Differentiating Axonal from Demyelinating Neuropathies using Multiparametric Quantitative MRI of Peripheral Nerves

Jacob D. Baraz  
Wayne State University School of Medicine, hi2873@wayne.edu

Stephanie Xuan  
Wayne State University School of Medicine, syxuan@wayne.edu

Sadaf Saba  
Wayne State University School of Medicine, ssaba@med.wayne.edu

Xue Yang  
Wayne State University School of Medicine, hb4381@wayne.edu

Ryan Castoro  
Wayne State University School of Medicine, rcastoro@wayne.edu

See next page for additional authors  
Follow this and additional works at: https://digitalcommons.wayne.edu/som_srs

Part of the Bioimaging and Biomedical Optics Commons, Nervous System Commons, Nervous System Diseases Commons, Neurology Commons, and the Radiology Commons

Recommended Citation
Baraz, Jacob D.; Xuan, Stephanie; Saba, Sadaf; Yang, Xue; Castoro, Ryan; Xuan, Yang; Roth, Alison; Dortch, Richard D.; Li, Jun; and Chen, Yongsheng, "Differentiating Axonal from Demyelinating Neuropathies using Multiparametric Quantitative MRI of Peripheral Nerves" (2023). Medical Student Research Symposium. 284.  
https://digitalcommons.wayne.edu/som_srs/284

This Research Abstract is brought to you for free and open access by the School of Medicine at DigitalCommons@WayneState. It has been accepted for inclusion in Medical Student Research Symposium by an authorized administrator of DigitalCommons@WayneState.
Authors
Jacob D. Baraz, Stephanie Xuan, Sadaf Saba, Xue Yang, Ryan Castoro, Yang Xuan, Alison Roth, Richard D. Dortch, Jun Li, and Yongsheng Chen
Differentiating Axonal from Demyelinating Neuropathies using Multiparametric Quantitative MRI of Peripheral Nerves

Jacob Baraz,1 Stephanie Xuan,1 Sadaf Saba,1 Xue Yang,1 Ryan Castoro,1 Yang Xuan,2 Alison Roth,3 Richard D. Dortch,3 Jun Li,4 and Yongsheng Chen1

1Neurology, 2Radiology, Wayne State University School of Medicine, Detroit, MI, USA. 3Division of Neuroimaging Research, Barrow Neurological Institute, Phoenix, AZ, USA. 4Neurology, Houston Methodist Research Institute, Houston, TX, USA.

Grant Support: NIH R61NS119434, NIH R21TR003312

Objectives: To develop a multiparametric quantitative MRI (qMRI) method to track pathological changes in the peripheral neuropathies.

Background: Irrespective of the causes or types of polyneuropathies, peripheral nerves are mainly afflicted by two kinds of pathologies – axonal loss and demyelination. It is critical to differentiate between the two as treatments are different for the two conditions. While nerve conduction studies (NCS) have been used to differentiate the two pathologies in the distal nerves, there are no tools to probe the pathologies in the proximal peripheral nerves. This is particularly needed when distal nerves become non-responsive in NCS.

Methods: We have developed a qMRI method that quantifies the sciatic and tibial nerves with 10 parameters that are sensitive to different aspects of myelin and axonal pathologies: magnetization transfer ratio (MTR), magnetization transfer saturation index (MTsat), longitudinal relaxation time (T1), proton density (PD), effective transverse relaxation time (T2*), fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), radial diffusivity (RD), and nerve fascicular volume (fVol). In this pilot study, we studied 4 patients with Charcot-Marie-Tooth type-1A (CMT1A), 2 patients with CMT type-2S (CMT2S), and 17 healthy controls.

Results: Compared with the healthy controls, patients with CMT2S (axonal type) had a comparable MTR, MTsat, T1, PD and fVol, but a reduced T2*. While patients with CMT1A (demyelinating type) had a reduced MTR and MTsat, increased fVol, T1 and PD, and comparable T2*. All 6 patients with CMT shared a change in reduced FA, which was driven by a reduced AD and an increased RD.

Conclusions: The data show different qMRI patterns between axonal and demyelinating neuropathies. The differential changes will be further verified in a larger cohort of patients with peripheral neuropathies.