A retrospective study of the correlation between duration of monitoring in the epilepsy monitoring unit and diagnostic yield

Mohammad Hijaz Adenan a,b,⇑, Mohamed Khalil a, Kai Sheng Loh a, Luke Kelly a, Arif Shukralla a, Stephen Klaus a, Ronan Kilbride a, Gerard Mullins a, Peter Widdess-Walsh a,b, Michael Kinney d,e, Norman Delanty a,b,c, Hany El-Naggar a,b,c

a National Epilepsy Programme, Beaumont Hospital, Dublin, Ireland
b Royal College of Surgeons, Ireland
c FutureNeuro, Science Foundation Ireland Research Centre, Ireland
d Department of Neurology, Royal Victoria Hospital, Belfast, UK
e Queen’s University, Belfast, UK

ARTICLE INFO

Article history:
Received 14 February 2022
Revised 11 September 2022
Accepted 11 September 2022
Available online 24 September 2022

Keywords:
Diagnosis
Long-term video-EEG monitoring
Conclusive

ABSTRACT

Objective: Long-term video-electroencephalographic (LTVEM) monitoring is a valuable tool in the evaluation of paroxysmal clinical events. However, vEEG itself is costly. Hence, we aimed to establish if longer duration of monitoring (DOM) is associated with higher diagnostic yield.

Method: A retrospective review of patients admitted into the epilepsy monitoring unit (EMU) for the diagnostic evaluation of paroxysmal events was performed. Patients’ demographic, clinical characteristics, and vEEG data were analyzed. In the cohort of patients with DOM > 7 days, the reasons for prolonged DOM were identified and the differences in clinical characteristics and vEEG data between conclusive and inconclusive studies were analyzed.

Result: A total of 501 patients were included. Four hundred and thirty-six (87 %) patients had conclusive studies. Of these patients, 67.9 % patients with conclusive studies received diagnosis within the first 7 days of monitoring with the highest on day 7. The likelihood of conclusive studies decreased beyond 7 days. A total of 175 had DOM > 7 days, of which 140 (80 %) had conclusive studies. In the cohort with DOM > 7 days, patients with previous abnormal routine EEG, previous vEEG monitoring, first event recorded before day 5 of admission and events recorded during vEEG monitoring were more likely to have conclusive studies. The most common reason for prolonging DOM beyond 7 days was to adequately record semiologically distinctive events (76 %).

Conclusion: Our study supports that longer DOM is associated with an increase in diagnostic yield. More than one-third of our cohort were monitored beyond 7 days with majority (80 %) being conclusive. Our findings may guide clinicians in planning the DOM and predicting the likelihood of conclusive vEEG studies in patients with prolonged DOM based on the clinical characteristics and vEEG data.

1. Introduction

Long-term video-electroencephalographic monitoring (LTVEM) is a valuable diagnostic tool in the assessment and diagnostic clarification of paroxysmal events and seizures. It aids in the classification of epilepsy syndromes and provides useful evidence for the localization and lateralization of the seizure onset zone in medically refractory epilepsy prior to epilepsy surgery [1].

Diagnostic clarification with LTVEM has clinical and economic implications. Approximately thirty percent of people with psychogenic nonepileptic seizure (PNES) are misdiagnosed with epilepsy [2]. Misdiagnosis results in inappropriate management which may lead to harmful consequences such as iatrogenic harm from side effects of antiseizure medications (ASMs), worse quality of life, excessive driving restrictions, and unemployment [3]. LTVEM is therefore essential for accurate diagnosis and appropriate management. It has been shown that patients who had a confirmed diagnosis of PNES with vEEG monitoring resulted in an 84 % average reduction in seizure-related costs in the first 6 months of follow-up, demonstrating the economic benefits of LTVEM [4].
However, LTVEM is an expensive investigation with substantial upfront costs. Among European countries, the average cost per day for inpatient vEEG monitoring has been reported to be as high as €2200 [5]. In addition, LTVEM is limited to specialized centers resulting in potentially long waiting list of Epilepsy Monitoring Unit (EMU) admission. It is essential that epileptologists utilize evidence-based approaches to justify the duration of monitoring (DOM) for LTVEM.

The primary purpose of this study was to determine if longer duration of monitoring will achieve a higher rate of conclusive studies for patients admitted into the EMU for diagnostic vEEG monitoring.

