STANDING update: A retrospective analysis in the Emergency Department one year after its validation

Alice Ceccofiglio,1 Rudi Pecci,2 Giulia Peruzzi,1 Giulia Rivasi,1 Martina Rafanelli,1 Simone Vanni,3 Andrea Ungar1

1Syncope Unit, Department of Geriatrics, Azienda Ospedaliero-Universitaria Careggi and University of Florence; 2Unit of Audiology, Head and Neck Oncological and Robotic Surgery, Oncology and Robotic Surgery Department, Azienda Ospedaliero-Universitaria Careggi and University of Florence; 3Department of Emergency Medicine, Azienda Ospedaliero-Universitaria Careggi and University of Florence, Florence, Italy

Abstract

A structured four-step bedside algorithm, named SponTAneous Nystagmus, Direction, head Impulse test, standiNG (STANDING), has been proposed to differentiate central from peripheral acute vestibulopathy in the Emergency Department (ED). We aimed to evaluate the effective application of STANDING in the management of vertigo in the ED and to define its role in deciding the patient’s pathway after discharge. We retrospectively analysed data from 131 consecutive patients (65% female, mean age 56) undergoing ED visits for a vertigo complaint between April and May 2016. Our study showed that the STANDING algorithm is underused, being performed only in the 18% of patients. The positivity of the STANDING did not influence the choice of the following pathway (e.g. outpatient fast track or discharge). Moreover, a small percentage of patients had a non-audiological diagnosis (mainly presyncope), for which no defined pathways were yet foreseen. Our study emphasized the need for continuous updating with appropriate training courses and the importance of a multidisciplinary assessment of vertigo in the ED.

Introduction

Dizziness (including vertigo and non-vestibular dizziness) ranks among the most common complaints in medicine, affecting ~20 to 30% of the general population,1,2 of which almost a quarter is represented by vestibular vertigo.3 Its prevalence rises with age and it’s about two to three times higher in women than in men.4,5 Furthermore, vertigo and dizziness are among the main reasons for patients’ referral to the Emergency Department (ED), currently amounting to 2-3% of all consultations.6,7 In this setting, the identification of central or otherwise serious vertigo is a major concern.8,9 However, stroke was found to be a rare cause of dizziness in the ED; indeed, only the 0.7% of patients presenting with isolated dizziness and the 3.2% of those presenting with any dizziness had an acute cerebrovascular event.9 More frequently, symptoms are caused by a benign peripheral vestibular disorder, which has characteristic features enabling a bedside diagnosis. Thus, the most effective way to rule-out a central disorder is to rule-in a specific peripheral vestibular disorder.10

A structured bedside algorithm (STANDING: SponTAneous Nystagmus, Direction, head Impulse test, standiNG) has been proposed to differentiate central from peripheral vestibular syndromes in an unselected population presenting with acute vertigo in ED.11 The four-step algorithm identified central acute vestibular syndromes with a very high sensitivity (72-100%) and specificity (91-94%) and was associated with a significant reduction of neuroimaging and hospitalization rates compared to the standard clinical examination (~28% vs ~51% and ~32% vs ~71%, respectively). The aim of the present study was to evaluate the effective application of STANDING in the management of vertigo in the ED, one year after its validation. The second aim of our study was to establish its role in deciding the patient’s pathway after discharge.

Materials and Methods

All adult patients complaining of vertigo at the triage of the ED, (main attendance 130,000 people/year) between April and May 2016 were included. Clinical data were retrospectively col-
lected from the First Aid program in order to obtain the baseline characteristics (age, sex, main comorbidities and home therapy), the episode’s characteristics (clinical features, predisposing factors, precipitating events, after event’s symptoms, associated injuries), the patient’s assessment in the ED, focusing on blood tests, electrocardiogram, echocardiography, carotid Doppler study, Computed Tomography (CT) brain scan, brain Magnetic Resonance Imaging, orthostatic challenge, supine carotid sinus massage, STANDING test, audiological evaluation and neurological evaluation, and the final diagnosis.

The STANDING test (Figure 1) is a structured diagnostic algorithm based on clinical signs and bedside manoeuvres assembled into a four-step sequence: i) assessment of the presence and type of nystagmus (Spontaneous, positional, absent); ii) assessment of nystagmus direction (Nystagmus Direction); iii) Head Impulse Test (HIT); iv) evaluation of the standing position and gait (standing).

The presence of nystagmus is assessed using Frenzel lenses in the supine position after at least 5 min of rest. When no spontaneous nystagmus is detected in the primary position and in the five main gaze positions, the presence of positional nystagmus is investigated using the Pagnini–McClure test (supine roll test) and the Dix–Hallpike test. The presence of a paroxysmal positional nystagmus (lasting 1–2 minutes), beating on the plane of the assessed canal is considered typical of Benign Paroxysmal Positional Vertigo (BPPV). More in details, from the observer’s perspective, typical BPPV nystagmus is counterclockwise and upbeatng for the right posterior canal, clockwise and upbeatng for the left posterior canal and horizontal for lateral canals.

