A Cross sectional Study on role of MRI and its Clinico-Radiological correlation of Patients with White Matter Disease

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Abstract
Objectives: *our study was to evaluate the clinico and radiological correlation and to find the role of MRI as an investigative modality for diagnosis of patients with white matter diseases.*
Methodology: *A total of 30 cases of white matter lesions were selected for this study. A detail history, clinical examination and relevant investigations were performed to all cases. All the patients were examined with 1.5 Tesla systems (Toshiba Medical System). Head coil was used in all the patients. A combination of T1 and T2 weighted and FLAIR sequences and post gadolinium T1 weighted was obtained in each patient.*
Results: *Data was analyzed by using simple statistical methods with the help of MS-Office software.*
Conclusions: *Multiple Sclerosis was the most common white matter disease. Female was more preponderance than male. Patients with second or third decade of life were commonly suffered with MS. Acute Disseminated Encephalomyelitis and Progressive Multifocal Leukoencephalopathy were the second most common disorders of white matter. Cerebral white matters with asymmetric and patchy involvement were seen in all cases of ADEM. Hence, MRI is one of the best invaluable choices for the detection of white matter diseases.*
Keywords*: White matter disease, Multiple sclerosis, ADEM, MRI.*

Introduction

Multifocal white matter abnormalities are characteristic of multiple sclerosis (MS), a primary demyelinating disease. Multiple sclerosis most commonly affects females, and is most prevalent in the 20-40 year old age group. In middle aged adults, the female-to-male radio is 1.5-2:1, but in younger patients the female preponderance is greater.[1] Although 75% of patients with multiple sclerosis present between the ages of 20 and 50 years of age, it is important

to bear in mind that 15% present in the first and second decade, and 10% present after 50 years of age. A negative brain MR does not exclude multiple sclerosis, as the disease may present with spinal cord involvement only (with a normal cranial MR). In patients with intracranial involvement, the periventricular white matter is most commonly involved, usually with an asymmetrical distribution.[1]
Magnetic resonance imaging (MRI) was found to be more sensitive than computed tomography

(CT) in the detection of (white matter) lesions of the brain. Following initial enthusiasm about the new diagnostic possibilities, like in multiple sclerosis (MS),[2] it was reported that clinically silent (incidental) magnetic resonance (MR) lesions could also be found in normal ageing and a variety of other diseases.[3] During a period of scepticism about the apparent lack of specificity of MR in the diagnosis of brain lesions, the term UBO (unidentified bright object) was employed to describe incidentally discovered brain abnormalities. In the second half of the 1980s, further studies on white matter lesions (WML) in a variety of diseases increased our knowledge about the prevalence of incidental MR lesions and risk factors for such lesions. Improved image quality, newer MR techniques (including gadolinium enhancement), and knowledge about the shape, size and distribution of incidental MR lesions have provided further clues to the differential diagnosis of (incidental) MR lesions.[4] Aim of our study was to evaluate the role of MRI as an investigative modality for diagnosis of white matter diseases and its value in early diagnosis and management and its clinico-radiological correlation of patients with white matter disease.

Materials & Methods

This present study was conducted in department of Radiodiagnosis, Kathihar Medical College and Hospital, Katihar, Bihar, India during a period from January 2017 to February 2018. Attendants of entire subject signed an informed consent approved by institutional ethical committee of Katihar Medical College and Hospital, Katihar was sought.

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Selection of data: A total of 30 cases of white matter disease with irrespective of sex were enrolled in this study. Age group of cases were 7 to 75 years. Male and female ratio was 17:13.

Methods

A detail history, clinical examination and relevant investigation were performed to all cases.

All the patients were examined with 1.5 Tesla systems (Toshiba Medical System). Head coil was used in all the patients. A combination of T1 and T2 weighted and FLAIR sequences and post gadolinium T1 weighted was obtained in each patient. Each MR image was interpreted by two Radiologists proficient in reporting brain MRI. In case of difference of opinion, consensus was developed through discussion between the two radiologists. The diagnosis was confirmed by laboratory findings of CSF oligoclonal band in patients with MS. Among cases of acute disseminated encephalomyelitis and leukodystrophies, the diagnosis was established through typical imaging findings and clinical course without any relapse.

Statistical Analysis

Data was analyzed by using simple statistical methods with the help of MS-Office software.

Results

In this present study, we were included a total 30 cases of white matter disease. Patient with age group was 7 – 75 years. Out of 30 cases, 17(56.67%) cases were males and 13(43.33%) cases were females.

