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MRI EVALUATION OF SEIZURES IN AN ADULT AGE GROUP

Radiodiagnosis

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ABSTRACT

Introduction: Seizures are one of the most troublesome of adult pathologies. Seizure is a paroxysmal alteration in neurologic function resulting from abnormal excessive neuronal electrical activity. The incidence of epilepsy is approximately 0.3 to 0.5% and prevalence of epilepsy estimated as 5 to 10 persons per 1000.

Aims: To the study the role of MRI in evaluating spectrum of Seizures in an adult age group.

Material and methods: MRI brain (Plain) & MRI brain (Plain + Contrast, if required) was done in 100 patients with clinical history of seizures. MRI is the investigation of choice for detection of organic cause of seizures. It has higher sensitivity and specificity detection rate as compared to CT or X-ray.

Results: MRI is useful in determining different spectrum of findings of Seizures.

KEYWORDS

MRI, seizures, convulsions, epilepsy.

INTRODUCTION

Epilepsy is a chronic condition characterized by recurrent seizures unprovoked by an acute systemic or neurologic insult. The incidence of epilepsy is approximately 0.3 to 0.5% and prevalence of epilepsy estimated as 5 to 10 persons per 1000. It is age dependent and higher in children and elderly persons than in young adults[1].

Cerebral infarct 20%, NCC 7.27%, atrophy 5.45%, cortical malformation 3.64%, tuberculoma 3.64%, venous thrombosis 3.64% constitute the main etiological factors other being neoplasm, tuberous sclerosis, SWS and abscess[1].

The high diagnostic yield of MRI to identify the common pathological findings in individuals with focal seizures including mesial temporal sclerosis, vascular anomalies, low-grade glial neoplasms and malformations of cortical development has been demonstrated [2].

All patients with epilepsy should undergo an MRI, except those with very typical forms of primary generalized epilepsy (e.g., juvenilemyoclonic epilepsy, childhoodabsence) or benign focal epilepsies of childhood with characteristic clinical and EEG features (e.g., benign epilepsy with centrotemporal spikes, early-onset childhood epilepsy with occipital spikes (Panayiotopoulos type)) and adequate response to antiepileptic drugs (AEDs)[2].

AIMS AND OBJECTIVES

- To emphasize on the role of MRI in detection and characterization of Seizures.
- To provide pictoral review of the different neuroimaging abnormalities of convulsions using MRI.

LITERATURE REVIEW

The superiority of Magnetic Resonance Imaging (MRI) over X-ray, Computed Tomography (CT) scanning in terms of sensitivity and specificity for identifying the aetiology of epilepsy in both adults and children is firmly established. The most common abnormalities identified are Hippocampal Sclerosis (HS), Malformations of Cortical Development (MCD), vascular malformations, tumours and acquired cortical damage[3].

The principal clinical applications of MRI are to identify the structural basis of epilepsy and patients, who are suitable for surgical treatment. Rapid advances are being made in MRI techniques, so that patients who were previously regarded as being MRI negative may have relevant abnormalities, which can be identified with contemporary optimal imaging. MR imaging has emerged as the more diagnostically relevant and most valuable tool for preoperative localization of epileptogenic focus because of its excellent soft tissue contrast, allowing for detailed depiction of anatomy, freedom from beam–hardening artifact in basal brain that occur with CT and capacity for multiplanar imaging[3].

MATERIAL AND METHODS

This is a cross sectional prospective case series study involving 100 adult patients with signs and symptoms epilepsy.

MRI performed using 1.5 T Siemen's Magnetom Essenza Scanner. MR imaging protocol used was sagittal T1 weighted images, axial T1 & T2 weighted images and coronal, axial FLAIR sequence. Axial diffusion weighted, ADC and GRE images were also used. Gadolinium Paramagnetic contrast used if a known tumor or vascular malformation (0.1 mg/kg wt). MR spectroscopy to rule out the nature of the found tumor.

Gadolinium paramagnetic contrast agent used in MRI. Contrast agent was used if a known tumour or vascular malformation.

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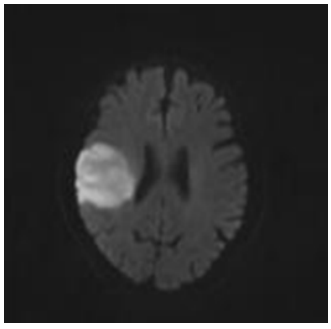
MRI positivity

The MR examination revealed pathological findings in 45 out of 100 patients (45%) which includes, cerebral infarct with gliosis (20%), NCC (5%), cerebral atrophy (5%), gliomas (2%), tuberculoma (3%),

venous thrombosis (3%), cavernoma (2%), tuberous sclerosis (1%), cerebral abscess (2%), and SWS (1%) meningioma (1%).

