



Characterization Intraspinal Pressure Following Traumatic Rodent Spinal Cord Injury

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Introduction

Worldwide, approximately 500,000 individuals suffer from traumatic spinal cord injury (SCI) annually. The initial traumatic insult rarely severs the spinal cord and primary gross tissue damage is remarkably limited. However, minutes following injury a cascade of biochemical and molecular processes initiate secondary injury. A central dogma for treatment of SCI is that the anatomy of the spinal column allows for substantial room for tissue swelling. However, we believe that the constraining effect of the spinal cord pial and dural covering has not been adequately considered.

Methods

Adult rats underwent a T8 contusion injury (Ohio State University spinal contusion device). Following injury intraspinal parenchymal pressure as well as arterial pressure monitoring was performed (Millar Mikro-Tip® catheter). Durotomy and myelotomy was carried out using microsurgical technique. Hindlimb function was assessed using the BBB locomotor scale.

Results

Our preliminary data demonstrate that traumatic SCI leads to an acute rise in intraparenchymal pressure at the spinal cord injury site. Thus, at 4 hours post injury, intraspinal pressures are significantly higher (6.76 ± 1.2 mmHg) compared to uninjured controls (1.48 ± 0.38 mmHg, $p < 0.001$). Intraspinal pressures were reached their maximum 12 hours after injury (8.18 ± 1.6 mmHg). Surgical decompression of the contused spinal cord by opening the dura and pia linings significantly decreased intraspinal pressure to physiological levels (2.08 ± 0.53 mmHg, $p < 0.001$). Importantly, surgical decompression resulted in significantly improved behavioral outcome at three weeks post injury (18.0 ± 1.8) compared to lesion alone controls (12 ± 0.58 , $p < 0.02$).

Conclusions

We hypothesize that increased intraspinal pressure contributes significantly to acute spinal cord dysfunction as well as to the development of secondary injury. Our preliminary data also indicate that surgical decompression (opening of dural and pial linings of the spinal cord) reduces intraspinal pressure and promotes functional recovery after acute SCI.

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the possible role of intraspinal pressure on secondary injury in traumatic spinal cord injury, 2) Discuss, in small groups the possible impact of decreased spinal cord perfusion on intensive care of spinal cord injury victims, 3) Identify possible novel treatment strategies for patients with acute traumatic spinal cord injuries.

References