

## SHORT REPORT

## Reliability and validity of the Geriatric Depression Scale in depression in Parkinson's disease

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The objective of this study was to investigate reliability and validity of the self rated 30 item Geriatric Depression Scale (GDS) in screening and diagnosis of depression in Parkinson's disease (PD). The study sample comprised 109 non-demented patients with PD admitted to the movement disorders outpatient unit. The reference diagnosis of depression was made according to DSM-IV criteria. Discriminant validity and internal consistency of the total scale were studied. Sensitivity, specificity, and positive and negative predictive values (PPV and NPV) were calculated for different cutoff scores. Receiver operating characteristics (ROC) analysis was also carried out. The sample comprised 56 patients with and 53 without depression. In the discriminant validity analysis, the mean total GDS score of subjects with depression was significantly higher compared with those without depression. The Cronbach's  $\alpha$  score was 0.92 and the split half correlation coefficient 0.91. The cutoff score of 13/14 provided the highest sum of sensitivity and specificity level. The sensitivity of this cutoff score was 0.78 and specificity 0.85, while PPV was 0.84 and NPV 0.79. The area under the curve value in the ROC analysis was 0.891. Sensitivity and specificity analysis showed that cutoff scores of 8/9 or 9/10 could be useful for screening and 14/15 or 15/16 for diagnostic purposes. This study showed that the 30 item GDS, with its high discriminant validity, internal consistency, and reasonably clear cutoff scores, could be a useful screening or diagnostic self rated depression scale in patients with PD.

Depressive symptoms are the most common non-motor symptoms of Parkinson's disease (PD).<sup>1</sup> "Somatic symptoms", which are common in depression, are also seen in non-depressed patients with PD, and may cause overdiagnosis of depression in this group.<sup>2</sup> Several authors have emphasised the need for screening and diagnostic instruments that do not include items related to somatic symptoms of depression that may also occur in non-depressed patients with PD.<sup>3</sup> Because of their ease of application and no requirement for experienced staff, self rated scales may be preferred for screening and research purposes. The Beck Depression Inventory (BDI), is the only self rated scale so far studied for its reliability and validity in patients with PD, but it includes a significant number (7 of 21) of somatic items.<sup>4,5</sup> The Geriatric Depression Scale (GDS) is one of the most commonly used self rating depression scales in geriatric populations. It comprises 30 easy to use items, with answers in yes/no format, and is designed to exclude those somatic symptoms of depression that are also seen in non-depressed elderly people.<sup>6</sup> Because most patients with PD are elderly and most somatic symptoms seen in PD are not included in the scale, we hypothesised that the GDS

could be a useful instrument in screening and diagnosis of depression in patients with PD. Although long and short forms of the scale have been previously used in patients with PD, no study addressing its reliability and validity in this population has so far been published.<sup>7,8</sup>

In this study, we investigated the reliability and validity of the 30 item GDS in screening and diagnosis of depression in patients with PD. This scale was previously studied for its psychometric properties in depression in a Turkish elderly population.<sup>9</sup>

## METHODS

The sample was composed of patients with PD admitted to the Movement Disorders Outpatient Unit of the Department of Neurology, Istanbul University Cerrahpaşa Medical School, who volunteered and gave consent to participate in the study. The diagnosis of PD was made using Brain Bank Criteria.<sup>10</sup> The presence of dementia was determined by clinical interview according to the *Diagnostic and statistical manual of mental disorders, 4th edition* (DSM-IV) dementia criteria, and patients who were not demented were included in the study sample.<sup>11</sup> A complete physical and neurological examination was performed in all of the patients, and disease severity was measured by the Unified Parkinson's Disease Rating Scale (UPDRS)<sup>12</sup> and the Hoehn and Yahr (HY) scale.<sup>13</sup> The two Turkish versions of the Mini Mental State Examination, one for patients with education and the second for those without, were used for objective scoring of the cognitive status.<sup>14,15</sup> All patients were screened for the presence of depression by clinical interview using DSM-IV criteria<sup>11</sup> as the reference standard. We preferred to use the DSM-IV as the reference standard because it is one of the most commonly used criteria for diagnosis of depression in psychiatric research field and because there are no specific criteria for diagnosis of depression in PD. Patients who met at least five of the DSM-IV criteria for major depression were classified as having major depression and those with fewer than five as having minor depression. After the interview, the sample was divided in two groups, based on the presence and absence of depression. The diagnosis of PD was made by neurologists, and depression by a psychiatrist or a neurologist with sufficient (at least 9 months') training in psychiatry.

The Turkish version of the GDS was completed by all of the literate patients. For illiterate patients the scale was read by the researchers without any comment and the patients were asked to choose one of the answers. The GDS was presented to the patients after the interview was completed, thus the interviewers were blinded to the results of the scale while making the diagnosis of depression.

**Abbreviations:** AUC, area under the curve; BDI, The Beck Depression Inventory; DSM-IV, *Diagnostic and statistical manual of mental disorders, 4th edition*; GDS, Geriatric Depression Scale; HY, Hoehn and Yahr Scale; NPV, negative predictive value; PPV, positive predictive value; UPDRS, Unified Parkinson's Disease Rating Scale

### Statistical analysis

Cronbach's  $\alpha$  and split half correlation coefficients were calculated for the internal consistency analysis. For the validity analysis, the mean GDS scores of the depressed and non-depressed groups were compared by Student's *t* test. Sensitivity, specificity, and positive and negative predictive values (PPV and NPV) were calculated for different cutoff scores. Cutoff scores were also assessed by the receiver operating characteristics (ROC) curve. As the GDS had showed sufficient test-retest correlation in the general elderly population previously,<sup>10</sup> we did not investigate test-retest reliability in this study.

