

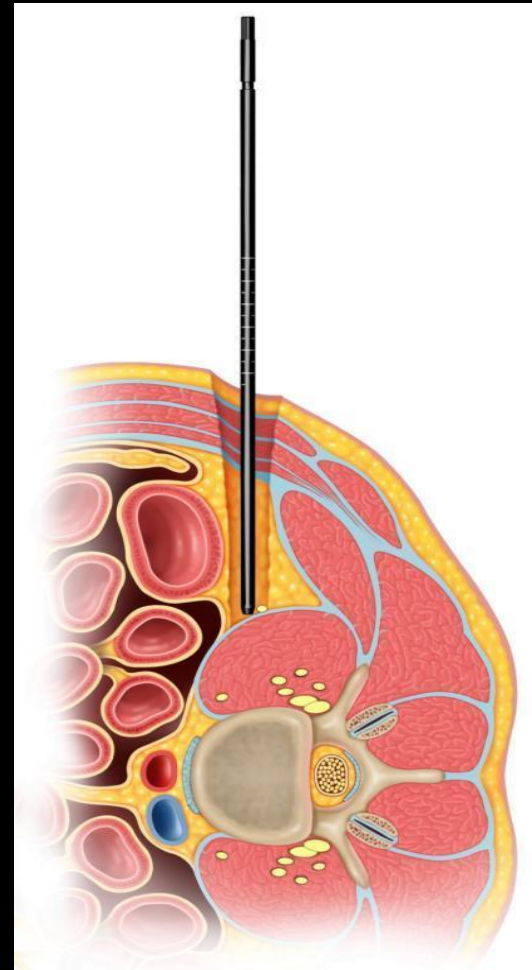
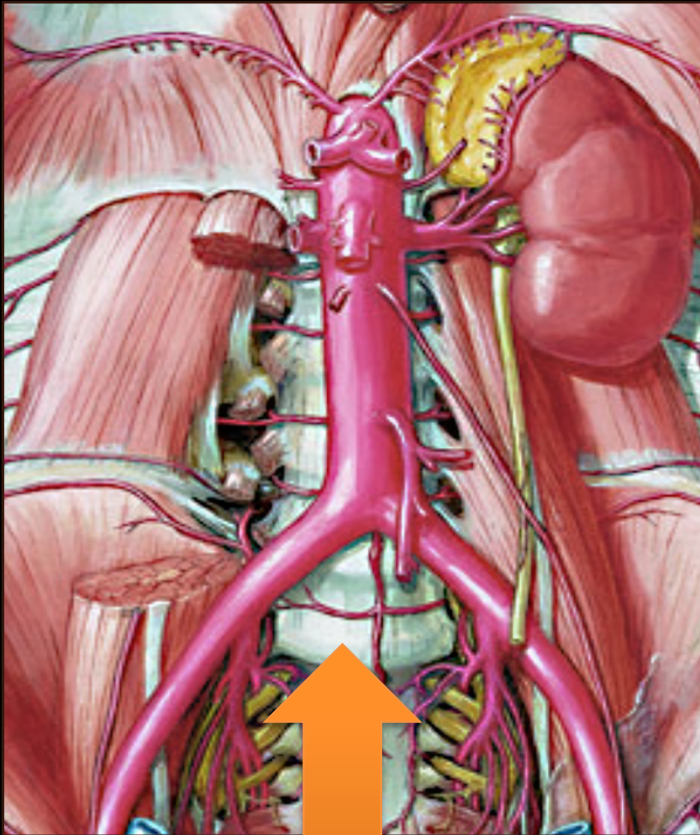
Anterior Approaches for Lumbar Interbody Fusion

Glen Manzano, MD



Anterior Techniques

- ALIF

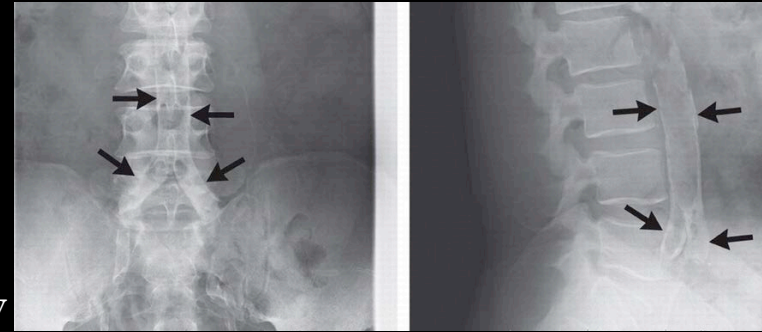


- Lateral transpsoas approaches (XLIF/DLIF)



Anterior Approaches - Contraindications

- ALIF
 - Contraindications
 - Calcified aorta
 - Prior vascular reconstructive surgery
 - Prior intra-abdominal or retroperitoneal surgery
 - History of severe pelvic inflammatory disease
 - Prior anterior spinal surgery
- Transpsoas
 - Contraindications
 - At L5/S1 and sometimes at L4/5 because of obstruction from iliac crest
 - Prior retroperitoneal surgery or scarring





