An 8-year-old boy is brought to the emergency department 3 hours after having a 2-minute episode of violent, jerky movements of his right arm at school. He was sweating profusely during the episode and did not lose consciousness. He remembers having felt a chill down his spine before the episode. Following the episode, he experienced weakness in the right arm and was not able to lift it above his head for 2 hours. Three weeks ago, he had a sore throat that resolved with over-the-counter medication. He was born at term and his mother remembers him having an episode of jerky movements when he had a high-grade fever as a toddler. There is no family history of serious illness, although his father passed away in a motor vehicle accident approximately 1 year ago. His temperature is 37.0°C (98.6°F), pulse is 98/min, and blood pressure is 94/54 mm Hg. Physical and neurologic examinations show no abnormalities. A complete blood count and serum concentrations of glucose, electrolytes, calcium, and creatinine are within the reference range. Which of the following is the most likely diagnosis?

A Sydenham chorea

B Sporadic transient tic disorder

C Conversion disorder

D Hemiplegic migraine

E Focal seizure

A	Sydenham chorea	21%	−
B	Sporadic transient tic disorder	2%	−
C	Conversion disorder	4%	−
D	Hemiplegic migraine	3%	−
E	Focal seizure	70%	✓

A focal seizure may occur with or without dyscognitive features (e.g., loss of consciousness) and can manifest with a variety of positive and negative symptoms, including focal motor activity that may be followed by transient weakness in an affected limb. Focal seizures may arise in the setting of hippocampal sclerosis, infection, trauma, or perinatal injury, among others. The majority of affected patients also experience an "aura," with higher cortical sensations such as déjà vu and fear that precede the focal seizure. This patient experienced violent, jerky arm movements preceded by a "chill down his spine" and followed by temporary focal paresis without residual effects (Todd paralysis) upon presentation to the emergency department, which is consistent with the diagnosis of a focal seizure without impairment of consciousness, previously referred to as a simple partial seizure.

SEIZURES AND EPILEPSY

FEEDBACK

An 18-month-old boy is brought to the emergency department 25 minutes after an episode of loss of consciousness. The child began crying after his 4-year-old brother snatched a toy from him. The brief shrill cry was followed by a period of expiration; he then turned blue, became unconscious, and briefly lost his muscle tone, before he stiffened and had jerky movements of his arms and legs for 15 seconds. After this episode, he immediately regained consciousness. He had a similar episode 2 weeks ago when his father refused to give him a juice box. He has been healthy and has met all his developmental milestones. Vital signs are within normal limits. He is alert and active. Cardiopulmonary examination shows no abnormalities. Neurologic examination shows no focal findings. Which of the following is the most appropriate next step in management?

A CT scan of the head

B Echocardiography

C Reassurance

D Electroencephalography

E Lumbar puncture

F Tilt table test

A CT scan of the head

Neuroimaging is indicated in children who present with a first unprovoked seizure if a structural lesion (e.g., congenital malformations or neoplasms) is suspected. However, the episode in this patient was not unprovoked; it was triggered by emotional distress. The preceding cyanosis and the short duration (< 2 minutes) of his jerky movements favor the diagnosis of an anoxic seizure (i.e., secondary to breath-holding) over an epileptic seizure. In addition, this patient has no other symptoms (e.g., neurologic deficits) that would be indicative of a structural lesion. More importantly, MRI, not CT scan, is the modality of choice in children. MRI has a higher sensitivity and does not carry the risk of exposure to radiation.

FEEDBACK

D Electroencephalography

EEG is warranted in all patients presenting with a seizure of unknown cause. However, this patient does not have typical signs of a generalized seizure such as tongue biting, bladder or bowel incontinence, or postictal confusion. Furthermore, cyanosis and the short duration (15 seconds) of jerking movements are unusual for seizures. This child is most likely experiencing breath-holding spells, which may be accompanied by jerky movements due to cerebral hypoxia (i.e., anoxic seizure). Unlike epileptic seizures, breath-holding spells are always preceded by a precipitating event (e.g., tantrums, minor injuries, and distress) followed by a sequence of crying, exhaling and holding the breath, and cyanosis.

