Cognitive predictors of functional decline in vascular dementia

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SUMMARY

Background   This study examined changes in cognitive-functional relationships in vascular dementia (VaD) over the course of one year.
Methods   Twenty-four patients with probable VaD were administered the Dementia Rating Scale (DRS). Caregivers completed an informant-based measure of instrumental (IADL) and basic activities of daily living (BADL). Follow-up assessment was conducted one-year post-baseline.
Results   Logistic regression revealed that changes in the DRS Initiation/Perseveration and DRS Memory subscales were significantly associated with declines in IADLs and BADLs, respectively.
Conclusions   Among patients with VaD, longitudinal changes in IADLs and BADLs are most strongly associated with changes in executive functioning and memory abilities, respectively. Findings suggest that different cognitive functions subserve complex instrumental and rote, habituated basic functional activities, and neuropsychological screening measures are useful in the prediction of such functional changes. Copyright © 2006 John Wiley & Sons, Ltd.

KEY WORDS — activities of daily living (ADLs); vascular dementia (VaD); functional decline; neuropsychology; cognition; memory; executive function; Dementia Rating Scale (DRS)

Impairment in instrumental activities of daily living (IADLs) or basic activities of daily living (BADLs) is an essential feature for a dementia diagnosis. Elucidating the cognitive predictors of functional decline is an important research endeavor, as clinicians are frequently involved in prognostic determinations regarding patients' personal independence and safety. Such information would be invaluable in cases where patients lack direct care providers.

Cognitive-functional relationships have been examined in cross-sectional studies of Alzheimer's disease (AD), with executive dysfunction as a significant correlate (Boyle *et al*., 2003). Cognitive-functional relationships have received less attention in vascular dementia (VaD), despite its prevalence. A better understanding of longitudinal functional decline is needed, particularly with regard to the identification of dementia screening predictors of functional change.

METHODS

This is a longitudinal study of cognitive capacity and functional decline in 36 patients with VaD. Participants included 18 women and 18 men enrolled

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in a 12-month, double-blind, placebo-controlled pharmacologic trial of citicoline for the treatment of VaD (18 = drug, 18 = placebo). Pharmacologic trial findings revealed no significant drug effect on cognitive or functional outcomes (Cohen *et al.*, 2003). Due to attrition, one-year follow-up data is based on 24 individuals (placebo = 12, citicoline = 12).

Probable VaD diagnoses were made by clinical neurologists according to NINDS/AIREN and DSM-IV criteria. Inclusion criteria required that participants were age 55 or older with MMSE scores ranging 9–24. Exclusion criteria included current terminal systemic disease, unstable medical condition, other neurological disorder (e.g. Alzheimer's disease), or major psychiatric disturbance. The following assessments were performed at baseline and one-year later:

Dementia rating scale (DRS; Mattis, 1973)

The DRS provides an estimate of global cognitive functioning tapping five cognitive areas: *Attention (ATT)*: auditory-visual and verbal-nonverbal attention; *Initiation/Perseveration (I/P)*: initiation, switching, and termination of cognitive activities; *Conceptualization (CONCEPT)*: verbal and nonverbal abstraction; *Construction (CONSTR)*: visuoperception and reproduction of geometric designs; *Memory (MEM)*: verbal and nonverbal recall and recognition.

Instrumental activities of daily living & physical self-maintenance scale (IADL-PSMS)

The IADL–PSMS is an informant-based measure of IADLs (shopping, housekeeping/maintenance, cooking, driving, finances, medication management, telephone use, laundry) and BADLs (bathing, grooming, dressing, feeding, toileting, physical ambulation). Scoring is based on performance needs (i.e., *dependence*, *requires assistance*, *independence*).

Procedures

The study was approved by the local IRB, and informed consent was obtained from all participants and primary caregivers. Procedures were identical at baseline and 12-month assessment. Cognitive measures were administered by a trained psychometrician, while primary caregivers completed the IADL-PSMS.

RESULTS

Demographic characteristics are presented in Table 1. No significant differences were observed between participants retained versus those lost to attrition for baseline age ($F_{(1,35)} = 0.26$, ns), education ($F_{(1,35)} = 2.10$, ns), DRS total ($F_{(1,35)} = 1.20$, ns), IADLs ($F_{(1,34)} = 0.96$, ns), or BADLs ($F_{(1,34)} = 1.23$, ns).

To balance predictive capability with model parsimony and account for multicollinearity, a stepwise logistic regression procedure was used to assess the contribution of five cognitive change scores to the IADL and BADL change scores. IADL and BADL change scores were each recoded into dichotomous variables for the analysis (i.e. decline *vs* no decline). Both forward and backward stepwise procedures, using a likelihood ratio criterion for variable addition/deletion, selected a model with I/P change as the single significant predictor of IADL change (beta = 0.25, $p = 0.03$) and MEM change as the single significant predictor of BADL change (beta = 0.61, $p = 0.03$).

Table 1. Demographic statistics and baseline and follow-up cognitive and functional data

		M (SD)	
Demographics	Age (years)	77.56 (5.74)	
	Education (years)	12.0 (3.47)	
		Baseline M (SD)	12-months M (SD)
DRS Subscales (range)	ATT (0–37)	33.83 (3.24)	33.38 (4.03)
	I/P (0–37)	25.75 (7.05)	23.25 (9.04)
	CONCEPT (0–39)	28.92 (5.70)	27.83 (9.47)
	CONSTR (0–6)	5.17 (1.61)	4.33 (1.99)
	MEM (0–25)	15.46 (4.55)	13.29 (5.61)
ADL Subscales (range)	IADL (0–16)	8.67 (4.31)	6.88 (4.01)
	BADL (0–12)	10.58 (1.72)	9.96 (1.65)

M = mean; SD = standard deviation; DRS = Dementia Rating Scale; ATT = Attention subscale; I/P = Initiation/Perseveration subscale; CONSTR = Construction subscale; CONCEPT = Conceptualization subscale; MEM = Memory subscale; ADL = activities of daily living; IADL = instrumental activities of daily living; BADL = basic activities of daily living.

DISCUSSION

Among patients with VaD, changes in executive functioning and memory over a one-year period were predictive of IADL and BADL changes, respectively, suggesting that different cognitive functions subserve complex and rote, habituated functional activities. These findings are consistent with prior cross-sectional studies in AD linking executive functioning to IADLs (Boyle *et al*., 2003; Cahn-Weiner *et al*., 2003) and memory to BADLs (Drachman *et al*., 1990) and augment the cognitive-functional literature by demonstrating that such relationships maintained in VaD.

The current study is limited by a small sample and brief follow-up period. Future studies should include larger samples and follow patients for several years. Inclusion of mild cognitive impairment participants with a suspected vascular etiology may help identify early functional compromises.

Our study highlights the importance of longitudinally assessing cognitive-functional relationships in dementia as well as the relevance of using neuropsychological screening measures in the prediction of functional changes. Such information has clinical significance, as changes in executive functioning and memory appear to have the strongest relationship to changes in IADLs and BADLs, respectively.

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