INTRODUCTION

Verbal fluency is defined as the ability to form and express words compatible with the required criteria. While a normal level of verbal fluency is necessary for optimal communication, the verbal fluency test can be a good diagnostic tool of particular changes in the brain that might cause a disruption in normal social functioning. The test consists of two tasks – phonemic or letter fluency and semantic or category fluency. The individual is given a 60 second time interval to produce as many unique words as possible beginning with a particular letter (e.g. F, A, S) for the phonemic fluency task and a 60 second time interval to produce as many unique words as possible belonging to a specific category (e.g. animals, things you can find in a supermarket) for the semantic fluency task [1]. The test evaluates the
individual’s ability to retrieve specific information, generate a response and voice it out correctly to the tester within restricted search parameters [2]. During the test, executive control processes, such as focusing on the task, selecting the words that meet the testing criteria, avoiding repetition are evaluated [3]. Broca’s region and dorsolateral prefrontal cortex of the left hemisphere are active during the performance of this test. The inferior part of the left prefrontal cortex is activated during the letter (phonemic) test and the anteroinferior part of the prefrontal cortex is activated during the category (semantic) test. Poor results of the verbal fluency test can indicate dysfunction of the frontal lobe, temporal cortex, and prefrontal cortex of the left hemisphere [1]. The verbal fluency test can be used to support the diagnosis of neurodegenerative diseases which cause cognitive and executive impairment, such as Alzheimer’s disease or Parkinson’s disease [3].

Using the verbal fluency test we sought to assess types of dementias called atypical parkinsonian syndromes: progressive supranuclear palsy (PSP), corticobasal degeneration (CBD), and multiple system atrophy (MSA). These dementias all exhibit symptoms called “Parkinsonian features” which are rarely seen in cortical dementians, such as Alzheimer’s disease. Even though every one of these diseases have their own specific symptoms (even thought of as pathognomonic) there is no single symptom which can be used to make a definite diagnosis. For example – prominent tremor is most often observed in Parkinson’s disease, apraxia in corticobasal degeneration but both of them are seen, even though rarely and not as extensive, in progressive supranuclear palsy [4]. Patients with MSA usually exhibit subcortical symptoms (e.g. parkinsonism and ataxia) and pathological changes are limited to subcortical structures. Patients with PSP have the most pronounced pathological changes in the subthalamic nucleus, zona compacta, superior colliculi, and internal pallidum. In CBD both cortical and subcortical changes have been registered. Substantia nigra (most often), striatum, thalamus colliculi, red and dentate nuclei, and inferior olive may be affected. As for the cortical pathology, direct involvement of the frontal lobes and parietal lobes had been reported [5].

The verbal fluency test is extremely useful and practical when dealing with or suspecting such diseases because it is very easily administered and clinically meaningful in testing frontal and temporal function of the patient. In former studies it was shown that the verbal fluency test reflects the difficulty in generation of actions which is the most important feature of parkinsonian syndromes. Impaired verbal fluency was also noticed in all atypical parkinsonian syndromes but more extensive in progressive supranuclear palsy in which it is one of the earliest exhibited symptom even preceding motor abnormalities. Because of such findings the verbal fluency test has been included in multiple cognitive batteries such as Dementia Rating Scale (DRS) and Adenbrooke’s Cognitive Examination (ACE) [4]. We hypothesise that because of specific changes caused by PSP, CBD and MSA in the brain, the verbal fluency test may be useful in differentiating between these conditions.

AIM

Our study sought to investigate how various types of atypical parkinsonian syndromes can be differentiated with phonemic and semantic fluency tests in the Lithuanian-speaking population.

OBJECTIVES

1. To calculate the average of total words produced with 95% CI for phonemic and semantic fluency in each group.
2. To analyze the results using a one-way ANOVA and determine the significance of our findings for each patient group.

METHODS

Patients

Consecutive referrals to the Neurology Department of the Vilnius University Hospital Santariskiu Clinics were screened for possible inclusion into the study. All patients in the PSP group fulfilled clinical research criteria for the diagnosis of progressive supranuclear palsy (Steele-Richardson-Olszewski syndrome) NINDS-SPSP International Workshop [6]. All patients in the MSA group fulfilled the diagnostic criteria of the second consensus statement on the diagnosis of multiple system atrophy [7] and all patients in the CBD group fulfilled the criteria for the diagnosis of corticobasal degeneration [8]. For our testing, we recruited 20 patients with diagnosed atypical parkinsonian syndromes from the Lithuanian speaking population: 8 patients with progressive supranuclear palsy (PSP) (mean age 71, SD 5.5, education 12 years, SD 3), 5 patients with corticobasal degeneration (CBD) (mean age 73.8, SD 4.2, education 12.8 years, SD 2.9) and 7 patients with multiple system atrophy (MSA) (mean age 71, SD 4, education 13.5 years, SD 1.9). All patients had sufficient knowledge of the Lithuanian language to participate in the study. All study participants were able to perform all tasks in the test. No patients had severe hearing impairments.

