

The Effect of Cerebrospinal Fluid on Spinal Cord Deformation in an in vitro Burst Fracture Model

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ABSTRACT

Spinal cord injury affects more than 25 people/million annually in the United States and has significant economic, social and personal costs (Burke et al., 2001). Current research seeks to investigate the mechanical behavior of the spinal cord during high speed injury events. Knowledge of the column-cord interaction and its relationship to neurological injury could have implications for preventative strategies and clinical interventions as well as aid the development and validation of finite element and experimental models.

The current study extended a previously developed in vitro animal model of the burst fracture process (Hall et al., 2005). In particular, the study investigated the effect of cerebrospinal fluid (CSF) on the biomechanics of the cord when subjected to high speed transverse impact. The impact of a propelled bone fragment analogue with the animal cord model was recorded with high speed video and the images analysed to determine the deformation trajectory. Each cord was tested with dura and pseudo-CSF, with dura only and without dura. The trajectories obtained for each condition were compared by means of spatial and temporal descriptors.

The dura was found to have no significant effect on deformation behaviour. Cord deformation was significantly reduced, although not eliminated, in the presence of CSF when compared to the bare state. The time to achieve maximum deformation and the duration of deformation were generally increased in the presence of CSF, though not statistically significantly, which may indicate a reduction in the cord-fragment interaction force for a given impulse. The difficulty in reconciling data to obtain quantitative measures of cord deformation when surrounded by dura and CSF is discussed. This study indicates that while the protective mechanism of CSF may not fully extend to the high energy impact characteristic of a burst fracture, it may contribute to a lessening of cord deformation and applied force.

REFERENCES

- Burke, D.A., et al (2001) Incidence rates and populations at risk of spinal cord injury: A regional study, *Spinal Cord* 39, 274-8.
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