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Technical note

Anatomic considerations of the anterior upper cervical spine during decompression and instrumentation: a cadaveric based study

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ABSTRACT

We evaluated the anatomical considerations specific to the high anterior retropharyngeal approach to the cervical spine. Surgical exposure of the anterior upper cervical spine can sometimes be challenging due to the surrounding neurovascular structures. Using three adult cadavers, we performed high anterior retropharyngeal cervical dissection of the left and right side for a total of six approaches (six sides). During the dissection, all important neurovascular elements were noted and photographed, and anatomical relationships to the spinal vertebral bodies and disc spaces were analyzed. There are certain anatomic considerations that are unique to the high anterior cervical spine. The unique structures include the hypoglossal nerve and the superior thyroid artery/nerve. Only the superior thyroid artery in this region has numerous anatomical variations. Awareness of other structures, including the carotid artery, recurrent laryngeal nerve, and esophagus also remains important. Awareness of the anatomical structures in the anterior upper cervical spine is essential for performing safe anterior upper cervical spinal surgery, avoiding serious complications.

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1. Introduction

The anterior retropharyngeal approach to the cervical spine is a time tested technique in the treatment of degenerative, traumatic, and other spinal pathologies. However, the upper cervical spine (C1–C4) poses unique anatomic and technical challenges [1–3]. In this anatomic study, we present a step by step cadaveric dissection of the high anterior cervical spine approach to elucidate anatomical considerations and key anatomical variants which may be encountered.

2. Methods

Three adult, embalmed cadavers underwent bilateral high anterior retropharyngeal cervical dissection for a total of six approaches to the upper cervical spine. During the dissections, all important neurovascular elements were noted and anatomical relationships were analyzed. We also exposed all upper cervical muscles, the carotid sheath, hypoglossal nerve, superior thyroid artery and nerve, and recurrent laryngeal nerve. At the end of the approach, instrumentation with a cervical plate and screws at both the C2–C3 and C3–C4 levels was performed.

3. Description of the technique

3.1. Step 1: Position

The head position is a key technical point for the high cervical retropharyngeal approach. For optimal exposure to the upper cervical spine, the head is positioned with 30° of rotation toward the contralateral side of the surgical approach, to bypass the mandible from the approach window, with the neck extended slightly [3].

3.2. Step 2: Skin incision

A wide horizontal skin incision is placed 2 cm inferior to the mandibular angle, just under the chin, extending across the midline to the anterior border of the sternocleidomastoid muscle (SCM). The marginal mandibular branch of the facial nerve runs forward, below the angle of mandible, under cover of the platysma muscle. Maintaining the skin incision 2 cm below the inferior border of the mandible ensures its preservation [4]. Next, skin undermining is key for spine exposure, without excessive or forceful retraction.

3.3. Step 3: Identifying the platysma muscle

The superficial cervical fascia and platysma muscle are then divided transversely. The subplatysmal plane is bluntly

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undermined superiorly and inferiorly to achieve good exposure. In this step, the inferior border of the submandibular gland, facial artery, and vein, which cross the field of dissection, are the important anatomical structures. The facial artery is retracted superolateralerally toward the mandible. For better exposure, we can scarify facial vessels limiting the surgical corridor.

3.4. Step 4: Identifying the SCM, digastric muscle, and hypoglossal nerve

After the deep cervical fascia is exposed and opened, the SCM, strap muscles, larynx, and esophagus are seen. The anterior belly of the digastric muscle runs parallel to the incision, under the inferior edge of the mandible. The hypoglossal nerve courses deep, slightly inferior and parallel to the digastric tendon. In an extended cervical exposure such as the high cervical approach, the digastric muscle can be divided at its tendinous part to improve the exposure and allow mobilization of the hypoglossal nerve superiorly and the carotid sheath laterally. However, according to Finn et al., this maneuver is rarely needed [3]. Aggressive superior retraction of regional anatomical structures can injure the facial nerve which exits from the stylomastoid foramen (Fig. 1, 2).

3.5. Step 5: Identifying the cervical fascial plane

Wide dissection of the fascial plane between the SCM and the carotid sheath laterally, and the hypopharynx, and trachea and esophagus medially, permits better exposure to the high cervical spine. In this stage, an important technical note is to achieve wide, gentle, blunt dissection of each fascial plane, identifying landmarks that are easily visualized through the fascial planes.

