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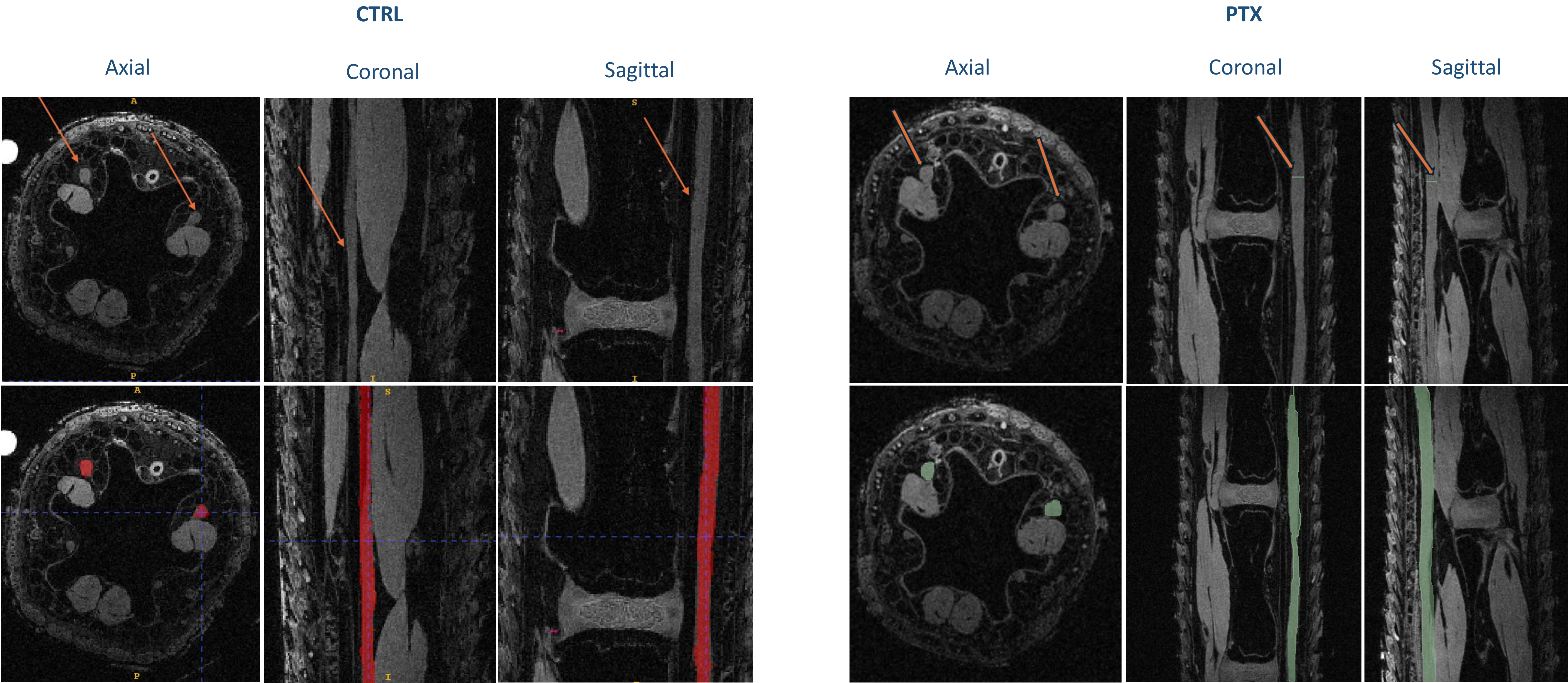
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Background:

