Lessons Learned from 100 Consecutive Pediatric Deep Brain Stimulator Patients: The Cook Children's Hospital Experience

John H. Honeycutt MD; Warren Marks; Fernando Acosta
John and Jane Justin Neuroscience Center
Cook Children's Medical Center

Introduction

Since 2007 we have offered Deep Brain Stimulator (DBS) placement in select pediatric movement disorder patients at Cook Children's Hospital. Over time we have modified the surgical approach to help increase efficacy and minimize morbidity.

Methods

An IRB approved retrospective review was performed on our first 100 DBS patients. All patients enrolled for DBS surgery at Cook Children's Hospital undergo a rigorous consent process approved by our institutional review board in accordance with the current United States FDA Humanitarian Device Exemption status of this device for dystonia.

Results

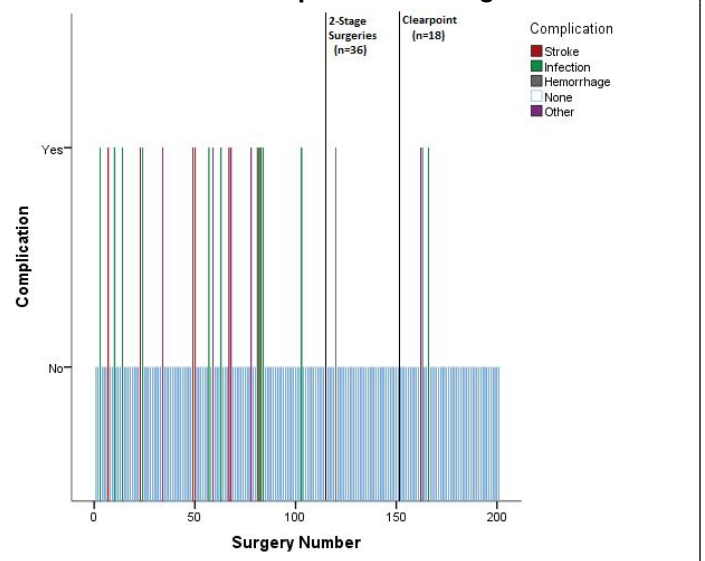
The average age at implantation was 13.8 years. Diagnosis was primary dystonia in 34 patients, secondary dystonia in 61, and tremor in 5. Implant site was globus pallidus internus (GPi) in 92, ventral intermediate nucleus (VIM) of thalamus in 4, subthalamic nucleus (STN) in 3, and one combo of GPi / STN. Complications were common with 12 infections in 9 patients, 8 strokes or hemorrhages in 8 patients, 15 electrode revisions (4 fractured, 11 repositioned) and 8 extension wire revisions due to malfunction / fractures. The first 80 patients were awake with microelectrode recordings, but have transitioned to asleep surgery for the last 20 patients with no change in outcomes

Discussion

Over time, we have adjusted our surgical technique to minimize complications. We switched to two stage surgery (electrode placement then extension wire / generator placment one week later) and have seen a dramatic drop in infection. We are unsure of etiology, but have speculated that reprepping the scalp may be less effective the second time, possibly due to wet hair from irrigation during lead placement. Our hemorrhage / stroke rate has also decreased over time as we have chosen a more lateral trajectory for lead placement. This lateral trajectory may be avoiding fragile vessels near the caudate head. It seems our electrode revision rate is also decreasing since swiching to iMRI asleep surgery with live targeting without seeing change in outcomes. However, revision of extension wires and generators has remained stable over time.

Conclusions

Over the last 9 years, we have modified our surgical approach to minimize complications (more lateral trajectory to decrease strokes / hemorrhage, two stage placement to decrease infection, and asleep surgery to increase comfort). Although fraught with complications, pediatric DBS affords another viable treatment option that movement disorder teams can offer to these challenging patients.



Timeline graph showing all DBS surgery (initial DBS placement, revision surgery, replacement of end of life generators, etc...) over 9 years. Solid lines indicate transition to two stage surgery and asleep iMRI ClearPoint technique. The graph highlights the significant drop in infection since adopting the two stage surgery protocol.