Unilateral Medial Trans-palpebral Anatomical Step-by-Step Dissection of Complex Skull Base Approaches for Trainees: Surgical Anatomy of the Transmastoid High Cervical Approach to the Jugular Foramen and C1-C2 Junction

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RHOTON PROGRAM

BACKGROUND

The extradural portion of the Jugular Foramen and the occipito-C1-C2 junction regions are challenging surgical targets. The The transmastoid high cervical approach and its extensions are the most suitable methods for accessing these areas from the posterolateral perspective.

While several cadaveric studies have refined these approaches, few offer a detailed, step-by-step description.

OBJECTIVE

Our goal is to provide a didactic description of the steps involved in the transmastoid high cervical approach to the jugular foramen and C1-C2 junction for trainees.

MATERIAL AND METHODS

Twelve sides of six latex injected, formalin-fixed cadaveric head specimens were dissected, using a surgical microscope, a 0° endoscope, and standard micro-neurosurgical instruments.

The key steps of the transmastoid high cervical approach with vertebral artery transposition were photographed in 3D on illustrative specimens.

RESULTS

Firstly, a high cervical approach was performed to expose the extracranial craniocervical junction. The vertebral artery was identified in between the transverse processes of C1and C2 and, the posterior and lateral aspects of the transverse process of C1 were removed to free the vertebral artery.

For the second step, a retrolabyrinthine mastoidectomy was performed, affording full exposure of the extradural portion of the jugular foramen, including the jugular bulb and vein, and cranial nerves IX, X, and XI. The occipital condyle was then drilled medially to expose the hypoglossal canal and nerve.

The anterior arch of C1 was then followed contralaterally to reach and remove the contralateral lateral mass of C1 as well as the odontoid process of C2. The mesial portion of the contralateral V3 was visible at the end of the exposure (**Figures 1** - **4**).

