Editorial

Endoscopic endonasal surgery

MARC R. MAYBERG, M.D.
Swedish Neuroscience Institute, Swedish Medical Center, Seattle, Washington

Kassam and colleagues retrospectively analyzed their experience using endonasal endoscopic approaches to treat 800 patients with a variety of ventrally situated skull base lesions at a single institution over a 9-year interval. The latter 200 patients were analyzed from a prospectively derived database. Patients were categorized according to age and the complexity of the surgical approach. Outcomes in this analysis were restricted to complications that occurred in the perioperative period, including mortality, nonfatal vascular and systemic events, and CSF leakage and its consequences. Endocrine function and extent of tumor resection were not considered in this analysis, and complication outcomes were for the most part noted for the 1st 30 days after surgery.

Important to this analysis was the authors’ development of categories to define case complexity and the surgical approach. The complexity levels were derived from the authors’ experience and were based on anatomy, pathology, and anticipated surgical challenges. Similarly, various modules or categories of surgical approach were defined by the relationship of the lesion to critical neurovascular structures, especially the internal carotid artery. Although arbitrary, these categories and surgical modules were derived from the incremental experience of the authors and provided a good correlation to complication risk (see below). Complexity Level I (endoscopic sinus surgery) was not analyzed in this report. Level II (the transsellar approach) is familiar to most neurosurgeons who perform transsphenoidal surgery. Levels III–V represent case complexity that extends the scope of neurosurgical treatment to greater rostral-caudal and lateral extents of the ventral skull base, as enabled by the modular approaches described.

The 800 cases reviewed comprise a heterogeneous group of lesions; the analysis precluded their categorization by size or presenting symptoms. The majority of the lesions were sellar and immediately parasellar; approximately 40% were pituitary adenomas and 40% were removed through a transsellar approach. For the entire cohort, intraoperative (2.7%) and postoperative (6.7%) complications were surprisingly low for a series including many complex skull base lesions. Intraoperative vascular complications occurred in less than 1% of patients and produced permanent deficit in 0.4%. Intraoperative neural injury (cranial neuropathy) was present in less than 2% of patients, producing permanent deficit in 0.5%. Similarly, delayed postoperative complications were uncommon, including serious infection (1.9%), delayed neurological deficit (usually vision loss [1.9%]), and systemic disorders (2.9%). The overall perioperative mortality rate was 0.7%, mostly related to medical disorders in elderly patients. By multivariate analysis, the relevant factors relating to these complications were age (for systemic disorders), and surgical complexity as determined by the authors’ grading scale. In this regard, complication risk for the combined Level IV and V cohorts was 18.3%, which represented a 3- to 7-fold increased risk compared with Level II. The increased risk associated with higher levels of surgical complexity was present for every category of complication. For surgical approaches, there appeared to be an increased risk for transodontoid, transbital, and transclival procedures.

Although these results are not directly comparable to other retrospective analyses, the complication rate for Level II surgeries in this series is similar to reported rates for microsurgical transsphenoidal adenectomy (see Table 15 in the article). Prospective comparisons of endoscopic and microscopic approaches for these lesions have not been performed, but several retrospective analyses have shown generally comparable results between the 2 modalities. It is not surprising that complications were higher in the current series for lesions requiring intradural dissection, mobilization of the carotid artery, or extension beyond the confines of the immediate parasellar region. However, the results for Level III and IV cases in this series should not be compared with microsurgical skull base approaches, which likely comprise a different group of surgical lesions with different surgical indications and therapeutic imperatives.

