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Verbal memory dysfunctions among patients with Alzheimer's disease, vascular and mixed dementia

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Abstract:

Alzheimer's disease (AD) and vascular dementia (VD) frequently coexist among elderly and are united under the term mixed dementia (MxD). The study aimed to evaluate and compare verbal memory functions among patients with AD, VD and MxD. Methods: A total of 146 elderly participants (38 with AD, 56 with VD and 52 with MxD) were assessed twice over a period of 2 years, using standardized neuropsychological tests, including 10 Words Verbal Memory Test for short term memory (STM), 5 min. delayed recall (DR) and Word Recognition Test (WRT). Statistical analysis was conducted at a 95% confidence level ($p < 0.05$). Results: Patients with VD had the best performances on all tests. Patients with AD and MxD had similar results, although patients with MxD showed more prominent 2-year delay on STM and WRT. Conclusions: This study demonstrates that patients with MxD show more rapid delay on STM and memory fixation than those with AD only. These findings support the hypothesis that MxD should be considered as an independent disease, with poor course and prognosis than VD or AD alone.

Key words: Alzheimer's disease, Vascular dementia, Mixed dementia, memory dysfunction, neuropsychological tests.

Background:

Dementia is one of the leading medical and social problems all over the world. The leading causes for dementia are Alzheimer's disease (AD) and vascular dementia (VD) (Ng, 2025). The term mixed dementia (MxD) is most often used in cases, when AD and VD coexist and contribute to the cognitive decline in the same individual (Emrani, 2020; Sarhan, 2025). It is a relatively new entity and is often under-diagnosed in clinical practice, although the high prevalence, reported

among elderly and differences in pathogenesis and management (Emrani, 2020; Fierini, 2020; Sarhan, 2025). Moreover, a relatively few data exist with regard to the differences in clinical picture and memory delay between MxD and other common dementias (AD and VD) (Custodio, 2017; Fierini, 2020; Mimenza-Alvarado, 2021)

The aim of our study was to examine and describe verbal memory dysfunctions among patients with AD, VD and MxD.

We examined 38 patients with AD (78.18±7.03 years old, 12 males and 26 females), 56 patients with VD (77.54±7.62 years old; 21 males and 35 females) and 52 patients with MxD (79.04±4.47 years old, 15 males and 31 females). The inclusion criteria for the study were 1. Age ≥ 60 years; 2. Confirmed by neuropsychologist cognitive impairment at ≥2 cognitive domains; 3. Confirmed on the basis of history, neurological and somatic examination, laboratory data and imaging study diagnosis of AD or SVD or MD; 4. Lack of other neurological diseases such as trauma, brain tumors, neuroinfections, demyelinating diseases or epilepsy; 5. Lack of decompensation of coexisted somatic diseases during the study; 6. Lack of psychiatric diseases, except of mild depression or anxiety; 7. Lack of treatment or usage of benzodiazepines, modafinile acetate, hallucinogens and other psychoactive drugs, except for low dosages of Quetiapine (≤50mg/d), Pregabaline (≤150mg/d), Gabaneural (≤600mg/d), Hydroxyzine (≤25mg/d) or antidepressants; 8. Lack of alcohol abuse or usage of forbidden substances; 9. All patients should be from the Bulgarian ethnic group. 10. Signed written informed consent.

After signing the informed consent, the patients were distributed into three groups: with AD only: with VD only and with MxD. The patients were examined via 10 Words Verbal Memory Test (10WT) in Bulgarian. The short term memory (STM) was evaluated by the average result on immediate recall from 5 trials. The delayed recall (DR) was examined 5 minutes after the last immediate recall. The

memory fixation was examined via Word List Recognition (WLR), using the same 10 words and 10 other new similar words with regard to meaning or phonetic construct. The patients were examined with the same memory tests again 2 years after the first examination. The statistical analysis was done via descriptive analysis (for age, sex, level of education) and t-test (for normal value distribution) or non-parametric test (Mann-Witney/Wilcoxin) for analysis of cognitive differences between the groups and cognitive parameters. “Startgraphics 20 Plus” and SPSS 20 were used for statistical purposes. All results were interpreted at a 95% confidence level ($p < 0.05$).

Results:

Demographics: The demographic data is summarized at table 1. The age of onset of cognitive complaints was earliest in VD and was similar in AD and MxD. Most of our patients were women, however the women predominance was highest in MxD. The majority of them were with middle formal education (10-12 years) and the minority of them were low educated (≤8 years). Above 1/3 of all were with high formal education (>13 years).

Short term memory: The STM results were summarized at table 2. Patients with VD had the best test performances. AD and MxD had similar test results. STM delay showed AD and MxD, but not VD. However, patients with MxD had more severe STM delay than those with AD.

Delayed recall (ability to recollect information): The DR results were summarized at table 3. Patients with VD showed the best 5 min DR. Moreover, they did not have DR delay during the 2-year follow up. Patients with AD and MxD had similar DR results. Both groups had statistically significant 2-year DR delay. There was no statistically significant difference between AD and MxD on DR 2-year delay.

