

## DIAGNOSING PSEUDOSEIZURES: DON'T HOLD YOUR BREATH

**Postictal Breathing Pattern Distinguishes Epileptic from Nonepileptic Convulsive Seizures.** Azar NJ, Tayah TF, Wang L, Song Y, Abou-Khalil BW. *Epilepsia* 2008;49(1):132–137. **PURPOSE:** To examine postictal breathing pattern in generalized convulsive nonepileptic seizures (GCNES) and generalized tonic-clonic seizures (GTCS) and evaluate this feature as a discriminating sign. **METHODS:** We reviewed the postictal breathing pattern seizures in 23 generalized tonic-clonic seizures in 15 consecutive patients with epilepsy and 24 convulsive nonepileptic seizures in 16 consecutive patients with pure psychogenic seizures. We also analyzed 21 frontal lobe hypermotor seizures (FLHS) in 9 patients with frontal lobe epilepsy. **RESULTS:** The breathing after GTCS was deep with prolonged inspiratory and expiratory phases, regular, and loud (except for two short seizures). The breathing after GCNES was characterized by increased respiratory rate or hyperpnea with short inspiratory and expiratory phases, as can be noted after exercise. The breathing was often irregular, with brief pauses. The altered breathing lasted longer after GTCS. The two groups differed significantly in loudness of postictal respiration, postictal snoring (only with GTCS), respiratory rate (faster for the GCNES group), and duration of altered breathing (longer after GTCS) ( $p < 0.00001$  for all features). FLHS shared postictal breathing features of GCNES, but had other distinguishing features. **CONCLUSIONS:** The postictal breathing pattern can help differentiate generalized tonic-clonic seizures from nonepileptic psychogenic seizures with generalized motor activity and may be helpful to the practitioner obtaining a seizure history in the clinic setting or witnessing a seizure.

### COMMENTARY

Discriminating between true seizures and pseudoseizures—even when they occur in front of a physician—long depended solely on behavioral clues. Yet just as a careful, step-by-step history of abnormal episodic symptoms or physical events always has been the cornerstone of epilepsy diagnosis, a meticulous history of potentially ambiguous episodes similarly can elicit reliable indicators of nonepileptic spells. Pelvic thrusting, bicycling leg movements, and violent thrashing were once confidently thought to be suggestive, if not diagnostic, of nonepileptic attacks. In contrast, incontinence, physical injury, and an initial positive response to a therapeutic trial of antiepileptic drugs generally were considered hallmarks of genuine seizures. The widespread use of 24-hour EEG video (EEG/video) monitoring, however, quickly undermined the validity of such clinical hallmarks (1). In particular, seizures arising from the frontal lobes proved to break most of the established assumptions. Hypermotor seizures (as they are termed by Azar et al. in this report) associated with frontal lobe epilepsy commonly display all of the behaviors thought to be virtually diagnostic of pseudoseizures, while EEG/video of pseudoseizures has revealed that urination, injury, and drug responsiveness may be part of many nonepileptic episodes (2,3). As a result, EEG/video has become the gold standard for discriminating between epileptic and nonepileptic attacks.

Because EEG/video is still not available to all clinicians, the neurological literature remains thick with studies, vignettes, and case histories aimed at suggesting or confirming the diagnosis of pseudoseizures on clinical grounds. Historical characteris-

tics of pseudoseizures, including long duration, a start-stop pattern, directed actions, situational triggers (e.g., arguments, bizarre sensations or hallucinations, and weeping), have been identified by experienced clinicians and documented in case-control studies using EEG/video as being more common to pseudoseizures than to true seizures (4). However, clinical observations still may be important when an attack is observed first-hand by medical personnel. Identifying probable pseudoseizure symptoms or signs may be vital to a patient's welfare, as when someone presents to an emergency department with apparent status epilepticus (5). With an alert physician, historical features suggestive of pseudoseizures are used routinely as reasonable indications for more definitive diagnostic monitoring.

