The submandibular retropharyngeal approach as a safe route to the upper anterior cervical spine - an anatomical step by step dissection and surgical case presentation

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Introduction

Surgical access to the anterior upper cervical spine (C1–C2) and craniovertebral junction is challenging due to complex anatomy, steep working angles, and the need to protect critical structures including the carotid artery, jugular vein, pharynx, esophagus, and larynx. Traditional anterior approaches such as anterolateral and transoral routes are limited by restricted exposure, suboptimal trajectory, and potential postoperative complications, especially in the case of splitting the soft palate or even the mandible.

The submandibular retropharyngeal approach (SRA) has emerged as an effective alternative, providing more direct access with improved visualization while reducing pharyngeal retraction. Although prior publications describe the technique, detailed high-quality anatomical documentation in a controlled cadaveric setting remains limited. This study systematically evaluates the SRA using a cadaveric head specimen, providing detailed anatomical illustrations to facilitate safe surgical application. We also compare its advantages and limitations with other anterior approaches. Finally, we present a clinical case of C2 corpectomy for metastatic vertebral destruction, supported by a surgical video demonstrating the practical benefits of the SRA in accessing the upper cervical spine.

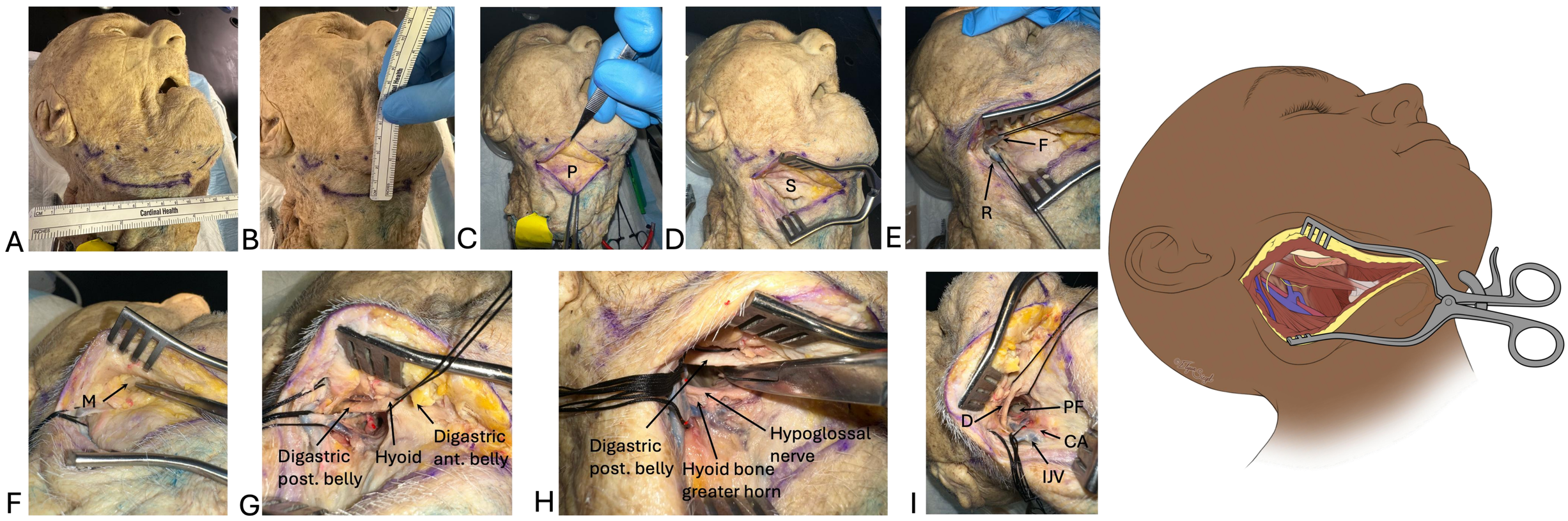

Figure 1.: Surgical steps of the submandibular retropharyngeal approach in a cadaveric specimen.
(**A**, **B**) Course of the skin incision, placed 2–3 cm below the mandible, extending from the mandibular angle to the midline.
(**C**) Incision of the skin and subcutaneous tissue reveals the platysma (P).
(**D**) Horizontal transsection of the platysma exposes the submandibular gland (S).
(**E**) The facial vein (F) passes superficial to the submandibular gland and is identified at the most posterior aspect of the incision. In this specimen, the facial vein is joined by an anterior branch of the retromandibular vein (R), forming the common facial vein, which drains directly into the internal jugular vein (here not visible).
(**F**) The osseous mandibular arch (M), which does not need to be exposed, can be palpated easily for orientation.
(**G**) Elevation of the submandibular gland exposes the digastric muscle. A tie is placed on the intermediate tendon between the anterior and posterior bellies of the digastric muscle, which is directly attached to the hyoid bone. The corridor to the retropharyngeal space is bounded superiorly by the posterior belly of the digastric muscle, anteriorly by the insertion of the intermediate tendon on the hyoid body, caudally by the greater horn of the hyoid bone, and posteriorly by the facial vein and artery. The retromandibular vein can be divided if necessary to improve access.