2. Materials & methods

2.1. Setting and patients

The study was conducted at the EMU in Beaumont Hospital in Dublin, Ireland, which is the national referral center for the investigation of patients with epilepsy and related disorders. A retrospective review was performed on the medical charts and electronic records of all patients with epilepsy admitted from January 2016 to July 2020. Only patients admitted for vEEG monitoring for the evaluation of paroxysmal events were included. Patients who were admitted primarily for presurgical evaluation, invasive intracranial studies, or patients who self-discharged against medical advice were excluded. The patients’ demographic, clinical characteristics, previous routine EEG, neuroimaging reports, and vEEG data were collected. An abnormal routine EEG was defined as diffuse background slowing, focal slowing, or epileptiform activity. Abnormal MRI brain findings included mesial temporal sclerosis, focal cortical dysplasia, vascular malformation, cerebral infarction, tumors, encephalomalacia, cortical atrophy, or demyelination. Non-specific white matter changes or small vessel disease were not considered to be abnormal in this study.

2.2. VEEG monitoring technique

All patients underwent scalp video-EEG monitoring. Electrodes were placed using the standard International 10–20 electrode placement system. Patients underwent continuous vEEG monitoring using the Xltek® EMU40EX® amplifier with Natus® base unit. A handheld push-button was available to the patient or observer if a clinical event occurred. The majority of patients underwent ASM dosage reduction during monitoring. The medication reduction strategy was not standardized in a uniform protocol and was decided by the attending physician on an individual basis. Other provocation measures such as photic stimulation, sleep deprivation, and hyperventilation were performed on selected patients. The character of each event was compared with the patients’ clinical history to ensure that the event recorded was the habitual event. Day 1 was defined as the first day of admission and initiation of monitoring. Time to onset of first event was defined as the duration from initiation of monitoring to the occurrence of first event recorded during admission. The final diagnosis was made on the day of vEEG termination based on EEG and semiological criteria. A conclusive study was defined as the completion of vEEG monitoring accompanied with a final diagnosis, categorized as epileptic seizure (ES), psychogenic nonepileptic seizure (PNES), dual diagnoses, or other diagnoses. The diagnosis “other” was given to patient who has a diagnosis apart from ES, PNES, or dual diagnoses such as syncope, cardiac arrhythmias, or sleep disorders. Prolonged DOM was defined as vEEG monitoring duration of more than 7 days. For these patients, we identified the clinical characteristics, vEEG data, and reasons for prolonged DOM.

2.3. Statistics

The data in this study were analyzed using SPSS Version 27. Descriptive statistics including mean and median were used for continuous data whereas percentage was used to describe categorical data. The differences in median time to onset of first event based on outcomes were analyzed using Kruskal–Wallis H test. The differences in the mean of DOM between outcomes were analyzed using a one-way ANOVA test. The differences between the clinical characteristics in patients with DOM > 7 days versus ≤7 days were analyzed using Fisher’s Exact test. The differences in time to onset of first event and number of events were analyzed using Mann–Whitney U test. The same statistical method was used in the subgroup analysis of patients with DOM > 7 days to compare patients with conclusive and inconclusive studies. P-value < 0.05 was considered statistically significant.

3. Results

3.1. Subjects

Five-hundred and one patients were included in the study. 40.3 % were men and 59.7 % were women. The mean age was 37.7 (SD 14.8, range 15 to 82) years. The mean age of first event in life was 22.5 (SD 15.6) years. The mean duration from first event in life to EMU admission was 14.3 (SD 13.5) years. Three hundred and twenty-seven patients had documented pre-admission routine EEG, of which 49.8 % were abnormal. Seventy-two (14.4 %) patients had previous vEEG monitoring and 29 (5.8 %) patients had previous epilepsy surgery. Three-hundred and seventy (73.9 %) patients were on at least one ASM. The clinical characteristics of patients based on LTVEM outcomes are summarized in Table 1.

3.2. Outcomes of admission

A conclusive study was obtained for 436 (87 %) patients. The most common diagnosis was ES (n = 225, 44.9 %), followed by PNES (n = 146, 29.1 %). From all patients with conclusive studies, 140 (32.1 %) patients obtained diagnosis only after 7 days of monitoring. The diagnoses of patients with conclusive studies are summarized in Table 2.

