CT and MRI Value for Diagnosing Cerebrospinal Fluid Rhinorrhea: A Case Report

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Introduction

Cerebrospinal fluid (CSF) rhinorrhea is a rare clinical entity with possible major complications. CSF rhinorrhea can be classified as spontaneous, traumatic, postoperative. The incidence of CSF rhinorrhea following traumatic brain injury is equal to 4.6 %. In extended endonasal surgeries, the incidence of postoperative CSF rhinorrhea was initially as high as 58%. Untreated CSF rhinorrhea may result in meningitis, abscess, pneumocephalus and intracranial hypotension.(1,3,4,6)

History of case report and clinical findings

A 56-year-old woman with a long history of massive skull base trauma (20 years ago) and numerous transcranial and endonasal surgeries due to recurrent CSF leak from various different locations. Since the year 2000, the patient experienced two episodes of purulent meningitis. After the last episode of meningitis (2015 year), severe headaches along with persistent left sided rhinorrhea remained. In year 2016, she admitted to an otorhinolaryngologist. Following endoscopic examination displayed postoperative anatomical changes, leakage of a clear fluid from the left side of the nose. All kinds of tests were performed: no bacteria were found in CSF; the CSF pressure was normal.

Because patient complained about severe headaches, HRCT was performed prior to decline purulent meningitis (Fig 1), no radiological signs of meningitis were observed. After that, CTC and MRI followed. Combining these radiological diagnostic methods, the accurate site of the CSF leak was finally determined. Otorhinolaryngologist decided to repair the defect by performing endonasal duraoplasty.

Discussion

It may be a difficult task to identify the exact location of a recurrent CSF leak radiologically, especially after multiple skull base fractures and former endonasal and transcranial CSF leak repair surgeries. HRCT and CTC is the preferred method of localizing the site of skull base defect and CSF leakage, also these methods can be coupled with MRI or MRC (1,2,4). In this clinical case, after HRCT a CTC (Fig 2) has been considered to detect the accurate site of the CSF leak, caused by multiple skull base defects (1,5,6). After the CTC, the possibility of rhinorrhea from the left side frontal and sphenoid sinus bone defects was excluded. However, the changes in the left side ethmoid and Onodi cells projections were suspicious:

1. In CT imaging they were observed only in two sections (section collimation 0.625 mm)
2. Mucosa accumulated contrast physiologically after intrathecal contrast injection.
3. There was no reliable similarity in contrast densities between (350-450 HU) subarachnoid space and fluid (30-35 HU) in the cells.
4. Although intensive rhinorrhea was presented clinically, there was no obvious connection between left lamina cribrosa defect and fluid in the cells. These main aspects are the reason why high resolution axial, coronal and sagittal thin slices T1 and T2 weighted sequences MRI (Fig 3) was performed in order to specify the nature of the substance in left side ethmoid and Onodi cells (2,5,7). Axial and coronal planes were the most informative. In these planes T2 weighted images accurate difference between CSF and thickened mucosa (Fig 3) signals in nose and cells were found (4,7). Accurate site of the CSF leak was located by combining CT and MRI (2,4). The defect was proven during the surgery in the projection of left Onodi cell and posterior ethmoid cell (Fig 4).

References


Figure 1
Fig.1 Brain CT in bone window. (a) Coronal reformation shows old bone defect of sphenoide bone greater wing-left sphenoide sinus lateral wall (arrow). Left sphenoide sinus filled up with a material (soft tissues) used for previous defect reconstruction. (b) Axial CT scan shows old linear fracture of left side ethmoid lamina cribrosa in anterior-posterior ethmoid cells projection (arrow). Unevenly thickened mucosa of ethmoid cells on the left. (c) Sagittal reformation shows old posttraumatic-postoperative frontal bone defect (arrow), after previous craniotomy which extends through left frontal sinus upper wall.

Figure 2
Fig. 2 Thin-slice CTC after intrathecal contrast injection. (a) Coronal plane. Despite that contrast evenly fills subarachnoid spaces and left sphenoide bone greater wing defect, there is no contrast extravasation through a bony defect to the left sphenoide sinus (arrows). (b,c) Axial CTC. Contrast evenly fills up subarachnoid spaces and flows towards postoperative frontal bone defect, but there is no obvious leak in the left side anterior and posterior ethmoid cells projection, below lamina cribrosa defect and in left frontal sinus (black arrows). Compact osteoma in projection of the left anterior cell (red arrow). (d) Axial CTC. The contrast evenly fills subethmoidal spaces. There is suspicious contrast leak in the left Onodi cell in thickening mucosa background (arrow).

Figure 3
Fig.3(a,b) Scull base MRI in axial and coronal planes (T2 CISS 3D iso). Accurate signal intensity differs between plastic material (long arrows) in left sphenoide sinus, thickened mucosa (red arrows) and fluid. Between pneumatized right and repaired left sphenoide sinuses there is Onodi cell filled with a fluid (isosensitive compared to CSF) (short arrows) – site of CSF leak.

Figure 4
Fig 4 Intraoperative endoscopic view shows oval shape oseous defect (arrow) and active CSF leak.