Multiple-Choice Questions—Preferred Responses

Following are the preferred responses for the Multiple-Choice Questions in this CONTINUUM issue. The questions and answer options are repeated, and the preferred response appears in bold print followed by an explanation and a reference with which you may seek more specific information. You are encouraged to review the responses and explanations carefully to evaluate your general understanding of the course material. The comments and references included with each question are intended to encourage independent study.

1. Which of the following is the major role of the neurologist after a diagnosis of psychogenic nonepileptic events?
   A. appropriately weaning antiepileptic drugs
   B. describing events in ambiguous terms
   C. ensuring that patients continue to refrain from driving a motor vehicle
   D. ordering follow-up EEG in 6 to 12 months
   E. prescribing a selective serotonin reuptake inhibitor or other antidepressant

   The correct answer is A (appropriately weaning antiepileptic drugs).
   After a diagnosis of psychogenic nonepileptic attacks, one of the major roles of the neurologist is the rational weaning of antiepileptic medications. This should be done with the caveat that coexistent epilepsy may also be present, so the physician needs to keep an open mind regarding new events (although routine surveillance EEGs are not necessarily indicated). Driving restrictions should be handled on an individual case basis, although most patients can return to driving with little chance of injury. Neurologists should use unambiguous terms when describing the diagnosis to the patient and other providers so that the misdiagnosis of epilepsy is not perpetuated. While mental health care is often needed, the routine prescription of antidepressants is not always indicated. For more information, refer to page 724 of the CONTINUUM article “Nonepileptic Behavioral Disorders: Diagnosis and Treatment.”

2. Deep brain stimulation for drug-resistant epilepsy targets which of the following structures?
   A. anterior nucleus of the thalamus
   B. centromedian nucleus of the thalamus
   C. cingulate gyrus
   D. hippocampus
   E. internal segment of the globus pallidus

   The correct answer is A (anterior nucleus of the thalamus). The anterior nucleus of the thalamus is part of the Papez circuit and is therefore believed...
to be a relay station for information passing from the amygdala and hippocampus to the cerebral cortex. Data have shown that inhibition of the anterior nucleus may result in prevention or cessation of seizures. For more information, refer to page 746 of the CONTINUUM article “Neurostimulation for Drug-Resistant Epilepsy.”

3. According to the International League Against Epilepsy’s 2010 revision of its seizure classification system, which of the following factors is most helpful in initially focusing the scope of diagnostic possibilities for specific electroclinical syndromes?
   A. age at onset
   B. family seizure history
   C. frequency of spells
   D. history of toxic exposure
   E. severity of the disorder

   The correct answer is A (age at onset). While all the other factors mentioned should be part of an initial seizure history, they are not as important in establishing the ultimate diagnosis. For more information, refer to page 580 of the CONTINUUM article “The 2010 Revised Classification of Seizures and Epilepsy.”

4. Which of the following conditions would likely preclude the consideration of epilepsy surgery in a patient?
   A. dominant hemisphere focus
   B. low-grade tumor
   C. mental retardation
   D. primary generalized epilepsy
   E. prior vagus nerve stimulator use

   The correct answer is D (primary generalized epilepsy). Patients who are typically not surgical candidates include those with clear evidence of bilateral onset of habitual seizures, those with severe psychiatric or medical comorbidities increasing surgical risk or compromising recovery, those with rapidly progressive CNS disease, and those with primary generalized epilepsy. For more information, refer to page 731 of the CONTINUUM article “Surgical Treatment of Epilepsy.”

5. A 63-year-old woman is hospitalized with herpes simplex virus encephalitis. Which of the following EEG patterns is most likely to be seen in this patient?
   A. burst suppression
   B. generalized periodic discharges
   C. periodic lateralizing discharges
   D. small sharp spikes
   E. stimulus-induced, rhythmic, periodic, or ictal discharges

   The correct answer is C (periodic lateralizing discharges). Periodic lateralizing discharges are EEG abnormalities commonly seen in certain scenarios, including herpes encephalitis. Other conditions in which periodic lateralizing discharges are seen include focal brain lesions, nonketotic hyperglycemia, alcohol withdrawal, and theophylline exposure. Generalized periodic discharges are more commonly seen in anoxic brain injury,
Creutzfeldt-Jakob disease, and other diffuse processes. Stimulus-induced, rhythmic, periodic, or ictal discharges (SIRPIDs) are most commonly seen in critically ill patients, even those without neurologic illness. Burst suppression is typically seen in anoxic encephalopathy or in the setting of certain medications (eg, propofol, barbiturates). For more information, refer to Table 2-3 in the CONTINUM article “EEG and Epilepsy Monitoring.”

