Role of Interictal Neonatal Electroencephalogram in Diagnosis and Prognosis of Recurrent Neonatal Seizures

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ABSTRACT

Neonatal EEG is an effective tool for evaluation of seizure disorders in neonates. It can monitor normal and abnormal development of the brain very early and efficiently than other tools. It can be used to differentiate between seizures and other movements and paroxysmal disorders. Aim of the work: to show the different EEG abnormalities in neonates with seizures and to demonstrate its role in diagnosis and follow up, and to study the impact of EEG based diagnosis on the prognosis of each case. Material and Methods: we studied 24 neonates according to inclusion criteria, 12 of whom had recurrent seizures: 6 premature and 6 mature. The other 12 were normal controls. Family and case history were taken with an accurate description of seizure semiology, lab investigations were done . Digital EEG was done according to the 20-40 system for no less than one hour. Results: showed that EEG could predict the outcome of neonates with seizures, interictal EEG can settle the diagnosis of seizures when clinically doubtful and can thus aid in determining the appropriateness of giving antiepileptics. Conclusion: EEG is an essential tool for studying neonates with paroxysmal disorders and has a prognostic value when assessing the short term outcome. (Egypt J. Neurol. Psychiat. Neurosurg., 2007, 44(1): 177-191).

INTRODUCTION

Neonatal electroencephalography has been firmly established as a highly rewarding, noninvasive tool for the clinical evaluation of all neonates “at risk”, and for the study of the ontogenetic schedules governing both normal and deviant development of the central nervous system during the earliest epochs of postnatal existence.¹

Seizures are the main paroxysmal disorder of the newborn. The challenge for the clinician is to differentiate seizure activity from normal neonatal movements and from pathological movements caused by other mechanisms. Seizures in newborns, especially those who are premature, are poorly organized and difficult to distinguish from normal activity.²

In this aspect EEG is an excellent tool to help diagnose subclinical seizures or to avoid a misdiagnosis of seizures in the presence of atypical non-ictal neonatal behaviours. When used selectively through serial recordings, neonatal EEG’s greatest value is its potential for prediction of short- and long-term prognosis. The EEG background, static abnormalities, and EEG maturational indices are the best prognostic factors. Although some ictal discharges may have specific significance, a normal interictal EEG indicates the greatest chance of favorable outcome, even in the case of early recurrent seizures. EEG is clearly preferable to a neurological examination of a neonate who inherently displays a narrow behavioural and clinical profile.³

Aim of the work:
To studying the ability of 1-hour interictal neonatal EEG to:
* Prove, or disprove, the epileptic nature of a suspect seizure behaviour.
* Predict the short term clinical outcome of the seizing infants (within 2 weeks).
PATIENTS AND METHODS

The study included 24 subjects: 12 cases of recurrent seizures: 6 preterm and 6 full term, and 12 normal age matched subjects for control.

The subjects of the study were divided into full term and preterm according to gestational age (the number of weeks/months the child was in the womb).

Neonates < 38 wk were considered preterm and those between 38 to 42 wk were considered full term.

Inclusion criteria for cases of recurrent seizures:
- First neonatal seizure reported before the end of 44 wks of conceptional age (gestational age plus number of weeks since birth), with recurrence of the seizure in any pattern.
- All types of motor and behavioral seizures were considered; e.g. focal, multifocal, hemiconvulsive, tonic or clonic, stepping or pedaling of the legs, swimming or rowing movements of the arm, in addition to tonic deviation of both eyes and paroxysmal disturbance of consciousness with rhythmic increase in systolic arterial blood pressure, heart rate, and oxygenation.

Exclusion criteria for cases:
- Neonates with multiple congenital anomalies or scalp swelling.
- Neonates receiving any major sedative drug or those with uncontrolled fever (38°C), hypothermia (36 °C) or hypercapnia during the time of recording.
- Neonates developing any form of clinically manifested seizures during the recording process.

