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Developing a culture of safety in the epilepsy monitoring unit: A retrospective study of safety outcomes

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ABSTRACT

This study retrospectively reviewed 971 consecutive admissions to our epilepsy monitoring unit (EMU) from July 2007 to May 2011 to compare falls and missed seizures before and after implementing stricter safety processes in May 2009. New safety processes included enhanced staff education, a falls prevention signed contract with patient/family, observation of video-EEG monitors only by EEG technologists, hourly nurse rounding, standby assistance for hygiene needs, and immediate review of adverse events. Wilcoxon's two-sample tests were used for statistical analysis of the two groups. Reduced events between pre-intervention (492 patients) and post-intervention (479 patients) were significant for missed seizures (26 pre- vs 6 post-intervention, $p = 0.009$) but not for falls (12 pre- vs 7 post-intervention, $p = 0.694$). Intensive safety efforts in the EMU produced a 15% reduction in the fall rate per 1000 patient days and a 77% decrease in missed seizures. This study shows stricter safety processes help improve EMU patient safety.

1. Introduction

Patient falls, status epilepticus (SE), and postictal psychosis have been reported as known risks and common adverse events in patients admitted to an epilepsy monitoring unit (EMU) for withdrawal of anti-seizure medications and prolonged video-EEG [1–5]. Choking and aspiration have been confirmed as rare risks to EMU patients [6]. Since 2008, the American Epilepsy Society (AES) has intensified its efforts to evaluate patient care and safety issues in EMUs across the United States [4]. In a recent survey of AES members, falls were identified as the most common adverse event in the EMU [4].

As part of our large health system's "No Harm Campaign" [7] launched in 2008, our urban 800-bed academic medical center identified the need to monitor the falls rate weekly hospital-wide and to implement and reinforce measures to decrease falls. This campaign along with core safety mandates by the Joint Commission [8] and the AES safety initiative spearheaded our effort to build a culture of safety within our EMU with a focus on reducing falls, missed seizures, and other adverse events.

This study compares the incidence of falls and missed seizures before and after implementation of stricter safety processes in our EMU.

2. Methods

Consecutive EMU admissions from July 1, 2007 through May 31, 2011 were retrospectively reviewed. With the launch of the EMU safety initiative in May 2009, pre-intervention patients were defined as EMU admissions from July 2007 to May 2009 and post-intervention patients as EMU admissions from June 2009 to May 2011. This study was approved by our system's Institutional Review Board.

Falls and missed seizure data were extracted from our EMU Patient Safety Assessment Tool, a database established in 2007 that includes date and time of the incident, room number, and brief description of the incident. Incidents include falls, missed seizures by staff assigned to the video-EEG monitor room, SE, postictal psychosis, non-functioning resuscitation equipment, inadequate nursing response to a seizure or postictal state, lack of restraints when needed, suboptimal EEG recording, and delay in medication administration. Video-EEG clips of the incidents are saved for subsequent review and analysis. The epilepsy monitoring unit leadership (nurse manager and neurologist medical director) reviews the automated weekly incident report of EMU falls generated by the hospital's Falls Committee and compares it with the EMU safety database for discrepancies.

2.1. EMU safety process improvements

A checklist was developed to identify patients at increased risk for falls and injuries during seizures, such as those with a history of generalized tonic-clonic seizures, those with previous injuries during a seizure, or patients who were elderly, developmentally challenged, demented,

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or had motor weakness (paresis or paralysis). Restraint orders were expanded to include these predetermined high-risk patients.

Before implementation of stricter safety processes in 2009, 24-hour continuous observation of video-EEG monitors involved one EEG technologist during the day shift (8 am to 4 pm) with weekend and night coverage provided by nursing assistants with experience with the EEG equipment but with limited knowledge on seizure recognition. In 2009, entry-level EEG technologists were recruited to institute 24-hour continuous observation of video-EEG monitors after hours and during weekends. Effective April 2009, the staffing model for our 7-bed EMU included two nurses, two EEG technologists (one level 1 and one level 2), and one nursing assistant. Our EMU is a closed unit where medical care is provided by nine epileptologists, one nurse practitioner, and Clinical Neurophysiology fellows.

As part of the hospital-wide falls prevention effort in 2009, a nurse rounding "6 Ps protocol" was implemented in the EMU to check on each patient's 1) pain; 2) personal needs (toileting); 3) pulmonary hygiene (incentive spirometry); 4) position (pressure ulcer prevention); 5) possessions (items within reach such as call light, glasses, tissues); and 6) place (alerts in place, environment clean). This rounding protocol requires nurses to visit each patient once every hour to check the six categories and to sign the poster in the patient's room to indicate the hourly protocol was completed.

Specific to the EMU, the nursing staff provides standby assistance to all patients during personal hygiene needs, even with the presence of the family members.

