BSNO

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ABSTRACTS

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33 Queens Square, London, UK

Interacoustics

Ménière's Society
for dizziness & balance disorders

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KEYNOTE GUEST LECTURE

Cognitive & perceptual dysfunctions in patients with vestibular disorders

Dr Christophe Lopez
Research scientist, Laboratoire de Neurosciences Sensorielles et Cognitives, Marseille

ORAL PRESENTATIONS

Side dependent hemispheric influences upon motion detection in acute vestibular neuritis

Q Arshad[1,2], S Cousins[1], D Kaski[1], M Gresty[1], B M Seemungal[1], A M Bronstein[1]

1. Academic Department of Neuro-otology, Charing Cross Hospital Campus, Fulham Palace Road, London, W6 8RF, UK.
2. Department of Neuroscience, Psychology and Behaviour, University of Leicester, University Road, Leicester, LE1 7RH, UK

Considerable evidence supports the notion that vestibulo-cortical areas are predominantly represented in the non-dominant hemisphere. In healthy individuals, the degree of vestibulo-cortical dominance impacts upon body sway and motion perception. However, the functional relevance of cortical lateralisation in patients with peripheral vestibular loss remains unknown. To investigate this, we performed a retrospective analysis on 34 right-handed patients with acute vestibular neuritis (VN) (21 right-sided VN; 13 left-sided VN; mean age 53) and assessed the interrelationship between a novel surrogate marker of hemispheric vestibulo-cortical dominance and motion detection. To assess motion detection, patients were seated on a motorized chair and rotated from rest with an initial acceleration of $0.3°/s^2$, increasing by $0.3°/s^2$ every 3 s until a consistent oculomotor response was observed. In patients with right VN, we observed a positive correlation (R^2 0.497) between hemispheric dominance and oculomotor thresholds, whereas, in left VN patients we observed a negative correlation (R^2 0.459). Our findings, (i) illustrate the importance of interhemispheric competition on gating subconscious brainstem functions regarding physical motion onset and, (ii) provide a behavioral demonstration of lateralised asymmetries in vestibulo-cortical processing influencing vestibular-behaviour following acute side-specific peripheral vestibular loss.

A direct, unmediated effect of vestibular disruption on cognition?

J Corcoran[1,2], J Golding[1], A Towell[1], M Gardner[1]

1. Department of Psychology, University of Westminster, 115 New Cavendish Street, London W1W 6UW
2. Multidisciplinary Balance Clinic, Guy's Hospital, Great Maze Pond, London SE1 9RT

Prevailing theory implies that disruption of higher cognition is an indirect, mediated consequence of aberrant vestibular information. The objective was to determine if such misinformation can also affect cognition directly.

Seventy-eight healthy participants undertook either the 'Single Avatar Stimulus Set' (SASS) task, invoking mental self-translocation, or one of two spatial control tasks. All tasks were administered six times, in one-minute trial blocks, after one minute of constant angular velocity (90°/s). Halfway through alternate trial blocks, chair velocity reduced abruptly from 90 to 0°/s, giving rise to aberrant vestibular information. A measure of anxiety, the low frequency-high frequency ratio, was calculated from pulse recordings acquired during all trial blocks.

Following abrupt deceleration, responses on the SASS task were less cautious as denoted by a significant decrease in boundary separation, a latent performance variable (simple effect: $p = .014$). The disruption of performance was selective to the SASS task (interaction effect: $p = .025$), and not secondary to an increase in anxiety according to mediation analyses (direct effect: $p = .009$).

The selective disruption of an aspect of SASS task performance by abrupt deceleration, in the absence of a concurrent disturbance of the physiological state of the participants in the SASS task group, suggests that aberrant vestibular information can affect higher cognition directly.

Attentional network impairment following vestibular dysfunction

A Bonsu[1a], Z Britton[1a], Z Asif[1], A M Bronstein[1], D Kaski[1], Q. Arshad[1,2] ([a] authors contributed equally)*

1. Academic Department of Neuro-otology, Charing Cross Hospital Campus, Fulham Palace Road, London, W6 8RF
2. Department of Neuroscience, Psychology and Behaviour, University of Leicester, University Road, Leicester, LE1 7RH

Previous research has provided evidence to support the existence of an intricate anatomical and functional relationship between brain networks that direct visuo-spatial attention and process vestibulo-cortical signals. However, to date the effect of vestibular dysfunction upon the attentional network remains unknown. Accordingly, we recruited 25 patients with peripheral vestibular loss, 25 patients with vestibular migraine and 50 age and sex matched controls. To assess the attentional network, we employed the Attentional Network task (ANT) which derives measures for three components of the attentional network: alerting, orienting, and executive control. Both peripheral and vestibular migraine patients demonstrated a significant increase in reaction time to respond to the attended target irrespective of the preceding stimulus cue type or the presence of distractors when compared to healthy controls. With respect to the specific components of the attentional network, we observed a significant impairment in executive control when comparing vestibular migraine patients to controls. No specific abnormalities were observed in peripheral vestibular disorders, or in the alerting or orientating network in vestibular migraine patients. Our results illustrate a global attentional network impairment following peripheral and central vestibular dysfunction, albeit a specific deficit in the executive control network in vestibular migraine patients.

Vestibular influences upon visual conscious awareness

Z Britton[1a], N James[1a], M Sharif[1], A Bonsu[1], H Rust[1], D Kaski[1], A Bronstein[1], Q Arshad[1,2]
([a] authors contributed equally)

1. Academic Department of Neuro-otology, Charing Cross Hospital Campus, Fulham Palace Road, London, W6 8RF, UK
2. Department of Neuroscience, Psychology and Behaviour, University of Leicester, University Road, Leicester, LE1 7RH, UK

Functionally, vestibular cortical areas interact with both visual and emotional brain networks. However, the interrelationship between this network remains obscure. We explored this triad by probing semantically dependent emotional influences upon visual conscious awareness utilising the breaking continuous flash suppression (b-CFS) paradigm with and without galvanic vestibular stimulation (GVS) in 32 right-handed healthy individuals. In healthy controls, we observed that GVS significantly modulated visual conscious awareness of semantically related stimuli. That is, vestibular stimulation selectively increased reaction times to words semantically associated with the perceptual experience of dizziness, but not for neutral words or negative words unrelated to dizziness. Further, we proceeded to assess visual conscious awareness using b-CFS in 12 patients with functional dizziness (Persistent Postural Perceptual Dizziness or PPPD) without GVS. In PPPD, we observed that patients selectively had reduced reaction time to words semantically related to dizziness but not for neutral or negative words. Furthermore, the extent of dizziness symptoms experienced in patients correlated with the decreased RTs to dizzy words. Our results support a semantic dependent automatic vigilance modulatory effect upon visual conscious awareness in healthy controls and an illustration of how this is violated in patients with functional dizziness.

Saccadic bradykinesia in idiopathic Parkinson's disease

N Koohi, L F Meehan, H Akram, T Warner, D Kaski

UCL Queen Square Institute of Neurology, London

BACKGROUND: Slowed execution of movement is a cardinal feature of Parkinson's Disease (PD), with progressive difficulty initiating movements (akinesia). When movements are initiated, they are characteristically of low velocity (bradykinesia), and reduced amplitude (hypokinesia). We sought to describe the dynamic saccadic characteristics during both reflexive and voluntary saccades in idiopathic PD.

METHODS: Eye movements were recorded using binocular video oculography in 10 patients with idiopathic PD and 10 aged matched controls. Saccade amplitude, velocity and latency were calculated for the first major saccade towards the target, during reflexive visually-guided saccades and voluntary alternating gaze shifts between two fixed visual targets. Eye movement data was correlated with motor impairment using the united Parkinson's disease rating scale.

RESULTS: Alternating horizontal reflexive saccades towards visual targets were normal in PD, but voluntary saccadic eye movements decreased in velocity and amplitude over a 25s epoch, with evidence of lateralisation congruent with the most affected motor side.

CONCLUSIONS: Prefrontal and parietal regions are more active during voluntary than reflexive saccades and such cortical networks may be more susceptible in PD than lower-order reflexive oculomotor pathways. Saccadic bradykinesia appears to be a useful clinical sign as an adjunct to repetitive hand movements in patients with suspected PD.

The ototoxic potential of cobalt from metal-on-metal (MoM) hip implants: objective auditory and vestibular outcome

L Leyssens[1], B Vinck[1,2], C Van Der Straeten[3], K De Smet[4], I Dhooge[5], F L Wuyts[6], H Keppler[1], S Degeest[1], R Valette[6], R Lim[7], L Maes[1]

1. Department of Rehabilitation Sciences, Faculty of Medicine & Health Sciences, University of Ghent, Belgium
2. Department of Speech-Language Pathology and Audiology, University of Pretoria, South Africa
3. Health Innovation and Research Institute, Ghent University Hospital, Belgium
4. ANCA Medical Center, Sint-Martens-Latem, Belgium
5. Department of Ear Nose Throat, Ghent University Hospital, Belgium
6. Lab for Equilibrium Investigations and Aerospace, University of Antwerp, Belgium
7. School of Biomedical Sciences and Pharmacy, University of Newcastle, Australia

Introduction. Local and systemic toxic side effects have been associated with excessive metal ion release from MoM implants, in which cobalt (Co) plays an important role. Systemic cobaltism seems to manifest as a clinical syndrome including hearing- and balance-related symptoms. In most cases, revision surgery led to (partial) symptom alleviation, suggesting a causal relationship with Co exposure. Moreover, the ototoxic potential of Co has recently been demonstrated in animal experiments. Therefore, the current study aimed to objectively examine the auditory and vestibular function in this population.

