

Research Article

The Study of Noun and Verb Naming in Behavioral Variant of Frontotemporal Dementia and Non-Patients Persian-Speaking

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Running title: Noun and verb naming in bvFTD

Abstract

Background: Due to the prevalence of cognitive disorders such as bv FTD and the consequences these disorders follow, early diagnosis and awareness of the deficiencies of these people in the cognitive and language areas is essential. Because of the language is dependent on culture, examining the linguistic characteristics of these patients in different languages can provide valuable findings. Therefore, this study aimed to compare noun and verb naming abilities in individuals with bv FTD and non-patients Persian-speaking.

Methods: In this cross-sectional research, 3 cognitive tests including FAB, MOCA and MMSE and 2 noun naming and verb naming tests were performed on 15 patients with bv FTD and 30 homogeneous non-patient individuals.

Results: The bv FTD group had significantly different scores for both noun and verb naming compared to the non-patient group ($p < 0/05$). Also, the bv FTD group was more impaired in naming verbs than nouns, with the largest difference between groups in the verb naming task.

Conclusion: the results showed that bv FTD patients have poorer noun and verb naming abilities than non-patients. Specifically, in verb naming, they showed more deficits than noun. One possible explanation is that the processing of verbs is more complicated than nouns, so involves a more complex neural system and cognitive processes than noun processing. Another possibility is that verbs rely more heavily on frontal and temporal regions of the brain, which are typically affected by bv FTD.

Keywords: Behavioral variant of FrontoTemporal dementia, Cognition, naming.

1. Introduction

Dementia is the most common cognitive disorder that has a significant prevalence among elderly people (1). Frontotemporal dementia (FTD) is used to describe a spectrum of progressive dementia conditions associated with focal atrophy of the frontal lobes and/or temporal lobes, which is now considered the second most common cause of young-onset dementia after Alzheimer's (2). Clinically, FTD can be divided into two variants: behavioral variant (bvFTD) and the language variant, the latter also known as Primary Progressive Aphasia (PPA). PPA is typically classified into a nonfluent/agrammatic (nfvPPA), logopenic (lvPPA) and semantic (svPPA) variant, the latter also referred to as semantic dementia. Among the clinical types of frontotemporal dementia, the behavioral type (bvFTD) is the most common. Behavioral type dementia accounts for approximately 60% of FTD cases and the other 40% is the linguistic type of FTD (3). Unfortunately, no study was found in Iran regarding the prevalence of this disease.

Indeed, bvFTD is a neurodegenerative disease that causes profound changes in patients' behavior and personality, associated with progressive frontal and anterior temporal lobe atrophy(4). Behavioral changes may include disinhibiting, social inappropriateness, and compulsions, loss of insight, loss of empathy, excessive jocularity, and gluttonous overeating. These changes generally appear in the earlier stages of the disease, usually preceding the onset of cognitive deficits, and tend to be best recognized by the patient's closest relatives, friends, and colleagues (5). This disease is more common in men and tends to start in the middle or late fifth decade of life(3).

Although PPA is known with dominant language problems, there are also some language problems in bvFTD (6). Deficits in confrontation naming (7), comprehension of single words and sentences and more generalized semantic and language impairment have been described in bvFTD (8). The evidence of a study showed the bvFTD patients overall showed impairments of noun naming, verb naming and concrete single word comprehension. In addition, contrary to previous evidence patients with bvFTD did not show deficits of abstract single word comprehension, sentence comprehension or any other language domains(9).

Based on previous research, we concluded that patients with bvFTD have deficits particularly affecting language functions such as naming, sentence comprehension and production that are likely to engage executive and semantic processes. So, in this study we will compare the differences between noun and verb naming in individuals with bvFTD and non-patients who speak Persian. Through a series of experiments and analyses, we expect to find new results in this field.

2. Materials and Methods

This research is a cross-sectional study. Fifteen patients with bvFTD that referred to the neurology clinic of Roozbeh Hospital participated in the study. At the first, the neurologist diagnosed the type of dementia then, the patients were included based on the inclusion criteria. These criteria were 1) no patient had medical disorders other than dementia 2) age was over 50

years 3) duration of dementia were over one year 4) participants must be monolingual in Persian or in case of bilingualism, having proficiency in both languages (obtaining a score of 3 or more in self-rating questionnaire), and 5) having minimum literacy (having at least primary education). The control group consisted of 30 non-patient subjects that were selected from public places such as libraries, parks and gyms. The two groups were matched for age, gender and education. The sampling was carried out in one or two days depending on the cooperation of the people. Also, the tests were performed in a quiet environment. The average of performance was one hours and a half for each person.

