

Approaches of Nuclear Medicine in Psychiatry: Perfusion Against Function, the Psychiatric Question

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Abstract

The scintigraphy images obtained with the use of radiopharmaceuticals or radiobiocomplexes in the nuclear medicine (NM) have strong importance to the professionals that need clinical information about their patients, as physicians and physiotherapists. Other health professionals, as biologists, pharmacists, physics, chemists, psychiatrics, have the responsibility to research, to develop and to perform quality controls concerning to the radiobiocomplexes. The main message of this article is to awaken in psychiatry and NM the potential that resides in brain scintigraphy with HMPAO through a database to diagnose psychiatric illnesses. These images (SPECT and PET) are considered metabolic images and are powerful guns to the professionals that are using them. These procedures involve basically the administration of a radiobiocomplex, which perfusion into the target organ, consist the ammunition that will permit the acquisition of these images. In conclusion, perfusion scintigraphy with HMPAO should be included in the investigation of diseases where brain function could be modified. Neuronal damage caused by drugs and neurotoxic agents is well documented in these cases.

Keywords: *Technetium-99m; Radiobiocomplexes; Radiopharmaceuticals; SPECT; PET; Nuclear Medicine; Psychiatry*

Introduction

The scintigraphy images obtained with the use of radiopharmaceuticals or radiobiocomplexes in the nuclear medicine have strong importance to the professionals that need clinical information about their patients, as physicians and physiotherapists [1-4].

Other health professionals, as biologists, pharmacists, physics, chemists, psychiatrics, have the responsibility to research, to develop and to perform quality controls concerning to the radiobiocomplexes [5].

Throughout the history of modern medicine, the function of organs has been of interest, and nuclear medicine (NM) is always in demand [6]. Several examples are given, since its beginnings with studies on hypo and hyperthyroidism, as renal function tests with DMSA (tubular function) and DTPA (glomerular function), among others [7,10].

Bringing the question to the brain, the peculiarity is that the functions are in different places: the vision is occipital [11,12] and the hearing is parietal [12]. Therefore, the exploration of brain function is unique. In the authors' opinion, perfusion can and should be part of any protocol that wishes to investigate brain function.

Using technetium (99mTc) to mark the ECD [11] and HMPAO [12] drugs, as well as TRODAT [13], and the gamma camera devices, scintigraphy exams in NM are obtained. Perfusion with ECD and HMPAO occur when these drugs cross the blood-brain barrier and penetrate

neurons, thus translating the total and segmental blood flow [11,12]. Perfusion with TRODAT aims to investigate the function of the nuclei of the base regarding the use of dopamine, through the analogue of DAT (active dopamine transporter in the striated nucleus). When the hypofixation of TRODAT is related to Parkinsonism presents 100% of sensitivity and 89% of specificity [14].

The main message of this article is to awaken in psychiatry and MN the potential that resides in brain scintigraphy with HMPAO through a database to diagnose psychiatric illnesses.

Use of HMPAO and artificial intelligence in psychiatry

It is well known that psychiatric signs and symptoms are similar to different types of mental disorders, and for that reason, a patient can receive different diagnoses of consulted by different examiners [15]. Both bipolar and schizophrenia can cause hallucinations, delusions and disorganized thoughts etc. [16]. Typical pictures are easy to diagnose. Bipolar, for example, defined as the disease where one cries in the morning and dances at night, has rapid cycling. Unfortunately in daily practice this is not frequent and mood fluctuations sometimes take months or years, and the diagnosis of bipolar is difficult, entering the gap with the NM and the database.

Database with HMPAO

The next decade of humanity is predicted to be of artificial intelligence, which is based on data organized in a computer, allowing, for example, the reading of a mammogram with micro calcifications to be done before the human eye. In the United States of America (USA), for example, the American psychiatrist Daniel Amen, author of numerous publications [17-20], has organized more than 120 thousand cases of cerebral perfusion with HMPAO. Anywhere in the world that has access to the database and uses HMPAO, you can reach the diagnosis of psychosis, Alzheimer's disease, autism, etc.

The authors' experience with HMPAO in psychiatry

Based on the article of Ismael Mena [21], using HMPAO as a tracer, clinical cases where there was consensus among psychiatrists, according to the images (Figures 1 and 2), for the diagnosis of bipolar and Alzheimer's. In divergent cases from the clinic, it has always been emphasized that the clinic is sovereign, but that the opinion given by the NM should be observed. The complementation of the cerebral perfusion scintigraphy must be done with CT, EEG, or even with another examination of the NM (PETSCAN).

