

How to reduce Spinal complications

Why Minimally Invasive Anterolateral fusion is the Best approach!!

Tony Y Tannoury, MD

Department of Orthopedics

Chief of Spine

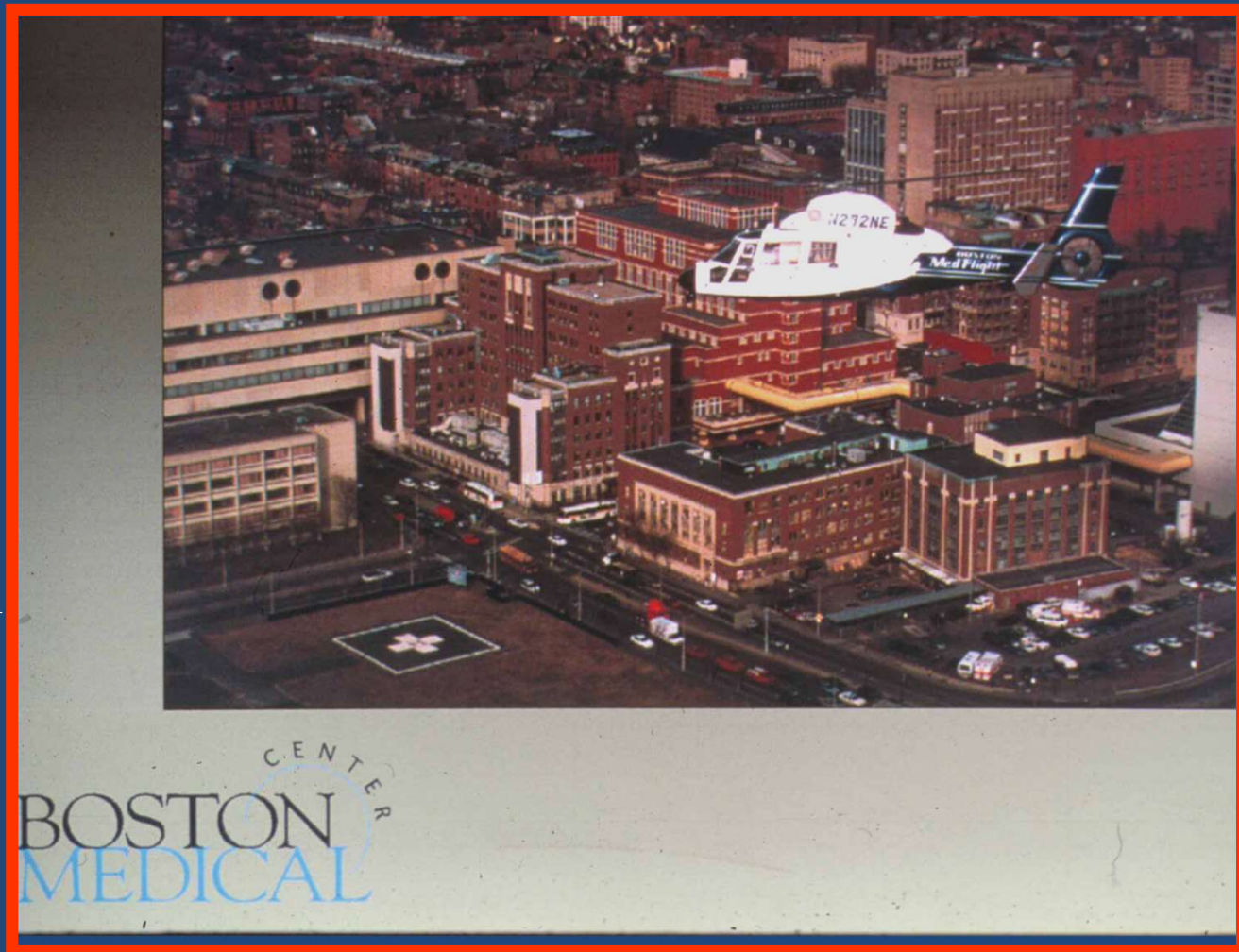
Boston University

tannoury@bu.edu

Founding President of

