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The utility of monitoring urinary incontinence in the determination of shunt responsiveness in normal-pressure hydrocephalus: A case report

A 59-year-old male was admitted to our clinic with complaints of gait disturbance and urinary incontinence which had started and progressed over the prior 10 months. The patient had noticeably suffered from gait disturbance and balance problems during this period, such that he had particular difficulty in turning and had fallen several times over the previous one-month period. During the two months prior to his visit, complaints of urinary incontinence had emerged, leading to several visits to urology polyclinics where medications including oxybutynin and tolterodine were initiated with a diagnosis of urge urinary incontinence. Unfortunately, the medications had not provided an amelioration of his symptoms. Initially, he was suffering from frequent urination; however, nocturia and urge incontinency (three to four times a day) had emerged over the previous month, which had severely impaired his functional status and quality of life. Upon admission to our clinic, the patient was oriented and cooperative; however, he was evaluated as being slightly apathetic, and his verbal reaction times were reduced, suggesting a mild cognitive impairment. The motor, sensory and cerebellar evaluations were within normal limits. On the other hand, his gait was evaluated as being slow, magnetic and wide-based, which was in accordance with "frontal gait." The patient received 27 points on the Mimi-mental state examination, which suggested mild cognitive deterioration. In addition, he demonstrated severe deterioration on the phonemic verbal fluency test and low performance on the Stroop test, revealing deterioration in attentional cognitive skills. A cranial computed tomography (CT) scan showed enlarged lateral and third ventricles out of proportion to the cortical sulcal enlargement, suggesting a diagnosis of normal-pressure hydrocephalus (NPH) (Figure 1). After informed consent was obtained, a large volume spinal tap test was performed which revealed normal cerebrospinal fluid (CSF) opening pressure [150 millimeters (mm) H_2O] with normal CSF biochemistry [CSF proteins: 30 milligrams per deciliter (mg/dL); CSF glucose: 70 mg/dL] and no cells on microscopic examination. Following the spinal tap test, there was a slight improvement in his gait; however, the patient and his relatives stated there was a dramatic resolution in the complaints of urinary incontinence. To quantitatively evaluate the resolution of the disturbance in urinary symptoms, we reperformed the uroflowmetry the next day of the spinal tap test, which also revealed a decrease in post-void residual urine volume (from 180 ml to 160 ml) and improvement in the peak urine flow rate (from 12 ml/second to 15 ml/second). The urinary incontinence subpart of the idiopathic normal pressure hydrocephalus (iNPH) grading scale improved from grade 4 to grade 2. The revised urinary incontinence scale (RUIS)[1] was applied, which improved from 14 points to 4 points at the evaluation one day later. In particular, the resolution of urinary symptoms (determined by the RUIS) and also the improvement in the uroflowmetry results were encouraging. Of note, no medical history of an antecedent disease such

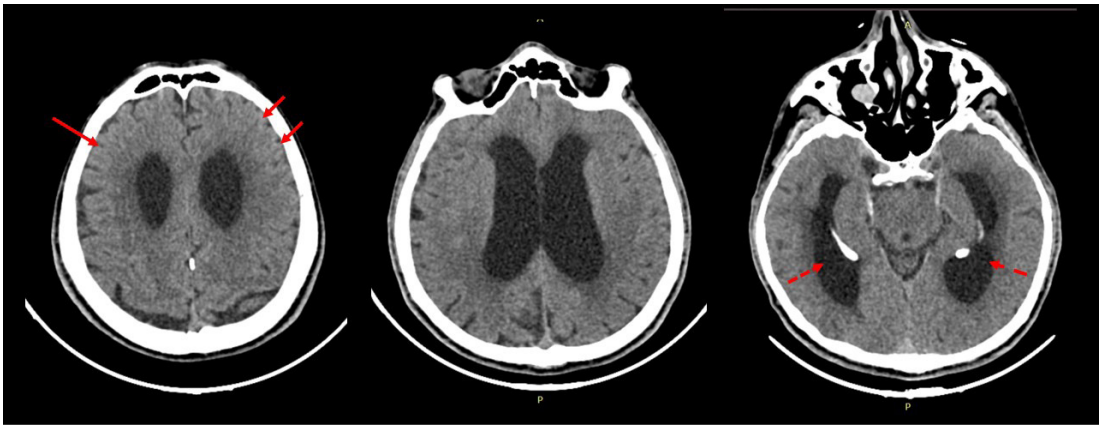

Figure 1. Pre-op cranial CT showing narrow high-convexity sulci (arrows) and widened temporal horns (jagged arrows).

