Minimally Invasive Brain Surgery at Mount Sinai

Transnasal resection of intracranial tumors using an expanded endonasal, endoscopic-assisted skull base approach.

Until recently, approaches to the skull base were preformed primarily using open craniotomy techniques such as sub-frontal, transmaxillary/transfacial and combined craniofacial exposures. Although advances in intraoperative visualization and localization technologies have made these techniques safer, interest has grown in endonasal and endoscopic-assisted approaches. Developments in surgical technique, imagery equipment, and surgical instrumentation have made broader application of transnasal procedures to approach lesions that previously required open surgery. The transnasal technique avoids an open craniotomy and brain retraction and is highly accepted by patients. Shorter hospital length of stay may be possible as well. Increasingly, patients come in having extensively researched their options, and they are asking for minimally invasive procedures. At Mount Sinai, Dr. Joshua Bederson, Chairman of the Department of Neurosurgery, and Dr. Eric Genden, Chairman of the Department of Otolaryngology, have pioneered these procedures since 1999. They have expanded the applications of endonasal endoscopic-assisted surgery for a wider range of skull base and intracranial lesions.

“Neurosurgeons have long used the transnasal approach for the treatment of pituitary tumors. My experience in this area led to an interest in using an expanded endonasal approach for intracranial lesions near the skull base. There was a steep learning curve early in our experience with this approach. As we refined the exposure, instrumentation and technique, it became clear that I could apply many of the same microsurgical principles of tightly controlled two-handed microsurgery, even through the long narrow window provided by this exposure,” says Dr. Bederson.

When Dr. Bederson operates with Dr. Genden, the two surgeons sometimes work simultaneously during the initial exposure, each manipulating instruments in both hands. Dr. Bederson explains, “During exposure we sometimes use a four-handed technique with both surgeons operating at the same time through both nostrils. It’s rare to find two surgeons from two different specialties who are able to work simultaneously like we do. It has led to a new treatment paradigm that benefits patients.” “In ENT, we have been operating through the nose for years,” says Dr. Genden. “Neurosurgeons have been removing tumors at the base of the skull for years. This is a combined approach in its richest form—and is emblematic of the Multidisciplinary Head and Neck Cancer Center at Mount Sinai.”

Computer guided brain imaging is used to help the surgeons achieve even greater precision during surgery. It serves as a guide for surgeons who are treating patients with tumors located in critical areas of the brain. By combining an advanced computer with state of the art imaging technology and infrared optics, the surgeons have a three-dimensional view inside a patient's head and can pinpoint the exact position of their surgical instruments within the cranial cavity. This can help surgeons during exposure of the lesion and also during resection, to avoid critical vascular and intracranial structures.
Types of conditions that have been successfully treated using an expanded transnasal approach at MSMC are:

- Adenoid cystic carcinoma
- Basilar trunk aneurysm (ruptured)
- Cerebrospinal fluid leak
- Cholesterol granuloma
- Clival chordoma
- Craniopharyngioma
- Encephalocele/meningocele
- Esthesioneuroblastoma
- Fibrous dysplasia
- Fifth cranial nerve schwannoma
- Fungal sinus infection

- Giant pituitary tumor
- Intracranial mucocele
- Nasopharyngeal carcinoma (primary & recurrent)
- Petroclival chondrosarcoma
- Petrous apex granuloma
- Planum sphenoidale or tuberculum sella meningioma
- Rathke’s cleft cyst

Minimally invasive approaches to the skull base are feasible in selected patients and complete resections are possible. The Skull Base Team is currently expanding the applications of this technique to include lesions of the medial petrous bone, the infratemporal fossa and the posterior fossa. Although this is a technically demanding surgical technique, it is “safe” in terms of serious complications, and patients report high levels of satisfaction.
CASE EXAMPLES

Maria Cea, a mother of two young children on Long Island, was told that she would need open brain surgery to remove a MENINGIOMA of the planum sphenoidale (a benign tumor at the base of the skull). In the course of looking for other options, Mrs. Cea learned about the minimally invasive procedure performed by Dr. Bederson and his team. Mrs. Cea had an expanded endonasal endoscopic-assisted procedure to remove the tumor and was discharged a few days later – sent home with nothing more than some salt water nasal spray. “When I left the hospital,” says Mrs. Cea, who is now at home with her children and tumor-free, “you couldn’t even tell I had had surgery. It was unbelievable. It looked like I was in for something minor. I wanted to tell everyone that I’d had brain surgery.”

Melanie Fickeissen, a 32-year-old nurse, developed right-sided visual loss during the summer of 2007. This was not associated with headache, nausea, vomiting, or other symptoms. Her workup included an MRI, and a MENINGIOMA of the tuberculum sella (near the optic nerves and pituitary gland) was discovered. She had significant visual loss in the right eye with only the upper nasal quadrant remaining and decreased visual acuity in that quadrant. Various treatment options including continued observation, radiosurgery, a frontal craniotomy, and an extended transnasal approach were discussed. She elected a sublabial, transnasal approach because it would probably include a lesser degree of brain retraction and a greater possibility of preservation of smell. The patient underwent a successful resection and was discharged home after two nights in the hospital. She continues to do extremely well. She returned to work full time four weeks after surgery and says she barely even remembers having the surgery, aside from an occasional “funny” sensation in her nose. Her vision on formal visual field testing has returned almost to baseline, as have her sense of smell and taste.
CASE EXAMPLES continued

Another patient, a teacher in her mid-fifties, came in after noting memory loss, confusion, nausea, vomiting, and fatigue over several months. An MRI revealed a **CRANIOPHARYNGIOMA** in the suprasellar region. Endocrine studies showed that she had panhypopituitarism treated with hormone replacement. After a thorough discussion of her surgical options, the patient and her spouse decided to proceed with an extended transnasal sublabial resection of the tumor. Following surgery she was briefly transferred to the MSMC acute rehabilitation service and then returned home to be followed by her endocrinologist. Her post-operative MRI shows no evidence of residual tumor. She resumed teaching full-time several months after the procedure, and continues to note improvements in her vision, short term memory, balance, and energy levels.

The expanded endonasal approach is a novel method of treating selected intracranial lesions and pathologies in and around the skull base. Not every tumor or lesion is appropriate for a transnasal approach, and each lesion is evaluated individually. Collaborations between the Departments of Neurosurgery and Otolaryngology have enhanced our capabilities in this area and are providing patients with exciting new options.

To learn more about endoscopic and minimally invasive skull base surgery, or for a physician referral, please contact the Department of Neurosurgery at Mount Sinai or visit [www.mssm.edu/neurosurgery](http://www.mssm.edu/neurosurgery).

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