



Diagnostic decision-making after a first and recurrent seizure in adults

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ABSTRACT

Purpose: The role of EEG after a first seizure has been debated. Epileptiform EEG activity is a good predictor of seizure recurrence, but is reported in only 8–50% of first-seizure adult patients. Even if the EEG is abnormal, the opinions about treatment after a first seizure differ. The role of EEG in treatment decisions after remission or recurrence is also unclear. This study aims to identify neurologists' diagnostic strategies compared to guidelines about the use of EEG (i) after a first unprovoked generalized seizure in adults, (ii) after a recurrent seizure and (iii) in treatment decisions after recurrence or remission.

Method: All members of the Dutch Neurological Society were invited to participate in our on-line survey about the use of EEG after a first seizure, after recurrent seizures and in treatment decisions. Ten percent ($N = 110$) of invitees participated, including mainly clinical neurophysiologists, general neurologists and neurologists-in-training.

Results: Ninety-five percent of the respondents would request a routine EEG after a first seizure. After normal MRI and EEG findings, 4% would record a second routine EEG, 48% a sleep-deprived EEG and 45% would not repeat the EEG. If a recurrent seizure occurs within six, or after 12 or 24 months, 87%, 67% and 44% would respectively conclude that the patient has epilepsy, while 57%, 65% and 72% would request an EEG. When a patient experiences a recurrence while being treated with anti-epileptic drugs, 11% of the respondents would request an EEG. Twenty-five percent would request an EEG before stopping medication after two years of remission.

Conclusion: The variability in neurologists' reported strategies about the use of EEG in the diagnosis of seizures is remarkably large. Consequences for the individual patient may be significant, including treatment decisions and driving restrictions. The availability and use of more sensitive diagnostic methods may be necessary to enhance agreement between neurologists.

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1. Introduction

When an adult presents to the emergency department (ED) after a first seizure, an important question is whether or not there is an increased risk of seizure recurrence.¹ After an unprovoked first seizure, symptomatic etiology and epileptiform EEG activity are the two most consistent predictors of seizure recurrence.² Therefore, MRI and routine (20–30 min) EEG including hyperventilation and photic stimulation, are both part of the standard diagnostic approach in first-seizure patients. This study specifically addresses the role of EEG in first-seizure diagnosis.

The estimated probability of seizure recurrence after a first seizure in adults with epileptiform EEG abnormalities is 49.5%, compared to only 27.4% in individuals whose EEGs are completely normal.³ Still, the value of a routine EEG after a first seizure has been debated.⁴ A normal routine EEG does not exclude the presence of a seizure disorder. Furthermore, presence of epileptiform activity was reported in only 8–50% of first-seizure adult patients.³ Routine EEGs are therefore often repeated, or followed by a sleep-deprived EEG, as this may increase sensitivity.^{5,6} Still, there are epilepsy patients in whom repeated EEGs do not show any epileptiform abnormality. The main reason may be that scalp electrodes sample only one-third of the cortex. This limits the sensitivity for IEDs arising from within sulci or with tangential dipoles. IEDs may also be generated by such a small amount of cortex, that the resulting extracellular currents are insufficient to allow reliable detection with scalp EEG.⁷ Another issue is the limited duration of routine EEG-registrations, which will not show any discharges that occur infrequently. On the other hand, even if

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the EEG is abnormal, the opinions on treatment after a first seizure differ. Immediate treatment reduces the number of recurrences, but some patients may be treated unnecessarily.^{8,9}

The majority of patients (92%) who present with a first unprovoked seizure and are treated with anti-epileptic drugs attain a two year remission within five years after the first event, regardless of immediate or deferred treatment.¹⁰ When informing patients about the consequences of discontinuing treatment after such a period of seizure-freedom, accurate risk assessment is essential. In these circumstances, the routine EEG may assist, as it allows prognostication about the likelihood of remission or may be used to predict seizure recurrence in the event of epileptiform activity.¹¹ In children, persistent interictal epileptiform activity is associated with an increased risk of seizure recurrence if AEDs are discontinued after remission. However, in adults, the relevance of interictal epileptiform activity is much less certain.¹²

Guidelines may assist physicians in decision-making concerning the diagnosis and treatment after a first seizure or recurrent seizures. The clarity and clinical applicability of a guideline may be important attributes that contribute to the effects of practice guidelines.¹³ Several guidelines or practice parameters regarding the use of EEG after a first seizure or recurrent seizures have been developed.

