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A critical appraisal on the utility of long-term video-EEG monitoring in older adults

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KEYWORDS
Video-EEG;
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Summary
Background: World-over, the majority of patients undergoing video-EEG monitoring (VEM) are in their second or third decades. Although elderly represent the fastest growing segment of population with epilepsy, only few of them undergo VEM. We critically evaluated the utility of VEM in the diagnosis and long-term management of older adults with paroxysmal behavioral events.
Methods: 148 consecutive patients aged 45 and above, who underwent long-term (≥8 h) inpatient VEM from 1996 to 2009 formed the study cohort. Utilizing a structured proforma, we gathered their demographic, clinical, electrophysiological and long-term outcome data. VEM was considered as ''useful'' when it changed the diagnosis and/or management; it was ''corroborative'' when it helped the treating physician to confirm the diagnosis and ''not useful'' when it neither helped to improve the diagnosis nor the management.
Results: The mean age was 51.3 (SD 6.4) years; mean duration of VEM was 69.3 h. Out of 117 patients with a diagnosis of epileptic seizures referred for presurgical evaluation or classification, VEM was ''useful'' or ''corroborative'' in 111 patients (94.8%; $p = 0.0001$). It was also ''useful'' or ''corroborative'' in 29 out of 31 patients (93.5%) referred with a suspicion of associated or pure psychogenic non-epileptic seizures ($p = 0.0001$). None developed any complications during monitoring. At a mean follow-up of 37.7 months there was significant reduction in AED usage in patients with epilepsy ($p = 0.0001$) and epilepsy with associated PNES ($p = 0.001$). At a mean follow-up of 34.2 months, all patients with pure PNES were event-free and medication-free at last follow-up ($p = 0.002$). Twenty-three patients (19.6%) underwent surgery, all except one remaining seizure-free at a mean follow-up of 39.2 months.
Conclusions: VEM is a safe and cost-effective investigation strategy in older-adults. It aided in improving the diagnosis, offered better treatment including surgery and helped in excluding non-epileptic paroxysmal events in majority.

Abbreviations: VEM, video-EEG monitoring; *N*, number; PNES, psychogenic non-epileptic seizures; PNEE, physiological non-epileptic events; AED, antiepileptic drug; FUP, follow-up.

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Introduction

Inpatient long term digital video electroencephalographic monitoring (VEM) is routinely used since early days in the diagnostic classification of paroxysmal spells (i.e., epilepsy versus non-epileptic spells), classify seizure type(s), and to evaluate surgical candidacy in patients with drug resistant partial seizures (Binnie et al., 1981; Sutula et al., 1981). Video-EEG monitoring is essential in determining the localization of the epileptogenic zone (i.e., the site of seizure onset and initial seizure propagation) in adult patients being considered for surgical ablative procedures (Casino, 2002). The high diagnostic yield of VEM in adult patients with recurrent and unprovoked spells has been confirmed (Alsaadi et al., 2004; Benbadis et al., 2004; Ghougassian et al., 2004; Chemmanam et al., 2009). The investment in equipment and the time spent for VEM makes this procedure expensive and labor intensive thus limiting its use to situations where it is highly fruitful. Therefore, it is important to define the diagnostic value of this high-cost and time-consuming diagnostic procedure especially in a developing country where the treating physician and the patient is forced to choose their investigations, which brings maximum yield to them.

In all parts of the globe, the majority of patients undergoing VEM and surgery are in their second or third decades (Alsaadi et al., 2004; Chemmanam et al., 2009; Parnell et al., 1999). Although older adults and elderly subjects represent the fastest growing segment of population with epilepsy, only few of them undergo VEM (Drury et al., 1999; Lancman et al., 1996). This could be attributed to the fact that the yield of VEM in older adults and elderly is not well characterized. VEM in elderly is generally restricted to distinction of seizures from pseudo seizures (Kipervasser and Neufeld, 2007). Despite its widespread use, very little information is available on the actual benefits of VEM in older adults, other than choosing few of them for appropriate resective surgery. Hence this investigation is less often considered as a primary diagnostic modality when it comes to a patient who is beyond the fourth or fifth decade of his life who presents with paroxysmal spells later in life.

