

Confirmed Usefulness of Three-dimensional Echocardiography in Mitral Valve Evaluation

Utilidad comprobada del eco tridimensional en la evaluación de la válvula mitral

DIEGO MEDVEDOFSKY, ROBERTO M. LANG

Over the past decade, real-time three-dimensional (3D) echocardiographic images have become an integral part of the world of echocardiography for their proven advantages over two-dimensional (2D) images in multiple areas. With the wide availability of equipment and software analysis for 3D echocardiography (3DE) and the increasing growth of knowledge in the area, this new methodology has earned its place as the new standard in many areas. One area with particularly well established advantages over 2D echocardiography (2DE) is the visualization and analysis of the mitral valve. (1) Most 3D mitral valve studies have been performed with transesophageal echocardiography (TEE), but recently the possibility of also acquiring transthoracic images has been successful.

Three-dimensional echocardiography provides a unique visualization and better understanding of the relationship between different cardiac structures than 2D images, as well as accurate valve function measurements. Real time 3D TEE consistently offers excellent quality volume-rendered images of the mitral valve apparatus (both from the atrial and the left ventricular perspective), including the anterior and posterior leaflets, the annulus and the subvalvular structures. (2) This level of understanding has made this technique one of the modalities of choice for mitral valve surgery perioperative planning as well as guideline for percutaneous interventions. (3, 4) With an unprecedented level of anatomical detail, these volume-rendered images enable detailed volumetric analysis of the geometry and dynamics of the mitral valve. The result is that this modality has already been incorporated to clinical practice and has a major role and impact on the management of patients with valve disease. (5-9)

Whereas 2DE allows the diagnosis of mitral valve disease but does not provide information about its precise location, extent and relationship with adjacent anatomical structures, 3DE enables the visu-

alization of the mitral valve similarly to the way it is seen by the surgeon during surgery. Additionally, the valve can be visualized from the left ventricle granting an even greater anatomical understanding. For these reasons, teams including surgeons, clinical cardiologists, interventional cardiologists and expert cardiology echocardiographers have been formed worldwide. Thus, surgical preparation is significantly superior and surgeons have an ideal and specific comprehension of both the anatomy and physiology of each patient at the moment of surgery. Nowadays, several companies offer the possibility of printing 3D models with the information obtained from 3DE analysis. This option can provide an even higher level of surgical preparation, including the possibility of verifying the surgical technique before reaching the operating room. It is known that many mitral valve repair surgeries are complicated and thus require expert surgeons in these techniques. With the advantages provided by 3DE it is possible that a large proportion of patients with degenerative disease will receive a successful repair.

Myxomatous/degenerative mitral valve disease is the most common cause of mitral regurgitation (MR) in developed countries, while the rheumatic cause is still common in developing countries. The process of degenerative mitral valve disease comprises a range of possibilities, with its most severe form known as Barlow's disease and its milder form known as fibroelastic deficiency. The diagnosis has been greatly facilitated by the use of 3DE, improving not only the precision of injury location, but also the quantification of the associated MR. These improvements have modified the techniques of mitral valve surgical repair and its percutaneous interventions. In this context, the study of Munin et al., (10) published in this issue of the Journal represents a significant contribution to understanding the characteristics of a group of patients in Argentina with degenerative

REV ARGENT CARDIOL 2016;84:298-299. <http://dx.doi.org/10.7775/rac.v84.i4.8933>

SEE RELATED ARTICLE: Rev Argent Cardiol 2016;84:317-322. <http://dx.doi.org/10.7775/rac.v84.i4.6162>

Address for reprints: Roberto M. Lang, MD- Section of Cardiology, University of Chicago Medical Center, 5758 South Maryland Avenue, MC 9067, Room D-CAM 5501 - Chicago, Illinois 60637 - Tel.: (773) 702-1842 - FAX: (773) 702-1034 - E-mail: rlang@medicine.bsd.uchicago.edu

Department of Medicine, University of Chicago Medical Center, Chicago, Illinois, USA