International Musculoskeletal

www.IMSsociety.org



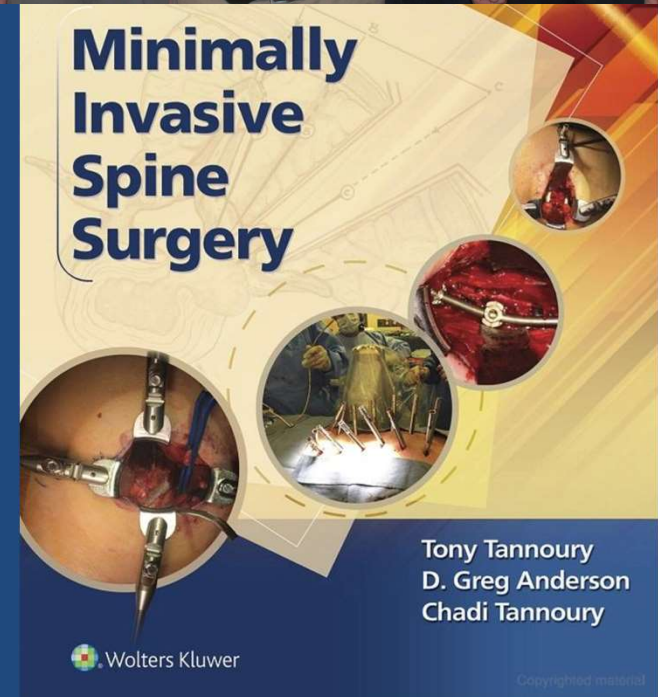
Disclosure

Depuy Johnson & Johnson:

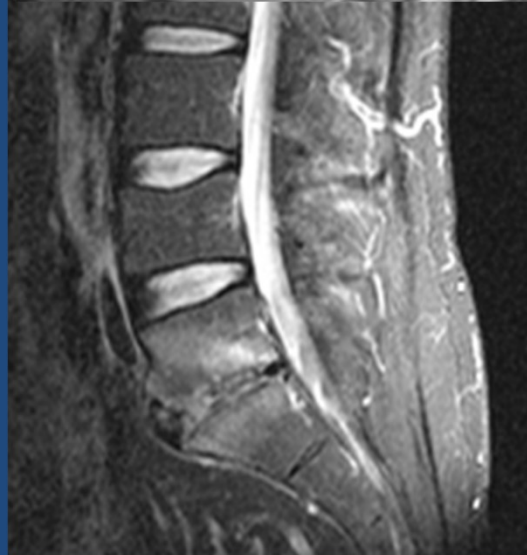
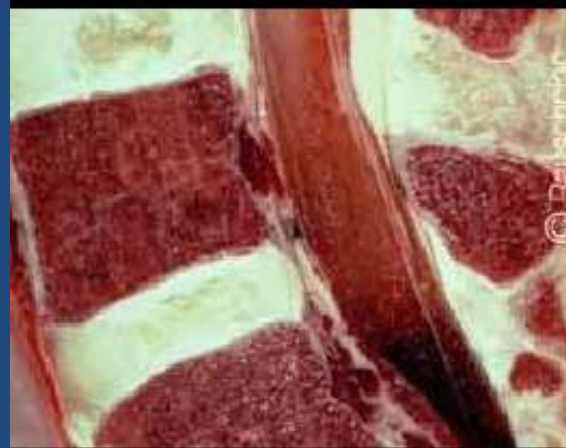
- Consultant
- Speaker Bureau
- Royalty

