Abstract:

Introduction: The neurovascular anatomy of the cavernous sinus severely limits surgical approaches for resection of tumors. Recent advances in endoscopic skull base surgery have defined surgical corridors to this challenging area. We present a series of cadaveric dissection using the endoscopic approach to the cavernous sinus and review the successful application of the endoscopic technique to eight patients.

Study Design: Ten fresh injected cadaver heads were studied by the endoscopic approach to the cavernous sinus. A review of 275 cases of a prospectively acquired database of endoscopic transsphenoidal surgeries yielded 8 patients with cavernous sinus tumors who underwent endoscopic resection by senior authors (VKA and THS). These charts were retrospectively reviewed.

Results: In our experience of 275 cases, 8 patients underwent endoscopic approaches to their cavernous sinus lesion. Pre-operative symptoms included vision changes, pituitary dysfunction, and headaches. Five patients underwent resection of lesions extending from the sella and 3 underwent biopsy. Three required post-operative radiation and all had resolution of vision changes (excluding the biopsy only group). There were no carotid injuries or post-operative cerebrospinal fluid leaks. The pathology revealed adenomas, metastatic lymphoma and adenocarcinoma, hemangioma, neuroendocrine tumor, and metastatic squamous cell carcinoma.

Conclusions: Even though the cavernous sinus neurovascular structures pose a surgical challenge, this can be successfully overcome with image guidance, angled endoscopes, neurovascular studies and endoscopic doppler to map the carotid artery. This area is amenable to endoscopic resection in carefully selected cases.

Introduction

• Cavernous sinus invasion occurs in between 6-10% of pituitary tumors
• Surgery in this area remains challenging due to the high functional importance and critical neurovascular structures housed here
• The panoramic view afforded by the endoscope and the advancement of angled endoscopes into the surgical field has allowed the extended transsphenoidal approach to the cavernous sinus to include the resection of tumors with significant extension into the cavernous sinus
• This approach enables us to inspect both the parasellar and middle cranial fossa areas of the cavernous sinus
• Various anatomical and clinical transsphenoidal approaches to the cavernous sinus have been described in the literature

Table 1: Patient Data

<table>
<thead>
<tr>
<th>Age</th>
<th>Pre-Operative Deficit</th>
<th>Surgery</th>
<th>Pathology</th>
<th>Additional Treatment</th>
<th>F/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>#3, 4, 6 Palsy</td>
<td>Removal adenoma extending to left cavernous sinus</td>
<td>Pituitary Adenoma</td>
<td>Gamma knife</td>
<td>26</td>
</tr>
<tr>
<td>2</td>
<td>#3, 4, 6 Palsy</td>
<td>Removal adenoma extending to left cavernous sinus</td>
<td>Pituitary Adenoma</td>
<td>Proton beam</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>#3, 4, 6 Palsy</td>
<td>Removal adenoma extending to left cavernous sinus</td>
<td>Prolactinoma</td>
<td>Gamma knife</td>
<td>22</td>
</tr>
<tr>
<td>4</td>
<td>#3, 4, 6 Palsy</td>
<td>Removal adenoma, very firm, residual on cavernous sinus</td>
<td>Prolactinoma</td>
<td>Proton therapy</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>#3, 4, 6 Palsy</td>
<td>Tumor removed from bilateral cavernous sinuses</td>
<td>Non-Hodgkin's B-cell lymphoma</td>
<td>Chemotherapy</td>
<td>13</td>
</tr>
<tr>
<td>6</td>
<td>#3, 4, 6 Palsy</td>
<td>Tumor into right cavernous sinus adherent to carotid, biopsy only</td>
<td>Hemangiopericytoma, spindle cell neoplasm</td>
<td>Chemotherapy</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>SCCA facial skin</td>
<td>Biopsy only</td>
<td>SCCA</td>
<td>8</td>
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<tr>
<td>8</td>
<td>#3, 4, 6 Palsy</td>
<td>Biopsy only</td>
<td>Metastatic adenocarcinoma</td>
<td>6</td>
<td></td>
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</tbody>
</table>

Discussion

• Ten fresh cadaver heads were injected and the transnasal transsphenoidal extended endoscopic approach was performed
• Eight patients underwent transnasal transsphenoidal approaches to the cavernous sinus
• Of the eight patients who underwent the extended approach to the cavernous sinus, three had biopsy only
• All patients had resolution of visual defects
• There were no carotid injuries or cerebrospinal fluid leaks
• Three patients required post-operative radiation due to residual tumor
• Pathology revealed four pituitary adenomas, lymphoma, and metastatic squamous cell carcinoma and adenocarcinoma
• Pre-operative selection of appropriate cases is essential in approaching this delicate area endoscopically
• Intricate knowledge of the complicated neurovascular anatomy remains of paramount importance to avoid damage to these structures

Conclusions

• Incomplete resection of tumors with cavernous sinus invasion causes resistance to treatment in pituitary adenomas
• Transnasal transsphenoidal approach allows an increased field of view and more than adequate visualization of the parasellar cavernous sinus
• Endoscopic surgical removal is technically feasible and our results in a limited number of patients are encouraging
• The ideal lesions are soft tumors, like pituitary adenomas, which do not infiltrate the internal carotid artery
• Image guidance and the ultrasound doppler are invaluable tools in mapping the carotid and avoiding injury

References


Figure 1: A. Axial MRI demonstrating left pituitary macroadenoma extending into left cavernous sinus and abutting the carotid artery. B. Post-operative axial MRI of same patient after removal and replacement with fat. C. Coronal T2 MRI demonstrating eight pituitary adenoma with extension into eight cavernous sinuses. D. Post-operative MRI of same patient demonstrating resected tumor and replacement with fat.