Combined Microsurgical and Endoscopic Removal of Extensive Suprasellar and Prepontine Epidermoid Tumors

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Abstract

Epidermoids tend to grow around and adhere to critical neurovascular structures, but total or maximal tumor removal is recommended to reduce the risk of recurrence. We describe our method of combined microscopic and endoscopic resection for extensive epidermoid tumors. Thirteen patients with epidermoid tumors located in the suprasellar, prepontine, or surrounding cisterns underwent microsurgical resection with a rigid endoscope and a high definition camera system. An anterior petrosal and/or a pterional approach was selected in 6 patients and a lateral suboccipital approach in 7 patients. An endoscope was used with the operating microscope to remove 6 tumors through the anterior petrosal and/or pterional approaches in 5 cases and the lateral suboccipital approach in 1 case. An endoscope was used to confirm microscopic removal in 5 patients. Total removal was achieved in 5 patients and subtotal removal in 8 patients. We recommend the combined microsurgical and endoscopic approaches to achieve maximal resection of extensive suprasellar and prepontine epidermoids.

Key words: anterior petrosal approach, endoscope, epidermoid, lateral suboccipital approach, microsurgery

Introduction

Epidermoid tumors are histologically benign, slow-growing congenital neoplasms of the central nervous system that may arise from retained ectodermal implants, and account for approximately 1% of all intracranial neoplasms. Epidermoid tumors generally occur at the base of the cranium, either in the sellar or parasellar regions, the prepontine cistern, or the cerebellopontine angle. Epidermoid tumors spread along pathways determined by the lowest resistance to growth, invaginating into and expanding through cisterns, sulci, and the subarachnoid space, and often grow around and may adhere firmly to critical neurovascular structures.4) Nevertheless, total or maximal removal via microsurgery is considered the therapy of choice to reduce the likelihood of recurrence.4,17) However, complete removal of a tumor which has adhered to neurovascular structures is difficult even using skull base approaches. To facilitate tumor resection, endoscopic surgical techniques have been developed.6,8,9) Endoscopic surgeries include solo endoscopic surgery and endoscope-assisted microsurgery using transcranial or transnasal approaches.5,6,8,9)

We propose a combination of microscopic and endoscopic resection for the treatment of extensive epidermoid tumors.

Patients and Methods

A total of 14 patients have undergone surgical resection of intracranial epidermoid tumor using the combined microsurgical and endoscopic techniques in our hospital since 2001. Thirteen patients who presented with epidermoids located in the suprasellar, prepontine, and surrounding cisterns were analyzed retrospectively (Table 1). One patient with tumor in the fourth ventricle was excluded. Two tumors had recurred after surgery performed in other institutes.
Table 1 Characteristics of patients with epidermoid tumors

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age (yrs)</th>
<th>Sex</th>
<th>Symptoms</th>
<th>Main tumor location</th>
<th>Approach</th>
<th>Removal</th>
<th>Complications</th>
<th>Follow-up period (mos)</th>
</tr>
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<tbody>
<tr>
<td>With endoscopic removal:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>48</td>
<td>F</td>
<td>diplopia</td>
<td>SS + PP</td>
<td>AP + E</td>
<td>subtotal</td>
<td>IV, V nerves</td>
<td>57</td>
</tr>
<tr>
<td>2</td>
<td>33</td>
<td>F</td>
<td>epilepsy</td>
<td>SS + ST + PP</td>
<td>AP, P + E</td>
<td>subtotal</td>
<td>none</td>
<td>46</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>M*</td>
<td>hemiparesis, diplopia</td>
<td>SS + PP</td>
<td>P + E</td>
<td>subtotal</td>
<td>none</td>
<td>40</td>
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<tr>
<td>4</td>
<td>37</td>
<td>F</td>
<td>visual loss</td>
<td>SS + PP</td>
<td>AP + E</td>
<td>total</td>
<td>none</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>35</td>
<td>M</td>
<td>hearing loss</td>
<td>PP + SS</td>
<td>AP + E</td>
<td>subtotal</td>
<td>IV nerve</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>37</td>
<td>F</td>
<td>ataxia</td>
<td>PP + SS</td>
<td>LSO + E</td>
<td>total</td>
<td>IV nerve</td>
<td>29</td>
</tr>
<tr>
<td>Without endoscopic removal:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>29</td>
<td>M</td>
<td>hemiparesis, visual loss</td>
<td>SS + PP</td>
<td>AP, P + E</td>
<td>subtotal</td>
<td>III, VI nerves</td>
<td>57, recurrence</td>
</tr>
<tr>
<td>8</td>
<td>69</td>
<td>F</td>
<td>ataxia</td>
<td>PP</td>
<td>LSO + E</td>
<td>subtotal</td>
<td>V nerve</td>
<td>105</td>
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<tr>
<td>9</td>
<td>34</td>
<td>M</td>
<td>headache</td>
<td>PP</td>
<td>LSO</td>
<td>total</td>
<td>none</td>
<td>60</td>
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<tr>
<td>10</td>
<td>48</td>
<td>M</td>
<td>facial spasm</td>
<td>PP + SS</td>
<td>LSO + E</td>
<td>total</td>
<td>V nerve</td>
<td>50</td>
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<tr>
<td>11</td>
<td>32</td>
<td>F</td>
<td>facial pain</td>
<td>PP + SS</td>
<td>LSO + E</td>
<td>total</td>
<td>none</td>
<td>24</td>
</tr>
<tr>
<td>12</td>
<td>40</td>
<td>M</td>
<td>facial pain</td>
<td>PP</td>
<td>LSO</td>
<td>total</td>
<td>none</td>
<td>20</td>
</tr>
<tr>
<td>13</td>
<td>63</td>
<td>M</td>
<td>facial pain</td>
<td>PP + SS</td>
<td>LSO + E</td>
<td>total</td>
<td>none</td>
<td>20</td>
</tr>
</tbody>
</table>


