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NEUROPSYCHOLOGICAL EVALUATION OF NARRATIVE DISCOURSE PATTERNS IN INDIVIDUALS WITH EARLY STAGE VASCULAR DEMENTIA VS. PATIENTS WITH EARLY STAGE ALZHEIMER'S DISEASE

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SUMMARY

Background: Individuals in the early stages of dementia may demonstrate language difficulties. The aim of the study was an evaluation of the differences in narrative discourse abilities across two types of dementia, i.e., Vascular Dementia (VaD) and Alzheimer's Disease (AD) in comparison to the young and old elderly.

Material/ Methods: Four groups included patients presenting an early stage of VaD (N=14), an early stage of AD (N=14), a young control elderly – YE (N=19), and an old control elderly – OE (N=29) were set up. Neuropsychological testing examined the verbal and nonverbal functions classified into the following cognitive domains: verbal memory, executive functions, reasoning, attention/working memory. Narrations were elicited with two tasks of story retelling and were analyzed on the micro-, macro-, and super-structure level of discourse organization.

Results: The AD and VaD groups displayed a lower performance than the age-matched YE on tasks involving reasoning. The VaD participants outperformed patients with AD in verbal memory and narrative discourse. Discourse macrostructure analyses showed that the VaD reproduced more propositions than did the AD participants, but that these were comparable to YE and OE. There were more conjunctions in narratives reproduced by the VaD participants as compared to other groups, although this tendency was only present in the story but not in fairy tale reproductions themselves. Individuals in the AD group had more difficulties than YE and OE individuals in figuring out the moral of fairy tales. Clinical and control groups reproduced the microstructure and superstructure of texts comparatively well. Discourse recall correlated with performance on verbal memory, attention/working memory, and reasoning.

Conclusions: Differences in narrative discourse abilities were found. Alzheimer's Disease (AD) patients scored lower in verbal memory than did Vascular Dementia (VaD) patients. Both groups however obtained lower results than the young and old elderly.

Key words: working memory, attention, executive function, communication disorders, aging

INTRODUCTION

Vascular dementia (VaD)is the second most prevalent dementia type after Alzheimer's disease – AD (O'Brien& Thomas, 2015). VaD is commonly caused by the dysfunction of arteries and venous vessels carrying blood through the brain cortex, white matter and deep structures (Román et al., 1993). The clinical presentation varies greatly depending on the etiology, size, and location of brain lesions. Thus, several VaD syndromes have been differentiated such as: the multi-infarct dementia, the strategic single-infarct dementia, cerebral small vessel disease with subcortical dementia syndrome, hypoperfusion, or hemorrhagic dementia (Román et al., 1993). In many cases of small vessel disease, blood flow abnormalities result in white matter hyper-intensities, lacunes, microbleeds that may be accompanied by cortical-subcortical atrophy (Altermatt et al., 2019;Wallin et al., 2018). Cognitive disorders in VaD include primarily executive functions, verbal fluency, mental speed, attention, visual-spatial abilities, and motor functions. Memory and learning deficits start to appear later on in the course of the disease (Gorelick, Counts &Nyenhuis, 2016; Li et al., 2017; Wallin et al., 2016). In AD however, episodic memory failures are among the first alarming symptoms of the condition (Belleville et al., 2017). Patients with AD also present difficulties in visual-spatial abilities and language. Naming and verbal comprehension become impaired as the disease progresses (Tsantali, Economidis&Tsolaki, 2013). These data provide evidence of distinct cognitive profiles for patients in the early stage of VaD and AD (Gorelick, Counts &Nyenhuis, 2016), even though differentiating deficits related to vascular burden from those due to an early phase of neurodegenerative disease or cognitive fluctuations in normal aging remains challenging in many cases (Belleville et al., 2017; De Carolis et al., 2017).

Assessment of language and narrative discourse can enrich existing knowledge about cognitive functioning in various types of dementia. Narrative discourse is defined as a verbal or written statement in which the subject describes an event or series of events. It is transmitted through a linguistic-narrative form and is characterized by a distinctly organized form and content. It is also coherent which means that subsequent plots are interrelated (Kurcz, 2010). The discourse is built according to specific rules and has a structure (Thorndyke, 1977). The model of narrative discourse organization by Kintsch and van Dijk (1978) assumes that the narrative discourse is composed of propositions related to each other on three levels:

1. **Microstructure** – the surface layer of the text, which is the outcome of the meaning of words, grammar, syntax and the consistency of subsequent sentences (Kintsch& van Dijk, 1978;Osiejuk, 1994);
2. **Macrostructure**–reflects the content, organization and pragmatic components in a larger portion of the text (Osiejuk, 1994). On this level, assumed is logical and thematic continuity of information, i.e., coherence. The coherence of discourse can be disturbed by missing words, unfinished sentences, unrelated propositions, or repetitions (Duong et al., 2005; Marini et al., 2005);

3. **Superstructure**–constitutes a generally accepted organization scheme comprising: a) an introduction to the circumstances of the events; b) complicating action; c) evaluation or resolution. Understanding and remembering a narrative is best achieved when it is constructed according to this scheme (Osiejuk, 1994; Thorndyke, 1977).

In the subject literature we can find more research on discourse in AD than other types of dementia. Common errors in the utterances of AD patients include: anomia, semantic paraphasias, and grammar errors. Patients omit words, do not finish sentences, or use simple sentences (Croisile et al., 1996; Dijkstra et al., 2004; Ehrlich, Obler, & Clark, 1997; Maxim & Bryan, 2006; Pąchalska et al., 2015; Toledo et al., 2018). They often use pronouns (*e.g. this, there, he, she, it*) without specifying the noun to which they are referring to (March, Wales, & Pattison, 2006). Patients' discourse is also characterized by irrelevant judgments, digressions, and poor content (Freitas et al., 2018; Mitzner & Kemper, 2003; Toledo et al., 2018). Patients' attempts to remember and then reproduce the given text are marked by skipping a lot of important information and being unable to summarize the content (Chapman, Anand, & Sparks, 2006; Gawron, 2008).

