Resident Journal Review

Approach to the Dizzy Patient

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Dizziness, often a challenging presentation, refers to a variety of vague sensations including lightheadedness, disequilibrium, and vertigo. Life-threatening disorders, such as stroke, are easily mistaken for benign illnesses, such as acute vestibular syndrome (AVS). This review focuses on recent developments in the evaluation of dizzy patients including some bedside tests which may improve diagnostic accuracy and reduce the cost and time of the ED evaluation.


This article reviews various bedside exams that are useful in determining benign from central causes of vertigo including examinations for ocular alignment, spontaneous and gaze-evoked nystagmus, the vestibulo-ocular reflex, saccades, smooth pursuit, and balance. Paying special attention to eye movements (provoked and unprovoked) often reveals the etiology of the dizziness.

Nystagmus is a fast beating eye movement and is termed spontaneous when present without being provoked by head maneuvers. For spontaneous nystagmus, focus on the direction of the movement and how gaze effects the intensity and direction of the nystagmus. Nystagmus from peripheral pathology is horizontal-torsional, in the direction opposite to the lesion, and will be suppressed by visual fixation. Nystagmus from central pathology is more variable with no consistent direction or response to fixation.

Gaze Evoked Nystagmus (GEN) is a sensitive ocular-motor finding in central pathology. To test for GEN, the patient is asked to hold their gaze in an eccentric position. GEN will beat in the direction of the gaze.

Head shaking nystagmus may be present in patients with peripheral unilateral vestibular pathology. It is evoked by tilting the patient’s head forward 20 degrees and shaking it in a sinusoidal fashion. The nystagmus will decrease after about 20 seconds and will point in the opposite direction of the lesion. Similar to spontaneous nystagmus, central causes of head shaking nystagmus are variable and can include intense nystagmus in response to weak head shaking, ipsilesional nystagmus, and nystagmus in the opposite direction to the spontaneous nystagmus.

Positional nystagmus is evoked by changing the head position relative to gravity. In peripheral pathology, such as benign paroxysmal positional vertigo, the positional nystagmus is paroxysmal (sudden onset and short lived). In central pathology, positional nystagmus is more often constant.

The most effective test for the vestibulo-ocular reflex (VOR) is the head impulse test. With the patient focusing on a fixed point, the examiner abruptly turns the patient’s head. Normal patients and those with a central pathology will smoothly turn their eyes in the opposite direction of head movement to keep them fixed on the point. Patients with unilateral vestibular pathology will have a catch-up saccade back towards the target. This corrective saccade indicates a decreased VOR in patients with peripheral pathology.


This prospective cross-sectional study compared the sensitivity and specificity of a 3-step bedside oculomotor examination (HINTS) to computed tomography (CT) and magnetic resonance imaging (MRI) in diagnosing stroke in patients presenting with AVS. The HINTS exam has three components: horizontal-head impulse test (h-HIT), nystagmus test, and test of skew. The h-HIT tests the VOR and a normal result strongly predicts a central origin of symptoms. An abnormal result will be seen in peripheral lesions, but can also be seen in lateral pontine strokes; therefore, it is unhelpful in eliminating central pathology. The second component is to test for GEN. Vertical or torsional nystagmus indicates central pathology. Test of skew is done through the alternate cover test. Vertical misalignment constitutes a positive test result and has high specificity for central pathology. If any one of these three tests is positive, then the HINTS exam is considered positive.

For a video of the HINTS exam, please visit http://content.lib.utah.edu/cdm/singleitem/collection/ehsl-dent/id/6.

The study enrolled 101 consecutive patients presenting with AVS and one or more risk factors for stroke. Patients were considered to have AVS only if they exhibited rapid onset of vertigo, nausea/vomiting, and an unsteady gait. Risk factors for CVA included smoking, hypertension, diabetes, hyperlipidemia, atrial fibrillation, eclampsia, hypercoagulable state, recent cervical trauma, prior stroke, and prior myocardial infarction. Patients were enrolled from the ED (59), as inpatients (4), and as transfers to the neurology stroke service (37). Patients with recurrent vertigo were excluded. All patients underwent both HINTS testing by a single neuroophthalmologist and neuroimaging. The HINTS examination was performed within an hour of the onset of symptoms in 75% of subjects, but the mean time from onset of symptoms to examination was 26 hours with a range of 1 hour to 9 days. Time of symptom onset was known for 96 patients and CT or MRI occurred within 72 hours of time of symptom onset in 97% of these. Central pathology was found in 76 patients (69 ischemic strokes, four hemorrhagic strokes, two demyelinating diseases, and one carbamazepine toxicity).

