Visual and Quantitative Analysis of Cisternography for the Detection of Cerebrospinal Fluid Leakage

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Abstract We herein present a case of a 29-year-old man with clear rhinorrhea, which persisted for 8 years following a myringotomy. After cotton pledgets were placed in several different regions of the nasal cavity, cisternography using Tc-99m DTPA was performed to measure the radioactivity of each pledget. Cisternography showed subtle uptake in the nasal cavity. However, intense uptake was detected in the pledget

placed in the right eustachian tube orifice, where the pledget:serum count ratio was 10.3:1. The patient underwent duroplasty and cranioplasty, and the rhinorrhea resolved.

Keywords Cerebrospinal fluid leak · Cerebrospinal fluid rhinorrhea · Radionuclide imaging · Technetium Tc 99m pentetate

The manuscript has not been published before or is not under consideration for publication anywhere else and has been approved by all co-authors.

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Fig. 1 A 29-year-old man presented with clear rhinorrhea aggravated by leaning forward, following a myringotomy 8 years prior. With high suspicion of CSF rhinorrhea, radionuclide cisternography was performed using 111 MBq of Tc-99m DTPA injected into the lumbar subarachnoid space. Planar images taken 4 h post-injection revealed subtle uptake in the nasal cavity (**a**, arrow), which was equivocal for the diagnosis of CSF leakage. CSF rhinorrhea was not definite on planar images of cisternography. Cotton pledgets were placed in the cribriform plate (I), middle meatus (II), sphenoid-ethmoid recess (III), and eustachian tube orifice (IV). Intense radioactivity was detected in the pledget in the eustachian tube orifice (**b**). At the time at which the pledgets were removed from the nasal cavity, a venous blood sample of the same weight as the pledget was drawn to measure radioactivity. The ratio of pledget radioactivity from the right eustachian tube orifice to that of serum was 10.3:1, suggesting CSF leakage from the right eustachian tube (**c**). Temporal bone CT revealed a bony defect lateral to the jugular bulb (**d**, arrow). The patient underwent duroplasty and cranioplasty, and his symptoms resolved. Approximately 80% of CSF leaks are caused by non-surgical trauma and 16% by surgical procedures [1]. The mainstay of treatment is conservative management over 7–10 days [2], with the next step being CSF diversion or surgical repair if leaks do not resolve [3]. Radionuclide cisternography is useful for diagnosis of CSF leakage and localization of the leakage site [4–6]. In addition to radionuclide cisternography, SPECT/CT has been used to improve the identification of CSF leakage sites; the latter technique affords better spatial resolution [7–9]. In this case, after insertion of the pledgets, the patient was placed in the sitting position, leaning forward. Pledgets were then removed, and their radioactivity was compared to that of a blood sample collected at the same time. The ratio of pledget to serum radioactivity does not exceed 1.3:1 in normal subjects, whereas the pledget radioactivity is 1.3–1.5-fold greater than serum in CSF leaks [10]. We herein demonstrate that combined visual/quantitative analysis was useful to detect and localize a CSF leak in the case of equivocal imaging findings on planar cisternography

Compliance with Ethical Standards

Conflict of Interest Eun Kyoung Choi, Jin Kyoung Oh, Sonya Youngju Park, Ikdong Yoo, Dong-Hyun Kim, and Yong-An Chung declare that they have no conflict of interest.

Ethical Statement The study was approved by an institutional review board or equivalent and has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The institutional review board waived the need to obtain informed consent.

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