Material & Methods. 20 MoM hip implanted patients and 20 age- and gender-matched controls were subjected to an extensive audio-vestibular test battery and a blood sample collection to determine the plasma Co concentration.

Results. The plasma Co concentration was significantly higher in the MoM patient group ($p<0.001$). Within the auditory test battery, a clear trend was observed towards higher audiometric thresholds (11.2–16 kHz), lower DPOAE (4 & 8 kHz) and total TEOAE (1-4 kHz) amplitudes, and a higher inter-aural latency difference for wave V of the ABR in the patient group ($0.0 \leq p<0.05$). Within the vestibular test battery, considerably longer cVEMP P1 latencies, higher oVEMP amplitudes ($0.01 \leq p<0.05$) and lower asymmetry ratio of the vHIT gain ($p<0.01$) were found in the MoM patients.

Conclusions. The auditory results seem to reflect signs of Co-induced damage to the high-frequency hearing function, largely corresponding to previous findings on drug-induced ototoxicity and recent animal experiments with cobalt. The vestibular outcomes are currently inconclusive and require further elaboration.

Using eye movement responses to Electrical Vestibular Stimulation to diagnose vestibular paresis

R F Reynolds[1], S W Mackenzie[1], R Iriving[2], P Monksfield[2], A Dezso[2], N Dawe[2], K Lindley[2]

1. School of Sport, Exercise & Rehabilitation Sciences, University of Birmingham, UK
2. Centre for Rare Diseases, University Hospital Birmingham, UK

Caloric irrigation is currently the mainstay of vestibular diagnosis but it has limitations, which include numerous health contraindications. Here we investigated the possibility of using the eye movement evoked by Electrical Vestibular Stimulation (EVS) to detect vestibular deficiency. Firstly, we established a non-invasive technique for recording ocular torsion responses to sinusoidal EVS in healthy participants. We observed a clear eye movement at all stimulus frequencies ranging from 0.05 to 20Hz. Secondly, we confirmed that this technique can be used to detect vestibular paresis by applying monaural EVS to 30 patients with unilateral vestibular schwannoma. By comparing the magnitude of the eye movement evoked by ipsi- versus contra-lesional stimulation, we calculated an asymmetry ratio of ~20% in these patients. Lastly, we performed a direct comparison of EVS with Caloric irrigation in the same patient group, and found a significant moderate correlation between the two techniques in terms of asymmetry ratio ($r=0.53$; $p<0.01$). Furthermore, 85% of patients preferred EVS over calorics in terms of subjective comfort, and it took less than 20 minutes to complete the EVS test. These results offer the proof of principle that EVS could be a viable alternative to caloric irrigation.

Functional gait disorders and the broken escalator phenomenon

D Lin, P Castro, A Edwards, A Sekar, M J Edwards, A M Bronstein, J Coebergh, D Kaski

UCL Queen Square Institute of Neurology, London

BACKGROUND: Walking onto a stationary platform, which had been previously experienced as moving generates a locomotor aftereffect (LAE) - the 'broken escalator' phenomenon. Here, we use this phenomenon to explore motor learning in Functional Gait Disorder (FGD) patients, for which underlying mechanisms are unknown.

METHODS: 14 FGD patients & 17 healthy age matched controls walked onto a stationary sled (BEFORE condition, 5 trials), then onto a moving sled (MOVING condition, 10 trials) and then again onto the stationary sled (AFTER condition, 5 trials). Subjects were warned of the change in conditions. Kinematic measures (trunk displacement, step timing, gait velocity) and subjective measures of anxiety/instability were recorded per trial.

RESULTS: Patients had slower gait velocities in the BEFORE trials but were able to increase this to accommodate the moving sled, with similar learning curves to controls. Although trunk and gait velocity LAE was present in both groups, there was a persistence of the LAE only in patients. Instability and anxiety were greater in patients than controls only during explicit phases of the task.

CONCLUSIONS: Despite a dysfunctional locomotor system, patients show normal adaptive learning. The process of de-adaptation however is prolonged in patients indicating a tendency to perpetuate learned motor programs.

Impaired vestibular perception in acute traumatic brain injury

E Calzolari[1], R Smith[1], M K Chepisheva[1]; H Rust[1], B M Seemungal[1]

1. Brain & Vestibular Group, Neuro-otology Unit, Imperial College London

Background:
Dizziness and imbalance affect >80% of traumatic brain injury (TBI) patients. Pathological vestibular activation typically causes both a prominent vestibular-ocular reflex (VOR) nystagmus and illusionary self-motion perception ('vertigo'). In acute TBI patients, we observed a severely attenuated vertigo sensation despite preserved VOR responsivity.

Methods:
In this an ongoing, prospective study, patients with a closed head injury were consented from an acute major trauma unit and were clinically examined, completed questionnaires (vestibular symptoms, functional ability, cognition), laboratory testing, and neuro-imaging. They underwent three assessments, three months apart, in order to delineate the neuro-correlates of the observed vestibular-motion perception disorder.

Results:
Objective assessment during passive whole-body rotations in darkness confirmed markedly elevated self-motion perceptual thresholds in half of the acute TBI patients enrolled so far (N=26, current average = 2.91°/s^2, range = 0.34 - 9.75°/s^2), compared to healthy controls (current average = 0.76°/s^2, range = 0.21 - 1.74°/s^2), despite showing preserved VOR (average onset of slow phase nystagmus, TBI patients = 0.67°/s^2, controls = 0.60°/s^2). These findings cannot be explained by a general reaction time or arousal deficit.

Discussion:
The brain mechanisms that mediate vestibular sensation of self-motion are disrupted in acute TBI.

Linking anti-saccades and postural control mechanisms in acute traumatic brain injury

E Calzolari, M K Chepisheva, R Smith, H Rust, B M Seemungal

Brain & Vestibular Group, Neuro-otology Unit, Imperial College London

Background:
Acute TBI patients commonly display a frontal dysexecutive syndrome, which us associated with worse error rate and response time to anti-saccades. Our pilot data in acute TBI show impaired balance (>80%) despite preserved afferent function. We assessed the hypothesis that impaired frontal function may mediate a link between anti-saccades and balance (see Ewenczyk et al. 2017 Neurology).

Methods:
Postural sway was assessed in 24 acute TBI patients and 24 healthy controls in four conditions: surface hard vs soft and vision eyes open vs closed. Separately, anti-saccades were recorded via electrooculography.

Results:
TBI patients showed increased sway in all the postural conditions, but worse in the 'vestibular' condition (eyes closed/soft surface) and showed higher latency of anti-saccades. In TBI patients there was a positive correlation between anti-saccades latency ($r = 0.6$, $p < 0.01$) and increased sway (average displacement of the centre of pressure and 95% ellipse confidence interval of the area of sway) in the vestibular condition compared to the easiest postural condition.

Conclusions:
In acute TBI, there is worsened initiation of voluntary eye movements and vestibular-mediated postural control, possibly mediated by frontal mechanisms.

Skull fractures predict BPPV in acute traumatic brain injury: a prospective study

H M Rust, R Smith, B M Seemungal

Brain and Vestibular Group, Neuro-Otology Unit, Division of Brain Sciences, Charing Cross Hospital Campus, Imperial College London, Fulham Palace Road, London, W6 8RF.

Traumatic brain injury (TBI), the commonest cause of death in young adults, also causes significant morbidity in survivors with vestibular complaints being a major feature. In a previous retrospective study, we found BPPV in 38% of acute TBI cases. The current prospective study aimed to establish the true frequency of BPPV in acute TBI and risk factors for BPPV. We hypothesised that BPPV is related to severity of (survivable) impact force which predicts that BPPV is more common in TBI with skull fractures.

The data represent neuro-otological examinations in patients either eligible for a prospective study inclusion or referred for clinical assessment by the ward team. Skull fractures (via CT) were recorded.

814 patients were screened and 129 were assessed. BPPV was present in 56% (72/129) of all patients assessed. On CT imaging skull fractures were found in 71% (91/129) of these patients. BPPV in acute TBI was more likely when the patient had a skull fracture on CT imaging (P=0.007; Chi Sq).

BPPV is present in more than half of patients with acute TBI. This warrants screening for this potential dangerous vestibular condition. Especially in TBI patients with a skull fracture who are even more likely to have BPPV, a screening should be performed. Whether treatment of BPPV in the acute phase of TBI has an overall beneficial effect on the short and/or long-term outcome of these patients (e.g. falls, development of persistent postural perceptual dizziness (PPPD)) is not known to date. We are running prospective studies to answer this question.