Ability for fixation (hippocampal memory): The statistical analysis of our data from WLR test results is summarized at table 4. Patients with VD showed the best results on WLR and they did not have statistically significant 2-year recognition delay. AD and MxD obtained similar results on WLR, they showed significant 2-year recognition delay. Despite that, patients with MxD had more prominent delay than those with AD during the follow up period.

Discussion:

Memory loss is one of the most frequent complains among patients with AD and VD. It is associated with low quality of life and self-care inability (Stites, 2018). However, although it is suggested that patients with AD have inferior performance on episodic memory tasks than VD, there are no such studies among patients with MxD (Sokolovič, 2023). We also find that patients with AD have poor results on episodic memory than those with VD. However, patients with MxD have almost similar to AD performances on memory tests, but they show more pronounced delay on STM and WRL, but not on DR, during the follow up. In other words, MxD is the group with the most rapid delay in STM and fixation. The mechanism of such difference is unclear, although the additional role of vascular risk factors, small vessel disease and increased white matter damage can be suggested (Groh, 2025; Hu, 2025). Patients with MxD might be genetically more vulnerable to vascular risk factors than those with AD (Biesbroek, 2025; Sarhan, 2025), showing more rapid progression of STM dysfunction. Vascular risk factors can also aggravate amyloid deposition and hippocampal dysfunction (Waigi, 2024; Sarhan, 2025), which can explain the more pronounced delay on ability for informational fixation of such patients.

Conclusions: This study demonstrates that patients with MxD show more rapid delay on STM and memory fixation than those with AD only. These findings support the hypothesis that MxD should be considered as an independent disease, with poor course and prognosis than VD or AD alone.

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Table 1. Demographic data

	AD	VD	MxD
Number of patients	n=38	n=56	n=52
Age of the onset of cognitive complaints (years)	74.11±7.20	70.86±7.28	75.08±6.79
Age of the first examination (years)	78.18±7.03	77.54±7.62	79.04±4.47
Male: Female Ratio	12:26 (32%:68%)	21:35 (38%:62%)	15:37 (29%:71%)
Education (Basic:Middle:High)	4:21:13 (11:55:34%)	4:30:22 (7:54:39%)	4:32:16 (8:62:30%)
Legend: AD – Alzheimer's disease only, VD – vascular dementia only, MxD – Mixed Alzheimer's and vascular dementia			

Table 2. Short term memory.

	AD	VD	MxD	p(AD,VD)	p(AD;MxD)	p(VD,MxD)
STM 1 (words)	4.64±1.36	5.86±1.12	4.53±1.33	0.0001	>0.05	0.0001
STM 2 (words)	3.96±1.54	5.71±1.16	3.78±1.70	0.0001	>0.05	0.0001
p(STM 1,2)	0.0417	>0.05	0.0049			
STM 2-year delay (words)	Med -0.4	Med -0.2	Med -0.6	0.0031	0.0429	0.0001
Legend: AD – Alzheimer's disease only, VD – vascular dementia only, MxD – Mixed Alzheimer's and vascular dementia STM – average immediate recall result from 5 trials on 10 words test in number of words 1 – first examination; 2 second examination (2 years after the first one).						

Table 3. Delayed recall.

	AD	VD	MxD	p(AD,VD)	p(AD;MxD)	p(VD,MxD)
DR 1 (words)	2.14±2.11	4.51±1.93	2.32±1.98	0.0001	>0.05	0.0001
DR 2 (words)	Med 0.0	Med 4	Med 0.0	0.0001	>0.05	0.0001
p(DR 2,1)=	0.0001	p>0.05	0.0031			
2 year DR delay	-0.78±1.06	-0.35±0.87	0.94±0.51	0.0353	>0.05	0.0101
Legend: AD – Alzheimer's disease only, VD – vascular dementia only, MxD – Mixed Alzheimer's and vascular dementia DR – 5 min delayed recall, measured with number of words obtained at the 5th min. 1 – during the first examination; 2 – during the second examination (2 years after the first one).						

Table 4. Word List Recognition

	AD	VD	MxD	p(AD,VD)	p(AD;MxD)	p(VD,MxD)
WLR 1 (words)	Med 15	Med 19	Med 15	0.0001	p>0.05	0.0001
WLR 2 (words)	Med 14	Med 19	Med 13.5	0.0001	p>0.05	0.0001
p(WLR 1,2)	0.0171	>0.05	0.0001			
2 year WLR delay	Med -1.0	Med 0.0	Med -1.5	0.0001	0.0419	0.0001
Legend: AD – Alzheimer's disease only, VD – vascular dementia only, MxD – Mixed Alzheimer's and vascular dementia WLR- Word List Recognition; 1 – first examination; 2 second examination (2 years after the first one).						