Lippincott Publishing

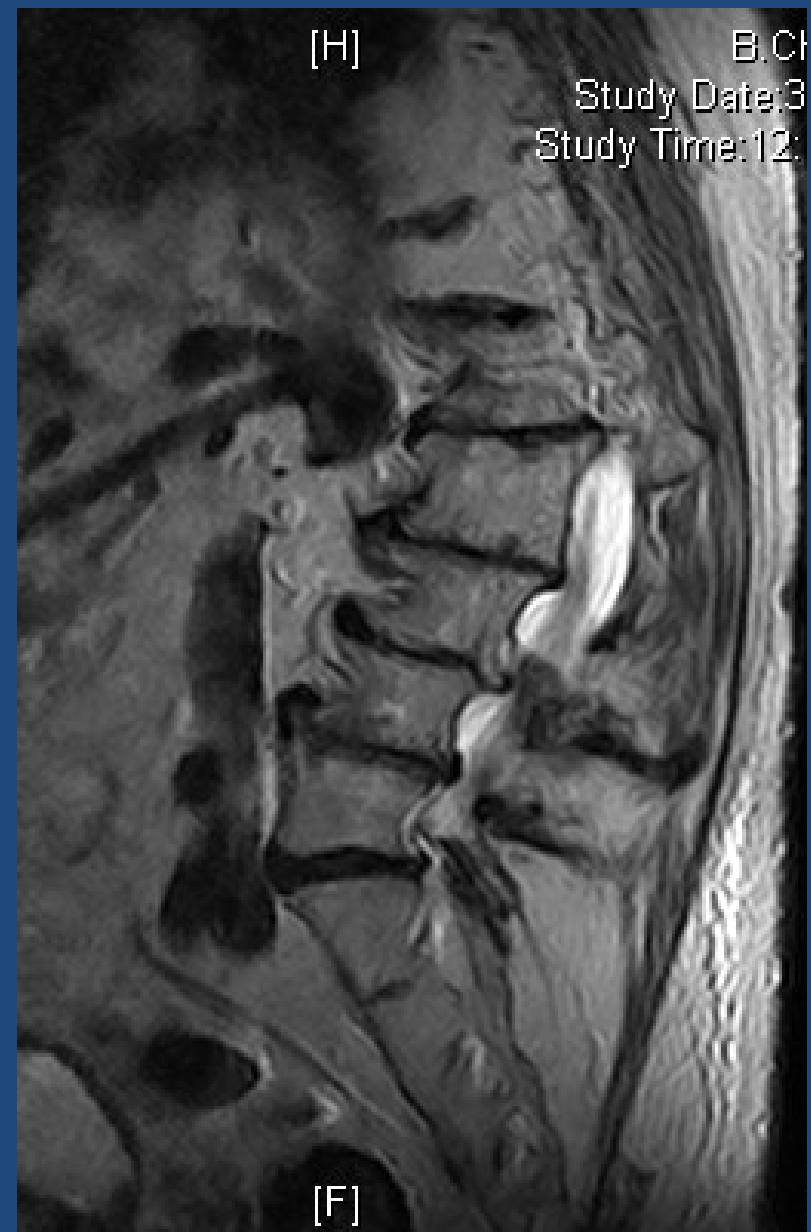
- Royalty



Degenerative Disc Disease



MRI

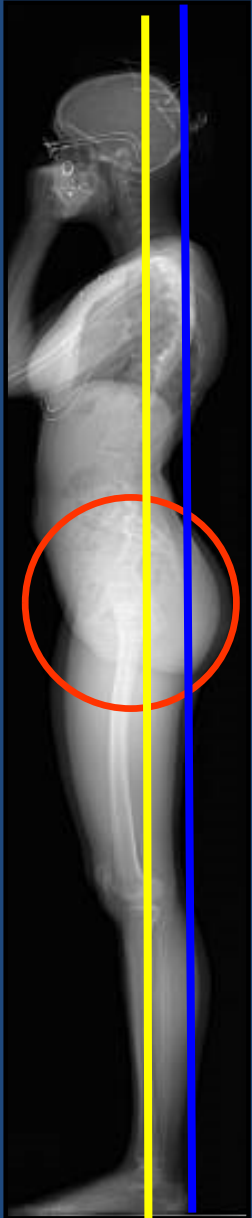


Spinal Bony Anatomy

- Five Sagittal Curves
 - Kyphosis – Occiput to C2
 - Lordosis – C2 to T2
 - Kyphosis – T2 to T11
 - Lordosis – L1 to L5
 - Kyphosis – S1 to Coccyx

