EDITORIAL

Status Epilepticus
Redefined or Increasingly Detected?

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There are not many epidemiological studies regarding status epilepticus in the United States, especially in recent years. Much of the available data on status epilepticus are 10 to 15 years old and derived from small population-based observational studies, before the availability of electronic coding from a large number of centers, thus limiting the generalizability of the results.[1-4] The study by Betjemann et al[5] in this issue of *JAMA Neurology*, using large administrative databases, shows that both diagnosis of and association of mortality with status epilepticus has increased over the past 10 years, specifically in intubated patients for whom status epilepticus was not the principle diagnosis. Thus, it raises questions about why there is an increase in the number of patients receiving a diagnosis of status epilepticus and in status epilepticus-related mortality, how we define status epilepticus, and how this affects hospital outcomes and the allocation of health care resources.

Related article

Betjemann et al[5] looked at coding for hospital admissions (using the 1999-2010 Healthcare Cost and Utilization Project Nationwide Inpatient Sample) and for death certificates (using data from the Centers for Disease Control and Prevention) to determine trends in both hospital admission for status epilepticus and mortality associated with status epilepticus. With regard to death certificate data, they further examined whether status epilepticus was listed as the principal cause of death (ie, the underlying cause of death) or a secondary or associated cause of death (ie, any mention of the cause of death) and whether those patients were intubated or not intubated at the time of death. The results of this study[5] support and expand on another study,[6] which used a different large administrative database, the National Hospital Discharge Survey, but found a similar increase in the incidence of status epilepticus from 3.5 to 12.5 cases per 100 000 persons between 1979 and 2010, and concluded that an increased detection of status epilepticus and an increased frequency of its coding are likely contributing to an apparent increased incidence of status epilepticus.

The first thing made painfully clear in this study[5] is the inadequacy of the current coding system for accurately reflecting hospital diagnosis. The 2 *International Classification of Diseases, Ninth Revision* (*ICD-9*) codes that they looked at for hospital admissions are code 345.3, which is used for convulsive status epilepticus, and code 345.2, which is sometimes used for nonconvulsive status epilepticus, although it is actually meant to refer to absence status. The accuracy of the *ICD-9* codes for the diagnosis of convulsive status epilepticus has not been validated in a US population. Also, because of a lack of proper coding to describe status epilepticus, many cases of nonconvulsive status epilepticus or even partial status epilepticus were likely not included in this study,[5] and the overall incidence of status epilepticus was probably underestimated.

With regard to the increased frequency of coding for status epilepticus, there are likely 2 explanations. First, the clinical definition of status epilepticus has changed over the past 15 years, as increasing emphasis has been placed on the rapid treatment of status epilepticus, from any seizure lasting 30 minutes or longer to any seizure lasting 5 minutes or longer.[7,8] This results in a new subpopulation of patients with seizures lasting between 5 and 30 minutes who are now part of a group of patients who are considered to have status epilepticus.[9] It is not clear how this subpopulation might differ from those patients with seizures lasting 30 minutes or longer, but morbidity and mortality outcomes could be affected. The second explanation for the increased frequency of coding for status epilepticus, which is discussed by Betjemann et al,[5] is the financial incentive, or rather the insurance reimbursements for continuous electroencephalography (EEG) monitoring, justified by a diagnosis code of status epilepticus. One would hope that financial incentives for hospital procedures are not resulting in the inappropriate coding of the conditions of patients with status epilepticus who might not otherwise receive such a diagnosis. However, there may be a legitimate increase in the recognition of status epilepticus, and in the coding of it, where it was either missed or not coded for in the past, because of changes in financial incentives.

With regard to the increased detection of status epilepticus, even more significant than either a change in definition or an increase in coding is the increase in the use of continuous EEG monitoring in the critically ill population resulting in the increased diagnosis of previously unrecognized status epilepticus. This study[5] adds to the ongoing discussion about the roles that status epilepticus and continuous EEG monitoring play in the treatment and prognosis of critical illness. No one will be surprised to hear that status epilepticus is increasingly being diagnosed under clinical circumstances in which it was not previously considered. Continuous EEG monitoring is becoming increasingly accepted as a monitoring technique in intensive care units, and understandably so, given that up to 34% of neurological patients in intensive care units have nonconvulsive seizures and that 76% of these will have nonconvulsive status epilepticus.[10] It was very helpful that Betjemann et al[5] also included data from the *ICD-9* code for video EEG monitoring, which, although relatively insensitive and likely to underestimate the use of continuous EEG monitoring, nevertheless showed a 3-fold increase during the study period.

