

A case of anomalous origin of the right coronary artery from the pulmonary trunk: Imaging of abnormal flow by Doppler color flow mapping

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Summary

An asymptomatic 48-year-old woman was admitted to our hospital for evaluation of a precordial continuous murmur. The chest radiograph showed a normal cardiac silhouette. The resting electrocardiogram showed incomplete right bundle branch block. A multistage, graded treadmill exercise test did not affect the ST-T segment. A thallium-201 myocardial perfusion scan with a multistage ergometer exercise test showed no distinct perfusion defect. A two-dimensional echocardiogram disclosed a dilated left coronary artery arising from the left sinus of Valsalva, and a dilated right coronary artery crossing the aorta anteriorly to the pulmonary trunk. Real-time two-dimensional Doppler echocardiography of the same region showed an abnormal jet coming from the right coronary artery into the pulmonary trunk during diastole. A continuous wave Doppler flow study in the pulmonary trunk revealed a high-speed, disturbed flow which began in mid-systole, and continued during diastole. These findings were compatible with anomalous origin of the right coronary artery from the pulmonary trunk. An aortogram confirmed the diagnosis.

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Key words

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Introduction

Anomalous origin of the right coronary artery from the pulmonary trunk is a relatively rare anomaly, and only 33 cases have been reported previously¹⁻⁵. It is difficult to detect this anomaly during life. Reported here are the diagnostic images of real-time two-dimensional Doppler echocardiography (color flow mapping) of an abnormal jet in the pulmonary trunk.

Case report

An asymptomatic 48-year-old woman was referred for evaluation of a precordial continuous murmur. On examination she was acyanotic, and her blood pressure was 140/70 mmHg. A grade 3/6 high-pitched continuous murmur was audible over the second left intercostal space near the sternal margin. Her resting electrocardiogram showed incomplete right bundle branch block with a normal QRS axis, without evidence of ventricular hypertrophy. A multi-stage, graded treadmill exercise test had no effect on the ST-T segment at the stage IV of the Bruce's protocol. Chest radiography showed a normal cardiac silhouette and normal pulmonary vasculature. An exercise thallium-201 myocardial perfusion scan using a multistage ergometer showed no perfusion defect.

A two-dimensional echocardiogram (Toshiba SSH-65A) disclosed a dilated left coronary artery arising from the left sinus of Valsalva, and a dilated right coronary artery crossing the aorta anteriorly to the pulmonary trunk (**Fig. 1-A**). At the same level in the short-axis view, Doppler color flow mapping showed an abnormal jet from the right coronary artery into the pulmonary trunk, which was detected mainly during diastole (**Fig. 1-B, 1-C**). Continuous wave Doppler examination of the pulmonary trunk was done, focussing on the abnormal jet using a continuous wave Doppler probe combined with

the Doppler color flow mapping system. This demonstrated a high speed disturbed flow which began during mid-systole and continued during diastole with a maximum speed of 2.2m/sec suggesting that the right coronary artery pressure was higher than the pulmonary artery pressure by 20 mmHg even during systole (**Fig. 1-D**). Both ventricles were of normal size and functioned normally. Mild pulmonary and tricuspid regurgitation were also imaged by Doppler color flow mapping, but there was no sign of pulmonary hypertension.

Right and left cardiac catheterization and arteriography confirmed anomalous origin of the right coronary artery from the pulmonary trunk. A step-up in oxygen saturation was observed near the bifurcation of the pulmonary trunk (shunt ratio=20%), and all pressures were normal. An aortogram demonstrated a dilated left coronary artery arising from the left sinus of Valsalva (**Fig. 2-A**), but the right coronary artery was not imaged. Flow was directed through large tortuous intercoronary collaterals into the right coronary artery which originated from the pulmonary trunk (**Fig. 2-B, C, D**). Selective left coronary arteriography demonstrated extremely rapid run-off of the contrast material from the left coronary artery to the pulmonary circulation.