Cerebral infarcts with gliosis

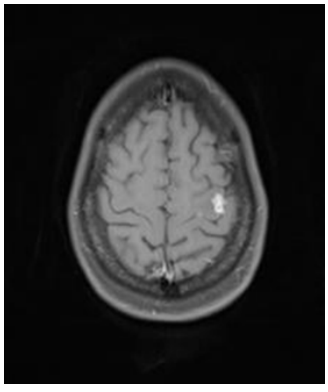
Twenty patients (20%) revealed cerebral infarction on MRI study. Four patients revealed acute infarct in parieto-occipital lobes characterized by diffusion restriction with mild swelling and effacement of adjacent sulci. One patient showed features of subacute hematoma in parietal lobe showing hyper intensity on T1, T2 and FLAIR sequences. The lesion shows hypointense thin rim on T2WI, FLAIR images. Perilesional edema was seen. Chronic ischemic changes with gliosis in left fronto-parietal lobe noted in 6 patients and one patient showed cystic encephalomalacia changes in right parieto-occipital lobe. Ten patients showed tiny chronic ischemic lesions in deep white matter with bilateral periventricular hyperintense lesions on T2 and FLAIR with no restriction on diffusion sequences. Danier C, et al. [4], conducted prospective cohort study of early onset of seizures in 661 stroke patients and concluded that infarcts involving cerebral cortex, there was a high risk of early stroke in watershed infarcts (23%) than territorial strokes (5.3%).



In a 65 yr old female with acute and old infarct s presented with weakness in the left side with seizures,

Neurocysticercosis

Five patients showed evidence of neurocysticercosis (NCC). All patients had parenchymal form of NCC, with multiple ring enhancing lesions in cerebral hemispheres. Lesions showed T1 hypointense and T2 hyper intense contents. Few lesions showed perilesional edema. Most of lesions were seen in parietal lobe and some showed cystic signals with eccentric speck within the lesion. MRS showed tall choline peak in all patients. Four patients had few ring enhancing lesions with perilesional edema and four patients had multiple intra parenchymal lesions of different stages. TR Velasco, et al. [5], evaluated 512 patients of intractable epilepsy and concluded that isolated NCC was found in eight patients (1.56%). Tushar B. Patil, Madhuri M. Paithankar, et al. [6] studied 40 patients with probable diagnosis of NCC and concluded that 72% patients showed one lesion, 27% with multiple lesions and common site was parietal lobe (4%).



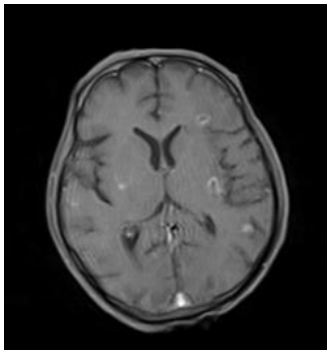
In a 27 yr old female - Multiple well defined T1 hypointense and T2/FLAIR iso to hypointense lesions with tiny calcifications within and mild perilesional edema, were noted in the left fronto-parietal region and in left occipital region. Few of the lesions are conglomerated. No diffusion restriction seen. These lesions shows nodular and ring enhancement – proven to be Neurocysticercosis.

Cerebral atrophy

Five patients showed features of Cerebral atrophy. Four patients revealed atrophic changes mainly involving bilateral frontal and temporal lobes with periventricular leukomalacia changes. One patient revealed chronic right frontal infarct with gliosis and diffuse cerebral atrophy and one patient showed cortical, subcortical atrophic changes in bilateral parietal lobes. Rabecca SN Liu, et al. [7], studied 7 patients with epilepsy underwent MRI scan and revealed that significant atrophy of hippocampus, neocortex in 17% and concluded that the brain volume reduction in epilepsy is the cumulative effect of an initial precipitating injury and age related cerebral atrophy. Significant atrophy developed in individual patients particularly those with temporal lobe epilepsy. Ghayyur Khan, et al. [8], studied 100 patients with MRI associated symptoms of seizures, dementia and diabetes and found cerebral atrophy in 47% male and 43% female, concluded that cerebral atrophy is a complication of long standing diabetes well recognized by MRI.

