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Variation in the Use of Vestibular Diagnostic Testing for Patients Presenting to Otolaryngology Clinics with Dizziness

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Author Contributions

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Abstract

Objective—We used a national otolaryngology practice-based research network database to characterize the utilization of vestibular function testing in patients diagnosed with dizziness and/or a vestibular disorder.

Study Design—Database review.

Setting—The Creating Healthcare Excellence through Education and Research (CHEER) practice-based research network of academic and community providers

Subjects and Methods—Dizzy patients in the CHEER retrospective database were identified through *ICD-9* codes; vestibular testing procedures were identified with *CPT* codes. Demographics and procedures per patient were tabulated. Analysis included number and type of vestibular tests ordered, stratified by individual clinic and by practice type (community vs academic). Chi-square tests were performed to assess if the percentage of patients receiving testing was statistically significant across clinics. A logistic regression model was used to examine the association between receipt of testing and being tested on initial visit.

Results—A total of 12,468 patients diagnosed with dizziness and/or a vestibular disorder were identified from 7 community and 5 academic CHEER network clinics across the country. One-fifth of these patients had at least 1 vestibular function test. The percentage of patients tested varied widely by site, from 3% to 72%; academic clinics were twice as likely to test. Initial visit vestibular testing also varied, from 0% to 96% of dizzy patients, and was 15 times more likely in academic clinics.

Conclusion—There is significant variation in use and timing of vestibular diagnostic testing across otolaryngology clinics. The CHEER network research database does not contain outcome data. These results illustrate the critical need for research that examines outcomes as related to vestibular testing.

Keywords

dizziness; vestibular; videonystagmography; rotary chair; diagnostic testing

Symptoms of dizziness, vertigo, and/or imbalance are common, affecting 20% to 30% of the general population.¹⁻³ The prevalence of these symptoms increases in older patients, with >60% of adults 70 years old failing a balance screening test.⁴ The most common causes of dizziness are peripheral and central vestibular disorders, in an estimated 55% of patients.⁵ The third-most common etiology is psychiatric, accounting for 16% of cases, and an additional 13% are not given a diagnosis.⁵ An unexplored diagnosis or an unexplained syndrome of symptoms may lead to an incorrect treatment or no treatment at all. In such cases, the persistent symptoms have been reported to lead to absence from work,² anxiety leading to increased health service utilization,⁶ secondary psychosomatic dizziness,^{7,8} and an injurious fall.⁹

Given both the high percentage of vestibular etiologies among patients presenting with dizziness and the significance of finding the correct diagnosis, it is important for the clinician to evaluate for underlying vestibular disorders. During the initial evaluation of dizziness, clinicians have several options to determine whether the etiology of the patient's complaint is vestibular, including a thorough case history, bedside examination, and/or vestibular function testing. Unfortunately, there is an absence of evidence-based guidelines regarding which diagnostic strategies should be applied to which patients among the clinically heterogeneous group that presents with dizziness.

The knowledge regarding the use of vestibular diagnostic testing and health services utilization in patients with dizziness is very limited. There are no published studies examining variations in vestibular test referral patterns among otolaryngology clinics across the country. Given the lack of clinical practice guidelines, clinicians and hospitals may use different diagnostic approaches that may or may not include vestibular testing, whether in-house or via referral.

The aim of this study was to characterize the use of vestibular function testing for otolaryngology patients presenting with dizziness. We hypothesized that there would be variability in test utilization across individual sites as well as between practice types (academic vs community).

Methods

Data Collection and Participants

This study was approved by the Duke University Medical Center Institutional Review Board. We conducted a retrospective cohort study as part of the retrospective data collection (RDC) project of the Creating Healthcare Excellence through Education and Research (CHEER) network. CHEER is a practice-based research network encompassing 30 academic and community-based otolaryngology clinics throughout the country. For the RDC project, each CHEER clinic site contributed 1 year's worth of de-identified patient data to a single database, including patient demographics, diagnosis codes, and procedure codes. The RDC currently holds >260,000 unique patient visits and >650,000 encounters. The CHEER RDC data contain 1 year of de-identified patient-level data from each participating site. Each site provided the most recently available year of data at the time of its contribution to the database, and the data years range from 2010 to 2012. While de-identified, the medical record numbers are still unique; therefore, patients can be tracked across the data set. The database includes only month and year of visit, which limits calculations of time between visits or mean number of visits (ie, no way of knowing whether a visit occurred before or after another visit if within the same month).

