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Management of Mitral Stenosis Using 2D and 3D Echo-Doppler Imaging

Nina C. Wunderlich, MD,*† Roy Beigel, MD,‡§ Robert J. Siegel, MD‡

Rostock and Darmstadt, Germany; Los Angeles, California; and Tel Hashomer and Tel Aviv, Israel

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CME Objective for This Article: At the end of this activity the reader should be able to: 1) recognize and identify the severity of mitral stenosis (mild, moderate, severe) using various echocardiographic methods; 2) recognize those patients who would benefit and are amenable to treatment by percutaneous mitral balloon valvuloplasty (PMBV); and 3) utilize echocardiography to guide and assess the result of PMBV.

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From the *University Hospital Rostock, Rostock, Germany; †Cardiovascular Center Darmstadt, Darmstadt, Germany; ‡The Heart Institute, Cedars-Sinai Medical Center, Los Angeles, California; and §The Heart Institute, Sheba Medical Center, Tel Hashomer, Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel. The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

Management of Mitral Stenosis Using 2D and 3D Echo-Doppler Imaging

Although the prevalence of rheumatic fever is decreasing in developed countries, it still affects numerous areas in the nonindustrialized world. Untreated mitral stenosis (MS) contributes to a significant global morbidity and mortality. Echocardiography is the main diagnostic imaging modality with which to evaluate mitral valve (MV) obstruction and assess the severity and hemodynamic consequences of MS as well as valve morphology. According to current guidelines and recommendations for clinical practice, the severity of MS should not be defined by a single value but assessed by valve areas, mean Doppler gradients, and pulmonary pressures. Transthoracic echocardiography is usually sufficient to grade MS severity and to define the morphology of the valve. Transesophageal echocardiography is used when the valve cannot be adequately assessed with transthoracic echocardiography and to exclude intracardiac thrombi before a percutaneous or surgical intervention. Three-dimensional transthoracic and transesophageal echocardiographic assessment provide more detailed physiological and morphological information. Current definitive treatment for severe MS involves percutaneous mitral balloon valvuloplasty (PMBV) or surgery. The effectiveness of PMBV is related to the etiology of MS, and certain anatomic characteristics tend to predict a more successful outcome for PMBV, whereas other MV structural findings might suggest balloon valvuloplasty to be less likely successful or even contraindicated. (J Am Coll Cardiol Img 2013;6:1191–205) © 2013 by the American College of Cardiology Foundation

Rheumatic fever (RF) is the major cause of mitral stenosis (MS), and although its prevalence has been steadily decreasing in industrialized countries (1,2), rheumatic MS remains the most common heart disease in developing countries (3–5). Globally, there are >15 million cases of rheumatic heart disease, with 233,000 deaths each year and 282,000 new cases per year (6).

Surgical commissurotomy, first described in 1923 (7), became the standard treatment for patients with MS in the late 1940s (8). Since the introduction of the Inoue balloon catheter in 1984 (9), percutaneous mitral balloon valvuloplasty (PMBV) emerged as a safe and effective treatment for MS (10–18) and has evolved as the preferred treatment option for selected symptomatic patients with rheumatic MS (19–21).

The focus of this review is on current 2-dimensional (2D) and 3-dimensional (3D) echocardiographic imaging for the selection of suitable patients for PMBV and on the perioperative aspects of PMBV.

Rheumatic MS

If the mitral valve (MV) orifice area exceeds 1.5 cm^2 , patients are generally asymptomatic at rest (1). The clinical exacerbation of MS occurring with pregnancy or complications such as atrial

fibrillation or embolic events (22) confer a poor prognosis if no intervention is performed to correct the MS (1,2,23–25). Commissural fusion is the requisite lesion for PMBV to be effective (Fig. 1). Thus, the effectiveness of PMBV is related to the etiology of MS. RF, the major cause of MS (1,2), results in commissural fusion of the MV, which leads to narrowing of the valve orifice and valve obstruction. In degenerative MS (Fig. 2), generally seen in the elderly or in patients with severe renal disease and secondary hyperparathyroidism, advanced mitral annular calcification is the main lesion and commissural fusion is not present. Other rare causes of MS include congenital MS, as demonstrated in Figure 3, inflammatory diseases, infiltrative diseases, carcinoid heart disease, and drug-induced MS. As with degenerative MS, commissural fusion is rare in these cases; most commonly, the leaflets are thickened and restricted, and, thus, these cases are generally not well suited for PMBV.

Echocardiographic assessment of MS

Echocardiography is the main diagnostic imaging modality to evaluate MV obstruction and to assess the severity and the hemodynamic consequences of MS, as well as valve morphology and extent of the disease (19,20).

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