Characterization of Degenerative Mitral Valve Disease using Morphologic Analysis of Real-Time 3D Echocardiographic Images

Sonal Chandra, Ivan S Salgo, Lissa Sugeng, Lynn Weinert, Masaaki Takeuchi, Wendy Tsang, Roberto M Lang and Victor Mor-Avi*

University of Chicago, IL, United States

Pre-surgical planning of mitral valve (MV) repair in patients with Barlows disease (BD) and fibroelastic deficiency (FED) is challenging due to inability to accurately assess the complexity of MV prolapse. We hypothesized that the etiology of degenerative MV disease (DMVD) could be objectively and accurately determined using morphologic analysis of MV geometry real-time 3D echocardiographic (RT3DE) images. Eighty-eight patients underwent transesophageal RT3DE study: 58 patients with DMVD studied intra-operatively (29 BD, 29 FED classified during surgery) and 30 patients with normal MV who were used as controls (NL). MVQ software (Philips) was used to measure parameters of annular dimensions and geometry, and leaflet surface area, including billowing volume and height. Patients were divided into a study group (34 DMD; 20 NL) used to define cutoff values of MV billowing parameters for differential diagnosis of NL vs FED vs BD using ROC analysis, and a test group (24 DMVD; 10 NL) to test the accuracy of these criteria in an independent sample when compared with surgical inspection. In the study group, morphologic analysis revealed a progressive increase in multiple parameters from NL to FED to BD, which allowed accurate diagnosis. 3D billowing height with cutoff of 1.3 mm differentiated DMVD from NL without overlap, and billowing volume with cutoff of 1.4 ml differentiated between FED and BD without overlap. The accuracy of this approach was confirmed in the test group, as reflected by high sensitivity and specificity for both parameters. Morphologic analysis as a form of decision support of assessing MV billowing revealed significant quantifiable differences between NL, FED and Barlow, allowing accurate classification of the etiology of MV prolapse and determination of the anticipated complexity of repair.