Studies on discourse in a VaD patient population were primarily conducted in comparison to discourse in healthy, elderly patients in the initial phase of AD or patients with mixed dementia (Bryan et al., 2001; Duong et al., 2005). It has been observed that individuals with VaD speak less fluently, slower, and are more laconic than healthy people or AD patients (Baillon et al., 2003; Jensen, Chenery & Copland, 2006). Other studies have shown that VaD patients make the same mistakes as AD patients: on the microstructural level, difficulties are noted in naming and the omitting of words (Emery, Gillie& Smith, 2005); on the macrostructural level, VaD patients misuse pronouns, include digressions, or repeat the content (Jensen, Chenery & Copland, 2006). These disturbances in VaD patients are less intense than in patients in the early stages of AD (Hier, Hagenlocker&Shindler, 1985). Previous research also compared the characteristics of discourse recall in patients with VaD and patients with AD. Patients from the first group recalled more details. However, both groups showed comparable problems with providing their own discourse based on picture stories (Vuorinen, Laine & Rinne, 2000). Other reports have stated that the cognitive and language differences in VaD vs. AD patients may be difficult to outline at the early stages (Li et al., 2017; Stephan et al., 2017).

This study aimed at expanding the current knowledge on narrative discourse in the early phase of two dementia types, i.e., VaD and AD, as compared to two groups of healthy seniors: (1) young elderly – YE, who were the same age as the clinical groups; and (2) old elderly – OE controls, who were significantly older than the other groups. We also wanted to examine the associations between discourse (assessed with story retelling), and cognitive functioning (assessed with standard neuropsychological tests). Based on previous research, we hypothesized that narrative reproduction and cognitive functioning would be lower in individuals in the early stages of dementia than in YE or OE. According to pre-

vious research (Baillon et al., 2003; Chapman, Anand & Sparks, 2006; Croisile et al., 1996; Dijkstra et al., 2004; Ehrlich, Obler, & Clark, 1997;Emery, Gillie& Smith, 2005;Hier, Hagenlocker & Shindler, 1985;Jensen, Chenery & Copland, 2006; Laine et al., 1998; Maxim & Bryan, 2006;Vuorinen, Laine & Rinne, 2000), we also expected that the narratives in VaD and AD patients would be characterized by difficulties in maintaining the correct micro-, macro- and super-structure of the reproduced discourse in comparison to healthy controls.

The aim of the study was an evaluation of the differences in narrative discourse abilities across two types of dementia, i.e., Vascular Dementia (VaD) and Alzheimer's Disease (AD).

MATERIAL AND METHODS

Participants

A total of 76 older adults participated in the study, including 14 patients in the early stages of AD, 14 patients in the early stages of VaD or subcortical VaD (the group was named VaD), 19 healthy YE, and 29 healthy OE. The healthy individuals were aged 65+ and had not been diagnosed with diseases of the central nervous system (CNS) or cognitive disorders that could hinder everyday functioning. The OE group was older than all the other groups, while the YE group was at a comparable age to the clinical groups. The OE group was included in order to make comparisons between the cognitive symptoms of early phase of dementia and the manifestations of advanced aging.

Inclusion criteria

Intact sight and hearing, stable emotional state, without critical stenosis of the Internal Carotid Artery (ICA), without brain stroke. The YE and OE group included people without features of dementia (MMSE ≥ 24 pts.). However, with various health conditions, especially low blood pressure, hypertension, atherosclerosis, hypercholesterolemia, type II diabetes.

Exclusion criteria

Exclusion criteria were psychiatric and neurological diseases (except for VaD and AD), addictions, moderate and mild aphasia, poor understanding of speech, hemiparesis, paralysis, other focal neurologic deficits hindering the assessment: patients whose emotional state did not allow them to conduct the research or had previously experienced psychotic states, and patients who could not express their consent to participate in the research.

Screening tests

General cognitive status was assessed with the Mini Mental State Examination – MMSE (Folstein, Folstein, & McHugh, 1975). Emotional state was examined with the Beck Depression Inventory (BDI-II, Beck, Steer, & Brown, 1996). All sub-

Table 1. Demographics, general cognitive functioning, and depression in research groups

Variable	VaD N = 14 M (SD)	AD N = 14 M (SD)	OE N = 29 M (SD)	YE N = 19 M (SD)	$F/^*\chi^2$	η^2	Between-group differences
Age	77.5 (4.3)	75.1 (5.3)	83.8 (4.2)	73.8 (4.2)	< .001	.495	OE > YE,VaD, AD
Percent female	35.7	57.1	62.1	63.2	*ns	–	–
Education	13.8 (3.1)	13.6 (3.5)	14.9 (3)	14.9 (2. 6)	ns	.039	–
MMSE	26.4 (2.4)	23.1 (2.7)	28.1 (1.5)	28.2 (1.5)	< .001	.498	AD<VaD, OE, YE
BDI-II	8.7 (7.2)	5.8 (4.1)	8.2 (4.8)	8.5 (5.2)	ns	.038	–

Note. MMSE – Mini Mental State Examination; BDI –II – Beck Depression Inventory; ns – not significant; F – ANOVA test; *χ2 - Chi Square test.