When spontaneous nystagmus is present, its direction is assessed. Multidirectional nystagmus, such as bidirectional gaze-evoked nystagmus (i.e., right beating nystagmus on rightward gaze and left beating nystagmus present on leftward gaze), and vertical (up or down beating) nystagmus are considered to be signs of central vertigo.

If a spontaneous, horizontal and unidirectional nystagmus is detected (i.e., horizontal nystagmus beating on the same side independently of the gaze direction) the HIT is performed. If an acute unilateral labyrinthine lesion exists, inputs from the opposite side are unopposed resulting in the eyes moving with the head, when the latter is rapidly moved toward the affected side. Immediately thereafter, a corrective eye movement (corrective saccade) back to the point of reference is seen. When the corrective saccade is present, the HIT is considered to be positive and indicates a peripheral disorder, whereas a negative HIT indicates a central vertigo.

Once nystagmus has been assessed the patient is asked to stand and the gait is evaluated, particularly in patients showing neither spontaneous nor positional nystagmus. When a marked imbalance is present (inability to stand and walk without assistance), vertigo is suspected to be of central origin.

The innovative nature of the STANDING mainly lies in i) the sequence of tests (i.e., the algorithm), ii) the setting (i.e., the ED), and - most importantly - iii) the health professionals performing the algorithm, i.e., emergency physicians, who are not neuro-otology specialists.

All the study information was recorded from patients as part of the routine clinical care and collected into a database anonymously for the purpose of the present analysis.

No Ethics Committee formal approval was needed for this study, as recent Italian Legislation [General Authorization to Process Personal Data for Scientific Research Purposes-1 March 2012 (web document no. 1884019)] conceded that Ethics

Table 1. Diagnostic tests performed in the emergency room for assessment of vertigo.

| Test                          | Evaluated (n=131) | Diagnosed (n=evaluated) |
|-------------------------------|-------------------|------------------------|
| Blood tests (n,%)*            | 65 (48.6)         | 2 (3.1)                |
| Electrocardiogram (n,%)*      | 56 (42.7)         | 0 (0.0)                |
| Carotid Doppler Ultrasound (n,%)* | 16 (12.2)       | 1 (6.3)                |
| Brain CT (n,%)*               | 52 (39.7)         | 3 (5.8)                |
| Brain MRI (n,%)*              | 5 (3.8)           | 1 (20.0)               |
| Orthostatic challenge (n,%)*  | 7 (5.3)           | 1 (14.3)               |
| Supine carotid sinus massage (n,%)* | 4 (3.1)      | 0 (0.0)                |
| STANDING test* (n,%)*         | 24 (18.3)         | 9 (37.5)               |
| Audiological evaluation* (n,%)* | 29 (22.1)      | 21 (72.4)              |
| Neurological evaluation* (n,%)* | 8 (6.1)         | 7 (87.5)               |

CT: Computed Tomography; MRI: Magnetic Resonance Imaging. *Diagnosis: Blood tests: abnormal electrolyte balance (n=1), pulmonary embolism (> d-dimer, n=1); carotid Doppler ultrasound: significant carotid stenosis (n=1); brain CT: white matter inflammatory lesion (n=1), cerebellar infarction (n=1), posterior fossa stroke (n=1); brain MRI: posterior fossa stroke (confirmation of the TC scans finding); STANDING tests: peripheral vertigo (n=18); audiological evaluations: peripheral vertigo (n=18), central disorders (n=3); neurological evaluations: central diseases (n=7).
Results

One-hundred thirty-one patients (65% female) presented to the ED complaining of vertigo, the mean age was 56±18 years. Thirty-six patients had a previous diagnosis of hypertension (27.5%), while audiological and psychiatric diseases were present in 13 patients (9.9%). Orthostatic hypotension was detected in 1 patient only (0.8%). Almost the 50% of patients was taking drug therapies, with a mean number of 3.6±2.5 drugs (range 1-12), mainly including antihypertensives (30.5%), antiplatelets (17.6%) and antidepressants (9.1%).

Table 1 illustrates the diagnostic tests carried out in the ED for the assessment of vertigo.

At the end of the diagnostic workup, peripheral vertigo was diagnosed in 85 patients (64.9%) and BPPV was the most common cause. In 17 patients (13%) a central vertigo was diagnosed, while 9 (6.9%) had a presyncope. Other diagnoses were psychogenic dizziness (4.6%), metabolic disorders (1.5%) and miscellaneous (9.2%).

Did the application of STANDING influence the patient’s pathway after Emergency Department evaluation?

The use of the STANDING did not significantly influence the patient’s pathway after ED evaluation.

