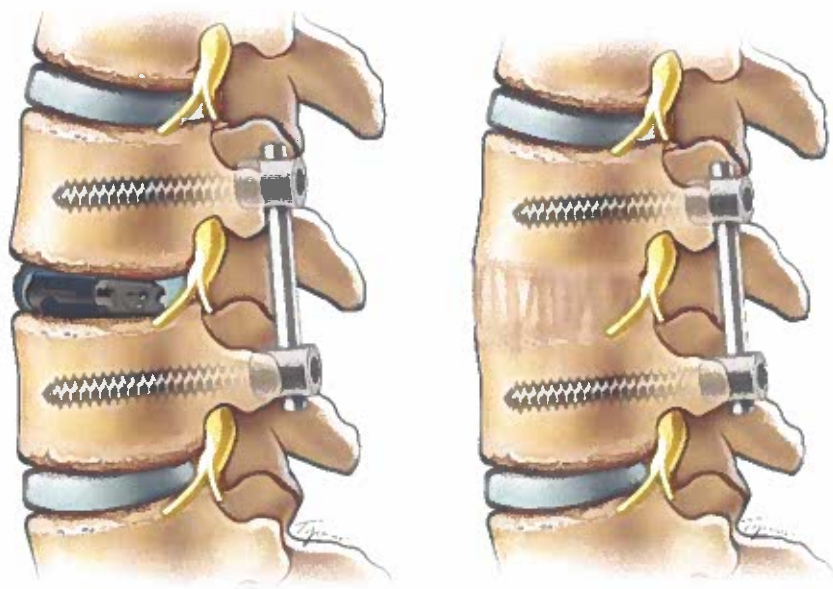




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**Minimally Invasive Spinal Fusion
Through a Tubular Retractor**



**Transforaminal Lumbar
Interbody Fusion
(MIS-TLIF)**

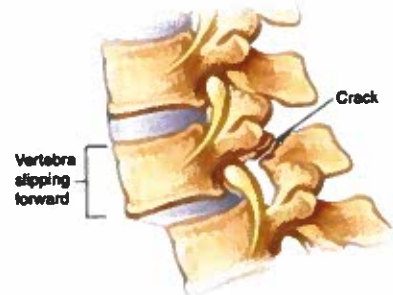
Understanding the Spine

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 Low Back Issues Requiring Fusion

Spondylolisthesis

- Slipping of one vertebra forward or backward relative to one another
- Can be congenital (born with it) or result from normal aging, trauma, or prior surgery
- Narrowing of the spinal canal and neural foramen may cause pressure on the nerves which can also cause low back pain with possible leg 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), and/or herniated or bulging discs
- Foraminal narrowing may lead to trapping or constriction of the nerves which can cause low back pain, hip pain, buttock pain, leg pain, numbness, weakness, or cramping



Degenerative Disc Disease

- Degeneration of the intervertebral disc is normal as we age
- Can result in disc space collapse, which can result in compression of the nerves and lead to low back pain, buttock pain, leg pain, numbness,
- tingling, or weakness

Treatment Options:

Conservative Treatment Options

These common low back issues may first be treated with conservative management. This may include rest, weight reduction, medication, physical therapy, and/or steroid injections.

Surgical Options

Surgery is usually saved as the last treatment option for those who have not had improvement of symptoms with conservative treatments. Surgery involves fusion of the bones in the spine. This requires placement of screws and rods, and a metal "cage" in between the vertebrae. For spondylolisthesis, surgery involves fixing the bones in place so they are no longer able to move and decompression to remove any pressure on the nerves. For foraminal stenosis, surgery involves direct decompression, where the pressure is removed from the nerve. In doing so, the facet joint is removed which leaves the vertebrae unstable, requiring fusion to prevent abnormal movement of the bones. These surgeries can be done via a traditional open approach, which requires extensive muscle dissection and large incisions.

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

How Is MIS-TLIF Better?