jects were informed about the objectives of the study and gave consent prior to participation. Clinical groups were selected among those patients with early phase of AD or VaD at the Outpatient Memory Clinic, Institute of Neurology and Psychiatry, Warsaw, Poland. The decision about including a patient in the study was made by the geropsychiatrist and neuropsychologist at the abovementioned institution, according to prior examinations completed for clinical purposes, which included measures of attention, verbal learning, visual-spatial functioning, language, reasoning, and executive functioning (Kotapka-Minc,2007), medical history, computer tomography (CT) and/or magnetic resonance imaging (MRI) of the CNS. Diagnosis was carried out in accordance with the DSM-IV criteria (Wciórka, 2008) and the National Institute of Neurological Disorders and Stroke and the Association Internationale pour la Recherche et l'Enseignementen Neurosciences (NINDS-AIREN) (Román et al., 1993; 2002). Therefore, the VaD group was determined vs. AD based on evidence of ischemic, haemorrhagic and / or ischemic-hypoxic brain lesions. Patients also had hypertension, pressure drops, pressure surges, TIA, stroke, cardiac arrhythmias,cardiac arrest, intermediate coronary syndromes or atrial fibrillation. Decline was present in memory and at least two other domains, including orientation, attention, language-verbal skills, visuo-spatial abilities, calculations, executive functions, motor control, praxis, or abstraction. Diagnosis of early stage AD was established based on cortical atrophy, particularly in the anterior and medial portions of the temporal lobes, enlargement of the temporal horns, and widening of the sulci along with cognitive difficulties, particularly in episodic memory. The AD group was clinically heterogeneous – some patients had apparent enlargement of the subarachnoid spaces in the frontal, temporal and parietal lobes. Others had no signs of brain atrophy such as ventricular enlargement or signs of infarction in the brain, while others had been diagnosed AD with leukoaraiosis and/or coexisting cerebrovascular disease manifesting itself, for instance, in disinhibition (Román et al. 1993; 2002). Control participants were recruited from the wider community and patients' family members. They had declared good cognitive and physical health status and were not diagnosed with VaD or AD. In control participants, data on their health was obtained from self-reports and medical records when available.

Detailed characteristics of the studied groups have been published previously (Gawron et al., 2013; Gawron &Łojek, 2014). The research was approved by the Ethics Committee at the Faculty of Psychology, University of Warsaw, and was completed in accordance with the Helsinki Declaration.

One-way analysis of variance (ANOVA) with an independent variable group and Games-Howell post-hoc tests revealed that the OE group was significantly older than all the other groups ($F_{(3,72)}$=23.496, P<.001, η_p^2=.49), across which age did not differ significantly. The AD group obtained significantly lower scores on MMSE than all other groups (MMSE $F_{(3,72)}$ =23.829, P <.001,η_p^2=.49). There were no significant differences on MMSE between VaD, YE and OE groups. The groups did not differ in relation to years of education, or on the severity of the depression symptoms, which were non-substantial. The percent of female participants was 35.7 in the VaD group, 57.1 in the AD group, 63.2 in the YE group, and 62.1 in the OE group. There were no statistical gender differences across the groups (Table 1).

Neuropsychological Assessment

The administered neuropsychological test battery examined the following cognitive domains: attention, speed, memory, reasoning, executive, and visuo-spatial functions (Gawron et al., 2013). Attention was evaluated with the Bourdon Letter Cancellation Test (Dudek &Kietliński, 1968) where the accuracy score was calculated with the formula: ([number of letters to be cancelled – number of omissions] / [number of letters cancelled + number of omissions]). Short-term memory was measured with the Digit Span Forward subtest in its Polish version from the WAIS-R (WAIS-R(PL); Brzeziński et al., 1996). Working memory was measured with the Digit Span Backward subtest of the WAIS-R (PL). Memory and learning abilities were assessed with the California Verbal Learning Test-Polish normalization (CVLT; Łojek & Stańczak, 2010). Executive functions were assessed with the Wisconsin Card-Sorting Test – Polish normalization (WCST; Jaworowska, 2002). Visual-constructional abilities were measured with the Block Design subtest of the WAIS-R(PL): Block Design accuracy was calculated with standard scoring, and speed was calculated with the formula (mean time to complete design/number of designs completed; cf. Joy et al., 2001). Abstract reasoning and inferring were evaluated with the Similarities Subtest from the WAIS-R (PL) and the Inference Test of the Right-Hemisphere Language Battery-Polish version (RHLB-PL; Łojek, 2007), which requires one to follow a written text and to draw logical conclusions based on information hidden in the text, confronted with one's own general knowledge.

Discourse Assessment

Two stories, i.e., "The Story of a Robbery" (Łojek-Osiejuk, 1996) and the fairy tale "The Oak and the Reed" (an adaptation of the Aesop's fable, Kiernicka, 2002, see supplementary material), were used to assess the understanding and reproduction of narrative discourse. The researcher read the stories aloud once

and asked the participant to reproduce each text respectively. Statements were recorded using a voice recorder and then transcribed verbatim.

Micro-, macro- and superstructures of the narratives were analyzed based on previous research (Dijkstra et al., 2004; Fraser, 1999;Infantidou, 2005; Marini et al., 2005 and 2008; Osiejuk, 1994) and according to Polish lexicon, grammar, and classification of parts of speech in the Polish language dictionary compiled by R. Dunaj (Dunaj, 1996). **Microstructure indices** included: a) paraphasias, i.e., unintended utterances on the phonemic or semantic level, substitutions, neologistic paraphasias, i.e., non-real words used in place of the intended word; b) omissions, i.e., omitted words disrupting the logic of the utterance; c) repetitions i.e., word perseverations; d) conjunctions, i.e., words that link other words, phrases, or clauses together. **Macrostructure indices included**: a) propositions or judgements, i.e., simple sentences with a predicate (14 in the story and 38 in the fairy tale); b) pronouns; c) comments, i.e., sentences not directly related to the content; and d) pragmatic phrases that (i) divide the text into smaller units (*first, second, next, then, before, in the end, finally*); (ii) maintain the receiver's attention (*you know, right?*); (iii) hierarchize units (*in other words, for example, in brief, that is, in addition, moreover, as far as, except, because, in addition, anyway, to sum up, let's say,*); (iv) evaluate judgments (*apparently, even, almost, not at all, at least, maybe, obviously, evidently, unfortunately, interestingly, unexpectedly, probably, certainly, it would seem, above all, after all*); (v) describe wishes (*hopefully*); (vi) and opinions (*I think, I doubt, I believe, I suspect*).At the macrostructure, the topic of the provided story and the moral of the fairy tale were also examined. Examples of the correct topic are *“Burglary Night”, “Thief”*; incorrect: *“Bad Night”, “Anecdote”, “Vicious”*. An example of the correct moral is *"Sometimes the weak turn out to be actually strong, while the strong to be weak"*; incorrect *"Something strong can fall apart and something frail to hold up"*. **Superstructure indices:** preservation of discourse frame structure was assumed if propositions from both setting/introduction, action, and resolution of the narrative were reproduced by the study participant (Łojek-Osiejuk, 1996).

