Petrosal Meningioma

Mahmoud Al-Yamany MD, MHA, FRCSC, FAANS
Yasser Orz MD, JBNS, PhD
Fahad AlFawaz MD, SBORL

Department of Neurosurgery
National Neuroscience Institute (NNI)
King Fahad Medical City (KFMC)
Definition & Characteristics

- Meningiomas originating from one of the surfaces of the petrous bone
- Account for 10-20% of Meningiomas
- Variable Growth Patterns
- Special Considerations are given to Petro-Clival Meningiomas
- Different Classification Systems

Types of Posterior Petrosal Meningiomas

- Posterior Petrosal
- Superior Petrosal
- Ventral Petrosal

Lee, Springer 978-1-84628-784-8
Types of Posterior Petrosal Meningiomas

- Posterior Petrous Meningiomas
  - Type I (Lateral to IAM)
  - Type II (Medial to IAM)
  - Type III (Extensive Attachment)

Classification of Petroclival Meningiomas

According to Main Attachment & Displacement of TGN

- Subtypes
  - Upper Clivus (UC)
  - Cavernous Sinus (CS)
  - Tentorium (TE)
  - Petrous Apex (PA)

Difficulties

- Location
- Neurovascular Structures
- Rarity
- Relentless Nature
- Variable Outcome
Advantages

- Improved Technology
- Simulation
- IO Imaging
- Image Guided Surgery
- IONM & NEM
- Doppler US
- Team Approach
- Neurocritical care
Approaches to Petrosal Meningiomas

- Orbitozygomatic
- Middle Fossa
- Petrousectomy
Orbitozygomatic Osteotomy

**Pros**
- Wide Exposure
- Access to Cavernous Sinus part

**Cons**
- Long Distance
- Limited Access to CPA
- Hidden Neurovascular Structures
Orbitozygomatic Osteotomy

- Viable Alternative to Petrosal approach
- Progression-free survival rates are excellent over short-term follow-up

Middle Fossa Approach

Pros

- Minimally Invasive
- Short Access
- Devascularises the Lesion
- Access to Cavernous Sinus & CPA

Cons

- Limited Access & Visibility
Middle Fossa Approach

The Anterior Transpetrosal approach could be used for all subtypes and with an absolute indication in the UC and TE types showing middle fossa extension.

Retrosigmoid Approach

Pros

- Frequently used
- Less Risk on Sigmoid Sinus

Cons

- Difficult Access to Middle Fossa Extension
- Positioning Issues
- Long Distance
Combined Approach
Subtemporal Retrosigmoid

Pros
- Wide Exposure
- Access to Cavernous Sinus & CPA
- Short Distance

Cons
- Extensively Invasive
- Sigmoid Sinus injuries
- High Risk of CSF Leak
Combined Petrosal Approach

**Pros**
- Short Access
- Wide Exposure
- Access to Cavernous Sinus & CPA
- Early Devascularization
- Limited Bone Resection

**Cons**
- CSF Leak
- Limited Access to Anterior CS
Combined Petrosal Approach

- Used for large petroclival meningioma & serviceable hearing
- Enhances the degree of tumor resection (apical petrous, cavernous sinus, & Meckel's cave)
- Visualization of the contralateral side
- Significant working space

Al-Mefty O. Neurosurgery. 2002 Sep;51(3):708-16
Subtemporal-Presegmoid Modified Petrosectomy
Subtemporal-Presegmoid Modified Petrousectomy
Subtemporal-Preseggmoid Modified Petrousectomy
# Our Skull Base Tumor Series

<table>
<thead>
<tr>
<th>Skull Base Tumors</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Skull Base Tumors</td>
<td>202</td>
<td>100</td>
</tr>
<tr>
<td>Anterior Skull Base Tumors</td>
<td>92</td>
<td>46%</td>
</tr>
<tr>
<td>Anterior Skull Base Meningiomas</td>
<td>71</td>
<td>35%</td>
</tr>
<tr>
<td>Lateral Skull Base Tumors</td>
<td>88</td>
<td>44%</td>
</tr>
<tr>
<td>Lateral Skull Base Meningiomas</td>
<td>60</td>
<td>30%</td>
</tr>
<tr>
<td>Petroclival Meningiomas</td>
<td>17</td>
<td>8%</td>
</tr>
<tr>
<td>Foramen Magnum Tumors</td>
<td>22</td>
<td>11%</td>
</tr>
<tr>
<td>Foramen Magnum Meningiomas</td>
<td>15</td>
<td>7%</td>
</tr>
<tr>
<td>All Skull Base Meningiomas</td>
<td>163</td>
<td>81%</td>
</tr>
</tbody>
</table>

