Neurosurgical forum
Letters to the editor

Auditory brainstem implants in neurofibromatosis Type 2


Those of us involved in the care of patients with neurofibromatosis Type 2 (NF2) and placement of auditory brainstem implants (ABIs) have been aware for some time of excellent results being obtained in a few European centers. Prior to this report, most of this information had been anecdotal or delivered in small meetings and conferences. There was one previous report in the otolaryngology literature. In fact, awareness of these results in NF2 patients led to a small meeting to discuss the possible reasons for differences in results, held in Munich in 2012, and attended by Professors Matthies and Behr, who have been the primary surgeons for these cases.

Due to the rarity of the disease, there are no truly large centers for ABI placement and only a few with substantial numbers of cases. Given the improved results that have now been reported, those of us continuing to place ABIs are obliged to critically evaluate our own methods to determine whether there is room for improvement. For instance, as a surgeon with a greater than 50 case experience in ABI placement for NF2, I have a number of patients with excellent open-set speech discrimination but not nearly the 44% (8 of 18) achieving greater than 25% open-set discrimination in this series.

It is also possible, however, that part of the difference in results lies in methodological aspects that cannot or need not be addressed. In addition, there may be both a numerator issue and a denominator issue.

In terms of issues that can clearly be addressed, I would agree with the authors that an extremely important one is the technical care taken in tumor resection and ABI placement. The authors report that they do not use bipolar cautery in the process of tumor resection, and we minimize cautery use as well. In my opinion, the important concept is to understand that there is a higher degree of delicacy needed akin to that needed for hearing preservation surgery.

The use of the semisitting position may also facilitate brain relaxation and bloodless dissection. We do not utilize the semisitting position, and I am not aware of any center in the US that does (for vestibular schwannoma resection). Adoption of this technique may pose significant challenges in this country due to medicolegal concerns regarding the perceived increased risk of air embolism, as well as surgeon comfort and familiarity. It is possible that the benefits of the semisitting position are required to obtain improved ABI results. These benefits would have to be weighed against any additional risks, either real or perceived.

The next issue is that of the ABI device. The authors use the Med-El ABI, while the only device available in the US is the one manufactured by Cochlear Ltd. The editorial and response preceding the article itself debate this issue in some detail in terms of electronics and processor technology. I would posit, however, that differences in outcome could as well be due to the physical characteristics of the electrode arrays. For instance, the Cochlear Nucleus ABI cable is not ideally flexible, which sometimes interferes with exact array positioning.

Yet another issue is that of postimplantation ABI follow-up. The authors stress the importance of continuous intervention in ABI programming by experienced audiologists. In the experience of our center, follow-up is often problematic due mostly to vast geographic distances in North America, an issue that may pose less of a problem in Europe. Our patients typically travel long distances for surgery and initial ABI activation. They must then choose to continue contact with our audiologist on a regular basis, and not all can do this due to either practical or financial concerns. I am not sure there is an easy solution to this problem, since the presence of more centers necessarily dilutes experience at each center.

In terms of “denominator” issues, it is unclear to me whether the authors’ pool of implanted patients is the same as ours or other centers in the US. The authors’ 18 implanted patients are derived from a series of 104 patients. Did these patients present for surgical treatment of vestibular schwannomas, observation of vestibular schwannomas, or investigation of other NF2-related pathology? While our center treats patients for a variety of NF2-related issues, a higher proportion presents for vestibular schwannoma surgery and ABI placement. Perhaps we are less selective in whom we implant the devices.

This selectivity could be on the basis of preoperative evaluation but also could be on the basis of intraoperative findings. The Med-El device includes a 4-channel test electrode via which electric auditory brainstem responses (E-ABRs) can be confirmed prior to ABI implantation. The authors report that the ABI was implanted “if adequate activation of the cochlear nucleus was evident,” suggesting that the ABI was not implanted in all cases. In contrast, the Cochlear ABI allows E-ABR testing only with the ABI device itself. The device must first be implanted to even test, and testing is carried out only to optimize positioning. We do perform electrophysiological mapping in all cases, but only after the ABI has already been implanted.

