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Research Article

Contribution of the Electroencephalogram in Precose Neonatal Epilepsies

Halladain Mpung Mansoj[1]*, Mualaba Celebre[2] and Adaratou Dieynabou Sow[1]

[1]*Department of Neurology, Fann Teaching Hospital, Dakar, Senegal*

[2]*Department of Neurosurgery, CHU Fann, Dakar, Senegal*

***Corresponding Author:** Halladain Mpung Mansoj, Department of Neurology, Fann Teaching Hospital, Dakar, Senegal.

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Abstract

Introduction: Epilepsy, a chronic neurological disease, is a public health problem because it is frequent, potentially serious, cosmopolitan without distinction of age, sex or race [1].

Objective: To study the contribution of electroencephalography in the diagnosis and management of epilepsy in newborns: aged between 2 and 3 months.

Material and Methods: Descriptive and analytical retrospective analysis carried out during the period 2017 - 2020, i.e. 36 months.

Results: The age group concerned were predominantly month-old infants with 50% of cases, followed by newborns under one month with 28.6% and 21.4% of cases, respectively. The male sexes were mainly concerned, in 92% of cases and a sex ratio of 13. The main indications of the electroencephalogram were represented by chronic tonic convulsive seizures (92%), followed by non-febrile neonatal convulsions and focal seizures in respectively 21.4% of cases.

Keywords: Contribution; Electroencephalogram; Precose Neonatal Epilepsies

Introduction

Epilepsy, a chronic neurological disease, is a public health problem because it is frequent, potentially serious, cosmopolitan without distinction of age, sex or race [1]. Its prevalence in children worldwide is estimated between 4 and 5%; with a higher incidence, particularly in small children, of the order of 80-120/100,000 between 0 - 10 years, against 20 - 40/100,000 in adults [4].

The diagnosis of epilepsy is clinical, but the electroencephalogram constitutes a very useful examination in Epileptology by participating in the syndromic diagnostic confirmation, in determining the prognosis, in the choice of treatment and in its follow-up [10,11]. The electroencephalogram is an easy, reproducible, non-invasive means of brain exploration. It is not only used to study the functioning of the brain in healthy individuals, but also to diagnose certain diseases, which modify the electrical activity of the brain (for example: epilepsy, metabolic diseases...).

Objective of the Study

Main objective: To study the contribution of EEG in the diagnosis and management of neonatal epilepsy.

Specific objectives: Determine the frequency of epilepsy in newborns in the neonatal unit; two. To analyze the contribution of EEG in the positive and syndromic diagnosis of neonatal epilepsies;

three. Analyze the contribution of EEG in the differential diagnosis; four. To determine the main epileptic syndromes most commonly encountered in newborns.

Materials and Methods

Study framework our study took place at the CHU Fann, in the Department of Clinical Neurophysiology within the Ibrahima Pierre NDIAYE Neuroscience Clinic and at the Albert Royer Children's Hospital (HEAR). These are university hospital structures with a sub-regional vocation, unique in their reception capacity and grouping together the sub-specialties. Research and teaching have a big place there.

Type of study

This is a retrospective, descriptive and analytical study.

Study period

This study took place during the period from January 1, 2017 to December 15, 2020, i.e. a period of 36 months.

Study population

- **Inclusion criteria:** Was included in the study any newborn or infant aged 0 to 3 months who received an EEG for epileptic-like seizures.
- **On-inclusion criteria:** Any newborn or infant having presented epileptic-like seizures but not having benefited from an EEG or uninterpretable reading; and/or infants over 3 months of age. Methods we have not done any sampling; we carried out a systematic selection of patients meeting the selection criteria.

We have made a collection sheet to facilitate data collection. The data were recorded on Excel software.

Variables in study

Our study variables are socio-demographic data and EEG aspects.

Analysis of the results

We used SPSS version 22 software for statistical analyzes. The confidence interval was calculated at 95% and the significance level retained at 0.05. Pearson's correlation tests, Chi-square test and Anova test were used for the correlation and comparison of the data.

Ethical considerations

As the study is retrospective, we did not seek consent from patients, however their identity and the data collected is on condition of anonymity.

Results

During our 2017 - 2020 study period, we registered 14 newborns aged less than 3 months in the Electrophysiology laboratory of the Clinique de Neurosciences du CHUN de Fann. The dominant age group consisted of infants from 3 months with 50%, followed by newborns of 2 months and less than 1 month with respectively 28.6 and 21.4% of cases; boys predominated with a rate of 92.86%. On the semiological level, the seizures were very polymorphic; dominated by tonic-clonic seizures 37.71%, followed by neonatal non-febrile seizures (21.43%). On EEG, the majority of newborns in our series had a background rhythm in the delta frequency band -theta or 71.48% of cases. The EEG was normal in the majority of cases, in a frequency of 64.3%. Syndromically, in 60% of cases, one could not make a syndromic orientation given the normality of the EEG; and in 40% of cases, non-idiopathic epilepsies (4 out of 6) were found, including complete encephalopathies for a good interpretation of the EEG.

