Sphenoid wing meningiomas

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Meningiomas have long defied crisp categorization. They can be firm or soft, globoid or en plaque, single or multiple, confined or infiltrative, and so on. In our efforts to understand them fully, the neurosurgical community has resorted to classifying them generally either based on histological findings, genetic makeup, or location. Location may seem an obvious classifying marker, but we are all too familiar with meningiomas that straddle multiple compartments, fossae, or dural surfaces, and are therefore resistant to unambiguous categorization.

The University of California, San Francisco, neurosurgical group has mined their prospectively collected surgical database to focus on a very common entity, the subgroup of sphenoid wing meningiomas. A sampling of the recent literature shows a fair interest among various groups internationally in examining this issue. Cushing and Eisenhardt, based on astute and detailed observations of a relatively small number of patients, had realized more than 70 years ago that meningiomas of the sphenoid wing tend to fall into 1 of 3 groups. The 3-tier classification (medial, middle, and lateral) has been fairly universally accepted. There have been various modifications of this grouping over the years by various authors, but the basic schema has withstood the test of time. The goal of the University of California, San Francisco, study is stated as a desire to present the “modern surgical outcomes” for these patients. The study design is retrospective over 9 years, with multiple surgeons involved. The series consists of 56 microsurgical patients. Reasons for excluding other patients were: radiosurgery (3 [these patients were excluded from outcomes analysis but were included in the analysis of presenting symptoms]), en plaque tumor (6), not localizable (4), hyperostosing (7), and orbital (8), for a total of 28 excluded patients.

The surgical philosophy appears to be fairly mainstream: maximal safe resection, and fractionated radiation/radiosurgery for adjuvant treatment in selected patients. Demographics were standard, and clinical presentations were as expected. Optic canal, internal carotid artery (ICA), and middle cerebral artery (MCA) involvement were more prevalent in the medial group. Orbital involvement was more common in the middle group. The surgical results are also in keeping with the rest of the literature. The medial group presented with the most complex tumors and therefore suffered the most surgical complications. Specifically, postoperative deficits (new or worsened) occurred in 10 (19%) of 56 patients overall, and the medial location conferred an OR of 2.7. Location was indeed an independent prognosticator.

I agree with the authors on several points made in the article. A few comments are however worth making. The issue of surgical approach is important. The authors simply state that they favor a cranio-orbital (orbital osteotomy) approach for medial tumors only. I am not sure that this is necessarily true or generalizable. Do they mean removing the orbital rim, or part of the posterior roof, and/or both? Justifications are not made explicitly. The authors are very aware that there are several variations of the cranio-orbital and cranio-orbitozygomatic approach that can be tailored to the individual situation (or not used at all). To my mind, removing the orbital rim allows a steep angulation of surgical viewing from below up, resulting in less brain retraction. It is therefore potentially helpful in the presence of giant lesions with brain edema that extend superiority (“looking up”). On the other hand, resection of a portion of the orbital roof posteriorly offers a distinctively different advantage: uncovering periorbita, unlocking the superior orbital fissure, initiating the interdural dissection of the cavernous sinus (CS), and, when combined with an anterior clinoidectomy, decompression of the optic nerve.

These maneuvers are indeed critical in exposing tumors in the posterior orbit (“looking down”). The zygomatic component of an orbitozygomatic approach, additionally, helps uncover the temporal and infratemporal fossae, and thus may be useful in some extensive lateral meningiomas. One therefore needs to consider the variations on these anterior skull base approaches as a “menu” of choices, to be used as needed, not based on the arbitrary label we give these tumors, but rather the specific needs generated by the specific case. These needs are dependent on 2 types of tumor extent: bone involvement and cisternal involvement. Some skull base modifications may be appropriate for the lateral, or middle, or medial meningioma. Some might be entirely superfluous. It is
also very evident from the collective reporting of skull base surgeons that experience generally begets minimalism. The enthusiasm for the extensive “destructive” newly mastered skull base procedures of the 1980s has largely waned, and the seasoned skull base surgeon of today has generally learned to do more (resection) with less (exposure), when appropriate.

