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Neuropsychiatric and cognitive profile of early Richardson's syndrome, Progressive Supranuclear Palsy-parkinsonism and Parkinson's disease

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ABSTRACT

Introduction: The two main variants of Progressive Supranuclear Palsy (PSP), Richardson's syndrome (PSP-RS) and PSP-parkinsonism (PSP-P), share motor and non-motor features with Parkinson's disease (PD) particularly in the early stages. This makes the precocious diagnosis more challenging. We aimed at defining qualitative and quantitative differences of neuropsychiatric and neuropsychological profiles between PSP-P, PSP-RS and PD patients recruited within 24 months after the onset of symptoms, in order to clarify if the identification of peculiar cognitive and psychiatric symptoms is of help for early PSP diagnosis.

Methods: PD (n = 155), PSP-P (n = 11) and PSP-RS (n = 14) patients were identified. All patients were submitted to clinical, neurological, neuropsychiatric diagnostic evaluation and to a comprehensive neuropsychiatric and neuropsychological battery. Predictors of PSP-P and PSP-RS diagnosis were identified by multivariate logistic regressions including neuropsychiatric and neuropsychological features that differed significantly among groups.

Results: The three groups differed significantly at the Apathy Rating Scale score and at several neuropsychological domains. The multivariate logistic regressions indicated that the diagnosis of PSP-RS was predicted by phonological verbal fluency deficit whereas the presence of apathy significantly predicted the PSP-P diagnosis.

Conclusion: Peculiar neuropsychiatric and neuropsychological symptoms are identifiable very precociously in PSP-P, PSP-RS and PD patients. Early phonological verbal fluency deficit identifies patients with PSP-RS whereas apathy supports the diagnosis of PSP-P.

1. Introduction

Progressive Supranuclear Palsy (PSP) is the second most common degenerative parkinsonism after idiopathic Parkinson's disease (PD) [1]. Despite of profound neuropathologic differences, PSP and PD share similar features, including bradykinesia, loss of dexterity and gait disturbances that may complicate the differential diagnosis particularly early along disease course. Further increasing the diagnostic challenge, recent clinic pathological data distinguished several clinical phenotypes of PSP including the PSP-parkinsonism (PSP-P), characterized by asymmetric onset of symptoms, tremor, early bradykinesia, non-axial dystonia and a response to levodopa, that more closely overlaps with PD than the classic description of 'Richardson's syndrome' (PSP-RS) [2].

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PSP patients in the advanced stages consistently suffer from more severe affective and cognitive symptoms, including apathy, depression, executive and visual-spatial deficits, than patients with PD [3,4]. The question arises as to whether differences of the pattern and severity of neuropsychiatric and neuropsychological symptoms among PD, PSP-P and PSP-RS are precociously detectable, along the time span of potential motor symptom overlap.

The results of previous studies are rather contradictory [5–7]. Aarsland et al. described increased apathy and disinhibition in PSP patients in comparison with PD patients [5]. Lee et al. [6] reported more robust impairment of verbal memory and processing, planning and set-shifting in a small cohort of PSP with respect to PD patients, all recruited within the first five years of the illness. Conversely, Borroni et al. [7] found similar neuropsychiatric and neuropsychological features in patients suffering from several degenerative parkinsonisms (PD, PSP, corticobasal degeneration, dementia with Lewy bodies). Data concerning a shorter frame time after the onset of motor symptoms are, however, missing. Further, a detailed investigation using a complete neuropsychiatric and cognitive battery in early PSP-P and PSP-RS patients is still lacking.

The aim of this study was to investigate comprehensive neuropsychiatric and cognitive profiles in PSP-P and PSP-RS patients examined within 24 months from motor symptom onset, and to compare possible dysfunctions with those found in PD. We hypothesized that discrete neuropsychiatric and neuropsychological profiles may be identified in early phases of PSP-RS, PSP-P and PD.

2. Methods

2.1. Participants

The study was carried out on 180 consecutive patients. Inclusion criteria were: a) age between 40 and 80 years; b) diagnosis of degenerative parkinsonism (i.e., PD, PSP-RS and PSP-P), with onset of symptoms dating less than 24 months at enrollment. Patients were recruited during scheduled visits at the Outpatient Services for Movement Disorders of our Institutions in the period between May 2006 and January 2014.

Exclusion criteria were: a) co-morbidity with major, not stabilized, medical illnesses; b) known or suspected history of alcoholism, drug dependence or abuse, other neurological disorders, head trauma and mental disorders (apart from mood and anxiety disorders) according to the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition - Text Revision (DSM-IV-TR) [8]; c) presence of vascular brain lesion or neoplasm at CT or MRI brain scan; d) noncompliance with testing procedure.