6. A 60-year-old woman develops generalized seizure activity lasting 10 minutes; seizure activity appears to arrest after administration of 4 mg of IV lorazepam. She has chronic kidney disease but is otherwise in good health. Which of the following is the best next pharmacological step in management?

A. continuous midazolam infusion
B. continuous propofol infusion
C. IV fosphenytoin
D. IV ketamine
E. IV phenobarbital

The correct answer is C (IV fosphenytoin). Regardless of whether prolonged seizure activity stops after the administration of an appropriate dose of a benzodiazepine, rapid administration of a longer-acting anticonvulsant is generally recommended. This allows for prevention of additional seizures as the effect of the benzodiazepine wears off over the course of several hours. Of the options listed, fosphenytoin is the preferred option. A continuous infusion of propofol or midazolam is not indicated in this setting unless clinical or EEG evidence of ongoing seizures (ie, refractory status epilepticus) exists. If the patient does not wake up rapidly, an urgent EEG should be obtained. For more information, refer to pages 777–778 of the CONTINUM article “Status Epilepticus.”

7. Which of the following antiepileptic drug combinations is most likely to result in symptoms of diplopia and dizziness?

A. phenobarbital and valproate
B. phenytoin and carbamazepine
C. phenytoin and gabapentin
D. topiramate and carbamazepine
E. valproate and lamotrigine

The correct answer is B (phenytoin and carbamazepine). The combination of phenytoin and carbamazepine frequently results in the adverse effects of dizziness and diplopia. In addition, both medications have enzyme-inducing properties, resulting in complex pharmacologic interactions and difficulty maintaining therapeutic levels. Phenobarbital and valproate have a higher likelihood of resulting in weight gain. Combining valproate and lamotrigine may increase the risk of Stevens-Johnson syndrome, so dosing adjustments need to be made carefully. For more information, refer to page 649 of the CONTINUM article “Antiepileptic Drug Treatment: New Drugs and New Strategies.”
8. Which of the following EEG patterns is rarely seen in normal patients and has a high specificity for temporal lobe epilepsy?

A. 14 and 6 positive spikes
B. diffuse slow activity
C. rhythmic temporal delta
D. triphasic waves
E. wicket spikes

The correct answer is C (rhythmic temporal delta). Of the options listed above, rhythmic temporal delta activity is most suggestive of temporal lobe epilepsy. While sensitivity for this finding is not especially high, it is rarely seen outside of the context of temporal lobe seizures and therefore carries high specificity. Triphasic waves are most commonly seen in patients with metabolic encephalopathy. Diffuse slow activity is seen in patients with traumatic brain injury, subarachnoid hemorrhage, toxic-metabolic encephalopathies, and other processes that affect the brain more diffusely. Wicket spikes and 14 and 6 positive spikes are considered normal EEG variants seen in older adults and adolescents, respectively. For more information, refer to page 607 of the CONTINUUM article “EEG and Epilepsy Monitoring.”

9. The cortical hamartomas of tuberous sclerosis display different MRI characteristics depending on a patient’s age. Which of the following pathophysiologic processes is responsible for this age-related change in the MRI characteristics of these lesions?

A. breakdown of blood-brain barrier
B. calcification
C. inflammation
D. myelination
E. neovascularization

The correct answer is D (myelination). Cortical hamartomas (tubers) are the most characteristic lesions in tuberous sclerosis complex. These lesions can cause focal seizures, which in some patients may be refractory to antiepileptic drugs; however, not all tubers are epileptogenic. The MRI appearance of tubers changes with myelination. In neonates they are hyperintense on T1 and hypointense on T2-weighted images compared to the surrounding white matter. In older children they are hyperintense on T2-weighted images with poorly defined borders. For more information, refer to pages 637–638 of the CONTINUUM article “Neuroimaging in Investigation of Patients With Epilepsy.”

10. Surgery for which of the following types of epilepsy is least likely to result in seizure freedom?

A. epilepsy due to a hemispheric syndrome
B. epilepsy due to neonatal infarct
C. epilepsy due to tumor
D. mesial temporal lobe epilepsy
E. nonlesional neocortical epilepsy

The correct answer is E (nonlesional neocortical epilepsy). The best outcomes from epilepsy surgery are for temporal lobectomy for mesial
temporal sclerosis, lesional resections, and hemispherectomy, with lower seizure-free rates in patients with nonlesional neocortical resections. For more information, refer to page 740 of the CONTINUUM article “Surgical Treatment of Epilepsy.”

