

Video-EEG Monitoring in the Elderly: A Review of 94 Patients

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Summary: *Purpose:* We sought to determine the utility and results of video-EEG monitoring in elderly patients. There is an increased incidence of epilepsy in the elderly population. Few studies have assessed the characteristics of epileptic and nonepileptic seizures in this age group. Diagnostic evaluation with video-EEG monitoring is a means to distinguish these different types of events.

Methods: The authors reviewed all patients aged 60 years and older who were admitted to the epilepsy monitoring unit at Columbia–Presbyterian Medical Center from January 21, 1991, to April 12, 1999.

Results: A total of 94 patients and 99 patient admissions were identified, accounting for 8% of all admissions. The average age was 70 years, and the mean length of stay was 3.8 days. Typical events were recorded in 75 of the 99 patient admissions. A total of 118 seizures was recorded in 46 patients,

and 98 nonepileptic events were seen in 27 patients. Of the patients with nonepileptic events, 13 had psychogenic seizures. The majority of patients with nonepileptic events were taking antiepileptic medication. Whereas 76% of the patients with epileptic events had interictal epileptiform discharges, 26% of the patients with nonepileptic events had epileptiform discharges as well.

Conclusions: Video-EEG monitoring in the elderly leads to a definitive diagnosis in the majority of patients in a relatively short time. Interictal recordings are inadequate in determining the nature of paroxysmal events. Nonepileptic events are common in the elderly, including psychogenic seizures, and these are often misdiagnosed and mistreated as epileptic seizures.

Key Words: Video-EEG monitoring—Elderly—Epilepsy in elderly patients.

An increased incidence of epilepsy occurs in the elderly population, representing a second peak in incidence of epilepsy in all age groups after an initial peak in the first years of life (1–5). Whereas a number of studies have examined the etiology of epilepsy in the elderly, there are few data on the nature of typical nonepileptic paroxysmal events in older patients. Direct observation of epileptic and nonepileptic events with video-EEG monitoring provides the ideal method of assessing these episodes. Few studies discuss video-EEG monitoring in the elderly. This may partially be because the elderly represent a small percentage of admissions to epilepsy monitoring units, 4.6% and 1.5% in two separate studies (6,7).

This review was carried out to characterize further epileptic and nonepileptic events occurring in the elderly as determined by the findings from video-EEG monitoring.

MATERIALS AND METHODS

Subjects

A retrospective analysis was performed on all patients aged 60 years and older admitted to the epilepsy monitoring unit (EMU) at Columbia–Presbyterian Medical Center from January 12, 1991, to April 12, 1999. EMU reports were reviewed in detail. Reasons for patient admissions were categorized as diagnosis of paroxysmal events, further characterization of known seizures, pre-surgical evaluation, medication adjustment or toxicity, and evaluation to rule out nonconvulsive status epilepticus or subclinical seizures.

Procedures

Patients underwent continuous CCTV/EEG monitoring with a cable telemetry system; electrodes were placed according to the 10-20 international electrode system. Additionally, T1, F9, T9, P9, T2, F10, T10, and P10 electrodes were placed in all patients. EEG activity was recorded referentially to P1 and P2 electrodes, digitized, and stored on videocassette tape.

Periods of interest were subsequently reformatted to the montage of interest, and hard copies were printed. For ~18 h each day, the patient was attended by an EEG

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technician, and a neurologist was available in person or on call. During other times, EEG recording, video recording, and computer analysis continued, but other testing was scant.

The Gotman spike-and-seizure detection computer program (trademarked "Monitor") was used throughout the monitoring period to screen the EEG in real time and mark the data file with pointers to possible electrographic seizures and interictal discharges. Detections were reviewed in detail by a fellow in neurophysiology and the attending epileptologist. Attending epileptologists were all electroencephalographers board certified by the American Clinical Neurophysiology Society. Benign "pseudoepileptiform" patterns such as wicket spikes and benign epileptiform transients of sleep were not classified as epileptiform discharges.

RESULTS

A total of 94 patients and 99 patient admissions were identified, with five patients having been admitted at two separate times. The average age was 70 years (range, 60–94 years), and the mean length of stay was 3.8 days (range, 1–14 days). There were 62 female and 37 male patient admissions.

The reasons for admission are described in Table 1. The majority of the patients (56%) were admitted to diagnose the nature of paroxysmal events. Epileptic seizures were recorded in 46 patient admissions, and nonepileptic events were found in 27 admissions. Four patients had both epileptic seizures and nonepileptic events. No events were recorded in 30 admissions. For overall results, see Table 2.

