TRANSCRANIAL SONOGRAPHY IN DEPRESSION

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In patients with depression, brain magnetic resonance (MR) scans have detected a number of alterations in brain structure compared to those without the illness. In spite some inconsistency in the results, meta-analyses showed that there is a strong evidence for smaller hippocampal volumes, reduction in the left anterior cingulate cortex gray matter and increased load of white matter hyperintensities (WMH). In particular, WMH in depressed individuals have been associated with a late age of onset of the depression and led to the development of the vascular depression theory. Another structure probably critical in depressive disorder (DD) is the brainstem raphe (BR), an accumulation of nuclei and fiber tracts in the mesencephalon. BR has important connections with limbic systems, basal ganglia, thalamus, frontal and temporal lobes, hippocampus and cerebellum, and contains ascending and descending fiber tracts of the medial forebrain bundle, dorsal longitudinal fascicle, mammilotegmental tract and fasciculus retroflexus.

The use of transcranial parenchymal sonography (TCS) enables fast and reliable imaging of BR and other brain midline structures that need to be assessed in patients with DD. The method has emerged over the last 15 years as an imporant diagnostic tool in differential diagnosis of various movement disorders. Over the years, certain sonograhic feature of the brain midline structures have been recognized as biomarkers of several diseases. One of the most studied finding on TCS is hyperechogenicity of substantia nigra (SN) in idiopathic Parkinson's disease (IPD). The main limitation of the methodology is an inadequate temporal bone window, precluding examination in up to 15% of elderly subjects. Normal BR in healthy persons is seen as a highly echogenic continuous line in the midline of the mesencephalic brainstem, with echogenicity identical to the red nucleus. Pathological finding of hypoechogenic BR (hBR) stands for invisible, hypoechogenic or interrupted BR line.

Depression is not infrequent in neurological disorders. DD is detected in up to 70% of patients with IPD, 50% of patients with acute stroke within 6 months of the ictus, up to 50% of patients with various types of dementia and as many as half of patients with epilepsy. The use of TCS in DD provided new insight in the pathogenesis of DD in general. It led to the concept of existence of two subtypes of depression in the regard to the structural changes/lesions localization: 1. disorders affecting basal limbic system (depression in IPD, Wilson's disease and idiopathic dystonia), 2. disorders affecting primarily the basal limbic system projections, such as subcortical or subcortical/cortical regions (DD in multiple sclerosis, large ischemic areas).

First TCS studies in patients with unipolar depression showed that 50-70% of patients had hBR. This finding is not related to the age, gender or severity of depression but indicates responders to serotonine reuptake inhibitors. It aslo probably detects a subpopulation of depressed patients with more severe symptoms (suicidal ideations). In patients with IPD, hBR is seen in up to 85% of patients who were also depressed, and correlates negatively with the degree of motor impairment. Interestingly, hBR appeared to be associated with overactive bladder symptoms in IPD and multiple sclerosis patients. An alteration of BR is also reported in depressed patients with Huntington and Wilson's disease.

TCS of the BR can be particularly useful in differential diagnosis of DD and parkinsonsim. Depression can be an early, premotor sign of IPD but is also a putative risk factor for IDP. hBR is frequently found in IPD, and correlates negatively with the degree of motor impairment in IPD patients with depression.

On the other side, in subjects with depression SN hyperechogenicity correlates with motor asymmetry and reduced verbal fluency. Furthermore, this interplay is interesting if we have in mind that patients with depression are 2-3 times more likely to develop IPD later in life. It is noteworthy that patients with DD have 3 times increased frequency of SN hyperechogenicity, compared to the general population.

In summary, TCS finding of hBR is frequent in unipolar depression, as well as in DD associated with IPD, Wilson's and Huntington's disease. In combination with hyperechogenicity of SN, hBR finding can be used to differentiate between DD and IPD. TCS use provided new introspection in DD pathogenesis in neurological patients and in general.