Original article

A Retrospective Study of Magnetic Resonance Imaging Findings in Acute Encephalitis Syndrome.

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Abstract

Introduction: MRI is the imaging modality of choice to investigate acute encephalitis and is recommended in all patients as soon as possible in whom diagnosis is uncertain. This study aimed to study the pattern of brain involvement in MRI in patients with acute encephalitis syndrome and to correlate the findings with clinical and laboratory data.

Methods: The study was a retrospective hospital record based review conducted at Tribhuvan University Teaching Hospital. MRI and records of patients undergoing MRI for acute encephalitis syndrome during two years duration was studied. Data analysis was done using IBM SPSS 20.0.

Results: A total of 47 MRI were studied among which 11(23.40%) were pediatric and 36(76.59%) were adult population. Edema was the commonest manifestation. Cerebral hemisphere (temporal lobe) was the commonest location involved 34(72.3%). Basal ganglia and thalamus involvement was also fairly common.

Five (26.31%) out of 19 patients had positive Japanese encephalitis, 5(26.31%) had HSV antigen positive serology and in 8(42.10%) no etiology could be found. Posterior fossa and basal ganglia involvement was the most predominant findings in Japanese encephalitis and involvement of medial temporal lobe was seen in all cases of Herpes encephalitis. Fifteen patients had good prognosis: complete recovery or minimal residual deficit, while four patients were either dead or left against medical advice.

Conclusion: Medial temporal lobe involvement was seen in all cases of Herpes encephalitis; and thalamus and basal ganglia involvement was predominant pattern in Japanese encephalitis. Posterior fossa involvement was common probably due to a non-conventional etiological agent.

Key Words: Acute Encephalitis Syndrome, MRI, Herpes encephalitis

Introduction

Acute encephalitis syndrome (AES) is a clinical syndrome constituting constellation of fever and altered sensorium of recent onset which is used to facilitate the surveillance of Japanese encephalitis.[1] Though acute encephalitis syndrome can be caused by a wide spectrum of causes including infection due to various pathogens and non infectious causes, most cases of AES are considered to be due to viral infection.[2] Cerebrospinal fluid (CSF) examination along with serological tests plays a key role in diagnosing and identifying etiology of encephalitis and excluding conditions like pyogenic meningitis and subarachnoid hemorrhge. Imaging plays a role in ruling out contraindication for lumbar puncture and in equivocal cases, helps to confirm diagnosis and rule out mimics of encephalitis like cerebrovascular accidents[3]. MRI is the imaging modality of choice to investigate acute encephalitis and is recommended to be performed in all patients as soon as possible in whom diagnosis is uncertain.[3, 4] However MRI is not always feasible due to patients low Glasgow Coma Scale (as sedation is to be avoided), and also particularly in our setup where MR availability also is a limiting factor, and CT scan is performed in most cases[3]. This study aimed to study the pattern of brain involvement

in MRI in patients with acute encephalitis syndrome and to correlate the findings with clinical and laboratory data.

Methods:

The study was a hospital record based retrospective study performed at Tribhuvan University Teaching Hospital. The sample of the study was all MRI Brain performed in the Department of Radiology and Imaging for Acute Encephalitis Syndrome from the January 2012 to December 2014. MRI findings suggestive of cerebrovascular events (ischemia or hemorrhagic stroke) were excluded from the study. MRI were retrospectively assessed for involvement of cerebral hemispheres deep grey matter including basal ganglia and thalamus, posterior fossa and involvement of limbic system including insular cortex. Also diffusion weighted images were assessed for presence of restriction. Clinical details were obtained from the request form for MRI and available case records were also traced and reviewed at the medical record department of Tribhuvan University Teaching Hospital for clinical details, laboratory findings including serology, CSF study and outcome at discharge. Data were entered in a predesigned proforma, entered in Microsoft Excel Spreadsheet and analysed in IBM SPSS Version 20.0 software.

Results:

A total of 47 MRI which met the inclusion criteria were included in the study. However hospital records of only 19 cases could be traced from the medical records department. The group consisted of both the pediatric (11; 23.40%) and adult population (36; 76.59%) with mean age of 33.00±18.61 years. The age ranged from 8 years to 82 years with median of 32 years (Interquartile range 32). Males and females constitute almost equal proportion with female to male ratio of 1:1.24. Fever (42; 89.4%) and altered sensorium (43; 91.5%) were two most common clinical presentations. Seizure was present in 10 (21.3%) patients while focal signs were rare and seen in only 4(8.3%) cases.