Table.1. Distribution of white matter disease (N=30)

Diseases	Sex		No. of cases	%
Multiple sclerosis	M	F		33.33%
	4(40%)	6(60%)	10	
Acute disseminated encephalomyelitis	M	F		20%
	4(66.67%)	2(33.33%)	6	
Progressive multifocal leukoencephalopathy	M	F		10%
	2(66.67%)	1(33.33%)	3	
Central pontine myelinolysis	M	F		6.66%
	1(50%)	1(50%)	2	
Radiation injury	1(100%)	0	1	3.33%

				6.66%
Leukodystrophies	M	F		
	1(50%)	1(50%)	2	
Periventricular leukomalacia	0	1(100%)		3.33%
Diffuse axonal injury	M	F		6.66%
	1(50%)	1(50%)	2	
Reversible posterior leukoencephalopathy	1(100%)	0	1	3.33%
Motor neuron disease	M	F		6.66%
	2(100%)	0	2	
Total	17(56.67%)	13(43.33%)	30	100%

In this study, multiple sclerosis was the most common white matter disease. Out of 30 cases of white matter disease, 10(33.33%) cases was the multiple sclerosis. Male 4(40%) and females 6(60%) were suffered with multiple sclerosis. Male and female ratio was 2:3.

Mean age was 31.2 years. Average age of female cases was 25 years and male cases were 36 years of patients with multiple sclerosis.

In this present study, out of 30 cases of white matter disease, 6(20%) cases were encountered of acute disseminated encephalomyelitis. 4(66.67%) cases were male and 3(33.33%) cases were female.

3(10%) cases were of progressive multifocal leukoencephalopathy. All the three patients presented with motor symptoms in the form of hemiparesis and one patient had cerebellar signs in addition. On MR, one patient showed patchy hypointense lesions on T1WI in subcortical white matter of right occipital and parietal lobe, which were hyperintense on T2WI and FLAIR sequences.

Central pontine myelinolysis and leukodystrophies cases were 2(6.66%). Male and female ratio was 1:1. One of them had definite predisposing factors like hyponatraemia and the other patient was alcoholic. Both the patients showed extra pontine involvement in addition to the characteristic involvement of central pons.

1(3.33%) case of Periventricular Leucomalacia - (PVL): Patient was an 8-year-old female child presented with history of preterm delivery and both asphyxia with microcephaly. At present, the patient has presented with mental retardation and seizures. MRI showed loss of white matter volume and bilateral symmetrical hyperintensity

of the periventricular white matter especially of the periatrial region. 1(3.33%) male case was of radiation injury. 2(6.66%) male cases were encountered with motor neuron disease.

Table.2. Presenting complains of MS (N=10).

Symptoms	No. of cases	Percentage
Visual loss	8	80%
Weakness	5	50%
Sensory loss	2	20%
Ataxia	2	20%
Seizures	1	10%
Facial palsy	2	20%

In this present study, most common symptom of multiple sclerosis was visual impairment 8(80%) followed by 5(50%) weakness, 2(20%) sensory loss, ataxia and facial palsy and 1(10%) of seizures.

Table.3. Symptoms of acute disseminated encephalomyelitis (N=6).

Symptoms	No. of cases	Percentage
Altered consciousness	4	66.67%
Motor symptoms	2	33.33%
Urinary retention	2	33.33%
MRI appearance		
Cerebral white matter with asymmetric and patchy involvement	6	100%
Brain stem involvement	2	33.33%
Spinal cord and cerebellar Involvement	1	16.67%
Thalamic involvement	1	16.67%

All cases 6(20%) of Acute Disseminated Encephalomyelitis (ADEM) were a history of fever prior to the onset of clinical symptoms. Ages were varied to 6-75 years. Out of total 6 cases of ADEM, most common symptoms were 4(66.67%) altered consciousness followed by 2(33.33%) motor symptoms and urinary retention.

On MRI appearance, all cases of ADEM were shown cerebral white matter with asymmetric and patchy involvement. 2 (33.33%) were shown brain stem involvement. And 1(16.67%) case was shown spinal cord, cerebral involvement and thalamic involvement.

Discussion

MRI is an important noninvasive imaging modality which has a very high sensitivity for detecting white matter lesions due to its excellent gray-white matter resolution. Multiplanar imaging is possible only with MRI, which helps in the detection and localization of lesions.[5]

In this present study, we were enrolled a total of 30 cases with age group of 7 to 75 years of white matter disease. 17(56.67%) cases were male and 13(43.33%) cases were female. Multiple sclerosis was the most common disease of all the white matter disease. Male and female ratio was 2:3. Multiple sclerosis was more preponderance in female than male. Mean age was 31.2 years. In female average age was 25 years and in male average age was 36 years. Most common symptom of multiple sclerosis was visual impairment 8(80%) followed by 5(50%) weakness, 2(20%) sensory loss, ataxia and facial palsy and 1(10%) of seizures. MR imaging findings include all patients showing bilateral periventricular hyperintensities on T2 weighted and FLAIR images. Deep grey matter hyperintensities were also identified in all patients. Two patients showed hyperintense lesions in bilateral frontal, parietal and occipital lobes, each lesion measuring approximately 5-10 mm in size.