Exclusion criteria for control group:
In addition to the exclusion criteria mentioned for the case group:
- Cases with perinatal asphyxia defined by 5 min. APGAR score < 5 in none intubated neonates.
- Neonates needing vigorous resuscitation including intubation and/or cardiac massage, intraventricular hemorrhage with a grade more than 1, and those with CNS infection as meningitis, brain abscess ...etc

Procedures:
* Family history, antenatal, natal and postnatal detailed history.
* Full eye-witness description of different patterns of neonatal seizures.
* Full neurological assessment of the neonate at the time of recording.
* Digital EEG recording with the following criteria:
  - 20-40 system was used instead of 10-20 system because of small skull size.
  - EEG test was run for 60 minutes or more to ensure recording at least one change in sleep state.
  - Close monitoring and documentation of any physiological change or abnormal movement that might contribute to artifact waves in EEG.
* Recording was done with a portable digital EEG machine, and Toenis-21 software. An electrode cap designed for neonatal head size was used, with 10 electrodes. Infant bipolar montage was the one of choice in this study.

Correlation between EEG based diagnosis and prognosis with the final outcome was the target issue, as follows:
- Defining any interictal findings suggestive of seizure activity.
- For prognosis, the model of Clancy and Tharp, was employed:
  - Background dysmaturity of 2-3 wks less than the reported age was considered as a mild abnormality.
  - Background dysmaturity of 4 wks or more was considered as a moderate abnormality.
Classification of abnormalities as persistent or transient, was not considered as it needs longer follow up time.

* The clinical outcome on very short follow up (2 weeks) was classified as follows:
  - **Normal:** if seizure activity was controlled, AED was stopped, and the baby was discharged from NICU, with no abnormalities detected on thorough neurological examination, within 1 week of onset.
  - **Mild:** if seizure activity was controlled on monotherapy for more than 1 week, or if there was persistent focal neurological deficit with no effect on conscious level.
  - **Moderate:** if seizure activity was controlled on more than 1 AED, or if seizure activity recurred in a period more than 2 weeks, or with evidences of diffuse insult to the brain, e.g. weak suckling, increased sleepiness, decreased spontaneous motor activities.
  - **Severe:** death or intractable seizure activity, or markedly disturbed conscious level for more than 2 wks after admission in NICU.

Data management:

Data were collected, revised, verified, then edited on PC. The data were then analyzed statistically using SPSS statistical package version 12. The following tests were done:
1. $X = \text{mean}$
2. $SD = \text{Standard deviation}$
3. $T$- test of independent samples.
4. $X^2 = \text{chi square test}$

**RESULTS**

Age characteristics of cases and controls showed no significant difference between both groups (Table 1).

**Prevalence of different clinical types of seizures:**

Subtle seizure manifestations were present among (50%) of the study sample, clonic seizures in (58.3%), tonic seizures in (33.3%), and myoclonic in (41.7%) (Table 2).

**Neurological examination:**

All neonates of the control group showed normal findings on neurological examination. Neurological examination was normal in (25%) of the seizures group, showing focal lesion in a single case (8.3%), mild diffuse brain dysfunction in (41.7%), and severe diffuse brain dysfunction in (25%) (Table 3).

**EEG findings:**

* **Sleep state differentiation:**

  All neonates of the control group, showed well differentiated sleep states, while (50%) only of the seizure group showed this sleep differentiation. (25%) of the seizure group showed excessive transitional sleep pattern, and another (25%) showed undifferentiated sleep states (Table 4).

* **Relative duration of different sleep states:**

  On comparison of the relative durations of different sleep states, with the total duration of the sleep cycle between cases and controls, there were significant statistical differences as regards the relative duration of quiet and transitional sleep ($P < 0.05$), while there was no statistically significant difference as regards relative duration of active sleep between both groups (Table 5 and Fig.1).

* **EEG Background activity:**

  No abnormalities were detected in the background of EEG activity of the control group. However, the seizure group showed abnormalities of spatial organization of different electro-cerebral waves as the most common (33.3%), followed by persistent slowing and excessive discontinuity in (25%). Excessive asynchrony and low voltage amplitude in 2 cases (16.7%), and lastly asymmetry and loss of reactivity, each being recorded in a single case (8.3%) (Table 6).
*Voltage amplitude:*
There was a statistically significant difference between mean voltage amplitude in the MP (mixed frequency pattern) between the seizure and control groups (P < 0.05). Also there was a high statistically significant difference between both groups in the mean voltage amplitude in the CSWS (continuous slow wave sleep) (Table 7 and Fig. 2).