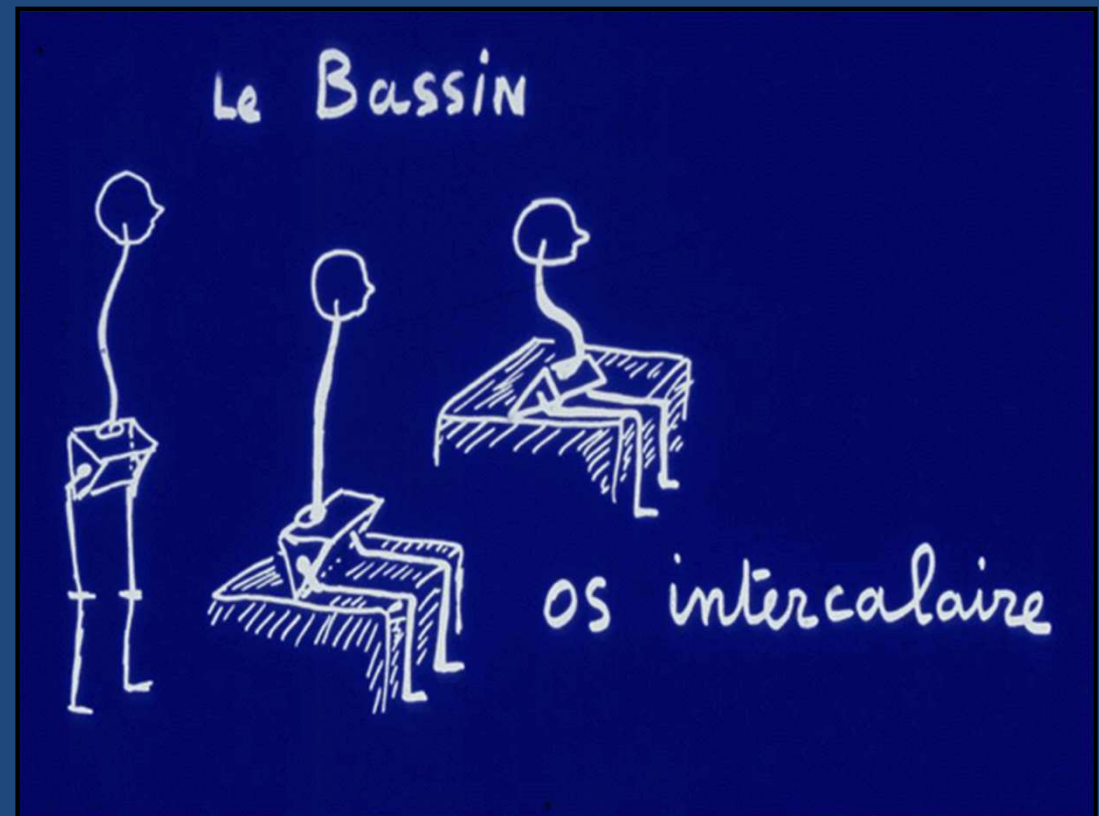


Alignment... More Than Just the Spine

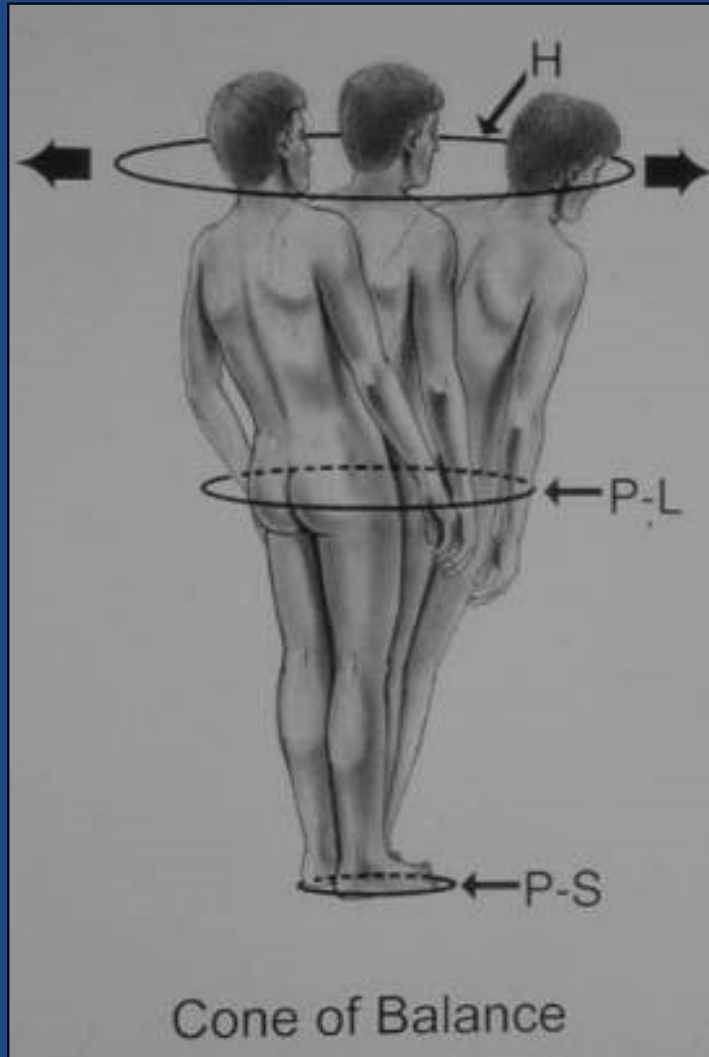


**Regulator of
Alignment
Link between
Above and
Below**

The 'Pelvic Vertebra'
J Dubousset



