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ROLE OF CONTRAST-ENHANCED FLUID-ATTENUATED INVERSION RECOVERY (FLAIR) IMAGING IN VARIOUS INTRACRANIAL LESIONS.

Radiodiagnosis

Dr. Anshul Shah Assistant Professor, Department of Radiodiagnosis, GCS Medical College, Hospital and Research Center

Dr. Jaideep Jagani* 2nd year Resident, Department of Radiodiagnosis, GCS Medical College, Hospital and Research Center *Corresponding Author

Dr. Asutosh Dave Professor and Head, Department of Radiodiagnosis, GCS Medical College, Hospital and Research Center

ABSTRACT

Summary: 50 patients with a known intracranial lesion or with clinical suspicion underwent the gadolinium-enhanced magnetic resonance (MR) imaging using 1.5T. Postcontrast axial, coronal, and sagittal T1 fat-saturated, axial FLAIR images were acquired after administration of gadobenate dimeglumine.

We found that postcontrast FLAIR images are useful by showing better meningeal involvement in various pathologies and enhancement of the solid component in intra-axial lesions. However, it was not much helpful in extra-axial lesions lesions with perilesional edema.

Contrast enhanced FLAIR MR imaging is definitely promising in diagnosis and characterization of various intracranial lesions. It is more useful especially when contrast enhanced T1WI findings of the brain are either inconclusive or if it shows minimal amounts of contrast enhancement. However, one important aspect that we would like to take note is that it cannot substitute post contrast T1 FS sequences.

KEYWORDS

Intracranial lesions, postcontrast fluid-attenuated inversion recovery, postcontrast T1-weighted imaging

INTRODUCTION

MRI is one of the best known modality to evaluate various intracranial lesions. Contrast enhanced sequences are widely used to evaluate patients suspected with intracranial lesions which may show enhancement.

Contrast enhanced T1-weighted images is most commonly used sequence.

Fluid-attenuated inversion recovery (FLAIR) is a type of inversion recovery pulse sequence having a long repetition time (TR) and echo time (TE) and an inversion time (TI) and hence effectively nulls signals from the cerebrospinal fluid.[1]

Because of mild T1 effect due to long TI, there is an enhancement on post contrast study. Therefore, lesions showing enhancement on contrast enhanced T1WI also show enhancement on contrast enhanced FLAIR images. Many clinical trials have revealed that Contrast enhanced FLAIR offers more information than Contrast enhanced T1WI alone. FLAIR imaging is sensitive for detecting parenchymal lesions and also in detecting extra-axial diseases. [2]

This study attempts to describe utility of Contrast enhanced FLAIR imaging in various intracranial lesions.

MATERIALS AND METHODS

A retrospective study was carried out involving 50 (32 male, 18 Female) of all age groups with a known intracranial lesion or with clinical suspicion who underwent the gadolinium-enhanced magnetic resonance (MR) imaging using 1.5T scanner over a period of 1 year (from January 2018 to December 2018).

Following the acquisition of routine multiplanar and multi-echo sequences, namely, sagittal and axial T1 SE, coronal and axial T2 SE, axial gradient-recalled echo and diffusion- weighted images, axial FLAIR fat-saturated (FS). Postcontrast axial, coronal, and sagittal T1 FS, axial FLAIR images were acquired after administration of gadobenate dimeglumine.

The MR imaging parameters for the postcontrast T2-FLAIR images were 6000–9000/90–110/1845–2030 ms/150 (TR/TE/TI/flip angle), and the acquisition time was 2 min 12 s Moreover, the MR imaging parameters for T1-weighted images were 700/8–10/90 (TR/TE/flip angle), and the acquisition time was 1 min 42 s.

All images were acquired with a section thickness of 5 mm, an intersection gap of 2 mm, and a field of view of 256 mm × 144 mm.

The lesions were assessed for number, conspicuity and degree of contrast enhancement on both pre and post contrast FLAIR and T1W sequences.

Simple descriptive analysis was carried out. Sensitivity and specificity of postcontrast FLAIR in various pathologies were calculated.

