Application of anterior cervical discectomy with or without fusion is a method used for cervical disc hernia not responding to conservative treatment. Soft disc hernia causing radiculopathy or compressive pathologic lesions including spondylotic bone spurs is mostly located in the anterior of the cervical nerve root. This patho-anatomical feature brings the anterior approach to the front place in the curative surgical approaches in this region. Anterior cervical discectomy survived as a frequently used and acceptable method since its description by Cloward and Smith & Robinson in 1950's. Different variations have been reported and applied within this period. In this article, the surgical method, risks and the surgical anatomy that is important as regards the precautions against these risks.

Risks: Although the vascular risks regarding the carotid and vertebral arteries are among the risks mentioned in the first place, they are very rare. Although the risk is low, the risk of vertebral artery injury is higher than that of the carotid artery. Vertebral artery injury can occur in relation with the operation of the surgeon at more lateral during foraminotomy. Although carotid artery injury risk is less, embolic ischemic event is possible during the manipulation of this artery.

Infection rate is less than 1%. Dysphagia, which is the most frequent complication, often disappears within one or two weeks following the surgery. Hoarseness related to the injury of the recurrent laryngeal nerve is seen about 1% of the patients. This complication is seen in approaches to the lower levels including C6-7 and C7-T1 related to the more oblique course of this nerve. Since the injury risk for the recurrent laryngeal nerve will be less on the left side of the patient as it has a course closer to the trachea, some surgeons recommend left lateral approach in this level. The method that will reduce the injuries in approaches from both sides is to perform the dissection as a blunt dissection using the Kittner dissector or small-sized compressed gauze. While the risk of injury is low on the left side, the thoracic duct can be injured on this side because of its long and high trajectory on this side.

The rate of pseudoarthrosis in the single-level cervical discectomy with added fusion ranges between 2 and 8%. This rate increases in multi-level interventions. Performing the fusion with the accompaniment of instrumentation reduces the rate of pseudoarthrosis, and it also prevents the dislocation of the graft as well as facilitates the return to daily living activities.

Surgical technique

Position: The most important issue during positioning is the amount of extension to be given to the neck. Overextension can lead to neurologic injury by increasing the compression on the spinal chord particularly in patients with myelopathy.

The patient is given the supine position, and his/her neck is given a slightly extended position by placing soft supports under both scapulas and neck. The distance is determined under fluoroscopy with C-arm. Although the risk of recurrent laryngeal nerve injury is greater in the left lateral approach, since it....
is possible to reduce this risk with careful surgical manipulation, most of the right-handed surgeons prefer the right lateral approach. In case a left-side approach has been performed previously, access through the old incision will be preferred. Together with this, in case subclinical vocal chord is present at the preferred side for approach, the counter-lateral incision will not be preferred 3.

Although fluoroscopy is used to determine the distance, there are also some anatomic pathfinders. For example, the cricothyroid membrane coincides with the C5-6 intervertebral disc space. In addition, the carotid tubercle is the most prominent protrusion in this level and can be palpated. However, since this method will increase the carotid embolism risk in elderly patients, it is not used.

Transverse incision is preferred in single- or double-level procedures and in patients with long necks, vertical incision is preferred in patients with narrow necks. Transverse incision is made so that one-third will be on the sternocleidomastoid muscle, and two-thirds will extend to the medial.

*Exposure:* Following the skin incision, platysma will be exposed. Internal and external juguler veins will be seen. The fascia extending on and along the medial side of the sternocleidomastoid (SCM) muscle will be excised and dissected upwards and downwards. The carotid artery will be palpated within the carotid sheath. The SCM muscle, carotid pack will be flapped over to the lateral side, and the esophagus, trachea and strap muscles are flapped over to the medial side. The omohyoid muscle, inferior and superior thyroidal arteries and veins are dissected or can be excised if needed. Superior laryngeal nerve injury must be avoided in C3-4 level. Prevertebral area is reached with blunt dissection. After palpating the anterior face of the vertebra, the fascia covering this area is visualized with the help of hand retractors and cut. After definitely establishing the disc spaces, a needle is placed in the estimated disc space as a marker. The level is determined under the fluoroscopy control. Following the determination of the level, the longus colli muscle is cauterized with lateral monopolar cautery for 2-3 mm on both sides and the threads of the automatic retractor will be placed under this muscle. In case the anterior osteophytes prevent the placement of the retractor during this procedure, these osteophytes are removed using a pituitary rongeur. Sympathetic nerve injuries must be avoided during the dissection of the longus colli muscle. The midline opening must be about 20 mm in the transverse direction. There is the risk of vertebral artery injury with over dissection. Automatic retractors are placed vertically and horizontally. N. laringeus recurrence can be compressed between the esophagus and trachea. Legs of the retractor must be placed below the longus colli muscle. Otherwise, lethal complications related to esophagus and carotid artery injuries can occur. Retractors must be frequently released and re-tightened.

