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MRI findings and CSF analysis in patient diagnosed with meningitis

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Abstract

Background: To study the MRI findings and CSF analysis in patient diagnosed with meningitis

Methods: It was a cross-sectional observational study conducted on patients with meningitis

Results: MRI had a sensitivity of 92%, specificity of 90%, PPV and NPV of 81% and 96% respectively with a diagnostic accuracy of 92%.

Conclusion- MRI has a huge potential superiority in the diagnosis of meningitis.

Keywords: CSF, MRI, meningitis.

Introduction

The primary imaging modality, like in most CNS disorders is magnetic resonance imaging (MRI). Coming to an exact etiological agent on the basis of conventional MRI sequences with Gadolinium enhancement is always difficult due to overlapping imaging characteristics. The purpose of this review is to provide a rational MRI approach to narrow the list of differentials, to quickly classify and characterize CNS infections. The flow-charts presented in this review guides the radiologist to first recognize the pattern of findings on routine MRI sequences and subsequently narrow the differential diagnosis based on the addition of other MR parameters such as diffusion weighted imaging (DWI).[1]

Cerebrospinal fluid (CSF) in normal human body has certain chemical components and pressure, which can maintain the relative stability of intracranial pressure. When there are central nervous system diseases, pathological changes will produce in the central nervous system and the metabolism of nervous cells will be disordered, which can change the property and components of cerebrospinal fluid. Therefore, the detection of cerebrospinal fluid is one of the important auxiliary diagnostic approaches for central nervous system impairment. Both MRI and cerebrospinal fluid can detect pathological changes in human body, which makes contributions to the prevention of diseases. Hence

exploring MRI in combination with detection of cerebrospinal fluid has clinical values in diagnosing and identifying central nervous infection. [2]

Material and methods

Study design: It was a cross-sectional observational study.

Inclusion criteria: All cases referred to department of radio diagnosis with suspected neuro-infections.

Exclusion criteria:

1. All patients in whom MRI is contraindicated
2. Clinical conditions precluding the conductance of MRI.
3. Hypersensitivity to contrast media
4. Pregnant patients (use of contrast is contra indicated).

Results

Table 1: Diagnostic performance of MRI as compared to CSF examination/clinical follow up

MRI	CSF	
	Positive	Negative
Positive	22	5
Negative	2	45
Total	24	50

MRI had a sensitivity of 92%, specificity of 90%, PPV and NPV of 81% and 96% respectively with a diagnostic accuracy of 92%. Among the two false negative cases, one turned out to be with no neuro-infection. This case had mild sulcal hyperintensity on T1 contrast, iso-intensity on T2 without perilesional edema.

Discussion

In the present study, all cases of bacterial and viral meningitis had meningeal enhancement, while 61.5% of tubercular meningitis had meningeal enhancement and rest had dura-based thickening of cisterns. Hydrocephalus was observed in one case of bacterial meningitis, five cases of tubercular meningitis and none of the patients with viral meningitis. We also observed that 21 cases were diagnosed on the basis of CSF and clinical examination, of which 19 were correctly identified in MRI. There as one false positive case as well. Thus, MRI had a sensitivity of 92%, specificity of 90%, PPV and NPV of 81% and 96% respectively with a diagnostic accuracy of 91%..

Zhang et al [3]evaluated the MRI finding and CSF parameters in patients with meningitis. In their study, the MRI results demonstrated that, the positive rate of the observation group was 96.05%; the positive rate of the tubercular meningitis group was 100%; the positive rate of the viral meningitis group and the purulent meningitis group was 90.48% and 92.86% respectively.

Vaswani et al studied 50 patients suspected of having meningitis.[4] The analysis of unenhanced images did not demonstrate an altered signal on T1-weighted or T2-weighted images but two cases showed meningeal hyperintensities on plain FLAIR images. As contrast-enhanced images are included in the evaluation, 49 patients (96%) showed pathological meningeal enhancement at MRI examination and two patients (3.9%) had normal MRI. In 35 cases (70%), the meningeal enhancement was observed in both contrast-enhanced T1-weighted and FLAIR sequences and in 14 cases (28%) enhancement was only demonstrated on postcontrast FLAIR sequence. CSF examination was done in 57 patients, 50 patients (87.71%) had CSF positive meningitis and 1 patient showed malignant cells on CSF analysis and was also positive on postcontrast MR examination (false positive). Remaining 6 patients were true negative. Out of 50, 35 cases (70%) had bacterial (including tuberculous) meningitis, 12 cases (24%) had viral meningitis, and three cases (6%) had fungal meningitis. The authors found that with respect to

etiology, no specific findings were registered on MRI to differentiate between viral, bacterial, or fungal meningitis. However, the meningeal enhancement was located in basal and subarachnoid cisterns in tuberculous and fungal meningitis whereas, in bacterial meningitis, the enhancement was located over the cerebral convexity and along sylvian fissures. Six patients also had parenchymal changes like cerebritis and tuberculomas that appeared as focal hyperintense parenchymal signals with postcontrast enhancement.

In one study, Singer et al reported non-contrast FLAIR sequences to be superior to post contrast T1W1.[5] The reason for the difference in observation is most likely that the diagnosis of meningitis on FLAIR depends on the CSF protein concentration. In studies which concluded that contrast-enhanced T1WI are better than FLAIR, it could have been because of less protein concentration in the CSF of their patients. Other reasons could be different imaging parameters, different MRI machines with different specifications, and different sample sizes.

Galassia et al showed that abnormal meningeal enhancement was positive in 35 contrast-enhanced T1-weighted MR images with Fat Saturation and in 33 contrast- enhanced FLAIR studies. [6] They concluded that contrast-enhanced T1-weighted MR imaging with Fat Saturation is superior to contrast-enhanced FLAIR imaging in most cases for depicting intracranial meningeal diseases.

Conclusion

MRI has a huge potential superiority in the diagnosis of meningitis.

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