

Summary

Assessment of ECG-gated Myocardial SPECT Analysis Program with Cardiac Phantom and Clinical Data

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[Purposes] ECG-gated myocardial SPECT program (QGS) is coming into wide use. This program permits measurement of end-diastolic volume (EDV), and end-systolic volume (ESV) and ejection fraction (EF) by automatic detection of myocardial edges. We assessed the reproducibility, accuracy, factors that affect the measurement of these indices using a cardiac phantom and clinical data. [Methods] In the phantom study, we evaluated the effects of ventricular volume, location, absorption, acquisition time, enlarged acquisition and pre-filter on the calculated indices. In the clinical study using ^{99m}Tc -MIBI, reproducibility between 2 observers, comparison with left ventriculography and effects of pre-filter were assessed. In clinical cases of ^{201}Tl and ^{123}I -BMIPP, left ventricular volume and EF were also analyzed by QGS with various pre-filters. [Result] Although the true phantom volumes (y) and calculated volumes (x) showed an excellent linear correlation ($y = 0.94x - 13.8$, $r = 0.999$), calculated volumes were significantly underestimated by 14.5–33.8%. An absorbent material around the phantom caused reduction in calculated volumes

by 4.1–9.1%. Duration of acquisition times, 3 to 60 seconds per projection, did not influence the calculation of the parameters. With enlarged data collection, calculated volume (37 ml) was larger than that of normal acquisition (33 ml). When the cut-off frequency of Butterworth filter was changed, these indices of volume and EF were almost stable over 0.41 cycle/cm. There was an excellent correlation in intra-observer measurements for EDV ($r = 0.998$, $p < 0.0001$), ESV ($r = 0.998$, $p < 0.0001$) and EF ($r = 0.995$, $p < 0.0001$). In comparison with left ventriculography, correlation of parameters was good in ESV ($r = 0.91$, $p < 0.0001$), EF ($r = 0.88$, $p < 0.0001$), but was fair in EDV ($r = 0.78$, $p < 0.0001$). The QGS program underestimated EDV, ESV and EF. [Conclusion] QGS program with gated SPECT is useful to calculate relative volume and EF. However, to calculate absolute values, we should understand the various factors that affect the result of QGS.

Key words: ECG gated myocardial SPECT, Left ventricular volume, Ejection fraction, Quantitative gated SPECT program (QGS).