Verbal Fluency Performance in Patients with Non-demented Parkinson's Disease

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Objective: While Parkinson's disease (PD) has traditionally been defined by motor symptoms, many researches have indicated that mild cognitive impairment is common in non-demented PD patients. The purpose of this study was to compare verbal fluency performance in non-demented Parkinson's disease patients with healthy controls .
Method: In this cross-sectional study thirty non-demented Parkinson's disease patients and 30 healthy controls, matched by age, gender and education, were compared on verbal fluency performance. Verbal fluency was studied with a Phonemic Fluency task using the letters F, A, and S, a semantic fluency task using the categories animals and fruits. The independent t-test was used for data analysis.
Results: Overall, participants generated more words in the semantic fluency task than in the phonemic fluency task. Results revealed significant differences between patients and controls in semantic fluency task ($p<.05$). In addition, PD patients showed a significant reduction of correctly generated words in letter fluency task. The total number of words produced was also significantly lower in the PD group ($p<.05$).
Conclusion: Verbal fluency disruption is implied in non-demented PD patients in association with incipient cognitive impairment .

Keywords: *Verbal Fluency, Semantic fluency, Phonemic Fluency, Parkinson's diseas*

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Parkinson's disease (PD) is a neurodegenerative disorder which results from death of dopaminergic neurons in the substantia nigra (1). Based on recent studies, in addition to motor problems, PD patients may encounter cognitive and language impairments (2). Deficits in cognition include impairment in memory, concept formation, and executive function that long-term memory and executive function is prominent. Both verbal and non verbal memory are impaired, but impairment of verbal memory is more than non-verbal memory (2, 3). Parkinson's disease has demonstrated impairment in language content (performance on a variety of tasks apparently calling for semantic processing) and language processing (2, 4). Crosson (1985) suggested that deficits in language formulation could be due basal ganglia damage through their connections with the cortex (5).Goberman et al. (2010) reported that the speech of the PD patients was diffluent, marked by more pausesper word (6) .Disfluency may be associated with difficulty in retrieving, from semantic and lexical memory(4). In addition, reduced speed of information Processing and dysarthria could exacerbate the problems (6). In some patients, these symptoms are not detected in the early stages of the disease and could interfere with communication at home or at work. There fore, specific neuropsychological tests are needed to detect these deficits. Verbal fluency is a common neuropsychological test that does not require writing or reading and is most widely used to asses cognitive functioning and language content after neurological damage (7).In verbal fluency tests, participants have to say as many words as possible from a semantic category, such as animals or fruits, or phonemics, such as words that begin with letter in restricted time(8).To our knowledge, a few studies in the literature have examined verbal fluency in non-demented PD patients. Previous studies have indicated that verbal fluency is reduced in demented PD (8, 9, 10). Moreover, some studies have reported significant deficits on semantic fluency, but not on phonemic fluency (11). Taylor et al (1986) reported that PD patients performed better than control son this task (12). However, language differences can have an effect on this ability because of their phonological and semantic features. In addition, previous research has indicated that performance on verbal fluency tests is influenced by culture. Culture-specific factors such as

socioeconomic status, environmental and, educational systems are effective in verbal fluency tests (13).
Thus, the aim of this study was to evaluate semantic and phonemic fluency in non-demented PD patients. To our knowledge, this is the first study to assess semantic and phonemic fluency in PD patients in Persian language and culture. We expected that non-demented PD patients would exhibit impairment on these fluency tasks.

Materials and Methods

Participants

Thirty adults with Parkinson's disease and 30 neurologically healthy controls individually matched by chronological age (mean age: 52.03 years, SD=9.7; range from 27 years to 70 years), gender (19 males and 11 females for both groups, and education (6.66% no diploma, 26.6 % Primary degree,39.9% Secondary degree, and 26.66 % undergraduate and higher) participated in this cross-sectional study. The native language of all participants was Farsi. The PD patients were selected based on sample availability from neurology clinic of Tehran University of Medical sciences hospitals and were diagnosed by a neurologist. The severity of the disease for PD group was assessed with the Unified Parkinson's Disease Rating Scale (UPDRS), and ranged from mild to moderate.
Patients with dementia (scoring under the recommended cutoff point of 23 on the MMSE)(14), patients who were illiterate, and those with other neurological disorders such as CVA or history of epilepsy, psychiatric disorder (depression) based on medical files and neurologist assessment were excluded. Also the healthy control should to be free from all neurological or psychiatric diseases .

Procedure

In the current study, verbal fluency test included semantic fluency task and phonemic fluency tasks. Onsemantic fluency tasks, participants were asked to name as many animals and fruits as possible. On phonemic tasks, subjects were allowed to generate as many words as possible that began with each of the letters / a/, /f /and /s/. Both tasks were time limited to 60 s of word generation. Responses were recorded on an audio tape for later analysis. Repeated words or words with similar suffix were not counted. For each task, the total numbers of correct words were determined. The total verbal fluency score was obtained by counting the total number of words. The independent t-test was used to test group mean differences.

