ORIGINAL RESEARCH PAPER

Medical Science

ROLE OF HIGH-RESOLUTION CT AND MR CISTERNOGRAPHY IN EVALUATION OF PATIENTS WITH CSF RHINORRHEA

KEY WORDS: CSF rhinorrhea, HRCT, MR Cisternography.

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ABSTRACT

INTRODUCTION : CSF rhinorrhea is a potentially dangerous problem. Accurate preoperative localization of the site of leakage is mandatory. HRCT is effective in demonstration of the bony defect at the site of leak. MR Cisternography can detect CSF fistula by bright signal of CSF on T2-weighted images.
OBJECTIVES : To evaluate the role of HRCT and MR Cisternography in identifying the presence and site of CSF leak.
METHODS : Study of 20 patients presenting with CSF rhinorrhea to the department Radiodiagnosis, MGM Hospital was done using HRCT and MR Cisternography during July 2017 TO OCTOBER 2017.
RESULTS : Using combined HRCT and MR Cisternography the site of CSF leak could be identified in all cases. Most common site was ethmoid roof. Most common cause was trauma.
CONCLUSION : HRCT combined with MR Cisternography are accurate and non-invasive methods for localization and characterization of the defect in cases of CSF rhinorrhea.

INTRODUCTION

CSF rhinorrhea indicates the presence of abnormal communication between the intra-cranial CSF spaces and the nasal cavity. It is very serious condition because of the risk of development of meningitis [1,2].

CSF rhinorrhea may be traumatic, pathological, developmental or spontaneous. The leak may be located at the ethmoid roof, cribriform plate, frontal sinus, or the sphenoid sinus [1,2].

The popularity of endoscopic closure of CSF leak has continually increased and endoscopic repair has almost completely replaced more traumatic transcranial and extracranial procedures [3]. However successful repair of CSF leaks depends on accurate preoperative localization of the site of the defect.

Several diagnostic studies have been used for the last two decades to detect CSF fistula. CT cisternography has been considered the most reliable and accurate method of diagnosing CSF fistula. However this technique is invasive, time consuming and has a relative risk of infection [4].

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 [1,5,6].

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 [3]. Thus, CT and MRI seem to be complementary in the diagnosis of CSF leaks.

This study was therefore conducted to determine the reliability and accuracy of combining HRCT and MR Cisternography to identify the site of CSF leakage without the need for CT cisternography.

AIM AND OBJECTIVES

- To evaluate the role of HRCT and MR Cisternography in identifying the presence and site of CSF rhinorrhea.
- To detect the presence of any other associated abnormality.

MATERIALS AND METHODS

Source of data: 20 patients with clinical diagnosis of CSF rhinorrhea during the study period of 4 months who underwent HRCT and MR Cisternography at the Department of Radio-Diagnosis, MGM Hospital, Kamothe, Navi Mumbai were included this study.

Method of collection of data:
a) Study design: Retrospective study

b) Study Place: Department of Radiodiagnosis, MGM hospital, Kamothe, Navi Mumbai

c) Study duration: July 2017 TO OCTOBER 2017

d) Sample Size: 20

e) Inclusion criteria:
1. Patients with clinically diagnosed CSF rhinorrhea using glucose and b2-transferrin test on suspected fluid.
2. Patients who were willing to take part in the study as well as follow up .

f) Exclusion Criteria:
- Pregnant and lactating patient
- Cardiac and cochlear implant
- Clinically unstable patients

g)Methodology:
- 20 patients who presented with CSF rhinorrhea during the study period of 4 months were included in the present study after obtaining informed consent in written form.
- All patients underwent a full otorhinolaryngological history and examination to determine the presence of CSF leakage. All suspected fluid was collected and tested for glucose and b2-transferrin for verification of CSF leak, which was positive in all cases.
- Radiological investigation was performed in the form of HRCT and MR Cisternography to identify the site of the leak.
- Imaging protocol: HRCT was performed using Toshiba Aquilion 64 multidetector scanners. Axial helical acquisition was obtained from the roof of the frontal sinuses to the hard palate. A field of view of 120 mm and a matrix size of 512 x 512 were used. A bone algorithm was used to enhance bony detail. Fine reconstructions (1 mm) were then made in the sagittal and coronal planes. MRI was performed on 1.5T TOSHIBA Vantage ExcelART scanner.T2 weighted axial and coronal sections of the brain were first obtained to rule out intracranial space occupying lesion or any other associated abnormality. MRI cisternography was obtained as a heavily weighted T2 sequence (CISS) in the axial and coronal planes [16.1 / 8 / 2(TR / TE / Excitation)] and post processed with

mutiplanar reformats and maximum intensity projections as necessary. Contrast material was not used in either examination.

- Image Analysis:

HRCT: The site of CSF leak was identified as a focal bony defect on HRCT with contiguous opacification of the adjacent sinus. The site of the defect and the size in three planes was measured to aid surgical planning.

MRI: On MR Cisternography, CSF leaks were visualized as tracts of high signal traversing the skull base contiguous with the intracranial CSF compartment. In addition, pooling of CSF in the dependant paranasal sinuses was identified. Associated meningoencephaloceles and any features of idiopathic intracranial hypertension (partially empty sella, prominent optic nerve sheaths, tortuous optic nerves and slit like ventricles) were also evaluated.

OBSERVATIONS AND RESULTS

The study included 20 patients. 8(40%) were females and the remaining 12(60%) patients were males. They had a mean age of 41 years (range 24-65 years). Most common cause was trauma. The possible site of leak was identified in all the 20 patients who underwent HRCT and MR Cisternography.