*Abnormalities of the EEG maturity index:*
Of the seizure group, (58.3%) had their EEG consistent with their reported CA, (16.7%) had mild inconsistency and (8.3%) severe inconsistency with CA. The last (16.7%) had undifferentiated background activities, from which estimation of their CA was inapplicable (Table 8 and Traces 1a & b, 2, 3, 4).

*Abnormal superimposed patterns:*
Among the seizure group, abnormal superimposed patterns were found in 8 cases (66.7%). Monorhythmic patterns, either ictal (>10 sec) or BIRD (brief ictal rhythmic discharge<10 sec) were found in (25%), slow dysrhythmias in (33.3%), PRWS (positive rolandic sharp waves) in (25%) and SET (sharp electroencephalographic transients) in (50%). None was found in the control group (Table 9 and Traces: 5, 6, 7).

EEG could prove the epileptic nature of a seizure behaviour in 6 cases (50%), depending on monorhythmic discharge, either ictal or BIRDs, focal or multifocal spikes, as well as excessive centrottemporal SETs.

*EEG as a prognostic tool:*
Consensus between the EEG predicted prognosis and the short term clinical outcome was confirmed in 7 cases out of 12 (58.3%) of the seizures group. No significant difference was found between the two prognoses (p: 0.16), which means that EEG prognosis coincided with clinical prognosis. Thus EEG could predict the short term prognosis (Table 10).

| Table 1. Mean ages (weeks) of different subgroups of the studied neonates. |
|------------------|------------------|------------------|------------------|
|                  | PT               | FT               |
|                  | Case            | Control          | Case            | Control          |
| GA   | Mean X  | 35.5  | 34.2  | 39.2  | 39.5  |
| GA   | SD      | 1.6   | 2.1   | 1     | 0.5   |


| Table 2. Prevalence of different clinical subtypes of seizures. |
|------------------|------------------|------------------|
| Type            | No.              | %               |
| Subtle          | 6                | 50%             |
| Clonic          | 7                | 58.3%           |
| Tonic           | 4                | 33.3%           |
| Myoclonic       | 5                | 41.7%           |

More than one seizure type might be presented in a single neonate.
Table 3. Neurological deficits among seizure group.

<table>
<thead>
<tr>
<th>Finding</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td>Focal</td>
<td>1</td>
<td>8.3%</td>
</tr>
<tr>
<td>Mild diffuse</td>
<td>5</td>
<td>41.7%</td>
</tr>
<tr>
<td>Marked diffuse</td>
<td>3</td>
<td>25%</td>
</tr>
</tbody>
</table>


Table 4. Sleep state differentiation among infants of seizure group.

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well differentiated</td>
<td>6</td>
<td>50%</td>
</tr>
<tr>
<td>Excessive TS</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td>Undifferentiated</td>
<td>3</td>
<td>25%</td>
</tr>
</tbody>
</table>

TS: transitional sleep.

Table 5. Relative durations of sleep states among cases and controls.

<table>
<thead>
<tr>
<th></th>
<th>Seizure group</th>
<th>Control group</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean X ± SD</td>
<td>Mean X ± SD</td>
<td></td>
</tr>
<tr>
<td>AS</td>
<td>49.5 % 8.5</td>
<td>51% 7.3</td>
<td>0.668</td>
</tr>
<tr>
<td>QS</td>
<td>34.3% 8.6</td>
<td>44.1% 6.8</td>
<td>0.007</td>
</tr>
<tr>
<td>TS</td>
<td>16.2% 10.1</td>
<td>7% 2.8</td>
<td>0.006</td>
</tr>
</tbody>
</table>

AS: active sleep; REM; QS: quiet sleep; NREM; TS: transitional sleep from one stage to another.

Fig. (1): Relative duration of sleep states among cases and controls.
Table 6. Abnormalities in different components of EEG background activities among seizure group.

<table>
<thead>
<tr>
<th>Disturbance</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial org.</td>
<td>4</td>
<td>33.3</td>
</tr>
<tr>
<td>Discontinuity</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>Persis. slowing</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>Asynchrony</td>
<td>2</td>
<td>16.7</td>
</tr>
<tr>
<td>Low Amplitude</td>
<td>2</td>
<td>16.7</td>
</tr>
<tr>
<td>Asymmetry</td>
<td>1</td>
<td>8.3</td>
</tr>
<tr>
<td>Reactivity</td>
<td>1</td>
<td>8.3</td>
</tr>
</tbody>
</table>

Discontinuity: continuous vrs. intermittent activity, asynchrony: bursts of similar activity of homologus head regions separated by >2sec, asymmetry: amplitude difference between hemispheres >1:2.

