Video-EEG monitoring of paroxysmal events in the elderly


Objectives – To determine the importance of video-EEG monitoring (VEM) in elderly patients with various paroxysmal events. Material and methods – We retrospectively identified 16 subjects ≥ 60 years old out of 834 (1.9%; 7 females, mean age 67.8 ± 7.7 years), who were admitted to the Video-EEG Unit between 1997 and 2005 and compared data between those with and without epileptic events. Results – Epilepsy was confirmed in six patients, psychogenic non-epileptic seizures (NES) were diagnosed in seven, one patient had NES and epilepsy whereas the recorded events were non-conclusive in two. NES patients had a higher predisposition to psychiatric disturbances (P < 0.02). Following VEM and management alteration, the frequency of monthly events decreased significantly for the cohort as a whole (P < 0.001). VEM directly influenced the diagnosis, treatment and outcome of 14 of 16 (88%) patients. Conclusion – Video-EEM plays a vital role in the evaluation of paroxysmal events in the elderly, but is vastly underutilized in this population group.

Introduction

Epilepsy is one of the most common neurological disorders in the older population and, as the general population ages, the incidence of epilepsy vis-à-vis the age curve is shifting toward older persons (1–3). Diagnosis is often difficult in these patients because of differing presentations of epileptic events on the one hand and non-epileptic events mimicking seizures on the other. Yet, there are only scarce publications on video-EEG monitoring (VEM) as a diagnostic aid for the elderly who suffer paroxysmal events (4–6), and only few studies have assessed the differences in the characteristics of epileptic and non-epileptic seizures (NES) in this age group (4, 7–10).

Epilepsy in the elderly is often of unknown cause or associated with cerebrovascular diseases, central nervous system (CNS) tumors, neurodegenerative diseases, CNS infections, metabolic changes or drug toxicity (1, 3). The extensive variety of symptom manifestations in the elderly complicates diagnosis. Compared with younger patients, the presentation of epileptic events in the elderly is often less specific and has atypical features, among them memory disturbances, confusion, inattention, loss of contact or apparent syncope (6). Moreover, many elderly individuals live alone, and so corroborative evidence from the family is often unavailable. Unlike younger individuals who experience seizures, many elderly patients also suffer concomitantly from other conditions for which they receive multiple medications.

EEG is helpful in the diagnosis of epilepsy and in determining seizure types. A single standard EEG, however, may be too short to detect a specific abnormality. We sometimes need to repeat EEG recordings to discover epileptiform activity and even multiple EEG studies may fail to reveal abnormalities in ~10% of patients with epilepsy (11). Alternatively, nonspecific EEG findings often seen in the elderly population, such as wicket spikes or benign epileptiform transients of sleep, especially in patients with NES, can be misinterpreted as evidence of epilepsy (7, 8, 12, 13) and
may lead to over-interpretation, misdiagnosis and inappropriate treatment (4).

Video-EEG monitoring is the gold standard method for correctly identifying seizures. The aim of the current study was to evaluate the utility of VEM specifically among elderly patients and compare the clinical features of those with epileptic seizures and those with NES.

Materials and methods

We retrospectively reviewed the charts of patients ≥ 60 years of age who had been admitted to our VEM Unit in Tel-Aviv Sourasky Medical Center, a tertiary referral center, between 1997 and 2005. The reasons for their admission to our unit included diagnosis of paroxysmal events, evaluation of suspected seizures, and presurgical evaluation for intractable epilepsy.

The parameters we selected to analyze included age, gender, age of disease onset, disease duration, type of events, frequency and duration of events prior to VEM, physical and psychological trauma, CNS infection, status epilepticus, family history of epilepsy, computerized tomography (CT) and magnetic resonance imaging (MRI), interictal and ictal EEG, antiepileptic drugs (AEDs), neurological examination, other neurological disorders, psychiatric disorders, other diseases, and other medications. During and following VEM, we analyzed the number and length of events, semiology, final diagnosis, change of treatment and outcome and compared these features between patients with epilepsy and patients with NES.

Follow-up information was obtained by telephone and by physician interview.

Results

The patients’ characteristics are listed in Table 1a and 1b. We identified 16 patients ≥ 60 years of age out of a total of 834 (1.9%) patients admitted during the study period. These 16, who comprised our study cohort, included seven females and nine males, mean age 67.8 ± 7.7 years (range 60–82), mean age at disease onset 51.1 ± 21.4 years (20–82), mean disease duration 16.6 ± 17.6 years (4 days–51 years), and mean number of AEDs 1.5 (range 0–5). All patients had experienced at least one of their characteristic events. The mean number of events during VEM was 5.3 (1–14), and the duration of VEM was 6.9 days (1–18). Following VEM, seven (43%) patients had psychogenic NES verified and epilepsy excluded, and six (38%) patients had epilepsy verified, localized and AED treatment adjusted. One patient (6%) had psychogenic NES and epilepsy, while the recorded events were non-conclusive (simple partial seizures or transient ischemic attack) in the remaining two (13%). Of the two latter patients, one is event free and one died. The patients’ median follow-up data were 3 years (range 1–8) that were retrieved from the hospital database over a period of 8 years (1997–2005): one patient was followed for 8 years, 1 for 7 years, 2 for 6 years, 2 for 5 years, 2 for 4 years, 3 for 3 years, 3 for 2 years, 1 for 1 year, while the final patient died shortly after undergoing VEM.

