Electroencephalographic (EEG) Video Monitoring

Number: 0322

Policy

*Please see amendment for Pennsylvania Medicaid at the end of this CPB.

I. Aetna considers electroencephalographic (EEG) video monitoring medically necessary for the following indications, where the diagnosis remains uncertain after recent (within the past 90 days) neurological examinations and standard EEG studies, and non-neurological causes of symptoms (e.g., syncope, cardiac arrhythmias) have been ruled out:

   A. To differentiate epileptic events from psychogenic seizures; or
   B. To establish the first diagnosis of a seizure disorder; or
   C. To establish the specific type of epilepsy in poorly characterized seizure types where such characterization is medically necessary to select the most appropriate therapeutic regimen.

In addition, EEG video monitoring is considered medically necessary to establish the diagnosis of epilepsy and to

Policy History

Last Review 03/23/2017
Effective: 04/13/1999
Next Review: 03/22/2018

Review History

Definitions

Additional Information

Clinical Policy Bulletin Notes
evaluate response to treatment in very young children (3 years of age or younger) with clinical symptoms consistent with epilepsy, and abnormal routine EEG consistent with epilepsy.

**Note:** Once the cause of seizures and specific type of epilepsy has been established, continued video EEG monitoring (e.g., for monitoring response to therapy or titrating medication dosages in older children and adults) is considered not medically necessary. In these cases, response to therapy can be assessed using standard EEG monitoring or ambulatory EEG monitoring.

II. Aetna considers EEG video monitoring medically necessary for identification and localization of a seizure focus in persons with intractable epilepsy who are being considered for surgery. See also [CPB 0394 - Epilepsy Surgery](../300_399/0394.html).

III. Aetna considers EEG video monitoring experimental and investigational for all other indications (e.g., assessment of obstructive sleep apnea, cardiac arrest, coma, headache, and assessment of the effectiveness of drug treatment in epilepsies, and prognosis of (i) cardiac arrest treated with hypothermia, and (ii) newborns with hypoxic-ischemic encephalopathy treated with hypothermia; not an all inclusive list) because its effectiveness for these indications has not been established.

**Note:** The medically necessary level of care a member requires should be addressed individually according to the member's clinical needs. An acute level of care is not considered medically necessary for many persons requiring video EEG monitoring.

See also [CPB 0221 - Quantitative EEG (Brain Mapping)](../200_299/0221.html), [CPB 0289 - Grid Monitoring and Intraoperative Electroencephalography](../200_299/0289.html), and [CPB 0425 - Ambulatory](../200_299/0425.html)
Electroencephalography (../400_499/0425.html).

**Background**
The Agency for Health Care Policy and Research has stated that information provided by video electroencephalographic (EEG) monitoring has improved patient outcome by permitting accurate diagnoses and modified therapy. Furthermore, the American EEG Society has noted that this procedure is widely regarded as safe and effective for evaluating seizures disorders. The American Epilepsy Society has stated that this technique is the method of choice for the evaluation of intractable and/or undiagnosed seizure disorders. Additionally, many studies have reported the usefulness of this technique, and recommended its use for the diagnosis of psychogenic seizures.

An evidence report prepared for AHRQ (Ross et al, 2001) concluded that EEG video monitoring was useful for diagnosis of epilepsy if the EEG, CT, and MRI are non-diagnostic, and in diagnosis in very young children, in patients with poorly characterized seizure types, and in those with suspected psychogenic seizures. The report concluded that video EEG has a role subsequent to a new diagnosis if the diagnosis is or becomes uncertain or if surgery is considered. "In summary ... [t]he literature suggests that ambulatory and video EEGs are useful in a first diagnosis if standard EEG, CT, and MRI are non-diagnostic. Video EEGs are also useful in diagnosis in very young children, in patients with poorly characterized seizure types, and in those with suspected psychogenic seizures, especially if episodes are frequent." The report continued: "[T]he evidence, although scant, suggests there is no role for standard EEG in routine monitoring of patients after a new diagnosis of epilepsy. Video EEG has a role subsequent to a new diagnosis if the diagnosis is or becomes uncertain or if surgery is considered" (Ross et al, 2001).

The role of video and ambulatory EEG is confined to refining or changing an uncertain diagnosis or in preoperative evaluations for seizure surgery (Ross et al, 2001). When seizures are frequent and features are atypical or uncertain, these EEGs may
well contribute information necessary to correct a
misdiagnosis. The literature describing these EEGs appears
confined to specialists in academic centers.