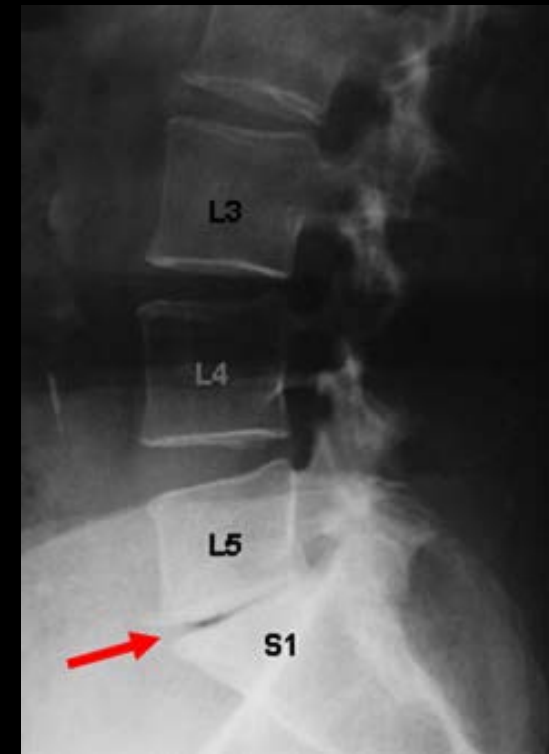
Clinical Presentation DDD

- 20 -50 year-old, recurrent or persistent back pain
- Pain
 - Dull ache in lower back
 - Often involves buttocks and sacroiliac joints
 - Exacerbated with flexion
 - Worsened with prolonged sitting or walking
 - Radiculopathy may be seen late in disease due to disc collapse
 - Claudication only seen with concomitant stenosis
- Exam
 - Decreased back range of motion, flexion
 - Paraspinal muscle and sacroiliac joint tenderness
 - Normal sensorimotor exam
 - Normal reflexes
 - Generally negative straight leg raise



Radiographic Findings DDD

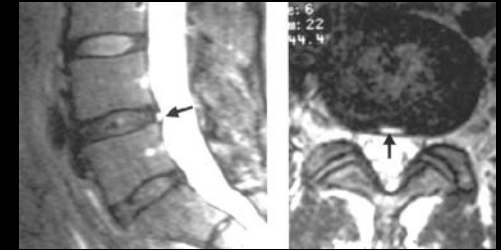
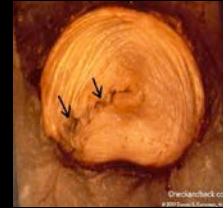
- Plain X-rays
 - Disc space narrowing
 - Endplate sclerosis
 - Osteophytes
 - Advanced - secondary spondylolisthesis



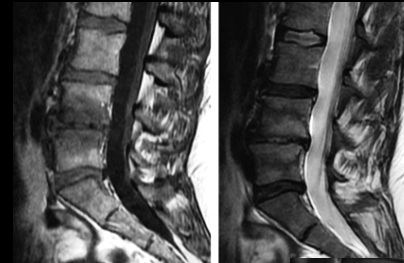


Radiographic Findings DDD

- MRI
 - “High intensity zone” (annular tear)
 - Radial tear from nucleus to outer posterior annulus



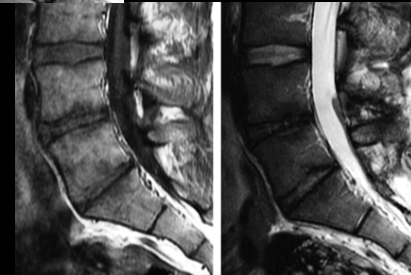
- Dark disc
- Endplate signal changes (Modic)
 - Stage I - edema
 - Dark on T1, bright on T2



- Stage II - fatty degeneration
 - Bright on T1, intermediate on T2



- Stage III - advance degenerative changes and endplate sclerosis
 - Dark on T1 and T2



Images from *Rahme R et al . The Modic Vertebral Endplate and Marrow Changes: Pathologic Significance and Relation to Low Back Pain and Segmental Instability of the Lumbar Spine. AJNR 2008 39; 838-842.*

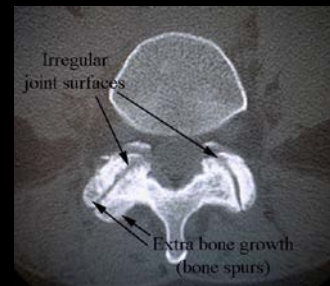
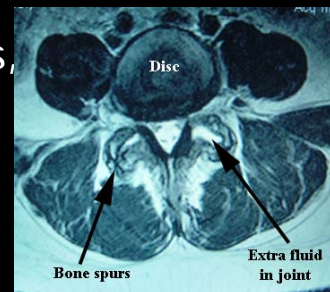


Guidelines Committee

- January 2003
 - Committee formed by the leadership of the American Association of Neurological Surgeons and Congress of Neurological Surgeons Joint Section on Disorders of Spine and Peripheral Nerves
 - 12 orthopedic and neurosurgical spine surgeons active in the Joint Section and/or North American Spine Society
 - Perform an evidence-based review of the literature on lumbar fusion for degenerative spine disease and formulate treatment recommendations