CANVAS - the very old and the very new

A Cortese, D N Kaski, A M Bronstein, M M Reilly, H Houlden
(on behalf of all authors listed on Nat Genet. 2019; 51:649-658)

UCL Queen Square Institute of Neurology, London

In 1990 two patients with imbalance due to a combination of vestibular, cerebellar and peripheral neuropathy were reported (Bronstein et al; Brain. 1991;114:1-11), followed by a review by the same group of 53 patients with bilateral loss of vestibular function, including 13% with a cerebellar syndrome and peripheral neuropathy (Rinne et al;J Neurol.1998;245:314-21). In 2004 Migliaccio et al described 4 patients with cerebellar ataxia and bilateral vestibulopathy, emphasising the oculomotor sign of broken up doll's head manoeuvre (Brain 2004;127:280–293). The term CANVAS (cerebellar ataxia/neuropathy/vestibular areflexia syndrome) was coined by Szmulewicz et al (Neurology. 2011;76:1903-10) who delineated the clinical-electrophysiological profile of the sensory neuropathy. Although only 20-40% of patients have a family history, Cortese et al (Nat Genet. 2019;51:649-658) identified a recessive repeat expansion in intron 2 of RFC1 as a cause of this disorder - 23 cases from 11 families and 33 sporadic cases carried the biallelic AAGGG repeat expansion. Interestingly, out of 150 cases diagnosed with late-onset cerebellar ataxia, 22% tested positive for the biallelic AAGGG repeat expansion but the percentage increased if only patients with sensory neuronopathy and cerebellar involvement (62%), CANVAS (92%), and familial CANVAS (100%) were considered. *RFC1* repeat expansion should be considered in cases with full blown CANVAS disease as well as in cases with site-restricted variants, including those with bilateral vestibular failure as the predominant clinical feature.

Expert Automated Diagnostics in Acute Stroke with Vertigo

M Xiang[1], M Chepisheva[1], H Rust[1], A Bharat[2], D Mandic[3], B M Seemungal[1]

1. Brain & Vestibular Group, Neuro-otology Unit, Imperial College London
2. BioEngineering, Imperial College London
3. Electrical & Electronic Engineering, Imperial College London

Introduction:
Acute vertigo – the commonest symptom of vertebrobasilar stroke - is a diagnostic challenge for stroke physicians since common benign diagnoses can present with vertigo. Additionally, stroke-optimised MRI is only 88% sensitive for stroke with acute vertigo. Eye-movement examination by an expert provides a diagnostic sensitivity of circa 100% however experts are few. We hypothesised that gait patterns possessed significant information available to classify vertigo patients into stroke and non-stroke.

Methods:
A Microsoft Kinect 2 depth camera was used to record the 3-dimensional coordinates of 25 joint centroids of the human body during walking and balancing on a treadmill in 19 acute vertigo patients (10 stroke, 9 vestibular neuritis) and healthy controls. A feature set was extracted and used by machine learning algorithms to classify the subjects.

Results:
During tandem walking, the algorithm was 90% sensitive and 86% specific in diagnosing patients (grouped together) from healthy subjects. The algorithm was only able to provide a chance level classification between the two patient diagnoses with tandem walking. Using dark quiet standing, for the patients only, we found a sensitivity of 100% and specificity 71% for stroke detection.

Conclusion:
Image-based, 'hands-free' diagnosis of acute vertigo patients is tractable.

Physical and emotional burden of the Epley manoeuvre in the elderly

B Maas, T D Bruintjes, S M Winters, P P G van Benthem and R B van Leeuwen

Apeldoorn Dizziness Centre, Gelre Hospital Apeldoorn, Netherlands

Objective: To analyse and compare experiences of anxiety and discomfort caused by the Epley manoeuvre and willingness for potential re-treatment between younger (≤70 years) and older (>70 years) patients.

Methods: Dutch adults, with posterior canal benign paroxysmal positional vertigo (BPPV), were included. Patients with dementia or subjected to an Epley manoeuvre ≤4 months before the hospital visit were excluded. Patients were asked about their experiences with the Epley manoeuvre directly after the manoeuvre, after two weeks, and after two months.

Results: Out of 179 included patients, 115 (64%) were aged ≤70 and 134 (75%) were female. In both the younger and older group, 25% reported anxiety directly after the Epley manoeuvre. Two weeks later, 19% and 27%, respectively, (p=0.26) reported anxiety. In the young group, 30% expressed discomfort directly after treatment compared to 45% in the elderly (OR 1.98, 95%CI 1.05-3.75, p=0.04). Two weeks later, this was 36% and 38%, respectively (p=0.87). There was no significant difference in willingness for potential re-treatment between both groups after two weeks (93% and 95%, respectively, p=0.75).

Conclusion: The Epley manoeuvre results in little anxiety and discomfort in both young and elderly patients. Most patients show willingness for potential re-treatment in case symptoms recur.

How unsteady are you? How unsteady do you feel you are?

P Castro[1,2], R Ibitoye[1], D Kaski[1], A M Bronstein[1]

1. Neuro-otology Unit, Division of Brain Sciences, Charing Cross Hospital Campus, Imperial College London, London, UK.
2. Escuela de Fonoaudiologia, Facultad de Medicina, Clinica Alemana Universidad del Desarrollo, Santiago, Chile.

Body sway and instability perception are correlated in healthy subjects. We thus investigated this relationship between objective and subjective instability in two groups of patients, to help understand their balance symptoms. 24 patients with unexplained dizziness in the elderly (UDE) and 13 patients with bilateral vestibular hypofunction (BVH) with their correspondent age matched controls performed a dynamic postural task. We measured objective and subjective instability, and anxiety. Body sway and subjective instability were significantly related in both patients' groups following a logarithmic function. However, both patient groups reported more instability for the same amount of body sway when compared to controls. Sway path was not different between UDE and controls, but it was larger in BVH than controls. Our data confirms the strong relationship between objective and subjective instability in two patient groups. Interestingly, patients perceive higher instability when facing a similar amount of body sway, suggesting a reduced internal reserve of balance resources modulating their perceived instability. As expected, BVH patients sway significantly more than controls hence their perception of instability is following the objective cues, unlike UDE patients. As cerebral small vessel disease contributes to the syndrome of UDE, its presence may interfere with internal estimates of self-stability.

Stressful pictures and persistent postural perceptual dizziness: connecting two literatures.

G Powell[1], H Derry-Sumner[2], S Rajenderkumar[2], P Sumner[1], S Rushton[1]

1. School of Psychology, Cardiff University, Tower building, Park Place, Cardiff, CF10 3AT, UK.
2. Dept of Audiovestibular Medicine, University Hospital of Wales, Cardiff CF14 4XW

Images and environments that deviate from the properties of natural scenes – in their spatial frequencies and distribution of orientations - are known to elicit more visual stress than natural do images that conform to the properties of natural scenes. For example, a leafy garden is visually pleasant, but a building with a predominance of horizontal and vertical bars at a repetition frequency in the region of 1 to 5 cycles per degree elicits visual discomfort in many people. These same properties over-activate computational models of visual cortex, produce higher visual responses in neuroimaging studies, and are the kinds of visual properties that are stressful for migraine sufferers or can be difficult for people with dyslexia. Here we connect this literature on natural vs non-natural scene properties with the literature on Persistent postural perceptual dizziness (PPPD), a common chronic condition presenting in neuro-otology clinics. we found that patients with PPPD and individuals with more PPPD symptoms report higher visual discomfort to images that deviate from natural spectra than do individuals with few PPPD symptoms. Images that produce visual discomfort tend to share similarities with the types of challenging, highly cluttered environments that trigger PPPD symptoms. Although PPPD is often described as a condition driven by vestibular deficiencies and later visual dependence, our results suggest that visual processing in PPPD may also be atypical.

MRI for visualisation of endolymphatic hydrops – early experience with 30 cases at a UK hospital

L Murdin[1], S Connor[2], S Mendis[1], I Pai[1]

Departments of ENT[1] and Radiology[2], Guy's and St Thomas' NHS Foundation Trust, London, UK

Endolymphatic hydrops (EH), thought to be the structural correlate of Meniere's Disease, has been demonstrated in post-mortem studies of temporal bones. Recent developments in magnetic resonance imaging (MRI) have allowed the visualisation of EH in living patients. We present our experience with a hydrops MRI protocol in patients presenting with audiovestibular symptoms suggestive of potential EH.

A total of 30 analysable hydrops MRI studies were performed between September 2017 and January 2019 for episodic vertigo, including 21 patients with unilateral MD. Grade 1 or 2 cochlear hydrops was demonstrated in the symptomatic ear in 100% of the cases (21/21) and in the asymptomatic contralateral ear in 71% (15/21). Six patients had previously been diagnosed with unilateral MD 5-30 years previously (mean 21, median 25) and subsequently developed symptoms in the contralateral ear. Bilateral grade 2 cochlear and vestibular hydrops, together with fusion of the vestibular structures, were observed in all cases of bilateral MD. Three patients had episodic vertigo thought to be unrelated to MD, with mixed findings.

