Long Term Polygraphic Study of Paroxysmal Events in Infancy and their Relationship to Sleep

Ann Ali Abdel Kader¹, Manal El-Kattan², Shahira Mostafa¹, Amira El-Gohary¹, Gihan Ramzy², Amani Nawito¹
Departments of Clinical Neurophysiology¹, Neurology², Cairo University

ABSTRACT

Background: The differential diagnosis of paroxysmal disorders is very broad in children. Objectives: This work aims at accurate diagnosis and classification of paroxysmal events in infancy by linking EEG data with the clinical semiology of these events and investigating the effects and relationship of these paroxysmal events and sleep. Methods: The present study included 50 infants ranging in age from 5-24 months complaining of paroxysmal events. They were subjected to long term EEG polygraphic study with concomitant video recording in addition to monitoring of additional physiological parameters as EOG, EMG, EKG, and respiration. The study included also recording during spontaneous sleep. Results: The event detection rate was 84%. 64% of the patients were diagnosed as epileptics and 28% had nonepileptic events leaving 8% of the studied patients undiagnosed. Recording during sleep showed activation of some and suppression of other clinical seizures during certain portions of the sleep-wake cycle in addition to alterations in distribution or morphology of epileptiform waveforms for the epileptic events. As for the nonepileptic events many of the recorded events were sleep-related paroxysmal events. Conclusion: EEG polygraphic monitoring with video recording helps in distinguishing nonepileptic attacks from epileptic seizures and defining seizure type and syndromic classification. Many of the paroxysmal events in infancy demonstrate a relationship to sleep. (Egypt J. Neurol. Psychiat. Neurosurg., 2009, 46(2): 409-420)

Key words: paroxysmal events; polygraphic recording; long term EEG

INTRODUCTION

Accurate diagnosis of children with episodic events is often difficult, even after observing the attacks. Seizures are commonly the leading diagnostic consideration but historic data needed to confirm the diagnosis are often unknown; the physical examination is rarely helpful. Outpatient electroencephalography (EEG) frequently does not provide useful information because of the limited time period sampled. On the other hand, long term EEG-monitoring, especially with simultaneous electromyography (EMG) and video recording temporally links EEG data with paroxysmal behavioral events. Reliable studies have been obtained in older children and adults, whereas fewer studies have been conducted in younger patients. With time synchronized video-EEG (VEEG) monitoring the diagnosis of neonatal seizures can be established. In children not every event that involves jerking, staring, or impairment of consciousness is a seizure. All kinds of behavior can look like seizures including: daydreaming, "blue" breath-holding spells, pallid infantile syncope, and movement disorders.

Episodic, stereotyped behavior may also be related to sleep e.g. parasomnias, which are defined as episodic nocturnal behaviors, often involving disorientation, autonomic and, skeletal muscle disturbances; these parasomnias include: night terrors; somnambulism: sleep walking, sleep talking; sleep starts which may occur in 60-70% of the normal population; also bruxism, and rhythmic movement disorders as repetitive stereotypic movements involving large muscle groups as body rocking, head banging, head rolling.
The aim of this work was to diagnose and classify paroxysmal events in infancy by linking EEG data with the clinical semiology of these events and also to investigate the effects and relationship of these paroxysmal events and sleep.

SUBJECTS AND METHODS

Subjects:
The present study included 70 infants, 50 patients and 20 age and sex matched normal infants. The patients recruited for this study were either diagnosed previously as epileptics and had already started antiepileptic treatment, or were suspected to have epilepsy, but the clinical history and/or the EEG were uninformative. We included infants between 30 days and 2 years of age, giving a history of a paroxysmal event, whether motor or behavioral, with a frequency of at least twice weekly. Neonates, patients older than 2 years, and patients with infrequent events were excluded. Mean age of the patients was 14.17±6.39 months they were 28 males and 18 females.

Methods:
I. **Clinical evaluation**: 1. detailed clinical history was obtained from the parents with special reference to the description of the paroxysmal event and the circumstances surrounding its occurrence, in addition to family history, perinatal history, and developmental milestones. 2. A general and neurological examination was carried out to the patients. The examination sheet was adopted from the neuropediatric sheet of the neurology department, Cairo University.

