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Test Characteristics of the 15-Item Geriatric Depression Scale and Hamilton Depression Rating Scale in Parkinson Disease

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Abstract

Objective—The objective of this study was to compare the sensitivity, specificity, and diagnostic accuracy of the 15-item Geriatric Depression Scale (GDS-15) and the Hamilton Depression Rating Scale (HDRS) in patients with Parkinson disease (PD).

Method—A convenience sample of 148 outpatients with idiopathic PD receiving specialty care completed the GDS-15 and were administered the HDRS and Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (SCID) depression module by a research psychiatrist or trained research assistant. Receiver-operating characteristic (ROC) curves were plotted for the GDS-15 and HDRS scores with a SCID diagnosis of a depressive disorder as the state variable.

Results—Thirty-two subjects (22%) were diagnosed with a depressive disorder. The discriminant validity of the GDS-15 and HDRS were both high (ROC area under the curve: 0.92 and 0.91, respectively), with greatest dichotomization for the GDS-15 at a cutoff of 4/5 (87% accuracy, 88% sensitivity, 85% specificity) and the HDRS at a cutoff of 9/10 (83% accuracy, 88% sensitivity, 78% specificity).

Conclusions—The GDS-15 performs well as a screening instrument and in distinguishing depressed from nondepressed patients in PD. Its test characteristics are comparable to the HDRS. Because it is a brief instrument and can be self-administered, it is an excellent depression screening tool in this population.

Keywords

Parkinson disease; depression; Geriatric Depression Scale

Depression is a common psychiatric complication in Parkinson disease (PD), with recent prevalence estimates of up to 25%–40% for all depression diagnoses combined.^{1,2} In this population, depression contributes significantly to functional disability,³ diminished quality of life,⁴ increased caregiver distress,⁵ and more rapid cognitive decline.⁶ Despite its frequency and detriment to patients and their caregivers, depression in PD (dPD) appears to be underrecognized and undertreated clinically, even in specialty care settings.^{7,8} It is important,

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therefore, for clinicians to be able to identify depression more efficiently and reliably in this population.

Because depressive symptoms can be confounded with the physical symptoms of PD, diagnosing depression in this population is challenging, and validating depression rating scales specifically in PD is important. Depression rating scales can be used for several purposes: to screen for depression, to diagnose the presence of a depressive disorder, to dichotomize patients into depressed and nondepressed groups, and to measure symptom severity and response to treatment. For a scale to be useful as a screening instrument, the proposed cutoff point should maximize the proportion of depressed patients scoring positive (sensitivity) and maximize the proportion of negative test results corresponding to nondepression (negative predictive value [NPV]), because the purpose of the screen is to identify as many depressed patients as possible. To be used as a diagnostic instrument, it should maximize the proportion of nondepressed patients who score negative (specificity) and maximize the proportion of positive test results corresponding to a diagnosis of depression (positive predictive value [PPV]), because a diagnostic instrument should avoid misdiagnosis of depression as much as possible. To be useful as an instrument to differentiate depressed from nondepressed individuals, it should have high sensitivity and specificity (i.e., discriminant validity), which maximizes the proportion of patients whose test results are accurate.

To date, three major rating scales have been validated for use in dPD: the Hamilton Depression Rating Scale (HDRS),^{9,10} the Montgomery-Åsberg Depression Rating Scale (MADRS),^{10,11} and the Beck Depression Inventory (BDI).^{12–14} All three demonstrate good psychometric properties as screening and diagnostic instruments, but only the HDRS and MADRS adequately dichotomize patients into depressed and nondepressed groups.^{10,14}

The 15-item Geriatric Depression Scale (GDS-15),¹⁵ consisting of a series of yes/no questions, is a widely used instrument for the screening of depression in the elderly and in medically ill populations. Because it is brief, nonsomatically focused, and can be either observer- or self-administered, the GDS-15 offers promise as a practical, valid rating instrument for dPD. The sensitivity and specificity of the GDS-15 have been evaluated in a variety of elderly populations,¹⁵ geriatric inpatients,¹⁶ primary care outpatients,^{17,18} elderly medical patients,¹⁹ and subjects older than 85 years²⁰ with an optimal cutoff point for depression usually found to be a score of five or more.¹⁷ However, the GDS-15 has not been assessed as a rating scale in PD.

