

## ORIGINAL ARTICLE

## PAEDIATRICS BRAIN IMAGING IN EPILEPSY: COMMON PRESENTING SYMPTOMS AND SPECTRUM OF ABNORMALITIES DETECTED ON MRI

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**Background:** Epilepsy, a common neurological disorder can present at any age and has a number of aetiologies with underlying brain disease being the most common aetiology. Brain imaging becomes important and mandatory in the work up for epilepsy in localization and lateralization of the seizure focus. **Methods:** This cross-sectional study was conducted in the department of Radiology Ayub Medical Teaching Institution Abbottabad from 1<sup>st</sup> March 2015 to 31<sup>st</sup> March 2016. A total of 209 children aged 28 days to 14 years were included in the study who presented with seizures to clinicians. Information obtained from history, clinical examination and investigations especially MRI brains were recorded in a prescribed *pro forma*. The data was analysed in SPSS 20. **Results:** MRI examination was unremarkable in 44.01% (n=92) and mild generalized brain atrophy was noted in 12.91% (n=27). Arachnoid cysts, mild unilateral brain atrophy and hydrocephalous due to aqueduct stenosis were recorded in 3.82% (n=8) of each group. Neoplastic lesions were the second most common abnormal MRI finding and constituted 5.74% (n=12). Leukodystrophy was diagnosed in 4.78% (n=10). MRI examination showed ring enhancing lesions (tuberculomas) and AVM in 1.43% (n=3) of each group. Perinatal ischemia and intracranial infection, (focal or generalized) were recorded in 2.87% (n=6) of each group. A 0.95 % (n=2) of children in each group had agenesis of corpus callosum and cavernoma. The radiological MRI diagnosis of Rausmussen encephalitis was made in 3.34% (n=7). Single case, each of mesial temporal sclerosis, subdural haemorrhage, infarct and craniopharyngioma was recorded making 0.47 % of the total patients in each case. **Conclusion:** MRI examination was abnormal in significant number of patients (55.86%), so therefore if properly utilized, in a good clinical context, this can identify most of the structural brain abnormalities in paediatric patients presenting with seizures.

**Keywords:** Brain imaging; MRI; Epilepsy; Paediatrics; Abnormalities; Radiology

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### INTRODUCTION

Epilepsy is a chronic neurological disease characterized by unprovoked seizures. This disorder is associated with abnormal electrical activity in the brain. The overall prevalence of epilepsy in Pakistan is 9.99 per 1000 population.<sup>1</sup> Highest prevalence is seen in people younger than 30 years of age. Higher prevalence is observed in rural population. Aetiology of epilepsy is more commonly identified in paediatric population.<sup>1</sup>

The mean prevalence of active epilepsy worldwide is approximately 8% of the general population.<sup>2</sup> Epilepsy has psychological and social effects on the child himself/herself and his/her family. Epilepsy produce high levels of psychosocial difficulties for all family members including stigmatization, stress psychiatric morbidity, marital problem, poor self esteem and restriction of social activities.

There are different classification systems for epilepsy commonly based on anatomy or aetiology. Anatomically epilepsy can be classified into temporal

lobe epilepsy (mesial and neocortical) and extra-temporal epilepsy.<sup>3</sup>

Depending on response to antiepileptic drugs, epilepsy may be sometime refractory to medical treatment especially in children. Refractory epilepsy usually has underlying structural abnormalities in the brain. The underlying brain abnormalities are usually subtle and pose a challenge to the diagnostic radiologist and imaging modalities.

Neuroimaging becomes important and mandatory in the work up for epilepsy in localization and lateralization of seizure focus. Recent advances, in particular ‘high quality’ magnetic resonance imaging (MR), have increased our understanding of the underlying disease process as well as revolutionized evaluation and management of epilepsy.<sup>4</sup>

The imaging evaluation in paediatric epilepsy is mandatory for determining the possible etiological cause. This is important for curative neurosurgery and counselling of the patient.

The first imaging modality of choice is MRI with special protocols, sequences and gadolinium

enhanced images. Our study aimed to find out different structural abnormalities of brain on MRI in paediatric population presenting with seizures. In the light of these results further studies can be done and paediatric brain MRI imaging protocols can be designed for local community.

