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Electroencephalographic Profile of Acute Encephalopathy Patients

B Ram Abhishek*, R Viveka saravanan***, K Malcolm Jeyaraj**, S Sakthi Velayutham**, Sowmini PR**, Mugundhan Krishnan****

*Post graduate in Neurology
**Assistant Professor of Neurology
***Associate Professor of Neurology and corresponding author
****HOD and Professor of Neurology
Department of Neurology , Stanley Medical college, Chennai, Tamilnadu

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ABSTRACT

Emergent EEG(eEEG) is an important investigation in patients with acute encephalopathy. The indications, practices and usefulness of eEEG have not been clearly defined until now. We prospectively studied 180 patients of acute encephalopathy admitted in Government Stanley Hospital between September 2018 and March 2020. Various EEG patterns and etiology were analyzed among the study group. Vascular related cause (25.5%) was most common etiology followed by metabolic encephalopathy in our study population. Among various EEG patterns, non specific dysfunction (36.6%) was the most frequent. Few specific patterns of EEG provided useful information in certain clinical situations among critically ill patients.

Key words- Emergent EEG, Encephalopathy, EEG patterns, NCSE

I. INTRODUCTION

Emergent EEG is being increasingly looked into to provide objective evidence of brain dysfunction especially in patients with altered sensorium. Diagnostic evaluation of patients with encephalopathy frequently includes EEG with a goal to exclude epileptic activity.[1] As per updated definition, Emergent EEG(eEEG) is defined as Electroencephalogram performed on a non elective basis for seemingly emerging condition upon request from a clinician preferably neurologist or neurosurgeon or intensivist.[2]With this background we decided to study the various EEG patterns in emergent EEG in patients admitted with acute encephalopathy at Stanley Medical College Hospital.

II. MATERIALS AND METHODOLOGY

This was a prospective study done between September 2018 and March 2020 at Govt. Stanley Hospital, Chennai.Patients admitted in emergency ward and intensive care unit with acute encephalopathy (within 24 hours of admission) were included in the study.Among the study population, GCS(glascow coma scale) ranging from 3- 12 at the time of admission were included in the study. Patients admitted for trauma and pediatric population were excluded from the study.A total of 180 patients wererecruited over a period of 1 year and 6 months.Within 24 hours, a trained Neurotechnologist performed the eEEG and a Neurologist or Epileptologist reported the same.All recordings were carried out on a 32-channel digital EEG acquisition system, with the scalp electrodes placed according to the International 10–20 system.Every EEG was recorded for a minimum of 40 minutes irrespective of referral diagnosis.Response to pain and other physiological stimuli during EEG recording were noted.Evaluation for final diagnosis was done for all patients.While reporting EEG, we looked for background activity, specific EEG patterns and stimulus sensitive responses.A systematic review of each case was carried out and various EEG findings were analyzed.EEGs with poor quality and artifacts were excluded from the study.

III. RESULTS

A total of 180 patients were selected and EEG was performed on them. Mean age was 55.2 years. Most of the patients were between 50 and 70 years of age(as shown in figure 1).Majority of the EEGs were performed within a day of admission with a mean delay of 1 day and 8 hours.Out of the 180 patients, 101(56%) were males and 79(44 %)were females(shown in figure 2).Among the study group, various etiologies weremetabolic, septic, hypoxic, uremic and hepatic

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encephalopathies. The other etiologies were vascular related,epilepsy related and CNS infections[as shown in table 2]. Vascular causes(25.5%) were the most common etiology identified among the studypopulation.Vascular group included ischemic stroke, intracerebral bleed, subarachnoidhemorrhage and vasculitis.After expert reporting, we analyzed and grouped EEG findings.Few patients had mixed or overlap of two important EEG findings. We grouped them based on major findings of that particular EEG record. Non specific electrophysiologicaldysfunction was the most frequent (36.6%) EEG finding identified.Other EEG findings werediffuse suppression, electrocerebral silence, triphasic waves, periodic waves, burst suppression patterns, focal and multifocal epileptiform discharges,focal intermittent rhythmic delta activity(FIRDA) , electrographic seizures and non-convulsive status epilepticus(findings listed in table 1).About 3.8% of patients had normal EEG pattern.

