Immuno- and serological evaluation of neurodegeneration after spinal cord injury (SCI) and the potential impact of high oxygen therapy

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Several epitopes on the neurofilament light chain (NF-L) are exposed by degeneration induced proteolysis and are specifically recognized by Degenotag™ type antibodies, novel reagents for visualizing neurodegeneration (PMID 37091583). We used a rat cervical (C4) contusion SCI model to compare the time course of NF-L release into serum (Quanterix® Simoa™ NF-L assay) with spinal cord staining quantified with the NF-L Degenotag™ MCA-6H63 antibody (RRID Ab_2923484). Spinal cords and serum were collected at intervals from 1 hr - 10 days post-SCI. Serum NF-L and spinal MCA-6H63 staining peaked at 1-3 days. Serum NF-L values correlated with the number of MCA-6H63 positive axons (R^2=0.739; p<0.0001). We also examined the impact of hyperoxia on the injured spinal cord. We previously demonstrated that hyperbaric oxygen delivered at acute (min-hrs) through sub-acute (days) times after SCI can partially mitigate neuronal loss (PMID: 35152735). Subsequent work suggested that normobaric oxygen may have similar impact (PMID: 38110993). Thus, adult rats were treated with normobaric hyperoxia (100% O_2, 2 hours) within 20 min of C4 contusion and daily for 7 days. Cords were harvested on day 14 and analyzed ± 2 mm from the lesion epicenter by staining with an antibody to neuronal nuclear protein (NeuN). Hyperoxia treated rats (n=3) had an approximately 30% increase in neuronal counts vs. sham (n=3). Ongoing work will examine MCA-6H63 staining after hyperoxia treatments. This work demonstrates the utility of serum NF-L as a biomarker axonal degeneration and suggests that normobaric hyperoxia treatments in the acute through sub-acute period may provide benefit.

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