualization of the dilated and elongated arteries.

**Supplementary Movie Legend**

Movie 1. Left coronary artery and pulmonary artery were shown via collateral vessels in right coronary artery angiography.

**Supplementary Materials**

The online-only Data Supplement is available with this article at https://doi.org/10.22468/cvia.2017.00164.

**Conflicts of Interest**

The authors declare that they have no conflict of interest.

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