In our experience so far, there is a very good correlation between the clinical picture and lateralisation of hydropic changes on MRI, despite high rates of mild hydrops in asymptomatic ears.

KEYNOTE GUEST LECTURE

Standing and feeling upright with cerebellar ataxia

Professor Brian L Day
UCL Queen Square Institute of Neurology, London UK

Each sensory channel provides the nervous system with a unique view of the state of the body in the world. How are these different strands of information combined to control whole-body actions and how are those processes affected by neurological disease? This talk will focus on cerebellar disease and how it impinges on the multisensory processes that are used to stand and feel upright. Using empirical evidence from people with spinocerebellar ataxia type 6 (SCA 6), a relatively pure form of cerebellar degeneration, it will be shown that the disease is associated with an excessive sensitivity to visual information which scales with disease severity. A case will be made that this is an epiphenomenon stemming from aberrant vestibular processing by the damaged cerebellum.

POSTER PRESENTATIONS

Motorist Disorientation Syndrome: Clinical Features and Vestibular Findings

C Ainsworth, L Murdin, R Davis, I Colvin

Guy's and St Thomas NHS Foundation Trust

BACKGROUND: 'Motorist's Disorientation Syndrome' (MDS) describes patients who present with an illusion that their car is pulling or turning. This study presents the largest case series of patients to date with these symptoms and describes the clinical features, psychological features and vestibular findings in this group.

METHODS: 18 patients were studied by interview and questionnaires and vestibular testing. A nestled case control study compared symptoms with healthy individuals and those with vestibular migraine.

RESULTS: Symptoms were predominately reported in the middle adult age range, with no gender preponderance. Consistent features were reported, including a unidirectional pulling feeling with consistent triggers such as fast roads, bumps, dips and hills.

Symptoms were severe enough to change driving habits in 94%. Self-reported anxiety symptoms in the MDS group were significantly higher than 'healthy' controls.

Vestibular abnormalities were found in 50% of subjects; 4 had peripheral findings, 3 central and 2 mixed. Those without vestibular abnormalities had higher self-reported handicap.

CONCLUSIONS: Motorist Disorientation Syndrome represents a chronic set of consistently described symptoms. The burden of symptoms is high in this patient group. These symptoms cannot be solely attributed to a structural disorder. MDS may represent a chronic functional vestibular disorder, with features similar to Persistent Postural Perceptual Dizziness.

Modes of VOR central compensation for an acute unilateral peripheral vestibular deficit differ between canal planes.

J H J Allum and F Honegger

Division of Audiology and Neurootology, Department of ORL, University of Basel Hospital, Basel, Switzerland

BACKGROUND: The video head impulse test (vHIT) is used to quantify deficits in vestibular ocular reflex (VOR) responses to high accelerations in each canal plane. We examined these responses at 2 time-points to determine whether bilateral central compensation processes (CCP) acting on each plane's VOR pathways differed between planes after acute onset of a unilateral peripheral vestibular deficit (aUPVD).

METHODS: 14 patients diagnosed with acute vestibular neuritis were examined with vHIT in all 3 canal planes on average 4.5 and 38.2 days after onset of aUPVD. Response asymmetries in the pitch and roll plane and coplanar canals were calculated from the vertical canal responses.

RESULTS: Lateral and anterior deficit side average gains were equal at aUPVD onset, 0.42, as were those on the normal side, 0.82. Posterior plane gains were different, 0.62; normal side 0.67. After ca. 6 weeks all deficit side canal gains were ca. 0.66. However lateral and anterior normal side gains were 0.9, and posterior normal side gain 0.74. These gains resulted in significantly higher lateral and anterior gain asymmetries (mean 31%) than posterior plane asymmetries (mean 14.3%) at onset but not at 6 weeks (all ca 16%). Roll plane asymmetries decreased slightly (19 to 14%) but pitch plane asymmetries were not different from 0%. Canal paresis average values were 90% and 76% at the 2 time points.

CONCLUSIONS: These results indicated that CCP are different between canal VORs. For the lateral and anterior canal responses, CCP increases the deficit side responses and maintains normal side responses close to 1. In contrast for the posterior canal deficit side responses hardly improve and normal side responses decrease. These differences are similar to those seen with low acceleration rotating chair responses. Presumably, these differences in CCP will affect the contribution of canal signals to balance responses.

Manifestations of otolithic dysfunction: a scoping review

S Baskerville

Advanced Audiologist, St Georges University Hospital NHS Foundation Trust, London
This project is currently being carried out as part of a part time Masters in Clinical Research through the University of Manchester (as such the project will be completed Sept 2019).

Aims & Objectives:

To identify the scope of the evidence supporting our understanding of otolithic dysfunction manifestations as a precursor to the subsequent development of diagnostic criteria for the condition

- Examine the extent, range, nature and quality of available research on manifestations of otolithic dysfunction
- To characterise manifestations and heterogeneity of otolithic dysfunction in the literature
- Identify research gaps in the literature to aid planning and commissioning of future research in order to move towards a diagnostic tool for clinical application in the assessment of otolithic dysfunction

Methodology:

Assessment and diagnosis of balance disorders is variable nationally and can involve extensive waiting times and expensive diagnostic test batteries to ascertain a most likely diagnosis. We are aware of the significant cost to mental health with dizziness, with high risk of leading to more chronic condition if left undiagnosed and untreated which results in poorer outcomes, increased cost to the NHS, society and patient wellbeing.

The ISVR (International Society of Vestibular Research), has started to try and address these variations by developing differential diagnosis criteria for balance conditions, which as yet does not touch upon otolithic dysfunction. Management for this condition currently is Vestibular Rehabilitation however there are few journals to support its success in this population, most notably because this population are rarely diagnosed separately to the wider 'peripheral vestibular dysfunction' population. Despite us knowing that their symptoms and descriptives from patients are very different.

Being able to understand this cohort's outcomes requires us to address their clear diagnosis which is currently lacking in the literature as such I found the most appropriate place to start is to scope to review of our current understanding of the manifestations of the condition before we might begin to move towards developing clear diagnostic criteria to monitor their management and outcomes

A scoping review is exploratory in its approach, to synthesise research evidence around a broad question and demonstrate a picture of the current evidence base (Peterson et al, 2016., Booth and Grant, 2009., Peters et al, 2015., Armstrong et al, 2011). This is of particular use and relevance to my topic, due to the literature which has not yet been comprehensively reviewed and exhibits, large, complex and heterogeneous nature which is therefore not amenable to a more precise systematic review (Peters et al, 2015) This scoping review will be used to summarise and disseminate research findings to identify research gaps, clarify key concepts and report on the types of evidence that address and inform practice in the field in order to inform practice and

make recommendations for future research priorities in working towards a diagnostic guideline for otolithic dysfunction (Colquhoun et al, 2014., Peters at al, 2015).

My scoping review will be conducted using the JBI recommendations (Joanna Briggs Institute, 2015) with the modified PRISMA statement for scoping reviews (Tricco et al, 2018) with further consideration of methodological enhancements from cited researchers (Daudt et al, 2013., Colquhuon et al, 2014, Peters et al, 2015., Levac et al, 2010).

Search strategy will include terminology of otolith, otolithic, assessment, presentation, manifestation, symptoms. Databases included; CINAHL, Embase, Medline, Grey literature database 'open grey'.

As per referenced scoping review guidance abstracts will be screened to eligibility criteria; including humans only, adults only, articles accepted internationally, articles in English, articles from 1992.

Following this a level 2 screen will be completed to ensure full text articles are appropriate. Prisma flow diagram will demonstrate article choices.

Results

Final articles will be summarised and results will be synthesised with narrative and thematic approach.

Conclusions

Project will be completed in September 2019. Conclusions will address objectives as above

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Vestibular-guided spatial orientation in healthy young and aged controls and patients with neurodegeneration

M Chepisheva[1], E Calzolari[1], J B Rowe[2], B M Seemungal[1]

1. Brain & Vestibular Group, Neuro-otology Unit, Imperial College London
2. Department of Clinical Neurosciences, Cambridge University.

Background:
Navigating in the environment is essential for our daily activities. Dementia patients commonly present with spatial disorientation. In the dark, vestibular cues guide orientation, particularly for angular rotations but it is unknown if dementia affects vestibular-guided spatial orientation.

Methods:
Working memory performance for vestibular-guided spatial orientation was assessed in controls and dementia patients. For the EGOCENTRIC task, participants sat on a computer-controlled, motorized rotating chair and following discrete passive rotations to one of six angles (range 30-180°) in the dark, were required to move the chair back to the perceived start using a joystick. For the ALLOCENTRIC task, participants wore a virtual reality headset showing a 360° natural visual scene. For each trial, subjects were passively rotated in the dark to one of six angles (30-180°) and were required to indicate their perceived position using the VR setup (now switched on).

Results:
Our preliminary data show that patients and controls are accurate in the egocentric task. Allocentric task analysis is ongoing.

