

ENDOSCOPIC TRANSNASAL VERSUS OPEN TRANSCRANIAL CRANIAL BASE SURGERY: THE NEED FOR A SERENE ASSESSMENT

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During the past decade, endoscopic endonasal surgery, initially of the sellar region, and then of the cranial base, has entered the neurosurgical armamentarium. This concept has gained greater and greater acceptance among physicians and patients and, at the same time, has attained some prominence in the relevant literature, with increasing levels of interest and numbers of contributions.

As already experienced previously with other novel approaches and instrumentation, the debate between the supporters of established techniques and those of new strategies and concepts has evolved, occasionally exceeding the boundaries of formal scientific discussion and venturing into the unsafe area of unproven conclusions and poorly validated attributions. Therefore, it is important to clear the air of turbulence and to reestablish proper limits of an intellectually honest dispute.

We will attempt to define the current state of endoscopic surgery of the cranial base using the transnasal route, indicating some major conceptual landmarks:

- 1) The endoscope is a tool that affords excellent visualization of the surgical target area at close distance and with wide and expansive vision. Its use and its major importance are to give the surgeon the possibility of a different type of visualization, nothing more.
- 2) The procedure used by the endoscopic surgeon is a strict 2-handed microsurgical technique, not at all different from the basic principles used in operations that require the use of the operating microscope.
- 3) Any endoscopic neurosurgical intervention requires proper microsurgical training and precise endoscopic skills, with both being necessary to accomplish a successful operation (3). Needless to say, one's anatomic knowledge must be meticulous, including a detailed perspective on the same fine

anatomic details and relationships seen from a different point of observation, i.e., coming from below instead of reaching the lesion from above.

- 4) The concepts derive from a collaborative team approach with other specialists. Along with ear, nose, and throat surgeons, we have experienced a reinvention of collaborations previously developed in transsphenoidal, transfacial, and transcranial procedures involving the cranial base. Credit should be given to the group in Pittsburgh, Amin B. Kassam and his colleagues, for having expanded this collaboration and systematically evaluated and realized the possibilities of reaching a significant extent of the cranial base in both the coronal and sagittal planes, from one infratemporal fossa to the other, and from the frontal sinus to C2. Surgeons representing schools have previously performed similar work, with sporadic reports and, ultimately, with increasing experience, enlarging the surgical target around the sella, a concept initially contributed by neurosurgeons such as Gerard Guiot and Jules Hardy (2).

The work is still in progress, and further development of new instruments is ongoing. More effective solutions to correct limits and pitfalls such as cerebrospinal fluid leaks must be realized. However, just like the evolution of pituitary surgery at the end of the 20th century, when endoscopy passed the test of time and is here to stay, endoscopy will stay in cranial base surgery, with proper indications and well-trained surgeons and collaborative groups leading such innovations.

Dogmatic statements regarding the unique and best way to manage specific lesions are not helpful; there is not and cannot be only one way to solve every complex case. What is important to clarify is that the surgeon who approaches

cranial base lesions with these new methods is a surgeon who routinely uses the microscope, one who is thoroughly skilled in microsurgical techniques, and one who knows and respects the basic principles of contemporary neurosurgical education.

Regarding certain specific challenges that are the recent subjects of debate, such as surgery for meningiomas and craniopharyngiomas, the present indications and trends for the forthcoming generations of neurosurgeons are no longer to be considered exclusively defined in favor of transcranial approaches. In fact, given the extra-arachnoidal location of most of these lesions, the endoscopic endonasal method and the endoscope-assisted method in which established microsurgical techniques are used, safe and effective tumor removal has been demonstrated by numerous groups and yields advantages for the adjacent optic pathways, neurovascular structures, and hypothalamic-pituitary axis. This is true for tuberculum sellae meningiomas, for some olfactory groove meningiomas (unless the extent of involvement of the optic canal makes the removal not practical), and for most craniopharyngiomas.

