

Asymmetric radiotracer activity of enlarged cerebral spinal fluid space on radionuclide cisternography with SPET/CT

Julie C. Bulman¹ MD,
Jason Wachsmann¹ MD,
Fangyu Peng^{1,2} MD, PhD

1. Department of Radiology,
2. Advanced Imaging Research
Center, UT Southwestern Medical
Center, Dallas, TX, United States of
America

Keywords: -Cerebrospinal fluid leak
-Radionuclide cisternography
-Cisternogram -SPET/CT

Corresponding author:

Fangyu Peng MD, PhD
Department of Radiology,
University of Texas Southwestern
Medical Center, 5323 Harry Hines
Blvd, Dallas, Texas 75390-9140
Tel 214-645-2625 Fax 214-645-6479
Fangyu.Peng@UTSouthwestern.
edu

Received:

1 May 2016

Accepted:

16 June 2016

Abstract

Objective: Cerebrospinal fluid (CSF) leak is a well-known complication of skull or sinus surgery. Radionuclide cisternography has high sensitivity for detection of CSF leak, commonly performed in conjunction with radioactivity assay of nasal pledgets. Our objective was to highlight the usefulness of single photon emission tomography/computed tomography (SPET/CT) in radionuclide cisternography by presenting a case of a 41 years old man with right sided rhinorrhea following craniotomies and sinus surgery, who was subjected to radioactivity assay of nasal pledgets and radionuclide cisternography for suspected CSF leak. Although no CSF leak was detected by radioactivity assay of pledgets placed in the nasal cavity, asymmetric radiotracer activity was noted on cisternographic images in the left temporal region, which was found to correspond to an enlarged CSF space in the left middle cranial fossa, not CSF leak, on SPET/CT images. **Conclusion:** SPET/CT was useful in the differentiation of asymmetric CSF radiotracer activity caused by a normal variant or post surgical changes of anatomic structures from abnormal radiotracer activity secondary to CSF leakage on radionuclide cisternography.

Hell J Nucl Med 2016; 19(3): 269-271

Epub ahead of print: 8 November 2016

Published online: 10 December 2016

Introduction

Cerebrospinal fluid (CSF) leak is a well-known complication of skull or sinus surgery. Radionuclide cisternography has high sensitivity for detection of CSF leak, in conjunction with radioactivity assay of nasal pledgets [1-2]. Visual interpretation of planar scintigraphic images from a radionuclide cisternogram are less sensitive in the detection of CSF leaks than SPET/CT. Difficulties with planar image interpretation include relatively low spatial resolution compared to that of single photon emission computed tomography (SPET) imaging. The addition of a localization computed tomography (CT) has the advantage of also providing for more definitive identification of the location of suspected abnormal tracer accumulation. Hybrid SPET/CT imaging is useful for accurate interpretation of cisternography by allowing anatomic localization of focal radiotracer activity visualized on planar images of cisternography [3-6].

Case Report

We report a case of a 41 years old man with right-sided rhinorrhea following several craniotomies and sinus surgery, who was subjected to radioactivity assay of pledgets and radionuclide cisternography for suspected CSF leak. The patient had a prior history of left frontotemporal craniotomy for treatment of a left temporal arachnoid cyst in 2005, which subsequently recurred in 2013 and required a second surgery. The patient reported rhinorrhea after the second surgery that was intermittent. Pledgets were placed in the patient's nasal cavities for detection of CSF leak by ex vivo radioactivity assay using a gamma counter prior to injection of the radiotracer. Radionuclide cisternography for visualization of CSF leak was performed after injection of 55.5MBq of indium-111 diethylenetriamine pentaacetic acid (¹¹¹In-DTPA) intrathecally on the day prior to examination. There was no evidence of CSF leak by radioactivity assay of pledgets placed in the

nasal cavities 24 hours post injection of radiotracer. Focal asymmetry of radioactivity was noted in the left temporal region on the cisternographic images obtained at 24 hours post injection of the tracer (Figure 1). Asymmetric radiotracer activity was thought to represent either a CSF leak, asymmetric distribution of radiotracer activity due to normal asymmetric variant of CSF spaces, or anatomic changes related to prior surgery or trauma. This prompted further evaluation of the asymmetric radiotracer activity with SPET/CT.

