The Perils of Fusion

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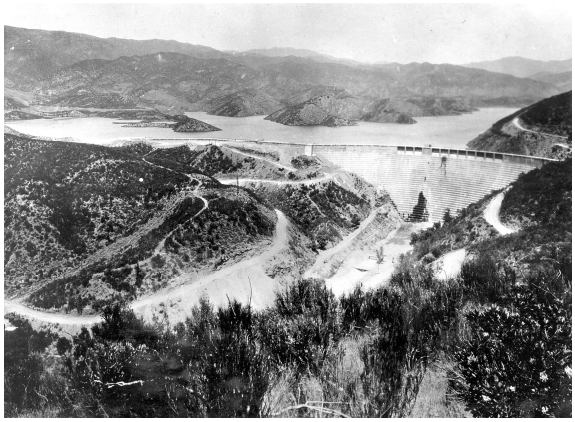
Disclosures:

- Depuy Synthes – Paid consultation
- OnPoint Surgical, Inc. – Member, Medical Advisory Board
- Prime Consulting – IME/PIR/Record Review/Expert Witness



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- 82 year old female
- “scoliosis surgery” 18 months prior
- Presents with severe back pain, kyphotic deformity, lower extremity weakness, difficulty with ambulation.

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fusion

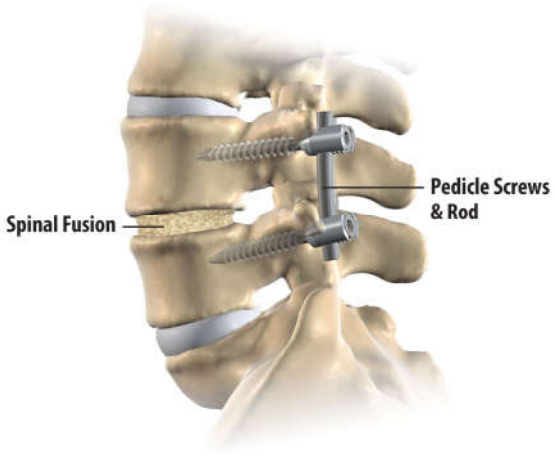
[fyoo-zhuh n]

NOUN

1. the act or process of fusing; the state of being fused.
2. that which is fused; the result of fusing
3. Politics.

Fusion, as it relates to the spine

- Permanent joining of two or more vertebrae to create a single osseous structure.

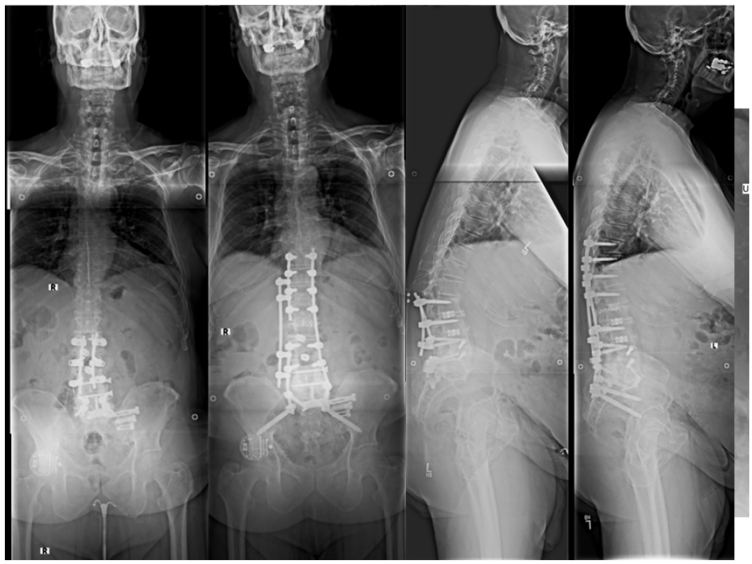


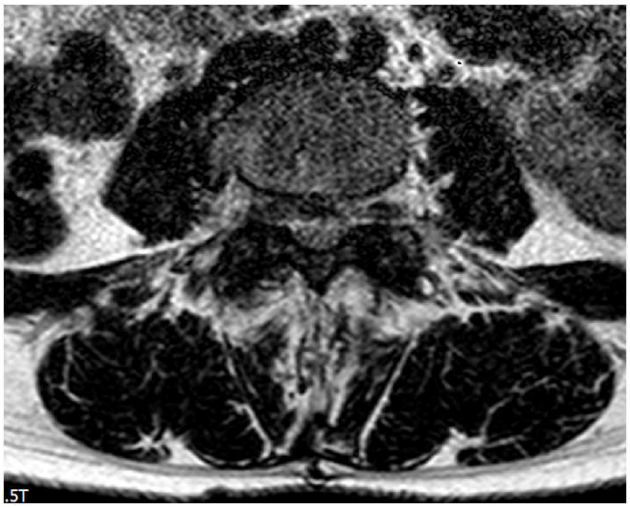
Why do we fuse?

<u>Unrelenting back pain, radiculopathy or neurogenic claudication in the setting of instability or progressive deformity</u>

Why do we fuse?

- Trauma
- Instability
- Deformity correction
- Revision of previous fusion.
- Malignancy/pathologic lesion

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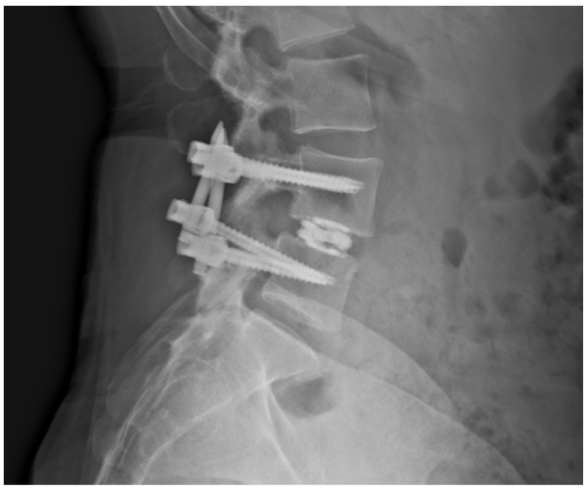
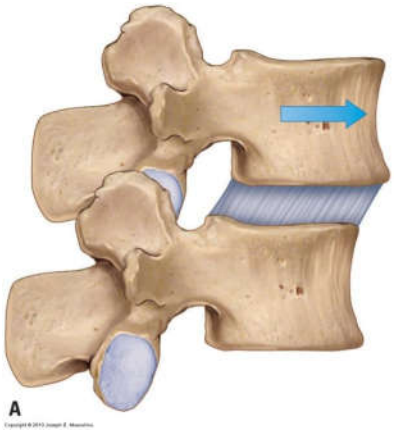


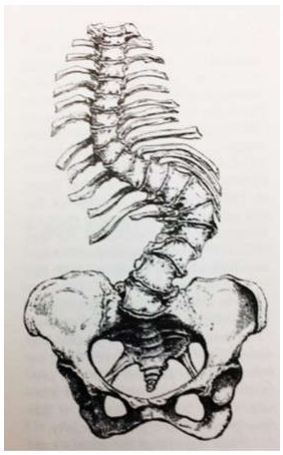
Spondylolisthesis:

Sagittal plane displacement of one vertebral body relative to the vertebral body immediately caudad.

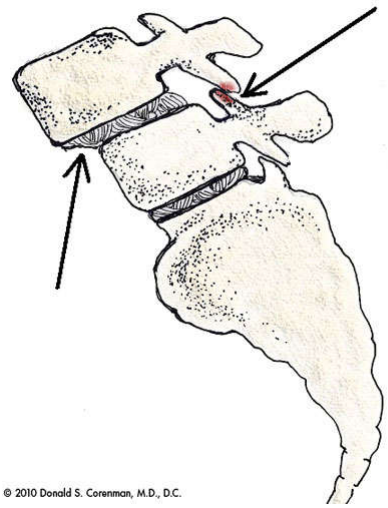


Scoliosis:

3 dimensional deviation in the axis of the spine resulting in coronal plane deformity of more than 10 degrees.