Recalled propositions were evaluated by three neuropsychologists blinded to group membership, according with the sets of model propositions (in the supplemental material). Inter-rater reliability was evaluated with Cohen's kappa coefficient. Raters’ agreement was calculated for the story and fairy tale retellings of 14 patients with VaD, 14 patients with AD, and 14 control elderly from a larger study sample (Gawron et al., 2013). Cohen's kappa coefficients were calculated for three pairs of raters (rater 1- rater 2, rater 1-rater 3, rater 2-rater3).Out of 120 paired comparisons for story propositions and 121 for fairy tale propositions, 86.7% yielded a significant result (Kappa $P<.05$), i.e., raters agreed on the propositions being the content of the story and fairy tale that the study participants retold successfully. The raters also generally agreed in rating the story themes and fairy tale morals given by study participants. Kappa coefficients for story theme were as follows: rater 1- rater 2 Kappa = .40, $P < .01$; rater 1-rater 3 Kappa = -. 09, $P < .001$; rater 2-rater 3 Kappa = - .05, $P = .07$. Kappa coefficients for the fairy

Table 2. Pattern matrix of the variables' loadings in the neuropsychological components (n = 76)

Component	Test	Variable	Loading
Verbal memory	CVLT	Long Delay Free Recall	.905
		List A Tasks 1–5	.923
	RHLB-PL	Inference Test	.512
Reasoning	WAIS-R (PL)	Similarities	.542
		Block Design - Accuracy	.852
		Block Design - Speed	-.906
Executive functions	WCST	Correct Responses	.839
		Percent Perseverative Responses	-.870
Attention / working memory	WAIS-R (PL)	Digit Span	.461
	Bourdon Letter Cancellation	Accuracy	.887
	RHLB-PL	Inference Test	.566

Note. Loadings > 0.4 are shown. CVLT – California Verbal Learning Test – Polish normalization; RHLB-PL – Right Hemisphere Language Battery – Polish version; WAIS-R (PL) – Polish version of the Wechsler Adult Intelligence Scale – Revised; WCST – Wisconsin Card Sorting Test – Polish normalization.

tale moral were as follows: rater 1- rater 2 Kappa = .49, *P* = .005; rater 1-rater 3 Kappa = .122, *P* = not significant; rater 2 – rater 3 Kappa = .39, *P* = .05. Statistical analysis was conducted on the ratings of rater 3.

Statistical Analysis

A principal components analysis (PCA) with Varimax rotation was performed with chief 10 variables from the neuropsychological tests. This resulted in four orthogonal components representing cognitive domains (the measure of the adequacy of the selection of the sample K-M-O = .620, Bartlett's sphericity test approximate χ^2 = 266.210, df = 45, *P* <.001). The factors accounted for 73.6% of the total variance of results: the verbal memory factor for 22.6%, the reasoning factor for 19.7%, the executive function factor for 15.7%, the attention and working memory factor for 15.5%. The matrix of rotated components is shown in Table 2. Scores on the Inference Test of the RHLB-PL were assigned equally to the verbal memory factor as well as to the attention and working memory factor (Table 2).

Neuropsychological differences between the examined groups were evaluated with one-way analysis of variance (ANOVA). Differences in discourse reconstruction were assessed using ANOVA for variables with normal distribution, and Kruskal-Wallis and Chi-square tests for variables with non-normal distribution or categorical variables. The relationships between neuropsychological functioning and discourse were studied using Pearson *R* correlation coefficient.

RESULTS

Neuropsychological Assessment

Factors were converted into T-scores with mean M = 50 and standard deviation SD = 10. One-way ANOVA was applied with *post-hoc* Games-Howell tests and a correction for the significance at *P* <.006(the result of dividing.05/8, i.e.,

by the number of groups plus the number of components. Significance *.05> P> .006* was treated as a statistical trend). It turned out that the groups differed on the verbal memory factor ($F_{(3.68)}$=21.128, *P*<.001, η^2=.482)and the reasoning factor ($F_{(3.68)}$=3.313, *P*<.05; η^2=.141). The OE and YE groups scored higher than the VaD and AD groups. The lowest results were obtained by the AD group –in terms of verbal memory their scores were lower than in the groups OE (*P*<.001), YE (*P*<.001) and VaD (*P*<.001). In terms of reasoning, the scores of patients with early phase AD were lower vs. the YE group (*P*<.05). The results obtained by patients with early phase VaD on reasoning were lower only in comparison to the YE group (*P*<.05). The YE group obtained the highest results in all domains. The OE group had decreased functioning in the reasoning domain, where they scored lower than the YE group (*P*<.05). Otherwise, their results were comparable to those obtained by the VaD group (Table 3).

Cognitive patterns in the research groups are presented in Fig. 1. Bars represent mean *T* scores (*M* = 50, *SD* = 10) for verbal memory, reasoning, executive

Table 3.Neuropsychological outcomes in research groups

Component	VaD N = 14 M (SD)	AD N = 14 M (SD)	OE N =29 M (SD)	YE N = 19 M (SD)	*F*	η^2	Between-group differences
Verbal memory	48.7 (7.6)	35.5 (4.9)	52.6 (7.8)	55.3 (7)	< .001	.482	AD<VaD, OE, YE
Reasoning	46.7 (9.6)	47.4 (8.8)	48.1 (10.9)	55.9 (7.3)	< .05	.141	YE >VaD, AD, OE
Executive functions	48.6 (9.3)	51 (11.7)	49.3 (11.7)	50.3 (6.9)	ns	.007	–
Attention/working memory	48 (12.2)	50 (11.6)	49.4 (10.4)	52.6 (6.9)	ns	.027	–

Note. F – ANOVA test; ns – not significant.