RESULTS

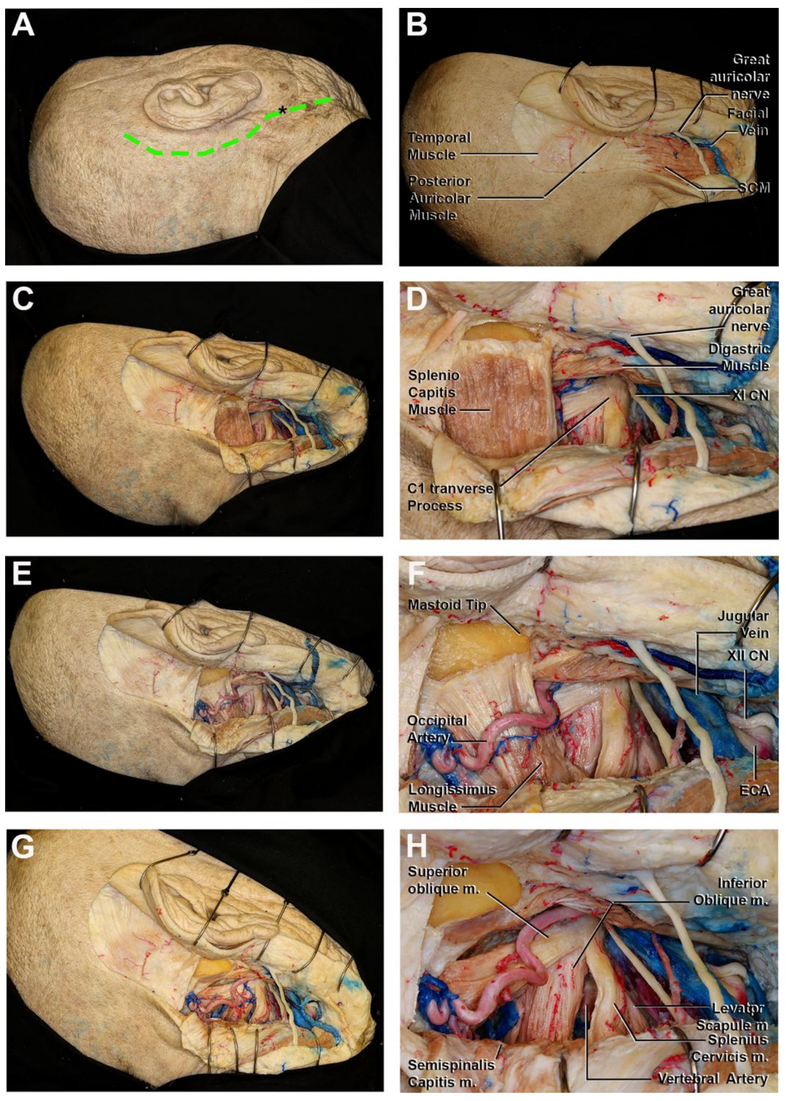

Figure 1. High cervical approach. **A**- Curvilinear skin incision following the anterior border of the sternocleidomastoid muscle. **B**- Exposure of sternocleidomastoid muscle and the greater auricular nerve. **C-** Reflection of sternocleidomastoid posteriorly. **D-** Close view of the lateral craniocervical junction after posterior reflection of the sternocleidomastoid muscle. **E-** Reflection of the splenius capitis muscle posteriorly. **E-** View of the suboccipital triangle after posterior reflection of the splenius capitis muscle. The suboccipital triangle is formed by the superior and inferior oblique muscle and rectus capitis posterior major muscle. In the middle of the suboccipital triangle, the vertebral artery can be found as it lies in the sulcus arteriosus.