One or Two-Level Degenerative Disease without Stenosis or Spondylolisthesis

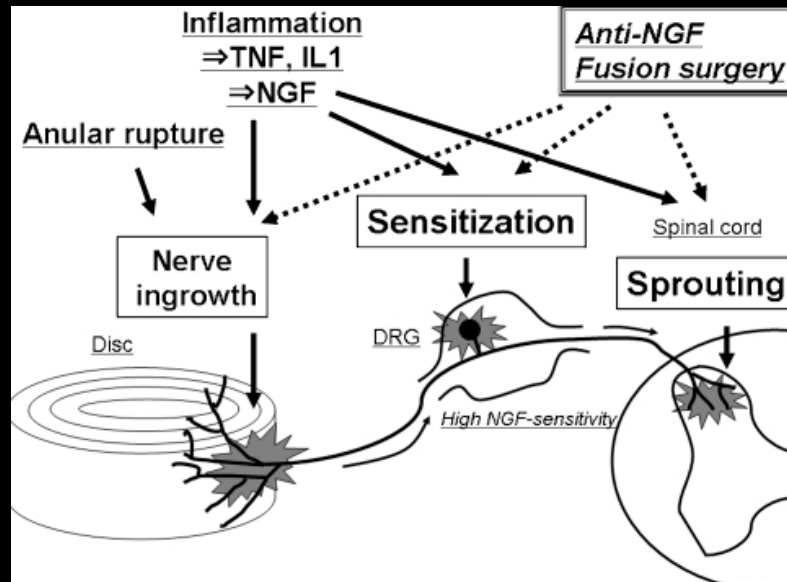
- Standard
 - Lumbar fusion recommended for patients with disabling low back pain due to one or two-level degenerative disease without stenosis or spondylolisthesis
 - 2001 Fritzell et al.
 - 294 surgical candidates randomized; 2-year follow-up
 - PT, education, pain relieving measures vs. PLF, PLF + pedicle screws, or interbody fusion + PLF + pedicle screws
 - Surgical group statistically significant better results in:
 - Outcome measures (pain VAS, ODI, Million VAS, GFS)
 - Return to work status
 - Patient satisfaction
 - Independent analysis by second spine surgeon
- Option
 - Intensive physical therapy and cognitive therapy





Fusion for DDD

- Posterolateral fusion
 - Patients with some level of residual discogenic pain due to micromotion



Eur Spine J. 2008 December; 17(Suppl 4): 428–431



Fusion for DDD

- Interbody techniques
 - Remove pain generator
 - Large surface area for fusion where majority of spinal load bearing occurs
 - 90% of the surface area
 - 80% of the load
 - Compressive force through graft
 - Correction coronal and sagittal alignment

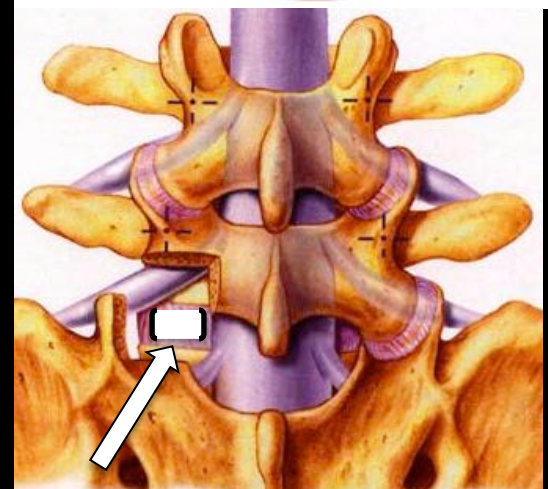
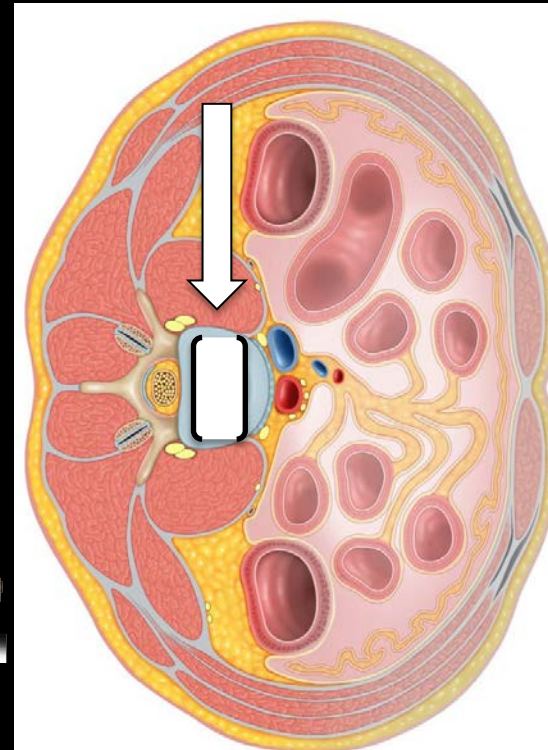
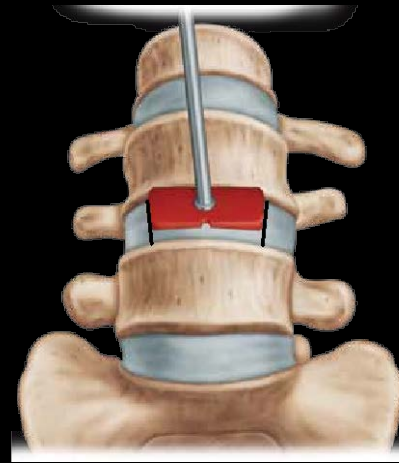


