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HOW I DO IT - NEUROSURGICAL ANATOMY

How I do it: total uncinatectomy during anterior diskectomy and fusion for cervical radiculopathy caused by uncovertebral joint hypertrophy

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Abstract

Background Cervical radiculopathy from uncovertebral joint hypertrophy and foraminal stenosis is a common indication for anterior cervical diskectomy and fusion (ACDF). Often, the uncinate hypertrophy extends lateral to the foramen and impinges on the nerve close to the vertebral artery as it travels in between the transverse foramina.

Method Using an injected cadaveric specimen to highlight the vital neurovascular and bony structures pertinent to this procedure, we demonstrate the technical details of complete uncinatectomy for cervical foraminal stenosis.

Conclusion Total uncinatectomy is a useful adjunct during ACDF for complete foraminal decompression in cases of uncovertebral joint hypertrophy.

Keywords Cervical radiculopathy · Foraminal stenosis · Uncinatectomy · Uncinate process · ACDF · Diskectomy · Surgical video

Relevant surgical anatomy

The cervical uncinate processes (UCP) are superior projections of bone continuous with the pedicle in the lateral portions of the vertebral body. The UCP comprises the medial portion of the cervical foramen, and articulates with the inferolateral vertebral body of the superior adjacent vertebrae, forming the uncovertebral joint (UVJ) [8]. The cervical nerve roots exit immediately posterior to the UVJ and superior to the inferior pedicle. The vertebral artery is closely associated with the UVJ, and travels immediately lateral within the transverse foramen [3].

The UVJ contribution to symptomatic cervical radiculopathy is well known, and is caused by hypertrophy of the uncinate process which narrows the foramen and compromises the exiting nerve [5]. This hypertrophy may extend lateral to the edge of the cervical disc space, making complete foraminal decompression difficult from a deep-to-superficial trajectory from within the disc space, such as during an anterior cervical diskectomy and fusion (ACDF) [6].

Complete exposure of the uncinate process and separation of the vertebral artery from the hypertrophied bone during ACDF allows for safe and total decompression of the exiting cervical nerve to ensure symptom relief in cases of foraminal stenosis [7].

Description of the technique

Preoperative considerations

An MRI is performed in patients with cervical radiculopathy as part of standard preoperative planning. The vertebral artery course within the transverse foramen and the location relative to the cervical foramen are studied in detail to determine if there are any anatomic variations that preclude total uncinatectomy to avoid neurovascular injury.

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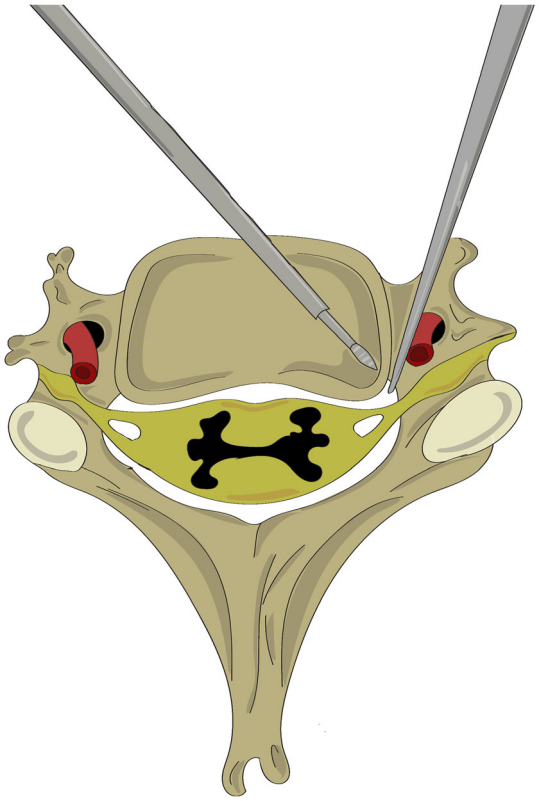

Fig. 1 Separation of the vertebral artery from the lateral uncinate with a blunt dissector. This key step protects the vertebral artery from the drill during uncinatectomy. Care is taken not to insert the instrument too deep, injuring the exiting cervical nerve root

Patient positioning

The patient is positioned with the head supine and slightly extended. The side of approach is chosen opposite to the symptomatic side of radiculopathy in order for the surgeon to have a complete working view of the uncinate process during decompression. If both sides are symptomatic, then the side of approach is performed from the patient's right from surgeon preference.

Technique

A standard Smith-Robinson approach to the anterior cervical spine is utilized within a 3–4-cm transverse incision. The carotid sheath is mobilized laterally and the esophagus medially in order to access the prevertebral space. The prevertebral fascia is incised sharply with scissors and the vertebral bodies and disc spaces are exposed with monopolar cautery. After fluoroscopic localization of the correct level, the UVJ are exposed completely under the longus coli with cautery. Complete exposure of the UVJ allows for direct visualization of the limits of bony decompression required for total uncinatectomy. The disc is then removed with a series of Kerrison punches and curettes. Once the posterior longitudinal ligament (PLL) is identified after complete diskectomy, the uncinate process is palpated within the disc space and traced to the superficially exposed UVJ. The PLL is left intact during the uncinatectomy portion of the procedure to protect the nerve root and dura. A freer dissector or Penfield no. 4 dissector is then traced along the subperiosteal plane of the lateral uncovertebral joint under the longus coli. This move separates the vertebral artery from the UVJ and is protected during uncinatectomy by the blunt instrument. Care is taken not to insert the instrument into the exiting nerve root, which is immediately medial and ventral to the UVJ and traveling anteriorly to join the brachial plexus trunks (see Fig. 1). A high-speed burr is then used to drill the UCP until it is thin enough to fracture with the blunt instrument inserted lateral to the bone. The UCP is fractured medially into the disc space and may be removed with a Kerrison punch or pituitary rongeur. At this point, the pedicle of the lower cervical vertebrae may be palpated, indicating complete foraminal

