Supplementary material - Diagnostic errors in the acutely dizzy patient – lessons learned
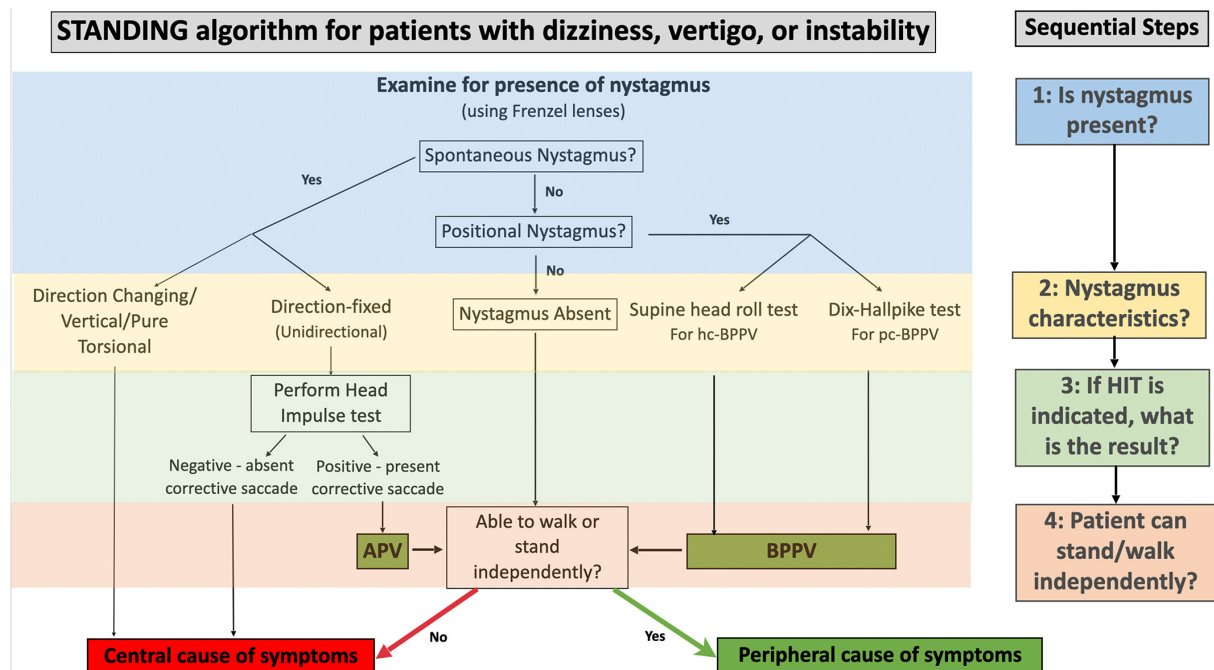Tarnutzer et al. 2024

**Supplementary material**


**Supplementary figures and tables for algorithms discussed in the manuscript**

**Figure S1 - STANDING algorithm**.



STANDING Algorithm. APV, acute peripheral vestibulopathy (usually vestibular neuritis); BPPV, benign paroxysmal positional vertigo; hc-BPPV, horizontal canal BPPV; HIT, head impulse test; pc-BPPV, posterior canal BPPV. Figure 6 is adapted from Vanni et al. [1,2]

Figure reprinted from [3] with permission from the publisher (John Wiley and Sons)

