JOURNAL OF CARDIOVASCULAR MAGNETIC RESONANCE®
Vol. 5, No. 2, pp. 403–405, 2003

CASE STUDY

Comparison of MSCT and MRA in the Evaluation of an Anomalous Right Coronary Artery

**Liesbeth P. Salm,[1,2,3,*] Jeroen J. Bax,[1]
Martijn S. Dirksen,[2] Hubert W. Vliegen,[1]
J. Wouter Jukema,[1,4] Martin J. Schalij,[1]
Ernst E. van der Wall,[1,3] and Hildo J. Lamb[2]**

[1]Department of Cardiology and [2]Department of Radiology, Leiden University
Medical Center, Leiden, The Netherlands
[3]Interuniversity Cardiology Institute of the Netherlands, Utrecht, The Netherlands
[4]Clinical Investigator of the Netherlands Heart Foundation (2001D032),
Leiden, The Netherlands

A 25-year-old female was referred to our clinic with episodes of palpitations, chest pain and near-collapse. These episodes began during pregnancy and continued after delivery. An exercise ECG showed a nonsustained ventricular tachycardia (VT) with right axis deviation and right bundle branch block; similar VTs were inducible during electrophysiological testing. Radiofrequency ablation was not possible due to the nonsustained character of the VTs. The right ventricle appeared normal on contrast ventriculography and arrhythmogenic right ventricular dysplasia was further excluded by 2D echocardiography using intravenous contrast.

X-ray coronary angiography showed an anomalous origin of the right coronary artery (RCA) from the left aortic sinus with a separate ostium (Fig. 1). Atherosclerotic changes were not present. The coronary angiogram was inconclusive about the exact course of the RCA, therefore single breath-hold Multislice Spiral Computed Tomography (MSCT) was performed (Fig. 2). MSCT imaging was performed using a multislice CT scanner (Aquilion, Toshiba Medical Company, Japan) with a rotation time of 0.5 sec, 4 detector rows, resulting in a slice thickness of 4×2 mm and a reconstructed pitch of 1 mm. An intravenous x-ray contrast agent, jobitridol (Xenetix®, Guerbet, Aulnay Sous Bois, France), was administered at 3.5–4 ml/sec to a total of 160 ml. The total radiation exposure was estimated to be 10–13 mSv. The MSCT data were processed on a Vitrea workstation (Vital Images, Plymouth, MN). The MSCT scan confirmed the anomalous origin of the RCA from the left coronary cusp and revealed an interarterial course between the aorta and pulmonary trunk. This malignant course is associated with an increased risk of myocardial infarction and sudden death.

In order to compare MSCT with an established noninvasive imaging technique for coronary anomalies, with the patient's informed consent, coronary Magnetic Resonance Angiography (MRA) was planned (McConnell et al., 1995; Post et al., 1995; Vliegen et al., 1997). According to the protocol described by Stuber et al. (1999), free breathing, navigator-gated 3D coronary MRA was executed, using a 1.5 T MR scanner

*Correspondence: Liesbeth P. Salm, M.D., Leiden University Medical Center, Department of Cardiology (C5-P), Albinusdreef 2, 2333 ZA Leiden, P.O. Box 9600, 2300 RC Leiden, The Netherlands; Fax: 31-71-5266809; E-mail: L.P.Salm@lumc.nl.

DOI: 10.1081/JCMR-120019423
1097-6647 (Print); 1532-429X (Online)
www.dekker.com

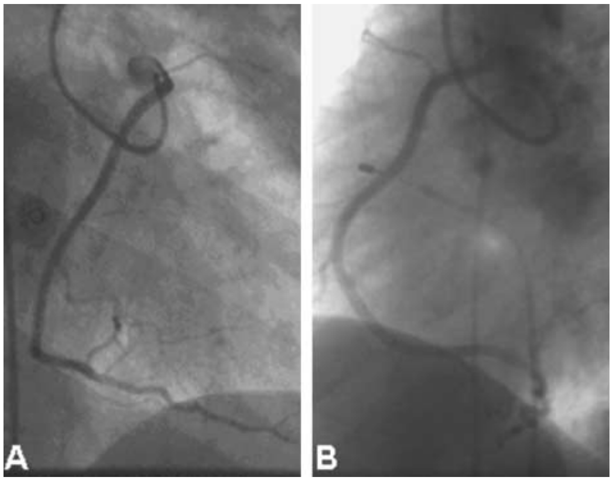

Figure 1. X-ray coronary angiography. (A) Right anterior oblique view of the right coronary artery (RCA). (B) Left anterior oblique view of the RCA, showing its anomalous origin from the left aortic sinus.

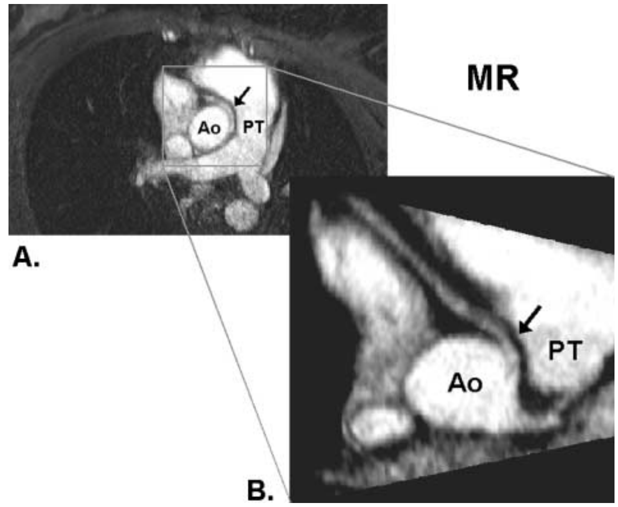

Figure 3. Coronary magnetic resonance angiography. The RCA originates from the left aortic sinus and courses between the aortic root and the pulmonary trunk (see arrow). (A) Original stack image, caudal view. (B) Curvilinear multiplanar reconstruction, representing the anomalous RCA and the left main coronary artery.PT = pulmonary trunk, Ao = aortic root.

