MR Neurography and MR Tractography of the Brachial Plexus

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The Brachial Plexus (BP) represents an important neural structure that provides motor and sensitive innervation of the upper extremity. Brachial plexus injury is one of the most common injuries in young people of working age, causing socio-economic problems and psychiatric disorders. The goal of the proposed study is to optimize, improve and develop new techniques for imaging of the brachial plexus using qualitative and quantitative advanced MRI methods including structural 3D MR Neurography (MRN) and Diffusion Tensor Imaging (DTI). MRN provides an excellent evaluation of the 3D anatomy of peripheral nerves in multiple planes. DTI methods can be used to assess the microstructure of axonal bundles and to depict the integrity of brachial plexopathies based on diffusion properties of the PB tissue.

Methodology: 12 subjects (8 controls/4 patients with root avulsions) underwent MR examination on a 3T MR scanner with DWI using Spin-Echo Echo-Planar Imaging (SE-EPI) sequence, and 3-dimensional T2-weighted STIR sequence used for high-resolution MRN. The MRN was performed in MedINRIA and post-processed using the Maximum Intensity Projection (MIP) method to demonstrate BP tracts in multiple planes. Fiber tracking of the BP was performed using DSI studio and the DTI data was calculated to extract diffusion parameters (e.g. Fractional Anisotropy (FA), Mean Diffusivity (MD), etc.) from the left and right sides of the BP. Data were statistically analyzed using the paired-sample T-test.

Findings: The T-test showed no significant effect of laterality in diffusion parameters (NS = $p > 0.05$) of the brachial plexus in control subjects. Representative MRN and MRT are shown in figure1. The above-mentioned methods are challenging and not yet well-established in clinical practice, but have the potential to help in decision making in many neuropathies and plexopathies in terms of correct diagnosis establishment, conservative versus surgical treatment, presurgical planning, and post-operative follow-up.

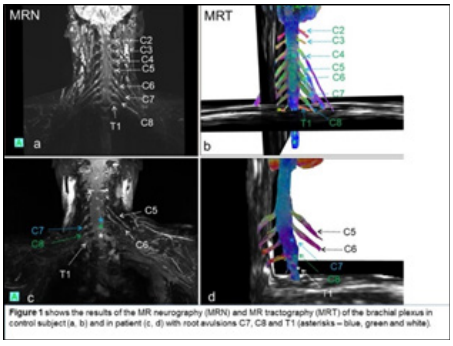

Figure 1 shows the results of the MR neurography (MRN) and MR tractography (MRT) of the brachial plexus in control subject (a, b) and in patient (c, d) with root avulsions C7, C8 and T1 (asterisks – blue, green and white).

Biography

Ibrahim Ibrahim is graduated from Charles University of Medicine, Prague, Czech Republic (field of study: Medical Technology and Informatics, Master's Degree, MSc. (2004), and completed his doctoral study in Medical Biophysics, Ph.D. (2012)), He interested in all aspects of Neurology, though has specific interests in Peripheral Nerve Disorders (Brachial and Lumbosacral Plexopathies) and their imaging using advanced MRI techniques using MR Tractography (MRT) and MR Neurography (MRN).

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