Cognitive Function tested by multi-domain assessment is Reduced During Haemodialysis

Findlay MD[1], McGlynn D[2] , Dawson J[1], Mark PB[1]
[1]University of Glasgow, [2]Queen Elizabeth University Hospital, Glasgow

Background

- Cognitive impairment (CI) is common in those with CKD
- It is estimated that for each 10ml/min loss in GFR there is an associated 11% increase in prevalence of CI
- Reports suggest that up to 70% of those on haemodialysis (HD) for established renal failure (ERF) have moderate to severe CI
- In addition to the effect on patient concordance with treatment CI is an independent risk factor for mortality - yet remains poorly recognised
- Analogous to myocardial stunning noted during dialysis, cerebral stunning is likely and may predispose to progressive cognitive decline.

Aims

- Describe the frequency of CI in patients receiving HD for ERF
- Describe baseline cognitive function in a contemporary HD cohort
- Describe differences in cognitive assessment both during dialysis and on a "day-off"

Method

- Prospective observational study in all patients on HD for ERF
- We excluded those with documented diagnoses of cerebrovascular disease (clinical or on previous imaging) or cognitive impairment
- A neurocognitive assessment was performed during and out-with dialysis– separated by a 3-4 week gap to abate potential learning effects
- Assessment consisted of a basic screening tool for cognitive impairment, the Montreal Cognitive Assessment (MOCA), and further assessments chosen to assess multiple domains. Namely - language (Semantic memory and Phonemic fluency), processing speed (Letter Digit Substitution Test (LDST)), executive function (Trail Making Test A (TMT-A) & Trail Making Test B (TMT-B)) and memory (Hopkin's Verbal Learning Test (HVLT))

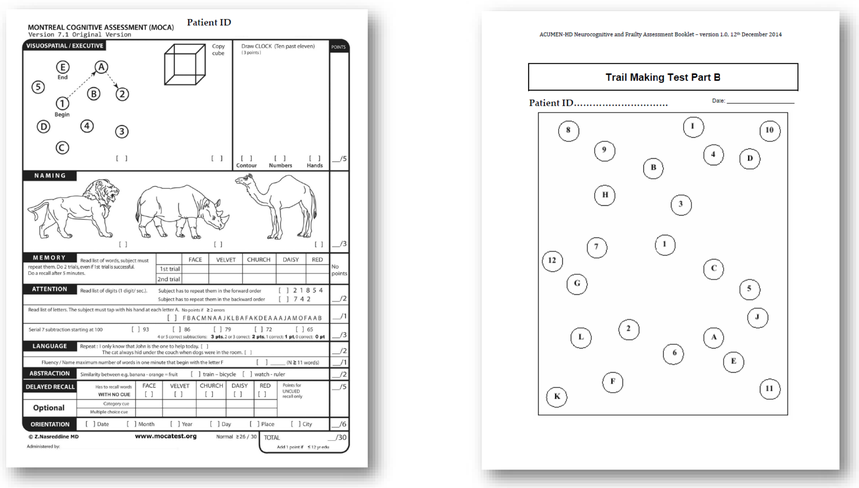

Figure 1 *Examples of Cognitive Assessments - MOCA and TMT-B*

- Age, sex and education level matched scores from the 50th centile were generated using published population normative values
- We compared baseline "day-off" cognitive scores to paired intradialytic scores and population normative scores using the Wilcoxon-signed rank test
- Data were analysed using SPSS v22

Results

- 40 patients completed both visits, median age 59 years [IQR 51,67]
- 30% were female and the median duration on renal replacement therapy (RRT) was 2.4 years [IQR 0.9,5.7]. Further demographics are shown in table 1
- Using the accepted MOCA score cut off of <26 to define frequency of cognitive impairment, 75% of this cohort had objective evidence of CI
- Aside from higher systolic hypertension in those with cognitive impairment, there were no significant differences in demographics between groups (144.6 v 125.7mmHg, *p=0.028*)
- Median time between visits was 3.9 [IQR 3,5.5] weeks
- Number of years in education was median 12 years [IQR 11,13]
- Compared to population normative scores patients on HD for ERF scored low in all domains except phonemic fluency, p<0.05
- During dialysis there was significantly lower performance in tests of language, processing speed and executive function (figure 2 and table 2)

