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ROLE OF DIFFUSION WEIGHTED IMAGING IN INTRACRANIAL LESIONS

Radio-diagnosis

Dr. Stefi Makadiya* Resident Doctor, Department of Radio-diagnosis, PIMS, Udaipur *Corresponding Author

Dr. Sanjay B. Shahu Professor and HOD, Department of Radio-diagnosis,PIMS,Udaipur

ABSTRACT

Introduction: Intracranial lesions include a wide gamut of conditions causing significant morbidity and mortality. MRI has become an integral part of evaluation and assessment of these pathologies. Diffusion-weighted magnetic resonance (MR) imaging provides image contrast that is different from that provided by conventional MR techniques. The role of diffusion weighted imaging has gained immense significance in the past decade as it helps in improved lesion identification and characterization. **Method:** 100 patients referred to the radiology department with complaints suggestive of intracranial lesions or even those with already diagnosed cases of intracranial lesions which needed follow up radiological investigations were evaluated with MRI brain with addition of diffusion weighted imaging in each scan protocol. **Results:** I studied 100 patients with suspected intracranial lesions using MRI. The Study had a large spectrum of conditions with major contributors being infarcts (24%), tumors (43%), infective etiologies (12%) and non-neoplastic cystic lesions (5%). Diffusion restriction was seen in 100% of the acute arterial and venous territory infarcts thus giving a sensitivity and specificity of 100% in my study. Diffusion weighted imaging is also an effective tool to evaluate non-neoplastic cystic lesions of brain and excellent tool to differentiate between epidermoid cysts and arachnoid cysts with restricted diffusion seen in epidermoid cysts. Also it is effective in identifying intracranial abscess formation and showed 100% sensitivity in identification of the same. **Conclusion:** The DW MR is a very useful sequence in evaluating stroke like symptoms. It can detect hyper acute infarcts within its window period i.e. 6 hours. In patients with multiple infarcts diffusion weighted imaging can correctly differentiate between acute and chronic lesions.

KEYWORDS

AIM &OBJECTIVES:

- To evaluate the role of diffusion weighted imaging in intracranial lesions.
- To study the role of diffusion weighted imaging (DWI) and establish the findings in various intracranial lesions.
- Observe DWI findings of various intracranial lesions with their conventional MRI findings.

INTRODUCTION

Diffusion weighted magnetic resonance imaging has been a significantly important area of research in the past decade. Application of Diffusion weighted imaging is being done in newer and newer disease conditions in CNS and in the body.

Molecular diffusion, or "brownian motion" was first formally described by Einstein in 1905(1). The term molecular diffusion means that any type of molecule in a fluid (ex. water) exhibits a random movement mainly due to temperature differences (thermal gradients) at various points in the fluid.(2) DW imaging is a mathematical combination of T2W and DW images. Pure diffusion weighted image is obtained by subtracting the T2W image from the DW image. The resultant mapping of DW values in a voxel is called ADC mapping. ADC mapping represents true diffusion without T2 influence. Signal intensity on a gray scale is directly related to ADC values on DWI. Brain tissues with low ADC appears relatively hyperintense, whereas regions with higher ADC values appears hypointense.

MATERIALS AND METHODS

This is a prospective descriptive study done on patients who came to radiology department of PIMS hospital. Sample size was 100 patients. Only those patients are included who referred to the radiology department for evaluation of lesions suggestive of intracranial pathologies and had positive findings. Patients having contraindications for MR imaging are excluded.MRI Scan was performed in Siemens Magnetom Essensa machine 1.5 tesla.

DISCUSSION

The results of the present study are discussed as follows:

Gender distribution:

According to my study gender distribution in intra cranial lesions was 65 males (65%) and 35 females (35%) with the ratio of M: F being approximately 2:1.

