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Magnetic Resonance Neurography: redefining the diagnostic frontier in musculoskeletal disease

Theodoros Soldatos*

IASIS Diagnostic Center, 24134 Kalamata, Greece

***Correspondence:** Theodoros Soldatos, IASIS Diagnostic Center, 24134 Kalamata, Greece. soldatos@gmail.com
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The diagnostic approach to peripheral nerve disorders has long been dominated by the "black box" of physical examination and the functional, yet anatomically silent, findings of electrodiagnostic tests (NCS/EMG). However, we are currently witnessing a paradigm shift. As we launch this special issue of *Exploration of Musculoskeletal Diseases*, we celebrate the transition of Magnetic Resonance Neurography (MRN) from a specialized research interest to an indispensable pillar of clinical practice.

The precision revolution

The "Advances" highlighted in this issue represent more than just incremental improvements in signal-to-noise ratios. The integration of 3D isotropic imaging and high-gradient 3T (and 7T) systems has allowed us to peel back the layers of the nerve, moving beyond simple swelling or signal intensity to visualize fascicular architecture. We are no longer just identifying if a nerve is injured, but where and how, at a microscopic level.

Bridging the gap: techniques and clinical utility

A recurring theme in this collection is the marriage of quantitative MRN with surgical outcomes. Techniques such as diffusion tensor imaging (DTI), which provides a window into the microstructural integrity of the axon, and T2 mapping, which offers a biomarker for nerve regeneration and chronic inflammation that predates clinical recovery, are not merely "academic" tools. They are the keys to solving the most frustrating clinical dilemmas: distinguishing a post-operative scar from a recurrent neuroma, or determining the optimal timing for surgical intervention in a traumatic brachial plexus injury.

The road ahead: AI and the "Living" map

As Guest Editor, I am particularly excited by the papers herein that discuss the integration of artificial intelligence (AI). The automation of nerve segmentation and the application of radiomics are poised to remove the "subjective" barrier of MRN interpretation. By standardizing how we quantify nerve health, we move closer to a future where a "Nerve Health Score" is as common as a bone mineral density report.

Conclusion

This special issue serves as both a roadmap of our current achievements and a compass for our future research. The "Best of the Best" in MRN is not defined solely by the strength of the magnet, but by the clarity of the clinical answers we provide to our patients. It is my hope that the insights shared in these pages will inspire further cross-disciplinary collaboration between radiologists, neurologists, and surgeons.

Peripheral nerves are no longer hidden; the map is drawn. It is now up to us to refine the navigation.

Declarations

Author contributions

TS: Writing—original draft, Writing—review & editing. The author read and approved the submitted version.

Conflicts of interest

Theodoros Soldatos, who is the Editorial Board Member and Guest Editor of Exploration of Musculoskeletal Diseases, had no involvement in the decision-making or the review process of this manuscript.

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