Table 7. Voltage amplitude differences during continuous sleep states among cases and control.

<table>
<thead>
<tr>
<th></th>
<th>Seizures</th>
<th>Control</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>MP</td>
<td>136.8</td>
<td>56.8</td>
<td>186.7</td>
</tr>
<tr>
<td>CSWS</td>
<td>185.7</td>
<td>37.8</td>
<td>266.1</td>
</tr>
</tbody>
</table>

MP: mixed pattern; CSWS: continuous slow wave sleep.

Fig. (2): Amplitude of voltage in continuous sleep states.
Table 8. Abnormalities in EEG maturity in seizure group.

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistent with CA</td>
<td>7</td>
<td>58.3%</td>
</tr>
<tr>
<td>Mild anachronism</td>
<td>2</td>
<td>16.7%</td>
</tr>
<tr>
<td>Severe anachronism</td>
<td>1</td>
<td>8.3%</td>
</tr>
<tr>
<td>Undifferentiated</td>
<td>2</td>
<td>16.7%</td>
</tr>
</tbody>
</table>

CA: conception age. Anachronism: persistence of immature pattern; mild if conception age discrepancy of 2-3 wks, severe if conception age discrepancy more than 4 wks.

Table 9. Prevalence of abnormal superimposed patterns in seizure group some cases showed more than one abnormality.

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monorhythmic</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td>Dysrhythmic</td>
<td>4</td>
<td>33.3%</td>
</tr>
<tr>
<td>PRWS</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td>SET</td>
<td>6</td>
<td>50%</td>
</tr>
</tbody>
</table>

PRWS: positive rolandic sharp waves; SET: sharp electroencephalographic transients.

Table 10. Relation between EEG based prognosis and short-term clinical outcome.

<table>
<thead>
<tr>
<th>EEG prognosis</th>
<th>Clinical prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
</tr>
<tr>
<td>Normal</td>
<td>2</td>
</tr>
<tr>
<td>Mild</td>
<td>4</td>
</tr>
<tr>
<td>Moderate</td>
<td>5</td>
</tr>
<tr>
<td>Severe</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
</tr>
</tbody>
</table>

P value: 0.16
Trace (1a,b): This tracing shows excessive slowing in Rt. frontal region (1a), shifting later on to Lt occipital region (1b). Last lead is nearly isoelectric because of scalp canula, notice also the evident ECGs artifact in most leads. This infant was 39 wks CA, with neonatal sepsis and jaundice manifested by generalized and multifocal myoclonic seizures.
Trace (2): Excessive discontinuity for age considering that the CA for this infant, being 42 wks (sure date), however the interburst interval duration exceeds 8 seconds in most of the recording. No continuous activity was recorded at all during her quiet sleep.

Trace (3): Excessive asynchrony for reported age of this 40 wks infant of diabetic hypertensive mother, as evidenced in trace alternation (TA) epoch of the record. Interhemispheric synchrony should be 100% for term infants. Here it is about 80-85% only, other dysmaturity findings were also present.
Trace (4): Delta brushes are present in excess for this 40 wks CA infant, of a diabetic hypertensive mother. Along with excessive discontinuity in his quiet sleep, both are considered as an evidence of dysmaturity. However, couldn’t be assigned transient or persistent as he was discharged before follow up. Background here is of mixed frequency pattern characteristic of active sleep state.

Trace (5): Positive rolandic sharp waves are seen in excess in this 39 wks CA baby with hypoxic ischemic encephalopathy, and seizures of multiple types.
Trace (6): Negative temporal sharp waves can be no longer considered normal in this 39 wks CA infant with hypoxic ischemic encephalopathy and recurrent seizures.

Trace (7): BIRDs (brief intermittent rhythmic discharges) are present in excess in both frontal regions of this 39 wks CA baby with hypoxic ischemic encephalopathy. They are usually preceding or just following the burst interval of TA pattern, with no clinical manifestation. No source of artifact could be recognized during recording. The discharge has a rhythmic evolution 7-8 Hz, and then disappears within 4-5 seconds, alternating between both sides.
DISCUSSION

Seizures in the newborn are one of the neonatal emergencies. Prompt diagnostic and therapeutic plans are necessary. However, unresolved issues continue to challenge the physician’s evaluation of the newborn with suspected seizures because neonatal seizures may be strikingly different from the clinical and electrical seizures of older children and adults. Another crucial issue is that the gap between the onset of brain insult and EEG recording may predispose to renormalization of its patterns.

