Comparative Analysis of Far-lateral versus Endoscopic Endonasal Approaches for Clipping of Proximal AICA Aneurysms

Alaa S. Montaser, M.D.\textsuperscript{1,2}, Mostafa Shahein, M.D.\textsuperscript{1}, Alexandre B. Todeschini, M.D.\textsuperscript{1}, Juan Carlos Yanez-Siller, M.D.\textsuperscript{2}, Bradley A. Otto, M.D.\textsuperscript{1,3}, Ricardo L. Carrau, M.D.\textsuperscript{1,3}, Daniel M. Prevedello, M.D.\textsuperscript{1,3}

\textsuperscript{1}Department of Neurosurgery, The Ohio State University Wexner Medical Center, Columbus, Ohio, USA
\textsuperscript{2}Department of Neurosurgery, Ain Shams University, Cairo, Egypt
\textsuperscript{3}Department of Otolaryngology - Head and Neck Surgery, The Ohio State University Wexner Medical Center, Columbus, Ohio, USA
Disclosure

Nothing to disclose
Introduction

- Anterior inferior cerebellar artery (AICA) aneurysms are uncommon; however, they represent a significant challenge in their surgical management, especially those originating at proximal segment of AICA, because of their deep location in the medial aspect of the pre-pontine cistern.

- Endovascular treatment of proximal AICA aneurysms is the current treatment of choice; nevertheless, it is not always an option. Microsurgical clipping of proximal AICA aneurysms via far-lateral approach requires a long narrow corridor with limited exposure and maneuverability.

- Endoscopic endonasal approaches (EEA) have been widely implemented for surgical management of different skull base pathologies; nonetheless, their application for management of intracranial aneurysms is still undefined.
Methods

• Five latex-injected cadaveric heads (10 sides) were used for dissection in the Anatomical Laboratory for Visuospatial Innovations in Otolaryngology and Neurosurgery (ALT-VISION) at The Ohio State University Wexner Medical Center.

• Bilateral far-lateral approach, and endoscopic endonasal transclival approach with supracondylar extension were performed in all specimens to expose proximal AICA bilaterally. An aneurysm simulation model with two different sizes was used at proximal AICA bilaterally in different directions.

• The key measured parameters for the comparative analysis of both approaches were “depth of the surgical corridor”, “surgical freedom of instruments manipulation”, “the ability to obtain safe proximal control”, and “the ability of safe clip placement” according to the size and direction of the aneurysm simulation model at the AICA origin. The ability to reapply the clips in each step was also assessed.
The depth of the operative corridor and the anatomic target surgical freedom at the proximal AICA aneurysm model for EEA and far-lateral approach is shown in Table 1.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Depth of operative corridor</th>
<th>Surgical freedom at the AICA aneurysm model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean SD</td>
<td>Range</td>
</tr>
<tr>
<td>EEA</td>
<td>116 ± 7</td>
<td>106-127</td>
</tr>
<tr>
<td>Far-lateral</td>
<td>69.2 ± 5.5</td>
<td>57-77</td>
</tr>
</tbody>
</table>

Table 1. Depth of operative corridor and anatomic target surgical freedom at the proximal AICA aneurysm models
Endoscopic endonasal clipping

- In all specimens, we were able to achieve safe proximal and distal controls of the aneurysm models at the Proximal AICA without manipulation of any critical neurovascular structures. The perforating branches of the basilar artery were visualized in all specimens.

- Clipping of aneurysm models at the Proximal AICA was achieved in all specimens under complete visualization (Figure 1).

- The size and direction of the aneurysm simulation model didn’t affect the overall ability of safe clip placement; however, clipping of superiorly and inferiorly directed models was achieved easier than ventrally directed models, due to the technical limitation of the angulation of the currently available single shaft clip applier.
Results (contd.)

Figure 1. EEA clipping of proximal AICA aneurysm. A small superiorly-directed aneurysm model is placed at the Proximal AICA on the right side (A). Proximal (B) and distal (C) controls were achieved, followed by clipping of the aneurysm model (D). The final step is to remove the temporary clips (E). Two different sizes (small and large) of aneurysm simulation models were used at the right and left proximal AICAs respectively (F).
Microsurgical clipping via far-lateral approach

- Proximal control was achieved at the basilar artery in 3 specimens, and at the ipsilateral vertebral artery in 7 specimens. Distal control was not achieved in any of the specimens, because the field was obscured by the temporary clip after obtaining the distal control.

- Clipping of aneurysm models at the Proximal AICA was achieved in 4 specimens (Figure 2); while in the rest of specimens, the aneurysm model couldn’t be seen and/or manipulated upon unless a considerable retraction is applied on the brainstem (an option not feasible in the real life). Furthermore, the maneuverability of instruments was limited by the cranial nerves.

- The anatomical course of the basilar artery had an impact on the feasibility of clipping. In specimens where the basilar artery attained a curved course, clipping of aneurysm models at the convex side of the basilar artery curvature was easier than their counterparts at the concave side.
Figure 2. Microsurgical clipping of proximal AICA aneurysm via far-lateral approach.

A small-sized ventrally directed aneurysm model is placed at the Proximal AICA on the left side (A). The aneurysm model was better visualized after careful retraction of the cerebellum (B). Proximal control was achieved at the basilar artery, followed by clipping of the aneurysm model (C). The final step is to remove the temporary clips (D).
Conclusion

• EEA through focal transclival approach with supracondylar extension provides excellent direct angle of attack and wide exposure of proximal AICA, without manipulation of cranial nerves.

• Although the anatomic target surgical freedom was better from a far-lateral approach, the maneuverability of instruments and visualization at proximal AICA was better in EEA.

• Aneurysm models at Proximal AICA could be safely clipped via EEA after obtaining proximal control with improved visualization of perforating branches.

• EEA can be considered a feasible option for the surgical clipping of superiorly, inferiorly, and ventrally directed aneurysms of proximal AICA in select patients.