11. A patient with which of the following conditions should not be placed on a ketogenic diet?

A. diabetes  
B. hyperlipidemia  
C. obesity  
D. pancreatitis  
E. Rett syndrome

The correct answer is D (pancreatitis). Ketogenic diets are contraindicated in patients with pancreatitis, hepatic failure, primary carnitine deficiency, carnitine palmitoyl transferase I and II deficiency, carnitine translocase deficiency, beta-oxidation defects, pyruvate carboxylase deficiency, and porphyria. In the intensive care setting where diet therapy is being considered for treatment of refractory status epilepticus, the ketogenic diet is also contraindicated in patients who cannot tolerate enteral feeds, including those with ileus, who are receiving a propofol infusion (to avoid fatal propofol infusion syndrome), and in patients who have metabolic, hemodynamic, or cardiorespiratory instability. For more information, refer to page 763 of the CONTINUUM article “Dietary Treatment of Intractable Epilepsy.”

12. A 10-year-old child with epilepsy since age 2 that is refractory to medical treatment has been followed serially with brain MRI scans, which show progressive atrophy of the left hemisphere. What is the most likely diagnosis?

A. focal cortical dysplasia  
B. neurofibromatosis  
C. Rasmussen encephalitis  
D. Sturge-Weber syndrome  
E. tuberous sclerosis

The correct answer is C (Rasmussen encephalitis). MRI in Rasmussen encephalitis shows progressive atrophy of one of the cerebral hemispheres, usually beginning in the opercular region. For more information, refer to page 639 of the CONTINUUM article “Neuroimaging in Investigation of Patients With Epilepsy.”
13. A 21-year-old man is seen in clinic for management of seizures. He has had several episodes of generalized tonic-clonic seizure activity with resultant oral trauma and incontinence. Some of his events may have started with focal shaking in the right arm, although this history is unclear and is unable to be corroborated. EEG reveals no epileptiform activity or asymmetry, and brain imaging is unremarkable. Of the following anticonvulsants, which would be most appropriate for this patient?

A. gabapentin  
B. lacosamide  
C. oxcarbazepine  
D. phenobarbital  
E. zonisamide

The correct answer is E (zonisamide). The description of this patient’s episodes is consistent with generalized seizures. However, based on the history, EEG, and imaging studies, it is hard to determine whether these events are primary or secondary generalized in nature. In cases where it is difficult to determine whether seizures are primary generalized or focal in onset, a broad-spectrum anticonvulsant medication is preferable. Of the options listed above, zonisamide and phenobarbital are both considered broad-spectrum drugs, although zonisamide would be preferable based on its more favorable side-effect profile. Oxcarbazepine and gabapentin are more narrow-spectrum and would only be indicated if the events were more clearly focal in onset. The exact spectrum of lacosamide is unknown at this time, since it has only been studied in the setting of focal seizures. For more information, refer to page 645 of the CONTINUUM article “Antiepileptic Drug Treatment: New Drugs and New Strategies.”

14. Which of the following is a possible predictor of refractory status epilepticus (status epilepticus not responding to two antiepileptic medications)?

A. convulsive status epilepticus  
B. hypoxic-ischemic encephalopathy  
C. older age  
D. prior stroke  
E. underlying malignancy

The correct answer is B (hypoxic-ischemic encephalopathy). Some etiologies of status epilepticus or patient factors may be more predictive of a refractory course that does not respond to initial treatments. Of the options listed above, hypoxic-ischemic encephalopathy (and other etiologies that are not associated with an underlying structural lesion) may be more likely to be refractory. Encephalitis, delays in diagnosis and treatment, and subtle symptoms as a manifestation of status epilepticus are other possible predictors. Physicians should be aware that these etiologies of status epilepticus may require more aggressive treatment. For more information, refer to pages 783 and 788 of the CONTINUUM article “Status Epilepticus.”
15. Approximately what percentage of patients with epilepsy will become seizure free on the initial antiepileptic drug regimen?

A. 10%
B. 40%
C. 60%
D. 80%
E. 95%

The correct answer is B (40%). Data suggest that 35% to 40% of patients will be well controlled on the initial antiepileptic drug regimen chosen for them. Once a patient is well controlled, both the patient and physician may be reluctant to make changes in the regimen, even if there is good rationale for making an adjustment. This underscores the importance of making a wise initial choice in an antiepileptic medication because there may be limited ability to make changes in the future. This choice must weigh data on effectiveness, adverse effects, teratogenicity, and patient compliance, among other considerations. For more information, refer to page 647 of the CONTINUUM article “Antiepileptic Drug Treatment: New Drugs and New Strategies.”