In this study the HINTS exam was 100% sensitive and 96% specific for stroke. The HINTS exam had a positive likelihood ratio of 25 (95% CI, 3.66 to 170.59) and negative likelihood ratio of 0 (95% CI, 0.00 to 0.11) for stroke.

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The HINTS exam may be better to “rule out” an acute stroke than neuroimaging. It also suggests that the skew test is a strong marker of brainstem stroke given that it was positive in two of three cases of lateral pontine stroke despite a positive h-HIT as well as in seven of eight cases in which MRI was falsely negative. Neuroimaging by MRI with DWI was falsely negative in eight of patients whose strokes were discovered on repeat imaging. Given the high rate of misdiagnosed acute posterior circulation strokes, this bedside exam may be very useful to emergency physicians.

The study has several limitations including the very high-risk population (76 of 101 subjects had a central lesion) which is not similar to the patient population seen in the ED with similar symptoms. Also, the results may not be generalizable as the study used a single neuroophthalmologist as the examiner. Future studies conducted with typical ED patients and physicians may help determine whether the HINTS exam is a beneficial test in the ED.


This systematic review included 10 studies with a total of 392 patients. Initially, 779 observational studies on the clinical features, diagnostic evaluation, and differential diagnosis of AVS studies were identified on MEDLINE. However, all but 10 met exclusion criteria: lacked original patient data, offered no symptom data about dizziness, provided no information about diagnostic accuracy for acute central or peripheral vestibulopathies, did not evaluate patients in the acute stage of disease, involved patients under age 18 years, or reported fewer than five patients.

Overall, there was insufficient data to evaluate the effectiveness of using tests for spontaneous nystagmus, smooth-pursuit eye movement, saccades, or optokinetic nystagmus to classify symptoms as central or peripheral. However, some interesting associations were found.

Two studies included in the review (Kattah et al., 2009 and Norrving et al., 1995) addressed whether head or neck pain is associated with a posterior fossa stroke. A statistically significant association was found between head or neck pain and a central cause of AVS (38% vs. 12%, p < 0.005); however, lack of head or neck pain was diagnostically inconclusive in ruling out central pathology.

Seven case series examined focal neurologic signs in patients with acute dizziness. In aggregate focal neurologic signs were present in 80% (n=185/230) of patients with strokes, but this is likely a substantial overestimate due to diagnostic ascertainment bias. One prospective study of 101 patients with AVS found neurologic or oculomotor signs in 51% of the 76 patients with a central cause (Kattah et al., 2009). Findings included facial palsy, sensory loss, limb ataxia, hemiparesis, gaze palsy, and vestibular syndrome. None of the 25 patients found to have a peripheral cause had these deficits. However, some of the findings were subtle and may not be reliably detected by non-neurologists.

A normal result of the h-HIT was the single best bedside predictor of a central cause of AVS, with a specificity of 0.95 (95% CI 0.90-1.00) for detecting a stroke, essentially matching that of an MRI with a positive likelihood ratio of 18.39 (95% CI 6.08-55.64). An abnormal result of the h-HIT usually indicated a peripheral lesion; however, the systematic review found that 15% of patients with a central cause of AVS had an abnormal response to the h-HIT.

GEN was evaluated in six of the 10 studies and correctly identified central causes with high specificity of 92% (95% CI 0.86-0.98) but low sensitivity (38%). Skew deviation was evaluated in two of the 10 studies and also correctly identified central causes of AVS with high specificity (98%), but low sensitivity (30%).

The presence of any of the three signs of the HINTS exam had a sensitivity of 100% (n=76/76) and a specificity of 96% (n=24/25) for stroke. Another study by Cnyrim et al., of the three tests that make up HINTS found a sensitivity of 91% (n=21/23) and a specificity of 78% (n=31/40). The pooled sensitivity and specificity of the two studies (184 total patients) was 98% and 85% respectively with a negative likelihood ratio of 0.02 (95% CI 0.01-0.09). The data suggests that bedside utilization of HINTS can outperform MRI in ruling out stroke in early presentations of AVS.

