The Egyptian Journal of Radiology and Nuclear Medicine (2014) **45**, 841–847

Egyptian Society of Radiology and Nuclear Medicine

The Egyptian Journal of Radiology and Nuclear Medicine

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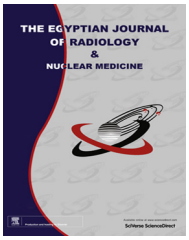

ORIGINAL ARTICLE

Cerebrospinal fluid rhinorrhea: Diagnostic role of gadolinium enhanced MR cisternography

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Received 15 April 2014; accepted 7 May 2014
Available online 15 June 2014

KEYWORDS

CSF;
Rhinorrhea;
MRI cisternography

Abstract *Background:* Accurate localization of the defect is crucial for successful surgical repair of CSF rhinorrhea. This could be achieved by MRI cisternography using T1 weighted sequences followed by intra-thecal injection of low dose of gadolinium for valuable localization and characterization of the defect.

Aim: The aim of this study was to evaluate the role of intrathecal gadolinium enhanced MR cisternography in localization of the defect in cases of CSF rhinorrhea to demonstrate how to utilize it as a roadmap to select the most appropriate approach for leak repair.

Patients and methods: This study included 24 patients (16 male and 8 females) with CSF rhinorrhea, referred from Otorhinolaryngology Department. Seventeen leaks were spontaneous, 5 cases were traumatic and two iatrogenic. All cases underwent MR gadolinium enhanced cisternography via lumbar puncture.

Results: Gadolinium enhanced MR cisternography accurately diagnosed and confirmed the site of CSF leak in 22/24 (91.7%) cases. The most common site was the ethmoidal roof in 18/24 cases. Our results were correlated with endoscopic surgery and repair with an accuracy rate of 100%.

Conclusions: Intra-thecal gadolinium enhanced MR cisternography is essential for accurate preoperative localization and characterization of the defect in cases of CSF rhinorrhea.

1. Introduction

The presence of CSF rhinorrhea indicates the existence of abnormal communication between the intra-cranial CSF spaces and the nasal cavity (1). It is potentially very serious because of the risk of an ascending infection which could produce fulminant meningitis (2).

CSF rhinorrhea may be traumatic, pathological, developmental or spontaneous (1,2). The leak may be located at the ethmoid roof, cribriform plate, posterior wall of frontal sinus, or the sphenoid sinus (2–4).

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Peer review under responsibility of Egyptian Society of Radiology and Nuclear Medicine.

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The popularity of endoscopic closure of CSF leak has continually increased and endoscopic repair has almost completely replaced more traumatic transcranial and extracranial procedures (5–7) as the endoscopic technique offers a direct access, exact targeting of the site of the dural tear so precise placement of the graft with less operative time and high success rates and smell preservation (8,9). However successful repair of CSF leaks depends on accurate preoperative localization of the site of the defect (4).

The goals of imaging in CSF fistulae are to confirm the diagnosis, evaluate any underlying cause, localize the defect site and exclude associated lesions at the defect (2).

High-resolution computed tomography (HRCT) enables good definition of bony structures but CSF may appear as an opacification of a sinus that could not be distinguished from mucosal reaction, meningocele or percolated CSF from a distal breach (1,3,7). CT metrizamide cisternography is considered to be the gold standard for detecting CSF leaks. However its detection rate ranges between 40 and 92%, and the leak must be active (5,6,8). Furthermore, it is contraindicated in patients with high intracranial pressure and in those with spinal disorders beside the contraindications of CT. Its acceptability is low and accurate results are highly operator dependent (3).

Magnetic resonance imaging (MRI) cisternography depends on heavily T2-weighted sequences with fat suppression. CSF appears as a bright signal without the need to inject contrast media intrathecally. Furthermore, MRI details the intra-cranial anatomy and pathology in multiple planes within a relatively short time. The main disadvantage of MRI is poor spatial resolution and lack of bony details (5,6).

Intrathecal gadolinium-enhanced MR cisternography is a promising technique that may permit direct, sensitive visualization of the site of CSF leakage. It is also apparent that thin section CT is complementary to gadolinium-enhanced MR cisternography and therefore should be performed in all cases (7).