Only data from clinic sites that included vestibular diagnostic data and vestibular testing data were included in this investigation, to ensure that clinics routinely evaluating dizzy patients also had access to vestibular testing. Sites that referred elsewhere for testing or did not record vestibular procedural codes in the database were excluded. In total, data were compiled from 7 community clinics and 5 academic clinics.

Patients with a vestibular diagnosis or dizziness were identified through *ICD-9* codes (International Classification of Diseases, Ninth Revision; 780.4, 386.0-386.9). Demographic information was collected as well as the number of unique patient visits associated with the vestibular diagnosis. Data regarding the use of vestibular function testing were calculated as the number of unique patient visits at each clinical site associated with specific *CPT* codes (*Current Procedural Terminology*; see Table 1). Receipt of vestibular testing was defined as 1 vestibular tests as identified with *CPT* codes.

Laboratory tests for assessing dizzy patients include videonystagmography (ie, basic vestibular evaluation and caloric irrigations), rotary chair, cervical and ocular vestibular evoked myogenic potentials (cVEMP and oVEMP, respectively), computerized dynamic posturography, video head impulse testing (vHIT), and electrocochleography (ECoChG). Tests that are performed may depend on results from case history or physical examination and on the facility's protocol. Not all tests have *CPT* codes and thus cannot be tracked from the RDC database. For example, although cVEMP, oVEMP, and vHIT are becoming widely used tests of vestibular function, there is no designated *CPT* code for any of these procedures, and it is unclear how different sites choose to document this procedure. Thus, at the present time, there is no accurate way of assessing the use of cVEMP, oVEMP, and vHIT in dizzy patients through a large coded database. Furthermore, ECoChG testing was rarely used in this cohort of patients. In fact, only a single clinic site reported using ECoChG in the assessment of dizziness during the year that data were collected. For this reason, ECoChG testing was not included in any of the analyses.

Data Analysis

A descriptive analysis was conducted, including number and type of vestibular tests ordered, stratified by individual clinic and by practice type (ie, community or academic). Chi-square tests were performed to assess if proportion of patients receiving testing was statistically different across clinics. We used a logistic regression model to examine whether being tested on the first visit was associated with more patients being tested overall. The logistic model examined the association between receipt of testing and being tested on the first visit, as we observed that some clinic sites tested a large number of patients prior to the ear-nose-throat consult while others did not. We modeled the likelihood of being tested on initial visit based on site type, given the patient was tested utilizing a logistic regression model. Data were subset on those who were tested at all (outcome = tested on initial visit; predictor = site type). All analyses were done on SAS 9.4 or JMP Pro 11 (SAS Institute Inc, Cary, North Carolina).

Results

A total of 221,833 patients from 12 clinic sites resulted in 12,468 (6%) patients presenting with the chief complaint of dizziness (see Figure 1). The mean age of this cohort was 56.0 years. The percentages of patients receiving various vestibular diagnoses are shown in Table 2. The most frequent diagnosis, given to 55% of patients, was *ICD-9* code 780.4 (dizziness and giddiness). The most frequent specific diagnosis was benign paroxysmal positional vertigo (14.5%), followed by Ménière's disease (12.3%). We performed analysis looking at

whether *ICD-9* code 780.4 (dizziness and giddiness) was more common in particular practices (specifically, academic vs community). The percentage of that diagnosis ranged from 56% to 91% and was not more common in any particular practice ($\chi^2 = 0.346$, $P = .554$).

Overall, 2572 (20.6%) of dizzy patients had at least 1 vestibular function test. Of the testing group, a total of 2495 (97%) had caloric testing; 797 (31%) had rotational testing; and 343 (13%) had computerized dynamic posturography. The variation in testing significantly differed by site ($\chi^2 = 271.52$, $P < .0001$), as there was a 24-fold variation in the rate of vestibular testing among individual sites ranging from 3% to 72% (see Figure 2).

The variation in testing was also seen between academic and community practice types. A total of 31% of all dizzy patients from academic sites underwent testing, whereas only 18% of all dizzy patients from community clinics had testing. The odds of a dizzy patient undergoing a vestibular diagnostic test are 2 times greater in an academic clinic than a community clinic (odds ratio = 2.01, 95% confidence interval [95% CI] = 1.8-2.2).