An assessment of EEG video monitoring by the Institute for
Clinical Effectiveness and Health Policy (Pichon Riviere, et al.,
2011) concluded: "In patients with refractory epilepsy who have
previously been studied using the standard diagnostic tests,
telemetry video electroencephalography (V-EEG) seems to be
an adequate diagnostic test to: differentiate a crisis from a
pseudocrisis, characterize the different types of crises and
localize the epileptic area. Continuous video-EEG monitoring is
not considered medically necessary to monitor the antiepileptic
drug response or drug titration."

Stefan et al (2011) stated that a reliable method for the
estimation of seizure frequency and severity is of value in
assessing the effectiveness of drug treatment in epilepsies.
These quantities are usually deduced from subjective patient
reports, which may cause considerable problems due to
insufficient or false descriptions of seizures and their frequency.
In a feasibility study, these researchers presented data from 2
difficult-to-treat patients with intractable epilepsy. Patient 1
has had an unknown number of complex partial (CP) seizures.
A prolonged outpatient video-EEG monitoring over 160-hr and
137-hr (over an interval of 3 months) was performed with an
automated seizure detection method. Patient 2 suffered
exclusively from nocturnal seizures originating from the frontal
lobe. In this case, an objective quantification of the
effectiveness of drug treatment over a time period of 22 weeks
was established. For the reliable quantification of seizures, a
prolonged outpatient video/video-EEG monitoring was
appended after a short-term inpatient monitoring period.
Patient 1: The seizure detection algorithm was capable of
detecting 10 out of 11 seizures. The number of false-positive
events was less than 0.03/hr. It was clearly demonstrated that
the patient showed more seizures than originally reported.
Patient 2: The add-on medication of lacosamide led to a
significant reduction in seizure frequency and to a marked
decrease in the mean duration of seizures. The severity of seizures was reduced from numerous hyper-motoric seizures to few mild, head-turning seizures. The authors concluded that outpatient monitoring may be helpful to guide treatment for severe epilepsies and offers the possibility to more reliably quantify the effectiveness of treatment in the long-term, even over several months. The findings of this feasibility study need to be validated by well-designed studies.

Therapeutic hypothermia (TH) is becoming standard of care in newborns with hypoxic-ischemic encephalopathy (HIE). The prognostic value of the EEG and the incidence of seizures during TH are uncertain. Nash and colleagues (2011) described evolution of EEG background and incidence of seizures during TH, and identified EEG patterns predictive for MRI brain injury. A total of 41 newborns with HIE who underwent TH were included in this study. Continuous video-EEG was performed during hypothermia and re-warming. EEG background and seizures were reported in a standardized manner. Newborns underwent MRI after re-warming. Sensitivity and specificity of EEG background for moderate-to-severe MRI brain injury was assessed at 6-hr intervals during TH and re-warming. EEG background improved in 49 %, remained the same in 38 %, and worsened in 13 %. A normal EEG had a specificity of 100 % upon initiation of monitoring and 93 % at later time points. Burst suppression and extremely low voltage patterns held the greatest prognostic value only after 24 hrs of monitoring, with a specificity of 81 % at the beginning of cooling and 100 % at later time points. A discontinuous pattern was not associated with adverse outcome in most patients (73 %). Electrographic seizures occurred in 34 % (14/41), and 10 % (4/41) developed status epilepticus. Seizures had a clinical correlate in 57 % (8/14) and were subclinical in 43 % (6/14). The authors concluded that continuous video-EEG monitoring in newborns with HIE undergoing TH provides prognostic information about early MRI outcome and accurately identifies electrographic seizures, nearly 50 % of which are subclinical. The findings of this small study need to be validated by well-designed studies.
Rosetti et al (2010) examined if continuous EEG (cEEG) may predict outcome of patients with coma after cardiac arrest (CA), particularly in the setting of TH. From April 2009 to April 2010, these researchers prospectively studied 34 consecutive comatose patients treated with TH after CA who were monitored with cEEG, initiated during hypothermia and maintained after rewarming. EEG background reactivity to painful stimulation was tested. They analyzed the association between cEEG findings and neurologic outcome, assessed at 2 months with the Glasgow-Pittsburgh Cerebral Performance Categories (CPC). Continuous EEG recording was started 12 +/- 6 hours after CA and lasted 30 +/- 11 hours. Non-reactive cEEG background (12 of 15 (75 %) among non-survivors versus none of 19 (0) survivors; p < 0.001) and prolonged discontinuous "burst-suppression" activity (11 of 15 (73 %) versus none of 19; p < 0.001) were significantly associated with mortality. EEG seizures with absent background reactivity also differed significantly (7 of 15 (47 %) versus none of 12 (0); p = 0.001). In patients with non-reactive background or seizures/epileptiform discharges on cEEG, no improvement was seen after TH. Non-reactive cEEG background during TH had a positive predictive value of 100 % (95 % confidence interval (CI): 74 to 100 %) and a false-positive rate of 0 (95 % CI: 0 to 18 %) for mortality. All survivors had cEEG background reactivity, and the majority of them (14 of 19 (74 %)) had a favorable outcome (CPC 1 or 2). The authors concluded that cEEG monitoring showing a non-reactive or discontinuous background during TH is strongly associated with unfavorable outcome in patients with coma after CA. Moreover, they stated that these data warrant larger studies to confirm the value of cEEG monitoring in predicting prognosis after CA and TH.

