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Use of the Head Impulse, Nystagmus, Test of Skew ('HINTS') assessment to aid differential diagnosis in acute vestibular syndrome in the hyperacute stroke setting

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Abstract

Background. Differential diagnosis of acute vertigo syndrome is challenging given the similarities between clinical presentations of posterior circulation stroke and peripheral vestibular dysfunction. The Head Impulse, Nystagmus, Test of Skew ('HINTS') assessment is a clinical bedside test used to aid diagnosis.

Methods. Comprehensive training on use of the Head Impulse, Nystagmus, Test of Skew assessment was provided to one stroke consultant, and the effectiveness of the test in that setting was assessed. Further education was completed with more members of the stroke and emergency department multi-disciplinary team. Quality improvement measures including magnetic resonance imaging use and bed utilisation were explored.

Results. Following training of one stroke consultant, the Head Impulse, Nystagmus, Test of Skew assessment was found to be a feasible, accurate bedside test within this acute stroke service. Further training for the multi-disciplinary team was completed, but outcome measures were not explored because of the coronavirus disease 2019 pandemic and maternity leave.

Conclusion. There is a role for trained members of the multi-disciplinary team to successfully use the Head Impulse, Nystagmus, Test of Skew assessment in hyperacute stroke settings, to aid diagnosis in acute vertigo syndrome.

Introduction

Acute vertigo syndrome is defined as collective symptoms of acute dizziness, nystagmus, nausea and/or vomiting, head motion intolerance, and/or poor balance.¹ Differential diagnosis of acute vertigo syndrome is challenging. Similarities in patients' clinical presentation make it difficult to ascertain whether a person has peripheral vestibular dysfunction or a posterior circulation stroke, and therefore a bedside clinical test assisting this diagnosis is of benefit to stroke and emergency medicine departments.

Initial research demonstrated that the Head Impulse, Nystagmus, Test of Skew ('HINTS') assessment is efficacious, specific and sensitive in non-UK countries^{2,3} when determining whether acute vertigo patients have dangerous (stroke) or benign (peripheral vestibular) pathology. Kattah *et al.*² found the three-step Head Impulse, Nystagmus, Test of Skew assessment to have high sensitivity (100 per cent) and specificity (96 per cent) for identifying central lesions, when completed by expert clinicians who regularly practice vestibular assessments (Table 1). They found it rules out stroke more effectively than magnetic resonance imaging (MRI) 24–48 hours after symptom onset.

In acute vertigo syndrome, neurological examination findings of the limbs will likely be normal. The main presenting symptoms of acute vertigo syndrome are dizziness, nausea and imbalance. Mismanagement of acute vertigo syndrome patients is economically inefficient in relation to MRI scanner use; there are limitations regarding daily availability, bed utilisation within acute stroke services, and overall hospital bed capacity. In this service, up until 2018, patients with peripheral vestibular dysfunction were, at times, managed in hyperacute stroke unit beds. This limited the resources for stroke patients, and led to less optimal follow up and discharge planning for patients with peripheral vestibular dysfunction. Inefficiencies in diagnosing posterior circulation stroke have been shown to lead to delayed, or even missed, use thrombolysis treatment,^{4,5} and likely worse outcomes for this patient population; thus, clinical tools are vital for assisting this diagnosis in terms of stroke medicine.

A systematic review suggested that the Head Impulse, Nystagmus, Test of Skew assessment is useful in the clinical differentiation of posterior circulation stroke from peripheral vestibular dysfunction.⁶ The review recommended further research regarding its use by non-specialist vestibular and neurology clinicians. This is reflected in current National Institute for Health and Care Excellence (NICE) guidance, which specifies that the Head Impulse, Nystagmus, Test of Skew assessment should be performed on adults

Table 1. HINTS assessment findings*

Test	Dangerous (posterior circulation stroke) findings	Benign (peripheral vestibular dysfunction) findings
Nystagmus	Direction changing	Uni-directional, horizontal intensity changes with gaze in direction of fast beat
Head thrust	Negative	Positive
Test of skew	Vertical or diagonal re-fixation	No deviation or horizontal only

*Head Impulse, Nystagmus, Test of Skew (HINTS) assessment performed to differentiate posterior circulation stroke from peripheral vestibular dysfunction (normally vestibular neuritis)

with sudden onset acute vertigo syndrome 'if a healthcare professional with training and experience in the use of this test is available'.⁷

