Original Article

Transcervical Approach for Resection of Lateral Skull Base Tumors

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Abstract/Objectives Conventional approaches for removal of lateral skull base tumors, including transmandibular, infratemporal fossa, preauricular transzygomatic subtemporal approaches, are major invasive procedures that often sacrifice hearing and cause abnormal occlusion and cosmetic defects. Reports of the transcervical approach for resection of skull base tumors are rare, although it was described for resection of clival chordomas in as early as 1966. The purpose of this study is to review our experiences in management of lateral skull base tumors using the transcervical approach. Study Design Retrospective chart review. Methods Six lateral skull base tumor cases treated with transcervical approach procedures were reviewed, including the medical records. Results There were 4 males and 2 females. Age ranged from 12 through 52 years. Histopathological diagnoses included malignant schwannoma(n = 1), malignant carotid body tumor(n = 1), haemangioma(n=1), schwannoma (n=2) and pleomorphic adenoma (n = 1). Transcervical techniques were used in all cases with the use of microscope in the lateral skull base area. Complete tumor removal was achieved in all cases. Postoperative radiotherapy was implemented in 1 case of malignant schwannoma and 1 case of malignant carotid body tumor. Jugular foramen syndrome occurred as a surgical complication in 1 case of malignant Schwannoma of the vagus nerve. There was no tumor recurrence during the 10 - 42 month follow-up period. Conclusion Compared with conventional approaches, the transcervical approach provides a easy, safe, minimal invasive and effective procedure for removal of selected lateral skull base tumors.

Key words skull base tumor; transcervical approach; excision

Introduction

Conventional techniques for removal of lateral skull base tumors include infratemporal fossa[1,2], transmandibular [3-5], transmaxillary [6, 7], and preauricular transzygomatic subtemporal approaches [8,9]. Infratemporal approaches provide wide exposure of the skull base and allow for excellent dissection and preservation of the internal carotid artery and cranial nerves, and as a result can be utilized for diverse pathologies. These procedures are often accompanied by postoperative temporalmandibular joint dysfunction, trismus, malocclusion, permanent hearing loss, facial and tongue anes-
42 years). Histopathological diagnoses included malignant schwannoma (n=1), malignant carotid body tumor (n=1), hemangioma (n=1), schwannoma (n=2) and pleomorphic adenoma (n=1). See Table I for additional clinical data.

Preoperative imaging

Computed tomography (CT) and magnetic resonance imaging (MRI) were performed in all 6 patients. Angiography was performed in 2 patients with hemangioma and schwannoma.

Surgical techniques

General anesthesia was used with oral intubation. The patient was placed in a supine, head-extended position, with the chin rolled away from the side of the tumor for optimal exposure. A submandibular skin incision was made from the mastoid tip to the level of hyoid bone, with a “T” extension going inferiorly from the upper one forth of this incision across the sternocleidomastoid muscle to the level of the cricoid cartilage (Fig. 1A). The subplatysmal skin flaps was elevated both superiorly and inferiorly and the mandibular branch of the facial nerve was identified for protection. The posterior belly of the digastric muscle was retracted superiorly. The superficial layer of deep cervical fascia was incised parallel to the anterior border of the sternocleidomastoid muscle, which was then retracted posteriorly for exposure of the carotid sheath. The common carotid artery was dissected and encircled with a vascular tape (Fig. 1B). The hypoglossal and vagus nerves were identified and protected. For exposure and blunt dissection of tumors in the lateral skull base area near the internal carotid artery and jugular vein, deep bladed retractors were used and the posterior belly of digastric muscle and angle of mandible were retracted. Important neurovascular structures were clearly identified and protected prior to attempting tumor removal (Fig. 1C).