(**H**) A Kelly clamp is positioned in the correct space between the posterior belly of the digastric muscle and the hyoid. The hypoglossal nerve runs along the inferior border of the corridor and must be carefully protected. In most cases, the hypoglossal nerve can be mobilized cranially if additional space is required.
(**I**) Further dissection of the retropharyngeal space exposes the prevertebral fascia (PF) in the depth. At the lateral border, the carotid artery (CA)and the internal jugular vein (IJV) are identified.

Methods

A cadaveric head specimen was prepared with colored vascular injections to enhance anatomical delineation. Stepwise dissection was performed to document the surgical corridor of the submandibular retropharyngeal approach SRA, complemented by photography and illustrations. Endoscopic assistance was employed to extend cranial visualization to the anterior arch of C1. The approach was compared with transoral, transnasal, and anterolateral techniques in terms of exposure, safety, and surgical accessibility. A clinical case of a patient undergoing anterior C2 corpectomy for metastatic destruction of the C2 vertebral body was presented to illustrate practical application.

Results

The SRA provided a safe, direct, and oblique surgical trajectory to the anterior C2 vertebral body and craniovertebral junction, with reduced need for pharyngeal retraction and preservation of the pharyngeal plexus. Endoscopic assistance further enhanced cranial exposure. The illustrative case demonstrated successful anterior reconstruction with a bone strut graft and plate fixation, achieving spinal stability without significant postoperative dysphagia or speech deficits.

Conclusion

The submandibular retropharyngeal approach represents a reliable alternative to traditional anterior routes for upper cervical spine surgery, offering adequate exposure while avoiding the morbidity associated with mandibular or soft-palate–splitting techniques. Its incorporation into neurosurgical practice may expand the surgical armamentarium for the treatment of complex anterior cervical pathologies.

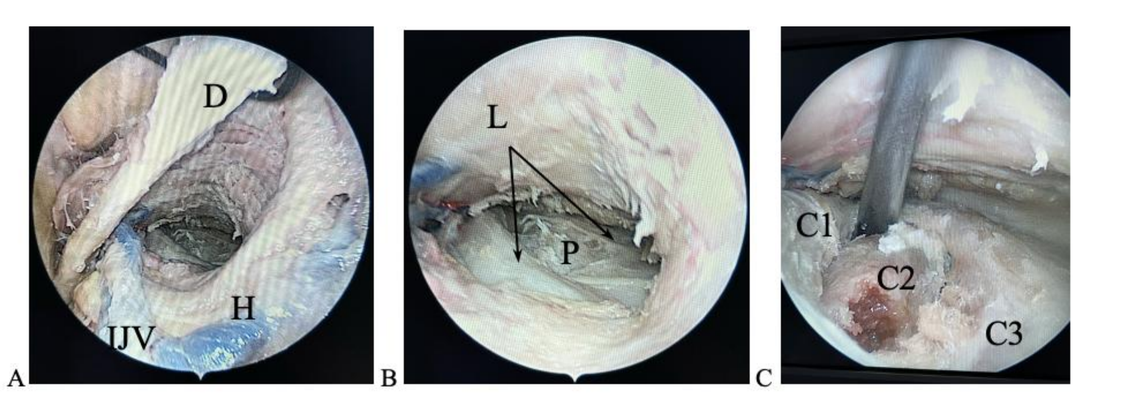

Figure 2.: Endoscopic extension of the submandibular retropharyngeal approach.
(A) Endoscopic view of the entry zone. The posterior belly of the digastric muscle (D) is seen superiorly; posterolaterally lies the internal jugular vein (IJV); and inferiorly, the hypoglossal nerve (H).
(B) Deeper within the operative corridor, the prevertebral fascia (P) and the bilateral bellies of the longus colli muscles (L) become visible.
(C) Opening the prevertebral fascia provides access to the anterior aspects of the C1–C3 vertebral bodies. Endoscopy facilitates exposure of the anterior arch of C1 while further minimizing retraction.

