MEDICAL PRACTICE

Diagnostic value and safety of long-term video-EEG monitoring

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This paper aimed to assess the usefulness and safety of video-EEG (video-electroencephalography) monitoring in patients with refractory epilepsy. We analysed the video-EEG recordings of consecutive patients over a 3-year period from 2002 to 2005. The pre-admission diagnosis, demographic information, number of ictal episodes, adverse events, and final diagnosis were recorded in all patients. The diagnostic labels before and after monitoring were compared in order to assess whether it had led to a change in diagnosis and management. Of the 100 patients who underwent video-EEG, 227 clinical events were recorded in 62 cases. The most common events were complex partial seizures followed by non-epileptic attacks. Video-EEG allowed a diagnosis to be made in 81 patients and the diagnosis at discharge was altered in 19 cases. Major injuries and status epilepticus did not occur during monitoring. In our experience video-EEG is safe and provides important clinical information in over 80% of patients.

Introduction

Video-EEG (video-electroencephalography [VEEG]) monitoring is an important tool that allows correlation between behavioural changes and electrophysiological signals.[1-3] It is becoming indispensable for distinguishing non-epileptic attacks from seizures and defining seizure type and syndromic classification. Assessments of the usefulness of VEEG in the literature vary, depending on the sample population, referral source, the objective and the duration of monitoring.[4-14] We investigated specifically the diagnostic usefulness and safety of long-term EEG in a group of patients who had been diagnosed with refractory epilepsy at a neurology clinic.

Methods

We reviewed the recordings and charts of consecutive adult patients who were diagnosed as having refractory epilepsy, had been put on anti-epileptic drugs (AEDs), and were admitted for long-term VEEG monitoring. This was a retrospective study performed at the Prince of Wales Hospital in Hong Kong, a regional hospital serving the district of Shatin that is also a tertiary referral centre. All the individuals had been referred from the Neurology Clinic.

Patients who continued to have unprovoked seizures despite at least two appropriate AEDs at adequate dosages were considered to have refractory epilepsy (this does not include AEDs that produced intolerable side-effects). Cranial magnetic resonance imaging had been performed on an out-patient basis on all patients prior to their admission for monitoring. Patients who had been admitted for pre-surgical work-up or intracranial recordings were excluded. Our VEEG protocol consisted of standard channel scalp-EEG, subtemporal electrodes, electro-oculogram and electrocardiogram with electrodes placed according to the international 10/20 system, and recorded using the Oxford Medelec Profile Digital VEEG system (Oxford Instruments, UK). Patients had access to a portable alarm system and were asked to record any events on the nursing staff's observation chart. Hyperventilation and intermittent photic stimulation were used to provoke seizures on the first day. Patients on a single drug with seizure frequency of more than two per week would usually have their AED dosage halved while in those with a lower frequency, we would recommend discontinuation before the day of admission. For patients taking multiple drugs, anticonvulsants were tapered until they were down to one drug. If no seizures had been provoked by the end of the third day we would consider stopping all drugs, except in patients with a history of status epilepticus. Monitoring was continued until the epileptologist was satisfied that sufficient information had been obtained to enable a diagnosis to be made or until the end of 6 days. For the purposes of the study, two doctors reviewed the archived recordings and had to agree on the nature of the attacks and their interpretation made.

We recorded relevant clinical and demographic information: name, age, the most likely preadmission epileptic syndromic diagnosis and AED use. Information obtained during monitoring consisted of the nature and frequency of clinical events, onset of first seizure after the start of recording, the presence of interictal and ictal activity, and the occurrence of adverse

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TABLE 1. Seizure type and clinical events recorded

Event	No. of patients
Complex partial seizure (CPS)	28
CPS and secondary generalised seizure	13
Non-epileptic attack	13
Tonic seizure	3
Myoclonus	3
Simple partial seizure	2
Unclassified	2
Total	**64***

* **No. >62 as some patients had more than one seizure type**

TABLE 2. Diagnosis after video-EEG monitoring

Diagnosis	No. of patients
Temporal lobe epilepsy	31
Diagnosis uncertain	19
Psychogenic disorders	12
Epilepsy	17
Frontal lobe epilepsy	9
Idiopathic generalised epilepsy	6
Others*	6
Total	**100**

* **Others included vasovagal syncope (n=1), Lennox-Gastaut syndrome (n=1), subacute sclerosing panencephalitis (n=1), combined complex partial seizures and psychogenic disorder (n=1) and simple focal motor seizures (n=2)**

events such as peri/postictal violence, psychosis, status epilepticus, and physical injuries secondary to seizures. We compared the diagnosis before monitoring with the final diagnosis in the light of this additional information.