The National Institute for Health and Clinical Excellence’s clinical guideline on “The epilepsies: The diagnosis and management of the epilepsies in adults and children in primary and secondary care” (NICE, 2012) stated that “Long-term video or ambulatory EEG may be used in the assessment of children, young people and adults who present diagnostic difficulties after clinical assessment and standard EEG.”
The consensus of experts in a 2010 review was that effective treatment of infantile spasms is defined by complete cessation of spasms and resolution of hypsarrhythmia on electroencephalography (EEG) (Glaze, 2015; Pellock, et al., 2010). Both parents and trained observers may miss the occurrence of spasms, especially if they are subtle. Less commonly, they may “over count” imitators of spasms, especially in infants and young children in the symptomatic group. A standard EEG to evaluate interictal activity may miss the hypsarrhythmia pattern, which can be variably present in an awake child, but is detected more sensitively in sleep. As a result, video-EEG monitoring is ideally used to assess treatment response in children with infantile spasms.

**Duration of Continuous EEG Video Monitoring:**

Asano et al (2005) retrospectively reviewed the clinical utility of initial video-EEG monitoring in a series of 1,000 children suspected of epileptic disorders. The ages of patients (523 boys and 477 girls) ranged from 1 month to 17 years (median age of 7 years). The mean length of stay was 1.5 days (range of 1 to 10 days). Outcomes were classified as: “useful-epileptic” (successful classification of epilepsy), “useful-non-epileptic” (demonstration of non-epileptic habitual events), “uneventful” (normal EEG without habitual events captured), and “inconclusive” (inability to clarify the nature of habitual events with abnormal inter-ictal EEG findings). A total of 315 studies were considered “useful-epileptic”; 219 “useful-non-epileptic”; 224 “uneventful”; 242 “inconclusive”. Longer monitoring was associated with higher rate of a study classified as “useful-epileptic” in all age groups (Chi square test: p < 0.001). In addition, longer monitoring was associated with lower rate of a study classified as “inconclusive” in adolescences (p < 0.001). Approximately 50% of the children with successful classification of epilepsy were assigned a specific diagnosis of epilepsy syndrome according to the International League Against Epilepsy (ILAE) classification. These researchers found only 22 children with ictal EEG showing a seizure onset purely originating from a unilateral temporal region. The authors
concluded that video-EEG monitoring may fail to capture habitual episodes. To maximize the utility of studies in the future, a video-EEG monitoring longer than 3 days should be considered in selected children such as adolescences with habitual events occurring on a less than daily basis. These investigators recognized a reasonable clinical utility of the current ILAE classification in the present study. It may not be common to identify children with pure unilateral temporal lobe epilepsy solely based on video-EEG monitoring.

Alving et al (2009) noted that inpatient long-term video-EEG monitoring (LTM) is an important diagnostic tool for patients with seizures and other paroxysmal behavioral events. The main referral categories are diagnosis (epileptic versus non-epileptic disorder), seizure classification and pre-surgical evaluation. The diagnostic usefulness of the LTM varies considerably (19 to 75 %) depending on how this was defined and on the selection of the patients. These researchers evaluated the diagnostic usefulness and the necessary duration of the LTM for the referral groups, in patients extensively investigated before the monitoring. An LTM was considered diagnostically useful when it provided previously not reported, clinically relevant information on the paroxysmal event. For the pre-surgical group, reaching a decision concerning surgery was an additional requirement. These investigators reviewed data from 234 consecutive LTM-sessions (221 patients) over a 2-year period. In 44 % of the cases the LTM was diagnostically useful. There were no significant differences concerning diagnostic usefulness among the main referral groups: diagnostic (41 %), classification (41 %) and pre-surgical (55 %). Diagnostic usefulness did not differ among the age groups either. The duration of the successful LTM-sessions was significantly longer in the pre-surgical group (mean of 3.5 days) than in the diagnostic and classification groups (2.4 and 2.3 days, respectively). The authors concluded that LTM is a valuable diagnostic tool even in patients extensively investigated before the monitoring, and is equally effective in the referral and age groups. However, patients referred for pre-surgical evaluation need considerably longer LTM, and this should be taken into
account when planning the resources and calculating the costs.

