

NEUROCOGNITIVE TESTING SUPPORTS A BROADER CONCEPT OF MILD COGNITIVE IMPAIRMENT

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ABSTRACT

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BACKGROUND: The narrow concept of Mild Cognitive Impairment (MCI) as an early form of Alzheimer's disease (AD) has been broadened by research that established the existence of alternative forms of the condition that may presage other forms of dementia.

METHOD: This was a naturalistic, cross-sectional study of patients in a community referral clinic: patients with MCI and mild dementia (MD), compared to normal controls. A comprehensive computerized neurocognitive screening battery (CNS Vital Signs) was administered to all of the subjects.

SUBJECTS: Thirty-six patients with MCI and 53 patients with mild dementia, diagnosed by standard criteria, compared to 89 matched normal controls.

RESULTS: Multivariate analysis indicated significant differences among the three groups for all 15 primary test variables and for all five domain scores. Tests of memory, processing speed and cognitive flexibility were the most cogent discriminators between normals and MCI patients, and between MCI patients and patients with mild dementia. Tests of memory, processing speed and cognitive flexibility had the greatest sensitivity and specificity.

CONCLUSIONS: Computerized testing can differentiate among normals, MCI patients and patients with mild dementia. In a diverse group of MCI and MD patients, impairments in memory, processing speed and cognitive flexibility were the most prominent deficits.

Table 1. Multivariate Analysis of 5 Domains and 15 Primary Test Variables

	NML	MCI	MD	F	P<
N	89	36	53		
AGE	63.12	66.11	62.23		
MMSE		28.00	22.33		
MEMORY	93.70	86.90	79.53	45.81	0.00000
PMS	141.11	118.41	108.83	25.33	0.00000
RT*	718.65	784.44	875.59	19.99	0.00000
COMPLEX ATT*	14.90	31.44	32.60	17.65	0.00000
COGN FLEX	29.72	14.19	4.60	31.19	0.00000
VIGILANCE*	1.43	7.70	9.44	6.29	0.00230
VBM	50.38	45.68	41.84	43.98	0.00000
VIM	43.70	41.12	36.72	33.13	0.00000
TAPS	97.59	82.33	79.34	11.28	0.00002
SDCcorr	42.13	36.14	28.74	38.28	0.00000
STsrt*	334.12	393.19	434.00	5.47	0.00497
STcrt*	661.33	718.78	788.50	13.97	0.00000
STstrt*	775.97	851.19	964.53	16.15	0.00000
Sterr*	1.31	3.30	5.91	20.05	0.00000
SATcorr	42.66	36.75	29.97	26.67	0.00000
SATerr*	11.64	19.80	19.37	12.99	0.00001
SATrt*	1135.03	1028.98	1248.31	8.44	0.00032
SATq*	1.61	1.65	2.40	16.27	0.00000
CPTcorr	39.67	36.67	36.90	8.28	0.00037
CPTerr*	1.43	7.70	9.44	6.29	0.00230
CPTrt*	427.24	458.20	518.07	11.44	0.00002

NOTES, Table 1: NML = normal controls matched for age, race and gender. MCI = patients with mild cognitive impairment. MD = patients with mild dementia. F = F statistic. P< = significance value. MMSE = mini-mental state exam. PMS, psychomotor speed. RT, Reaction Time, COMPL ATT, complex attention; COGN FLEX cognitive flexibility, VBM Verbal Memory, VIM Visual Memory, FTT right & left, finger tapping test, average for right & left tapping; SDC, Symbol Digit Coding; ST, Stroop Test, simple reaction time, complex reaction time, Stroop reaction time; SAT Shifting Attention Test, correct responses, errors, reaction time, and Q, Efficiency ((SAT RT/per cent correct)/1000); CPT Continuous Performance Test, correct responses, errors, reaction time. An asterisk indicates that a lower score is better.

Table 2. ANOVA with Bonferroni Correction

	NML-MCI	NML-DEM	MCI-DEM
MEMORY	0.0004	0.0000	0.0004
PMS	0.0016	0.0000	0.5248
RT	0.1168	0.0000	0.0271
COMPLEX ATT	0.0003	0.0000	1.0000
COGN FLEX	0.0016	0.0000	0.1408
VIGILANCE	0.0762	0.0038	1.0000
VBM	0.0001	0.0000	0.0040
VIM	0.0367	0.0000	0.0003
TAPS	0.0091	0.0002	1.0000
SDCcorr	0.0368	0.0000	0.0141
STsrt	0.2875	0.0046	0.8719
STcrt	0.1802	0.0000	0.1104
STstrt	0.2104	0.0000	0.0384
Sterr	0.0642	0.0000	0.0172
SATcorr	0.0315	0.0000	0.0216
SATerr	0.0010	0.0004	1.0000
SATrt	0.0977	0.0288	0.0002
SATq	1.0000	0.0000	0.0009
CPTcorr	0.0042	0.0024	1.0000
CPTerr	0.0762	0.0038	1.0000
CPTrt	0.4702	0.0000	0.0380

Table 3. ROC Curves, Sensitivity and Specificity

	NORMALS & MCI PTS				NORMALS & DEMENTED PTS			
	AUC	P<	90% SENS	SPCFCTY	AUC	P<	90% SENS	SPCFCTY
MEMORY	0.667	0.0035	102	82%	0.695	0.0019	89	56%
PMS	0.679	0.0018	164	77	0.569	0.2716		
RT	0.663	0.0045	640	64	0.637	0.0294	605	94
COGN FLEX	0.692	0.0008	47	76	0.612	0.0750		
COMPLEX ATT	0.741	0.0000	7	65	0.537	0.5528		
VBM	0.711	0.0002	53	65	0.692	0.0022	47	56
VIM	0.601	0.0772			0.715	0.0006	41	50
SDCcorr	0.638	0.0158	51	75	0.674	0.0054	46	81
SATcorr	0.658	0.0058	55	85	0.660	0.0105	44	78