

Surgical management of medium and large petroclival meningiomas: benchmark and limits

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Received: 11 December 2015 / Accepted: 14 December 2015 / Published online: 4 January 2016
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Da Li and co-workers present a detailed sub-analysis of their series of petroclival meningiomas, which is the largest monocentric series published to date [5, 6]. In the current work, they restrict the analysis to medium and large tumours of more than 2 cm in diameter—the tumours that really cause difficulties for microsurgery as well as stereotactic radiosurgery. Gross total resection was achieved in 56 % of patients; dysfunctions of the cranial nerves were the most common complication and occurred in two-thirds of the patients. Immediately following surgery, morbidity temporarily increased and the Karnovsky Performance Scale temporarily decreased on average. The case fatality rate amounted to 2 %. Permanent surgical morbidity remained in 20 % of patients during the average long-term follow-up of almost 10 years, but significantly more patients lived independently after than before surgery (61 vs 46 %). One-fourth of patients were lost to long-term follow-up, so that the numbers regarding long-term outcome must be appreciated with sound judgment.

These key data focusing on medium and large petroclival meningioma are important, although difficult to compare with the smaller unselected series [1, 3, 7–9, 12]. Petroclival meningiomas smaller than 2 cm carry a much smaller surgical risk than large tumours, and in unselected series the small tumours dilute information regarding the problematic larger tumours. Numbers for the rate of gross total resection and surgical morbidities given in the published unselected series

differ widely: gross total resection between one-third and two-thirds, and surgical morbidity also between one-third and two-thirds.

Stereotactic radiosurgery is an obvious alternative for primary treatment of these tumours. There are not very many reports—a fact that reflects concerns regarding tolerance in view of the vicinity of the brainstem. The Pittsburgh group reported their experience in a series of 39 patients with a median follow-up period of 37 months. Neurological status improved in 21 %, remained stable in 66 %, and eventually worsened in 13 %. Tumour volumes decreased in 23 %, remained stable in 68 % and increased in 8 % [13]. It appears that there is some kind of consensus that radiosurgery is an adjuvant modality for larger petroclival meningiomas, which cannot be recommended as first-line therapy. However, there is little doubt that in analogy to vestibular schwannomas, stereotactic radiosurgery has evolved to an alternative for small-sized meningiomas.

The substantial proportion of incomplete removal in most series and the significant rate of morbidity suggest that petroclival meningiomas remain not only difficult but basically problematic for microsurgery. Finding the balance between radicality and risk is the real challenge of managing petroclival meningiomas. The surgical risk appears to be influenced by (1) tumour size, (2) consistency and texture of the tumour and (3) the interface between tumour and arteries, brainstem and cranial nerves. In my opinion, it is hardly possible to dissect an adherent or even encased pontine artery from the tumour.

Better presurgical imaging should provide more information with regard to tumour consistency and interface to vital structures. The techniques to define mechanical properties are partially already available, but they must be integrated into clinical routine [10, 11, 15]. The techniques to define interfaces are also available with the heavily contrasted T2-

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weighted series such as (constructive interference in steady state [CISS]). Although it appears highly desirable to know prior to surgery exactly what to expect, it remains an open issue knowing exactly whether to expect a soft tumour or a hard, rubber-like one makes a difference at the end in a situation where there is no reasonable treatment alternative. Regarding the interface to neighbouring structures, exact presurgical knowledge most likely makes a real difference, since dissection should not even be tried if the images suggest encasement of small pontine arteries.

In the current series of Li et al., intraoperative neurophysiological monitoring did not play a role. The patients were operated upon between 1993 and 2003. Today intraoperative neurophysiological monitoring certainly belongs to the standard procedure, although it is less helpful than, for example, with vestibular schwannomas [4]. Petroclival meningiomas are in contact with multiple cranial nerves that are partially difficult or impossible to monitor. Regarding long-tract evoked potentials, electrophysiological monitoring can reliably identify damage related to surgical microdissection within the vicinity of the brainstem. The damage is, however, most often of ischaemic nature and not reversible.

The approach to petroclival meningioma is also an issue of continuing discussion [2, 7, 12, 14]. Li et al. based their surgical approach selection on tumour features, patient age and co-morbidities, and the surgeon's preference. The presigmoid approach was used in cases in which the tumour was low and limited to below the IAC with broad attachment to the posterior petrous surface and partial extension into the middle fossa. The subtemporal transtentorial approach was used when the tumour's lower limit was above and medial to the IAC. Extended middle fossa approaches including zygoectomy and partial petrosectomy were used when the tumour extended anterior-superiorly to the sellar region and inferiorly to the mid-clivus. The retrosigmoid approach was used when broad attachment to the posterior petrosal surface without middle fossa invasion was present. I would agree with this concept. As the authors state, the surgeon's preference is important. Many tumours can be approached by the subtemporal route as well as by the retrosigmoid route.

Li and co-authors conclude from their analysis that radically aggressive resection might not be judicious in terms of postoperative morbidity. There is little to add to the conclusion. The challenge associated with large petroclival meningiomas is not of surgical or technical nature; the challenge is to find the right balance between acceptable risk and radicality. The challenge lies in the preoperative and intraoperative judgment by the surgeon.

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