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A quantitative study of intracranial hypotensive syndrome by magnetic resonance

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ABSTRACT

Objectives: The study aims to investigate the magnetic resonance imaging (MRI) findings of intracranial hypotension syndrome (IHS) and the change of quantitative indicators, so as to yield a deeper understanding of the disease.
Patients and methods: The clinical data and MRI findings of 26 cases of IHS which were confirmed by lumbar puncture were retrospectively analyzed. Two physicians evaluated the MRI findings including thickening and enhancement of dural, pituitary enlargement, subdural effusion (hematocele), venous engorgement and brain sagging, and measured the quantitative indicators including mamillopontine distance and pontomesencephalic angle. The consistency between the two results of the physicians was assessed by Kappa consistency test. The differences of mamillopontine distance and pontomesencephalic angle between the patient group and the control group were determined by paired *t*-test. The diagnostic efficiency of mamillopontine distance and pontomesencephalic angle was assessed by area under the ROC curve, and their best diagnostic thresholds were also determined, respectively. Age- and sex-matched healthy volunteers controls ($n = 26$) were recruited and served as the control group.
Results: All of the 26 patients suffered from the characterized by orthostatic headache of IHS. The clinical evaluations of dural thickening and enhancement, pituitary enlargement, subdural effusion (hematocele), venous engorgement by the two physicians showed excellent agreements ($\kappa = 0.808$, 1 and 0.906, $P < 0.01$), and the clinical evaluations of brain sagging showed medium agreements ($\kappa = 0.606$, $P < 0.01$). The mamillopontine distance and pontomesencephalic angle of the patient group were 5.4 ± 1.6 mm and $47.8 \pm 8.7^\circ$, respectively, which were obviously less than those of the control group (6.9 ± 1.1 mm and $61.0 \pm 6.1^\circ$, respectively), and the differences were statistically significant ($t = -4.563$, $P < 0.01$; $t = -.329$, $P < 0.01$). The area under ROC curve of mamillopontine distance and pontomesencephalic angle were 0.774 and 0.908, respectively, and the diagnostic value of pontomesencephalic angle was higher than that of the mamillopontine distance. The sensitivity and specificity were 73.1% and 73.1%, respectively, when diagnostic threshold of mamillopontine distance was 6.4 mm. The sensitivity and specificity were 76.9% and 96.2%, when diagnostic threshold of pontomesencephalic angle was 51.7°.
Conclusion: The MRI findings presented characteristic features of IHS. The quantitative indicators including mamillopontine distance and pontomesencephalic angle were helpful for clinical diagnosis of subjective findings of IHS.

1. Introduction

Intracranial hypotension syndrome (IHS) is a series of clinical syndrome caused by cerebral spinal fluid leakage, in which the decreased cerebral spinal fluid (CSF) opening pressure is less than 60 mm H_2O [1–4]. IHS is characterized by an orthostatic headache, which is worsened in the upright posture and alleviated in the recumbent position, and sometimes accompanied by nausea, vomit, dizziness, visual impairments, hearing disorder, mental disorder and so on [5,6].

Magnetic resonance imaging (MRI) findings of IHS have their own characteristic features. These MRI findings include dural thickening and enhancement, pituitary enlargement, subdural effusion (hematocele), venous engorgement, brain sagging and so on [7–12].

