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Validity of the Cornell Scale for Depression in Dementia (CSDD) in Parkinson's Disease with and without Cognitive Impairment

James R. Williams, M.H.S.^{1,4} and Laura Marsh, M.D.^{2,3,4}

¹Department of Mental Health, Bloomberg School of Public Health, Johns Hopkins University School of Medicine, Baltimore, MD, USA

²Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD, USA

³Department of Neurology and Neurological Sciences, Johns Hopkins University School of Medicine, Baltimore, MD, USA

⁴Morris K. Udall Parkinson's Disease Research Center of Excellence at Johns Hopkins, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Abstract

Introduction—Valid tools are needed to assess depression across the spectrum of cognitive impairment in PD. The validity of the Cornell Scale for Depression in Dementia (CSDD) was tested in a PD sample with a range of cognitive impairment.

Methods—Psychiatric diagnoses were established according to *DSM-IV-TR*. Receiver operating characteristic curves tested the discriminant validity of the CSDD compared to the clinical diagnoses of major and minor depression.

Results—The curve for symptomatic depression had an area under the curve of 0.82. For the cut-off score ≥ 6 , sensitivity was 0.83 and specificity was 0.73; for the cut-off score ≥ 8 , sensitivity was 0.75 and specificity was 0.82. There was no evidence for differential measurement with respect to cognitive impairment or any other demographic or clinical variables.

Conclusion—This study suggests that the CSDD is a valid tool for identifying depressive disorders in PD patients across a spectrum of cognitive impairment.

Keywords

Depression; Parkinson's disease; Cognition; Dementia; Rating Scale; Cornell Scale

Depressive disturbances affect up to 50% of patients with Parkinson's disease (PD) and negatively impact quality of life.^{1,2} Several studies have shown that depressive symptom rating scales are valid measures of depression in PD populations; however, depression rating scales have not been evaluated in patients with PD-dementia.³

Correspondence to: Laura Marsh, M.D. Johns Hopkins University School of Medicine, 600 N. Wolfe Street- Phipps 300, Baltimore, MD 21287, lmarsh@jhmi.edu; o:410-502-6945; f: 410-614-3676.

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Given that dementia develops in up to 80% of patients with PD, valid tools are needed to assess depression, irrespective of the patient's cognitive status, over the course of the disease.^{4,5} The Cornell Scale for Depression in Dementia (CSDD), a rater-administered instrument, has potential for this purpose; it was developed specifically for assessment of depression in dementia and has been validated in both demented and non-demented geriatric patients.^{6,7} An important feature of the CSDD is that ratings are based on information obtained from clinical observation and interviews with the patient and an informant. As validation studies in PD have not been conducted, this study investigated the discriminant validity of the CSDD in a PD sample relative to a clinical assessment for depression.

METHODS

Participants with idiopathic PD were enrolled in a longitudinal research protocol with prospective brain donation to study motor, cognitive, psychiatric, and clinical-pathological features of PD.⁸ The cohort was recruited from tertiary care and community practices and included older individuals with advanced disease along with those younger and less affected who could be followed for a longer duration. Participants or their powers of attorney gave written informed consent to participate. The Johns Hopkins University Institutional Review Board approved the protocol. Only baseline data was used for this analysis. A complete CSDD and psychiatric diagnostic assessment were the only inclusion criteria for this analysis.