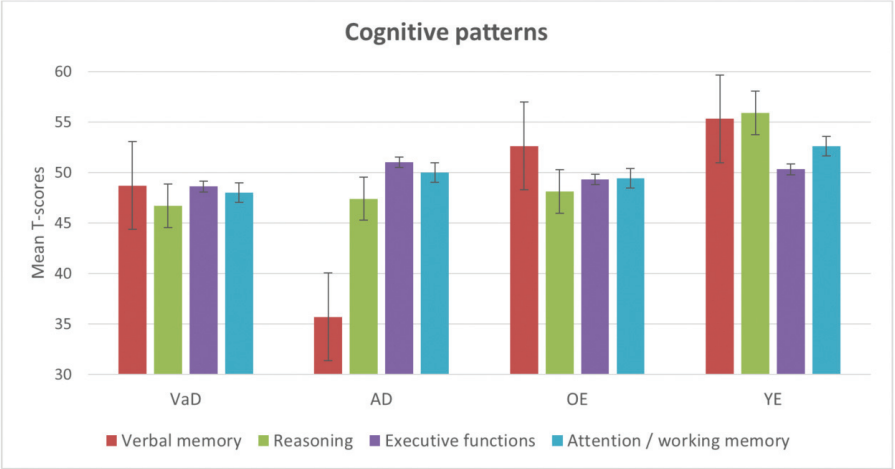

Fig. 1. Cognitive patterns in the research groups. Bars represent mean T scores (M = 50, SD = 10) for verbal memory, reasoning, executive functions, and attention/working memory. VaD = Vascular Dementia; AD = Alzheimer's disease; OE = old elderly; YE = young elderly

functions, and attention/working memory. VaD = Vascular Dementia; AD = Alzheimer's disease; OE = old elderly; YE = young elderly.

Discourse Assessment

First, the scores in groups obtained from the story and fairy tale retelling were compared with the Kruskal-Wallis ANOVA, the *post-hoc* U Mann-Whitney statistic, or the chi-square. In the story retelling, the groups differed on the macrostructure indicators: the number of the reconstructed propositions ($H_{(3)}$=19.451, *P*<.001) and the number of correctly used conjunctions ($H_{(3)}$=7.645, *P*=.54). The AD patients recalled fewer story propositions than the OE group (U=64.50, *P*<.001), the YE group (U=25.00, *P*<.001) or the VaD group (U=39.00, *P*<.01). The VaD patients incorporated slightly more conjunctions in their statements than the OE participants (U=125.00, *P*<.05), the YE group (U=70.00, *P*<.05), and the AD group (U=50.00, *P*<.05). There were no significant group differences in terms of story microstructure indices. The correct story topic was named by a comparable number of participants across the groups. A notable percentage of participants from all groups recalled at least one proposition from both story setting, action, and resolution (Table 4).

In the fairy tale task, differences were observed on the micro- and the macrostructure indices – the number of recalled propositions ($F_{(3,72)}$=6.328, *P*<.005, η^2=.209) and the number of correctly used conjunctions ($H_{(3)}$=15.372, *P*<.005). The retellings also differed between the groups on the number of words ($F_{(3,72)}$ = 4.195, *P*<.01,η^2=.149) and sentences ($F_{(3,72)}$= 5.69, *P*<.002,η^2=.192). Patients with

Table 4. Story retelling in research groups

Variable	VaD (N=14) M (SD)	AD (N=14) M (SD)	OE (N = 29) M (SD)	YE (N= 19) M (SD)	F/ ªH / *X^2	Between-group differences
Words	46.3 (21)	30.5 (13)	42.6 (24.3)	42 (22.7)	ns.	–
Sentences	11.3 (4.6)	7.6 (3.9)	10.8 (3.9)	10.4 (4.2)	ns.	–
Paraphasias	0 (0)	0.14 (0.36)	0.14 (0.5)	0.16 (0.5)	ª ns.	–
Incomplete sentences	0.36 (0.6)	0.3 (0.6)	0.2 (0.4)	0.16 (0.37)	ª ns.	–
Repeated words	0.9 (2)	0.6 (0.9)	1 (2.5)	0.2 (0.7)	ª ns.	–
Propositions	8.2 (3)	5.2 (2.2)	8.3 (2.1)	9.5 (2.4)	< .001	AD<VaD, OE, YE
Conjunctions	4.3 (2.8)	2.3 (1.4)	2.9 (2.7)	2.9 (4.2)	ª = .54	VaD > OE, YE, AD
Pronouns	0.64 (0.7)	0.5 (0.7)	0.66 (1)	0.8 (1)	ª ns.	–
Comments	1.1 (2)	0.3 (1)	0.6 (2.4)	0.95 (3.5)	ª ns.	–
Pragmatic phrases	2.3 (2.3)	2.8 (1)	2.1 (2.9)	1.16 (1.5)	ª ns.	–
Correct story subject (%)	85.7	71.4	79.3	94.7	*ns.	–
Full fairy supersturcture (%)	71.4	78.6	79.3	89.5	*ns.	–

Note. % – percent of participants in group; ns. – not significant; F – ANOVA test; ªH – *Kruskal*–Wallis *H* test; *χ2 - Chi Square test.

