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Anomalous origin of the right coronary artery: The importance of choosing the stress modality

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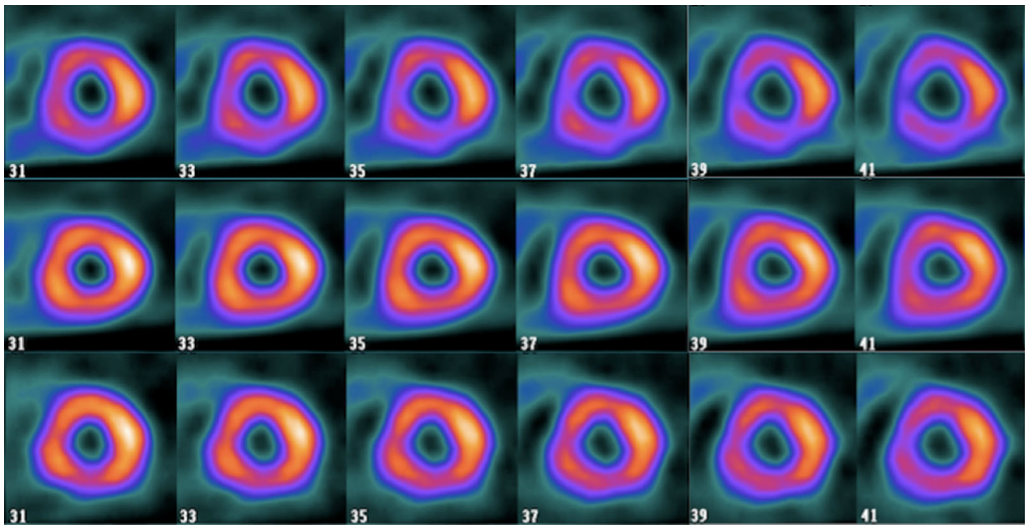
INTRODUCTION

Anomalous origin of right coronary artery (RCA) is a common form of the spectrum of anomalous coronary arteries.[1] There is no agreement about which type of stress is better to demonstrate myocardial ischemia in such patients.



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CASE HISTORY

A 20-year-old man, with dyspnea and angina during intense exercise for 4 years, was evaluated in 2014 at another medical center. His physical examination and ECG were normal. A multi-slice CT (MSCT) showed high anomalous origin of the RCA, emerging from the left side of the aortic roof, 14.4 mm above the sino-tubular junction, with an acute take-off angle and interarterial course (ITC), between pulmonary artery and aorta, above the plane of the pulmonary valve (Figure 1).

A rest-dipyridamole myocardial-gated SPECT demonstrated mild inferior-basal ischemia, with normal left ventricular ejection fraction (LVEF) (Figure 2). Invasive coronary angiography showed the same coronary anomaly. He was discharged on medical therapy.

In the following 2 years, angina and dyspnea during exercise became more frequent and severe. At 22 years of age, he was evaluated by our institution. His weight was 84.5 kg. (186 lb) and his height was 179 cm. (5.87 ft). His physical cardiovascular examination and ECG remained normal.

Repeat SPECT imaging was performed including one with maximal exercise and a second one with dipyridamole on separate days (only one rest study on a separate day to compare to the two stress studies).

The dipyridamole SPECT images were normal. The post-stress and rest left ventricular (LV) ejection fraction (EF) were 55% and 57%, respectively (Figure 3)

The patient exercised for 9.5 min and achieved 10 METs. The maximum heart rate was 173 beat per minute, (88% of maximum predicted for age). The test was terminated because of chest pain and shortness of breath without ECG changes (Figure 4)

The exercise SPECT images showed moderate-to-severe inferior and infero-septal ischemia with LV transient ischemic dilatation (TID) and post-stress stunning; the LVEF decreased from 57% at rest to 47% post exercise (Figure 5).

A bare metal stent Kaname® was implanted, 24 × 3.75 mm^2 along the interarterial course of the anomalous RCA (Figure 6). A stress treadmill test performed 12 months after the stent implantation was normal. Sixteen months post stent implantation, the patient remained asymptomatic in NYHA class I.

