pISSN 1975-4612/ eISSN 2005-9655

www.kse-jcu.org
http://dx.doi.org/10.4250/jcu.2016.24.3.199
EDITORIAL COMMENT J Cardiovasc Ultrasound 2016;24(3):199-200

Assessing Right Ventricular Function: The Role of Echocardiography in a Murine Model of Pulmonary Hypertension

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A wide variety of small animal heart failure models are available.[1-3] The role of these models for understanding the disease and developing new treatment cannot be overemphasized. Many investigators have scaled down from large animal models to small models because they are easier to manipulate, cheaper to maintain, and similar to the human cardiovascular system. Moreover, recent advances in echocardiography and micronanometer conductance catheters have made it possible to reliable evaluate cardiac function in small animal models.[4][5] Complete hemodynamic assessment of the animals used is essential, including assessment of both static and dynamic parameters as well as structural remodeling in determining the magnitude of these parameters. However, many of these advances involving the assessment of left heart only. In humans, echocardiographic assessment of right ventricular (RV) size and pulmonary hypertension is particularly challenging due to the retrosternal position and unusual crescent shape of RV. Small animal models have the added challenges of small size and extremely rapid heart rates (250–600 beat/min).

In this issue of the Journal, Kohut et al.,[6] in their research using high-frequency transducer probe (VisualSonics MS400, FUJIFILM VisualSonics, Inc., Toronto, Canada with a frequency range of 18–38 MHz), they have assessed the right heart of CD1 and C57BL/6 which are two commonly used murine models according to standard clinical guidelines and provided the practical guide and standard valued for cardiac assessments. A strongpoint of this study is accurate and in detail measurement of right heart dimension in different view, right heart systolic function with RV index of myocardial performance, tricuspid annular plane systolic excursion, S' and fractional area change, right heart diastolic function using pulse wave Doppler of the trans-tricuspid flow including the peak early filing, the late diastolic filling, the ratio of E/A wave velocities and deceleration time and finally pulmonary artery hemodynamics with pulmonary artery acceleration time, pulmonary ejection time. They describe a protocol for assessing RV and pulmonary vascular function in a specific mouse model of pulmonary hypertension; however this protocol is applicable to any diseases affecting the pulmonary vasculature or right heart. They provide a detailed description of animal preparation, image acquisition and hemodynamic calculation. Several new techniques, including cardiac MRI and small conductance catheter (pressure-volume analysis) are available for assessing RV function. MRI is highly accurate for the assessment of RV function.[7] However, despite the excellent image quality and reproducibility, availability is still limited and the data acquisition and analysis is rather time consuming. RV function also can be evaluated invasively using pressure-volume loop analysis, which is very attractive because it quantifies various determinants of ventricular function in a relatively independent fashion. It is very important data but requires invasive measurement and the accurate data needs researcher's learning curve. In practice, clinicians largely rely on non-invasive imaging methods for assessment of RV function. Kohut et al.[6] showed nice echocardiographic images for assessing RV function in murine model of pulmonary hypertension. Their practical guide on how to image and assess the right heart of murine models could provide comprehensive standard values which would be used for preclinical research studies using echocardiography.

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• Editorials published in the Journal of Cardiovascular Ultrasound do not necessarily represent the views of JCU or the Korean Society of Echocardiography.
• Received: August 26, 2016 • Revised: September 5, 2016 • Accepted: September 6, 2016
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