MR, and implicitly supports the feasibility of performing this 3DE analysis in Argentina. The study of Munin et al. (10) evaluated with 3DE the mitral valve anatomy of patients with severe degenerative MR. Patients were divided into two groups: one with prolapse of a single segment was compared another group with prolapse of more than one segment and then, both groups were compared with a population without heart disease. Although the study involved a small number of patients, the authors described the different characteristics of these groups: as expected, the group of patients with prolapse of more than one segment presented a larger left ventricle, mitral annulus, anterior leaflet and volume prolapse. The study has some limitations properly addressed by the authors, but is methodologically sound and provides relevant results. First, it demonstrates the possibility of performing this echocardiographic analysis as an integral part of the pre-surgical preparation. Second, it provides information about the frequency of different lesions observed in an advanced center in Latin America, with the potential to improve these patients' management. The study of Munin et al. (10) has the potential to bring 3DE analysis in Argentina to a first level in the local daily practice, which will undoubtedly generate a better understanding of the anatomy and thus of the pre-surgical management of each individual patient. This study opens the door to 3DE technology and generates optimism for its application in routine pre-surgical evaluation.

Conflicts of interest

None declared.

(See authors' conflicts of interest forms in the website/Supplementary material).

REFERENCES

1. Lang RM, Tsang W, Weinert L, Mor-Avi V, Chandra S. Valvular heart disease. The value of 3-dimensional echocardiography. *J Am Coll Cardiol* 2011;58:1933-44. <http://doi.org/dkntwk>
2. Sugeng L, Shernan SK, Salgo IS, Weinert L, Shook D, Raman J, et al. Live 3-dimensional transesophageal echocardiography initial experience using the fully-sampled matrix array probe. *J Am Coll Cardiol* 2008;52:446-9. <http://doi.org/c25r86>
3. Lang RM, Mor-Avi V, Dent JM, Kramer CM. Three-dimensional echocardiography: is it ready for everyday clinical use? *JACC Cardiovasc Imaging* 2009;2:114-7. <http://doi.org/fp9b99>
4. Mor-Avi V, Sugeng L, Lang RM. Real-time 3-dimensional echocardiography: an integral component of the routine echocardiographic examination in adult patients? *Circulation*. 2009;119:314-29. <http://doi.org/fg4m77>
5. Tsang W, Weinert L, Sugeng L, Chandra S, Ahmad H, Spencer K, et al. The value of three-dimensional echocardiography derived mitral valve parametric maps and the role of experience in the diagnosis of pathology. *J Am Soc Echocardiogr* 2011;24:860-7. <http://doi.org/fp5svw>
6. Chandra S, Salgo IS, Sugeng L, Weinert L, Tsang W, Takeuchi M, et al. Characterization of degenerative mitral valve disease using morphologic analysis of real-time three-dimensional echocardiographic images: objective insight into complexity and planning of mitral valve repair. *Circ Cardiovasc Imaging* 2011;4:24-32. <http://doi.org/c9qfsh>
7. Sugeng L, Shernan SK, Weinert L, Shook D, Raman J, Jeevanandam V, et al. Real-time three-dimensional transesophageal echocardiography in valve disease: comparison with surgical findings and evaluation of prosthetic valves. *J Am Coll Cardiol* 2008;21:1347-54. <http://doi.org/bcz6h6>
8. Veronesi F, Corsi C, Sugeng L, Caiani EG, Weinert L, Mor-Avi V, et al. Quantification of mitral apparatus dynamics in functional and ischemic mitral regurgitation using real-time 3-dimensional echocardiography. *J Am Coll Cardiol* 2008;21:347-54. <http://doi.org/c4vmpd>
9. Addetia K, Mor-Avi V, Weinert L, Salgo IS, Lang RM. A new definition for an old entity: improved definition of mitral valve prolapse using three-dimensional echocardiography and color-coded parametric models. *J Am Coll Cardiol* 2014;27:8-16. <http://doi.org/bjm7>
10. Munin MA, Thierer J, Goerner MS, Raggio IM, Godia J, Ortega J et al. Three-dimensional Echocardiography in Characterization of Degenerative Mitral Valve Disease. *Rev Argent Cardiol* 2016;84:317-22.