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Assessment of coronary vasodilator reserve by N-13 ammonia PET using the microsphere method and Patlak plot analysis

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Noninvasive quantification of regional myocardial blood flow (MBF) has been successfully achieved with N-13 ammonia. The microsphere method as a simple method for quantifying regional myocardial blood flow was reevaluated in comparison with Patlak graphical analysis. In addition coronary vasodilator reserve (CVR) was estimated by both methods. Methods: Dynamic N-13 ammonia PET studies were performed in 10 healthy volunteers and 10 patients with coronary artery disease at baseline and after dipyridamole infusion (0.56 mg/kg). MBF was estimated by the microsphere method at various times and by Patlak graphical analysis. In order to reduce the noise level in the microsphere method, MBF estimates were also performed after data in 10–40 seconds were averaged. Results: In the studies on normal subjects MBF (ml/min/g) determined by the microsphere method significantly differs from time to time. However, MBF determined by the modified microsphere method [with average (Extraction fraction) × MBF values obtained between 100 and 120 sec] linearly correlated well with MBF by Patlak graphical analysis ($r = 0.97$, slope = 0.98, intercept = 0.20). In the studies on patients with coronary artery disease a good agreement of the MBF estimates was also observed ($r = 0.97$, slope = 0.98, intercept = 0.22). In the studies on the normal subjects and patients with coronary artery disease, CVR obtained by the modified microsphere method after correcting the overestimated MBF values also correlated well with that by Patlak graphical analysis ($r = 0.90$, slope = 1.14, intercept = –0.15, and $r = 0.92$, slope = 0.82, intercept = 0.25, respectively). Conclusion: The modified microsphere method is a very simple and reliable approach for quantifying MBF with N-13 ammonia PET which is comparable to Patlak graphical analysis. It also makes possible CVR assessment as accurate as Patlak graphical analysis.

Key words: positron emission tomography, N-13 ammonia, myocardial blood flow, coronary vasodilator reserve