

**Introduction of novel mesoscopic MRI diffusion parameters
for diagnosis of cervical myelopathy –
First results of a prospective observational trial**

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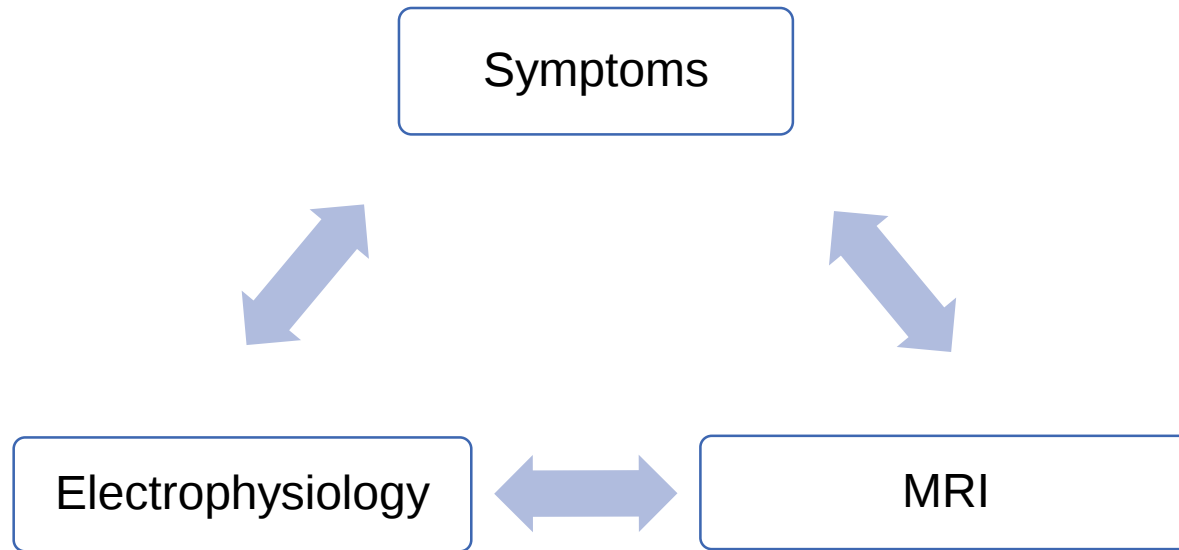
Disclosures

- Our work received funding from the German Spine Foundation (number 12/2017)

Introduction & Background

Problem:

Restricted „Matching“ of the single diagnostic parameters in DCM



Materials and Methods

AIM: Development of novel imaging parameters to improve the correlation between clinical symptoms and imaging

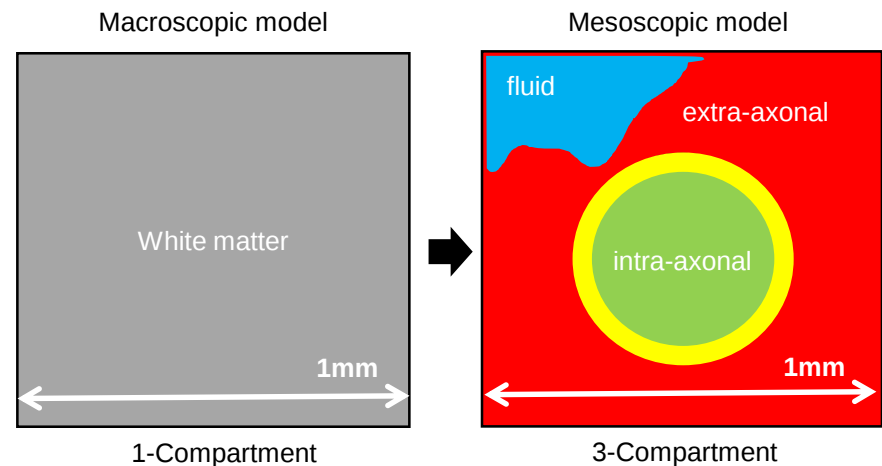
Microstructural Diffusion-based Imaging (MIDI)

Specific, high-resoluted, spinal cord
Diffusion-based Imaging
with **Subvoxelanalysis**¹

In-house machine-learning based
post-processing pipeline

Analyzed parameters:

Volume intra-/extra-axonal/free fluid
Axial / Radial Diffusivity intra-/extra-axonal