In this background, we evaluated the utility of VEM in the diagnosis and long-term management of older adults and elderly with paroxysmal behavioral events. We critically assessed the efficacy of this diagnostic tool in this segment of population, which has not been studied meticulously by many centers undertaking this investigation.

Materials and methods

Study setting and subjects

This study was conducted at the R. Madhavan Nayar Center for Comprehensive Epilepsy Care at the Sree Chitra Tirunal Institute for Medical Sciences and Technology, a tertiary referral center in South India. Patients with epilepsy are referred to this center from all regions of south India and elsewhere from India. Patients get admitted for VEM only after being seen in the epilepsy clinic by one of the epileptologists involved with the Comprehensive Epilepsy Program (AR and KR). Patients are subjected to VEM for either diagnostic purposes (to distinguish between epileptic and non-epileptic spells or for categorization of the seizure types and epilepsy syndromes), or for presurgical evaluation. The epilepsy-monitoring unit (EMU) had three VEM beds till 2007 when it was increased to six. This center has undertaken over 1000 surgeries during the past 14 years and more than 5000 patients have undergone VEEG monitoring so far (Radhakrishnan, 2009). The decision regarding surgical candidacy is taken in a patient management conference by a multidisciplinary team comprising of epileptologists, neuroradiologists, neurosurgeons, clinical psychologist, speech pathologist, occupational therapist and medico-social worker involved in the Comprehensive Epilepsy Care Program.

All consecutive patients aged 45 and above, who underwent long-term ($\geq$8 h) inpatient VEM between January 1996 to June 2009 were included in the study.

Technique of VEM

VEM was performed by using 32-channel digital video-EEG systems (BMSI 6000, Nicolet Biomedical Inc., Madison, WI) with scalp disk electrodes placed according to the International 10/20 system. Anterior temporal (T1 and T2) electrodes were used routinely, although sphenoidal electrodes were inserted as and when indicated. At least 16 channels of EEG and one channel of EKG were monitored. The monitoring was carried out as described in our previous study (Chemmanam et al., 2009). One of the relatives of the subject, who was familiar with the habitual events, stayed in the monitoring room throughout the procedure. Patients, who were on antiepileptic drugs (AEDs), had their medicines withdrawn gradually, approximately at a rate of one-third of the total daily dose every 24 h. Patient surveillance during VEM was conducted round the clock by an EEG technologist or nursing staff well experienced in response testing and acute management of seizures. The monitoring was continued uninterrupted till sufficient number of events was recorded. For presurgical evaluation, we insist on recording at least two habitual seizures in those with strictly unilateral imaging abnormalities and concordant interictal epileptiform discharges (IEDs) with single clinical semiology, and at least six habitual seizures in those with discordant data. Specific spell/seizure provocative triggers were inquired and employed as and when indicated including hyper ventilation and intermittent photic stimulation.

VEM data analysis

Samples of interictal EEG and events identified were reviewed 12 or 24 hourly by trained epileptologists (AR and KR) experienced in the procedure. The ictal semiology and ictal EEG were carefully analyzed to look for features that helped in distinguishing between epileptic and non-epileptic events, and in lateralizing and localizing the seizure origin. The distribution of IEDs during VEM was assessed by visual analysis of interictal EEG samples of 15 s every 15 min. The ictal semiology and ictal EEG were carefully analyzed to look for features that helped in distinguishing between epileptic and non-epileptic events. Based on the video semiology, ictal and interictal data, those with epileptic events were classified, according to the International Classification of Epileptic Seizures and the International Classification of Epilepsy and Epileptic Syndromes guidelines (ILAE classification 1981, 1989).

Data collection

Utilizing a structured proforma, we retrospectively gathered the demographic, clinical, video-EEG details and long-term outcome data from the prospectively maintained records of the patients in the institutional database. To determine the proportion of patients in whom the diagnosis was changed as a result of VEM, we compared the referral diagnosis at admission to the diagnosis reached after VEM. We sub classified the patients into the following categories. VEM was considered as ''*useful*'' when it changed the diagnosis and/or management in these patients. It was considered