

Minimally Invasive Endoscopic Surgery For Malignant Tumors Of The Skull Base

Over the last 3 decades, we have witnessed a tremendous expansion of the applications of the rigid endoscope as a surgical tool. Improved understanding of endoscopic sinonasal anatomy, technological advances in instrumentation and imaging protocols, and advent of computer-aided surgery applications have enabled the endoscopic surgeon to address complex sinonasal and skull base pathology. Adoption of minimally invasive endoscopic approaches to manage skull base malignancies has generated controversy and forced a healthy debate on the validity of traditional surgical oncologic principles in extirpating cranial base tumors.

Assessing effectiveness of the endoscopic or endoscopic-assisted “trend” requires consideration of its advantages, limitations and comparing its outcomes with the traditional time-honored open approaches. Rigid telescopes and new generation high definition cameras and monitors provide the endoscopic surgeon with unparalleled illumination, magnification and image resolution. This allows better judgment of tumor origin and boundaries therefore facilitating maximal resection while preserving uninvolved structures. Endoscopic techniques allow great access to areas where external approaches are notoriously known to fail, such as the sphenoclivar region and frontal recess. In the postoperative period, the endoscope plays an important role in tumor surveillance. Finally, the endoscopic approach obviates the need for facial incisions.

The main limitation of endoscopic techniques probably relate to the bleeding potential of malignant and vascular lesions. Even for the most experienced endoscopists, significant bleeding may seriously compromise the safety and completeness of the resection. It should be stressed that when the intent of the intervention is cure, endoscopic techniques should uphold the oncologic principle of complete resection. Positive margins have been shown to be negative prognostic indicators of survival.^{1,2} As such, lesions deemed inoperable by traditional open approaches and/or lesions involving the facial soft tissues should not be managed endoscopically except when the objective of the surgical procedure is palliative.

Initial reports and emerging larger studies substantiate the efficacy of endoscopic techniques in managing skull base neoplasms. Its relative short track record, however, has precluded comprehensive outcome stratification based on specific tumor histopathology. Nonetheless, critical analysis of outcome data available in the literature supports the role of endoscopic techniques as a viable option in treating malignant skull base tumors. One study compared the outcome of traditional craniofacial resection (tCFR) with endoscopic or endoscopic-assisted resection in 25 patients with anterior skull base malignancies.³ Both groups had similar tumor extent as determined by anatomical subsite involvement. There was no statistical difference in survival or recurrence between the 2 groups. Similarly there was no statistically significant difference in operative time, blood loss, hospital or ICU stay although the trend favored the endoscopic group. A recent study from Italy reported on 184 patients with anterior skull base malignancies treated through an exclusive endoscopic or a craniotomoscopic approach (endoscopic resection and bifrontal craniotomy).⁴ Patients in this study had diverse tumor histopathologies with adenocarcinoma being the most common (37%). The authors reported an impressive 5-year disease-specific survival (DSS) of 81.9%. These outcomes and those from many other studies utilizing endoscopic techniques, compare very favorably with the 54% 5-year DSS rates of traditional craniofacial resections reported in an international collaborative study of over 1300 patients.¹

Defining the role of and indications for adjunctive therapy in anterior skull base malignancies has been a frustrating task. Standardized, evidence-based adjunctive therapy protocols are lacking. Also, advances in radiation planning, delivery and dosing are not reflected in current literature of skull base tumors. Nonetheless, patients in most studies do receive some form of adjunctive therapy, typically neoadjuvant or adjuvant radiotherapy, sometimes combined with chemotherapy. One study from Europe reported on 14 patients with esthesioneuroblastoma who underwent endoscopic resection followed by GammaKnife radiosurgery.⁵ Nine of these patients presented with advanced Kadish stage C. The authors reported 100% survival at a median follow-up of 58 months. Considering the favorable side effect profile of GammaKnife versus traditional external radiotherapy, these results support the consideration of radiosurgery as an adjunctive modality in treating esthesioneuroblastoma.

Traditional CFR are associated with a high rate of perioperative complications. In the largest collaborative study of almost 1200 patients, the reported overall complication rate was 36% with a mortality rate of 4.7%.⁶ Studies employing endoscopic techniques have consistently reported much lower complication rates.^{2,3,7} These results, when coupled with the reported favorable survival outcomes lend credence to the role of endoscopic techniques in treating malignant skull base tumors.

References

1. Patel SG, Singh B, Polluri A, et al. Craniofacial surgery for malignant skull base tumors: report of an international collaborative study. *Cancer* 2003;98:1179–87.
2. Zafereo ME, Fakhri S, Prayson R, et al. Esthesioneuroblastoma: 25-year experience at a single institution. *Otolaryngol Head Neck Surg.* 2008 Apr;138(4):452-8.
3. Batra PS, Citardi MJ, Worley S, et al. Resection of Anterior Skull Base Tumors: Comparison of Combined Traditional and Endoscopic Techniques. *Am J of Rhinol* 2005;19:521-28.
4. Nicolai P, Battaglia P, Bignami M, et al. Endoscopic surgery for malignant tumors of the sinonasal tract and adjacent skull base: A 10-year experience. *Am J Rhinol* 2008;22:308-16.
5. Unger F, Haselsberger K, Walch C, et al. Combined endoscopic surgery and radiosurgery as treatment modality for olfactory neuroblastoma (esthesioneuroblastoma). *Acta Neurochir (Wien)* 2005;147:595–602.
6. Ganly I, Patel SG, Singh B, et al. Complications of craniofacial resection for malignant tumors of the skull base: report of an international Collaborative Study. *Head Neck* 2005;68.
7. Lund V, Howard DJ, Wei WI. Endoscopic resection of malignant tumors of the nose and sinuses. *Am J Rhinol.* 2007 Jan-Feb;21(1):89-94.