Hupalo et al (2016) determined the optimal duration of the long-term video-EEG (LTM) and evaluated diagnostics utility of LTM in patients with epilepsy and other paroxysmal events in terms of future diagnosis and management. These researchers carried out a retrospective analysis of 282 LTM s performed in the last 5 years in their Epilepsy Monitoring Unit (EMU), in 202 consecutive patients. The analysis included demographic data, monitoring time, number and type of paroxysmal events, the time until their onset, influence of LTM result on the diagnosis and future management. There were 117 women and 85 men, mean age of 34.2 years. Mean duration of LTM was 5 days (range of 3 to 9), with 447 paroxysmal events recorded in 131 (65 %) patients. Epileptic seizures were recorded in 82 % cases (in 11 % associated with psychogenic non-epileptic seizures (PNES)). The remaining 18 % had either PNES (11 %), or parasomnias (7 %). Only 15 % of epileptic seizures took place within the first 24 hours of the LTM (53 % and 32 % on the 2nd and 3rd day, respectively), whereas as many as 62 % of PNES did (while only 28 % and 10 % on the 2nd and 3rd day, respectively). The LTM results changed the diagnosis in 36 % of the patients, most frequently in PNES (from 2 % to 14 %). Overall, it changed the management in 64 % of the patients, especially with PNES and those who underwent epilepsy surgery. The authors concluded that LTM should last at least 72 hours in patients with refractory epilepsy; most of cases with PNES could be diagnosed after 48 hours.

Cox and colleagues (2017) noted that LTM aims to record the habitual event and is a useful diagnostic tool for neurological paroxysmal clinical events. In the authors' EMU setting, admissions are usually planned to last up to 5 days. These investigators ascertained time taken for the recording of a first event and determined correlations between different clinical characteristics and timings. They retrospectively reviewed diagnostic and classification LTM recording performed at a tertiary epilepsy center. A total of 63 recordings were reviewed. Most subjects (89 %) had events at least
once-weekly before admission. In 40 (63%) a habitual event was recorded, mostly (93%) within the first 2 days. No events were recorded on day 4 or 5. A few characteristics were associated with a trend for events occurring earlier (events more than once-weekly versus less than once-weekly, motor symptoms compared with aura or dyscognitive events, and reduction of anti-epileptic drugs versus no reduction). The authors concluded that the findings of this study suggested that, for diagnostic event recording in people with epilepsy or psychogenic non-epileptic attacks (PNEA), a maximum recording time of 3 days is sufficient in 2/3 of them, if event frequency is at least once a week. In the remaining 1/3, prolonged recording up to 5 days did not result in capturing a clinical event. For these individuals, shorter admission could be planned, for example for 2 days rather than 5 days.

An UpToDate review on “Video and ambulatory EEG monitoring in the diagnosis of seizures and epilepsy” (Hirsch et al, 2017) states that “Duration of recording -- The likelihood of recording an event (and therefore making a diagnosis) increases with the duration of recording. In 1 case series of 248 adult patients admitted to an epilepsy monitoring unit, the median time to first diagnostic event, whether epileptic seizure or non-epileptic event, was 2 days; 35% of patients required 3 or more days of monitoring, and 7% more than 1 week. In another series of consecutive patients admitted to a video-EEG monitoring unit for diagnosis of spells, a stay of longer than 5 days was no less likely to be inconclusive than shorter stays in patients with epileptic seizures. In patients with presumed non-epileptic events, stays longer than 5 days were more likely to be inconclusive. When a 1st video-EEG study is not diagnostic, repeat testing can be helpful; in 1 study a 2nd study was diagnostically useful in 35 of 43 cases. The duration of recording will depend on the indication: subjects undergoing pre-surgical evaluation often require a significantly longer period of long-term monitoring to obtain clinically relevant (and previously unreported) information (mean of 3.5 days) compared to patients who are being recorded for diagnosis or classification (2.4 and 2.3 days, respectively)”. The duration of
For patients undergoing pre-surgical evaluation – mean of 3.5 days.