**Figure S2 – Summary receiver operating characteristic curve analysis for various bedside tests compared to brain imaging and clinical scores (retrieved from [4])**
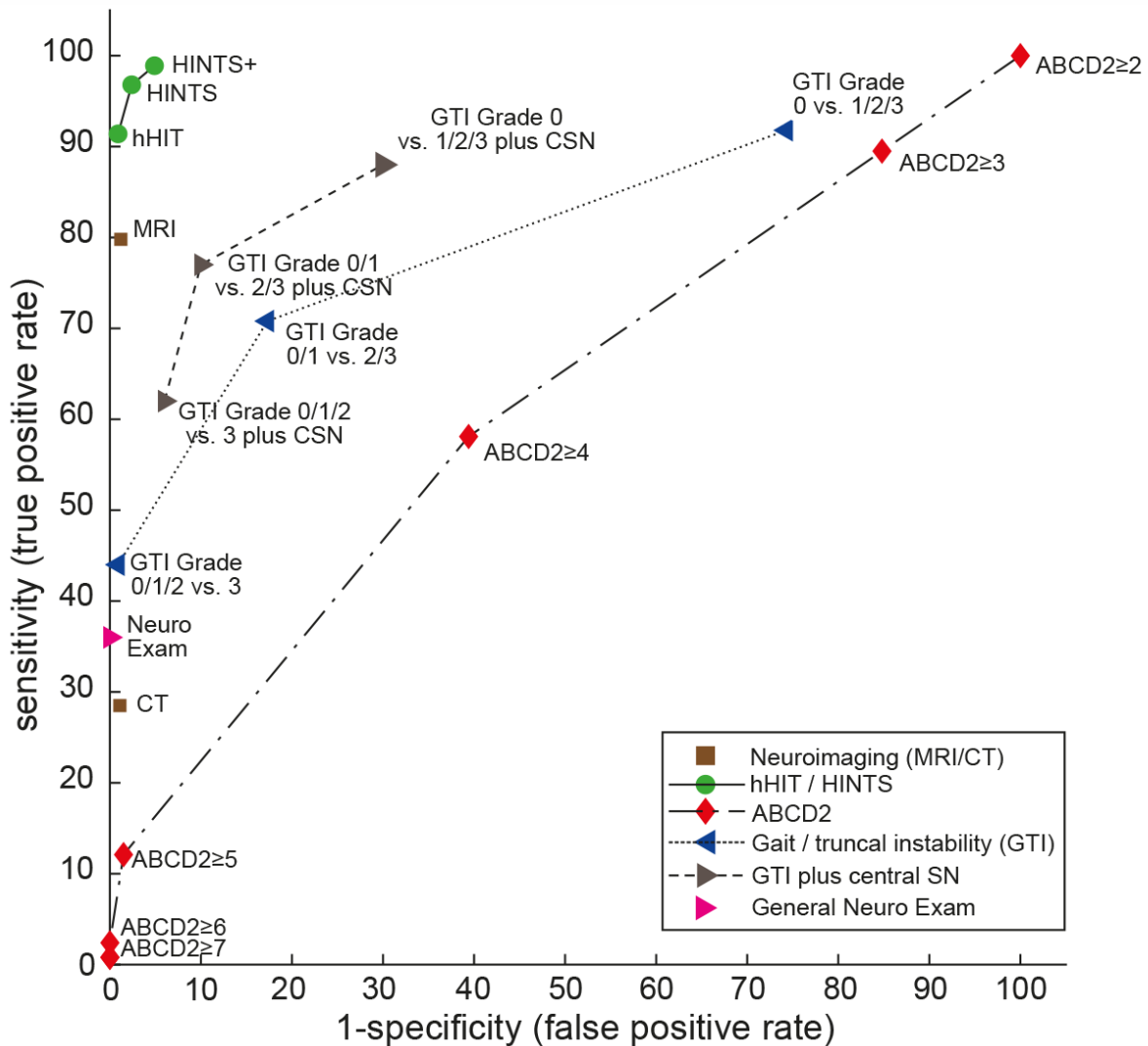


Summary receiver operating characteristic (SROC) curve analysis for the graded gait/truncal instability (GTI) ratings (with or without additional central-type spontaneous/gaze-evoked nystagmus compared to the "HINTS (Head Impulse, Nystagmus, Test of Skew) family", neuroimaging (computed tomography [CT] or magnetic resonance imaging with diffusion-weighted sequences [MRI-DWI], values used as published by Shah and colleagues [5]), general neurologic exam and vascular risk stratification by ABCD2 (age, blood pressure, clinical features, duration of symptoms, diabetes) score (data from a single study [6]) for detecting stroke in patients presenting the acute vestibular syndrome (modified after [7]).

