Incompetent Bicuspid Aortic Valve with Perforation and Aneurysm of the Right Coronary Artery: Improved Definition by Magnetic Resonance Imaging

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We describe the case of a 46 year old male with an endocarditis affected bicuspid aortic valve and an aneurysm of the right coronary artery. Magnetic resonance imaging not only provided the same findings as echocardiography and coronary angiography, but also gave further information that probably otherwise could only have been obtained by using transesophageal echocardiography.

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A man aged 46, was admitted to our department with progressive symptoms of heart failure (NYHA Class II) during the last month and clinical findings consistent with aortic valve insufficiency. He had a history of infective endocarditis one year previously, on a bicuspid aortic valve.

A transthoracic echocardiographic study showed the bicuspid aortic valve with mild calcification and significantly reduced mobility of the anterior leaflet (Figure 1). Continuous wave Doppler showed a slightly increased aortic flow velocity (Vmax 2.5 mm/s). Aortic color flow mapping revealed mild to moderate regurgitation with an eccentric jet. The patient refused to undergo a transoesophageal echo exam.

Diagnostic cardiac catheterization further revealed normal left and right coronary arteries and a saccular aneurysm with a maximum diameter of 3 cm near the origin of the right coronary artery (Figure 2).

Magnetic resonance imaging (MRI) was performed in order to clarify the anatomic situation before valve replacement. This procedure initially confirmed both the echo-Doppler and the catheterization findings. In addition, it revealed perforation of the anterior leaflet and provided clearer anatomical definition of the aneurysm, showing that it arose from the anterior wall of the right coronary artery, shortly beyond its origin (Figures 3, 4, 5).

The above findings led to the diagnosis of perforation of the anterior leaflet of a bicuspid aortic valve and valvular insufficiency, due to infective endocarditis, as well as probable mycotic aneurysm of the right coronary artery. This diagnosis was fully confirmed during the operation for valve replacement and excision of the aneurysm.

Discussion

Diseases of the heart and blood vessels are the main cause of death in developed countries. The value of any new imaging technique rests in its success rate and in its contribution to the evaluation of cardiovascular disease.

Cardiac catheterization is, of course, the method of choice and the gold standard for the evaluation of both the anatomy of the heart and coronary vessels and

Figure 1. Transthoracic echocardiogram in parasternal short axis view, showing a bicuspid aortic valve with anteriorly (1) and posteriorly (2) oriented leaflets. The anterior leaflet is mildly calcified, while the posterior leaflet shows calcification on one side (*arrows*). Ao: aorta; LA left atrium; RA: right atrium; RV: right ventricle.

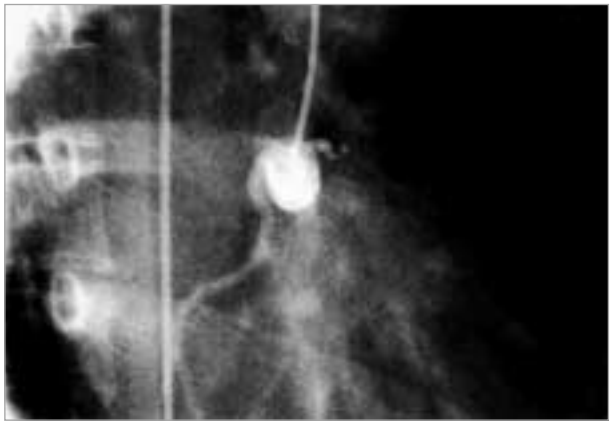
the severity of disease. However, this method, apart from being costly, exposes the patient and doctor to ionizing radiation and also involves a risk of major complications. The increasing use of noninvasive, technologically advanced imaging methods (echocardiography with wall motion analysis, transesophageal echocardiography, radial tomography) aims at reducing both the complications and the cost of an examination.

