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A STUDY ON ROLE OF DIFFUSION WEIGHTED MAGNETIC RESONANCE IMAGING FEATURES OF INTRACRANIAL PATHOLOGIES – A SERIES OF 115 CASES.

Radiodiagnosis

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ABSTRACT

Diffusion weighted imaging (DWI) is a specialized magnetic resonance imaging technique that depends on the random movement of water molecules within and between the intracellular and extracellular spaces. Regions with restricted mobility of water molecules yield a greater DW-MRI signal and appear bright. In apparent diffusion coefficient (ADC) maps, regions that contain high water mobility appear bright.

Objective: The objectives of the study were to describe the imaging characteristics of intra cranial lesions on DWI and to compare these features with ADC and T2W images.

Materials and methods: A descriptive MR Study was undertaken in 115 patients detected to have intracranial lesions on DW MRI of the brain in ASRAMS. In all these patients the DWI findings were noted and correlated with ADC and T2 FLAIR images. All the MRI scans in this study were performed using 1.5 T MRI scanner (SIEMENS MAGNETOM AVANTO).

Duration of study: The study was carried over a period of 1 year from August 2016 to July 2017.

KEYWORDS

DWI- diffusion weighted imaging, MRI-magnetic resonance imaging, ADC-apparent diffusion coefficient.

INTRODUCTION:

Diffusion weighted imaging is a technique that assesses local environment at the cellular level to determine changes in the random movement of water protons. . The amount of diffusion weighting of a DW image depends on the magnitude of the applied gradients, how long they are switched on, and the time between the two lobes[1].

Water diffusivity in the extracellular space is inversely related to the constituents of intracellular space; cells with a high nucleus to cytoplasm ratio and tissues with high cellularity cause increased volume of intracellular space, resulting in diminished mobility of water protons with restriction of diffusion. Thus reduced diffusion can be seen in highly cellular tumors such as lymphoma, meningioma and glioblastoma. Several reports have reported an inverse correlation between ADC value and glioma grade for grade II through IV astrocytomas[2].

Conventional MR imaging and clinical findings might be non-specific in cases of herpes encephalitis. DW image shows high signal in the lesions with usually decreased ADC values representing cytotoxic edema and rarely higher ADC values representing vasogenic edema. Thus it may increase the diagnostic accuracy when combined with other sequences. Likewise in Creutzfeld-Jacob disease, DWI imaging helps differentiate from infarct by showing persistent restricted diffusion[3].

Multiple sclerosis is the most common demyelinating disease. DWI may improve lesion detection when combined with standard T2-weighted techniques. On DWI, acute lesions may show increased ADC due to vasogenic edema and myelin destruction with axonal preservation; or decreased ADC due to intramyelinic edema[4,5].

Thus DWI has a wide range of applications in the evaluation of intracranial pathological conditions. It provides a specific diagnosis in few situations, and adds to the information provided by conventional sequences in many others. It is in this backdrop, that the objectives set out in this research programme will enable us to understand the appearances of various intracranial pathologies on diffusion weighted images. The signal characteristics of these lesions on ADC images and T2 FLAIR images will also be described.

SELECTION OF PATIENTS:

Inclusion criteria: The criteria for inclusion of the patients in the study included those patients who were clinically referred for diffusion weighted MRI of the brain and were detected to have any of the following.

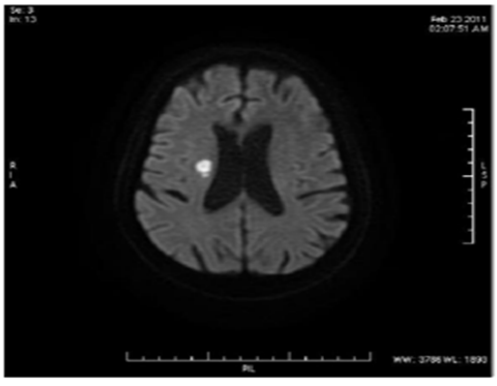
1. Infarction
2. Infection
3. Degenerative disorders
4. Dymyelination
5. Tumors – extra axial and intra axial
6. Hypoxic ischemic injury
7. Metabolic or toxic insults to the brain .

