# Depression in Parkinson's disease: prevalence, pharmacological treatment and association with brainstem raphe echogenicity

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## Introduction

With an average prevalence of about 40% and ranging from 27 to 76% [1,2], depression is one of the most common non-motor manifestations of Parkinson's disease. Depressive symptoms in PD patients often remain untreated [3], underlining the need to understand the factors that play a role in the prevalence of depression in PD. Transcranial sonography (TCS) of substantia nigra (SN) has been established as a substantially sensitive and specific procedure to diagnose PD relatively early by visualizing the severity of brain pathology [4]. Low brainstem raphe (BR) echogenicity on TCS has been found to be a common finding in 50–70% of patients with unipolar depression [5,6] and is associated with responsivity to serotonin-reuptake inhibitors [7]. Reduced echogenicity of BR, thought to reflect an alteration of the serotonergic system, has been found to be more frequent in depressed than in non-depressed subjects, irrespective of the presence of PD [5] (Figure 1). The objective of our study was threefold: to describe the prevalence and pharmacological treatment of depression, as well as analyze possible associations between brainstem raphe (BR) echogenicity and depressive symptoms in an Estonian sample of patients with PD and age- and education-matched healthy controls.

## Methods

The study included 266 PD patients and 168 age- and education-matched healthy controls (Table 1). Disease and depression severity were assessed. In addition, data on independence in daily living and quality of life, cognitive functioning, and antidepressant use was collected. BR was visualized by transcranial sonography. Data was pooled and analyzed using group comparisons and correlation analysis.

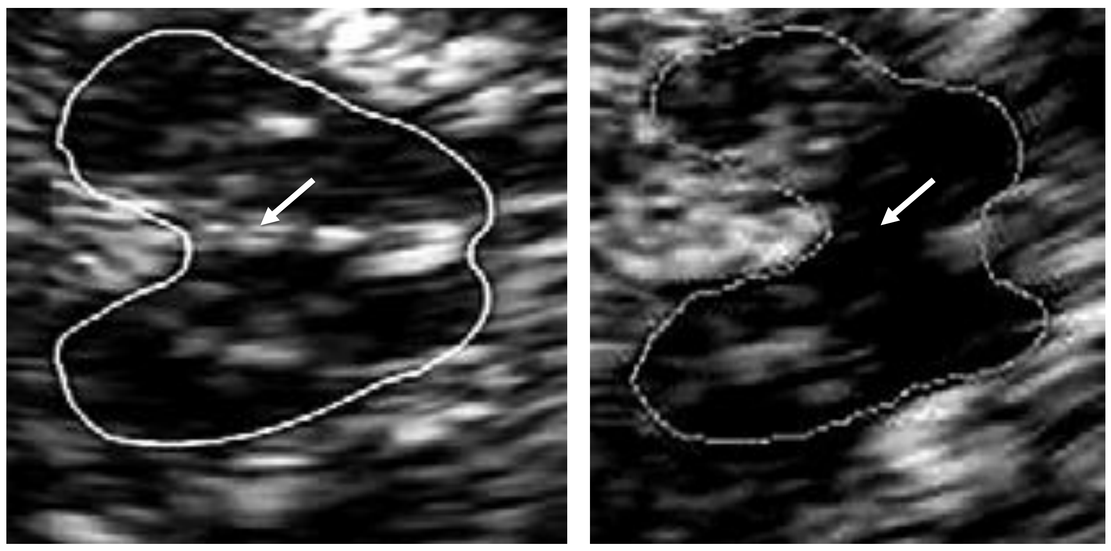

**Figure 1**. Transcranial sonogram (zoom) of brainstem continuous midline raphe from a PD patient without depression (left) and an absent brainstem midline raphe from a PD patient with depression (right). Location of the midline raphe is depicted with an arrow. The echogenic region of the mesencephalon is encircled for better visualization.

**Table 1**. Characteristics of PD patients and healthy controls

| Characteristic | PD (n = 266) | Controls (n = 168) | p |
|---|---|---|---|
| Age at evaluation, y | 69.3 ± 9.19 | 70.4 ± 7.79 | .56 |
| Male, n | 140 (52.6) | 88 (52.4) | .96 |
| Education, y | 12.8 (2.85) | 12.4 (2.52) | .17 |
| Disease duration, y | 6.1 ± 5.21 | NA | |
| *Neurological assessment* | | | |
| MDS-UPDRS III ("on" state) | 31.23 ± 14.58 | 3.0 ± 2.24 | <.001 |
| Hoehn-Yahr stage | 2.66 ± 0.80 | NA | |
| 1 | 28 (10.5) | | |
| 2 | 88 (33.1) | | |
| 3 | 113 (42,5) | | |
| 4 | 35 (13.2) | | |
| 5 | 2 (0.8) | | |
| *Behavioral assessment* | | | |
| BDI | 14.6 (8.3) | 11.9 (6.0) | .001 |
| MMSE | 27.91 (2.84) | 29.2 (1.31) | <.001 |
| Schwab-England | 77.2 (14.60) | NA | |
| PDQ-39 | 29.2 (17.47) | NA | |
| *Medication* | | | |
| L-Dopa daily dose, mg | 418 ± 366 | NA | |
| Antidepressants, n | 20 (7.5) | NA | |
| Neuroleptics, n | 5 (1.9) | NA | |

Data are presented as mean ± SD and number (percent) where applicable.
MDS-UPDRS III indicates Movement Disorders Society Unified Parkinson's Disease Rating Scale, motor part; and NA - not applicable.

