Reappraisal of radionuclide cisternography in the diagnosis of chronic hydrocephalus—a single institution report

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A B S T R A C T

Functional classification of hydrocephalus into “obstructive” and “communicating” used to form a scheme regarding diagnosis and treatment but is nowadays considered outdated. We present our retrospective clinical experience with a series of patients with signs and symptoms of chronic hydrocephalus that were investigated by radionuclide cisternography (RC) and discuss the method’s possible contemporary role. During the past five years, RC was used during the investigation of 12 possible hydrocephalus patients (5 male, 7 female, ages 26 to 77 years, mean 59.5, std 18.19). The patients’ symptoms ranged from headache to gait disturbance, dementia and urine incontinence. Patients were investigated with CT and MRI scans and had an RC examination using In-111-DTPA. According to the RC results the patients were divided into three groups: 5 patients with chronic hydrocephalus, 2 patients with borderline hydrocephalus and 5 patients without hydrocephalus, based on the delay of radiotracer drainage from the subarachnoid space. The clinical presentation was the chief reasoning in the decision for shunting of patients diagnosed with chronic hydrocephalus. No conclusive outcomes were produced by our experience, however, RC might be under researched and could potentially complement modern MRI studies of CSF spaces (i.e. CISS or FIESTA).

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Introduction

Functional classification of hydrocephalus into “obstructive” and “communicating” used to form a scheme [1] regarding diagnosis and treatment but is nowadays considered outdated. We present our retrospective clinical experience with a series of patients with signs and symptoms of chronic hydrocephalus that were investigated by In-111-DTPA cisternography (indium 111 diethylenetriaminepenta-acetic acid) and to discuss a possible contemporary role of radionuclide cisternography in chronic decision support.

Cases report

During the past five years, RC was used during the investigation of 12 possible chronic hydrocephalus patients (5 male, 7 female, ages 26 to 77 years, mean 59.5, std 18.19). The patients’ symptoms ranged from headache to gait disturbance, dementia and urine incontinence.

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Five out of twelve patients had at least one symptom of the classic clinical triad of NPH and three of them presented with at least two symptoms. One patient had history of subarachnoid hemorrhage (SAH) four months before the onset of gait disturbances, decline of higher cortical functions and urinary incontinence. Five patients had history of elevated arterial pressure.

Eleven patients had a brain CT scan performed and five of them were further investigated with brain MR (one patient was initially evaluated with brain MR) that showed signs of non-obstructive hydrocephalus. All patients had an RC examination; a lumbar puncture and administration of 0.5–1.0 mCi of pentetate indium disodium In111 diluted to 1 cc saline. Sagittal and coronal images of the cisternogram were obtained at 1, 3, 6, 24, 48 and 72 hours consecutively after injection (Fig. 1) and in two patients images were also obtained at 90 hours.

RC depicts hydrocephalus as pooling of the radioisotope due to delay of drainage from the subarachnoid space (Fig. 2) that can be measured by a radioisotope concentration per pixel ratio in the lateral ventricles toward the concentration in the subarachnoid space of the cerebral hemispheres. According to the RC results the patients were divided into three groups: 5 patients with chronic hydrocephalus, 2 patients with borderline hydrocephalus and 5 patients without hydrocephalus (no evidence of pathological CSF flow). The patients’ age distribution was tested for normality using Normal Probability Plot with a critical \( \alpha \)-value of 0.05. Using one-way analysis of variance (ANOVA), we tested for statistically significant age difference between the three groups. We then used Fisher’s Exact Probability Test to test for statistical significance regarding the following factors: sex, elevated blood pressure, the presence of one or two symptoms of the clinical triad and the presence of headache. No statistically significant difference was observed for any parameter for any group of patients.

Patients (2 male, 3 female, mean age 55 years) with no conclusive evidence of pathological CSF flow were referred to neurology specialists for further investigation regarding other neurodegenerative disorders. Regarding borderline hydrocephalus patients according to RC (male 73, female 76), the initial decision was to be treated conservatively, by short-term oral administration of low-dose acetazolamide and be re-evaluated for the need of surgical treatment. Both patients displayed a significant amelioration of their headache (no improvement of the rest of neurological symptoms of one patient) and were regularly examined for a period of 6 months, during which they remained neurologically stable. After this period, both patients were lost to follow-up.

Two patients (female, ages 67 and 74) one with a history of SAH and a fully developed clinical triad and one with headache, vertigo, dementia and gait disturbances had a conclusive confirmation of hydrocephalus by the RC and were treated by ventriculoperitoneal shunting and placement of a programmable valve.

The remaining patients of chronic hydrocephalus group were chosen for initial conservative treatment and reassessment of the need for shunting during follow-up. The reasoning was the mildness of headaches of two patients (female 46, male 26) and the atypical presentation with gait disturbances alone of one patient (male 77). In 6-month follow-up, the third patient was diagnosed with Parkinson’s disease and was referred to neurology specialists. The two patients with headaches reported improvement of the symptoms with no change in radiological findings (CT scan) and displayed an endurance of the neurological improvement during one-year follow-up examination.
Discussion

Our experience with the method did not produce definite results to support our decision-making regarding clinical management of the chronic hydrocephalus patients. In those patients with atypical and mild symptoms RC did show a normal pattern in 5 patients out of 9. Interestingly, those patients were younger (mean 55 years) than the average of the study. The diagnosis of chronic hydrocephalus in younger patients should be concretely established, and all clinical decisions should be strictly evidence-based before proceeding to shunting. On the bottom-line, this is perhaps the only group, identified by our study, where RC offers a reliable result, as a normal RC helped to support the low clinical suspicion and to appropriately move those patients into a conservative treatment arm. Based on our observation, we should mention that RC is by no means a golden standard in chronic hydrocephalus or NPH diagnosis and the method did not offer more than a conventional thorough clinical and radiological examination including the history (for example the patients with a history of SAH) would have. A number of important questions are raised and were not convincingly answered by our experience with the method or the relevant literature. In short, is the method really worth it? The most obvious answer would remain a conclusive “No”.

Conclusions

Diagnosis and evaluation of chronic hydrocephalus remains a multimodal procedure that should mostly rely on clinical findings and conventional radiological imaging. Due to inconclusive studies RC was abandoned [6]; however, its role might be under-researched. Chronic hydrocephalus continues to present an intractable controversy in modern neurosurgery [5]. Patient selection for shunting (with clearly defined questions) could benefit from directed research in the field of RC where there is need to reinforce conventional methodology and CSF studies and in the light of modern MRI techniques that allow to better visualize the CSF spaces (i.e. constructive interference in steady state (CISS) or fast imaging employing steady-state acquisition (FIESTA)) [7,8]. A specialist should make use of the method only in select cases.

References