

Clinical Value of Constructional Skill Testing in Patients With Secondary Normal Pressure Hydrocephalus

—Two Case Reports—

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Abstract

Cognitive functions are frequently impaired in patients with normal pressure hydrocephalus (NPH). Two patients with NPH initially had dysfunctional constructional skill but exhibited improvements after shunt surgery. Dysfunction of constructional skill should be added to the important clinical features of NPH. The geometric test can be used as a practical tool for evaluation of parietal lobe function in patients with NPH.

Key words: normal pressure hydrocephalus, dysfunction of constructional skill, dementia

Introduction

Gait disturbance, incontinence, and dementia form the triad of symptoms of normal pressure hydrocephalus (NPH). However, chronic or symptomatic NPH are often difficult to discriminate in patients with dementia based on patterns of performance. Patients with NPH often have impaired cognitive functions such as attention, memory, visual spatial ability, and understanding of language.^{2,5,6,11,14-16} However, whether NPH also impairs constructional skill remains unclear.

The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) consists of five functional components, recent memory, visual spatial and constructional ability, understanding of language, attention, and delayed memory, combined into a total score.^{9,13} Each component is scored as an index, with scores under 75 considered abnormal.

We treated two patients with secondary NPH who underwent neuropsychological assessment of cognitive functions before and 1 week after shunt operation using the RBANS and the Mini Mental State Examination (MMSE).

Case Reports

Case 1: A 70-year-old woman developed dementia,

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sensory disturbance, and pain in the left side of her face in June 2002. She was right hand dominant. She was admitted to our hospital in May 2004.

Magnetic resonance (MR) imaging identified hydrocephalus with a mass lesion (40 × 30 mm) in Meckel's cave in the left middle cranial fossa (Fig. 1A). The RBANS showed lower than normal scores in all domains, recent memory 87, visual spatial and constructional ability 53, understanding of language 60, attention 60, and delayed memory 56, with total score 55, and the MMSE score was 21 points. She was not able to copy a geometric figure in the geometric test (Fig. 2A left). Cerebrospinal fluid examination revealed high total protein level (80 mg/dl).

The patient underwent surgery under a diagnosis of trigeminal neurinoma. The sensory disturbance and pain disappeared after the operation, but her cognitive function showed no sign of improvement. MR imaging showed hydrocephalus, so ventriculoperitoneal shunt surgery was performed. Initial pressure in the ventricle was 150 mmH₂O intraoperatively. After the second operation, the RBANS showed better scores of recent memory 81, visual spatial and constructional ability 126, understanding of language 82, attention 79, and delayed memory 78, with total score 85, and the MMSE score was 29 points. The visual spatial and constructional ability score dramatically increased after shunting, with slight improvement of the attention score. She also regained her ability to copy a figure (Fig. 2A right).

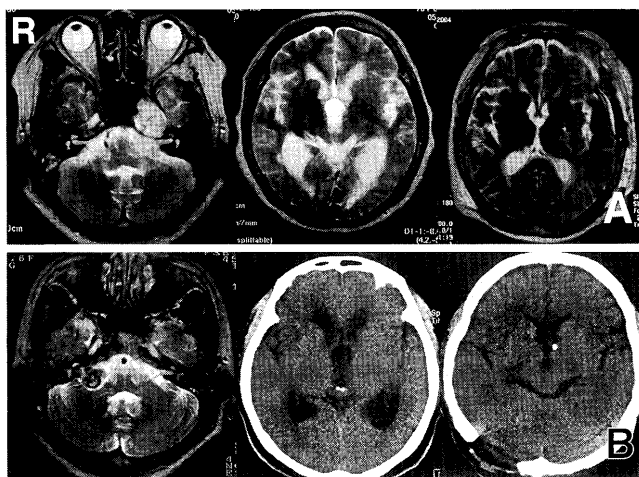


Fig. 1 A: Case 1. T₂-weighted magnetic resonance images before shunt surgery (left, center) showing a heterogeneous mass lesion (40 × 30 mm) in Meckel's cave in the left middle fossa and enlargement of the ventricle. T₂-weighted magnetic resonance image after surgery (right) showing decreased size of the ventricle. B: Case 2. T₂-weighted magnetic resonance image (left) and computed tomography scan (center) before shunt surgery showing a heterogeneous mass lesion in the right cerebellopontine angle and enlargement of the ventricle. Computed tomography scan after surgery (right) showing decreased size of the ventricle.

Case 2: A 63-year-old woman had suffered dementia, incontinence, and loss of hearing in her right ear since January 2004. She was right hand dominant. She was admitted to our hospital in September 2004.