At present, the Head Impulse, Nystagmus, Test of Skew assessment is not widely used in the UK,^{6,8} although research is growing. A recent study investigating the use of this assessment in emergency and stroke medicine, within two large hospitals in the UK,⁸ reported that only 40 per cent of clinicians used the test in their practice. This number is likely to be an over-representation given that the small sample studied had a specialist interest in this topic or worked in National Health Service (NHS) trusts where the Head Impulse, Nystagmus, Test of Skew assessment is already utilised. The study found that lack of training and clinician confidence in using the Head Impulse, Nystagmus, Test of Skew assessment are large barriers to its use.⁸

As one member of the clinical multi-disciplinary team (MDT) (a physiotherapist) had the expertise needed to use the Head Impulse, Nystagmus, Test of Skew assessment in our acute vertigo syndrome population, and to teach it to others, it felt appropriate and timely to further explore the use of this assessment within our setting. It was hypothesised that clinical improvements in bed utilisation, Sentinel Stroke National Audit Programme scores, and patient experience and care would be apparent if the assessment was used consistently within the acute stroke service.

Materials and methods

Plan-Do-Study-Act cycles⁹ were used to structure the implementation of the Head Impulse, Nystagmus, Test of Skew assessment within a large NHS acute stroke service in one university teaching hospital. The quality improvement effects that this may have for patients (correct diagnosis and management), the financial benefits for the trust (efficient use of MRI scanning) and the improvements to the stroke pathway (effective bed use and acute medical management) were also investigated.

Assistance was gained from the Trust Quality Improvement Team, and the project was uploaded and monitored via Life QI quality improvement software.¹⁰

In Plan-Do-Study-Act cycle one, one stroke consultant was trained and supported in the initial Head Impulse, Nystagmus, Test of Skew assessments. Data were captured for acute vertigo syndrome admissions under this consultant

Table 2. Participant information

Parameter	Value
Participants (<i>n</i>)	15
Male: female (<i>n</i>)	6:9
Age (median (range); years)	61 (44–70)
Stroke: peripheral vestibular dysfunction (<i>n</i>)	3:12

between October 2017 and September 2018. The assessment findings were compared to the MRI results, with the aim of assessing the efficacy of the Head Impulse, Nystagmus, Test of Skew assessment in a sample of our acute vertigo syndrome patient group.

The Plan-Do-Study-Act cycle two, conducted in 2018–2019, involved increasing awareness of the Head Impulse, Nystagmus, Test of Skew assessment and more comprehensive training – between two and five 60-minute theoretical and practical training sessions – within the static physiotherapy team, the stroke alert nursing team and the consultant and registrar stroke team. A one-off 60-minute theoretical and practical introduction to the Head Impulse, Nystagmus, Test of Skew assessment was provided for the accident and emergency advanced practitioners and some registrars. It was hoped this would help improve timeliness of patients admitted with acute vertigo syndrome to be referred and reviewed by the stroke team. Bed utilisation using Sentinel Stroke National Audit Programme outlier scores and non-stroke data were planned to be used as outcome measures, as well as confidence ratings amongst clinicians.

Results

In Plan-Do-Study-Act cycle one, the Head Impulse, Nystagmus, Test of Skew assessment was used on 15 patients admitted with acute vertigo syndrome (Table 2). In those with benign assessment results (*n* = 12), all had normal MRI findings at the two- to three-week follow up. In those with dangerous assessment results, indicating a stroke, the MRI findings confirmed a stroke at follow up. This data increased confidence within the stroke medical team, and raised the profile of the Head Impulse, Nystagmus, Test of Skew assessment as a useful tool within our stroke service. The results showed that the assessment is a feasible bedside clinical test, with 100 per cent accuracy in the patients it was used on within this acute stroke pathway involving one consultant. The patients' diagnosis from using the Head Impulse, Nystagmus, Test of Skew assessment was evaluated against routine follow-up MRI findings, as that was current practice within our department for acute vertigo syndrome patients.

In Plan-Do-Study-Act cycle two, the training was completed; however, because of the coronavirus disease 2019 (Covid-19) pandemic and maternity leave commitments, the outcome measurements were not explored.