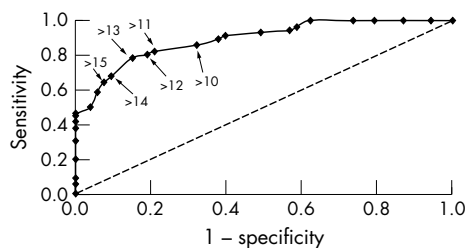
### RESULTS

The recruitment of patients was carried out between November 2001 and June 2004 and 109 patients (73 men; 67%) were included in the study. The mean (SD) of the sample was 66.5 (11) years (range 29–84). There were four patients (3.7%) under 40 years old, 10 (9.1%) in the range 40–49 years, 7 (6.5%) in the range 55–60 years, and the remaining 81 (74.3%) were  $\geq 60$  years old. The mean (SD) duration of education was 7.2 (4) years (range 0–22), and 16 patients (14.6%) had no education. The mean (SD) pooled MMSE score of the sample was 25.7 (3) (range 12–30), UPDRS score was 35 (19) (range 3–96), and HY scale was 2.1 (0.7) (range 1–5). There were 53 non-depressed patients (48.6%), while 56 (51.4%) had depression, 31 of whom were diagnosed with minor depression, and 25 with major depression. The GDS was administered to all of the patients and no item was left unanswered.

Cronbach's  $\alpha$  coefficient was 0.92 and split half correlation coefficient was 0.91. The validity analysis showed that the depressed group had significantly higher mean GDS total score compared with those without depression (19.7 (7) *v* 7.6 (5), *t* = 9.5, d.f. = 107, *p* = 0.000. 95% confidence interval 9.6 to 14.6). The highest sum of sensitivity and specificity value of 1.63, was obtained for the cutoff score of 13/14 followed by 1.61 for cutoff scores 11/12 and 12/13. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for cutoff scores between 6/7 and 16/17 are shown in table 1. The ROC curve, presented in fig 1, also showed that the three cutoff scores 11/12, 12/13, and 13/14 provided the best results, which were very close to each other, with 13/14 being closest to the upper left of the graph. The area under the curve (AUC) value was 0.891.

### DISCUSSION

Our results showed that the GDS has a high internal consistency in PD with high Cronbach's  $\alpha$  and split half values. These results are very similar to those obtained in elderly populations in both Turkish and other cultures. We previously reported a Cronbach's  $\alpha$  score of 0.91 in an elderly Turkish population,<sup>9</sup> and other authors have also reported results of around 0.90 in general elderly populations from different cultures.<sup>6, 16, 17</sup> In our opinion, the high internal consistency of the GDS in patients with PD, similar to that obtained in the general elderly population, reflects the uniformity of its structure. Data related to the internal



**Figure 1** Receiver operating characteristics (ROC) curve for GDS in discriminating subjects without (*n* = 53) from those with depression (*n* = 56). AUC, area under the curve. AUC = 0.891.

consistency of a depression scale in PD have been reported only by Levin *et al*,<sup>4</sup> who showed that the BDI had a Cronbach's  $\alpha$  score of 0.88, which is slightly lower than we obtained.

In our study, the cutoff score of 13/14 had the highest sensitivity and specificity sum, and PPV and NPV were also reasonably high. We observed that the range of cutoff scores between 11/12 and 13/14 in the GDS had the best sensitivity and specificity values, and that these results seemed to be better than those obtained with the BDI, as reported by Leentjens *et al*,<sup>5</sup> who showed a similar sum of sensitivity and specificity values in a wide range of cutoff scores (6/7 to 16/17) with the BDI. In our study, the best sensitivity and specificity values obtained for the GDS were observed for a narrower range (11/12–13/14), and the AUC value was also higher than that reported for the BDI (0.891 *v* 0.856). We think that the difference between the item content of the two scales may explain the better results provided by the GDS. Only one item (lack of energy) related to somatic symptoms that may be seen in non-depressed patients with PD is included in the 30 item GDS. The use of the BDI in patients with PD has also been previously criticised by other authors, and inclusion of items rating somatic symptoms that may be seen in non-depressed patients with PD was proposed to influence the scale.<sup>18, 19</sup>

The cutoff score table in our study also shows that the GDS can be a good instrument for screening purposes, with high sensitivity values and NPV when the cutoff score is lowered to 8/9 or 9/10. If the cutoff score is set to 14/15 or 15/16, the scale becomes a good diagnostic instrument, with high specificity and PPV. In our study, approximately half of the depressed group had minor depression, and the remaining half had major depression. As expected, this composition may influence the determination of the best cutoff score, which would probably be lower than 13/14 for minor depression and higher for major depression in a study designed to analyse validity in minor and major depression separately.

### CONCLUSION

The GDS seemed to be useful as a self rated scale for depression in patients with PD in our study. The cutoff score 13/14 had the highest sum of sensitivity and specificity

**Table 1** Discrimination between depressed (*n* = 56) and non-depressed (*n* = 53) groups

Cutoff	6/7	7/8	8/9	9/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
Sensitivity	0.94	0.93	0.91	0.89	0.85	0.82	0.80	0.78	0.68	0.64	0.59
Specificity	0.43	0.51	0.60	0.62	0.68	0.79	0.81	0.85	0.90	0.92	0.94
PPV	0.64	0.66	0.71	0.71	0.74	0.80	0.81	0.84	0.88	0.90	0.91
NPV	0.88	0.87	0.86	0.84	0.82	0.80	0.79	0.79	0.72	0.71	0.68

PPV, positive predictive value; NNPV, negative predictive value.

values, those of 8/9 and 9/10 provided the best results for screening, and 14/15 and 15/16 had the best results for diagnostic purposes.

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