Case Report

Mitral Valve Regurgitation: Use of the Standard and the Latest Echocardiographic Techniques for Establishing the Diagnosis

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An 80-year-old man had severe mitral regurgitation caused by myxomatous degeneration of the leaflets and perforation of the anterior leaflet. The patient underwent a transthoracic and transoesophageal echocardiographic study, and three-dimensional echo was used to reinforce the diagnosis. Modern echocardiographic techniques appear to open new horizons in the study and management of valvular diseases, although they are still a long way from replacing traditional methods.

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Mitral regurgitation is one of the most common valvular diseases. Simple forms are encountered in young healthy individuals.[1] The moderate and severe forms are the most common types of valvular disease in the USA[2] and the second most frequent reason for cardiac surgery in Europe.[3] The clinical examination provides the first indications of the presence and possible severity of the regurgitation. However, looking for symptoms of heart failure, or signs of severe valve regurgitation, is not sufficient to steer the therapeutic management in the direction of surgical repair or replacement.[4]

Echocardiography is the examination of choice for judging the severity of mitral regurgitation, investigating its aetiology, and evaluating the possibility of valve repair. In experienced hands, the various techniques of transthoracic echocardiography are valuable tools.[5] Transoesophageal echocardiography provides additional information for the precise anatomical determination of the lesions when the relevant findings from the transthoracic study are of poor quality, as well as in complex calcified lesions or damage due to endocarditis. The transoesophageal method is usually employed in patients who are to undergo surgical intervention, for precise preoperative stratification according to Carpentier, as well as intra- and postoperatively for the evaluation of the results of the procedure.[5-7] Modern echocardiographic techniques, such as three-dimensional echocardiography, do not yet have the desired resolution to give images of high diagnostic accuracy. The use of the three-dimensional technique in transoesophageal imaging is likely to give a boost to the development of this technology, even though its results are still the subject of extensive research.[1,8,9]

Case presentation

An 80-year-old man, hypertensive, with no risk factors for coronary artery disease, came to our hospital's emergency department with a typical clinical picture of pul-

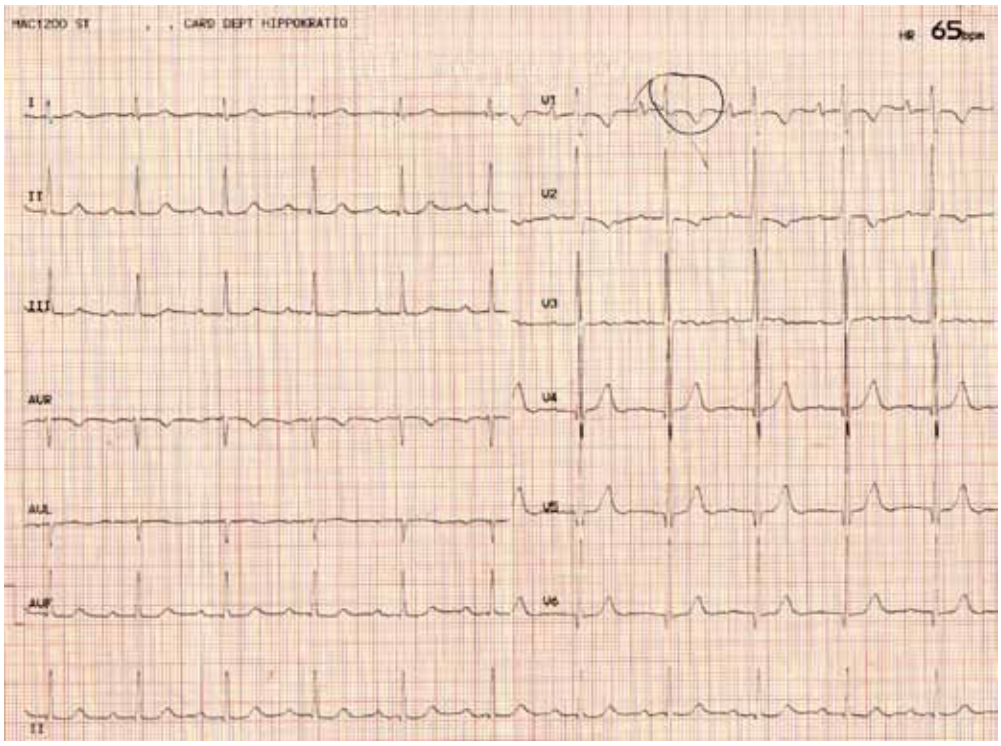

Figure 1. The patient's 12-lead ECG showing high potentials on the precordial leads and the anticlockwise rotation of the heart. Less apparent are the mitral P waves (especially on leads V_2 and V_3).