Results

The means and standard deviations for letter fluency and semantic fluency were demonstrated in table1. Overall, participants in both groups generated more words in the semantic fluency task than in the phonemic fluency task. Results indicated that normal subjects generated significantly more words in both tasks (semantic fluency task and letter-fluency task) than Parkinson's patients ($p<0.001$).
A paired t test indicated significance difference between Parkinson's patients and normal subject in total number of words in verbal fluency task ($p<0.001$).Tab1.

Discussion

The main objective of this study was to investigate performance of non-demented PD patients on verbal fluency. Our results showed that participants with Parkinson's disease have significant deficits on semantic and phonemic fluency measurement compared to the healthy group. These results are consistent with several previous studies indicating decline in verbal fluency tasks in Parkinson's patients. Gurd (2000) reported Parkinson's patients have difficulty in semantic and phonemic fluency (10). However, Auriacombe et al. (1993) found that PD patients did not differ from normal group in phonemic fluency (12).
In contrast, Ivory et al.(3) reported no significant difference between PD patients and normal subjects in verbal fluency. Further, Taylor et al.(1986) found that PD patients generated more words than control group on this task(12).
The difference found in results of different studies may be due to the differences in the investigated languages, as the frequencies of words that start with a particular letter vary between languages. However, this factor can influence the sensitivity of phonemic fluency test indifferent languages. In addition, language differences also affect semantic fluency by word length. Kempler et al.
1998) reported that Spanish subjects produced fewer words than Vietnamese participants, and this discrepancy might be due to differences in their languages because animal names in Vietnamese are one-syllable words whereas most animal names in Spanish are multisyllabic(15).
The results of the present study that PD demonstrate deficit in verbal fluency could be viewed as consistent with language impairment in PD. Crosson(1985) reported that basal ganglia damage could affect language formulation by their connections with the cortex(5). Verbal fluency not only evaluates semantic and phoneme knowledge of lexical memory by searching specifics emanticor phonemes class, but subjects should also be able to track previous responses and prevent activation of other categories by executive skills. Therefore, verbal fluency deficit in PD patients undoubtedly represents executive dysfunction. Higginson et al (2003) reported that working memory and verbal fluency correlated with executive functions (16).

Table1: Semantic, phonemic and verbal fluency performance in Parkinson's disease (PD) and Normal Control (NC) Subjects

Variable	Parkinson's disease (PD)	Normal Control (NC)	P
Mean of Phonemic fluency	16.20(7.34)	22.24(7.65)	P<0.001
Mean of Semantic fluency	29.48(6.06)	34.96(6.45)	P<0.001
Mean of Verbal fluency	45.51(12.01)	57.20(12.57)	P<0.001

Bohlhalter et al.(2009) and Raskin et al. (1992) have also suggested that poor performance in semantic fluency in these patients is associated with a specific deficit in semantic memory, whilst Raskin et al.(2009) suggested that this problem is caused by a deficit in semantic retrieval and the ability to register, store intact(17,18) .In addition, recently, Thames et al. (2012) reported that Basal ganglia structures are associated with verbal fluency (19).

However, a number of neuroimaging studies reported that left prefrontal cortex and subcortical regions correlate with verbal fluency (20, 21). On the other hand, there is much evidence of frontal dysfunction in Parkinson patients (17). Based on this reasoning, further studies are needed to investigate a possible relation between verbal fluency deficits with subcortical lesions in PD.

In summary, it seems that language and cognitive functions are impaired in PD patients. Assessing language and executive function by verbal fluency test and early intervention may be effective. Conclusion

A high proportion of patients with MDE also had a sub threshold hypomania or mania. Findings suggest that bipolar features are more frequent than symptoms indicated by DSM-IV-TR, and exclusion criteria of mood disorders in this classification should be revised. DSM-IV classification appears to be too narrow or rigid to distinguish amore subtle and "softer" form of bipolar cases from pure unipolar cases.

Limitations

There are some limitations. First, we did not assess the possible age-related changes in the cognitive and language abilities in our patients, although the previous research reported that aging does not affect the phonemic fluency. Second limitation of the present study was that we were unable to match patients for duration and the time course of their disease, although we attempted to control the severity of Parkinson in patients group according to Unified Parkinson's Disease Rating Scale. Future efforts will be directed Toward investigation of the time course of change in verbal fluency performance in PD.

Conclusion

The present study revealsa significant deficit in non-demented PD that supports findings from previous studies. The deficit in verbal fluency in PD might be associated with cognitive impairment (executive and memory) and complex language disorders in PD. Furthermore, a recent cross-sectional study on a small group of PD patients demonstrated that tests of memory, language processing and cognitive function are important in early stage in this group. Neuropsychologists and speech–language pathologists now routinely assess language and cognitive abilities of PD,and the data presented here illustrates the importance of developing neuropsychological instruments that are sensitive to cognitive deficit. Finally, further research using functional brain imaging during verbal fluency tasks is necessary to evaluate the pathology underlying the verbal fluency deficit in PD.

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