Broadhurst B:
Deformities of the human body.
London. 1871



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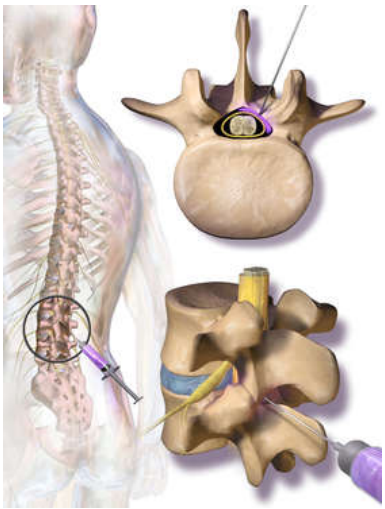
Conservative treatment options

- Physical therapy
- NSAID therapy
- Medial branch block
- Epidural steroid injection.



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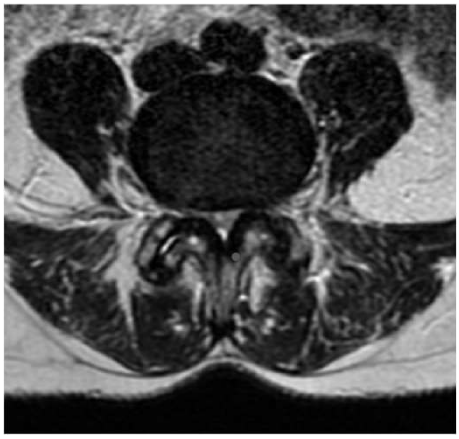
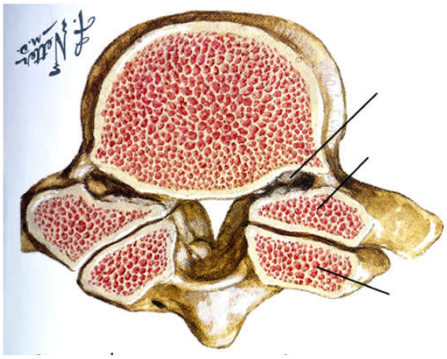


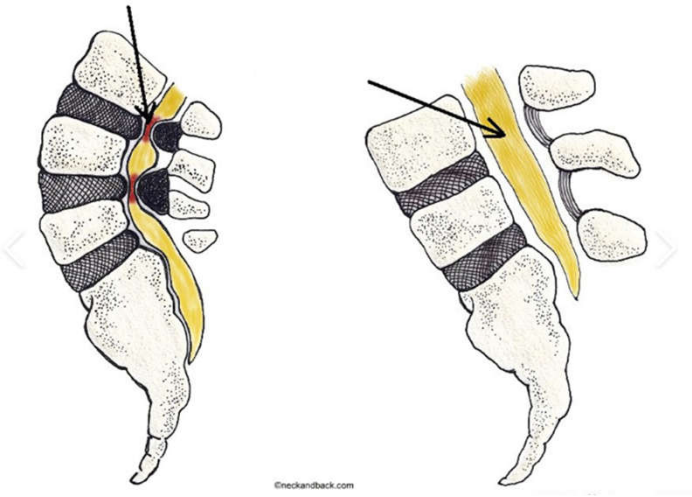


Spinal Stenosis:

Narrowing of the spinal canal or neuroforamen.

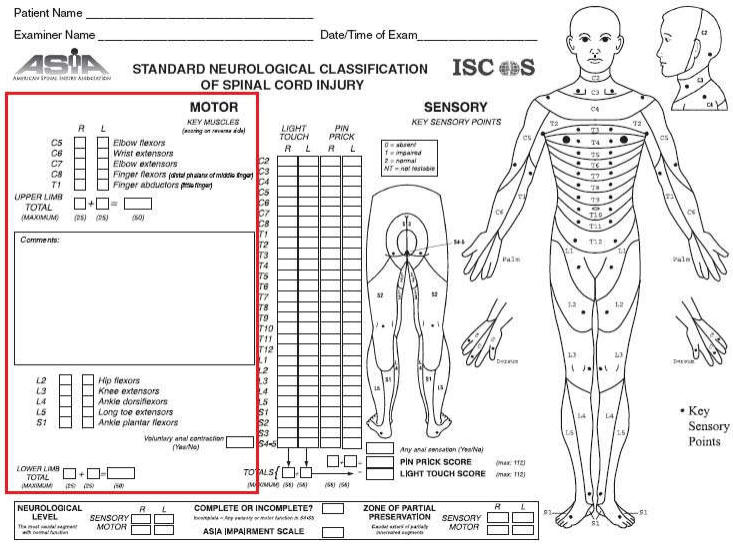
Neurogenic claudication:

Characteristic pattern of symptoms caused by central stenosis of the lumbar spine resulting in pain and cramping of the low back and lower extremeties worsened by lumbar extension

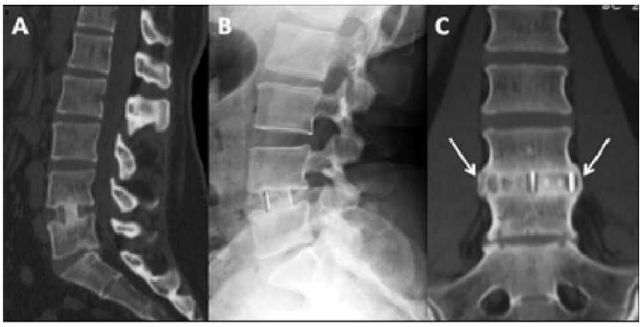


Radiculopathy

Pain, parasthesias, or weakness in the distribution of a specific spinal nerve.



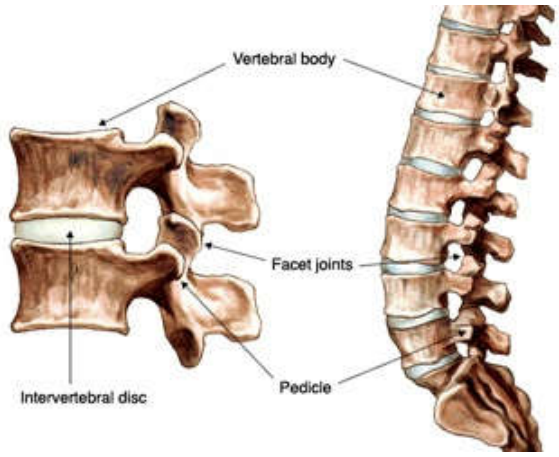
Goals of fusion



- To create an osseous structure that is the result of a permanent joining of two or more vertebrae.
- To recreate normal spinal alignment.

Methods of fusion

- Posterior stabilization (ie pedicle/cortical screws.
- Anterior stabilization (plate)
- Interbody stabilization (cage +/- graft)



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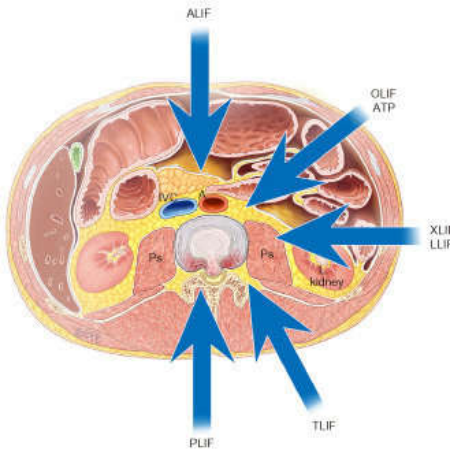

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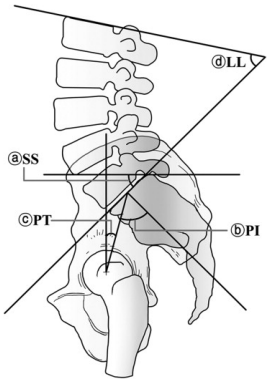
Lumbar basics:

-Lumbar lordosis is graduated.