Reassurance 68%

Breath-holding spells typically manifest between the age of 6–18 months. They are typically triggered by emotional distress, as is the case in this patient. The typical sequence includes crying, exhaling, and holding the breath, followed by cyanosis and loss of consciousness. Patients usually resume breathing and regain consciousness in less than 1 minute. Most importantly, parents should be reassured that the condition is benign and their child will outgrow it by the age of 4–8 years. The diagnosis is usually based on the clinical features and a detailed description of the episode; no treatment is required. Parents should be aware of the triggers of breath-holding spells, such as tantrums, minor injuries, and distress. However, they should not avoid reprimands for fear of triggering an episode.

A 22-year-old man is brought to the emergency department 25 minutes after an episode of violent jerky movements of his arms and legs. He has no recollection of the episode. The episode lasted for 3–4 minutes. His girlfriend reports that he has not been sleeping well over the past month. He is only oriented to place and person. His temperature is 37.0°C (98.6°F), pulse is 99/min, respirations are 18/min, and blood pressure is 110/80 mm Hg. Neurologic examination shows no focal findings. A complete blood count, as well as serum concentrations of glucose, electrolytes, and calcium, are within the reference range. Urine toxicology screening is negative. An MRI of the brain shows no abnormalities. Which of the following is the most appropriate next step in management?

Violent jerky movements of arms and legs and a loss of consciousness, along with a prolonged phase of confusion and mild anterograde amnesia after regaining consciousness, indicate a generalized tonic-clonic seizure. Normal blood tests, a negative toxicology screen, and the absence of findings on cranial imaging suggest that the patient has a primary seizure disorder.

A	Lorazepam	✕
B	Lumbar puncture	✕
C	Serum prolactin level	✕
D	Tilt table test	✕
E	Electroencephalography	✕
F	Lamotrigine	✕

A	Lorazepam	5%	−
B	Lumbar puncture	4%	−
C	Serum prolactin level	2%	−
D	Tilt table test	1%	−
E	Electroencephalography	83%	✓

In patients with a new-onset seizure, electroencephalography (EEG) is indicated if an epileptic disorder is suspected. Characteristic EEG findings – bursts of abnormal, rhythmic discharges featuring spikes and/or sharp waves with an abrupt onset and termination – establish the diagnosis of epilepsy.

ADDITIONAL INFORMATION

SEIZURES AND EPILEPSY FEEDBACK

F	Lamotrigine	5%	−

A 17-year-old boy is brought to the emergency department by his brother after losing consciousness 1 hour ago. The brother reports that the patient was skateboarding outside when he fell on the ground and started to have generalized contractions. There was also some blood coming from his mouth. The contractions stopped after about 1 minute, but he remained unconscious for a few minutes afterward. He has never had a similar episode before. There is no personal or family history of serious illness. He does not smoke or drink alcohol. He does not use illicit drugs. He takes no medications. On arrival, he is confused and oriented only to person and place. He cannot recall what happened and reports diffuse muscle ache, headache, and fatigue. He appears pale. His temperature is 37.0°C (98.6°F), pulse is 80/min, and blood pressure is 130/80 mm Hg. There is a small wound on the left side of the tongue. A complete blood count and serum concentrations of electrolytes, urea nitrogen, and creatinine are within the reference ranges. Toxicology screening is negative. An ECG shows no abnormalities. Which of the following is the most appropriate next step in management?

A. Lorazepam therapy
B. Reassurance and follow-up
C. MRI of the head
D. Lumbar puncture
E. Lamotrigine therapy
F. CT scan of the head
G. Electroencephalography

A	Lorazepam therapy	1%	−
B	Reassurance and follow-up	8%	−
C	MRI of the head	9%	−
D	Lumbar puncture	0%	−
E	Lamotrigine therapy	1%	−
F	CT scan of the head	57%	✓

Neuroimaging is the most appropriate next step in management in patients with an unprovoked first seizure if an intracranial process (e.g., hemorrhage) is suspected. This patient's protracted altered mental status (continued disorientation, headache) in the setting of a fall raises concern for intracranial hemorrhage. A noncontrast CT scan of the head is indicated to assess for intracranial hemorrhage. After ruling out any life-threatening bleeding via CT scan, the patient should also receive an EEG to assess whether his altered mental status is a result of continued seizure activity and an MRI to identify anatomic causes of the seizures.

