

Brain versus orbital MRI in evaluating idiopathic intracranial hypertension

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ABSTRACT

Objective: To evaluate the usefulness of brain MRI as compared to orbital MRI in the assessment of idiopathic intracranial hypertension (IIH).

Methods: The study was carried out at King Abdul-Aziz University Hospital, Jeddah, Kingdom of Saudi Arabia between January 2002 and December 2003. An MRI of the head and orbits was performed for 42 patients with the clinical diagnosis of IIH, and 15 normal volunteers. All cases of secondary increased intracranial pressure were eliminated. The images were evaluated for the presence of empty sella, parenchymal abnormalities, ventricular and sulcal size changes, optic disc elevation, and optic nerve sheath distention.

Results: The MRI of the head revealed empty sella in 29 patients and in one normal volunteer. Brain MRI did not reveal any parenchymal, ventricular or cisternal abnormalities in either group. Orbital MRI revealed optic nerve sheath distension and optic disc elevation in 36 patients, and were normal in all volunteers.

Conclusion: Brain MRI has limited value in the evaluation of IIH. Orbital MRI is the recommended imaging modality for this entity.

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Idiopathic intracranial hypertension (IIH) is a clinical condition characterized by headaches and visual disturbances. Fundoscopy reveals papilledema. The neurologic examination and the biochemical analysis of the cerebrospinal fluid are normal. Radiological investigations (CT and MRI) have been primarily concentrating on the brain to rule out various medical conditions that may cause increased intracranial pressure, such as space occupying lesions and dural sinus thrombosis. These examinations are normal in patients with IIH. Occasionally, empty sella and changes in the sizes of the ventricles, subarachnoid spaces and basal cisterns have been reported.¹⁻³ This study aims to evaluate the accuracy of brain MRI versus orbital MRI in the evaluation of IIH.

Methods. The study was carried out at King Abdul-Aziz University Hospital, Jeddah, Kingdom of Saudi Arabia between January 2002 and December 2003. Forty-two patients (27 females and 15 males) clinically diagnosed with IIH and 15 normal volunteers were included in the study. The clinical diagnosis was based on modified Dandy's criteria.^{1,4} All patients had headaches and visual disturbances. Fundoscopy was performed in all patients, and the presence of papilledema was noted but not graded. No evidence of any other neurological derangements was detected in any of the patients. The mean age was 31 years (range 13-43 years). Lateral decubitus lumbar puncture opening pressure was elevated in all patients with a mean pressure of 360mm CSF (range 250-530 mm

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CSF). The CSF chemistry was normal in all patients. All patients had MR imaging of the head and the orbits prior to lumbar puncture. The studies were performed on a 1-T magnet. All cases were performed using a head coil, and a standard protocol for the brain including sagittal T1 spin-echo and axial dual echo using a slice thickness of 5 mm. A 2-D phase contrast MR venography was performed for all cases. An MRI of the orbits was also performed for all the patients in the axial, coronal and oblique para-sagittal (parallel to optic nerve) planes using T1 spin echo and fat suppressed T2 turbo spin-echo sequences. A slice thickness of 3 mm and a 20 cm field of view was applied. No contrast-enhanced images were obtained for either the head or orbits. The MRI of the head was assessed for the presence or absence of parenchymal abnormalities, mass lesion and dural sinus thrombosis. The ventricles, sulci and basal cisterns sizes were visually assessed for signs of effacement or enlargement. The presence of partial or complete empty sella was recorded. The MRI of the orbits was assessed for globe, optic nerve, extra-ocular muscles and intra/extra conal abnormalities. The optic nerve sheath was assessed for distention at the mid-nerve level. The sheath was considered distended if its diameter were at least double the nerve diameter. The optic disc morphology was evaluated and classified as normal (concave) or abnormal [flat or bulging (convex)].

Results. The MRI of the brain of both the patient and volunteer groups did not reveal any mass lesions, dural sinus thrombosis, parenchymal changes or ventricular/cisternal abnormality. Empty sella was identified in 29 patients (69%) and in one normal volunteer (6.6%). The MRI of the orbits was normal in all the volunteers and 6 (14%) patients. Abnormal optic nerve disc, or nerve sheath, or both, was detected in 36 (86%) patients.

Discussion. Idiopathic intracranial hypertension is a clinical condition that usually affects young, obese women and is characterized by elevated intracranial pressure in the absence of intracranial morphologically visible pathology. The diagnosis is usually based on the presence of clinical features of increased intracranial pressure, including headache, nausea, vomiting, and disturbed vision. The ophthalmologic examination usually reveals variable degrees of papilledema, decreased visual acuity and possibly sixth nerve palsy. The brain imaging in IIH is usually normal. The lumbar puncture reveals elevated opening pressure (above 200mm CSF) with normal CSF biochemical analysis.¹⁻⁴

Since the term of "benign intracranial hypertension" was first used by Foley, several

pathophysiological theories have been proposed as possible mechanisms for the development of IIH. A defect in the CSF absorption mechanism at the arachnoid granulations, increased CSF production, cerebral edema and increased intracranial venous pressure are among the widely accepted mechanisms.⁵⁻¹⁰

Different therapeutic options are used in the treatment of IIH. These include the use of medical methods such as symptomatic therapy, diuretics, steroids and frequent lumbar punctures. Surgical options are occasionally utilized to treat the medically refractive cases through the placement of lumboperitoneal drain and optic nerve decompression surgery.^{7,8}

In this study 6 patients had normal orbital MRI. This is possibly due to minimal elevation of intracranial pressure (less than 300 mm Hg). This can be expected since the orbital findings are related to transmission of the increased intracranial pressure, and in cases of minimal pressure elevation, one may not expect orbital changes. The fundoscopic examinations of 5 of the 6 patients were normal, and one patient had minimal papilledema. Twenty-nine patients had empty sella (69%), and this is similar to reported literature.³ Empty sella is believed to be due to intrasellar herniation of CSF through a normally present opening in the diaphragma sellae. This will result in flattening of the pituitary gland against the floor of the sella. The relationship between elevated intracranial pressure and empty sella is well documented in the literature. Reversibility of the empty sella after medical therapy has also been reported.¹¹⁻¹⁶ An empty sella is also identified in normal population and its relation to increased intracranial pressure is not consistent. Thirty-six patients (86%) had distended optic sheaths, abnormal optic disc configuration, or both. Fourteen patients had a flat optic disc, while 22 patients had raised optic disc. All these patients had evidence of papilledema on fundoscopy. It is reasonable to expect that optic sheath distension and disc abnormalities would go hand in hand as they both represent a reflection of the increased intracranial pressure. These results are slightly different to the results of Jinkins et al of raised optic disc in 66.7% of their 15 patients and flat disc in all their volunteers.¹⁷ This discrepancy is possibly due to the use of dedicated orbital MRI protocol in our study; as described in the methods and materials section; while Jenkins's study is based on retrospective analysis in which the orbits evaluation was included as part of MRI of the brain using slice thickness of 5 mm and a 1.5mm inter-slice gap and a 24 cm field of view.

Brodsky et al³ reported the presence of empty sella in 70%, flat optic disc in 80% and distended optic sheath in 45%. Our results support their

findings. Based on the above, we suggest that orbital MR should be added to the routine brain MRI in cases of clinically suspected IIH and be used as a secondary criterion in addition to the modified Dandy criteria to aid in establishing the diagnosis.

In conclusion, we believe that brain MRI has limited value in the evaluation of IIH. Orbital MRI is a more accurate method to evaluate increased intracranial pressure.

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