Stereotactic Navigation for the Placement of Ventriculoperitoneal Shunts in Shunt-Naïve Patients

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Disclosures

- None
Introduction

- Cerebrospinal fluid (CSF) shunting is the most commonly performed procedure in neurosurgery.

- Advances in imaging technology and increased adoption of intraoperative stereotactic navigation have been postulated to improve shunt placement accuracy.

- However, conclusive evidence supporting the benefit of stereotactic navigation remains lacking.¹²

Methods

- **Shunt-naïve patients** receiving a ventriculoperitoneal shunt between 2007 and 2015 were identified from the IBM MarketScan Database
  - ICD-9/10 Diagnosis Codes
  - CPT Procedure Codes

- At least **90 days** of continuous post-surgery follow-up was required

- Multivariable regression models (logistic regression and Cox proportional hazards) and propensity score matching were used to **evaluate factors associated with repeat shunt surgery** (revision or replacement)
Cohort Characteristics

Cohort Size:
- 9,677 total
- 932 receiving stereotaxy

Figure Panels
A. Between 2007 and 2015, use of stereotactic navigation has increased by \(~9.5\) procedures/year
B. Stereotaxy use has increased regardless of geographic location
C. Patients frequently present with:
   - Obstructive hydrocephalus
   - Idiopathic normal pressure hydrocephalus
   - Idiopathic intracranial hypertension
D. Stereotactic navigation utilization stratified by presenting diagnosis
Stereotactic Navigation Does Not Reduce Need for Shunt Revisions/Replacement

Panel A. Intraoperative stereotactic navigation did not affect risk of long-term shunt failure requiring either replacement or revision.

Panel B. Rate of shunt failure was not different during the 30 and 90 days following initial shunt placement.

*Matched cohort were generated after balancing baseline characteristics using propensity score matching. Variable balance was confirmed by computing standard mean difference of included factors.
Differential Cause-Specific Risk of Late Shunt Failures

Panel A. In patients experiencing late shunt failures (>30 days after placement), stereotactic neuronavigation reduced risk of mechanical shunt failure.

Panel B. However, patients receiving stereotaxy experienced a higher risk of late shunt failures attributable to infection.
Stereotactic Neuronavigation Did Not Reduce Healthcare Costs

Panel A. Per day cost of hospitalization was higher in patients receiving intraoperative stereotactic neuronavigation.

Panel B. Post-discharge healthcare costs were similar between patients receiving intraoperative stereotactic neuronavigation and those receiving free-hand placement.
Discussion

- Intraoperative stereotactic neuronavigation is being increasingly used during ventriculoperitoneal shunt placement.

- While late mechanical shunt failures were reduced for shunts placed using stereotaxy, late shunt failures attributable to infection increased.

- It is possible that improved training and increased experience with stereotaxic use during shunt placement may improve outcomes.

- Overall, no long-term reduction of shunt failure or healthcare costs was observed.
Summary Points

- Stereotaxy use during initial shunt placement may not result in improved outcomes.

- It is possible that certain subset of patients may benefit more from stereotaxy than others.

- Additional studies are necessary to establish the role of stereotactic navigation during shunt placement.