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An Electron Microscope Study Of The Effects Of Decompression On The Spinal Cord And Hippocampus In The Rat: Preliminary Results

Dror Ofir[a], Eitan Kimmel[b], Dvir Menajem[a], Yehuda Arieli[a]

[a]Israel Naval Medical Institute, and

[b]Department of Bio-medical engineering, Technion-Israel Institute of Technology, Haifa, Israel

Introduction

There are a number of reports on the vulnerability of the spinal cord to decompression stress, but less on the sensitivity of the hippocampus. The purpose of the present study was to compare the effect of decompression from 8 or 10 ATA (bottom time 30 min) on the cellular structure of the hippocampus and the spinal cord.

Methods

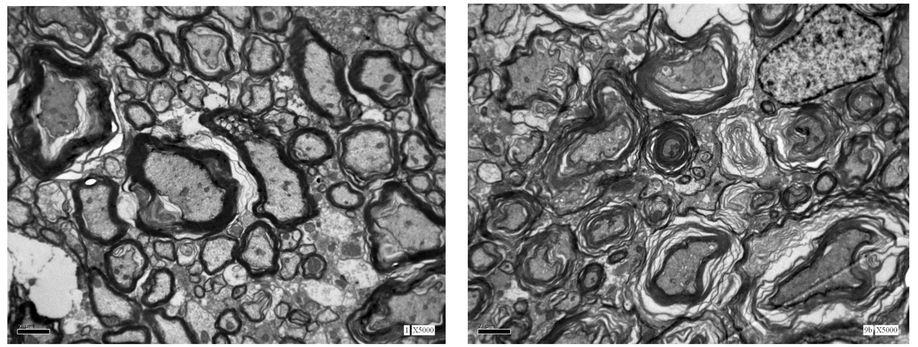
Ten male Sprague-Dawley rats (3 control, 7 experimental) weighing about 300 g were exposed to different dive protocols (no pressure, 8 ATA, 10 ATA, for 30 min). Animals were rested for 10-60 minutes outside the hyperbaric chamber and then anesthetized. Perfusion fixation was performed through the heart with paraformaldehyde 4%. The hippocampus and spinal cord were removed for electron microscope evaluation. Slides were analyzed with a magnification of 5,000 – 10,000. Myelinated axons were defined as small (≤2 µm) or large (>2 µm). Each axon was scored according to the level of conservation of the myelin architecture (normal, moderate, poor).

Table 1: Summary of analyzed myelinated axons

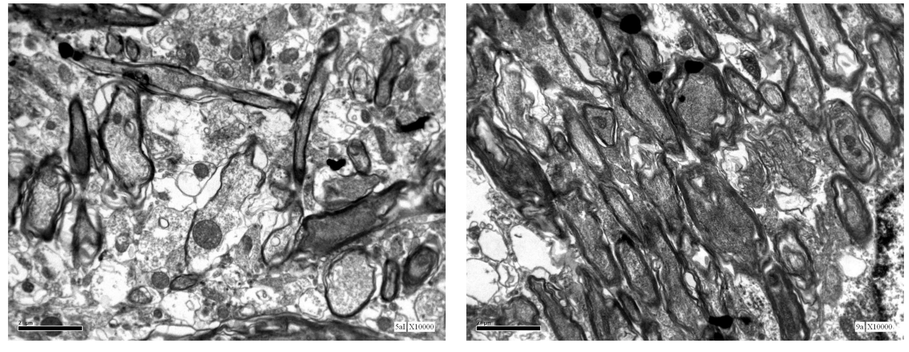
	Spinal Cord		Hippocampus	
	Large	Small	Large	Small
Control	103 (31%)	208 (69%)	0	179 (100%)
Decompression	113 (18%)	521 (82%)	3 (1%)	594 (99%)

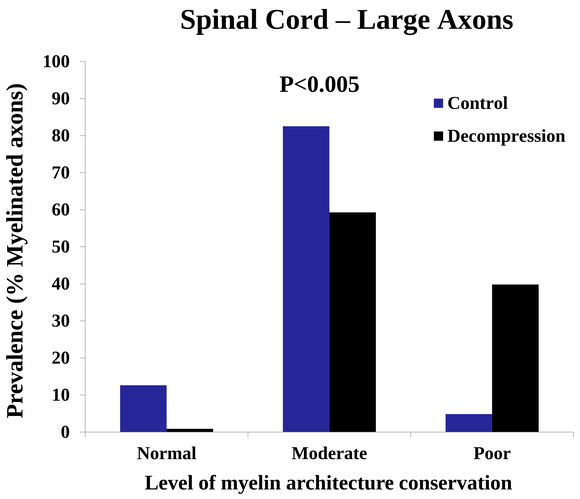
Large >2 µm; Small<2 µm.

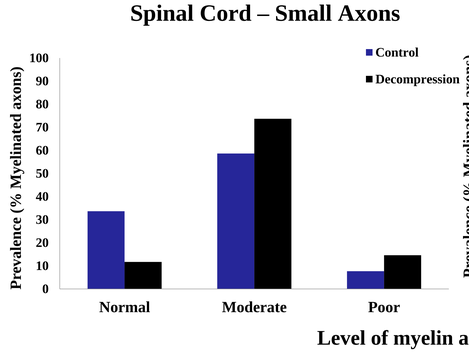
Control **Spinal Cord** Decompression

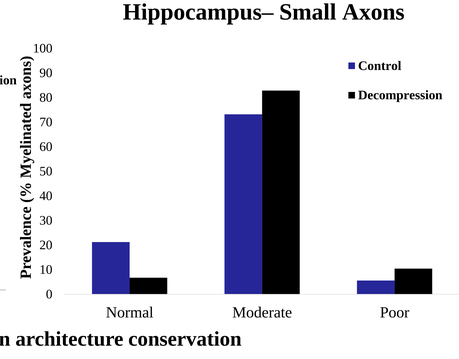


Control **Hippocampus** Decompression









Level of myelin architecture conservation

Conclusions

- These preliminary results suggest that myelin, due to its unique structure, is a major site for decompression- induced destruction.
- These structural changes may involved significant spinal cord decompression symptoms.
- The myelin structure was more vulnerable in axons having a diameter greater than 2 µm.
- Larger axons with a corresponding volume of myelin (80% fat) may attract nitrogen during pressure exposure.
- The hippocampus may be partially protected against major structural changes in myelinated neuron cells due to its having only small axons.