T2 and FLAIR high signal intensity with low T1 signal intensity suggesting edema was seen in 46(97.87%) cases. Hemorrhage was seen in only one patient with involvement of left medial temporal lobe with hemorrhage extending into lateral ventricle with associated hydrocephalus. The patient was at 22 weeks of pregnancy and presented with fever and altered sensorium. No features suggesting venous sinus thrombosis or vascular malformation was noted and clinical and radiological diagnosis of encephalitis was made and the patient was treated in line of encephalitis. However serological tests were negative for Herpes simplex virus (HSV) and Japanese encephalitis. (JE) Most of the MRI showed restriction in diffusion weighted imaging 44(93.6%). (Table 1)

Involvement of cerebral hemisphere was seen in 34 (72.3%). Temporal lobe involvement was seen in all cases with cerebral hemisphere involvement. (Figure 1) In 25(53.19%) cases, the involvement was bilateral. Insular cortex involvement was seen in 10(21.3%) cases. (Figure 2) Frontal lobe involvement was seen in 8(17%) and parietal lobe involvement was seen in 1(2.1%) patients. (Table 1)

Basal ganglia involvement was seen in 15(31.9%) patients, and thalamic involvement was seen in 18(38.3) patients. In 6 (12.77%) patients, basal ganglia involvement was seen in association with cerebral hemisphere involvement and involvement of thalamus in association with cerebral hemisphere involvement was seen in 10(21.28%) patients. Posterior fossa involvement was seen in 14(29.8%) patients. Brainstem was seen to be involved in 10(21.28%), cerebellum in 4(8.6%) and cerebral peduncles in 5(10.7%). (Table 1)

Table 1 MRI findings in Acute Encephalitis Syndrome .

MRI Features	Number (%) N=47
Cerebral hemisphere	34(72.3)
Temporal lobes alone	25(53.2)
Temporal and frontal lobes	8(17.0)
Temporal and parietal lobes	1(2.1)
Deep Grey	
Basal ganglia	15(31.9)
Thalamus	18(38.3)
Insular cortex	10(21.3)
Posterior fossa	14(29.8)
Brainstem	5(10.6)
Cerebral peduncles	2(4.3)
Cerebellum	2(4.3)
Brainstem and cerebral peduncles	3(6.4)
Brainstem and cerebullum	2(4.3)
MRI Character	
T1 low and T2 and FLAIR Hyperintensity	46(97.9)
Hemorrhage	1(2.1)
Restriction on DWI	44(93.6)

Among 19 patients whose hospital records were retrospectively assessed, 5 (26.31%) patients had positive Japanese encephalitis serology, 5(26.31%) had HSV antigen positive in CSF and one patient had cryptococcal antigen in CSF. In 8(42.10%) all efforts to identify causative organism was futile and patients were treated and discharged clinically as encephalitis. Among 5 patients with positive JE serology, 4 (80.0%) showed involvement of basal ganglia and 3(60.0%) showed involvement of thalamus. In 3 cases, there was associated involvement of brainstem as well. In one patient, there was involvement of only bilateral medial temporal lobes in typical location of herpes encephalitis without involvement of brainstem, basal ganglia or thalamus and in one patient temporal lobe was involved in association with involvement of basal ganglia. Involvement was unilateral in 4(80.0%) cases. Amongst patients with positive herpes simplex serology, MRI was characteristic with involvement of medial temporal lobes in all cases. Insular cortex was involved in 1(20.0%) patient, basal ganglia involvement was seen in 1(20.0%) and thalamic involvement was seen in 2(40.0%) patients. Involvement was asymmetric and bilateral in 2(40.0%) patients and unilateral in 3(60.0%) patients. Two patients were HIV positive; one of them had HSV antigen positive in CSF and one showed cryptococcal antigen in CSF and were managed accordingly. CSF analysis for counts showed mild pleocytosis ranging from 5 to 150 cells and the predominant cell type was mononuclear cells in all cases suggesting viral etiology. CSF protein was mildly elevated and CSF glucose was normal in all cases. The outcome of discharge was good for fifteen patients who were discharged with complete cure with no or very minimal nondisabling residual neurological deficits. Four of the nineteen patients were either dead or left the hospital against medical advice during the course of treatment. None of the MRI features or clinical features were significantly different between the poor outcome and good outcome group to be used as a prognostic sign.

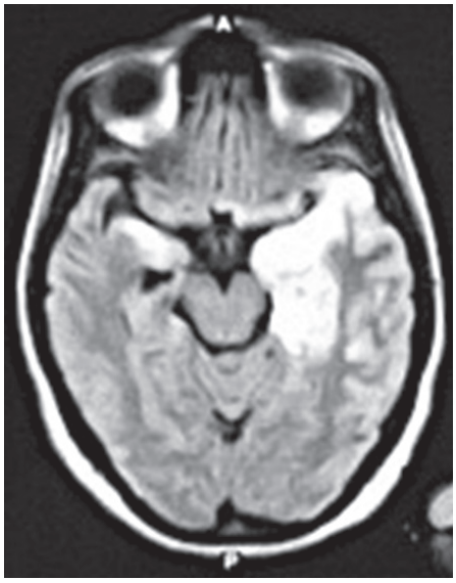

Figure 1 AXIAL FLAIR MRI demostrating assymetric high signal intensity in bilateral medial temporal lobe in a patient with acute encephalitis syndrome.