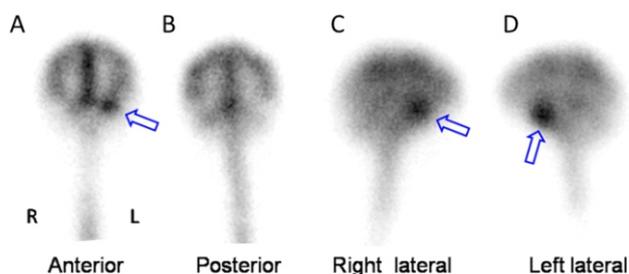


Figure 1. Asymmetric radiotracer activity in the left temporal region by nuclear cisternogram. Radionuclide cisternography was performed for detection of CSF leak 24 hours after the injection of 55.5MBq of ^{111}In -DTPA intrathecally. Focal asymmetry of radioactivity (blue open arrow) was noted in the left temporal region on the cisternographic images obtained at 24 hours post injection of the tracer, which may have represented a CSF leak or asymmetric distribution of CSF radiotracer activity due to normal variant of asymmetry of CSF spaces or anatomic changes from prior surgery or trauma. (R: right; L: left).

The patient underwent a SPET/CT for further evaluation of the asymmetric radiotracer activity in the left temporal region visualized on planar nuclear cisternography. On the SPET/CT images, asymmetric radiotracer activity was found to localize within an enlarged cerebrospinal space in the left middle cranial fossa (Figure 2A), corresponding to an enlarged CSF space in the left middle cranial fossa seen on T2 weighted images from a prior MRI performed 6 months earlier (Figure 2B). This enlarged CSF space in the left temporal region was caused by prior resection of a left temporal arachnoid cyst performed both eight years and two years ago.

Discussion

In this case report, asymmetric focal radiotracer activity was visualized on the planar images of nuclear radionuclide cisternography, which was localized to an enlarged CSF space in the left middle cranial fossa secondary to previous surgical resection of a left temporal arachnoid cyst. Previously, diagnostic imaging of porencephaly was reported with radionuclide cisternography [7]. To the best of our knowledge, this is the first case report of anatomic localization of asymmetric radiotracer activity on radionuclide cisternography to the surgical resection bed of a recurrent arach-

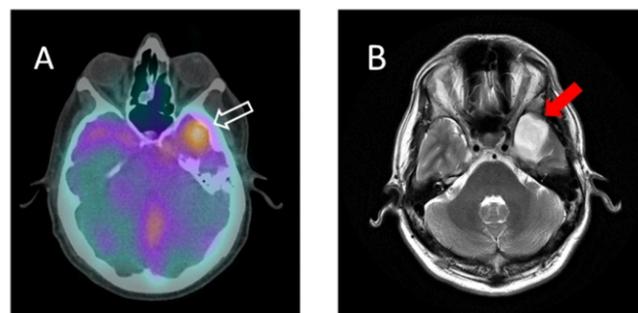


Figure 2. Anatomic localization of asymmetric radioactivity on cisternography to enlarged CSF space in the left middle cranial fossa by SPET/CT with correlated brain MRI. The patient underwent SPET/CT for further evaluation of asymmetric radiotracer activity in the left temporal region visualized on cisternography. On the SPET/CT images, asymmetric radiotracer activity was found to be activity localized within an enlarged CSF space in the left middle cranial fossa (A: white open arrow), corresponding to an enlarged CSF space in the left middle cranial fossa seen on T2 weighted images from a prior MRI performed 6 months earlier (B: thick red solid arrow). This enlarged CSF space in the left temporal region was caused by prior resection of a left temporal arachnoid cyst performed both eight years and two years ago.

noid cyst by SPET/CT. We propose that the reason for the persistent focal activity in the resection bed could have been related to increased amount of CSF radiotracer activity in the enlarged asymmetric space, and not related to increased uptake of ^{111}In DTPA due to postsurgical inflammation or osteomyelitis at this location. It remains to be determined how long this focal asymmetric radiotracer activity of an enlarged CSF space can persist and remain visible on the images of radionuclide cisternography, particularly in view of gradual clearance of radiotracer activity from CSF.

Hybrid SPET/CT is a useful technology that has been widely used in many clinical nuclear medicine services. The findings of this case demonstrate that hybrid SPET/CT is not only useful for anatomic localization of CSF leak on radionuclide cisternography, but also useful for accurate interpretation of asymmetric radiotracer activity on radionuclide cisternography caused by normal variants or postsurgical changes of CSF spaces.