SROC curves are shown for six different diagnostic approaches to diagnosing stroke in the acute vestibular syndrome. A perfect test or decision rule has threshold cutoffs in the upper left corner (100% sensitivity, 100% specificity) and an area under the curve (AUC) of 1.0. Note that the gait/truncal instability ratings outperform the ABCD2 score and the general neurologic exam but are inferior compared to the HINTS family of eye movement tests. This is also true when adding central-type spontaneous nystagmus to the GTI rating. Both HINTS and HINTS plus (HINTS plus new hearing loss detected by finger rubbing or similar) demonstrate a higher diagnostic accuracy for ruling out stroke than MRI including DWI.

Abbreviations: hHIT=horizontal head-impulse test

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## H.I.N.T.S. plus bedside testing battery (modified after [8])

| Table S1: *H.I.N.T.S. plus bedside testing battery** | | | | | |
|---|---|---|---|---|---|
| **Test performed** | **Property evaluated** | **How to perform this test** | **Pointing to a peripheral cause** | **Pointing to a central cause** | **Comments** |
| **Horizontal Head-Impulse test (HIT)** | Vestibulo-ocular reflex (VOR) | Fast, low amplitude (10-15°) head rotations to the left/right while the patient is looking at a fixed target in space (e.g., the examiner's nose) | Delayed to one side, pathological catch-up saccade | Normal HIT. | Note that central lesions involving the VOR (e.g. lesions in the root-entry zone or of the vestibular nuclei) may show a "pseudo-peripheral pattern" |
| **Testing for Nystagmus** | Eccentric gaze-holding on lateral gaze | Fixation of an object (e.g. the tip of a pen) during lateral (eccentric) gaze (~20-30°) for at least 5 sec. | Stable eccentric gaze-holding | Deficient eccentric gaze-holding with centripetal drift and centrifugal nystagmus (i.e., left-beating on left-gaze and right-beating on right-gaze). | Spontaneous, predominantly horizontal nystagmus (i.e., primary gaze nystagmus) can be found in both peripheral and central causes and thus allows no differentiation. |
| **Alternating cover test ("Test of Skew")** | Vertical alignment of the eyes | Rapid covering then uncovering one eye after the other while the patient is looking at a fixed target in space (e.g., the examiner's nose). The examiner should focus on only one eye. | No vertical deviation of the eyes | Vertical realignment of the uncovered eye (one eye goes up while the other eye goes down). This is why it does not matter which eye the examiner focuses on. | Note that rarely a vertical skew can also be observed in peripheral-vestibular deficits, but is usually of smaller amplitude and short-lived. |
| **New-onset unilateral hearing loss (fourth sign – "plus sign")** | Hearing | Finger rub on each side | Normal hearing | Hearing loss on the side with the abnormal head-impulse test | Hearing may also be compromised in inner ear disorders such as labyrinthitis or complicated otitis media, emphasizing the need for a dedicated examination of the ear. |

\* Teaching videos can be found under: http://novel.utah.edu/Newman-Toker/collection.php.

**Graded rating of gait and truncal instability (GTI)**

| Table S2: graded rating of gait and truncal instability (GTI) | |
|---|---|
| Grade of gait inability | Definition |
| 0 | Normal gait |
| 1 | Mild to moderate imbalance but can walk independently [9] or unable to stand on tandem Romberg with the eyes open at least for 3 seconds [10] |
| 2 | Severe imbalance with standing and cannot walk without support [9], or unable to stand on Romberg with eyes open for 3 seconds [10]. |
| 3 | Inability to stand upright unassisted [9,10] or inability to sit upright unassisted [10]. |

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