3.3. Time to onset of first event

The median time to onset of first event was 2.0 days (mean 2.1, SD 2.0, range 1–17 days). Seventy-six patients had no events during the duration of monitoring. Of patients who had events, 40.0 % (170/425) had events on day 1 and 60.9 % had events by day 2 of admission. From all the patients, six (1.2 %) had their first event recorded after more than 7 days of admission. Based on individual outcomes of vEEG, there were no statistically significant differences in the median time to onset of first event between ES (median 2 days, range 1 to 8), PNES (median 2 days, range 1 to 17), dual diagnoses (median 1 day, range 1 to 8) and other (median 2 days, range 1 to 6) (p > 0.05). The time to onset of first event according to the outcomes of patients with conclusive studies is summarized in Fig. 1.

3.4. Duration of monitoring and diagnostic yield

The mean DOM in EMU was 6.9 days (SD 3.2, median 7.0 days). The range of DOM was 1–17 days. The DOM in patients with
conclusive studies was significantly shorter compared to inconclusive studies (mean 6.8, SD 3.1 days versus 7.9, SD 3.9 days, *p* = 0.007). There was no statistically significant difference in DOM between patients with ES and PNES (*p* = 0.93). The majority of patients (67.9 %) with conclusive studies received diagnosis within the first 7 days of monitoring with an increasing number of diagnosis from day 1 and peaked on day 7. The number of conclusive studies decreased as the DOM went beyond 7 days (Fig. 2).

### 3.5. Patients with prolonged duration of monitoring

A total of 175 patients had DOM > 7 days. Patients with prolonged DOM had a later onset of first event in life compared to patients with shorter DOM (25.6 ± 16.6 years versus 20.7 ± 14.8 years, *p* = 0.003). The proportion of patients with previous vEEG monitoring (8.6 % vs 17.7 %, *p* = 0.005), previous epilepsy surgery (2.6 % vs 7.7 %, *p* = 0.015) and abnormal routine EEG (42.2 % vs 54.0 %, *p* = 0.049) were significantly lower in patients with prolonged DOM. The time to onset of first event was significantly longer for patients with prolonged DOM (median 2.0 versus 1.0 days, *p* < 0.001). Four out of 6 patients who had onset of first event recorded after day 7 had conclusive studies. There was no difference in the median number of events between patients with prolonged and shorter DOM (median 4 events versus 4 events, *p* = 0.59).

In the subgroup analysis of patients with DOM > 7 days, the proportion of abnormal routine EEG was significantly higher in patients with conclusive studies than with inconclusive studies (49.0 % versus 5.6 %, *p* < 0.001). Patients with conclusive studies were more likely to have an earlier time to onset of first event (median 3.0 days versus 5.0 days, *p* = 0.02). The number of events were significantly higher in patients with conclusive studies (median 5 events versus 0 events, *p* < 0.001). There was a high proportion of patients with conclusive studies who had previous vEEG (13/15, 86.7 %). The most common reason for prolonged DOM > 7 days was to adequately record multiple semiologially
distinctive events \( (n = 133, 76\%) \). One-hundred and two \( (76.7\%) \) patients who were monitored > 7 days for this indication had conclusive studies. The reasons for prolonged DOM are summarized in Table 3.

### 4. Discussion

Our study suggests that a longer duration of monitoring may yield an overall increase in conclusive studies. Although the majority of patients received their diagnosis within the first 7 days of monitoring, more than one-third of patients had a diagnosis determined when monitoring was prolonged beyond 7 days. Our findings are in agreement with previous studies which demonstrated the positive correlation between longer duration of monitoring and increased diagnostic yield \[6,7\]. The average duration of monitoring (mean: 6.9 days) in our study is slightly longer than other institutions which ranged between 2 and 4 days. The reported rate of conclusive studies from these institutions were between 60\% and 78\% \[8–11\]. The cost of prolonged duration of monitoring in our institution is offset by the higher proportion of patients (87\%) receiving a definitive diagnosis.

In our cohort, the median time to onset of first event was 2 days. The majority of patients (60.9\%) had their first event recorded during this period. Our findings were consistent with other studies demonstrating that the first event tends to be recorded within the first 2 days of monitoring \[8,12,13\]. Despite this, six patients (1.2\%) from our cohort had the first event recorded after 7 days of monitoring, of which 4 of these were conclusive studies. Although only a small percentage, it is diagnostically valuable to prolong duration of monitoring in patients who had no events within the first 7 days. Similarly, a study of 248 patients showed that there is an added diagnostic value by prolonging duration of monitoring as 7\% of patients with conclusive studies had the first event recorded after more than 7 days of monitoring \[14\].

