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Medizinische Fakultät Mannheim
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Topographical MRI Characteristics of the Medial Longitudinal Fasciculus in Internuclear Ophthalmoplegia in Patients with Multiple Sclerosis or Ischemic Stroke

Autor: Marie Therese Kleinsorge
Institut / Klinik: Neurologische Klinik
Doktorvater: Prof. Dr. P. Eisele

Background and Purpose
Internuclear ophthalmoplegia (INO) is a dysfunction of conjugate eye movements caused by lesions affecting the medial longitudinal fasciculus (MLF). Multiple sclerosis (MS) and acute ischemic stroke represent the most common patho-physiologies. While magnet resonance imaging (MRI) allows for localizing lesions affecting the MLF, comprehensive comparative studies exploring the potential different spatial characteristics of lesions affecting the MLF are still lacking.
Methods
The study group retrospectively investigated MRI examinations of 82 patients – 40 patients with MS and 42 patients with acute ischemic stroke. For lesion localization, the brainstem was segmented into representative levels: ponto-medullary junction, mid pons, upper pons, and mesencephalon. Lesions affecting the MLF were observed and assigned to brainstem levels and lateralization.
Results
Bilateral INO was significantly more frequent in MS compared to ischemic stroke (MS patients: 22/40 vs. stroke patients: 0/42; $p < 0.001$). Corresponding lesions affecting the MLF were observed in 29/40 (72.5%) MS patients and in 38/42 (90.5%) of the ischemic stroke cohort. Compared to the ischemic stroke group, the MS cohort showed significantly more lesions in multiple locations ($p < 0.001$). Ischemic stroke patients presented with more lesions at the level of mesencephalon ($p < 0.001$). Lesion load at the levels of the ponto-medullary junction, mid and upper pons did not statistically differ between the groups ($p > 0.05$ for all comparisons).
Conclusion
Our results demonstrate that multiple lesions affecting the MLF make inflammatory-demyelination due to MS more likely, while lesions localization at the level of the mesencephalon favors ischemia.