Robot-Assisted Endoscopic Third Ventriculostomy

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Introduction

Endoscopic Third Ventriculostomy (ETV) is an established and effective treatment for obstructive hydrocephalus. In its most common application, surgeons plan their entry point and endoscope trajectory based on anatomic landmarks, then free-handedly control the endoscope. We have introduced the Rosa robot-assistance to our ETV procedure to stereotactically optimize endoscope trajectories, to reduce risk of traction on neural structures by the endoscope, and to provide a stable mechanical holder of the endoscope.

Methods

At our institution, we performed Rosa robot-assisted ETVs on seven consecutive subjects within a 3 month period. Patients had to have a favorable expected response to ETV (ETVSS equal to or greater than 70) without additional endoscopic procedures (ex. Choroid plexus cauterization, septum pellucidum fenestration). The modality of image-registration (CT, MRI, or bone fiducials) was case-dependent.

Figure 1: Trajectory Planning for the Robot-assisted Biopsy

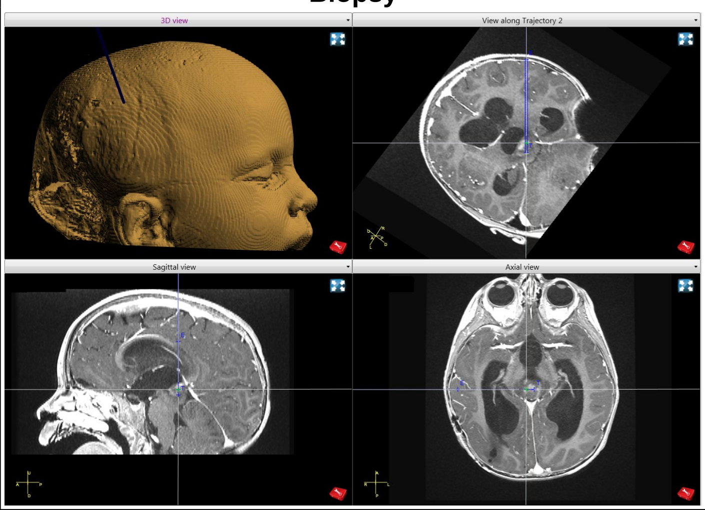

Figure 2: Trajectory Planning for the Robot-assisted ETV

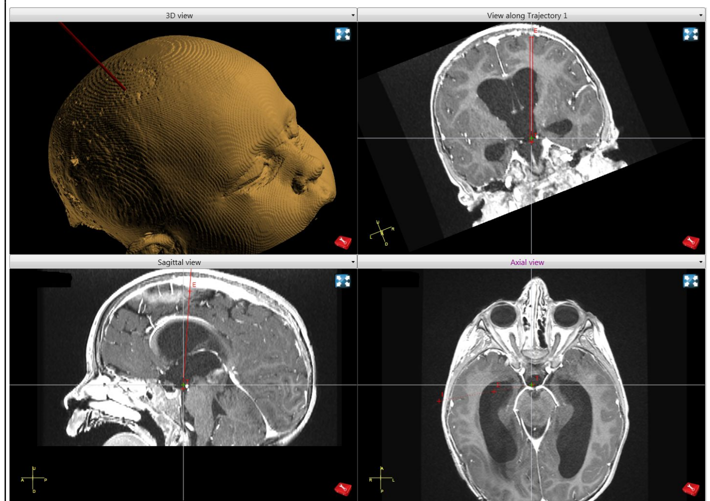

Figure 3: The Endoscope within the Rosa's Instrument Port

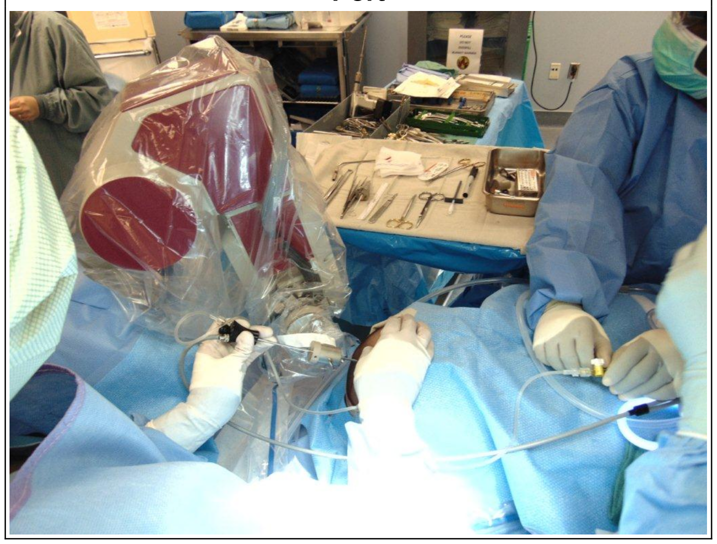

Table 1: Patient Characteristics and Operative Time

Patient	Age (years)	Sex	Diagnosis	Additional objectives	ETVSS	6-month follow-up outcome	Total Time (mins)
1	11	M	Tectal mass	Endoscopic biopsy	90	success	150
2	3	F	Tectal mass, shunt removal	Endoscopic biopsy + shunt removal + EVD placement	70	success	128
3	2	M	Porencephalic cyst (history of neonatal ICH)	None	70	success	143
4	14	M	Chiari 1 malformation	Suboccipital decompression	90	success	172*
5	11	M	Tectal mass	none	90	success	91
6	16	F	Aqueductal stenosis	none	90	success	85
7	1.5	M	Post-hemorrhagic HCP	none	70	success	101

*includes fiducial placement, intraoperative CT

Results

Seven total subjects with an age range of 2-14 years, 2 females and 5 males, ETV success score from 70-90, underwent successful ETV surgery with Rosa robotic assist within a 3 month period. Their pathologies included tectal gliomas (n=3), aqueductal stenosis (n=1), post-hemorrhagic hydrocephalus (n=2), and communicating hydrocephalus (n=1). Robot assistance was limited to the ventricular access in the first two procedures but was used for the entirety of the procedure for the following five cases. Four of these cases were combined with another procedural objective. A learning curve was observed with each subsequent surgery as registration and surgical times were shorter. All subjects had complete resolution of their pre-procedural symptoms, durable to the 6-month followup. There were no complications.

Conclusions

Assistance with the Rosa robot provides a safe, stable, precise, and minimally invasive approach to ETVs.

Learning Objectives

By conclusion of this session, participants should be able to 1) Discover if the Rosa-assisted ETV can be applied to their practice. 2) Identify the benefits of Rosa-assisted ETVs.