Despite these issues, I am extremely impressed and humbled by the authors’ results. Placement of ABIs should not be undertaken lightly, and the authors’ results certainly confirm that meticulous detail and experience are critical to achieving excellent outcomes. Perhaps the most important take-home lesson for all readers are the possibility of achieving better than previously thought au-
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diagnostic benefits with ABIs in NF2 and the importance of proceeding with ABI implantation soon after loss of hearing.

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Disclosure
Dr. Schwartz is a consultant for Cochlear Americas.

References

RESPONSE: I am thankful for the opportunity to respond to the letter by Dr. Marc Schwartz on our recent ABI article.

One important aspect addressed by Dr. Schwartz is acquisition and selection of patients for ABIs. In Europe, there is a great tendency for patients and colleagues to seek advice and treatment at major specialized centers and to travel long distances for this reason. Patient selection is based on a large cohort of patients with long-term follow-up who have various skull base pathologies and other neurofibromatosis-related tumors. My neurofibromatosis outpatient clinic that had been located in Hannover for 15 years is now located at Würzburg and is continuously growing. Here, patients receive complete counseling and treatment for tumors of the head, spine, and periphery from the interdisciplinary team, in addition to members of the neuro-oncology, neuro-ophthalmology, neuroradiology, and radiotherapy departments, and specialists in genetics and tissue engineering are also available to participate in patient care as needed. Currently about 250 patients with NF2 are seen for regular follow-up; of these patients 104 underwent surgery for a variety of tumors during the reported study period. For vestibular schwannomas, hearing preservation is the primary goal and is achieved in about 30% of our NF2 patients. Well-informed patients seek advice and ask for an ABI often before surgery for large tumors or are transferred after previous surgery elsewhere. As mentioned, about half of the patients in the study had undergone surgery once or several times before. In fact, in all of the patients in this continuous study, E-ABRs could be recorded, and the indication for implantation was confirmed at surgery and carried out. The quality of the E-ABRs showed specific variation and is probably an indicator for the potential of acoustic recovery.

For NF2 patients undergoing postintervention follow-up, long traveling means an additional burden in view of their lesions and physical disabilities, and also with regard to financial charges. Nonetheless, the experience of receiving complete and competent advice and care requires patients and families to keep in contact with the clinic and travel repeatedly 600 km (400 miles) or more. Since only a few centers are allowed to perform ABI surgery, health insurance often covers some of the travel expenses.

A further supportive factor is that patients, who have received the current device, experience fast hearing recovery. In contrast to previous studies, we now are seeing some useful hearing perception within the first days and weeks after ABI activation. This knowledge increases patients’ motivation to return and have the auditory frequencies tuned, loudness modulated, and program adaptations tried out.

Among the surgical aspects addressed, the semisitting position is advantageous, especially for patients with large tumors. Previous fears of transverse section syndrome can be minimized by electrophysiological control. The same applies to the risk of air embolism; this risk is now low, and, if it occurs, in my practice, related complications are rare thanks to the involvement of an experienced neuro-anesthesiologist and his close interactions with the surgical partners. In this surgical position, the option of continuous fluid irrigation helps avoid the need for cauterization. The danger of cauterization was identified and brought to light in the 1970s by Madjid Samii and Leonard Malis, before the era of monitoring. Dr. Samii started to resect giant tumors without any bipolar cauterization and obtained astonishing functional results. Without any monitoring, only the avoidance of bipolar cauterization could help protect the cranial nerves. The inherent risks of cauterization became evident when electrophysiological monitoring was first used, though the underlying mechanisms are multiple and still debated. At the Munich ABI Meeting of Neurosurgeons (Kempinski Hotel Airport, Munich, March 23 and 24, 2012), Robert Shannon discussed the biological processes possibly induced in the nervous tissue at current application. In some ABI placement surgeries I performed in the supine position at other centers, we were able to obtain the same quality of open speech perception. Thus, I do not think that the semisitting position is mandatory in ABI surgery, but it has specific advantages.

