Neuropsychological Prediction of Memory Performance in Parkinson's Disease

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Introduction

Cognitive changes are common in individuals with Parkinson's disease (PD). Studies of memory performance in PD, however, have yielded inconsistent findings. Many believe the memory dysfunction associated with PD may be due to executive deficits caused by pathology of striato-frontal circuitry. Because significant memory deficits may represent more extensive neuropathology and mark the onset of dementia, it is important to clarify the nature of memory problems in PD. Word list memory tests such as the California Verbal Learning Test and Hopkins Verbal Learning Test are commonly used to assess memory in neurologic populations. The goal of this study was to determine which neurocognitive tests were most strongly associated with level of performance on a verbal list learning task in a well-defined clinical sample of PD patients.

Methods

Sample Demographic and Clinical Characteristics

	N	Mean	SD	Range
Age	125	65.35	9.56	40-84
Education (yrs)	125	15.16	2.78	11-20
Duration of Symptoms (yrs)	125	8.49	5.76	0.83-30
UPDRS Motor (On Meds)	109	24.8	8.98	7-50
MMSE	125	28.4	1.5	24-30

Measures

1 **Hopkins Verbal Learning Test (HVLT)**

2 Mini Mental Status Exam (MMSE)
3 Dementia Rating Scale-2 (DRS-2)
4 Digit Span Forward & Backward
5 Trail Making Test A & B (TMT-A/-B)
6 Verbal Fluency (COWA: FAS)

7 Animal Naming
8 Stroop Color & Word Test
9 Boston Naming Test (BNT)
10 Facial Recognition Test
11 Judgment of Line Orientation (JoLO)

Data Analysis   **Cluster analysis** was used to distill patterns among subjects' HVLT Immediate, Delayed, and Recognition T-scores. **T-tests** were used to examine between cluster differences for clinical and test data. Stepwise **discriminant function analysis** and **binary logistic regression** were used to determine which neurocognitive tests best predicted group membership.

Results

Neuropsychological Test T-Score Means for All Subjects
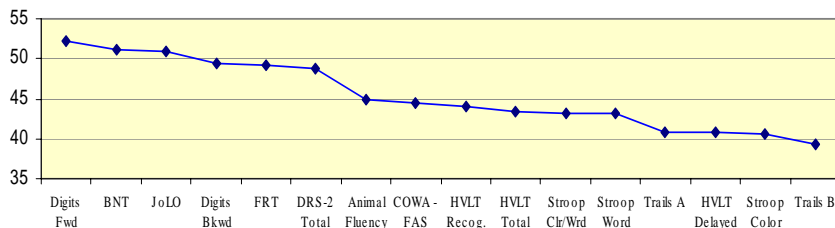
Results

- Cluster analysis uncovered two levels of HVLT performance (graphed below)
- No difference in age, education, duration of symptoms, or levodopa equivalent dose
- Abnormal Memory group had greater motor disturbance (UPDRS)
- Abnormal Memory group significantly lower ($p < .05$) on all neurocognitive tests (below)

Neuropsychological Test T-Score Means by HVLT Cluster
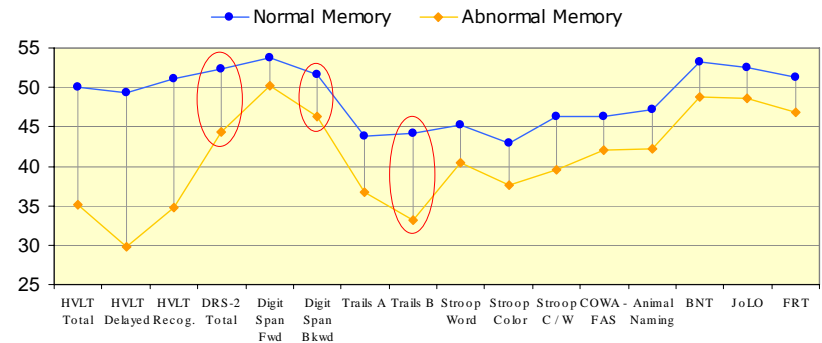
- Discriminant function analysis demonstrated that **TMT-B** and **Backward Digit Span** best discriminated the 2 HVLT groups, correctly classifying 72.8% of cases
- Wilks' Λ = .811, $p < .001$, dfc = .868 (TMT-B) and .495 (Digits Backward)

Memory Group Prediction Accuracy

Actual	Predicted	
	Abnormal Memory	Normal Memory
Abnormal (N= 55)	**40 (72.7%)**	15 (27.3%)
Normal (N=70)	19 (27.1%)	**51 (72.9%)**

- Using logistic regression, TMT-B, Backward Digit Span, and DRS-2 Total best predicted group membership (R^2 [Nagelkerke] = .289, χ^2 [3] = 27.92, $p < .001$).

Prediction of HVLT Group with Story Memory

Discriminant function analysis and logistic regression including patients' WMS-III Logical Memory I and II scores as predictor variables *did not* change the results.

Conclusions

The current findings suggest that word list memory performance in PD (as measured by the HVLT) is more strongly associated with performance on tests of executive abilities (i.e., working memory, mental efficiency/flexibility, & sequencing) than with other neurocognitive functions including story memory. Level of HVLT performance was correctly predicted for almost 73% of the study sample based on performance on Part B of the Trail Making Test and Backward Digit Span.