One is reminded of Ivan Ciric's title of his contribution to the Congress of Neurological Surgeons Meeting in Las Vegas in 1979: "Craniopharyngiomas: Transsphenoidal Method of Approach—for the Virtuoso Only?" Regarding the new transsphenoidal approaches we are discussing, the reply might be "for the virtuoso, if virtuoso is one who knows the relevant anatomy perfectly, correctly applies microsurgical technique, masters endoscopic skills, finds the optimal solution to specific surgical problems, and applies wise judgment, with consummate respect for his or her patients." This virtuoso will act as a role model for succeeding generations, allowing them to conduct these techniques as standard neurosurgical procedures. It is obvious that what we have suggested pertains to the parasellar compartment as well (i.e., the cavernous sinus both in its medial and lateral aspects), when adequate removal of lesions such as invasive adenomas might enhance further medical (1) or radiosurgical treatment. In addition, we wonder whether, today, there is any reason to operate upon most clivus chordomas via a transcranial approach, rather than a transsphenoidal option, or, if for the repair of anterior cranial fossa cerebrospinal fluid leaks, the transnasal option should not be preferred.

Progress has not been and cannot be seen as an obstacle. Michael L.J. Apuzzo's Theodore Kurze Lecture at the 2008 American Association of Neurological Surgeons Annual Meeting (April 26–May 1, 2008, Chicago, IL) dealt with the concept of minimalism, which, when applied to neurosurgery, describes an evolutionary process passing through microsurgery, stereotaxy, neuronavigation, endoscopy, radiosurgery, endovascular surgery, molecular adjuvants, and nanotechnology.

Let us try to join our efforts to reach progressive improvement in directions that belong to all of us, for the good of our patients and for our own sake. The revered and respected teachers should learn not to say to their trainees that this or that operation must be done this way (e.g., via a transcranial subfrontal approach), without adding the possibility of another perspective, namely, the transnasal endoscopic procedures, currently being applied routinely by some dedicated teams. The new pioneers

should learn not to alienate their mentors and should try to honor their opinions and involve them in their proposals. We must learn to respect people with ideas different from ours, those working in a similar fashion to us, and our competitors. In any case, no one is doing a proper job if he or she aggressively tries to advertise his or her own ideas, just like politicians, who are so often discredited among the people because of the lack of facts behind their words and promises.

We need proper and evolutionary evidence-based indications for surgery, rigid criteria for outcomes, adequate patient follow-up, prompt treatment and acknowledgment of complications, proper instrumentation, and advanced methods of medical and surgical education (Edward Laws' unpublished presentation). We need to respect our belief in truth if we do not want to miss out on the pace of progress.

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COMMENTS

Cappabianca et al. have written a thoughtful article about the evolving approach to parasellar and adjacent lesions. They rightfully indicate the concept of using the endoscope as a visualization tool, the use of standard two-handed microsurgical techniques regardless of the visualization tool, and the need for anatomic knowledge and a collaborative team approach. They seem to indicate that resection of parasellar and adjacent lesions is dichotomized into strictly endoscopic transnasal resection approaches on the one hand and transcranial approaches on the other hand. We believe that the endoscope-assisted technique, in which transnasal approaches to the cranial base use both microscopic and endoscopic visualization, has the potential for further expansion and evolution, particularly in resection of parasellar meningiomas and craniopharyngiomas. Cappabianca et al. provided a well-stated and reasonable interpretation of the controversy surrounding this evolving area.

Joshua B. Bederson
Kalmon D. Post
New York, New York

In this short essay, Cappabianca et al. remind us that neurosurgery is a scientific discipline founded upon the concept of empiricism. All hypotheses must be tested against real-world observations using the scientific method. There is no role for dogmatism. The role of the endonasal endoscopic approach in the treatment of cranial base lesions, whether they be extradural or intradural, will ultimately be defined over the next decade, not through the work of any one individual or group but by the collective efforts of the neurosurgical community.

The introduction and incorporation of novel techniques and perspectives are not a new phenomena in the evolution of neurosurgery. As with other such controversial topics, the targets move as technology progresses, and each institution will develop its own philosophy based

on the unique forces at work in a given environment. As we have seen, although some aneurysms are clearly best treated with a clip and others are best treated with a coil, perhaps the largest group can be treated using either technique. Whether any given patient's aneurysm is clipped or coiled may depend more on who controls the flow of patients in the emergency room, who gets the first referral, or which philosophical outlook has more power in a given institution. The same can be said about surgery or radiosurgery for a 2.5-cm acoustic neuroma.