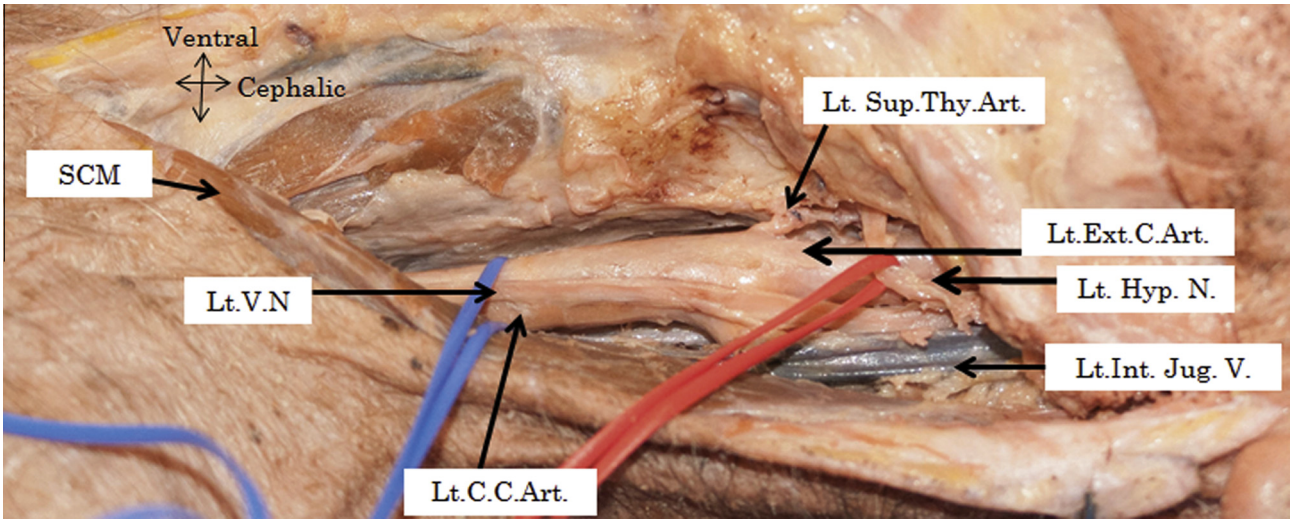

Fig. 1. Horizontal cervical incision and transection of platysma muscle. Lt.C.C.Art = left common carotid artery, Lt.Ext.C.Art = left external carotid artery, Lt.Hyp.N = left hypoglossal nerve, Lt.Int.Jug.V = left internal jugular vein, Lt.Sup.Thy.Art = left superior thyroid artery, Lt.V.N = left vagus nerve, SCM = sternocleidomastoid muscle. This figure is available in colour at www.sciencedirect.com.

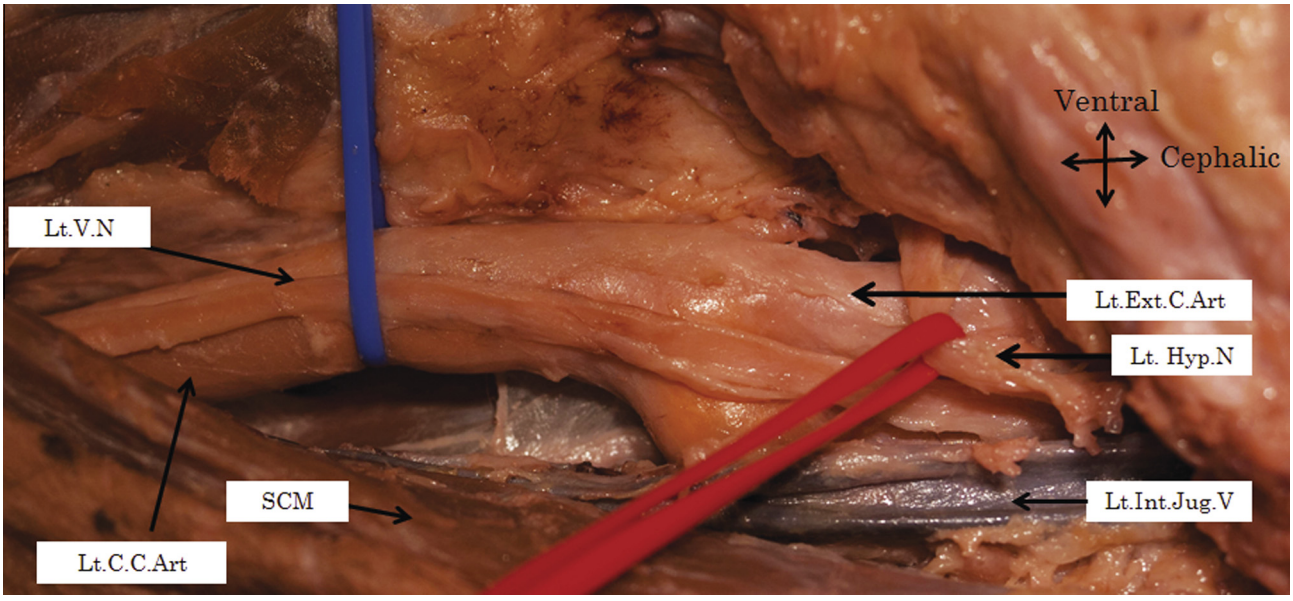

Fig. 2. Identification of the carotid sheath and its contents. Lt.C.C.Art = left common carotid artery, Lt.Ext.C.Art = left external carotid artery, Lt.Hyp.N = left hypoglossal nerve, Lt.Int.Jug.V = left internal jugular vein, Lt.V.N = left vagus nerve, SCM = sternocleidomastoid muscle. This figure is available in colour at www.sciencedirect.com.

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