The authors address also the issue of conservatism when it comes to CS involvement. I agree with this philosophy in general, with the proviso that intraoperative findings should trump preoperative planning. An unusually soft meningioma partially involving the CS may well be resectable with acceptable oculomotor morbidity. Additionally, even if intentional subtotal resection is achieved, it is important to take future planned radiosurgery into consideration. Every effort should be made during surgery to create a space between the residual tumor margin and the optic apparatus, when possible, to allow safe maximal radiosurgical dosing.

The issue of anterior clinoidectomy is important and was not covered in detail in the article. When and how should it be done? It is very clear that unsuspected optic canal involvement, particularly with the medial group, occurs with enough regularity. I have thus adopted the stance that all medial meningiomas warrant an anterior or clinoidectomy. Even a high-quality preoperative MRI study of the brain and orbits, including fat-suppression sequences, may miss subtle canal carpeting, a finding appreciated only after the clinoid is removed. Additionally, I favor performing the clinoidectomy and optic nerve decompression extradurally, for the simultaneous double benefit of devascularizing the tumor early and providing the optic nerve with surgical freedom that may minimize its injury during the subsequent intradural manipulation of the tumor. How often was this done in this series? One wonders about the implications with respect to visual outcomes in this subgroup.

What should the role of preoperative embolization be in these tumors? I would submit that it should be done very rarely if ever. The reasons are related to the issues of accessibility and necessity. The medial tumor will generally be supplied by branches of the cavernous or clinoidal or supraclinoidal ICA directly, rendering endovascular access hazardous or impossible. On the other hand, a middle meningeal artery (MMA) supply (more likely seen with the middle and lateral groups) rarely warrants preoperative embolization—and its potential risk of causing ischemia of nerves via the embolized vasa nervorum—when simple surgical obliteration is eminently feasible early during surgery. This is why bone drilling with diamond bits is a critical early maneuver in large tumors, offering the simultaneous benefits of exposure and devascularization. In our large experience with sphenoid wing meningiomas at the University of Miami, we have never used preoperative embolization and have not regretted it.

Last, the authors state in their conclusions that, based on their results, we should abandon the 3-tier classification of sphenoid wing meningiomas in favor of a 2-tier grouping: medial versus nonmedial group. I am not sure this would be a particularly fruitful change, even though this may appear to be a trivial issue of semantics. That medial sphenoid wing meningiomas portend a worse surgical outcome compared to both the middle and lateral groups has been a well-known fact for decades. This is no justification to amend the classification to 2 groups. The 3-tier grouping has been very useful in correlating site of origin with clinical manifestations, not to mention allowing the convenient and clear naming of the type of tumor in question (the diffuse en plaque meningioma being an exception to this). In the authors’ own data for example, proptosis was most common in the middle group. As an illustrative analogy, superior sagittal sinus meningiomas are stratified into 3 groups (anterior, middle, and posterior thirds), yet the middle third carries the worst surgical outcomes.

I am not sure that anybody would have an interest in reclassifying these superior sagittal sinus tumors into a 2-tier system: “middle third” versus “all others.” The topographical connotation would be lost. The argument that surgical decision making is more similar between the middle and lateral sphenoid wing groups than it is for the medial group is no justification either to dichotomize. In actuality, some authors would argue that there exists a subtype of medial sphenoid wing meningiomas, namely the “true” clinoidal meningioma, that always points superiority, never invades the CS, and shows excellent postoperative visual outcomes, hardly the rule for all medial tumors.

In this instance, “splitting” outperforms “lumping.”

I congratulate the authors for putting forth their surgical series of sphenoid wing meningiomas. It helps reinforce what is generally known about these tumors. The design of the study does not permit, of course, a comparative evaluation of different treatment methods. It rather allows a description of surgical outcome in the hands of experienced and thoughtful operators.

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The author reports no conflict of interest.

References


Response

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Dr. Morcos raises several points for discussion in his review of our paper on our recent experience in the digital imaging era with sphenoid wing meningiomas. We thank him for taking the time to do so and will respond to the issues he has raised.