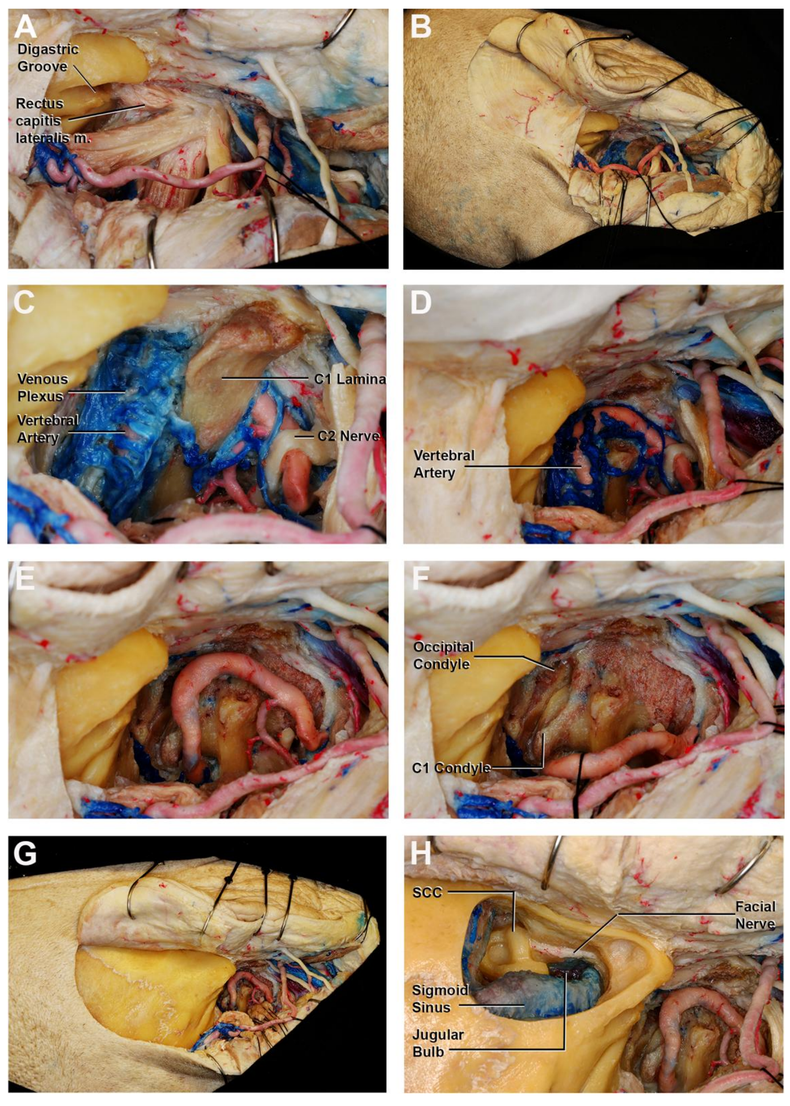

Figure 2. Mobilization of the vertebral artery and retrolabyrinthine mastoidectomy. **A**- Removal of the digastric muscle. This exposes rectus capitis lateralis muscle, which is the lateral border of the jugular foramen. **B**- Overview of the craniocervical junction after reflection of the muscles of the suboccipital tringle. The venous plexus surrounding the vertebral artery can be identified. **C-** Close up view of the vertebral artery in its venous plexus. **D-** Exposure of the vertebral artery. **E-** C2 Nerve root divided and vertebral artery skeletonized from transverse process of C2 to foramen magnum. **F-** Vertebral artery mobilized affording access to full occipital condyle. **G-** Overview of the high cervical approach after vertebral artery freeing. **H-** Retrolabyrinthine mastoidectomy.