Tuberculoma

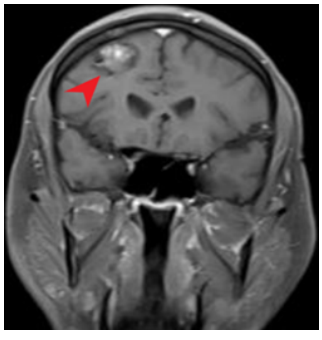
Three patients were diagnosed as having tuberculoma on MRI scan. The lesions were well defined, rim enhancing, conglomerate with thick wall of different size. The lesions showed perilesional edema and on MRS revealed elevated lactate, lipid peak. Diagnosis of tuberculoma was based on MR appearances along with one or more following supportive evidences – History of taking ATT in past, any history of contact, and any e/o tuberculosis in Xray chest. Three patients followed after treatment and significant resolution of the lesions found and one case not reported for follow-up imaging. Naser UAMA, Abdul Ghaffur MRCP, et al. [9], studied 925 intracranial space occupying lesions with seizures and found 1.4% intracranial tuberculoma and followed after treatment, 66.6% responded well to medical treatment and 33% failed to respond. Remarkable improvement of intracranial lesions within 6 weeks and complete resolution of the lesions within 12 weeks was found.



In a 49 yr old male, multiple peripherally enhancing round to oval lesions of varying sizes are noted in bilateral cerebral parenchyma, basal ganglia and cerebellar parenchyma, These lesions are iso/hypointense/hyperintense on T1 and hyperintense/hypointense on T2/FLAIR with surrounding mild perilesional edema, showing varying diffusion restriction – proven to be a tuberculoma.

Cavernoma.

2 patients revealed well defined focal non enhancing lesion showing hemorrhagic signal intensities in the sub cortical white matter of left frontal lobe in one patient and parietal lobe in another patient with complete hypointense rim on gradient echo sequence. Hakan Kayali, et al. [10], studied 37 patients with cavernoma on MR imaging 30 male and 7 female patients concluded that 57% of the patients showed supratentorial location of the lesions.



In a 19 yr old male with presenting complaints of GTCS, A fairly well defined T1 and T2/FLAIR hyperintense lesion with surrounding T2

hypointense rim noted in right frontal cortical -subcortical region showing prominent blooming on the GRE ("Popcorn" appearance).

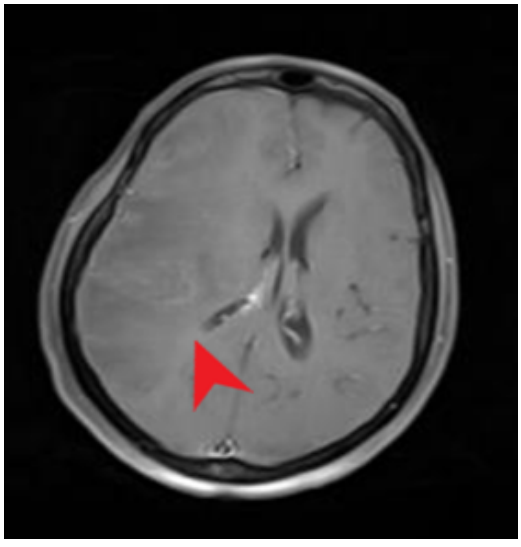
The lesion showed no obvious significant post contrast enhancement.-- of cerebral cavernous malformation (cavernoma) - Type II.

Tuberous sclerosis

One patient with clinical diagnosis of tuberous sclerosis undergone MR neuroimaging and revealed multiple ill defined areas of altered signal intensity affecting the cortex and sub cortical white matter of both cerebral hemispheres suggestive of cortical and subcortical tubers respectively. One patient in addition showed left frontal lobe subependymal nodules and bilateral frontal, right temporal, bilateral occipital and left parietal multifocal small white matter linear and patchy hyperintense lesions on T1WI. No mass effect or perilesional edema was present. Bilateral parietal periventricular cystic changes were noted. Barkovich, et al. [11] studied 7 patients with clinical history of tuberous sclerosis with MRI and revealed that parenchymal nodular and subependymal linear lesions hyperintense on T1 and hypointense T2 WI. Concluded that clinically suspected tuberous sclerosis in infancy the MRI should not be delayed and recognition of specific imaging characteristics of tuberous sclerosis in early infancy with MRI help in diagnosis as early possible. Thus ensuring appropriate clinical management of patients and counseling of parents.