(Gyroscan ACS-NT15 with R8.1.3; Philips Medical Systems, Best, the Netherlands), equipped with Power-trak 6000 gradient system and 5-element cardiac synergy coil (Fig. 3). The MR data were reconstructed on an Easy Vision workstation (Philips Medical Systems). On the coronary MRA scan the origin and course of the RCA as seen on MSCT were confirmed. The patient underwent successful surgical reimplantation of the RCA above the right coronary cusp.

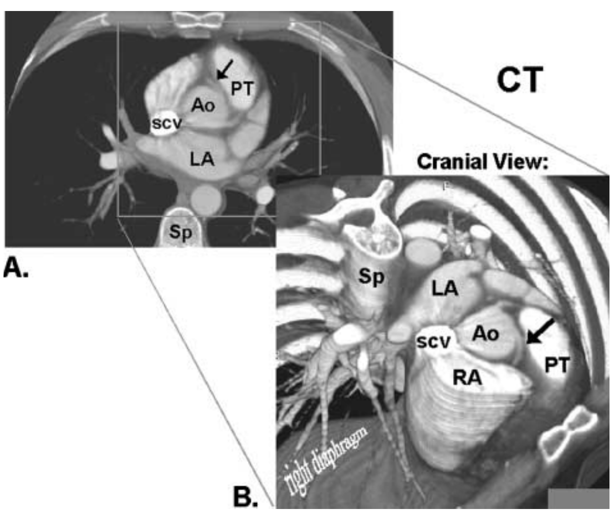

Figure 2. Multislice spiral computed tomography of the coronary arteries. The right coronary artery originates from the left aortic sinus and courses between the aortic root and the pulmonary trunk (see arrow). (A) Original stack image, caudal view. (B) 3D reconstruction with volume rendering, cranio-lateral view. PT = pulmonary trunk, Ao = aortic root, RA = right atrium, scv = superior caval vein, LA = left atrium, Sp = spine.

In this case both MSCT and coronary MRA provided a clear view on the origin and proximal course of the anomalous right coronary artery and its surrounding structures. Coronary MRA has an advantage over MSCT in that a patient is not exposed to ionizing radiation and contrast agents are not necessary. The total procedure duration of a MSCT scan is shorter (approximately 20 min) than that of a coronary MRA scan (approximately 60 min). In contrast, the time necessary to obtain 3D volume reconstruction images from the MSCT data (approximately 30 min) is comparable with the multiplanar reconstruction time necessary for the coronary MRA (approximately 25 min depending on the investigator's experience). For MSCT and coronary MRA different contraindications apply. Renal failure and allergy to x-ray contrast agents are contraindications for MSCT. For coronary MRA contraindications are implanted electronic devices (pacemakers, internal defibrillators, etc.), free metallic objects, and claustrophobia.

In this case navigator-gated, free-breathing 3D coronary MRA was used. In former studies 2D breath-hold coronary MRA sequences were employed to visualize coronary artery anomalies with high accuracy (McConnell et al., 1995; Post et al., 1995; Vliegen et al., 1997). Navigator-gated, free-breathing 3D coronary MRA, in contrast with the breath-hold technique, requires only limited patient cooperation and the contrast-to-noise ratio and spatial resolution are improved (Botnar et al., 1999; McConnell et al., 2000). Therefore, navigator-gated, free-breathing 3D coronary MRA is especially useful to evaluate the origin and course of coronary artery anomalies.

In conclusion, when choosing a noninvasive evaluation for a suspected coronary anomaly either MSCT or coronary MRA will clearly display the origin and course of the coronary artery. Different aspects of both techniques will then further refine the decision.

REFERENCES

Botnar, R. M., Stuber, M., Danias, P. G., Kissinger, K. V., Manning, W. J. (1999). Improved coronary artery definition with T2-weighted, free-breathing, three-dimensional coronary MRA. *Circulation* 99:3139–3148.

McConnell, M. V., Ganz, P., Selwyn, A. P., Li, W., Edelman, R. R., Manning, W. J. (1995). Identification of anomalous coronary arteries and their anatomic course by magnetic resonance coronary angiography. *Circulation* 92(11):3158–3162.

McConnell, M. V., Stuber, M., Manning, W. J. (2000). Clinical role of coronary magnetic resonance angiography in the diagnosis of anomalous coronary arteries. *J. Cardiovasc. Magn. Reson.* 2(3):217–224.

Post, J. C., van Rossum, A. C., Bronzwaer, J. G., de Cock, C. C., Hofman, M. B., Valk, J., Visser, C. A. (1995). Magnetic resonance angiography of anomalous coronary arteries. A new gold standard for delineating the proximal course? *Circulation* 92(11):3163–3171.

Stuber, M., Botnar, R. M., Danias, P. G., Sodickson, D. K., Kissinger, K. V., Van Cauteren, M., De Becker, J., Manning, W. J. (1999). Double-oblique free-breathing high resolution three-dimensional coronary magnetic resonance angiography. *J. Am. Coll. Cardiol.* 34(2):524–531.

Vliegen, H. W., Doornbos, J., de Roos, A., Jukema, J. W., Bekedam, M. A., van der Wall, E. E. (1997). Value of fast gradient echo magnetic resonance angiography as an adjunct to coronary arteriography in detecting and confirming the course of clinically significant coronary artery anomalies. *Am. J. Cardiol.* 79(6):773–776.

Received July 18, 2002
Accepted December 7, 2002