Clinical Policy Title: Vestibular evoked myogenic potentials (VEMPs)

Clinical Policy Number: 10.01.03

Effective Date: April 1, 2017
Initial Review Date: October 19, 2016
Most Recent Review Date: November 17, 2016
Next Review Date: November 2017

Policy contains:
- Vestibular disorders.
- Cervical VEMP.
- Ocular VEMP.
- Vestibular function testing.

Related policies:
CP# 09.01.06 Brainstem auditory evoked response (BAER)
CP# 10.02.03 Non-pharmacologic medical treatments for chronic vertigo

ABOUT THIS POLICY: AmeriHealth Caritas Iowa has developed clinical policies to assist with making coverage determinations. AmeriHealth Caritas Iowa’s clinical policies are based on guidelines from established industry sources, such as the Centers for Medicare & Medicaid Services (CMS), state regulatory agencies, the American Medical Association (AMA), medical specialty professional societies, and peer-reviewed professional literature. These clinical policies along with other sources, such as plan benefits and state and federal laws and regulatory requirements, including any state- or plan-specific definition of “medically necessary,” and the specific facts of the particular situation are considered by AmeriHealth Caritas Iowa when making coverage determinations. In the event of conflict between this clinical policy and plan benefits and/or state or federal laws and/or regulatory requirements, the plan benefits and/or state and federal laws and/or regulatory requirements shall control. AmeriHealth Caritas Iowa’s clinical policies are for informational purposes only and not intended as medical advice or to direct treatment. Physicians and other health care providers are solely responsible for the treatment decisions for their patients. AmeriHealth Caritas Iowa will update its clinical policies as necessary. AmeriHealth Caritas Iowa’s clinical policies are not guarantees of payment.

Coverage policy

AmeriHealth Caritas Iowa considers the use of VEMP testing to be investigational and, therefore, not medically necessary.

Limitations:
None.

Alternative covered services:
- Clinical examination.
- Diagnostic imaging (e.g., magnetic resonance imaging [MRI] and computerized tomography [CT]).
- Other tests as indicated to help rule out causes of imbalance unrelated to the vestibular
Background

Vestibular disorders result from damage to the parts of the inner ear and brain that process the sensory information involved with controlling balance and eye movements (Vestibular Disorders Association [VDA], 2016). Symptoms of vestibular disorders include vertigo and dizziness, imbalance and spatial disorientation, vision disturbance, hearing changes, cognitive and/or psychological changes, and other symptoms such as nausea and vomiting, motion sickness, and headaches.

Vestibular disorders can affect people of any age but are more common among the elderly, persons with diabetes, and persons with existing sensory disorders (Agrawal, 2013). They can adversely impact quality of life, activities of daily living and are associated with an increased risk of clinically significant outcomes (e.g., falls) (Agrawal, 2013). In children, vestibular deficits can impair motor development and balance, and affect gaze stability that interferes with learning to read (VDA, 2016).

Etiologies include disease or injury to these sensory processing areas, genetic or environmental conditions, or unknown reasons (VDA, 2016). Benign paroxysmal positional vertigo (BPPV) is the most common vestibular disorder and may account for up to one-third of vertigo presentations to dizziness clinics (Agrawal, 2013). In children, vestibular migraine, benign paroxysmal vertigo, and vestibular neuritis are the three most common forms (Gioacchini, 2014; Agrawal, 2013). Other vestibular disorders include labyrinthitis and vestibular neuritis, Ménière’s disease, secondary endolymphatic hydrops, and perilymph fistula, superior canal dehiscence, acoustic neuroma, ototoxicity, enlarged vestibular aqueduct syndrome, and mal de débarquement (VDA, 2016).

Assessment of vestibular disorders involves a number of tests to evaluate the auditory, visual and somatosensory systems that absorb information, as well as the associated nerves and brain centers that process the information and direct the appropriate response. Diagnostic imaging using MRI or CT may be indicated to evaluate the structures around the inner ear. Other tests may be indicated to help rule out causes of imbalance unrelated to the vestibular system (VDA, 2016). Studies of the vestibular-auditory system consist of OAE, ECOG, and BAER. Studies of the vestibular-visual system include caloric tests, ENG, NVG, and rotation tests; new emerging tests include video head impulse testing, computerized dynamic posturography, and vestibular evoked myogenic potential (VEMP) (VDA, 2016).
VEMP test:

The otolithic organs of the vestibular system sense motion according to their orientation. These inner ear organs comprise the saccule and utricle. VEMP, also known as click evoked potentials, is a noninvasive test that provides specific information about otolith function (Utah Hearing & Balance, 2016). The VEMP test uses skin surface electrodes to measure muscle activity evoked in response to acoustic stimuli. Computer technology amplifies the myogenic response, which is averaged and presented as a VEMP (Utah Hearing & Balance, 2016).