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

- Two small incisions
- 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
- High patient satisfaction scores
- Lower risk of infection

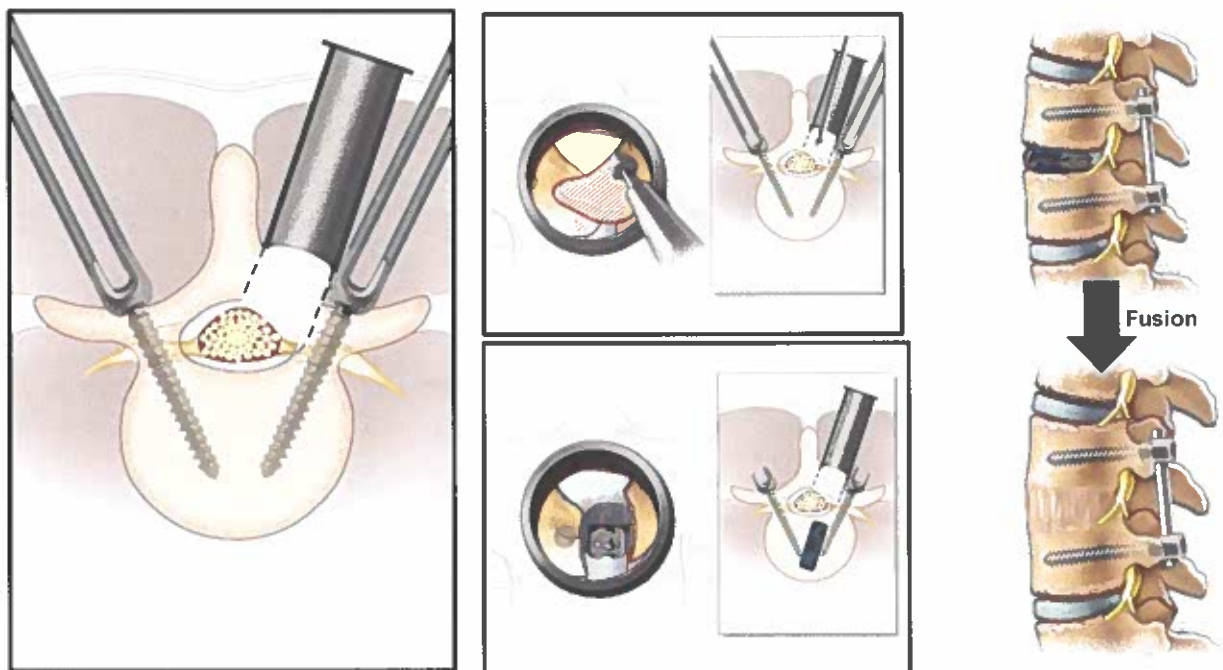
Another Key Benefit

We perform MIS-TLIF using computer-assisted navigation, which serves as a GPS of the patient's anatomy during the procedure. By using this GPS system, we can place the screws with very high accuracy. Additionally, the GPS allows us to identify important anatomic landmarks during surgery so we can perform the surgery as safely and effectively as possible

The Procedure: MIS-TLIF

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. To achieve bony fusion, the disc between the vertebrae is removed and a metal "cage" is placed between the bones. Screws are placed on both sides of the spine and are connected with a rod on each side of the spine to fix the bones in place. This is achieved through 2 small incisions.

Stages of Minimally Invasive (MIS) Transforaminal Lumbar Interbody Fusion (TLIF)



The Results and Scientific Evidence

- Multiple studies by our group and others show that compared to traditional "open" TLIF, MIS-TLIF has:^{1,2,3}
 - less postoperative pain
 - shorter hospitalization
 - faster recovery
 - less blood loss
 - similar fusion rates
 - similar or lower complication rates
- Our research also shows that with the use of computer-assisted navigation, a GPS-like system, we achieve extremely high accuracy for pedicle screw placement.^{4,5}

References:

1. Seng C, Siddiqui MA, Wong KPL, et al., Five-year outcomes of minimally invasive versus open transforaminal lumbar interbody fusion: A matched-pair comparison study. *Spine (Phila Pa 1976)*. 2013;38:2049-2055.
2. Wu RH, Fraser JF, Härtl R. Minimal access versus open transforaminal lumbar interbody fusion: meta-analysis of fusion rates. *Spine (Phila Pa 1976)*. 2010;35:2273-2281.
3. Goldstein CL, Macwan K, Sundararajan K, Rampersaud YR. Perioperative outcomes and adverse events of minimally invasive versus open posterior lumbar fusion: meta-analysis and systematic review. *J Neurosurg Spine*. 2016;24:416-427.
4. Lian X, Navarro-Ramirez R, Berlin C, et al. Total 3D AIRO® navigation for minimally invasive transforaminal lumbar interbody fusion. *Biomed Res Int*. 2016;2016: 5027340.
5. Torres J, James AR, Alimi M, et al. Screw placement accuracy for minimally invasive transforaminal lumbar interbody fusion surgery: a study on 3-D neuronavigation-guided surgery. *Global Spine J*. 2012;2:143-152.