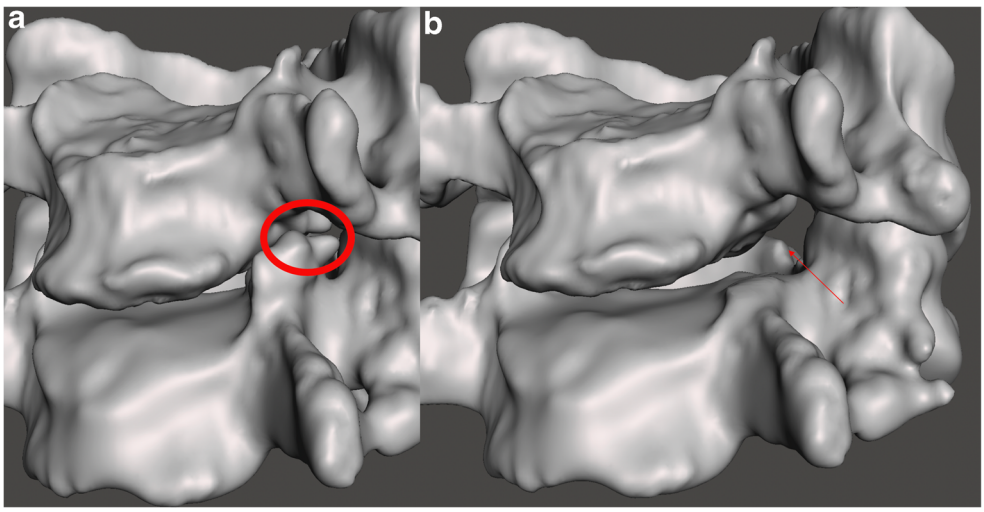

Fig. 2 Three-dimensional rendering of preoperative and postoperative imaging from a patient with cervical radiculopathy and foraminal stenosis. **a** Left foraminal stenosis from uncovertebral joint hypertrophy causing stenosis of the C5–C6 foramen (red circle). **b** Total removal of the hypertrophied uncovertebral joint provides satisfactory foraminal decompression (red arrow)

decompression. The exiting nerve root is also visualized and inspected for freedom from any remaining bony compression. The medial portion of the PLL may then be removed in order to visualize the cervical dura and confirm central canal decompression if desired. The remainder of the ACDF procedure can then be completed by insertion of an interbody graft and anterior screw/plate construct [4]. The wound is closed in anatomic layers. A drain may or may not be utilized depending on post-procedure hemostatic status.

Indications

Indications for total uncinatectomy during ACDF include cervical radiculopathy caused by foraminal stenosis and uncovertebral joint hypertrophy (Fig. 2). Cases of cervical radiculopathy caused by acute disc herniations are not included in the indications for this technique.

Limitations

As mentioned before, anatomic variations in vertebral artery location within the cervical foramen, disc space, or vertebral body may preclude total uncinatectomy due to the possibility of neurovascular injury [1].

How to avoid complications

Complete exposure of the UVJ under the longus coli is extremely important in order to properly define the boundaries of bone removal and estimation of the vertebral artery position. During positioning of the blunt instrument between the vertebral artery and UCP, it is important to "hug" the bony edge in order to avoid placing the instrument directly into the transverse foramen and risking injury to the vertebral artery.

Specific perioperative considerations

Postoperatively, patients are assessed under standard neurosurgical floor protocol. The majority of patients are discharged on postoperative day 1 after overnight observation.

Specific information to give to the patient about surgery and potential risks

Preoperatively, patients are counseled about the general risks of anterior cervical decompressive surgery including neurovascular injury, swallowing difficulty, and injury to visceral structures of the neck. The patients are also counseled about the extremely low risk (< 1%) of Horner's syndrome due to sympathetic plexus injury on the lateral portion of the longus coli muscles during exposure [2].

Summary of ten key points

1. Patient selection is made by cervical radiculopathy caused by uncinate hypertrophy.
2. Complete anterior foraminal decompression in cases of severe UVJ hypertrophy is difficult without total uncinate removal.
3. Preoperative imaging is carefully reviewed to ensure there are no variations of vertebral artery position within the cervical foramen.
4. Approach is made from the contralateral side of the symptomatic level.
5. Complete exposure of the UVJ is a key step before attempting uncinatectomy.
6. Diskectomy is completed first, leaving PLL intact.
7. A blunt instrument such as a Penfield no. 4 or freer dissector is used to separate vertebral artery from lateral UCP.
8. Do not insert instrument too deep into the exiting cervical nerve root lateral in the foramen.
9. The UCP is drilled until it is able to be fractured medially into the disc space by the blunt instrument.
10. The cervical pedicle can be palpated in order to confirm complete foraminal decompression.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

Informed consent This article does not contain any studies with human participants performed by any of the authors.

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