II. **Neurophysiologic assessment**: 1. Conventional EEG recording: All patients had at least one conventional EEG record done before being referred; all were under sedation, with no events recorded. Intermittent photic stimulation was used as a provocative procedure. 2. Long term video EEG/polygraphic recording was performed for all infants for at least 12 hours, including during sleep.

III. **Imaging**: brain CT and/or MRI of the patients were reviewed for structural abnormalities.

**Statistical analysis**:
An IBM compatible PC was used to store and analyze the data and to produce graphic presentation of important results. Calculations were done by means of statistical software package namely “MEGASTAT”. Statistical analysis included: the arithmetic mean, standard deviation, standard error, hypothesis student’s “t”, $X^2$, and Pearson’s correlation tests.

RESULTS

Of the tested 50 patients four were excluded from the study. In these patients the event in question was not recorded by the video EEG-polygraphic recording, the history included non specific complaints as: staring, back arching, jerking, shaking, and irritability. The interictal EEG did not show enough data to form a diagnosis.

According to the long term video EEG-polygraphic recording; patients were subdivided into the following groups:

- **Epileptic Group**: 32 patients (64%). This group included 28 patients whose event in question was recorded on video and the semiology of the event and/or the simultaneous EEG record were consistent with the diagnosis of epilepsy; and 4 patients (8%) with interictal EEG showing discharges clearly consistent with the diagnosis of epilepsy but no clinical events were recorded.

- **Non epileptic group**: 14 patients (28%). This group included patients whose event in question was recorded. Neither the semiology of the event nor the simultaneous EEG record suggested the diagnosis of epilepsy.

**Clinical data**:
The clinical data of epileptic and non epileptic groups are compared (Table 1).

**EEG data**:
I. **Conventional EEG**
None of the index events were captured during the short recording time of the conventional EEG. 21(42%) patients had abnormal EEG records. These sleep EEG records showed:
a. **Background activity:**
Normal physiological EEG sleep phenomena as sleep spindles, K complexes and vertex waves were poorly formed in 18(85%) patients; their background activity was mostly obscured by abnormal discharges. The other 3(15%) showed a normal for age sleep record.

b. **Abnormal discharges:**
Abnormal EEG changes were detected in 21 patients with the following distribution:
- Generalized discharges: 18(85%) patients showed generalized epileptogenic discharges, 7(39%) of them showed the suppression burst pattern. 4(22%) patients showed generalized slow (1.5-2.5 Hz) spike wave complexes.
- Focal discharges: Focal sharp waves and sharp slow wave complexes were detected in 3(14.2%) patients (Left temporal; bilateral temporo-parietal and right temporal).
- Photic stimulation as provocative procedure did not add further information.

II. **Long Term VEEG data**
All patients underwent long term VEEG recording while they were awake and during natural sleep; photic stimulation as provocative technique was used as well as inducing arousals. It showed the following data:

a. **Background activity:** The background activity rhythms were compared to that of the age matched control subjects and revealed: 23(50%) patients had generalized background activity disturbances:
- 5 patients (21.7%) had generalized slowing for age (in the delta frequency range), their sleep EEG showed poorly formed physiological EEG sleep phenomena as sleep spindles, K complexes and vertex waves.
- 18 patients (78.3%) had in addition to slowing, markedly disorganized background due to abundance of abnormal discharges as slow spike wave complexes (1.5-2 Hz) in 6(33.3%) patients and hypsarhythmia (high amplitude asynchronous slow waves intermixed with multifocal spikes) in 12(66.7%) patients. The same disorganization was also found in their sleep records. There was near complete occupation of the background activity by abnormal discharges to the extent that it was difficult to identify sleep stages.