All patients were regularly followed-up in our outpatient clinics. Clinical diagnosis of either PD (n = 155) or PSP (n = 25) were confirmed over a minimum of three years follow-up from symptom onset, according to the criteria by Gelb et al. [9] and Litvan et al. [1]. Specifically, according to diagnostic proposal of PSP phenotypes by Williams et al. [2,10], that is currently the reference classification to distinguish between PSP-P and PSP-RS, 14 patients were classified as PSP-RS since falls, supranuclear gaze palsy, postural instability and levodopa resistance were the predominant clinical features within the first 24 months from symptoms onset; eleven patients were classified as PSP-P as they showed in the first 24 months of the disease abnormality of saccadic eye movements, positive response to levodopa, asymmetric onset and postural instability. After a minimum of three years follow-up, the phenotype of PSP-P patients more closely overlapped the PSP-RS patients with severe postural instability (11/11), falls (7/11), supranuclear gaze palsy (11/11) and abnormal saccades (11/11) (Table 1).

Dopamine replacement therapy dosages were calculated as daily levodopa equivalents. The following conversion table was applied: 100 mg levodopa = 1 mg pramipexole = 5 mg ropinirole = 5 mg rotigotine. Within each group, the number (and %) of subjects receiving antidepressant, benzodiazepines and/or antipsychotic therapy was calculated.

The protocol was approved by the Ethical Committee of the Santa Lucia Foundation IRCCS, and each subject signed the informed consent before enrollment.

2.2. Sociodemografic and clinical assessment

The demographic and neurological features of patients were collected at enrollment by neurologists with expertise on parkinsonisms. The severity of motor symptoms was measured by the Unified Parkinson's Disease Rating Scale - part III scale (UPDRS-III).

Within 2 weeks from enrollment, all subjects underwent a structured psychiatric interview (SCID-P) for the identification of psychiatric disorders according to the DSM-IV-TR criteria. Apathy was diagnosed according to the adaptation by Starkstein [12] of the Marin criteria [13]. All psychiatric diagnoses were made by a senior psychiatrist.

Severity of anxiety symptoms was quantified by the Hamilton Anxiety Rating Scale (HARS). Severity of depressive symptoms was investigated by the Beck Depression Inventory (BDI) (total score, psychic and somatic sub-scores). Apathy severity was quantified by means of the Apathy Rating Scale (ARS). The Parkinson's Psychosis Rating Scale (PPRS) was used to assess the severity of psychotic symptoms.

All patients were submitted to a detailed neuropsychological evaluation including: *i.* the MMSE, a global index of cognitive impairment with scores ranging from 30 (no impairment) to 0 (maximum impairment); *ii.* tests taken from the Mental Deterioration Battery, a comprehensive neuropsychological battery that includes verbal and non-verbal tasks such as the Rey's 15-word test – Immediate Recall (RIR) and Delayed Recall (RDR) to evaluate short- and long-term episodic verbal memory, with total scores given by the total number of words recalled at each test, and the Phonological (PVF) and Semantic (SVF) Verbal Fluency test to assess language abilities, in which the total score is the total number of words produced during each test; *iii.* the Copy of the Rey-Osterrieth picture test (CRO) and Delayed Recall of the Rey-Osterrieth picture test (DRO) for evaluating complex constructional praxis and long-term visual memory, with score ranging from 0 (maximal impairment) to 36 (no impairment) at both tests; *iv.* the Stroop Word-Color Test (SWCT) to assess frontal abilities of simple attention, attention shifting and control, that consists of 3 parts: in the “word reading” task participants were asked to read as quickly as possible Italian words for colors (i.e., red, blue and green) that were printed in black ink on a white sheet; in the “color naming” task participants were shown a series of blue, red and green dots and were asked to name the colors as quickly as possible; finally, in the “interference time” task, Italian words indicating colors were printed in different colored ink (e.g., the word “red” was printed in blue ink) and participants were asked to name the color of the printed word (in the example, “blue” was the correct answer) as quickly as possible. If the case of an error, subjects were stopped and requested to go back to the previous word. All tests have been described in details elsewhere [11].

Neuropsychiatric symptom severity and neuropsychological performances were assessed by 3 trained neuropsychologists. Acceptable inter-rater reliability was defined as $k > 0.80$.

2.3. Ancillary assessment of emotion recognition and executive functions

We also assessed the recognition of facial emotion expressions

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