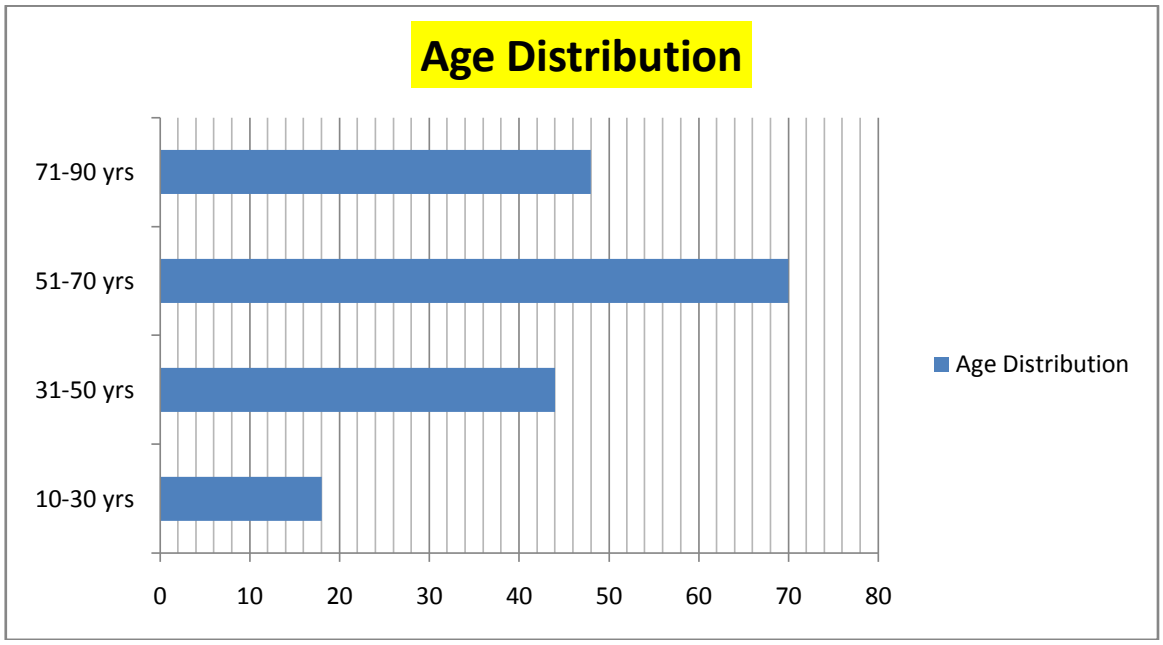

Figure (1)

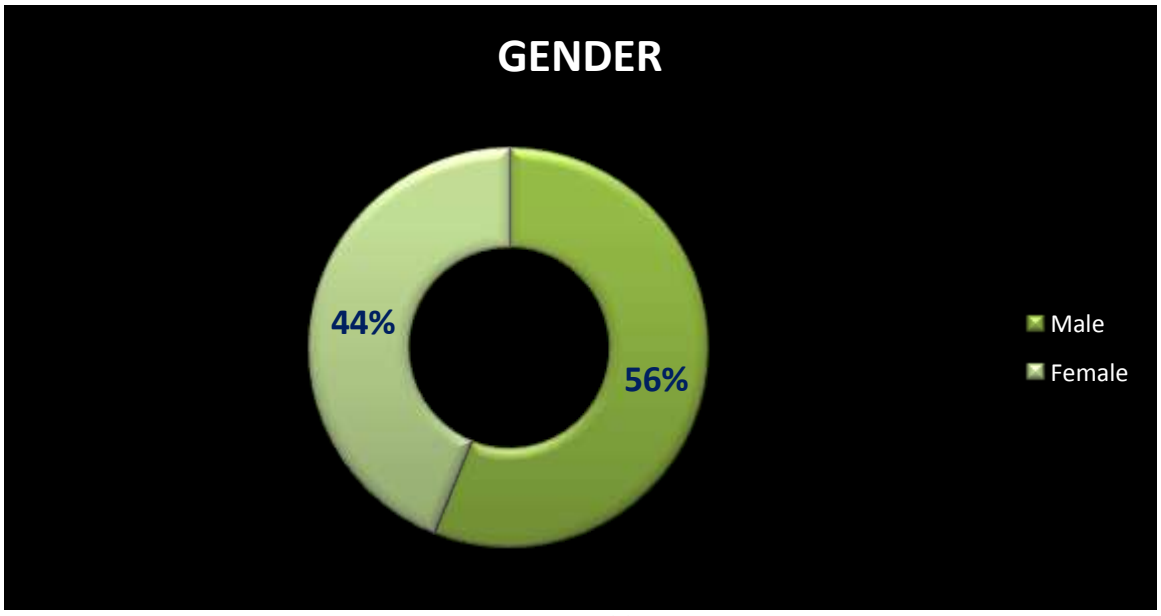

Figure (2)

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Table showing different EEG findings in 180 patients (Table -1)

