Treatment of Paraclinoid Aneurysms using the Endoscopic Endonasal Approach: An Anatomical Analysis

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Introduction

Endoscopic endonasal approaches (EEA) are being increasingly used for treatment of various skull base pathologies, including intracranial aneurysms. However, few anatomical assessments have been performed on the use of EEA for treating paraclinoid aneurysms.

Results

Favorable segments of the ICA to obtain proximal control included the extracavernous paraclival and clinoidal ICA. Clipping the extracavernous ICA put the trigeminal and abducent nerves at risk, whereas clipping the clinoidal segment put the oculomotor nerve at risk. The OphA origin was found within 4mm of the medial opticocarotid point on a line connecting the mid-tubercular recess point to the medial vertex of the lateral opticocarotid recess. Safe application of a distal ICA clip was possible at an average length of 7.2mm of the supraclinoid ICA. Relatively small superiorly or medially projecting paraclinoid aneurysms were favorable candidates to be clipped via EEA.

Learning Objectives

(1)Providing a comprehensive anatomical assessment of the EEA for treatment of paraclinoid aneurysms.

Methods

Five cadaveric heads underwent endoscopic endonasal transplanum-transtuberculum approach to expose the paraclinoid area. Feasibility of obtaining proximal and distal control over the internal carotid artery (ICA), as well as the topographic location of the origin of the ophthalmic artery (OphA) using several dural landmarks were assessed bilaterally. Limitations of the EEA in exposing the supraclinoid ICA were recorded to identify favorable paraclinoid ICA aneurysm projections to be treated using EEA.

References

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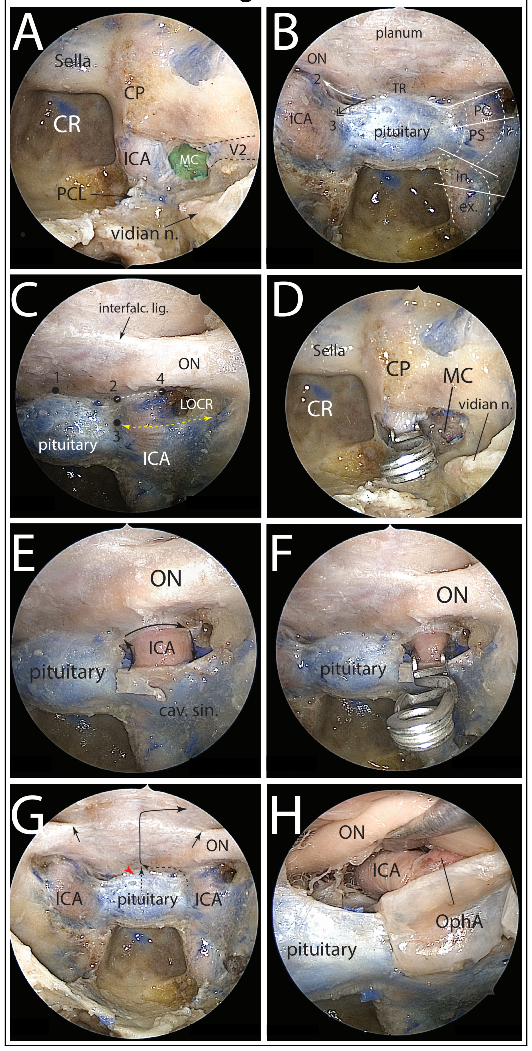
Conclusions

When performed to approach paraclinoid aneurysms, EEA carries certain risks to adjacent neurovascular structures during proximal control, dural opening, and distal control.

Figure 1



A. The ICA is prepared for proximal clipping by drilling bone on its lateral, anterior, and medial aspects. On the lateral aspect of the ICA, there is a quadrangular space, drilling of which leads to Meckel's cave. B. Dural exposure extending from the planum sphenoidale to the anterior sellar region in the sagittal plane, and extending laterally to the optic canals, and parasellar carotids. Dashed lines designate the approximate course of the paraclival, parasellar (PS) and paraclinoid (PC) segments of the ICA separated by solid white lines. The lateral tubercular recess faces medially; the upper arm (white arrow) reaches the medial opticocarotid point [point 2]; and the lower arm (double black arrow) reaches the caroticosellar point [point 3]. C, dural reference points: 1 = mid-tubercular recess point; 2 = medial opticocarotid point; 3 = caroticosellar point; 4 = medial vertex of LOCR. White dashed line shows the approximate level of the ddr, and the yellow dashed double-arrowed line shows the approximate level of the pdr. D, proximal control obtained on the extracavernous paraclival ICA. E, exposure of the clinoidal ICA using 3 consecutive dural cuts (black arrows). F, proximal control on the clinoidal ICA. G, dural incision to expose the supraclinoid ICA. The dural incision could be started either on the lateral tubercular recess or in the midline (dashed arrows –both crossing the superior intercavernous sinus [red arrowhead] to reach the tubercular recess. Small black arrows show the interfalciform ligament. H, supraclinoid ICA is exposed by reflecting the dural flap. Views taken with a 0º-endoscope. cav. = cavernous; CP = carotid protuberance; CR = clival recess; ex. = extracavernous segment of paraclival ICA; ICA = internal carotid artery; in. = intracavernous segment of paraclival ICA; LOCR = lateral opticocarotid recess; MC = Meckel's cave; n. = nerve; ON = optic nerve; OphA = ophthalmic artery; PCL = pterygoclival ligament; sin. = sinus; TR = tubercular recess.