AD recalled fewer propositions than the VaD (*P*<.005)), the OE (*P*<.005) or the YE group (*P*<.005). Patients with AD used fewer conjunctions in their statements than the VaD (*P*<.005), the OE (U=59.00, *P*<.001) or the YE group (U=53.00, *P*<.005). Fairy tales in patients with AD had fewer words than the fairy tales in the OE (*P*<.05) and YE group (*P*<.05), and fewer sentences than in the OE (*P*<.005),YE (*P*<.01) and VaD group (*P*<.05).The VaD patients reproduced a higher number of fairy tale propositions and used more conjunctions than patients with AD (U=46.00, *P*<.05). The groups differed on the number of people who provided the correct abstract moral ($chi^2_{(1)}$=7.404, *P*=.06). Fewer individuals in the AD group reported a moral than in the YE group ($chi^2_{(1)}$=7.404, *P*=.06) and in the OE group ($chi^2_{(1)}$=3.802, *P*=.051). Fewer participants with VaD provided an accurate moral than in the YE group ($chi^2_{(1)}$=3.860, *P*<.05).The groups reproduced the fairy tale structure at a comparable level, i.e., a similar percentage of participants from all groups recalled at least one proposition from both fairy tale setting, action, and resolution (Table 5).

When the story and fairy tale reproduction results were pulled for a single analysis, group differences were found in the number of words ($F_{(3.72)}$=4.240, *P*<.001, η^2=.150), the number of sentences ($F_{(3.72)}$=6.195, *P*<.005, η^2=.205) as well as the number of recalled propositions ($F_{(3.72)}$=9.583, *P*<.001, η^2=.285). Patients at early phase AD underperformed all other groups. Their reproductions included fewer words (all comparisons with other groups *P*<.05), sentences (all

Table 5. Fairy tale retelling in research groups

Variable	VaD (N=14) M (SD)	AD (N=14) M (SD)	OE (N=29) M (SD)	YE (N=19) M (SD)	F/ [a]H / *χ^2	Between-group differences
Words	110.6 (48.2)	68.4 (41.8)	114.9 (44.1)	116.5 (42.4)	< .01	AD< YE, OE
Sentences	22.1 (7.4)	12.9 (7.4)	22.4 (8.1)	22.3 (7.4)	< .002	AD<VaD, OE, YE
Paraphasias	0.6 (1.1)	0.4 (0.6)	0.6 (1)	0.5 (0.8)	[a] ns.	–
Incomplete sentences	0.36 (0.6)	0.2 (0.4)	0.6 (0.8)	0.37 (0.5)	[a] ns.	–
Repeated words	1.36 (2.2)	0.5 (1.3)	2.31 (3.9)	1.37 (1.9)	[a] ns.	–
Propositions	13.1 (3.9)	7.3 (3.9)	13 (5)	14.3 (5.8)	< .002	AD<VaD, OE, YE
Conjunctions	12.7 (4.5)	8 (4.2)	14.8 (5.1)	14.4 (5.9)	[a]< .005	AD<VaD, OE, YE
Pronouns	3.8 (3.2)	2.1 (2.4)	4.7 (3.1)	3.9 (3.4)	[a] ns.	–
Comments	1.7 (4)	1 (1.4)	0.8 (2.7)	0.9 (2)	[a] ns.	–
Pragmatic phrases	5 (4.8)	3.6 (3)	5.9 (5.4)	6.4 (4.1)	[a] ns.	–
Correct tale moral (%)	28.6	21.4	34.5	63.2	*	AD< YE, OE
Full fairy tale supersturcture (%)	71.4	71.4	62.1	78.5	*ns.	–

Note. % – percent of participants in group; ns. – not significant; F – ANOVA; [a]H – *Kruskal*–Wallis *H* test; *χ2 - Chi Square test.

Table 6.Narrative retelling in research groups – story and tale results combined

Variable	VaD (N=14) M (SD)	AD (N=14) M (SD)	OE (N=29) M (SD)	YE (N=19) M (SD)	F/ [a]H	Between-group differences
Words	156.9 (58.5)	98.9 (47.3)	157.5 (58.3)	158.5 (55)	< .01	AD < VaD, OE, YE
Sentences	33.4 (10.3)	20.6 (8.7)	33.2 (10.1)	32.7 (9.9)	< .005	AD < VaD, OE, YE
Paraphasias	0.6 (1.1)	0.5 (0.9)	0.7 (1.4)	0.6 (1.2)	[a] n.s.	
Incomplete sentences	0.7 (1.1)	0.5 (0.7)	0.8 (0.9)	0.5 (0.5)	[a] n.s.	
Repeated words	0.03 (0.06)	0.036 (0.06)	0.034 (0.04)	0.021 (0.04)	[a] n.s.	
Propositions	21.3 (5.5)	12.5 (5.5)	21.2 (5.9)	23.7 (7.6)	< .001	AD < VaD, OE, YE
Conjunctions	17 (6.4)	10.4 (4.4)	17.7 (6.9)	17.3 (7.5)	[a]< .005	AD< VaD, OE,YE
Pronouns	4.4 (3.2)	2.6 (2.2)	5.3 (3.5)	4.7 (3.9)	[a] n.s	
Comments	2.9 (4.8)	1.3 (2.2)	1.4 (5.1)	1.8 (4.7)	[a] n.s	
Pragmatic phrases	7.4 (6.3)	6.4 (4.2)	8 (7.1)	7.5 (4.7)	[a] n.s	

Note. % – percent of participants in group; ns. – not significant; F – ANOVA; [a]H – *Kruskal*–Wallis *H* test.

comparisons *P*<.05), and propositions (all comparisons *P*<.005). Significant differences were also found for conjunctions ($H_{(3)}$=14.401, *P*=.05) where the reproductions of the AD participants included fewer correct conjunctions than the retellings of VaD (*P*<.005), OE (*P*<.001), and YE (*P*<.005) participants (Table 6).

