

Implementation of a Novel Seizure Assessment Tool for Unified Seizure Evaluation Improves Nurse Response

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ABSTRACT

BACKGROUND: Ictal and postictal testing is an essential aspect of clinical care when diagnosing and treating seizures. The epilepsy monitoring unit (EMU) has standard operating procedures for nursing care during and after seizure events, but there is limited interrater reliability. Streamlining ictal and postictal testing processes may enhance care consistency for patients in the EMU unit. The purpose of this study was to create an ictal and postictal seizure assessment tool that would increase the consistency of nursing assessment for EMU patients. **METHODS:** This prospective study had 4 phases: baseline assessment, instrument development, staff education, and field testing. During baseline assessment, an advanced practice provider and an epilepsy fellow graded nurse ictal and postictal assessment via survey questions. After instrument development, education, and implementation, the same survey was administered to determine if nursing consistency in assessing seizure events improved. The tool used in this study was created by a team of clinical experts to ensure consistency in the assessment of seizure patients. **RESULTS:** A total of 58 first seizure events were collected over a 6-month intervention period; 27 in the pretest and 31 in the posttest. Paired *t* test analyses revealed significant improvement in the clinical testing domains of verbal language function ($P < .005$), motor function ($P < .0005$), and item assessment order ($P < .005$) postintervention. There was nonsignificant improvement in the domains of responsiveness (feeling [$P = .597$], using a code word [$P = .093$]) and visual language function ($P = .602$). **CONCLUSION:** The data captured in this study support the need for this instrument. There is strong need to increase consistency in assessing seizure events and to promote continued collaboration among clinical teams to enhance care to EMU patients. Validation of this instrument will further improve team collaboration by allowing nurses to contribute to their fullest extent.

Keywords: epilepsy monitoring unit, epilepsy, ictal assessment, neurology, nursing, nursing research, postictal assessment, seizure

Ictal and postictal testing provides valuable information in diagnosing and treating seizures.¹ Although there are standard operating procedures for the epilepsy monitoring unit (EMU) outlining nursing responsibilities during and after seizure events, these may not be consistently followed.¹ Standardizing the ictal and postictal testing process could improve

patient care.² More consistent EMU assessment data can be used to drive vital treatment decisions about resective surgery, laser ablation, neuromodulation, or further medical therapy.^{3,4} The purpose of this study is to explore if a new EMU assessment tool improves consistency in nursing assessment during ictal and postictal events.

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A primary aim during admission to an EMU is to observe a patient's seizure and correlate observational data, such as videographic evidence of the seizure, with electroencephalographic (EEG) data to accurately diagnose the seizure and develop a personalized treatment plan.^{5,6} A hospital admission to the EMU can increase diagnosis certainty, aid with epilepsy management, and guide treatment options including pharmacologic or surgical treatment.^{7,8}

When a patient experiences a seizure in the monitored setting of the EMU, information regarding lateralization and localization of the seizure onset, frequency of seizures, medication response, and semiology can be attained.⁹⁻¹² Ictal and postictal testing plays an important role in distinguishing between different types of seizures.¹³ Responsiveness is tested to determine if the patient is aware or impaired during a seizure.¹⁴ Motor, verbal, and visual testing helps localize the seizure.¹⁰ For example, temporal lobe seizures are associated with short-term memory loss.¹⁵ The risk of a poor seizure assessment can lead to misdiagnosis, poor medication management, unnecessary costly procedures, and even prolonged hospital stays. This can cost the patients thousands of dollars and may increase morbidity and mortality.

International guidelines classify seizures as focal onset, generalized onset, or unknown onset.^{16,17} Focal seizures are further qualified by awareness or impaired awareness, and if they progress to bilateral tonic-clonic (formerly known as generalized tonic clonic seizures). All 3 initial classifications are also qualified by motor versus nonmotor onset. Focal aware seizures can be difficult to capture on scalp EEG, because they typically originate deep in the brain furthest away from the scalp electrodes.¹⁸ Scalp EEG is the criterion standard for diagnosing epilepsy. Unfortunately, this is not always helpful in pinpointing the exact area of seizure onset. For the scalp EEG to detect a seizure, it needs to be near the surface and large enough to be detected. For example, focal aware events are seizures but are infrequently picked up by the scalp EEG. Because there have been numerous advances in epilepsy care over the last several decades, we can now offer patients a more tailored approach to seizure freedom. Standardized seizure assessment can aid us in tailoring each patient's treatment plan. For example, if an assessment in a right hand dominant and nonverbal patient during a seizure suggests a left temporal onset. After detailed imaging and diagnostic confirmation, we can offer that patient a resection that can reduce seizures significantly. If it is noted during the assessment that a patient is unable to raise their right hand during/after a seizure, this indicates Todd paralysis and could be a possible left-sided onset. The EEG and assessment are 2 very important tools in localizing and lateralizing which leads to better

patient outcomes. Focal impaired awareness seizures typically give us the best localization information during our evaluation. This type of seizure is typically captured on scalp EEG and may spread slow enough to localize onset.^{12,19}