-Motion is segmental.

-Alignment is local, regional and global



Thoracic basics:

-Thoracic kyphosis is progressive.

-Sagittal imbalance = back pain.

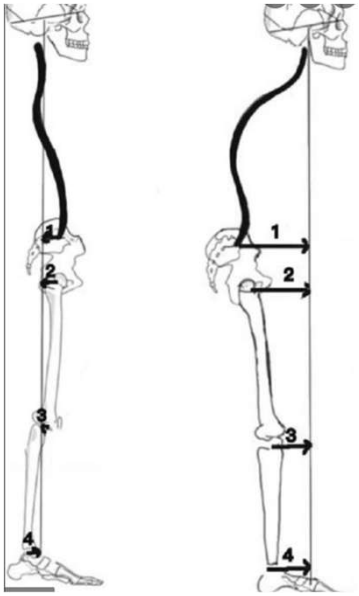
-Sagittal balance worsens throughout life

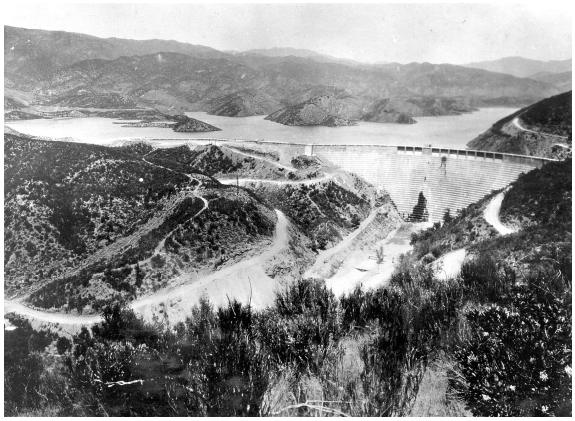
Global spinal alignment

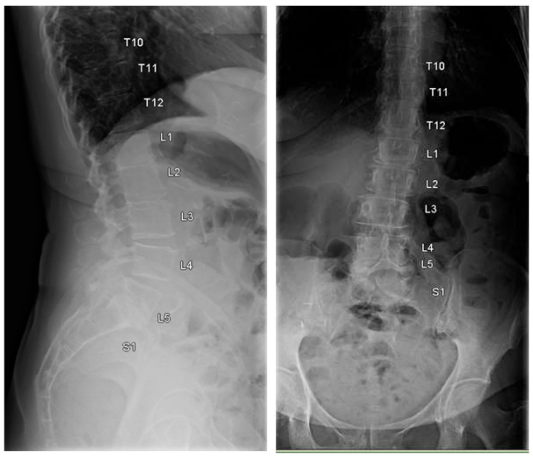
-Anterior sagittal imbalance is associated with:

- Pelvic retroversion
- Knee flexion
- Intervertebral hyperextension and retrolisthesis.

-Back/neck pain.
-increased work of ambulation.







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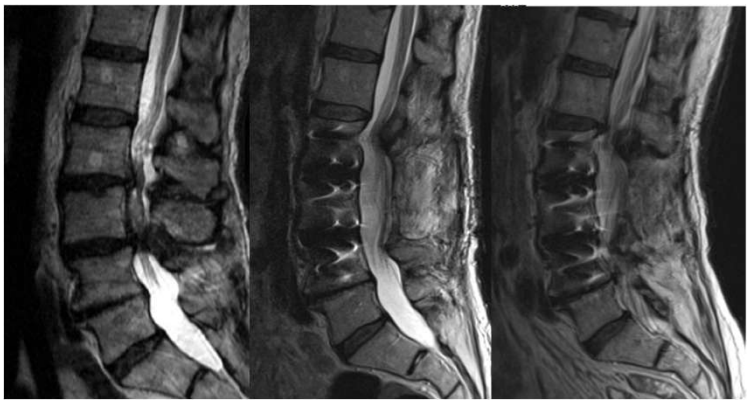
Adjacent level pathology

- Results from increase in translational and rotational stress at unfused segments adjacent to fusion.
- Typically presents after a pain free interval of at least 2 years.
- Risk approximately 2.5%/year, cumulative.

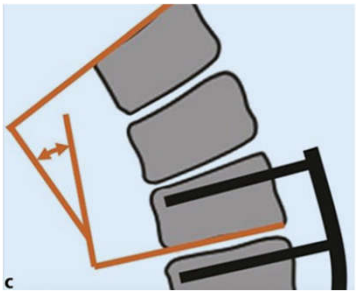


Risk factors for adjacent segment disease

- Advanced age (>60 years)
- Female gender
- Postmenopausal status
- Osteopenia/osteoporosis
- Preoperative degeneration at the adjacent level
- **Long fusion segment**
- **Stiffness of construct (ie 360deg fusion)**
- **Altered coronal or sagittal alignment**
- **Injury to the adjacent segment facet joint.**
- **Loss of segmental lordosis**

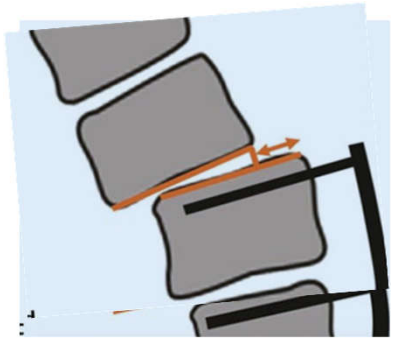
Proximal junctional Kyphosis(PJK)

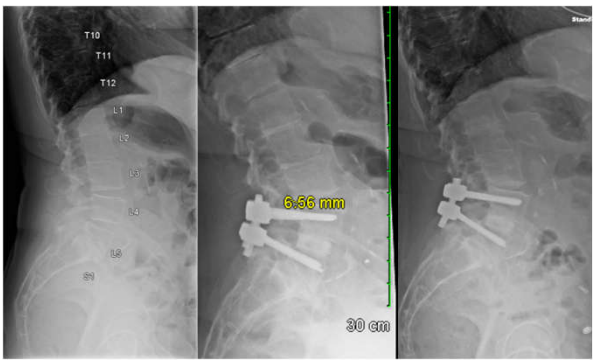
- PJK – Specific type of adjacent segment disease in which post operative regional kyphosis is at least 10 degrees increased over preoperative regional kyphosis within 2 segments of the UIV.
  - Incidence = 20-40%



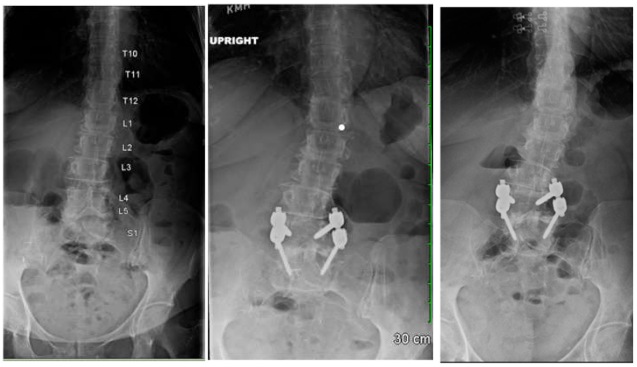
Proximal junctional Failure (PJF)

- PJF – Acute, progressive type of PJK characterized by vertebral fracture at UIV or UIV+1, subluxation between UIV and UIV+1, failure of fixation, and/or neurological deficit requiring surgical revision.
  - Incidence = 5-20%....MAJOR cause of revision surgery





