Utility of the Clinical Dementia Rating Scale in Detecting Autopsy-Proven Dementia in Patients with Low Education

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Introduction

The Clinical Dementia Rating scale (CDR) assesses impairment in 6 cognitive and functional domains to stage cognitive decline and dementia.[1] Each domain is scored from 0 (no impairment) to 3 (severe impairment), with scores added to form a sum-of-boxes (CDR-SB) score ranging from 0 to 18. The CDR-SB score has shown high reliability in staging dementia.[2-4] However, no studies have determined whether the CDR remains effective for less-educated individuals. As such, we investigated the sensitivity and specificity of the CDR-SB score in detecting dementia associated with autopsy-proven AD in patients with less than 12 years of education.

Methods

Participants from the National Alzheimer's Coordinating Center Uniform Data Set (Version 2) with less than 12 years of education were selected into 2 groups matched for age and sex:

1. Autopsy-proven AD: intermediate or high likelihood of AD based on 1997 NIA-Reagan neuropathological criteria (n=17).
2. Normal age-related brain changes: low or no likelihood of AD (n=17).

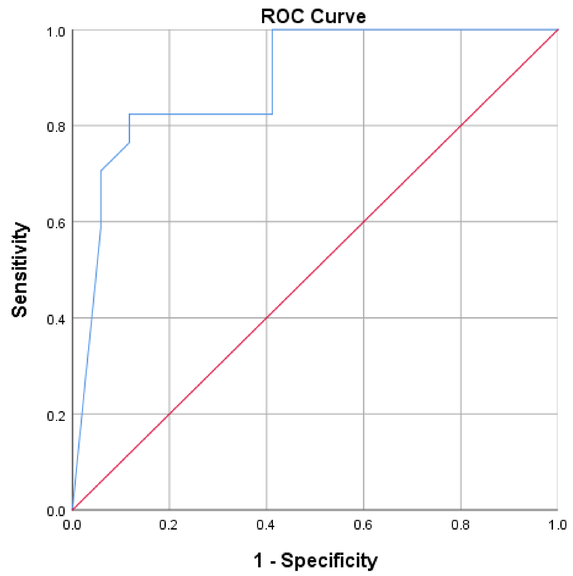
Cases were excluded if they had other major neurological syndromes, including: stroke, TBI, Lewy body disease, vascular or frontotemporal dementia, CNS lymphoma, chronic traumatic encephalopathy, hippocampal sclerosis, or prion-related pathological changes. Demographic and clinical characteristics of the sample are shown in **Table 1**.

Receiver Operating Characteristic (ROC) analysis was performed to determine the sensitivity and specificity of CDR-SB scores in discriminating between the two cohorts.

Results

ROC analysis (**Figure 1**) showed that CDR-SB scores discriminated between those with autopsy-proven AD and those with normal age-related brain changes.

The optimal cut score was 9.5, yielding a sensitivity of 0.824 and specificity of 0.882, correctly classifying 15 of 17 patients with normal age-related brain changes and 14 of 17 with autopsy-proven AD (overall 85% correct classification rate).



Coordinates of the Curve

Positive if ≥	Sensitivity	1 – Specificity
0.5	1.000	.529
3.0	1.000	.412
4.5	.941	.412
5.0	.824	.412
5.5	.824	.353
6.5	.824	.294
7.5	.824	.235
8.0	.824	.176
9.5	.824	.118
11.5	.765	.118
12.5	.706	.059
14.5	.647	.059
17.0	.588	.059

Figure 1. ROC curve and coordinates of the curve. The "Positive if ≥" column lists CDR-SB cut scores used to separate participants into the two cohorts. A score greater than or equal to the cut score indicates "positive" for AD. Sensitivities and specificities were calculated for each cut score, then mapped onto the ROC curve.

	Normal (n = 17)	Autopsy-proven AD (n = 17)	Significant Difference?
% Female	47	65	No; $\chi^2(1, N = 34) = 1.07, p = .30$
% Caucasian	100	88	No; $\chi^2(1, N = 34) = 2.13, p = .15$
Years Education, M (SD)	8.88 (1.73) Range: 6-11	8.47 (2.32) Range: 3-11	No; t(32) = .59, p = .56
Age at Last Clinic Visit, M (SD)	83.94 (9.07) Range: 67-101	82.71 (9.05) Range: 68-99	No; t(32) = .40, p = .69
Months from Last Visit to Death, M (SD)	12.59 (11.07) Range: 0-39	11.06 (9.22) Range: 0-38	No; t(32) = .44, p = .67
CDR-SB Score at Last Visit, M (SD)	3.85 (5.38) Range: 0-18	14.35 (5.46) Range: 3-18	Yes; t(32) = -5.65, p < .001

Table 1. Demographic and clinical data for normal and autopsy-proven AD cohorts

Conclusions

1. In patients with less than 12 years of education, the optimal CDR-SB cut score to detect AD-related dementia (9.5) is in a range associated with moderate dementia,[3,4] which may be too high for clinical utility.
2. Although numerous neurological and neuropathological syndromes were excluded from the present study, factors other than low education may have contributed to high CDR-SB scores in the normal cohort, artificially inflating the optimal cut score.
3. Further research in larger samples is needed to validate the results of this preliminary investigation.

References

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3. O'Bryant SE, Waring SC, Cullum CM, et al. Staging dementia using clinical dementia rating scale sum of boxes scores: a Texas Alzheimer's Research Consortium study. *Arch Neurol*. 2008;65(8):1091-1095.
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