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Coronary angiography and dual-source computed tomography are complementary methods in diagnosis of significant stenosis of the right coronary artery originating from the left aortic sinus

Case report

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Abstract: Anomalous origin of the right coronary artery from the contralateral aortic sinus is a rare but potentially fatal congenital abnormality. We analyzed 8.066 consecutive coronary angiograms and found 4 cases demonstrating this anomaly. In 2 cases the right coronary artery was without significant atherosclerotic lesions and coursed between the aorta and pulmonary trunk. In the 2 other cases the right coronary artery was significantly stenosed. In the last case, diagnosis was based on angiographic and dual-source computed tomographic examinations. Dual-source computed tomography showed precisely the origin and course of the right coronary artery between the ascending aorta and pulmonary artery. Moreover, stenoses of the anomalous coronary artery were depicted. Subsequent coronary interventions required modification of the Amplatz left guiding catheter, which enabled a sufficient support even for coronary artery stenting. Both methods seem to be complementary in the diagnostic and therapeutic process of this coronary anomaly.

Keywords: *Coronary anomaly • Stent • Dual-source computed tomography • Angina • Guiding catheter*

1. Introduction

Anomalous origin of the right coronary artery (RCA) from the contralateral aortic sinus is a rare but potentially fatal congenital abnormality [1]. As reported in the past, this coronary anomaly was associated with angina pectoris, acute coronary syndromes and sudden cardiac death even in the absence of significant coronary artery disease [2,3]. Catheterization of the anomalous RCA arising from the left aortic sinus poses a marked technical challenge because the anomalous origin is usually located both anteriorly and superiorly to the ostium of the left coronary artery and courses downward and rightward between the aorta and the pulmonary trunk. Moreover, the acute angle of the origin of RCA can be associated with an abnormal slit-like luminal orifice of its ostium. Dual-source computed tomography (DSCT) is a new diagnostic, heart rate-independent method that imaging of the origin and course of the anomalous RCA, including possible atherosclerotic changes [4].

We report four cases of anomalous RCA originating from the left aortic sinus where we used both complementary imaging methods and, moreover, we performed modification of the Amplatz left catheter to improve the selective cannulation of the RCA.

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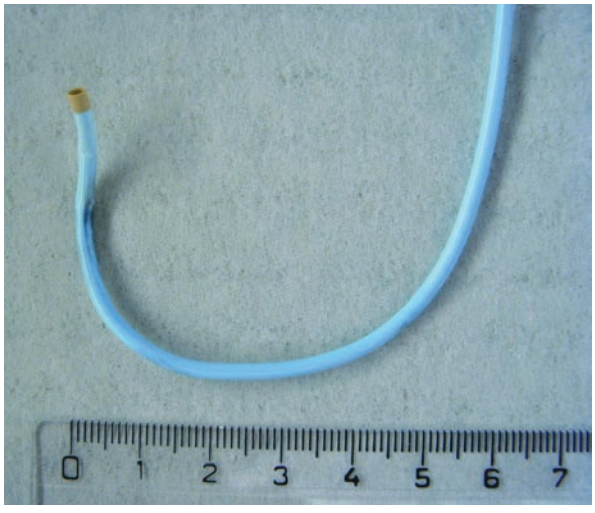
Figure 1. A 7 Fr Amplatz left 1.5 guiding catheter. The tip of the catheter was turned anteriorly and the secondary curve was prolonged (scale in cm).



2. Case Reports

Among 8.066 patients examined in our catheterization laboratories in the period between January 2005 and April 2007, we found 4 patients with the RCA originating from the left aortic sinus.

In two patients the finding was accidental and was not associated with any clinical signs of myocardial ischemia. In both cases we performed coronary angiography using the Amplatz left catheter with only semi-selective intubation of the RCA. Coronary angiograms were of limited quality and showed no significant stenoses of the RCA.

The third patient was scheduled for elective cardiac catheterization for stable angina pectoris. He was a 72-year old man with a history of hypertension, diabetes mellitus and dyslipidemia. Coronary angiography revealed insignificant coronary atherosclerosis in the left coronary system. Selective cannulation of the RCA could not be achieved even with 13 different diagnostic catheters; finally an Amplatz left 1 catheter was used for semi-selective and unstable RCA intubation. The coronary angiogram revealed the anomalous origin of the RCA from the left aortic sinus and a critical 90% lesion in the mid-portion of the RCA. One day later, an elective percutaneous intervention was performed. A 7 Fr Amplatz left 1.5 guiding catheter (Cordis, Johnson and Johnson, Miami, FL, USA) was modified using a hot-air gun. We turned the tip of the catheter anteriorly at a 60° angle and prolonged the secondary catheter curve (Figure 1).

Following modification, the RCA was cannulated without any technical difficulties and direct coronary stenting was performed (FlexMaster F1 coronary stent 3-12 mm, Abbott Vascular Devices, Ulestraten, NL). The residual stenosis was less than 5% (Figure 2A, B). The patient had an uneventful postprocedural recovery and was discharged home the next day.

