

## TRANSCRANIAL SONOGRAPHY IN IDIOPATHIC PARKINSON'S DISEASE AND ATYPICAL PARKINSONIAN SYNDROMES

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### Abstract

Transcranial B-mode sonography (TCS) has been increasingly used as a diagnostic tool in Parkinson's disease (PD) and related movement and other neurodegenerative disorders. The specific advantages of TCS are the different visualization of brain structures compared to other neuroimaging methods due to the different physical imaging principle, high-resolution imaging of echogenic deep brain structures, real-time dynamic imaging with high resolution in time, low costs of ultrasound equipment, wide availability, short investigation time, noninvasivity, mobility and bedside availability, and little interruption by patients' movements.

TCS through the temporal bone window allows the depiction of characteristic abnormalities in the echogenicity of substantia nigra (SN) and basal ganglia (BG).

Increased echogenicity ("hyperechogenicity") of the SN could be detected in more than 90% of PD patients. Importantly, SN hyperechogenicity can also be found in healthy subjects. The prevalence of this echo feature is about 10% in the healthy adult population.

The accuracy of the clinical diagnosis of PD is still limited. According to population-based studies in the United Kingdom, there is still a high rate of false diagnoses, when comparing the initial diagnosis with later diagnoses according to the clinical UK Brain Bank criteria. Especially in the early stages, when cardinal symptoms are not conclusive, diagnosis can be delayed as structural neuroimaging methods such as CT or MRI do not provide characteristic findings that allow the diagnosis of this chronic neurodegen-

erative disease. Especially in the very early stages of the disease, when no full spectrum of clinical signs necessary to establish the clinical diagnosis is obvious, diagnosis of PD can be a real challenge. Mixed tremor (including resting and postural/action tremor) could be a sign of both essential tremor or a parkinsonian syndrome; bradykinesia and rigidity may occur not only in PD, but also in Wilson's disease or atypical parkinsonian syndromes (APS); hypokinesia may be a sign of both depression and PD; and slowness and gait disturbances may not only occur in PD, but also be associated with hydrocephalus and vascular parkinsonism. Already in the early stages of PD, hyperechogenicity of SN is visible, allowing the differentiation of very mildly affected patients with idiopathic PD from healthy persons and from patients with APS with high sensitivity and specificity.

Typically, in patients with APS echogenicity of the SN is normal, whereas often BG are hyperechogenic. TCS is a very useful diagnostic technique to differentiate between different parkinsonian disorders. MSA and PSP can be distinguished from PD by the absence of a hyperechogenic SN on TCS. A hyperechogenic lenticular nuclei indicates MSA or PSP in favor of PD. Differentiation between MSA and PSP can be done by examining the third ventricle. If this is dilated (>10mm), PSP is the more likely diagnosis. In DLB, a hyperechogenic SN is found in general as well as a dilated third ventricle, which can differentiate between DLB and PD without dementia.

Clinically it is often difficult to distinguish between CBD and PSP. In contrast to PSP patients with CBD generally show hyperechogenicity of the SN and a normal width of the third ventricle.

In contrast to patients with idiopathic PD, patients with vascular Parkinsonism in general show no hyperechogenicity of the SN. In contrast to a number of patients with APS, also the BG show normal echogenicity on TCS.

A more specific approach to vascular Parkinsonism includes the Doppler or duplex technique in order to show stenosis of vessels. Therefore, the combination of TCS and Doppler/duplex imaging might help to improve diagnosis of vascular Parkinsonism.