The events were grouped as epileptic and non-epileptic. The criteria for diagnosis of NES were based on a comprehensive evaluation, including a history of non-stereotypic events, the length of events and normal ictal EEG activity during events associated with unresponsiveness.

Table 1 Patients’ characteristics (group comparison)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Patients with epileptic seizures (n = 6)</th>
<th>Patients with non-epileptic seizures (n = 10)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Age, years (range)</td>
<td>69 ± 7.3 (60–82)</td>
<td>67 ± 8 (68–80)</td>
<td>0.54</td>
</tr>
<tr>
<td>Gender (M/F)</td>
<td>4/2</td>
<td>5/5</td>
<td>0.63</td>
</tr>
<tr>
<td>Age at seizure onset, years (range)</td>
<td>41 ± 25 (20–82)</td>
<td>57 ± 17.4 (25–79)</td>
<td>0.15</td>
</tr>
<tr>
<td>Duration of disease, years (range)</td>
<td>28 ± 20.6 (9.08–51)</td>
<td>10 ± 12 (0.04–38)</td>
<td>0.16</td>
</tr>
<tr>
<td>Duration of events &gt; 5 min</td>
<td>0/6</td>
<td>4/10 (40%)</td>
<td>0.09</td>
</tr>
<tr>
<td>Frequency/month of events before hospitalization (range)</td>
<td>31 ± 21 (7–60)</td>
<td>23.5 ± 11.7 (8–42)</td>
<td>0.61</td>
</tr>
<tr>
<td>Number of antiepileptic drugs (range)</td>
<td>2 ± 1.26 (1–4)</td>
<td>1.2 ± 0.92 (0–3)</td>
<td>0.26</td>
</tr>
</tbody>
</table>

| b Physical trauma                              | 1/6                                    | 4/7                                           | 0.27    |
| Psychological trauma                           | 0/6                                    | 2/7                                           | 0.46    |
| Psychiatric conditions                         | 0/6                                    | 5/7                                           | < 0.02  |
| Additional medical conditions                  | 4/6                                    | 7/7                                           | 0.19    |
Patients with Psychogenic NES

All seven patients had been admitted to VEM for the evaluation of paroxysmal events suspected as being epileptic. The clinical presentation of events was unresponsiveness in three patients, generalized weakness and speech arrest in one, disorientation, amnesia, and convulsions in one, involuntary movements of neck, trunk, dystonia and occasional unresponsiveness in one, and unresponsiveness, chaotic movements of hands and repetitive movements of mouth in the seventh. Prior to hospitalization, the patients had between 8 and 30 events per month. The duration of events was less than 5 min in three patients and from minutes to hours in another four patients.

On neurological examination, one patient had mild cognitive decline and another had tremor and right arm rigidity as well as non-organic sensory disturbances. Three patients had nonspecific brain changes consisting of white matter changes, small lacunar infarcts, periventricular unidentified bright objects (UBOs) and parietal atrophy. There had been focal nonspecific slowing in one patient and interictal sharp waves in two patients on routine EEG prior to hospitalization. Five patients had psychiatric conditions [depression, anxiety disorder, post-traumatic stress disorder (PTSD), or conversion disorder]. All seven patients were on AEDs: four were taking one AED, two were taking two, and one was taking three. The AEDs of five of the seven patients were tapered off: three of them have not experienced any paroxysmal events, the frequency of events decreased from daily to once monthly in one, there were no changes in one, while the seizure frequency increased from 15 per month to 8 per week in the fifth patient. Lamotrigine was started in one patient with NES and atypical facial pain and event frequency decreased from 3 per week to 2 per month. In one patient with both NES and epilepsy, the frequency of non-organic events became very rare, although the seizure frequency persisted.

Patients with epilepsy

Among the six patients with VEM-confirmed epilepsy, five had complex partial seizures and one had simple partial seizures. The reasons for their admission were evaluation prior to surgery for intractable epilepsy in two of them, work-up for involuntary movement of left extremities suspicious of epilepsy vs vascular origin in one, and evaluation of increased frequency of seizures as well as for the excluding of additional non-epileptic events in another. Three of these six patients had evidence of a mild cognitive decline. Brain imaging showed mesial temporal sclerosis in three, UBOs in one, and chronic ischemic changes in one. The ictal and interictal EEG was epileptiform in five patients. AEDs were started in one patient with daily events and she has been seizure free and has shown signs of cognitive improvement during the 1.5 years of follow-up. In another patient, seizure frequency decreased from seven to four monthly following changes in her drug regimen. Seizure frequency decreased from two daily to 1–2 per month in one and from 10 to 3 monthly in another. Another patient who had daily events is seizure free. In the sixth patient, the seizure frequency decreased from three daily to three weekly and ultimately to twice monthly. No patient with epilepsy underwent surgery. Of the three surgical candidates, one failed the Wada test, the second patient had bilateral temporal epileptic foci, and the third was 71 years old who had additional diseases and his seizures improved following drug changes.