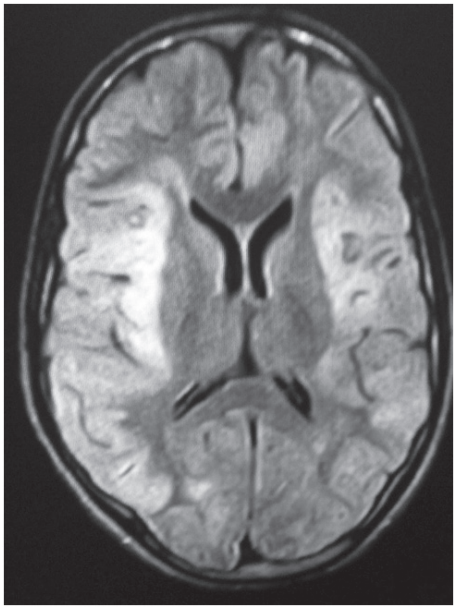

Figure 2. FLAIR image showing assymetric high signal intensity involving bilateral insular cortices in a patient with acute encephalitis syndrome.

Discussion:

Acute encephalitis syndrome, being infective condition, is common in extremes of ages and pediatric population than in adults.[5] Our study however demonstrated a higher proportion of adults undergoing MRI of brain for

evaluation of acute encephalitis syndrome than children. This discrepancy might be due to the difficulty in imaging children with MRI (and need for sedation) for which reason they frequently undergo CT scan instead. Though the age ranged from pediatric to geriatric group, the population constituted mainly young adults that is of the productive age group.

Edema of the cingulate gyrus and medial temporal lobe is the earliest MRI finding, which later may show hemorrhagic conversion.[3] This pattern of involvement of limbic system is common in Herpes simplex encephalitis.[6] Restriction in diffusion is a more sensitive sign than conventional T1 and T2 sequences and can detect lesions earlier.[3] However some of the studies has also indicated T2W imaging to be more sensitive in some case of encephalitis rather than diffusion weighted sequences.[7] The commonest finding in our study was also edema of medial temporal lobe with involvement of the frontal and parietal lobes also. The findings were bilateral in almost half of the cases. The findings are consistent with Herpes simplex encephalitis which is also the commonest cause of sporadic viral encephalitis[7]. Thalamic involvement and basal ganglia involvement were also relatively common in our study which is common in Japanese encephalitis, which is endemic in our part of the world[6].

Serological reports of the available cases showed one fourth of cases with positive serology for HSV and JE respectively with almost half of cases showing negative serology for JE and HSV demonstrating a changing pattern of viral infection of the central nervous system. A systemic review also showed change in etiological agent to enterovirus or non Japanese encephalitis viruses[8]. The changing pattern may be due to JE immunization and mosquito control measures. However the fact that JE still represents one fourth cases still indicates need for continuous public health concern for JE.

Our study shows posterior fossa involvement in about one fourth of cases with brainstem involvement being the commonest. Posterior fossa encephalitis is common with etiological agents like listeria, tuberculosis, or certain viruses like enteroviruses and also with JE[3]. This could probably represent changing etiological agent[8]. Posterior fossa lesions are also more common with acute disseminated encephalomyelitis, a parainfectious autoimmune demyelination of central nervous system. However such lesions are small round to oval, discrete, multiple and scattered differentiating them from encephalitis, also the clinical history helps differentiation of these two entities[9].

Treatment of viral encephalitis is nonspecific except for Herpes encephalitis and consists of supportive care. Thus identification of etiological agent is of parmount importance for administration of acyclovir to HSV encephalitis patients which is only certain with CSF polymerase chain reaction or other antigen detecting serological tests. MRI has been shown to have a highly specific pattern for HSV encephalitis but cannot confirmatively be used for differentiating HSV from non HSV encephalitis.[3, 4, 10] In our study, involvement of medial temporal lobe was seen in all patients with HSV encephalitis, and basal ganglia and thalamus involvement was more common in JE, However the sample size was too small to detect any significant difference.

Outcome of acute encephalitis is grave with hemorrhagic conversion and mortality reaching up to 50% with specific antiviral treatment in HSV encephalitis; without specific treatment the mortality was as high as 75%. Outcome was good in our study with poor outcome in 4(21.05%) cases. However neither MRI nor clinicolaboratory studies could be used as a predictor for poor outcome. Previous studies also have failed to show any role of MRI in prediction of long term or short term outcomes[10].

Our study had many limitations. The study was a retrospective study and traced patients record from MRI reports which may not be representative of all AES cases treated in the hospital. Secondly not all patients' hospital record could be traced and thus resulting in a small sample with in complete clinical picture. Long term follow up for neurological sequel was not done.

Conclusion

The MRI findings in encephalitis constituted of edema in majority of patients with restricted diffusion. Medial temporal lobe involvement was predominant pattern in Herpes encephalitis, thalamus and basal ganglia involvement was more common in Japanese encephalitis. Posterior fossa involvement was also common in our study probably representing a non conventional etiological agent. A study with a large sample size and detailed serological analysis also including other uncommon agents like enterovirus could help to assess this pattern of brain involvement.

Conflict of interests: None declared.

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