monary oedema. During the clinical examination, auscultation revealed a strong systolic apical murmur, the presence of a third heart sound, and diffuse fine respiratory crackles in both lung fields. The jugular veins were dilated, and there was severe oedema in both lower limbs. The patient improved after the administration of diuretic medication, intravenous nitrates and morphine, and was admitted to the clinic for further examination. The ECG findings (Figure 1) were non-specific (mitral P, anticlockwise heart rotation). The chest X-ray showed cardiomegaly, straightening of the left heart margin, and findings suggestive of heart failure, including portal congestion, blood regurgitation, and Kerley lines (Figure 2).

The main finding from the patient's history was the progressively deteriorating severe mitral regurgitation over six months. The patient brought with him his echocardiographic report from the year before, which referred to mild concentric left ventricular hypertrophy with a satisfactory ejection fraction and a small degree of mitral regurgitation because of a prolapsed anterior leaflet. From the coexisting tricuspid regurgitation the pulmonary artery pressure had been estimated at about 50 mmHg.

The patient's history also recorded his hospitalisation three years previously in a tertiary hospital for fever, anaemia, and bone pains. Because of the anaemia, the patient underwent bone marrow biopsy which showed dysplasia with non-specific changes (elevated monocytes and dysplasia of the granular series) so the differential diagnosis was between tuberculosis, chronic myelomonocytic leukaemia, and in-

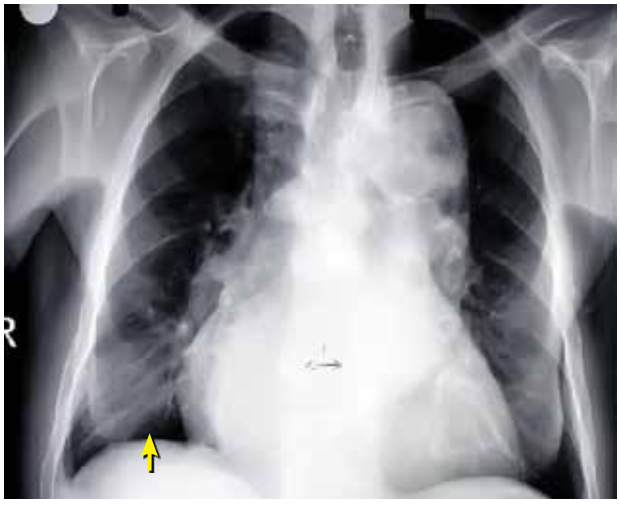

Figure 2. The patient's chest X-ray with clear widening of the cardiothoracic index, portal congestion, blood regurgitation, and Kerley lines (arrow).

fective endocarditis. Haemolytic *Staphylococcus* was isolated from blood cultures and the patient was put on an empiric antimicrobial regimen with ceftazidime and teicoplanin for three weeks, during which the clinical symptoms disappeared.

During the current hospitalisation, transthoracic echocardiography showed eccentric left ventricular hypertrophy with a preserved ejection fraction, dilation of the left atrium, and tricuspid regurgitation, which corresponded to a pulmonary artery systolic pressure >60 mmHg. Examination of the mitral valve in the apical four-chamber view showed a large prolapsed anterior leaflet with a floppy texture (Figure 3). Colour Doppler imaging of transmitral flow showed dual-jet regurgitation, with one jet being eccentric and directed towards the posterior left atrial wall, and the second emerging via the anterior leaflet (Figure 4).

The transoesophageal study that followed confirmed the findings of the transthoracic imaging regarding the existence of a floppy anterior leaflet with a large degree of valvular regurgitation (Figure 5).

The use of the three-dimensional transthoracic transducer showed similar mitral valve morphology to the two-dimensional study (Figure 3), but also suggested the presence of a hole in the centre of the anterior leaflet (Figure 6).

The remaining examinations, including haematological and biochemical tests, showed leucocytosis (white cell count 17×10^3 /μL) of polymorphonuclear type (90%) and mild anaemia (Ht: 39%). No strains were isolated from the blood cultures and it was notable that the patient remained afebrile throughout his hospitalisation. To rule out coronary artery disease,