Discussion

Dilatation of the coronary arteries is a distinctive echocardiographic finding that suggests anomalous origin or fistulous connection of one or both coronary arteries⁴. The large right coronary artery runs the anterior portion of the aorta and reaches the pulmonary trunk. Abnormal diastolic flow in the pulmonary trunk shown by Doppler examination could be evidence of anomalous origin of the right coronary artery from the pulmonary trunk^{3,5}. However, a flow mapping method using pulsed Doppler echocar-

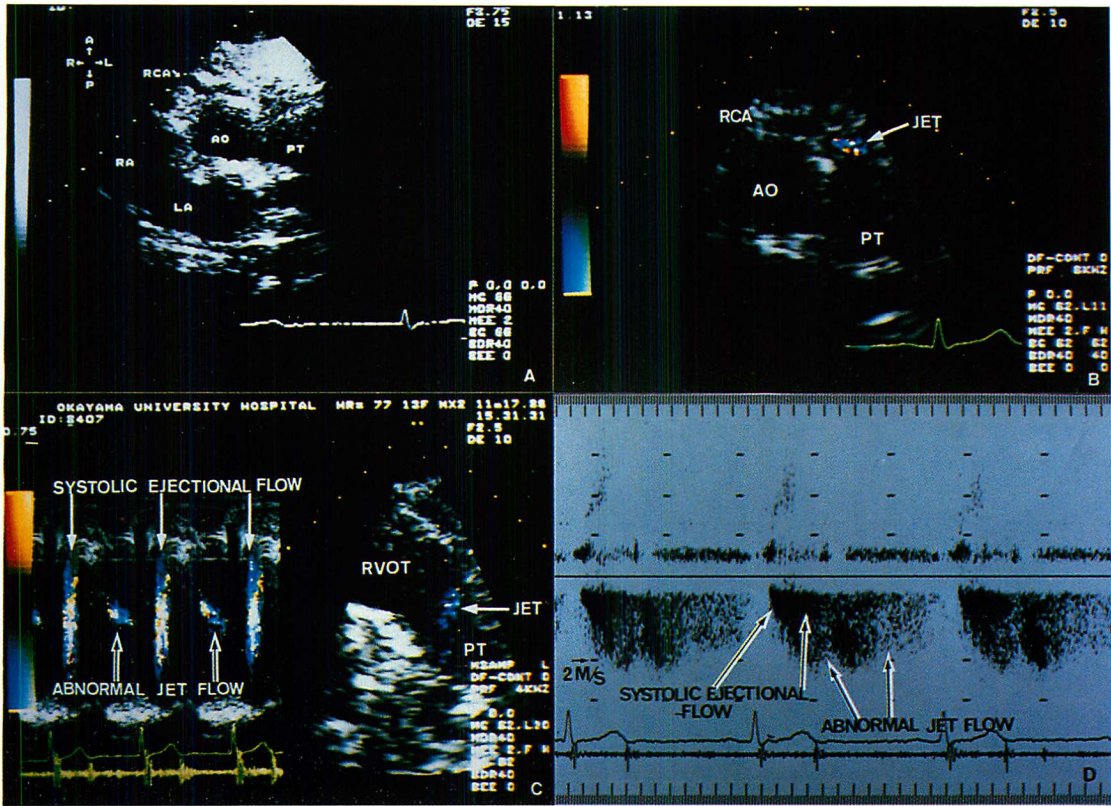


Fig. 1. Echocardiographic findings.

A (top, left): Parasternal short-axis view of the two-dimensional echocardiogram showing the right coronary artery crossing the aorta anteriorly and connecting with the pulmonary trunk.

B (top, right): Doppler color flow mapping at the same level showing an abnormal jet from the right coronary artery into the pulmonary trunk.

C (bottom, left): M-mode color flow mapping image of the pulmonary trunk showing an abnormal jet which is seen mainly during diastole.

D (bottom, right): Continuous wave Doppler examination in the pulmonary trunk using a continuous wave Doppler probe combined with a Doppler color flow mapping system focused on the abnormal jet. A high-speed disturbed flow begins at mid-systole and continues up to diastole.

RCA=right coronary artery; PT=pulmonary trunk; AO=aorta.

diography limits disclosure of the abnormal flow from the anomalous right coronary artery into the pulmonary trunk, because the position and direction of the abnormal flow are continuously changing during the cardiac cycle. On the other hand, Doppler color flow mapping revealed an abnormal flow pattern easily, since this method visualize the abnormal flow on a two-dimensional echocardiogram in real time. In our patient,

an abnormal jet in the pulmonary trunk was easily detected. Continuous wave Doppler examination can depict an abnormal flow beginning during mid-systole, suggesting that the right coronary artery pressure was high. Real-time two-dimensional Doppler echocardiography may be helpful for detecting abnormal flow from the congenital coronary anomaly.