History – Minimally Invasive Spine Surgery



Technical Goals LIF

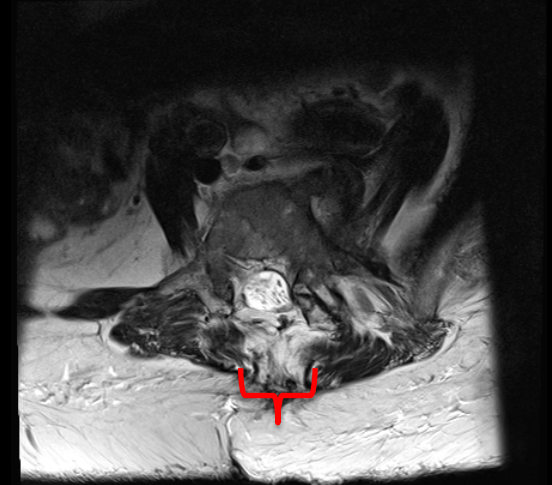
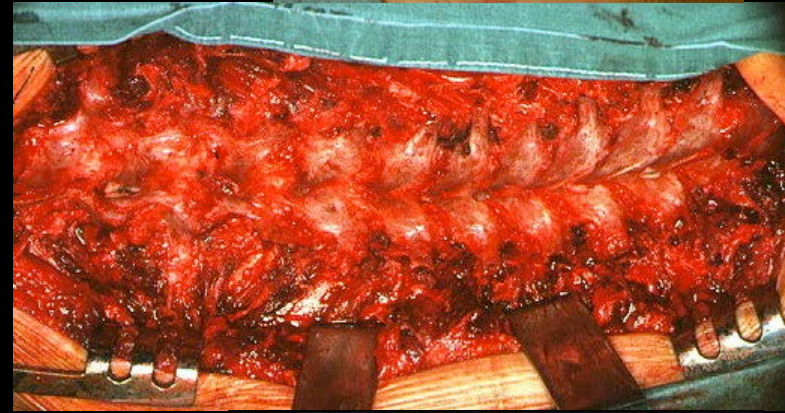
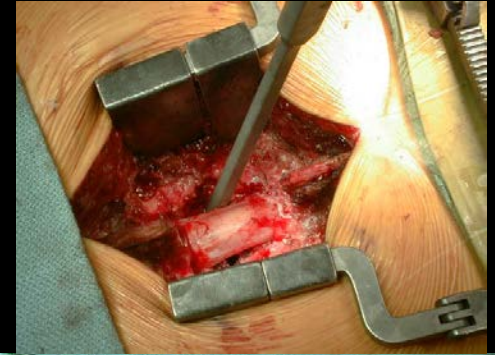
- Complete discectomy
- Place large graft
 - Restoration of disc height
 - Indirect decompression
 - Reestablish/maintain lordosis
 - Maximize surface area for fusion
 - Minimize risk of subsidence





PLIF/TLIF

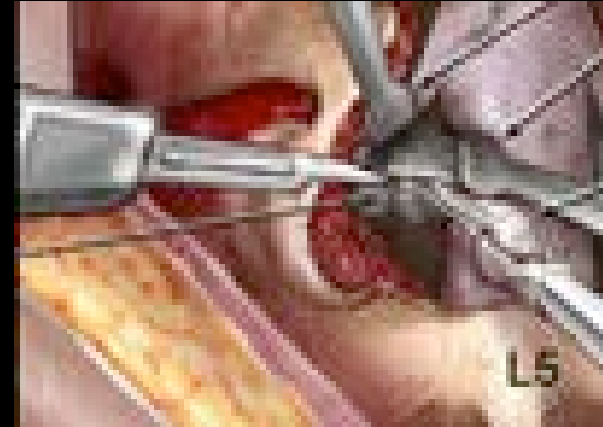
- Posterior interbody techniques (PLIF TLIF)
 - Problems
 - Muscle dissection, denervation
 - Acute postop pain
 - Blood loss
 - Longer length of stay
 - Narcotic requirements
 - Limited postop mobility
 - Perioperative complications
 - Chronic dysfunction
 - Muscle atrophy
 - Core deconditioning
 - Chronic pain





PLIF/TLIF

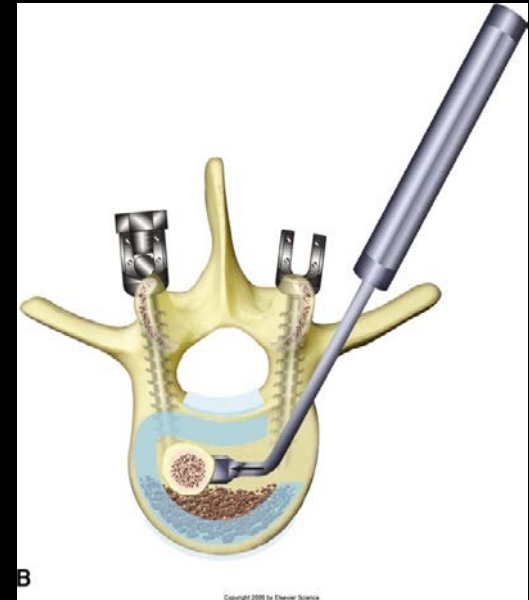
- Posterior interbody techniques (PLIF TLIF)
 - Problems
 - Limited window to disc space
 - Thecal sac/nerve root retraction
 - Weakness (2-7%)
 - Postop neuralgia (5%)
 - Dural tears (5-20%)





PLIF/TLIF

- Posterior interbody techniques (PLIF TLIF)
 - Problems
 - Graft size vs. nerve root injury vs endplate fracture
 - Suboptimal restoration of disc height and surface area for fusion
 - Poor visualization of disc space/endplates
 - Limited endplate preparation for fusion
 - Endplate damage/fractures graft subsidence
 - Time
 - Blood loss