The last patient was a 73-year old woman who presented with unstable angina pectoris. Coronary angiography revealed a subtotal stenosis of the mid-segment of the left anterior descending artery that was treated by immediate coronary artery stenting. The anomalous RCA originating from the contralateral aortic sinus was poorly examined using the Amplatz left catheter. On the other day the patient was examined by DSCT that showed the anomalous origin

Figure 2A, B. Angiogram of the RCA in a left anterior oblique view before (A) and after (B) coronary intervention.

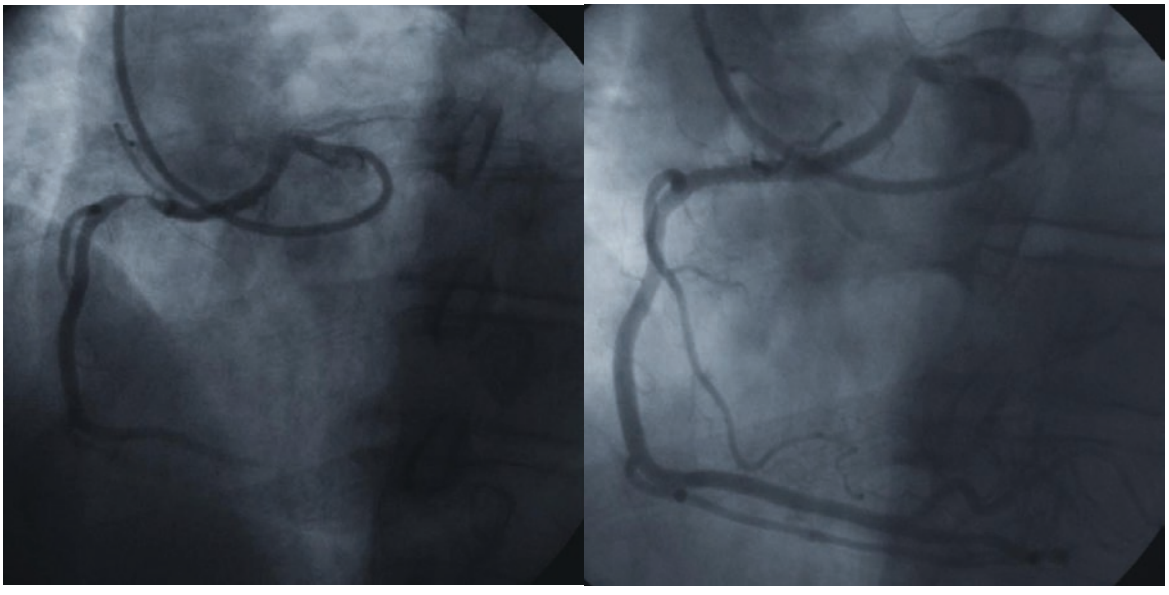
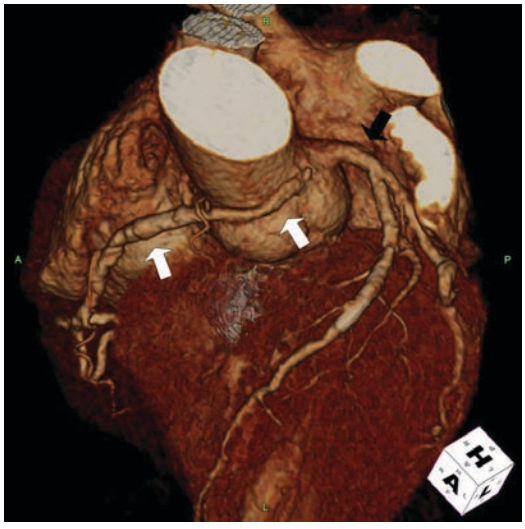
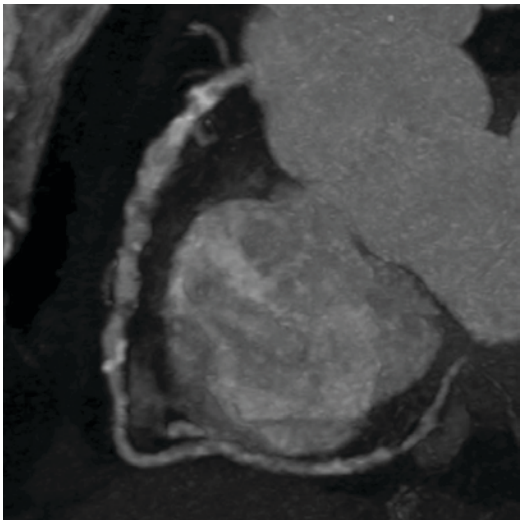


Figure 3A, B. A) DSCT of the RCA originating from the left aortic sinus (white arrows), the left coronary artery (black arrow) – volume rendered image; B) apparent coronary atherosclerosis of the RCA – multiplanar reconstruction.





of RCA from the left coronary sinus and the course of the RCA between the ascending aorta and pulmonary artery (Figure 3A). Moreover, significant stenoses of the RCA were revealed (Figure B). The patient underwent elective coronary intervention using the same modification of the guiding catheter as described above. The interventional procedure was short, uneventful, and a bare metal stent (Coroflex blue 25-3 mm, BBraun, Melsungen, Germany) was implanted after balloon predilation without residual stenosis (Figure 4A, B). The patient was discharged home the next day.

