Comparing the sensitivity of brief cognitive assessments in detecting behavioural variant frontotemporal dementia.

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BACKGROUND

Behavioural variant frontotemporal dementia (bvFTD) is a complex neurodegenerative disease that presents with personality change and cognitive impairment. Measuring the degree of cognitive impairment is a useful tool for aiding the diagnosis of bvFTD, however, formal neuropsychometry is time consuming. Brief cognitive assessments have proven useful in measuring mild cognitive impairment (MCI) and cognitive impairment in Alzheimer's disease (AD)[1,2], but research into other diseases is limited. Here we investigate the effectiveness of brief cognitive assessments in detecting cognitive abnormalities in bvFTD.

METHODS

31 individuals with a clinical diagnosis of bvFTD were recruited consecutively from the UCL Dementia Research Centre FTD cohort, and were tested on: the Edinburgh Cognitive and Behavioural ALS Screen (ECAS), the Mini-Mental State Examination (MMSE), the Montreal Cognitive Assessment (MoCA), Addenbrooke's Cognitive Examination (ACE-III), and formal neuropsychometry. Predefined cut-off scores for abnormal cognition were used to determine the sensitivity of each assessment.

Subtests of brief cognitive assessments were correlated with scaled neuropsychometry scores within matching domains to ensure validity. The neuropsychometry tests included were: the Graded Naming Test (GNT), the Recognition Memory Test (RMT) for Words and Faces, the Camden Paired Associated Learning (CPAL) test, Stroop Ink Naming, Trail Making task part B, the Visual Object and Space Perception (VOSP) object decision task, and the WASI Block Design task.

Participant Demographics

Age	Gender (%M)	Age of onset	Disease duration (y)	Education (y)	CBI-R	FRS (%)
63.6 (7.0)	68	56.4 (7.3)	7.2 (5.13)	13.9 (3.0)	79.4 (24.9)	34.5 (21.3)

Table 1. Mean participant demographics of 31 individuals with bvFTD. Standard deviations in parenthesis. CBI-R= Revised Cambridge Behavioural Inventory, FRS= FTD Rating Scale.

Subtest	ECAS			MoCA			ACE-III			MMSE		
	Max	Mean	SD	Max	Mean	SD	Max	Mean	SD	Max	Mean	SD
Total score	136	67.4	30.9	30	18.4	6.8	100	67.1	19.1	30	22.7	5.2
Language	28	21.1	6.6	8	4.5	2.4	26	20.5	5.8			
Memory	24	5.7	5.3	5	1.8	2.0	26	14.7	6.6			
EF/Attention	48	24.3	14.7	6	4.4	1.9	18	13.0	3.6			
Visuospatial	12	9.7	3.1	5	3.1	1.7	16	13.3	3.1			
Verbal Fluency	24	6.5	6.9				14	5.6	3.9			
Orientation				6	4.3	1.8						

Table 2. Mean scores and standard deviations for each brief cognitive assessment and their subtests. Blank boxes indicate a lack of this subtest in the assessment. Max=maximum score.

Table 3.

Psychometry Subtest	ECAS Subtest			
	Language	Memory	Executive Function	Visuospatial
GNT	rs=0.615	rs=0.549	rs=0.281	rs=0.166
	p<0.001***	p=0.002**	p=0.132	p=0.382
RMT Words	rs=0.423	rs=0.750	rs=0.601	rs=0.580
	p=0.020*	p<0.001***	p<0.001***	p=0.001***
RMT Faces	rs=0.546	rs=0.493	rs=0.606	rs=0.715
	p=0.002**	p=0.006**	p<0.001***	p<0.001***
CPAL	rs=0.312	rs=0.545	rs=0.530	rs=0.349
	p=0.093	p=0.002**	p=0.003**	p=0.059
Stroop - Ink Naming	rs=0.527	rs=0.522	rs=0.881	rs=0.743
	p=0.003**	p=0.003**	p<0.001***	p<0.001***
Trails B	rs=0.249	rs=0.258	rs=0.646	rs=0.529
	p=0.184	p=0.169	p<0.001***	p=0.003**
VOSP	rs=0.219	rs=0.331	rs=0.325	rs=0.273
	p=0.245	p=0.074	p=0.080	p=0.144
Block Design	rs=0.418	rs=0.458	rs=0.650	rs=0.789
	p=0.022*	p=0.011*	p<0.001***	p<0.001***

Table 4.

