Editor's Page

Imaging of the Neglected Cardiac Chamber: The Right Ventricle

CHRISTODOULOS I. STEFANADIS

1st Department of Cardiology, University of Athens Medical School, Hippokration Hospital, Athens, Greece

Experimental studies on open-chest canine models in the 1940s suggested that even extensive damage to the right ventricular wall does not significantly influence circulation. For 3-4 decades, the right ventricle was considered "dispensable" for cardiac function. In the 1980s and 1990s, once its key role in various physiological and pathological conditions had been recognised, the right ventricle regained attention. Right ventricular performance has a great impact on the prognosis of patients with pulmonary hypertension, myocardial infarction and left ventricular dysfunction, as well as of patients with congenital heart diseases.

The right ventricle is positioned directly behind the sternum, anterior to the left ventricle. It has a very complex geometry, appearing triangular when viewed from the front, and crescentic when viewed in a transverse section of the heart. It is worth noting that the septum is the most important determinant of shape. Furthermore, the myocyte arrangement in the right ventricular wall differs from that of the three-layered left ventricle. Myocytes are predominantly oriented in the longitudinal direction in the subendocardial layer. For this reason, the right ventricular contraction pattern is predominantly longitudinal. Studies report a sequence of contraction during ejection that can be recognised first at the apex as it propagates towards the outflow tract.

Echocardiography is the modality of choice for the assessment of both morphology and function of the right ventricle in clinical practice. Echocardiography is a non-invasive, widely available and cost-effective technique. Recent developments have provided new insights into right ventricular analysis. Two-dimensional methods, Doppler techniques and, recently, the emergence of three-dimensional echocardiography are some of the modalities that may now add to a better understanding of right ventricular function. Because of the complex anatomy of the right ventricle, there is not an accurate method for assessing right ventricular volumes and function by 2D-echocardiography. In contrast, real-time three-dimensional echocardiographic imaging overcomes the geometric limitations of 2D techniques, potentially allowing volume assessment, irrespective of the right ventricle's irregular shape, without the use of any geometrical assumption. Recently, new quantification software adapted for the right ventricular cavity has been proposed for the evaluation of right ventricular volumes. Moreover, myocardial velocities and strain rate imaging display promising results in the assessment of the right ventricle.

Although cardiac magnetic resonance imaging is considered to be the method of reference for the evaluation of the right ventricle, it has important limitations, such as the relatively low temporal resolution, resulting in inaccurate definitions of the true end-diastolic and end-systolic times and consequently volumes. More importantly, cardiac magnetic resonance imaging is expensive and time-consuming, and the presence of a pacemaker or implantable cardioverter-defibrillator constitutes a relative contraindication.

Given the prognostic implications of RV function, the development and use of an accurate diagnostic tool for the evaluation of the right ventricle is of significant clinical importance. Published studies prove that real-time three-dimensional echo is an available, feasible and accurate method that can be integrated into bedside clinical practice. In the future, the ability to assess the right ventricle quantitatively by real-time 3D echocardiography and the advancement of novel myocardial deformation technology may become a milestone in the management of this "neglected" chamber's diseases.