A method for the quantification of benzodiazepine receptors by using
$^{123}$I-iomazenil and SPECT with one scan and one blood sampling

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Iodine-123-iomazenil (Iomazenil) is a ligand of central type benzodiazepine receptors for single
photon emission computed tomography (SPECT). Previously we reported a simple, table look-up
method for quantification of its binding potential (BP) by using two SPECT scans and calibrated
standard input function with one blood sampling. This method is based on a two-compartment
model ($K_i$: influx rate constant; $k_e$: efflux rate constant; $V_i$ ($=K_i/k_e$): the total distribution
volume corresponding BP), and requires two SPECT scans for calculating both $K_i$ and $V_i$ values. If the $K_i$
value in the two-compartment model can be assumed to be constant, the radioactivity of one SPECT
scan at 180 min after injection can be considered to tabulate as a function of $V_i$ for a given $K_i$ value
and a given input function, and a table look-up procedure provides the corresponding $V_i$ value. The
purpose of this study was to develop a simple, autoradiographic method for quantification of BP by
using one SPECT scan and calibrated standard input function with one blood sampling. SPECT
studies were performed on 14 patients. A dynamic SPECT scan was initiated following an
intravenous bolus injection of Iomazenil. A static SPECT scan was performed at 180 min after the
injection. Frequent blood sampling from the brachial artery was performed on all subjects to
determine the arterial input function. Simulation studies revealed that errors in calculated $V_i$ values
were around ±10–15% for varied $K_i$ values. A good correlation was observed between total
distribution volume values calculated by three-compartment model analysis and those calculated
by the present method ($r = 0.90$), supporting the validity of this method. The present method is
simple and applicable for clinical use, and will be able to provide images of BP.

Key words: iodine-123-iomazenil, SPECT, benzodiazepine receptor, brain