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ORIGINAL ARTICLE

Positive Predictive Value of Contrast Enhanced- Fluid Attenuated Inversion Recovery (CE -Flair) MRI in Diagnosing Meningitis is Taking CSF Findings as Gold Standard

NASMA WABASA[1], DELIMA MARIA[2], KAMRAN NASEEM[3], NAIMA MUJAHID[4], ARSHAD FAHEEM[5], SUMAIRA ASLAM[6]
[1]*PGR Radiology, QAMC/BVH, Bahawalpur*
[2]*Demonstrator Physiology, Shahida Islam Medical College, Lodhran*
[3]*Assistant Professor Radiology, QAMC/BVH, Bahawalpur*
[4]*Assistant Professor Radiology, Shahida Islam Medical College, Lodhran*
[5]*Senior Registrar Radiology, QAMC/BVH, Bahawalpur*
[6]*Senior Registrar Radiology, Central Park Teaching Hospital, Lahore*
Correspondence to Dr. Nasma Wabasa, PGR Radiology, QAMC/BVH, Bahawalpur

ABSTRACT

Aim: PPV of contrast enhanced fluid - attenuated inversion recovery (CE -FLAIR) MRI for diagnosis of meningitis considering CSF as gold standard
Study Design: It is a cross-sectional study
Setting & duration: Radiology department,, BVH, Bahawalpur 01-01- 2019 to 30- 06- 2019
Methods: A total of 130 patients having signs & symptoms of meningitis for last 72 hours with age group 15-50 years were included. MRI was performed on a 1.5 tesla MR System. The MRI protocol included the T1W SE sequence, the T2W SE sequence, the T1W sequence wit h FS, the FLAIR sequence. The CE-FLAIR, T1W sequences wit h MT and FS were obtained after administration of intravenous gadobutrol in a dose of 0.1mmo l/kg body weight. After this, lumbar puncture was done and CSF was sent to the laboratory for analysis. CE -FLAIR MRI findings were correlated with CSF report.
Results: All the patients were subjected first to CE-FLAIR MRI. CE-FLAIR MRI supported the diagnosis of meningitis in 80 (61.5%) patients. CSF confir med meningitis in 71 (true positive) cases where as 09 (False Positive) had no meningitis on CSF. PPV of CE -FLAIR MRI in diagnosis of meningitis was 88.8%.
Conclusion: PPV of CE -FLAIR MRI in diagnosing meningitis is quit e high.
Keywords: Meningitis, CE -FLAIR MRI

INTRODUCTION

Meningitis is a clinical syndrome characterized by inflammation of the meninges. Bacterial meningitis is a life -threatening illness that result s from bacterial infection of the meninges which can lead to altered sensorium, generalized tonic clonic fits, and raised intracranial pressure and stroke[1].Delay in diagnosis and treatment can lead to grave outcome of disease[2]. Bacterial meningitis remains a serious threat to global health accounting for an estimated annual 303,000 deaths worldwide[3].

MRI has an important role in the diagnosis of infectious meningitis in situations where LP is difficult. Fluid-attenuated inversion recovery (FLAIR) is a special inversion recovery pulse sequence with a long repetition time (TR) and echo time (TE), and an inversion time (TI) that effectively nulls signals from CSF[4].

METHODOLOGY

It is a cross-sectional study after permission from IRB conducted in Radiology Department, BVH, Bahawalpur from January 1, 2019 to June 30, 2019. Sample size of 130 cases is calculated with 95% Confidence level, 4% margin of error and taking expected percentage of PPV of CE-FLAIR MRI in diagnosing meningitis as 94.3%. Sample Technique used was non-random, consecutive sampling.
Inclusion Criteria: Patients presenting with signs & symptoms of meningitis for last 72 hours with age 15-50 years of either gender.
Exclusion Criteria: Patients with already diagnosed meningitis on CSF report, patients with MRI incompatible prosthesis or cardiac pacemaker holders and patients with chronic renal failure.