SEIZURES AND EPILEPSY

FEEDBACK

G	Electroencephalography	23%	−

A 45-year-old man with a history of epilepsy comes to the physician for a follow-up examination. He has had trouble moving the right side of his body for 2 weeks. Three weeks ago he was admitted to the hospital for a generalized convulsive seizure. He was treated with intravenous lorazepam and phenytoin; the seizure activity resolved after 50 minutes on EEG monitoring. He was discharged 2 days later after no further epileptic activity occurred. Physical examination at discharge showed no abnormalities. He has had multiple hospitalizations for similar episodes over the past year. His only medication is lamotrigine, though he says that he sometimes forgets to take it. His temperature is 37.0°C (98.6°F), pulse is 70/min, and blood pressure is 130/80 mm Hg. Physical examination shows right-sided hemiparesis, right homonymous hemianopsia, and receptive aphasia. Which of the following is the most likely underlying cause of this patient's current symptoms?

A Lacunar stroke

B Brain abscess

C Cortical laminar necrosis

D Intraventricular hemorrhage

E Ruptured intracranial aneurysm

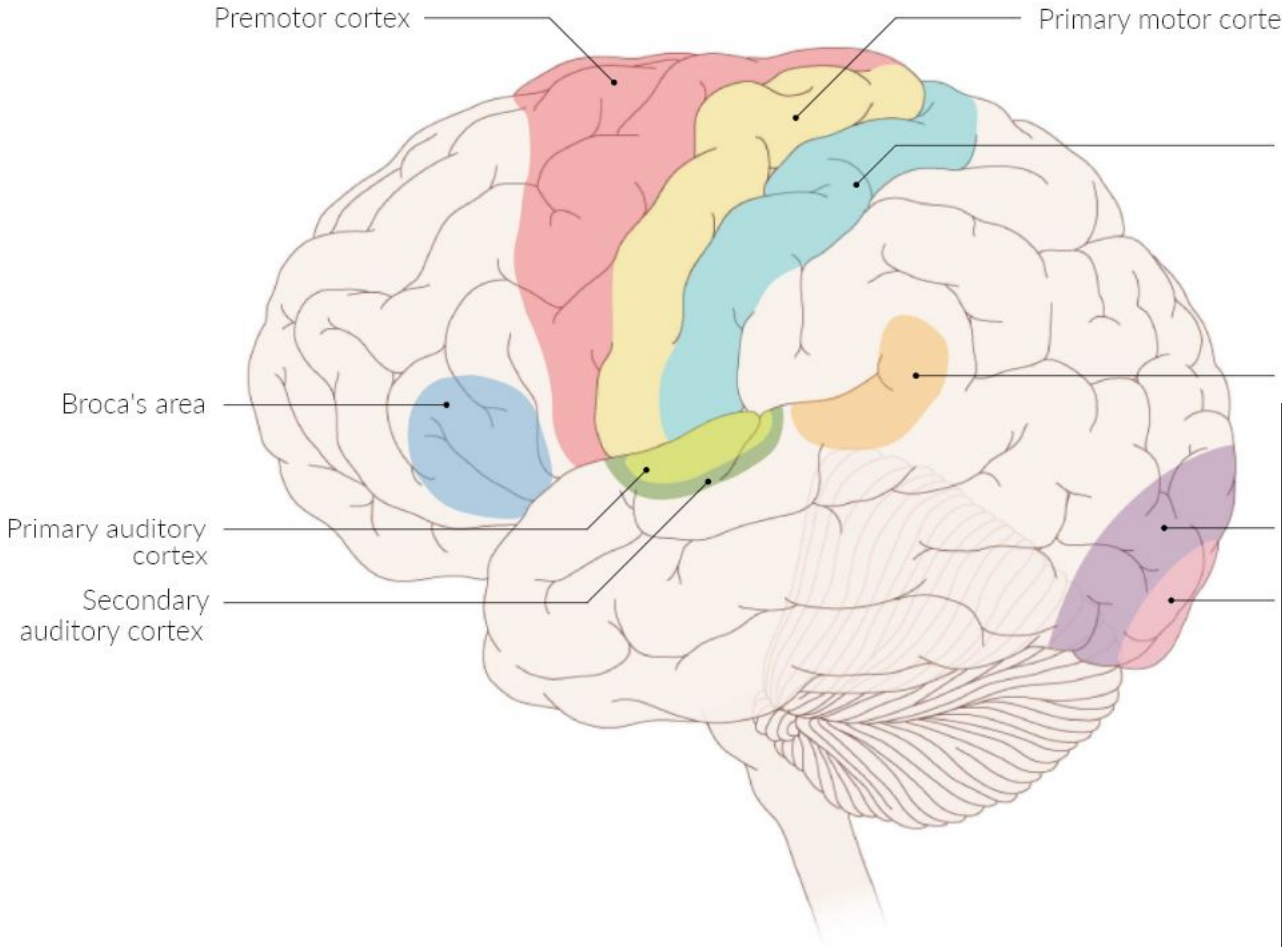
A	Lacunar stroke	19%	−
B	Brain abscess	2%	−
C	Cortical laminar necrosis	65%	✓