Discussion

Given the effectiveness of the Head Impulse, Nystagmus, Test of Skew assessment at differentiating posterior circulation stroke from peripheral vestibular dysfunction in acute vertigo syndrome patients, as carried out by one specifically trained

consultant within our service, the assessment training was subsequently provided on a wider scale to the stroke consultant and registrar team, stroke alert nurses, some accident and emergency registrars and advanced clinical practitioners, and more intensely to senior physiotherapists within the acute stroke pathway. The Head Impulse, Nystagmus, Test of Skew assessment is now sometimes used within the service for patients presenting with acute vertigo syndrome. A greater awareness and confidence in using the assessment is demonstrated in some clinicians, who report case study findings back to the team on occasion, particularly when 'text-book' Head Impulse, Nystagmus, Test of Skew assessment findings for peripheral vestibular dysfunction have been found, to aid learning across the team.

- The Head Impulse, Nystagmus, Test of Skew ('HINTS') assessment may be used to differentiate peripheral vestibular dysfunction from posterior circulation stroke
- This paper outlines a quality improvement project undertaken to assess the ability of one consultant to implement this assessment in acute vertigo syndrome cases
- Assessment by a trained consultant led to increased confidence and interest within the stroke service
- Use of the assessment increased within our teaching hospital, in line with best practice for acute vertigo syndrome patients

The consultant in Plan-Do-Study-Act cycle one had an interest in the Head Impulse, Nystagmus, Test of Skew assessment, but was not an expert. Chen *et al.*¹¹ explored whether you have to be an expert to perform the Head Impulse, Nystagmus, Test of Skew assessment within acute stroke medicine. Our results for one consultant agree with their findings, in showing that non-experts can conduct the Head Impulse, Nystagmus, Test of Skew assessment successfully after training.

There is very limited evidence for the use of the Head Impulse, Nystagmus, Test of Skew assessment in the ageing population, with the average age of patients in the literature reviewed being 58 years.⁶ This is of specific interest in our local setting. Clinically, it is likely to be more challenging to perform the Head Impulse, Nystagmus, Test of Skew assessment on an older person; this is important, as it could make the assessment less effective. The 15 patients in our first Plan-Do-Study-Act cycle were all aged under 70 years. Clinical considerations, such as identifying which patients fit into the acute vertigo syndrome group (e.g. nystagmus at rest and no focal limb neurology), have been continually re-iterated, to help reinforce effectiveness and safety using the Head Impulse, Nystagmus, Test of Skew assessment.

There are limitations to this quality improvement project, performed at one NHS site. Overall, the process of implementing the Head Impulse, Nystagmus, Test of Skew assessment, supported in NICE guidelines,⁷ has been slow. This fits with the '17 years' suggested as to how long it takes to embed research into clinical practice.¹² Alongside this, the Covid-19 pandemic and maternity leave commitments meant training in the assessment was de-prioritised. Its use is evolving steadily within the service, particularly in the emergency department, by a range of clinicians, but mainly involves the stroke consultant, registrar team and the specialist stroke physiotherapists.

Further focus will now be on the outcome measures in Plan-Do-Study-Act cycle two, to explore the assessment's effectiveness in our setting with regard to bed use, Sentinel Stroke National Audit Programme scores and which MDT

member is best placed to provide the Head Impulse, Nystagmus, Test of Skew assessment. There is further research suggesting that evaluation of balance is useful following the Head Impulse, Nystagmus, Test of Skew assessment, to further aid confidence in the clinical test.¹³ Physiotherapists are best placed to complete examinations of sitting and standing balance, but this could be explained further in MDT training, to compensate for periods when a formal physiotherapy assessment is not available (i.e. out of hours). Lately, in cases where the Head Impulse, Nystagmus, Test of Skew assessment has indicated a peripheral vestibular dysfunction diagnosis, the virtual ward has been utilised, which is an innovative development available since the Covid-19 pandemic, and which could become a standard part of our acute vertigo syndrome pathway.

Conclusion

The Head Impulse, Nystagmus, Test of Skew assessment, performed by individuals trained to carry out this test, can be used to identify cases of acute stroke. The implementation of a quality improvement audit cycle shows that this assessment is a feasible bedside clinical test, with 100 per cent accuracy in the patients within an acute stroke pathway, when conducted by one consultant trained by a specialist physiotherapist with skills in performing the assessment. The diagnosis of patients made using the Head Impulse, Nystagmus, Test of Skew assessment was evaluated against routine follow-up MRI, as is current practice for patients presenting with acute vertigo syndrome within the department. Future investigations using the second Plan-Do-Study-Act cycle may help identify which members of the MDT are best suited to execute the Head Impulse, Nystagmus, Test of Skew assessment within the acute stroke pathway.

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Competing interests. None declared

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