Why is Alignment Important ?

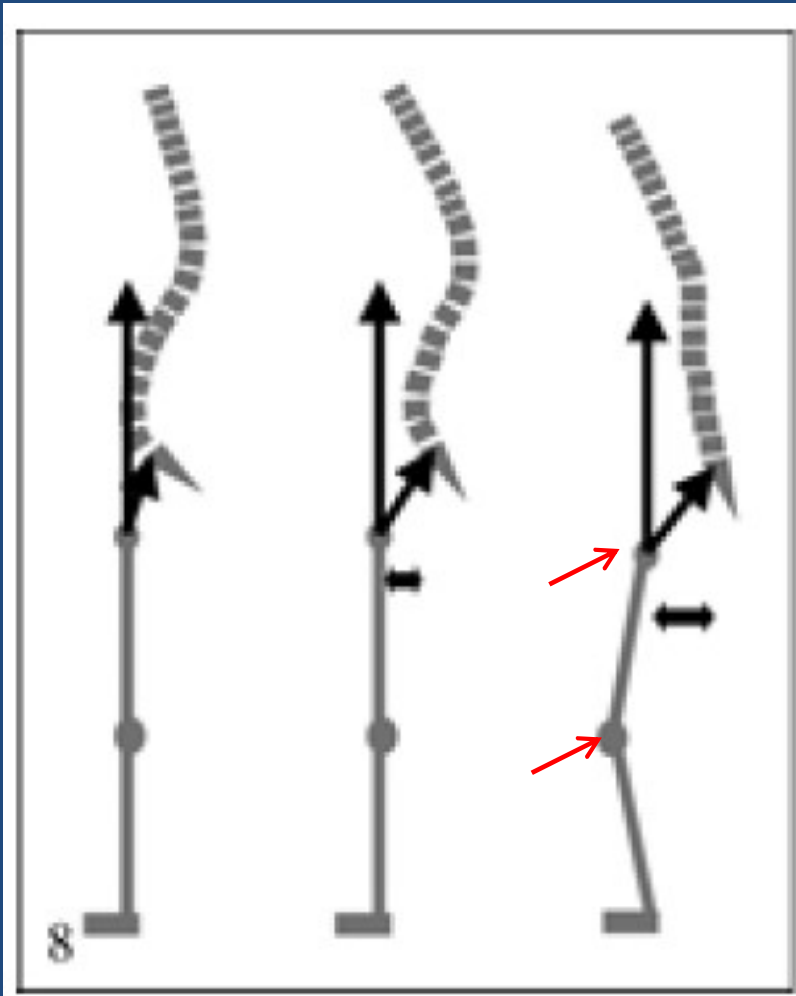


Jean Dubousset

Poor alignment = disability

- Must compensate for anatomic deformation
- Mechanical disadvantage challenges balance mechanisms