Conclusion:
The neural transformation of vestibular head velocity signal to angular distance is preserved in dementia patients. Ongoing work will assess if dementia differentially affects allocentric orientation, and whether this is linked to reduced visual landmark memory.

Validation of a novel optical tracking solution for the assessment of patients' motion characteristics during vestibular rehabilitation

J Corcoran[1], M Ayers[2]

1. Jeremy Corcoran, Multidisciplinary Balance Clinic, Guy's Hospital, Great Maze Pond, London SE1 9RT
2. Michael Ayers, Medical Engineering and Physics, King's College Hospital, Denmark Hill, London SE5 8RX

Assessing the motion characteristics of patients undergoing vestibular rehabilitation requires remote or head-mounted tracking solutions which do not restrict their exercise performance. The objective of this study was to validate an affordable optical motion tracking device, the Optitrack V120:Duo (NaturalPoint, USA).

To replicate the yawing rotations of patients' heads during vestibular rehabilitation, a custom device, comprising a dummy head mounted on a custom test rig, was used. During a single 20-second trial, the dummy head was oscillated through 30° in yaw by a physiotherapist at approximately 2Hz. Yaw data was collected simultaneously from the V120:Duo and from a Vicon MX motion analysis system (Oxford Metrics, UK), the criterion tracking solution. A second order low-pass Butterworth filter was applied to both data sets, and the angular velocities of dummy head motion were calculated.

In order to provide a quantitative assessment of the accuracy of the V120:Duo relative to the Vicon MX, a Bland-Altman plot was constructed. From this plot, the derived limits of agreement between the devices, when tracked movements peaked near 180°/s, was +/- 12°/s.

This study has shown that the Optitrack V120:Duo is a suitable device for tracking patients' motion characteristics, assuming that vestibular exercises do not encourage yawing head velocities in excess of 180°/s.

Psychometric Properties of Motor and Cognitive Dual-task Studies with the Aim of Developing a Test Protocol for Vestibular-Impaired Patients: a Systematic Review

M Danneels[1], R Van Hecke[1], H Keppler[1,2], S Degeest[1], D Cambier[1], R van de Berg[3,4], V Van Rompaey[5,6] and L Maes[1,2]

1. Ghent University, Department of Rehabilitation Sciences, Ghent, Belgium
2. Ghent University Hospital, Department of Otorhinolaryngology, Ghent, Belgium
3. Maastricht University Medical Center, Department of Otorhinolaryngology and Head and Neck Surgery, Maastricht, Netherlands
4. Faculty of Physics, Tomsk State Research University, Tomsk, Russia
5. Department of Otorhinolaryngology and Head & Neck Surgery, Antwerp University Hospital, Edegem, Belgium
6. Faculty of Medicine and Health Sciences, University of Antwerp, Antwerp, Belgium

Introduction

Patients with vestibular disorders frequently suffer from cognitive impairment, which can be attributed to extensive vestibular projections throughout the cortex or to increased cognitive-motor interference (CMI). CMI can be assessed by performing dual-tasks, however, literature on this topic is scarce in the vestibular population. Therefore, a systematic review on the psychometric properties of dual-tasks in a variety of populations was conducted.

Material & Methods

The systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Results

Thirty-three studies were included in the current review. The cognitive and motor tasks varied in terms of test-retest reliability, and some were valid in persons with Parkinson's Disease, multiple sclerosis, dementia, stroke, or elderly.

Conclusions

In order to maximally evoke CMI in the vestibular population, both static and dynamic motor tasks should be performed while challenging the vestibular cognitive domains (visuospatial abilities, memory, attention, executive function, and processing speed). Out of all cognitive tasks employed in dual-task studies, multiple tests can be suggested for executive function and processing speed and a Backward Digit Span Test is recommended for assessing memory. As attention is required in every dual-task, this domain cannot be challenged separately. Finally, visuospatial cognition was not reliably or validly assessed in the included dual-task paradigms.

In Press in Ear & Hearing

Impact of caloric testing for the diagnosis of vestibular migraine

M Debaugnies, P Van Meerbeeck, J Schulz, S De Reys. V Jacquet, M E Debaty

Clinique du Vertige, CHU Saint Pierre, Brussels, Belgium.

Aim

Vestibular migraine (VM), one of the most frequent cause of recurrent vertigo attack remains underdiagnosed. Based on the hypothesis that migraine may be caused by sensory hypersensitivity, we investigated whether VM patients show vestibular hyperactive response to caloric irrigation.

Material and Method

We performed a retrospective comparative study of patients seen in a tertiary referral hospital between 2011 and 2018. 100 patients diagnosed with vestibular migraine were compared with 30 controls. The diagnosis of VM was based on the diagnosis criteria of the consensus of the Barany Society for Neuro-otology and the International Headache Society (2012). The diagnosis was confirmed by a neurologist examination and normal imaging of the posterior fossa structures. We compared the two groups summed caloric responses from cool and warm water stimuli of the patient's both ears

Results

The VM group was composed of 84% of women and the control group of 59% of women. The average age of the VM group at the time of examination was 44 years old and 50 years old for the control group. The VM group exhibits higher caloric response values, with a mean of 169 degrees per second, which was statistically significant when compared to the values for the control group with a mean of 86 degrees per second.

Conclusion

Vestibular hyperreactivity to caloric testing is a feature of vestibular migraine. In addition to patient history and complete oto-neurological examination, overall canal response to caloric stimulation could be used for the diagnosis of VM.

Predicting individual susceptibility to visually induced motion sickness (VIMS) by questionnaire

J F Golding [1], B Keshavarz [2,3], A Rafiq [1]

1. Psychology, School for Social Sciences, University of Westminster, London UK
2. Toronto Rehabilitation Institute, iDAPT, Toronto, Canada
3. Ryerson University, Department of Psychology, Toronto, Canada

BACKGROUND

Introduction of new visual technologies increases the risk of visually induced motion sickness (VIMS). The aim was to evaluate the 6-item Visually Induced Motion Sickness Susceptibility Questionnaire (VIMSSQ) and other predictors for individual susceptibility to VIMS.

METHODS

Healthy participants (10M+20F), mean age 22.9 (SD 5.0) years, viewed a 360^{O} panoramic city scene projected in the visual equivalent to the situation of rotating about an axis tilted from the vertical. The scene rotated at 0.2Hz (72^{O} s^{-1}), with a 'wobble' produced by superimposed 18^{O} tilt on the rotational axis, with field of view 84^{O}. Exposure was 10min or until moderate nausea. Simulator Sickness Questionnaire (SSQ) was the index of VIMS. Predictors/correlates were VIMSSQ, Motion Sickness Susceptibility Questionnaire (MSSQ), Migraine (scale), Syncope, Social & Work Impact of Dizziness (SWID), Sleep quality/disturbance, Personality ('Big Five' TIPI), Vection during exposure, and a prior multisensory Stepping-Vection test.

RESULTS

VIMSSQ had good scale reliability (Cronbach's alpha=0.84). VIMSSQ correlated with SSQ (r=0.58). Higher MSSQ, Migraine, Syncope & SWID also correlated significantly with SSQ. Vection, Age, Gender & Personality had no significant relationships with SSQ. Poorer sleep and Stepping test showed inconsistent relations to SSQ.

CONCLUSIONS

The VIMSSQ was a useful adjunct to MSSQ in predicting VIMS. Other predictors included Migraine, Syncope & SWID. No significant relationship was observed between Vection and VIMS.

The impact of distress, illness perceptions, cognitions and behaviours on chronic dizziness handicap: longitudinal results

D Herdman[1,2], S Norton[1], M Pavlou[3], L Murdin[2], R Moss-Morris[1]

1. Health Psychological Section, King's College London, London, UK
2. Guy's & St Thomas' NHS Foundation Trust, Balance Clinic, London, UK
3. Centre for Human & Applied Physiological Sciences, King's College London, UK

Objective: To investigate the longitudinal relationship between psychological variables and self-reported dizziness handicap.

Methods: Patients (n=185) were recruited from a tertiary neuro-otology clinic waiting list and completed questionnaires before and three months after their initial consultation. All patients were clinically assessed and underwent comprehensive audio-vestibular investigations.

Results: Seventy three percent of participants responded at follow up (n=135, 73% female, M age 54.23 [SD 17.53]) of whom 88% were diagnosed with a neurotological condition. No differences were noted for handicap or psychological profile across diagnoses or objective tests. Dizziness handicap at follow-up was significantly associated with baseline anxiety (r=.59), depression (r=.68), cognitive responses to symptoms (e.g. catastrophising/fear) (r=.37 to .51), avoidance (r=.61), an all-or-nothing approach to activity (r=.50), perfectionism (r=.35), attributing more symptoms to the condition (r=.39) and negative illness perceptions (e.g. belief that dizziness will be long-lasting/serious) (r=.21 to .54). Depression, anxiety, all-or-nothing behaviour and beliefs about chronicity continued to predict dizziness handicap even after controlling for baseline handicap.

