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ORIGINAL ARTICLE

To Study the Electroencephalogram Changes in Children with Acute Encephalitis

NASREEN ALI, HINA HUSSAIN
Children's Hospital PIMS, Islamabad
Correspondence to Dr. Nasreen Ali, Email: dr.nasreen.ali.2011@gmail.com, Tel. 03442737797

ABSTRACT

Aim: To study the electroencephalogram changes in children with acute encephalitis.
Study design: Cross-sectional study.
Place and duration of study: The cases were admitted from OPD and emergency over duration of 10 months from May2009 to March 2010 in Children Hospital PIMS, Islamabad.
Method: Patients with Cerebral Palsy, Degenerative Brain disease, Cerebral Malaria and Meningitis were excluded. Written informed consent was taken from parents /guardians. All patients, from both genders, age varying from 4 months to 12 years, fitting the criteria of Acute Encephalitis according to ICD 9 & 10 were included in the study, which were 56 in total. All cases had Lumbar puncture and Cerebro Spinal Fluid examination. The findings of pleocytosis (WBC count more than5 u/l), protein and sugar were recorded. EEG (Electroencecephlogram) was done in 52 patients, frequencies and percentages were calculated of the findings.
Results: The mean age was 4. 6 years, (varying from 4 months to 12 years) with a standard deviation of 3. 2. From a total of fifty six patients, 38(68%) were males and 18(32%) females. All cases presented with fever (100%). Cerebro Spinal Fluid examination, showed Pleocytosis in 30(54%) while 46(46%) had normal cell count. Cerebro Spinal Fluid protein content was normal in 45(80%) and increased in 11(20%). Cerebro Spinal Fluid sugar was normal in 50(89%) and 6(11%) had low. Electroencephalogram was done in fifty-two patients out of which 30(58%) were normal, 22(42%) were abnormal. Intermittent slowing was found in 17(77%) and 5(23%) cases had focal discharges along with intermittent slowing, out of which three were unilateral temporo-frontal discharges, two cases had other focal discharges on EEG.
Conclusion: In patients with Acute Encephalitis, slowing of the rhythm was the most frequent abnormal Electroencephalogram finding, followed by focal discharges in children admitted in Children's Hospital PIMS, Islamabad.
Keywords: Acute Encephalitis, Electroencephalogram (electro encephalogram), Cerebro Spinal Fluid Pleocytosis, Fever

INTRODUCTION

Encephalitis, inflammation of brain parenchyma, is a neurological emergency which can cause severe disability and death if not diagnosed promptly[1,2,3].

It has nonspecific presentation which includes fever, changes in sensorium with or without focal neurological deficit and/or seizures[3,4,5]. These symptoms may be due to a variety of other infective or non-infective causes[6,7,8]. Acute encephalitis is most commonly caused by a viral infection especially Herpes Simplex virus type 1, which is the most common causative organism and fortunately treatable. It has an incidence of one case per million per year in US[1,4,9].

An infectious encephalitis may be difficult to distinguish and diagnose. The early treatment of the central nervous system diseases are decisive for the prognosis of the patient therefore the clinician should have a high index of suspicion. The most frequent symptom reported is Fever[1,2,5]. The diagnosis hinges crucially on cerebro Spinal Fluid examination, Cerebro Spinal Fluid Pleocytosis has been reported to be a common finding. In the early course of the disease (2-4 days) despite the onset of neurological symptoms cerebral imaging is mostly unremarkable and Cerebro Spinal Fluid PCR for viral DNA also takes time and waiting for results delays treatment.[3,5] Electroencephalogram (EEG), is a noninvasive and economical tool which helps in diagnosing and assessing the severity of neurological diseases. Serial Electroencephalograms done during the disease process, help in evaluating the prognosis of the patient and anticipating future complication and counseling of the family[2,3,5].

A delayed, incorrect or insufficient treatment would result in mortality and irreversible sequlae. Suspected cases should be started on Aciclovir, which has revolutionized the treatment of viral encephalitis is, lowering mortality from 70% to between 6-19%[5,10,11]. Neuromonitoring through EEG helps a lot in predicting the course of the disease. This study was done to determine Electroencephalogram findings in children diagnosed as acute encephalitis, however we were unable to perform serial EEGs due to lack of in hospital facility.

The objective of this research was to study the Electroencephalogram changes in children with Acute Encephalitis.