The primary goal of this study was to determine the psychometric properties of the GDS-15 in PD. We determined the optimal cutoff points for its use as a screening, diagnostic, and dichotomization instrument against the “gold standard” of a depressive disorder diagnosis (either a major or minor depressive episode) according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)*.²¹

METHODS

Subjects

The study population consisted of a convenience sample of 148 outpatients, all (but two) male, who were new or established patients at the Parkinson's Disease Research, Education and Clinical Center (PADRECC) at the Philadelphia Veterans Affairs Medical Center (PVAMC) or the Parkinson's Disease and Movement Disorders Center (PDMDC) at the University of Pennsylvania. The PVAMC and University of Pennsylvania Institutional Review Boards approved the study, and only patients able to provide informed consent were included. Subjects were participants in a study evaluating the frequency and correlates of depression in PD and

were diagnosed with idiopathic PD by an attending neurologist with expertise in movement disorders.

Procedures

Subjects were recruited by approach or referral for evaluation either at intake or during a routine clinic visit. Patients either self-administered the GDS-15 at home before their initial clinic visit or were administered the instrument during a clinic appointment. The 24-item HDRS was administered by a research psychiatrist (DW) or a trained research assistant. Global cognitive function was assessed by the MMSE²² (N = 143), severity of parkinsonism was rated with the Unified Parkinson's Disease Rating Scale (UPDRS)²³ (N = 137), and overall PD disease severity was rated according to the Hoehn and Yahr staging system²⁴ (N = 134). A research psychiatrist (DW) or trained research assistant administered the Depression Module of the Structured Clinical Interview for *DSM-IV* (SCID)²⁵ and assigned a diagnosis of no depression, major depression, or minor depression, the latter in accordance with the proposed criteria set in Appendix B of *DSM-IV*. Consistent with the recommendations of experts in dPD,² an inclusive approach (i.e., scoring items irrespective of presumed etiology) was used when administering the SCID and the HDRS. An inclusive approach ensures consistency in evaluating patients and maintains the sensitivity of these instruments. Although symptom overlap between depressive and PD symptoms is reported, there is yet no consensus on the particular depressive symptoms that may fail to discriminate between depressed and nondepressed patients with PD and contribute to a misdiagnosis of depression.^{26–28} Results of the SCID interview constituted the “gold standard” for a diagnosis of a depressive disorder.

Statistical Analysis

A receiver operating characteristic (ROC) curve²⁹ was plotted for the GDS-15 and HDRS scores (for all SCID depression diagnoses versus no SCID diagnosis) to compare the sensitivity and specificity of each as a diagnostic measure for dPD. The ROC curve shows the sensitivity versus one minus the specificity for every possible cutoff point; optimal cutoff points are determined by visually assessing which score combines maximum sensitivity and specificity. The area under curve (AUC) was used as an indicator of the ability of the scales to differentiate patients meeting or not meeting SCID criteria for depression. Optimal cutoff scores for the purposes of screening, diagnosis, and dichotomization into groups of depressed and nondepressed individuals were determined. To determine whether the GDS-15 could be used as a predictive test for this population, the PPVs and NPVs were calculated for different cutoff scores in the central range of the scale. Additionally, screening characteristics were obtained for SCID diagnoses of major and minor depression individually. All analyses were performed with SPSS 11.5.³⁰

RESULTS

Characteristics of the sample population included: mean age = 72.0 years (standard deviation [SD]: 8.5, range: 40–90), MMSE score = 27.5 (SD: 2.6, range: 13–30), duration of PD = 7.8 years (SD: 5.8, range: 1–25), UPDRS score = 24.5 (SD: 11.5, range: 3–60), Hoehn and Yahr stage = 2.3 (SD: 0.6, range: 1–4), and mean daily L-dopa dosage = 440 mg (SD: 322 mg, range: 0–1420 mg). Thirty-two subjects (21.6%) met *DSM-IV* diagnostic criteria for a depressive disorder (18 [12.2%] with major depression and 14 [9.4%] with minor depression). A comparison of the mean age, duration of PD, UPDRS score, Hoehn and Yahr stage, daily L-dopa dosage, MMSE score, GDS-15 score, and HDRS score for the depression-positive and depression-negative groups is shown in Table 1.

Sensitivity, specificity, PPV and NPV values, and percent correctly diagnosed with either major or minor depression for different cutoff scores are shown for the GDS-15 in Table 2 and

for the HDRS in Table 3. The respective ROC curves are shown in Figures 1 and 2. The score representing the optimal dichotomization cutoff point for the GDS-15 was 4/5 (sensitivity 0.88, specificity 0.85) and for the HDRS was 9/10 (sensitivity 0.88, specificity 0.78). The AUCs for the two curves were high and similar (GDS-15 = 0.92, 95% confidence interval [CI]: 0.87–0.93); HDRS = 0.91, 95% CI: 0.86–0.96), indicating that the two instruments discriminated depressed from nondepressed patients equally well.

