

Summary

The role of metal accumulation in the pathophysiology of neurodegenerative diseases has been a hot topic in recent years due to the possibility of its treatment by chelating agents. Although the mechanisms of neurodegeneration are well known, the role of metal accumulation is still unclear. The main limitation are unsatisfactory methods for in vivo metal imaging; the most widely used technique is magnetic resonance imaging (MRI). Our aim was to assess the possibility of using transcranial sonography (TCS) in differential diagnosis of neurodegenerative diseases and to further explore the underlying factors of echogenicity.

In the first study, using TCS fusion with MRI, we focused on location verification of the commonly assessed structures (substantia nigra and nucleus lentiformis) and exclusion of possible focal structural changes affecting the echogenicity in WD and PD patients. Moreover, obtained MRI were used for semi-quantitative comparison with TCS images. Although TCS has been confirmed to be highly beneficial in differential diagnosis of Wilson's disease and it should be recommended as a screening method for extrapyramidal patients with atypical course of the disease, the direct relationship between TCS and metal deposits could not be proven. The obtained results from the ultrasound fusion imaging allowed the assessment of further structural changes and revealed hyperechogenicity of insula as another potential diagnostic marker of Wilson's disease. In the last study, we compared TCS findings in idiopathic REM sleep behavior disorder (iRBD) and synucleinopathy with and without RBD. We evaluated the correlation between TCS and SPECT.

Only few ultrasound imaging fusion studies have been published. Thus, we do not have enough data yet to evaluate the direct effect of metals on TCS. Nevertheless, based on our findings, we assume that TCS changes reflect metal-induced secondary changes, with predilection to certain areas: iron to SN and copper to nucleus lentiformis and insula. However, due to close interactions of metals, it is not possible to separate their role in neurodegeneration.

Key words: neurodegeneration, transcranial sonography, substantia nigra, metal accumulation, iron, copper, manganese, zinc, Wilson's disease, Parkinson's Disease