As shown in Figure 2, site K was an outlier in that it tested a much greater percentage of dizzy patients. A secondary analysis was performed without site K. Results showed a smaller variation in the rate of testing among sites, from 3% to 44%, and we still observed significant variation in testing by site type ($\chi^2 = 99.071$, $P < .0001$). However, by removing site K, the odds of a patient undergoing vestibular testing are 2 times greater in a community clinic versus an academic clinic (odds ratio = 2.03, 95% CI = 1.7-2.4).

Among the patients who underwent testing, the percentage tested on initial visit significantly varied ($\chi^2 = 506.39$, $P < .0001$) and ranged from 0% to 96% (see Figure 3). A total of 83% of tested patients from all academic sites underwent testing on initial visit, whereas only 23% of tested patients from all community sites were tested on initial visit (see Figure 4). The odds of a patient undergoing vestibular testing on the initial visit are 15 times greater in academic clinics versus community clinics (odds ratio = 15.9, 95% CI = 13.0-19.4). Site K was an outlier, with 96% of its tested patients being tested on the initial visit. A secondary analysis with the removal of site K still resulted in a wide range of testing on initial visit (0%-80%), and the variation among sites was still significant ($\chi^2 = 23.83$, $P < .0001$). However, the odds of a patient undergoing vestibular testing on the initial visit in an academic clinic are greatly reduced, as the odds ratio is now 2.1 (95% CI = 1.6-2.9).

The Epley maneuver was explored, and overall 3.4% of the total patients included in the analyses had an Epley maneuver and did not have vestibular function testing. At the site level, the average number of patients who had an Epley maneuver and did not have vestibular function testing was 0.3% (SD = 0.8%, range = 0%-2.5%).

Discussion

There are no clear clinical practice guidelines for the evaluation of dizzy patients, which may contribute to notable variations in diagnostic evaluations. These data show significant variation in how often vestibular function testing is used to evaluate dizziness in otolaryngology clinics. Although 21% of dizzy patients in this study received vestibular

testing, the percentage tested ranged from 3% to 72% among individual sites. One particular clinic site was an outlier in that it tested 76% of patients. Removing that site resulted in a range between 3% and 44%. It is not clear from the data if this variability is due to a lack of consensus regarding who should be tested or whether different types of patients were evaluated at different clinics; thus, some clinics tested substantially more than others. Undergoing vestibular testing on the first office visit also differed among sites, with a range from 0% to 96%. This implies that some facilities or clinicians prefer to see the patient first and then decide if testing is warranted, whereas others have made vestibular testing standard of care for all patients presenting with dizziness and they are scheduled for testing on or before the first specialist visit. Perhaps not surprising, sites that tested a large percentage of patients also tended to test more patients on the initial visit. Patients seen in academic clinics were more likely to have testing on the initial visit. It is likely that these vestibular testing results are part of the patient's initial intake and examination. This may be a reflection of a greater percentage of complicated patients being referred to academic settings from other physicians, while simpler diagnoses (eg, more benign paroxysmal positional vertigo) are seen in community clinics. It is also possible that some patients are referred elsewhere for testing and more specialized follow-up or that some bring test results with them from their referring providers. These variations suggest that exploring policies, specialty (general vs neurotologist), and differences in payer/coverage would be of interest for future studies. What is not clear from this is whether patient outcomes differed between those who underwent testing and those who did not.

The implications of variation in diagnostic testing have been investigated in other areas of medicine. For example, observational studies have shown that the use of positron emission tomography (PET) imaging is associated with better patient outcomes in patients with non-small cell lung cancer.¹⁰ However, PET imaging is most likely to be used in nonblack patients <81 years old.¹¹ Thus, better outcomes associated with PET imaging may be biased if the test is used selectively in populations with greater access to health care. Conversely, investigations in the area of noninvasive cardiac imaging have shown that patients who undergo testing have a greater likelihood of also undergoing invasive procedures and further expensive testing.¹² The overall outcome of the patient may or may not change, but her or his medical care was both more invasive and more expensive.