High-functioning level 4 EMU centers offer intracranial monitoring and surgical options to persons with epilepsy in addition to scalp electrode monitoring.²⁰ Upon arrival to an EMU, EEG technologists apply electrodes to initiate monitoring and record brain activities during their stay.²¹ Because the EMU aims to record seizure activities, many patients will be titrated off their antiseizure medication to provoke seizures.²² Additional measures such as sleep deprivation, photic therapy with a rapidly flashing light, and hyperventilation are performed to trigger seizure events.²³ Upon EMU admission, the clinical team encourages anyone in the patient room who witnesses a seizure or suspects a seizure event to push the seizure alarm button (push button event). The button will alert the EMU nursing staff to come to rapidly respond and test the patient for the clinical domains of responsiveness, motor function, and verbal language and visual language functions during and after a seizure. Therefore, the purpose of this study was to create a novel ictal and postictal assessment tool to increase the consistency of EMU nursing assessment for push button events and measure its use in an inpatient EMU setting.

Methods

This study compared baseline and postimplementation fidelity of nursing assessment during ictal and postictal events in a level 4 EMU at a university teaching hospital. The study was approved by the local institutional review board as exempt before the conduction of any research procedures. The primary hypothesis was that the implementation of a new standardized assessment tool would increase the consistency of nursing assessment during suspected seizure events. The subjects in the study were nurses, and both ictal and postictal assessments are standard of care at the enrolling institution.

This study was conducted in 4 phases—baseline assessment, instrument development, pilot testing, and postimplementation testing. The primary source of data collection was scoring the consistency of the assessment; the scores for each assessment were provided by the advanced practice provider (APP) and physician (MD) team members. At the enrolling institution, each push button event is recorded on video and reviewed by the clinical team as standard of care. The APP and MDs used a formal scoring rubric during their standard review of push button events to evaluate the consistency of nursing assessment in both pre- and posttest. Although this scoring rubric

is not externally validated, it is provided in Supplemental Digital Content 1, <http://links.lww.com/JNN/A542>. To reduce bias, the study team developed the formal scoring assessment after institutional review board approval but before initiation of the baseline assessment phase.

Although EMU patients often experience multiple push button events during their admission, all of which are reviewed, we included only the first scored assessment for each patient to reduce oversampling and repeated measures bias. In our EMU, the standard of care is to mark each and every event as a push button event; as such, non-push button events are very rare (eg, sub-clinical seizure). The APP and MD team members are epilepsy specialists and uniquely qualified to score events. The formal scoring system was used to assess nursing seizure response at baseline between May and July of 2023. During this period, every first push button event was reviewed, scored, and entered into a REDCap database.

The instrument development phase was conducted after the completion of baseline assessment. During this period, the clinical and research teams developed the University of Texas Ictal and Post-ictal Assessment (UTIPA). The UTIPA (Table 1) was developed collaboratively by the EMU medical director, an epilepsy fellow, an EMU nurse practitioner, a doctorally prepared nurse, the EMU nurse manager, and the research team. Multiple iterations of the instrument were discussed and based on the International League Against Epilepsy recommendations, nursing literature, and the current standard of care protocol in place at the enrolling institution.²⁴

The pilot testing phase occurred after the finalization of the UTIPA instrument and included staff education about the study and the new standardized ictal and postictal assessment tool. During this phase, the

UTIPA was introduced during staff meetings and educational events before being used by nurses, APPs, and MDs. Suggestions for instrument refinement, location of instrument materials, and clarification on scoring criteria were addressed. Additional nursing staff education was provided to employees during daily huddles, one-on-one educational training, and by way of a “badge-buddy” that could be added to employee identification badges. When a suspected seizure event occurs, the nurse uses the UTIPA assessment tool to ensure that all nursing assessments are performed in the manner and in the same order. The assessment should begin with responsiveness followed by motor function, then visual language function, and lastly verbal language function. The UTIPA mirrors the required documentation for suspected seizure events and aids in documentation.

The postimplementation phase began only after all parties of interest (nursing management, nursing staff, APP staff, and medical staff) had agreed on the final version of the UTIPA tool. Postimplementation data were obtained between September and November of 2023. During this time, the APP and MD research team members again reviewed and scored first push button events using the same scoring system used in the pretest. Push button event data were again entered into a REDCap database. After the conclusion of the postimplementation phase, data were entered into SAS v9.4 for Windows (SAS Institute) for analysis.

