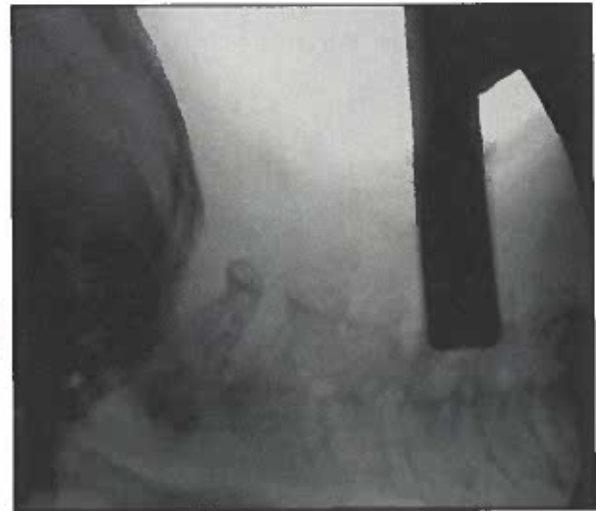
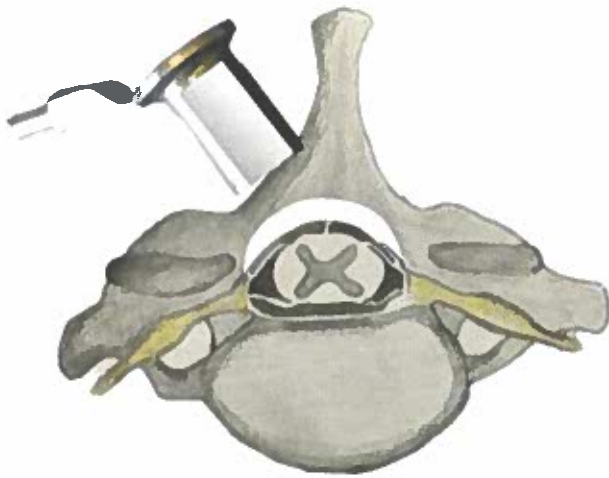




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**Microsurgical Treatment of Cervical Spinal
Compression Through Minimally Invasive Tubular
Retractors**



Understanding the Spine

The spine is made up of vertebrae, which are bones that are stacked on top of each other in a column. Between these bones are discs that act as cushions. The discs have a tough outer ring called the annulus fibrosus. This outer layer covers the inner gel-like center of the disc, called the nucleus pulposus. The vertebrae meet at bony junctions called facet joints connected by ligaments called ligamentum flavum. The spinal cord and nerves are contained in the spinal canal, which runs through the column made by the vertebrae. Nerves exit the spinal canal on each side through the foramina, which are openings between the vertebrae.

Common Cervical Spine Issues

Spinal Canal Stenosis (Narrowing)

- Usually develop slowly over years
- Maybe caused by disc breakdown, disc herniation, osteoarthritis, bone spurs and thickening of the ligaments (ligamentum flavum)
- Narrowing of the spinal canal may cause pressure on the nerves, which can cause neck pain, leg symptoms, balance problems and abnormal reflexes with possible arm pain, numbness or weakness

Foraminal Stenosis

- Narrowing of the openings between vertebrae where the spinal nerves exit the spinal column
- May be caused by bone spurs (outgrowth of bone), herniated or bulging discs
- Foraminal narrowing may lead to trapping or constriction of the nerves which can cause neck pain, arm pain, numbness, weakness or cramping.

Disc Herniation

- As the body ages, disc height can become reduced, which can lead to "rupture" or "herniation" of the inner gel-like disc (nucleus pulposus).
- Disc herniation may bulge into the spinal canal, causing pressure on the nerve, which may cause sudden neck pain, numbness/tingling in the shoulders, arms, and fingers. (See above in foraminal stenosis and spinal canal stenosis.)

Treatment Options:

Conservative Treatment Options

All of these cervical spine issues may first be treated with conservative management. This may include rest, medication, physical therapy, and/or steroid injection.

Surgical Treatment Options

Surgery is usually saved as the last treatment option for those who have not had improvement of symptoms with conservative treatments.

Cervical spine surgical approach can be done via anterior or posterior approach. General anterior spine techniques are anterior cervical discectomy and fusion (ACDF) and disc arthroplasty. Posterior cervical spine approach may involve direct decompression, where the pressure is removed from the nerve, which may include discectomy, foraminotomy and/or laminectomy which may disturb structures and cause or worsen instability.

Implants can be used to prevent the instability of spine.

The alternative approach is minimally invasive approach (MIS). This method of minimally invasive technique avoids distraction of muscles and preserves stabilizing structures. Compared to open approaches, MIS decompression may result in less post-operative pain and instability of the spine.

How is MIS decompression better?