Magnetic resonance imaging (MRI) has been used in recent years for anatomical imaging of the heart and great vessels, in both ischemic and congenital heart diseases[1-7]. In addition, it may be used for evaluation of left ventricular function and, with newer techniques, of coronary flow and flow reserve[8-10]. This technique does not employ damaging radiation, has high reproducibility and provides extremely high-resolution images at all orientation levels, while allowing depiction of a three-dimensional representation as well as the motion of the region under examination.

To our knowledge, the combination of a bicuspid aortic valve, affected by endocarditis and a coronary artery aneurysm has not previously been reported in the international literature.

In this case, the use of MRI confirmed the damage found using coronary angiography and echocardiography, but in addition revealed the cause of

A



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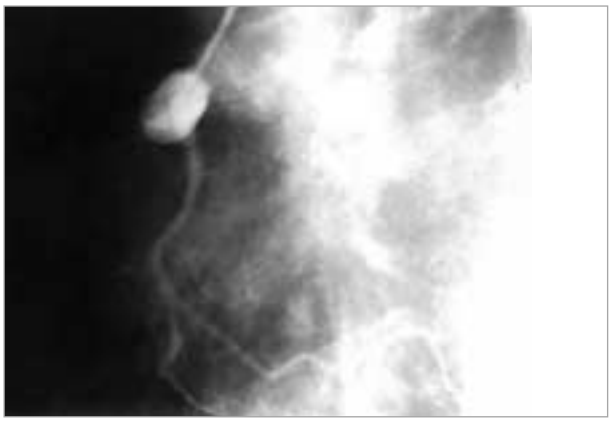

C

Figure 2. Aortography in the left view (A) clearly shows the aneurysm near the origin of the right coronary artery (*white arrow*) and the eccentric regurgitation jet (*arrowhead*). B and C show selective opacification of the aneurysm in right and left views, respectively. It is difficult to distinguish the precise anatomical position of the aneurysm from diagnostic catheterization.

Figure 3. MRI (FISP-2d with gradient rephasing technique) in a view corresponding to the short-axis echo view. Pictures A, B and C are from the same view (anterior and head left) during different phases of the cardiac cycle. The bicuspid structure of the aortic valve is clear, corresponding to the image on the echocardiogram. Additional observations are: 1) the rather limited mobility of the anterior leaflet (comparing A, B and C); 2) the eccentric jet at the level of the anterior leaflet, which corresponds to the perforation (A, *double arrow*); 3) the aneurysm (*single arrow* in all) arising from the anterior wall of the right coronary artery (*broken arrow* in all) and the cone artery (C, *double arrow*). Image D is from a different view (anterior feet and right feet posterior) and clearly shows the aneurysm (*arrow*), the right coronary artery (*broken arrow*) and the main stem of the left coronary artery, which bifurcates into the left anterior descending and circumflex arteries (*double arrow*).

Figure 4. Magnetic resonance imaging (FISP-2d with gradient rephasing technique), anteroposterior view during different phases of the cardiac cycle. Image A shows the jet from the opening of the valve (*arrow*) and the separate eccentric systolic jet (*broken arrow*) from the perforation of the anterior aortic valve leaflet. Image B shows the regurgitation jet in diastole (*broken arrow*) and the left coronary artery (*arrow*).

