

## Mitral valve prolapse: a source of arrhythmias?

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Cardiac arrhythmias are frequently detected in patients with mitral valve prolapse (MVP). The proper mechanisms causing ventricular arrhythmias in patients with MVP have not been fully investigated. In the current issue of the International Journal of Cardiovascular Imaging, Turker et al. [1] evaluated the clinical, echocardiographic and heart rate variability (HRV) parameters, and plasma concentrations of electrolytes and inflammatory markers in predicting ventricular arrhythmias in 58 consecutive patients with MVP. Ventricular arrhythmias were defined as the occurrence of ventricular premature contractions (VPCs), VPC couplets, and ventricular tachycardias documented by Holter analysis, continuous monitoring or by electrocardiography. Twenty patients (34%) showed ventricular arrhythmias, and 38 (66%) patients did not have ventricular arrhythmias. Seventeen patients had VPC, 2 patients had VPC couplets and one patient had ventricular tachycardia. Univariable predictors of ventricular arrhythmias included echocardiography-determined isovolumetric relaxation time and the presence of moderate to severe mitral regurgitation. Interestingly, multivariable logistic regression analysis showed that

occurrence of moderate to severe mitral regurgitation was the only independent predictor of ventricular arrhythmias.

Several recent studies did already address the relation between cardiac arrhythmias and the presence of MVP. Chen et al. [2] showed that improper autonomic tone is to be considered the etiology of arrhythmias in conjunction with MVP. Heart rate turbulence (HRT) and HRV are methods assessed for autonomic dysfunction. The authors studied the relationship of HRT, HRV and the number of ventricular premature beats in patients with MVP and non-significant mitral regurgitation. No significant correlation was found between the number of VPCs and HRT/HRV parameters. Markiewicz-Łoskot et al. [3] studied electrocardiographic abnormalities in ten young athletes with MVP. Abnormal ECG repolarization was found in seven athletes. Young athletes with MVP are therefore often predisposed to electrocardiographic abnormalities of ventricular repolarization. Cetinkaya et al. [4] evaluated the risk of vasovagal syncope and cardiac arrhythmias in 37 children with MVP. Arrhythmias and the risk of vasovagal syncope, indicated by a positive tilt test, were found to be increased in children with MVP.

Similar to echocardiography [5–13], cardiovascular magnetic resonance (CMR) imaging can identify MVP by similar anatomic and functional criteria [13–30]. In addition, CMR allows tissue characterization in various cardiac diseases using hyperenhancement

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techniques [31–38]. In this way, CMR can identify myocardial fibrosis involving the papillary muscle in MVP patients. Delayed contrast enhancement (DCE) of papillary muscles is often present in a subgroup of patients with complex ventricular arrhythmias [39]. This tissue hyperenhancement is indicative of fibrosis which may act as a focus for arrhythmias. Kwon et al. [40, 41] using delayed contrast enhancement CMR, showed a clear association of myocardial fibrosis, electrocardiography and ventricular tachyarrhythmia in hypertrophic cardiomyopathy (HCM). HCM subjects with ventricular tachycardias showed a higher percentage of myocardial scarring on DCE-CMR. As a consequence, the presence of fibrotic papillary muscles in patients with MVP might give rise to both cardiac arrhythmias and mitral regurgitation. In addition to echocardiography and CMR, multislice computed tomography (MSCT) has recently been shown to evaluate the functional status of the mitral valve in patients with MVP [42–45]. MSCT may therefore have a major role in preoperative assessment of the mitral valve apparatus before mitral valve surgery.

To summarize, nowadays the diagnosis of MVP can be made by several imaging techniques. Apart from echocardiography, CMR and MSCT are capable of accurately delineating the structure and function of the mitral valve. Next, there is a clear association between the level of incompetence of the mitral valve and the presence of cardiac arrhythmias, in particular in case of MVP. These findings have been proven both by echocardiography and DCE-CMR. The study by Turker et al. [1], using echocardiography, add to these results by showing that the occurrence of moderate to severe mitral regurgitation was the only independent predictor of ventricular arrhythmias in patients with MVP.

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