Extended Endoscopic-assisted Kawase versus Endoscopic Endonasal Anterior Petrosectomy: Cadaveric Study

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Background Less invasive techniques involving endoscopic assistance have been proposed for treatment of lesions of the cavernous sinus, petrous apex, medial jugular foramen, upper and lower clivus, and condylar regions. Performing a two-step CT-guided extended endoscopic-assisted approach, we observed gains in visibility and surgical freedom, and defined landmarks for surgical application.

Materials & Methods In 10 cadaveric formalin-fixed, silicone-injected heads, bilateral subtemporal extradural and endoscopic endonasal CT-guided dissections were performed.

Subtemporal approach: Kawase area was drilled and the dura opened. Resections were completed for the postmeatal triangle (PMT) between cranial nerve (CN) VII, superior petrosal sinus (SPS), and superior semicircular canal, and anteriorly for the petrous apex covered by the mandibular nerve (V3). After each step, angled 4-mm endoscopes (0, 30, 45 degree) were used to assess intradural visibility and maneuverability. Exposure depth was measured anteriorly and posteriorly at the level of the inferior petrosal sinus (IPS).

Endoscopic endonasal approach was subsequently performed to reach the petrous apex was extended: laterally, between Meckel’s cave (MC) and internal carotid artery (ICA), medially at the petroclival junction, and inferiorly to expose the lower cranial nerves.

Results In comparing the extended endoscopic-assisted Kawase with the endonasal anterior petrosectomy, we found improved bone removal and maneuverability with a wider lateral extension below the vertebrobasilar junction and at the perimesencephalic cistern.

BONE REMOVAL IMPROVED average length of transcranial bone removal at the level of the SPS (posterior to the Kawase area) for the PMT was 11.4 mm and 3.8 mm anteriorly after mobilizing V3. Exposure depth averaged 14 mm anteriorly and 20.5 mm posteriorly. Combination of microscopes (30 and 45-degree endoscopes) and image guidance proved extremely effective for maximal bone removal affording wide views: ipsilaterally, the upper clivus and medial condylar complex; and bilaterally, Dorello’s canal, lower clivus, medial jugular foramen, and hypoglosal canal. Average length of endonasal bone removal at the upper and lower clivus averaged 13.17 mm and 17.33 mm, respectively. Height of the exposure averaged 25.67 mm.

MANEUVERABILITY WAS ACHIEVED ipsilaterally at the level of basilar artery and bilaterally below the vertebrobasilar junction using the endoscope-assisted approach. Endonasally, visualization of CNs III to VI was achieved by lateral extension of the approach (medial mobilization of the ICA averaged 4.43 mm for the right side and 4.10 mm for the left side) whereas visualization of CNs V to VIII was achieved by the transclival approach (lateral mobilization of MC averaged 6.57 mm for the right side and 6.73 mm for the left side). The lower CNs were exposed after extensive transpterygoid drilling. Distance between medial jugular tubercles and the inferolateral margin of the transclival exposure averaged 16.03 mm and 16.67 mm at the right and left sides, respectively. Maneuverability decreased with lateral extension of dissection.

Conclusions
• The extended endoscope-assisted transcranial approach should be considered for intradural lesions that extend inferiorly and/or contralateral to the lower clivus and medial jugular foramen and superiorly to the perimesencephalic cistern (ie, brainstem cavernoma).
• The endonasal approach remains a better choice for extradural lesions located medially in the upper and middle clivus.