Regarding the device, the option of using a test electrode is advantageous, especially as the paddle has the identical size as that of the final implant. If another company’s device is used, I would suggest using a bipolar stimulating probe to test the responsiveness of the cochlear nucleus. This probe may be designed for direct nerve stimulation with rounded poles. In our series with other devices (Nucleus and Clarion) implanted in Hannover, we used such a probe and connected it to our electrophysiological recording system and had it triggered by the Nucleus stimulation system.

The cable of the Medel device is very flexible and allows gentle introduction of the implant into the recess at any angle that might be necessary according to the individual anatomy. Once the “paddle” with the electrodes is placed and moving with the brainstem, the cable ensures sufficient freedom of movement. With the exception of 1 of our patients who fell within a few weeks after surgery and who needed implant repositioning, I have not observed any dislocation in more than 30 implants I have placed using this model.

The current speech processor provides the engineer...
with the opportunity of precise adaptation at each single electrode. All stimulation parameters may be tuned at wide variation and so may be finely individually modulated according to the patient’s individual acoustic perception. The latest modification allows some patients to listen and enjoy music, and these patients describe clearly that they not only recognize known songs, and their lyrics and melody, but they also perceive completely new pieces of music.

I agree with Dr. Schwartz that the auditory nucleus requires some “higher degree of delicacy” even as in surgery for hearing conservation, and for me it is similar to the handling of the optic nerve. Similar to the auditory nerve, the nucleus does not “forget” any manipulation it has endured, and it seems that all events are cumulative. What we also had to learn was that very delicate handling and perfect implant placement with all electrodes achieving acoustic sensations is still not enough. If deafness has been present for too long, speech recognition at a high level is not likely.

Once again, on behalf of our team I would like to express our sincere thanks for the open-minded discussion on this exciting topic in the Journal of Neurosurgery.

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Closed-loop electrochemical feedback system for DBS

TO THE EDITOR: We read with interest the article by Chang et al.2 (Chang SY, Kimble CJ, Kim I, et al: Development of the Mayo Investigational Neuromodulation Control System: toward a closed-loop electrochemical feedback system for deep brain stimulation. Laboratory investigation. J Neurosurg 119:1556–1565, December 2013). The article presents results of animal tests showing that electrochemical information can serve as a feedback in a proposed closed-loop deep brain stimulation (DBS) system. For this, it is necessary to implant at least 2 electrochemical sensors based on a neurochemical concentration sensing system (WINCS) in addition to separate stimulation electrodes in each cerebral hemisphere. The authors propose using this approach to monitor the levels of dopamine oxidation and orthoquinoine reduction over time to provide feedback on the patient’s momentary status and thus control DBS accordingly.3 This approach implies using a total of 4 additional electrodes (for recording and reference) in addition to 2 stimulation electrodes. In contrast, our previous work on volunteer human patients with Parkinson disease (PD) and essential tremor (ET) implanted with FDA-approved DBS systems2,3 suggested that onset of tremor in each patient may be predicted by sensing and subsequent online processing of surface electromyography (EMG) signals from affected limbs. In our patient-tested approach1,3 this sensing is totally noninvasive and maintains the current practice of implanting only a single electrode on each side of the patient’s brain.

Furthermore, while Chang et al.2 indicate using stimulation pulse trains of 30 seconds (see their Results section), we reported tests using pulse trains of 26 to 73 seconds1 and 20 to 50 seconds.3 Interestingly, our review of Fig. 3, specifically displayed elements 4 and 6 of it, in the cited paper2 shows that following a DBS pulse train of 19 seconds (time markers 1332 to 1351), there was a substantial decrease in dopamine oxidation level that continued for another approximately 20 seconds after the end of the stimulation pulse train in the animal tests. Similarly, we reported1,3 that the ratio of the pulse-train duration to the tremor-free period at the end of that pulse train was of approximately the same order as the duration of increased dopamine oxidation levels for similar pulse trains as reported by Chang et al.2 This may indicate that the tremor-free period at the end of a DBS pulse train is indeed more or less the period over which the levels of dopamine remain elevated at the end of the pulse train.