When major neural structures were involved in the
<table>
<thead>
<tr>
<th>NO</th>
<th>Age</th>
<th>Sex</th>
<th>Symptoms</th>
<th>Signs</th>
<th>Imaging</th>
<th>Pathology</th>
<th>Follow-up</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>M</td>
<td>Throat discomfort half a year</td>
<td>Right slight tongue atrophy</td>
<td>MRI and enhanced MRI revealed a mass in size of 4×2 cm inferior to foramen of jugular vein, with nonhomogenous enhancement.</td>
<td>Malignant vagal schwannoma</td>
<td>9 months, No recurrence</td>
<td>Jugular foramen syndrome</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>M</td>
<td>Left facial mass 3 years, increased 2 years</td>
<td>Left mandibular angle posterior mass</td>
<td>MRI indicated a mass in parapharyngeal space extended to lateral skull base. Digital subtraction angiography revealed a highly vascular lesion.</td>
<td>Hemangioma</td>
<td>24 months</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>41</td>
<td>F</td>
<td>Health checkup revealed right parapharyngeal bulge 2 months</td>
<td>Right upper cervical and submandibular mass</td>
<td>MRI showed a 4×3 cm mass in the right parapharyngeal space that displaced the internal carotid artery anteromedially. Digital subtraction angiography was negative.</td>
<td>Schwannoma</td>
<td>2 months</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>33</td>
<td>F</td>
<td>Right facial paraesthesia for one month</td>
<td>No positive signs</td>
<td>MRI indicated a 5×3 cm mass in right infratemporal fossa.</td>
<td>Schwannoma</td>
<td>24 months</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>52</td>
<td>F</td>
<td>Cervical mass recurred accompanied with pain 6 months, after two operations of carotid body tumor during 6 years</td>
<td>Left cervical tender mass, left corner of the mouth downward, the tongue protruded toward left side, left tongue atrophy</td>
<td>MRI demonstrated a mass originated from bifurcation of carotid artery extended to lateral skull base, with nonhomogenous enhancement, without defined margin with adjacent normal tissue. Ultrasonography indicated carotid body tumor.</td>
<td>Malignant carotid body tumor</td>
<td>12 months</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>M</td>
<td>Feeling of a foreign body in the throat half a year</td>
<td>Left pharyngeal bulge, and left tonsil was pushed toward medial line</td>
<td>MRI and enhanced MRI showed a 3×4 cm mass in right parapharyngeal space with obvious homogenous enhancement.</td>
<td>Pleomorphic adenoma</td>
<td>12 months</td>
<td>No</td>
</tr>
</tbody>
</table>

Tumor, the feasibility of separating the tumor from the main trunk of the nerve was carefully assessed, sometimes using a microscope. Following complete tumor removal and thorough hemostasis, a suction drain was placed in the depth of the wound and brought out through a separate stab incision. The wound was closed in layers and the patient allowed to recover in the recovery room before returning to
common care units. Prophylactic antibiotic treatment was begun during the operation and maintained for 2 days post-operatively. The drain was connected to a continuous negative pressure suction box and removed between the third and fifth postoperative day. Postoperative radiotherapy was administered in the 2 cases with malignant schwannoma and malignant carotid body tumor.

**Results**

Complete tumor removal was achieved in all cases. There were no major surgical complications, except for 1 case with malignant schwannoma of the vagus nerve where jugular foramen syndrome occurred following the operation. The patients were followed for 10 to 42 months and no tumor recurrence was found.

**Selected case presentation**

**Case 1**

A 35-year-old man presented with throat discomfort for half a year. Physical examination revealed slight tongue atrophy on the right side. MRI scan disclosed a tumor in parapharyngeal space with extension toward the lateral skull base (Fig. 2-A, B). Complete tumor removal was achieved through the transcervical approach (Fig. 2-C, D). Jugular foramen syndrome was present on the first postoperative day. Histopathological diagnosis was malignant schwannoma. Radiation was administered postoperatively at 60 Gr. The patient was well and free of disease at 9 month follow up.