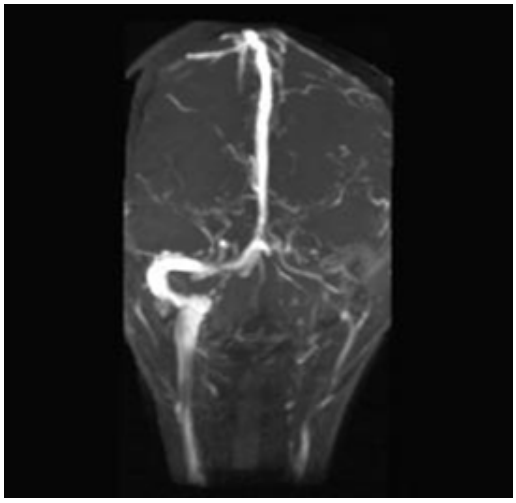
Glioma

Two patients revealed low grade glioma on MRI. One patient showed lesion in right frontal region and other patient in left frontal lobe. The MR features The lesions hypointense on T1WI and hyperintense on both T2WI and FLAIR sequences. Mild perilesional restriction with mild mass effect was seen. MRS showed elevated choline peak in both cases and the lesions showed no contrast enhancement. The above features suggestive of low grade glioma



In a 34 yr old Female with complaints of GTCS, a diffuse T1 hypointense and T2/FLAIR hyperintense signal lesion seen in white matter region of right fronto-temporo-parietal lobes, involving right external capsule and posterior limb of right internal capsule. On post contrast study no obvious enhancement was seen in the lesion. MR Spectroscopy revealed-- low NAA peak and mildly elevated choline peak and elevated choline : creatinine ratio-- Diffuse low grade glioma.
Venous sinus thrombosis

Three patients showed MRI features of cerebral venous sinus thrombosis in our study. Two patients showed superior sagittal sinus thrombosis and one revealed left transverse sinus thrombosis and other patient showed thrombosis in transverse and sigmoid sinuses Out of four cases, two patients showed hemorrhagic infarct with thrombus and one patient showed extension of thrombus into superficial cortical vein with focal gyral edema. In our study two patients presented with the history of puerperium and one patient with history of oral contraceptive use. Rishi K. Gupta, et al. [12], reported a case of superior sagittal sinus (SSS) thrombosis with long history of continous headache and MRV confirmed the presence of SSS thrombosis with small venous infarct where CT was normal.



In a 23 yr old female in puerperium, Absent flow voids noted in left transverse and left sigmoid sinuses ---- s/o cerebral venous sinus thrombosis.

Meningioma

One patient revealed the features of meningioma in frontal convexity. Well defined extra axial, enhancing SOL noted in left anterior frontal convexity, measuring 5x4 cm. It was dural based lesion with dural tail at its margin revealed subtle cortical hyperosteosis of the roof of the left orbit and Perilesional edema extending into adjacent white matter compressing the lateral ventricle. The lesion was compressing the underlying cerebral parenchyma and causing midline shift. In our study, the neuroimaging showed features of meningioma with mass effect.

Sturge-weber syndrome

One patient revealed MR features of Sturgeweber syndrome showing focal cortical atrophy in right frontoparietal and occipital lobe with predominant involvement of occipital lobe. Intense pial enhancement noted in these regions. Morphological features suggestive of angiomatous malformations in the above mentioned regions.

Cerebral abscess

Two patients showed evidence of space occupying lesion in right posterior high parietal lobe with perilesional edema with low signal intensity on T2WI with peripheral hyper intensity on T1WI. The lesion showed rim enhancement on contrast. Restriction noted on diffusion weighted images and MRS shows high lactate, lipid peak. IJ Cranen, et al. [13], reviewed from 2000 adult patients on MRI with localization related epilepsy in 2005 to 2011 using a standard epilepsy protocol. The study revealed 61% normal, 36% abnormal and 2% non diagnostic. In abnormal patients 53% MTS, 18.3% cortical malformations, 10.9% gliosis and infarcts, 7.1% vascular malformations and 5.1% tumors

DISCUSSION:

I) Incidence of seizures:

In our study of 100 patients of seizure disorder.
No organic cause was most common (55%) in biliary tract this is followed by cerebral infarct with gliosis (20%), NCC (5%), cerebral atrophy (5%), gliomas (2%), tuberculoma (3%), venous thrombosis (3%), cavernoma (2%), tuberous sclerosis (1%), cerebral abscess (2%), and SWS (1%) meningioma (1%).

II) Gender distribution:

In our study of seizure disorder incidence was more in males (n=4) as compared to females (n=3) in by ratio of 1.1:1.

SUMMARY AND CONCLUSION

In our study, no organic cause was found to be more common than any other cause of seizures.

In organic causes cerebral infarct with gliosis was the most common cause of seizures.

Seizures are more common in males as compared to females with a ratio of 1.1:1.

MR Spectroscopy gives added advantage in MRI for accurate detection of organic causes of seizures specially for identifying its morphology.

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