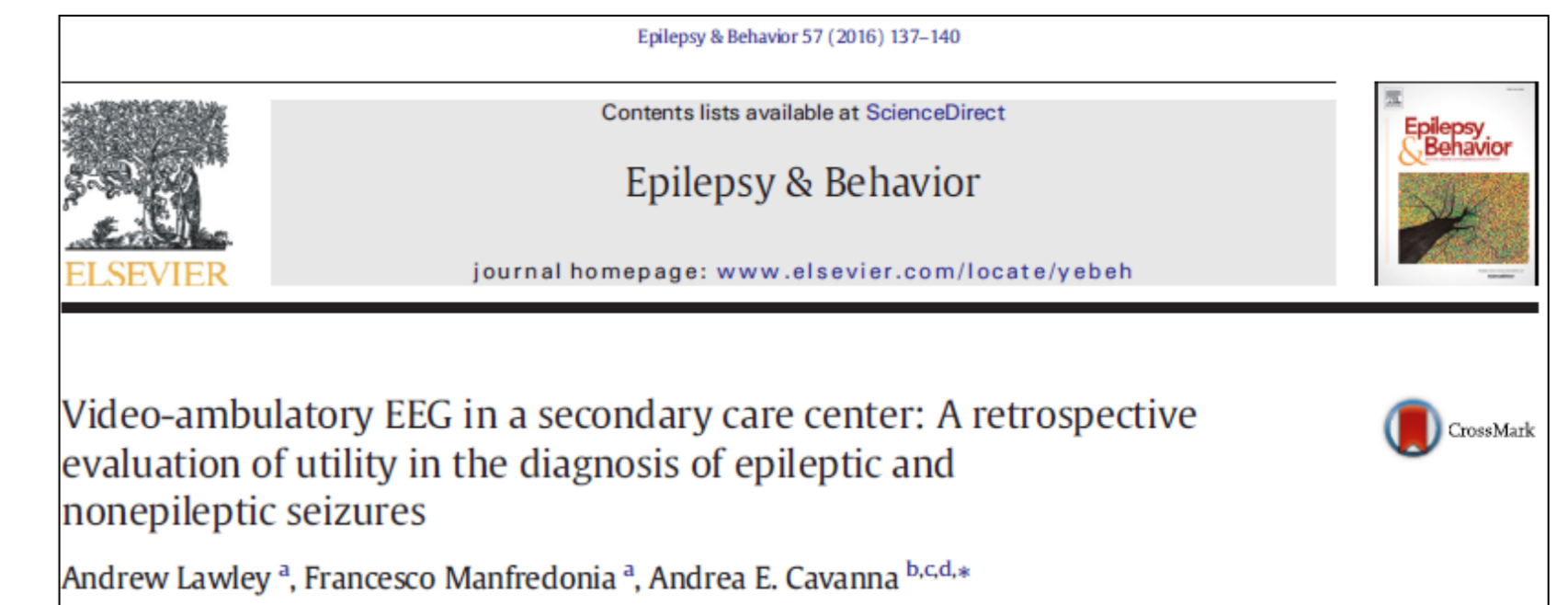


Video-ambulatory EEG in a secondary care centre: A retrospective evaluation of utility in the diagnosis of epileptic and nonepileptic seizures

Lawley A¹, Manfredonia F¹, Cavanna AE^{2,3,4}

¹Department of Neurology, Royal Wolverhampton NHS Trust, Wolverhampton, UK, ²Department of Neuropsychiatry, Birmingham and Solihull Mental Health NHS Foundation Trust, Birmingham, UK, ³School of Life and Health Sciences, Aston Brain Centre, Aston University, Birmingham, UK, ⁴Sobell Department of Motor Neuroscience and Movement Disorders, Institute of Neurology at UCL, London, UK



Introduction

Long-term electroencephalography (EEG) is an established investigation for patients with paroxysmal clinical events raising the diagnostic possibility of epilepsy¹. Due to demand on inpatient video-telemetry services, ambulatory EEG (AEEG) has been suggested as a cost-effective, more widely available alternative, although does have several important limitations². The development of video recording alongside AEEG (video-AEEG) has received increasing attention over the last few years because of its potential to further improve diagnostic utility³. Here we present a retrospective service evaluation of an outpatient AEEG service using video-recording in a secondary care centre.

Aims

- To assess the diagnostic utility of video-recording alongside AEEG in a large group of patients referred to a neurophysiology department.
- To identify potential difficulties and areas for improvement with implementation of this service.

Methodology

101 video-AEEG studies were performed over a 20 month-period, with regional referrals coming from neurology (N=75), paediatric neurology (N=17), neuropsychiatry (N=7), neurorehabilitation (N=1), and stroke medicine (N=1). Referral criteria stipulated that patients experienced at least two clinical events per week. After exclusion of 13 studies, 88 video-AEEG studies (on 87 patients) were included in final analysis.