MR imaging found hydrocephalus with a mass lesion in the right cerebellopontine angle (Fig. 1B). The RBANS showed lower than normal scores of recent memory 57, visual spatial and constructional ability 53, understanding of language 78, attention 64, and delayed memory 48, with total score 52, and the MMSE score was 17 points. She was not able to copy a figure in the geometric test (Fig. 2B left).

She underwent ventriculoperitoneal shunt surgery and tumor removal. Initial pressure in the ventricle was 120 mmH₂O intraoperatively. The histological diagnosis was neurinoma. The RBANS showed improvements in scores of recent memory 83, visual spatial and constructional ability 81, understanding of language 82, attention 64, delayed memory 81, with total score 72, and the MMSE score was 25 points. The visual spatial and constructional ability score markedly increased, with regain-

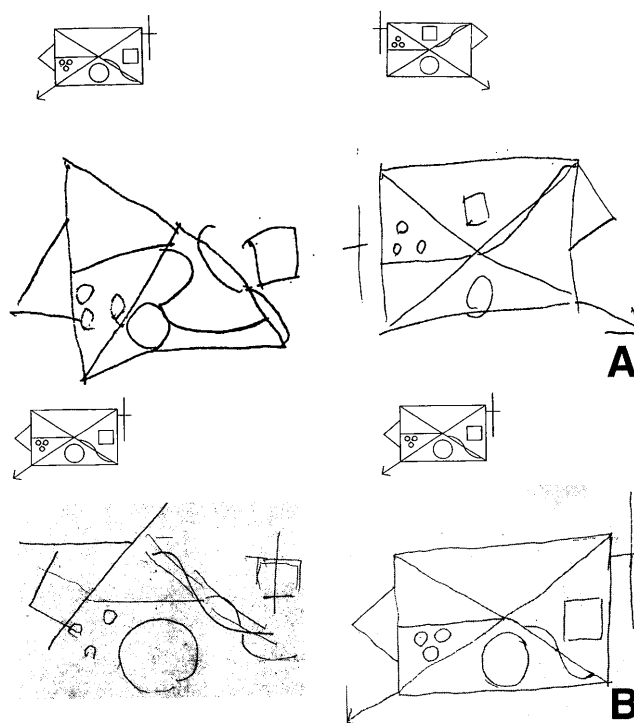


Fig. 2 Geometrical figures used to assess constructional skill before (left) and after (right) shunt surgery. A: Case 1, B: Case 2.

ing of copying skill (Fig. 2B right), but without improvement of the attention score.

Discussion

The present two patients had secondary NPH associated with intracranial neurinoma probably caused by hyperproteinorrhachia.¹⁾

The diagnosis of NPH has become increasingly sophisticated since the first descriptions.⁴⁾ NPH and other diseases affect cognitive function through frontal lobe dysfunction which impairs attention, memory, and language understanding.^{2,5,6,11,14-16)} Patients with Alzheimer's disease and frontotemporal dementia do not have significant problems with constructional skill because their parietal regions remain intact.^{3,4,8)} However, few reports have investigated the effect of NPH on constructional skill, although the parietal regions are also affected.

Various changes in cognitive function occur after shunt surgery. Evaluation of neuropsychological tests for early and reliable outcome assessment for chronic hydrocephalus investigated psychomotor functions in patients with NPH including visual and verbal attention, learning and visual motor skill, and verbal memory before and after shunt operation.⁷⁾

Visual attention was the most sensitive to shunting as measured by early postoperative psychometric changes. Evaluation of patients with ventricular dilation and borderline dementia before and after shunt surgery showed no improvement in pattern or spatial recognition tasks after shunting, but slight improvement in spatial span of attention.⁶⁾ Assessment of patients with NPH after ventricular shunting found significant improvements in constructional skill and other neuropsychological functions, but whether impairment of constructional skill actually improved after surgery remained unclear.¹²⁾

Patients with NPH and dementia generally have dysfunction of the frontal lobe causing impaired attention, memory, etc. In contrast, our two patients exhibited dysfunction of the parietal regions causing impaired constructional skill. The RBANS before and after shunt surgery clearly showed that NPH caused both impaired attention and constructional skill, since the visual spatial and constructional ability score dramatically increased after shunting but with little or no improvement of the attention index. The right posterior superior temporal-parietal region processes information on global properties, whereas the left region processes information on local properties.¹⁰⁾ We speculate that our patients suffered functional impairment of the frontal and parietal lobes, consequently losing their ability to draw global and local features of geometric figures, but regaining it after shunt surgery.

The present cases suggest that hydrocephalus readily impairs parietal lobe function and causes dysfunction of constructional skill. Clinical symptoms of dementia due to NPH are caused by dysfunction of both the frontal and parietal lobes. Dysfunction of constructional skill should be added to the list of important clinical features of dementia caused by NPH. The geometric test can be used to assess parietal lobe function in patients with NPH.

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