Comparison between the background activity of the epileptic and the non epileptic groups showed: 22(68.75%) patients of the epileptic and 1(7.14%) patient of the non epileptic groups had background activity disturbance with a statistically significant difference between the epileptic and non epileptic group (P<0.01).

b. **Abnormal EEG discharges and Video-electrographic correlation**

**Epileptic events**
1) **Epileptic spasm:**
Epileptic spasms were seen in 12(37.5%) patients.

**Semiology:** The patients showed flexion of the trunk and extension of the extremities, and abduction of the arms.

**Ictal correlate (Trace 1):** A generalized sharp-slow wave complex followed by attenuation of the EEG activity (electro decrement) lasting for about 10 to 20 seconds followed by restoration of the original rhythm. EMG burst about 500 msec in duration was recorded just following the generalized sharp wave. Other physiologic variables did not show any abnormality.

**Interictal EEG correlate:** In 8(66.7%) patients a typical hypsarhythmic pattern where the background activity was obscured by high amplitude (up to 500 µV) asynchronous slow waves intermixed with multifocal spikes.

The modified hypsarhythmic pattern, where these discharges show some degree of synchronization was seen in the remaining 4(33.3%) patients.

2) **Atypical absence**
Atypical absence seizures (hypermotor seizures) were seen in 6(18.75%) patients.
Semiology: Clinical seizure was diagnosed when there was some degree of change of ongoing activity or association with eyelid fluttering or some lip smacking. It was not possible to assess level of consciousness in these preverbal children.

Ictal correlate: Generalized, diffuse, slow (1.5-2.5Hz), and irregular spike waves suggesting atypical absence. Duration ranged from few seconds to up to 30 seconds. Physiologic variables did not show any additional data except for eye movements recorded in the EOG during eyelid flutter.

Interictal correlate: Background activity was disorganized and slow for age (in the delta range). Interictal bursts showed the same characteristics as the ictal bursts, it was sometimes difficult to differentiate ictal from interictal bursts without the video recording. Two patients showed additional multifocal spikes. 4 patients (12.5%) presented with myoclonic seizures.

3) Myoclonic seizures: were detected in 4(12.5%) patients.
Semiology: The patients showed sudden brief jerks in the form of extension of the trunk and head with extension and abduction of the arms. One patient showed in addition an immediate head drop after this sudden jerk suggesting an additional atonic component.

Ictal correlate (Trace 2): Generalized polyspike-wave discharges 3(75%) of the 4 patients. In the remaining patient (25%) the EEG showed irregular spikes. The duration of the paroxysms was between 1-3 seconds. The very brief EMG burst, about 50 msec in duration, immediately followed the initial spike components. Other physiologic variables did not show any abnormality.

Interictal correlate: Background activity was within normal for age, except in one patient (25%), generalized slowing (delta range) was evident. The EEG showed interictal discharges of generalized brief (2-3 seconds) paroxysms of spike or polyspike-slow wave discharges.

4) Tonic seizures: Generalized tonic seizures were observed in 4(12.5%) patients.
Semiology: Tonic contraction of the limbs, occasionally with tonic neck extension lasting about 20 to 30 seconds, with variable intensities.

Ictal correlate: Generalized voltage attenuation throughout the duration of the fit followed by post ictal depression of the EEG lasting for about 10 -15 seconds. EMG recording showed continuous bursts throughout the duration of the seizure.

Interictal correlate: In 2 patients there were multifocal abnormalities, in one generalized paroxysms of sharp waves, spikes and slow waves, and in the other focal changes (left frontotemporal).

5) Tonic clonic seizure: Tonic clonic seizure was seen in one patient (3.125%).
Semiology: The patient showed extension of the trunk and extremities lasting for about 20 seconds followed by clonic movements of the forearms at the elbows lasting for about 10 seconds. Occasionally at the onset of the seizure the patient showed turning of his body to the right side. The seizure was observed in clusters.

Ictal correlate: Tonic phase: EEG showed generalized voltage attenuation. EMG showed continuous bursts. Clonic phase: EEG was masked by movement artifacts. EMG showed rhythmic bursts coinciding with the clonic movements.

Interictal correlate: The background activity was normal. The patient showed focal sharp waves over the left frontal region.

6) Versive seizure: It was seen in one patient (3.125%).
Semiology: Repeated sustained conjugate eye deviation consistently to the right side, not associated with head version. This seizure was observed in clusters.