Indeed, among those who underwent a standard clinical examination, one patient (0.9%) was hospitalized for further investigations following audiological consultation; 44 patients (41.1%) were discharged with a fast-track program to audiology or syncope unit, 8 of them after audiological consultation; 62 patients (57.9%) were discharged without further diagnostic assessment, 16 of them after audiological consultation.

Among those who were evaluated using the STANDING, one patient (4.1%) was hospitalized for further investigations following audiological consultation; 14 patients (58.3%) were discharged with a fast-track program, one of them after audiological consultation; 9 patients (37.5%) were discharged without further assessment, 2 of them following audiological consultation.

Table 2. Final diagnosis according to patients’ pathway after discharge from the ED.

| Diagnosis                  | Fast-tracks (n=58) | Discharged | No fast-tracks (n=71) | Hospitalized (n=2) |
|---------------------------|--------------------|------------|-----------------------|--------------------|
| Peripheral vertigo (n%,%) | 52 (88.7)          | 33 (46.5)  | 0 (0.0)               |
| Central vertigo (n%,%)    | 1 (1.7)            | 16 (22.5)  | 0 (0.0)               |
| Presyncope (n%,%)         | 1 (1.7)*           | 8 (11.3)   | 0 (0.0)               |
| Psychogenic dizziness (n%,%) | 0 (0.00)       | 6 (8.5)    | 0 (0.0)               |
| Metabolic disorders (n%,%) | 0 (0.00)          | 2 (2.8)    | 0 (0.0)               |
| Miscellaneous (n,%)       | 4 (6.9)**          | 6 (8.5)    | 2 (100.0)             |

ED: Emergency Department. *The patient was referred to a Syncope Unit. **External otitis (n=3), sobred vertigo (n=1). Miscellaneous: external otitis (n=1), sobred vertigo (n=1), hypertension (n=1), acute renal failure (n=1), pulmonary embolism (n=1), arrhythmia (n=1), abdominal colic (n=1), gait disorder (n=1).
Discussion

The STANDING algorithm demonstrated a high sensitivity and specificity and a good reliability in the identification of central vestibulopathies in the ED, allowing a significant reduction in hospitalizations and neuroimaging.11 Three years after its publication, a prospective study was carried out, to verify the reliability and diagnostic accuracy of the algorithm in the differential diagnosis of acute vertigo in the ED. The follow-up study highlighted a high negative predictive value of STANDING (99%), i.e. it showed that a benign STANDING allows to exclude the presence of a central vertigo with a high level of certainty.13

Despite the high reliability of the STANDING, our study showed an under-utilization of this algorithm (~18%). The under-use of the STANDING algorithm was attributed to a renewal of the emergency medical staff, not yet adequately trained during the study period. Therefore, the high turnover of physicians in the ED emphasized the need for continuous updating with appropriate training courses.

Our results are consistent with other recent studies showing a widespread underuse of the diagnostic tests and algorithm for vertigo/dizziness in the ED. McDowell et al. present a retrospective chart review of patients presenting to the ED over a one year-period and receiving a final diagnosis of dizziness or vertigo. Their study clearly demonstrates that HIT was under-utilized by both emergency physicians and neurologists, being performed in only 31 of 642 (5%) patients.18 The Authors hypothesize different explanations for this finding. In particular, physicians may be unfamiliar with the test and they may lack confidence in performing it. In addition, they may consider it to be too subjective in its interpretation, thus considering clinical history a more reliable diagnostic tool.

Similarly, another retrospective cohort study analysed data from 500 randomly selected ED patients receiving a diagnostic test and they may lack confidence in performing it. In addition, they may consider it to be too subjective in its interpretation, thus considering clinical history a more reliable diagnostic tool. Conversely, it is unlikely that the time necessary to the test has demonstrated that HIT was under-utilized by both emergency physicians and neurologists, being performed in only 31 of 642 (5%) patients. The Authors hypothesize different explanations for this finding. In particular, physicians may be unfamiliar with the test and they may lack confidence in performing it. In addition, they may consider it to be too subjective in its interpretation, thus considering clinical history a more reliable diagnostic tool. Conversely, it is unlikely that the time necessary to the test has played a role, as the HIT is simple and rapid to administer in the emergency room.

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Figure 2. Patient's examination and pathway. The figure shows the screening log of patients evaluated in the Emergency Department for vertigo. ST: STANDING; ST+: STANDING diagnostic; ST -: STANDING no diagnostic; Audio: audiology consultancy.

Conclusions

The diagnostic assessment of vertigo may be challenging for emergency physicians. The STANDING test is helpful to differen-
tiate central vertigo from other disorders, however it is still widely underused. Our study emphasizes the need for continuous updating with appropriate training courses for emergency physicians and the importance of a multidisciplinary assessment of this condition, including the Audiology Unit and the Syncope Unit.

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