

# WORKSHOP – TRANSCRANIAL BRAIN PARENCHYMA SONOGRAPHY IN NEUROLOGICAL AND PSYCHIATRIC DISEASES

## METHOD AND VALIDITY OF TCS IN MOVEMENT DISORDERS

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During the past two decades, transcranial sonography (TCS) has developed to an increasingly used brain imaging method that visualizes characteristic patterns of brain structures alterations in distinct movement disorders. Findings of abnormal hyperechogenic appearance of substantia nigra (SN) on TCS in Parkinson's disease (PD), which is stable during the course of the disease and probably present already in preclinical disease stages have promoted the idea that this TCS finding in healthy subjects might be a risk marker of PD.

Hyperechogenicity of the SN is a typical finding in about 90% of patients with PD, but not in patients with essential tremor (ET). In ET patients, the prevalence of hyperechogenicity is in the range of healthy control subjects or slightly above, which may indicate an increased risk for PD in the subgroup of ET patients with SN hyperechogenicity.

TCS findings in restless legs syndrome (RLS) include hypoechogenicity of the substantia nigra and raphe as well as hyperechogenicity of the red nucleus.

Transcranial sonography (TCS) can detect trace metal accumulation in deep brain structures with higher sensitivity than conventional MRI. Increased iron content in the substantia nigra in Parkinson's disease, increased copper content in the lenticular nucleus (LN) in Wilson's disease and idiopathic dystonia, and increased manganese content in the LN in manganese-induced Parkinsonism.

No characteristic abnormalities were found in the basal ganglia of primary dystonia patients. It remains to be explored whether this is due to a true absence of signal alterations in the basal ganglia of dystonia patients or to limitations of the current technology used.

The TCS finding of substantia nigra hyperechogenicity in Huntington's disease (HD) was related to higher clinical disease severity. A poorer cognitive performance correlated with larger width of third ventricle. Moreover, widths of frontal horns of lateral ventricles measured with TCS corresponded closely to diameters estimated by CT imaging. Depressive symptoms were found to be associated with abnormal echogenicity of mesencephalic raphe structures. Furthermore, a larger number of CAG repeats in the huntingtin gene correlated with presence of SN hyperechogenicity.

TCS also reveals signal alterations of basal ganglia in several forms of hereditary and nonhereditary ataxia. hyperechogenicity of substantia nigra (SN) as a frequent finding in spinocerebellar ataxia type 2, type 3, and type 17, indicating a vulnerability of the nigrostriatal system in SCA patients. A new "cerebellar examination plane" was proposed, allowing better visualization of fourth ventricle enlargement and nucleus dentatus hyperechogenicity as a characteristic finding in SCA3 patients.

In sporadic Creutzfeldt-Jakob disease, a blurry inhomogeneous hyperechogenic signal pattern of

lentiform nucleus was identified in all of the patients in a small case series. Furthermore, distinct bilateral hyperechogenicity of pallidostriatal regions have been described as a novel diagnostic feature in the sonographic differentiation of extrapyramidal and atactic movement disorders.

TCS has shown correlation of raphe hypoechogenicity and primary depressive disorders such as major depression and depression in Parkinson's disease.

TCS is a commonly available, noninvasive, and inexpensive diagnostic tool, which provides reliable information about the morphology of the brain, even in agitated patients who do not tolerate other imaging techniques.