RESULTS

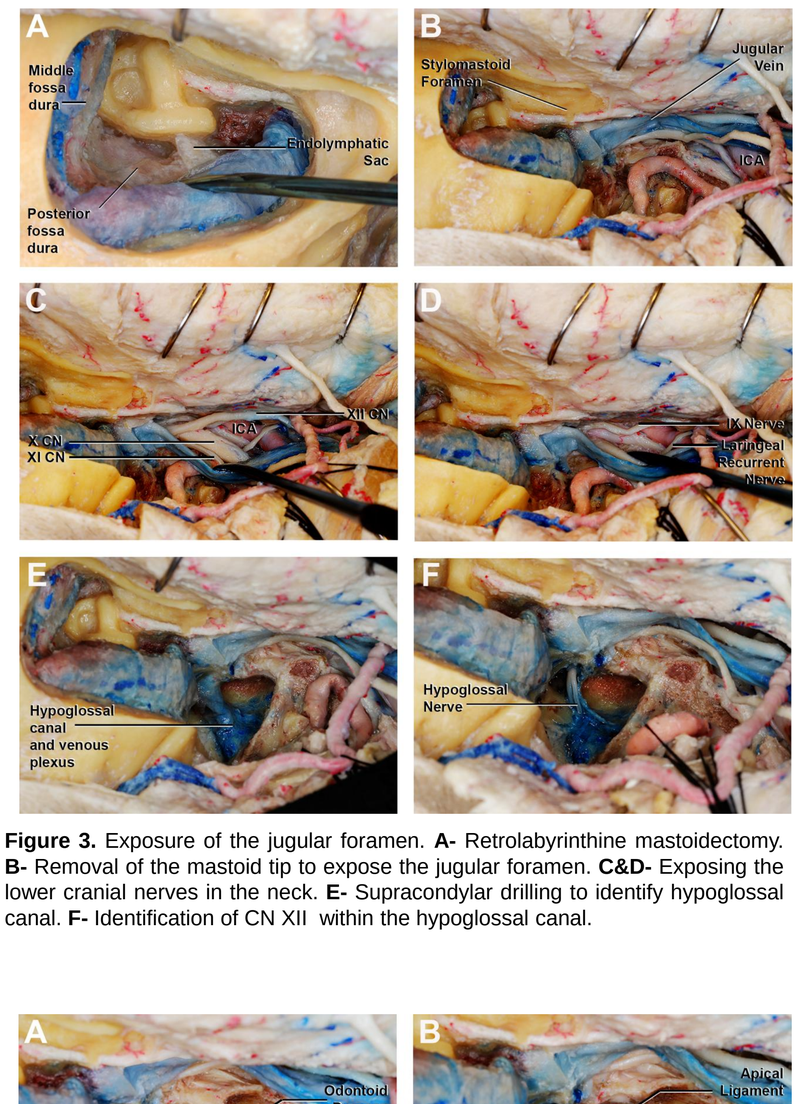

Figure 3. Exposure of the jugular foramen. **A-** Retrolabyrinthine mastoidectomy. **B-** Removal of the mastoid tip to expose the jugular foramen. **C&D-** Exposing the lower cranial nerves in the neck. **E-** Supracondylar drilling to identify hypoglossal canal. **F-** Identification of CN XII within the hypoglossal canal.

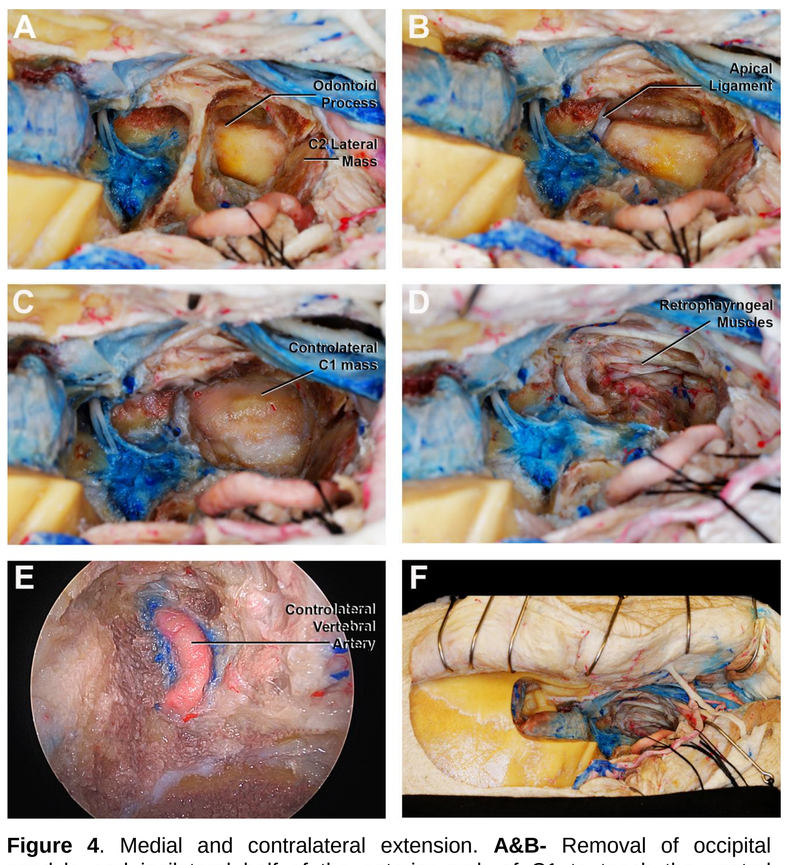

Figure 4. Medial and contralateral extension. **A&B-** Removal of occipital condyle and ipsilateral half of the anterior arch of C1 to teach the ventral craniocervical junction. **C-** Removal of dens to identify the contralateral anterior arch of C1. **D-** Exposure of the retropharyngeal muscles. **E-** After removal of the contralateral anterior arch of C1, the contralateral V3 segment of the vertebral artery is identified. **F-** Overview of the approach after its full extension.

CONCLUSIONS

The transmastoid high cervical approach is a powerful tool for the skull-base surgeon, offering a direct corridor to the extradural jugular foramen, the ventral and lateral portions of the craniocervical and C1-C2 junction, and the V3 segment of the vertebral artery.

To facilitate easier understanding of the anterolateral approach and its extensions for trainees, we described the anatomy and surgical nuances in a didactic and step-by-step fashion.