Testing

The verbal fluency test adapted to the Lithuanian speaking population was administered to each patient from every group. The patients were asked to carry out two tasks: name as many words as they could think of starting with the letter P for the first task (letter fluency) and name as many animal names as they could think of for the second task (category fluency). A 60 second time period was given for the completion of each task. Proper nouns, numbers and multiple root forms of the same words were not permit-
The test was carried out in the Lithuanian language. The score calculated was the total number of words generated for each task.

Data analysis

SPSS for windows was used for data analysis. We calculated the mean of total words generated with 95% CI for both phonemic and semantic fluency in each patient group. For group comparison, a one – way ANOVA with a post-hoc Bonferroni was performed to compare the mean differences of total words generated between groups and to determine whether those differences were statistically significant. The mean difference significance level was set at 0.05.

RESULTS

Mean values of total words generated with 95% confidence intervals

We calculated the mean values of total words generated with 95% CI for both phonemic and semantic fluency in each group.

The mean words generated with 95% CI for phonemic (letter) fluency (Fig. 1):
1. PSP = 4.87 (4.18; 5.57)
2. CBD = 6.20 (5.64; 6.75)
3. MSA = 9.28 (8.26; 10.31)

The mean words generated with 95% CI for semantic (category) fluency (Fig. 2):
1. PSP = 7.00 (6.22; 7.77)
2. CBD = 8.40 (7.71; 9.08)
3. MSA = 12.86 (12.03; 13.69)

Analysis of Variance

A one – way ANOVA with a post – hoc Bonferroni was carried out to scan for statistically significant differences in mean values of total words generated between each group. We determined that there were statistically significant differences between groups and within groups in both phonemic (F=48.422, p<0.01) and semantic (F=94.991, p<0.01) fluency. The post – hoc Bonferroni analysis revealed that significant differences were between the following groups: PSP compared to MSA (p<0.01) and MSA compared to CBD (p<0.01) for phonemic (letter) fluency and PSP compared to MSA (p<0.01), MSA compared to CBD (p<0.01) for semantic (category) fluency. The PSP (mean difference = -4.41) and CBD (mean difference = -3.09) groups showed significant impairment in phonemic fluency compared only to the MSA group. When comparing phonemic fluency values between CBD and PSP patients they held no statistical significance (p=0.051). Similar results were found in the semantic fluency group as well. PSP (mean difference = -5.86) and CBD (mean difference = -4.46) groups showed significant semantic fluency impairment compared to the MSA group. Comparison of semantic fluency values between PSP and CBD patients held no statistical significance (p=0.029).

DISCUSSION

The only definite conclusion we can make is that the MSA group had significantly better results in both phonemic and semantic fluency than the CBD and PSP groups and should be differentiated accordingly. Even though the fluency comparison between CBD and PSP groups held no statistical value, the score of total words generated for phonemic and semantic fluency was lower in the PSP group, which may be helpful in differentiating between these conditions. We also determined that phonemic (letter) fluency impairment was greater in all three patient groups than the semantic (category) fluency impairment. Similar findings were published by T. H. Bak et al (2005), stating that the cognitive impairment was not as extensive in the MSA patients compared to CBD and PSP patients. In fact, the cognitive impairment in MSA is so unpunounced, that most pa-
patients do well on cognitive screening tests, except for verbal fluency and free recall [5, 9]. Rosser and Hodges (1994) and T. H. Bak et al (2005) demonstrated that letter fluency is more impaired in PSP than category fluency and our research supports this claim [5, 10]. Such findings would support our current understanding of the pathological changes in atypical parkinsonian syndromes: basal ganglia pathology reflected by the subcortical deficit, shared in all three diseases as well as the frontal and fronto-parietal involvement in PSP and CBD [5].

The drawback of our study was a low number of patients in each group. The results would have been more reliable if it was possible to include more patients in the study.

The verbal fluency test does not evaluate all the changes usually found in atypical parkinsonian syndromes, which is why we recommend to assess patients with the full ACE test for a definite diagnosis. However, the fluency test is useful because it is brief, easy to administer and can be performed at the patient’s bedside while being sensitive to executive and cognitive abnormalities in atypical parkinsonian syndromes [5]. We recommend the verbal fluency test to be carried out for every patient with an atypical parkinsonian syndrome.

References