Key Results

- 59/88 studies (67.0% of the total) provided diagnostically useful information
- A typical clinical event occurred in 55 studies (62.5%), with an event recorded on video in 26 of the 50 studies in which video-recording was attempted (52.0%)
- Of the 36 patients diagnosed with nonepileptic seizures (36), use of video-AEEG allowed 14 to be classified as having a "documented" diagnosis
- 96.2% of studies where an event was seen on video influenced subsequent management decisions
- 4 patients in the "possible" nonepileptic seizures category were referred for IVT, compared to 0 patients in the "documented" nonepileptic seizures category
- The most common reasons for failure to successfully record an event were the camcorder not being activated by the patient or guardian (N=14), the patient being out of view or obscured (N=5), or the patient refusing consent (N=5)
- Technical difficulties with equipment or artefacts were rarely encountered, and did not result in any events being uninterpretable

Demographics	Patients (N=87)
Age (in years)	2-80 (mean 38) 19 patients under 18 years
Gender (F:M)	55:32
<u>Reason for AEEG request</u>	(88 studies)
Diagnostic clarification	86
Assessment of seizure frequency	1
Assessment for subclinical seizures	1
AEEG duration (in hours)	24-48 (mean 31)
<u>Routine EEG findings</u>	(N=87)
Normal	59
Non-epileptiform abnormality	15
Focal epileptiform abnormality	6
Generalised epileptiform abnormality	7
<u>Sleep-dep/sedation EEG findings</u>	(N=27)
Normal	20
Non-epileptiform abnormality	3
Focal epileptiform abnormality	2
Generalised epileptiform abnormality	2
<u>Antiepileptic medication</u>	
None	29
1 antiepileptic medication	29
2 antiepileptic medications	21
3+ antiepileptic medications	8

Video-Ambulatory EEG Recording

- XLTEK 32-channel recording system with electrode placement as per the International 10-20 system
- Electrodes secured using colloidon +/- head net
- Patients received a letter detailing test procedure and were further counselled by a senior clinical physiologist
- Utilised clinical diary and event marker requiring patient activation
- Patients returned every 24h for battery change, electrode check and download of data
- Video recording was performed with an off-the-shelf integrated Trex HD(XLTEK,USA) camcorder:

- ✓ 48h of HD video storage on memory card
- ✓ Time-locked to AEEG via bluetooth connection
- ✓ Infrared mode allowing night time recording
- ✓ 2 hour battery life
- ✓ Continuous recording requires connection to a mains supply