It is also worth noting that the prediction of the tremor onset from surface EMG signals averaged 100% sensitivity and 85% accuracy over the 8 patients tested (4 with PD and 4 with ET).1 This is particularly important in light of Temperley and colleagues’ report4 that tremor is the symptom that reappears the earliest after discontinuation of DBS in most PD patients who have tremor.

With this in mind, we feel that if the important development reported by the Mayo Clinic researchers2 is combined with predictions of tremor onset via EMG, the combination may help in determining if such EMG-based prediction is a reasonable estimate of changes in striatal dopamine release. If this is established with sufficient confidence, then a closed-loop on-demand control of DBS without actual implantation of chemical sensors in the brain will be a much more reasonable and attractive option, especially in those patients who present with dominant rest tremor as well as those with postural and action tremor. Hence, it will be useful to test the conclusions of a prediction based on peripheral signals in the same patient population to determine if the results of prediction from electrochemical sensing and EMG signals are similar.

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Disclosure

The authors report no conflict of interest.

References


RESPONSE: No response was received from the authors of the original article.

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Edwin Smith Papyrus Case 8

To The Editor: In his reappraisal of the Edwin Smith Papyrus Case 8, Ganz1 concludes that the combination of ipsilateral spastic hemiparesis in this closed-head injury can only be explained as an injury occurring in a patient with the hemiparesis antedating (Ganz JC: Edwin Smith Papyrus Case 8: a reappraisal. Historical vignette. J Neurosurg 120:1238–1239, May 2014). Ganz further elaborates on possible explanations for the given neurological findings and suggests the possibility of a frontoorbital fracture. Ganz’s sound assessment would be valid in Case 8 if the cases presented in the Edwin Smith Papyrus were “case reports” or equivalent narratives of specific injuries occurring to specific individuals, but they are not.

In agreement with Dr. Ganz, our recent translation of this Papyrus2 shows “no major difference in the reports of the components of the clinical picture of Case 8.” However, our linguistic analysis, including the function and syntax of Egyptian verb forms, reveals in this case and throughout the document important aspects of its fundamental structure as a didactic text in which traumatic entities are presented as “case types.” Supporting this view, we can cite two examples: 1) The title of each of the traumatic entities addressed in the Edwin Smith Papyrus begins as follows: “Necessary knowledge and skills for …” (type of injury and its major anatomical features). In Case 8 the text reads, “Necessary knowledge and skills for a crushed fracture of his braincase, under the skin of his head.” 2) Knowing full well what the student will find in the examination of a specific type of injury, the master physician issues instructions in each of the 48 cases: “How you find him is …” (with the key findings for every injury proceeding). Clearly, the clinical entities are presented in the Edwin Smith Papyrus as case types, not as case reports. We suggest that the findings described in Case 8 do not necessarily refer to an individual.

Case 8 is a convexity closed-head injury without specific localization, frontal or otherwise.

Our clinical commentaries about symptoms and neurological findings in each case of our translation2 are oriented to their appropriateness and possible explanation, not as an attempt to make them all fit together as an individual case. Our Appendix 2 (p 301) groups and expands on all the neurological findings described in the Edwin Smith Papyrus.

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Disclosure

The authors report no conflict of interest.

References


RESPONSE: I studied the fascinating and elegant monograph by Drs. Sanchez and Meltzer with great interest prior to writing my short paper. In consequence, I am somewhat at a loss to understand the objections in their letter. As far as I understand it, they are suggesting that on the basis of linguistic analysis Case 8 is not a case report but a case type, which will form a basis for guidance for students. I am not sure how that affects the notions expressed in my paper. The main reason for writing it was to emphasize that a posttraumatic hemiparesis in a fresh traumatic brain injury is not compatible with an ambulant patient. This remains true whether the text describes a type of case or a specific patient. The key elements to discuss here are the mechanisms of injury and the time of the trauma.

There have been two suggested mechanisms to explain this phenomenon. These are described in my original paper and do not need to be repeated in detail here. In brief, Breasted suggested that the ipsilateral hemiparesis was due to an extensive contrecoup lesion. Sanchez and Meltzer suggest compression of the opposite cerebral peduncle against the tentorial edge. Both of these are well-recognized mechanisms for producing an ipsilateral paresis, but neither is consistent with a conscious ambulant patient soon after injury.

