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Image Guidance for Ventricular Shunt Surgery: an Analysis of Ventricular Size and Proximal Revision Rates

Nickalus Khan MD
University of Tennesssee Health Sciences Center
Memphis, TN

Introduction

Image guidance is a promising technology that could lead to lower rates of premature shunt failure by decreasing the rate of inaccurate proximal catheter placement. The objective of the study was to perform a detailed radiographic analysis of ventricular size using 3 well-described methods and compare proximal revision rates.

Methods

Our shunt surgery research database was queried to identify procedures (new placement or revision) where frameless stereotactic electromagnetic neuronavigation was used (January 2010–June 2016). A randomly selected cohort of surgeries done without image guidance during the same time period served as the comparison group. A radiographic analysis utilizing the following indices was used to classify ventricular size: bifrontal, bicaudate, and frontal-occipital horn ratio. The primary outcome was shunt failure due specifically to proximal catheter malfunction at 90 and 180 days.

Results

A total of 108 stereotactic and 95 free-hand cases were identified. Overall, there was no difference in ventricular size between the 2 groups. Neuro-navigation yielded improved accuracy rates (73% grade 1; $p<0.001$). Although there was no statistically significant difference in proximal revision rates when all patients were analyzed, there was a clinically beneficial reduction in the 90 and 180-day failure rates across all radiographic indices in children with small-to-moderate ventricular sizes when using image guidance.

Learning Objectives

Ventricular size is important when evaluating proximal revision rates. Patients with harder to cannulate ventricles likely have the most benefit from electromagnetic neuronavigation.

Conclusions

Electromagnetic neuronavigation results in more accurate placement of catheters, but did not result in an overall reduction in proximal shunt failure at 90 and 180-days after the index surgery. However, subgroup analysis suggests a clinically important benefit in those patients with harder to cannulate ventricles.

Figure 1