2012 2017 2019



2012 2017 2019

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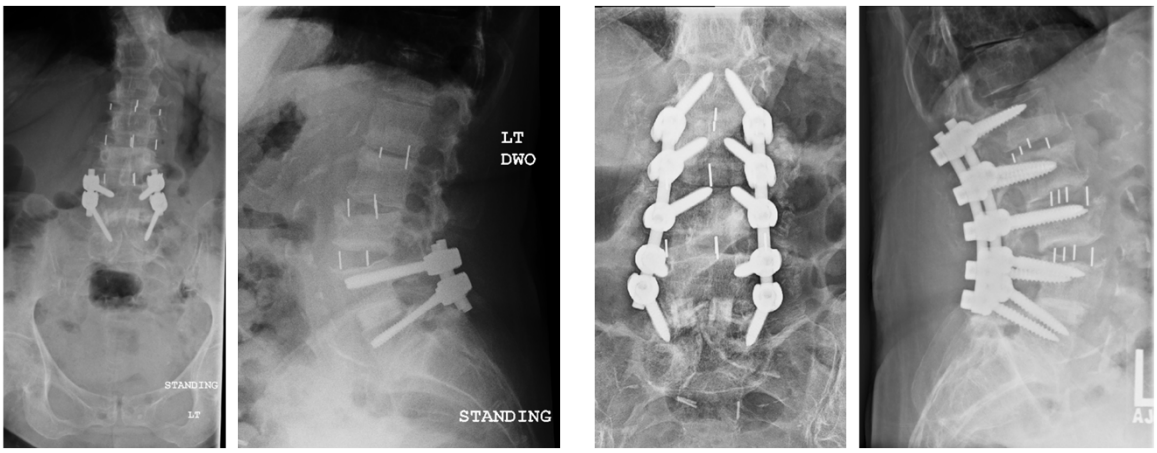
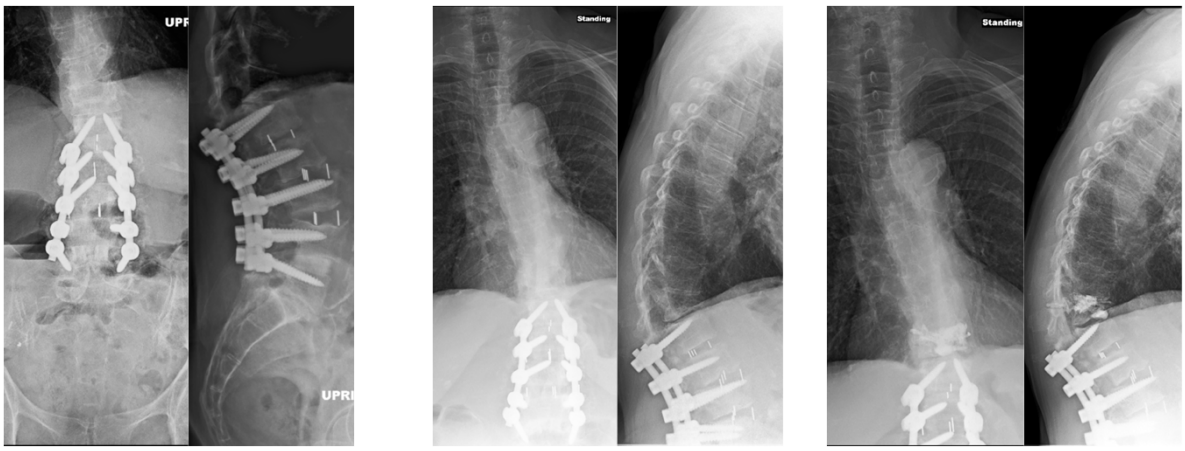


Staged revision fusion L1-L5 with lateral interbodies performed 2/2019



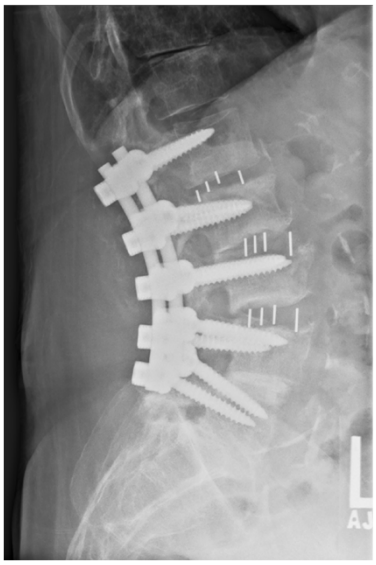
1 month post op

2 month post op

4 month post op – T12 Kyphoplasty performed

Risk factors for PJK/PJF

- Age >55
- Osteoporosis/osteopenia (T score < -1.5)
- High preoperative SVA
- **Combined anterior/posterior fusion**
- **UIV at thoracolumbar junction (T11-L1)**
- **Disruption of posterior ligamentous complex**
- **Length of construct**

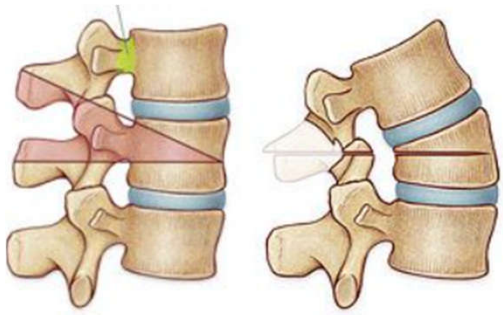


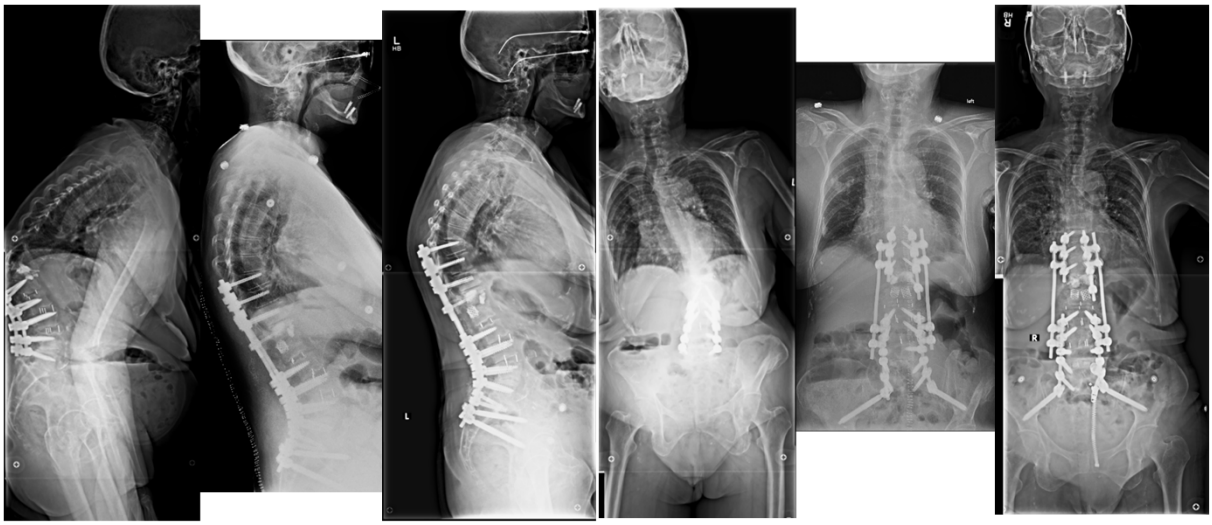
- 82 year old female
- "scoliosis surgery" 18 months prior
- Presents with severe back pain, kyphotic deformity, lower extremity weakness, difficulty with ambulation.