Cutoff points of 4/5 on the GDS-15 and 9/10 on the HDRS had high NPVs in addition to high sensitivity and specificity, suggesting that the two rating scales performed well at the same cutoff points both as depression screening instruments and in dichotomizing patients. Regarding diagnostic accuracy, a cutoff point of 6/7 for the GDS-15 and 15/16 for the HDRS yielded reasonably high specificity and PPV.

Separate analyses were performed on the GDS-15 for major or minor depression only versus no depression diagnosis. For a SCID diagnosis of major depression (N = 18), a GDS-15 cutoff of 6/7 maximized sensitivity (0.89) and specificity (0.93), a screening cutoff of 4/5 maximized sensitivity (1.00) and NPV (1.00), and a diagnostic cutoff of 6/7 yielded high specificity (0.89) and PPV (0.84). Although the cutoff of 6/7 correctly identified the most patients with a diagnosis of major depression or no depression diagnosis (93.2% accuracy), the common cutoff of 4/5 was equally high (92.3% accuracy). For a SCID diagnosis of minor depression (N = 14), a GDS-15 cutoff of 3/4 maximized sensitivity (0.86) and specificity (0.72), a screening cutoff of 2/3 maximized sensitivity (0.93) and NPV (0.98), and a diagnostic cutoff of 6/7 maximized specificity (0.97) and PPV (0.67). Again, although the cutoff of 3/4 correctly identified the most patients with a diagnosis of minor depression or no depression diagnosis (78.7% accuracy), a cutoff of 4/5 performed comparably (78.0% accuracy).

DISCUSSION

The GDS-15 is a commonly used instrument for depression screening in the general geriatric population and has been piloted for use in PD as well.³¹ Its clinical use in identifying depressed patients and its usefulness as a research tool for dPD, however, are predicated on the assumption that the GDS-15 is a valid measure of depression in this population. We evaluated the psychometric properties of the GDS-15 against the “gold standard” of *DSM-IV* criteria for a depressive disorder and compared its performance in a PD population with the performance of a previously validated rating scale, the HDRS.^{10,32}

ROC analyses revealed that the two scales had similar and high discriminant validity (i.e., good sensitivity and specificity) for a *DSM-IV* diagnosis of depression. In this particular sample, the HDRS performed comparably to that reported in previous PD studies in dichotomizing depressed from nondepressed patients, although the optimal cutoff points were lower in our sample.^{10,32} Most significantly, our results suggest that the GDS-15 is as good as the HDRS at discriminating between depressed and non-depressed patients with PD with the GDS-15 correctly diagnosing a similar percentage of patients to the HDRS at the optimal cutoff points. As a screening instrument, the GDS-15 performed as well as the HDRS with high sensitivity and NPVs at the same cutoff scores identified for optimal dichotomization.

The similarity in performance of these two instruments points again to the ambiguities in the contribution of somatic and neurovegetative symptoms to the diagnosis of depression in diagnoses of dPD.^{26–28} Although the GDS-15 is a much shorter and less time-intensive instrument than the HDRS, it was also designed specifically for an elderly population. Thus, its treatment of symptoms common in nondepressed geriatric patients is modified, taking into account the potential influences of comorbid medical conditions, cognitive impairment, vegetative symptoms, and thoughts of death and the future that can occur in elderly patients

without depression. In contrast with the HDRS, sleep, appetite, gastrointestinal symptoms, autonomic symptoms, and sexual symptoms are not assessed in the GDS as a result of their low correlation with the total GDS score.³³ Therefore, although the HDRS is possibly a more comprehensive evaluation of depressive symptomatology, it may be the case that the GDS-15 succinctly targets the critical symptoms of depression in the PD population.

A practical way to implement routine screening for depression is important in this population, because there is evidence that dPD is underrecognized and undertreated.^{7,8} In addition, some patients with PD may be unaware of being “depressed” despite endorsing clinically significant depressive symptoms,³⁴ and others may appear to be withdrawn or depressed by observers but not endorse symptoms of depression,³⁵ so it is clearly necessary to have a validated instrument for depression in this population.

This validation of the use of the GDS-15 in PD both as a screening instrument and in discriminating depressed and nondepressed patients is of clinical significance, because it is a brief instrument that can easily be used in routine clinical care either as a self- or rater-administered instrument. The optimal cutoff scores for discriminating both major and minor depression from no depression also performed very well in discriminating either type of diagnosis individually from a nondepression diagnosis, indicating that the GDS-15 can be a sound clinical tool in identifying depression of either severity with the same cutoff.

Although the HDRS and MADRS also have high discriminant validity in PD, they are lengthy and rater-administered, requiring significantly more time for training and administration. The BDI, although relatively brief, can only be self-administered and does not adequately discriminate between depressed and nondepressed patients with PD.¹⁴

One limitation of this study was its use of a nearly all male and geriatric population, limiting the generalizability of the findings. In addition, the GDS-15 was both self- and rater-administered, and limitations in the data set did not allow us to determine which method was used at an individual level.