First, we wanted to review only those cases that had pre- and postoperative imaging available; hence the relatively narrow time window for our review. This would allow us to assess imaging extent of resection and look for imaging evidence of approach-related brain injury.1 Our decision to use the term “modern” was meant to indicate that in this period we too had moved away from the aggressive approach taken in the 1980s with surgery for skull base meningiomas. Our use of the term “cranio-orbital” was meant to define a frontotemporal-sphenoidal craniotomy with orbitozygomatic osteotomy, the latter including the supraorbital rim lateral to the supraorbital notch/foramen, the frontozygomatic process down to the body of the zygoma, and the roof and lateral wall of the orbit. We agree with Dr. Morcos that the approach can be tailored for each tumor and that skull base approaches limit brain retraction and injury. We did not routinely remove the zygomatic arch unless there was a large component along the middle fossa floor medially and posteriorly.2 Our aim was not to detail the technical aspects of the craniotomy choices, which have been described elsewhere, but we agree that there is a “menu” of variations that the surgeon must consider that are specific to each case.2,3

The second issue raised relates to craniotomy for optic nerve decompression and creating room to allow for safe radiosurgical dosing. We agree that when possible for medial tumors that involve the clinoid region and cover the optic nerve and ICA, decompression of the optic canal, whether done all extradurally or both extra- and intradurally, will allow one to find the optic nerve before debulking begins and may provide for improved visual outcome postoperatively. However it is not necessary to remove the entire clinoid to open the optic canal, but rather the roof and lateral wall of the canal is sufficient. This may be part of our “conservatism” since complete clinoidectomy is not without risk of optic nerve injury, CSF leak, ICA injury, or third nerve dysfunction. For medial tumors Simpson Grade I removals are rarely possible. In this light if there is CS involvement, we only remove the portion exophytic from the lateral wall and do not open the corridors to the CS to remove a little more meningioma subtotally. Removing tumor below the clinoid/optic canal also might not guarantee providing a safe distance for radiosurgery, and fully fractionated radiotherapy has been proven to be safe and effective around the optic apparatus.3,9

We have recently reviewed a separate group of clinoid meningiomas in an attempt to address the issues of risk and visual improvement or worsening (unpublished data). These tumors arise from the clinoid region and extend superiorly into the inferior frontal lobe. We tried to separate these from “medial” third meningiomas, which have broader attachments to the medial sphenoid wing, middle fossa, and orbital roof. “Semantics” again? I guess some of us are guilty. In that review the issue of optic canal decompression and the techniques for extradural/intradural opening of the optic canal are discussed in detail. We hope the readers of this journal have the opportunity to review that paper as well.

Finally the issue of embolization. We tend to embolize our largest tumors, and do so several days before surgery. We were initially skeptical of allowing for the delay, which Mitch Berger recommended doing, but now we believe that waiting helps.2,5,10 The morbidity from embolization in our hands is minimal, and there is nothing like suctioning out an avascular, somewhat necrotic large tumor as opposed to moving millimeters at a time in the face of persistent tumor bleeding. There is no question that the goal of embolization is to reduce tumor blood supply to the lateral component supplied by the MMA, superficial temporal artery, and internal maxillary artery and their branches. Perforating arteries off the ICA are rarely suitable for embolization and the risk/benefit calculation clearly does not favor it. We are not aware of an acute cranial neuropathy in our series of embolized meningioma in the anterior cranial fossa. Our interventional radiologists are careful to avoid embolizing branches of the MMA that show reflux from vessels supplying the tumor back into the ophthalmic circulation.

Dr. Morcos is a skilled skull base and vascular tumor surgeon who knows these territories well, and he has raised some provocative points. Our review simply shows that for these relatively large tumors, the risks of surgical intervention are highest with the medial group. Middle and lateral tumors, irrespective of size, are not as risky to remove, and most of the surgically treated tumors in this series one might call medium- to large-sized tumors. We agree that surgeons should choose from their menu well, and as Cushing said years ago these tumors are “formidable” and “the ultimate prognosis hinges more on the surgeons wide experience with the problem in all its many aspects than is true of almost any other operation that can be named.”10
References


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