

XXXI Bárány Society MEETING



MADRID, MAY 9th-11th 2022

SP04

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SYMPOSIUM FORM

- ORGANIZER'S NAME and SURNAME: Amir Kheradmand
- ORGANIZER'S E-MAIL: akherad@jhu.edu
- ACADEMIC/HOSPITAL AFFILIATION: Johns Hopkins/Johns Hopkins Hospital
- SESSION TITLE: Vestibular perception: Updates on clinical implications from peripheral to central vestibular disorders

3 or 4 SPEAKERS PER SYMPOSIUM:

- SPEAKER 1

NAME AND SURNAME: Pieter Medendorp
TOPIC DESCRIPTIVE TITLE: Multisensory processing and sensory reweighting in bilateral vestibulopathy
ACADEMIC / HOSPITAL AFFILIATION: Radboud University/ Donders Institute for Brain, Cognition and Behaviour

- SPEAKER 2

NAME AND SURNAME: Marianne Dieterich
TOPIC DESCRIPTIVE TITLE: Neuroimaging insights into the cerebral cortical involvement in functional dizziness
ACADEMIC / HOSPITAL AFFILIATION: Ludwig-Maximilian-University/ German Center for Vertigo and Balance Disorders

- SPEAKER 3

NAME AND SURNAME: Jeffrey P. Staab
TOPIC DESCRIPTIVE TITLE: Pathological shifts in spatial perception – PPPD and vestibular migraine
ACADEMIC / HOSPITAL AFFILIATION: Mayo clinic/ Mayo clinic

- SPEAKER 4

NAME AND SURNAME: Qadeer Arshad/Amir Kheradmand
TOPIC DESCRIPTIVE TITLE: Multisensory mechanisms of dizziness in vestibular migraine/ Synopsis and Further Directions
ACADEMIC / HOSPITAL AFFILIATION: University of Leicester/ Johns Hopkins

- **A BRIEF (<300 WORDS) DESCRIPTION OF THE THEME AND TARGET AUDIENCE:**

Clinical research into the vestibular system has mainly focused on the low-level, brainstem or cerebellar mediated vestibulo-ocular functions in recent decades. Relatively little attention has been paid to the perceptual functions of the vestibular system including its role in spatial orientation, which is directly linked with the disabling symptoms of diseases affecting the vestibular system. In recent years, however, with the progress in the clinical classifications of the vestibular disorders, and the formal recognition of conditions such as vestibular migraine and persistent postural-perceptual dizziness (PPPD), the gaps in understanding higher-level vestibular functions and their link to the clinical symptoms are now more evident than ever.

In this symposium our goal is to present recent findings focused on the pathophysiology of vestibular perception and advances made in their clinical applications. Given the translational nature of this topic, both clinicians and scientists with interest in the vestibular disorders and sensory physiology will be the proper target audience for these presentations. In the first talk, Pieter Medendorp will start with the effect of peripheral vestibular loss on perception of spatial orientation, and how the findings can be applied clinically for diagnosis and development of targeted treatments. The second talk by Marianne Dieterich will discuss the neuroimaging evidence for involvement of specific brain regions in perceptual symptoms of PPPD. In the third talk, Jeffrey Staab will review the emerging concepts related to the pathophysiology of vestibular perception based on the common features in PPPD and vestibular migraine. Finally, the last talk by Qadeer Arshad will provide updates on vestibular migraine with a review of recent findings related to the pathophysiology of spatial disorientation and motion perception in these patients. At the end, Amir Kheradmand will provide a summary of scientific findings from other talks and their clinical relevance to highlight some of the key findings and 'take-home' messages.

- **A 150-WORD ABSTRACT FROM EACH OF THE SPEAKERS:**

ABSTRACT 1

Perception of spatial orientation involves a weighted fusion of visual, vestibular, proprioceptive and somatosensory signals, as well as internal beliefs. When one of these signals breaks down, such as the vestibular signal in bilateral vestibulopathy, patients can compensate by relying more on the remaining cues. How the remaining signals are reweighted in this integration process has remained difficult to quantify since the quality of these signals can typically not be measured in isolation. I will present our recent work combining experimental psychophysics with a reverse engineering approach based on Bayesian inference principles to characterize sensory reweighting in individual bilateral vestibular patients. This personalized quantification approach could aid in the diagnostics and prognostics of multisensory integration deficits in vestibular disorders, and contribute to the evaluation of the effect of rehabilitation therapies, including balance training exercises.

ABSTRACT 2

Functional dizziness is among the most common diagnoses in patients with vestibular symptoms with largely unknown pathophysiology. In this presentation I will review the recent neuroimaging studies in patients with persistent postural perceptual dizziness (PPPD), which found structural changes in the prefrontal cortex and the associated thalamic projection zones. With respect to the visual functions, the patients showed increased visual motion-induced activity and aftereffect in the anterior cingulum compared to healthy controls. The results agree with the features of dizziness in PPPD, including excessive self-awareness, anxious appraisal, and obsessive controlling of posture. These findings indicate that the symptoms are caused not only by aberrant processing in the cortical visual or vestibular regions, but they also involve the networks that contribute to mood regulation, fear generalization, and interoception as part of the pathophysiology.

ABSTRACT 3

Persistent postural-perceptual dizziness (PPPD) and vestibular migraine (VM) are two of the most common diagnoses in tertiary neurotology. Both are associated with increased sensitivity to space-motion stimuli. In physiological studies, patients with PPPD and VM showed increased sensitivity to complex or moving visual stimuli compared to healthy controls. Patients with VM also showed increased sensitivity to head tilt. In resting state and task-driven functional MRI studies, patients with PPPD compared to healthy controls had reduced activity and connectivity in vestibular cortex and hippocampus, but increased activity and connectivity in frontal and occipital regions. In a PET

study, two patients with VM had increased activity in the vestibular cortex and decreased activity in visual areas during attacks. Thus, patients with PPPD and VM both demonstrate alterations in perception of space-motion information, though underlying brain mechanisms may involve differential hypersensitivity to visual and vestibular stimuli.

ABSTRACT 4

Patients with vestibular migraine typically have a normal vestibulo-ocular examination with no sign of peripheral vestibular dysfunction. Further, objective laboratory testing of peripheral vestibular function is unremarkable, implying that dizziness in these patients is mediated by higher-level central mechanisms. Accordingly, elucidating the neural correlates of spatial disorientation in vestibular migraine and the link with dizziness in these patients is a research priority, as it can open the window to novel therapeutic strategies. This presentation will focus on recent findings in vestibular migraine related to multisensory mechanisms that contribute to spatial disorientation and altered weighting of visual and vestibular signals that contribute to motion misperception in these patients. We will also address the clinical gap related to lack of objective measures of dizziness in vestibular migraine and how the approaches outlined here can be applied to develop biomarkers for diagnosis, track recovery, or evaluate the effects of treatments in these patients.