The second question is the timing of the injury. Sanchez and Meltzer refer to Appendix 2 in their book in which the neurological findings are tabulated. In the table they note that the patient had spasticity, which is a late finding, and state “This case has passed the acute stage.”
However, the table contains no mention of bleeding from the nose and ear and the meningism described in the text, which are both indicative of a fresh injury.1

In conclusion, for the reasons given, this was almost certainly a fresh injury. The patient was ambulant, so the suggested mechanisms for hemiparesis are inconsistent with clinical experience. There is no disagreement that the presence of spasticity takes many weeks to develop. This suggests that its presence was unrelated to the fresh injury described in the text.

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References


Suprajugular extension of the retrosigmoid approach

To The Editor: We read with interest the article by Matsushima et al.3 on using the so-called suprajugular extension of the retrosigmoid approach (Matsushima K, Kohno M, Komune N, et al: Suprajugular extension of the retrosigmoid approach: microsurgical anatomy. Laboratory investigation. J Neurosurg 121:397–407, August 2014). This study is about extension of the classic retrosigmoid approach to remove cerebellopontine angle lesions extending to the upper part of the jugular foramen. They explained suprameatal drilling to expose the area limited above by the internal acoustic meatus, cranial nerves (CNs) VII and VIII, and the labyrinthine artery and the area limited below by CNs IX–XI and the jugular bulb. Traditionally, the retrosigmoid, far lateral with transcondylar or paracodylar extensions, postauricular transtemporal, and preauricular subtemporal-infratemporal approaches have been used for lesions located inferior to the internal acoustic meatus with extension into the jugular fossa.1,2 This approach is an alternative for more extensive approaches that have been traditionally used to expose the jugular foramen and the caudal end of the petroclival fissure.

In our recent article,4 we explained the successful application of the “retrosigmoid intradural inframeatal (RSIM) approach” in 3 cases. As we discussed in the article, the area of bone drilling in this approach is inferior to the internal auditory canal and above the exit of the lower cranial nerves (Fig. 1). The amount of bone removed is not fixed in this approach and depends on the location and extension of the tumor. Under the control of neuronavigation and micro-Doppler ultrasonography, the resection can be safely extended medially to the petrous apex and anteriorly to the petrous internal carotid artery. Adding an operative endoscope, the surgeon can determine if there is a remaining part extracranially or inside the jugular foramen.

Considering the above-mentioned details, we believe that suprajugular extension of the retrosigmoid approach and the RSIM approach have significant overlap, and that the suprajugular bone drilling can be considered as a variant of the RSIM approach tailored to the lesions of the upper part of the jugular foramen. We prefer the term “retrosigmoid inframeatal approach” because it reminds us that it is an evolution of the well-known retrosigmoid “meatal” approach, which is commonly used for the resection of vestibular schwannomas, and because the term “inframeatal” is more specific for the bone drilling area than the general term of “suprajugular.”

We find anatomical studies like this very valuable in clarifying the details of this approach and for educating young neurosurgeons. However, we emphasize that the real intraoperative anatomy may be much more variable according to distortion of the anatomical landmarks because of the presence of the lesions and alterations in the relations between different neurovascular elements as compared with those observed in healthy subjects.

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Fig. 1. Photographs of the inframeatal approach. Left: The right inframeatal region (double asterisks) is demonstrated in a presigmoid exposure. The area is bounded anteriorly by the facial nerve (F), posteriorly by the posterior fossa dura, superiorly by the posterior semicircular canal (asterisk) and the internal auditory canal (IC), and inferiorly by the jugular bulb (JB) and lower cranial nerves. Right: The left inframeatal region (double asterisks) is viewed from a retrosigmoid approach to demonstrate its relation to the lower cranial nerves (LCN), a skeletonized posterior semicircular canal (asterisk), and the vestibular nerve (VIII).3

This article contains some figures that are displayed in color online but in black-and-white in the print edition.

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Disclosure

The authors report no conflict of interest.

