

Automatic quantification of right ventricular function with gated blood pool SPECT

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Background. Quantification of right ventricular (RV) function is clinically relevant for the risk stratification and follow-up of patients with a wide spectrum of disease. This can be achieved with electrocardiography-gated blood pool single photon emission computed tomography (GBPS). We aimed to evaluate the accuracy of the completely automatic QBS GBPS processing software as compared with equilibrium planar radionuclide angiography (RNA) and with a GBPS manual segmentation method (GBPS_{35%}) for the measurement of global RV ejection fraction (EF), taking the first-pass RNA (FP-RNA) as the gold standard. In parallel, we compared the RVEF, RV end-diastolic volume (EDV), and RV end-systolic volume (ESV) provided by QBS and GBPS_{35%}.

Methods and Results. The population included 85 patients with chronic post-embolic pulmonary hypertension. Twenty-one patients were excluded because of unsuccessful FP-RNA. Intraobserver and interobserver RVEF, RVEDV, and RVESV reproducibilities encountered with planar RNA, QBS, and GBPS_{35%} were similar and compared favorably with those calculated with FP-RNA for RVEF. Mean RVEF was different between all methods. RVEF calculated with FP-RNA was better correlated to QBS ($r = 0.68$) and GBPS_{35%} ($r = 0.70$) than to planar RNA ($r = 0.59$). RVEDV and RVESV with QBS were lower than with GBPS_{35%}, by $29\% \pm 14\%$ and $36\% \pm 13\%$, respectively. RVEDV and RVESV with QBS were highly correlated to corresponding GBPS_{35%} values: $r = 0.88$ and $r = 0.91$, respectively.

Conclusion. As opposed to FP-RNA, GBPS is highly successful for the quantification of RV function. Both QBS and GBPS_{35%} provide RVEF values similarly well correlated to FP-RNA and performed better than planar RNA. RVEF, RVEDV, and RVESV provided by QBS and GBPS_{35%} are highly correlated. All of these RV functional measurements require further validation versus a better gold standard before their accuracy can be established. (J Nucl Cardiol 2004;11:293-304.)

Key Words: Right ventricular function • electrocardiography-gated blood pool single photon emission computed tomography • first pass • radionuclide angiography • technetium 99m • red blood cells

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Quantification of right ventricular (RV) function is clinically relevant for the risk stratification and follow-up of patients with a wide spectrum of disease including ischemic cardiomyopathy, idiopathic dilated cardiomyopathy, valvular heart disease, congenital heart disease, primary pulmonary hypertension, and chronic post-embolic pulmonary hypertension.¹⁻¹¹

With planar radionuclide angiography (RNA), quantification of RV function is mostly limited to the first-pass technique because of its ability to temporally separate structures that are spatially superimposed. However, this technique is technically demanding, and its final results are dependent on the quality of the bolus injection. This renders the use of equilibrium RNA imaging techniques better suited for the evaluation of RV function.