Comparison Implant Dimensions

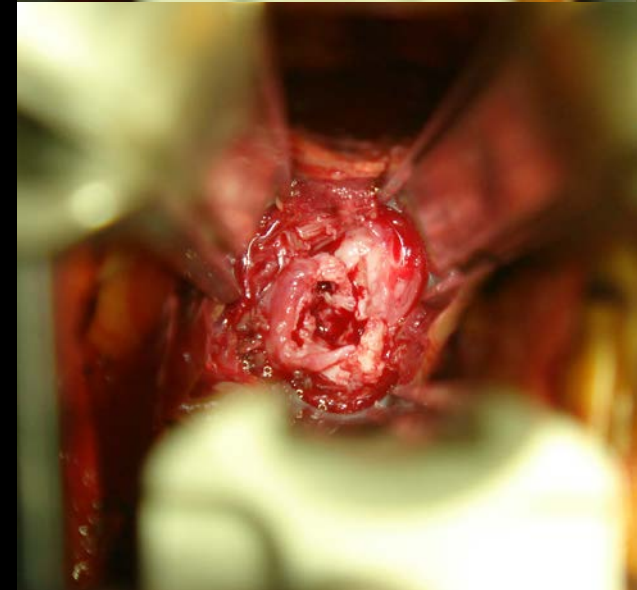
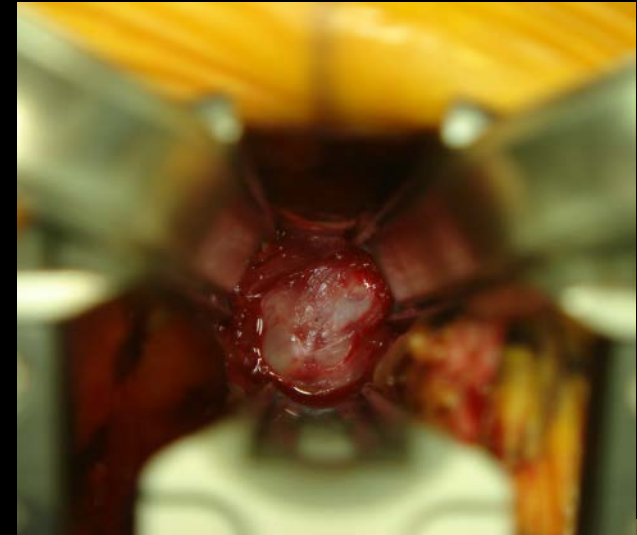
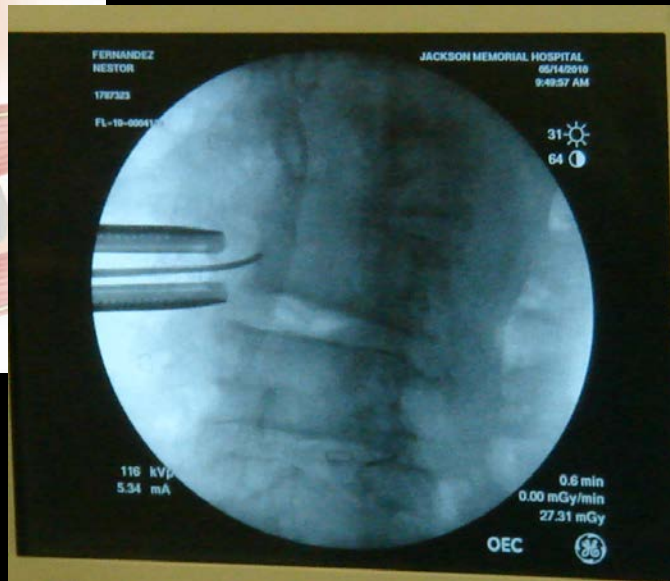
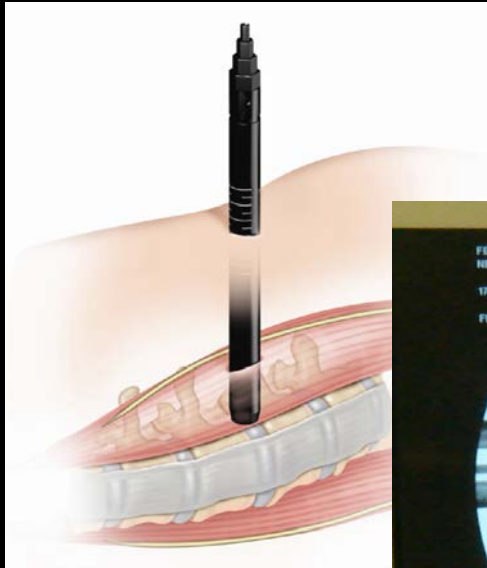
IMPLANT TYPE	HEIGHT (mm)	ANTERO-POSTERIOR (mm)	MEDIO-LATERAL (mm)	LORDOSIS (degrees)
XLIF	8 – 16	18 - 26	45 - 60	0 - 10
ALIF	10 - 20	23 - 30	32 - 42	8 - 12
PLIF, TLIF	6 - 12	22 - 32	8 - 10	0 - 8