Conclusions: Tertiary patients with chronic dizziness report negative illness perceptions and unhelpful cognitive and behavioural responses to symptoms which are associated with self-perceived disability over time. Patients that experience significant dizziness handicap may benefit from intervention that specifically addresses these factors.

Suppression head impulse (SHIMP) in patients with functional (psychogenic) eye movement disorders

D Herdman[1,2], P Premachandra[1], L Murdin[1]

1. Balance Clinic, Guy's & St Thomas' NHS Foundation Trust, London, UK
2. Health Psychology Section, IoPPN, King's College London, UK

OBJECTIVE:
To determine whether the suppression head impulse (SHIMP) protocol is less susceptible to the effects of functional (psychogenic) eye movement disorders than the standard video head impulse.

METHODS:
A retrospective case report of two patients with functional eye movement disorders undergoing vestibular testing in a tertiary neuro-otology service. Video head impulse (vHIT) and SHIMP tests were performed by an experienced audiologist.

RESULTS:
When functional eye movements resulted in abnormal or artefactual results with the conventional video head impulse, the SHIMP protocol was completed using a head-fixed target which indicated normal vestibular-ocular reflex function and appears to be more reliable in this patient subgroup.

CONCLUSION:
We have observed that SHIMP testing is a valuable addition to measure vestibulo-ocular reflex gain in patients with functional eye movement disorders, where other evaluations may either be uninterpretable or potentially misleading.

Customisation of exercises in a group-based vestibular rehabilitation programme

N Hill[1], S Greenan[1], T Sandell[1], A Loose[1], L Williams[1] and J Corcoran[1]

1. Multidisciplinary Balance clinic, Guy's Hospital, Great Maze Pond, London, SE1 9RT

Introduction:
Vestibular rehabilitation (VR) should be customised for optimal outcomes in the management of vestibular disorders. This study aimed to investigate whether individualised and customised VR could be provided in a novel group class setting for individuals of various vestibular pathologies at various levels of ability.

Methods:
A retrospective, cross-sectional and purposive sample of 29 participants were identified from the dizziness and balance exercise programme (DBEP) at Guy's Hospital. Data from the 4th session attended at the class was analysed including diagnosis, demographics, Dizziness Handicap Inventory (DHI) and details of the exercises completed.

Results:
Mean (+/- SD) age (years) was 62(14). 72% were female. Mean (+/- SD) DHI was 45(17). Nine distinct vestibular disorders were identified, the mode being unilateral peripheral vestibulopathy (n=7). The median (IQR) number of exercises completed was 5(2). A range of 10 different exercise stations, aimed at different vestibular and balance deficits, were performed across the sample. In 7 out of 10 stations easy, medium and difficult rated exercises were performed. 154 exercises were performed in total; 50% were rated medium difficulty, 32% difficult and 18% easy.

Conclusion:
A novel group class setting can effectively deliver individualised and customised VR for a wide range of vestibular disorders of varying levels of ability and severity.

A pilot study of a novel vestibular intervention for lateropulsion in acute stroke

N Hill[1, 2], P Fordham[3] and L Sztriha[1].

1. Princess Royal University Hospital, King's College Hospital NHS Foundation Trust, Orpington, Kent BR6 8ND
2. Multidisciplinary Balance clinic, Guy's Hospital, Great Maze Pond, London SE1 9RT
3. School of Health Sciences, University of Brighton, 49 Darley Road, Robert Dodd Building, Eastbourne BN20 7UR

Introduction:
Lateropulsion following stroke causes acute disability and delay in recovery. A pilot randomised controlled trial was undertaken across two stroke units to investigate a novel vestibular intervention targeted at lateropulsion in acute stroke rehabilitation.

Methods:
Participants received a vestibular stimulation exercise, involving 360° rotations to the contralesional side, or standard therapy. Measurements were taken of postural alignment (head and trunk bony landmarks) and balance (Postural Assessment Scale for Stroke (PASS)) over a six-week period.

Results:
Eight patients were recruited (42% recruitment rate). Five were randomised to receive the intervention. Two patients from the vestibular group did not complete all measures due to early discharge or repatriation (75% retention rate). The intervention was readily administered and adapted by the therapists. There were no adverse effects of the vestibular intervention. Both groups showed improved PASS scores (median (IQR) Vestibular – 10 (6); Control – 11 (5.5)) and trunk postural alignment measurements (Vestibular – 1.5cm (6cm); Control – 9cm (4cm)). Head postural alignment showed minimal changes in both groups (Vestibular – 2cm (1cm); Control – 2.5cm (3.5cm)).

Conclusion:
This pilot study proposes a novel vestibular intervention for treating lateropulsion in acute stroke rehabilitation, which is well tolerated, and easily learned by physiotherapists. Adjustments to the protocol, such as broadening the inclusion criteria, would improve the feasibility of a larger trial.

Small vessel disease impairs postural control in "unexplained dizziness" of the elderly

R Ibitoye[1,2], P Castro[1], O Guven[1], D Kaski[1,3], L Murdin[4,5],A Bronstein[1]

1. Neuro-otology Unit, Imperial College London, London, UK
2. The Computational, Cognitive and Clinical Neuroimaging Laboratory (C3NL), Imperial College London, London
3. Department of Clinical and Movement Neurosciences, University College London, London, UK
4. Guy's and St Thomas' NHS Foundation Trust, London, UK
5. Ear Institute, University College London, London, UK

Background
Postural dizziness is common in over 65s and often remains unexplained despite neuro-otological investigation. The cause of this "unexplained dizziness" (UD) is poorly understood; peripheral vestibular degeneration and cerebral small vessel disease (SVD) have been suggested. EEG in quiet standing provides insight into cortical resource demand in postural control, with decreases in central theta and alpha band power.

Aim
We use postural EEG and brain MRI to investigate if SVD may cause UD symptoms through deleterious effects on postural control.

Methods
18 subjects with UD recruited from neuro-otology clinic, mean age 79, and 22 age-similar controls (HC) underwent postural EEG and T2 FLAIR brain MRI. Vestibular function was normal. EEG was recorded with eyes closed in sitting and standing postures. Normalised power (standing/sitting) was calculated at each channel. White matter hyperintensity volume (WMH), a marker of SVD burden, was inferred using an automated method.

Results
WMH volume was higher in UD than HC ($p=0.05$), and central theta power decreased more extensively ($p<0.05$). A generalised linear model showed greater central theta power reduction in UD was mediated by WMH volume ($p<0.05$).

Conclusion
Symptoms in unexplained dizziness may arise from the adverse effects of excess small vessel disease on postural control.

MRI Evidence for Atelectasis in a Case of Bilateral Vestibular Hypofunction and Confirmed Tullio's Phenomenon

R Ibitoye, P Castro, D Kaski, A Bronstein

Room 10L14, Lab block, Charing Cross Hospital Campus, St. Dunstan's Road, London W6 8RF (Imperial College London).

Background

Bilateral vestibular hypofunction (BVH) with sound induced nystagmus (Tullio's phenomenon) is rare and the structural basis is unknown. Vestibular atelectasis has been suggested, with reports of utricular and ampullary atelectasis. We present a 48 year old woman with long-standing BVH and Tullio's in whom post-contrast MRI suggests atelectasis, in support of this emerging theory.

Case

Aged 35 she presented with acute vertigo post-partum, followed by subacute imbalance worse in the dark, and oscillopsia when ambulant. Co-incident diagnosis of anti-thyroid peroxidase positive hypothyroidism was made.

Caloric tests confirmed BVH with no left response, and <3 degree per second responses on the right. Clinical head impulse tests (HIT) were bilaterally positive, and video HITs confirmed reduced gain in all canals. Off-axis rotation showed impaired left utricular function, and possible hypofunction on the right. Cervical Vestibular Evoked Myogenic Potentials were symmetrically present at 125dB. 500Hz tones at 110dB produced right-beating nystagmus in both ears. High resolution temporal bone CT was unremarkable. 4 hour delayed post-contrast MRI showed reduced enhancement of the utricle on the right in keeping with atelectasis.

Conclusion

BVH with Tullio's is linked to imaging markers suggestive of vestibular atelectasis. The possibility of an auto-immune basis is raised.

It's all in the history – four cases of dizziness referred to a falls/syncope service

J Lawson

Falls/Syncope Service, Newcastle upon Tyne Hospitals Trust

Subject- 4 cases of dizziness sent to a Falls/Syncope service highlighting the benefit to patients where a doctor with a broad understanding of all causes of dizziness can significantly improve the service for patients and help achieve timely and appropriate diagnosis and treatment.

Case1
88-year-old deaf, gentleman who is only dizzy at specific times namely 09.30 and 17.30 each day. Symptoms present for 10 weeks, sometimes falls to the ground.

Case 2
74-year-old lady with multiple episodes of short-lived collapse when sits up. She cannot be left on her own

Case 3
58-year-old gentleman who developed dizziness after acute myocardial infarct. He has been off work for 5 months. He has normal MRI head scan. And cardiologists say his heart is normal.

