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Evaluation of a commercial PET tomograph-based system for the quantitative assessment of rCBF, rOEF and $rCMRO_2$ by using sequential administration of ^{15}O-labeled compounds

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The purpose of this study was to develop a reliable and practical strategy that generates quantitative CBF and OEF maps accurately from PET data sets obtained with ^{15}O-tracers.

Sequential sinogram data sets were acquired after the administration of ^{15}O-tracers, and combined single-frame images were obtained. The delay time between sampled input function and the brain was estimated from the $H_2{}^{15}O$ study with the whole brain and the arterial time-activity curves (TACs). The whole-brain TACs were obtained from the reconstructed images (image-base method) and the sinogram data (sinogram-base method). Six methods were also evaluated for the dead-time and decay correction procedures in the process of generating a single-frame image from the dynamic sinogram.

The estimated delay values were similar with both the sinogram-based and image-based methods. A lumped correction factor to a previously added single-frame sinogram caused an underestimation of CBF, OEF and $CMRO_2$ by 16% at maximum, as compared with the correction procedure for a short sinogram. This suggested the need for a dynamic acquisition of a sinogram with a short interval. The proposed strategy provided an accurate quantification of CBF and OEF by PET with ^{15}O-tracers.

Key words: O-15 water, O-15 oxygen, positron emission tomography, arterial input function