Associations between Neuropsychological and Discourse Characteristics

The results of 74 participants revealed that discourse reproduction was related to the efficiency in several cognitive domains. Individuals with higher verbal memory retold stories using more words (r=.259, *P*<.05), sentences (r=.245, *P*<.05), and propositions consistent with the story content (r=.478, *P*<.001). Individuals with more efficient attention and working memory reproduced more story propositions (r=.361, *P*<.005). Individuals with higher reasoning abilities used more words (r =-.286, *P*<.05), fewer conjunctions (r=-.306, *P*<.01), and fewer pragmatic phrases (r=-.320, *P*<.01) when retelling the story. Participants with higher verbal memory retold fairy tales using more words (r=.474, *P*<.001), sentences (r=.490, *P*<.001), propositions (r=.431, *P*<.001), conjunctions (r=.422, *P*<.001), and pronouns (r=.369, *P*<.002). More fairy tale propositions were additionally reproduced by participants with higher outcomes on attention/working memory (r=.336, *P*<.005). Similar results were found after pulling the story and fairy tale results. Positive correlations were found among verbal memory and the number of words (r=.468, *P*<.001), sentences (r=.476, *P*<.001), propositions (r=.505, *P*<.001), conjunctions (r=.390; *P*<.005), and pronouns (r=.364, *P*<.005). Higher attention/working memory abilities were correlated with more propositions consistent with the texts (r=.389; *P*<.005). Finally, higher reasoning abilities were associated with a lower number of comments i.e. propositions not directly related to the content, beside the point (r=-.278; *P*<.05).

DISCUSSION

The present study revealed distinct cognitive patterns in patients diagnosed with the early stage of two dementia types, i.e., VaD vs. AD. The participants with VaD demonstrated difficulty with reasoning as evaluated with the WAIS-R (PL) Similarities and Block Design in comparison to the age-matched YE group. Moreover, patients with VaD outperformed patients with AD on verbal memory as measured with the CVLT and the RHLB-PL Inference Test. Patients with VaD also reproduced more narrative details than did patients with AD. The AD group performed lower than all other groups on verbal memory tasks and recalled fewer details from the narratives in comparison to other groups. Patients with AD also showed difficulties on the reasoning domain in comparison to the YE group. The current results are in line with numerous clinical observations and research outcomes demonstrating that episodic memory deficits are the primary cognitive symptoms in the development of AD (Bäckman et al., 2005; McKhann et al. 2011; Vyhnalek et al., 2014). In patients with early stage VaD, verbal memory performance was lower than in the control groups, but the differences were not statistically significant. In line with prior studies, it may be assumed that difficulties in learning new information in the VaD group were not due to the immediate forgetting of newly learned information (Gorelick, Counts, &Nyenhuis, 2016; Nyenhuis et al. 2004).

The current results demonstrated no significant group differences on executive functions as measured with the WCST. Potential declines including reduced inhibition of previous mental sets, perseveration, and difficulties in problem solving were of a similar degree in the studied groups. Such findings are contrary to our assumptions since we expected deterioration in executive functions in the VaD group (Román et al., 1993). However, there has been evidence demonstrating declines in all the above functions in both early phase of VaD as well as AD(McKhann et al., 2011; Wallin et al., 2016). It has also been suggested that the WCST may not be sensitive to detect individuals at the early phases of dementia as much as speeded tests such as the Trail Making Test or fluency tasks (Gorelick, Counts, &Nyenhuis, 2016; Hammers et al., 2016), with the current findings possibly being in line with this statement. Furthermore, the results of the present study suggest that the clinical and control groups were not impaired on attention/working memory as measured with the WAIS Digit Span, the Bourdon Letter Cancellation, and the Inference Test. Such results are in line with meta-analyses reporting small decrements in visuospatial skills and attention in patients at the earliest phases of AD(Bäckman et al., 2005) and small decrements of attention in patients with post-stroke Vascular Cognitive Impairment-No Dementia (Nyenhuis et al. 2004).Another possible explanation to clarify the observed cognitive patterns is the potential effect of cognitive reserve (CR), i.e., pre-existing cognitive processes or compensatory strategies helping the brain to cope actively with age-related alterations, neurodegenerative or vascular pathologies. According to this approach, it is likely that participants with high CR

could use cognitive and brain compensation more flexibly in order to maximize cognitive performance (Devita et al., 2020).

With reference to the abilities of retelling narrative discourse, between-group differences in the current study were observed on the macrostructure level of discourse. The VaD participants reproduced a higher number of propositions than did the AD participants but comparatively the same as the healthy groups. There were more conjunctions in stories reproduced by the VaD participants as compared to other groups, although this tendency was not present in fairy tale reproductions. Individuals in the AD group showed more difficulties in providing the fairy tale moral than YE and OE individuals. Healthy and clinical groups reproduced the microstructure and superstructure of texts comparatively well. The results of the current study are in agreement with prior research reporting lower story recall in individuals at the early phase AD than in patients with mild subcortical VaD (Traykov et al., 2005). When studying conversational discourse, it had been observed that patients with VaD produce statements that are more similar to the statements of control individuals than the statements of patients with AD, in which many sentences were not related to the central theme of the conversation (Laine et al., 1998). A more recent study by Toledo et al. (2018) compared the Cinderella storytelling of individuals diagnosed with AD or amnestic mild cognitive impairment (MCI), and healthy controls. Participants were instructed to narrate the story in their own words based on a strip cartoon of the Cinderella story. The stories provided by the participants were analysed through a program in terms of metrics related to cohesion and coherence. Patients with mild AD performed the lowest as compared to the other groups: their discourse was less informative and less coherent, narrative structure was not always preserved. However, such abnormalities were difficult to notice in patients in earlier phases of dementia such as MCI. This is congruent with the findings from the present study as we found few micro- and macro-linguistic errors such as paraphasias, repetitions, missing words, incomplete sentences, or irrelevant propositions in the utterances of all the studied groups. Findings from the present study also demonstrate that patients at the early stage of AD have more difficulty with providing a moral derived from a fairy tale than do individuals with VaD and the control elderly group matched in age. Similar outcomes have been reported in prior studies on providing a generalised meaning of text passages (Chapman et al., 2006).