- DEXA : minimum T score -2.2.
- SVA: + 20
- Focal kyphosis >65

Surgical revision

- Extension of fusion.
- Frequently requires 3 column osteotomy.
- Cost – avg $55K per case
- Increased risk of PJK/PJF after revision.





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Circumferential Minimally Invasive Spine Surgery (for lumbar degenerative disease)

- Less blood loss
- Shorter recovery times
- Shorter length of stay
- Quicker return to work/MCID
- Fewer Complications
- Better Patient Reported Outcomes
- Fewer Readmissions/Reoperations

MIS TLIF

Minimally Invasive Transforaminal Lumbar Interbody Fusion

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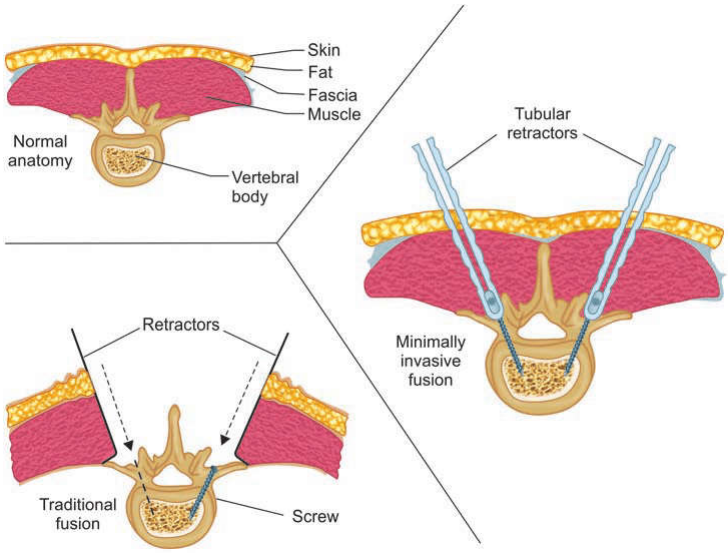

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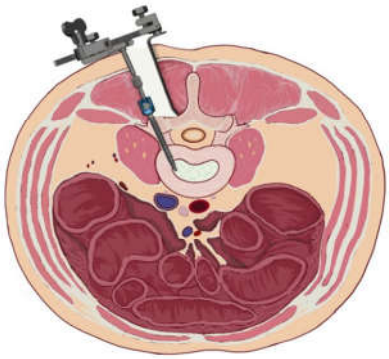

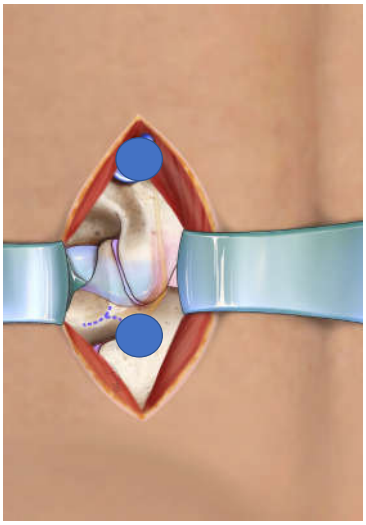

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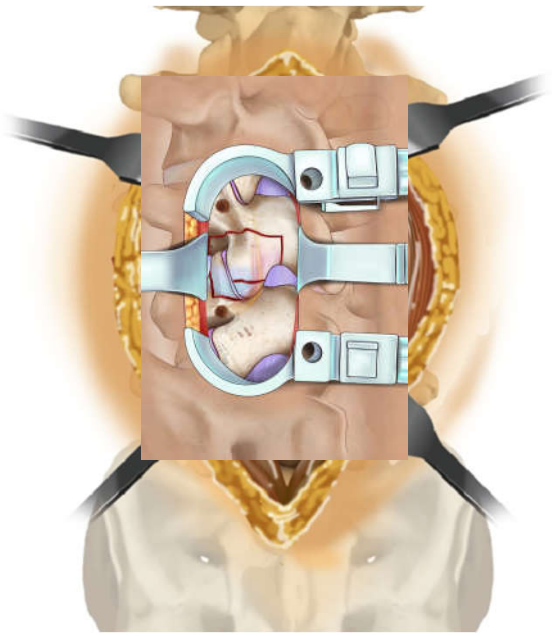

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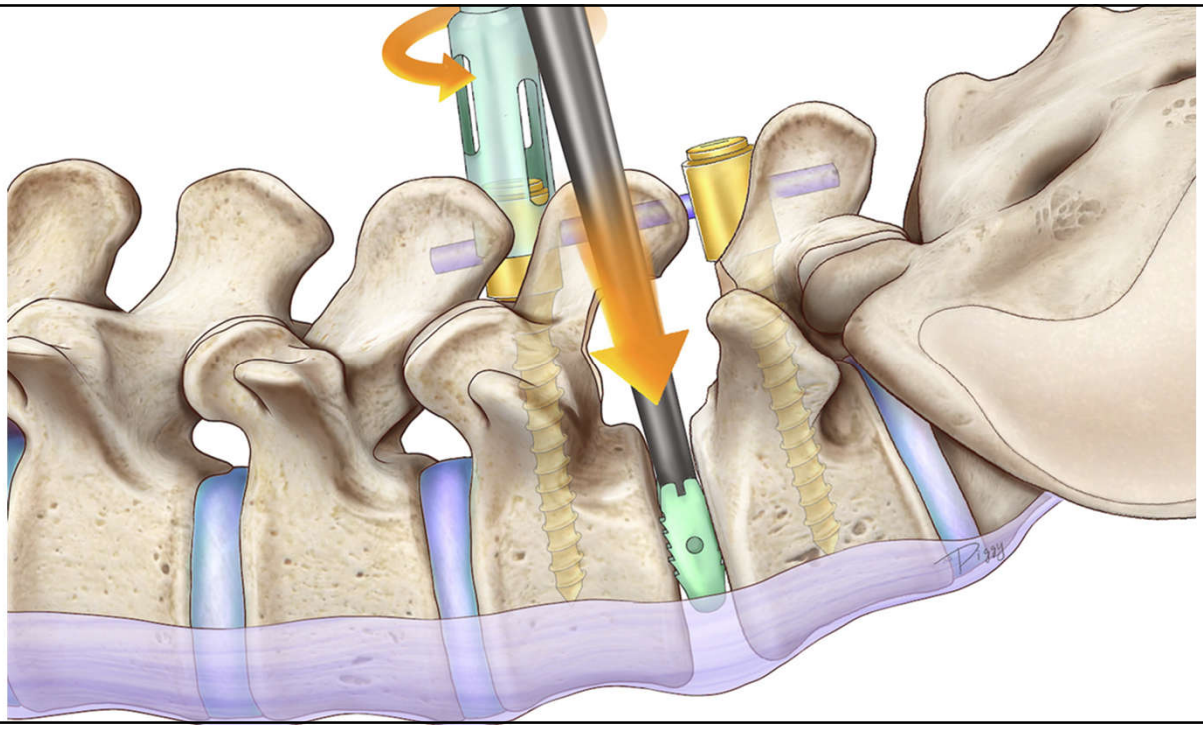

"Open" TLIF

Minimally Invasive TLIF

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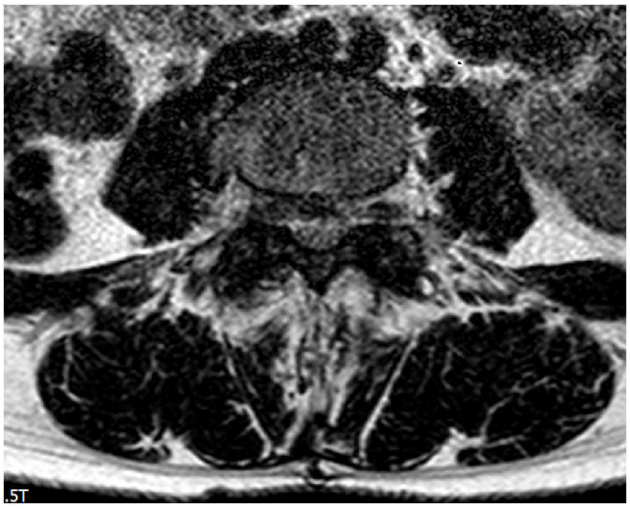