Similar study was conducted by BN Lakhkar, et al. (2002)[6] and stated that Demyelinating and dysmyelinating white matter diseases are important components of neurological problems. White matter diseases include Multiple Sclerosis (MS), Leukodystrophies, Central Pontine Myelinolysis, Acute Disseminated Encephalomyelitis and Progressive Multifocal Leukoencephalopathy. MS is the commonest of all the white matter diseases.

Dr. Sindu P. Gowdar, et al. (2015)[5] also found that female was more preponderance than male with multiple sclerosis.[5]

In this present study, out of 30 cases of white matter disease, 6(20%) cases were encountered of acute disseminated encephalomyelitis. 4(66.67%) cases were male and 3(33.33%) cases were female. Among cases of acute disseminated encephalomyelitis and leukodystrophies, the diagnosis was established through typical imaging findings and clinical course without any relapse. On MRI, Asymmetrical hyperintense signals in the subcortical white matter of frontal, parietal and occipital lobe and cerebellum with enhancement on post contrast scans were seen in the cases of ADEM.

2 (33.33%) cases were shown brain stem involvement. And 1(16.67%) case was shown spinal cord, cerebral involvement and thalamic involvement

All cases 6(20%) of Acute Disseminated Encephalomyelitis (ADEM) were a history of fever prior to the onset of clinical symptoms. Ages were varied to 6-75 years. Out of total 6 cases of ADEM, most common symptoms were 4(66.67%) altered consciousness followed by 2(33.33%) motor symptoms and urinary retention.

3(10%) cases were of progressive multifocal leukoencephalopathy. . All the three patients presented with motor symptoms in the form of hemiparesis and one patient had cerebellar signs in addition. On MR, one patient showed patchy hypointense lesions on T1WI in subcortical white matter of right occipital and parietal lobe, which were hyperintense on T2WI and FLAIR sequences.

Central pontine myelinolysis and leukodystrophies cases were 2(6.66%). Male and female ratio was 1:1. One of them had definite predisposing factors like hyponatraemia and the other patient was alcoholic. Both the patients showed extra pontine involvement in addition to the characteristic involvement of central pons.

Humera Ahsan, et al.(2008)[7] were stated that leukodystrophies, which include Metachromatic

Leukodystrophy and Adrenoleukodystrophy, Alexender's and Niemen Pick Diseases, were the other most common group of white matter diseases. In their results showed those 10 (28.6%) patients, 7 (70%) males and 3 (30%) females, suffered form leukodystrophies. Each type of leukodystrophy presented with different frequencies and MRI findings.

In this present study, 1(3.33%) case of Periventricular Leucomalacia (PVL): Patient was an 8-year-old female child presented with history of preterm delivery and both asphyxia with microcephaly. At present, the patient has presented with mental retardation and seizures. MRI showed loss of white matter volume and bilateral symmetrical hyperintensity of the periventricular white matter especially of the periatrial region. 1(3.33%) male case was of radiation injury. 2(6.66%) male cases were encountered with motor neuron disease.

Ashikaga R et al (1996)[8] found that FLAIR sequences had a better sensitivity for subtle demyelinating foci especially those with periventricular locations. The most common site of lesion in this study was the periventricular area. Fazekas, et al. (1993)[9] and Jena AN, et al. (1991)[10] have also noted the periventricular area as the commonest location.

BN Lakhkar, et al. (2002)[6] conducted a study in which four cases of periventricular Leukomalacia (PVL) were reported. In their study, two had a history of preterm delivery & asphyxia while the remaining two were full term infants with insult in the prenatal life. The most common clinical presentation was spastic diplegia (cerebral palsy) followed by seizures. MRI showed loss of white matter volume and bilateral symmetrical hyperintensity of the periventricular white matter especially of the periatrial region in all patients. Ventriculomegaly and scalloping of ventricular margins were seen in two patients. They opined that the typical imaging findings include peritrigonalhy perintensities on T2WI, focal ventricular enlargement and irregular, scalloped ventricular contours. White matter volume is reduced and the posterior corpus callosum appears moderately atrophic.

Conclusion

Multiple Sclerosis was the most common white matter disease. Female was more preponderance than male. Patients with second or third decade of life were commonly affected with MS. Second most common disorders of white matter were acute disseminated encephalomyelitis and progressive multifocal leukoencephalopathy. Cerebral white matters with asymmetric and patchy involvement were seen in all cases of ADEM. Hence, MRI is one of the best invaluable choices for the diagnosis of white matter disease.

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