There are two main types of VEMP for evaluating vestibular disorders that measure saccular or utricular function. Cervical VEMP (cVEMP) uses electrodes placed on the sternocleidomastoid muscle and is presumed to reflect the vestibulo-colic (or sacculo-colic) reflex, while ocular VEMP (oVEMP) employs electrodes on the ocular muscles below the eye believed to reflect the vestibulo-ocular (or utriculo-ocular) reflex (Hain, 2016).

Searches

AmeriHealth Caritas Iowa searched PubMed and the databases of:

- UK National Health Services Centre for Reviews and Dissemination.
- Agency for Healthcare Research and Quality’s National Guideline Clearinghouse and other evidence-based practice centers.
- The Centers for Medicare & Medicaid Services (CMS).

We conducted searches on October 7, 2016. Search terms were: "Vestibule, Labyrinth/diagnosis" (Mesh), "Vestibular Evoked Myogenic Potentials" (Mesh), "Labyrinth Diseases/diagnosis" (Mesh), and the free text term "vestibular evoked myogenic potential."

We included:

- **Systematic reviews**, which pool results from multiple studies to achieve larger sample sizes and greater precision of effect estimation than in smaller primary studies. Systematic reviews use predetermined transparent methods to minimize bias, effectively treating the review as a scientific endeavor, and are thus rated highest in evidence-grading hierarchies.
- **Guidelines based on systematic reviews.**
- **Economic analyses**, such as cost-effectiveness, and benefit or utility studies (but not simple cost studies), reporting both costs and outcomes — sometimes referred to as efficiency studies — which also rank near the top of evidence hierarchies.

Findings

For this policy, we identified one systematic review and meta-analysis (Zhang, 2015), one Hayes Search & Summary report (2015) without analysis, two studies with a narrative literature review addressing
normal values for VEMP (Blakley, 2015; Meyer, 2015), and five evidence-based guidelines (Lopez-Escamez, 2015; American Academy of Otolaryngology—Head and Neck Surgery [AAO-HNS], 2014; Nguyen, 2012; Bhattacharyya, 2008; Fife, 2000). The growing body of evidence consists of primarily small, observational studies assessing the diagnostic performance of VEMP in persons with benign paroxysmal positional vertigo (BPPV), and to a lesser extent, persons with Ménière’s disease.

The evidence is insufficient to support the use of VEMP testing for evaluating vestibular disorders. There is a lack of consensus regarding normal values, definition of an abnormal VEMP, standardization of testing protocols, and clinical application. Patient characteristics and aspects of the technique can influence test results, and guidelines differ on the value of VEMP testing in persons with BPPV or Ménière’s disease, despite being the most widely studied applications. While VEMP testing may have value as part of the battery of other accepted vestibular function tests, the selection of patients for whom addition VEMP test information may be beneficial has not been established, nor has its impact on patient management been studied.

Summary of clinical evidence:

<table>
<thead>
<tr>
<th>Citation</th>
<th>Content, Methods, Recommendations</th>
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| Blakley (2015) | **Key points:**  
| Normal values for cVEMP |  
| | • Literature review and case series (48 patients) at a tertiary academic center with no history of hearing loss or vestibular symptoms.  
| | • Normal values for cVEMP parameters are statistically consistent in the literature.  
| | • The clinical significance of abnormal values has not been validated. For clinical purposes, cVEMP "thresholds" should be reported.  
| | • Reporting of other parameters is optional. |
| Hayes (2015) | **Key points:**  
| VEMP testing in adults with vertigo |  
| | • Search and summary (no analysis) of 27 abstracts only with references to dizziness or vertigo, a minimum of 20 subjects published from 2010 to 2015: one prospective controlled study; three prospective comparison studies, two prospective clinical studies, 21 observational studies.  
| | • Conditions (number of studies) represented: BPPV (15); dizziness (four); migrainous vertigo (one); orthostatic dizziness (one); otosclerosis with vertigo (one); vertigo (four); whiplash injury with vertigo (one).  
| | • Safety: Twelve adverse events associated with auditory evoked response stimulators were reported to the FDA Manufacturer and User Facility Device Experience (MAUDE) database from January 1, 1996 to August 2015, using Product code GWJ.  
| | • Study abstracts present variation in study designs, definitions of abnormal results, and conflicting findings regarding VEMP testing in adults with vertigo. |
| Lopez-Escamez (2015) | **Key points:**  
<p>| for the Classification Committee for an International Classification of Vestibular Disorders (ICVD) |<br />
| | • Committee includes Bárány Society, The Japan Society for Equilibrium Research, the European Academy of Otology and Neurotology, the Equilibrium Committee of the AAO-HNS and the Korean Balance Society. |</p>
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| Diagnostic criteria for Menière’s disease | - Definite Menière’s disease is based on clinical criteria and requires observation of an episodic vertigo syndrome associated with low- to medium-frequency sensorineural hearing loss and fluctuating aural symptoms (hearing, tinnitus and/or fullness) in the affected ear. Duration of vertigo episodes is limited to a period between 20 minutes and 12 hours.  
- Probable Menière’s disease is a broader concept defined by episodic vestibular aural symptoms occurring in a period from 20 minutes to 24 hours.  
- No mention of VEMP testing. |
| Meyer (2015) | Key points:  
- Systematic review and meta-analysis of 60 reports.  
- Overall quality: Unclear. Methods of review unclear.  
- cVEMP technique had significant effects on all response parameters.  
- Authors’ conclusions: Optimal stimulus and recording parameters suggested by previous research are confirmed. Variations in stimulus and recording parameters influence response parameter values. Authors suggested normative response values as a guideline for cVEMP interpretation. |
| Zhang (2015) | Key points:  
- Meta-analysis of 30 studies (26 prospective, four retrospective). Likely overlapping study populations.  
- Overall quality: Moderate to high. Likely publication bias, no established gold standard, heterogeneous study designs with small sample sizes.  
- Sensitivity 49% (95% confidence interval [CI]: 46% to 51%), specificity 95% (95% CI: 94% to 96%), positive likelihood ratio 18.01 (95% CI: 9.45 to 34.29), negative likelihood ratio 0.54 (95% CI: 0.47 to 0.61), area under the summary receiver operating characteristic curve 0.78, and diagnostic odds ratio 39.89 (95% CI: 20.13 to 79.03).  
- Factors affecting diagnostic performance: (Caucasian patients vs. Asian patients, prospective design vs. retrospective design, healthy controls vs. patient controls, period between attacks vs. period during attacks, air conduction vs. bone conduction, oVEMP vs. cVEMP, comparison among different stages, tone burst vs. click, and funded projects vs. non-funded projects).  
- Authors’ conclusion: VEMPs test alone is not sufficient for Ménière’s disease or delayed endolymphatic hydrops diagnosis. It might be an important component of a test battery. VEMP’s high specificity and non-invasive nature might be a screening tool. |
| AAO-HNS (2014) | Key points:  
- Position statement: The AAO-HNS recognizes that VEMP testing is a useful neurophysiologic test and is medically indicated and appropriate in the evaluation of certain persons (not specified) with suspected auditory and balance or dizziness disorders.  
- Six references cited: two conference abstracts/one poster, one case series (13 total subjects), and one prospective cohort study (48 total subjects). |
| Nguyen-Huynh (2012) | Key points:  
- Addressed management of BPPV.  
- Dix-Hallpike or supine head roll test recommended. |
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<tr>
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| Bhattacharyya (2008) for the AAO-HNS Clinical practice guideline: BPPV | • Repeated testing in separate occasions may be necessary to avoid missing the diagnosis.  
• No mention of VEMP testing. |
| Fife (2000) for the American Academy of Neurology (update in progress) Vestibular testing techniques in adults and children | **Key points:**  
• Clinicians should not obtain radiographic imaging, vestibular testing, or either in a patient diagnosed with BPPV, unless the diagnosis is uncertain (i.e. atypical presentation or equivocal or atypical findings on Dix-Hallpike test) or there are additional symptoms or signs unrelated to BPPV that warrant testing.  
• Recommendation against based on diagnostic studies with limitations and a preponderance of benefit over harm.  
• Several functional tests mentioned, but not VEMP testing. |

**Glossary**

**Dizziness** — Lightheaded, floating, or rocking sensation.

**Otolith organs** — The saccule and utricle. Responsible for translating head movements into neural impulses that the brain can process.

**Saccule** — A bed of sensory cells of the inner ear that is sensitive to a change in horizontal movement.

**Semicircular canals** — Part of the inner ear vestibular apparatus that detects rotational movement.

**Utricle** — A bed of sensory cells of the inner ear that is sensitive to a change in horizontal movement.

**Vertigo** — Spinning or whirling sensation; an illusion of movement of self or the world.

**Vestibular system (apparatus or labyrinth)** — Comprises the utricle, saccule, and three semicircular canals in each ear. Provides sensory information about motion, equilibrium, and spatial orientation, and when functioning properly, they send symmetrical impulses to the brain.

**Vestibulo-colic reflex (VCR)** — Involves control of neck muscles for correction of the head's orientation and adjustment of posture.

**Vestibulo-ocular reflex (VOR)** — A reflex that generates eye movement while the head turns to remain
fixated on a stationary image.

References

Professional society guidelines/other:


Peer-reviewed references:


**CMS National Coverage Determinations (NCDs):**


**Local Coverage Determinations (LCDs):**


**Commonly submitted codes**

Below are the most commonly submitted codes for the service(s)/item(s) subject to this policy. This is not an exhaustive list of codes. Providers are expected to consult the appropriate coding manuals and bill accordingly.

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<td>Auditory evoked potentials for evoked response audiometry and/or testing on the central nervous system; comprehensive</td>
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