### MATERIAL AND METHODS

This cross-sectional study was conducted at the Department of Radiology, Ayub Medical Teaching Institution Abbottabad from 1<sup>st</sup> March 2015 to 31<sup>st</sup> March 2016. During this period, 209 patients with a history of seizures were examined by MRI for evaluation of cause of their CNS related symptoms, specially seizures. The patients who were too young or irritable were sedated in MRI room by a qualified anaesthetist to carry out MRI examination smoothly and optimally.

The MRI examination was performed on 1.5 Tesla Toshiba Titan Vantage. The standard protocol used included T1, T2, FLAIR, Diffusion weighted images. MRI contrast gadolinium was administered when required as decided by radiologist. The MRI studies were viewed by consultant radiologists of our department. The reports and findings were recorded. The prescribed proforma was filled. The data was analysed by SPSS-20. The results were described and compared.

### RESULTS

Among the total 209 children, 44.01% (n=92) patients demonstrated unremarkable normal MRI study of brain. Mild generalized brain atrophy was demonstrated in 12.91% (n=27). The second most common abnormality noted was primary neoplastic lesions (tumour) which constituted 5.74% (n=12). Leucodystrophy was diagnosed in 10 patients constituting 4.78% of the study sample. Arachnoid cysts and mild unilateral brain atrophy was found in 3.82% (n=8). Ring enhancing lesions (tuberculomas, abscesses), AVM and cerebellar atrophy constituted 1.43% each (n=3).

Changes of perinatal ischemia were recorded in 2.87% (n=6). Post traumatic changes/gliosis and cavernoma were MRI findings in 0.95% each (n=2). Among the 209 children, 6 children showed intracranial infections constituting 2.87%. Our study showed agenesis of corpus callosum in 0.95% (n=2). Mesial temporal sclerosis, SDH, infarct and craniopharyngioma each abnormality was recorded in single patient out of 209, constituting 0.47% each group. Rasmussen encephalitis was diagnosed in patients constituting 3.34%. Eight patients showed hydrocephalous with aqueduct stenosis constituting 3.82 %. Non-specific

increased signal in white matter on T2WI was noted in 6 patients (2.87%).

**Table-1: Abnormal Brain MRI findings in different percentages**

MRI Findings	Number of patients out of total	Percentage
Unremarkable	92	44.01
Mild generalized brain atrophy	27	12.91
Arachnoid cyst	08	03.82
Tumour	12	05.74
Leucodystrophy	10	04.78
Mild unilateral atrophy	08	03.82
Ring enhancing lesions	03	01.43
Perinatal ischemia	06	2.87
Post traumatic changes/gliosis	02	0.95
Infection	06	2.87
Agenesis of corpus callosum	02	0.95
Mesial temporal sclerosis	01	0.47
Rasmussen encephalitis	07	3.34
Subdural hematoma	01	0.47
Infarct	01	0.47
Craniopharyngioma	01	0.47
Cavernoma	02	0.95
AVM	03	1.43
Hydrocephalous, aqueduct stenosis	08	3.82
Cerebellar atrophy	03	1.43
Increased signal in white matter on T2	06	2.87

### DISCUSSION

Epilepsy is one of the commonest serious chronic neurological disorders with notorious physical and social disabilities.

To the best of our knowledge, large studies about incidence of paediatric epilepsy in Pakistan are not available. A study was conducted by Muhammad Akbar Malik and colleagues in Gujranwala district of Punjab and prevalence of childhood epilepsy was found to be 7.0/1000 population with similar distribution in urban and rural residents.<sup>5</sup> This was a small study and data representing one district of Punjab, cannot be representative of whole Pakistani population.

There is paucity of literature regarding objective oriented studies relevant to epilepsy. There is a need of detail studies especially regarding neuro-imaging findings. When provided to clinicians, these neuro-imaging studies can help them in developing management/therapeutic strategies for childhood epilepsy.

In our study 55.86% patients showed abnormal MRI findings. This is in accordance with the findings of previous study of Resta *et al* who reported positive MRI findings in 51.3%.<sup>5</sup> The study done by Amirsalari *et al* reported abnormal MRI findings (28.5%) in epileptic children and these findings include brain atrophy, benign cysts, vascular abnormalities, brain tumours, increased high signal in

white matter in T2 weighted images.<sup>5</sup> All these findings were also recorded in our study with almost the same frequency.

