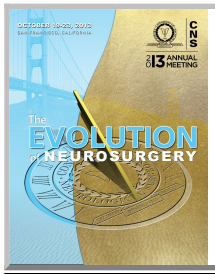

Reconstitution of the Intraventricular Cerebrospinal Fluid System Using a Perfusion-Based Fresh-Tissue Cadaveric Model: A Novel Training Paradigm for Intraventricular Neuro-endoscopic Surgery

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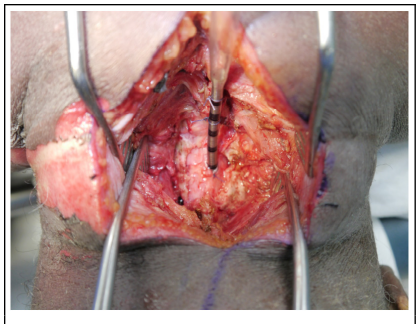
Learning Objectives

By the conclusion of this session participants should be able to understand and potentially replicate our cadaveric model for training in ventricular neuro-endoscopy.

Introduction

Adequate resident exposure to highly-specialized neurosurgical procedures (i.e. neuro-endoscopy) and alternative surgical educational models are at an increasing premium. We aimed to develop a novel cadaver -based model to simulate intraventricular neuro-endoscopic procedures.



Cervical laminectomy is performed for access to the subarachnoid space.

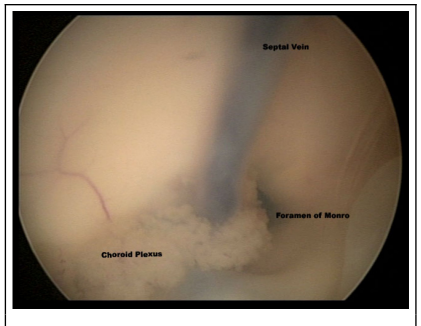
"CSF" flow is confirmed

Methods

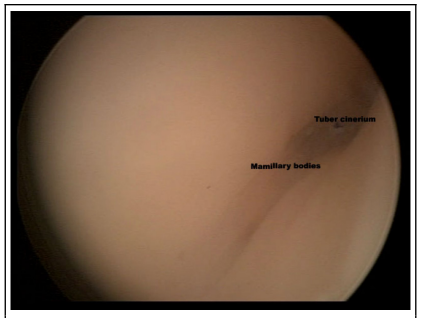
Ten fresh cadavers were utilized to demonstrate feasibility of the proposed model at the Keck USC fresh-tissue dissection laboratory. In each specimen, a cervical laminectomy and 3mm midline durotomy were performed, followed by insertion of a 12-guage pediatric arterial catheter into the intradural/subarachnoid space. Following a watertight, multilayer closure, saline and water were infiltrated into the catheter via a Medtronic Bio-pump (BP80) to reconstitute the CSF contents to a pressure of 15-30mm Hg. The specimen was placed in prone position, and a neurosurgical trainee was instructed to achieve intraventricular access via a right frontal burr-hole approach and trocar-based neuroendoscopic system with high-definition monitor and recording capability. The aim was to identify normal intraventricular anatomy of the Foramen of Monro and lateral/third ventricles, as well as perform an endoscopic third ventriculostomy and septum pellucidotomy when possible. Trainee confidence in the procedure was assessed via self-reported questionnaire.

Results

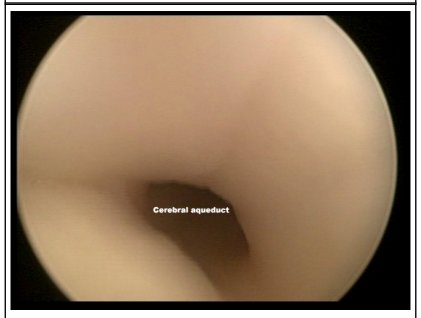
Successful reconstitution and access of the intraventricular system, defined as identification of the normal lateral and third ventricular structures, was achieved in 8 of 10 specimens (Figures 1-7). ETV and septum pellucidotomy were performed in 8 and 80% of attempted cases, respectively. Although adequate "CSF" perfusion of the ventricles was confirmed in all attempts by flow from the ventricular trocar, cerebral structures did not always maintain full integrity due to varying conditions of the specimens and variations in ventricular size. Self-reported trainee confidence in performing intraventricular neuro-endoscopic procedures improved following all simulations.



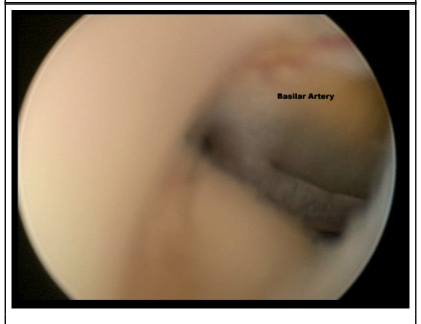
Right-lateral ventricular anatomy is appreciated prior to entering the Foramen of Monro.



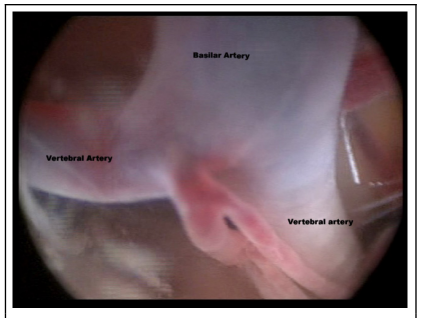
The anatomy of the floor of the third ventricle is appreciated.



The cerebral aqueduct is visualized.



The basilar artery is appreciated after third ventriculostomy.



Vertebrobasilar artery anatomy is visualized.

Movie

Conclusions

The intraventricular CSF pathways can be successfully reconstituted via a perfusion-based cadaveric model, thus serving as a novel and feasible educational alternative for intraventricular neuro-endoscopic operations.