

# 'Acquired' left ventricular to right atrial shunt after mitral valve replacement: Detection by transthoracic colour Doppler echocardiography

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Left ventricular to right atrial communications are rare types of ventricular septal defects usually of congenital origin. A case of an iatrogenic shunt between the left ventricle and the right atrium as a rare complication of mitral valve replacement is reported.

**Key Words:** *Acquired left ventricular to right atrial shunt; Echocardiography; Mitral valve replacement*

Left ventricular (LV) to right atrial (RA) communications are rare types of ventricular septal defects known collectively as the Gerbode defect. These defects are usually congenital, as indicated by Gerbode et al (1) in their original description of five cases in 1958. We report a case of an iatrogenic shunt between the LV and the RA as a rare complication of mitral valve replacement.

## CASE PRESENTATION

A 54-year-old white man was admitted to the hospital two months after undergoing mitral valve replacement (MVR) for severely calcified rheumatic mitral stenosis. His preoperative LV ejection fraction was 52%. The patient had done relatively well for a few days after surgery, when he developed worsening dyspnea. On admission, he was afebrile with a blood pressure of 110/55 mmHg and a pulse of 92 beats/min. A physical examination revealed a debilitated man in mild respiratory distress but stable vital signs. The neck veins were distended and showed evidence of large V waves. The lungs had bibasilar rales. On cardiac auscultation, a closing click of the mitral valve and a grade 4/6 holosystolic murmur were heard throughout the precordium, best along the left midsternal border. A transthoracic echocardiogram revealed normal systolic function of the left and right ventricles, with an estimated LV ejection fraction of 50% and biatrial enlargement. A bileaflet tilting disc mechanical valve was identified in the mitral position, with a mean systolic gradient of 11 mmHg. A small defect was visualized in the upper portion of the interventricular membranous septum above the insertion of the septal leaflet of the tricuspid valve (TV). Colour Doppler examination from the parasternal and apical short-axis and subcostal windows

## Un shunt du ventricule gauche à l'oreillette droite « acquis » après une chirurgie de remplacement de la valvule mitrale : Une détection par échocardiographie couleur Doppler par voie transthoracique

Les communications du ventricule gauche à l'oreillette droite sont des types rares de malformation congénitale du septum interventriculaire, qui sont généralement d'origine congénitale. On présente un cas de shunt iatrogène entre le ventricule gauche et l'oreillette droite, une rare complication après le remplacement de la valvule mitrale.

revealed a large paravalvular leak from the posterolateral aspect of the mitral valve, and a disturbed systolic and diastolic colour flow signal in the RA not originating from the TV. The jet was noted to arise from the upper interventricular septum toward the RA along the atrial aspect of the tricuspid leaflets (Figure 1). There was also mild aortic and tricuspid regurgitation. The high-velocity jet originating from the LV outflow tract was seen entering the RA and had a velocity in excess of 4.5 mm/s. The inferior vena cava and hepatic veins were dilated without respiratory variability.

The patient underwent aggressive diuresis because of congestive symptoms. An oximetry study showed a significant step-up in oxygen saturation at the level of the RA: superior vena cava 64%, inferior vena cava 68%, RA 77%, right ventricle 75%, pulmonary artery 74% and aorta 96%, with a Qp/Qs ratio of 1.4/1. Because of the deterioration in the patient's clinical status, he underwent urgent surgery. The surgery revealed detachment of the prosthetic valve at the annular level that resulted in severe paravalvular leak to the left atrium from the posterolateral aspect of the prosthetic valve. The prosthetic valve was removed and replaced by a 23 mm St Jude valve (St Jude Medical Inc, USA). There was also a defect from the LV to the RA, which was closed using Prolene sutures (Johnson and Johnson, Ethicon Division, USA). He had a complete resolution of his dyspnea and was discharged a few days after the operation.

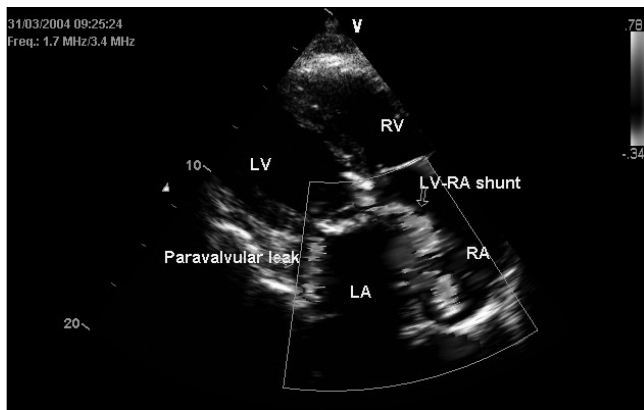
## DISCUSSION

LV-RA communications are rare intracardiac defects that may be either congenital or acquired. Both forms of LV-RA communications result from a defect in the membranous

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**Figure 1)** Transthoracic echocardiographic examination at apical four-chamber view that shows paravalvular leak to the left atrium (LA) and left ventricular (LV) to right atrial (RA) shunt. RV Right ventricle

interventricular septum, inferior to the crista supraventricularis. The congenital form accounts for less than 1% of all congenital heart disease and was first classified by Gerbode et al (1). Associated cardiac malformations, the most common being atrial septal defects, are present in up to one-third of patients (2). Acquired LV-RA communications arise from ventricular septal perforation as a result of endocarditis (3-7), trauma (8-10), mitral or aortic valve replacement (11), and myocardial infarction (12-14). Because the tricuspid annulus has a more apical location than the mitral annulus, the septal leaflet of the TV normally rests 5 mm to 10 mm more apically than the anterior leaflet of the mitral valve. This anatomical arrangement allows the septal leaflet to divide the membranous ventricular septum into two portions: a supravalyular (or atrioventricular) portion and an infravalvular (or interventricular) portion. A defect in the supravalyular portion results in a

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direct LV-RA communication. A similar defect in the infravalvular portion represents a perimembranous ventricular septal defect and would normally result in a communication between the LV and the right ventricle.

The prominent physical finding of an LV-RA shunt is a loud and harsh pansystolic murmur, often associated with a thrill along the left sternal border. Nevertheless, a diagnosis is usually not possible on the basis of physical examination alone. Transthoracic echocardiography has emerged as the diagnostic procedure of choice and has supplanted the need for LV angiography. In patients with large shunts, two-dimensional imaging often demonstrates four-chamber enlargement and dilated pulmonary arteries. On colour Doppler imaging, a high-velocity jet is seen originating from the upper membranous septum and directed toward the RA, a finding highly suggestive of an LV-RA shunt. However, this jet must be distinguished from other conditions, such as rupture of a sinus of Valsalva aneurysm and endocardial cushion defect (15). It is also important to distinguish LV-RA communication from tricuspid regurgitation. Dzwonczyk and Davidson (15) suggested that colour flow imaging in the parasternal short-axis, apical short-axis and subcostal projections is useful in eliminating the other possibilities and in confirming the diagnosis (15). They also indicated that a disturbed colour signal in the RA not originating from the TV and with a velocity of 4.0 mm/s or more should suggest a LV-RA communication.

In the present case, the supravalyular location of the defect resulted in a direct communication between the LV and the RA. While it may never be possible to ascertain the exact mechanism of septal perforation, one possibility is that the defect was caused by previous surgical trauma, because there was no defect on echocardiography performed before MVR.

This unusual complication after MVR is a rare condition and should be kept in mind in patients who present with progressive dyspnea after operation.