Advantages Anterior Approaches

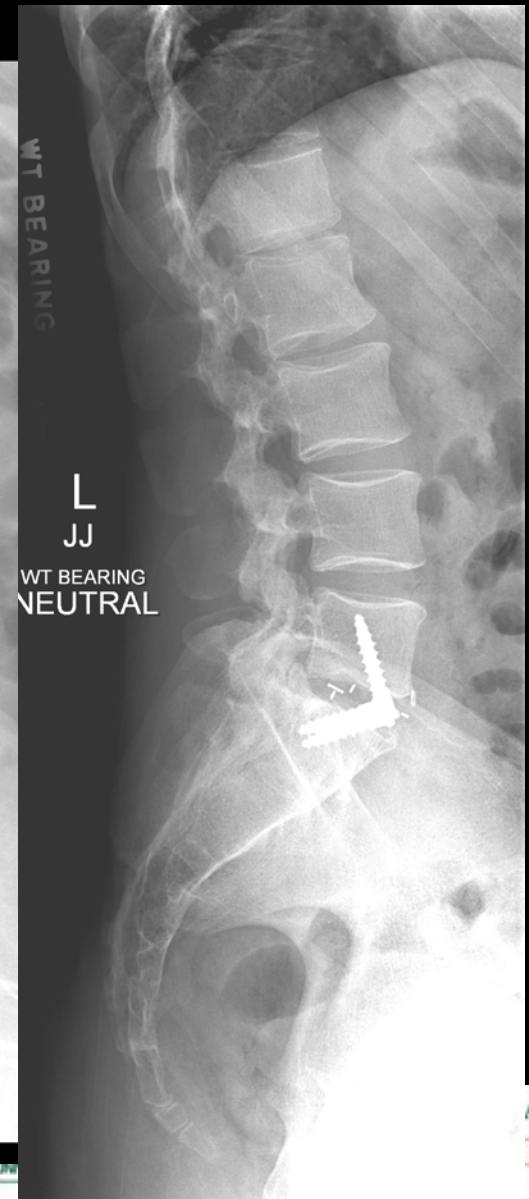
- More complete discectomy
- Better endplate preparation





Advantages Anterior Approaches

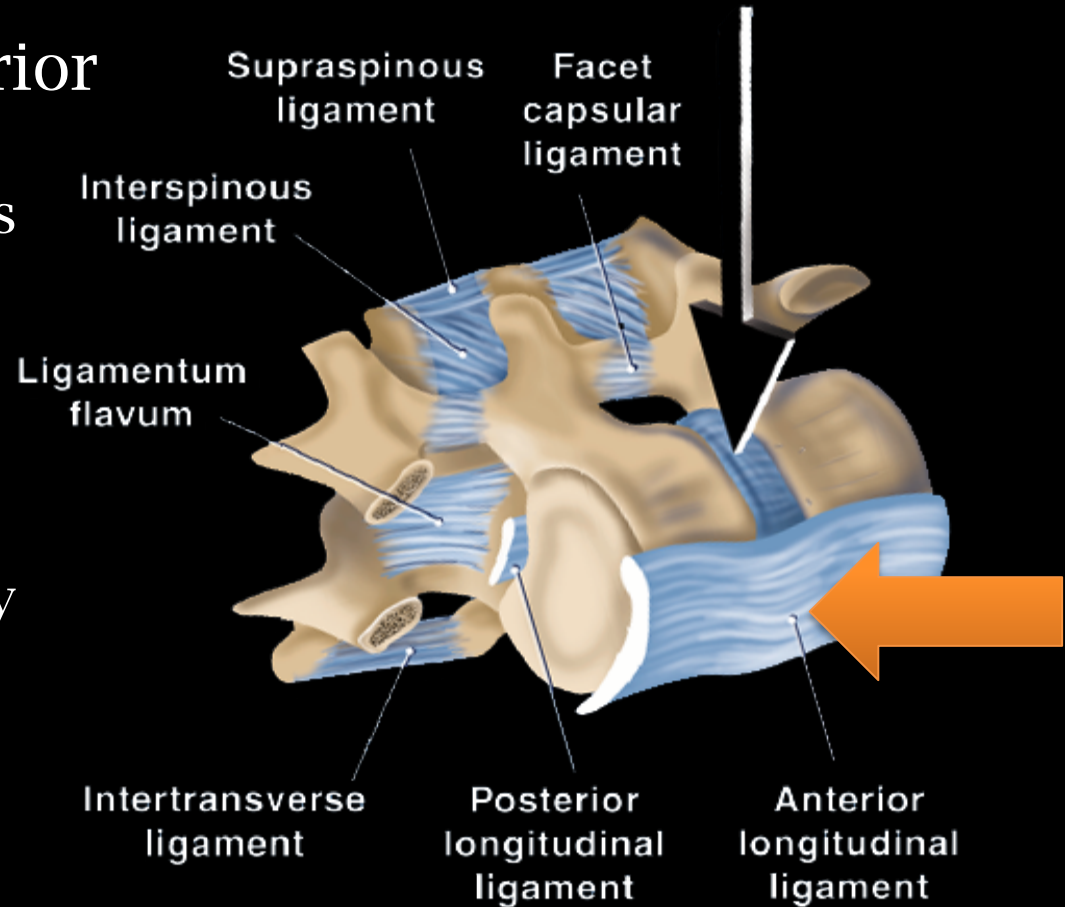
- Larger graft placement without manipulation of nerve roots
 - Deformity correction
 - Indirect decompression
 - Greater fusion surface area