Finally, based on this systematic review, parts of the history most suggestive of a stroke include multiple prodromes, headache, or neck pain. The presence of focal neurological signs or a normal head impulse test is likely indicative of a stroke; however, the absence of these findings is insufficient to rule out a stroke. However, a negative HINTS examination may essentially rule out a stroke with high sensitivity.

In this article, the chief complaint of “vertigo” was used as an example to evaluate financial cost and health outcomes that evolve from misdiagnosis. The inappropriate use of diagnostic tests, specifically the overuse of CT scans, was highlighted by doing an economic analysis.

National health care costs now exceed $2.7 trillion and diagnostic errors leading to death or disability are increasing. Misuse of diagnostic imaging costs $25 billion and harms over 1 million patients annually in the U.S. False positive tests are a major cause of the increased costs.

Annually in the U.S., there are 4 million ED visits for acute dizziness costing $4 billion. While stroke or other central causes make up only 5% of these cases, a significant amount is spent to exclude these causes of vertigo. Despite overuse of available tests, one third of vestibular strokes are still initially missed. Patients with peripheral vestibular disease are generally over-tested, misdiagnosed, and undertreated. The authors report an 80% diagnostic error rate triggering complicated work-ups and unnecessary hospital admissions. This is despite the fact that the physical exam arguably identifies more than 99% of strokes.

CT scans are grossly overused to “rule-out” stroke despite having a disappointing sensitivity (16%) in the within 24 hours of symptom onset. In 1995, 9% of dizzy patients underwent CT scan compared to 40% currently. However, this dramatic increase has not increased the diagnosis of stroke or other neurologic pathology. The authors list possible causes of the increased utilization of CT scans including: algorithms or practice guidelines, local standards, family wishes, time-efficiency-driven practice, and risk-averseness.

Central causes of vertigo have a low prevalence and thus liberal scanning leads to many false positives. The authors assert that good diagnosticians can rapidly diagnose and disposition dizzy patients at the bedside without inappropriate imaging. They advise considering sensitivity and specificity as well as pre- and post-test probability before testing. Additionally they recommend against ordering tests, which have post-test probabilities that do not change management. The authors propose considering the health utility of a test, contemplating all possible resultant outcomes before ordering it. Despite training in analytic decision-making, physicians often do not follow this rationale.

Research generally focuses on diagnostic accuracy or immediate results of a test. However, the authors argue, that focus on patient-centered outcomes is more useful for calculating test utility. Unlike therapies, which are easily associated with patient consequences, the causal relationship of testing to downstream patient outcomes is often uncertain. There is a false assumption that correct diagnosis and subsequent treatment leads to better clinical outcomes.

To try and quantify the complex value of diagnostic tests, the authors assert that the standard measure of health effect used in economic analyses of medical treatments, the quality-adjusted life year (QALY), should also be applied to diagnostic test outcomes. Tests that cost less than $100,000 per QALY would be considered cost effective. The authors then apply this economic analysis to dizziness.

They argue that physicians may be misled to think highly sensitive and specific bedside tests are the most beneficial diagnostics if applied to high-risk patients. However, economic analysis shows that targeting this subset is not economically beneficial due to increased stroke work-ups and costs. By focusing on better diagnosis of benign causes of vertigo, societal costs can be reduced by decreasing many unnecessary stroke work-ups and admissions. They calculate $1 billion annually can potentially be saved from ED workups of vertigo.

Finally, the authors recommend economic analysis to guide QI approaches to reducing error in areas with the highest economic burden. Despite temptation to target therapies and diagnostics for rare life-threatening illnesses, closer analysis shows that targeting more common illnesses with high misdiagnosis and expensive error rates is more economic. Perhaps healthcare costs could be reduced and patient outcomes improved by focusing research on misdiagnosis and inappropriate testing-related harms.

Conclusion

The correct ED approach to the dizzy patient remains unclear. The articles reviewed offer insight into several bedside neurologic examinations that may offer accurate and economic methods to evaluate patients presenting with dizziness. These tests may be more accurate than imaging at distinguishing between benign peripheral etiologies and more serious central ones. Many of these exams need to be further validated in an emergency setting. Ultimately these articles suggest that in evaluating the dizzy patient, using bedside exams as opposed to imaging may improve care and reduce costs.