Letters to the Editor

NEUROSURGICAL FORUM

Pituitary tumors and cavernous sinus extension

TO THE EDITOR: I read with interest the article by Micko et al.13 (Micko ASG, Wöhner A, Wolfsberger S, et al: Invasion of the cavernous sinus space in pituitary adenomas: endoscopic verification and its correlation with an MRI-based classification. J Neurosurg 122:803–811, April 2015). The authors have discussed surgery-related issues for pituitary tumors invading the cavernous sinus. The tumors are divided into groups as per the classification proposed by Knosp et al.12 The authors reported that in Grade 2 and Grade 3 adenomas, the use of an endoscope resulted in the finding of cavernous sinus invasion significantly less frequently than when microscope was in use for tumor resection. The authors mention that when the internal carotid artery was encased by the tumor (Grade 4), all adenomas invaded into cavernous sinus and the gross-total resection rate was 0%.

The issue of pituitary adenomas invading the cavernous sinus, particularly as it relates to the possibility of radical resection of the cavernous sinus component, has been under discussion for some time. We (and others) have identified that the true radiological indicator of cavernous sinus invasion is complete and circumferential presence of tumor around the intracavernous carotid artery.6,7,9–11 In this respect only Grade 4 cases, using the classification system proposed by Knosp et al.12 will fall into the group of actual cavernous sinus invasion. When the tumor spares the lateral aspect of the carotid artery, the medial wall of the cavernous sinus is displaced and buckled into the region of the cavernous sinus, and the tumor may be both above (Grade 3A) and below (Grade 3B) the carotid artery rather than being actually present within the dural confines of the cavernous sinus.12,13 It is therefore not surprising that the authors identified that with the use of an endoscope they did not find cavernous sinus invasion in a number of Grade 2 and 3 cases. The authors have extensively reviewed the literature on the subject of pituitary tumors “invading” the cavernous sinus. We are surprised that they could not locate any of our articles on the subject in the literature.1–11 We have presented our experience of “giant” pituitary tumors in several platforms and proposed a classification of these tumors depending on their dural relationships in general and cavernous sinus invasion in particular. We identified that pituitary tumors sometimes grow to a massive size but “respect” the dura, which is only displaced by the tumor and not transgressed. Consequently the diaphragm sellae is displaced superiority and the medial wall of the cavernous sinus is displaced laterally by a number of tumors (Goel Grade I). It is unclear as to how some tumors invade into the cavernous sinus and transgress its medial wall and some do not. The cavernous sinus is frequently considered to be an extradural entity, and the “dural” nature of its medial wall has been under discussion for some time. We believe that the histological aggressiveness of the pituitary tumor may be a factor that determines tumor invasion into the cavernous sinus. Cavernous sinus invasion (Goel Grade II and III) is identified when the tumor circumferentially encases the internal carotid artery. Despite the cavernous sinus invasion, the tumors never transgress the lateral dural wall of the cavernous sinus. We have observed that the tumors sometimes elevate the dural roof of the cavernous sinus (Goel Grade III) but do not transgress this membranous wall. We observed that the pituitary adenomas that invade into or transgress the medial wall of the cavernous sinus (Goel Grade II) are not only anatomically, but also behaviorally aggressive when compared to Goel Grade I tumors. We have found that tumors that elevate the roof of the cavernous sinus (Goel Grade III tumors) are more prone to recurrence than tumors that invade into the cavernous sinus but do not elevate its dural roof (Goel Grade II tumors).

Surgeons using the endoscope for pituitary tumor resection claim that the lateral vision into corners in general and the cavernous sinus in particular is better with the endoscope than with the microscope. We now have an experience of surgery on over 3200 cases of pituitary tumors using the conventional microsurgical techniques. We find that if the dural relationships are appropriately understood, particularly as they relate to pituitary tumors and their potential to invade the cavernous sinus, conventional microsurgery can—if appropriately learned and practiced—provide satisfactory lateral vision to explore the tumor inside the confines of the cavernous sinus in general and also the part of the tumor that is lateral to the internal carotid artery. The radicality of resection of the part of the tumor within the cavernous sinus depends more on tumor characteristics like fragility and vascularity. We relate the issue of postoperative radiation therapy to our grading system. In general, we prefer to treat residual tumor in cases of Goel Grade III (and Grade IV) tumors with adjunctive radiation therapy.

The need and possibility of “total” resection of the intra–cavernous sinus component of the tumor and the effectiveness of the endoscope compared with conventional
microscope-based surgery will have to be evaluated in further studies of this subject. More than instrumentation, appropriate evaluation of actual need for resection of the intra–cavernous sinus component of the tumor and experience in pituitary surgery seems to be defining.

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References

Disclosures
The author reports no conflict of interest.

Response
We appreciate Dr. Goel’s comments on our publications and his thoughts. Furthermore, we value his surgical experience as well as his classification of giant pituitary adenomas in general.

In contrast to Dr. Goel’s work, the goal of our work was to revisit our previous classification of pituitary adenomas invading the cavernous sinus using the endoscopic technique and not to discuss suprasellar, supracavernous, and/or subarachnoid spreading of giant pituitary adenomas in particular. The well-established classification of Hardy and Vezina already describes these growth patterns in detail was applied to all our cases.

In our experience, the endoscopic technique enabled us to remove more tumor tissue from the space of the cavernous sinus in particular and to have a better judgment whether invasion was present there than the microscopic technique. Unfortunately, histological specimens from the medial wall and from the space of the cavernous sinus are exceptionally rare, so the surgeon’s judgment of tumor invasion is fundamental but subjective in some way. Despite this drawback we were able to distinguish different grades of cavernous sinus involvement in which the likelihood of invasion of the cavernous sinus space clearly increased with higher grades. We emphasize that the grade of invasiveness inversely correlates with the rate of gross-total tumor resection and endocrine remission and thus is a crucial parameter for outcome prediction.

We disagree with Dr. Goel’s statement that invasion of the space of the cavernous sinus is only present in Grade 4 tumor extension, i.e., encasement of the internal carotid artery, which is absolutely not our experience. However, we agree that the structure of the medial wall as the weakest membrane of the cavernous sinus boundary has to be investigated further.

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References

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Last call for clipping aneurysms?

TO THE EDITOR: With the publication of the most recent results of the Barrow Ruptured Aneurysm Trial (BRAT), we would like to take the opportunity to comment on the accompanying editorial and the authors’ response to clarify some misconceptions about other trials...