In summary, the frequency of monthly events among patients in both groups decreased from 26.3 ± 16.2 to 4.7 ± 8.3 (P < 0.001). It declined from 22.8 ± 12.2 to 5.8 ± 10.6 (P < 0.027) in the NES patients and from 31.2 ± 21.1 to 1.8 ± 1.6 (P < 0.031) in the patients with epilepsy. The results of the evaluations following VEM (in %) in all of our elderly patients are shown in Fig 1.

Discussion

We assessed the contribution of VEM in diagnosing elderly individuals with paroxysmal events by comparing changes in the diagnosis of the seizure events, in the patients’ treatment regimens and in the frequency of seizures before and after the evaluation. VEM in our study directly impacted diagnosis and treatment of 14 of the 16 patients (88%). The percentage of patients in this age group within the population of all individuals with paroxysmal events listed in our database was very low (1.9%), and this was similar to the data published in the few available relevant studies: specifically, 1.5% (5), 3.3% (6), 4% (9), 4.6% (4), and 9.6% (14). Epilepsy in the elderly responds well to treatment (3). Recognizing and correctly diagnosing seizures in our study cohort led to optimizing AED therapy. VEM helped us to choose the best treatment for the individual patient based on the type of events. The most appropriate AEDs and dose changes following VEM led either to complete seizure control or a considerable decrease in seizure frequency in all our patients. Two of our six (33.3%) elderly epileptic patients are seizure-free after AED treatment changes and
four (66.7%) of our elderly epileptic patients have fewer seizures. Cognition also improved in one seizure-free patient.

Non-epileptic seizures usually occur in young adulthood or middle age (15), but they were also present in high numbers among our ≥ 60-year-old patients. Several studies reported a high incidence of NES in elderly patients admitted to diagnostic epilepsy centers (7, 14, 16, 17). Kellinghaus et al. (16) showed that almost two-thirds of the elderly patients admitted to an epilepsy center had NES. NES can mimic seizures, and event duration is sometimes similar to that of epileptic seizures, as was seen in some of our patients. Intercital EEG changes are common in patients with NES and can be interpreted as evidence of epilepsy (7, 8, 12, 13). Intercital epileptiform activity in two of our patients with NES and no associated epilepsy led to over-interpretation, misdiagnosis, and inappropriate treatment. Although seven of our patients did not suffer from epilepsy, all were taking AEDs that were unnecessary. Correct diagnosis of NES led to discontinuation of this inappropriate, ineffective, costly and, in some cases, dangerous treatment. Following VEM, the frequency of monthly events decreased significantly in the seven patients with NES: three had no events, there was a decrease in event frequency in two, there were no changes in one, while there was an increase of event frequency in one.

Abnormal routine EEG findings should be interpreted within the clinical context. When the diagnosis of paroxysmal events is in doubt, the patient should be referred for evaluation in a video-EEG unit. The selection of patients with different paroxysmal events, such as short memory disturbances, confusion, inattention, and loss of contact, is very important. Bearing in mind that NES may occur together with true epileptic seizures, VEM can show which kind is more frequent in a given individual and lead to optimizing the treatment.

There is little information on the comparative characteristics of epileptic events and NES among the elderly. Unlike earlier studies, we compared elderly patients with NES and epilepsy and characterized them. Our study looked into these features and showed that the demographic, clinical and imaging data, the history of physical and psychological trauma, and the various other medical conditions were similar in patients with both conditions. Our patients with NES, however, had a higher predisposition to psychiatric disturbances, such as depression, anxiety disorder, PTSD, and conversion disorder \((P < 0.021)\), confirming the findings of others (14).

One limitation of our study is its small sample size. This factor may introduce some selection bias, which is suffered by most tertiary referral centers, and may mean that ours is not representative of the general elderly epilepsy population. Even in this small cohort of patients, however, VEM led to verification of diagnosis as well as to better treatment in 14 of our 16 patients during a relatively short-term hospitalization.

In conclusion, VEM appears to be an under-utilized diagnostic tool in the elderly, as had also been noted by others (4–6). It must be borne in mind that this population has a high prevalence of underlying diseases and a greater vulnerability to different side effects caused by physiological changes, among them toxic AED levels and cognitive and neurotoxic side effects. Optimal management may be promptly administered after correct

![Figure 1. Results of the evaluations following video-EEG monitoring (VEM; in %) in all elderly patients. *One of 16 patients died shortly after undergoing VEM.](image-url)
diagnosis, and the patient’s quality of life may be considerably enhanced as a result. Larger future prospective studies on VEM for the elderly are needed to conclusively validate its more widespread application in this population.

Acknowledgement

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References