**Case 2**

A 12-year-old boy presented with a history of left facial mass of 3 years, increasing in size for 2 years. Physical examination demonstrated a mass posterior to the left mandibular angle. Imaging studies indicated parapharyngeal hemangioma extending to the lateral skull base (Fig. 3-A, B). Transcervical approach was used for tumor removal. Postoperative imaging one month after the operation showed complete removal of tumor (Fig. 3-C, D). The postoperative course was uneventful and the patient had no neurological sequela.

**Discussion**

Surgical exposure of the skull base presents a challenging problem for both the otolaryngologist and neurosurgeon. Anatomically, this portion of the skull base may be divided into two lateral and one midline compartments. Each lateral compartment is composed of a portion of the greater wing of the sphenoid bone and undersurface of the petrous portion of the temporal bone. Access to this region has been obtained by the techniques of the temporal surgery with which the otolaryngologist is familiar, i.e., transcervical-transmastoid [11], translabyrinthine [12], transcochlear [13], and infratemporal fossa [1, 2]. All these procedures approach the base of skull from a lateral direction through the temporal bone. The inferior exposure is limited, and the medial extent of the dissection does not allow adequate access to the midline compartment. Additional approaches to lateral skull base include inferior, anterior and posterior procedures (Table II). Report of transcervical-retrapharyngeal approach for resection of skull base tumors was originally described by Stevenson and his colleagues for resection of clival chordomas in 1966 [10]. This approach provides anterolateral access to the midline compartment including lower clivus, craniovetebral junction, and cervical spine. The applications of this approach are...
rare, because it is not an ideal approach for management of lesions at lower clivus, craniovertebral junction as well as cervical spine.

We intend to use transcervical approach to remove lateral skull base tumors, and the preliminary results are encouraging. Diverse pathologies in the lateral skull base region including malignant schwannoma, malignant carotid body tumor, schwannoma and hemangioma were successfully resected in 6 cases. Surgical complications were limited to jugular foramen syndrome in 1 case of malignant schwannoma of the vagus nerve. Follow-up between 10 and 42 months showed no tumor recurrence in this small series of cases.

The transcervical technique allows good control of major neurovascular structures of the neck and skull base. This procedure exposes the lateral skull base from an inferior approach without mandible and maxillary osteotomy.

Preoperative imaging plays an important role in choosing the best diagnostic and surgical approach for masses of the skull base. With the help of CT, MRI and angiography, decisions can be made by analyzing location, size and character of masses in the skull base area. MRI provides the ability to discern subtle differences in soft tissue and may be more sensitive to dural enhancement, while CT has an advantage in visualizing the bone. The angiographic modalities are important supplements to imaging classification of intensely vascularized processes and for vascular lesion in skull base.

Indications for transcervical approach are lesions on the extracranial surface of the lateral skull base, in the infratemporal fossa, as well as the parapharyngeal space. In terms of pathology, application of this procedure for removal of primary benign diseases, such as schwannoma and hemangioma, is feasible. Its limitation is that exposure of the lateral skull base is inadequate. Therefore, management of lesions involving the jugular bulb and intrapetrous portion of the internal carotid artery is difficult using transcervical approach. Advantages of this procedure over other approaches to lateral skull base include easier operation, improved patient safety and reduced local tissue and function compromise.

For adequate exposure of the lateral skull base in
transcervical approach for tumor removal, posterior belly of the digastric muscle and the angle of mandible must be retracted. Blunt dissection facilitates delivery of tumors from the adjacent tissue. A microscope is useful in dissecting tumor from adjacent major vessels and cranial nerves. For lateral skull base hemangioma, it is important to remove tumor en bloc rather than partial resection. Separating a hemangioma from adjacent normal soft tissue and identification of its pedicle help limiting blood loss.

**Conclusion**

From our preliminary experiences, transcervical approach can be successfully used for removal of lateral skull base tumors in selected cases. This approach provides an easy, safe and minimal invasive alternative technique.

**References**

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