Advantages Anterior Approaches

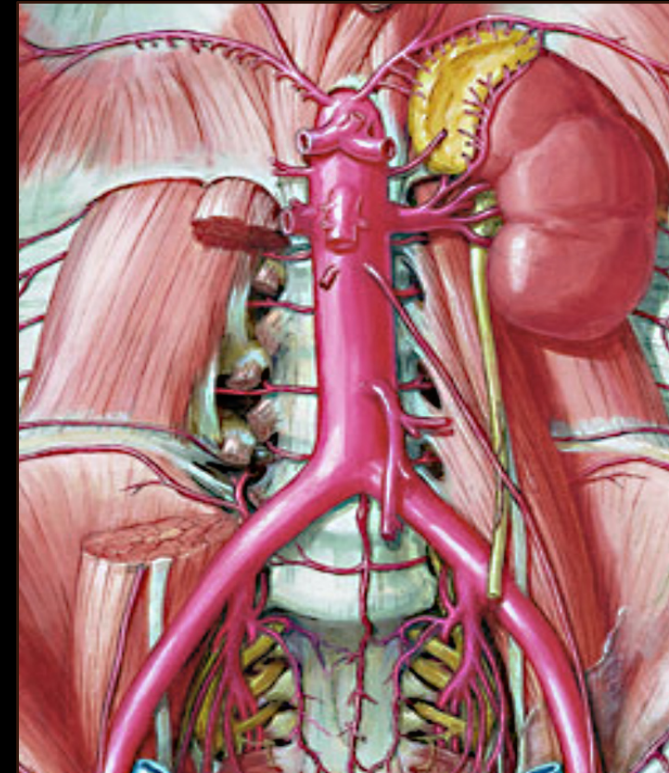
- Preservation of posterior stabilizing structures
 - Interspinous ligaments
 - Facet capsules
- No muscle disruption
 - Postop muscle atrophy
 - Chronic pain





ALIF - Complications

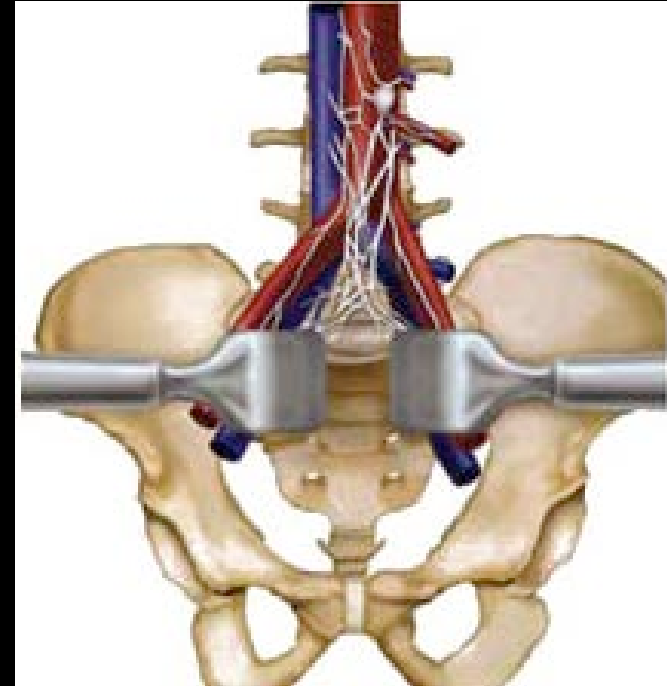
- Rates variable – highly surgeon dependent
- **Vascular complications of exposure for anterior lumbar interbody fusion.**
J Vasc Surg. 2010 Apr;51(4):946-50;
- 212 ALIF exposures
- 2% rate of “serious” vascular complication
 - 1 arterial injury required thrombectomy and stent
 - 4 venous injuries required multi-suture repair
 - No mortalities





ALIF - Complications

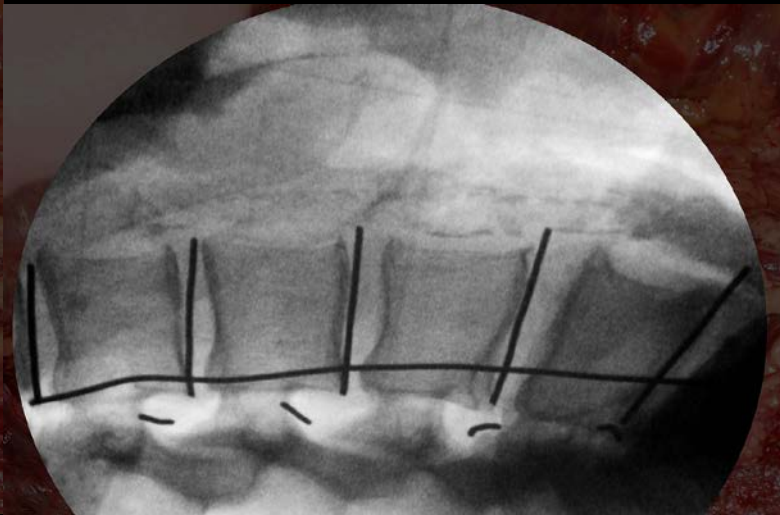
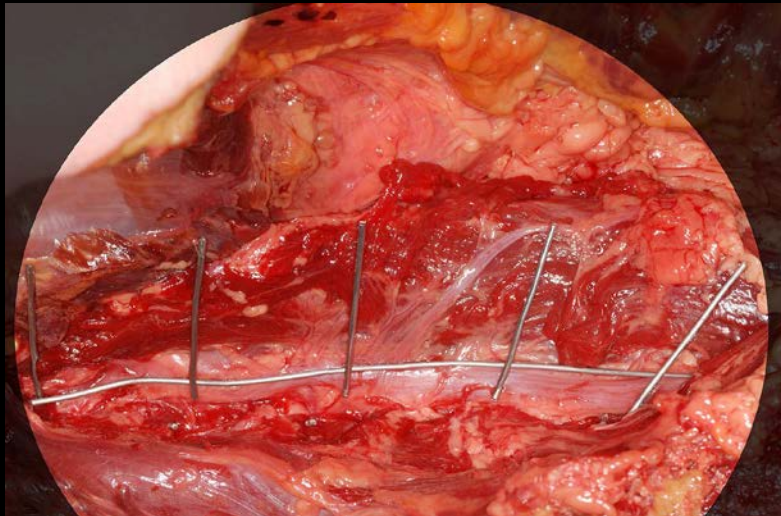
- Retrograde ejaculation
 - Most series < 1% to 7%
 - Much higher with transperitoneal approaches and with laparoscopic approaches
 - Blunt dissection versus electrocautery
 - Large majority of patients recover within 6 - 12 months
- Bowel
- Ureter