Notably, our patients were monitored longer after the occurrence of first event before a diagnosis is given. In our cohort, the number of conclusive studies increased from day 1 and peaked at day 7. A similar trend was observed in other studies where patients were monitored longer despite that the majority of first events occurred within the first 2 days of monitoring \[6,8,15,16\]. This allows sufficient recording of all typical events as patients may have more than one type of seizures. To further demonstrate this, 10\% of our cohort with conclusive studies were given dual diagnoses of simultaneous ES and PNES as both types of events were recorded during the same admission. It has been previously reported that the mean latency between ES and PNES in these patients was 3.9 days \[17\]. Given the time interval, this highlights the importance of prolonging monitoring in patients who reported multiple different events to confidently make a diagnosis.

Interestingly, we did not find any significant difference in time to first event between ES and PNES. Some studies reported that time to first PNES is earlier than first ES \[13,18\], while another study showed that first ES occurred earlier during vEEG monitoring \[19\]. This can be accounted by the stochastic nature of the occurrences of ES and PNES during video-EEG monitoring and the differences in drug reduction protocols and provoking measures.

The two most common reasons for prolonging duration of monitoring beyond 7 days in our study were to adequately record multiple semiologically distinctive events (76\%) and to determine lateralization and localization of seizure onset (18.3\%). These data suggest that prolonging the duration of monitoring for these reasons are diagnostically valuable as 74.8\% of these patients had conclusive studies as a result.

In addition to this, our findings may assist clinicians in planning the duration of LTVEM based on clinical characteristics and vEEG.

---

**Table 3**

| Reasons \( (n = 175) \) | Number (%) | Conclusive | Inconclusive |
|---------------------------|------------|------------|-------------|
| To adequately capture multiple distinctive events | 133 (76.0\%) | 102 | 31 |
| Difficulty localizing or lateralizing | 32 (18.3\%) | 29 | 3 |
| Consideration of alternative diagnosis | 5 (2.9\%) | 5 | 0 |
| Technical issue | 2 (1.1\%) | 2 | 0 |
| Treatment e.g. PPM insertion, IVIG, ASM adjustment | 3 (1.7\%) | 3 | 0 |

---

**Fig. 2.** Number of conclusive studies achieved with each day of monitoring. Cumulative percentage was plotted as a line graph.
data. Patients who had an onset of first event recorded at day 2 or beyond are more likely to have longer monitoring. Individuals with a younger onset of first event in life, abnormal routine EEG, previous vEEG monitoring or epilepsy surgery were associated with shorter duration of monitoring. Although our study did not find any significant difference in the duration from first event in life to EMU admission between patients with shorter and prolonged DOM, one study reported that patients with longer duration from the first event in life to EMU admission are more likely to have prolonged DOM [6].

Our study may further guide clinicians in predicting the likelihood of conclusive studies in patients with prolonged duration of monitoring. We showed that previous abnormal routine EEG, previous vEEG monitoring, onset of the first event before day 5 of admission and ≥1 events recorded were predictive factors of conclusive studies in patients who were monitored longer than 7 days. We suggest that it is diagnostically valuable to prolong monitoring patients with these indicators as they are likely to arrive to a diagnosis.

Predicting an optimal duration of vEEG monitoring is challenging. Variable optimal duration of monitoring have been recommended by different studies, ranging between 2 and 6 days with the majority suggesting 5 days [8,9,13,20,21]. However, based on our findings, artificially limiting duration of monitoring to 5 days will reduce the number of conclusive studies in our cohort by 65.8%.

Prolonged DOM is associated with significant economic cost. However, we strongly believe that this is short-term and well-justified. It is well established that misdiagnosis costs substantial healthcare resources in the short term and long term. It has been shown that patients who had shorter duration of monitoring in the EMU were associated with increased rate of readmission or Emergency Department encounter within 30 days of discharge [22]. This is due to the reduced diagnostic yield in patients who had shorter vEEG monitoring. Some centers may necessitate repeat admission following an inconclusive study from the initial vEEG monitoring. However, repeated admissions into the EMU were associated with decreasing diagnostic yield and successively longer duration of monitoring [23]. In our cohort, 15 patients who were monitored beyond 7 days had previous vEEG monitoring. Of these, 13 (86.7%) had conclusive studies. Therefore, in patients with previous vEEG monitoring, we suggest that prolonging the duration of monitoring is more cost effective than repeated admissions which results in diminishing returns of diagnostic yield and increasing economic cost.