DISCUSSION

The anomalous origin of coronary arteries has been reported in 1.3% of general population. There is no agreement about which type of stress is better to demonstrate myocardial ischemia in these patients.[1]

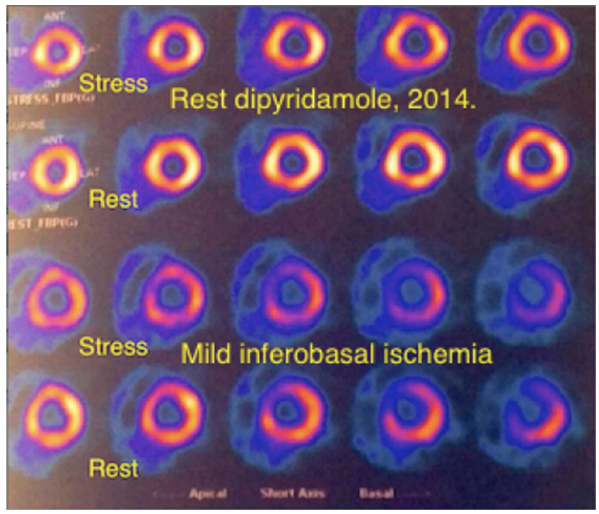

Figure 2. Dipyridamole/rest Tc-99m Sestamibi images performed in 2014. There is minimal inferior wall ischemia. Only the short-axis slices are shown.

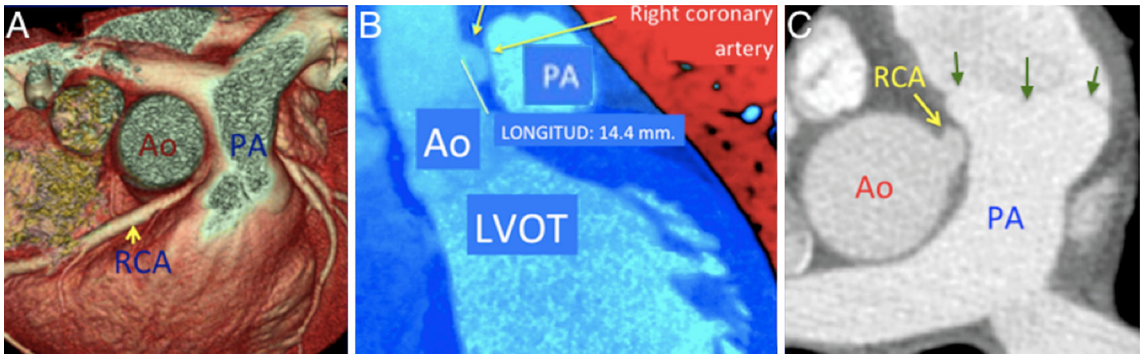

Figure 1. Pre stent coronary multi-slice CT (MSCT): anomalous origin of the right coronary artery (RCA) and interarterial course; RCA emerges from the left aortic wall, 14.4 mm. up of the sinotubular union, with an acute take-off angle. Green arrows: pulmonary valve plane. *Ao*, aorta; *LVOT*, Left ventricular outflow tract; *RCA*, right coronary artery; *PA*, pulmonary artery branch.