Patients and their families become engaged on EMU safety processes during the first encounter with the nursing staff who introduces the "falls prevention agreement" that highlights the potential side effects during an EMU evaluation such as specific risks for falls due to cables and electrode wires, withdrawal of anticonvulsants to induce seizures, medication with sedative effect given to stop seizures, and environmental hazards during a seizure and/or fall. Adult patients or the patient's guardian are required to sign the falls prevention agreement stipulating that the patient will not leave the EMU bed for any reason without nurse assistance.

Before intervention, restraint orders were applied only to patients undergoing invasive EEG recordings. Following intervention, patients undergoing scalp EEG recordings are also evaluated daily by nurses and physicians to determine if they are "at risk of injuring self" due to ictal behavior. In addition, improved restraint orders were developed which include restraint type (4 side rails up, lap restraint, use of mittens and/or posey), patient's response to restraints (calm, confused, agitated, restless), and assessment of skin circulation. Restraint orders are discussed before and at the time of admission with patients and their families and are signed daily by nurses and physicians.

Another process improvement aimed to improve hand-off communications at shift change for nurses and EEG technologists. Team huddles occur twice daily at shift change, 7 am and 7 pm, to reinforce team transitions and communications about patient status.

2.2. EMU staff education improvements

In 2009, a more formalized method was introduced for educating EMU staff. Clinical education for neuroscience unit and EMU nursing staff and EEG technologists focuses on the safe management of EMU patients from the pre-admission patient/family phone communication through EMU patient discharge. Education modules include seizure types and clinical presentations; epilepsy diagnostic tests and treatment; response to and care during seizures; the role of seizure observation and reporting back of observations during and after the seizure; pediatric safety issues, emergency codes, and use of the Broselow pediatric bag; pediatric respiratory and medication issues; invasive epilepsy monitoring and clinical complications, such as increased intracranial pressure and hemorrhage; cardiac medications, electrocardiogram lead placement, and cardiac rhythm interpretation; and psychiatric disorders associated with epileptic and psychogenic non-epileptic seizures (PNES). Education also focuses on the video-EEG monitoring room, response to an EMU event, electrode application and removal as well as electrical safety. The staff attended a two-day telemetry training class, and the nurses were required to complete both a written exam and skills competency with nursing development.

Physician education focuses on the ongoing quality improvement process of monitoring, measuring, modifying, and implementing process change for continual enhancement of EMU safety. Education discussions include identification and review of patients at high risk of adverse events, EMU safety reports, and root causes of any recent adverse events with process changes made. Education of the medical staff is reinforced at the epilepsy staff meetings.

2.3. Adverse event root cause analysis

Stricter safety in the EMU also involved development of a team process for review of adverse events as they occur. When a patient falls or any adverse event occurs in the EMU, the post-event team process requires immediate debriefing by the management and staff to review the event thoroughly, assess and analyze the root cause, and identify and implement any required process change. The incident video-EEGs are saved for review and root cause analysis. The incident report and any immediate process improvement are disseminated via multiple communication methods to reach all staff: email, posted notice in common staff area in the unit, and discussion at shift team huddles twice daily. Any patient experiencing an adverse event is immediately identified in the high-risk category if not already to identified.

2.4. Statistical methods

This study compared EMU patient falls and missed seizures among pre-intervention and post-intervention groups. Wilcoxon's two-sample tests were done to compare the two time intervals for rate of falls and rate of missed seizures.

3. Results

We defined missed seizures as the seizures during which there was lack of recognition or delayed recognition by the video monitors and/or inadequate intervention when they were recognized (malfunctioning equipment, poor nurse response postictally or during postictal psychosis and delayed antiepileptic drug administration).

In the four-year study period, 971 consecutive patients (age range: 7–81 years) were admitted to the EMU. Approximately 40% of the patients were admitted for pre-surgical work-up and the remainder for diagnosis of paroxysmal events or classification of epilepsy and appropriate medication management. The pre-intervention group (492 patients) had 2.7 falls per 1000 patient-days (12 falls for 3452 patient-days) and 26 missed seizures, whereas the post-intervention group (479 patients) had 2.3 falls per 1000 patient-days (7 falls for 3086 patient-days) and 6 missed seizures. One fall resulted in a fractured clavicle; no serious sequelae occurred in any missed seizure episodes.

Analysis included all falls, even those observed in patients with non-epileptic events. During the pre-intervention period, one patient fell during a narcoleptic attack. During the post-intervention period, one patient with pre-syncopal events slipped down to the floor while he was using the bedside commode, and another patient with non-epileptic psychogenic seizures fell against the bathroom door. In both cases, the nurses were close to the patients and took the appropriate action to break the patient's fall.

Falls and missed seizure rates are shown in Figs. 1 and 2, respectively. The difference in falls between pre- and post-intervention (12 vs 7) was not significant ($p = 0.694$). A statistically significant reduction in missed seizures was found (26 pre-intervention vs 6 post-intervention; $p = 0.009$).