Results

A total of 58 first-push button events were scored and collected during the 6-month run-in phase. Twenty-seven events occurred during the baseline assessment phase (pretest) and 31 in the postimplementation (posttest) phase. To fully explore consistency, each portion of the assessment was examined using paired *t* test analyses. There was no difference in the

TABLE 1. Ictal and Postictal Assessment Tool

Clinical Testing Domains	Ictal Assessment	Postictal Assessment
Responsiveness	1. What are you feeling?	Did you have a seizure? What is the first thing you felt?
Responsiveness	2. Remember code word <i>Have patient repeat code word, if they cannot only repeat 1 more time.</i>	What was the code word I told you to remember?
Motor function	3. Lift your arms.	What did I ask you to do? Ask them to do no. 3 again. <i>Do not mimic.</i>
Visual language function	4. Show all 3 laminated pictures and ask patient to identify the object.	Do you remember the pictures? <i>If they do not remember, show 3 pictures to see if they remember which one.</i>
Verbal language function	5. Show all laminated sentences and ask patient to read.	Ask them to do no. 5 again. <i>Note if they missed a word.</i>

TABLE 2. Comparing Frequency of Assessment Before and After the Intervention

Assessment	Pre (n = 27)	Post (n = 31)	P
Responsiveness (feeling)	20 (74.1%)	21 (67.7%)	.597
Responsiveness (code word)	24 (88.9%)	22 (71.0%)	.093
Motor function (arms)	6 (22.2%)	20 (64.5%)	<.005
Visual language (pictures)	18 (66.7%)	18 (58.1%)	.602
Verbal language (sentences)	5 (18.5%)	21 (67.7%)	<.0005
Assessing in correct order	11 (40.7%)	5 (16.1%)	<.005

frequency of assessing responsiveness through testing “feeling” variable ($P = .597$), responsiveness through testing “code word” recollection ($P = .093$), or visual language assessment “pictures” ($P = .602$). There was a statistically significant increase in the frequency of testing motor function “arms” (6 [22.2%] vs 20 [64.5%], respectively; $P < .005$) and testing verbal language “sentences” (5 [18.5%] vs 21 [67.7%], respectively; $P < .0005$). As shown in Table 2, there was also a statistically significant decrease in performing the assessments in the correct order (11 [40.7%] vs 5 [16.1%], respectively; $P < .005$).

Discussion

The UTIPA was designed to standardize nursing assessment to ictal and postictal events. The care of seizure patients is complex, involving the collaboration of multiple clinical teams. Nurses, being at the front line of seizure response, have strong need for clearly defined processes to assess seizing patients quickly and efficiently while maintaining a safe and comfortable environment.²⁵ This study revealed there is strong need to improve ictal and postictal assessment. This can be achieved through clinical collaboration and educational initiatives. Several factors influence compliance to the new protocols and guidelines such as education, method of implementation, staff turnover, etc.²⁶ They followed the order of questions with better response time and completed the assessment in more instances than the night shift. This could be due to lack of training and lack of knowledge or understanding of the purpose of the UTIPA. This could be rectified by offering more training to the night shift nurses.

The results support that the UTIPA tool significantly improved nursing response to ictal and postictal events in motor function, verbal language function, and the order in which clinical domains were tested. Responsiveness and visual language function improved, albeit not to a significant degree. A comprehensive approach to seizure testing is vital to the correct characterization and localization of seizures. The order of the questions was significantly less structured using the new model. Seizure events

happen so quickly, within seconds to minutes, that it is imperative to collect as much data as possible in assessing the patient under time constraints. The first question was designed to assess for aura before loss of consciousness. Next, the code word was provided; this allowed that even if the subject was not speaking, there was a mechanism to assess consciousness. If they remembered the code word during the postictal period, then they retained consciousness to the point in time when the code word was provided. The remaining items that are tested are in no particular order but play an important role in testing for motor function as well as visual and verbal language that can help us determine the localization and lateralization of the seizure. The order of the remaining items was provided to the staff to facilitate testing consistency.

The limitations of this study include the small sample size, and that we were not able to control for newly hired staff during the observation period. The inclusion of only 58 observations from a single site limits the generalizability of the results. Any newly hired registered nurses involved in the care of EMU patients were oriented to the revised push button protocol used in this study. Under ideal conditions, the results could be calculated to control for new hires in the field testing phase; however, when the APPs reviewed seizure event footage, it was often impossible to identify which nurse was assessing the patient. Therefore, newly hired nurses were not excluded from the analysis. In addition, the verbal language prompt was modified between the pre- and posttest for clinical usage. In the pretest, verbal language function was assessed by asking the patient to count 1–10. After video footage review, the clinicians on the research team identified that the clinical domain was not being assessed as intended but more so the ability to follow commands. Not tracking which provider scored each event is a recognized limitation and potential opportunity for future research.

Conclusion

Our results showed improvement in responses in some of the domains supporting not only the need for this

tool but also the need for more education to improve its use. Nurses performing a precise and quality assessment during and after a seizure onset are beneficial to determine seizure type, seizure localization, and lateralization and to better prognosticate the course of care for the EMU patient. Standard neurological examinations are helpful to create a broad medical picture of the patient, but the epileptic population necessitates the use of a specialized tool to allow nurses to better assess the patient to their fullest extent.

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