EEG FINDINGS	N.o of Patients	Percentage
NON SPECIFIC DYSFUCNTION	66	36.6%
FOCAL/DIFFUSE SLOWING	33	18.3%
SUPPRESSION	11	6.1%
ELECTROCEREBRAL SILENCE	01	0.5%
ELECTROGRAPHIC SEIZURE	10	5.0%
NCSE	02	1.1%
BURST SUPPRESSION	08	4.4%
FOCAL/MULTFIFOCAL IEDS	15	8.3%
TRIPHASIC WAVES	15	8.3%
PERIODIC DISCHARGES	08	4.4%
FIRDA	04	2.2%
NORMAL	07	3.8%
Total Number	180	100%

Etiologies of study group (Table -2)

Final Diagnosis	No of patients	Percentage
VASCULAR	46	25.5%
CNS INFECTION	14	7.7%
URAEMIC ENCEPHALOPATHY	10	5.5%
HEPATIC ENCEPHALOPATHY	12	6.6%
SEPTIC ENCEPHALOAPTHY	19	10.5%
EPILEPSY RELATED	10	5.5%
HYPOXIC ENCEPHALOPATHY	18	10%
METABOLIC ENCEPHALOPATHY	30	16.6%
MULTIFACTORIAL	16	8.8%
UNCERTAIN ETIOLOGY	05	2.7%
Total	**180**	**100%**

IV. DISCUSSION

Emergent EEGs were mainly requested for determination of brain death, non-convulsive status epilepticus, subtlestatus epilepticus and follow-up of convulsive status epilepticus after initial treatment[3]. Emergent EEG is largely not available due to resource constraints in many hospitals.Hence the utility in other conditions is also largely unstudied[4].Acute encephalopathy being a very common cause for admission in Intensive care units, we decided to study the various EEG patterns in the above condition in order to assess the utility of the eEEG in encephalopathy in future studies.The most frequently affected age group was between 50 and 70 years of age. Nearly 38% of our study population fell in this age group. Males were 57.5% among study population.

Vascular related (25.5%)aetiology was most common followed by metabolic encephalopathy in our study population .Abnormal EEG patterns reported in previous studies with acute encephalopathy or coma were non specific electrophysiological dysfunction,focal and diffuse slowing, alpha coma, spindle coma, theta coma, electro cerebral silence, periodic discharges, electrographic seizures, generalised suppression ,frontal intermittent rhythmic delta activity(FIRDA),non convulsive status epilepticus(NCSE), triphasic waves, burst suppression pattern and focal or multifocal spikes/sharp waves discharges.[1,2]Among our study population, the most frequent EEG finding wasnon-specific electrophysiological dysfunction(36.6%)which is similarto the study done by Firosh et al.[2] Focal/diffuse slowing is about 18.3% which is lower compared to previous study.Both Triphasic waves and focal/multifocal epileptiform discharges were noted around 8.3% of our study population. Triphasic waves were seen about 5.2% of the study population done by Firosh et al.

Generalised suppression, electrographic seizure,periodic discharges, FIRDA, burst suppression,NCSE,electro cerebral silence though less commonly encounteredwere either most useful or corroborative in the diagnoses. EEG patterns depends on various factors like time of EEG

performed, clinical diagnosis, external devices, medications used during hospitalisation and severity of illness. Triphasic waves were seen in hepatic, hypoxic, metabolic and uremic encephalopathies. Periodic discharges were mostly reported in vascular etiology followed by hypoxic and metabolic encephalopathies in our study. Focal and multifocal discharges were found in wide variety of encephalopathies. Only 2 patients had satisfied NCSE criteria.Generalised suppression indicates severity of brain dysfunction.[3] About ten patients had electrographic seizures in EEG which critically helped in managing those patients.Burst suppression was noted only in the hypoxic encephalopathy subset of patients.Manifold EEG patterns were noted among patients with epilepsy. The lists of various EEG findings among the study group are shown in Table [1].Continuous monitoring of EEG might increase the yield but could not be done due to resource limitations. Although EEG patterns may not aid in diagnosing the type of encephalopathy,it helps to rule out NCSE in doubtful cases. Further, the EEG patterns could help in management of patients and prognosticate the severity of illness.

V. CONCLUSION

EEG is an important diagnostic tool in assessing the ICU patients with acute encephalopathy.Vascular etiology was the most frequent etiology encountered among various encephalopathies in our study. Majority of the EEG patterns among the study group showednonspecific electrophysiological dysfunction and slowing.Specific EEG patterns like triphasic waves,NCSE, burst suppression, electrographic seizures noted in few of the patients aid in understanding underlying disease process. However, corroboration of EEG patterns and their usefulness needs to be explored in future studies.

LIMITATION OF STUDY

Mortality and outcome of the patients with EEG findings could not be compared in our study. Continuous EEG monitoring could not be performed due to resource limitations.

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