Age group our patients were predominantly 3-month-old infants with 50% of cases, follow end by 2 month old and less than 1-month-old infants with 28.6 and 21.4% of cases, respectively.

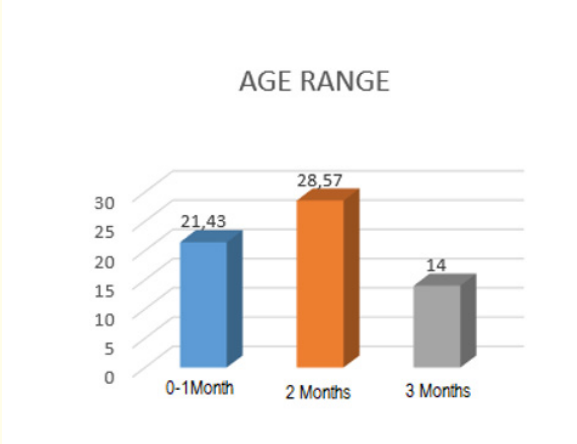

Figure 1

Distribution of patients according to age:

- Sex or gender
- Our patients were predominantly male with over 92% of cases and a sex ratio of 13.

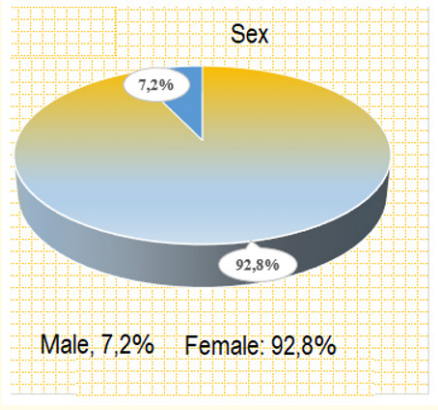

Figure 2: Distribution of patients by gender.

EEG indications

Seizures were the main reason for requesting EEG (92%). Thus, electroencephalography was requested mainly for generalized tonic-clonic convulsions (CTCG) (37.7%) followed by non-febrile neonatal convulsions and focal seizures in 21.4% of cases, respectively. The other isolated cases with respectively 1 case for Agenesis of the corpus callosum, febrile neonatal convulsion and comitiality.

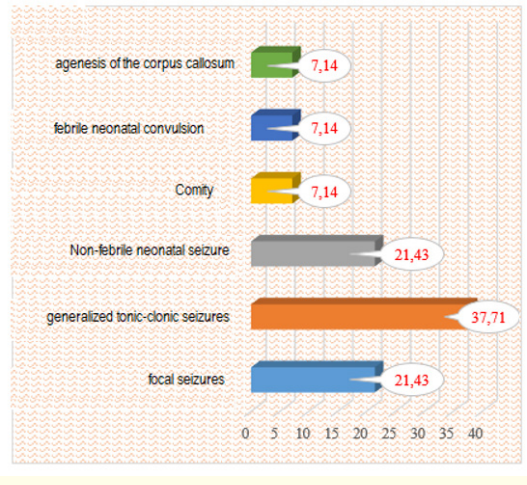

Figure 3: Distribution of patients according to the EEG indication EEG analysis ϖ stages of sleep.

In the majority (50%) of our patients a complete cycle of slow sleep could be recorded with stages I, II and III. Difficulty in identifying the stages of sleep was found in 21.4% of cases. Two respective cases of incomplete sleep were found with either stage I and II or stage II and III.

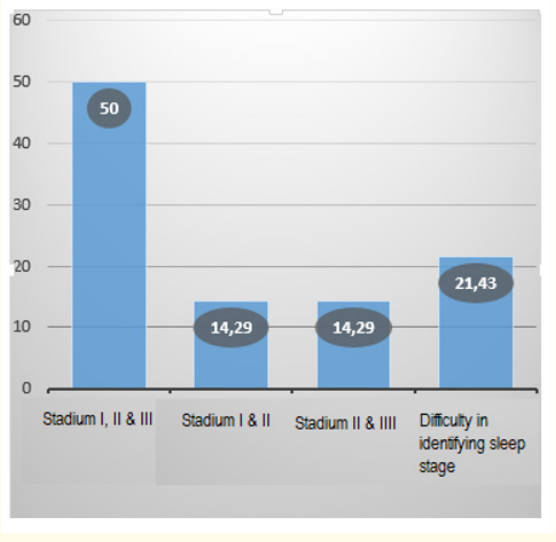

Figure 4: Distribution of patients according to recorded sleep stages.