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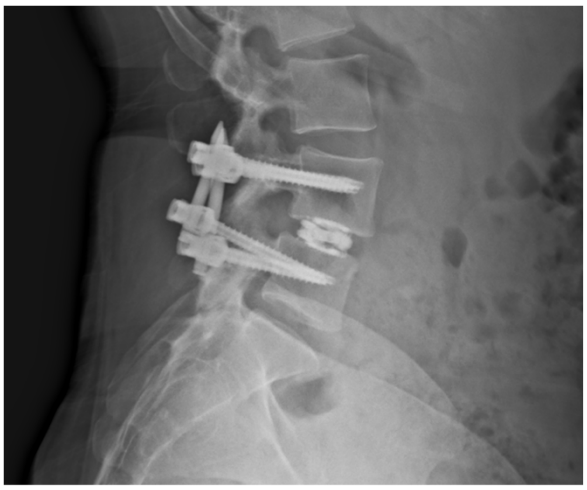

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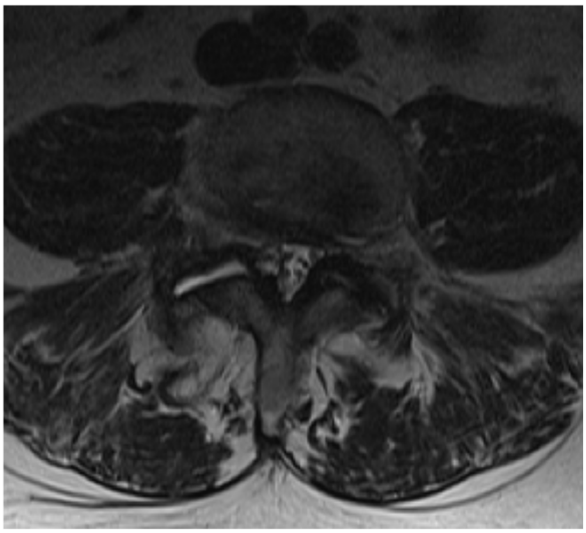

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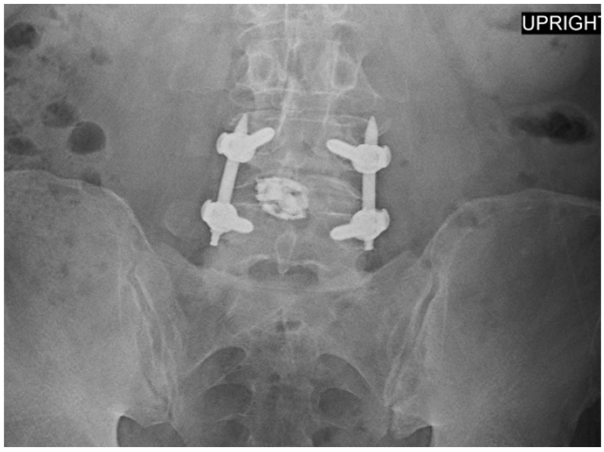
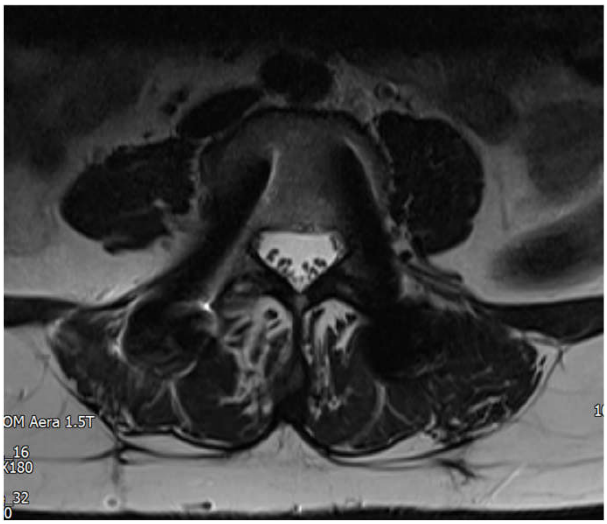


Post op course

- Immediate pain improvement.
- Discharged home in <24 hours.
- Early physical therapy.
- Return to work at 8 weeks, limited duty.
- Full duty at 3 months



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MIS PTP Fusion

Minimally Invasive Prone Transpsoas Fusion

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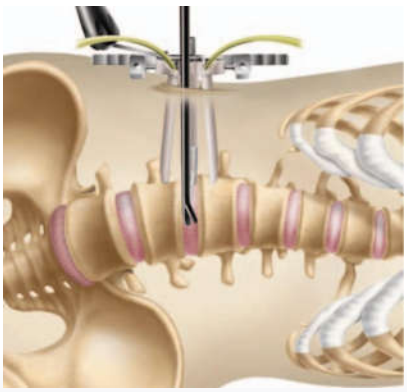
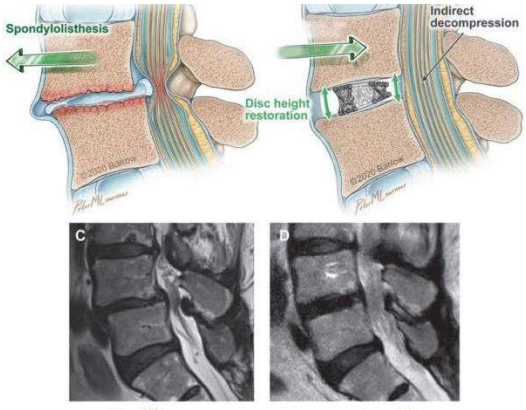
Direct lateral and Prone Transpsoas fusion

- Powerful distraction force with large cage
- Excellent for revision in setting of previous laminectomy.
- Prone positioning permits posterior access if necessary and improves lordosis.



Direct vs Indirect Decompression

- Traditional open treatment of stenosis requires direct decompression of neurologic structures via laminectomy/foraminotomy.
- MIS decompression relies on indirect decompression via ligamentotaxis and spinal realignment, using **distraction through the intervertebral disk space**.



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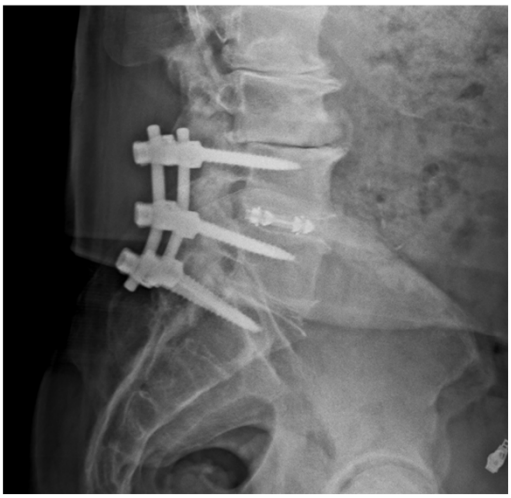

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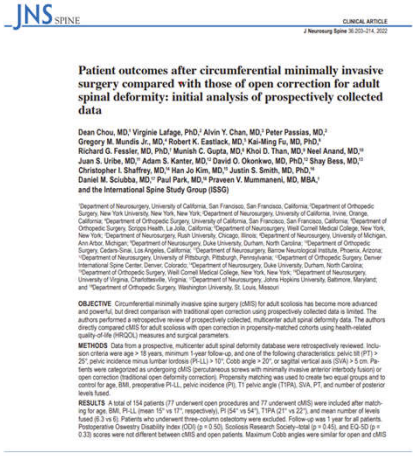
Circumferential minimally invasive spine surgery for adult spinal deformity