References


Response: We are well acquainted with Dr. Samii and colleagues’ excellent paper on the RSIM approach.1 The focus of their paper on the inframeatal approach and our paper on the suprajugular extension of the retrosigmoid approach are different. The lesions they described were between the internal auditory canal and the jugular tunnel with variable extension into the petrous apex. The lesion that we described extended into the upper part of the jugular foramen. The drilling areas of the inframeatal approach and the suprajugular extension may have some overlap, but the focus of their paper was the inframeatal area, while our focus was the roof of the jugular foramen, intrajugular process and ridge, and pyramidal fossa.

We believe that basic anatomical studies like ours will aid in understanding the complicated anatomy and pathologies involving these areas. We appreciate their comments and congratulate Dr. Samii’s group on the excellence of their many contributions to posterior fossa surgery. We believe that neurosurgeons operating in this anatomical area will benefit by gaining an understanding of both the inframeatal approach they describe and the suprajugular extension described in our paper.

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Reference


Fig. 1. A and B: CT sections showing a bony defect (arrows) with opacification of the nasal cavity below it. C and D: Sagittal T2-weighted MRI studies showing fluid in the defect (arrows) and nasal cavity; a partial empty sella (arrowheads) is also apparent. E and F: Coronal MRI studies showing lower position of the left gyrus rectus (larger arrow) and increased perioptic fluid (arrowheads); the defect (smaller arrow) outlined by fluid is noted in E. G and H: Axial (G) and sagittal (H) MRI studies showing prominent perioptic fluid (arrows); vertical buckling is noted in H.

Idiopathic intracranial hypertension presenting solely as CSF rhinorrhea

To The Editor: I read with interest the article by Yang et al.4 (Yang Z, Wang B, Wang C, et al: Primary sponta-...
herniation of the left gyrus rectus in a lower position (Fig. 1E and F).

The patient was put on acetazolamide, and bed rest was advised until successful surgical repair of the defect. She is asymptomatic on postoperative follow-up.

Discussion: CSF rhinorrhea is a known feature of IHT, but is usually associated with headache. Cerebral herniation is known in IHT, and fluctuations in intracranial pressure is the assumed etiopathology in intermittent brain herniation associated with intermittent CSF rhinorrhea.

Conclusions: Benign or idiopathic IHT presenting solely as CSF rhinorrhea is rare. I agree with the authors that when treating patients with CSF rhinorrhea or monitoring them during follow-up, intracranial pressure should be controlled, and they should also be checked for other symptoms of idiopathic IHT. ANITHA SEN, M.D., F.R.C.R. Thiruvananthapuram, Kerala, India

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Disclosure
The authors report no conflict of interest.

References

RESPONSE: No response was received from the authors of the original article.

Meningioma surgery in the era of 5-aminolevulinic acid fluorescence-guided surgery


The authors’ aim was to assess the role of 5-aminolevulinic acid (5-ALA) fluorescence in guiding the resection of bone-invading meningiomas. Because the Simpson grading system does not evaluate bone invasion, they radiologically assessed the amount of tumor resection, bone invasion, and hyperostosis by comparing pre- and postoperative MR images and CT scans.

When reading the article, we were confirmed in our opinion that in the era of 5-ALA fluorescence–guided surgery, another item has to be added to the Simpson grading scale. In fact, 5-ALA holds the potential to visualize tumor tissue infiltrating bone, dura mater, and brain, which would remain unrecognized under white light. When resecting meningiomas with 5-ALA there are 2 possible surgical scenarios at the end of surgery: 1) fluorescent tissue may be completely resected (for example, in cases of infiltration of bone and dura); or 2) further resection is impossible because it would compromise neurological function (for example, if there is infiltration of venous sinus, eloquent brain area, or cranial nerve), resulting in residual fluorescing tissue. Hence 5-ALA fluorescence–guided surgery has the potential to increase the extent of resection in a way not encompassed by the Simpson grading system. We therefore suggest adding an item to the Simpson grading scale reflecting whether or not fluorescing tissue was present at the end of surgery.