Deviation from stable zone = Increase Muscular activity / energy use

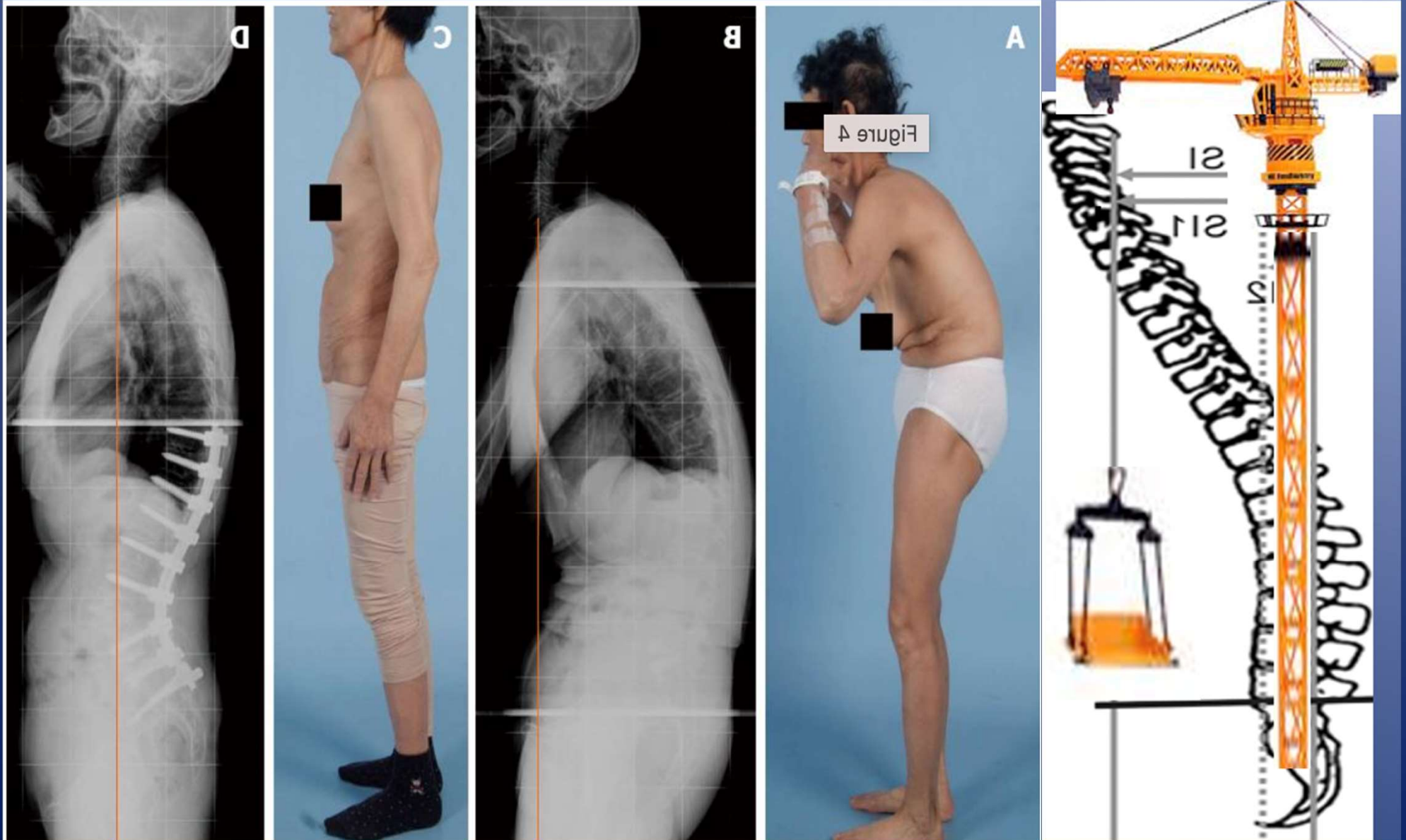


Compensation

↓ SS (Lumbar Kyphosis) → ↑ PT



Mechanics---Mechanics--Mechanics



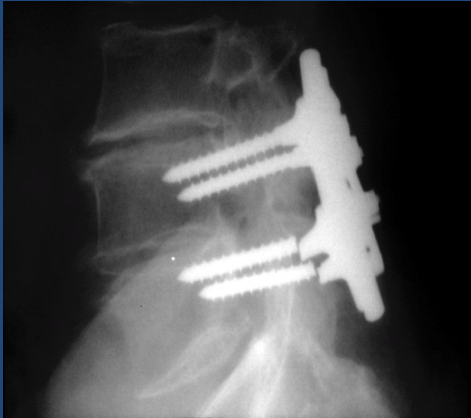
First Dictum

Primum Non Nocere

Patterns of Complications

- **Obvious Complications:**
 - Major bleeding
 - Infections
 - Neurological complications
 - Implants misplacement
- **Less obvious complications:**
 - Destabilizing the spine:
 - Muscles
 - Facet joints
 - Inadequate decompression
 - Inadequate Fusion
 - Inadequate spinal balancing
 - Inadequate surgery levels