Psychiatric symptoms and diagnoses were assessed comprehensively by a geriatric psychiatrist and research nurse using a combination of a semi-structured clinical interview [Schedule for Clinical Interview and Diagnosis (SCID)], supplemental questions to identify disturbances not addressed by the SCID, informant interviews (family members/caregivers and clinicians), and medical records review.⁹ Using this information and the mental status exam, the psychiatrist assigned final CSDD ratings and psychiatric diagnoses in consultation with the nurse. Thus, data on inter-rater reliability and length of administration for the CSDD is not available. An inclusive symptom attribution approach was used for diagnosing depression and when completing the CSDD. This approach rates all symptoms as related to depression, regardless of symptom overlap with PD or other medical conditions.¹⁰

Psychiatric diagnoses were established according to the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition Text Revision (DSM-IV-TR) criteria using all available information, but independent of CSDD ratings.¹¹ Diagnoses of symptomatic depression included current major depressive episode, major depressive episode in partial remission, minor depression, dysthymia, or depressive disorder not otherwise specified (NOS). Depressive disorders in full remission (asymptomatic) were classified as non-depressed. Diagnoses of clinically significant cognitive impairment, defined according to DSM-IV-TR criteria for dementia or cognitive disorder NOS, were based on the aforementioned diagnostic interview in addition to a mental status exam.

The Mini-Mental State Exam (MMSE) served as a continuous measure of global cognitive status.¹² The Unified Parkinson's Disease Rating Scale (UPDRS) motor subscale and Hoehn and Yahr (HY) Stage, both rated in the 'off' (end-of-dose) state, provided measures of motor deficits and disease progression, respectively.^{13,14}

Analyses were conducted using STATA statistical software (Version 9.0).¹⁵ Group differences were assessed using t-tests and Fischer's exact tests. Receiver operating characteristic (ROC) curves tested the discriminant validity of the CSDD, with the clinician's diagnosis providing the gold standard. The ROCCOMP command using a χ^2 statistic and logistic regressions were used to test the influence of demographic and clinical features on the area under the curve

(AUC). Indices were evaluated at cut-offs defined as the maximum sum of sensitivity and specificity. Reliability was measured by Cronbach's α .

RESULTS

As shown in Table 1, 36 of the 134 participants (27%) had a symptomatic depressive disorder and 49 participants (36.6%, 95% CI: 0.28 – 0.45) had a cognitive impairment diagnosis. Rates of cognitive impairment were comparable between the depressed and non-depressed groups.

As expected, mean CSDD scores were higher in the depressed group, but comparable among the two depressive subgroups [Mean (SD): major depression: 11.5 (6.1), minor depression: 10.3 (5.3), $p=0.52$; major depression>non-depressed: $p<0.001$; minor depression>non-depressed: $p<0.01$] and between participants with no depression and those with a remitted depressive diagnosis [no depression: 4.7 (4.1), remitted depression: 3.9 (2.9), $p=0.52$]. Additionally, participants with cognitive impairment had higher mean CSDD scores in both depression groups [Non-depressed: No Impairment: 4.0 (3.3), Cognitive Impairment: 5.9 (4.8), $p<0.01$; Depressed: No Impairment: 9.3 (5.7), Cognitive Impairment: 14.4 (4.8), $p<0.05$].

The ROC curve to discriminate cases of symptomatic depression was characterized by an AUC of 0.82 (std. err.=0.04, 95% CI: 0.73–0.91). As shown in Table 2, two cut-off points had near equivalent sums of sensitivity and specificity; one with higher sensitivity, the other higher specificity. Performance of the CSDD was statistically similar across cognitive impairment groups when treated as a trichotomous variable for no cognitive impairment, cognitive disorder NOS, and dementia and when treated as a dichotomous variable for no cognitive impairment versus any cognitive impairment. There were no statistically significant AUC changes after adjusting or stratifying by age, sex, education, MMSE score (treated as a continuous variable), HY stage, UPDRS motor score, or PD symptom duration. Discriminant indices were unchanged when minor depression was excluded from the analyses.

The CSDD demonstrated high internal consistency (Cronbach's $\alpha=0.84$).