Psychometry Subtest	MoCA Subtest			
	Language	Memory	Attention	Visuospatial/Executive
GNT	rs=0.556	rs=0.661	rs=-0.057	rs=0.393
	p=0.001***	p<0.001***	p=0.763	p=0.032
RMT Words	rs=0.547	rs=0.384	rs=0.317	rs=0.554
	p=0.002**	p=0.036*	p=0.088	p=0.002
RMT Faces	rs=0.555	rs=0.328	rs=0.444	rs=0.552
	p=0.001***	p=0.076	p=0.014*	p=0.002
CPAL	rs=0.467	rs=0.454	rs=0.098	rs=0.503
	p=0.009**	p=0.012*	p=0.607	p=0.005
Stroop - Ink Naming	rs=0.651	rs=0.338	rs=0.671	rs=0.569
	p<0.001***	p=0.067	p<0.001***	p=0.001***
Trails B	rs=0.353	rs=0.227	rs=0.571	rs=0.473
	p=0.055	p=0.227	p=0.001***	p=0.008**
VOSP	rs-0.072	rs=0.348	rs=0.040	rs=0.474
	p=0.706	p=0.059	p=0.832	p=0.008**
Block Design	rs=0.375	rs=0.123	rs=0.543	rs=0.617
	p=0.041*	p=0.516	p=0.002**	p<0.001***

Table 5.

Psychometry Subtest	ACE-III Subtest			
	Language	Memory	Attention/Executive	Visuospatial
GNT	rs=0.769	rs=0.664	rs=0.298	rs=0.275
	p<0.001***	p<0.001***	p=0.110	p=0.142
RMT Words	rs=0.586	rs=0.679	rs=0.733	rs=0.508
	p=0.001***	p<0.001***	p<0.001***	p=0.004**
RMT Faces	rs=0.644	rs=0.613	rs=0.610	rs=0.569
	p<0.001***	p<0.001***	p<0.001***	p=0.001***
CPAL	rs=0.455	rs=0.725	rs=0.512	rs=0.332
	p=0.012*	p<0.001***	p=0.004**	p=0.073
Stroop - Ink Naming	rs=0.490	rs=0.556	rs=0.349	rs=0.614
	p=0.006**	p=0.001***	p=0.060	p<0.001***
Trails B	rs=0.192	rs=0.416	rs=0.316	rs=0.514
	p=0.309	p=0.022*	p=0.097	p=0.004**
VOSP	rs=0.114	rs=0.187	rs=-0.043	rs=0.325
	p=0.549	p=0.323	p=0.822	p=0.080
Block Design	rs=0.368	rs=0.460	rs=0.542	rs=0.789
	p=0.046*	p=0.010**	p=0.002**	p<0.001***

Tables 3-5. Spearman's correlations between subtests of the ECAS, MoCA, and ACE-III respectively, and formal neuropsychometry measures. Matching domains are highlighted in blue. *p<0.05, **p<0.01, ***p<0.001.

RESULTS

Participant demographics are shown in Table 1. The ECAS and the MoCA were the most sensitive assessments in detecting bvFTD with 87% (27/31) of participants falling below the cut-off point in both tests (McNemar's test, p<0.001). The ACE-III detected 74% (23/31) of participants, and the MMSE 71% (22/31). Four participants did not score abnormally on any of the tests, including three *C9orf72* mutation carriers with a slowly progressive illness and one *MAPT* mutation carrier. Mean scores for brief cognitive assessments and their subtests are shown in Table 2.

Using the Spearman's rank correlation we found that language subtests for the ECAS, MoCA, and ACE-III respectively, correlated highly with the GNT (p<0.001), see Tables 3-5. Memory subtests for the ECAS and the ACE-III significantly correlated with RMT Words, RMT Faces, and CPAL tests (p<0.01). Memory subtests for the MoCA correlated with RMT words (p=0.036), and CPAL (p=0.012) but not RMT faces (p=0.076). Subtests of executive function/attention were highly correlated with Stroop Ink Naming and Trails B for the ECAS and MoCA (p<0.001), but no significant correlations of executive function were found for the ACE-III. Lastly, the Block Design test correlated with visuospatial subtests in the ECAS, MoCA, and ACE-III (p<0.001), however, the VOSP only significantly correlated with the MoCA (p=0.008).

CONCLUSION

The ECAS and the MoCA are the most sensitive assessments for detecting cognitive impairment in bvFTD. This is likely due to their inclusion of tests of executive function, (and in the case of the ECAS, social cognition). Only one test of executive function (the Serial 7 Subtraction task) is contained within the attention subtests of the ACE-III. This is likely to explain a lower sensitivity of the ACE-III in detecting bvFTD as well as a lack of correlation between subtests of attention/executive function and formal neuropsychometry. All other subtests among the brief cognitive assessments correlated well with neuropsychometry scores within matching domains. The MoCA is a shorter assessment compared to the ECAS and may therefore be the most practical brief cognitive test to use in the clinic for helping to detect bvFTD.

REFERENCES

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