Studies conducted in the USA and UK have demonstrated that misdiagnosis of epilepsy results in massive economic burden [24,25]. Accurate diagnosis with vEEG monitoring reduces cost significantly in the long-run due to decreased out-patient visits, ED attendance and medication prescriptions [4,26,27]. The findings from our study provide data for patients, healthcare providers, and insurance companies to better evaluate the short-term cost of prolonging duration of monitoring compared to the substantial cost incurred from misdiagnosis and inappropriate intervention. Future multi-center studies should evaluate the role of standardized drug reduction protocol and earlier seizure provocation measures to improve the efficiency of LTIVEM.

Our study is limited by being retrospective in nature. In addition, there was no uniform protocol for medication reduction. Hence, we are unable to study the effect of antiseizure medication tapering strategy on the duration of monitoring. In this study, we did not include pre-admission seizure frequency and inter-clinician preference on the duration of monitoring and minimum number of events recorded to make a diagnosis. Therefore, we cannot evaluate the effects of these variables on the duration of monitoring and diagnostic yield. Additionally, we did not account for patients who were admitted for a diagnostic study that were then converted into a presurgical evaluation which may result in a longer duration of monitoring.

5. Conclusion

Video-EEG monitoring is an invaluable diagnostic tool in the evaluation of paroxysmal events. Findings from our study suggest that prolonging duration of monitoring is associated with a higher yield of conclusive studies despite the decreasing rate of conclusive studies beyond 7 days. Our study showed that monitoring patients beyond 7 days to adequately record multiple semiologically distinctive events and to characterize the lateralization and localization on EEG are valuable. Our findings can guide clinicians in planning vEEG duration and predicting likelihood of conclusive studies in patients who require monitoring beyond 7 days based on clinical characteristics and vEEG data. There are long-term and short-term clinical and economic benefits of vEEG monitoring which secures an accurate diagnosis, even if it requires a longer admission.

