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ACCURACY, PRECISION AND RESOLUTION IN FUNCTIONAL IMAGES IN NUCLEAR MEDICINE : THE MAPPING OF CEREBRAL BLOOD FLOW AND OXYGEN UPTAKE RATE WITH PET AND 15-OXYGEN. J.C. Depresseux, H. Garnir, J.P. Cheslet

The complexity of processes involved in the pathophysiology of cerebral circulation and metabolic diseases justifies the search for methods simultaneously evaluating regional cerebral blood flow and energetic metabolisms. The classical approach for tomographically mapping cerebral circulation and oxygen uptake rate utilizes data from positron emission tomography and arterial blood counting performed at steady state concentration of the indicators in the body during the continuous inhalation of $C^{15}O_2$ and $^{15}O_2$. The unfavourable figure of merit of this method from the viewpoints of accuracy, precision, repeatability and absorbed dose of radiation has led the authors to design a different approach, using bolus inhalation of $C^{15}O_2$ and $^{15}O_2$, sequential PET detection and an original multiparametric iterative data analysis. Functional images, as obtained by this procedure, show a much improved accuracy and precision. The method additionally evaluate local cerebral volume of exchangeable water and local cerebral blood volume. Normal values in five individuals are (±S.D.) as follows, for predominantly gray and white cerebral matters (white matter value in brakets) : cerebral blood flow, 72.7 ± 8.0 (31.4 ± 6.3) cm^3/min.100g ; oxygen uptake rate, 236 ± 27 (108 ± 14) µmol/min. 100g ; volume of exchangeable water, 69.6 ± 5.4 (59.3 ± 5.0) cm^3/100g ; erythrocytic blood volume, 2.7 ± 0.2 (1.8 ± 0.2) cm^3/100g.
The method appears as a performant tool for the multiparametric investigation of cerebral disease in man.

Neurobiological Unit, Cyclotron Research Center, University of Liege, Sart-Tilman B30, B4000 LIEGE

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