The current investigation observed wide variation in the use of vestibular diagnostic testing. As a result, vestibular function testing may be over- or underutilized, either of which could be associated with unfavorable outcomes. Overutilization would unnecessarily increase health care costs and may expose patients to potentially unnecessary discomfort, while underutilization may leave patients without the diagnostic clarity that they need for appropriate clinical management. High-volume testing may be cost prohibitive, but the underuse of testing can be detrimental, particularly in older adults where the consequences of improperly diagnosed dizziness can lead to a fall with subsequent morbidity, mortality, and cost.¹³

The variation in vestibular testing observed in this study may be due to differences in diagnostic practices, including regional variation, payer and coverage variations, and referral policies. Research in other diagnostic test modalities, such as echocardiograms, has shown

variation in diagnostic testing across practices and regions,¹⁴ as well as different referral patterns among physicians treating patients with similar conditions.¹⁵ Although we did not analyze differences in diagnostic practices by regions, we did observe differences across practices that may be due to individual physician referral patterns or specific clinical policies or to differences in patient mix. For example, site K was an outlier in the percentage of patients tested and the percentage of patients tested at initial visit. That specific clinic had a policy in which all patients referred to the physician for dizziness were automatically referred for vestibular testing prior to the physician consult—hence, the very high percentage of patients tested on initial visit. As a result, site K had a high percentage of patients tested overall relative to the other clinics. Additionally, the differences observed between academic and community sites may be due to the patient mix from each site. In other words, it is possible that patients seen in community clinics had more straightforward and simple cases than those in academic settings. Overall, these results leave unanswered questions and suggest exploring clinical policies and payer/coverage areas in future investigations.

With the exception of benign paroxysmal positional vertigo, there are no published clinical practice guidelines available to help clinicians decide when to refer a patient presenting with dizziness for vestibular testing. Thus, the diagnostic evaluation depends heavily on the physician and clinic practice patterns, which may be in part independent of a patient's presenting symptoms. Although vestibular diagnoses can often be made through a complete history and physical examination, it is not known how often vestibular diagnostic testing provides an advantage in clinical management and leads to better outcomes. The finding of a lack of concordance across sites leaves open the possibility that outcomes such as health, costs, and satisfaction with care will also differ across sites.

These findings should be interpreted in light of several potential limitations. First, because our patient population was limited to members of an otolaryngology practice-based research network, we cannot necessarily generalize to other specialty practices. We speculate that greater practice variation may exist across different practice settings (eg, primary care, neurology). Second, we cannot exclude the possibility of residual confounding from unmeasured factors that could explain the degree of test variation observed across sites. Specifically, clinical details from each patient, such as symptom type, severity, and duration, and whether vestibular test results were normal or abnormal were not available from the database. We know that there is great variation in the clinical presentation of dizziness. Third, we did not differentiate among specific vestibular tests. Not all tests have a designated *CPT* code, making differentiation nearly impossible with a de-identified coded database. Fourth, while we do know that there are neurologists at the sites included (based on a separate site descriptor database), we did not capture the provider associated with the visit in the CHEER retrospective database used for this study and therefore cannot make assumptions about neurologist versus general otolaryngologist evaluation, either in testing or in timing of testing. Despite these limitations, the current study uses CHEER data to describe current practice patterns regarding vestibular testing in this patient population. It also identifies future areas of research.

In summary, our work demonstrates significant variation in the utilization of vestibular testing in a large practice-based network of otolaryngologists. These results highlight the critical need for research that examines outcomes associated with each diagnosis and the utilization of testing. Our hope is that there would be a concerted effort by practices to document outcome measures that examine how these tests can be valuable in the diagnosis and treatment of patients with dizziness.

