Endoscope-assisted microsurgical resection of epidermoid tumors of the cerebellopontine angle

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Object. Epidermoid tumors located in the cerebellopontine angle (CPA) are challenging lesions because they grow along the subarachnoid spaces around delicate neurovascular structures and often extend into the middle cranial fossa. The purpose of this study was to determine the value of endoscopic assistance in the microsurgical resection of these lesions, in which total removal is the therapy of choice.

Methods. Eight patients harboring an epidermoid tumor of the CPA were treated using an endoscope-assisted microsurgical technique. A retrosigmoid suboccipital approach was used in five patients and a pterional transsylvian approach was chosen in the other three. In four patients the lesion was resected microsurgically and the endoscope was used repeatedly to verify complete tumor removal, whereas most of the tumor mass was removed with the aid of an operating microscope in the other four. Tumor parts extending into other cranial compartments that were not visible through the microscope were removed under endoscopic view by using rigid rod-lens scopes with 30 and 70° angles of view.

All epidermoids were completely evacuated and the membranes were widely resected. Large tumors occupying both the middle and posterior cranial fossa were removed through a single small opening without enlarging the craniotomy. Permanent hearing loss and permanent hypacusis were observed in one patient each. One patient with facial and one with abducent nerve palsy recovered within 6 and 4 months, respectively. A transient weakness of the chewing muscles was encountered in one patient. Postoperative magnetic resonance imaging revealed no residual tumor in any patient. To date no recurrences have been observed (follow up range 12–98 months).

Conclusions. The endoscope-assisted microsurgical technique enables safe removal even when tumor parts are not visible in a straight line. Tumor extensions into adjacent cranial compartments can be removed with the same approach without retracting neurovascular structures or enlarging the craniotomy.

KEY WORDS • EPIDERMOID • CEREBELLOPONTINE ANGLE • NEUROENDOSCOPY •
Results

Complications, patient outcomes, follow-up periods, and MR imaging results are presented in Table 1. The follow-up periods ranged from 12 to 98 months. All epidermoids were completely evacuated. In three patients (Cases 1, 2, and 5) a total removal of the capsule was performed, resulting in permanent cranial nerve deficits in two of them. In the other patients, the non- or less-adherent parts of the capsule were resected. Small portions of the capsule that were tightly adherent to neurovascular structures or the brainstem were left in place. In the two patients who presented with recurrent tumor (Cases 6 and 8), the capsule coated the adjacent structures like sugar icing; these lesions were completely evacuated. The capsule was extremely adherent, and therefore no attempt was made to resect it.

There were no deaths, but permanent deficits occurred in two patients. Tearing of the labyrinthine artery while the tumor was being dissected with the aid of an operating microscope resulted in permanent anacusis (Case 5). Dissection of the adherent capsule from the sixth, seventh, and eighth cranial nerves led to transient abducens and facial nerve palsy as well as permanent significant hearing loss (Case 1). The facial and abducens nerve palsy recovered within 6 and 4 months, respectively. Weakness of the chewing muscles for 4 months was attributed to manipulation of the trigeminal nerve within the Meckel cave during tumor removal (Case 7).

The use of the endoscope was safe: no complications could be attributed to its application. In four patients (Cases 1–3 and 5), the endoscope was simply used for inspection during and after removal of the lesion. In these cases the endoscope was guided in freehand fashion. In one patient (Case 2), tumor remnants were identified that were not clearly visible with the microscope. These residual tumor parts were then removed with the aid of an operating microscope. In the other four patients (Cases 4 and 6–8), the endoscope was used not only for inspection but also for tumor resection. The endoscope was fixed with the aid of an endoscope-holding device (Karl Storz GmbH & Co.) and tumor removal was performed using regular microsurgical instruments. In all patients, tumor parts that were not visible in a straight line with the microscope were visualized and removed. It was not necessary to enlarge the craniotomy to remove tumor parts located in adjacent cranial compartments.

The symptoms caused by mass effect of the lesion resolved after surgery. The cranial nerve palsies remained unchanged in the two patients with recurrent lesions that
were sequelae of the first surgery. Postoperative MR imaging revealed no residual tumor in any patient. To date no recurrences have been observed (follow up range 12–98 months).

**DISCUSSION**

According to Obrador and Lopez-Zafra, because of the irregular nodular surface and pearllike shine, epidermoids were referred to as the “pearly tumor” by Cruveilhier. Epidermoids consist of a thin capsule filled with soft white material that is the result of progressive desquamation from the epithelial lining and breakdown of keratin. This material is rich in cholesterol, has a waxy consistency, and forms concentric lamellae. Removal of the cyst contents is easy because of their consistency and avascular nature. Nevertheless, the capsule may be firmly adherent to neurovascular structures, making any attempt at total removal risky. Therefore, many authors recommend complete evacuation of the cysts to relieve the mass effect, followed by resection.
of the nonadherent parts of the capsule. Small remnants of the capsule that are firmly attached to important neurovascular structures should be left in place to minimize the risk of neurological sequelae. In general, only small parts of the capsule cannot be safely removed in primary cases. Although a capsule remnant probably will result in recurrence, this will occur many years after surgery. Berger and Wilson reported that it may take 30 to 40 years for recurrent symptoms to develop, a finding that supports the rationale for avoiding radical excision. In our series, we observed two recurrent tumors that arose 15 and 19 years after surgery, respectively. These lesions were removed without causing new morbidity, thereby confirming claims in the literature of an excellent functional prognosis even after a second or third surgery.