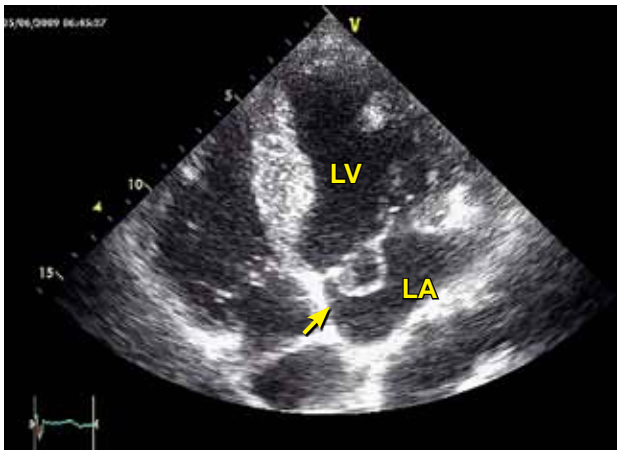

Figure 3. Transthoracic two-dimensional echocardiography, apical four-chamber view, showing the floppy prolapsed anterior mitral valve leaflet (arrow).

and because of the possibility of surgical intervention, coronary angiography was performed and showed ectatic coronary vessels without stenoses.

As the patient was haemodynamically stable, he was sent to the cardiac surgery department for surgical replacement of the afflicted valve with a metallic prosthesis, since repair was judged not to be possible. Figure 7 shows the surgical preparation of the mitral valve, where perforation of the anterior leaflet may be clearly seen.

Discussion

Degenerative mitral valve disease, as mentioned above, is a severe public health problem, since it is also the

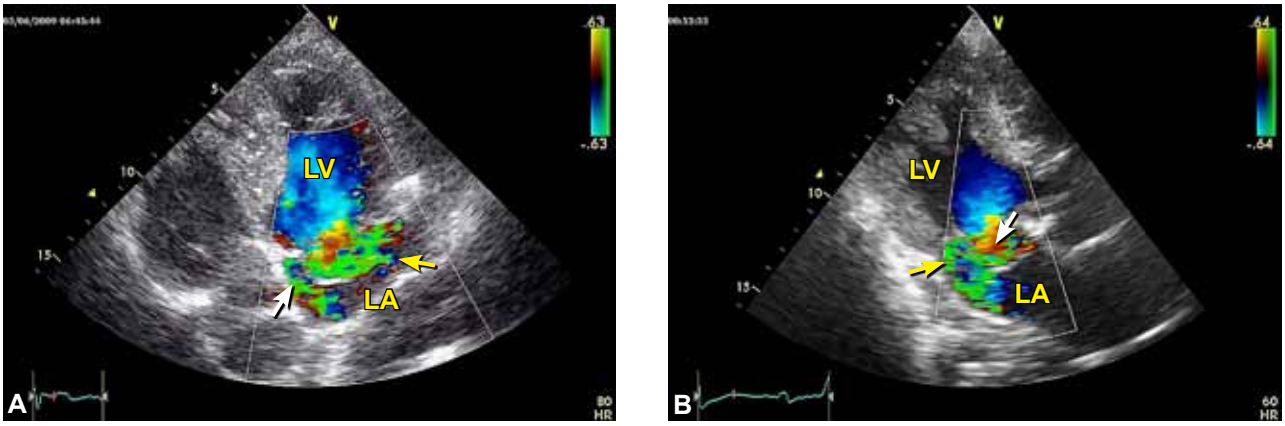

Figure 4. Transthoracic two-dimensional echocardiography, apical four-chamber view (A) and apical three-chamber view (B) with colour Doppler imaging, showing turbulent retrograde flow in the left atrium. There are two regurgitation jets, one eccentric (yellow arrow), directed towards the posterior atrial wall, opposite to the prolapsed leaflet, and a second jet (white arrow) through the anterior leaflet. LA – left atrium; LV – left ventricle.

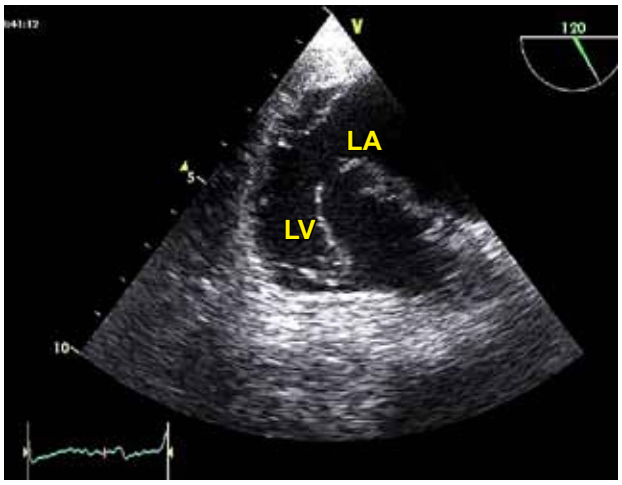

Figure 5. Transoesophageal two-dimensional echocardiography, transgastric view with 120° angulation, clearly showing the floppy anterior leaflet. LA – left atrium; LV – left ventricle.