Discussion

In this study, the CSDD was shown to be a valid tool for identifying clinically significant depressive disorders across the spectrum of cognitive dysfunction in patients with PD. The identified cut-off scores that maximized sensitivity and specificity are similar to those reported in non-PD samples.^{16,17} In addition, the reported discriminant indices are similar to other validated depressive symptom rating scales in PD, but weaker compared to validity studies of the CSDD in non-PD samples in which AUC values and sensitivities were greater than 0.90.^{16–19} Finally, scale performance was not affected by cognitive impairment or any demographic or clinical variable measured in this study, a finding also observed in non-PD samples.¹⁶ However, recruitment included patients from tertiary care practices and the high educational level of the sample are potential sources of bias.

In addition to being valid across a broad range of motor and cognitive symptom severity, the CSDD is applicable for identifying cases of major and minor depression. Yet, while CSDD scores distinguished depressed from non-depressed cases, they did not discriminate major and minor depressive disorders. We note that the diagnosis of minor depression is not validated in PD and remains a research diagnosis in DSM. However, inclusion of this subgroup in these analyses provided additional information on the ability of the CSDD to identify mild depressive disturbances. Even mild depression is clinically significant in PD as it is linked to greater physical disability and earlier initiation of symptomatic therapy for motor-related deficits.²⁰ However, since CSDD scores were comparable across depression subgroups, further evaluation of the ability of the CSDD to track symptom severity is needed. By contrast, the

15-item Geriatric Depression Scale discriminates major and minor depressive disorders, but its application with respect to cognitive dysfunction in PD has not been established.¹⁸

The lack of validated diagnostic criteria for either depressive disorders or dementia in PD limits studies in this area and the ability to compare results across studies. In keeping with the recommendations of a National Institute of Health workgroup on depression in PD, we used an inclusive approach for symptom assessment and diagnosis in order to enhance the sensitivity and reliability of diagnostic criteria.¹⁰ However, since the original CSDD used an etiologic approach to symptom attribution, this study, in the strictest sense, reports the validity of a modified CSDD. In our study, the cognitive disorder NOS category captured cases that did not meet DSM criteria for dementia because of the absence of significant memory deficits. However, these cases would meet the criteria for dementia proposed in a recent report by the Movement Disorder Society.²¹ Prominence of executive and other cognitive impairments, in comparison to memory impairment in the early to mid stages of PD dementia, complicate the direct application of DSM dementia criteria in PD.²¹

The quality of insight and awareness with respect to symptoms is often a concern when evaluating cognitively impaired patients. Interviews with informants and observation-based depressive symptom rating scales may be the most valid and reliable way to document depressive symptoms in cognitively impaired patients. However, this approach may not be satisfactory in time-limited situations. The Geriatric Depression Scale, a brief self-report instrument, is a potential alternative that has been validated in other cognitively impaired populations, but, as above, has not been studied explicitly in PD-dementia.^{3,18,22} The Neuropsychiatric Inventory, a multidimensional scale also developed for use in dementia populations, requires a potentially lengthy informant interview; its validity for identifying cases of depression is not established.^{3,23}

In conclusion, the CSDD holds promise as a depression screening tool for use across the spectrum of cognitive function in PD. For clinicians, the CSDD assesses relatively straightforward and observable psychopathological phenomena. An inclusive approach to symptom attribution, as used in this study, simplifies its administration and facilitates ratings by non-psychiatric clinicians. Further study of the CSDD is needed to recommend its use as a measure of depression severity or treatment response.

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References

1. Slaughter JR, Slaughter KA, Nichols D, et al. Prevalence, clinical manifestations, etiology, and treatment of depression in Parkinson's disease. *J Neuropsychiatry Clin Neurosci* 2001;13:187–196. [PubMed: 11449025]
2. Schrag A, Jahanshahi M, Quinn N. What contributes to quality of life in patients with Parkinson's disease? *J Neurol Neurosurg Psychiatry* 2000;69:308–312. [PubMed: 10945804]
3. Schrag A, Barone P, Brown RG, et al. Depression rating scales in Parkinson's disease: critique and recommendations. *Mov Disord* 2007;22:1077–1092. [PubMed: 17394234]
4. Aarsland D, Andersen K, Larsen JP, et al. Prevalence and characteristics of dementia in Parkinson disease: an 8-year prospective study. *Arch Neurol* 2003;60:387–392. [PubMed: 12633150]