16. A 40-year-old woman is admitted to an epilepsy monitoring unit for evaluation of paroxysmal episodes of neurologic dysfunction. Her episodes involve some nonrhythmic shaking of both arms and pelvic thrusting without any correlate on the EEG; psychogenic nonepileptic events are diagnosed. Which of the following characteristics is most associated with a good outcome (ie, resolution of episodes)?

A. episodes with prominent motor features
B. female gender
C. lower educational achievement
D. older age at diagnosis
E. shorter duration of illness

The correct answer is E (shorter duration of illness). The description of the events provided above and the lack of EEG findings during her episodes are both suggestive of nonepileptic events. Prognosis after a diagnosis of psychogenic nonepileptic events is variable but may be dependent on certain characteristics. Of the options listed above, a shorter duration of illness (ie, shorter time between the onset of spells and the diagnosis of nonepileptic events) is most predictive of a positive outcome. Some of the other options listed above (older age, prominent/dramatic motor features, lower educational achievement) are associated with a poorer outcome after a diagnosis of nonepileptic events. For more information, refer to pages 723–724 of the CONTINUUM article “Nonepileptic Behavioral Disorders: Diagnosis and Treatment.”
17. A 66-year-old woman is seen in clinic for a new diagnosis of epilepsy; she has experienced recurrent partial seizures attributed to a left hemispheric stroke. Her medical history is most notable for atrial fibrillation (for which she takes warfarin), osteoporosis, and a history of kidney stones. Her primary care physician started her on phenytoin, which resulted in a rash. Which of the following is the most appropriate antiepileptic medication for this patient?

A. carbamazepine
B. levetiracetam
C. primidone
D. valproate
E. zonisamide

The correct answer is B (levetiracetam). This patient with epilepsy is medically complex, with several notable comorbid medical conditions and a prior adverse reaction to phenytoin. Using either carbamazepine or primidone in this case would be challenging given the potential cross-reactivity with phenytoin (to which she has already had a hypersensitive reaction) as well as the potential drug-drug interactions with warfarin. Zonisamide is associated with a risk of kidney stones and should be avoided in this patient with prior calculi. Valproate and enzyme-inducing medications are associated with accelerated loss of bone density, which is already a concern in this patient with osteoporosis. Of the options listed, levetiracetam has the lowest risk of hypersensitivity, drug-drug interactions with warfarin, and potential worsening of her underlying osteoporosis and kidney stones. For more information, refer to page 650 of the CONTINUUM article “Antiepileptic Drug Treatment: New Drugs and New Strategies.”

18. Which of the following is the leading rationale for withholding antiepileptic therapy in a child after a first unprovoked seizure?

A. recurrence rates are generally very low
B. risk of recurrent seizure is not reduced
C. side effects of drugs outweigh benefits
D. the event may be nonepileptic
E. the long-term prognosis is unchanged

The correct answer is E (the long-term prognosis is unchanged). The recurrence rate for a second unprovoked seizure is not low and can be reduced by initiating antiepileptic therapy. However, delaying treatment until a second event confers the advantage of having better confirmation of epilepsy, while bearing in mind that the recurrence rate approximately doubles after two episodes. For more information, refer to pages 660–661 of the CONTINUUM article “Management of Childhood Epilepsy.”
19. In 2010, the International League Against Epilepsy departed from its 1989 classification scheme of epilepsies and revised its seizure classification system. What was the primary goal of this change?

A. advancement of a value system for syndromic severity
B. grouping of patients’ diagnoses in a new classification structure
C. keeping pace with advancing knowledge of epilepsy and seizures
D. linkage of seizure manifestations with a cause
E. modification of billing and coding practices with regard to epilepsy

The correct answer is C (keeping pace with advancing knowledge of epilepsy and seizures). While the advancement of a value system for syndromic severity and the modification of billing and coding practices with regard to epilepsy are desired goals, the overarching goal of revising the old classification scheme is to incorporate genetic, neuroimaging, and other new knowledge of epilepsy and seizures into a workable format for correct individual diagnosis. For more information, refer to pages 571–572 of the CONTINUUM article “The 2010 Revised Classification of Seizures and Epilepsy.”

20. Although not all data are available for all drugs (and keeping in mind that an individual patient may have other specific needs), which of the following antiepileptic drugs would be the best initial choice in an adolescent girl with juvenile myoclonic epilepsy?

A. carbamazepine
B. ethosuximide
C. lacosamide
D. valproic acid
E. levetiracetam

The correct answer is E (levetiracetam). Levetiracetam is considered to be effective in juvenile myoclonic epilepsy. Carbamazepine is probably better in partial or generalized tonic-clonic seizures. Ethosuximide has strong evidence in absence seizures. Valproic acid is effective in juvenile myoclonic epilepsy and related seizure types but is usually not the first choice in adolescent girls because of teratogenicity and risk of polycystic ovary syndrome. Lacosamide has no data for myoclonic epilepsy. For more information, refer to Table 5-2 in the CONTINUUM article “Management of Childhood Epilepsy.”