Table 1- Etiology and imaging findings in 20 patients with CSF rhinorrhea

Etiology	Site of leak	Associated findings
Traumatic - (11)55% Iatrogenic - (4)20% Non traumatic - (5)25%	Ethmoid roof - 8(40%) Cribriform plate – 6(30%) Frontal sinus – 4(20%) Sphenoid sinus – 2(10%)	Meningoencephalocele – 3(15%) Idiopathic intracranial hypertension – 1(5%)

ILLUSTRATIVE CASES

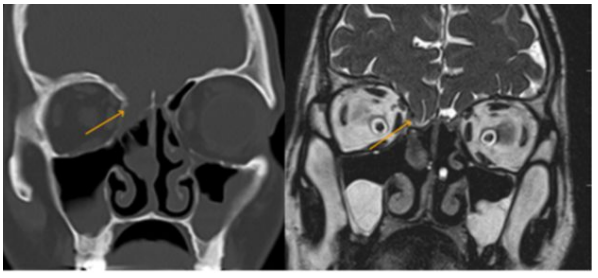

Figure 1- Post traumatic defect of the right ethmoid roof on HRCT. The coronal CISS sequence demonstrates a right frontal encephalocele.

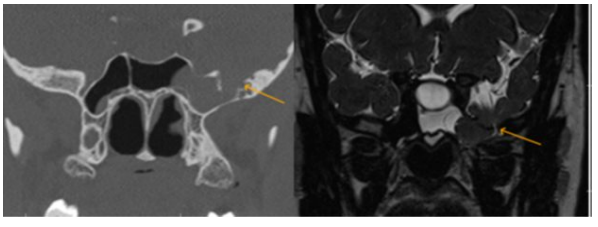

Figure 2- HRCT demonstrates bony defect in the sphenoid roof. MRI demonstrates herniation of the left inferior temporal gyrus into the lateral recess. Pooled CSF is also noted medially in the left sphenoid sinus. Also there is a large empty sella suggesting the possibility of idiopathic intracranial hypertension.

DISCUSSION

CSF leak is described as egress of CSF from the intracranial cavity through an osseous defect within the skull base. CSF leaks have been classified based on etiology into three categories: traumatic, non traumatic or spontaneous [1,2].

Traumatic CSF leaks are the most common type and are mostly secondary to skull base fractures. Also iatrogenic leaks sustained due to injury occurring during neurosurgical or otolaryngological procedures are included in this category. The most common sites of injury involve the anterior cranial fossa, with fractures through the frontal sinus or cribriform plates of the ethmoid bones. Central skull base fractures occur at the sphenoid sinus or sella [2].

Non traumatic CSF leaks may occur due to tumour, infection or previous radiotherapy/ chemotherapy. CSF fistulas may occur due to direct erosion through the skull base or secondary to the development of hydrocephalus.

Spontaneous CSF leaks have no discernible cause and are more common than previously believed. These may be associated with signs of idiopathic benign intracranial hypertension. The common locations of CSF fistulas are the ethmoid roof, cribriform plate and the sphenoid in a perisellar location and the lateral recess. Spontaneous CSF fistulas may be associated with a meningoencephalocele [8].

The goal of imaging is to identify the site of leak, characterise the defect and detect any associated meningocephalocele. The modalities available include CT cisternography, radionucleide cisternography, HRCT and MR Cisternography. CT cisternography and radionucleide cisternography are time consuming, invasive procedures that depend on the presence of an active leak for accurate detection. They are of low sensitivity with high false negative rates in intermittent leaks and may not depict defects accurately enough for surgical planning [8].

HRCT and MR Cisternography are non-invasive and do not depend on an active CSF leak for detection. HRCT is useful in measuring the size and site of leak, assessing the bony detail of the skull base and provides information regarding paranasal sinus anatomy and variants to aid surgical repair. Although MR Cisternography does not illustrate bony detail, it helps differentiate the leak from adjacent mucosal thickening and accurately depicts the contents of a large leak, particularly to differentiate meningoceles and meningoencephaloceles and any associated intracranial pathology.

In this study we combined both techniques of HRCT scans and MR Cisternography. The majority of patients (11) had a prior history of head injury and 5 patients had no relevant history and were therefore presumed to have non traumatic or spontaneous CSF leaks. 4 patients had iatrogenic leaks sustained during FESS surgery for sinonasal disease. Most common site of CSF leak was ethmoid roof, followed by cribriform plate, frontal sinus and sphenoid sinus. Three patients had associated meningoencephaloceles identified on MR Cisternography. Two of these were post traumatic in nature (following head injury) and localised to the ethmoid roof while the other was non traumatic and located in the lateral recess of sphenoid.

Similar study by Sabry Ragheb A et al involved 24 cases (16 men and 8 women, aged 10–66 years) of CSF rhinorrhea, 17 spontaneous cases, 5 traumatic cases and 2 iatrogenic cases with preceding multislice CT for bone defect and T2WI positive findings in the form of hyperintensity CSF in the ethmoid sinuses. Gadolinium- enhanced MR Cisternography showed positive contrast enhanced CSF leak in 22 cases, however, no false positive CSF leak was detected by contrast enhanced MR Cisternography [9].

CONCLUSION

CT and MRI are complementary in assessing patients with suspected CSF leak. CT aids accurate localization and multidimensional measurements, whilst MR Cisternography accurately characterizes the contents of the herniated sac and any associated intracranial findings. This aids precise surgical planning and appropriate patient counselling.

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