Summary

Evaluation of the ^{123}I-IMP Patlak plot Method Using the Pulmonary Differential Curve as an Input Function: A Comparison with Cerebral Blood Flow (CBF) Determined by the Noninvasive Micro-Sphere (NIMS) Method

Osamu Iseya*, Tsunemichi Mihara*, Kenji Suzuki**, Tatsuya Miyamae** and Hiroshi Matsuda***

**Division of Nuclear Medicine, **Department of Radiology, Saitama Medical School*
****Department of Radiology, National Center Hospital for Mental, Nervous and Musclar Disorders, National Center of Neurology and Psychiatry*

We explored the possibility of applying the Patlak plot method to clinical practice as a simple non-invasive quantitative method of measuring cerebral blood flow using *N*-isopropyl-4-[^{123}I]iodoamphetamine (^{123}I-IMP).

On the assumption that after temporarily accumulating in the lungs, all the administered ^{123}I-IMP is eliminated by the pulmonary arterial flow for systemic diffusion, we collected dynamic data by setting an area ranging from the brain to the whole lung field within the field of the camera. The lung clearance curve $L(t)$ was differentiated and divided by cardiac output. It was then converted a positive number by multiplying it of -1 to determine the volume of ^{123}I-IMP tracer diffused in arterial blood per unit of time. The calculated concentration was defined as the arterial time activity curve $A(t)$.

A Patlak plot analysis was conducted between $A(t)$ and the brain time activity curve $B(t)$ to determine K_1 (total cerebral blood flow [tCBF], m*l*/min) and V_n (nonspecific initial distribution volume, m*l*). The total volume of tracer diffused in the central cardiovascular system within a given (T) was also obtainer from the volume of tracer remaining in the lungs [$L_{peak}-L(T)$], and by reperting this calculation over time, an accumulation curve was produced. By differentiating the obtained accumulation curve, we were able to estimate the volume of tracer diffused in the central cardiovascular system per unit of time. With this value used as the input function index $I(t)$, a Patlak plot analysis was conducted to determine the unidirection influx index k_i, which was then multiplied by 100 to obtain the brain perfusion index (IMP-BPI).

The noninvasive micro-sphere method was performed concurrently on 16 patients with cerebrovascular and/or neurological disorders to obtain mean cerebral blood flow (mCBF). Correlations between K_1 and between IMP-BPI and mCBF were then determind and compared.

Both K_1 and IMP-BPI obtained from k_i were found to correlate highly with mCBF, $r=0.759$ ($y=0.032x+20.1$) and $r=0.833$ ($y=2.73x+0.10$) respectively, with a better result from IMP-BPI. These results indicate that the ^{123}I-IMP Patlak plot method with a wide-filed gamma camera is clinically applicable as a simpler noninvasive technique for measuring cerebral blood flow even when a simple input function is used.

Key words: ^{123}I-IMP, SPECT, Cerebral blood flow, Patlak plot, Brain perfusion index.