Acknowledgment

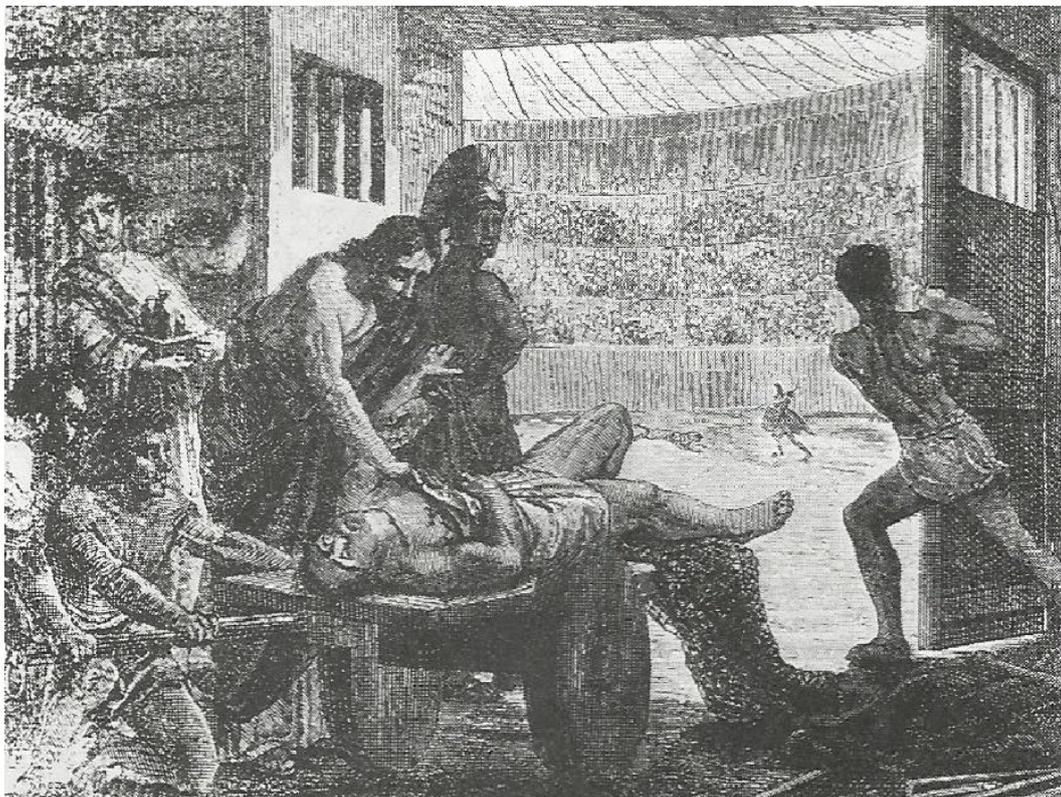
This work was supported by Faculty Research Development funding from Department of Radiology and Advanced Imaging Research Center, University of Texas Southwestern Medical Center, Dallas, Texas, USA.

The authors declare that they have no conflicts of interest

Bibliography

1. Glaubitt D, Haubrich J, Cordon-Voutsas M. Detection and quantitation of intermittent CSF rhinorrhea during prolonged cisternography with ^{111}In -DTPA. *Am J Neuroradiol* 1983;4(3):560-3.
2. Lund VJ, Savy L, Lloyd G, Howard D. Optimum imaging and diagnosis of cerebrospinal fluid rhinorrhea. *J Laryngol Otol* 2000;

- 114:988-92.
- Novotny C, Pötzi C, Asenbaum S et al. SPECT/CT fusion imaging in radionuclide cisternography for localization of liquor leakage sites. *J Neuroimaging* 2009; 19(3):227-34.
 - Pina G, Szathmari A, Scheiber C, Mottolese C. Contribution of SPECT/CT ¹¹¹In-DTPA cisternography in the localization of an intermittent cerebrospinal fluid leak in a 3-year-old girl with congenital bone defect. *Clin Nucl Med* 2011; 36(5):386-8.
 - Semirgin SU, Basoglu T, Cokluk C, Sahin Z. Radionuclide Imaging With SPECT/CT in Suspected Cerebrospinal Fluid Leakage *Clin Nucl Med* 2012; 37(3):289-92.
 - Nursal GN, Yapar AF. Demonstration of cerebrospinal fluid leakage on radionuclide cisternography by SPECT/CT. *Clin Nucl Med* 2015; 40:e55-57.
 - Front D, Beks JW, Penning L. Porencephaly diagnosed by isotope cisternography. *J Neurol Neurosurg Psychiatry* 1972; 35(5):669-75.



Gallen in Pergamon, Asia Minor, which was his birthplace, treating an injured man. As visualized by Ian Varhas, about 1870 A.C.