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Valvular heart disease: Multidetector computed tomography evaluation☆

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Abstract Heart valve disease is a clinical problem that has been studied with classical imaging techniques like echocardiography and MRI. Technological advances in CT make it possible to obtain static and dynamic images that enable not only a morphological but also a functional analysis in many cases. Although it is currently indicated only in patients with inconclusive findings at echocardiography and MRI or those in whom these techniques are contraindicated, multidetector CT makes it possible to diagnose stenosis or regurgitation through planimetry, to evaluate and quantify valvular calcium, and to show the functional repercussions of these phenomena on the rest of the structures of the heart. Given that multidetector CT is being increasingly used in the diagnosis of ischemic heart disease, we think it is interesting for radiologists to know its potential for the study of valvular disease.

PALABRAS CLAVE
Enfermedades de las válvulas cardíacas;
Tomografía computarizada multidetector;
Reconstrucción de imágenes;
Estenosis valvular;
Insuficiencia valvular

Enfermedad valvular cardíaca. Valoración con tomografía computarizada multidetector

Resumen La enfermedad valvular cardíaca es un problema clínico que se ha estudiado con técnicas de imagen clásicas como la ecocardiografía o la RM. El avance tecnológico de la TC permite obtener imágenes estáticas y dinámicas con las que hacer un análisis morfológico y, en muchas ocasiones, funcional. A pesar de que actualmente está solo indicada en los pacientes en los que la ecocardiografía o la RM no son concluyentes o están contraindicadas, la TC multidetector permite diagnosticar la estenosis o insuficiencia por planimetría, valorar y cuantificar el calcio valvular, y mostrar las repercusiones funcionales

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en el resto de estructuras cardíacas. Teniendo en cuenta que la TC multidetector es una técnica cada día más utilizada para el diagnóstico de la enfermedad isquémica, creemos interesante que el radiólogo conozca la potencialidad que esta técnica tiene en el estudio de la afección valvular.

Introduction

Cardiac valve disease causes a great number of deaths in Western countries. In 2004 in the United States mortality rate was around 20,260 patients.[1] Physiologically the valves ensure that blood flow from cardiac cavities is unidirectional −failure to do has serious functional repercussions.[2] To study them both the transthoracic and the transesophageal ultrasounds are the selected image modalities. MRI is a second line modality and the multidetector computed tomography (MDCT) is an exceptional indication modality used in patients in whom other modalities are inconclusive. This does not mean that the MDCT does not have any prognostic values since it provides morphological functional information from valvulopathies.[3] This together with the fact that the use of this modality is on the rise in studies of ischemic cardiopathies makes it interesting to know what the potentialities of this modality are in the study of valve affectation.

Technical issues

The modality used is no different from CT-coronarography with retrospective acquisition and synchronization to the ECG. To improve the quality of images it is important for the heart rate to be <65 b.p.m. So the use beta-blockers is not recommended. One multiphase contrast injection protocol allows us to assess right cavities too. Static images need to include multi-planar orthogonal reconstructions on the valves and it is also possible to obtain dynamic images with motion-compensated image reconstructions (MCIR) using intervals every 10% of cardiac cycle.[4]

Mitral valve

It opens during diastole enabling ventricular filling. The anterior leaflet is part of the left ventricular outflow tract and is slightly thicker and longer than the posterior leaflet. In normal conditions it is <5 mm-thick[4,5] (Fig. 1).

Mitral stenosis

It is defined as the incomplete opening of the valve. Its normal area is around 4–6 cm^2.[6] Functional repercussion occurs when the area is <2.5 cm^2 while clinical signs occur when the area is <1 cm^2. The most common cause is often rheumatic valvulopathy (Table 1) and less commonly the significant degenerative calcification of the valve (Fig. 2), congenital abnormalities, diseases of connective tissue or articular

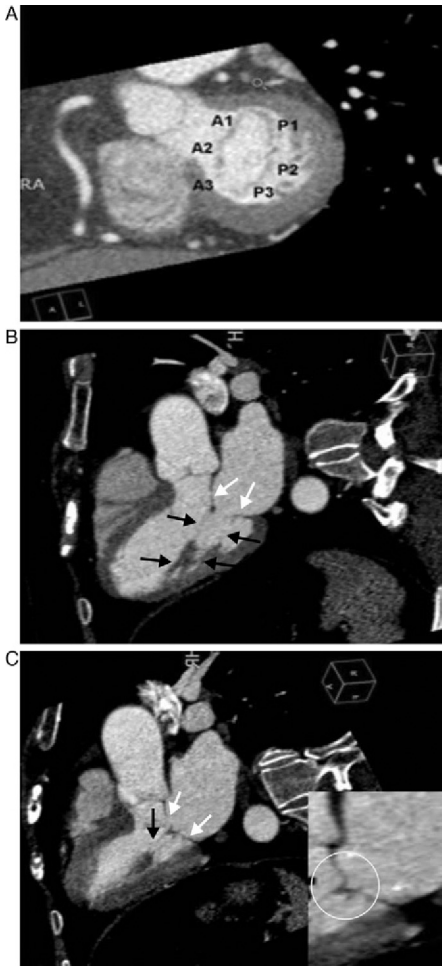

Figure 1 Mitral valvular apparatus. (A) Basal short-axis slice showing the opening orifice with the typical ''D''-shape. The valvular apparatus is not only a 2-leaflet structure but rather a more complex structure made up of 6 segments: 3 for the anterior leaflet (A1–A3), and 3 for the posterior one. (B) Three-camera projection showing the remaining components like tendon cords uniting from both leaflets towards the highest portion of papillary muscles (black arrows). The anterolateral muscle provides tendon cords for the posteriomedial leaflets while the posteromedial muscle provides tendon cords for both anterolateral leaflets (white arrows). (C) During systole papillary muscles are contracted with tendon cord-traction (black arrows) to close the valve (white arrows). The coaptation of both leaflets does not occur in one particular point but in a segment with variable length of several millimeters called ''coapted area'' (circle).