EEG is a valuable aid in the diagnosis of neonatal seizures. EEG correlates to neonatal seizures are focal or multifocal spikes or sharp waves and focal monorhythmic discharges. The interictal EEG may have a prognostic value. Severe suppression of the background activity is associated with an abnormal outcome in more than 90% of cases. In contrast, a normal background activity is rarely associated with subsequent neurological abnormalities.

In the current study we have tried to answer three principle questions, as regards (a) the ability of interictal EEG to confirm the diagnosis of epileptic nature of a seizure manifestation, or to disprove it, (b) to predict the short term prognosis for such cases.

Many authors had agreed that subtle seizures are the most common clinical subtype, however, in our study it is second in order after clonic seizures. This can be simply attributed to under observation of these fine phenomena by the nursing stuff. Otherwise, other subtypes were in the same order as for other studies. Additional factor to be mentioned is the common presentation of more than one type of seizure in most cases, which is in agreement with the former studies.

Among the seizure group, significant abnormalities of wake/sleep state differentiation were apparent in half of the cases, either as excessive transitional sleep or complete undifferentiation and lack of cycling characters. It has been reported that good differentiation of sleep state cycling is a healthy predictor. Moreover, absence of sleep organization for 2-3 day in association with seizure may be indicative of an unfavorable prognosis. Our study showed similar findings where there was a significant difference regarding sleep differentiation between seizure cases and normal controls.

Stockard-Pope and colleagues (1992) reported that, in some cases with seizures or on AEDs, relative duration of AS was diminished and that of QS was increased, but in the current study, the absolute duration of QS was significantly decreased in the whole seizure group as compared with the controls. When relative durations were calculated, this relative decrease was still significant. Also relative duration of the TS was significantly higher in the seizure group.

All items of EEG background activity were involved, where one or more items were abnormal in each case. Spatial organization abnormalities were the most common among other items (33.3%) of cases, despite being neglected in analysis of the background in many studies. However, no specific pattern of the background seemed to be characteristic of seizure type.

Slow dysrhythmias were found to be a non specific pathological pattern, but as for carrying poor prognosis per se, the little sample size made its correlation with clinical prognosis inapplicable, but many other authors suggest this bad prognosis.

The voltage amplitude in the continuous portions of different sleep states were correlated between the seizures and control groups, revealing significant decrease in mixed frequency pattern of AS, and highly significant decrease in voltage amplitude in CSWS of QS among seizure group. That may be confirmed with the recent advances in amplitude integrated studies, for different diagnostic and prognostic purposes of neonatal EEG.

Normally superimposed patterns have their significance when related to the CA of the studied sample. As mean CA of the seizure group is toward term, abnormalities of the frontal dysrhythmia were the most apparent, as other normal patterns markedly diminish in this age range. The abnormalities are non specific, but
sensitive for different causes of encephalopathy, as evidenced in many studies\textsuperscript{22,25,26}. We could not comment on the relationship between EEG patterns and different underlying pathologies due to the small sample size and lack of etiologically directed investigations, other studies reported on this correlation\textsuperscript{15,27}.

Interictal patterns suggestive of an epileptogenic pathology are of much debate regarding their reliability. However, centro-temporal SETs were seen in 50% of the seizures group, in agreement with studies of Clancy\textsuperscript{28}, Clancy & Legido\textsuperscript{29}, Scher et al.\textsuperscript{30}, Hughes et al.\textsuperscript{31} and Clancy\textsuperscript{26}. Monorhythmic discharges carry another debate as being ictal or inter-ictal\textsuperscript{32}, but it was evident without clinical ictal manifestations in 25% of cases; only one case had this pattern lasting for more than 10 sec. Depending on such patterns to diagnose the epileptogenic origin of suspected behaviors is in consensus with other studies\textsuperscript{29,30,33,34,32}.

