MR cisternography for CSF fistulas: a pilot study in Uruguay.

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Abstract
Cerebrospinal fluid fistulas are communications between the subarachnoid space and the craniofacial spaces or the middle ear. In surgical planning various imaging studies have been used to assess the topography of the fistula. Resonance cisternography seems to be an option for the assessment of these patients. In the present study we present the first patients studied with this technique in our country and provide a review of the literature.

Key words
Cerebrospinal fluid fistula, resonance cisternography, cisternal tomography

Introduction
Cerebrospinal fluid (CSF) fistulas are communications between the subarachnoid space and the cavities in the facial bones or the middle ear. They are of several kinds: post-traumatic, post-surgical and spontaneous. Most are caused by trauma. Spontaneous closure of leaks occurs in the first week after the trauma in 70% of the cases. If the fistula remains active there is a high risk of meningitis or pneumoencephalos. (1) In order to achieve surgical resolution of CSF fistulas, the site of the leak must be accurately identified. To this end several imaging methods have been employed, of which only CT cisternography and radioisotope cisternography are still in use.

A few years ago MR cisternography, by means of intrathecal injection of gadolinium, appeared to be an option for the study of CSF leaks. The first MR cisternography studies were performed in 1997. (1, 2, 3)

Objectives
We present the first 9 cases of CSF leak that were examined by means of MR cisternography in our country. We describe the indications for this method and the technique it involves.

Materials and methods
Nine patients with a clinical history of CSF leak were examined. Eight patients presented CSF rhinorrhea when the study was performed. As to the remaining patient, his CSF rhinorrhea had ceased a few days before the study. Previous CT scans were reviewed in order to detect the probable site of the fistula.

Once it was clear that the patient had no contraindications for MR and after he had signed an informed consent form, 2 ml of gadolinium were injected intrathecally, by means of a lumbar tap, at the level of L4-L5 space, under local...
Figure 1. Post-traumatic CSF leak into ethmoidal cells. 20-year old male. MR cisternography: A)Fatsat T-1 weighted images in the coronal plane, showing passage of contrast medium into anterior ethmoidal cells on the right (arrow). B)The sagital fatsat T1-weighted sequence shows the fistulous tract (arrow).

Figure 2. Post-traumatic CSF fistula into the frontal sinus. 28-year old male. A and B) Computerized Tomography: breach of the posterior wall of the frontal sinus (arrows). C and D) MR Cisternography: Fatsat T1-weighted sequence shows the fistulous tract (arrows) and the passage of contrast medium into the frontal sinus.

Figure 3. Post-traumatic leak into the right orbit. 17-year old male. Right orbital trauma. Proptosis. A and B) Coronal CT images: Fracture lines in right orbital roof, with displacement of a bone fragment in the cephalic direction (arrows). C and D) MR Cisternography: Coronal Fatsat T1-weighted sequence shows fistulous tract (arrows) and passage of contrast agent into the right orbit, where it collects in the extraconal space.
anesthesia. Patients remained in dorsal decubitus during one hour following the injection of contrast agent. Three mm-thick T1-weighted fatsat images of the anterior part of the base of the skull were acquired, in both coronal and sagital planes. Time of acquisition for the images was around 9-10 minutes.

After the study patients were kept under observation during one hour and were then discharged with orders to take some rest during the next 24 hours, as a precaution.

**Results**

The examination was well tolerated by all patients. Twenty-four hours after the procedure, one patient (a known epileptic who was not under treatment) presented a convulsive seizure requiring medication. The CSF leak was localized in 8 patients, and the location was confirmed during the subsequent surgical reparation.

The fistula was detected in the ethmoidal cells in six cases (figure 1), on the posterior wall of the frontal sinus in one case (figure 2) and in other single case, in the orbit (figure 3).

No leak was demonstrated in one patient. In this case, CSF rhinorrhea had ceased clinically a few days before the examination.

The eight patients with confirmed fistula in MR cisternography underwent surgery. In all cases the location of the fistulous tract was found to be in agreement with MR cisternography findings.

**Discussion**

Accurate preoperative identification of the CSF leak increases the probability of successful surgical repair.

The most frequently used examination, CT cisternography, presents a sensitivity ranging from 72 to 81%; this is due to the fact that iodinated contrast agents do not diffuse freely in CSF and tend to decant. Furthermore, narrow fistulous tracts may not be visible in CT cisternography because the diluted contrast has the same density as adjacent bone. (1, 4)

MR cisternography has a sensitivity of 81 to 100%, according to the references we reviewed. (2, 3)

Prospective trials have demonstrated that intrathecal gadolinium administration is not associated with behavioral changes, focal neurological alterations or increase in epileptic activity. (5)

We emphasize the decrease in the frequency of postoperative headache for MR cisternography in comparison with CT cisternography. (6)

Our experience included a patient who had abandoned antiepileptic medication; he presented with a seizure 24 hours after the procedure, the convulsion was successfully controlled with medication.

Both methods are more sensitive if the CSF leak is active. (6, 7)

The scientific literature we reviewed suggested the evaluation of these patients by a combination of CT and MR cisternography. (7, 8)

CT is useful for the evaluation of fracture lines, which may be multiple, and for the localization of the leak. In MR cisternography the passage of the contrast agent makes the fistulous tract visible. (7, 8)

**Conclusions**

For patients with CSF leaks, MR cisternography is an effective and well-tolerated examination, whose performance is relatively easy. Its sensitivity ranges from 81 to 100%.
It has several advantages over CT cisternography: lesser incidence of complications (headache, seizures) and lesser technical difficulties on account of its passive diffusion into the CSF.

Bibliografia