Simulation of Dural Repair in Minimally Invasive Spine Surgery with use of a Perfusion-based Cadaveric Model

Ian Andre Buchanan MD; Elliot Min MD; Martin H. Pham MD; Daniel Donoho MD; Joshua Bakhsheshian MD; Michael Minnetti; Gabriel Zada MD MS; Steven L. Giannotta MD; Patrick C. Hsieh MD, MSc; John C. Liu MD

Department of Neurosurgery, University of Southern California, Los Angeles, California

CNS 2018 ANNUAL MEETING
HOUSTON, TEXAS
OCTOBER 6-10, 2018

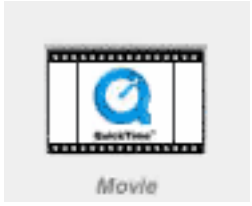
Introduction

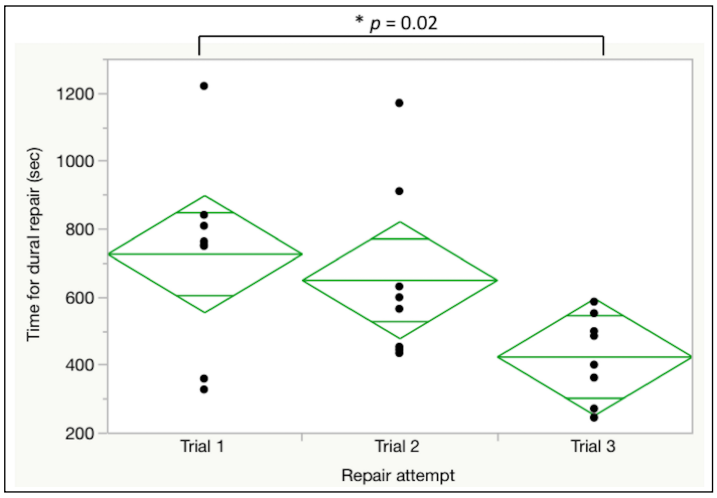
Neurosurgical training faces numerous constraints in an era of work-hour limitations and stricter regulatory oversight. Many training programs have therefore incorporated simulation models as adjuncts to conventional intraoperative learning. CSF leak repair after inadvertent durotomy in spine surgery is a fundamental skillset for neurosurgeons, however few intraoperative opportunities exist for resident trainees. And, even fewer opportunities exist during minimal access approaches, which are generally taught at the senior or fellowship level. We therefore endeavored to create a simulation model for CSF leak repair using minimal access spine surgery techniques.

Methods

Our institution has previously established a cadaveric model with CSF reconstitution for simulating durotomy repair in spine and skull-base surgery [1, 2]. Here we report on the successful stimulation of minimal access spine techniques for dural repair among a cohort of neurosurgery residents.

Simulation Model





Conclusions

Our results support use of perfusion-based simulation models as a complement to resident training. Their high degree of authenticity affords unrestricted access for honing important psychomotor skillsets with the potential for compressing the procedural learning curve and accelerating technical proficiency.

Results

Study participants showed consistent improvement across 3 trials at durotomy repair, exhibiting a significant reduction in mean closure times between their initial and final attempts ($p = 0.02$) [Figure below]. Additionally, all trainees were able to achieve robust dural closures resistant to Valsalva maneuvers at 40 mmHg. All trainees rated the simulation model as having a high degree of fidelity in terms of replicating the intraoperative experience. Furthermore, trainees exhibited significant increases in their post-procedure confidence at performing CSF leak repair.

Learning Objectives

(1)To present a novel approach at simulating dural repair via minimal access techniques.

(2)To demonstrate its utility for enhancing technical proficiency irrespective of postgraduate year.

References

1.Christian, E.A., et al., Perfusion-based human cadaveric specimen as a simulation training model in repairing cerebrospinal fluid leaks during endoscopic endonasal skull base surgery. J Neurosurg, 2017: p. 1-5.

2.Bakhsheshian, J., et al., The use of a novel perfusion-based cadaveric simulation model with cerebrospinal fluid reconstitution comparing dural repair techniques: a pilot study. Spine J, 2017. 17(9): p. 1335-1341.