Our study is comparable to others as regards the yield of EEG in confirming a seizure activity. The percentage of cases proved to be epileptic by EEG criteria is 50% as compared to 60% in the largest study of such issue performed upon 4575 cases along 11 years.\textsuperscript{35} This confirmatory rate had increased by 17% when nonspecific background abnormalities were considered. Thus, the use of EEG in differentiating seizures from non-ictal activities can be more or less satisfactory.

As regards the choice of AEDs, with the fact that all cases had their seizures controlled, within different durations, except the only one who died, the effect of AED was consistent with other studies\textsuperscript{13,36,37,38}. All emphasizing that choice of AEDs in neonatal seizures lies mainly on traditional and individual experiences but not on a scientific base. The need for re-evaluation of the role of different AED raises the question about the limits of the role that can be achieved using EEG specific criteria.

In consensus with other studies, interictal EEG background carried the most significant value of this study in predicting short-term clinical outcome. Most other studies had confirmed the same result for much more time windows, and with more than one serial EEG studies\textsuperscript{22,30,39,33,34,40,23,21}.

**Recommendations:**
- Routine 2nd day EEG for all neonates who are neurologically at risk can benefit in diagnosis and prognosis and serve as a baseline for subsequent insults.
- Follow up EEG can be employed as a part of a battery of investigations for neonates with neurologic symptoms.
- Introduction of EEG-based symptomatic treatment for neonatal seizures, which is still understudied field.

**REFERENCES**
الملخص العربي

دور رسم المخ الكهربائي فيما بين النوبات في تشخيص وتابعة حالات تشنج المتكرر لدى الأطفال حديثي الولادة

لم تتكن الدراسة الاستقصائية الأولوية في رسم المخ الكهربائي لأي حالة محددة، وفي دراسة التطورات المختلفة للمخ انتهى إلى النمو الطبيعي أو الخلل للعصب المركزي خلال الأطراف التلقائية في حالة الولادة، ففي الأول، فإن هذه الاضطرابات البارزة في الولادة، ومن هذه الاضطرابات، النوبات الصرعية والذين يعانون الاضطراب البارز البارز لدي حديثي الولادة، مع ما يمكنها من معجبات تواجد كل طبيب يقوم للتحري بين هذه النوبات وبين الحركات الطبيعية لدى الوليد، بل وبين الحركات النائجة عن الاتي مرضية أخرى.

أهداف الدراسة: 1) تحديد الاضطرابات الفيزيولوجية لرسم المخ الكهربائي لدى الأطفال حديثي الولادة في حالات النوبات الصرعية المتكررة ودورها في التشخيص وتابعها هذه الحالات 2) دراسة العلاقة بين التشخيص البياني على صورة رسم المخ وقدرات التشخيص بالمسار العلاجي لكل حالة على حد وبناء بين تطورها الناهي.

ملاحظات عينة البحث وخطوات الدراسة: أشتملت الدراسة على 24 وليداً، بناء على مواصفات حددها البحث. 12 حالة مصابة بنتيجة عينات من النوبات الصرعية من 6 مترسون و 6 كابلو النمو و 12 حالة من الأطفال الطبيعيين كمجموعة ضابطة بنفس التوزيع العرقي.

خطوات الدراسة: 1) تاريخ مرضي مفصل للعائليات والوليد مع توصيف دقيق و كامل لشهادات عيان لكل حالة، التطورات الفيزيولوجية لرسم المخ الصرعية. 2) اجراء الاتجاه العلاجي المعتمدة. 3) تجربة رسم المخ الكهربائي رقمي لكل حالة بالمصلحة القصيرة بنظام 20-40 دقيقة. 4) لعدة لا تتقل عن 6 ديقي. 5) التحليل البصري لصورة رسم المخ.

نتائج البحث: أن قيمة رسم المخ البارز لدى الولادة تتنام في كونه وحصا أمنا في قدرته على التنبؤ بالمسار المرضي للطفل حديث الولادة. إن رسم المخ الكهربائي بين النوبات الصرعية له القطرة على استقصاء طبيعة هذه النوبات ومدى نشأتها عن الاضطرابات المخ الكهربائية، وذلك قد أدرك أو نبني التشخيص بالإصلاحات الضرع وما يترتب على ذلك من الإفراط أو التفريغ في استخدام التفاير المكتشفة للصرع، وما لذا من أثر ضار على الوليد.