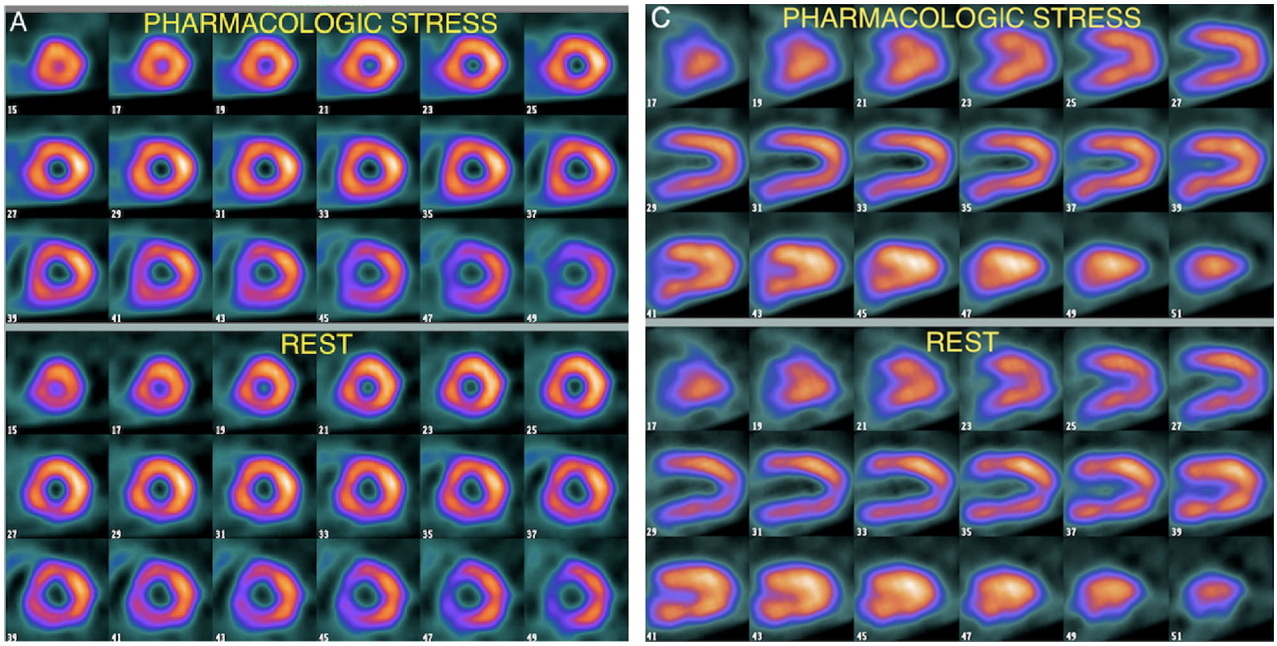

Figure 3. Gated myocardial SPECT showing the short-axis and vertical long-axis views. The images are normal.

Exercise is likely to be better than vasodilator stress because of differences in hemodynamic responses. The diameters of ascending aorta and pulmonary artery are likely to increase with exercise, and contribute to narrowing of the anomalous RCA with acute angulation and further compression along its interarterial course between aorta and pulmonary arteries during systole.[1,2]

In our patient, the SPECT with maximal exercise showed moderate inferior ischemia while the dipyridamole SPECT images were normal. To obtain optimal result, exercise must be symptom-limited rather than heart rate-limited. Submaximal exercise could explain some false negative results in patients with these coronary anomalies.

In selected cases of anomalous origin of coronary vessels associated to myocardial

Ischemia, a stent may be a reasonable option instead of surgical bypass.[3,4]

TEACHING POINTS

1 SPECT perfusion imaging using vasodilators like dipyridamole, adenosine, or regadenoson, may not elicit in patients with anomalous coronary arteries.
2 Symptom-limited exercise SPECT perfusion imaging on the other hand may show considerable ischemia in such patients.