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References

1. Neuhauser HK, Radtke A, von Brevern M, et al. Burden of dizziness and vertigo in the community. *Arch Intern Med*. 2008; 168:2118–2124. [PubMed: 18955641]
2. Yardley L, Owen N, Nazareth I, Luxon L. Prevalence and presentation of dizziness in a general practice community sample of working age people. *Br J Gen Pract*. 1998; 48:1131–1135. [PubMed: 9667086]
3. Neuhauser HK. Epidemiology of vertigo. *Curr Opin Neurol*. 2007; 20:40–46. [PubMed: 17215687]
4. Agrawal Y, Carey JP, Della Santina CC, et al. Disorders of balance and vestibular function in US adults: data from the National Health and Nutrition Examination Survey, 2001–2004. *Arch Intern Med*. 2009; 169:938–944. [PubMed: 19468085]
5. Kroenke K, Hoffman RM, Einstadter D. How common are various causes of dizziness? A critical review. *South Med J*. 2000; 93:160–167. [PubMed: 10701780]
6. Wiltink J, Tschan R, Michal M, et al. Dizziness: anxiety, health care utilization and health behavior: results from a representative German community survey. *J Psychosom Res*. 2009; 66:417–424. [PubMed: 19379958]
7. Best C, Tschan R, Eckhardt-Henn A, Dieterich M. Who is at risk for ongoing dizziness and psychological strain after a vestibular disorder? *Neuroscience*. 2009; 164:1579–1587. [PubMed: 19828125]
8. Staab JP, Ruckenstein MJ. Chronic dizziness and anxiety: effect of course of illness on treatment outcome. *Arch Otolaryngol Head Neck*. 2005; 131:675–679.
9. Jacobson GP, McCaslin DL, Grantham SL, Piker EG. Significant vestibular system impairment is common in a cohort of elderly patients referred for assessment of falls risk. *J Am Acad Audiol*. 2008; 19:799–807. [PubMed: 19358459]
10. Farjah F, Flum DR, Ramsey SD, et al. Multi-modality mediastinal staging for lung cancer among medicare beneficiaries. *J Thorac Oncol*. 2009; 4:355–363. [PubMed: 19156000]
11. Dinan MA, Curtis LH, Carpenter WR, et al. Variations in use of PET among Medicare beneficiaries with non-small cell lung cancer, 1998–2007. *Radiology*. 2013; 267:807–817. [PubMed: 23418003]
12. Wennberg DE, Kellett MA, Dickens JD, et al. The association between local diagnostic testing intensity and invasive cardiac procedures. *JAMA*. 1996; 275:1161–1164. [PubMed: 8609682]
13. Jacobson GP, McCaslin DL, Grantham SL, Piker EG. Significant vestibular system impairment is common in a cohort of elderly patients referred for assessment of falls risk. *J Am Acad Audiol*. 2008; 19:799–807. [PubMed: 19358459]
14. Stafford RS, Misra B. Variation in routine electrocardiogram use in academic primary care practice. *Arch Intern Med*. 2001; 161:2351–2355. [PubMed: 11606151]
15. Sirovich B, Gallagher PM, Wennberg DE, Fisher ES. Discretionary decision making by primary care physicians and the cost of US health care. *Health Aff (Millwood)*. 2008; 27:813–823. [PubMed: 18474975]

Figure 1.

Flow diagram showing the total number of patient encounters from the retrospective data collection database, followed by the total number and percentage of patients with a vestibular diagnosis and the percentages of patients who underwent vestibular testing.

Figure 2.

Bar graph illustrating the percentage of dizzy patients who received vestibular testing from each clinic site, designated with lowercase letter *a* through *l*. Community-based sites are in light gray and academic sites in black. The sample size from each clinic is also given.

Figure 3.

Bar graph illustrating the percentage of tested patients who were tested on their initial visits from each clinic site. Individual clinic sites are designated with lowercase letters *a* through *l*. Community-based sites are in light gray and academic sites in black. The sample size from each clinic is also given.

Figure 4. Mosaic plot of logistic regression showing patients tested on initial visit. Percentage tested on initial visit is plotted versus academic or community site type.

Table 1List of *CPT* Codes Associated with Vestibular Function Testing.

Procedures	<i>CPT</i> Code ^a
Basic vestibular evaluation	92540
Caloric vestibular test	92543
Sinusoidal vertical axis rotational testing	92546
Computerized dynamic posturography	92548
Electrocochleography	92584
Cervical vestibular evoked myogenic potential	n/a
Ocular vestibular evoked myogenic potential	n/a
Video head impulse test	n/a

Abbreviation: *CPT*, *Current Procedural Terminology*; n/a, not applicable.^a *CPT* code used in current investigation to identify a patient as having had a vestibular test.

Table 2

Most Common Diagnoses Reported.

<i>ICD-9</i> Code	Diagnosis	Patients, % ^a
780.4	Dizziness and giddiness	55.4
386.11	Benign paroxysmal positional vertigo	14.5
386.00-386.04	Ménière's disease	12.3
386.10	Peripheral vertigo, unspecified	5.8
386.2	Vertigo of central origin	3.6
386.12	Vestibular neuritis	2.4
386.50-386.58	Labyrinthine dysfunction	1.9
386.30-386.35	Labyrinthitis	1.5
386.9	Unspecified vertiginous syndrome	0.8
386.8	Other disorders of the labyrinth	0.5
386.43	Semicircular canal fistula	0.4
386.19	Other peripheral vertigo	0.3
386.40-386.42, 386.48	Other fistula	0.1

Abbreviation: *ICD-9, International Classification of Diseases, Ninth Revision.*^aFrom n = 12,468.