For patients being recorded for diagnosis or classification -- 2.4 days and 2.3 days, respectively.

Only a small percentage of patients (7%) needs more than 1 week.

Mahfooz et al (2017) stated that continuous V-EEG is an important diagnostic and prognostic tool in newborns with HIE undergoing therapeutic hypothermia. The optimal duration of continuous V-EEG during whole-body hypothermia is not known. These researchers conducted a retrospective study of 35 neonates with HIE undergoing whole-body hypothermia with continuous V-EEG; EEG ictal changes were detected in 9/35 infants (26%). Of these 9 infants, the seizures were initially observed within 30 minutes of EEG monitoring in 6 (67%), within 24 hours in 2 (22%), and during re-warming in 1 infant (11%). No new seizures were detected between 24 to 72 hours of therapeutic hypothermia. Background suppression was detected in 14 infants (40%) by 24 hours. The authors concluded that in neonates with HIE undergoing therapeutic hypothermia, continuous V-EEG has the highest diagnostic yield within the first 24 hours and during the re-warming phase. Moreover, they noted that in the absence of prior seizures or anti-epileptic therapy, limiting continuous V-EEG to these periods in resource-limited settings may reduce cost during therapeutic hypothermia.

<table>
<thead>
<tr>
<th>CPT Codes / HCPCS Codes / ICD-10 Codes</th>
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<tbody>
<tr>
<td>Information in the [brackets] below has been added for clarification purposes. Codes requiring a 7th character are represented by &quot;+&quot;:</td>
</tr>
<tr>
<td>CPT codes covered if selection criteria are met:</td>
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</tbody>
</table>
### Monitoring for localization of cerebral seizure focus

- **95951**: Monitoring for localization of cerebral seizure focus by cable or radio, 16 or more channel telemetry, combined electroencephalographic (EEG) and video recording and interpretation (e.g., for presurgical localization), each 24 hours.

### Other CPT codes related to the CPB:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>95816</td>
<td>Routine electroencephalography</td>
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<tr>
<td>95822</td>
<td></td>
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<tr>
<td>95950</td>
<td>Monitoring for identification and lateralization of cerebral seizure focus, electroencephalographic (eg, 8 channel EEG) recording and interpretation, each 24 hours.</td>
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<tr>
<td>95953</td>
<td>Monitoring for localization of cerebral seizure focus by computerized portable 16 or more channel EEG, electroencephalographic (EEG) recording and interpretation, each 24 hours unattended.</td>
</tr>
<tr>
<td>95956</td>
<td>Monitoring for localization of cerebral seizure focus by cable or radio, 16 or more channel telemetry, electroencephalographic (EEG) recording and interpretation, each 24 hours, attended by a technologist or nurse.</td>
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<tr>
<td>99184</td>
<td>Initiation of selective head or total body hypothermia in the critically ill neonate, includes appropriate patient selection by review of clinical, imaging and laboratory data, confirmation of esophageal temperature probe location, evaluation of amplitude EEG, supervision of controlled hypothermia, and assessment of patient tolerance of cooling.</td>
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### ICD-10 codes covered if selection criteria are met:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>F44.5</td>
<td>Conversion disorder with seizures or convulsions [psychogenic seizure]</td>
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<tr>
<td>G40.001-G40.919</td>
<td>Epilepsy and recurrent seizures [EEG video monitoring is not covered for the assessment of the effectiveness of drug treatment in epilepsies]</td>
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</tbody>
</table>
Absence and juvenile myoclonic epilepsy

Convulsions of newborn

Abnormal involuntary movements

Transient alteration of awareness

Complex febrile convulsions

Post traumatic seizures

Unspecified convulsions (e.g., seizure NOS)

Abnormal electroencephalogram [EEG]

ICD-10 codes not covered for indications listed in the CPB (not all-inclusive):

Cardiac arrest

Hypoxic ischemic encephalopathy [HIE]

The above policy is based on the following references:


6. Sundaram M, Sadler RM, Young GB, et al. EEG in epilepsy:


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Amendment to
Aetna Clinical Policy Bulletin Number: CPB 0322
Electroencephalographic (EEG) Video Monitoring

There are no amendments for Medicaid.