CRediT authorship contribution statement

Mohammad Hijaz Adenan: Data curation, Investigation, Formal analysis, Methodology, Writing – original draft. Mohamed Khalil: Data curation, Investigation, Methodology, Writing – review & editing. Kai Sheng Loh: Investigation, Writing – review & editing. Luke Kelly: Investigation. Arif Shukralla: Formal analysis, Writing – review & editing. Stephen Klaus: Investigation. Ronan Kilbride: Writing – review & editing. Gerard Mullins: Writing – review & editing. Peter Widdess-Walsh: Writing – review & editing. Michael Kinney: Writing – review & editing. Norman Delanty: Supervision, Writing – review & editing. Hany El-Naggar: Conceptualization, Methodology, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] Nordli Jr DR. Usefulness of video-EEG monitoring. Epilepsia 2006;47(Suppl 1):26–30.
[2] Chowdhury FA, Nashef L, Elwes RD. Misdiagnosis in epilepsy: a review and recognition of diagnostic uncertainty. Eur J Neurol 2008;15(10):1034–42.
[3] Smith D, Defalla BA, Chadwick DW. The misdiagnosis of epilepsy and the management of refractory epilepsy in a specialist clinic. QJM 1999;92(1):15–23.
[4] Martin RC, Gilliam FG, Kilgore M, Fought E, Kuzniecky R. Improved health care resource utilization following video-EEG-confirmed diagnosis of nonepileptic psychogenic seizures. Seizure 1998;7(5):385–90.
[5] Kobulnicky T, Höffler J, Dobesberger J, Ernst F, Ryvlin P, Cross JH, et al. Current practices in long-term video-EEG monitoring services: A survey among partners of the E-PILEPSY pilot network of reference for refractory epilepsy and epilepsy surgery. Seizure 2016;38:38–45.
[6] Moseley BD, Dewar S, Hanefi Z, Elbashir D, Stern JM. Reasons for prolonged length of stay in the epilepsy monitoring unit. Epilepsy Res 2016;127:175–8.
[7] Sauro KM, Macrodimitris S, Krassman C, Wiebe S, Pillay N, Federico P, et al. Quality indicators in an epilepsy monitoring unit. Epilepsy Behav 2014;33:7–11.
[8] Lobello K, Morgenlander JC, Radtke RA, Bushnell CD. Video/EEG monitoring in the evaluation of paroxysmal behavioral events: duration, effectiveness, and limitations. Epilepsy Behav 2006;8(1):261–6.
[9] Celik SY, Headley AJ, Shih JJ. Clinical characteristics of video-EEG patients: Limited utility of prolonging VEEG study duration beyond 5days for spell classification. Epilepsy Behav 2020;103(Pt A):106827.
[10] Cox FM, Reus EE, Visser GH. Timing of first event in inpatient long-term video-EEG monitoring for diagnostic purposes. Epilepsy Res 2017;129:91–4.
[11] Alving J, Beniczky S. Diagnostic usefulness and duration of the inpatient long-term video-EEG monitoring: findings in patients extensively investigated before the monitoring. Seizure 2009;18(7):470–3.
[12] Al Kasah S, Dawson RA, Jaramillo R, Halford JJ. Correlation of seizure frequency and medication down-titration rate during video-EEG monitoring. Epilepsy Behav 2016;64(Pt A):51–6.
[13] Foong M, Seneviratne U. Optimal duration of video-electroencephalographic monitoring to capture seizures. J Clin Neurosci 2016;28:55–60.
[14] Friedman DE, Hirsch LJ. How long does it take to make an accurate diagnosis in an epilepsy monitoring unit? J Clin Neurophysiol 2009;26(4):213–7.
[15] Ghogassian DF, d'Souza W, Cook MJ, O'Brien TJ. Evaluating the utility of inpatient video-EEG monitoring. Epilepsia 2004;45(8):928–32.
[16] Smolowitz JL, Hopkins SC, Perrine T, Eck KE, Hirsch LJ, O'Neil MM. Diagnostic utility of an epilepsy monitoring unit. Am J Med Qual 2007;22(2):117–22.
[17] El-Naggar H, Moloney P, Widdess-Walsh P, Kilbride R, Delanty N, Mullins G. Simultaneous occurrence of nonepileptic and epileptic seizures during a single period of in-patient video-electroencephalographic monitoring. Epilepsia Open 2017;2(4):467–71.
[18] Vázquez-Sánchez F, García-López B, Gómez-Menéndez AI, Martín-Santidrián A, Vicente JM, Hernando-Asensio A, et al. Long-term V-EEG in epilepsy: chronological distribution of recorded events focused on the differential diagnosis of epileptic seizures and psychogenic non-epileptic seizures. J Clin Med 2021;10(10):2080.
[19] Chen J, Zhou X, Huang Y, Lu Q, Jin L, Sun H. How to choose a practicable duration time for capturing paroxysmal events by prolonged video electroencephalogram monitoring in the elderly? Seizure – Eur J Epilepsy 2017;53:37–41.
[20] Moseley BD, Dewar S, Hanef Z, Stern JM. How long is long enough? The utility of prolonged inpatient video EEG monitoring. Epilepsy Res 2015;109:9–12.
[21] Lee C-h, Lim S-N, Lien F, Wu T. Duration of electroencephalographic recordings in patients with epilepsy. Seizure – Eur J Epilepsy 2013;22(6):438–42.
[22] Caller TA, Chen JJ, Harrington JJ, Bujarski KA, Jobst BC. Predictors for readmissions after video-EEG monitoring. Neurology 2014;83(5):450–5.
[23] Zarkou S, Grade M, Hoerth MT, Noe KH, Sirven JI, Drazkowski JF. Indeterminate EMU admissions: does repeating the admission help? Epilepsy Behav 2011;20(4):706–8.
[24] Nowack WJ. Epilepsy: a costly misdiagnosis. Clin Electroencephalogr 1997;28(4):225–8.
[25] National Clinical Guideline C. National Institute for Health and Clinical Excellence: Guidance. The Epilepsies: The Diagnosis and Management of the Epilepsies in Adults and Children in Primary and Secondary Care: Pharmacological Update of Clinical Guideline 20. Appendix C. London: Royal College of Physicians (UK) Copyright © 2012, National Clinical Guideline Centre; 2012.
[26] Nunez-Wallace KR, Murphey DK, Proto D, Collins RL, Franks R, Chachere DM, et al. Health resource utilization among US veterans with psychogenic nonepileptic seizures: A comparison before and after video-EEG monitoring. Epilepsy Res 2015;114:114–21.
[27] Chemmanam T, Radhakrishnan A, Sarma SP, Radhakrishnan K. A prospective study on the cost-effective utilization of long-term inpatient video-EEG monitoring in a developing country. J Clin Neurophysiol 2009;26(2):123–8.