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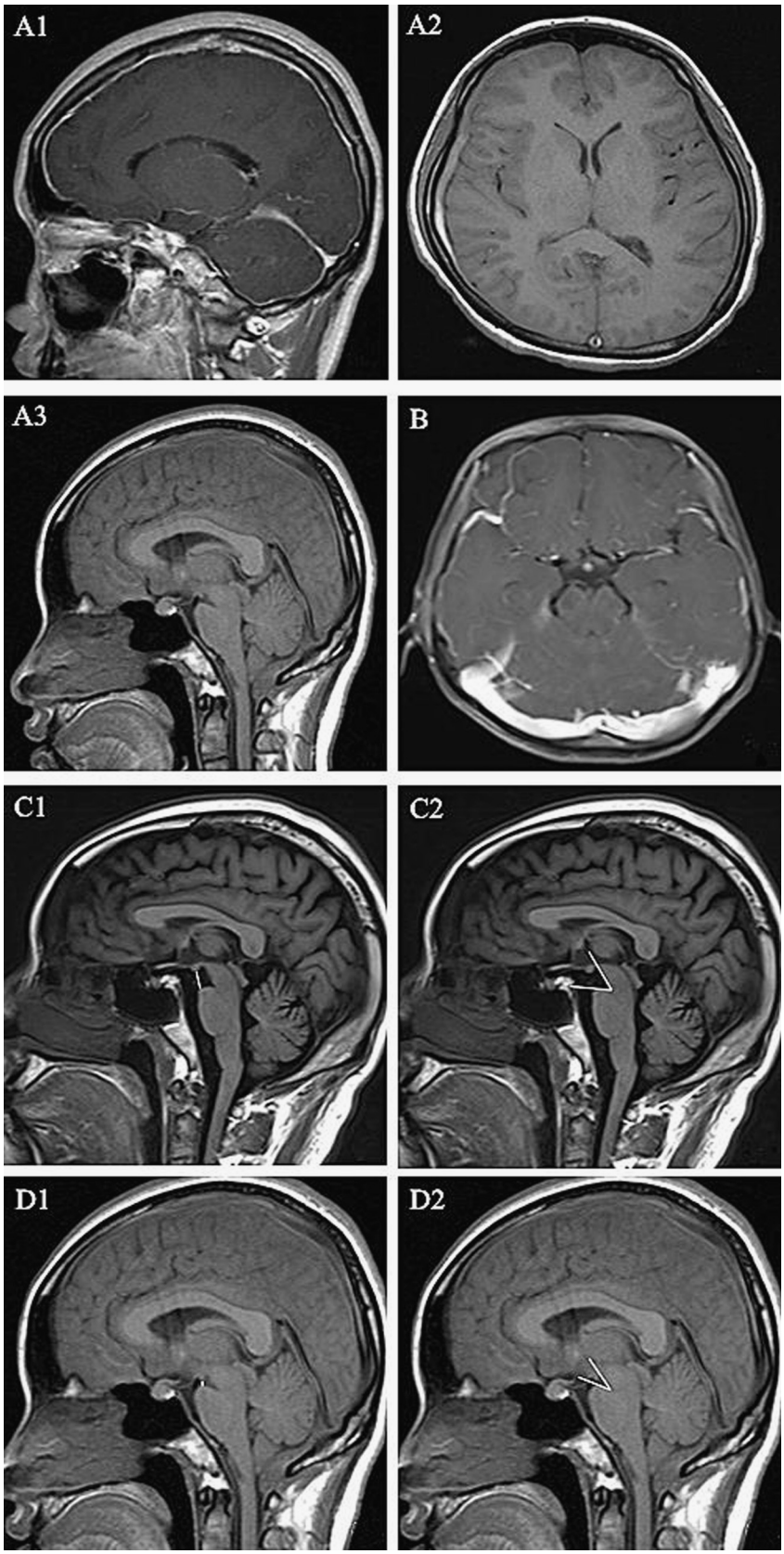

Fig. 1. A: MRI obtained in a 27-year-old female patient with orthostatic headache more than a month and accompanied by nausea, vomiting and nuchal rigidity. A1: dural thickening and enhancement and a smoother finished surface with no nodules of the enhanced dura. A2: arc-shaped short-T1 signal appeared at the left frontotemporal of dura which was caused by subdural blood. A3: brain sagging demonstrating enlargement of the pituitary, narrowing of cisterna chiasmatis, prepontine cistern and the fourth ventricle and descent of pointed cerebellar tonsil. B: MRI obtained in a 17-year-old male patient with orthostatic headache. Enhanced MRI scan suggested thickening and expansion of bilateral sigmoid sinus. C: MRI obtained in a 27-year-old female patient of the control group. C1: mamillopontine distance (8.8 mm). C2: pontomesencephalic angle (65.6°). D: MRI obtained in the same patient featured in A. D1: mamillopontine distance (mamillopontine distance). D2: pontomesencephalic angle (33.9°).