Endonasal endoscopic approaches are only in their infancy. Although some pioneers may be eager to apply the approaches to a broad spectrum of pathological lesions, other late adopters may resist and become overly critical. Ultimately, we must avoid dogmatism and keep an open mind as the truth probably lies somewhere in the middle. Although politics may influence practice, particularly at individual institutions, in the end, empiricism will win out. As we saw with interventional neuroradiology or radiosurgery, it is a mistake to try to compare a new technique that has only been implemented for a few years with conventional open surgical procedures that have been perfected over decades. Novel technologies undergo rapid improvements in a relatively short period of time, after which outcomes begin to level off as the techniques proliferate. Likewise, endonasal endoscopy will evolve as technology improves, and outcomes may need to be reassessed periodically. Although I agree with most of this essay, I would argue that it is not "serenity" that is most important in our assessment, rather it is "objectivity."

Theodore H. Schwartz
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Advances in medicine and surgery share many features; however, they also exhibit some sharp contrasts. In common, there can be bold, oftentimes, paradigm shifts led by pioneering investigators or teams motivated by solving difficult problems. Witness the changes wrought by antibiotics, antihypertensive agents, and cancer chemotherapies in medicine or laparoscopic surgery, coronary artery bypass grafting, or endovascular coiling of aneurysms in surgery.

But there are also sharp contrasts. Although medical advances are typically characterized by the rigid protocols of phased clinical trials and diligent reporting monitored by many skeptical eyes of the medical profession, competitors in pharmaceutical industry, and government, these occur infrequently in surgery. Rarely is there a clear path from conception to implementation. Oftentimes a lone figure or small core team will formulate a new operation or technique, implement it, present their findings and tutor others, and then man-to-man, institution-by-institution propagation takes place until it becomes the standard of care.

Phased trials are rarely performed, required, or reported, neither are randomized controlled trials. Few even rigorously compare data to established or proven techniques until compelled to do so. The profession is thus almost always at the mercy of the skills, transparency, and reporting of those initiating the advance. Even with properly executed evidence-based investigation there is still the matter of surgical judgment and patient selection as key elements of application of surgical therapy, new or old. Tools, no matter how advanced, cannot interpret anatomy or select patients or make surgical judgments—that is the work of trained, experienced surgeons.

To make matters more imprecise, the world is flatter today than ever before thanks to the Internet, globalization, wireless communication, and unfettered access to information and disinformation so that it is just as easy to spread good data as it is to spread bad data. This current situation may leave some partially educated or vulnerable to self-claims of evangelists not vetted by scientific tribunals or other more trusted discourse ("just like politicians," to quote Cappabianca et al.). Unaudited feats of glory and uncomplicated rewards pressure other

"Forty-Niners" unprepared for the hazards of exploration. Despite these obstacles, surgical innovation has and will continue to survive, bypassing amber entombed fossils and entrenched postures.

Cappabianca and Kelly, doyens and dear friends, together with Laws, Dean and dear friend, have rightly called for a "serene assessment" of "endoscopic transnasal versus open transcranial cranial base surgery" and I join them. We must foster and breed bold shifts and advances in our surgical portfolio, and change must occur for the field to evolve and improve. These actions demand courage, skill, contrariness, a pioneering spirit, and a will to accept challenges or even defeat should it come. But in doing so we must never shed our willingness and readiness to query, assess, and report the gains or cost of such advances so that those who depend on us—patients (most importantly), our profession (later adopters), and our trainees (our future)—will truly have access to a serene assessment.

Such assessment will include answers to the following questions: What problem(s) begs for solution? What advantage(s) does this advance bring to the table? What gains accrue as a result? At what cost? When and how should it be deployed? In answering these questions, we will arrive at a serene assessment.

In closing, I am reminded of the words of Czesław Miłosz, Polish-American poet, prose writer, and Nobel Laureate in Literature: "In a room where people unanimously maintain a conspiracy of silence, one word of truth sounds like a pistol shot."

Nelson M. Oyesiku
Atlanta, Georgia

This article makes several important points. Most pertinent, the authors call for neurosurgeons to evaluate new techniques such as neuroendoscopy with an unbiased and open-minded view and to avoid rejection of novel advances by dogmatic adherence to old principles. This approach is obviously true and important for any neurosurgical technique to advance. Second, the authors correctly point out that endoscopic neurosurgery requires expertise with microsurgical technique and anatomy. Finally, the evolution of new advances in neurosurgery must require the input and collaboration of physicians from other specialties, who bring unique skills and additional knowledge. In the history of mankind, nearly all progress has been met initially by skepticism and occasionally vehement opposition to changes in the status quo; endoscopic cranial base surgery is no exception. It is relatively certain that a new generation of neurosurgeons with endoscopic training and expertise will develop new techniques to make endoscopic surgery safer and less invasive.