Epileptic seizure types and their frequency are described in Fig. 1. One patient with juvenile myoclonic epilepsy had myoclonic jerks; otherwise, there were no patients with generalized-onset seizures. Five patients had both clinical and subclinical epileptic seizures, and two patients had only subclinical seizures, including one patient in nonconvulsive status epilepticus. One patient with simple partial seizures had *epilepsia partialis continua*. The average age at onset of patients with seizures was 56 years.

Of the 27 patients with nonepileptic events, 13 had psychogenic seizures, including three patients older than 80 years, and 14 patients had other types of nonepileptic events of various etiologies. Two of the patients with

TABLE 2. Results

Epileptic seizures	46
Partial onset ± secondary generalization	45
Generalized onset	1
Nonepileptic seizures	27
Physiologic	14
Cataplexy	1
Hypotensive episode	1
Nocturnal confusion	1
Episodic vomiting	1
Myoclonic jerks	2
TIA	2
Behavioral spell ^a	6
Psychogenic	13
No events	30

N = 99 patient admissions. Of note, four patients had both epileptic events and nonepileptic events.

TIA, transient ischemic attack.

^a See text.

psychogenic nonepileptic events also had complex partial seizures and partial seizures with secondary generalization. Of the 11 patients with purely psychogenic seizures, the average age at onset was 62 years. At least four typical spells were recorded in all of these patients except two. Seven (63%) of these 11 patients had onset of psychogenic seizures at age 60 years or older. The duration of psychogenic seizures was ≤2 years in seven (63%) of 11 patients. At least two of these patients had different types of events in the past that were thought to be epileptic, although current spells were nonepileptic in nature. Of the patients with both psychogenic seizures and epileptic seizures, the onset of psychogenic seizures was unclear. Two patients with psychogenic seizures had had ongoing events for 40 and 26 years, respectively.

Physiologic nonepileptic events occurring in individual patients included cataplexy, a hypotensive episode, nocturnal confusion, and episodes of vomiting. Two patients with suspected epileptic seizures were diagnosed with transient ischemic attacks (TIAs), one of whom had a limb-shaking TIA. Two patients had myoclonic jerks that were diagnosed as nonepileptic events; one had multiple sclerosis, and one patient had progressive cognitive decline of unknown etiology. Six patients had nonepileptic events labeled as behavioral spells. In these events, there was no electrographic correlate; however, it could not be determined with relative certainty that these events were psychogenic in origin. Two of the patients with physiologic nonepileptic events also had complex partial seizures, one patient with TIAs and one patient with intermittent nocturnal confusion.

The majority of patients with all types of nonepileptic events were taking antiepileptic medications (AEDs): seven (53%) of 13 patients with psychogenic seizures, five of six patients with behavioral spells, and five of six patients with physiologic types of nonepileptic events.

Whereas 35 (76%) of 46 patients with epileptic seizures had interictal epileptiform discharges, seven (26%)

TABLE 1. Reasons for admission

Diagnosis of paroxysmal events	56%
Characterization of known seizures	20%
Evaluation for subclinical seizures or nonconvulsive status epilepticus	15%
Presurgical evaluation	6%
Medication adjustment or toxicity	3%

Seizure Types

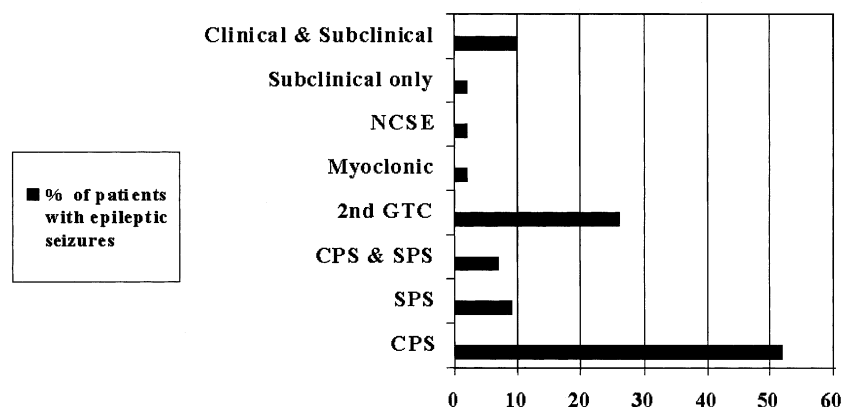


FIG. 1. CPS = complex partial seizures, SPS = simple partial seizures, 2nd GTC = secondarily generalized seizures, NCSE = non-convulsive status epilepticus.

of 27 patients with nonepileptic events had epileptiform discharges as well. Of the patients with only psychogenic seizures, four (36%) of 11 had epileptiform activity. Two of these four patients clearly had distinct seizure types, with epileptic seizures occurring in the remote past, and nonepileptic events at present. One of these four patients had a left temporal lesion.

