

Multi-Modal, Virtual Reality(VR) Case Preparation and Intra-Operative Navigation for Resection of A Giant Sphenoid Wing Meningioma(GSWM), Stepping Beyond Conventional Computer Assisted Surgery(CAS)

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Introduction

CAS has become standard practice in neurosurgery as imaging quality and computing power have improved. There is evidence that CAS navigation offers high-accuracy, reduced cost and morbidity for cranial procedures.^{1,2,3} Despite this, mainstream neurosurgical practice has been slow to adopt recent advances in imaging technology. Surgeons now have the ability to create detailed, patient specific 3-dimensional(3D) image reconstructions to assist in case preparation and surgical execution. We share our experience using VR for resecting a meningioma encapsulating the right MCA and ICA.

Methods

A volumetric T1-contrasted MRI and 3D-cerebral angiogram were obtained and fused in the Surgical Theater SNAP to create a 3D VR reconstruction. The Chief Resident and attending reviewed the case and performed a VR fly-through using an Oculus-VR headset before surgery. By adjusting segmentation and tissue transparency, it is possible to see through tissue, tumor and vessels, thus improving our understanding of the surgical anatomy and pathology. We used real-time VR navigation and

Results

We obtained a gross total resection of the supratentorial GSWM, preserving the enveloped ICA and MCA branches, without neuro-vascular injury.

Conclusions

We have recently published the positive impact of VR case preparation in aneurysm surgery, demonstrating decreased clip attempt time⁴. Additional surgical studies established that VR preparation groups made six times fewer intraoperative errors than the standard training group and decreased operative times and errors when a VR warmup is performed.^{5,6}

We used VR preparation for a patient with GSWM. MRI and 3D-angiogram fusion provided us with a highly detailed reconstruction, revealing the ICA and MCA coursing centrally within the mass. During the procedure we navigated in VR concurrently with conventional CAS, quickly identifying the MCA and ICA, affording us improved situational awareness.

VR preparation and navigation has great promise to impact neurosurgery. Further trials are indicated to elucidate the clinical and educational impact of VR

Learning Objectives

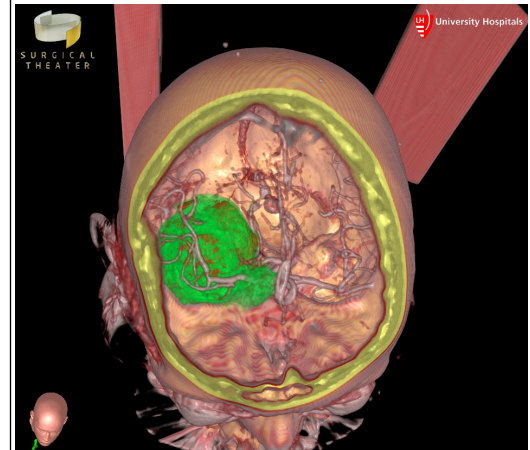
Identify new, enhanced imaging technology for neurosurgery

- Understand how visualization of anatomy and pathology in 3D virtual reality enhances spatial awareness
- Understand how enhanced visualization is used both pre-operatively for rehearsal and intra-operatively for navigation

References

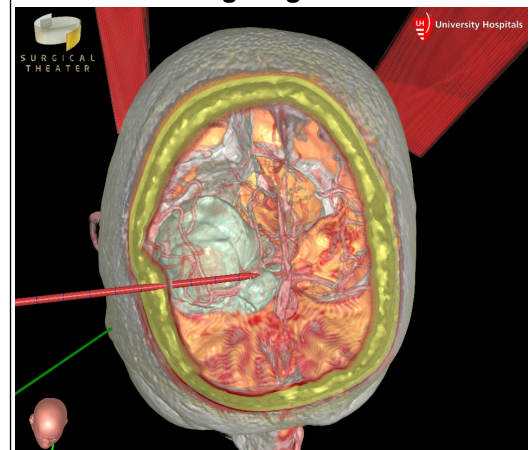
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Pre-Operative Vascular View



Highlights ICA and MCA traversing through the tumor.

Navigating in VR



Navigation pointer identifies the ICA terminus and MCA traversing through the tumor

Sagittal Intraoperative View