Ictal correlate: No clear ictal correlate was detected.

Interictal correlate: Background activity was normal for age. No abnormality interictally.

Non epileptic events
1) Sleep myoclonus: It was found in 5(35.72%) patients.
Semiology: The patients showed sudden jerky extension and abduction of the arms with extension of the lower limbs, with variable intensity. This occurred exclusively during sleep in 4 patients, in one patient it occurred in drowsiness.
Ictal correlate: The EEG showed no epileptic discharges. It showed normal sleep phenomena, as generalizes slowing, vertex waves, sleep spindles and K-complexes, indicating non REM sleep (stage II). A brief EMG between 50 and 100 msec was detected in the polygraph in synchronization with the movements. Other physiologic parameters were normal.

Interictal correlates: Normal for age EEG record.

2) Confusional arousal:
   It occurred in 1 patient (7.14%).

Semiology: During sleep the patient opened his eyes, with a staring look and occasional blinking lasting for about 20 seconds, during which the patient was looking about the room with no apparent response to his mother then the patient returned to sleep.

Ictal correlate: The EEG record showed before the attack sleep spindles (non REM). During the attack the EEG showed generalized slow waves of about 2.5-3 Hz lasting for the duration of the attack, about 20 seconds. By the end of the attack there was gradual restoration of the original rhythm. Other physiologic variables did not show any additional data except for eye movements detected by the EOG.

Interictal correlate: No abnormality could be detected.

3) Movement disorder:
   It was seen in 1 patient (7.14%).

Semiology: The patient experienced attacks of rhythmic side-to-side movement of the head lasting for about 5-10 seconds. These attacks did not seem to interrupt the activity of the child.

Ictal correlate: The EEG recording did not show any apparent abnormality during, before or after these attacks, except for movement artifacts. Other physiologic variables were normal.

Interictal correlate: No abnormality could be detected.

4) Gastroesophageal reflux:
   It was seen in 1 patient (7.14%).

Semiology: Immediately after lactation, especially when put in a supine position the patient showed extension of the neck, upper and lower limbs with frequent swallowing lasting about 2-3 minutes. These attacks occurred 3 times.

Ictal correlate: The EEG record showed only EMG and movement artifacts in relation to the attack.

Interictal correlate: No detectable abnormality.

5) Tonic spasms:
   Those were seen in 1 patient (7.14%), who had spastic cerebral palsy.

Semiology: The patient showed tonic contraction of both lower limbs, extension at the knee and plantar flexion lasting for about 20 to 30 seconds, occurring only during wakefulness.

Ictal correlate: During these attacks the EEG recording showed no detectable abnormal cerebral changes (and were not preceded or followed by any abnormal cerebral EEG changes). EMG activity showed continuous bursts during the attacks.

Interictal correlate: There were left temporal sharp waves, however no relation could be established to the tonic spasms.

6) Cyanotic breath-holding spell:
   It was seen in 1 patient (7.14%).

Semiology: The patient was crying then held his breath, which lead to progressive cyanosis for a few seconds with rapid recovery. The parents confirmed that it was the index event but it occurs more intensely as the child loses consciousness.

Ictal correlate: The EEG did not show any epileptiform discharges. There was cessation of respiratory movements.

Interictal correlate: There was no detectable abnormality.

7) Sleep disordered breathing:
   It was found in 1 patient (7.14%).

Semiology: The parents reported nocturnal arousals with difficulty in breathing. However these attacks were not recorded.

On the other hand the patient showed oxygen desaturations up to 82% in comparison to a baseline saturation of 98%.

Ictal correlate: EEG was normal for age. EOG showed REMs. The nasal flow showed cessation of breathing. The respiratory movements were continuing.

Interictal correlate: No detectable abnormality.
Sleep onset related movements:
It was seen in 2 (14.3%) patients.

Semiology: At the sleep onset period the patients showed side to side head movements and up and down leg movements respectively these occurred exclusively at sleep onset.

Ictal EEG: Normal for age. Some movement artifacts were recorded.

Interictal correlate: No detectable abnormality, no periodic leg movements were recorded.

Non epileptic staring: It was seen in 1 patient (7.14%).