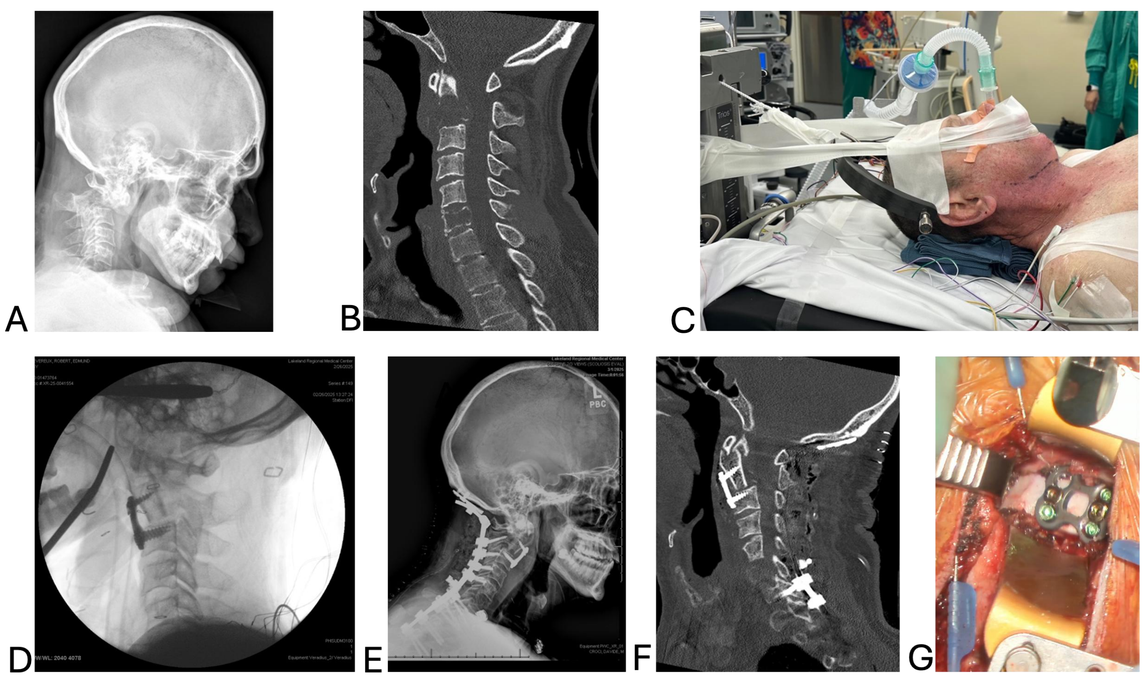

Figure 3.: Opreative case presentation using the submandibular retropharyngeal approach for anterior C2 vertebral corpectomy and bone graft placement.
(A) Standing preoperative lateral radiograph of the cervical spine showing collapse of the C2 vertebral body with associated instability.
(B) Lateral CT scan of the cervical spine revealing lytic lesions in the vertebral bodies of C2 and C6.
(C) Patient positioning in the supine position with Gardner-Wells tongs providing cervical traction. The planned incision for the submandibular retropharyngeal approach, located 3 cm below the mandibular rim, is marked.
(D) Intraoperative view demonstrating the superior extent of anterior exposure; the suction tip is positioned just above the anterior arch of C1 at the craniocervical junction.
(E) Postoperative standing lateral radiograph showing restored alignment and anterior column support achieved by interposition of a C2 cage.
(F) Postoperative cervical CT scan confirming that the C2 bone graft is securely locked beneath the anterior arch of C1 and stabilized with a small ACDF plate and screws fixed to the C3 vertebral body.
(G) Intraoperative view with the C2 bone graft in situ.

References

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