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RADIOLOŠKE KARAKTERISTIKE BILATERALNOG VESTIBULARNOG NEURITISA

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IMAGING FEATURES OF BILATERAL VESTIBULAR NEURITIS
Radiološke karakteristike bilateralnog vestibularnog neuritisa

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Running title: Imaging of Bilateral Vestibular Neuritis
Abstract

**Background:** Magnetic resonance imaging (MRI) was found to be insensitive diagnostic modality in detecting the abnormalities in patients with vestibular neuritis.

**Case presentation:** A 32-year-old man was admitted to the hospital with clinical signs of acute vestibular neuritis. Conventional MRI was inconclusive, including 3mm slice-thickness postcontrast study, while postcontrast high resolution study with 1mm slice-thickness, detected bilateral enhancement of the vestibulocochlear nerve’s vestibular branch, consistent with inflammation.

**Conclusion:** High-resolution 1mm or submilimeter slices should be performed to evaluate patients with vestibular neuritis in order to increase the MRI sensitivity and improve correlation with clinical findings.

Sažetak

**Uvod:** Smatra se da magnetno-rezonantni imidžing (MRI) nije dovoljno osetljiva dijagnostička metoda za detekciju poremećaja kod pacijenata sa kliničkom slikom vestibularnog neuritisa.

**Prikaz bolesnika:** Tridesetdvogodišnji muškarac je primljen u bolnicu sa kliničkom slikom akutnog vestibularnog neuritisa. Na snimcima konvencionalnog MR pregleda, uključujući i postkontrastne snimke debljine 3mm, nisu uočene patološke promene. Na postkontrastnim snimcima visoke rezolucije, debljine preseka 1mm, uočeno je postkontrastno pojačanje intenziteta signala vestibularne grane oba vestibulokohlearna nerva, što je nalaz karakterističan za inflamaciju.

**Zaključak:** Za evaluaciju pacijenata sa znacima vestibularnog neuritisa, a u cilju povećanja senzitivnosti MR pregleda, neophodno je koristiti snimke visoke rezolucije, debljine preseka 1mm, ili submilimetarske preseke.
Keywords: Vestibulocochlear Nerve; Ear, Inner; Neuritis; Magnetic Resonance Imaging; Inflammation;

Background

Vestibular neuritis (VN) still appears to be a controversial disease in clinical practice, with an unclear definition. According to Slivoniemi, the syndrome of VN is confined to the vestibular system with preserved hearing, while in labyrinthitis, reduced or distorted hearing in association with vertigo is evident (1). However, Murofushi et al. also detected the involvement of the labyrinth in patients with clinical VN with or without inferior vestibular nerve involvement, using galvanic vestibular evoked myogenic potentials, supporting the hypothesis that VN could be caused by labyrinthine lesions. This observation suggested potential renaming of VN into "vestibular neurolabyrinthitis". Imaging findings, however, have not been supporting the opinion of Murofushi (2). The data in the literature strongly suggested that the sensitivity of magnetic resonance imaging (MRI) in the detection of VN was rather poor, both on plain and contrast-enhanced MRI studies. The aim of this report is to prove the unequivocal role of high-resolution MRI in detecting the involvement of vestibular system and labyrinth in patients with clinical VN.

Case presentation

A 32-year-old man was admitted to the hospital with clinical signs of acute rotatory vertigo, nausea, and vomiting. There was no hearing loss, tinnitus or other hearing disturbances. Cardiopulmonary examination detected no abnormalities. Clinical otoneurologic examination revealed the presence of horizontal rotatory nystagmus. Dix-Hallpike test for benign paroxysmal positional vertigo was negative. Video head impulse test of the lateral semicircular canal found the gain of the vestibulocochlear reflex of 0.46
on the right and 0.89 on the left. Computerized tomography of the brain and skull base revealed no abnormalities. Betahistine dihydrochloride (Betaserc) in a dosage of 24mg/7 days was prescribed. On the control examination, the gain of vestibulocochlear reflex was 0.55 on the right and 0.89 on the left. Viral tests were negative on herpes simplex virus, type 1 (IgM 0.14 - normal range if less than 1.2, IgG 2.0, - normal range if less than 5 arbU/ml). IgM on Ebstein-Barr virus was 0.5 (normal range if <0.8), while IgG was positive - 2.91 (normal range if <0.8). IgM on adenovirus was 0.3 (normal range if <0.8), while IgG was slightly positive - 1.41(normal range if <1.1). No improvement was evident on follow-up otologic examination and MRI scan of temporal bones was ordered.