The current report is a remarkable series that shows the evolution and incorporation of a new technology (transnasal endoscopy) into neurosurgical practice. Comparable with technological innovations such as the operating microscope and stereotactic navigation, transnasal endoscopy is a disruptive innovation in neurosurgery, which has provided a means to safely treat a variety of lesions of the anterior skull base using minimally invasive approaches. In comparison with other surgical specialties, neurosurgeons were slow to adopt endoscopic surgery due to a pervasive reliance on the image fidelity and stereoscopic depth perception afforded by the operating microscope, as well as the limitations of adjunctive endoscopic instrumentation for tissue dissection and dural repair. Several factors precipitated the incorporation of endonasal endoscopy into neurosurgical practice. First, development of cohesive surgical teams with otolaryn-
gologists at several centers introduced neurosurgeons to the anatomy and endoscopic surgical techniques pertinent to the paranasal sinuses and ventral skull base. Second, a generation of neurosurgeons familiar with open microsurgical techniques for skull base surgery was able to apply knowledge of pertinent anatomy and tissue management to the endoscopic application. Finally, the evolution of high-resolution small-caliber endoscopes and associated instruments enabled hybrid teams to expand neurosurgical approaches that had previously been limited to the sella and immediate parasellar region. This evolution has enabled the accumulation of substantial initial experience with endonasal endoscopic neurosurgery at several institutions and the subsequent dissemination of these techniques to most major neurosurgical centers.

Despite its advances, endonasal endoscopic neurosurgery has limitations. Acquisition of technical skills for these procedures requires a dedicated multidisciplinary team, and as the authors demonstrate, outcomes during the learning phase may be inferior to microsurgical techniques. Endonasal endoscopy is time-consuming compared with microscopy, and it requires multiple surgeons. Although improving, instrumentation for endonasal endoscopic surgery is insufficient, especially for suturing and hemostasis. Finally, the monoscopic endoscopic view limits binocular depth perception. Although most surgeons can accommodate monoscopic depth perception with experience, advances such as endoscopic augmented reality and binocular endoscopes may improve the learning curve.

Several limitations of this report are inherent to retrospective analysis. As mentioned above, techniques and treatment paradigms evolved during the interval of study reflected by apparent differences in the incidence of complications in different epochs. Outcomes were not adjudicated, leading to potential observer bias. Analysis and follow-up were limited to the perioperative period of 30 days, and delayed complications beyond that interval may not be accounted for. The study was designed to examine safety, and outcomes related to surgical efficacy were not included. A comparison of endoscopic complication rates with outdated microsurgery series is not warranted. Details of lesion characteristics (size and location) were not included, thus limiting comparison to other endoscopic or microsurgical surgical series. Nevertheless, the current analysis by Kassam and colleagues is important. The authors have continuously analyzed their experience and immediate surgical outcomes in 800 patients treated over a 9-year interval. Experience with the endonasal endoscopic approach and ongoing assessment of complications enabled the authors to expand the scope of anatomical locations and lesions treated, and to modify techniques to minimize complications. Endonasal endoscopic surgery represents a significant advance in the neurosurgical armamentarium. It should be emphasized that the low complication rates achieved in this series were the result of an extended, comprehensive multispecialty endeavor by the authors and should not necessarily be applied to risk comparisons in centers lacking equivalent experience. On the other hand, it is likely that surgical complications for more complex endonasal endoscopic procedures (Levels III–V) will further decrease as instrumentation improves and adjunctive surgical techniques develop. It should be reiterated that this report describes feasibility and perioperative safety for endonasal endoscopic neurosurgery, and long-term safety and therapeutic efficacy remain to be demonstrated. As the authors aptly point out in conclusion, the endonasal endoscope is a new and exciting tool, and it is incumbent on neurosurgeons to use this tool wisely and document its effectiveness.

References


Response

Daniel M. Prevedello, M.D., Ricardo L. Carrau, M.D., and Amin B. Kassam, M.D.

1Department of Neurological Surgery, The Ohio State University, Columbus, Ohio; 2Neuroscience Institute, John Wayne Cancer Institute at Saint John’s Health System, Santa Monica, California; and 3University of Ottawa, Ontario, Canada.

We thank Dr. Mayberg for his kind and insightful comments regarding our manuscript describing our ex-