

Verbal working memory and the role of the phonological loop in Alzheimer's Disease

Introduction

In the last few years, the nature of neuropsychological deficits in Alzheimer's Disease (AD) has been intensely researched. There have been a few investigations of verbal working memory in AD, which reported more difficulties in verbal fluency test (e.g. Martin, A., Fedio, P. 1983; Martin, A., Brouwers, P., Cox, Ch., Fedio P. 1985; Tröster, A. I., Salmon, D. P., McCullough, D., Butters, N., 1989; Diaz, M., Sailor, K., Cheung, D., Kuslansky, G. 2004; Astell, A. J., Arlene J. Astell, Bucks, R. S., 2006; Marcziński, C. A., Kertesz, A. 2006), the role of the central executive (Papagno, C., Allegra, A., Cardaci, M. 2004) and auditory verbal working memory (Karrasch, M., Laine, M., Rinne, J. O., Rapinoja, P., Sinervä, E., Krause, Ch. M. 2006).

The main purpose of this research is to study verbal working memory and the role of phonological loop in different stages of Alzheimer's Disease (mild, moderate, severe) compared to age-matched healthy controls. We would like to map the neuropsychological profile of the participants. We used Baddeley's model (Baddeley 1998, 2003).

Materials and methods

In total, 50 participants participated in this study. AD persons (n=30) were sub-grouped according to the severity of the dementia syndrome: they were mildly to moderately demented as gauged by Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975; Addenbrook Cognitive Examination, Dudas et al. 2005). All AD participants met the DSM-IV and ICD-10 criteria for probable Alzheimer's Disease (American Psychiatric Association, 2000).

The following neuropsychological tests were used to map the verbal working memory of native Hungarian speaking participants: digit span (forward, phonological loop), nonword repetition (phonological loop), complex listening and reading span (complex working memory), verbal fluency (phonemic and semantic).

Results

The result of the verbal working memory tests are summarized in Table 1.

Tests		Mild AD (n=11)			Moderate AD (n=10)			Severe AD (n=9)			Control (n=20)		
		M	SD	R	M	SD	R	M	SD	R	M	SD	R
Complex Listening and Reading span (8)		2,36	0,92	0-3	0,8	1,03	0-2	0,00	0,00	0	2,45	0,68	2-3
Digit span (9)		4,9	0,53	4-6	4,7	0,94	3-6	3,77	0,44	3-4	4,7	0,8	4-6
Phonemic fluency	[s]	8,63	3,41	5-15	6,3	3,12	2-11	3,44	1,74	0-6	12,75	2,78	9-20
Semantic fluency	animal	11,72	3,34	7-17	8,5	2,99	4-13	6,40	3,43	2-12	15,9	3,55	11-25
Nonword repetition (9)		4,72	0,70	3-7	4,6	1,34	3-7	3,00	1,41	0-5	4,65	0,98	3-7

The results of the verbal working memory tasks revealed that the AD persons performance in the complex listening and reading span tasks (mild 2.36, moderate 0.80, severe 0.00 vs. 2.45±0.68), phonemic fluency (mild 8.63, moderate 6.30, severe 3.44 vs. 12.75±2.78) and semantic fluency (mild 11.72, moderate 8.50, severe 6.40 vs. 15.9±3.55) was lower than in the controls, while in the nonword repetition task (mild 4.72, moderate 4.6, severe 3.00 vs. 4.65±0.98) was close to that of the controls and in the digit span (mild 4.90, moderate 4.7, severe 3.77 vs. 4.7±0.8) task in mild AD was better than in the controls.

Conclusions

Verbal working memory has been different disordered in the different stages of Alzheimer's Disease. In the nonword repetition task results of AD persons were close to that of the controls and in the digit span task in mild AD was better than in the controls. In the mild and moderate stage of the disease phonological loop is intact. In the nonword repetition task results of mild and moderate AD persons were close to that of the controls and in the digit span task in mild AD was better than in the controls (but not significant). Central executive is from early stage disordered.

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