DISCUSSION

In our series, the average age was 70 years, with mean length of stay of 3.8 days, and elderly patients were 8% of all admissions. Two other series of older patients admitted to EMUs had relatively similar demographics of patients. Drury et al. (7) reviewed 18 patients with a mean age of 69.5 years and a mean length of stay of 4.3 days, with elderly patients representing 4.6% of total admissions. In their series, 18 patients were admitted for differential diagnosis of current episodes. Lancman et al. (6) reviewed 20 patients older than 60 years admitted to an EMU. They found a similar mean age of 67 years and mean length of stay of 4 days, but the percentage of total admissions was only 1.5%. Our larger percentage of total admissions for elderly patients may simply represent a referral bias and the patient population of admitting physicians.

Complex partial seizures were the most frequent seizure type, occurring in 52% of the patients with epileptic seizures. This was similar to the findings from Lancman et al. (6) and Drury et al. (7). Partial seizures have consistently been found to be the most common seizure type in the elderly (2–5). Whereas partial seizures suggest a localization-related epilepsy, in the majority of elderly patients with epileptic seizures, a definite etiology cannot be found (2,3,8).

Almost half (13 of 27) of the patients with nonepileptic events had psychogenic seizures. Two patients with

psychogenic seizures were found in the series by Lancman et al. (6). In the series by Drury et al. (7), seven of 10 patients had nonepileptic events, which included both medical and psychiatric diagnoses. In addition, four of five patients with complex partial seizures in the series of Drury et al. had a change in seizure semiology, and these new events were suspected to be psychogenic seizures. The high percentage of psychogenic seizures in our series may represent an atypical patient group, as psychogenic seizures were previously thought to be rare in patients older than 60 years. Psychogenic seizures typically occur in young adulthood to middle age (9). However, our larger number of patients studied could reflect a more accurate estimate of the prevalence of psychogenic seizures in older patients. In our series, three patients older than 80 years had psychogenic seizures, one having a history of epilepsy. Although depression may be seen in some elderly patients with psychogenic seizures (10), analysis of other comorbidities is needed to better understand this interesting group of patients.

Of the physiologic nonepileptic events that were not psychogenic, various etiologies were found. There were no typical categories, and a similar diversity of etiologies also was seen by Lancman et al..

Partial seizures and nonepileptic events can have subtle manifestations, making clinical distinction between them difficult. Psychogenic seizures may not have motor manifestations (11). In our series, the nature of behavioral spells in six patients remained unclear. Drury et al. (7) found a similar proportion of undetermined events with one patient of 18 with unclear events that were suspected to be complex partial seizures of frontal lobe origin. It is possible that ictal semiology may change in the elderly. Drury et al. found that the typical events in the patients with a history of epilepsy had changed, causing the need for further analysis with video-EEG monitoring. Ramsay, in a recent review of epilepsy in the elderly (14), asserted that clinical mani-

festations of partial seizures differ from those seen in younger patients, possibly because of the extratemporal foci seen more often in the elderly. Transient epileptic amnesia may represent a different manifestation of complex partial seizures (15). Further studies of the clinical semiology of epileptic and psychogenic seizures will help to clarify these issues. In addition, interictal findings and supplementary functional imaging may help to distinguish suspected atypical seizures in these patients.

Nonconvulsive status epilepticus or subclinical seizures was suspected in 15% of the elderly patient admissions to this epilepsy monitoring unit. Seven of the 99 admissions had subclinical seizures. One patient was diagnosed with nonconvulsive status epilepticus, and one patient had only subclinical seizures. Five patients had both clinical and subclinical seizures. In a series by Litt et al. (12) of critically ill elderly patients, 24 patients were described to have nonconvulsive status epilepticus, but only two patients had a history of a known seizure disorder. In our series, three of the patients with subclinical seizures did not have a history of epilepsy, but the typical patient admitted to an EMU is not critically ill, representing a different patient population. This suspected diagnosis was the third most common reason for admission to our monitoring unit, but fewer than 1% of patients had this diagnosis. Evaluation for potential subclinical seizures may be due to unusual behavior, prolonged confusion, and other behaviors that are not strictly paroxysmal events. This again reflects the suspected atypical presentation of seizures in the elderly.

The majority of patients with all types of nonepileptic events were taking AEDs. Of the 11 patients with purely psychogenic seizures, five were currently taking AEDs, and six were not. Two patients had both partial seizures and psychogenic seizures. Of the patients with physiologic nonepileptic events, 12 of 14 patients were taking AEDs. Drury et al. (7) also determined that most patients with nonepileptic events were treated with AEDs, finding eight of 10 patients in this category. This further demonstrates the importance of diagnosing nonepileptic seizures in the elderly to limit unnecessary medications and their potential morbidities.