- Prone positioning, correction achieved through interbodies.
- Navigation is preferred.
- When compared to traditional open surgery, decreased blood loss, decreased length of stay, increased operative times.
- No statistical difference in revision rates, spinopelvic parameters, HRQOL improvement



JNS SPINE

CLINICAL ARTICLE

J Neurosurg Spine 36:203-214, 2022

Patient outcomes after circumferential minimally invasive surgery compared with those of open correction for adult spinal deformity: initial analysis of prospectively collected data

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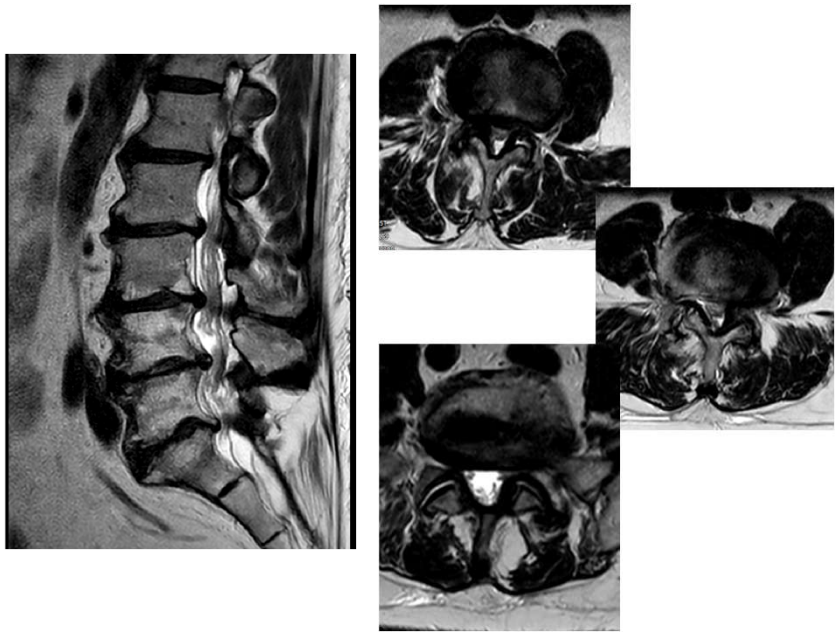
OBJECTIVE Circumferential minimally invasive spine surgery (cMIS) for adult scoliosis has become more advanced and powerful, but direct comparison with traditional open correction using prospectively collected data is limited. The authors performed a retrospective review of prospectively collected, multicenter adult spinal deformity data. The authors directly compared cMIS for adult scoliosis with open correction in propensity-matched cohorts using health-related quality-of-life (HRQOL) measures and surgical parameters.

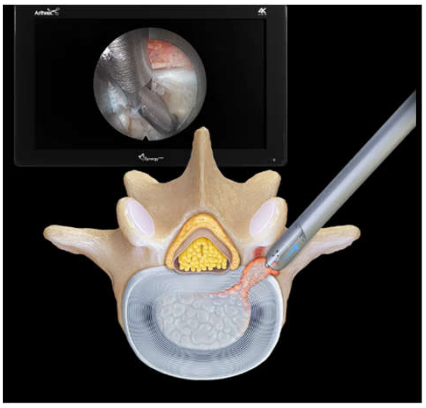
METHODS Data from a prospective, multicenter adult spinal deformity database were retrospectively reviewed. Inclusion criteria were age > 18 years, minimum 1-year follow-up, and one of the following characteristics: pelvic tilt (PT) > 25°, pelvic incidence minus lumbar lordosis (PI-LL) > 10°, Cobb angle > 20°, or sagittal vertical axis (SVA) > 5 cm. Patients were categorized as undergoing cMIS (percutaneous screws with minimally invasive anterior interbody fusion) or open correction (traditional open deformity correction). Propensity matching was used to create two equal groups and to control for age, BMI, preoperative PI-LL, pelvic incidence (PI), T1 pelvic angle (T1PA), SVA, PT, and number of posterior levels fused.

RESULTS A total of 154 patients (77 underwent open procedures and 77 underwent cMIS) were included after matching for age, BMI, PI-LL (mean 15° vs 17°, respectively), PI (54° vs 54°), T1PA (21° vs 22°), and mean number of levels fused (6.3 vs 6). Patients who underwent three-column osteotomy were excluded. Follow-up was 1 year for all patients. Postoperative Oswestry Disability Index (ODI) (p = 0.50), Scoliosis Research Society–total (p = 0.45), and EQ-5D (p = 0.33) scores were not different between cMIS and open patients. Maximum Cobb angles were similar for open and cMIS

- 73 year old former special forces operator with low back pain with radiation into b/l lower extremities.

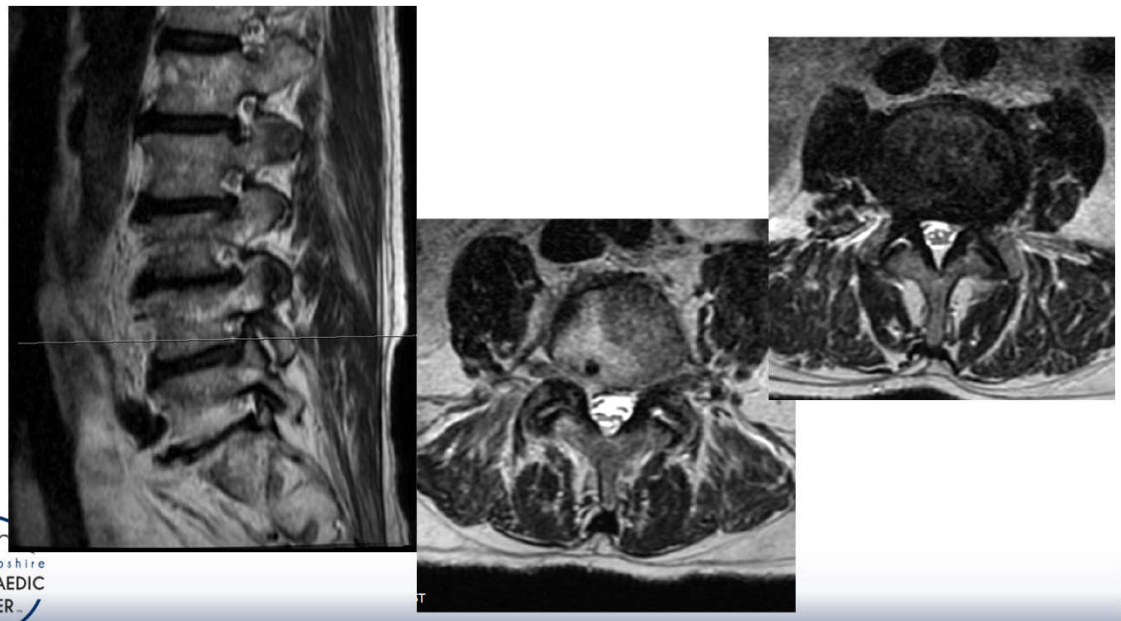
- Injections/PT treatment no longer effective.
- Activity level is significantly decreased.
- Wants surgery.





Endoscopic spinal decompression

Central and foraminal decompression with minimal disruption of the posterior elements.