Background rhythm (RDF) (Table 1).

Eeg sleep : background rhythm	Effective	Percentage
Theta	1	7,14
Delta	2	14,29
Delta-theta	10	71,43
Discontinuous	1	7,14
Total	14	100

Table 1: Distribution of patients according to the background rhythm at the EEG.

RDF was predominantly mixed with delta-theta association in over 71% of cases (Figure 5). It was discontinuous in 1 case (Figure 6).

Maturation - Richness of sleep EEG.

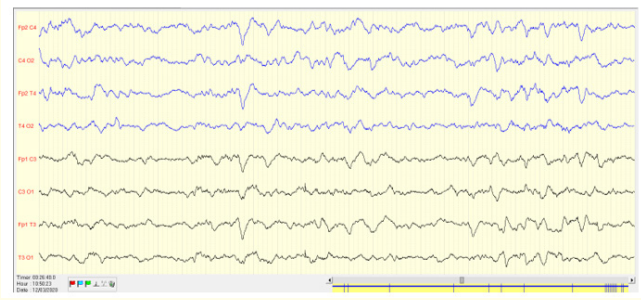

Figure 5: Illustrative EEG of a 1 month old infant. Continuous RDF of mixed type with mixture of diffuse delta and theta waves.

Physiological figures of sleep	Effective	Percentage
Present	8	57,14
Absent	3	21,43
Poor	3	21,4
Some figures	2	14,3
Rouching of spindles	1	7,1
Total	14	100

Table 2: Distribution of patients according to physiological figures of sleep.

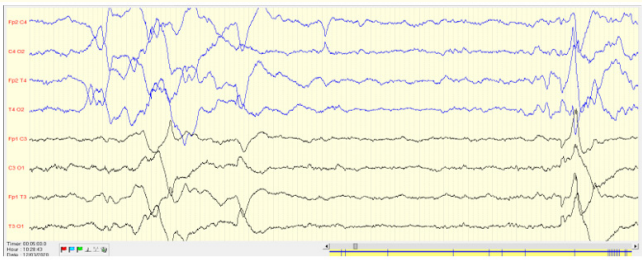

Figure 6: Discontinuous line illustration: Newborn 3 days old, premature birth at 8 months; Calm sleep. Discontinuous plot with broad, diffuse, mostly delta polymorphic puffs separated from also diffuse hypovoltage phases.

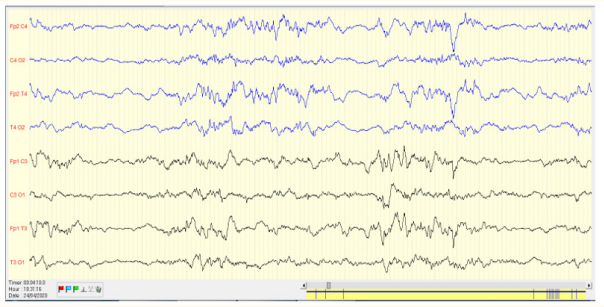

Figure 7

It was assessed on the basis of the presence of physiological elements of sleep. They were present and of correct abundance in more than half of the cases (57.1%) (Figure 7) against respectively 21.4% of poor tracing with rare physiological or poorly drawn figures; or even completely absent.

Normal EEG/3 month old slow sleep stage II infant. Continuous, rich line with many entangled spindles with K complexes.

Effect of Intermittent Light Stimulation (SLI).

SLI was mostly ineffective (92.9%) compared to only 1 case of activation of abnormalities.

Anomalies found (Table 2).

In the majority of cases (64.3%), no abnormalities were found. The anomalies were mainly focal (21.4%) (Figure 8) and more rarely generalized (14.3%) including a suppressive type trace.