5. Marder K, Tang MX, Cote L, et al. The frequency and associated risk factors for dementia in patients with Parkinson's disease. *Arch Neurol* 1995;52:695–701. [PubMed: 7619026]
6. Alexopoulos GS, Abrams RC, Young RC, et al. Cornell Scale for Depression in Dementia. *Biol Psychiatry* 1988;23:271–284. [PubMed: 3337862]
7. Alexopoulos GS, Abrams RC, Young RC, et al. Use of the Cornell scale in nondemented patients. *J Am Geriatr Soc* 1988;36:230–236. [PubMed: 3339232]
8. Hughes AJ, Daniel SE, Kilford L, et al. Accuracy of clinical diagnosis of idiopathic Parkinson's disease: a clinico-pathological study of 100 cases. *J Neurol Neurosurg Psychiatry* 1992;55:181–184. [PubMed: 1564476]
9. First, MB.; Spitzer, RL.; Gibbon, M., et al. Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Patient Edition. (SCID-I/P). New York: Biometrics Research, New York State Psychiatric Institute; 2002.
10. Marsh L, McDonald WM, Cummings J, et al. Provisional diagnostic criteria for depression in Parkinson's disease: report of an NINDS/NIMH Work Group. *Mov Disord* 2006;21:148–158. [PubMed: 16211591]
11. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (DSM-IV-TR). Washington, D.C.: American Psychiatric Association; 2000.
12. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975;12:189–198. [PubMed: 1202204]
13. Fahn, S.; Elton, RL. Members of the UPDRS Development Committee. Unified Parkinson's disease rating scale. In: Fahn, S.; Marsden, CD.; Goldstein, M., editors. *Recent developments in Parkinson's disease II*. New York: Macmillan; 1987. p. 153–163.
14. Hoehn MM, Yahr MD. Parkinsonism: onset, progression, and mortality. *Neurology* 1967;17:427–442. [PubMed: 6067254]
15. StataCorp. Stata Statistical Software. College Station, TX: StataCorp LP; 2005. [Release 9]
16. Korner A, Lauritzen L, Abelskov K, et al. The Geriatric Depression Scale and the Cornell Scale for Depression in Dementia. A validity study. *Nordic Journal of Psychiatry* 2006;60:360–364. [PubMed: 17050293]
17. Schreiner AS, Hayakawa H, Morimoto T, et al. Screening for late life depression: cut-off scores for the Geriatric Depression Scale and the Cornell Scale for Depression in Dementia among Japanese subjects. *Int J Geriatr Psychiatry* 2003;18:498–505. [PubMed: 12789670]
18. Weintraub D, Oehlberg KA, Katz IR, et al. Test characteristics of the 15-item Geriatric Depression Scale and Hamilton Depression Rating Scale in Parkinson disease. *Am J Geriatr Psychiatry* 2006;14:169–175. [PubMed: 16473982]
19. Leentjens AFG, Verhey FR, Lousberg R, et al. The validity of the Hamilton and Montgomery-Asberg depression rating scales as screening and diagnostic tools for depression in Parkinson's disease. *Int J Geriatr Psychiatry* 2000;15:644–649. [PubMed: 10918346]
20. Ravina B, Camicioli R, Como PG, et al. The impact of depressive symptoms in early Parkinson disease. *Neurology* 2007;69:342–347. [PubMed: 17581943]
21. Emre M, Aarsland D, Brown R, et al. Clinical diagnostic criteria for dementia associated with Parkinson's disease. *Mov Disord* 2007;22:1689–1707. [PubMed: 17542011]
22. Yesavage JA, Brink TL, Rose TL, et al. Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res* 1983;17:37–49. [PubMed: 7183759]
23. Cummings JL. The Neuropsychiatric Inventory: assessing psychopathology in dementia patients. *Neurology* 1997;48:10–16.

