Magnetic resonance imaging for idiopathic intracranial hypertension diagnosis

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Magnetic Resonance Imaging (MRI) plays an essential role in idiopathic intracranial hypertension diagnosis.

Idiopathic intracranial hypertension (IIH) has been associated with several MRI features.

Steinberg et al. assessed types of MRI findings and clinical-radiologic correlations in patients with IIH from one hospital system.

A retrospective chart review of IIH and control patients was conducted. Brain MRI/magnetic resonance venogram features were enumerated and assessed for correlation with body mass index (BMI) and lumbar puncture opening pressure (LPOP). Sensitivity, specificity, positive predictive value (PPV), and likelihood ratios (LRs) were calculated for each MRI sign. Significance was set at $P < 0.05$.

One hundred one patients diagnosed with IIH, and 119 control patients had complete files and were included. Patients with IIH were predominantly female (92.8% vs 59.7%; P = <0.001), younger (30.6 years vs 46.4 years; $P < 0.001$), and more obese (mean BMI = 35.2 vs 29.3; $P < 0.001$) than controls. Mean (SD) number of MRI findings was 2.21 (1.8) in IIH and 0.6 (1.2) in controls; ($P < 0.001$). Vertical nerve tortuosity (44.1%; $P < 0.001$), TVSS (37.8%; $P < 0.001$), sheath expansion (36.0%; $P < 0.001$), globe flattening (22.5%; $P < 0.001$), slit ventricles (18.9%; $P < 0.001$), optic disc protrusion (9.9%; P = 0.007), and complete empty sella (12.6%; $P < 0.042$) were observed more in patients with IIH than control patients. In the IIH group, mean (SD) LPOP was 33.6 (11.11) cmH2O and weakly correlated with number of MRI findings (rho = 0.182, P = 0.057). TVSS (sensitivity 37.84%; confidence interval [CI] 29.3%-47.2%, specificity 98.32%; CI 93.5%-99.6%) had the highest PPV (95.45%) and positive LR (22.51) for IIH diagnosis.

These results are consistent with IIH predominance in young, obese females. In patients with IIH, the

number of MRI findings exceeded controls and positively correlated with LPOP. TVSS was most predictive of IIH [1].

When evaluating a patient suspected of having IIH, MRI is commonly used for the following purposes:

Exclude Other Causes: An MRI of the brain is performed to rule out other conditions that may present with similar symptoms. These may include brain tumors, venous sinus thrombosis, or other intracranial abnormalities.

Assessment of the Brain and Ventricular System: MRI provides detailed images of the brain and can show any structural abnormalities, such as brain masses, cysts, or hydrocephalus (abnormal accumulation of cerebrospinal fluid). These findings can help identify or rule out potential causes of increased intracranial pressure.

Visualization of the Optic Nerves: MRI allows for visualization of the optic nerves and can detect any swelling or abnormalities, which can be crucial in diagnosing IIH. Enlargement of the subarachnoid space around the optic nerves (perioptic subarachnoid space distension) is a common finding in IIH.

Measurement of the Cerebral Venous Sinuses: MRI can assess the patency and flow within the cerebral venous sinuses, which are large blood vessels that drain blood from the brain. Abnormalities in these sinuses may contribute to IIH.

Assessment of Intracranial Pressure and Blood Flow: Specialized MRI techniques, such as MR venography and phase-contrast imaging, can be used to indirectly estimate intracranial pressure and evaluate cerebrospinal fluid (CSF) dynamics.

Follow-up and Monitoring: MRI may be used to monitor the progression of the condition and the effectiveness of treatment over time.

It's important to note that while MRI is an essential diagnostic tool, the diagnosis of IIH typically involves a combination of clinical evaluation, neuroimaging, and other tests, such as lumbar puncture (to measure CSF pressure) and visual field testing (to assess any impact on vision).

MRI and magnetic resonance venography findings are important tools in the diagnosis of IIH. Empty sella turcica, optic nerve protrusion, distension of the optic nerve sheath, optic nerve tortuosity, posterior globe flattening, and transverse sinus stenosis have been found to be the most promising diagnostic markers for IIH, although the absence of these findings does not rule out the diagnosis [2].

Bsteh et al. included patients from the Vienna-Idiopathic-Intracranial-Hypertension (VIIH) database with Idiopathic intracranial hypertension according to Friedman criteria and cranial MRI performed at diagnosis. The presence of empty sella (ES), perioptic subarachnoid space distension (POSD) with or without optic nerve tortuosity (ONT), posterior globe flattening (PGF) and transverse sinus stenosis (TSS) was assessed and multivariable regression models regarding visual outcome (persistent visual impairment/visual worsening) and headache outcome (headache improvement/freedom of headache) were fitted.

