ORIGINAL ARTICLE

Clinical Applications of Echocardiography for Patients with Stenotic Double Orifice Mitral Valve Pre- and Post-balloon Mitral Valvuloplasty

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Background: In previous studies, double orifice mitral valve (DOMV) was found to be a rare congenital anomaly, especially in isolated DOMV stenosis. The aim of this study was to demonstrate the usefulness of transthoracic echocardiography, which includes two-dimensional and Doppler echocardiography, for diagnosing and evaluating stenotic DOMV pre- and post-balloon mitral valvuloplasty (BMV). This is believed to be the first study ever reported in Taiwan.

Patients and Methods: We retrospectively reviewed the echocardiographic findings of eight symptomatic patients with stenotic DOMV who successfully underwent BMV between September 2000 and March 2005. We analyzed their echocardiographic characteristics of valve morphology, size, location and transmitral pressure gradient before BMV and valve restenosis after BMV.

Results: All patients had incomplete bridge type with larger posteromedial orifice. No associated lesions were noted in any of the patients. After medical treatment and evaluation, they all underwent BMV successfully. Follow-up echocardiography showed no mitral valve restenosis.

Conclusion: Two-dimensional echocardiography is a dependable method for diagnosing DOMV and evaluating stenotic DOMV post-BMV.

KEY WORDS — balloon mitral valvuloplasty, double orifice mitral valve, echocardiography

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Introduction

In 1876, the first case of double orifice mitral valve (DOMV) was reported by Greenfield [1]. DOMV is an uncommon congenital anomaly characterized by the presence of two mitral orifices, each possessing an independent chordal attachment to a papillary muscle [2,3]. In a study by Bano-Rodrigo

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et al, they found 27 cases of DOMV among 2733 necropsies from Boston Children's Hospital, where this pathology represented 1% of the congenital cardiopathies found [3]. DOMV might occur as an isolated anomaly or, more often, in association with other congenital anomalies such as mitral stenosis and regurgitation, endocardial cushion defect, bicuspid aortic valve and coarctation of the aorta [2,4].

Hartmann was the first to propose a classification for DOMV in 1937 [5]. According to an echocardiographic study, Trowitzsch et al classified DOMV into three types: an incomplete bridge, a complete bridge and a hole [6]. In the incomplete bridge type, a small strand of tissue connects the anterior and posterior leaflets at the leaflet edge level. In the complete bridge type, a fibrous bridge divides the atrioventricular orifice completely into equal or unequal parts. And finally, in the hole type, an additional orifice with subvalvular apparatus occurs in the posterior commissure of the mitral valve. These three types may be differentiated by sweeping the transducer in cross-sectional view from the apex toward the base of the heart. In the complete bridge type, both orifices can be seen throughout the scan, while in the incomplete bridge type, the two orifices can be seen only at the level of the papillary muscles. In the hole type, the second orifice can be seen at about the midleaflet level [6].

Mitral valvuloplasty and valve replacement both have a place in the management of DOMV. In order to effectively split the fibrous connection between the leaflets, Inoue-balloon mitral valvuloplasty (BMV) has been widely used [7]. Over the past few years, we have encountered eight moderately symptomatic patients with stenotic DOMV of the incomplete bridge type. Their clinical manifestations and physical examinations were indistinguishable from those of rheumatic mitral stenosis. After medical treatment and evaluation, they all underwent BMV successfully. The aim of this study was to demonstrate the usefulness of transthoracic echocardiography, which includes two-dimensional and Doppler echocardiography, for diagnosing and evaluating DOMV pre- and post-BMV.

Patients and Methods

From the electronic database of the echocardiographic laboratory of the Division of Cardiology, China Medical University Hospital, we studied eight patients (2 males, 6 females; age range, 35–67 years; mean age, 52.3 years) with stenotic DOMV who were referred to us because of cardiac symptoms and who underwent BMV between September 2000 and March 2005. Each patient was submitted for an echocardiographic study using SONOS 2500 or 4500 ultrasound systems (Hewlett-Packard, Andover, MA, USA) and a 2.5/2.0-MHz phased-array transducer before and after BMV. All projections were videotaped. Two-dimensional echocardiography of the parasternal long- and short-axis views, subcostal short-axis view, and apical two- and four-chamber views were performed for identifying the following: (1) the location of the mitral valve orifice; (2) the size of the orifices; (3) the function of the valve; and (4) the presence of associated lesions.

Mitral stenosis was diagnosed by combined color and pulse-wave Doppler echocardiography, supported by an abnormal Doppler flow profile with a decreased E-F slope and late diastolic acceleration and color Doppler flow mapping showing turbulent anterograde diastolic flow into the left ventricle. The severity of mitral stenosis was assessed from the mean pressure gradient across the mitral valve measured from spectral Doppler traces obtained from apical four-chamber views and mitral valve area (MVA). Mitral stenosis was classified into three levels: mild, moderate and severe. Mild stenosis was defined as a mean gradient of 3–5 mmHg or MVA of 1.6–2.0 cm^2, while moderate stenosis was defined as a mean gradient of 5–10 mmHg or MVA of 1.1–1.5 cm^2, and severe stenosis was defined as a mean gradient of >10 mmHg or MVA ≤ 1.0 cm^2.

There are several ways for calculating MVA, including visualization of the mitral valve with two-dimensional echocardiography, continuity equation, pressure half time, and proximal isovelocity surface area methods. In this study, MVA was directly determined using planimetric measurements of two-dimensional echocardiography at the short-axis view