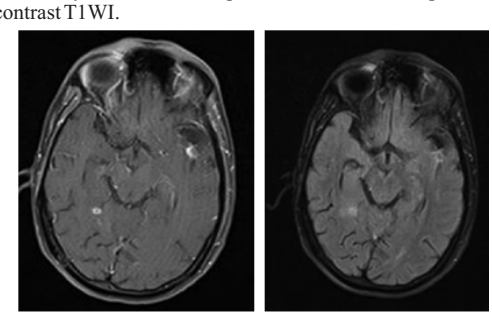
RESULTS

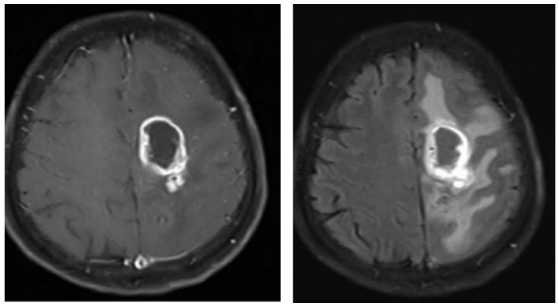
All the cases varied within the age group of 01-73 years. There was male predominance in our study (n=32).

Out of the 50 cases of intracranial lesions, 15 cases were extra-axial lesions and 35 cases were intra-axial lesions. Intra-axial lesions were further classified on the basis of etiology into infective and neoplastic. 23 cases were due to infective etiology and rest 12 cases were due to neoplastic etiology including both of benign and malignant etiology.

The infective intra-axial lesions mainly included those of the granulomatous etiology such as neurocysticercosis and tuberculomas. All these lesions showed peripheral enhancement on post contrast T1WI and also on post contrast FLAIR images which were almost equal in signal intensity. The lesions on postcontrast T1WI were better delineated due to the absence of perilesional edema which was seen on FLAIR images as hyperintensity resulting in nonvisualization of small peripherally enhancing lesions. However, some lesions showed more hyperintense enhancement than the perilesional edema on postcontrast FLAIR which helped us to see the extent of edema as well as enhancement. Furthermore, meningitis showed better meningeal enhancement on postcontrast FLAIR images which was not seen well on postcontrast T1WI.

The neoplastic intra-axial lesions include the primary tumors such as gliomas (both high and low grade), astrocytoma, and metastases. Enhancement on both post contrast T1 and FLAIR images was comparable. Some cases showed better enhancement on postcontrast FLAIR mainly in the solid component of lesion in comparison to the postcontrast T1WI.





The extra axial lesions included acoustic schwannoma, primitive neuroectodermal tumor, epidermoid cyst, meningioma. We did not find any extra-axial lesions which showed enhancement characteristic better on postcontrast FLAIR than in postcontrast T1WI.

Thus, postcontrast FLAIR images were seen to be better in the visualization of the meningeal enhancement and also improved delineation of the solid component in the various intracranial lesions. However, it was not found useful in extracranial lesions.

DISCUSSION

Gadolinium is the most commonly used intravenous contrast agent for imaging the brain. It helps in improved lesion detection and better characterization. Gadolinium causes shortening of both T1 and T2 of the tissues in which it has accumulated. It is due to the T1 shortening that there is contrast enhancement of a lesion on clinical MR images.[2]

T1WI are usually acquired in multiple planes before and after the administration of gadolinium. The areas which were previously hypointense on precontrast study and develop hyperintensity on postcontrast study are said to have enhanced. This enhancement occurs due to the accumulation of gadolinium in the extracellular space which influences the MR relaxation time of nearby tissue protons.[2]

For intra-axial brain lesions to enhance, the blood–brain barrier should be disrupted so that gadolinium can enter the extracellular space. While for extra-axial lesions, enhancement is mainly seen in those lesions which have relatively high vascularity.[3]

T1WI are primarily used for post contrast brain MR imaging in the detection and characterization of intracranial lesions. FLAIR images are equivalent to T2WI except for dark CSF which is due to T1 effect present because of the long TI. After administration of gadolinium, there is T1 shortening which is seen as hyperintensity on FLAIR images; therefore, lesions showing enhancement on postcontrast T1WI will also enhance on postcontrast FLAIR images. (5)(6)

CONCLUSION

Contrast enhanced FLAIR MR imaging is definitely promising in diagnosis and characterization of various intracranial lesions. It is more useful especially when contrast enhanced T1WI findings of the brain are either inconclusive or if it shows minimal amounts of contrast enhancement. However, one important aspect that we would like to take note is that it cannot substitute post contrast T1 FS sequences.

Contrast enhanced is an adjunct rather than a substitute to post contrast T1WI in equivocal cases. It is better in demonstrating the solid components in neoplastic lesions as well as in diagnosis of meningeal involvement in infective processes.

We would like to emphasize that our study has small number of patients and it studied variety of pathologies. Thus, wider study with more number of patients and study of individual pathology should be assessed further.

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