Semiology: Abruptly the patient had a blank stare lasting for about 20 seconds; distraction of the patient ended the episode.

Ictal: Normal EEG record for age.

Interictal: Normal EEG record for age.

Relationship to sleep:
In addition to wake recordings all patients were also recorded also during sleep. No medications were used to induce sleep; the patients were left to sleep naturally. The change, if any, of the paroxysmal event during sleep was reviewed as well as in the concurrent changes in the EEG and/or polygraph. These changes were reviewed in relation to REM and non REM sleep.

Non epileptic events

Semiology
- Events occurring exclusively during sleep: sleep myoclonus, sleep onset related rhythmic movements, confusional arousals, and sleep disordered breathing
- Events occurred during wakefulness and sleep: gastroesophageal reflux
- Events that did not occur during sleep: movement disorder
- Events related only to wakefulness: cyanotic spell, and staring episode

EEG data
- Normal for age phenomena. In addition to EMG and movement artifacts.
- Confusional arousal showed: during the event the EEG showed generalized slowing about 4 c/sec. The event arose from stage 2 non REM sleep.

Epileptic events

Semiology: No patients had their seizures occurring solely during sleep.
- Epileptic spasm and tonic seizures: These seizures occurred less frequently and more subtle during sleep. They were observed mainly during stage 2 non REM sleep and could not be detected in stage REM.
- Epileptic myoclonus was related mainly to sleep onset and to awakenings.
- The tonic-clonic seizure did not occur during sleep.

It was not possible to detect versive or absence seizure during sleep.

EEG data
- Hypsarrhythmia: Typical hypsarrythmic pattern consisting of high amplitude slow wave mixed with multifocal spikes changed during sleep to suppression burst activity formed of bursts of sharp waves and slow waves alternating with a nearly flat EEG.
  Atypical pattern, which showed some degree of synchrony during wakefulness, synchronization increased during non REM sleep with an evident suppression burst pattern. During REM sleep the hypsarrhythmic pattern decreased notably.

Slow spike wave pattern:
During non-REM sleep, discharges were more generalized, more frequent, and consist of polyspikes and slow waves. In REM sleep, spike waves decreased (Trace 3, 4).
- Polyspike wave pattern: Incidence of bursts increased at sleep onset then dropped as sleep progressed; when arousal was reinforced there was an abrupt increase in the rates of the interictal discharges.
- Focal and multifocal discharges: Focal and multifocal discharges were more frequent during lighter non REM sleep with propagation to ipsilateral and contralateral foci with occasional generalization.
### Table 1. Clinical data of epileptic and non epileptic groups.

<table>
<thead>
<tr>
<th>Past history:</th>
<th>Epileptic n=32</th>
<th>Nonepileptic n=14</th>
<th>Total n=46</th>
<th>Chi² value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eventful</td>
<td>20(62.5)</td>
<td>2(15.4)</td>
<td>22(47.83)</td>
<td>9.07</td>
<td>&lt;0.01 HS</td>
</tr>
<tr>
<td>Not eventful</td>
<td>12(37.5)</td>
<td>12(85.7)</td>
<td>24(52.17)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Family history</th>
<th>Epileptic n=32</th>
<th>Nonepileptic n=14</th>
<th>Total n=46</th>
<th>Chi² value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ve consanguinity</td>
<td>3(9.4)</td>
<td>2(14.3)</td>
<td>5(10.9)</td>
<td>0.24</td>
<td>&gt;0.05 NS</td>
</tr>
<tr>
<td>-ve consanguinity</td>
<td>29(90.6)</td>
<td>12(85.7)</td>
<td>41(89.1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cl. Neurological signs:</th>
<th>Epileptic n=32</th>
<th>Nonepileptic n=14</th>
<th>Total n=46</th>
<th>Chi² value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>3(9.4)</td>
<td>1(7.1)</td>
<td>4(10.86)</td>
<td>0.06</td>
<td>&gt;0.05 NS</td>
</tr>
<tr>
<td>Negative</td>
<td>29(90.6)</td>
<td>13(92.9)</td>
<td>42(89.14)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Developmental milestones:</th>
<th>Epileptic n=32</th>
<th>Nonepileptic n=14</th>
<th>Total n=46</th>
<th>Chi² value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delayed</td>
<td>22(68.75)</td>
<td>2(14.3)</td>
<td>24(52.17)</td>
<td>11.58</td>
<td>&lt;0.01 HS</td>
</tr>
<tr>
<td>Not delayed</td>
<td>10(31.25)</td>
<td>12(85.7)</td>
<td>22(47.83)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Trace (1): [Case no. 3] Ictal pattern of epileptic spasm showing electrodecrement
Trace (2): [Case no. 29 a one year old boy] Slow spike wave complexes (2 Hertz) in a patient showing a myoclonic seizure, with an EMG burst just following the spike component.