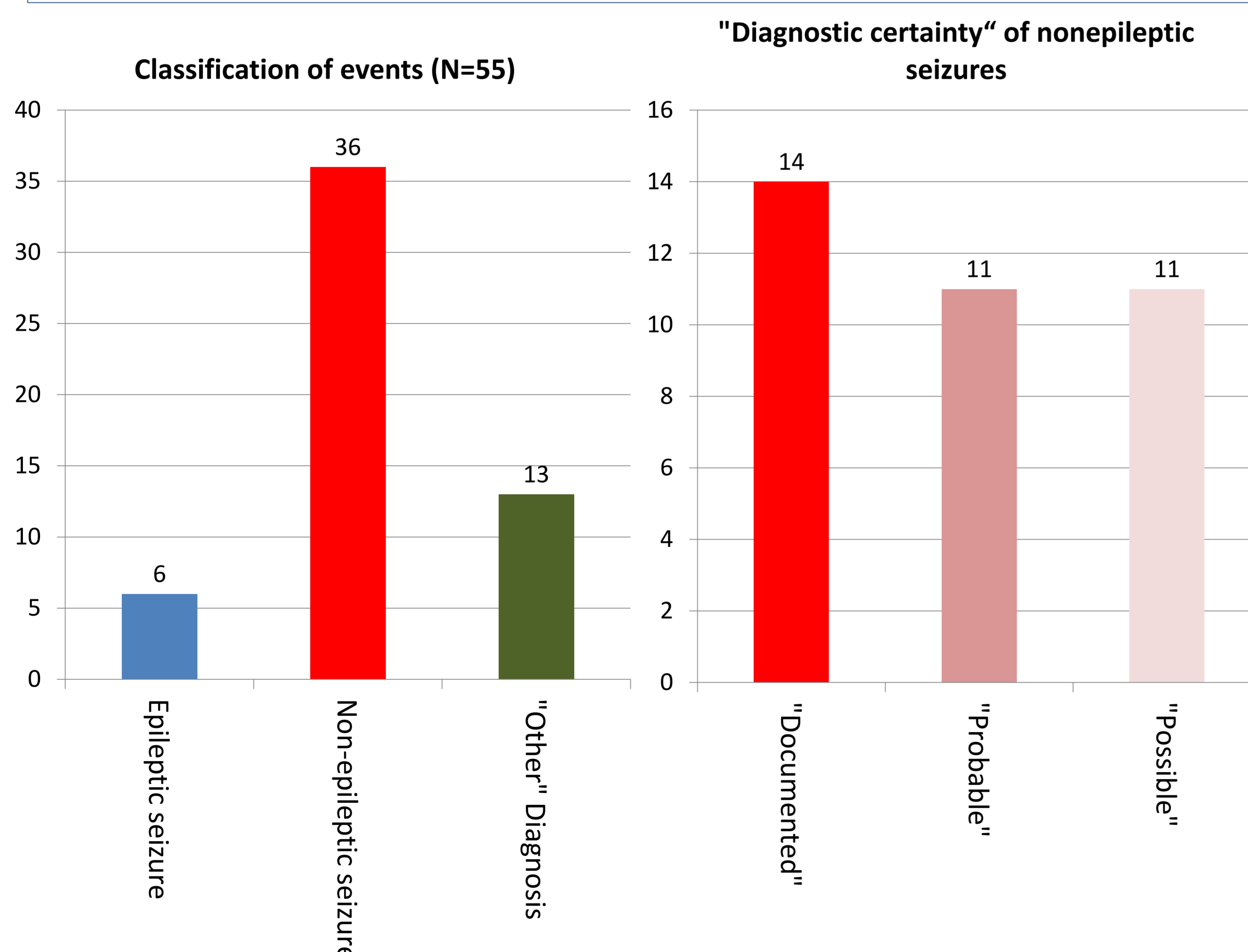
- Standardized instructions were provided to each patient/guardian for camcorder operation and positioning in the home environment
- All studies were reviewed by a clinical physiologist and reviewed and reported by same senior consultant experienced in EEG interpretation (FM)

Conclusions

- Diagnostic yield of 67.0% is consistent with previous reports of AEEG
- Addition of video-recording allows increased diagnostic confidence, particularly of non-epileptic seizures
- In a secondary care setting, this has implications for confident early diagnosis and managing referrals for tertiary centre investigation
- Continuous video-recording improves the success rate of recording a clinical event
- Improvements in patient education and training for use of video-recording may improve the number of events recorded on video

References:

- Velis D, Plouin P, Gotman J, Lopes da Silva F, for the ILAE DMC Subcommittee on Neurophysiology. Recommendations regarding the requirements and applications for long-term recordings in epilepsy. *Epilepsia* 2007; 48:379-84.
- Raymond AA, Gilmore WV, Scott CA, Fish DR, Smith SJ. Video-EEG telemetry: apparent manifestation of both epileptic and non-epileptic attacks causing potential diagnostic pitfalls. *Epileptic Disord* 1999; 1:101-6.
- Lawley A, Evans S, Manfredonia F, Cavanna AE. The role of outpatient ambulatory electroencephalography in the diagnosis and management of adults with epilepsy or non-epileptic attack disorder: a systematic literature review. *Epilepsy Behav* 2015;53:26-30.
- La France WC, Baker GA, Duncan R, Goldstein LH, Reuber M. Minimum requirements for the diagnosis of psychogenic non epileptic seizures: a staged approach. *Epilepsia* 2013;54:2005-18.



Diagnostic Level	History	Witnessed event	EEG
Possible	+	By witness or self-report/description	No epileptiform activity in routine or sleep-deprived interictal EEG
Probable	+	By clinician who reviewed video recording or in person, showing semiology typical of PNES	No epileptiform activity in routine or sleep-deprived interictal EEG
Clinically established	+	By clinician experienced in diagnosis of seizure disorders (on video or in person), showing semiology typical of PNES, while not on EEG	No epileptiform activity in routine or ambulatory ictal EEG during a typical ictus/episode in which the semiology would make ictal epileptiform EEG activity expectable during equivalent epileptic seizures
Documented	+	By clinician experienced in diagnosis of seizure disorders, showing semiology typical of PNES, while on video EEG	No epileptiform activity immediately before, during or after ictus captured on ictal video EEG with typical PNES semiology

Key: +, history characteristic consistent with PNES; EEG, electroencephalography (as noted in the text, additional tests may affect the certainty of the diagnosis—for instance, self-protective maneuvers or forced eye closure during unresponsiveness or normal postictal prolactin levels with convulsive seizures).

Assessing diagnostic certainty in psychogenic nonepileptic seizures (taken from Reference 4)