Extreme Lateral - Complications

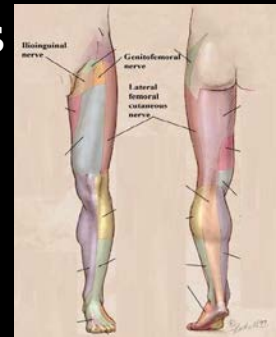
- Damage to lumbosacral plexus which progressively migrates anteriorly beginning at L1/2 level
- Psoas muscle injury and pain
- Traction injury to plexus postop dysesthesias





Extreme Lateral - Complications

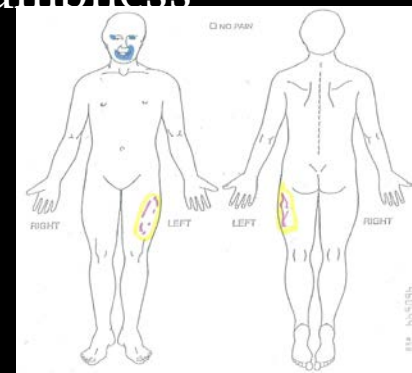
- New procedure introduced 2001
 - Reporting of complications has been inconsistent (3% - 60%)
 - Genitofemoral, ilioinguinal or lateral femoral cutaneous nerve injuries
 - Thigh numbness, paresthesias
 - Femoral nerve
 - Leg weakness



- **An analysis of postoperative thigh symptoms after minimally invasive transposas lumbar interbody fusion.**

Neurosurg Spine 15:11-18, 2011 Department of Neurological Surgery, University of Miami Miller School of Medicine, Miami, Florida

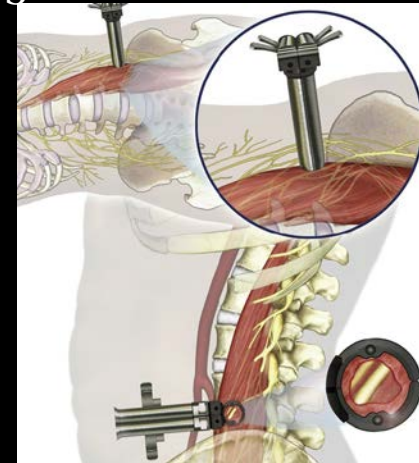
- 62% patients had thigh symptoms postop - mostly numbness and dysesthesias
- 23% had weakness
- 50% had complete resolution at 3 months
- 90% complete resolution at 1 year.





Extreme Lateral - Complications

- Learning curve
 - **Supra-psoas Shallow Docking in Lateral Interbody Fusion**
Neurosurgery 73[ONS Suppl 1]:ons48-ons52, 2013
 - Avoid blind dilation through psoas muscle fibers



- **Complications in 775 XLIF cases.** WB Rodgers. Spine Vol 10 (9). Supplement S95
 - 7.4% overall complication rate
 - 4 neural complications



- **Outcomes After ALIF vs TLIF For Treatment of Symptomatic L5-S1 Spondylolisthesis: A Prospective, Multi-Institutional Comparative Effectiveness Study**

Neurosurgery. 60(0):171, August 2013

Higher complication rates for TLIF (12.3 vs 7.8%)

ALIF more rapid reduction in 1-year back and leg pain VAS scores

- **Comparison of anterior- and posterior-approach instrumented lumbar interbody fusion for spondylolisthesis** J Neurosurg Spine. 2007 Jul;7(1):21-6

Adjacent level disease in 44% of ALIF and 83% of PLIF



Conclusions

- Both anterior and posterior approaches for interbody fusion are associated with good fusion rates and outcomes in patients with symptomatic lumbar degenerative disease.
- Anterior approaches allow better access to and visualization of the disc and endplates which facilitate:
 - More complete discectomy
 - Larger surface area for fusion
 - Better endplate preparation
 - Larger graft placement for disc height restoration and lordosis
- With a good access surgical team, the complications associated with ALIF are minimal
- Extreme lateral interbody fusion is a relatively new procedure. As surgeons become more proficient in the operation and as surgical technique is refined, sensory dysesthesias and psoas trauma associated with the procedure are becoming less prevalent.