

Ambulatory EEG

David M. Ficker, M.D.

Professor of Neurology

University of Cincinnati College of Medicine

1) Introduction

- a) Ambulatory EEG allows for prolonged EEG recording in an outpatient setting (with or without video)
- b) Initially studies used 4-channel recordings (1972) on cassette tapes.
- c) Now digital technology allows for up to 32-channel recording with continuous recording of EEG data.
 - i) Supplemented with automated spike and seizure detection
 - ii) Additional physiologic monitoring is possible (ECG, respiratory)
 - iii) Some systems have added video recording
- d) Advantages of ambulatory EEG
 - i) Recording of EEG in the patient's home environment
 - ii) Record EEG in multiple stages of sleep
 - iii) Less expensive than inpatient video/EEG recordings

2) Techniques of recording

- a) Electrode application
 - i) Since the patient is at home with the EEG recording, electrode integrity can be challenging.
 - ii) Apply electrodes with collodion to ensure maximal electrode stability
 - iii) Wrap head
- b) EEG recording
 - i) Continuous EEG recording versus intermittent EEG sampling.
 - (1) Intermittent recording saves time samples, spike and seizure detections and push button events. May miss events that are not associated with push buttons
 - (2) Continuous recording stores the entire EEG recording. Review is more complex since there is more EEG data to review, but this can be assisted with spike and seizure detection.
- c) Patient diary
 - i) It is essential for the patient or caregiver to keep a diary of activities and events. Since EEG recording is unattended, a written description of any recorded spells is important to provide clinical correlation of the EEG. Any recorded events should be confirmed to be typical prior to determining a diagnosis (especially nonepileptic seizures and without video recording).

- 3) Indications and clinical use of ambulatory EEG
 - a) Determination of interictal EEG abnormalities
 - i) Detection of interictal epileptiform abnormalities can provide supporting evidence of a clinical diagnosis of epilepsy.
 - ii) A single routine EEG only shows epileptiform abnormalities in ~50% of those who have epilepsy. Recording with sleep deprivation may increase the yield ¹⁻⁴.
 - iii) Ambulatory EEG is another option to assess for epileptiform abnormalities if routine EEG is normal.
 - (1) Allows recording of EEG during drowsiness and sleep when epileptiform abnormalities may be more frequent.
 - (2) Ambulatory EEG yield ranges from 11-78% ⁵.
 - b) Classification of seizures
 - i) Recording the ictal EEG is the gold standard in determining the type of seizure
 - ii) Recording of seizures is possible with ambulatory EEG depending on the patient's frequency of events
 - iii) Inpatient video/EEG monitoring is the preferred method to record ictal EEG recordings since video is available and technician interaction is possible.
 - (1) Recording of seizures for surgical evaluation should not be made with ambulatory EEG.
 - (2) Medications should not be tapered during ambulatory EEG studies.
 - iv) Some clinical circumstances may make inpatient video/EEG monitoring challenging and ambulatory EEG may be helpful in recording events
 - v) The diagnosis of nonepileptic events should be made with caution on ambulatory EEG especially if video recording is not used. One must confirm that habitual events are captured on EEG prior to making the diagnosis. Not all epileptic seizures are associated with a scalp EEG discharge and it therefore possible to erroneously diagnose nonepileptic events in this circumstance.
 - c) Quantifying seizure frequency
 - i) In patients who are unaware of their seizures, ambulatory EEG can be used to look for unrecognized seizures. A particular useful situation is to determine if someone with absence epilepsy is truly seizure free when making a determination for driving eligibility.
 - ii) Assessing for unrecognized nocturnal seizures can be performed with ambulatory EEG.
- 4) Limitations of ambulatory EEG
 - a) Technical
 - i) Artifacts
 - (1) Because the patient is unattended, electrode artifacts can be a significant issue.
 - (2) EEG technologists should provide instruction on electrode care

- (3) Electrode artifacts may simulate interictal or ictal abnormalities and care should be taken not to over interpret artifacts.
- ii) Battery life and storage
 - (1) Length of recording is limited by battery life and storage capacity
 - (2) Many systems have a limitation of 72 hours of recording which may be sufficient to record interictal EEG but not sufficient for recording of spells.
 - (a) If longer recording is desired, the patient may need to return to the lab to download recorded data and changing of batteries
 - (b) Longer recording time may be better assessed with an inpatient video/EEG study.
- b) Clinical
 - i) Medication taper
 - (1) In inpatient video/EEG units, AEDs are typically tapered or stopped to help record seizures in a timely fashion. This cannot be done during outpatient ambulatory EEG studies given the risk of increasing seizures or precipitating status epilepticus.
 - ii) Lack of clinical interaction during seizures
 - (1) Ambulatory EEG studies lack the interaction during seizures that is possible in inpatient epilepsy monitoring units (examples include assessing level of responsive, postictal language assessment, length of time for recovery).
 - iii) Video
 - (1) The patient may not be on video the entire time and seizures may be captured while off of video
 - (2) Some seizures (such as frontal lobe seizures) may not show a clear ictal scalp discharge and if recorded without video, the event may be incorrectly classified as a nonepileptic event.
- 5) Personal recommendations for ambulatory EEG
 - a) This author uses ambulatory EEG in the following clinical situations
 - i) Assessing for the presence of epileptiform discharges if routine EEG is normal when confirmation of their presence is important in deciding treatment (i.e. focal versus generalized epileptiform discharges).
 - ii) Assisting in determining if antiepileptic drugs can be tapered (especially in patients who undergo epilepsy surgery and are seizure free).
 - iii) Determining if there are unrecognized seizures (especially absence seizures)
 - iv) Recording of spells (only if inpatient video/EEG monitoring cannot be performed)

References

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