21. Fetal exposure to which of the following medications is most likely to be associated with decreased IQ during childhood?

A. carbamazepine
B. lamotrigine
C. phenytoin
D. topiramate
E. valproate

The correct answer is E (valproate). Of the options listed above, in utero exposure to valproate is most likely to be associated with a lower childhood IQ. Longitudinal studies have shown no changes with phenytoin, carbamazepine, and lamotrigine, but a lower mean IQ at age 3 was seen with exposure to valproate. This was also shown to have a dose-effect.
response, with lower IQs observed in children exposed to higher doses of valproate. There is no data on cognitive outcomes in children with in utero exposure to topiramate. Unlike valproate, topiramate does not cause apoptosis in immature brains of animals. For more information, refer to page 685 of the CONTINUUM article “Epilepsy and Neuropsychological Comorbidities.”

22. Psychogenic nonepileptic events occurring in which of the following populations are most likely to be misdiagnosed as epileptic seizures?
   A. children
   B. men
   C. military veterans
   D. patients with a history of substance abuse
   E. pregnant women

   The correct answer is C (military veterans). Of the options listed above, veterans are most likely to have their psychogenic nonepileptic events mischaracterized as epileptic seizures. The exact cause of this is unclear, although some attribute this to an antecedent history of trauma in this population with an assumption that their events are “post-traumatic” in nature. Other populations at risk of having their events inappropriately attributed to epileptic seizures include the elderly and patients with prior epilepsy surgery. For more information, refer to page 722 of the CONTINUUM article “Nonepileptic Behavioral Disorders: Diagnosis and Treatment.”

23. A 23-year-old woman is seen for evaluation of intermittent spells concerning for seizures. The presence of which of the following characteristics of her spells would be more suggestive of epileptic seizures as opposed to psychogenic nonepileptic events?
   A. ictal eye closure
   B. opisthotonic posturing
   C. side-to-side head movements
   D. stuttering quality of speech
   E. tongue biting

   The correct answer is E (tongue biting). Characterization of spells as epileptic or psychogenic (ie, nonepileptic) in nature can be challenging and often requires video-EEG monitoring, although aspects of the history often help to distinguish the etiology of the episodes. Of the options listed above, tongue biting (or other types of injury/trauma) would be most suggestive of an epileptic nature. Other factors that would favor an epileptic etiology include significant postictal confusion, occurrence in sleep, and incontinence. The other choices listed above would all be more suggestive of a psychogenic nonepileptic etiology. For more information, refer to page 717 and Table 8-1 of the CONTINUUM article “Nonepileptic Behavioral Disorders: Diagnosis and Treatment.”
24. Which of the following clinical factors is most predictive of cognitive decline after epilepsy surgery?
   A. higher preoperative cognitive performance
   B. presence of hippocampal sclerosis
   C. surgery on nonlanguage dominant hemisphere
   D. younger age at seizure onset
   E. younger age at time of surgery

   The correct answer is A (higher preoperative cognitive performance). Cognitive performance may improve in some patients after surgery, presumably related to better seizure control and possible decrease in the burden of anticonvulsants needed for seizure control. However, even with functional imaging or Wada testing to guide treatment decisions, some patients will note worsened cognitive functioning postoperatively. Of the options listed, patients with higher preoperative cognitive functioning are at a higher risk of new cognitive difficulties after surgery. Older age at seizure onset and at time of surgery, the lack of hippocampal atrophy or sclerosis, and surgery on the language-dominant hemisphere are other predictors of postoperative cognitive symptoms. For more information, refer to page 685 of the CONTINUUM article “Epilepsy and Neuropsychological Comorbidities.”

25. Which of the following medications is most likely to be associated with interictal spikes or epileptiform abnormalities on EEG?
   A. cefepime
   B. doxycycline
   C. fluoxetine
   D. methylphenidate
   E. modafinil

   The correct answer is A (cefpime). Cefepime is one of several medications that can be associated with interictal spikes on EEG. Other examples include bupropion, lithium, tramadol, and clozapine. Uremia, thyrotoxicosis, and some other medical comorbidities can also be associated with epileptiform abnormalities but are not diagnostic for epilepsy. Abnormal EEGs in these contexts need to be interpreted with appropriate caution. For more information, refer to page 600 of the CONTINUUM article “EEG and Epilepsy Monitoring.”