Results

Preoperative symptoms included cranial nerve dysfunction in 7 patients, cranial nerve palsy and hemiparesis in 2, ataxia in 2, temporal lobe epilepsy in 1, and headache in 1 (Table 1). Tumors were mainly located in the suprasellar cistern in 5 patients: an anterior petrosal approach was selected in Cases 1 and 4, a combined anterior petrosal and pterional approach in Cases 2 and 7, and a pterional approach in Case 3. Tumors were mainly located in the prepontine/cerebellopontine cistern in 8 patients: an anterior petrosal approach was selected in Case 5 and a lateral suboccipital approach in...
Cases 6 and 8–13.

An endoscope was used with the operating microscope to remove 6 tumors through the anterior petrosal and/or pterional approaches in 5 cases and the lateral suboccipital approach in 1 case. An endoscope was used to confirm microscopic removal of 5 tumors through lateral suboccipital approaches in 4 cases and the combined anterior petrosal and pterional approach in 1 case. Relatively small tumors were removed using a lateral suboccipital approach in 2 cases without using an endoscope.

Total removal was achieved in 5 and subtotal removal in 8 patients. During the follow-up period, 1 patient presented with regrowth of the tumor, which was then subtotally removed using the operating microscope and an endoscope via the same approach. Surgical complications included trochlear nerve palsy (2 patients), facial pain or dysesthesia (2 patients), trochlear nerve palsy and facial dysesthesia (1 patient), and oculomotor and abducens nerve palsy (1 patient). All symptoms except mild facial dysesthesia in 3 patients resolved during the follow-up periods.

Illustrative Cases

Case 2: A 33-year-old woman was referred to us with symptoms of temporal lobe epilepsy. MR imaging revealed a suprasellar and subtemporal tumor compressing the left temporal lobe and extending to the prepontine cistern (Fig. 2). We selected a combination of the anterior petrosal and pterional approaches. After microscopic removal, the tumor compressing the temporal lobe and extending into the prepontine cistern was removed using an endoscope. A small piece of the tumor capsule firmly adhered to the temporal lobe was not removed. After surgery, the symptoms of temporal lobe epilepsy disappeared.

Case 5: A 35-year-old man was referred to us with right hearing loss and facial spasm. MR imaging revealed a right cerebellopontine tumor extending to the supratentorial cisterns (Fig. 3). We selected an anterior petrosal approach. After microscopic removal, remnants of tumor in the suprasellar, crural, ambient, and lower part of the cerebellopontine cisterns were removed using an endoscope. A small tumor mass around the internal carotid artery was left to preserve the involved perforating arteries. After surgery, the patient experienced trochlear nerve palsy, which resolved in 3 months.

Case 6: A 37-year-old woman was referred to us with progressive ataxic gait. MR imaging revealed a right cerebellopontine and prepontine mass compressing the brainstem and cerebellum, and extending to the suprasellar cistern (Fig. 4). Since the main mass was located in the cerebellopontine and prepontine cisterns, we selected a lateral suboccipital approach. After microscopic resection, a suprasellar tumor remnant was removed using an endoscope. Total removal was achieved. After surgery, the patient experienced transient trochlear nerve palsy.

