IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 16, Issue 2 Ver. VII (February. 2017), PP 01-04
www.iosrjournals.org

An Observational Study of Magnetic Resonance Imaging Evaluation of Encephalitis

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Objective: *To evaluate the role of magnetic resonance imaging in encephalitis cases.*
Methods: The present descriptive study was carried out using a prospective study design. Age group included in the study was above 15 years. Patients clinically presenting with symptoms and signs suggestive of encephalitis were included in the study. MRI scan was performed in all patients.
Results: *The mean (±SD) age of the patients was 37.03 (±21.86) years. Thalami involvement was observed most commonly which is seen in 45% (18) case followed by Temporal lobe involvement in 42.5 %(17), then Frontal lobe and Basal ganglia in 35%(14),Mid brain in 32.5%(13),Cerebellum in 30%(12),Pons and Medulla both in 27.5%(11),Parietal lobe in 17.5%(7), Occipital lobe 20%(8).Hence most common sites of brain involvement were thalami, temporal lobe, frontal lobe and basal ganglia.*
Conclusion: *Suggestive MRI findings are present in some etiologies of viral encephalitis such as Herpes simplex encephalitis, JE, enterovirus encephalitis MRI may show non-specific features of viral encephalitis such as cortical hyperintensities and cerebral edema. MRI is also useful for diagnosing alternative etiologies such as Acute disseminated encephalomyelitis, and antibodyassociated encephalopathies.*
Keywords: *Encephalitis, Magnetic resonance imaging, Etiologies*

I. Introduction

Encephalitis is the presence of an inflammatory process in the brain parenchyma associated with clinical evidence of brain dysfunction. Encephalitis by the herpes simplex virus is the leading cause of most severe cases in all the ages including newborns (Beig, 2010). It is mediated via metabolic processes and can be caused by intoxications, drugs, systemic organ dysfunction (e.g. liver, pancreas) or systemic infection that spares the brain. (Steiner et al, 2005).

Acute encephalitis syndrome (AES) is a clinical condition caused by infection with Japanese encephalitis virus (JEV) or other infectious and noninfectious causes. A confirmed etiology is generally not required for the clinical management of AES. Thus, surveillance for JEV infection in India has focused on identifying AES cases rather than JE cases; this approach is more feasible given the limitations of public health resources (Hills et al, 2009).

Magnetic resonance imaging (MRI) is more sensitive and specific than CT for the evaluation of viral encephalitis, (Dun et al., 1986; Schroth et al., 1987; Dale et al., 2000; Marchbank et al., 2000). The advantages of MRI include its multiplanar imaging capability, improved soft tissue contrast, and high anatomical resolution. It is imaging technique of choice in evaluation of encephalitis. It allows earlier detection and treatment of inflammatory processes. MRI also provides valuable information for patient follow up.
The present study was designed to evaluate the role of magnetic resonance imaging in encephalitis cases.

II. Material And Methods

The present descriptive study was carried out using a prospective study design. Age group included in the study was above 15 years. Patients clinically presenting with symptoms and signs suggestive of encephalitis were included in the study. Patients confirmed to have diagnosis other than encephalitis were excluded from the study. All the patients clinically suspected to have encephalitis were invited to participate in the study.

Informed consent was obtained from all the patients/their guardians willing to participate in the study. After obtaining the informed consent and ensuring that they met the inclusion criteria and not falling into the domain of exclusion criteria were enrolled as the study subjects. From all the patients consenting to participate in the study, demographic information, detailed medical history, details of current illness were recorded. A thorough clinical examination was carried out. MRI scan was performed in all patients.

III. Results

The mean (±SD) age of the patients was 37.03 (±21.86) years. One fourth of patients were in between 12-20 years (25%) of age group followed by age group 41-50 years (22.5%), than >50 of year of age group (20%), 21-30 yr group (17.5%) and 31-40 years group (15%). More than half (55%) of the patients were males

and females cases were 45% (Table-1). The most common presenting symptom in encephalitis cases was fever which is seen in (92.5%) cases, followed by seizure (87.5%) altered sensorium (85%), Neck rigidity (70%) and headache (67.5%) (Table-2).

Thalami involvement was observed most commonly which is seen in 45% (18) case followed by Temporal lobe involvement in 42.5 %(17), then Frontal lobe and Basal ganglia in 35%(14),Mid brain in 32.5%(13),Cerebellum in 30%(12),Pons and Medulla both in 27.5%(11),Parietal lobe in 17.5%(7), Occipital lobe 20%(8).Hence most common sites of brain involvement were thalami, temporal lobe, frontal lobe and basal ganglia (Table-3).Out of the total 40 case encephalitis cases, 55 %(22) was JE (Thalami, Basal ganglia and Brain stem involvement is seen), 45 % (18) was HSV (Temporal lobe, Insular cortex, Frontal lobe involvement seen (Table-4).

IV. Discussion

The present study was conducted with the objective to evaluate the role of magnetic resonance imaging in encephalitis cases. A total of 65 clinically suspected cases were recruited in the study. Out of these, 40 cases were diagnosed encephalitis on MRI. The CSF routine examination was done in all diagnosed cases of encephalitis on MRI.

Encephalitis is associated with severe illness, appreciable mortality rates, and high health care costs (Khetsuriani et al, 2002), but its epidemiology remains poorly understood (Granerod et al, 2010). The etiology of encephalitis should be diagnosed early as increasing number of viruses have been found to cause encephalitis in humans (Whitley and Gnann, 2002; Warrell and Warrell, 2004; Warrell and Warrell, 2005). Although specific therapy is limited to only few viral agents, correct diagnosis with supportive and symptomatic treatment are mandatory to ensure best prognosis (Chaudhari and Kennedy, 2002; Redington and Tyler, 2002).