With few exceptions (e.g., shortness of breath associated with panic attacks), respiratory patterns are generally not a prominent part of a history of diagnostically puzzling spells. Although not well described in the medical literature, there are infrequent, anecdotal reports of focal seizures that begin with a sensation of catching one's breath or with an involuntary deep breath. The study by Azar et al. is one the first to focus on both ictal and postictal respiratory patterns of patients undergoing diagnostic EEG/video monitoring. The investigators demonstrate that respiratory patterns can be very sensitive and specific indicators of tonic-clonic or hypermotor seizures, on the one hand, and of convulsive-like but nonepileptic attacks, on the other hand. The study identifies certain other behavioral features, which reliably discriminate between epileptic and nonepileptic attacks or between tonic-clonic and hypermotor complex partial seizures. For instance, true tonic-clonic seizures—with their combination of postictal oxygen debt, accumulation of saliva, and reduced level of consciousness—are often followed by deep respirations and snoring or stertorous respiratory patterns. Such postictal respiratory patterns were

found by Azar et al. to be highly specific for genuine tonic-clonic seizures (e.g., snoring in 61%), were never observed after pseudoseizures (0%), and occurred only rarely in hypermotor seizures (1 in 20). The diagnostic power of postictal stertorous breathing also was documented by Sen et al., who found that such respirations occurred in 41 of 44 confirmed tonic-clonic seizures and in none of 17 proven pseudoseizures (6). Another key diagnostic element identified by Azar and colleagues was the open or closed position of the patient's eyes during an episode: the eyes remained open in every tonic-clonic and hypermotor seizure but were closed in almost 90% of pseudoseizures, a finding documented in other studies as well (7).

Disappointing for diagnosticians in the report by Azar et al. was the lack of clinical features clearly separating pseudoseizures from hypermotor, usually frontal, seizures. Whereas deep breathing was seen postictally after every tonic-clonic seizure, shallow respirations characterized both pseudoseizures (13%) and hypermotor seizures (19%). The occurrence of pelvic thrusting ruled out a tonic-clonic seizure, but it was a nearly constant feature of both pseudoseizures and hypermotor seizures (>90%). Side-to-side head turning almost never occurred with tonic-clonic seizures (1 in 22) but was common in both hypermotor seizures (76%) and pseudoseizures (63%).

A meticulous history will remain important to discriminating between true epilepsy and nonepileptic attacks, and some of the findings of Azar et al. now can help clinicians to diagnose nonepileptic attacks more accurately. The noisy, deep breathing

characteristic of the postictal phase of tonic-clonic seizures can be described vividly by most observers and used for diagnosis. In the emergency room, attention to postictal breathing patterns and ictal eye opening or closure may avoid unnecessary and sometimes risky therapy or conversely, spur clinicians to timely therapeutic action.

by Donna C. Bergen, MD

## References

1. Gates JR, Ramani V, Whalen S, Loewenson R. Ictal characteristics of pseudoseizures. *Arch Neurol* 1985;42:1183–1187.
2. Beierkord M, Will B, Fish D, Shorvon S. The clinical features and prognosis of pseudoseizures diagnosed using video-EEG telemetry. *Neurology* 1991;41:1643–1646.
3. Sussman NM, Jackel RA, Kaplan LR, Harner RN. Bicycling movements as a manifestation of complex partial seizures of temporal lobe origin. *Epilepsia* 1989;30:527–531.
4. Bergen D, Ristanovic R. Weeping as a common element of pseudoseizures. *Arch Neurol* 1993;50:1059–1060.
5. Gunatilake SB, De Silva HJ, Ranasinghe SB. Twenty-seven venous cutdowns to treat pseudo status epilepticus. *Seizure* 1997;6:71–72.
6. Sen A, Scott C, Sisodiya S. Stertorous breathing is a reliably identified sign that helps in the differentiation of epileptic from psychogenic non-epileptic convulsions: an audit. *Epilepsy Res* 2007;77:62–64.
7. Chung S, Gerber S, Panka K, Drista A. Ictal eye closure is a reliable indication of nonepileptic seizures. *Neurology* 2006;66:1730–1731.