Our results suggest that the GDS-15 is valid for use in discriminating depressed from nondepressed patients with PD. As a result of its ease of use and good test characteristics, the GDS-15 is appropriate for routine use in the clinical care of patients with PD as well as for research purposes. Because depression is underrecognized and undertreated in this population, more widespread use of the GDS-15 could potentially lead to improved treatment, outcomes, and quality of life for dPD patients.

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ROC: receiver-operating characteristic; GDS-15: 15-item Geriatric Depression Scale.

Figure 1. ROC Curve for the GDS-15 versus *DSM-IV* Diagnosis of Depression

ROC: receiver-operating characteristic; GDS-15: 15-item Geriatric Depression Scale.

ROC: receiver-operating characteristic; HDRS: Hamilton Depression Rating Scale.

Figure 2. ROC Curve for HDRS versus *DSM-IV* Diagnosis of Depression

ROC: receiver-operating characteristic; HDRS: Hamilton Depression Rating Scale.

Clinical Characteristics of Patients Diagnosed (Depression-Positive) and Not Diagnosed (Depression-Negative) with a Major or Minor Depressive Episode

	Depression-Positive	Depression-Negative	t-test (df)	p Value
Age				
Mean (SD)	(N = 32) 70.94 (7.85)	(N = 116) 72.32 (8.67)		
Range	54–81	40–90	0.86 (53.77)	0.39
PD duration				
Mean	(N = 32) 7.11 (5.25)	(N = 116) 7.94 (5.95)	0.77 (54.95)	0.45
UPDRS score				
Mean	(N = 30) 26.68 (11.30)	(N = 107) 23.94 (11.52)	-1.17 (47.28)	0.25
Hoehn & Yahr stage				
Mean	(N = 30) 2.35 (0.70)	(N = 104) 2.34 (0.58)	-0.131 (41.16)	0.90
Daily levodopa dosage (mg/day)				
Mean	(N = 32) 475.63 (315.99)	(N = 115) 430.70 (323.86)	-0.71 (50.60)	0.48
MMSE				
Mean	(N = 32) 27.31 (2.79)	(N = 111) 27.59 (2.50)	0.52 (46.32)	0.61
Range	17–30	13–30		
GDS-15				
Mean	(N = 32) 7.97 (3.22)	(N = 116) 2.63 (2.18)	-8.85 (39.16)	<0.001
HDRS-24				
Mean	(N = 32) 15.72 (6.19)	(N = 116) 5.86 (4.16)	-8.50 (39.06)	<0.001

PD: Parkinson disease; UPDRS: Unified Parkinson's Disease Rating Scale; MMSE: Mini-Mental State Examination; GDS-15: 15-item Geriatric Depression Scale; HDRS: Hamilton Depression Rating Scale.

Table 2

Sensitivity, Specificity, Positive and Negative Predictive Values, and Percent Correctly Diagnosed With Depression for the GDS-15

Cutoff	1/2	2/3	3/4	4/5*	5/6	6/7	7/8
Sensitivity	1.00	0.97	0.91	0.88	0.78	0.66	0.50
Specificity	0.35	0.51	0.71	0.85	0.91	0.97	0.97
PPV	0.30	0.35	0.46	0.61	0.69	0.84	0.84
NPV	1.00	0.98	0.96	0.96	0.93	0.91	0.88
Percent correctly diagnosed	68	74	81	87	85	82	73

* Maximum sensitivity and specificity.

GDS-15: 15-item Geriatric Depression Scale; PPV: positive predictable value; NPV: negative predictable value.

Sensitivity, Specificity, Positive and Negative Predictive Values, and Percent Correctly Diagnosed With Depression for the 24-Item Hamilton Depression Rating Scale

Table 3

Cutoff	6/7	7/8	8/9	9/10*	10/11	11/12	12/13	13/14	14/15	15/16
Sensitivity	0.97	0.94	0.91	0.88	0.78	0.67	0.59	0.56	0.56	0.44
Specificity	0.61	0.67	0.72	0.78	0.84	0.87	0.92	0.96	0.97	0.98
PPV	0.40	0.44	0.48	0.52	0.57	0.59	0.68	0.78	0.82	0.87
NPV	1.00	0.98	0.97	0.96	0.93	0.91	0.89	0.88	0.89	0.86
Percent correctly diagnosed	79	81	82	83	81	77	78	77	77	71

* Maximum sensitivity and specificity.

PPV: positive predictable value; NPV: negative predictable value.