



Learning Objectives

DESIGN A MODEL FOR SPINAL CORD COMPRESSION USING PORCINE SPINES TO DETERMINE POINT AT WHICH COMPRESSION RESULTS IN INCREASED CORD PRESSURE

Introduction

Previous animal models for spinal cord injury required laminectomy and exposure of the spinal cord to create direct trauma. Imaging studies were not always possible during these experiments. Furthermore, previous studies did not permit a correlation of extent of cord compression with cord injury. The purpose of our study is to determine the relationship between extent of cord compression and the increase in cord pressure in an in-vitro burst fracture model of graded cord compression.

Methods

12 Porcine spinal sections, six thoracic, and six lumbar were harvested from 30kg pigs. Each spine segment consisted of 7 vertebrae. With the cord exposed and tied off at each end. A hole was drilled in the middle of the most central vertebra of the segment that was carefully created from the most anterior portion of the vertebral body through the posterior wall of the vertebral body without damaging the underlying cord. A 12.5 mm diameter DHS hip screw with 3 mm thread pitch was then inserted into this hole and advanced in a graded fashion. Pressure at the cord was monitored by means of the central hole running longitudinally down the DHS screw toward the cord.

As the DHS screw was advanced, pressure was measured at the tip of the screw where it contacted the spinal cord. A radiolucent dye was administered in the subdural space to create a myelogram during the procedure. All the segments were observed under fluoroscopy to monitor the advance of the DHS screw.

Results

Accurate measurement of the time averaged pressure showed no significant difference ($p < 0.05$) in the pressure/compression curves before and after radiopaque dye injection. Cord Pressures increase dramatically at approximately 65% to full compression.

Conclusion

Cord Compression can be obtained in a systematic and controlled manner. Cord Pressures increase dramatically when cord compression reaches approximately 65% to full compression. Our samples exhibited Creep Phenomenon- the tendency of a material to slowly move or deform permanently under the influence of stresses, as repeated measurements at same percentage of compression showed substantially decreased pressures.

Reference

Allen AR, Surgery of experimental lesion of spinal cord equivalent to crush injury of fracture dislocation of spinal column. *JAMA*1911;57:878-880

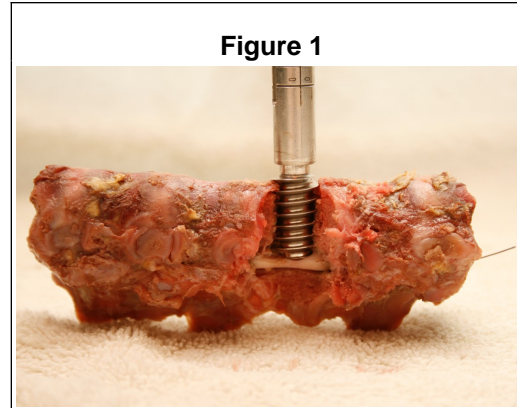


Figure 1

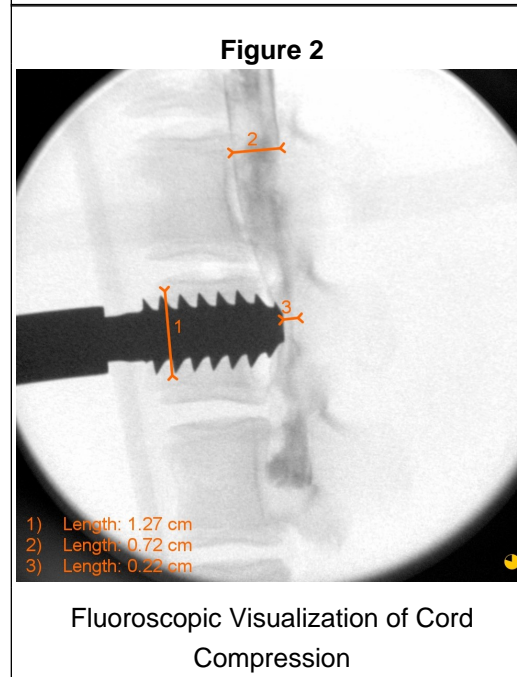


Figure 2

Fluoroscopic Visualization of Cord Compression

alderman JL, Osterholm JL, D'Amore BR, Moberg RS, Irvin JD. Influence of arterial blood pressure upon central hemorrhagic necrosis after severe spinal cord injury. *Neurosurgery*1979;4:54-55

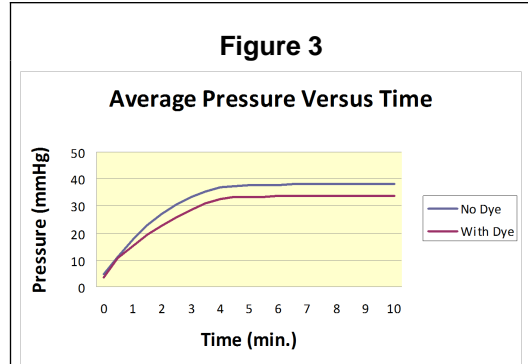


Figure 3

Average Pressure Versus Time

Average Pressure vs Time

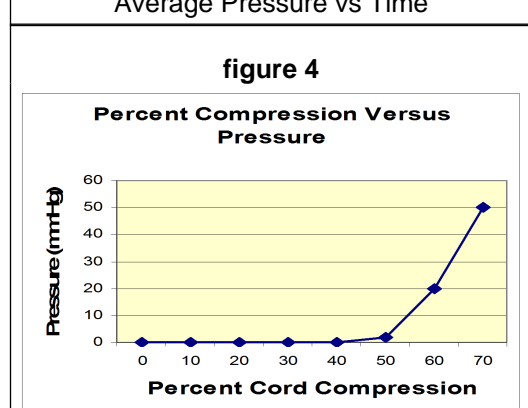


figure 4

Percent Compression Versus Pressure

percent compression vs pressure

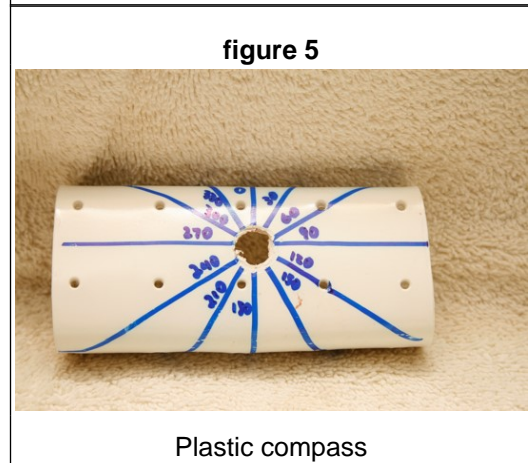


figure 5

Plastic compass