At-Home Video Goggles Provide Early, Accurate Vertigo Diagnosis

Batya Swift Yasgur, MA, LSW

June 04, 2019

Specialized goggles measuring eye movements during an episode of vertigo may rapidly and accurately diagnose the type of vertigo the patient is experiencing, new research suggests.

Investigators taught patients with recurrent vertigo to self-record spontaneous and positional nystagmus at home while they were symptomatic, using miniature video-oculography goggles.

Participants carried the diagnosis of either Ménière disease (MD), vestibular migraine (VM), or benign paroxysmal positional vertigo (BPPV).

The diagnostic accuracy of the goggles was highly effective in separating patients with BPPV from patients with other forms of positional vertigo (sensitivity 100%, specificity 78%).

It also showed diagnostic accuracy in patients with MD characterized by high-velocity spontaneous horizontal nystagmus (95% sensitivity, 82% specificity) and in VM (93% sensitivity, 24% sensitivity).

Study investigators Miriam Welgampola, BSc Med (Hon), PhD, associate professor at the University of Sydney in Australia, and Allison Young, MAud, of the Institute of Clinical Neurosciences at Royal Prince Alfred Hospital in Sydney, told Medscape Medical News in an email that the "take-home video glasses address the need to capture the acute events [of vertigo] and will enable an early and accurate diagnosis."

"Recurrent vertigo has 'ictal' characteristics that assist with identification of the underlying inner ear balance disorder, [and] in the future we will be able to profile these disorders and separate them by their ictal nystagmus patterns," they said.

The study was published online May 15 in Neurology.

Remote Self-Recording

Patients who have recurrent episodes of vertigo may not reach the clinic in time to be accurately diagnosed, Welgampola and Young stated.

"Often, the patient is too unwell or lives too far away or the episodes are too short-lived to make it possible for the clinician to see them while acutely symptomatic," they said.

Although the history and balance tests sometimes indicate the diagnosis, on other occasions, "the diagnosis is unclear, therefore it is frustrating for the patient and the clinician to have to wait until the next episode occurs," they observed.

For this reason, a diagnostic tool enabling a patient to self-record an episode remotely can facilitate accurate diagnosis and early treatment.

One such potential tool is a patient-initiated, home-based vestibular event monitor. To investigate its feasibility, the researchers conducted a proof-of-concept trial that also aimed to "describe and compare ictal nystagmus characteristics of the three most commonly encountered causes of episodic vertigo: BPPV, MD, and VM."

The study focused on 117 patients (mean age 51.2 [±14.3] years, 60% women) who presented with episodic vertigo to a neurology outpatient facility between August 2014 and August 2017.

The study focused on three types of vertigo: MD (43 patients), VM (67 patients), or BPPV (7 patients).
Participants were asymptomatic at recruitment and were required to have a history of spontaneous vertigo lasting more than 5 minutes or recurrent positional vertigo.

The intervention consisted of lightweight swimming goggles that were monocularly inlaid with two infrared lights and attached to an audio/video recorder, enabling a vision-denied video recording of the patient's open left eye.

Participants were taught to use the goggles to record eye movements at home during spontaneous and positional vertigo for a mean duration of 199.8 seconds (3 minutes, 19 seconds).

The video recording included four positional components:

- Sitting upright, looking straight ahead for 10 seconds
- Lying in supine position for 30 seconds
- Lying on the right side for 30 seconds
- Lying on the left side for 30 seconds

Patients were also instructed to verbally report their head orientation while recording.

Those who reported recurring symptoms lasting at least 30 minutes were asked to make multiple recordings at 15-minute intervals from vertigo onset for the first hour of vertigo.

No change of medication protocol was required, and patients were asked to take their usual prescribed vestibular suppressants and antinausea medications prior to beginning a recording.

The device captured the uncontrolled eye movements (ictal nystagmus) that accompany vertigo.