Age distribution:

In my study the age distribution in intracranial lesions was from 0 to 90 years. It was observed that intracranial lesions are more prevalent in the age group between 41-50 years and 61-70 years followed by 51-70 years. The youngest patient was a child of 1 year with hypoxic ischemic encephalopathy and the oldest patient was of the age group of 89 years with acute infarct with hemorrhage.

Ischemic Stroke:

The study consisted of 23 patients with arterial territory infarcts. Out of which 17 patients had acute infarcts, 3 patients had chronic infarcts and 3 patients had infarcts secondary to vasculitis /meningitis. A sensitivity and specificity of 100% was found in my study for the diagnosis of arterial infarcts. For infarctions imaged within 24 hours, a study conducted in 1987 by Andrew Kertesz, Sandra E. Black, Larry Nicholson, and Thomas Carr (3) on 175 patients reported a sensitivity of 58% for CT scan and 82% for MR Imaging. Another study conducted by Hoehn-Berlage M (4)in1995 concluded that diffusion weighted NMR imaging (DWI) has the potential to be a sensitive tool for the observation of stroke evolution. Another study conducted in the year 1995 by Moseley ME et al (5) have demonstrated that changes in the ADC occur as early as 10 minutes following onset of ischemia which all correlated well with my study.

RESULTS

MR DWI has been an important area of research in the past decade. Application of diffusion weighted imaging is being done in newer and newer disease conditions in the CNS and in the body.

The present study was performed on 100 patients who were either a suspectedintracranial pathology or a known case of intracranial pathology. I studied the role of MRDW imaging in evaluation of various intracranial lesions.

The maximum number of patients were between the age group of and 41-50 and 61-70 years followed by age group 51-60years.In my study there was a male predominance.65 (65%) were males and 35 (35%)were females.

The study had a large spectrum of conditions with major contributors being infarcts (24%), tumors (43%), infective etiologies (12%) and non-neoplastic cystic lesions (5%).Diffusion restriction was seen in 100% of the acute arterial and venous territory infarcts thus giving a sensitivity and specificity of 100% in our study.

No restricted diffusion was seen in three cases of chronic infarcts again giving a sensitivity and specificity of 100%in my study.DW Imaging is not a suitable tool for differentiating the various brain tumors but is an excellent tool to identify high cellularity, malignant intracranial tumors and may serve as a guide to a highly cellular area for stereotactic biopsy.

DW imaging is also effective in identifying metastatic disease and showed 100% sensitivity for the same in my study. Diffusion weighted imaging is also an effective tool to differentiate between epidermoid cysts and arachnoid cysts with restricted diffusion seen in epidermoid cysts.

Diffusion weighted imaging also is suitable to identify between various stages of Neurocysticercosis and Tuberculomas with restricted diffusion seen in stage 2 of neurocysticercosis demonstrating the scolex and also in cases of tuberculomas showing liquefactive necrosis.

Also, it is effective in identifying intracranial abscess formation and showed 100% sensitivity in identification of the same.

Overall, in my study DWI increased the sensitivity and specificity in diagnosis of intracranial lesions and should be an integral part of all MR imaging of brain pathologies.

CONCLUSION

This study evaluated the role of MR diffusion weighted imaging for intracranial lesions. The DW MR is a very useful sequence in evaluating stroke like symptoms. It can detect hyper acute infarcts within its window period i.e., 6 hours. In patients with multiple infarcts diffusion weighted imaging can correctly differentiate between acute and chronic lesions. DW MR is not very useful to grade tumors but may identify malignant potential of the tumor with high grade malignant lesions showing restricted diffusion. It also serves as a guide to a highly cellular area for stereotactic biopsy. Also, tumor margins are not clearly delineated on diffusion weighted imaging as compared to T1W and T2W imaging. DW imaging is also effective in identifying metastatic disease and showed 100% sensitivity for the same in my study. Diffusion weighted imaging also is suitable to identify between various stages of neurocysticercosis and tuberculomas. It is also an excellent tool for identifying intra parenchymal abscess formation. DWI is very useful in differentiating between the epidermoid from arachnoid cysts.

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