A new landmark for the middle fossa craniotomy approach to the internal auditory canal

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INTRODUCTION

The middle cranial fossa approach to the temporal bone provides extra-dural access to the IAC while minimizing the risk of injury to the cochlea or vestibular system. With the development of surgical technologies such as the operating microscope, the utility and safety of this approach has grown making it a preferred surgical approach for neurotologists addressing acoustic neuromas and other IAC pathology.

The technical demands of this surgery are high. The surgeon must rely on topographic landmarks of the floor of the middle cranial fossa to safely access the IAC contents. Precise knowledge of the relationship of these landmarks, the addition of another reliable bony landmark will serve as a useful aid to guide the surgeon's dissection in this critical area.

RESULTS

The following measurements of the operculum in relation to well established surgical landmarks of the floor of the middle cranial fossa were identified: operculum to foramen spinosum: 17.43mm [16.08-18.78mm]; operculum to foramen of the greater superficial petrosal nerve: 3.44mm [3.29-3.59mm]; distance from inner table of calvarium to operculum: 37.32mm [36.08-38.56mm]; length of operculum along petrosal ridge, 15.00mm [13.9-16.1]; medial projection from the blue-lined groove of the petrosal sinus (arrow) and sigmoid (star).


**TABLE 1: Measured distances (in millimeters)**

<table>
<thead>
<tr>
<th>Distance</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
<th>Standard Dev</th>
<th>95% CI</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dist A: operculum to foramen spinosum</td>
<td>17.43</td>
<td>16.72</td>
<td>17.43</td>
<td>5.92</td>
<td>37.32</td>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td>Dist B: operculum to foramen of the greater superficial petrosal nerve</td>
<td>3.44</td>
<td>3.34</td>
<td>3.44</td>
<td>0.63</td>
<td>3.34</td>
<td>1.09</td>
<td></td>
</tr>
<tr>
<td>Dist C: operculum to arcuate eminence</td>
<td>10.31</td>
<td>10.22</td>
<td>12.22</td>
<td>1.9</td>
<td>31.43</td>
<td>1.4</td>
<td>0.22</td>
</tr>
</tbody>
</table>

**METHODS**

We analyzed 25 cadaveric temporal bones. Precise measurements were taken to identify the relationship of the bony operculum of the petrous ridge to: the foramen spinosum, the foramen of the greater superficial petrosal nerve, the arcuate eminence, the porus acusticus and the inner table of calvarium.

**DISCUSSION**

The IAC is a berry-sized cavity within the petrous bone located lateral to the middle cranial fossa. The twelfth cranial nerve from the geniculate ganglion. This entails identifying the GSPN where it emerges from a bony shelf in the floor of the middle fossa, removing the bone to trace it in retrograde fashion to the geniculate ganglion and subsequently drilling out the labyrinthine segments of the facial nerve. The point at which the 7th cranial nerve enters the internal auditory canal is variable enough that the AE should not be simply considered a surrogate for the SSC in locating the IAC.

The dura was elevated from the squamous temporal bone and off of the floor of the middle cranial fossa to clearly expose the bony and neurovascular anatomy. Precise measurements were taken to identify the relationship of the bony operculum to the following landmarks listed in the results section. The point on the operculum from which all measurements were made was a point at its most medial extension in the axial plane in the midline of its length along the petrosal ridge. The dimensions of the operculum itself were also documented measuring the length along the petrous ridge and width (defined by the medial projection of the operculum perpendicular to a straight edge placed along the petrous ridge).

Basic statistical data was calculated to help establish the reliability of these measurements against the norm.

**CONCLUSIONS**

MCF approach to the IAC requires significant surgical skill and an intimate understanding of temporal bone anatomy to be conducted safely. Even with this knowledge base the surrounding structures are at risk of being injured during the blind, bony dissection portion of the procedure. Having an additional reliable bony landmark to help guide its dissection can only be seen as beneficial for the surgeon who is attempting to gain surgical exposure while limiting the risk of injury to surrounding structures.

This bony operculum is used reliably as an indicator of the vertical plane of the porus of the IAC, a starting point for dissection. Once the IAC is identified it is significantly easier to safely skeletonize in a lateral to medial fashion. It may also expedite exposure time and thereby decrease time of temporal bone retraction.