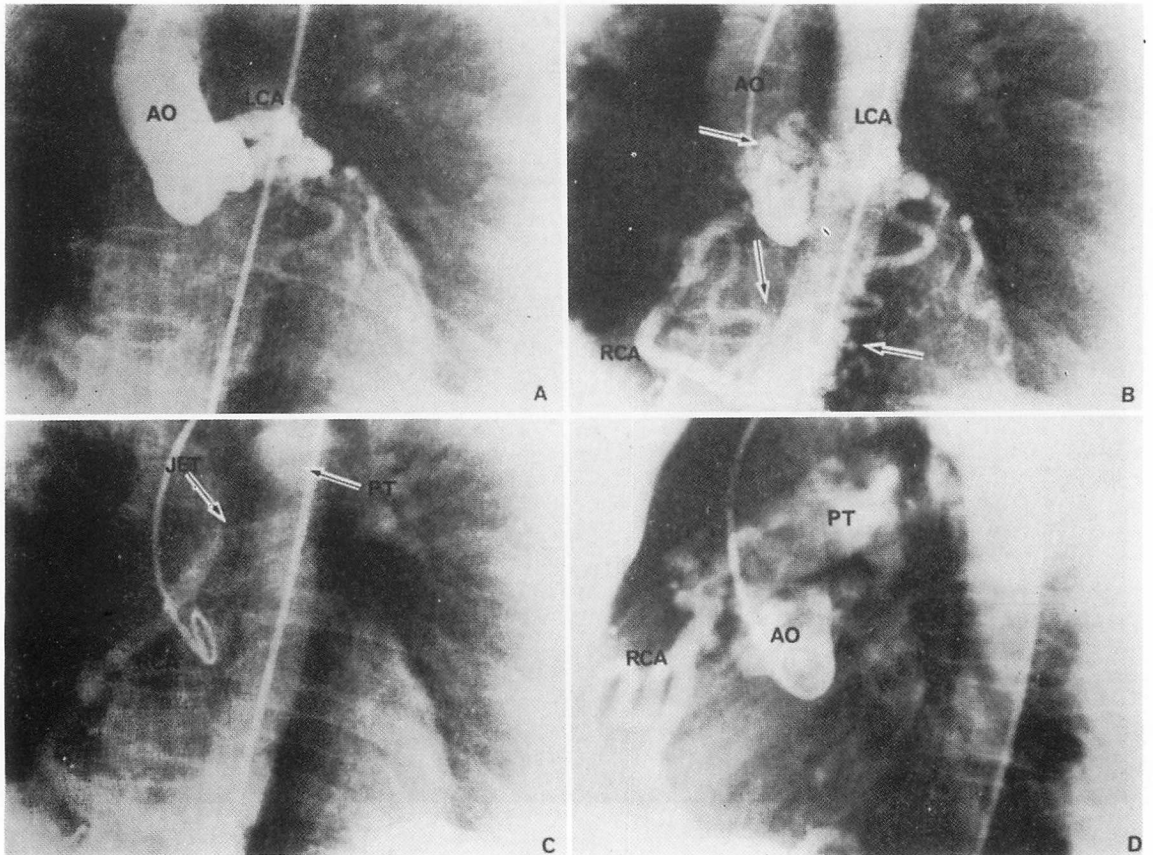


Fig. 2. Sequential frames of aortograms in the anterior view.

A: The dilated tortuous left coronary artery arising from the left sinus of Valsalva, without a visible right coronary artery.

B: Blood flow through the large intercoronary collaterals (arrow) to the right coronary artery.

C: The right coronary artery originated from the pulmonary trunk; and a small amount of contrast material is seen in the pulmonary trunk as a jet.

D: Lateral view of the aortogram near the end of aortography shows well the right coronary artery connected with the pulmonary trunk.

RCA=right coronary artery; LCA=left coronary artery; PT=pulmonary trunk; AO=aorta.

要 約

右冠動脈の肺動脈主幹部起始の1例：そのカラー
ドップラー像

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無症候の48歳女性が、連続性心雑音精査のために当院に入院した。胸部レントゲン像で心拡大無し。安静時心電図は不完全右脚ブロックを示す。トレッドミル多段階運動負荷テストでST-Tに変化無し。エルゴメーター運動負荷 Tl²⁰¹ 心筋シンチグラフィで欠損像を認めず。断層心エコー図で、大動脈 Valsalva 洞からは拡張した左冠動脈のみが認められ、右冠動脈は拡張し、大動脈

前方を横切り肺動脈主幹部へとつながっていた。同部位のカラードップラー法にて、右冠動脈から肺動脈へと吹き込む細い拡張期のジェット流を認めた。連続波ドップラー法で肺動脈主幹部内血流を測定すると、収縮中期から開始し拡張終期まで持続する高速の乱流を検出した。これらの所見は、右冠動脈の肺動脈主幹部起始症例の所見と合致すると考えられた。大動脈造影で本症を確認した。

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