

# iMAGE

LETTERS TO THE EDITOR

## 3D TEE for Evaluation of Commissural Opening Before and During Percutaneous Mitral Commissurotomy

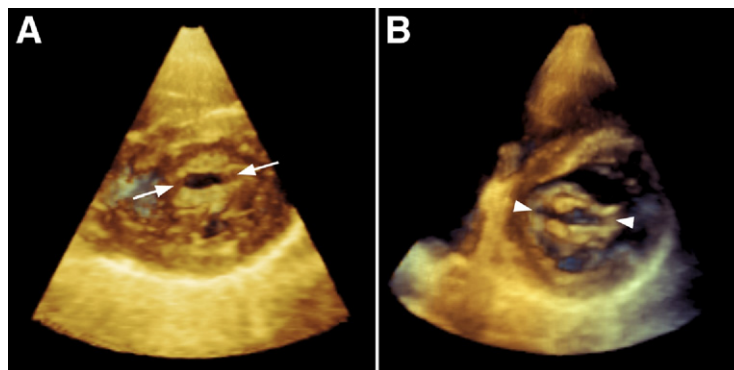
The report by Messika-Zeitoun et al. (1) evaluating the association of commissural opening (CO) after percutaneous mitral commissurotomy (PMC) with improved long-term clinical outcomes shows the utility of combining CO with other echocardiography parameters in the post-procedure assessment of PMC. Their findings also validate the longstanding but inadequately data-supported (2) practice of using echocardiographic assessment of CO as a guide for evaluation and treatment of patients with severe mitral stenosis.

Although 2-dimensional echocardiography remains the standard imaging modality for evaluating mitral stenosis, we agree with the investigators that the advent of 3-dimensional (3D) transthoracic echocardiography (TTE) and 3D transesophageal echocardiography (TEE) harbor the potential to revolutionize the noninvasive evaluation and invasive management (i.e., PMC) of severe mitral stenosis. Before the development of real-time 3-dimensional (RT3D) imaging, the use of 3D echocardiography in evaluating mitral stenosis was limited to offline reconstruction of gated 3D images acquired using 2-dimensional echocardiography before PMC. Although offline reconstruction helped to clarify the presence and extent of commissural fusion, it could be used for neither procedural guidance nor as a mechanism for immediate feedback on procedural results. After the introduction of RT3D TTE in 2002, it became obvious that this technological

advancement would serve as a useful tool to enhance our understanding and evaluation of mitral commissural fusion by providing “depth” to the mitral valve through the application of the “elevation” dimension (i.e., the third dimension). Furthermore, as opposed to the gated technique, RT3D imaging allowed visualization of the mitral valve throughout an unlimited number of cardiac cycles. Finally, the same evaluation could be performed before and after PMC as well as during the balloon inflation. Indeed, using the technology during PMC procedures, we noted several dramatic demonstrations of commissural splitting shown with pre- and post-procedure RT3D TTE (Fig. 1).

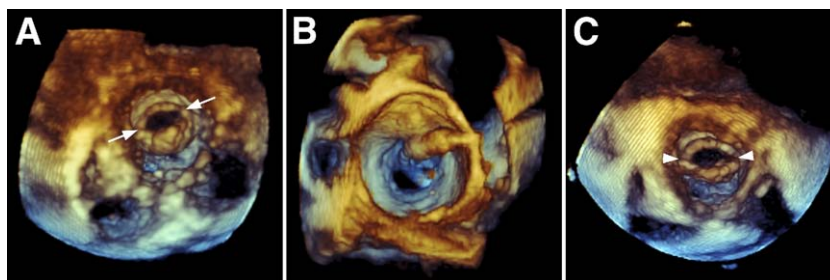
The advent of RT3D TEE in November 2007, however, represented the next frontier in the evaluation of mitral stenosis and allowed for optimal 3D imaging of the mitral commissures in virtually all patients. As a result, we have now transitioned to routinely using RT3D TEE to both pre-procedurally evaluate mitral stenosis (i.e., assessing commissural fusion) and assess the immediate results (i.e., assessing CO) of PMC (Fig. 2). Additionally, the enhanced imaging provided by RT3D TEE has provided an improved confidence in adopting the approach to PMC of proceeding with increased Inoue balloon inflations until one or both commissures are split, while exercising caution to stop earlier should progressive mitral regurgitation develop.