They included 84 IIH patients (88.1% female, mean age 33.5 years, median body mass index 33.7). At baseline, visual impairment was present in 70.2% and headache in 84.5% (54.8% chronic). Persistent visual impairment occurred in 58.3%, visual worsening in 13.1%, headache improvement was achieved in 83.8%, and freedom of headache in 26.2%. At least one MRI feature was found in 78.6% and 60.0% had ≥3 features with POSD most frequent (64.3%) followed by TSS (60.0%), ONT (46.4%), ES (44.0%), and PGF (23.8%). In multivariable models, there was no association of any single MRI feature or their number with visual impairment, visual worsening, headache improvement, or freedom. Visual impairment at baseline predicted persistent visual impairment (odds ratio 6.3, $p<0.001$), but not visual worsening. Chronic headache at baseline was significantly associated with a lower likelihood of headache freedom (odds ratio 0.48, $p=0.013$), but not with headache improvement.

MRI features of IIH are neither prognostic of visual nor headache outcome [3].

In a retrospective, observational study included demographic and clinical data from 10 patients with IIH and 10 controls. Brain MRI findings in IIH patients were recorded twice: once when patients had papilledema and again after resolution of papilledema. Neuroradiologists graded MRI findings in both groups based on an imaging grading scale.

Results: After the resolution of papilledema, all patients showed improvement in 2 or more of the MRI characteristics of IIH. This was especially the case for the height of the midsagittal pituitary gland and optic nerve sheath thickness (ONST), which were significantly different in all pairwise group comparisons. Sellar configuration, globe configuration, and horizontal orbital optic nerve tortuosity were different between the IIH pre-treatment group and controls, but not between controls and the IIH post-treatment group. We found no difference in optic nerve head hyperintensity or optic nerve thickness among the 3 groups.

demonstrated that several morphometric MRI characteristics in IIH are reversible to a certain extent after treatment. Enlarged subarachnoid spaces filled with cerebrospinal fluid seem to remain reduced, and the ONST and height of the pituitary gland are not fully normalized after treatment [4]

Neuroimaging, usually with computed tomography (CT/CAT) or magnetic resonance imaging (MRI), is used to exclude any mass lesions. In IIH these scans typically appear to be normal, although small or slit-like ventricles, dilatation and buckling of the optic nerve sheaths and “empty sella sign” (flattening of the pituitary gland due to increased pressure) and enlargement of Meckel's caves may be seen.

https://pedclerk.bsd.uchicago.edu/sites/pedclerk.uchicago.edu/files/uploads/pseudotumor_0.jpg

The protocol consists of a brain MRI and head magnetic resonance venography (MRV), both performed without and with intravenous gadolinium contrast material to minimize potential pitfalls of noncontrast MRV techniques and obviate ionizing radiation from CT/CT venography. Although low-field-strength MRI scanners may be sufficient to exclude large intracranial pathology, higher field strength (1.5 or 3.0 T) superconducting units are generally preferred to appreciate the imaging findings associated with chronically elevated ICP [5)].

Magnetic resonance venography

see Magnetic resonance venography for idiopathic intracranial hypertension.

1)
Steinberg YN, Parnes GJ, Raval NK, Pellerano Sosa FM, Parsikia A, Mbekeani JN. Analysis of Neuroradiologic Findings in Idiopathic Intracranial Hypertension-A Population-Based Study. J Neuroophthalmol. 2024 Sep 5. doi: 10.1097/WNO.0000000000002248. Epub ahead of print. PMID: 39233320.
2)
Barkatullah AF, Leishangthem L, Moss HE. MRI findings as markers of idiopathic intracranial hypertension. Curr Opin Neurol. 2021 Feb 1;34(1):75-83. doi: 10.1097/WCO.0000000000000885. PMID: 33230036; PMCID: PMC7856277.
3)
Bsteh G, Marik W, Krajnc N, Macher S, Mitsch C, Pruckner P, Novak K, Wöber C, Pemp B. MRI features of idiopathic intracranial hypertension are not prognostic of visual and headache outcome. J Headache Pain. 2023 Jul 28;24(1):97. doi: 10.1186/s10194-023-01641-x. PMID: 37507663.
4)
Batur Caglayan HZ, Ucar M, Hasanreisoglu M, Nazliel B, Tokgoz N. Magnetic Resonance Imaging of Idiopathic Intracranial Hypertension: Before and After Treatment. J Neuroophthalmol. 2019 Sep;39(3):324-329. doi: 10.1097/WNO.0000000000000792. PMID: 31430269.
5)
https://academic.oup.com/neurosurgery/article/80/3/341/2901909/Imaging-of-Intracranial-Pressure-Disorders