Results

100 consecutive patients underwent VEEG during a 3-year period from January 2002 to December 2005 (virtually no patients were monitored during the severe acute respiratory syndrome [SARS] outbreak and its aftermath in 2003, from March of that year until January 2004). The group consisted of 45 men and 55 women with a mean age of 34.8 years (range, 16-88 years). Magnetic resonance imaging showed focal lesions or incidental findings in 52 cases. All patients had out-patient EEGs before they were considered for VEEG, of which 13 patients had 'epileptiform activity' but these were not sufficient to support an accurate diagnosis. The mean duration of monitoring was 4.4 days (range, 3-6 days). No clinical or EEG events were detected in 38 patients but among the remaining 62, a total of 227 events were recorded; the most common events being complex partial seizures with or without secondary generalisation and non-epileptic attacks (Table 1). Among patients who did not have a clinical event, prolonged monitoring revealed sufficient interictal activity to support the diagnosis of a seizure disorder in half (19 cases). Five diagnoses predominated: temporal lobe epilepsy (31%), psychogenic disorders (12%), epilepsy without an exact syndromic diagnosis (17%), frontal lobe epilepsy (9%), and idiopathic generalised epilepsy (6%) [Table 2]. Seizures occurred most often on the second followed by the third day in most patients; the median time to the first event was 2 days for complex partial seizures and 1 day for non-epileptic attack seizures. In patients who developed a clinical event during hospitalisation, the mean number was 3.7 (range, 1-13). Video-EEG resulted in a change in management in 19 cases, the majority due to the discovery of non-epileptic attacks allowing eventual drug reduction or complete withdrawal. Some were also due to changes in classification, for example from temporal lobe epilepsy to idiopathic generalised epilepsy. One patient suffered a dislocated shoulder but this was a complication of his habitual seizures that had also occurred outside the hospital setting. No significant injuries or episodes of generalised tonic-clonic status epilepticus occurred during monitoring.

Discussion

As paroxysmal events occur unpredictably and infrequently, the diagnosis may not be apparent on just historical grounds or on a short period of out-patient EEG. Establishing that a patient does have real seizures and determining seizure and syndromic type is important for optimal management. Conversely, misdiagnosis and misclassification will lead to inappropriate treatment. Although monitoring is expensive and can be time-consuming for both patients and staff, costs can be recovered from the savings that follow improved diagnosis. Removing the stigma of epilepsy in someone who has had non-epileptic attacks can result in reductions in both health care utilisation and dollar costs

長期錄像腦電圖監測的診斷價值及其安全性

本文旨在評估應用錄像腦電圖監測於頑固型癲癇患者的有用程度和安全性。我們分析了在2002至2005年間三年內連續病例的錄像腦電圖監測，這些病例的病人紀錄包括了留院前的診斷、與人口數據有關的資料、癲癇發作的次數、不良事件以及最後診斷。為了評估錄像腦電圖監測會否影響醫生診療，我們亦比較了監測前後所作的診斷，在100位接受錄像腦電圖監測的患者中，有62個病例共錄得227次臨床事件，以複雜部分性發作繼發非癲癇性發作為最常見。有81位患者由於接受了錄像腦電圖監測而得以正確診斷，另外有19例的出院前診斷有所改動。在監測期間，沒有發生嚴重傷害，也沒有出現癲癇持續狀態。按我們的經驗，錄像腦電圖監測很安全，而且能為八成以上的病人提供重要的臨床資料。

from medication fees, clinic visits, and emergency room consultations.[15] Video-EEG effectively detects 46 to 73% of paroxysmal events.[4-14] This compares well with a yield of 16 to 66% from upright tilt-table testing or 24-hour ambulatory continuous electrocardiogram in patients being evaluated for unexplained syncope.[16-18] A recent review found that management was changed in 73% of cases following VEEG, a considerably higher percentage than in this study.[12]

As with all studies of VEEG, our results should be interpreted in terms of two important limitations: patient selection and referral bias. First, patients who are admitted for pre-surgical planning have usually undergone more rigorous evaluations than those who are admitted for diagnosing spells and paroxysmal events. Second, patients referred for monitoring by epileptologists and neurologists are more likely to have genuine seizures than those referred by generalists. Alsaadi et al[13] reported that the diagnosis was changed in 24% of cases in an epilepsy centre in which all patients had been screened by experienced neurologists or epileptologists.

In contrast with a study in which the rate of status epilepticus was 3% after drug withdrawal for in-patient monitoring, we did not observe episodes of status epilepticus.[19,20] We showed that in patients who had been referred by experienced neurologists, VEEG assessment resulted in practical alterations in management and has a low risk of adverse effects.

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