

Comparison of right ventricular volume measurements obtained using transaxial and short-axis slices acquired by cardiac MRI in patients with chronic thromboembolic pulmonary hypertension

Rieko Ishimura¹, Kenich Yokoyama¹, Toshiya Kariyasu¹, Shigehide Kuhara², and Toshiaki Nitatori¹

¹department of radiology, Kyorin University, Mitaka, Tokyo, Japan, ²Toshiba medical systems, Otawara, Tochigi, Japan

Target Audience Radiologist, Radiologic technologist, Cardiologist

Purpose In right ventricular volume measurement by cardiac MRI (CMR), it is known that the measurement results for healthy volunteers obtained using transaxial (TAX) slices show higher reproducibility than those obtained using classic short-axis (SAX) slices. However, there have been no reports on the reproducibility of right ventricular volume measurements in patients with chronic thromboembolic pulmonary hypertension (CTEPH). In patients with CTEPH, the increase in right ventricular loading due to severe pulmonary hypertension causes significant dilatation of the right ventricle and right atrium, and the compensatory hypertrophy of the trabeculae carneae in response to pulmonary hypertension leads to severe deformation of the right ventricle. This deformation makes it difficult to identify the anatomical positions of the tricuspid valve and pulmonary valve in discontinuous multislice images obtained by MRI, which affects right heart functional analysis. In this study, the reproducibility of right heart functional analysis using CMR was evaluated in patients with CTEPH who were followed by CMR. SAX images were used in patients with left and right axis deviation.

Method The subjects were 14 patients with CTEPH (27 examinations; 11 women and 3 men, age: 69.7±11.0 years, age range: 38-81 years) who underwent CMR examination between February 1, 2013, and May 30, 2014. A 1.5-T MRI system (EXCELART Vantage powered by Atlas, Toshiba Medical Systems Corporation, Otawara, Japan) was used for all scans. A function that expands the Knowledge-Based Automatic Slice-Alignment Method to the right ventricle was used to set the SAX slices in the patients with left axis deviation and to set the SAX and TAX slices in the patients with right axis deviation. Then, cine scanning with the steady-state free precession (SSFP) technique was performed. The acquired images were analyzed by three cardiac radiologists using cardiac function analysis software developed by Toshiba Medical Systems Corporation.

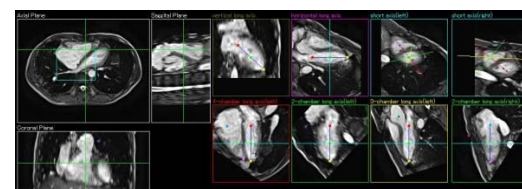
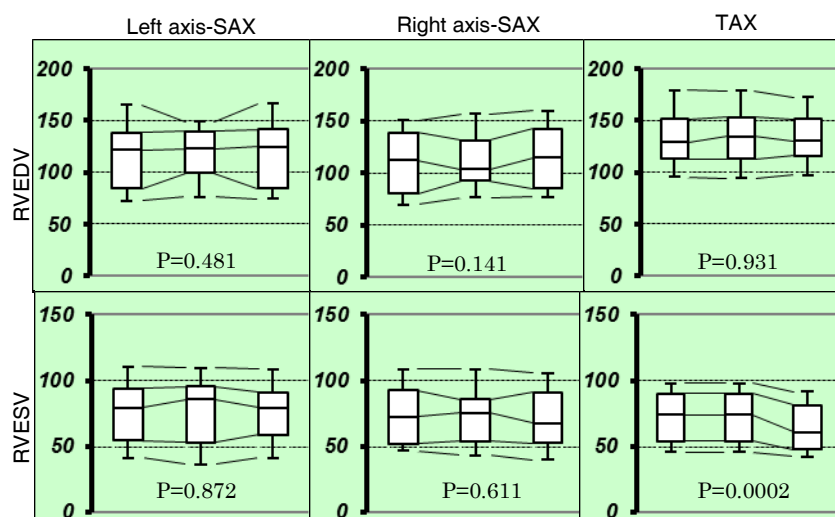
Results

No significant differences were observed between the three cardiac radiologists in the determination of the right ventricular end-diastolic volume in any of the three planes. In the determination of the right ventricular end-systolic volume and ejection fraction, no significant differences were observed between the three cardiologists in the evaluation of the SAX images (in patients with left or right axis deviation), but significant differences were observed in the evaluation of the TAX images.

Discussion & Conclusion

TAX images are thought to provide higher reproducibility than SAX images in healthy subjects. However, in patients with severe deformation of the right ventricle due to CTEPH, the reproducibility of TAX images was found to be lower, possibly because identification of the interface between the blood within the cardiac chambers and the myocardium is more difficult in the right heart

due to partial volume effects. In patients with diseases associated with deformation of the right heart, such as CTEPH, SAX images may be more useful than TAX images for right heart functional analysis. Further research is needed to determine whether the findings obtained in this study are in agreement with the information obtained by right heart catheterization and other methods.



Reference K.Alfakih, S Plein, et al. Comparison of right ventricular volume measurements between axial and short axis orientation using SSFP MRI. J Magn Reson imaging.2003;18(1):25-32