All participants and/or their caregivers gave informed consent, and ethical approval for the study was granted by Tehran University of Medical Sciences. Demographic information of participants was extracted through individual questionnaires (Table 1). After this, language and cognitive tests were implemented randomly.

Table 1: Demographic data and MMSE, MOCA, FAB scores of bvFTD and non-patient individual

participants	Gender (F/M**)	Age(y) (mean±SD)	MOCA ^a (mean±SD)	MMSE ^b (mean±SD)	FAB ^d (mean±SD)
bvFTD* patient (N= 15)	7.8	62.5±10.7	13.20±5	20.93±2.84	7.93±1.94
Non- patients (N=30)	13.17	63.2±9.4	22.07±3.59	25.83±3.04	16.97±0.92

**F= Female/ M=Male

^a Montreal Cognitive Assessment = MOCA

^b Mini Mental State Examination=MMSE

^d Frontal Assessment Battery =FAB

*bvFTD= behavioral variant of Frontotemporal Dementia

Assessment of naming

In this research, naming tests administered to participants examine the lexical retrieval (noun naming, verb naming). In naming tests, the stimuli are black and white pictures that representing objects and actions. Each participant (patients and controls) was asked to name each test stimulus as it was presented in screen. Noun naming test (10) includes 115 images of Persian nouns (109 main images and 6 practice images). Its 109 main images include names with one to four syllables. These names are classified in three levels of high, medium and low frequency in terms of usage in Persian language. Verb naming test (11) includes 90 pictures of Persian verbs. Participants have 10 seconds to name each picture of noun or verb. Both the participants' responses were recorded for further analysis.

Assessment of cognition

The neuropsychological tests that used in this research include: Frontal assessment battery (FAB), Persian version of Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MOCA). The FAB consists of six subtests that assess a number of specific cognitive functions,

including mental flexibility, motor programming, sensitivity to interference, inhibitory control, and environmental autonomy. The cut-off point for this test is 12 (12). Also the MMSE consists of a series of questions and tasks that are designed to evaluate an individual's cognitive abilities, such as orientation, concentration, attention, verbal memory, naming and visuospatial skills. The cutoff point for this test is 22 (13). Like the MMSE, the MOCA assesses short-term memory recall (5 points), visuospatial abilities through clock-drawing (3 points) and cube copy (1 point), and orientation (6 points). The cutoff point for MoCA test is 24 (14). Cognitive and executive function of bvFTD and normal individuals were examined with these three neuropsychological tests.

Statistical analyses of language and cognitive variables were conducted using SPSS v.25. Demographic data, cognitive and language test were compared between the bvFTD and normal groups. Before analysis, variables were checked for normality by Kolmogorov–Smirnov test. To compare mean score of FAB, MOCA, noun and verb naming test, Mann–Whitney test was used but for comparing the mean score of MMSE we were used independent t- test between bvFTD and normal group.

3. Results

In this research, 15 bvFTD and 30 non-patients people who were over 50 years old have participated. The participants with different educational levels have been involved. In both groups, the highest frequency of educational level is diploma (37%) and the lowest frequency belongs to people with a Bachelor's degree (7%) which shows that two groups were matched in terms of education. In both groups of patients and non-patient individuals, the number of males have been more than females which based on the conducted study suggests that this disorder is more prevalent in males than females(15).These people named 109 nouns and 90 verbs and examined by three cognitive tests. The results show, mean score of naming and cognitive test, in bvFTD groups were significantly lower than non-patients group.

In the following, the findings will be compared and analyzed:

Cognitive test

As shown in (Table 2), a significant difference was observed between the median score of FAB and mean score of MMSE in bvFTD and non-patients group (P=0.000) by Mann–Whitney test. Also, the results differed considerably between the mean score of MOCA test in bvFTD and non-patients group (P=0.000) by independent t-test. Therefore, the bvFTD patients scored lower than normal subjects in cognitive tests.

Table 2: compare the cognitive test in bvFTD and non-patient individuals

Variables	Participants	Median/(mean \pm SD)	p-value
FAB	bvFTD	9.00*	0.000
	Non-patient	17.00	
MOCA	bvFTD	13.20 \pm 5.0**	0.000
	Non-patient	22.07 \pm 3.5	
MMSE	bvFTD	21***	0.000
	Non-patient	26	

*FAB cut-off= 12/ ** MOCA cut-off= 24/ ***MMSE cut-off= 22

Verb and noun naming

The mean scores on naming of nouns and verbs for both groups of patients and non-patients individuals are summarized in (Table 3). These data revealed that the patients, on average, have scored 58, 79 respectively in verb and noun naming test which is lower than the score of non-patients group with 71.5, 95.5. As is observed, both group of patients and non-patient individuals earned lower score in verb naming test compared to noun naming test (P=0.000).

