

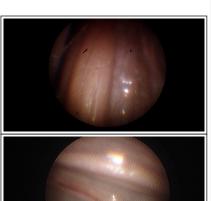
Cadaver Simulation of Endoscopic Untethering Surgery in Tethered Cord Syndrome TuongVy Thi Dang BA, MS; Mark E Stephens BS; Laszlo Nagy Texas Tech University Health Sciences Center, Lubbock, TX, USA

Introduction

Tethered cord syndrome (TCS) is defined by a set of neurological, orthopedic, and urological signs and symptoms resulting from abnormal attachment and stretching of the distal spinal cord. Open surgery to untether the spinal cord is currently the gold standard. However, minimally invasive endoscopic spinal surgery should be explored for its potential benefits.



Cadaver: Endoscopic View of Filum Before & After Section

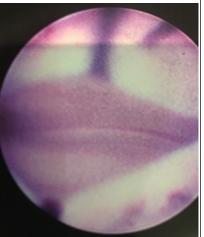


Cadaver Simulation A male formalin-embalmed cadaver was placed in a prone position. Dilators were inserted through two 8 cm midline incisions at vertebral levels T12-L1 and L4-L5, and laminectomy was performed at both locations. A cannula was introduced into the subarachnoid space at the T12-L1 opening to provide a steady infusion of Ringer's lactate solution to mimic CSF. In the L4-L5 opening, a 5 mm dural incision was made using endoscopic scissors and the fatty filum terminale was identified in the dorsal midline and sectioned. Subsequently, the dura surrounding the L4-L5 spinal segment was completely removed to allow for direct visual confirmation of the cut filum.

Cadaver: Gross View of Cut Filum



Live Surgery: Endoscopic View of Conus Medullaris



Live Surgeries

4Y 8M Female: sagittal synostosis, chiari I malformation, tethered cord, and lipoma of the dorsal spinal cord 2Y 9M Male: chiari I malformation, tethered cord, and fatty filum

Live Surgery: Endoscopic View of Cut Filum



Results

The live surgeries followed similar procedures as outlined in the cadaver simulation description, namely: 1) access and laminectomy at approximately L4 level, based on the location of the conus medullaris per imaging, 2) dura incision to expose the spinal cord, & 3) identification and section of the filum terminale. Both patients were stable postsurgery and were discharged within a week. They are currently doing well.

We demonstrated successful sectioning of the filum terminale using spinal endoscopy in both cadaver simulation and live surgeries.

Conclusions

Although open surgical management of TCS has resulted in good postoperative outcomes, endoscopic untethering provides many additional practical benefits. These include reductions in soft tissue injury, blood loss, postoperative pain, scarring, and recovery duration. Moreover, endoscopic untethering may decrease the incidence of retethering due to less scarring, which has been shown to be a contributing factor. Lastly, we advocate that formalinembalmed cadavers with Ringer's lactate infusion can adequately mimic live conditions and thus should be explored for its potential as an educational tool to practice minimally invasive endoscopic spinal surgeries. Formalinembalmed cadaver simulation is especially useful as a surgical model in medical school for students who wish to have early exposure to neurosurgery and who do not have access to freshfrozen or Thiel-embalmed cadavers.