

Palpating the brain with MR Elastography to diagnose normal pressure hydrocephalus

Normal pressure hydrocephalus (NPH) is a treatable cause of dementia that accounts for about 6% of dementia cases. It is a condition of elderly individuals of unknown cause, and is characterized by the presence of excessive fluid within the ventricles of the brain. It manifests clinically as a classic triad of symptoms: walking difficulty, urinary incontinence, and cognitive decline. What is remarkable about NPH, is that it is a potentially treatable condition. Unlike Alzheimer's disease or Parkinsonism (for which NPH is often confused), NPH symptoms can often be reversed by the placement of a ventriculoperitoneal shunt. This internal shunt from the brain to the abdomen drains excess cerebrospinal fluid (CSF) from the brain to the abdominal cavity where it is absorbed.

Magnetic resonance elastography (MRE) is a relatively new radiological technique that is capable of measuring tissue stiffness non-invasively. "Palpation" of the brain is now possible using MRE to determine the softness or stiffness of the brain tissue. This exam is done by special MR scanners using a soft pillow-like source of vibration placed under the patient's head, and imaging the resultant wave propagation through the brain. The complete scan can be performed in less than 7 minutes.

The purpose of our study was to investigate possible brain stiffness changes in patients with NPH. We studied 10 NPH patients (5 women and 5 men with a mean age of 71 years) using brain MRE and compared them to 21 age- and sex-matched healthy volunteers. A significant increase in overall brain stiffness was found in patients with NPH compared to the normal controls. Specific regions of the brain showed the most increased stiffness (the occipital, parietal and temporal lobes), while other areas showed no significant change in stiffness. After undergoing MRE, all 10 patients underwent CSF shunt surgery. Nine of them showed a considerable improvement in symptoms further supporting the diagnosis of NPH.

Currently the diagnosis of NPH lacks consensus-based guidelines, and is variable in different institutions around the world. On conventional MR imaging, NPH patients show enlargement of the brain ventricles. This finding is non-specific and overlaps with other neurological diseases, as well as with normal aging changes of brain atrophy. In our practice, we rely on the improvement of clinical symptoms following drainage of a large volume of CSF from the patient's spinal canal. This procedure is invasive and is associated with potential complications such as headache, infection and CSF leakage. MRE may eventually provide a non-invasive alternative, and could potentially identify patients with NPH from other forms of dementia in elderly individuals. For example, patients with Alzheimer's disease in contrast, have shown decreased brain stiffness in previous studies.

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Publication

[MR Elastography Demonstrates Increased Brain Stiffness in Normal Pressure Hydrocephalus.](#)

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