Table 3: compare the noun and verb naming in bvFTD and non-patient individuals

Variables	Participants	Median	p-value
Noun naming	bvFTD	79.00	0.01
	Non-patient	95.00	
Verb naming	BvFTD	58.00	0.000
	Non-patient	71.00	

4. Discussion

This study was conducted to compare noun and verb naming in bvFTD patients and non-patient individuals. The average age of patients and non-patient individuals was the same that conforms to previous studies (15, 16). (15).

In this study, patients earned a lower score in noun naming test compared to non-patient speakers. These findings are in line to the other studies, This is because bvFTD primarily affects the frontal and temporal lobes of the brain, which are responsible for language and communication skills. When these brain regions are damaged or degenerate, the ability to retrieve and generate words is affected. Patients with bvFTD may struggle to find the right words to describe objects, people or places(17). This can manifest as difficulty in naming common objects, such as a pen or a pencil, or more complex concepts that require a combination of words. in contrast, non-patient people typically have a greater ability to spontaneously generate and recall specific names for various objects, people or concepts. However, as with bvFTD patients, the ease of naming may vary between different individuals based on factors such as age, level of education, and other cognitive abilities(18, 19). So It's important to note that individual naming abilities can be influenced by a variety of factors, and it's essential to consider these factors when comparing naming nouns between bvFTD patients and non-patient individuals.

As in previous reports, the Findings of this research have shown that bvFTD patients obtained a lower score in verb naming test compared to non-patient groups. The research suggests that verb processing is critically dependent on the left frontal lobe, whereas noun processing is more widely distributed in the brain(9). In bvFTD, the left frontal lobe is one of the earliest regions to degenerate, resulting in a selective impairment of verb processing. Additionally, verbs are more complex than nouns, and require more processing steps to access their meaning. The impairment of verb processing in bvFTD patients may also be related to their more general cognitive deficits, which can impair the processing of complex linguistic information(20). Overall, the selective impairment of verb processing in bvFTD patients appears to be related to the specific pattern of brain atrophy in this condition, which affects the left frontal lobe and impairs the processing of complex linguistic information.

These findings suggest that individuals with bvFTD may have specific language impairments related to the processing of verbs. This is consistent with previous research indicating that the frontal and temporal regions, which are primarily affected in bvFTD, are important for the

processing of action-related words. The development of more sensitive clinical assessments that target verb processing may help with the early identification of language impairments in bvFTD, leading to earlier interventions and better management of language deficits in this patient population. Future research may use these findings to develop more sensitive clinical assessments and interventions that target verb processing in individuals with bvFTD.

5. Conclusion

In conclusion, this study aimed to compare noun and verb naming abilities in individuals with bvFTD and non-patients Persian-speaking. Our findings revealed significant differences between these two groups, the bvFTD patients showed poorer cognitive skills and noun and verb naming abilities than non-patients. Specifically, results indicated that verb naming was more impaired in bvFTD patients compared to noun naming. Overall, our study contributes to the growing body of literature on language processing in neurodegenerative disorders and emphasizes the importance of examining both noun and verb processing in individuals with bvFTD.

Limitations and suggestions

Limitations of our study include the relatively small sample size and the fact that we just used picture-naming tasks as a measure of noun and verb processing. Future studies could examine noun and verb processing using another tasks such as sentence completion or sentence generation tasks. Additionally, the use of other types of stimuli beyond pictures may also be beneficial for addressing the ecological validity of our findings. Another limitation is that did not examine the specific types of verbs that might be particularly sensitive to the effects of bvFTD. Future studies could investigate the nature of verb processing deficits in bvFTD by exploring whether certain types of verbs, such as action-related versus non-action-related verbs, are more impaired in this patient population.

In terms of suggestions, future research could investigate the neural mechanisms underlying noun and verb processing deficits in bvFTD using various neuroimaging techniques such as fMRI or EEG. This could provide more precise information on how the frontal and temporal regions are involved in noun and verb processing, and could help to explain why verb naming is more impaired in individuals with bvFTD.

Ethical Considerations

Compliance with ethical guidelines

The ethical committee of Tehran University of Medical Sciences approved this study (Code: IR.TUMS.FNM.REC.1400.122).

Authors' contributions

Study concept and design: Atefeh Ahmadi, Azar Mehri; Acquisition, analysis, or interpretation of data: Atefeh Ahmadi, Shohreh Jalaei; Drafting of the manuscript: Atefeh Ahmadi, Azar Mehri, Shohreh Jalaei, Vajihe Aghamolae; Administrative, technical, or material support: Atefeh Ahmadi, Azar Mehri; Study supervision: Azar Mehri and Shohreh Jalaei, Vajihe Aghamolae.

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Conflict of interest

The authors declared no conflict of interest.

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