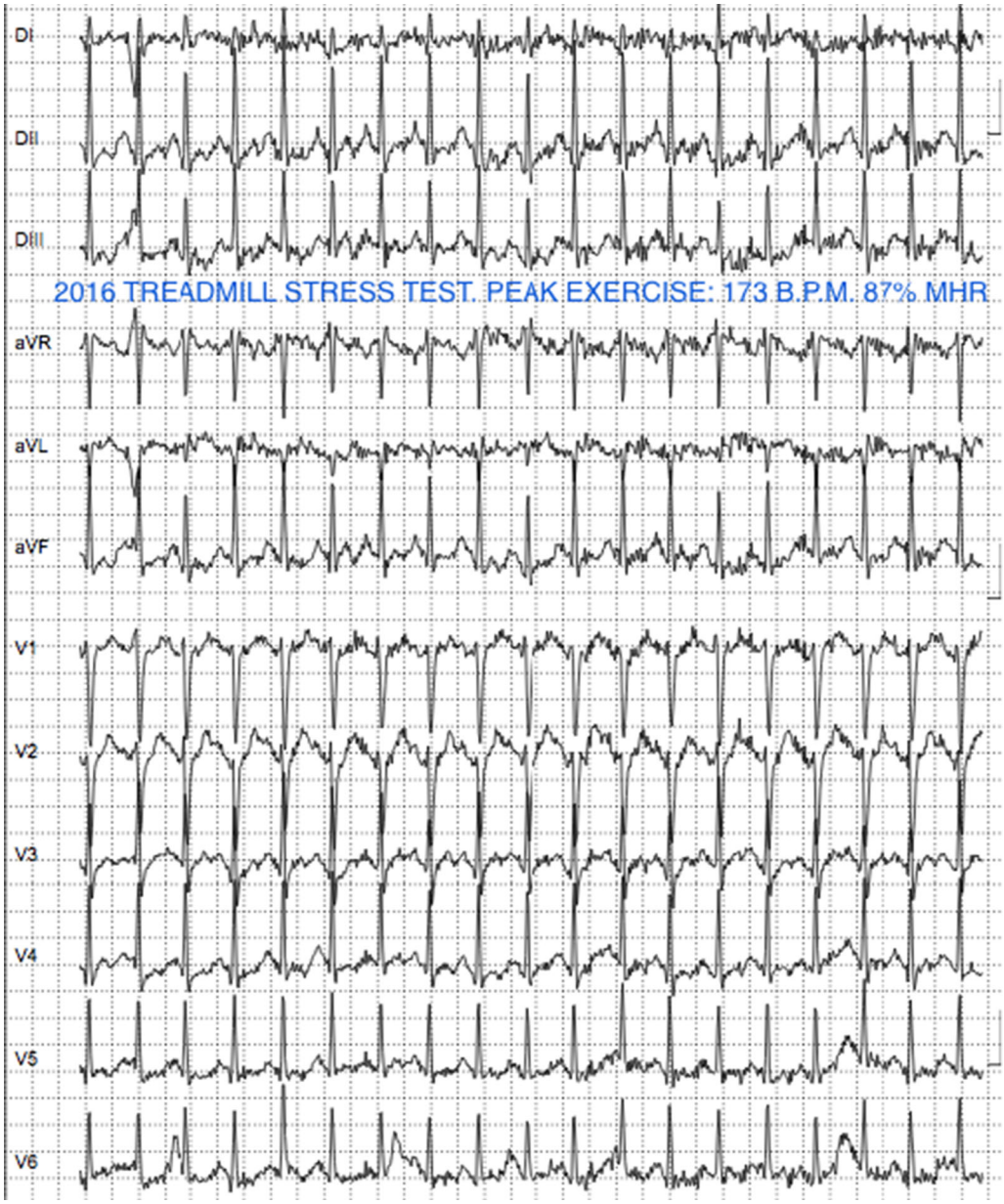

Figure 4. The ECG during treadmill exercise testing. There are no ischemic changes.

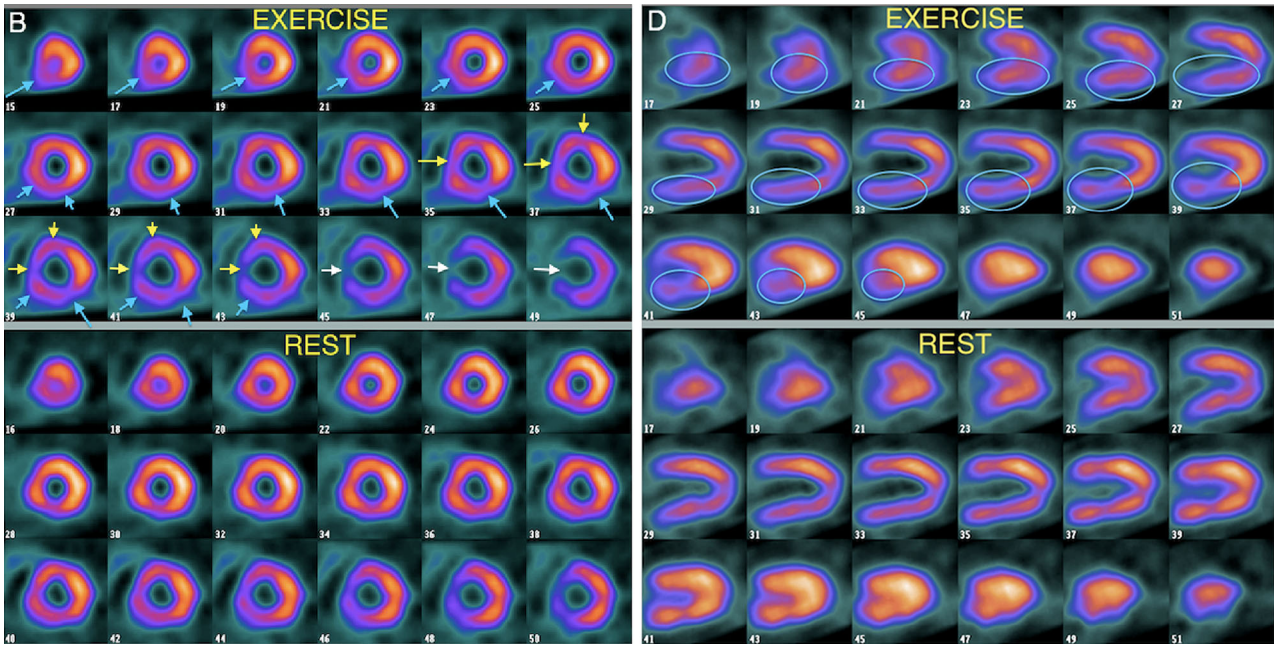

Figure 5. Gated myocardial SPECT showing the short-axis and vertical long-axis views. ABNORMAL PERFUSION: Blue arrows: inferior reversible defects; Yellow arrows: septal reversible perfusion defects. There is transient ischemic dilatation.

