# Neuromelanin Magnetic Resonance Imaging of Substantia Nigra in Patients with Parkinson disease dementia (PDD), Alzheimer disease (AD) and Age-matched controls.

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Purpose:
Neuromelanin loss of substantia nigra (SN) due to dopaminergic cell loss can be visualized by T1 signal reduction by using high-resolution T1-weighted imaging. Although neuromelanin loss is characteristic in Parkinson disease including Parkinson disease dementia (PDD), decreased neuromelanin of SN can be seen in other neurodegenerative diseases such as more common Alzheimer's disease (AD). Therefore, we investigated whether volumetric analysis of T1 hyperintensity for SN can be used for differentiating between PDD, AD and age-matched controls

Materials and Methods:
This retrospective study enrolled 10 patients with PDD, 18 patients with AD and 13 age-matched healthy elderly controls. MR imaging was performed at 3T (GE Signal HDx). To measure the T1 hyperintense area of SN, we obtained axial thin section high-resolution T1-weighted fast spin echo sequence with the following parameters: TR/TE, 600/14msec; ETL,2; slice thickness, 2.5mm (interslice gap 1mm); matrix, 512x320; FOV, 220mm. The sequence was obtained in the oblique axial plane perpendicular to the 4$^{th}$ ventricle floor with coverage from the posterior commissure to the inferior border of the pons. ROIs for T1 hyperintense SN were drawn onto heavily T1-weighted FSE sequence through midbrain level, using the MIPAV software. The measurement differences was tested by using Kruskal-Wallis test followed by a post hoc comparison.

Results:
In volumetric analysis, three groups showed significant difference in terms of volume of T1 hyperintensity ($p<0.0001$). Volume of T1 hyperintensity was significant lower in PDD than AD and normal controls ($p<0.005$, Bonferroni corrected). However, Volume of T1 hyperintensity was not different between AD and normal controls ($p=0.1359$, Bonferroni corrected). Conversely, Mean signal intensity of T1 hyperintense area was not different among three groups ($p=0.118$). The cutoff value for differentiation
ROC analysis revealed that the optimal T1 hyperintensity volume cutoff value for differentiating PDD from AD and controls was 111.8 mm$^3$ (sensitivity, 100% ; specificity, 80.6%; AUC = 0.939; 95% confidence interval, 0.866 – 1.000) ($p < 0.001$)

Conclusion:
Volumetric measurement of T1 hyperintense substantia nigra can be a useful imaging marker for evaluating neuromelanin loss in neurodegenerative diseases including AD and PDD.

Figure 1.

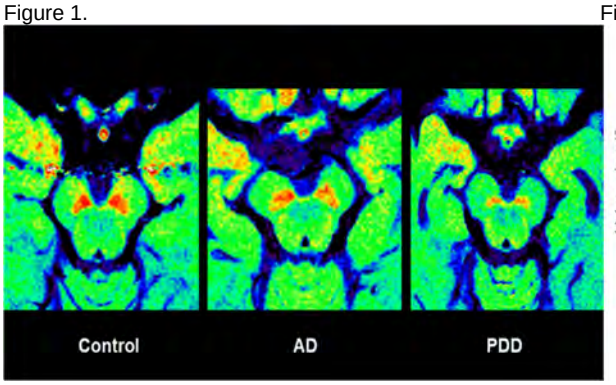


Figure 2.

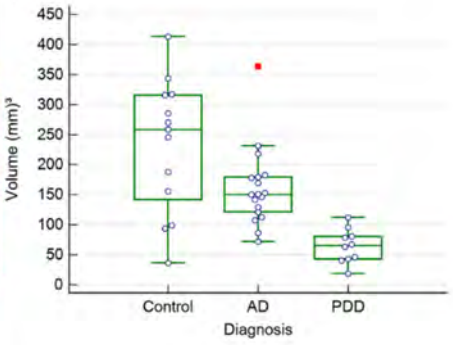


Figure 1. Neuromelanin Deposition in Control, AD, and PDD patients
Figure 2. Difference of volumes of T1 hyperintensity (neuromelanin volume) in control, AD and PDD patients.

Reference:

1. Sasaki M, Shibata E, Tohyama K et al. NeuroReport 2006:31:1215-1218
2. Sasaki M, Shibata E, Ohtsuka K et al. Neuroradiology 2010:52:83-89

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