26. A 27-year-old woman is seen in clinic for ongoing management of her juvenile myoclonic epilepsy. Her seizures have been well controlled on lamotrigine, with no seizures in the past 2 years. She does report some symptoms of depression, as well as anticipatory anxiety regarding the possibility of future seizures. Which of the following options is the best next step in management?
   A. bupropion
   B. citalopram
   C. nortriptyline
   D. taper off lamotrigine and begin levetiracetam
   E. venlafaxine
The correct answer is **B (citalopram)**. This patient is reporting symptoms of depression and anxiety, both of which are common in patients with epilepsy. In patients requiring pharmacotherapy for these symptoms, selective serotonin reuptake inhibitors (SSRIs) such as citalopram are considered first-line treatments because of lower likelihood of additional side effects and minimal drug-drug interactions. Venlafaxine is another option if an SSRI is not tolerated, and tricyclic antidepressants (such as nortriptyline) could be considered if neither of these first two agents is successful. Lamotrigine is not commonly associated with depression and is often used as a mood stabilizer; it is unlikely to be the cause of these symptoms in this patient and should not be changed to levetiracetam. Bupropion is associated with a higher risk of seizures and should not be used. For more information, refer to page 690 of the *Continuum* article “Epilepsy and Neuropsychological Comorbidities.”

27. A 25-year-old woman with a history of complex partial epilepsy has been treated successfully with topiramate for 2 years. She is contemplating initiating birth control and comes to discuss her options with her physician. Which of the following would be a reasonable contraceptive choice for this patient?

A. contraceptive hormonal patch
B. intrauterine device
C. low-dose combined oral contraceptive with estrogen and progestin components
D. progestin-only oral contraceptive pill
E. vaginal ring

The correct answer is **B (intrauterine device)**. This patient is content with her antiepileptic drug, and there is no compelling reason to change it. Instead, she can choose a form of contraception that is compatible with an enzyme-inducing antiepileptic drug such as topiramate. Low-dose oral contraceptive pills, patches, and rings may provide insufficient protection. One of the various long-acting reversible contraceptives—which include progestin implants, IM medroxyprogesterone acetate, and intrauterine devices—may be a good choice. For more information, refer to page 702 of the *Continuum* article “Pregnancy, Epilepsy, and Women’s Issues.”

28. Which of the following is the most common side effect seen after placement of a vagus nerve stimulator?

A. bradycardia
B. device infection
C. excessive cough
D. vocal cord paralysis
E. voice alteration/hoarseness

The correct answer is **E (voice alteration/hoarseness)**. After placement of a vagus nerve stimulator, alteration of voice quality (including hoarseness) and excessive coughing are the most common side effects, seen in one study in about 66% and 45% of patients respectively. The other choices listed above are possible adverse effects of this procedure but are seen much less commonly. For more information, refer to page 745 of the *Continuum* article “Neurostimulation for Drug-Resistant Epilepsy.”
29. A 23-year-old man is admitted to the hospital for long-term video-EEG monitoring. He has multiple events while in the hospital, but no clear abnormality is apparent on the EEG. Which of the following characteristics may still support a diagnosis of epileptic seizures as opposed to psychogenic nonepileptic events?

A. ability for events to be induced or suggested
B. high-amplitude, thrashing motor activity
C. lack of events occurring in sleep
D. prolonged alterations in level of alertness
E. stereotyped nature of events

The correct answer is E (stereotyped nature of events). There are some limitations on the ability of video-EEG monitoring to definitively make a diagnosis of epileptic seizures. Events with subtle, subjective symptoms (eg, simple partial seizures or auras) may involve only a small area of cortex and may not be detected by a surface EEG. Events of this type that are highly stereotyped in nature may still represent epileptic events despite the lack of EEG findings during monitoring. Thrashing motor activity can sometimes obscure the EEG because of motion artifact, but the semiology of these events usually allows for them to be characterized as nonepileptic. Similarly, in the setting of a reassuring EEG, the other options listed above (suggestibility, prolonged alterations in consciousness, lack of sleep-related events) would all be more suggestive of psychogenic nonepileptic events.

For more information, refer to pages 719–720 of the CONTINUUM article “Nonepileptic Behavioral Disorders: Diagnosis and Treatment.”

30. A 30-year-old man who has had focal epilepsy for 15 years still experiences four to five episodes per month despite medication. He takes two anticonvulsants; his current medications are the ninth and tenth drugs he has tried. Repeated EEGs have shown a right temporal focus. He is on disability and lives with his parents. What is the next best step in management of this patient?