Conventional head MRI protocol included 5mm slice thickness T1W, T2W, FLAIR images in the axial plane and coronal T2W images, as well as diffusion-weighted imaging in the axial plane (slice thickness 5 mm, TR 4900 ms, TE 111 ms, b0, 500, 1000 mm2/s). For the detailed evaluation of inner ear structures the MRI protocol was complemented with constructive interference in steady-state – 3D CISS (slice thickness 0.7 mm, TR 8.4 ms, TE 3.4ms), axial T1W fat sat (slice thickness 3 mm, TR 700 ms, TE 8.9 ms) and contrast-enhanced T1W fat sat sequence in axial and coronal planes as well as sagittal three-dimensional T1-weighted gradient echo MPRAGE sequence (slice thickness 1 mm, TR 1450 ms, TE 4.7 ms). MPRAGE sequence clearly detected marked contrast enhancement of the vestibular branch of the vestibulocochlear nerves bilaterally (Figure).

**Discussion**

In patients with VN, MRI is usually ordered to exclude other neurologic disorders, since it was found to be insensitive in confirming the presence of the disease itself. Strupp et al. did not detect contrast enhancement of the labyrinth, vestibulocochlear nerve or vestibular ganglion, in any of the 60 patients with acute idiopathic VN (confirmed by clinical
examination and caloric irrigation), even when high doses of gadolinium (0.2 mmol/kg) were administered. In that study, high-resolution MRI was performed between days 3 and 30 after symptoms' onset (3). Hasiuke at al. also reported no MRI abnormalities in all 8 patients with VN (4). The only report in the literature, showing that postcontrast MRI might be useful in the detection of vestibular nerve enhancement in patients with VN, was published by Karlberg et al. This study was performed on 3T scanner, with a slice thickness of 2mm (5). We also found postcontrast images with a slice thickness of 3mm inconclusive in our patient, but 1 mm slice thickness MPRAGE sequence detected bilateral involvement of the vestibulocochlear nerves. Fundakowski et al. found decreased size in both vestibular nerve cross-sectional area and height in patients with VN measured on parasagittal 3D CISS MRI (6). Recently, the profiles of afferent dysfunction in a cross section of patients with acute VN was characterized, using the tests of otolith and semicircular canal function, sensitive to each of the five vestibular end organs. Acute vestibular neuritis most often affects both vestibular nerve divisions. The horizontal canal-plane video head impulse tests alone identified superior nerve dysfunction in all patients with vestibular neuritis tested acutely, whereas both cervical/vestibular evoked myogenic potentials and posterior canal-plane video head impulse tests were necessary for diagnosing inferior vestibular nerve involvement (7). Another unusual finding in our patient was bilateral involvement, very atypical for classical unilateral VN. Bilateral involvement could be associated with autoimmune processes, like rheumatoid arthritis, Cogan’s syndrome, polychondritis or lupus erythematosus. In our patient, no acute infection could have been associated with acute vestibulopathy, while IgG on Ebstein-Barr virus was markedly positive. Several studies on immune-mediated sensorineural hearing loss detected IgG antibodies against the membranous labyrinth. The pathogenicity of these antibodies remained unclear, however, their appearance seemed to suggest organ-specific immune dysregulation (8-11).
Nevertheless, diagnosis of autoimmune inner ear disorders is still problematic due to lack of universally accepted set of diagnostic criteria or diagnostic test.

**Conclusions**

This report challenges the reevaluation of the current approach to high-resolution MRI role in the evaluation of patients with VN. This appears to be the second report suggesting that <3mm thin slices do increase the sensitivity of detection of vestibular nerves involvement on postcontrast MRI studies. Bilateral involvement documented by high-resolution MRI supports the consideration of VN as an immune-related vestibular neuropathy in certain circumstances.

**REFERENCES:**


Figure legends

No abnormalities evident on conventional – 3 mm slice thickness postcontrast T1W fat sat sequence (A) and 3D CISS, 0.7 mm slice thickness (B). Marked contrast enhancement of the vestibulocochlear nerves bilaterally on postcontrast 1 mm slice thickness MPRAGE sequence in axial (C), and coronal plane (D).