In our study, mild generalized brain atrophy was the commonest finding constituting 12.91% which is almost near to the findings of study done by Amirsalari *et al* in which they found brain atrophy in 10%. The second commonest finding was brain tumour. Twelve out of 209 patients showed primary brain tumour. This constitutes 5.74% of the study population. Similar results (4%) have been reported in literature.<sup>6</sup> Significant proportion of our patients had abnormal MRI findings relating to developmental brain abnormalities, like leucodystrophy (4.78%), arachnoid cyst 3.82%, agenesis of corpus callosum (n=2, 0.95%), AVM (1.43%). These findings are in accordance with the study conducted by Rachna Chaurasia and colleagues that showed leucodystrophy and cyst (porencephalic) in 3.7%, each.<sup>7</sup> They also reported infection, gliosis, tuberculoma, meningitis and encephalitis in different proportions. We also found these abnormalities in our patients but the proportion was different. (Table-1)

Hsieh DT and colleagues showed that the most common cause for epilepsy, were cerebral dysgenesis in developed countries.<sup>8</sup> This was followed by hypoxic-ischemic lesions, non-accidental injuries, infections, metabolic diseases and tumours as concluded in a study conducted by Guissard G and colleagues.<sup>9</sup> In our study the 3<sup>rd</sup> most common abnormal MRI finding was primary brain tumour, majority of them were in posterior fossa. This was in accordance with the study of Guissard G and colleagues.<sup>9</sup>

In our study the most common finding was mild brain atrophy (12.91%), which was found in patients with clinical history of perinatal hypoxia or difficult birth history.

Being much more sensitive than computed tomography (CT), MRI is the technique of choice to identify underlying cause in partial seizures (3 in Ravi Kumar).<sup>9</sup> Even when enhanced MRI has been compared with contrast enhanced CT; the superiority of MRI is seen especially in temporal lobe origin, since lesions in inferior temporal lobes may be in apparent on CT scan because of beam hardening artifacts.<sup>10</sup>

There are studies showing that the presence of an abnormality in the brain on MRI is resulting in continuing seizures at follow up. In a temporal lobe epilepsy report, an MRI abnormality of brain was the only independent predictor of seizure outcome.<sup>11</sup> Similarly in a report on partial seizures, the outcome was predicted by initial MRI findings.<sup>12</sup>

Betting and colleagues reported abnormal MRI findings in 24% of patients who presented with idiopathic generalized seizures.<sup>13</sup>

Gelisse and colleagues noted abnormal CT or MRI findings in 14.8% of children with benign epilepsy with centrotemporal spikes.<sup>14</sup>

Labate and co-workers found abnormal MRI findings in 38.6% of patients with benign temporal epilepsy.<sup>15</sup>

Our study was conducted to determine the frequency of MRI abnormalities in any child who presented with fits to the clinician and was referred to Ayub Medical Teaching Institution for MRI scan.

This study and analysis of findings is useful in many ways. Significant number of epileptic children showed abnormal MRI findings. These abnormal findings are highly related to the management strategies, counselling of the child attendants and prognosis.

Our study showed unremarkable MRI examination in 44.01 % which is not found in any other currently available international studies. This is may be due to inadequate pre MRI assessment/selection of patient and patients with pseudo-seizures are referred for MRI study. This causes undue extra burden on the limited resources. The patient is subjected to unnecessary MRI examination and if child is irritable, uncooperative, even unnecessary anaesthesia is given.

## CONCLUSION

In this modern era of practice of medicine and surgery, identification and localization of epileptogenic focus is essential for better curative treatment of epilepsy. Multimodality neuroimaging especially MRI plays an essential role in non-invasively localizing the epileptogenic foci.

MRI examination was abnormal in significant number of patients (55.86%), so therefore if properly utilized, in a good clinical context, this can identify most of the structural brain abnormalities in paediatric patients presenting with seizures. Management strategies can be outlined in the light of these abnormalities.

## AUTHORS' CONTRIBUTION

AA: Supervision, data analysis. FA: Data Collection and literature review. GK: Discussion, data arrangement. SH: Data collection and compilation.

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