The American Academy of Neurology (AAN) and American Epilepsy Society (AES) developed a practice parameter for evaluation of adults presenting with an apparent unprovoked first seizure. They conclude that in these patients, the EEG is probably helpful and that the routine EEG should be used as part of the neurodiagnostic evaluation of the adult because it has substantial yield and value in determining the risk of seizure recurrence.³

The National Institute for Health and Clinical Excellence (NICE) guidelines about the use of EEG state that an EEG should be performed only to support a diagnosis of epilepsy in adults in whom the clinical history suggests that the seizure is likely to be epileptic in origin. In those presenting with a first unprovoked seizure, unequivocal epileptiform activity on EEG should be used to assess the risk of seizure recurrence. If diagnosis is still unclear after a standard EEG, repeated standard EEGs may be helpful but should not be used in preference to sleep or sleep-deprived EEGs. Further, when a routine EEG has not contributed to diagnosis or classification, a sleep EEG should be performed. There is no information in the guidelines about the role of EEG in the decision to stop medication after remission.¹⁴

The International League Against Epilepsy (ILAE) has no international guidelines on the use and role of EEG in first-seizure and epilepsy diagnosis. However, according to the Italian League Against Epilepsy, an EEG should be performed within 24 h after a seizure, particularly in children. If the EEG is normal during wakefulness, a sleep EEG is recommended.¹⁵ The Dutch

Neurological Society has, together with the Dutch League Against Epilepsy, developed guidelines for diagnosis and treatment of epilepsy (revised, 2nd version, 2006). These guidelines however do not give information about which EEGs should be used after a first seizure or recurrent seizures in adults.

In this paper, we present neurologists' reported diagnostic decisions in adults where we will specifically emphasize on the use of EEG (i) after a first unprovoked generalized seizure, (ii) after recurrent seizures at different time-intervals, and (iii) in the decision to start or change medication after recurrence or to stop medication after remission. Responses reflect neurologists' diagnostic decisions regarding patients in the Netherlands and will be compared to both national and international guidelines.

2. Methods

Approximately 1100 members (neurologists and neurologists in training) of the Dutch Neurological Society were invited to participate in our online survey about the use of EEG after a first seizure in adults, after a second seizure at different time-intervals from the first, and when making treatment decisions after recurrence or remission. The invitation included an informative letter with a link to the on-line survey at www.epilepsydata.eu. Participation in the survey was anonymous.

Participants were first asked for their educational background, type of hospital they worked at and their number of years in practice. A case was then described in which an adult presents to the ED after a first unprovoked generalized seizure. Participants were asked what their policy would be, what conclusions they would draw and which EEGs they would request for several scenarios, including normal and abnormal EEG findings and seizure recurrence. Corresponding questions and response options are listed in Table 1. Second, participants were asked whether they would perform additional EEG measurements in treated epilepsy if a recurrence occurs after 18 months of seizure freedom or when considering stopping medication after two years of remission. The survey included multiple-choice, yes–no as well as open questions. Data were analyzed using PASW Statistics version 18.0.0, SPSS Inc., by means of descriptive statistics. Non-responses were excluded.

3. Results

Ten percent ($N = 110$) of the invited neurologists (in training) responded before the deadline. The majority of the respondents (56%) had worked for more than five years as a neurologist (see Table 2). Primarily, general neurologists, clinical neurophysiologists and neurologists in training (87% in total) responded to the survey (see Table 2).

Table 1

Three survey questions for the case: 'An adult presents to the ED after a first unprovoked generalized seizure – the neurological examination was normal'.

Q1. What is your policy? You can choose multiple answers from the options below:	Q2. What would be your conclusion and policy after each of the findings below? The MRI was normal.	Q3. What would be your conclusion and policy after each of the findings below?
- MRI-scan	(1) If the routine EEG is normal	(1) If the routine EEG contains 2 temporal spike-and-wave discharges
- Routine EEG	(2) If both routine and sleep-deprived EEGs are normal	(2) If the routine EEG contains generalized spike-and-wave discharges
- Sleep-deprived EEG	(3) After a recurrence within 6 months after the first one	
- Long-term EEG (~2 h)	(4) After a recurrence after 12 months after the first one	
- Start medication	(5) After a recurrence after 24 months after the first one	
- Hospitalization for one day/night		
- Routine blood tests		
- None of the options above		

Response options for Q2 and Q3: conclusion: epilepsy/first seizure, no epilepsy/possibly epilepsy but I will wait/no conclusion, I still miss information policy: no EEG/routine EEG/sleep-deprived EEG/long-term EEG (~2 h)/long-term EEG (>12 h).

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