The aim of this study was to evaluate the role of gadolinium enhanced MR cisternography in localization of the defect in cases of CSF rhinorrhea to demonstrate how to utilize it as a roadmap to select the most appropriate approach for leak repair.

2. Patients and methods

From October 2010 to March 2014, 25 patients suspected clinically to have persistent CSF rhinorrhea were referred from Otorhinolaryngology departments to MRI unit, Radiodiagnosis department. Informed written consent was signed by all patients after discussing the risks and benefits. CSF leak stopped in one patient (4%) after the MR cisternography and is still under follow up over 18 months without surgery so, it is excluded. So the study subjects became 24 patients. The study has been approved by the institutional ethics board.

Cases with persistent leak for more than 3 months (refractory to conservative therapy) who were operated upon after MRI in Otorhinolaryngology Department were included. Cases of leak associated with meningoceles or meningoencephalocele, patients with CSF rhinorrhea of temporal bone, patients having contraindication to MRI examination (artificial heart valve, cardiac pacemaker, metallic stents or joint prosthesis except that made of titanium) and cases refusing surgical interference were excluded.

Preoperative diagnostic endoscopy was performed in all cases before surgery to assess the nasal cavity, follow the leak to the affected site, and to detect any associated pathology.

2.2. MR imaging

MRI studies were done using Philips medical system (01.5 Tesla). All patients were asked to get rid of any metallic subjects. The patients were informed about the duration of the examination, the position of the patient and the importance of being motionless.

The imaging protocol included sagittal, axial and coronal spin echo T1WI and fast spin echo (FSE) T2WI sequences (500/15) and (3500-4000/70) TR/TE using standard head coil in supine position, 3 mm sections 0 mm gap, 20 cm FOV and 512×220 matrix. Hyperintensity was detected in our patient outlining the site of defect to fill the ethmoid and/or the sphenoid sinus on T2WI FSE.

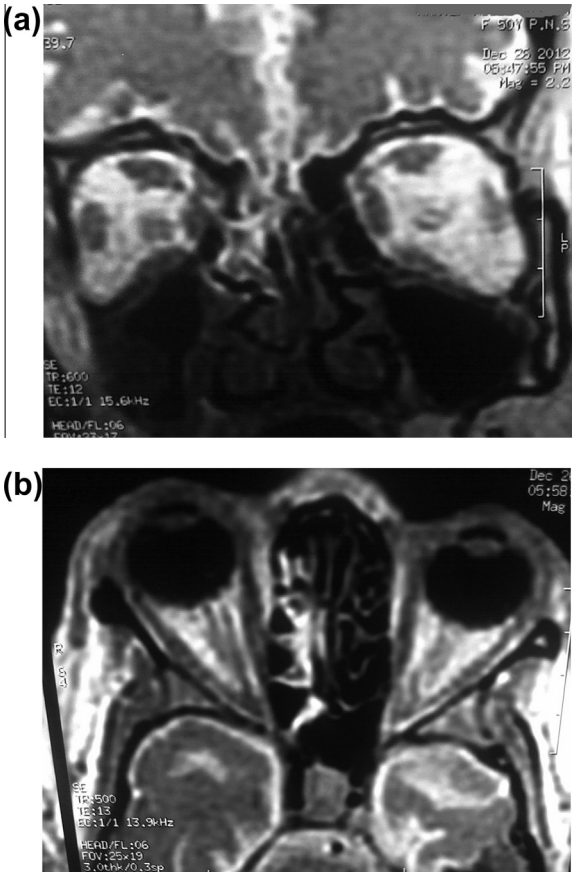

Fig. 1 CSF rhinorrhea following head trauma in a 50-year-old female. (a) Coronal T1-weighted intra-thecal gadolinium enhanced MR cisternogram shows contrast enhancement extending into the right ethmoidal air cells and to a lesser extent into the left side through defective cribriform plate of ethmoid bone. (b) Axial T1-weighted intra-thecal gadolinium enhanced MR cisternogram shows contrast leak into the right ethmoidal air cells from the cranial subarachnoid space.