Exclusion criteria :

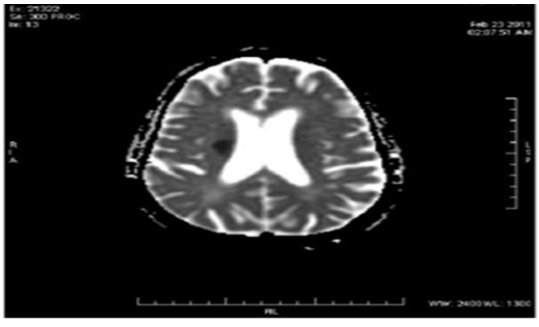
Patients who are detected to have

1) intracranial bleed .
2) claustrophobic patients.
3) patients with mettalic implant

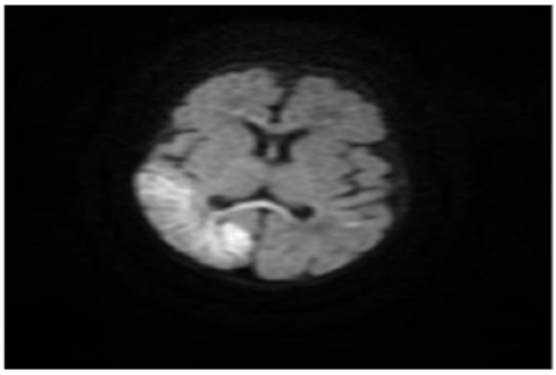
ACUTE INFART ON RIGHT SIDE.



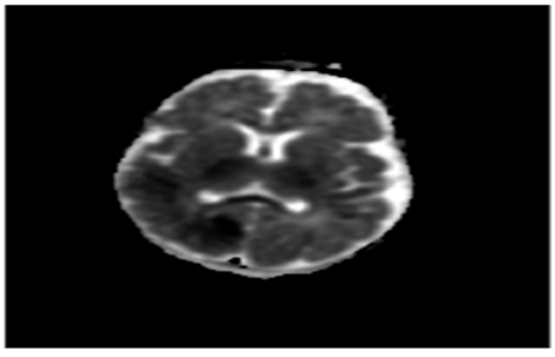
AXIAL DWI IMAGE



AXIAL ADC IMAGE
Profound term hypoxic ischemic encephalopathy



AXIAL DWI IMAGE



AXIAL ADC IMAGE

RESULTS:
Over the one year collection period 115 patients presented for mri brain in dwi were studied.

The age of the patients with intra cranial lesions studied ranged from 3 days to 78 years.

The patients involved in the study were divided into 7 age groups viz. 1-10 years, 11-20 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years and 61-70 years. There were nine patients (7.8%) in 1-10 year age group, ten (8.6%) in 11-20 year age group, ten (8.6%) in 21-30 year age group, sixteen (13.9%) in 31-40 year age group, sixteen (13.9%) in 41-50 year age group, twenty three (20%) in 51-60 year age group, twenty five (21.7%) in 61-70 year age group, six (5.2%) in 71-80 year age group.

Of the 115 patients studied, 31 were females and 84 were males. The mean age among females was 50 years and the mean age among males was 44 years.

Intra cranial lesion	Total
Acute infarct	30
Sub acute infarct	4
Chronic infarct	18
Arachnoid cyst	5
Epidermoid cyst	1
Ncc granuloma	3
Tb granuloma	6
Abscess	3
Preterm HII	3
Profound Hii	1
PRES	2
PVL	1
Extradural empyema	2
HSV encephalitis	1
Meningioma	9
Lymphoma	2
Medulloblastoma	4
Schwannoma	2
Pilocytic astrocytoma	1
Low grade glioma	4
GBM	5
Hemangioblastoma	1
Anaplastic astrocytoma	2
Adrenoleucodystrophy	1
ADEM	1
Multiple sclerosis	2
Demyelination toxic	1

DISCUSSION & CONCLUSION:
In this study 115 patients with intracranial lesions detected on DW MRI of the brain were included. It was found that DW MRI provides adjunctive information for intracranial lesions including stroke, neoplasms, infections, hypoxic ischemic encephalopathy and extra axial lesions in conjunction with conventional MRI.

DWI is a highly sensitive technique in the detection of acute infarcts and in characterizing infarcts as acute, subacute and chronic. DWI is a sensitive modality for detecting HII and shows the extent of involvement better than T2WI. Presence of diffusion restriction is a useful method of differentiating abscesses from necrotic or cystic neoplasms. Restricted diffusion may be a feature of high grade gliomas and may help in their grading. Highly cellular tumors such as lymphomas, medulloblastomas and meningiomas may show restricted diffusion. Arachnoid cysts can be differentiated from epidermoid cysts by the presence of low signal on DWI. PRES and demyelination do not show restricted diffusion probably due to lack of cytotoxic edema.

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