In summary, we agree with Messika-Zeitoun et al. (1) that 3D echocardiography, but particularly RT3D TEE, offers tremendous potential in assessing commissural fusion in mitral stenosis and CO after PMC, although further evaluation of this novel imaging modality is clearly needed before widespread adoption is achieved. Nonetheless, our positive experiences in using RT3D echocardiography in both the evaluation and the treatment of mitral stenosis have led to our laboratory incorporating it as a mainstay in the evaluation and percutaneous treatment of severe mitral stenosis.



**Figure 1.** Transthoracic 3-Dimensional Images From the Parasternal Short-Axis View at the Leaflet Tips

(A) The valve before percutaneous mitral commissurotomy with the commissures still fused. (B) The open commissures with the additional elevation dimension providing enhancement to appreciate the length of commissural splitting.



**Figure 2. Examples of Real-Time 3-Dimensional Transesophageal Imaging**

(A, C) The mitral orifice from the ventricular side before and after percutaneous mitral commissurotomy. As in Figure 1, C shows the opening of the commissures as a result of the procedure. (B) A view of the mitral orifice from the left atrial side. Further, the balloon catheter is seen within the left atrium as the operator moves it toward the mitral orifice.

\*Edward A. Gill, MD  
Michael S. Kim, MD  
John D. Carroll, MD

\*Department of Medicine  
Division of Cardiology  
University of Washington School of Medicine  
Harborview Medical Center  
Box 359748  
325 Ninth Avenue  
Seattle, Washington 98104  
E-mail: [eagill@u.washington.edu](mailto:eagill@u.washington.edu)

doi:10.1016/j.jcmg.2009.05.007

## REFERENCES

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## REPLY

We thank Dr. Gill and colleagues for their interest in our paper (1) and for their comments. In this work, we evaluated the prognostic value of the degree of commissural opening (CO) after percutaneous mitral commissurotomy (PMC) in patients with mitral stenosis (MS). We concluded that the degree of CO provides important prognostic information and thus should be systematically evaluated during and after PMC and considered as a complementary measure of procedural success in addition to the mitral valve area, which is not always easy to assess.

The degree of CO was prospectively evaluated between 1986 to 1995 using the only imaging modality available at the time, 2-dimensional echocardiography. Real-time 3-dimensional echocardiography (RT3DE) is a relatively new echocardiographic modality that may change our routine practice in general, and more specifically during noncoronary interventional procedures (2). We fully agree with Dr. Gill, that RT3DE is probably the best method to assess the degree of CO. RT3DE provides multiple views, en face of both atrial or ventricular perspective as well as lateral

rotations, allowing an easy visualization of the degree of CO. We have previously shown that 2-dimensional echocardiography underestimated the degree of CO compared with RT3DE in one-third of patients (3). We are now routinely using RT3DE during PMC to guide the procedure.

We also agree with Dr. Gill that real-time 3-dimensional transesophageal echocardiography (RT3D-TEE) provides an even more impressive visualization of the mitral valve and of the commissure anatomy, as they show in Figure 2. However, we would like to underline that if TEE is systematically performed before the procedure to exclude a thrombosis in the left atrium, PMC is usually performed under local anesthesia in a conscious state precluding its use during the procedure. In our institution, PMC is performed under general anesthesia and TEE guidance in certain circumstances such as pregnancy or complex transeptal puncture, and we are now using RT3D-TEE in these cases.

In summary, we all agree that RT3DE is probably the most accurate and easiest method for assessing the degree of commissural opening, but the use of RT3D-TEE remains limited to the assessment of valve anatomy before the procedure and to the rare PMC cases performed under general anesthesia due to the penibility of the examination.

\*David Messika-Zeitoun, MD  
Julie Blanc, MD  
Bernard Iung, MD  
Eric Brochet, MD  
Bertrand Cormier, MD  
Dominique Himbert, MD  
Alec Vahanian, MD

\*Cardiovascular Division  
Bichat Hospital  
46 rue Henri Huchard  
75018 Paris  
France  
E-mail: [david.messika-zeitoun@bcb.aphp.fr](mailto:david.messika-zeitoun@bcb.aphp.fr)

doi:10.1016/j.jcmg.2009.06.002