	n=40
Median Age, years [IQR]	59 [51,67]
Female (%)	12 (30)
Ethnicity (%)	
White British	37 (92.5)
South Asian	2 (5)
Other	1 (2.5)
Primary Renal Diagnosis (%)	
Glomerulonephritis	8 (20)
Interstitial	5 (12.5)
Multisystem	5 (12.5)
Diabetes	14 (35)
Other	8 (20)
Smoker (%)	
Never	15 (37.5)
Current	9 (22.5)
Ex	16 (40)
Past Medical History (%)	
Hypertension	37 (92.5)
Diabetes	19 (47.5)
Ischaemic Heart disease	15 (37.5)
AF	5 (12.5)
Depression	8 (20)
Transplant waiting list status (%)	
Active	13 (32.5)
Suspended	4 (10)
Not listed	23 (57.5)
Median duration of RRT, y [IQR]	2.4 [0.9,5.7]
Mean SBP [SD]	139.8 [25.8]
Mean DBP [SD]	73.4 [12.5]
Mean UF [SD]	2.04 [0.97]
Mean URR [SD]	71.5 [6.1]
Year of education	
8-12	30 (75%)
13-21	10 (25%)
Cognitive Impairment	
Normal (MOCA ≥26)	10 (25%)
Mild-Moderate (<26)	30 (75%)

Table 1 *Cohort Demographics*

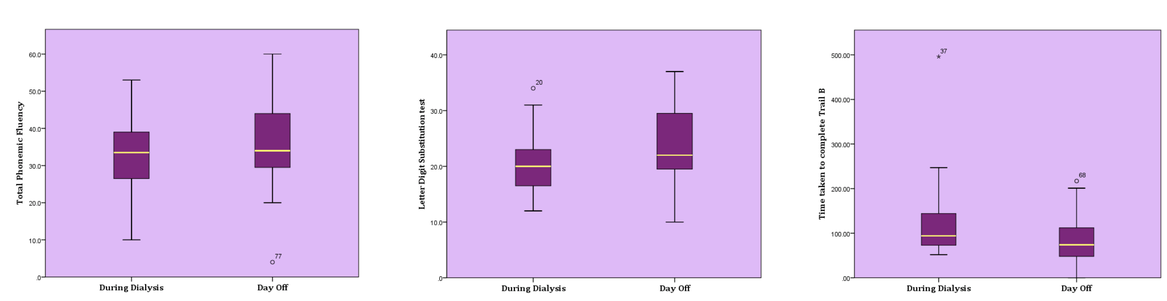

Figure 2 *Assessments of language, processing speed & executive function on dialysis day and day-off*

Assessment	Day-Off Score Median [IQR]	Intradialytic Score Median [IQR]	*P*	Population Norm Median [IQR]	*p*
MOCA	25.5 [23,27]	25 [23,25.5]	0.129	26	**<0.001**
Semantic Memory	16.5 [15,20.5]	16.5 [13.5,21.5]	0.595	20 [17,20]	**0.024**
Phonemic Fluency	34 [29.5,40]	33.5 [26.5,39]	**0.002**	40 [35,31]	0.128
LDST	22 [19.5,29.5]	20 [16,23]	**<0.001**	30.8 [29.5,33.6]	**<0.001**
TMT-A *(time, secs)*	44 [26.45,53.5]	47 [32, 54.9]	0.922	32 [31,38]	**<0.001**
TMT-B *(time, secs)*	74 [48,112]	94 [73,144]	**0.031**	68 [64,86]	**0.01**
HVLT Recall	20 [16.5,24]	21 [18.5,25]	0.234	28 [28,29]	**<0.001**
HVLT Delay	7 [4,10]	7 [3,9]	0.384	10 [10,11]	**<0.001**
HVLT Retention	83.8% [64.6,100]	76.4% [50,87.5]	0.073	92% [92,100]	**<0.001**
HVLT Discrimination	10 [8,11]	10 [8.5,11]	0.694	11 [11,11]	**0.002**

Table 2 *Median score on dialysis and on day-off alongside population normative values (50th centile), analysed using Wilcoxon Signed Rank Test*

Discussion

- Cognitive impairment is common in those on dialysis and poorly diagnosed
- Intra-dialytic cognitive assessment scores are lower than scores achieved on a "day-off"
- During dialysis patients score lower on tests of executive and frontal lobe function than out with dialysis
- Further study – including assessment of the cerebral circulation and structure is underway to assess if dialysis is responsible for alterations in cerebral blood flow - predisposing to advanced cognitive aging

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