

FIRST DO NO HARM: SAFETY IN THE EPILEPSY MONITORING UNIT

Safety of Long-Term Video-Electroencephalographic Monitoring for Evaluation of Epilepsy. Noe KH, Drazkowski JF. *Mayo Clin Proc* 2009;84(6):495–500. **OBJECTIVE:** To determine the rate of medical complications from long-term video-electroencephalographic (EEG) monitoring for epilepsy. **PATIENTS AND METHODS:** We reviewed the medical records of 428 consecutive adult patients with epilepsy who were admitted for diagnostic scalp video-EEG monitoring at Mayo Clinic's site in Arizona from January 1, 2005 to December 31, 2006; 149 met inclusion criteria for the study. Seizure number and type as well as timing and the presence of seizure-related adverse outcomes were noted. **RESULTS:** Of the 149 adult patients included in the study, seizure clusters occurred in 35 (23%); 752 seizures were recorded. The mean time to first seizure was 2 days, with a mean length of stay of 5 days. Among these patients, there was one episode of status epilepticus, three potentially serious electrocardiographic abnormalities, two cases of postictal psychosis, and four vertebral compression fractures during a generalized convulsion, representing 11% of patients with a recorded generalized tonic–clonic seizure. No deaths, transfers to the intensive care unit, falls, dental injuries, or pulmonary complications were recorded. An adverse event requiring intervention or interfering with normal activity occurred in 21% of these patients. Length of stay was not affected by occurrence of adverse events. **CONCLUSION:** Prolonged video-EEG monitoring is an acceptably safe procedure. Adverse events occur but need not result in substantial morbidity or increase length of hospitalization. Appropriate precautions must be in place to prevent falls and promptly detect and treat seizure clusters, status epilepticus, serious electrocardiographic abnormalities, psychosis, and fractures.

COMMENTARY

Nonmaleficence, to do no harm to patients, is the guiding principle of medical ethics and is epitomized by the well known, if often misattributed Latin phrase *primum non nocere* (1). The principle is applied daily in clinical practice. Clinicians utilize an ever-expanding body of medical literature, along with their own clinical experiences, to provide a meaningful assessment of the risks, benefits, and alternatives for patients. In order to facilitate the care of patients with seizures or other undiagnosed paroxysmal events, video-EEG recording in an epilepsy monitoring unit is often recommended. In order to help these patients, physicians must first cause the very thing they are trying to treat: a seizure. Although the goals for admission vary depending on the clinical circumstances, they frequently include recording the patient's typical clinical event. In order to minimize the amount of time in the hospital, provocation techniques are often employed to elicit the symptoms. These techniques may include withdrawal or discontinuation of antiepileptic drugs, along with hyperventilation, sleep deprivation, and photic stimulation.

The potential hazards associated with seizures contribute to a higher standardized mortality rate for patients with epilepsy compared with the general population (2–4). Numerous studies have examined the potential benefits of video-EEG monitoring for the patients, families, and the healthcare system in terms of long-term cost savings. However, there are relatively little data published on safety during epilepsy monitoring. Falls represent a preventable risk to patients in the hospital setting; although

in one epilepsy monitoring unit, falls were 1.5 more times more frequent than in the neuroscience department at the same center (5).

Noe and Drazkowski retrospectively reviewed the safety of video-EEG monitoring in a consecutive series of adult patients admitted to an epilepsy monitoring unit with a final diagnosis of either partial or generalized epilepsy. Of the 428 patients monitored with video-EEG, 149 met the study's inclusion criteria. Patients with a nondiagnostic study (14%), physiologic events (4%), or nonepileptic psychogenic seizures (24%) were excluded from the study; patients admitted for treatment of status epilepticus (3%) also were excluded.

Seizure-related injuries pose potential risks to patients in a monitoring unit. In this study, seizures were recorded in 109 of 149 patients. Two patients had prolonged seizures that responded to rescue medications. Seizure clusters, defined as three complex partial or generalized tonic–clonic seizures within a 24-h period, occurred in 23% of all the admitted patients, while the same type of clusters occurring within a 4-h timeframe was seen in 9%. None of the patients required transfer to an intensive care setting. However, four patients developed vertebral compression fractures following a generalized tonic–clonic seizure; however, all four had confirmed osteopenia, and two had evidence of chronic compression fractures. Little is known about the incidence of vertebral fractures in patients with epilepsy. The authors note that in the time following the study period, from January 2007 until their findings were published in 2009, only one additional patient with a vertebral fracture had been identified. There were no falls or fall-related injuries observed during the study period. Cardiac abnormalities were detected in three patients, leading to inpatient cardiology consultations. Although postictal psychosis has been reported in up to 6.7%

of patients with seizures and poses a potential risk for patients (6), only two (1.8%) patients developed postictal psychosis.

The authors demonstrate that there was excellent overall safety during video-EEG monitoring, with continuous observation of both the video and EEG by a trained technologist. However, the level of monitoring provided varies among institutions, thereby limiting the applicability of these findings to other centers. An international survey of 78 medical centers and 42 respondents revealed that epilepsy monitoring units ranged in size from 1 to 20 beds. In this survey, 32 of 42 units (77%) reported that they have continuous patient surveillance, either by epilepsy monitoring unit staff or by family and friends of the patient (7). Many potential sources of injury (e.g., falls, agitation, or confusional states) identified in the study by Noe and Drazkowski as well as reviewed by Sanders et al. can be mitigated by vigilant monitoring and early intervention (8). The guidelines of the National Association of Epilepsy Centers “highly recommend” continuous observation in the inpatient epilepsy monitoring unit setting (9). One could hypothesize that centers with lower levels of patient monitoring may have higher rates of falls and seizure-related injuries.

As the technology of video-EEG systems continues to evolve, improved surveillance techniques have become available, including integrated pulse oximetry, superior video capabilities (e.g., increased resolution allowing for larger and clearer images of the patient), and improved automated detection algorithms. Although technology can certainly enhance safety efforts, accurate data regarding safety and interventions still need to be compiled. An expert consensus panel on monitoring unit safety occurred at a symposium during the 2008 American Epilepsy Society’s Annual Meeting, with presentations addressing a wide range of potential safety issues. This systematic examination of epilepsy monitoring unit safety issues might foster a revisitation of the current standards and ultimately, improve safety for a set-

ting with such inherent risks, given the need to capture seizures. Yet, the study by Noe and Drazkowski illustrates that it is possible for monitoring to be performed in a safe manner, albeit not risk-free. As the healthcare system in the United States begins to focus on quality and outcome measures in an effort to curtail costs, the epilepsy community can be proactive in evaluating the risks and benefits of video-EEG monitoring. Most importantly, safety measures need to be identified and utilized so that the primary tenet of our profession is maintained: *primum non nocere*.

by Chad Carlson, MD

References

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