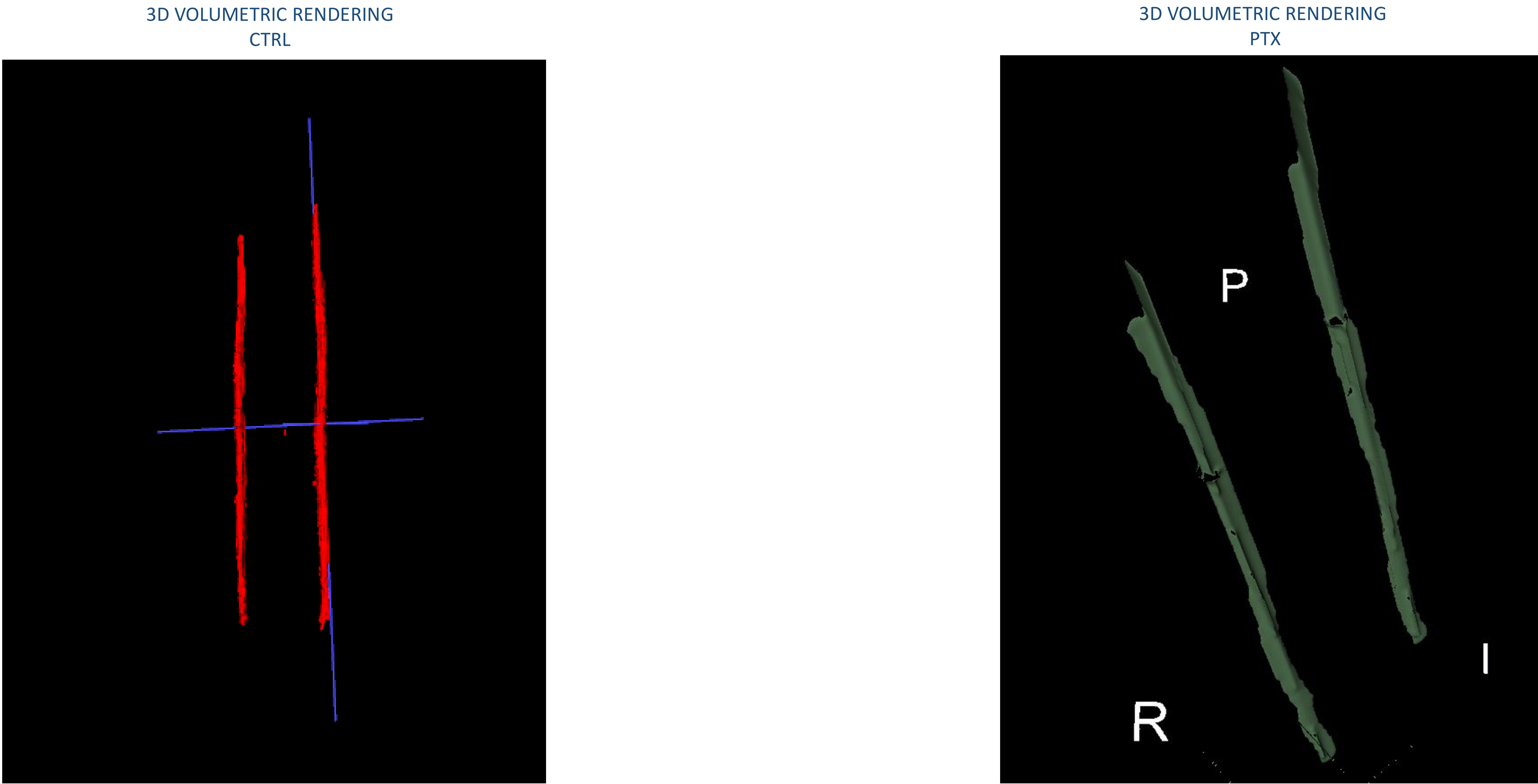
Peripheral neuropathies (NPs) are common conditions for which assessment, diagnosis, and long- term follow-up still present some challenges. Preclinical animal models are pivotal in filling these gaps and reliable translational outcome measures are crucial; in this regard, the role of neuroimaging is not fully established yet. High-resolution diffusion MRI holds promise as an early biomarker for detecting morphological changes in the peripheral nervous system. In a pilot experiment, feasibility of volumetric MRI rendering of the caudal nerve was assessed in a rat axonopathy model.

Materials and methods:

Axonal damage was induced using Paclitaxel (PTX, 10 mg/kg, 1qwx4, iv); treated animals were compared to vehicle-treated controls (VEH, iv). Axonopathy was confirmed via nerve conduction studies (NCS): in PTX animals, sensory nerve action potential was statistically significant reduced in a length-dependent way; moreover, light microscopy of the whole tail, light microscopy of the isolated ventral caudal nerve and electron examination microscopy of the isolated ventral caudal nerve were consistent with these findings showing mild axonal loss at the tail base, progressing to severe axonal degeneration from mid-tail onward, with only remnants of fibers in the most distal segments, correlating with absent NCS traces. Post- mortem, rat tails were formalin-fixed and imaged with 7T MRI. T1W sequences (50×50×50 μm<sup>3</sup> voxel size) and diffusion-weighted imaging (DTI) with five b-value shells (b = 500–2000–4500– 6000–8000 sec/mm<sup>2</sup>, 15–24–33–42–51 gradient directions, 125×125×125 μm<sup>3</sup> voxel size) were acquired.



Results:



Conclusions:

Volumetric rendering using 3D Slicer (3D Slicer 5.7.0-2025, Boston, MA, USA) of the caudal nerves was successfully performed in both groups, enabling 3D visualization of fine structures. In conclusion, this feasibility study supports using 7T MRI as a translational tool to monitor and study NPs.

References:

1. Pozzi E, Monza L, Ballarini E, Bossi M, Rodriguez-Menendez V, Canta A, Chiorazzi A, Carozzi VA, Crippa L, Marmiroli P, Cavaletti G, Alberti P. Morpho-Functional Characterisation of the Rat Ventral Caudal Nerve in a Model of Axonal Peripheral Neuropathy. Int J Mol Sci. 2023 Jan 14;24(2):1687 . Doi: 10.3390/ijms24021687 . PMID: 36675203; PMCID: PMC9863172