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PATIENTS AND METHODS

This cross sectional descriptive study was conducted over a period of 10 months from May 2009 to March 2010, after permission from IRB in Children Hospital PIMS, Islamabad. Cases were admitted through OPD and emergency department. A total of 56 patients were included in the study, diagnosed with Acute Encephalitis as per ICD 9-10. Cases were selected using non-probability purposive sampling, from both genders with ages varying from 4 months to 12 years. As per ICD (International classification of diseases) 9 and 10 encephalitis is defined as "encephalopathy plus two or more of the following:

fever> 37.5 °C
Fit/s
Focal Neurological deficit
Cerebro Spinal Fluid pleocytosis (> 5 WBC/ul) or
Characteristic changes in Neuroimaging (CT or MRI)

Encephalopathy means altered consciousness persisting for longer than 24 hours. Cases with Cerebral palsy and degenerative disease were excluded. Informed written consent was taken from parents / guardians. Age, gender and presence or absence of fever were recorded. All patients had lumbar puncture and the findings of Cerebro Spinal Fluid pleocytosis, Cerebro Spinal Fluid protein and Cerebro Spinal Fluid sugar (normal value 50-80 mg/dl, approx. 60% of serum glucose) were noted. Blood Sugar levels were also checked simultaneously. Electroencephalogram was done in 52 patients out of total 56 patients with acute encephalitis, as 4 patients were lost in follow up. EEG was performed between 5^{th}-14^{th} day of admission, after the patients were stabilized and their acute symptoms were controlled since Electroencephalogram facility was not available within the hospital setup. Findings of EEG were recorded.

RESULTS

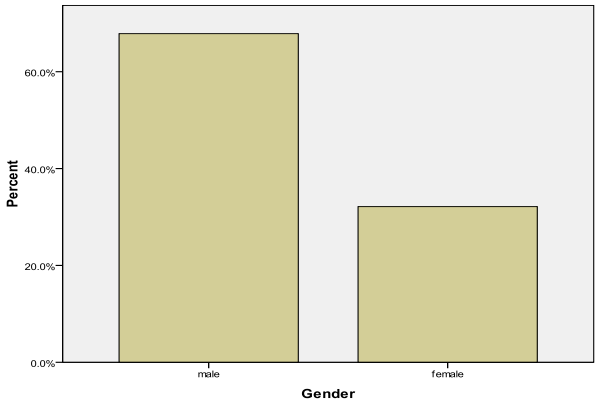
The study was carried out over a period of ten months from 2nd May, 2009 to 1st March, 2010, on admitted patients. A total of fifty-six cases were enrolled, 38(68%) were males and eighteen (32%) were females (figure 1). The mean age was 4.6 years, (ranged from four months to twelve years) with a standard deviation of 3.2 (Table 1). Fever was recorded in all cases (100%). Cerebro Spinal Fluid findings showed normal cell count in 26(46%) and Pleocytosis in thirty (54%). Cerebro Spinal Fluid Protein levels were within normal limit in 45(80%) and elevated in 11(20%). Cerebro Spinal Fluid Sugar values were normal in 50(89%) and low in 6(11%).

Out of fifty-six patients, Electroencephalogram examination was carried out in fifty-two patients between 5th-14thday of illness (after their acute symptoms were settled). Out of which, 30(58%) Electroencephalograms were normal and 22(42%) were abnormal. Slowing was the most common abnormal finding 17(33%). Focal Discharges were seen in 5(10%) patients, of which 3(6%) were unilateral fronto-temporal spikes and 2(4%) were other focal spikes. It was also noted that these five patients with findings of focal spikes with slowing of waves, had more severe symptoms at presentation and took a longer time to recover than the other patients. At the time of discharge these patients had residual neurological deficit (memory impairment) however there were no focal deficit or fits.

Table 1: Electroencephalogram findings (n=52)

Electroencephalogram Abnormalities	n
Normal	30(57.7%)
Slowing (mild to moderate)	17(32.7%)
Focal Discharges with intermittent slowing	5(9.7%)
Unilateral fronto-temporal discharges	3(5.71%)
Other focal discharges	2(3. 8%)

Figure 1: Gender representation of acute encephalitis



DISCUSSION

The diagnosis and early treatment of Acute Encephalitis are decisive for the prognosis of the patient. The mortality of HSE is considerable and large number of neurological sequelae such as cognitive deficit, mental retardation, behaviour changes, movement disorders, hemiparesis seizures have been reported. [1, 3]Electroencephalogram is a sensitive, accessible and economical tool for not only diagnosing but also in the form of neuro monitoring, to provide valuable information regarding evolution and possible sequelae of the disease process[3,4,5,6].