After approval from institutional ethical review committee, 130 patients were selected by clinicians of BVH, Bahawalpur who fulfilling the inclusion criteria. After taking informed consent, the MRI was performed on a 1.5 tesla MR System. The MRI protocol included the T1W SE sequence, the T2W SE sequence, the T1W sequence with FS, the FLAIR sequence. The CE FLAIR, T1W sequences with MT and FS were obtained after administration of intravenous gadbutrol in a dose of 0.1mmol/kg body weight. After this, lumbar puncture was done and CSF was sent to the laboratory for analysis. CE-FLAIR MRI findings were correlated with CSF report.

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RESULTS

Table 1: Distribution of age

Age (years)	n	%age
15-30	24	18.5
31-50	106	81.5
Total	130	100

Mean ± SD = 35.09 ± 6.2 years

Table 2: Duration of symptoms

Duration of symptoms(days)	n	%age
<5	105	80.8
>5	25	19.2

Mean ± SD = 4.37 ± 1.2 days

Table 3: PPV of CE-FLAIR MRI taking CSF as gold standard

	Positive result on CSF	Negative result on CSF
Positive results onCE-FLAIR	71 (TP)	09 (FP)
Negative results on CE-FLAIR	06 (FN)	44 (TN)

P value 0.202 PPV=88.8%

Table 4: PPV with respect to age

Age (yrs)	TP	FP
15-30	17	01
31-50	54	08

P value 0.385
PPV for age 15-30 years: 94.4%,
PPV for age 31 -50 years: 87.1%

Table 5: PPV with respect to Gender

Gender	TP	FP
Male	42	05
Female	29	04

P value =.836
PPV for Male: 89.4%, PPV for Female: 87.9%

Table 6: PPV WRT duration of symptoms

Duration	TP	FP
≤5	54	07
>5	17	02

P value 0.909
PPV for ≤ 1 year: 88.5%, PPV for >1 year: 89.5%

DISCUSSION

In this study, age range was from 15-50 years with mean age of 35.1±6.2years. 106(81.5%) cases were between 31 to 50 years of age. Out of 130 patients, 79(60.8%) were male and 51(39.2%) were females with M:F ratio of 1.5:1. All the patients were subjected first to CE -FLAIR MRI. CE-FLAIR MRI supported the diagnosis of meningitis in 80(61.5%) patients. CSF confirmed meningitis in 71 (true positive) cases whereas 09 (False Positive) had no meningitis on CSF. PPV of CE-FLAIR MRI in diagnosing meningitis, taking CSF findings as gold standard was 88.8%.

In a study, PPV of CE -FLAIR MRI in diagnosing meningitis was found to be 94.3%[5]. Melhem et al[6] in their study on phantoms which emulated CSF and human volunteers, also suggested better visualization of meninges with the FLAIR sequence compared to the conventional T1W sequence, in pathological conditions that show laboratory evidence of elevated CSF protein concentration. Parmar et al in 2006[7] showed that post contrast FLAIR images have similar sensitivity but higher specificity as compared to contrast-enhanced T1-weighted images for detection of leptomeningeal enhancement. It can be a useful adjunct to post contrast T1-weighted images in evaluation of infectious leptomeningitis.

In another study, it is seen that contrast -enhanced T1-weighted MRI with fat saturation is superior to CE-FLAIR MRI in most cases for depicting intracranial meningeal diseases[8] and these result s are not consistent with our study. In one study, it is seen that post contrast FLAIR imaging is a valuable adjunct to post contrast T1W imaging. Pre contrast and post contrast FLAIR imaging effectively delineate parenchymal metastases[9].

In 2015, Ahmad A et al[10] suggested that post contrast FLAIR sequence has significant meningeal enhancement and non-significant vascular enhancement. The overall qualitative accuracy was 90.3% for post contrast FLAIR match upto 54.8% for post contrast T1W with fat saturation sequence.

CONCLUSION

PPV of CE -FLAIR MRI in diagnosis of meningitis is high. It improved our ability to diagnose meningitis for proper management.

Conflict of interest: Nil

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