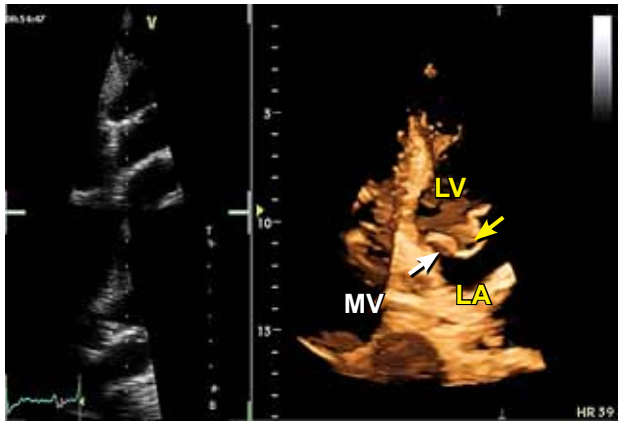

Figure 6. Transthoracic three-dimensional echocardiography, apical four-chamber view. The solid white arrow shows the anterior leaflet and the yellow arrow on the right shows the region of probable perforation. LA – left atrium; LV – left ventricle; MV – mitral valve.

Figure 7. Surgical preparation from the excision of the mitral valve leaflets during the valve replacement procedure, showing the perforation of the anterior leaflet.

most common cause of severe mitral regurgitation, either alone, or in combination with an inherited predisposition to infection of the already afflicted valve.[1,5,10,11] From the above analysis it appears that the case reported here falls into this category. There was already a myxomatous valve with prolapse of the anterior leaflet, which over a long period of time caused slight to moderate regurgitation. The key point was probably the previous hospitalisation for fever, although the possibility of endocarditis was not confirmed, nor was the corresponding medication given in accordance with current guidelines.[12] The complete structural and functional degeneration of the valve and the perforation of the anterior leaflet are suggestive of an infection, although no symptoms or indications of acute infective endocarditis were found during the current hospitalisation in either the clinical or the other examinations (blood cultures, echocardiography). Degenerative mitral valve disease today is most often treated by surgical repair and not complete replacement, but the former was not feasible in our patient because of the large degree of destruction of the anterior leaflet.[5]

The role of echocardiography in the overall evaluation of mitral regurgitation is a definitive one, as in every valvular disease. Ultrasound imaging can be used to evaluate the severity of the regurgitation; in most cases it will allow an aetiological diagnosis, suggest the mechanism causing the regurgitation, while in combination with a transoesophageal study it is able to reveal any existing anatomical damage, to guide the surgical treatment of the disease, and finally to assist in the evaluation of the results of any intervention.[1,5]

The latest echocardiographic technology, in particular the three-dimensional techniques, are very promising and appear to have a place in valvular disease, despite the problems that the existing software has in analysing images from a transthoracic study.[1,8,9] Their applications for the aortic and tricuspid valves, as well as the mitral valve, may be expected to expand in the future, since they provide a better anatomical depiction of the geometry of the structures, which can be of assistance in surgical and percutaneous interventions.[8,9,13-16]

Three-dimensional transoesophageal imaging of the mitral valve (which is not yet available in our laboratory) offers a wide range of possibilities, both in stenosis—where it is possible to measure the effective valve orifice and to evaluate the degree of thickening and damage to the leaflets, as well as any calcification—and in regurgitation.[14,15,17] Indeed, in mitral regurgitation, where the prolapse is very often under- or overestimated, it is possible to perform detailed imaging of the

scallops that are affected on each leaflet, as well as the anatomy of the *chordae* and the subvalvular apparatus, information which is invaluable in the light of a possible repair procedure. In each case (stenosis or regurgitation) the three-dimensional transoesophageal technique can be used either during or after the procedure (surgical or percutaneous), to evaluate the final result.[13,15,18]

Nevertheless, under current conditions, the software used in three-dimensional techniques cannot replace the two-dimensional ones, at least as far as the initial diagnosis is concerned, while the images from three-dimensional transthoracic studies have not yet reached the desired level of resolution. These new techniques complement the older ones, as in the case of our patient, where three-dimensional imaging served to complement the transthoracic and transoesophageal studies, reinforcing the existing indications for the presence of a perforation. Therefore, more efforts are needed and we have a long way to go until we have a practically useful transthoracic three-dimensional transducer that will establish three-dimensional imaging in daily clinical practice.[9,19,20]

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