## Results

The control group was found to be significantly less depressed than the patient group (p=0.001). 55.4% of controls were found to be depressed, whereas the percentage of depressed individuals in the PD group was 74.4, of which 35.7% had major depression. 6.8% and 13.7% of the patients with minor and major depression, were using antidepressants at study time, respectively. A linear relationship between raphe echogenicity and scores on the BDI was found (Figure 2). Raphe echogenicity in patients with PD was significantly correlated with the overall severity of depression as assessed by the BDI (ñ=0.593, p<0.001). In the control group, the relationship was found to be similar (ñ=0.663, p<0.001).

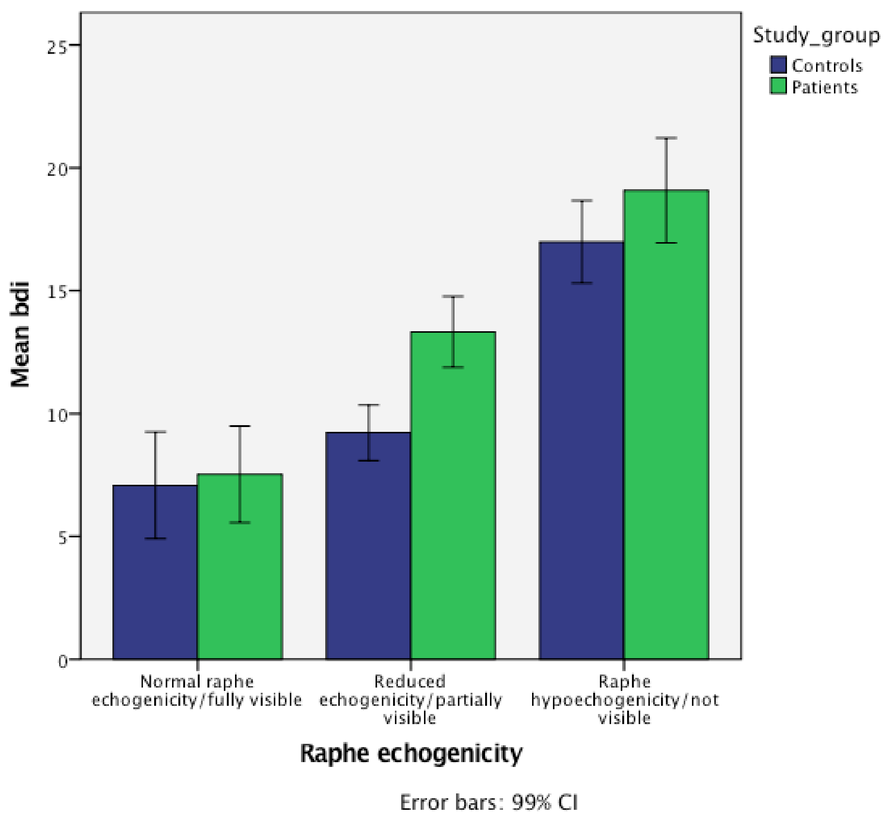


Figure 2. Relationships of depression rate and echogenicity level between subject groups

## Discussion

In line with other studies [1,2], 35.7% of our PD patients had major depression. When we combined patients with minor and major depression, almost 75% of our patients were indicative of a depressive state. The scores on the assessment scales tended to worsen along with the depression. The control group was significantly less depressed than the patient group, amounting to 55.4% of subjects, of whom 28.6% had major depression. Antidepressant use was documented in the patient group. Only 6.8% of patients with minor depression and 13.7% of patients with major depressive disorder were using antidepressants at assessment time.

We found a significant reduction of BR echogenicity in patients with PD and depression compared with non-PD controls. BR echogenicity in both patients with PD and non-PD controls was directly related to the overall severity of depression. The effect was stronger in the PD group, indicating a broader monoaminergic deficit. New efficacious treatment avenues to account for treatment-resistant depression should be pursued.

## References

[1] J.R. Slaughter, K.A. Slaughter, D. Nichols, S.E. Holmes, M.P. Martens, Prevalence, Clinical Manifestations, Etiology, and Treatment of Depression in Parkinson's Disease, JNP. 13 (2001) 187–196.
[2] J.S.A.M. Reijnders, U. Ehrt, W.E.J. Weber, D. Aarsland, A.F.G. Leentjens, A systematic review of prevalence studies of depression in Parkinson's disease: The Prevalence of Depression in PD, Movement Disorders. 23 (2008) 183–189.
[3] T.C. van der Hoek, B.A.A. Bus, P. Matui, M.A. van der Marck, R.A. Esselink, I. Tendolkar, Prevalence of depression in Parkinson's disease: Effects of disease stage, motor subtype and gender, Journal of the Neurological Sciences. 310 (2011) 220–224.
[4] T. Toomsoo, I. Liepelt-Scarfone, R. Kerner, L. Kadastik-Eerme, T. Asser, I. Rubanovits, et al., Substantia Nigra Hyperechogenicity Validation of Transcranial Sonography for Parkinson Disease Diagnosis in a Large Estonian Cohort, JUM. 35 (2016) 17–23.
[5] U. Walter, J. Hoeppner, L. Prudente-Morrissey, S. Horowski, S.C. Herpertz, R. Benecke, Parkinson's disease-like midbrain sonography abnormalities are frequent in depressive disorders, Brain. 130 (2007) 1799–1807.
[6] G. Becker, M. Struck, U. Bogdahn, T. Becker, Echogenicity of the brainstem raphe in patients with major depression, Psychiatry Research: Neuroimaging. 55 (1994) 75–84.
[7] U. Walter, L. Prudente-Morrissey, S.C. Herpertz, R. Benecke, J. Hoeppner, Relationship of brainstem raphe echogenicity and clinical findings in depressive states, Psychiatry Research: Neuroimaging. 155 (2007) 67–73.

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