Effect of intermittent light stimulation (SLI):

- SLI was mostly ineffective (92.9%) compared to only 1 case of activation of abnormalities.
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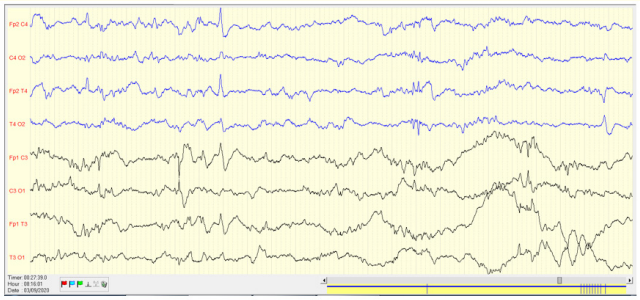

Figure 8

Types of anomalies	Effective	Percentage
FOCAL		
Diffuse tips anteriorly	1	7,14
Diffusing left centro-parietal points	1	7,14
Diffuse PO Predominant in left rolandic	1	7,14
Generalized		
Generalized spike-wave flushes	1	7,14
Suppressive plot	1	7,14
Absent	9	64,29
Total	14	100

Table 3

Conclusion of the sleep EEG

The EEG returned to normal in the majority of cases (57.1%) with a syndromic orientation depending on the clinical context and presentation. Early epileptic encephalopathy was evident in relation to 1 suppressive trace. There are 2 cases of focal idiopathic epilepsy (EFI) and 3 cases of non-idiopathic epilepsy, including 1 focal form, 1 generalized form and 1 indeterminate encephalopathy, respectively (Table 3).

Discussion

Our study looked at the EEG aspect in newborns from day zero up to and including 3 months. A subject little documented in Senegal.

Sociodemographic data In our series, the admission age group of 0 to 30 days represents 21.43% against 28.57% at 2 months and mostly 50% at the age of 3 months. The figures are very variable in the literature but generally higher than ours are. In the study by Eghbalian in 2007, the mean age of newborns was 14.03 days and 6.91 ± 6.29 days in other studies done in collaboration with Rassali Winter in 2015. The average age of onset of seizures according to Mishra was 3.7 days. Also, in his series, Dehan notes two frequency peaks, one during the first day of life (41%), the other on the fifth day (10.3%). Paswan, reports 56% of convulsions occurring in the first 24 hours, 72% in the first 72nd hours and only 18.4% between the 8th and 28th day. The same is true with Kone who noted 50% convulsions on day 1, 73.3% in the first 48 hours and 76.6% in the first 3 days, respectively. Other authors report lower rates. According to Nunes, 45% of newborns have seizures within the first 24 hours of life; Saliba found 38% of newborns but in the first 48 hours against 50% within 72 hours and 70% during the 1st week. The male predominance observed, without being explained, in our series (92.86%) is the rule in most series. In the USA, Glass., *et al.* found 57.3% male newborns; Tudehope in Australia and Nunes in Brazil found 56% and 55% respectively, as well as in Iran where 3 studies carried out in 2007 by Taliban, Sabzehee and Eghbalian show 54% respectively; 57% and 73.5%. In India, also the data are in favor of the male sex with respectively 60%, 56.2%, 64% and 70.3% for Mistra, Streram, Paswan and Ghanshyambhai. Lansha, de Logan, and Voena, de Tekgul, Yadav, Sued and Kohelet all report the same data. Saliba in his analytical study corroborated the finding by showing that male babies were 1.8 times more likely to have seizures than girls. Few studies have shown the opposite: Pisani., *et al.* in Italy and Eghbalian and Rassule in 2015 in Iran, with a frequency of 47.4% and 32% respectively for male newborns.

Semiology of seizures

The appearance of seizures is very polymorphic. In our series, tonic-clonic seizures are the most frequent (37.71%), as reported by Tudehope (36%), Brosset (78%), and the Moroccan series Kri-

Conclusion	Final EEG Summary	Effective	Percentage	Syndromic orientation
Normal	Well organised	8	57,14	
RDF normal + anomalies	Diffuse irritative signs predominantly anterior	1	7,14	EFI
	Diffuse irritative signs predominantly centrally	1	7,14	
RDF poor +/- anomalies	Poorly organized without paroxysmal abnormalities	1	7,14	Encephalopathy X
	Poor with irritative signs in the left centro-parietotemporal	1	7,14	EFNI
	Disorganized with generalized irritative signs	1	7,14	EGNI
Destructure	Suppressive path	1	7,14	Epileptic encephalopathy
Total		14	100	

Table 4: Distribution of patients according to the conclusion of the EEG and the syndromic orientation.
RDF: Background Rhythm; EFI: Idiopathic Focal Epilepsy; X: Indeterminate; EFNI: Focal Non-Idiopathic Epilepsy; EGNI: Non-Idiopathic Generalized Epilepsy.

ouille., *et al*. (81.6%). But in the other series, atypical seizures are the most frequent Trabelsi M and Volpe J.J. In the face of a tonic or clonic seizure, the diagnosis is easy based on simple inspection, but to label atypical seizures, which are most frequent in the neonatal period, an EEG recording is essential, in particular in front of ocular, oral, respiratory or respiratory signs. abnormal movements of the body and face. Regarding non-febrile generalized convulsions (21.43% in our series), this is a sudden onset event, reflecting paroxysmal depolarization of a group of immature neurons, which can influence motor, sensory and muscle activity. Autonomic nervous system. This cerebral immaturity will be at the origin of the peculiarities in the neonatal period concerning the excitability of neurons but also semiological, and this regardless of the cause. Indeed, the seizures are most often focal type of pedaling movements, lateralized or rocking or migratory, sometimes generalized tonic or clonic, but never tonic-clonic as is the case in infants and children. These motor-type manifestations are often associated with vegetative disorders N Gandoura., *et al*.