The sharp increase in hospitalizations associated with diagnoses of status epilepticus in 2005 correlates with an increase during the same time in the literature on the use of continuous EEG for critically ill patients, reflecting an increased awareness of the use of continuous EEG monitoring for the detection of previously unrecognized seizures in critically ill patients and an exponential increase in the use of continuous EEG monitoring in intensive care units. It is interesting that Medicare seemed to reflect this trend more than other insurance types. Recent recommendations of the Neurocritical Care Society Status Epilepticus Guideline Writing Committee regarding the use of continuous EEG include the following: (1) The use of continuous EEG is usually required for the treatment of status epilepticus. (2) Continuous EEG monitoring should be initiated within 1 hour of onset of status epilepticus if ongoing seizures are suspected. (3) The duration of continuous EEG monitoring should be at least 48 hours for comatose patients in order to evaluate for nonconvulsive seizures.[8] Unless you look, you will not see it. The more we look for status epilepticus in critically ill patients, the more we are finding it and, therefore, including it as part of the hospital diagnosis.

One of the strengths of this study,[5] which differs from many prior studies, was the use of the underlying cause of death as defined by the World Health Organization to distinguish death directly caused by status epilepticus from death merely involving, but not primarily caused by, status epilepticus. Betjemann et al[5] postulate that use of the underlying cause of death may be one reason for the strikingly lower mortality rates in their study compared with prior studies in which mortality statistics included status epilepticus as secondary cause of death. The lower mortality rates, however, may also reflect the increased awareness and more rapid treatment of status epilepticus, including improved treatment in intensive care units.

Betjemann et al[5] hypothesized that status epilepticus-related mortality would have decreased over the past 10 years owing to the early identification of status epilepticus and improved prehospital treatment. With more cases fulfilling status epilepticus categorization in the 5- to 30-minute window, one would also have expected decreasing status epilepticus-related mortality. The fact that mortality related to status epilepticus as an indirect cause of death has increased, while mortality related to status epilepticus as the primary or underlying cause of death has remained relatively unchanged, is likely related to the increased recognition of the role that status epilepticus plays in the morbidity (but not primary mortality) of an otherwise ill population. We have many more cases of nonconvulsive status epilepticus accurately coded as status epilepticus, and these tend to have a worse prognosis.

As Betjemann et al[5] elegantly demonstrate, the largest increase in the number of patients receiving a diagnosis of status epilepticus is for intubated patients for whom status epilepticus is not the principle diagnosis. These patients largely represent patients in intensive care, where status epilepticus is a complication or a manifestation of a primary illness. Betjemann et al[5] point out that status epilepticus in these patients is merely a sign of severe secondary brain injury and that, ultimately, mortality will be driven by the underlying etiology of the status epilepticus, be it cerebral hemorrhage, hypoxic brain injury, ischemic stroke, severe sepsis, etc. In so doing, Betjemann et al[5] are indirectly calling into question the benefits of using a "scarce and costly resource" (ie, continuous EEG monitoring to find status epilepticus, which will simply confirm severe brain injury in a patient for whom the underlying etiology is ultimately driving mortality). This is, of course, speculative and likely meant to engage the medical community in an important and necessary discussion regarding the allocation of health care resources. Many would strongly disagree with the statement that the underlying etiology of status epilepticus is the prevalent cause of mortality among patients with increasingly recognized complications of status epilepticus during their illness. In fact, it is a presumption to suppose that these patients will necessarily have poor outcomes simply because of their underlying disease, when the reasons for poor outcomes are increasingly recognized as potentially reversible complications (such as status epilepticus).

Although status epilepticus may be a secondary sign of brain injury, inasmuch as that brain injury may be reversible, continuous EEG may be quite useful in directing timely treatment that may improve outcomes. Asking how status epilepticus directly affects prognosis may be the wrong question, and, instead, asking how it is a reliable surrogate marker for those underlying etiologies that do determine outcomes may be where the use of continuous EEG monitoring will be found in the next decade.

The definition of status epilepticus has changed over time in US practice, and so has the protocol for its detection, with increased numbers of patients receiving a diagnosis of nonconvulsive or convulsive status epilepticus primarily from critically ill populations in the past 10 years. More questions remain unanswered, provoked by these findings. How are the outcomes different in principle vs nonprinciple status epilepticus? Does continuous EEG monitoring with detection and treatment of nonprinciple status epilepticus in critically ill patients improve their prognosis? Or is it improper use of health care resources? More true epidemiological studies not based on reimbursement coding are needed, using large databases representative of the general population and properly differentiating subtypes of status epilepticus. In the new *ICD-10* coding, there will be more options for properly coding status epilepticus, although nonconvulsive status epilepticus remains somewhat elusive. We also need improved *Current Procedural Terminology* coding that accurately reflects how we use continuous EEG in intensive care units, where status epilepticus is not always the reason for such monitoring (instead, eg, monitoring can be used for the detection of focal ischemia in vasospasm or the determination of prognosis after cardiac arrest). Future studies need to specifically examine nonprinciple status epilepticus in the critically ill population vs principle status epilepticus often diagnosed in patients with premorbid epilepsy (who are known to have better outcomes), convulsive vs nonconvulsive status epilepticus, and refractory vs nonrefractory status epilepticus, and whether increased detection of status epilepticus in these populations changes management or outcomes.

ARTICLE INFORMATION

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Published Online: April 27, 2015. doi:10.1001/jamaneurol.2015.0204.

Conflict of Interest Disclosures: None reported.

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