Trace (3): [Case no. 26 a 2 years old boy] Slow spike-wave complexes (1.5 - 2 Hz), patient awake, interictal
DISCUSSION

Paroxysmal motor and behavioral events in infants and children are frequent occurrences\(^7,8\). Accurate diagnosis is crucial to proper management. Clinicians have traditionally relied on routine EEG; however, the index event is rarely captured during the brief recording time\(^9\). Long term monitoring by video EEG (LTMVEEG) produces a record of the index behavior, permitting physician observation of all episodes\(^8\).

The present study included 50 infants ranging in age from 5 to 24 months complaining of paroxysmal events. They were subjected to long term EEG polygraphic study for at least 12 hours with concomitant video recording. The study included also recording during natural sleep to investigate the relationship between these paroxysmal events and sleep, which may help in establishing the nature of the event.

In the present study 42 out of 50 patients (84\%) had their events recorded, leaving 8(16\%) patients with no recorded events. The question—epilepsy versus no epilepsy—could be reached, in spite of not recording the event, in 4(8\%) patients who had interictal discharges consistent with an epileptic seizure disorder which correlated with the clinical data of each patient, (these interictal discharges were not previously recorded by conventional EEG recordings).

The conventional EEG record showed a normal study in 29 patients thus not aiding in the diagnosis of the paroxysmal event especially the distinction between epileptic and non epileptic events. Using the long term polygraphic study a diagnosis could be reached in 25(86.2\%) of them. The study showed that 14(56\%) patients had nonepileptic events and 11(44\%) had epileptic events.

Studies have demonstrated that poor response to treatment due to inappropriate choice of antiepileptic drugs may be a result of incorrect
diagnosis of seizure type. They found that uncertainties in the clinical diagnosis of seizure based on historic data and routine EEG are more common in complex partial seizures, myoclonus, tonic/atactic seizures, infantile spasms, and atypical absence. Our findings agree with this study as we found 4(12.5%) patients with tonic seizures, 4(12.5%) with myoclonic and 12(37.5%) with epileptic spasm one (3.125%) versive and one (3.125%) tonic clonic.

In our study 7 patients were referred with behavioral symptoms (arrest of behavior; staring). The child who stares is a frequently encountered problem. The "gold standard" of differentiating non epileptic staring from seizures is ictal VEEG recording. We found through ictal recording, one patient was diagnosed as nonepileptic staring where during the staring episode no EEG changes were identified and 6 had with atypical absence showing generalized slow spike slow wave complexes (about 2Hz). As regards the semiology the patient with the non epileptic staring did not show any automatisms while the patients with atypical absence showed automatisms in the form of eyelid twitching or lip smacking in addition to arrest of behavior.