The surgical outcome and relief of symptoms with MIS is similar to a traditional open procedure. However, since tubular retractors allow surgeons to decompress nerves through a small tube, it offers several advantages:

- A small incision
- Less muscle damage – retractor tools spread the muscle instead of stripping or cutting it from the bone, which decreases post-operative pain and allow for an easier recovery
- Less post-operative pain
- Shorter hospitalization and speedier recovery – may even be done as an outpatient
- High patient satisfaction scores

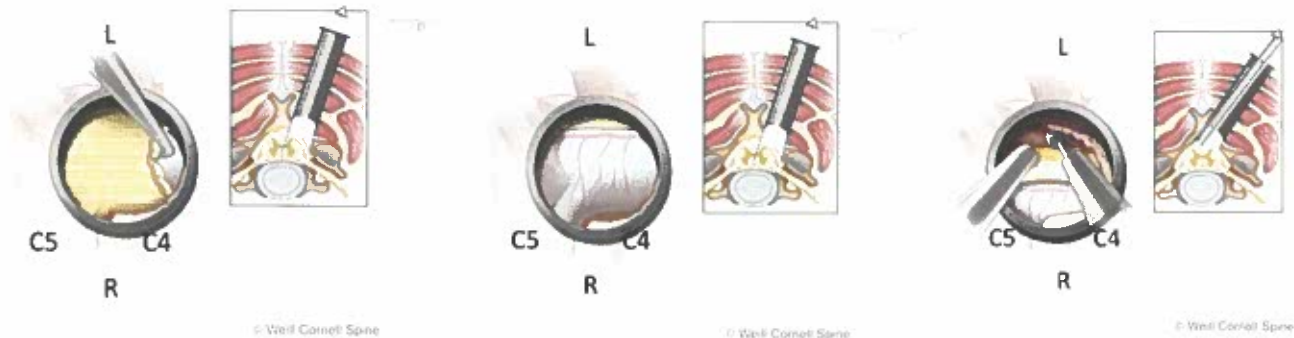
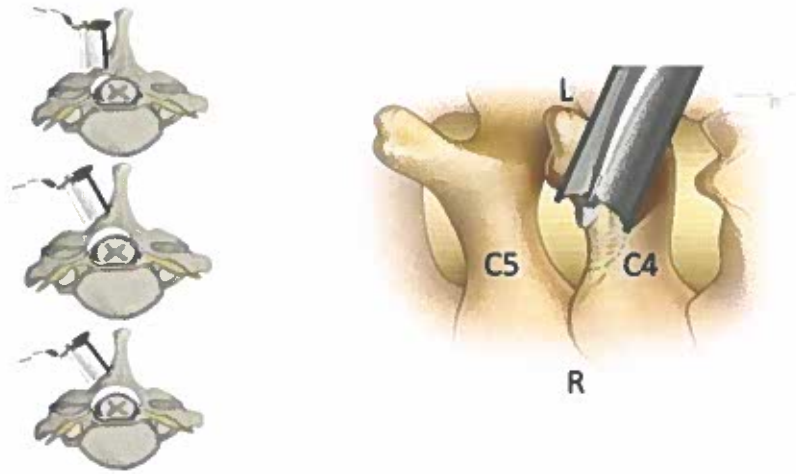
Another Key Benefit

Traditionally, patients with cervical spinal canal and foraminal stenosis are treated by open decompressive surgery and additional fusion to ensure stability.

Recently, it was noted that MIS approaches are associated with a lower post-operative instability rate when compared to open decompressive surgery. Therefore, a fusion with cages and screws can be avoided.

The Procedure

Tubular retractors are tools that create tunnels through which the spine can be accessed. The muscles are not scraped away from the bones of the spine, but stay attached to it. A microscope is used to look through the small tubular retractor to visualize compressed neural elements. They are then decompressed using special microsurgical instruments.



Stages of minimally invasive (MIS) decompressive procedure using tubular retractors

The Results and Scientific Evidence

- A meta-analysis of cervical foraminotomy: open versus minimally-invasive techniques showed no significance difference between the groups while having the advantages of MIS surgery.¹
- Another study showed that minimally invasive microscopic posterior cervical decompression is a safe and effective treatment for cervical spondylosis in selected cases.²
- Benefits of tubular retractors are not only limited to laminectomy. They have also been successfully applied to foraminotomy and discectomy procedures.^{1,2}

References:

1. McAnany SJ, Kim JS, Overley SC, Baird EO, Anderson PA, Qureshi SA. A meta-analysis of cervical foraminotomy: open versus minimally-invasive techniques. *Spine J.* 2015 May 1; 15(5):849-56.
2. Vergara P. Minimally Invasive Microscopic Posterior Cervical Decompression: Simple, Safe, and Effective. *J Neurol Surg A Cent Eur Neurosurg.* 2017 Sep; 78(5): 440-445.
3. James A, Hartl R, Moraes O. Posterior foraminotomy (2012). in Hartl R, Korge A, "MISS: Techniques, evidence and controversies" Thieme, NY, p 109-120.