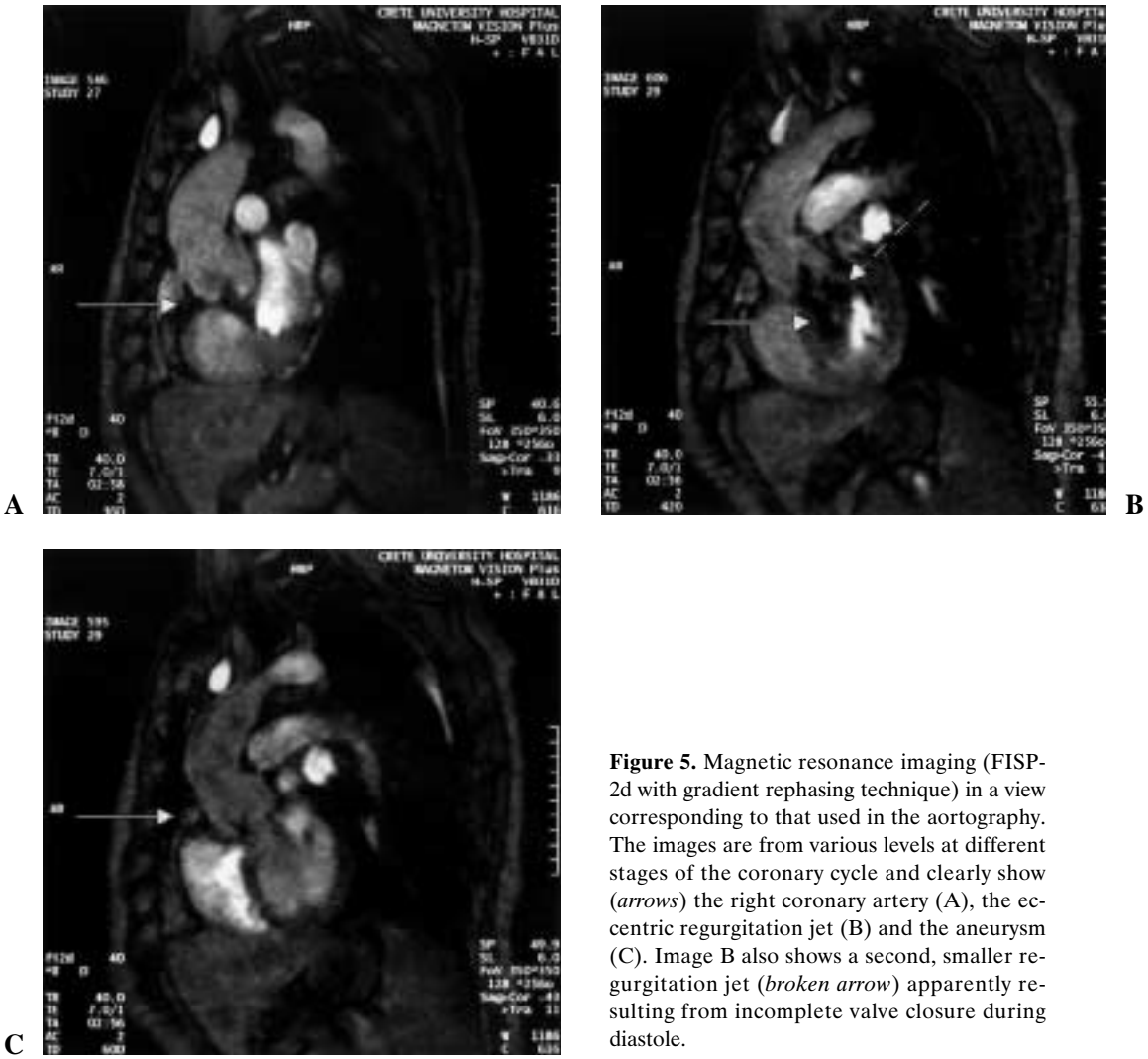

Figure 5. Magnetic resonance imaging (FISP-2d with gradient rephasing technique) in a view corresponding to that used in the aortography. The images are from various levels at different stages of the coronary cycle and clearly show (*arrows*) the right coronary artery (A), the eccentric regurgitation jet (B) and the aneurysm (C). Image B also shows a second, smaller regurgitation jet (*broken arrow*) apparently resulting from incomplete valve closure during diastole.

the aortic regurgitation, i.e. the perforation of the valve leaflet and showed its precise location. Thus, it not only provided the same findings as two other high quality imaging techniques, but also gave further information that probably could only have been obtained otherwise by using transesophageal echocardiography.

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