

# THE ROLE OF MECHANICAL DYSSYNCHRONY ON FUNCTIONAL MITRAL REGURGITATION IN PATIENTS WITH DILATED CARDIOMYOPATHY

JANG-YOUNG KIM, MD, PHD

DIVISION OF CARDIOLOGY, DEPARTMENT OF INTERNAL MEDICINE, WONJU COLLEGE OF MEDICINE, YONSEI UNIVERSITY, WONJU, KOREA

## REFER TO THE PAGE 69-75

Functional mitral regurgitation (FMR) occurs despite a structurally normal mitral valve (MV) as a consequence of global or regional left ventricular (LV) dysfunction. It is a common complication and predicts poor outcome in patients with dilated cardiomyopathy.<sup>1)</sup>

The pathophysiology of FMR is closely related to several factors such as systolic MV tenting as a result of LV geometric changes, a reduced closing force, dilatation of the mitral annulus and LV dyssynchrony.<sup>2)</sup>

Of these, mechanical dyssynchrony of the LV may play a potential role in determining the degree of FMR as a result of uncoordinated contraction of the papillary muscles and reduced closing force.<sup>3)</sup> This hypothesis supports the ability of cardiac resynchronization therapy (CRT) to decrease the severity of FMR due to improved coordinated timing of the papillary muscles and reverse remodeling of the LV, which tends to recur when CRT is withdrawn.<sup>4)</sup> However, a mechanistic study has suggested that mechanical dyssynchrony is less important than LV remodeling and MV tethering.<sup>5)</sup> The role of mechanical dyssynchrony in the pathophysiology of FMR remains unclear.

In this issue of the journal, Choi et al.<sup>6)</sup> reported the role of mechanical dyssynchrony on FMR in patients with dilated cardiomyopathy using real time 3D echocardiography. The dyssynchrony index was significantly higher in the patients with FMR than that in the patients with non-FMR and the dyssynchrony index was well correlated with the effective regurgitation orifice area (ERO) of the FMR. However, the dyssynchrony index was not a significant determinant of ERO on the multivariate model. Displacement of the anterior papillary muscle and consequent MV tenting remained the strongest determinants of the degree of ERO. These findings suggested

that the distorted geometric change of the LV with MV tenting is a necessary condition for the development of FMR, whereas mechanical dyssynchrony could have a minor role.

There are several limitations of the study by Choi et al.<sup>6)</sup> First, the study had a relatively small sample size ( $n = 53$ ), a mild degree ( $ERO = 0.17 \pm 0.10 \text{ cm}^2$ ) of FMR and a small percentage of left bundle branch block (18%) as compared to the previous studies. These factors might affect the results between mechanical dyssynchrony and the degree of FMR. Second, they measured the geometric parameters using 3D echocardiography and the multi-planar reconstruction (MPR) mode of a 3D image analysis program. This method is ideal to measure the mitral apparatus at a specific angle compared with that of 2D echocardiography. But the reproducibility is modest (the intra-observer correlation coefficients were 0.69-0.73 for the measurement of the mitral apparatus). This might also have affected the results.

Despite the limitations, Choi et al's study is the first trial to estimate the distances of both papillary muscles using MPR by 3D echocardiography. This method is promising to evaluate the mechanism of FMRs if the technical issues related to the image resolution of 3D echocardiography and the learning curve can be resolved.

## REFERENCES

1. Agricola E, Stella S, Figini F, Piraino D, Oppizzi M, D'Amato R, Slavich M, Ancona MB, Margonato A. *Non-ischemic dilated cardiomyopathy: prognostic value of functional mitral regurgitation. Int J Cardiol* 2011;146:426-8.
2. Ray S. *The echocardiographic assessment of functional mitral regurgitation. Eur J Echocardiogr* 2010;11:i11-7.
3. Kanazaki H, Bazaz R, Schwartzman D, Dohi K, Sade LE, Gorcsan J 3rd. *A mechanism for immediate reduction in mitral regurgitation after cardiac resynchronization therapy: insights from mechanical activation strain mapping. J Am Coll Cardiol* 2004;44:1619-25.
4. Ypenburg C, Lancellotti P, Tops LF, Bleeker GB, Holman ER, Pie-

• Received: June 3, 2011 • Revised: June 9, 2011 • Accepted: June 9, 2011

• Address for Correspondence: Jang-Young Kim, Division of Cardiology, Department of Internal Medicine, Wonju College of Medicine, Yonsei University, 162 Ilsan-dong, Wonju 220-701, Korea Tel: +82-33-741-0909, Fax: +82-33-741-1219, E-mail: kimjy@yonsei.ac.kr

• This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

- rard LA, Schalij MJ, Bax JJ. *Acute effects of initiation and withdrawal of cardiac resynchronization therapy on papillary muscle dyssynchrony and mitral regurgitation.* *J Am Coll Cardiol* 2007;50:2071-7.
5. Agricola E, Oppizzi M, Galderisi M, Pisani M, Meris A, Pappone C, Margonato A. *Role of regional mechanical dyssynchrony as a determinant of functional mitral regurgitation in patients with left ventricular systolic dysfunction.* *Heart* 2006;92:1390-5.
6. Choi WG, Kim SH, Park SD, Baek YS, Shin SH, Woo SI, Kim DH, Park KS, Lee WH, Kwan J. *Role of dyssynchrony on functional mitral regurgitation in patients with idiopathic dilated cardiomyopathy: a comparison study with geometric parameters of mitral apparatus.* *J Cardiovasc Ultrasound* 2011;19:69-75.