The Value of Radionuclide Cisternography in a Case of Spontaneous Cerebrospinal Leak

Carlyle Marques Barral1, Thaís Ribeiro Lemos2, Shirleide Santos Nunes3, Sandra Monetti Dumont Sanches4

1 Densitometry and Nuclear Medicine Physician at Hospital das Clínicas – Federal University of Minas Gerais (HC-UFMG), Belo Horizonte, Minas Gerais, Brazil
2 The Nuclear Medicine Service of Hospital das Clínicas - Federal University of Minas Gerais Clinics (HC-UFMG), Belo Horizonte, Minas Gerais, Brazil
3 Radiopharmacist at the Nuclear Medicine Service of Hospital das Clínicas - Federal University of Minas Gerais Clinics (HC-UFMG), Belo Horizonte, Minas Gerais, Brazil
4 Head of the Nuclear Medicine Service of Hospital das Clínicas - Federal University of Minas Gerais Clinics (HC-UFMG), Assistant Professor at the Department of Anatomy and Image, Faculty of Medicine, UFMG. Belo Horizonte, Minas Gerais, Brazil

Address for correspondence Carlyle Marques Barral, MMed, Rua Prof. Morais, 476/901, Savassi, Belo Horizonte – MG Brazil CEP 30150-370, Brazil (e-mail: cbarral@terra.com.br).

Abstract

Spontaneous intracranial hypotension (SIH) is an infrequent cause of daily persistent orthostatic headache with an incidence of 5 to 100,000 persons/year. In very rare cases, no cause can be found and these conditions may be called spontaneous cerebrospinal fluid leak (CSFL). Radionuclide cisternography (RNC) has played useful role in detecting CSFL. Although RNC has been used in many cases, few have been reported in which CSFL out of the subarachnoid space was detected. A case of CSFL confirmed by RNC direct findings is reported. SIH is difficult to diagnose and 95% of patients may initially receive an incorrect diagnosis. RNC has been shown to be fairly characteristic in SIH patients.

Keywords

► spontaneous intracranial hypotension
► spontaneous cerebrospinal fluid leak
► orthostatic headache
► Tc 99m-DTPA

Introduction

Spontaneous intracranial hypotension (SIH) is an infrequent cause of daily persistent orthostatic headache with an incidence of 5 to 100,000 persons/year. Other SIH common symptoms arise from brainstem compression and nearby nerves traction. Cerebrospinal fluid leaks (CSFL) occur under several conditions: lumbar puncture performed for contrast myelography, spinal surgery, spinal stab wounds, spine fracture, inadvertent spinal puncture during epidural anesthesia, traumatic lumbar meningocele, and bronchopleural subarachnoid fistula due to bronchogenic carcinoma. Non-traumatic leaks result from cranial base focal areas pathologic destruction such as hydrocephalus, meningocele, global...
atrophy, congenital deformities, osteomyelitis or tumors, leading to dura mater penetration. In very rare cases, no cause can be found and these conditions may be called spontaneous cerebrospinal leak.\(^2\)

Radionuclide cisternography (RNC) can readily demonstrate and has played useful role in detecting CSFL. Although RNC has been used in many cases, few have been reported in which CSFL out of the subarachnoid space was detected.\(^3\)

**Case Report**

CFS, a 26-year-old female, presented with one vomiting episode in the last week and throbbing severe parieto-occipital headache for the last 3 months, and analgesic daily use. No history of comorbidities, trauma, sinusitis, or previous surgeries was found. Patient was normotensive, afebrile, eupneic, without focal deficits or meningeal irritation signs. Glasgow coma scale was 15, pupils were isochoric, and Romberg test was negative.

Computed tomography showed bilateral frontoparietal laminar subdural collection. Brain magnetic resonance imaging (MRI) showed laminar subdural fluid in frontoparietal lobes with discrete extension to the left temporal region. Narrowing cortical sulci, inferior brainstem displacement, inferior projection of the cerebellar tonsils toward the foramen magnum, and signs of venous congestion. Brain MRI showed bilateral frontoparietal laminar subdural effusion with slight extension to the left temporal region, erased cortical grooves, inferior brainstem displacement, midbrain located at the dorsum of the saddle level, and inferior projection of the cerebellar tonsils toward the foramen magnum without collapse. Spine MRI showed dural sac meningeal thickening with contrast hypercaptation and epidural venous plexus distension along the spine compatible with pachymeningeal thickening, without leak localization. Lumbar puncture showed 10 cm H\(_2\)O opening CSF pressure.

After receiving 20 mCi of technetium-99m-diethylene-triamine-pentaacetate (\(^{99m}\)Tc-DTPA) intrathecally via lumbar puncture, posterior views of the brain and spine were performed at 0, 1, 2, and 4 hours post-injection. RNC showed bilateral CSFL at the lower lumbar spine level throughout the study (\(\text{►Fig. 1}\)) and isotope accumulation was also noted in the kidneys at the 1-hour image (\(\text{►Fig. 2}\)). Patient’s symptoms subsided after conservative treatment (bed resting and hydration) and she was discharged asymptomatic.

**Discussion**

SIH diagnosis is based on clinical history, neurologic examination, neuroimaging studies, and CSF pressure measurement. SIH is difficult to diagnose and 95% of patients may initially receive an incorrect diagnosis.\(^4\) It is important to understand risk factors and symptoms to obtain appropriate imaging and avoid care delays. Otherwise, chronic pain and disability ensue with the potential for more serious neurological sequelae.\(^5\)

RNC is used to study the CSF kinetics and for differential diagnosis of hydrocephalus and surgical shunts patency. The radiopharmaceutical used must follow the CSF flow without affecting its dynamics and then be reabsorbed quickly into

![Fig. 1](image-url) Technetium-99m-diethylene-triamine-pentaacetate (\(^{99m}\)Tc-DTPA) radionuclide cisternography showing bilateral cerebrospinal fluid leak at the lower lumbar spine level throughout the study.
RNC has been shown to be fairly characteristic in SIH patients, with findings including parathecal activity, less than 4 hours’ renal uptake, and early urinary bladder radionuclide accumulation, slow ascent along spinal axis, activity delaying, and paucity over cerebral convexities. If leak is present, isotope concentration at the leak site increases progressively and isotope passage from basal cisterns to the sylvian fissure and interhemispheric cistern is reduced, consistent with low CSF pressure state. Direct evidence of spinal leak was reported in approximately 40% of patients in one series of 67 patients referred for clinically suspected SIH.\(^7\) If SIH is caused by reduced CSF production, then cisternography would probably show slow isotope egress and high concentration remaining for prolonged period at injection site.\(^8\) Indirect signs are sufficient to establish CSF leakage diagnosis. If RNC does not show any leak but is suggestive of rapid tracer uptake, presence of generalized CSF hyperabsorption is not necessarily indicated, but rather, leak presence is below the study resolution limit. Tracer activity semiquantitative graphical analysis over multiple craniospinal segments may aid in reduced intracranial activity indirect signs detection and rapid spinal activity loss and may improve this technique sensitivity and specificity.\(^9\)

Several SIH cisternographic findings reports have been published, but lesions that clearly show the leaking site are rare. The reported case revealed small CSF leak in the early phase and clearly defined kidney images, which were helpful in lesion location. RNC is not only the diagnostic investigation key, but is also useful for better management planning, to help select the patients who need early intervention, to guide the level of epidural blood patch injection and to evaluate therapeutic effects.

Conflict of Interest
None declared.

References