**High Sensitivity, Specificity**

The video recordings helped to distinguish the various types of vertigo from each other (ie, VM vs Ménière disease, and BPPV vs other positional causes).

In spontaneous vertigo (ie, vertigo while at rest), of the 43 patients with MD, 40 showed high-velocity spontaneous horizontal nystagmus (>12.05°/second) and 21 patients showed horizontal nystagmus reversing direction within 12 hours.

In patients with MD, spontaneous horizontal nystagmus was found to have a sensitivity and specificity of 95.3% and 82.1% (95% confidence interval 0.84 - 0.99, 0.71 - 0.90), while nystagmus direction change within 12 hours was "highly specific" (95.7%) for MD (95% CI, 0.85 - 0.99).

But it was spontaneous vertical nystagmus that was found to be highly specific for VM (93.0% [95% CI, 0.81 - 0.99]), although it had low sensitivity (23.9%).

Spontaneous nystagmus was absent or minimal (< 3°/second) in the 7 patients with BPPV.

"MD demonstrated an interested characteristic of eye movements that beat to the affected ear and then reversed direction. This finding, although not demonstrated in all patients, was highly specific for MD," Welgampola and Young said.

"We then looked at patients who experience vertigo on changing head position—ie, positional vertigo," they report.

When lying with the affected ear downward, the patients with BPPV demonstrated paroxysmal positional nystagmus, "which rapidly increases in velocity and decays quickly. We measured this decay by recording the time taken for peak nystagmus velocity to halve (T50)," they said.

Patients with VM and patients with MD both demonstrated persistent positional nystagmus (median T50; 93.1 seconds, 213.2 seconds).
Peak nystagmus velocity and decay of velocity (T50s < 47.3 seconds) separated BPPV and positional nystagmus of MD and VM with very high sensitivity and high specificity (100% and 77.8%, respectively [95% CI, 0.54 - 1.00, 0.64 - 0.88]).

Study limitations included the following: some of the participants did not feel well enough to wear the goggles during the experience of vertigo, and others did not wear them when they thought the episode was too mild.

"Providing people with a pair of goggles that they can easily use at home to record eye movement has the potential to help with vertigo diagnosis, not only by a neurologist in clinic but also by physicians in an emergency room and physicians diagnosing patients remotely as well," Welgampola said in a release.

**Fewer Clinic Visits, Diagnostic Tests**

Commenting on the study for *Medscape Medical News*, Terry Fife, MD, director of otoneurology and balance disorders, Barrow Neurological Institute, and professor of neurology, University of Arizona College of Medicine, both in Phoenix, called it a "nicely done paper that demonstrated the application of a portable device that can not only record sound so the patient's comments are captured, but can also document patient-identified spells of dizziness and associated nystagmus."

Fife, who was not involved with the study, said that patients "often come to their doctors with reports of recurrent dizziness, but the details of what triggered the spells and how long they last can be difficult for patients to remember."

He likened the video goggles to a loop memory monitor and symptom event monitor in cardiology.

"This kind of device could be more widely deployed in patients with recurrent, unexplained spells of dizziness to aid in diagnosing these patients, with perhaps fewer clinic visits and fewer expensive diagnostic studies," Fife said.

Welgampola and Young noted that future studies with larger populations are needed to confirm and expand these findings.

_The study was funded by the Garnett Passe and Rodney Williams Memorial Foundation and the National Health and Medical Research Council of Australia. Young reports receiving funding through the University of Sydney Postgraduate Award. Welgampola receives funding from the National Health and Medical Research Council of Australia and the Garnett Passe and Rodney Williams Memorial Foundation. The other authors' disclosures are listed on the original paper. Fife has disclosed no relevant financial relationships._

*Neurology.* Published online May 15, 2019. [Abstract](https://www.medscape.com/viewarticle/913879_print)

For more *Medscape Neurology* news, join us on [Facebook](https://www.facebook.com/Medscape/) and [Twitter](https://twitter.com/Medscape)

Medscape Medical News © 2019