Table 1

Group Characteristics and Scale Scores

Overall Prevalence of Cognitive Diagnoses		
Cognitive Disorder NOS	19 (14%, 95% CI: 0.09 – 0.21)	
Dementia	30 (22%, 95% CI: 0.16 – 0.30)	
	No Symptomatic Depressive Disorder	Symptomatic Depressive Disorder
N	98 (73%, 95% CI: 0.65–0.80)	36 (27%, 95% CI: 0.20–0.35)
Age	67.7 (10.7, 42–90)	67.8 (9.9, 45–81)
Sex^{**} (Male/Female)	70 M/28 F	17 M/19 F
Education[*] (years)	16.5 (3.4, 5–23)	15.2 (2.9, 10–24)
PD Symptom Duration (years)	9.4 (6.3, 1–29)	10.9 (8.1, 1–38)
Hoehn and Yahr Stage^{**}	2.4 (0.7) I-5, II½-4, II-35, II½- 29, III-19, IV-3, V-3	3.1 (1.2) (n=34) I-1, II-11, II½- 5, III-5, IV-6, V-6
UPDRS-Motor (“Off”) ^{**}	28.6 (16.1, 3–77)	38.8 (21.3, 7–78)
MMSE[*]	27.1 (3.0, 17–30) (n=97)	25.3 (5.8, 7–30) (n=35)
CSDD Total^{***}	4.6 (4.0, 0–20)	11.3 (5.9, 1–22)
Cognitive Impairment (n)	35 (36%, 95% CI: 0.26–0.46)	14 (39%, 95% CI: 0.23–0.57)
Major Depression (n)	0	29 (22%, 95% CI: 0.15–0.30)
Minor Depression (n)	0	7 (5%, 95% CI: 0.02–0.10)
Remitted Depression (n)	11 (8%, 95% CI: 0.04–0.14)	0
Informant Type (n)		
None	19 (19%, 95% CI: 0.12–0.29)	2 (6%, 95% CI: 0.01–0.19)
Spouse	62 (63%, 95% CI: 0.53–0.73)	19 (53%, 95% CI: 0.35–0.70)
Other Family Member^{***}	11 (11%, 95% CI: 0.06–0.19)	14 (39%, 95% CI: 0.23–0.57)
Paid Caregiver	1 (1%, 95% CI: 0.00–0.06)	0 (0%)
Other	5 (5%, 95% CI: 0.02–0.12)	1 (2%, 95% CI: 0.00–0.15)

Mean (SD, Range); Two sample t-test

*
p<.05**
p<.01***
p<.001

Sensitivity, specificity, positive and negative predictive values at different scores for the Cornell Scale for Depression in Dementia.

Table 2

Score	≥2	≥4	≥6*	≥8*	≥10	≥12	≥14	≥16	≥18	≥20	≥22
Sensitivity	0.97	0.89	0.83	0.75	0.56	0.44	0.39	0.31	0.17	0.06	0.03
Specificity	0.18	0.47	0.73	0.82	0.87	0.93	0.96	0.97	0.99	0.99	1.00
PPV	0.30	0.38	0.54	0.60	0.61	0.70	0.78	0.79	0.86	0.67	1.00
NPV	0.95	0.92	0.92	0.90	0.84	0.82	0.81	0.79	0.76	0.74	0.74

* Scores correspond to the maximum sum of sensitivity and specificity. This cut-off criterion is a mathematical representation of the best simultaneous combination of sensitivity and specificity that is possible given the data. It is useful in evaluating the validity of rating scales and comparing results across studies. In practice, clinicians and researchers should choose cut-off scores that reflect the purpose of depression assessment (e.g., screening program, diagnostic tool, treatment response) and the consequences of misclassification.