Status epilepticus can cause potentially irreversible tissue damage of the CNS, resulting in cortical laminar necrosis (CLN), which is often characterized by permanent neurological deficits. While the exact cause of CLN in status epilepticus is unknown, it seems to be associated with repeated seizures, hypoxia, and hypoglycemia. The clinical features depend on the affected cortical area and may include motor dysfunction, vision impairment, and aphasia. CLN can also result in additional seizures, increasing the risk for further cortical damage.

SEIZURES AND EPILEPSY

FEEDBACK

D	Intraventricular hemorrhage	6%	−
E	Ruptured intracranial aneurysm	8%	−



Lateral view of important areas of the brain

The primary motor cortex, in the frontal lobe, is the origin of the fibers of the pyramidal tract.

The primary and secondary auditory cortices, where auditory input is processed, are located in the temporal lobe. The primary visual cortex is located at the occipital pole and is surrounded by the secondary visual cortex.

Different functions converge at association areas. The most well-known examples are the motor (Broca) and sensory (Wernicke) areas of speech, which are commonly located in the dominant hemisphere.

A previously healthy 10-year-old boy is brought to the emergency department 15 minutes after he had a seizure. His mother reports that he complained of sudden nausea and seeing "shiny lights," after which the corner of his mouth and then his face began twitching. Next, he let out a loud scream, dropped to the floor unconscious, and began to jerk his arms and legs as well for about two minutes. On the way to the hospital, the boy regained consciousness, but was confused and could not speak clearly for about five minutes. He had a fever and sore throat one week ago which improved after treatment with acetaminophen. He appears lethargic and cannot recall what happened during the episode. His vital signs are within normal limits. He is oriented to time, place, and person. Deep tendon reflexes are 2+ bilaterally. There is muscular pain at attempts to elicit deep tendon reflexes. Physical and neurologic examinations show no other abnormalities. Which of the following is the most likely diagnosis?

A Focal to bilateral tonic-clonic seizure

B Focal seizure with dyscognitive features

C Convulsive syncope

D Sydenham chorea

E Generalized myoclonic seizure

F Generalized tonic-clonic seizure

A	Focal to bilateral tonic-clonic seizure	56%	✓

A focal to bilateral tonic-clonic seizure (formerly called partial seizure with secondary generalization) is a seizure that begins in a limited area of one hemisphere of the brain and progresses to involve both hemispheres. Often, these seizures begin with an aura that may include feelings of nausea or seeing shiny lights. This patient's initial facial twitching and muscle contractions were characteristic of a focal seizure (repetitive movements on one side). The bilateral tonic-clonic portion of the seizure occurred when he lost consciousness and began jerking all extremities. After tonic-clonic seizures, consciousness usually returns slowly and a postictal phase (in this case, lethargy and confusion) begins.

ADDITIONAL INFORMATION

SEIZURES AND EPILEPSY

FEEDBACK

B	Focal seizure with dyscognitive features	2%	–
C	Convulsive syncope	1%	–
D	Sydenham chorea	4%	–
E	Generalized myoclonic seizure	8%	–
F	Generalized tonic-clonic seizure	29%	–