FEATURE RESULTS

There were 29 responses, of which 4 (17%) were near correct.

By draw, the winner is:

Ashwani Sood, MD from PGIMER in Chandigarh, India

Other (incorrect) responses included FDG images, normal perfusion, attenuation artifacts, prone imaging, gated and ungated images, breast attenuation artifacts, ischemic cardiomyopathy, left ventricular hypertrophy, pulmonary hypertension

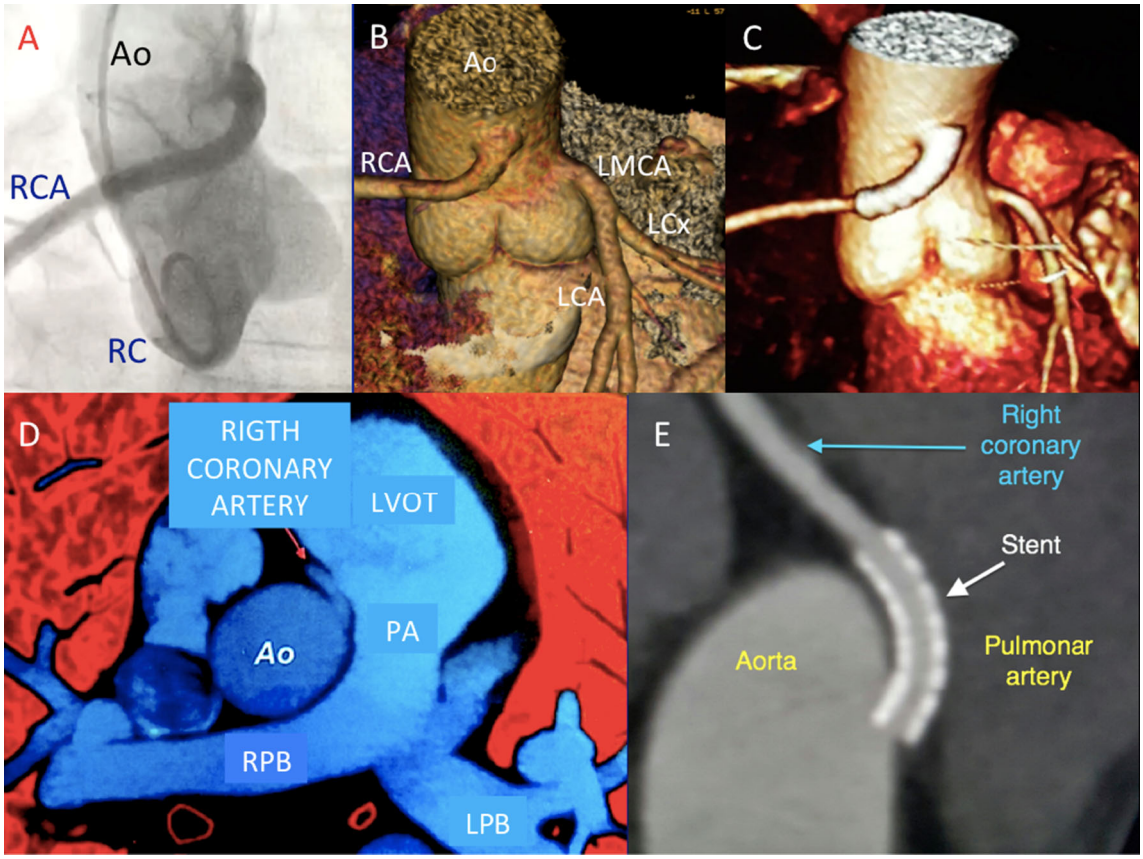

Figure 6. **A** Invasive coronary angiography (ICA) shows the anomalous origin of the right coronary artery (RCA), with high take-off from the left side of the aortic roof. **B** **C** 3-D multi-slice CT (MSCT); RCA, pre and post stent. **D** Pre stent MSCT, 2-D, axial view. **E** post stent MSCT; **D** and **E** show the acute take-off angle of RCA with its interarterial course, between aorta and pulmonary arteries. *Ao*, aorta; *LCx*, left circumflex; *LDA*, left descending coronary artery; *LMCA*, left main coronary artery; *LPB*, left pulmonary branch; *PA*, pulmonary artery; *RC*, right coronary cusp; *RCA*, right coronary artery; *RPB*, right pulmonary branch; *RVOT*, right ventricular outflow tract.

Disclosures

All the authors declare that they do not have any conflict of interest.

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