In our study, the mean age of presentation was 4.6 years, which is consistent with Kamble, who documents 1-5 years as the most common age of presentation[7]. Tan L V et al, in his study reported 4.5 years as the mean age of children with Acute Encephalitis[10]. In a study by Hsieh W B three fifth of the children with encephalitis were below the age of 6 years.[12] Males were in majority (68%) in our study. Kamble[7] and Hseih W B et al[11] also report that males were in majority in their study.

In herpes virus encephalitis, electroencephalography (Electroencephalogram) were abnormal in four fifths of biopsy-proven cases. In a study to determine the outcome of HSE (Herpes simplex encephalitis), the rate of abnormal Electroencephalogram was higher in poor outcome patients than good outcome patients (92% vs 78%)[3]

Electroencephalogram, lacks specificity (32%) but has 84% sensitivity to abnormal patterns in Herpes simplex encephalitis. Focal abnormalities, (for example spike and slow or periodic sharp-wave forms involving the temporal lobes) or diffuse slowing are seen. Periodic complexes and periodic lateralizing epileptiform discharges (PLEDs), in the presence of clinical neurological findings are strongly suggestive of HSE[4,5,8]. On the other hand, Beneto et al reported 9 patients with confirmed HSE with no PLED activity or had other Electroencephalogram abnormality[15]. Which is consistent with our study, where majority (68%) of the Electroencephalograms were normal, (that could be because they were done later in the disease, between 5- 20 days of admission in the hospital, when most of the patients were out of acute phase). Abida B F et al in their study also reported that most of their (51%) Electroencephalogram findings were normal[16].

None of our patient was ventilated. According to Hseih et al[12] in viral encephalitis electroencephalogram is frequently abnormal in acute phase, if the cortical gray matter is involved predominantly polymorphic delta activity is observed, while the sub-cortical involvement, a rhythmic pattern is common. A periodic pattern, periodic epileptiform discharges (PLED) may develop as the disease progresses. However, the sensitivity of Electro-encephalogram recordings decreases after 48 hours. They found the Electroencephalogram to be of important diagnostic use when obtained within first 48 hours of symptoms[2,3,4].

In our study, those patients with the Electroencephalogram findings of focal spikes along with intermittent slowing (n=5), had more severe symptoms at the time of presentation and took a longer time to recover. Their treatment was carried out for 21 days while others were treated for 10 -14 days. These children had residual neurological deficit at the time of discharge in terms of memory impairment and mental slowing. The abnormal electroencephalogram findings helped us to counsel the family and plan frequent follow up visits to monitor neurological status and late complications. Unfortunately, cerebrospinal fluid PCR was not done to find out the etiological agent, due to lack of facility. In our study, serial Electroencephalograms were not done as a part of neuromonitoring, which has more chance of picking up abnormal findings and is more helpful in determining the course of the disease and prognosis[3,4].

Cerebro Spinal Fluid pleocytosis was found to be 54%. Cerebro Spinal Fluid pleocytosis has been documented by Mekan S F et al[13]. Hsieh W B et al[12]. Jameel M N et al[14]also reports pleocytosis in his study. Cerebro Spinal Fluid Protein content was normal in 80% and increased in 20% in our study, while Jameel M N et al[14], Mekan S F et al[13], Hsieh W B et al[12] and Pritz T[11] report protein to be mostly raised. Elevated Cerebro Spinal Fluid protein has been linked to poor outcome by Jameel M N et al[14]. In our study, the protein levels were normal this difference of Cerebro Spinal Fluid protein content could be because of small sample size of our study. Cerebro Spinal Fluid sugar was within limit in 89% and low in 11% which is similar to the studies carried out by Hsieh W B et al[12], Mekan S F et al[13] and Jameel M N et al[14]. Though there were no specific findings in Cerebro Spinal Fluid examination and the diagnosis was mainly clinical, but Cerebro Spinal Fluid examination helped to exclude meningitis.

CONCLUSION

Acute Encephalitis not only poses difficulty in diagnosis but is also associated with huge number of morbidity and mortality. Electroencephalogram, a noninvasive, economical modality offers

great benefits in early detection of complications, indication of neurological sequelae or residual brain damage.

Conflict of interest: This study has no conflict of interest.

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