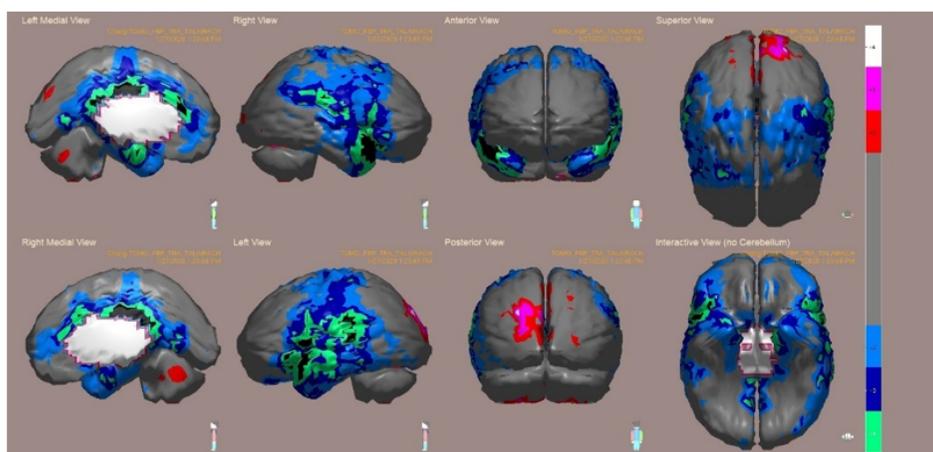


Figure 1: SPECT obtained with HMPAO of Alzheimer's patient. The areas in blue are altered by Alzheimer's disease showing hypo capitation originated by cerebral perfusion of radiopharmaceutical HMPAO.

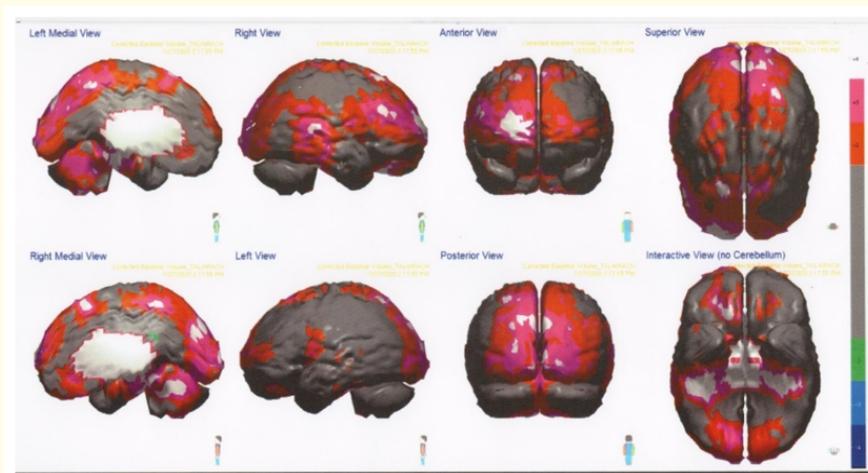


Figure 2: SPECT obtained with HMPAO of Bipolar patient. The areas in red are altered by bipolar disease showing hyper capitation originated by cerebral perfusion of radiopharmaceutical HMPAO.

These nuclear images are obtained with gamma camera and single photon emission computed tomography (SPECT), and also should be done with positron tomography emission (PET) [22]. A relevant feature that must be understood is these images depend on the physiology rather than the anatomy. Thus, these images (SPECT and PET) are considered metabolic images and are powerful guns to the professionals that are using them [23,24]. These procedures involve basically the administration of a radiobiocomplex, which perfusion into the target organ, consist the ammunition that will permit the acquisition of these images [1]. Some of these radiobiocomplexes used in psychiatric are showed in table 1.

Radiobiocomplex	Available structure
Oxime (HMPAO)	Cerebral perfusion
Etil cysteine dimer (ECD)	Cerebral perfusion
18F-Fluordesoxiglicose (18F-FDG)	Cerebral studies
99mTc-TRODAT	Dopamine transport diagnostic

Table 1: Radiobiocomplexes used in Psychiatry studies.

The cerebral perfusion performed by NM can translate information about brain physiology and function, as it is a simple, safe and low cost method. When incorporated into a database, it allows the diagnosis of various psychiatric disorders, identifying which topographies are hypo or hyper-perfused. It is also an excellent tool for stratification and prognostics, as it demonstrates by image a brain area functioning more or less, and thus, drug dosages can be adjusted depending on the perfusion.

The absence of cerebral perfusion closes the diagnosis of brain death.

Conclusion

In the authors' opinion, perfusion scintigraphy with HMPAO should be included in the investigation of diseases (bipolar, autism, Alzheimer etc.) where brain function could be modified. Neuronal damage caused by drugs and neurotoxic agents is well documented in

these cases. A group of diseases of the nuclei of the base, including Parkinsonism, can be diagnosed by TRODAT, well before the classic signs and symptoms.

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