Following this stage, the midpoints of the lower and upper bodies are determined, and the nails of the Caspar retractors are placed within the body, and the retractor is placed. The microscope is taken in the operation area and the anterior longitudinal ligament and the annulus fibrosis within the determined disc space are cut with a blade. Then, the already placed Caspar retractor is extended; extension before the incision of the above-mentioned structures is not recommended. In addition, overextension of the retractor is not recommended, since this will cause postoperative neck pain.

Following the incision of the ligament and annulus fibrosis, the disc is entered and two-thirds of the disc material is excised with the help of a curette and disc punches. The bony labium, which is generally present in the upper vertebral body, is removed with Kerrison rongeur or is removed by drilling. Fragments of disc can sometimes migrate behind the posterior longitudinal ligament. PLL will be seen, the bilateral foramina are controlled and the extruded part is removed. After seeing PLL, it is recommended coagulate this structure to see its fibers and also to eliminate the venous structures passing through it. In addition, this procedure will facilitate to enter beneath PLL with a micro curette. PLL will be incised and removed with Kerrison rongeur.

The symptomatic will be decompressed in the first place. The patient’s position will be tilted about 10-20 degrees opposite the surgeon to see the foramen better. The right-handed operator will go to the left side of the patient to perform foraminotomy, if applied. Removing the osteophytes and disc material with micro curettes and micro Kerrison rongeurs performs foraminotomy.

In some cases, the herniated disc is at the posterior of PLL and can be recognized during the operation. Determining the degree to extend the dissection
in the lateral may not be possible in this case. The following data must be used for orientation: excessive venous bleeding will occur towards lateral (this can be controlled with bipolar), seeing the uncovertebral joint, seeing the origin of the nerve root and/or the fatty tissue in the axilla of the root.

There will be enough space to trim the posterior angles of the vertebrae after removing the osteophytes, and Kerrison rongeur and/or angled curettes will be used in this area. The surgeon must feel the bony tissue at the tip of the tool during this procedure, otherwise blank punching or injury of the vertebral artery during curettage can occur. The same procedure will be repeated on the opposite side after completing the symptomatic side. Drilling procedure will be continued till the medial border of the uncovertebral joint is removed. If bone fusion will be made, the endplates will be prepared as the graft beds depending on the method to be applied.

For the anterior simple discectomy, bony structures will not be excised and no material or bone will be used for fusion purposes. The Caspar retractor will be removed after establishing the hemostasis. The bleeding from bone in the area of the body that the retractor has been removed from will be controlled bone wax. Then, the retractors placed beneath the longus colli with medial-lateral orientation and cranio-caudal orientation (if any) will be removed. Platysma will be sutured according to the subcutaneous and cutaneous anatomy.

The complete intervertebral disc is removed in the method described above. With the method described under the anterior microforaminotomy, however, the compressive lesion is reached by removing the Uncinate process by drilling its medial or lateral part and the pathology is removed\(^6\). Since the disc tissue is left intact, the functional structure is maintained as a minimum in this method. Corpectomy can be added to the same approach. The latter method requires mastery on the surgical anatomies of the uncinate process, vertebral artery and the nerve roots to prevent damage on these structures.

**Surgical anatomy:** The two important components throughout the cervical spine are the vertebral body and the discs between the two bodies. Cervical discs in C2-7 levels can be more easily degenerated with micro traumas. Knowing the vertebral body heights and disc space values is important for both the interbody fusion and for determining the dimensions of the graft to be placed following the corpectomy. The vertebral body heights range between 12.5 and 15 mm in the anterior for C3-7 levels. The posterior heights of bodies exceed the heights of anterior past by 0-1 mm. The antero-posterior dimension of the disc space is 18-21 mm, while the width is about 22-29 mm. It has been shown that the height of the It has been shown that the disc space height, which ranges between 2.5 and 4.5 can extend up to 8.5-9 mm after the distraction.

The transverse processes in the cervical region end in anterior and posterior tubercles from C2 to C6. The transverse foramen is present in the medial of both tubercles. The distance between the transverse foramen and the medial border of the vertebral artery in the levels between C3 and C7 ranges between 30.5 mm and 31.52 mm.\(^4\) (Figure 1) While TUR is used for neural foraminal decompression in the lateral, care must be taken when removing the posterior border of the C3 vertebral body; because the vertebral artery is at more posterior in this level as compared to other segments. The same is true also for C7. However, this has no clinical significance since the vertebral artery does not pass through the transverse foramen in this level.

The distance between the medial surfaces of the transverse processes is left intact, the functional structure is maintained as a minimum in this method. Corpectomy can be added to the same approach. The latter method requires mastery on the surgical anatomies of the uncinate process, vertebral artery and the nerve roots to prevent damage on these structures.