Reproduction of discourse content was associated primarily with the efficiency of verbal memory, attention/working memory, and reasoning abilities. Individuals with better cognitive status provided narratives containing more words and propositions, used more conjunctions and pronouns. Other discourse indices were correlated with cognitive decline. As such, people with lower reasoning functions intruded more propositions not directly related to the content of the story and pragmatic expressions. The above results are consistent with theoretical models which assume that the remembering of the discourse involves multiple cognitive resources (Burke & Shafto, 2008; Kintsch & van Dijk, 1978;

Wingfield & Stine-Morrow, 2000). The results of the present study also suggest that more frequent use of conjunctions may be a distinguishing feature of statements produced by the VaD patients. Subsequent studies should confirm this tendency as it was revealed only in the reproductions of the story but not the fairy tale. Conjunctions can serve as fillers which are used when the discourser has difficulties with continuing the narration (e.g. *and, and that, if*), and therefore may reflect cognitive decline. But they may also be associated with an individual expressive style (Bestgen, 1998; Gayraud, Lee, & Barkat-Defradas, 2011; Marini et al., 2008).

Despite lower cognitive function in clinical groups as compared to healthy individuals, most people managed to recapture the propositions from the introduction, complicating action as well as the resolution of the story and fairy tale, i.e., to recreate the superstructure – the main content framework. This is consistent with prior evidence showing that seniors remember the general content of the macrostructure quite well, and at the same time fail to remember the detailed information (Chapman, Anand, & Sparks, 2006). It has been suggested that this tendency may reveal seniors rely on the knowledge contained in the situational model, i.e., a mentally scripted representation of the events and characters described in the text (Radvansky& Dijkstra, 2007). Furthermore, the results of our study indicate that remembering the superstructure is preserved to a certain extent in patients at the early stages of dementia, even if the remembered content of the narrative is reduced..

Limitations of the study include the difficulties in studying narrative discourse associated with a wide diversity in verbal fluency and the length of discourse produced by individuals. Patterns of story and fairy tale recall might differ, as in the present study, which may relate their length, content, and plot complexity. Therefore, in order to obtain a better understanding and evaluation of discourse abilities, it is advisable to administer several tasks varying on the aforementioned dimensions (Wingfield & Stine-Morrow,2000). The second limitation concerns lack of brain imaging data from the entire study cohort and the small size of the clinical groups comprising individuals at the earliest stages of dementia. Further research is also needed to determine which indices of the discourse can be reliable, universal indicators of any preserved cognitive function, and which are indicators of impaired functions. This knowledge will allow the development of novel diagnostic tools to help clinicians examine patients' narrative discourse (Asgari, Kave, & Dodge, 2017; Fraser, Metzler, & Rudzicz, 2016).

To sum up, the study revealed few differences and many similarities between neuropsychological and narrative patterns in VaD, AD and normal aging. Differences were observed in verbal memory, reasoning and narrative recall with the AD group performing more poorly and the VaD group performing similarly to the control groups.

From a clinical perspective, the results of this study encourage one to use narrative recall as a method complementing any standard neuropsychological examination. Discourse recall may expand episodic memory, reasoning and at-

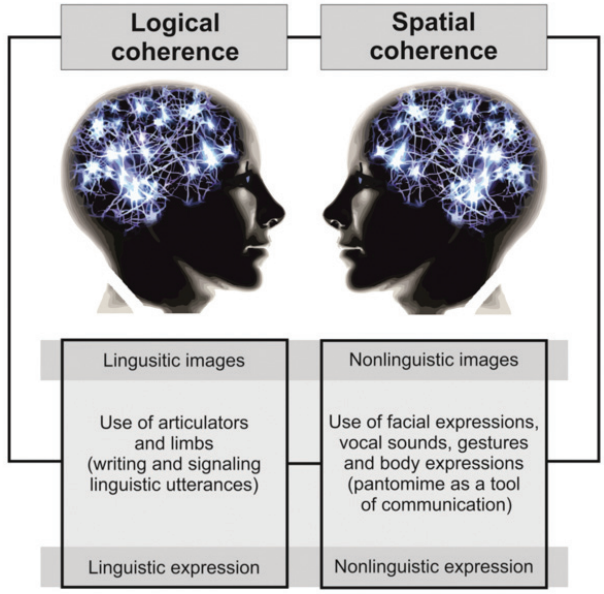

Fig. 2. Functioning of the right and left hemispheres of the brain within the Self system during narrative discourse.
Source: M. Pąchalska (2019), with permission.

tention assessment in clinical settings (De Carolis et al., 2016). It should be stressed that patients with VaD as well as with AD, because of brain damage, exhibit disturbances in logical or spatial coherence (fig. 2) depending on the location of the damage (structures and neural connections) in the right or left hemisphere of the brain (Pąchalska et al. 2015). Linguistic representations are more or less disintegrated, which makes creating language constructions more difficult, as a result of which the process of creating ideas about yourself and the world is disturbed, which is why the image of oneself and, as a result, the whole system of the self is disintegrated (Ehrlich, Obler, Clark 1997). Damage to the subcortical structures and connections is also not without significance, however, the picture of disorders is different. Narrative discourse may revive the patterns of neural connections between the left and right hemispheres of the brain and improve the ability to communicate with others, and therefore the Self system of these patients (Pąchalska 2019).

Our findings encourage the use of narrative reproduction as a method complementing any standard neuropsychological examination.

CONCLUSIONS

We found differences in narrative discourse abilities. Alzheimer's Disease (AD) patients obtained worse results in verbal memory than did Vascular De-

mentia (VaD) patients. Both groups obtained, however, worse results than did the young and old elderly.

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Conflict of Interest

The authors had no conflict of interest when conducting and reporting this research.

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