Beyond Pituitary Tumors: Advancing Minimally Invasive Approaches in Skull Base Surgery

By E. Hunter Dyer, MD

Over the last 15 years, a focus of neurological surgery has been the development of safe, minimally invasive solutions for brain and spinal procedures. At Atrium Health Neurosciences Institute, the surgeons of Carolina Neurosurgery and Spine Associates have been at the forefront of this changing landscape in treatment of lesions of the anterior cranial skull base and pituitary region.

Through a combination of technological advances such as neuronavigation and endoscopy, and multispecialty care including neurosurgeons, endocrinologists, ophthalmologists, otolaryngologists and radiation oncologists, we've achieved quality care for these complex lesions.

Transnasal Pituitary Surgery

Since 1985, over 1,500 surgical lesions of the pituitary gland have been treated at Atrium Health. Traditionally, benign pituitary tumors were managed successfully through a transnasal approach with microscopic visualization. In the last decade, improvements in intraoperative neuronavigation and endoscopy have further improved surgical outcomes for these tumors that, at times, can be as large as 5 centimeters.

Navigation involves the use of surgical tools that are attached virtually to preoperative CT and MRI images to accurately show the surgeons their position "within" the tumor as well as vital surrounding structures, such as the carotid arteries and optic nerves. Endoscopic cameras have allowed dramatic advances in visualization using straight and angled endoscopes and have led to more complete resections of very large and eccentric tumors, previously sub totally resected with microscopic techniques. Lastly, the availability of intraoperative MRI at Atrium Health has provided "real-time" imaging for unusual, difficult lesions.

Benign pituitary tumors can affect pituitary hormonal function and the surrounding visual pathways, and multispecialty expertise is vital to quality care. At Atrium Health, we use preoperative endocrinology and ophthalmologic evaluations to obtain baseline function and to establish care pathways for the postoperative period. We also utilize a multispecialty quarterly pituitary conference to discuss difficult cases and achieve treatment consensus for both surgical and medical management. In the hospital setting, endocrinologists consult on all patients treated surgically by managing their medical needs while inpatient and preparing their outpatient medication needs.

Transnasal Endoscopic surgical conditions:

- Pituitary tumors (microadenomas and macroadenomas)
- Rathke's cysts
- Sellar arachnoid cysts
- Anterior cranial fossa CSF leaks

Extended Transnasal Anterior Skull Base Surgery

Before 2005, transnasal surgery was limited primarily to tumors of the pituitary gland and pituitary fossa. In addition to endoscopic and navigation advances mentioned above, a major surgical improvement in skull base "closure and repair" has allowed neurosurgeons to successfully enter the intracranial space and limit concerns of postoperative spinal fluid leak.

At Atrium Health, co-surgeon otolaryngologists have perfected the use of a vascularized rotational nasal flap to cover the skull base opening. In combination with postoperative antibiotics and lumbar drainage of spinal fluid, this has resulted in markedly diminished rates of postoperative leaks and complications.

Extended transnasal skull base surgical conditions:

- Craniopharyngiomas
- Meningiomas (planum sphenoidale and tuberculum)
- Chordoma
- Petrous apex granulomas

Craniopharyngioma care has changed dramatically with improvements in the extended transnasal skull base approach. These complex tumors occur in both children and adults, and often involve the pituitary fossa and suprasellar space. They are notorious for their invasive tendencies, endocrine and visual dysfunction, and need for multiple surgical approaches and multimodal treatment, sometimes involving postoperative radiation.

As visualization and safety have improved, the extended transnasal approach has become the most frequent choice for the initial surgical approach to these tumors. Although not always for complete surgical removal, this route provides a safe corridor for decompression of the lesion, elimination of optic nerve pressure and preservation of the pituitary stalk.

Supraorbital Eyebrow Approach

Another approach used frequently by the Atrium Health Skull Base team utilizes a minimally invasive cranial approach done through the eyebrow. This procedure has been extremely successful for vascular

lesions in the suprasellar space and for tumors in the anterior frontal and skull base space not otherwise amenable to the transnasal approaches.

Unlike, traditional craniotomy, the eyebrow approach involves a small incision in the eyebrow hairline, a small cranial opening at the low frontal skull base, and a shorter hospitalization and recovery time. At Atrium Health, over 100 eyebrow craniotomies have been performed over the last 8 years. Much like the endonasal skull base approaches, each skull base lesion is reviewed by multiple practitioners to determine consensus on the appropriate corridor for approach. While minimizing hospital and recovery time is a goal, quality and safety remains the primary mission for each patient.

Recent examples of Atrium Health patients treated successfully through an eyebrow approach include an 18-month-old with a subdural empyema (infection) and a 2-year-old with a suprasellar tumor, both of whom in years past would have likely required more extensive cranial approaches. The eyebrow approach has also proven safe and effective for aneurysms of the anterior communicating artery, with excellent visualization, proximal control, and shorter recovery.

Eyebrow craniotomy conditions:

- Anterior skull base meningiomas
- Midline gliomas
- Frontal intracerebral hematomas
- Anterior communicating aneurysms (ruptured and unruptured)
- Dermoid cysts
- Craniopharyngiomas

The Atrium Health Skull Base team is committed to advancing minimally invasive surgical care for lesions of the anterior skull base through an experienced multispecialty team and multimodal approach. We treat local and regional patients and welcome the opportunity to offer second opinions for physicians and patients seeking safe and effective care for these complex issues.

To learn more about these minimally invasive approaches and our Skull Base Surgery Program, contact Dr. E. Hunter Dyer, Neurosurgeon and President of CNSA at Hunter.Dyer@CNSA.com. John Parish, MD, Resident – Department of Neurological Surgery Carolinas Medical Center at John.Parish@CNSA.com