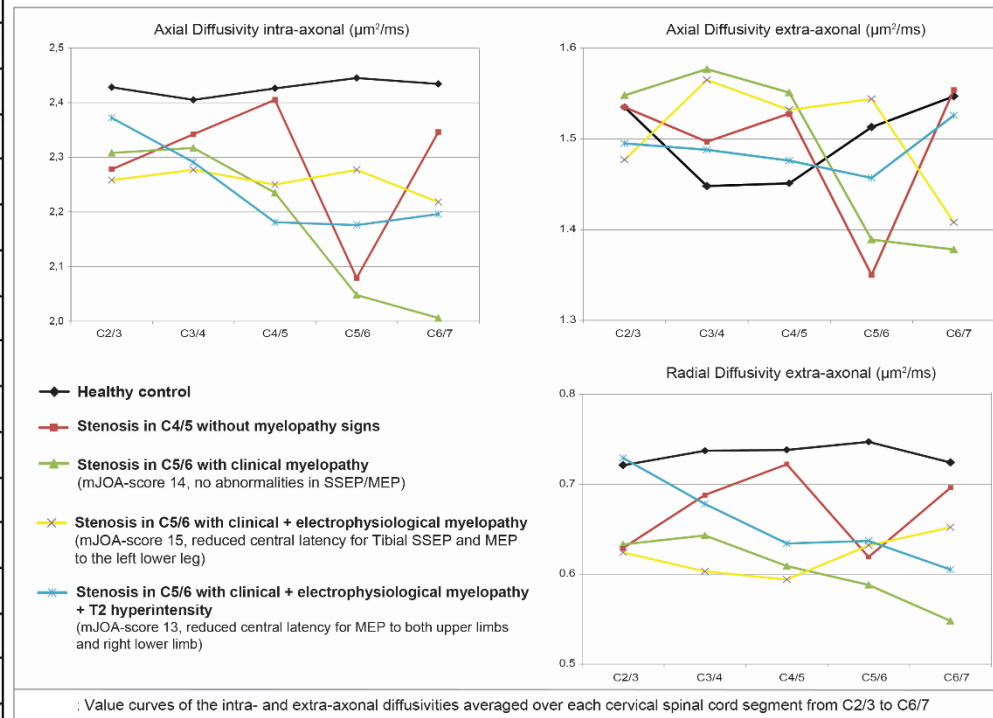
¹ Reisert M, Kellner E, Dhital B, Hennig J, Kiselev VG. Disentangling micro from mesostructure by diffusion MRI: A Bayesian approach. Neuroimage. 2017 Feb 15;147:964-975.

Results

Exemplary 4 patients in different stages of DCM and 1 healthy control

	Mesoscopic compartment	Averaged volume fractions		Difference
		C2/3 level	stenotic level	
Healthy control	V_i	0.341	0.341*	0
	V_e	0.367	0.393*	+0.026
	V_f	0.306	0.274*	-0.032
Patient with stenosis in C4/5 without myelopathy signs	V_i	0.352	0.353	+0.001
	V_e	0.136	0.183	+0.047
	V_f	0.550	0.496	-0.054
Patient with stenosis in C5/6 with clinical myelopathy	V_i	0.297	0.206	-0.091
	V_e	0.279	0.098	-0.181
	V_f	0.446	0.723	+0.277
Patient with stenosis in C5/6 with clinical + electrophysiological myelopathy	V_i	0.398	0.351	-0.047
	V_e	0.230	0.229	-0.001
	V_f	0.399	0.444	+0.045
Patient with stenosis in C5/6 with clinical + electrophysiological myelopathy + T2 hyperintensity	V_i	0.210	0.149	-0.061
	V_e	0.377	0.219	-0.158
	V_f	0.429	0.654	+0.225

Table 1: Evaluation of changes of the volume fractions of all three mesoscopic compartments in patients with different stages of DCM. **Volume changes of more than 10%** are marked in bold type. (V_i = volumen intra-axonal, V_e = volumen extra-axonal, V_f = volume free water, *reference stenotic level for healthy patients was defined at C5/6).



Discussion

- Novel mesoscopic diffusion MRI parameters for patients with DCM
- Ongoing prospective observational trial² for clinical and electrophysiological correlations
 - Up to now 105 patients and 20 healthy probands included
 - Volume displacement seems to be the most sensitive parameter
 - Further results scheduled for 2022
- Long-term reliable imaging to indicate surgical treatment and for estimation of prognosis in DCM affected patients

² Hohenhaus M, Egger K, Klingler JH, et al. Is Microdiffusion Imaging Able to Improve the Detection of Cervical Myelopathy? Study Protocol of a Prospective Observational Trial (MIDICAM-Trial). BMJ Open. 2019;9(9):e029153.

36th ANNUAL MEETING

CERVICAL SPINE RESEARCH SOCIETY – EUROPE