EEG data Common inherent difficulties EEG is known to aid in the positive diagnosis of incipient epilepsy by recording interracial abnormalities or critical manifestations in Video EEG. The EEG should always be interpreted with all.

Clinical data (age, history, semiology of seizures, clinical examination, imaging and treatment). Interpretation is more difficult in newborns due to three aspects: Brain maturation is dynamic and leads to an evolution of grapho-elements according to age Recording can be more problematic because it requires several phases

of sleep for an optimal overall assessment; difficulty linked to the need for calm, specific habits and rituals, which vary according to the children. There are more sources of artefacts: they can be "intrinsic" (muscle movements, crying, sucking) or "extrinsic" (if there are devices around the child).

Background rhythm analysis

Seventy-one percent (71.4%) of patients had a mixed background rhythm belonging to the Delta-Theta band. This can be explained by the progression of stages of light then deep sleep respectively consisting of a theta then delta rhythm with anterior maximum and large amplitude. On the other hand, this prevalence of slow waves can be explained by the time lag between the onset of sleep of the newborn and the actual achievement of EEG; the children, sensitized beforehand by Theralene* (Alimemazine) and pampered outside by their parents (8 to 10 children per day), are recorded being already in stage II and III of the sleep. However, 50% of our patients had progressive sleep, i.e. stages II then III and I. The discontinuous or suppression-burst trace concerned 7.14% of cases. Indeed, encephalopathies of the neonatal period are characterized by deletion-burst traces. These are mainly early myoclonic encephalopathy-type syndromes and early infantile epileptic encephalopathy. According to Aicardi and Ohtahara, brain imaging shows a malformative cause in about 50% of cases.

Slow sleep maturation on the EEG

The majority of the cases (57.14%) of our sample had physiological figures of sleep (K complex and spindles). We had one case of so-called poor tracing; the poverty of the trace in microarchitecture of sleep often represents a cerebral suffering which can be of origin infectious, metabolic, vascular or related to a notion of perinatal asphyxia or fetal distress. The cerebral parenchyma is fragile, its response to the aggression is polymorphic, often complex and the EEG indirectly reflects the neurochemical and neurophysiological consequences of this aggression on the functioning of neurons and glial cells or more exactly on the functional harmony of these. Innumerable neuro-glial couples, which constitute the cellular basis of the most evolved mental functions.

Effect of Intermittent Light Stimulation (ILS) the ILS was mostly ineffective (92.9%) compared to only one case of activation of the abnormalities. The electro encephalographic response to intermittent light stimulation is variable; some are physiological and others are pathological. According to Kasteleijin 1 to 2% of healthy subjects, have EEG abnormalities during SLI. Photosensitivity concerns 5% of epileptics, more frequent in girls than in boys 60% according to Cavani.

Anomalies found in the majority of cases (64.3%), no abnormalities were found. The anomalies were mainly focal (21.4%) and more rarely generalized (14.3%) including 7.14% of the suppressive type. Contrary to our study, Lanska found 67% of epileptic discharges, 46% of 'anomalies of the bottom tracing and 22% of seizures recorded [1-31].

Conclusion

During our 2017 - 2020 study period, we registered 14 newborns aged less than 3 months in the electrophysiology laboratory of the Clinique de Neurosciences du CHUN de Fann. The dominant age group consisted of infants from 3 months with 50%, followed by newborns of 2 months and less than 1 month with respectively 28.6 and 21.4% of cases; boys predominated with a rate of 92.86%. On the semiological level, the seizures were very polymorphic; dominated by tonic-clonic seizures 37.71%, followed by neonatal non-febrile seizures (21.43%). On EEG, the majority of newborns in our series had a background rhythm in the delta frequency band -theta or 71.48% of cases. The EEG was normal in the majority of cases, i.e. a frequency of 64.3%. Syndromically, in 60% of cases, one could not make a syndromic orientation given the normality of the EEG; and in 40% of cases, non-idiopathic epilepsies (4 out of 6) were found, including complete encephalopathies for a good interpretation of the EEG.

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