Interictal EEG findings typically change with age (10). Prior literature suggests that paroxysmal activity is seen infrequently or in the minority of elderly patients with seizures (8,13), and there is not an increase in epileptiform activity comparable to the increase in epilepsy in the elderly (10). In patients with poststroke seizures, focal epileptiform discharges are not clearly predictive of developing epilepsy (13). Ramsay and Pryor (14) cited data from an ongoing Department of Veteran Affairs study of seizures in the elderly, which finds that only 37% of 293 patients with new-onset epilepsy have epileptiform activity on routine EEG. In our series, 76% of the patients with epileptic seizures had interictal epilep-

tiform discharges on prolonged EEG monitoring. This includes patients with seizure onset before age 60 years, although the average age at onset of our patients with epileptic seizures was 56 years. We found epileptiform activity in 36% of admissions with only psychogenic events and 26% of patients with all types of nonepileptic events, suggesting potential comorbidities causing focal epileptiform activity. Most or all of these patients probably had epileptic seizures in the past, but their recent recurring spells were psychogenic in origin. These variable findings of interictal epileptiform activity in patients with and without seizures demonstrates further the importance of recording typical spells with video-EEG monitoring, as interictal recordings appear to be inadequate for diagnosis in this age group.

CONCLUSION

In our series, video-EEG monitoring in the elderly led to a definitive diagnosis in the majority of patients. Furthermore, the mean length of stay was 3.8 days, allowing a relatively short-term hospitalization. Although not directly investigated in this study, this suggests that video-EEG monitoring in the elderly is cost effective. Interictal EEG may be misleading because epileptiform activity may be seen in patients with nonepileptic events. A majority of patients with nonepileptic events were taking AEDs; therefore, accurate diagnosis of these paroxysmal events can lead to discontinuation of unnecessary and potentially harmful medication. From our review, we suspect that a significant number of elderly patients are misdiagnosed with epileptic seizures and inappropriately prescribed AEDs. It is critical that physicians recognize the possibility of nonepileptic events, including late-onset psychogenic seizures, and the need for a definitive diagnosis in this growing elderly population.

REFERENCES

1. Loiseau J, Loiseau P, Duche B, et al. A survey of epileptic disorders in southwest France: seizures in elderly patients. *Ann Neurol* 1990;27:232-7.
2. Hauser WA. Seizure disorders: the changes with age. *Epilepsia* 1992;33(suppl 4):S6-14.
3. Hauser WA, Annegers JF, Kurland LT. Incidence of epilepsy and unprovoked seizures in Rochester, Minnesota: 1935-1984. *Epilepsia* 1993;34:453-68.
4. Thomas RJ. Seizures and epilepsy in the elderly. *Arch Intern Med* 1997;157:605-17.
5. Scheuer ML, Cohen JC. Seizures and epilepsy in the elderly: epilepsy I: diagnosis and treatment. *Neurol Clin* 1993;11:787-804.
6. Lancman ME, O'Donovan CO, Dinner D, et al. Usefulness of prolonged video-EEG monitoring in the elderly. *J Neurol Sci* 1996;142:54-8.
7. Drury I, Selwa LM, Schuh LA, et al. Value of inpatient diagnostic CCTV-EEG monitoring in the elderly. *Epilepsia* 1999;40:1100-2.

8. Holt-Seitz A, Wirrell EC, Sundaram MB. Seizures in the elderly: etiology and prognosis. *Can J Neurol Sci* 1999;26:110–4.
9. Fakhoury T, Abou-Khalil B, Newman K. Psychogenic seizures in old age: a case report. *Epilepsia* 1992;34:1049–51.
10. Lee KS, Pedley TA. Electroencephalography and seizures in the elderly. In: Rowan AJ, Ramsey RE, eds. *Seizures and epilepsy in the elderly*. Boston: Butterworth-Heinemann, 1997:139–58.
11. Leis AA, Ross MA, Summers AK. Psychogenic seizures: ictal characteristics and diagnostic pitfalls. *Neurology* 1992;42:95–9.
12. Litt B, Wityk RJ, Hertz SH, et al. Nonconvulsive status epilepticus in the critically ill elderly. *Epilepsia* 1998;39:1194–202.
13. Luhdorf K, Jensen LK, Plesner AM. Etiology of seizures in the elderly. *Epilepsia* 1986;27:458–63.
14. Ramsay RE, Pryor F. Epilepsy in the elderly. *Neurology* 2000;55(suppl 1):S9–14.
15. Zeman AZJ, Boniface SJ, Hodges JR. Transient epileptic amnesia: a description of the clinical and neuropsychological features in 10 cases and a review of the literature. *J Neurol Neurosurg Psychiatry* 1998;64:435–43.