![Bar chart showing tumor distribution](chart.png)
## Petrosal Meningiomas

<table>
<thead>
<tr>
<th>Skull Base Tumors</th>
<th>Total</th>
<th>Relevant %</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Skull Base Tumors</td>
<td>202</td>
<td>100%</td>
</tr>
<tr>
<td>Lateral Skull Base Tumors</td>
<td>88</td>
<td>44%</td>
</tr>
<tr>
<td>Lateral Skull Base Meningiomas</td>
<td>60</td>
<td>30%</td>
</tr>
<tr>
<td>Petroclival Meningiomas</td>
<td>17</td>
<td>8%</td>
</tr>
</tbody>
</table>

![Graph showing distribution of skull base tumors and meningiomas](image)
# Simpson-Grade Resection

<table>
<thead>
<tr>
<th>Resection Grade (Simpson)</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 0</td>
<td>0</td>
</tr>
<tr>
<td>Grade 1</td>
<td>0</td>
</tr>
<tr>
<td>Grade 2</td>
<td>58</td>
</tr>
<tr>
<td>Grade 3</td>
<td>16</td>
</tr>
<tr>
<td>Grade 4</td>
<td>3</td>
</tr>
</tbody>
</table>

Simpson's Grade Resection

- Grade 0
- Grade 1
- Grade 2
- Grade 3
- Grade 4
Petroclival Meningiomas Resectability

<table>
<thead>
<tr>
<th></th>
<th>Fukushima</th>
<th>Yamany</th>
<th>Al Mefty</th>
<th>Spetzler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td>137</td>
<td>13</td>
<td>7</td>
<td>46</td>
</tr>
<tr>
<td>GTR</td>
<td>47%</td>
<td>54%</td>
<td>70%</td>
<td>43%</td>
</tr>
<tr>
<td>NTR</td>
<td>40%</td>
<td>31%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Res.</td>
<td>87%</td>
<td>85%</td>
<td>70%</td>
<td>43%</td>
</tr>
</tbody>
</table>
# Factors Predicting Resect. & Outcome

<table>
<thead>
<tr>
<th>Predicting Factor</th>
<th>Favorable</th>
<th>Unfavorable</th>
<th>Predictive Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>&lt;60</td>
<td>&gt;60</td>
<td>High</td>
</tr>
<tr>
<td>Pre-Op Deficit</td>
<td>No</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td>Greatest Diameter</td>
<td>&lt;4 cm</td>
<td>&gt;4 cm</td>
<td>Medium</td>
</tr>
<tr>
<td>Flair MRI</td>
<td>Hyper-intense</td>
<td>Iso/Hypo-intense</td>
<td>High</td>
</tr>
<tr>
<td>CSF Cleft on T2</td>
<td>Yes</td>
<td>No</td>
<td>Medium</td>
</tr>
<tr>
<td>Surface Configuration</td>
<td>Smooth</td>
<td>Finger Projections</td>
<td>Medium-Low</td>
</tr>
<tr>
<td>Relation to IAM</td>
<td>Lateral</td>
<td>Medial</td>
<td>High</td>
</tr>
<tr>
<td>Tumor Extension</td>
<td>Tentorial</td>
<td>Cavernous Sinus</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clivus</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtemporal</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jugular Bulb</td>
<td>Medium</td>
</tr>
<tr>
<td>Neurovascular Structures</td>
<td>Displaced</td>
<td>Encased</td>
<td>High</td>
</tr>
<tr>
<td>Consistency</td>
<td>Soft</td>
<td>Firm/Hard</td>
<td>High</td>
</tr>
<tr>
<td>Exposure</td>
<td>Adequate</td>
<td>In-Adequate</td>
<td>Medium</td>
</tr>
<tr>
<td>Approach</td>
<td>Tailored</td>
<td>Classical</td>
<td>Medium</td>
</tr>
<tr>
<td>IO Neurophysiology Monitoring</td>
<td>Yes</td>
<td>No</td>
<td>Medium</td>
</tr>
<tr>
<td>Image Guided Navigation</td>
<td>Yes</td>
<td>No</td>
<td>Medium</td>
</tr>
</tbody>
</table>
Conclusion

- Multimodality Approach
  - Surgery +/- Focused-Beam Radiation

- Outcome Scales
  - Clinical Scales
  - NTR Might be better than GTR

- Choice of Surgical Approach
  - Familiarity, Dexterity, Set up
  - Try different stuff, get read of what doesn’t work & keep what works (Jim Collins)
Thank You

National Neuroscience Institute NNI