In the present study, the percentage of encephalitis cases is higher among the age group of 12-20 years and after 40 years with higher incidence among males, which is consistent with previous studies (Lee et al, 2003; Cizman and Jazbec, 1993; Nicolosi et al, 1986) which also illustrated these age groups more susceptible to viral encephalitis. Hyporesponsiveness of the immune system in early life and later immunosenescence render these age groups more susceptible to infection, to reactivation of latent infection, or development of encephalitis once infected (Tregoning and Schwarze, 2010).

Clinical features of encephalitis comprise an incubation period of 1–4 weeks (average, 2 weeks), then a prodrome of 2–5 days that usually includes fever (often > 40°C) and headache (Cordova et al, 2000). Other prodromal features may include nausea, vomiting, diarrhoea, macular rash and cough (Burrow et al, 1998). Neurological features occur early and may include lethargy, irritability, confusion and Seizures almost invariably occur in children, and may also occur in adults (Burrow et al, 1998)[30] In the present study also fever, headache, seizures, altered sensorium and neck rigidity was the most common symptoms find in encephalitis cases which were common among children and adults also.

In the present study, temporal lobe involvement was present in 42.5% of patients; frontal lobe in 35%, parietal lobe in 17% and occipital lobe in 10%. The findings of this study is consistent with previous study of 18 patient by Salih et al (2009) which showed s unilateral or bilateral hypointensity in the temporal lobes in eight patient (44.4%),frontal lobe in six patient (35%,) parietal lobe in three patient (16.6,) and occipital lobes in two patient (11.1%).

In this study, thalamic involvement was present in 45% of cases and basal ganglia involvement was present in 35% of cases, midbrain involvement was present in 32.5%, Pons & medulla involvement was present in 27.5% and cerebellum involvement was present in 30% of cases. The result of this study is consistent with study by Kalita and Misra (2004) of 31 cases which showed lesion in the thalami in 41.9% cases, basal ganglia in 35.5% cases, midbrain in 29% cases, Pons in 25.8% cases, cerebellum and cerebral cortex in 19.4% cases each.

In the present study, out of the total 40 cases of encephalitis, 55 % (22) were JE (Thalami, basal ganglia and brain stem involvement was seen). JE was first recognized via a serological survey in the 1950s in India (Smithburn et al, 1954). The first JE outbreak was reported in West Bengal in 1973, followed by reports in southern, eastern, and western states (Chakravarty et al, 154). JE was first reported in Uttar Pradesh, the main JE epidemic area in the northern part of India in 1978 (Mathur et al, 1982) after that, a severe outbreak of JE occurred with 5,700 cases and 1,315 deaths in Uttar Pradesh state in 2005 (Kumar et al, 2006).

In the present study, out of the total 40 cases of encephalitis, 45 %(18) were HSV (temporal lobe, insular cortex, frontal lobe involvement was seen). Reuter et al. (2007) reported that MRI abnormalities were existent in 21 (87.5%) of 24 examined cases of HSVE-2 which were proven by PCR in adults. Elbers et al, (2007) conducted a study that included 16 of 322 patients with acute encephalitis that fulfilled the criteria for HSVE on MRI. Of the 16 patients, 12 (75%) had HSVE detected by the CSF. In 10 (83%) of the 12 patients,

the virus detected by PCR was HSVE-1, while the virus detected for 2 (17%) patients was HSVE-2. PCR is the gold standard for the diagnosis of encephalitis etiology.

V. Conclusions

Suggestive MRI findings are present in some etiologies of viral encephalitis such as Herpes simplex encephalitis, JE, enterovirus encephalitis MRI may show non-specific features of viral encephalitis such as cortical hyperintensities and cerebral edema. MRI is also useful for diagnosing alternative etiologies such as Acute disseminated encephalomyelitis, and antibodyassociated encephalopathies.

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Table-1: Age and sex distribution of the patients

	No. (n=40)	**%**
Age in years		
12-20	10	25.0
21-30	7	17.5
31-40	6	15.0
41-50	9	22.5
>50	8	20.0

Mean±SD (Range)	37.03±21.86 (12-76)	
Sex		
Male	22	55.0
Female	18	45.0

Table-3: Distribution of the patients according to clinical features (N=40)

Symptoms*	**Present**	
	No.	**%**
Fever	37	92.5
Headache	27	67.5
Seizures	35	87.5
Altered sensorium	34	85.0
Neck rigidity	28	70.0

*Multiple responses

Table-3: MRI findings in encephalitis (N=40)

Particular Sites of brain involvement	**Present**	
	No.	**%**
A. Cerebral hemisphere		
Frontal lobe	14	35.0
Temporal lobe	17	42.5
Parietal lobe	7	17.0
Occipital lobe	4	10.0
Basal ganglia	14	35.0
Thalamus	18	45.0
B. Brain stem		
Midbrain	13	32.5
Pons	11	27.5
Medulla	11	27.5
C. Cerebellum.	12	30.0

*Multiple responses

Table-4: Etiology of encephalitis cases (N=40)

Etiology of encephalitis	**No. (n=40)**	**%**
Herpes simplex virus encephalitis	18	45.0
Japanese Encephalitis	22	55.0