We recently analyzed the influence of 5-ALA fluorescence on surgical decision making in high-grade meningiomas and the impact on the extent of resection (data not yet published). It turned out that 5-ALA had no influence on surgical strategy in a way that changed the Simpson grade. However, 5-ALA improved the extent of resection at the level of infiltrated brain and around arteries, veins, and cranial nerves. We came to the conclusion that an additional grade is necessary.

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Disclosure
The authors report no conflict of interest.

References

RESPONSE: We thank Drs. Cornelius and Slotty for the interest they show toward our recent paper dealing with...
Fig. 1. A–C: Case 1. Recurrent atypical meningioma previously treated with radiotherapy is seen infiltrating the middle fossa on a coronal CT scan (A) and intraoperative photograph (B). Under blue light (C) a residual meningioma is detected after dura mater resection.  
D–F: Case 2. Axial MRI study showing a convexity benign meningioma (D). After resection under white light (E), a small residual fragment was detected under blue light (F).  
G–I: Case 3. Sagittal CT scan demonstrating a large recurrent benign meningioma (G). The cortical surface of healthy tissue is dissected away from the meningioma under white (H) and blue (I) light.  
J–L: Case 4. Axial MRI study demonstrating a parasagittal benign meningioma (J). Intraoperative photographs showing detection under blue light (L) of small residual fragments of meningioma (arrows) not clearly detectable under white light (K).  
Panels A and G are CT scans; D and J are MRI studies; B, E, H, and K are intraoperative photographs obtained with white light; and C, F, I, and L are intraoperative photographs obtained with blue (fluorescent) light.
the accuracy of 5-ALA in guiding the resection of bone-invading meningiomas. They raise the engaging issue of whether the Simpson grading system is still adequate in the era of 5-ALA fluorescence-guided surgery. The authors postulate that a revision of the Simpson grading system is necessary in light of 5-ALA fluorescence-guided surgery data.

Such an assertion entails some due considerations. We should bear in mind that the Simpson grading system was published in the last century, almost 60 years ago, based on a collection of cases that had been surgically treated over the previous 30 years. Neurosurgery has completely changed since then. The current protocol for surgical management of meningiomas aims to improve the tumor resection rate through more and more sophisticated technologies, while preserving neurological function and thus the quality of life. Modern neurosurgery seeks to define the correct balance between these two perspectives, which at times are in conflict. However, despite the technical advances and the partial change of attitude toward aggressive meningioma resection, the Simpson grading system remains valuable and up to date. Indeed, it maintains both its prognostic value and its usefulness in the selection of patients for adjuvant treatments (that is, radiosurgery for residual tumors).

We must consider that the Simpson grading system was conceived almost 60 years ago, specifically as a tool to predict the recurrence of meningiomas after surgical treatment, and that it rests on clinical and surgical principles of that time: the recurrence was defined in a “purely clinical sense to imply the reappearance of symptoms due directly to tumour growth after a period of symptomatic relief.” The intraoperative techniques were less advanced, and the assessment of resection pattern was retrospectively obtained from the surgical charts. In such a setting, bone infiltration was regarded as relatively “indolent” in terms of recurrence, and the extent of resection of bone-invading meningiomas was not considered independently.

We do agree with the authors that the Simpson grading system may be improved. In our study, 5-ALA fluorescence had a sensitivity of 89.06% and a specificity of 100% in detecting bone invasion. This only means that 5-ALA is an efficient tool in detecting meningiomatous tissue. However, our study was not designed to assess whether the extent of resection was greater under blue than under white light. Furthermore, the few series available in the literature at present do not provide data on whether 5-ALA technology is able to improve the extent of resection of meningiomas.

We agree with Drs. Cornelius and Slotty on the usefulness of 5-ALA in meningioma surgery: in our experience this was particularly evident for some specific subgroups of meningiomas (large, infiltrating, aggressive, and previously treated with radiotherapy) (Fig. 1). We think that the neurosurgical community should take the suggestion of the authors into consideration, and this could be the hint for further studies in which the purpose is to evaluate whether 5-ALA can improve the extent of resection of meningiomas, and whether such improvement has an actual impact on the recurrence rate, the prognosis, and the patients’ quality of life. Should this be the case, the Simpson grading system may be improved, almost 60 years later, by 5-ALA technology.

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