The transverse processes, which are important structures in the anterior cervical approach, are found in the upper surface of the vertebral body and the uncovertebral joints they form (the Luschka’s joint) hold on the lateral surface of the adjacent upper vertebra. They are responsible for the stability and mobility of the cervical spine.\(^3\) The stability problem related to the surgical removal of this structure must be kept in mind. Uncinate processes limit the lateral flexion to a certain degree. While the lower uncus
Figure 1: Cross-sections through the mid cervical vertebrae (given as the average values from C3 to C7 respectively). (Neurosurgery, Volume 38(6), June 1996, 1139-1144)

Upper left:
1: The distance between the anterior border of the vertebral body and the anterior border of the transverse: 8.66 (C3) – 10.21 (C7) mm
2: The distance between the posterior borders of the vertebral body and the transverse foramen: 2.17 – 0.91 mm
3: The distance between the medial border of the Luschka’s joint and the medial border of the transverse foramen: 4.91 – 5.62 mm
4: The distance between the Luschka’s joints: 15.18 – 20.28 mm
5: The distance between the medial border of the Luschka’s joint and the medial border of the pedicle: 1.91 – (- 0.36) mm
6: Anteroposterior diameter of the spinal channel: 14.55 – 14.28 mm
7: Transverse diameter of the spinal channel: 23.62 – 24.25 mm
8: Anteroposterior diameter of the vertebral body at the upper end-plate level: 15.9 – 17.63 mm

Upper right:
9: Anterior height of the vertebral body: 14.37 – 14.97 mm
10: Posterior height of the vertebral body: 14.43 – 15.14 mm
11: Anteroposterior diameter of the vertebral body at the lower end-plate level: 16.67 – 17.05 mm

Lower left:
12: Distance of the medial border of the Luschka’s joint to the medial border of the transverse foramen: 4.91 – 5.62 mm
13: Distance between the Luschka’s joints: 15.18 – 20.28 mm

Lower right: View of the C7 vertebra from above. The transverse foramen in C is at the posterior border of the vertebral body. The medial border of the C7 pedicle is immediately right of the medial side of the Luschka’s joint.
that the distance between the medial faces of the two Luschka’s joints is about 15 mm in the C3, and 20 mm in the C7 level (Figure 1). In another study, the mean distance between the medial surfaces of the two transverse foramina has been shown as 23.8 mm in the average. With this reason, decompression in patients with myelopathy must extend from one Luschka’s joint to the other as a minimum, and it must extend more laterally in cases with radiculopathy accompanied by foraminal stenosis. Transverse decompression with a width of 20 mm must be considered as sufficient.

After exposing the uncinate process, it must be kept in mind that vertebral artery is close to the lateral border of this process. It must be known that the distance between the Luschka’s joint and the medial border of the transverse foramen is always less than 6 mm. The risk of injuring the vertebral artery is not low particularly when removing the uncinate process with TUR to remove the osteophytes. The anterior part of the uncus as a minimum must be preserved in anterior surgical approaches in order not to spoil the stability of the cervical spine.

**Figure 2:** Relation of the uncinate process and the surrounding anatomical structures: (average values of C2-3, C3-4, C4-5, C5-6 and C6-7 disc spaces, respectively): (Neurosurgery, 1996 Oct; 39(4):769-76)

- **a:** Distance between the medial and lateral borders in the mid portion of the uncinate process (uncinate process width): 6 – 6.1 – 5.3 – 5.8 – 6.7 mm
- **b:** Height of the uncinate process: 6 – 7.5 – 5.8 – 8.1 – 6.4 mm
- **c:** The line to differentiate the uncinate process from the costal process.
- **h:** Height of the coastal process (CP): 8.2 – 8.3 – 10.8 – 10.8 – 7.3 mm
- **w:** Width of the coastal process: 11.3 – 11.9 – 12.8 – 12.9 – 24.8 mm

The decompression width in cervical spondylosis accompanied by myeloradiculopathy is recommended as 15-18 mm. However, it has been shown

**Figure 3:** The relation between the top of the uncinate process and the surrounding anatomical structures: (average values of C2-3, C3-4, C4-5, C5-6 and C6-7 disc spaces, respectively). (Neurosurgery, 1996 Oct; 39(4):769-76)

- **UP-VA:** The distance between the top of the uncinate process and the vertebral artery: 0.8 – 1.3 – 1.6 – 1.4 – 1
- **UV-VC:** The distance between the top of the uncinate process and the vertebral body: 1 – 1.3 – 1.5 – 1.4 – 1
  (The post-distraction values in the same distances: 4.3 – 4.5 – 3.7 – 3.4 – 3.3 mm)
- **d:** The observed distance between the uncinate process and the root: 1.7 – 0 – 1.6 – 0.8 – 0.8
References