Case 4
54-year-old lorry driver has had episodes where suddenly felt as if something terrible was about to happen to him when driving. He feels his vision changed and something in his head. He describes 2 episodes when driving over Shap. He had to stop his lorry. The DVLA will not allow him to resume driving until he has a diagnosis. He has no other symptoms of presyncope or dizziness.

A gap analysis of global guidelines for falls rehabilitation. Where do they fall short?

M B Liston[1], G Genna[2], D Bamiou[2], M Pavlou[1]

1. Centre for Human and Applied Physiological Sciences, King's College London. London UK.
2. Ear Institute, University College London, London, UK

Introduction: Clinical practice guidelines provide critical analyses of the available research literature in order to support evidence-based practice. Critical analyses of guidelines are uncommon, however, can provide insight into areas where current research evidence / guidance is lacking.

Methods: Systematic searches of MEDLINE, EMBASE, CINAHL, alongside searches of guideline clearing houses, national governing bodies were completed, with recommendations extracted for narrative synthesis. Six modifiable domains were extracted from an established model of postural control and used to develop a gap analysis tool for assessing selected guidelines.

Results: Searches identified 5029 articles, with 140 articles selected for full text review, of which 19 were included in the final analysis. No guidelines used a model for postural control to rationalise intervention approaches. All guidelines advocated balance and/or strength training, although less than half provided further details on how to implement this. Gap analysis identified that included guidelines addressed; one(n=2), two(n=13), three(n=3) or four (n=1) of the six modifiable domains within the postural control model.

Conclusion: No guidelines use a theoretical framework for postural control to justify their recommendations. Accordingly, only one third of modifiable domains are addressed by the majority of guidelines (n=15).

Effectiveness of canal occlusion for intractable posterior canal benign paroxysmal positional vertigo – a systematic review

B Maas[1], H van der Zaag-Loonen[1], P van Benthem[2], T Bruintjes[1]

1. Apeldoorn Dizziness Clinic, Gelre Hospital, Apeldoorn, The Netherlands
2. Department of Otorhinolaryngology and Head and Neck Surgery, Leiden University Medical Centre, Leiden, The Netherlands

Objectives: A last resort therapy for intractable benign paroxysmal positional vertigo (BPPV) is occlusion of the semicircular canal. The aim of this review was to assess the effect of posterior canal occlusion for intractable posterior canal BPPV on vertigo, and to determine the risk of loss of auditory or vestibular function.

Search method: A systematic literature search according to the PRISMA statement.

Eligibility criteria: Cohort studies with original data and case reports describing >5 cases were included if they analysed the effect of posterior semicircular canal obliteration on vertigo in adults with intractable posterior BPPV.

Results: Eight retrospective studies met the eligibility criteria. The quality of all individual studies was rated fair. Canal occlusion was performed in 196 patients. All studies reported a complete resolution of vertigo in all patients (100%). A total loss of auditory function was reported in two out of 190 (1%) and a loss of caloric function in nine out of 68 (13%) patients tested postoperatively.

Conclusion: There is weak evidence that posterior semicircular canal plugging is an effective treatment for patients with intractable BPPV. Potential serious complications, such as deafness and loss of vestibular function, should be taken into account.

Peripheral vestibular dysfunction in the adult Vestibular Migraine (VM) population: A one-year single consultant experience.

J Chan[1], A Perera[2], K Hall[2], A Pajaniappane[3],

Specialist Registrar[1], Consultant Audiovestibular Physician[3] St George's University Hospitals NHS Foundation Trust
[2]St George's Medical School, University of London

Background and Aim:
Vestibular dysfunction in Vestibular Migraine (VM) is often thought to originate centrally. However, several studies have shown evidence of peripheral vestibular dysfunction (PVD) during the interictal (symptom-free) period in the VM population. Previous studies have used caloric test (prevalence of 20-30%), video head impulse test (vHIT) (8-11%) and vestibular-evoked myogenic potentials (VEMPs) (11-68%) in order to demonstrate PVD in this population. An underlying PVD can co-exist with VM, potentially serving as a trigger. Previous studies have also suggested a negative correlation between the presence of PVD and the medication responsiveness of VM. Identification and appropriate treatment of co-morbid PVD is hence critical for the optimal management of VM patients. Our study examines the prevalence of PVD in our local VM population.

Method:
A retrospective case note analysis was undertaken of all VM patients under one neuro-otology consultant between April 2018 to March 2019, at a large tertiary care centre which covers a diverse South London population. Only those patients who clearly met the diagnostic VM criteria of the Bárány Society were included in our study. Multiple objective vestibular function test results were reviewed and analysed to identify the presence of PVD in this population.

Results:
A total of 91 patients with a diagnosis of VM were identified, with 28 rejected due to uncertainty on whether Barany criteria was met. Of the 63 patients who clearly met the criteria for VM, 14 (22.2%) were identified to have an associated peripheral vestibular disorder on at least two objective tests, one of which was the rotational chair.

Discussion
Our findings are in keeping with previous studies which demonstrate a significant number of VM patients with associated PVD. It is therefore prudent to maintain a low index of suspicion of co-morbid PVD in this patient group. A diagnosis based solely on history and examination may not suffice in demonstrating the true picture and, can lead to sub-optimal treatment. Diagnosis should only be made following detailed clinical and objective neurotological assessment in specialist clinics.
Our findings using rotational chair to assess PVD yielded similar results compared to previous studies which employed other objective tests (calorics, vHIT). Rotational chair, which is generally better tolerated, is worthy of consideration as a first line objective test to assess for PVD in VM patients.

Keywords : Vestibular migraine, Vestibular diseases, Peripheral vestibular disorder

A retrospective comparative analysis of skull (mastoid) vibration induced nystagmus test (SVINT) using 60hz and 100 Hz stimuli versus Calorics

K Melotte, A Gill, S Kuttva, M Perera, P Radomskij, A Pajaniappane[1]

1. Correspondence Author: Consultant in Audiovestibular Medicine, St George's Hospital, London

Background:
Bone-conducted vibration of either mastoid is reported to induce horizontal nystagmus beating away from the affected ear in individuals with a unilateral vestibular lesion, whilst it has no impact on individuals with symmetrical function.

The value of SVINT in total unilateral vestibular loss (tUVL) is well recognised with sensitivity and specificity reported at 98% and 100% respectively (Dumas et al., 2017). However, in real life, patients do not present typically with tUVL and hence the value of the test is uncertain. In fact, SVINT is only strongly correlated in individuals with a unilateral caloric hypofunction of >50%.

Methods:
The Audiovestibular Medicine and Neuro-otology service at St George's hospital is a large tertiary referrals centre with a significant dizzy patient load. We retrospectively reviewed case notes and test records at our centre over a 3-year period to identify individuals who have had both bi-thermal caloric and SVIN tests.

Results:
30 patients were identified with 3 rejected due incomplete data. Of the patient sub-group, 17 were identified to have a significant unilateral vestibular dysfunction on calorics (>20% asymmetry). SVINT was positive in 6 out of the 16 patients with unilateral dysfunction on calorics (37.5%). All positive SVINT lateralised accurately to the side of the caloric hypofunction. We did not have any false positives in our data set suggestive of high specificity.

Discussion:
SVINT is of value when there is a significant unilateral vestibular loss on calorics of >40% in our study. Although sensitivity at less significant CP values is poor, the test has a high specificity value when positive. Hence as a screening tool in the community to identify significant vestibular asymmetry it has potential value, but its usefulness in a tertiary Neuro-otology service is unclear.

Why is routine vestibular screening not undertaken by major trauma ward staff? A qualitative study

R Smith[1], J Marsden[2], C Burgess[3], B M Seemungal[1]

1. Brain & Vestibular Group, Neuro-otology Unit, Imperial College London
2. Plymouth University
3. King's College London

Purpose
Vestibular disorders are a burdensome consequence of TBI. Although there is growing evidence to support the importance of routine vestibular screening, clinical audit data demonstrates a lack of routine vestibular assessment in Major Trauma settings. We aimed to explore any person factors which may account for this.

Methods
A qualitative approach was used for this study. Data collection comprised of semi-structured interviews using a topic guide. Ward staff whose role include assessing patients with dizziness and/or imbalance (therapists, junior and senior doctors) were purposively sampled across two Major Trauma Centres (St Mary's Hospital and King's College Hospital). Data was analysed using the Framework approach.

Results
28 ward staff participated (19 females; Mean age 31). Interview data suggests ward staff do not complete routine vestibular assessments. Pertinent barriers include role and knowledge-based factors which appear specific to different groups of healthcare professionals. Therapists were identified to be the most appropriate group to adopt routine vestibular assessment within their clinical practice.

Conclusions
This study demonstrates a variety of knowledge and role-associated factors to be linked to a lack of routine vestibular screening following TBI. Focused multidisciplinary theoretical and practical education is recommended.

