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SPECT neuroimaging in schizophrenia with religious delusions

Basant K. Puri[a,*], Sudesh K. Lekh[b], Kuldip S. Nijran[c], Manjinder S. Bagary[d], Alexandra J. Richardson[e,f]

[a] *MRI Unit, MRC Clinical Sciences Centre, Imperial College School of Medicine, Hammersmith Hospital, Du Cane Road, London W12 0HS, UK*
[b] *Redhill and Reigate Community Mental Health Team, Shaw's Corner, Blackborough Road, Reigate, Surrey RH2 7DG, UK*
[c] *Department of Nuclear Medicine, Kings College Hospital, London SE5 8AZ, UK*
[d] *Institute of Neurology, Queen Square, London WC1N 3BG, UK*
[e] *Division of Neuroscience & Psychological Medicine, Imperial College School of Medicine, Charing Cross Campus, St Dunstan's Road, London W6 8RP, UK*
[f] *Laboratory of Physiology, University of Oxford, Oxford OX1 3PT, UK*

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Abstract

Functional neuroimaging techniques such as single-positron emission computed tomography (SPECT) and positron emission tomography (PET) offer considerable scope for investigating disturbances of brain activity in psychiatric disorders. However, the heterogeneous nature of disorders such as schizophrenia limits the value of studies that group patients under this global label. Some have addressed this problem by considering schizophrenia at a syndromal level, but so far, few have focussed at the level of individual symptoms. We describe the first neuroimaging study of the specific symptom of religious delusions in schizophrenia. ^{99m}Tc HMPAO high-resolution SPECT neuroimaging showed an association of religious delusions with left temporal overactivation and reduced occipital uptake, particularly on the left.

Keywords: Single-positron emission tomography (SPET); Single-positron emission computed tomography (SPECT); Schizophrenia syndromes; Religious delusions

* Corresponding author. Tel.: +44-20-8383-3035; fax: +44-20-8383-3038.
E-mail address: basant.puri@csc.mrc.ac.uk (B.K. Puri).

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1. Introduction

The clinically heterogeneous nature of disorders such as schizophrenia limits the value of studies that group patients under this global label. One method of addressing such heterogeneity is to adopt a syndromal approach. However, while most syndromal structures, such as those of Liddle (1987a,b), are essentially based on clinical rating-scale analyses, an alternative syndromal model that was originally founded on physiological measures, and that has subsequently been shown to have considerable etiological validity, is that of Gruzelier (Gruzelier and Manchanda, 1982; Gruzelier, 1996a, 1999). The delineation by Gruzelier of a three-syndrome structure in schizophrenia, that is, the active, withdrawn and unreality syndromes (Gruzelier, 1991, 1994), was derived from studies of patterns of cerebral hemispheric imbalance using both electrophysiological and neuropsychological measures (Gruzelier, 1996b). Gruzelier's delineation of his 'active syndrome' consists of raised activity levels, accelerated cognition, positive thought disorder, positive labile affect and affective delusions, and is associated with a greater left than right functional asymmetry. In contrast, the opposite pattern of functional hemispheric imbalance (greater right than left hemispheric activation) is associated with the 'withdrawn syndrome', comprising the essential negative features of schizophrenia, including poverty of speech, blunted affect, social withdrawal and motor retardation. Gruzelier's third syndrome, the 'unreality syndrome', involving Schneiderian delusions and hallucinations, is not consistently associated with lateral imbalance, and can coexist with either the active or withdrawn syndromes.

Functional neuroimaging techniques, such as single-photon emission computerised tomography (SPECT) and positron emission tomography (PET), have considerable potential for furthering our understanding of the disturbances in brain activity that underlie schizophrenia syndromes. A particular advantage of the use of the radiotracer [^{99m}Tc]-D,L-hexamethylpropylene amine oxime (^{99m}Tc-HMPAO) with SPECT stems from the fact that this radiopharmaceutical displays regional cerebral blood-flow (rCBF)-dependent uptake, with little redistribution over time (Puri and Lewis, 1992). The lipophilic ^{99m}Tc complex has been demonstrated, in vitro, to convert slowly to a secondary complex, and this may underlie the relative lack of cerebral redistribution (Neirinckx et al., 1987); after crossing the blood–brain barrier on first pass, ^{99m}Tc-HMPAO enters brain cells, where the pH change renders the molecules lipophobic. Following the formation of the cerebral lipophilic ^{99m}Tc complex, a relatively high proportion of the radioactivity left in the blood is trapped in erythrocytes, possibly by a similar mechanism to that causing cerebral retention. However, as the total volume of blood in the adult human brain is of the order of 0.031 l, the contribution of photons from the blood to the total photon count from the brain is very small, being less than 2% at 1 h postinjection. Therefore, following injection of the radiotracer, the SPECT scan can be delayed for, say, up to 1 h; when scanned, the rCBF found will represent the blood flow pattern immediately following the injection.

By studying the differences in rCBF found by carrying out SPECT neuroimaging during the manifestation of a particular symptom of schizophrenia, and then repeating the examination in the same patient(s) when well, it is possible to localise those cerebral regions associated with that symptom. For example, using this methodology McGuire et al. (1993) found that auditory hallucinations in schizophrenia are associated with an increased blood flow in Broca's area.

Here, the case is described of a patient with the active syndrome of schizophrenia who underwent SPECT neuroimaging on two occasions: first, while suffering from florid religious delusions, and again during remission.

2. Methods

2.1. Subject

The patient was a 37-year-old right-handed man with a history of schizophrenia and no family