Epidermoid tumors grow slowly at a linear rate resembling the growth of the human epidermis and they may reach an enormous size before causing symptoms. Epidermoids spread along pathways of least resistance (normal cleavage planes and anatomical canals). The Meckel cave has often been involved with epidermoids of the CPA; however, they do not extend into the internal auditory canal. Epidermoids often extend along the basal cisterns through the tentorial incisura from the posterior cranial fossa to the middle cranial fossa, or vice versa. Because of the mass effect, they may displace the brainstem considerably, which creates space for tumor removal.

In our series, epidermoid tumors involving both the posterior and middle cranial fossa were removed through a single small craniotomy. Combined approaches have been recommended, although they are not necessary when endoscopes are applied. By using optics with 30 or 70° of view, tumor parts hidden behind delicate neurovascular structures can be safely visualized and removed. The endoscope was especially useful for visualization and removal of epidermoids extending into the Meckel cave. Via a retromastoid suboccipital approach, these tumor parts could be removed without enlarging the craniotomy.

Perneczky and Fries pioneered the concept of endoscope-assisted microsurgery. Using endoscopes during microsurgical procedures allows a reduction in the craniotomy size, improves illumination and visualization, and enables the surgeon to look around important neurovascular structures, thus eliminating or at least reducing the need for retraction. Compared with the microscope, endoscopes provide a wide angle of view with superb illumination in the depth of the brain and an increased depth of focus even with high magnification. In several reports researchers have suggested a beneficial effect of using endoscopes while performing intracranial microsurgery. Nevertheless, epidermoids have not yet been specifically addressed. Zhang, et al., mentioned 34 epidermoids in their series of 126 neuroendoscopic procedures; however, no details regarding the surgical technique were given.

In four of our patients we removed tumor parts under endoscopic view without using the microscope; this has been termed endoscope-controlled microsurgery. We agree that the ideal goal in surgery for epidermoids is total tumor removal, but not at the expense of neurological deficits. It is our strategy to attempt a total removal of the capsule. When the capsule is firmly adherent to critical neurovascular structures, we leave the adherent parts in place to minimize the risk of neurological sequelae. In general, only small parts of the capsule cannot be safely removed in primary cases. Although a capsule remnant probably will result in recurrence, this will occur many years after surgery. Berger and Wilson reported that it may take 30 to 40 years for recurrent symptoms to develop, a finding that supports the rationale for avoiding radical excision. In our series, we observed two recurrent tumors that arose 15 and 19 years after surgery, respectively. These lesions were removed without causing new morbidity, thereby confirming claims in the literature of an excellent functional prognosis even after a second or third surgery.

FIG. 2. Case 7. Views through an operating microscope showing an epidermoid in the left CPA. Upper: “Pearly” tumor within the CPA above the vestibulocochlear nerve and covering the trigeminal nerve. Center: After partial resection the trigeminal nerve comes into view. Lower: View of the CPA after tumor removal.
after insertion of the endoscope, we put the scopes in warm sterile saline at 37˚C before use. The lens is cleaned by irrigation or wiping. It is of utmost importance to irrigate the operating field regularly, because the tip of the scope may become very hot. Irrigation is mandatory when the scope is in front of cranial nerves to avoid causing neurological deficits. The use of dental mirrors has been advocated in epidermoid surgery; however, the image quality and illumination is much poorer compared with the endoscope.

Aseptic meningitis is reported to be the most common cause of postoperative morbidity; although in our small series aseptic meningitis was not a problem. A moderately increased body temperature was noted in two patients 2 and 5 days after surgery; no other signs of meningitis occurred. The absence of aseptic meningitis in our small series may be attributed to abundant irrigation during surgery as well as the routine use of corticosteroid therapy perioperatively.

Magnetic resonance imaging is the diagnostic modality of choice for the detection of epidermoids. Nevertheless, differentiation between arachnoid and epidermoid cysts is
still sometimes difficult. On standard T1- and T2-weighted spin-echo MR images epidermoids can often barely be distinguished from CSF.13,14,22 Therefore, other imaging sequences have been investigated. Fluid-attenuated inversion-recovery imaging, diffusion-weighted imaging, and CISS sequencing have been recommended for the characterization of epidermoid cysts.6,8,13,27 In our experience, CISS is the best sequence for detecting epidermoids; CISS imaging allows a clear differentiation from CSF, and it accurately shows the extent of the lesion. On CISS images epidermoids usually appear as inhomogeneous, low-intensity structures with irregular borders.7,27 Although most epidermoid tumors are slightly hyperintense relative to CSF on T1-weighted images,14 CISS sequences demonstrate these lesions more clearly.13

Conclusions

The endoscope-assisted microsurgical technique enables a safe tumor removal even when parts of the lesion are not visible in a straight line. Tumor extensions into adjacent cranial compartments can be removed via the same approach without resecting neurovascular structures or enlarging the craniotomy.

Disclosure

Dr. Gaab is a consultant to Karl Storz GmbH & Co.

Acknowledgments

We thank Drs. Kallwellis (Greifswald, Germany), Schweim (Stralsund, Germany), and Kairies (Demmin, Germany) for performing MR imaging. We are grateful to Manuela Jahnke and Jürgen Peters for assistance in preparing the illustrations.

References


Manuscript received December 10, 2003. Accepted in final form April 14, 2004.
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