Marc R. Mayberg
Seattle, Washington

We believe this article by Cappabianca et al. is timely, well written, and balanced in its presentation. The authors are senior surgeons who have been involved in the field since its inception and can provide a true longitudinal perspective. The evolution of endoscopy in neurosurgery follows a natural progression that has occurred in many surgical subspecialties including urology, abdominal/thoracic surgery, and otolaryngology. The use of the endoscope in each of these fields has allowed the creation of minimal access and has been founded on improved technologies and instrumentation.

Over the last decade, these concepts have been extended to cranial base neurosurgery as the use of the endoscope expanded beyond the pituitary fossa. In our view, the most critical component in this development has been the new level of collaboration between otolaryngologists and neurosurgeons, leading to hybrid techniques that are funda-

mental to the endoscopic approaches to the cranial base. As with any new technique, it is critical that the same basic tenets that created the foundation of the standard (in this case microsurgery) be rigorously applied at each phase of approach, resection, and reconstruction.

As Cappabianca et al. point out, a thorough understanding of the anatomy as seen from this central vantage point forms the entire foundation of all cranial base approaches and endoscopic approaches in particular. This anatomy (as with that for other cranial base approaches) crosses the lines of knowledge of both ear, nose, and throat surgeons and neurosurgeons, requiring collaboration. Maintaining the fundamental techniques of bimanual dissection using the principles of microsurgery has been critical in the evolution of endoscopic endonasal resection and has required the development of a four-handed, two-surgeon, two-nostril approach to allow the microsurgical technique to be applied, although under endoscopic visualization, a principle that we have strongly advocated over the past decade. Again, this requires the collaboration of two surgeons. Finally, reconstruction techniques have undergone significant evolution, as was the case with conventional cranial base surgery, ultimately culminating in the use of local vascularized flaps to effectively create a barrier between the cranial cavity and the paranasal sinuses, once again respecting the fundamental tenets of microsurgery.

In our opinion, there are two main sources of morbidity in cranial base approaches: blood vessels and cranial nerves. A thorough understanding of and comfort with cerebrovascular surgery is critical for the cranial base surgeon, forming the foundation regardless of the approach being used. However, in our opinion, the nerves determine the selection of the approach. The basic guiding principle we adhere to when choosing an approach is to avoid crossing the plane of nerves, i.e., in general, the nerves are kept on the perimeter of the lesion. As with other specialties, endoscopic techniques represent progress. They allow us to potentially expand our surgical capabilities and minimize our patients' morbidity. They are not, however, the solution to every surgical problem. Endoscopic approaches are not a substitute for but rather are a complement to traditional transcranial and microscopic approaches; therefore, it is critical that cranial base surgeons be versed

in all techniques to be able to offer the best alternative to their patients. Endoscopic techniques will never completely replace the microscope as the guiding anatomic principles will always require a need for alternative approaches. Therefore, in our opinion, there are no "endoscopic cranial base surgeons" or "microscopic cranial base surgeons"; rather, there are simply cranial base surgeons who use the endoscope or microscope as a tool based on anatomic principles.

Is there a need for this article? Based on the nature of recent discussions at several venues, we believe there absolutely is. There is a long history of similar controversies over emerging technologies that went against established dogmatic principles. The skepticism that meets new techniques is an appropriate and necessary aspect of the evaluation process. Candid and even harsh discussions and debate regarding the effectiveness of different approaches is welcome. However, when these discussions degenerate into personal attacks, it serves only to leave the audience, particularly young trainees and faculty, confused and troubled. In this article, Cappabianca et al. suggested civility in scientific discussion, with a focus on limitations and outcomes, rather than personal attacks. These circumstances are not unique to endoscopy and in fact were prevalent during the evolution of many emerging technologies such as endovascular surgery, radiosurgery, and even the introduction of the microscope itself. It is our hope that perhaps in the future when the next new technology or approach is evaluated, there will not be a need for articles such as this.

Cappabianca, Kelly, and Laws have not only played pioneering roles in the evolution of the technique but also, more importantly, have been role models during scientific debate. In the final analysis, we agree with them: the endoscope is simply a tool and the outcomes are determined by the judgment with which the tool is selected and the technique with which it is applied.

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