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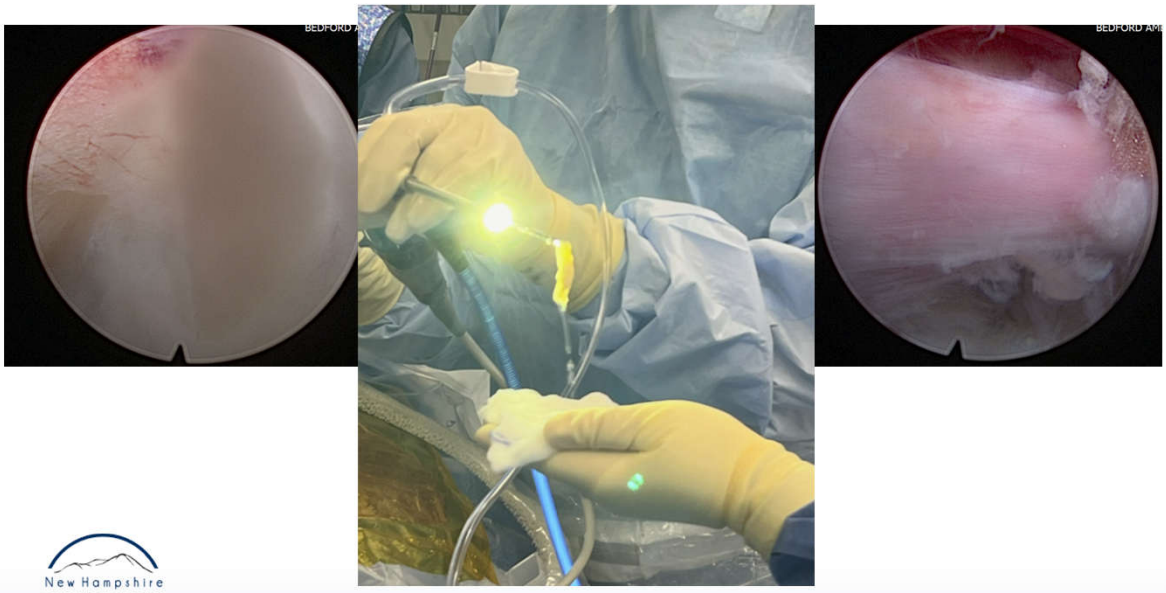

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cases

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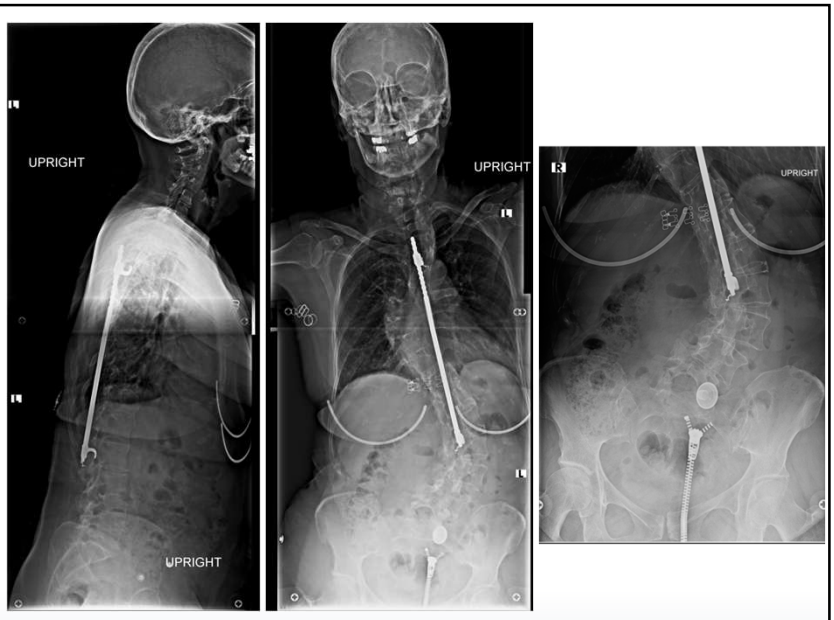
- 68 year old female with severe back pain, bilateral leg pain.
- History of “scoliosis surgery” 50 years ago.
- DEXA= -2.7
- Conservative therapy failure



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- Returned to full-time employment at 6 weeks.
- Radicular pain completely resolved.
- Complains of occasional morning stiffness

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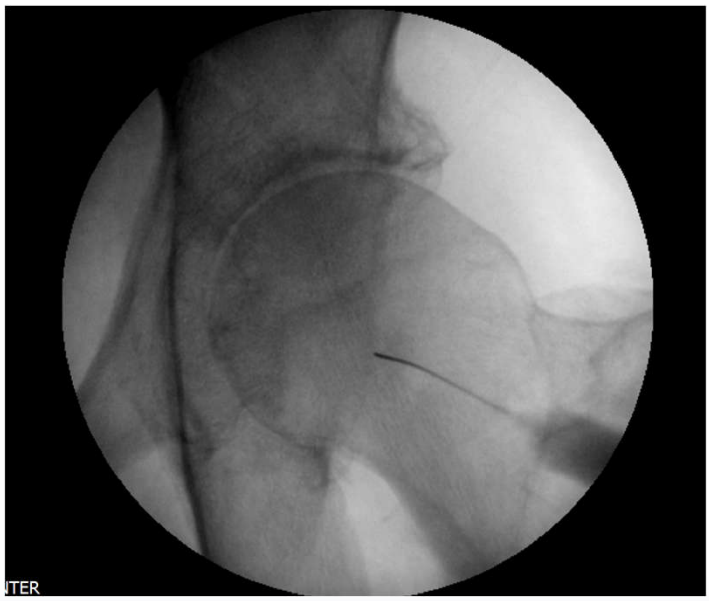
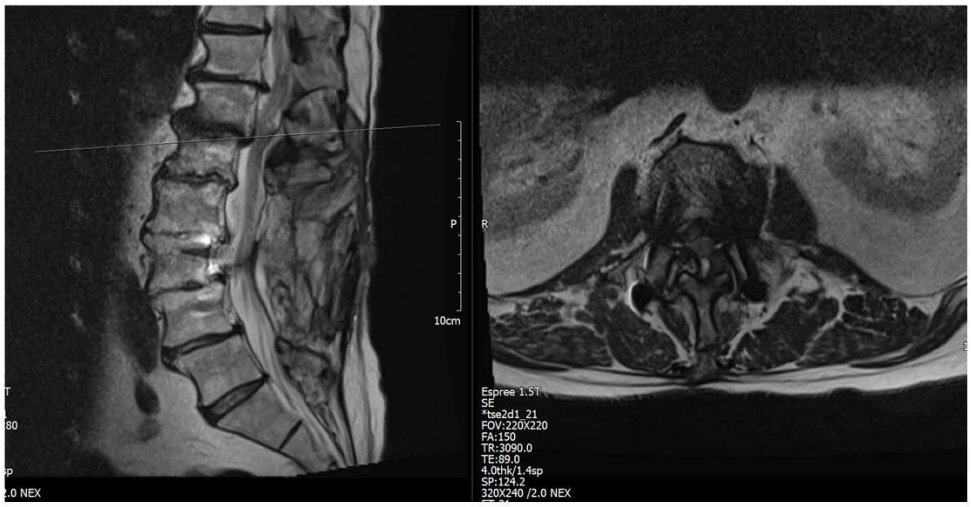
- 66 year old male, recently retired, has back, groin and leg pain and wants to play golf.
- L1-L5 fusion done 2 years ago down in MA.

- "is the hip why I've started having trouble with urination?"





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- 1 year later, had THA, playing a lot of golf, presents with worsening back pain.
- “I’m having that problem with urination again…”

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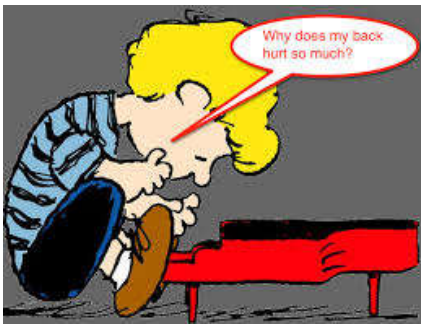

Questions

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