

# Augmented Reality for Surgical Training in Skull Base Neurosurgery

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## INTRODUCTION

Significant advances in computer vision have led to the development of sophisticated augmented reality platforms that can be used in medicine.

The ability to render three-dimensional high resolution magnetic resonance and computed tomography images for visualization of anatomy and pathology has already begun to influence neurosurgical preoperative planning and surgical training.

Dyna three-dimensional rotational angiography (DynaCT) provides extremely detailed imaging of the cerebral vasculature and bony anatomy, making it an ideal image set for use in augmented reality.

The anatomy of the cranial base is well suited to this approach due to the intricate relationships between neurovascular structures, the overlying bone.

The use of these augmented reality platforms can enhance surgical training and knowledge of complex skull base anatomic relationships.

## METHODS

All patient information was deidentified. The Medivis SurgicalAR platform was used to render images in augmented reality, which could be freely manipulated using an augmented reality headset and pointer tool.

The preoperative high resolution dynaCT images were annotated by hand by a senior neurosurgery resident.

Segmented structures included the internal carotid artery, optic nerves, internal acoustic meatus, semicircular canals, and cochlea.

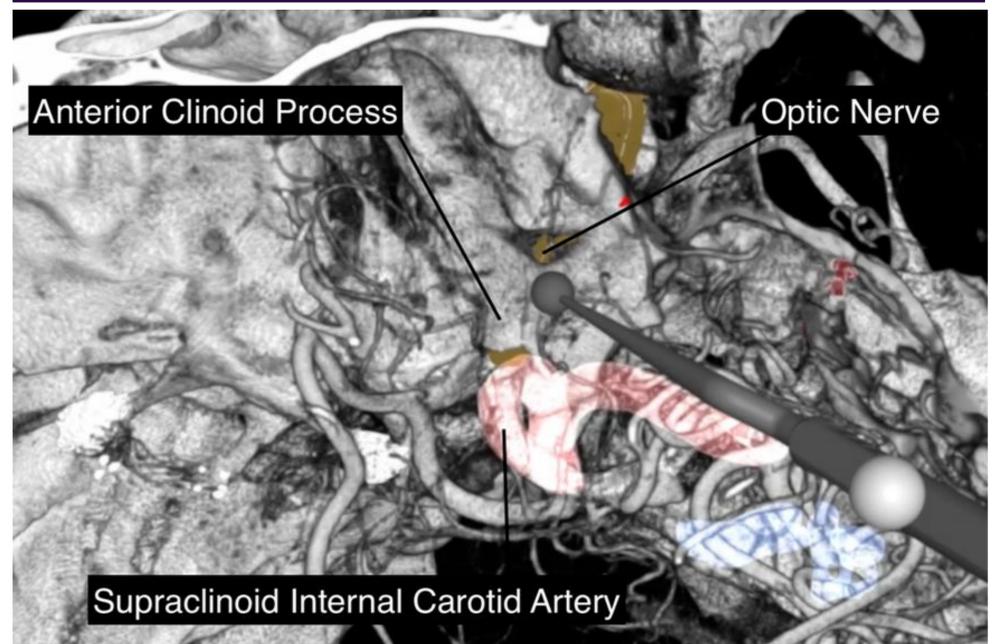
## RESULTS

Annotated anatomic models for endoscopic endonasal, orbitozygomatic osteotomies, anterior petrosectomy, posterior petrosectomy, and retrosigmoid approaches were successfully created based on preoperative, deidentified dyna CT imaging.

Imaging datasets were easily imported into the Medivis SurgicalAR software and could be displayed and recorded on the headset.

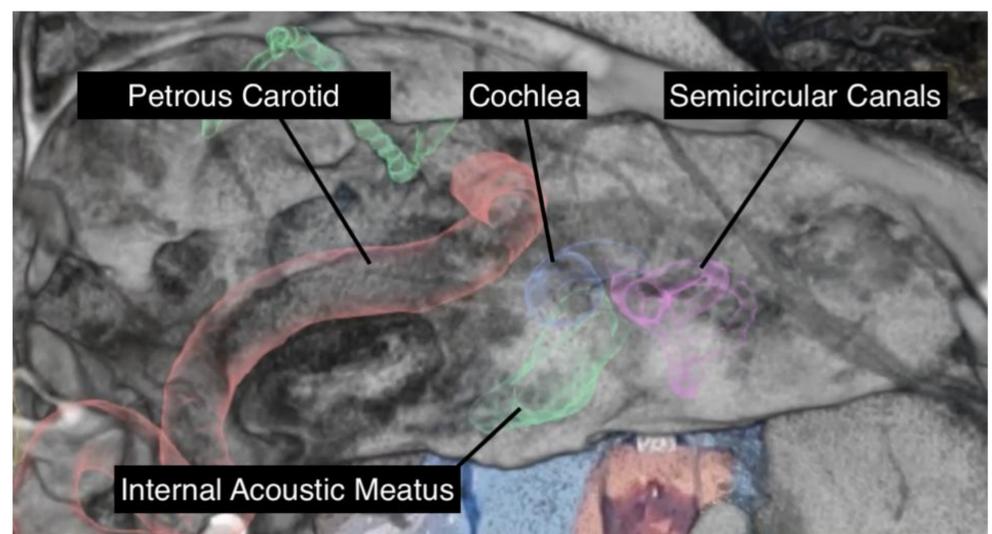
Various skull base approaches were simulated using the pointer tool to perform virtual craniotomies and identify key anatomic structures (Figures 1 and 2).

## FIGURE 1



Augmented reality view of anterior clinoidectomy with segmented anatomy

## FIGURE 2



Augmented reality view of Kawase approach anatomy

## CONCLUSION

We were able to construct three-dimensional augmented reality models using deidentified, annotated, high-resolution computed tomography imaging from three-dimensional rotational angiography datasets for use in neurosurgical education and preoperative planning.