A. addition of a third antiepileptic drug to his current regimen
B. substitution of a new drug for one of his current antiepileptic drugs
C. surgical evaluation
D. transcranial magnetic stimulation
E. vagus nerve stimulator trial

The correct answer is C (surgical evaluation). Failure to respond adequately to proper trials of two anticonvulsants and presence of focal epilepsy should lead to a surgical evaluation. Vagus nerve stimulation is much less effective than surgery in this setting. For more information, refer to pages 730–731 of the CONTINUUM article “Surgical Treatment of Epilepsy.”
31. Which of the following best describes the relationship between vagus nerve stimulation and risk of bradycardia?

A. can be seen with stimulation of either nerve  
B. higher risk with left nerve stimulation  
C. lowest risk seen with bilateral stimulation  
D. no risk with left nerve stimulation  
E. no risk with right nerve stimulation  

The correct answer is A (can be seen with stimulation of either nerve). Efferent fibers of the vagus nerve originating from the nucleus ambiguous include cardiac branches that help control heart rhythms. Since fibers originating from the right vagus nerve primarily innervate the sinoatrial node, it was thought that right nerve stimulation (or bilateral stimulation) may be most likely to cause bradycardia. However, at certain stimulator settings, even stimulation of the left vagus nerve (which primarily innervates the atrioventricular node) may precipitate bradycardia. Neurologists involved in programming stimulators should be aware that bradycardia can be a risk with stimulation of either nerve. For more information, refer to page 744 of the CONTINUUM article “Neurostimulation for Drug-Resistant Epilepsy.”

32. A 27-year-old woman with longstanding complex partial seizures, well controlled on monotherapy with carbamazepine, is seen in the first trimester of pregnancy. She is concerned about seizures becoming more frequent during pregnancy. Which of the following is the most appropriate counseling of this patient regarding her pregnancy and seizure recurrence?

A. most women experience a decrease in seizure frequency  
B. most women experience an increase in seizure frequency  
C. most women experience no change in seizure frequency  
D. seizures are least likely to occur in the third trimester  
E. seizures are more likely to be generalized in nature  

The correct answer is C (most women experience no change in seizure frequency). Although the effect of pregnancy on seizure frequency is variable, most women with epilepsy do not experience a significant change in the number or severity of their seizures. Expected physiologic hormonal changes, alterations in sleep and other routines, and other factors can alter the seizure frequency in some cases. Noncompliance can also play a role, since some women will discontinue their medications with the assumption that the teratogenic effects of antiepileptic medications outweigh their potential benefits. For more information, refer to page 709 of the CONTINUUM article “Pregnancy, Epilepsy, and Women’s Issues.”

33. Which of the following seizure/epilepsy subtypes appears to respond best to deep brain stimulation techniques?

A. absence seizures  
B. frontal lobe epilepsy  
C. juvenile myoclonic epilepsy  
D. Lennox-Gastaut syndrome  
E. temporal lobe epilepsy  

The correct answer is E (temporal lobe epilepsy). In pivotal studies of deep brain stimulation of the anterior nucleus of the thalamus, patients with...
temporal lobe epilepsy responded best to this treatment approach. Patients with this form of epilepsy had a 44% reduction in seizures (compared to 22% in controls); patients with seizures originating from other lobes had no significant effect from this procedure. One possible explanation for this finding is the connection between the hippocampus and the anterior nucleus as part of the Papez circuit. For more information, refer to page 749 of the CONTINUUM article “Neurostimulation for Drug-Resistant Epilepsy.”

34. Which of the following clinical characteristics is associated with an increased risk of suicidal ideation in patients with epilepsy?

A. coexistent depression
B. higher frequency of seizures
C. lower reported quality of life
D. male sex
E. partial-onset seizures

The correct answer is A (coexistent depression). Among many potential predictors, only the presence of a coexisting mood disorder such as major depression is associated with a higher incidence of suicidal ideation in epilepsy patients. Other characteristics, including age, sex, seizure type, seizure control, duration of epilepsy, and lower quality of life, have not been associated with a higher risk of suicide. Because of this, routine screening for depression and suicidality in patients with epilepsy is recommended. For more information, refer to page 688 of the CONTINUUM article “Epilepsy and Neuropsychological Comorbidities.”

35. A 76-year-old man is admitted with a right frontal intracerebral hemorrhage. After some initial improvement in his neurologic status, he has become a bit less responsive. EEG shows fluctuating right greater than left periodic discharges at 1 to 2 Hz without definite evolution. Which of the following is the best next step in management?

