

# The future of AVS, dizziness and vertigo in emergency departments: Part I. Towards a cost-effective and sustainable healthcare system

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10 January 2024

**In this first of five articles, Dr Millie Nakatsuka discusses the socio-economic implications associated with the diagnosis of acute vestibular syndrome and why more cost-effective and sustainable approaches are needed**

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Dizziness is one of the most common presentations to hospital emergency departments. Acute vestibular syndrome (AVS) is a major subtype of dizziness, characterised by intense feelings of spinning (vertigo), often accompanied by nausea and vomiting, balance problems, and involuntary eye movements (nystagmus). These symptoms are caused by an impaired vestibular system – the sensory network that maintains our spatial awareness and coordinates balance and movement.

Vestibular disorders are classified into peripheral or central disorders. In peripheral vestibular disorders, the problem is localised between the inner ear and the vestibular division of the eighth cranial nerve, whereas in central vestibular disorders, the problem lies within the brain or brainstem. It is necessary for emergency physicians to confidently distinguish between the two types because medical conditions affecting the peripheral vestibular system are common and relatively benign (such as a mild viral infection), while medical conditions affecting the central vestibular system are rare and may potentially be life or brain-threatening (such as a stroke).

## **The revolutionary HINTS Examination**

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The HINTS examination (Head Impulse, Nystagmus, Test of Skew) is a simple, three-step bedside physical examination that has revolutionised the approach to the dizzy patient since 2009. It was rapidly adopted because it identified stroke with greater sensitivity (97%) and specificity (99%) than an early MRI of the brain (when performed by neurologists).

There are many variants of the original HINTS method, including the 2014 STANDING algorithm (SponTaneous or positional, Nystagmus Direction, head Impulse test, staNding), which incorporated another bedside test. Video-oculography-based HINTS (VOG- HINTS) is a technological variant that enables quantitative measurement of subtle eye movements by video-based eye tracking.

## **Why is the HINTS examination not used widely in the emergency department?**

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Despite the many benefits of the HINTS exam, even by 2020, studies showed that only 18% of eligible patients with AVS had a HINTS examination performed. (1) Meanwhile, dizziness-related neuroimaging in the emergency department has continued to trend upward despite clinical guidelines recommending against the routine use of neuroimaging in dizziness. The largest increase in neuroimaging (281%) occurred amongst patients at relatively low risk of stroke, those aged 20-44. (2)

Studies furthermore emerged suggesting that emergency physicians are unable to perform the HINTS exam with sufficient diagnostic accuracy like their more specialised colleagues (neurologists). However, the emergency physicians in the studies were not provided with education or training and were not previously familiar with the three components of the HINTS exam. The unfavourable conclusions drawn from these studies about emergency physicians made VOG-HINTS and telemedicine appear very attractive as alternative options, especially for non-metropolitan hospitals with limited or no onsite access to neuroimaging facilities and specialised specialists (neurologists).

## **Game-changing new research**

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As a physician with a special interest in cost-effective clinical practice and health inequity in regional and rural hospitals, I conducted a large-scale analysis which demonstrated that when emergency physicians do receive appropriate education and training, they can utilise the STANDING algorithm with high diagnostic accuracy, with a pooled sensitivity of 0.96 and a specificity of 0.88. (3) Public funding is a limited and valuable resource that needs to be utilised cost-effectively, especially given the financial impacts of the coronavirus pandemic, growing physician shortages, and increasing demand from an ageing population.

Unnecessary neuroimaging for AVS in emergency departments is a substantial financial burden, offering patients little or no health benefit whilst causing potential harm. Incidental findings, in particular, may result in anxiety, time away from work, and further unnecessary investigative workup.

Wide-spread VOG-assisted care and telemedicine are not feasible to implement in non-metropolitan hospitals and underfunded healthcare systems as they are expensive and resource-intensive.

My new research thus reveals a new avenue of exploration with major ramifications for delivering cost-effective emergency care, particularly for resource-deprived non-metropolitan services. Although integration of emergent technologies and innovation is important for the future of healthcare, we must remember that they are not a substitute for addressing physician shortages, lack of training for physicians, and insufficient healthcare expenditure,

nor do they address health inequity between privileged metropolitan and small non-metropolitan hospitals. Smartphone-based VOG is one promising future development; most physicians already own a smartphone.

## Upcoming articles in 2024

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In the following article in this series, we explore systemic barriers that contribute to the overuse of AVS-related neuroimaging by frontline point-of-care emergency physicians. I also propose strategies to rationalise the use of neuroimaging and suggest adapting medical education to facilitate this goal.

In my third article, we examine the impact of isolation on health equity and medical decision-making for emergency presentations of AVS.

In my fourth article, I suggest public health interventions to achieve a population-wide paradigm shift to reduce the burden of unnecessary neuroimaging.

In the fifth and final article, I explore emerging innovative technologies in telemedicine, artificial intelligence, and smartphone technology.

1. Rau CJ, Terling L, Elkhodair S, Kaski D. Acute vertigo in the emergency department: use of bedside oculomotor examination. *Eur J Emerg Med.* 2020;27(5):381–383. doi: 10.1097/MEJ.0000000000000674.
2. Kanzaria HK, Hoffman JR, Probst MA, Caloyeras JP, Berry SH, Brook RH. Emergency physician perceptions of medically unnecessary advanced diagnostic imaging. *Academic Emergency Medicine.* 2015;22(4), 390–398. doi: 10.1111/acem.12625
3. Nakatsuka M, Molloy EE. The HINTS examination and STANDING algorithm in acute vestibular syndrome: A systematic review and meta-analysis involving frontline point-of-care emergency physicians. *PLoS One.* 2022 May 5;17(5):e0266252. doi: 10.1371/journal.pone.0266252. PMID: 35511910; PMCID: PMC9070939

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