Fig. 2 Case 2. Diffusion-weighted magnetic resonance images. Preoperative images (upper row) showing a suprasellar and subtemporal tumor compressing the left temporal lobe with a prepontine extension. Postoperative images (lower row) showing no detectable remnant tumor.

Fig. 3 Case 5. Diffusion-weighted magnetic resonance images. Preoperative images (upper row) showing a right cerebellopontine tumor compressing the brainstem and extending to the suprasellar, crural, and ambient cisterns. Postoperative images (lower row) showing subtotal removal of the tumor.
Fig. 4 Case 6. Diffusion-weighted magnetic resonance images. Preoperative images (upper row) showing a right cerebellopontine and prepontine tumor compressing the brainstem and cerebellum with a suprasellar extension. Postoperative images (lower row) showing total removal of the tumor.

Discussion

Intracranial epidermoids can be effectively diagnosed due to recent advancements in neuroimaging, such as diffusion-weighted MR imaging or MR spectroscopy which can clearly visualize preoperative extension and postoperative remnant tumors.2,11 Intracranial epidermoid tumors tend to encroach into the cisterns around the cranial nerves, blood vessels, and brainstem, rather than compressing these structures. A high rate of recurrence after long follow-up periods has been reported.17,20 The goal of epidermoid treatment should be complete surgical resection while causing no damage to vital neurovascular structures, because complete removal of the tumor eliminates the chance of recurrence and diminishes the risk of postoperative aseptic meningitis.17,21 Reports of possible malignant transformations of remnant tumors emphasize the necessity of complete removal.7 On the other hand, complete removal of tumor capsules adhering to neurovascular structures is difficult even with skull base approaches, leading to recommendations against attempting total removal.13,19 The ideal is total capsule removal, but if the capsule is firmly adhered to critical neurovascular structures, the adherent parts should be left in place to minimize the risk of neurological sequelae.

We have utilized the endoscopic endonasal transsphenoidal approach for pituitary tumors since 1996. However, we started to employ an endoscope for the removal of epidermoid tumors in 2001. The benefits of using an endoscope for the microsurgical removal of epidermoids have been previously reported.13 Neuroendoscopy can be an important tool in the resection of epidermoids with minimal trauma, by helping to reduce brain retraction and at the same time avoiding additional dural and bone resection. Tumor parts extending into other cranial compartments that are not visible through the operating microscope can be removed using 30- or 70-degree angled endoscopic views through a monitor.13

Only endoscopic removal via temporal craniotomy for middle fossa epidermoids and via the lateral suboccipital route for cerebellopontine angle epidermoids have been described elsewhere.3,18 However, dissection of the capsule from neurovascular structures demands accurate procedures. Therefore, we selected a combined microscopic and endoscopic resection approach. In this combined approach, the tumor capsule was dissected using conventional microsurgical instruments with an excellent endoscopic view. Our rates of total tumor removal and surgical complications were compatible with previous reports.17,20,21 Because of our accurate dissection procedures in this series, postoperative cranial nerve palsies resolved except for mild facial hypesthesia in 3 patients. A total of 13 postoperative neurological deficits occurred in 20 patients with cerebellopontine epidermoid at follow-up examination.17 Surgical complications were found in 13 of 43 epidermoid or dermoid patients, including seven transient cranial nerve palsy.21 Abducens nerve palsy occurred in 6 (transient in 5) patients, dysphagia in 4 (transient in 2), deafness in 2, cerebellar signs in 2, and facial and trigeminal nerve palsy in 1 each among 14 patients with cerebellopontine epidermoid.20

Combined microscopic and endoscopic removal via a retrosigmoid suboccipital or a pterional approach has been reported previously.1,13 We prefer an anterior petrosal approach since tumors in the ambient cistern and upper part of the prepontine cistern can be approached with lower risk of damaging the facial and acoustic nerves.19 The anterior petrosal approach is useful to expose and remove the main capsule portions of epidermoids, which usually extend around the trigeminal nerve. We re-
moved this main part of the tumor using an operating microscope. The caudal limitation of the anterior petrosal approach is at the level of the jugular foramen in patients with functional hearing loss. With this approach, the caudal area around the lower cranial nerves, the medial portion of the temporal lobe, the deep portion of the ambient cistern, and the contralateral side of the prepontine cistern are blind spots for the microscope. In our series, epidermoid tumors, which were treated with an anterior petrosal and/or a pterional approach, tended to extend into these spaces. By using an endoscope, we were able to reach and remove tumors in these spaces with a curved dissector, forceps, curette, or suction under control of the endoscopic view. We conclude that combined microsurgical and endoscopic resection is ideal to achieve maximal resection of epidermoid tumors extending into multiple cranial spaces.

References


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