Bilateral vestibular failure may improve with treatment of the underlying cause

D Smyth and S Mossman

Department of Neurology, Wellington Hospital, Wellington, New Zealand

ABSTRACT

Bilateral vestibular failure has a multitude of causes, and in the majority of cases is permanent. We present two patients with rare causes of bilateral vestibular failure, one due to audio vestibular sarcoidosis and the other a probable paraneoplastic syndrome associated with a glucagonoma, in which vestibular function improved significantly with treatment of the underlying condition. It is important to look carefully for an underlying cause of BVF as treatment of the underlying condition may lead to subjective and objective improvement.

Persistent postural perceptual dizziness is on a spectrum in the general population

G Powell[1], H Derry[2], D Rajenderkumar[2], P Sumner[1] and S Rushton[1]

1. School of Psychology, Cardiff University, Tower building, Park Place, Cardiff, CF10 3AT, UK
2. Dept of Audiovestibular Medicine, University Hospital of Wales, Cardiff CF14 4XW

Persistent postural perceptual dizziness (PPPD) is a common chronic condition presenting in neuro-otology clinics. It is generally thought to be a maladaptive long-term consequence of compensatory changes elicited by acute vestibular insults. Here we find high levels of PPPD symptoms in healthy populations, suggesting instead that PPPD is a spectrum the pre-exists in the population and may predispose some vestibular patients to more severe and longer lasting symptoms, rather than arising as a consequence of vestibular insult. We collected responses to two common clinical questionnaires (VVAS and SCQ) in three healthy cohorts: community public health research volunteers (N=2011 for VVAS, N=1616 for SCQ); paid online participants (N=209 for VVAS, N=139 for SCQ); students (N=202 for VVAS only). We compared scores to a cohort of patients diagnosed with PPPD (N=24) and found that around 10%, 8% and 20%, respectively, of the three healthy cohorts scored above the 25th percentile patient score on one PPPD measure (VVAS) and 50% and 54% scored above the 25th percentile patient score on the other measure (SCQ). Scores correlated negatively with age, counter to expectation if PPPD arises following unknown insults that have rising cumulative probability with age. Scores were associated with migraine in two populations, but leaving the majority of variance unexplained, suggesting that migraine is not the major factor underlying the spectrum of PPPD symptoms in the general population.

The relationship between dizziness, anxiety, and multisensory processing

G Powell[1], H Derry-Sumner[2], D Rajenderkumar[2] P Sumner[1] and S Rushton[1]

1. School of Psychology, Cardiff University, Tower building, Park Place, Cardiff, CF10 3AT, UK
2. Dept of Audiovestibular Medicine, University Hospital of Wales, Cardiff CF14 4XW

Persistent postural perceptual dizziness (PPPD) is a common chronic condition presenting in neuro-otology clinics. Its cause is generally assumed to lie mainly in the interactions between the three sensory systems underlying balance: vestibular, visual and somatosensory. Here we find that PPPD symptoms are also associated with self-reported over-sensitivity in other sensory domains: touch, hearing, smell and taste. We use structural equation modelling to unpack this relationship and its additional associations with anxiety and migraine – which are both long-known but underspecified correlates of dizziness. We find that anxiety partly, but not wholly, mediates the association between multi-sensory sensitivity and PPPD symptoms. Most of the path coefficients and mediation effects in our model were unchanged between participants with and without migraine. Our findings support the idea that PPPD is a complex, neurological condition that includes both psychogenic and perceptual factors, and may suggest that thus some brains are pre-disposed to generalised cross-modal sensory-overload, and this in turn may makes them more prone to severe PPPD should a vestibular insult occur.

The Leicester Paediatric Balance Experience

H Turner, P Rea

The Leicester Balance Centre, Leicester Royal Infirmary, Infirmary Square, Leicester LE1 5WW

Ten years of paediatric referrals to the Leicester balance team were reviewed. Forty-eight patients were seen with a mean age of 13.75 years. Children with imbalance in the presence of Otitis media with effusion were excluded.

Our commonest diagnosis was Vestibular Migraine (VM), in 44% (21/48) of our patients. 13% of patients were diagnosed with a vestibulopathy and benign Paroxysmal Positional vertigo was seen and treated in 8%. Benign Paroxysmal Vertigo of Childhood (BPVC) was seen in one child, this was also the youngest patient at 3 years old.

No brain tumours were identified. One patient was diagnosed with an Arnold Chiari malformation. 19% of children were thought to have cardio-respiratory disorders (e.g. hyperventilation syndrome, postural hypotension) alongside another vestibular diagnosis or as the sole presentation. Some children received more than one diagnosis.

Our data has been compared to a review of 724 paediatric balance patients from 10 studies. (1) Our series features a higher diagnosis rate of VM in comparison but this may be in part explained by the relatively high average age of presentation especially given that BPVC is seen in a much younger cohort and may in fact be a precursor diagnosis to VM.

1. Gioacchini M, Alicandri-Ciufelli M, Kaleci S, Magliulo G and Re M. Prevalence and diagnosis of vestibular disorders in children: A Review. International Journal of Pediatric Otorhinolaryngology 78 (2014) 718–724

The feasibility and acceptability of doing video Head Impulse Test in an inpatient setting

B Ubhi, L Murdin

Guy's and St Thomas Hospital, London

Objective: What is the feasibility and acceptability of doing video Head Impulse Test in an acute inpatient setting?

Background: vHIT is a useful test for vestibular dysfunction and is well established in outpatient Audiology settings. However, it is not yet widely used in acute patient populations and settings. This project aims to assess the practical issue and clinical value of vHIT in such clinical environments.

Main outcome measures: This study examined obstacles in the test environment, procedure, patient and equipment related variables influencing vHIT in acutely unwell inpatients.

Results: Qualitative analysis of pilot data in 4 patients (aged 30-77) identified that vHIT can be done reliably in acutely dizzy patients. Calibration could be achieved but at the cost of increased test time and required flexible procedure at the bedside. All patients were able to complete adequate number of trials. Adequate head velocity was reliability obtained with no issues of undershoot or overshoot in any case. The procedure was well tolerated. Six canal vHIT took an average of 45 minutes per patient of audiologist time, with no compromise in quality. Clinically useful results were obtained in all cases. The main barriers to inpatient assessment were procedural, around accessing patients who are moving between departments during an admission.

Conclusion: vHIT is a practical and feasible test in the acute environment. Further testing is required with a wider population to allow for more generalizable results.

Vestibular Function in Children with Neurodevelopmental Disorders: A Systematic Review.

R Van Hecke[1], M Danneels[1], I Dhooge[2,3], H Van Waelvelde[1], R Wiersema[4], F Deconinck[5], L Maes[1,2]

1. Ghent University, Department of Rehabilitation Sciences, Ghent, Belgium
2. Ghent University Hospital, Department of Otorhinolaryngology, Ghent, Belgium
3. Ghent University, Department of Head and Skin, Ghent, Belgium
4. Ghent University, Department of Experimental-Clinical and Health Psychology, Ghent, Belgium
5. Ghent University, Department of Movement and Sports Sciences, Ghent, Belgium

A vestibular dysfunction in children may result in symptoms and characteristics which often tend to overlap with symptoms found in children with neurodevelopmental disorders (NDDs). To examine the potential link between vestibular dysfunctions and NDDs and to investigate the presence and characteristics of vestibular dysfunctions in this population, a systematic review was performed.

The systematic searches in MEDLINE, EMBASE, Cochrane Register of Controlled Trials and reference lists of all included studies revealed twenty studies that addressed vestibular function in children with NDDs. The majority of these studies suggested a possible vestibular involvement in children with NDDs since central and/or peripheral vestibular aberrations were found in a subset of these children. These alterations may result in symptoms of distorted motor coordination or postural instability, respectively, and might explain some of the balance problems observed in this population.

However, current findings are ambiguous and mainly based on evaluation of the horizontal semicircular canals alone. Therefore, high-quality studies with an extensive vestibular test battery are required to further characterize vestibular function in children with NDDs. Importantly, since comparable symptoms may occur in both groups of children, clinicians should be aware of these similarities when establishing the vestibular or NDD diagnosis.

Impact of migraine episodes in Meniere patients following chronic use of weak prismatic spectacles

E Vente[1], A Shepherd[2]

1. Utermöhlen Foundation The Netherlands
2. Birkbeck, University of London, United Kingdom.

One non-invasive treatment of Ménière disease is the consistent use of Weak Asymmetric Base-in Prism spectacles (WABIPS), as determined by the deviation from straight-ahead during walking with eyes closed after having imprinted an after-image of an Earth-fixed visual target. A report by Vente, et al, evaluated this treatment in a cohort study of 580 unilateral Ménière patients. They found 97% subjective satisfaction and reduction of vertigo, and 57% reduced or stopped concomitant medication. The present paper reports the results on a subset of this group who also experienced Migraine. Patients had to fulfill the criteria for unilateral Ménière disease according to the AAO-HNS `95 and the IHS criteria for Migraine `95. 325 patients were thereby included in the present study. Patients had to use the WABIPS permanently over a twelve-month period. After the treatment, 43% of patients with Ménière disease and migraine experienced no migraine episodes (McNemar chisquare = 78, $p<0.0001$). The explanation is based on the oculogyric illusion, (vestibular) efference copies and (ocular) re-afferent signals.