A. 0.1 mg/kg IV lorazepam
B. continuous propofol infusion
C. observation with repeat 30-minute EEG in 24 hours
D. oral levetiracetam
E. sequential small doses of midazolam or other IV antiepileptic drug until the EEG pattern resolves

The correct answer is E (sequential small doses of midazolam or other IV antiepileptic drug until the EEG pattern resolves). Nonconvulsive status epilepticus is increasingly being identified as a cause of altered mental status in critically ill patients, including patients with structural brain lesions such as intracerebral hemorrhage. The persistent mental status change is suggestive of nonconvulsive status epilepticus. Initial management consists of sequential administration of low-dose benzodiazepines (preferably short-acting agents, such as midazolam) or IV administration of a relatively nonsedating antiepileptic medication (such as levetiracetam or lacosamide). After initiation of these medications, improvement in the clinical state and EEG is supportive of a diagnosis of nonconvulsive status epilepticus. Initiation of additional antiepileptics should be held until the diagnosis...
is clearer. For more information, refer to page 770 of the CONTINUUM article “Status Epilepticus.”

36. A 6-year-old child with Lennox-Gastaut syndrome and medically resistant epilepsy is currently on two anticonvulsants and still has several seizures daily despite trials of more than five antiepileptic drugs. Dietary treatment with a ketogenic diet is proposed. What is the approximate percent chance that this patient will respond with a greater than 50% seizure reduction?

A. 5%
B. 10%
C. 25%
D. 50%
E. 90%

The correct answer is D (50%). Randomized controlled studies and meta-analyses have shown that approximately 50% of children with pharmacoresistant epilepsy have greater than 50% reduction in seizures on the ketogenic diet. For more information, refer to page 760 of the CONTINUUM article “Dietary Treatment of Intractable Epilepsy.”

37. A 25-year-old man with a 10-year history of medically intractable focal epilepsy undergoes an evaluation for possible epilepsy surgery. His clinical symptoms and EEG findings suggest a left mesial temporal focus. Which of the following MRI sequences is most sensitive for diagnosing hippocampal sclerosis in this patient?

A. diffusion-weighted images
B. fluid-attenuated inversion recovery (FLAIR)
C. gadolinium-enhanced T1
D. gradient echo
E. T1 without contrast

The correct answer is B (FLAIR). Both routine T2-weighted images and FLAIR images are useful, with FLAIR images being the most sensitive, for the demonstration of the abnormalities associated with hippocampal sclerosis defined on histopathologic examination. For more information, refer to page 626 of the CONTINUUM article “Neuroimaging in Investigation of Patients With Epilepsy.”

38. A 33-year-old man with known epilepsy is seen in the emergency department after a seizure with an associated fall. IV access is obtained. He is initially at his baseline neurologic status but then develops generalized seizure activity that has lasted 5 minutes. Which of the following is the most appropriate next step in management?

A. buccal midazolam
B. IV diazepam
C. IV fosphenytoin
D. IV lorazepam
E. rectal diazepam

The correct answer is D (IV lorazepam). This patient with underlying epilepsy has had continuous seizure activity for at least 5 minutes and meets criteria for status epilepticus. In patients with IV access, IV lorazepam
is considered the initial treatment of choice. It has been shown to be more effective than IV diazepam or phenytoin. In patients without IV access, administration of rectal diazepam or buccal midazolam can be considered. For more information, refer to page 777 of the CONTINUUM article “Status Epilepticus.”

39. The presence of a photoparoxysmal response to photic stimulation during an EEG is most commonly seen in which of the following settings?
   A. cognitively normal patients
   B. occipital lobe epilepsy
   C. primary generalized epilepsy
   D. sleep-deprived patients
   E. temporal lobe epilepsy

   The correct answer is C (primary generalized epilepsy). The photoparoxysmal response is an abnormal response seen in the setting of photic stimulation and goes beyond the “photic driving” of the posterior dominant rhythm seen in cognitively normal patients. It can be seen in different types of epilepsy but is most commonly seen in primary generalized epilepsies, especially childhood absence epilepsy. For more information, refer to page 601 of the CONTINUUM article “EEG and Epilepsy Monitoring.”

40. In addition to a risk of major congenital malformations, which of the following antiepileptic drugs is also associated with an elevated risk of autism spectrum disorders and lower IQ at age 6?
   A. carbamazepine
   B. lamotrigine
   C. phenobarbital
   D. phenytoin
   E. valproate

   The correct answer is E (valproate). Women treated with valproate (either monotherapy or in combination with other antiepileptics) are at elevated risk of giving birth to children with major congenital malformations. In addition, of the medications listed above, valproate is also associated with a higher risk of neurodevelopmental effects in children exposed during pregnancy, as measured by lower IQ at age 6 and a higher risk of autism spectrum disorders. For more information, refer to page 708 of the CONTINUUM article “Pregnancy, Epilepsy, and Women’s Issues.”