In the present study 21 patients (65.6 %) of the epileptic group could be classified according to International League Against Epilepsy (ILAE) classification. We found 2(9.5%) patients with focal epilepsy and 19(90.5%) patients with generalized epilepsy. 73.6% fall under the category of symptomatic generalized epilepsy as they had abnormalities in their imaging studies. This group included 63% with West syndrome and 29% with Lennox Gastaut syndrome. Steffenburg et al.13 and Moser et al.14 found abnormal MRI studies in their studies with children with intractable epilepsy (in 70% and 86%, respectively). Patients with epileptic spasms, in our study, constituted 24% of the total number of patients, and 37% of the epileptic group. Foley et al.4 did not have any patients with epileptic spasms while in the study of Chen et al.5, they formed 11% of the total number of patients, the high percentage of the infantile spasm in our study, which is largely due to an underlying etiology, could be attributed to perinatal insults especially obstructed labour. Of the patients with generalized epilepsy, 5(26.4%) patients were diagnosed as cryptogetic as imaging were normal, 4 patients of them showed slow spike wave complexes (1.5-2Hz) and atypical absences as could be seen in Lennox Gastaut syndrome and one patient showed myoclonic atonic components without absences and a disturbed background activity which could be in favor of myoclonic atatic epilepsy.

Thus regarding the classification of the epileptic events in our study we could classify all the seizures recorded in the epileptic group according to the semiological classification, while classification according to ILAE criteria could be achieved in 21 of the epileptic patients (65.6%).

As regards the nonepileptic events, we found 14 patients were found to have nonepileptic event forming 28%. Whereas in the study by Foley et al.4 they were 46%, Chen et al.15 they formed 65 %, Bye et al.17 they were 43% and Kotagal et al.18 they formed 15%.

In our study we found that the most common nonepileptic event was benign sleep myoclonus forming 35.7% of cases which is similar to the study by Foley et al.4, who found that benign physiological events such as sleep myoclonus formed 39% however Bye et al.17 found that non epileptic staring to be the most common non epileptic event. Chen et al.15 found the most common nonepileptic event in their study to be repetitive brief movement as twitching and jerking, similar to Kotagal et al.18 found the most common diagnoses to be stereotyped movements.

We investigated the relationship to sleep in both the epileptic and non epileptic events. As regards the non epileptic events 9(64%) patients were complaining of events related to sleep which was spontaneous with no sedation. They included 5 patients with benign sleep myoclonus, 2 patients with sleep onset related movements, 1 patient with confusional arousal and 1 patient with sleep disordered breathing. These events occurred exclusively in relation to sleep as recorded in our study, and were not recorded in the conventional EEG which was done under sedation and was about 20 minutes in duration. Chen et al.15 found 21% of the nonepileptic events to be sleep related. The tonic spasm and the movement disorder were not recorded during sleep. While the gastroesophageal reflux was recorded in wakefulness and sleep, however we noticed that it was related to the supine position rather than to wakefulness and sleep.
As regards the epileptic events atypical absence seizures were not detected during sleep. The patient may have had a seizure during sleep but it was not possible to be detected. The same was applied to the patient with versive seizure. Here in addition there was even no ictal pattern recorded during wakefulness. However all the patients with infantile spasms, tonic seizures and the patient with the tonic clonic seizure had their seizures occur during sleep, in non REM mostly stage 2, the seizure however was less in frequency and in intensity? These findings are stated by Dinner and Aneja and Gupta. The myoclonic seizures occurred in relation to drowsiness and sleep onset and with forceful awakening it occurred in clusters, a finding similar to Aneja and Gupta.

As regards the EEG patterns all interictal EEG pattern showed a change during sleep, in non REM, while they decreased notably in the REM stage. These data were also stated by Aneja and Gupta. The hypsarrhythmic pattern change to suppression burst activity the slow spike wave discharges became more generalized, more frequent, and consist of polyspikes and slow waves. The polyspike wave burst increased mainly at sleep onset and with arousal.

Focal and multifocal discharges were more frequent during sleep with occasional generalization. These findings were also stated by Aneja and Gupta.

Our study showed that the video EEG polygraphic monitoring was of valuable in classification of paroxysmal events in infancy which had an impact on determining the management and the prognosis, although some patients still require further investigation, they represented the minority of the patients.

REFERENCES

1. Wheless JW: Conditions confused with epilepsy 2004.ww.epilepsy.com
17. Bye AM, Kok DJ, Ferenschid FT, Vles JS: Paroxysmal nonepileptic events in children: a


The diagnosis of the conditions generally in children with epilepsy is often a difficult and confusing task. It often takes a long time to establish a correct diagnosis. When the diagnosis is not clear, it is important to consider other possibilities and obtain further tests.
