

Demonstration of the Anomalous Origin of the Left Coronary Artery from the Pulmonary Artery in Children using a Multi-Detector CT

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Abstract: Objective: To explore the value of multi-detector CT coronary angiography (CTCA) in detecting anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA) in children. Materials and methods: Seven children aged from 2 months to 4 years who had surgically confirmed ALCAPA were enrolled in this study. Their CTCA images were retrospectively analyzed. Results: The left coronary arteries were detected to originate from the left wall of the main pulmonary artery in 2 patients, from the posterior wall of the main pulmonary artery in 3 patients, and from the left pulmonary sinuse in 2 patients. In a 4-year-old girl, CTCA showed collateral circulation between the right and the left coronary arteries. Conclusion: CTCA is a valuable non-invasive method to show the anomalous origin of the coronary artery in small children with ALCAPA.

1 INTRODUCTION

Anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA) is a rare congenital cardiac anomaly. It is important to demonstrate the anomalous origin of the left coronary artery and its course before surgery. In this paper, we try to explore the value of multi-detector CT coronary angiography (CTCA) in detecting ALCAPA in children.

2 MATERIALS AND METHODS

Seven children aged from 2 months to 4 years (median age, 13 months) who had surgically confirmed ALCAPA were enrolled in this study. CTCA was performed with a 64-slice multidetector CT scanner for all patients. Images were reconstructed from the diastolic phase (75% R-R interval) for a 4-year-old girl with heart rate 80 beats per minute. For other patients with heart rates >120 beats per minute, images were reconstructed from the end-systolic phase (45%~50% of the R-R interval).

Two pediatric radiologists independently assessed the image quality according to Paul et al (Paul, 2011) and the origin of the coronary artery.

3 RESULTS

The result of image quality was summarized in Table 1. CTCA showed enlargement of the left heart in all patients. The left coronary arteries were detected to originate from the main pulmonary artery (MPA) in all patients (Figs. 1 and 2). The sites of origin were summarized in Table 2. In a 4-year-old girl, CTCA showed collateral circulation between the right and the left coronary arteries (Fig. 3).

Table 1: Result of image quality.

Coronary artery	Image quality scale
LMT	4.29 ± 0.95
LAD	4.43 ± 0.53
LCX	3.43 ± 1.81
RCA	4.43 ± 0.79

LMT = left main trunk, LAD = left anterior descending artery, LCX = left circumflex artery, RCA = right coronary artery.

Table 2: The origin of the left coronary artery.

Origin	Case number
Left wall of the MPA	2
Posterior wall of the MPA	3
Left pulmonary sinuse	2

MPA = main pulmonary artery.

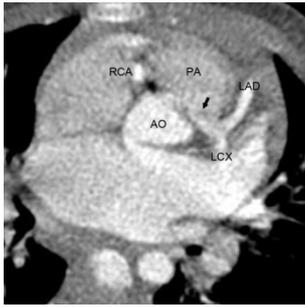


Figure 1: CTCA in a 21-month-old girl with ALCAPA. Axial CT image demonstrates the left coronary artery originates from the left pulmonary sinus (arrow). AO = aortic artery, PA = pulmonary artery, RCA = right coronary artery, LAD = left anterior descending coronary artery, LCX = left circumflex coronary artery.

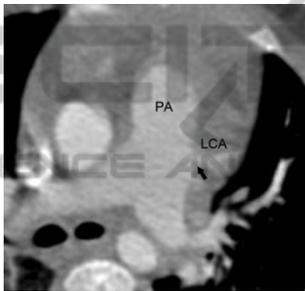


Figure 2: CTCA in a 5-month-old girl with ALCAPA. Axial CT image demonstrates the left coronary artery originates from the left wall of the main pulmonary artery (arrow). PA = pulmonary artery, LCA = left coronary artery.



Figure 3: CTCA in a 4-year-old girl with ALCAPA. Axial CT image (a) demonstrates the left coronary artery originates from the posterior wall of the main pulmonary artery (arrow). Volume rendering image (b) shows the dilated right coronary artery and the tortuous collateral vessel between the right and the left coronary artery (arrow). AO = aortic artery, PA = pulmonary artery, LCA = left coronary artery, RCA = right coronary artery.

4 DISCUSSION

CTCA can provide direct anatomic detail of the coronary arteries and their origins as well as the degree of collateralization (Cowles, 2007). Depending on the acquired raw data, various phases of the cardiac cycle may be available. In children with low heart rate, images are usually reconstructed from the diastolic phase (around 70% of the R-R interval). But for children with heart rates >80/min, it has been shown that the end-systolic phase (between 35% and 45% of the R-R interval) provides the best sharpness for the coronary arteries. In case of cardiac motion artefacts, additional sets may be reconstructed from other available phases of the cardiac cycle (Lederlin, 2011).

One drawback of CTCA is the ionizing radiation. Children have unequivocally higher radiosensitivity and longer life expectancy than the older population (Goo, 2012). In our study, we lowered the tube voltage to 80-kV. The tube current was adapted to the body weight. These settings do not impair image quality too much and are considered sufficient for diagnostic evaluation.

5 CONCLUSIONS

In conclusion, CTCA with a low-dose technique is a valuable non-invasive method to show the anomalous origin of the coronary artery in small children with ALCAPA, especially for patients whose origin of the left artery cannot be detected by TTE. It is helpful to make a correct diagnosis before surgery and lower the mortality.

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