MRI Depiction and Quantification of Blood-Spinal-Cord-Barrier Permeability after Spinal Cord Contusion Injury

M. Rossmann[1], Z. Majdisova[2], P. Szomolanyi[2], E. Sezemsky[1], M. Brejnikow[1], R. Schmidhammer[1], S. Trattnig[2], H. Redl[1], N. Walder[1]

[1]) Ludwig Boltzmann Institute for Experimental and Clinical Traumatology in the Research Center of the AUVA, Vienna, Austria, Austrian Cluster for Tissue Regeneration

[2]) MR Center of Excellence, Department of Radiology, Medical University Vienna, Vienna, Austria, Austrian Cluster for Tissue Regeneration

Objectives: *The Blood-Spinal-Cord-Barrier (BSCB) represents a selective physiologic barrier that provides a stable microenviroment within the neuronal tissue. Spinal cord injury (SCI) causes a BSCB breakdown, which results in increased capillary-permeability for plasma molecules that increase neuronal damage as well as for intravenously administered neuroprotective drugs. Here we used contrast enhanced MRI to determine evolution and duration of BSCB-breakdown after standardized SCI and define the "therapeutic window" for this injury model.* ***Materials/Methods:*** *In male Sprague-Dawley rats, a laminectomy was carried out at TH11 and a contusion injury was inflicted, using the IH® Impactor with a force of 150kdyn. Rats were divided into groups with different observation times: 0h (n=8); 24h, 72h, 4d, 5d, 6d, 10d (n=5 each). At the end of the observation time each rat received an intravenous injection of 0.8ml/kg gadopentetate dimeglumine (Magnevist®, Bayer HealthCare). Rats were euthanized 10 minutes (0h group, n=3) or 1 hour after contrast agent administration and MRI was performed on a 3Tesla scanner.* ***Results:*** *Pronounced signal enhancement at the injury epicenter was measured after observation periods up to 5 days, gradually decreasing in cranial and caudal direction. After 6 days or later, no signal enhancement was visible. When euthanization and MRI were performed 10 minutes after contrast agent application, the measurement revealed lacking signal enhancement at the lesion site, whereas adequate distribution of contrast agent within the neuronal tissue and strong signal enhancement could be observed 1 hour after contrast agent application.* ***Conclusion:*** *The inflicted SCI increases BSCB-permeability for 5 days. Delayed dispersion of the contrast agent within the neuronal tissue has to be considered.*