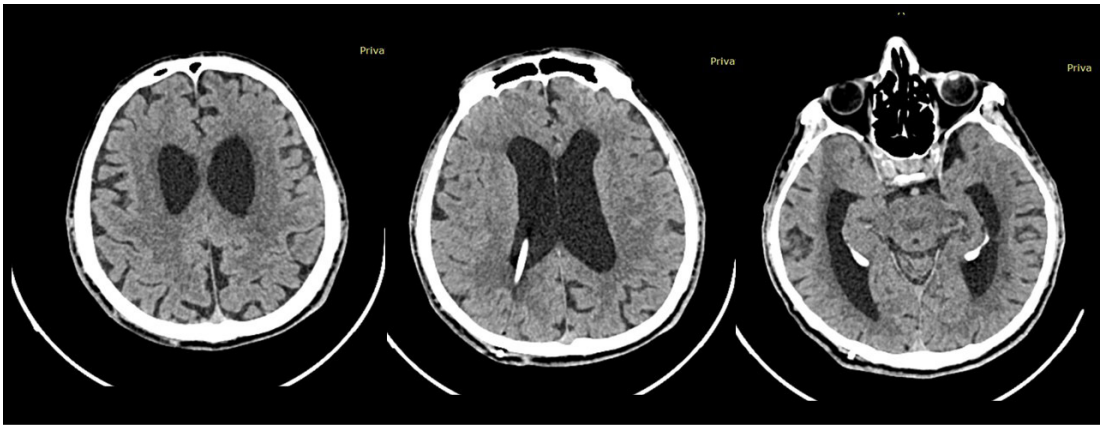

Figure 2. Pos-op cranial CT showing partial resolution of hydrocephalus.

as a subarachnoid hemorrhage, meningitis or head trauma was taken. In conclusion, we established the diagnosis of probable idiopathic NPH, and after interviews with the patient and his relatives, we decided to do shunt surgery. After VP-shunt surgery, a dramatic improvement in all the clinical symptoms was achieved. At a polyclinic follow-up visit two months after the surgery, the patient had no urinary symptoms, and the symptoms of gait disturbance and his cooperation and verbal reactions were significantly better. All of his gait parameters including his gait width, stride length, cadence of stepping, and balancing ability during gait initiation and turning had improved significantly. A repeat cranial CT scan showed moderate resolution of the hydrocephalus (Figure 2).

Gait disturbance is the main and first symptom of NPH, which generally best responds to shunt therapy.[2,3] Urinary incontinence (UI), one of the clinical triad of NPH symptoms, is also a critical symptom and may significantly impair the quality of life of both patients and caregivers.[4] Nevertheless, the significance of UI in the diagnostic course of the disease and its resolution after shunt surgery have rarely been addressed in the literature.[5-9] It is noted that UI may be preceded by symptoms of urgency in the early stages and worsen during the disease's progression, as was the case in our patient. However, symptoms of UI improve significantly following shunt surgery.[7] The remarkable point was that our patient had visited the urology polyclinic several times over the preceding two months where antimuscarinic treatment was initiated without providing an amelioration of his symptoms. However, after we made the diagnosis of iNPH and performed shunt surgery, the urinary symptoms totally resolved. UI is estimated to occur in 53% of patients with dementia, and its prevalence is higher in nursing home patients with dementia disorders. Taking into account that UI is a frequent symptom in the elderly population in general, it can be understood that UI may be underestimated as a symptom in routine clinical practice, preventing further investigation for diagnosing a possible underlying iNPH in this population. In support of this view, we know that a substantial number of patients with NPH are underdiagnosed because the clinical presentation of NPH may be perceived as being part of the normal aging process.[10] Ergo, we think that the recognition of NPH as an etiology of UI among clinics other than neurology (such as urology) is also critical for the timely diagnosis and appropriate treatment of the disease. Accordingly, we emphasize the need to keep in mind NPH in elderly patients suffering from UI, particularly in those patients with accompanying neurological symptoms of gait problems.

The more interesting point was that we observed a dramatic improvement in the score on the RUIS[1] after the spinal tap test, and the uroflowmetry test also revealed a quantitative improvement in urinary functions, supporting the positive response to the spinal tap test. The appropriate interpretation of the response to the spinal tap test (which is the gold standard for the diagnosis of NPH) is also a critical point in clinical practice.[11] There are various rating scales for measuring the triad of iNPH symptoms in different studies evaluating the response to the spinal tap test.[12-14] The most commonly used ones are the iNPH grading scale[12], the Timed Up and Go Test (TUG)[15,16], quantitative methods of gait analyses[16,17], and cognitive tests[18] including the mini-mental status examination, the frontal assessment battery, the Stroop test, etc. However, studies addressing the utility of evaluating improvement in UI after the

spinal tap test are extremely rare.[9] The subpart of urinary functions on the iNPH grading scale consists of grades ranging from 0 to 4. However, we think that performing a more detailed urinary evaluation scale which we included in the evaluation processes of our case may present substantial contributions during the clinical evaluation processes of iNPH patients and response to spinal tap test. In the study by Ahlberg *et al*., four patients with NPH were evaluated with urodynamic testing before and after large-volume spinal tap tests.[9] In conclusion of the study, they found that the bladder hyperactivity was temporarily improved by a spinal tap test and later abolished by a shunt surgery.[9] Remarkably, they suggested that performing a urodynamic testing after the spinal tap test may be a reliable way to predict the outcome of shunt operation in patients with urinary incontinence due to NPH.[9] In our patient, there was only a slight improvement in gait after the spinal tap test which confused the interpretation of response to the test. However, the patient and his relatives stated a significant improvement in symptoms of UI. Besides, the RUIS evaluations revealed a dramatic improvement in symptoms of urgency and the follow-up uroflowmetry test also confirmed improvement quantitatively which aided to decide on the positive response to the spinal tap test. Via the presentation of our case, we remark the importance of evaluating urinary symptoms while interpreting the response to the spinal tap test. Besides, performing a quantitative test such as uroflowmetry may potentially provide contributions during the diagnostic processes and deciding on shunt surgery. Future prospective reports of large case series with detailed scales as well as quantitative tests evaluating urinary functions before and after spinal tap test may provide critical contributions to clinical practice.

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DISCLOSURE

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