3. Discussion

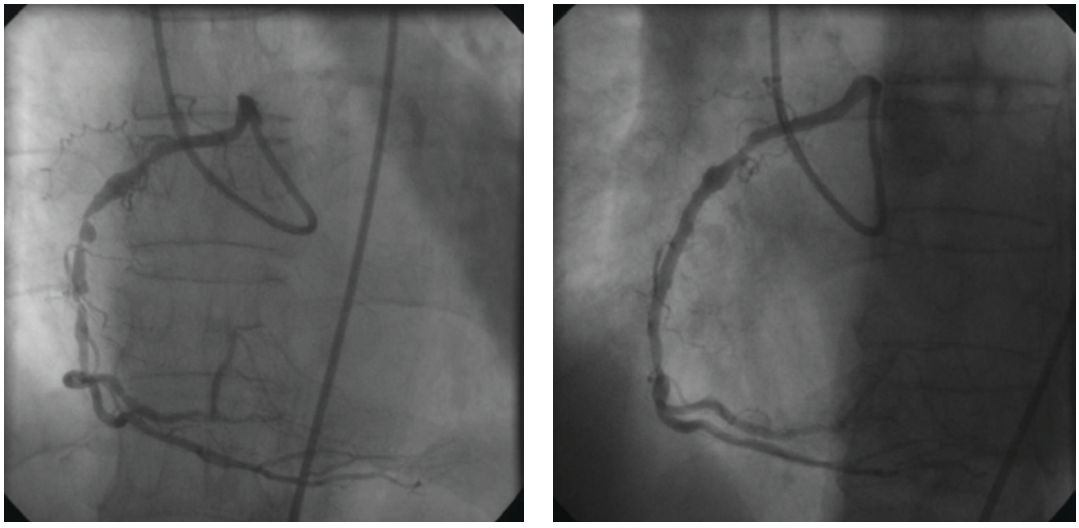
Anomalous origin of the RCA from the left aortic sinus is an uncommon anatomic condition [5]. In the catheterization laboratory, the percutaneous intervention of the RCA originating from the left aortic sinus is a rare coronary procedure that is considered to be technically challenging, particularly with regard to proper guiding catheter support [6-11].

Recently, several case reports and small series described different types of guiding catheter modifications for facilitation of percutaneous interventions of anomalously originating RCA [6-11]. Usually, the catheter modifications are based on heating and reshaping of extra-support catheters (Voda or XB) or Amplatz left catheter. The unusual modification of Amplatz left 2 catheter described by Qayyum et al. [7] involves bending the catheter tip anteriorly and was named Leya catheter. We used a similar catheter design in our cases. Recently, Seth [9] summarized different types of guiding catheter modifications for catheterization of anomalously originating RCA from the left aortic sinus and his preferred technique was the inverted Judkins. All the above described innovative techniques and catheter modifications result in a stable and coaxial catheter position, which is necessary for the percutaneous intervention of this unusual coronary anomaly.

DSCT, with two arrays consisting of an X-ray tube and detectors arranged at a 90° angle with a gantry rotation time of 330 ms, allows a temporal resolution better than 100 ms (83 ms). This new concept of cardiac CT permits imaging of the coronary arteries (anomalies) without motion artifacts and independently from heart rate [4]. Moreover, initial experience have already shown that DSCT permits imaging of the coronary arteries in a substantially increased number of patients compared to earlier scanner generations [12]. Thus, as suggested recently, it seems to be questionable whether coronary angiography is still a gold standard in the examination of patients with coronary anomalies [13-15]. On the other hand, the catheterization technique is still indispensable for endovascular treatment of these patients.

We believe four main conclusions can be drawn from this report. 1) Diagnosis of the anomalous RCA can be easily established by DSCT. 2) This method allows detailed depiction of the RCA origin and course, usually between the aorta and pulmonary artery, and moreover, the quantification of the coronary artery stenoses. 3) Coronary angiography and mainly coronary intervention of this coronary anomaly can be performed using modification of the Amplatz Left 1.5 catheter, which involves bending the catheter tip anteriorly, and the secondary curve prolongation. 4) This is the first report of direct coronary stenting of the RCA arising from the left aortic sinus, which was enabled mainly by the unique shape of modified Amplatz left guiding catheter. We feel this catheter re-shaping is reproducible and can be easily done in a catheterization laboratory using a hot-air gun.

Figure 4A, B. Angiogram of the anomalous RCA performed by the modified Amplatz catheter before (A) and after (B) intervention.



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