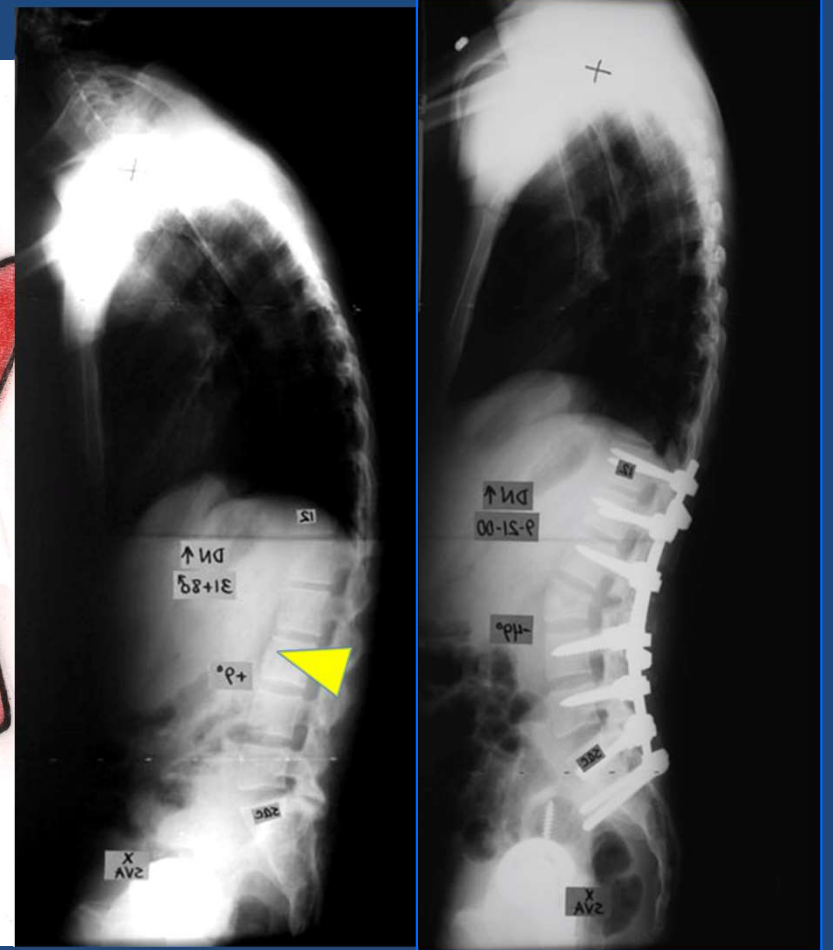
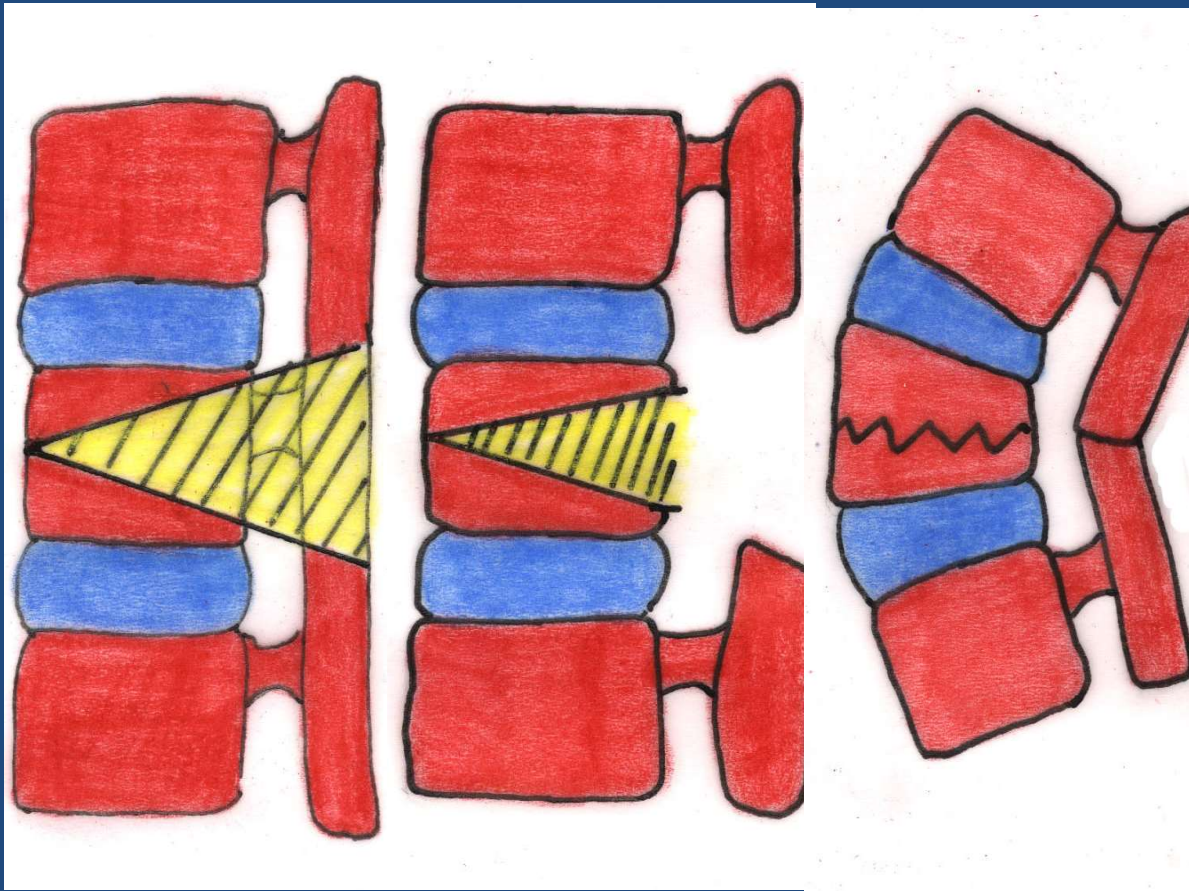
Complications



How to improve results and reduce risks!

- Understand biomechanics
 - Achieve balanced spine
 - Better clinical results
- Treat the entire disease
 - Reduces pain sources
 - Less adjacent segment disease
- Reduce collateral damage from the Rx
 - Less invasive techniques

Spinal Alignment via Posterior Shortening osteotomy



Preop

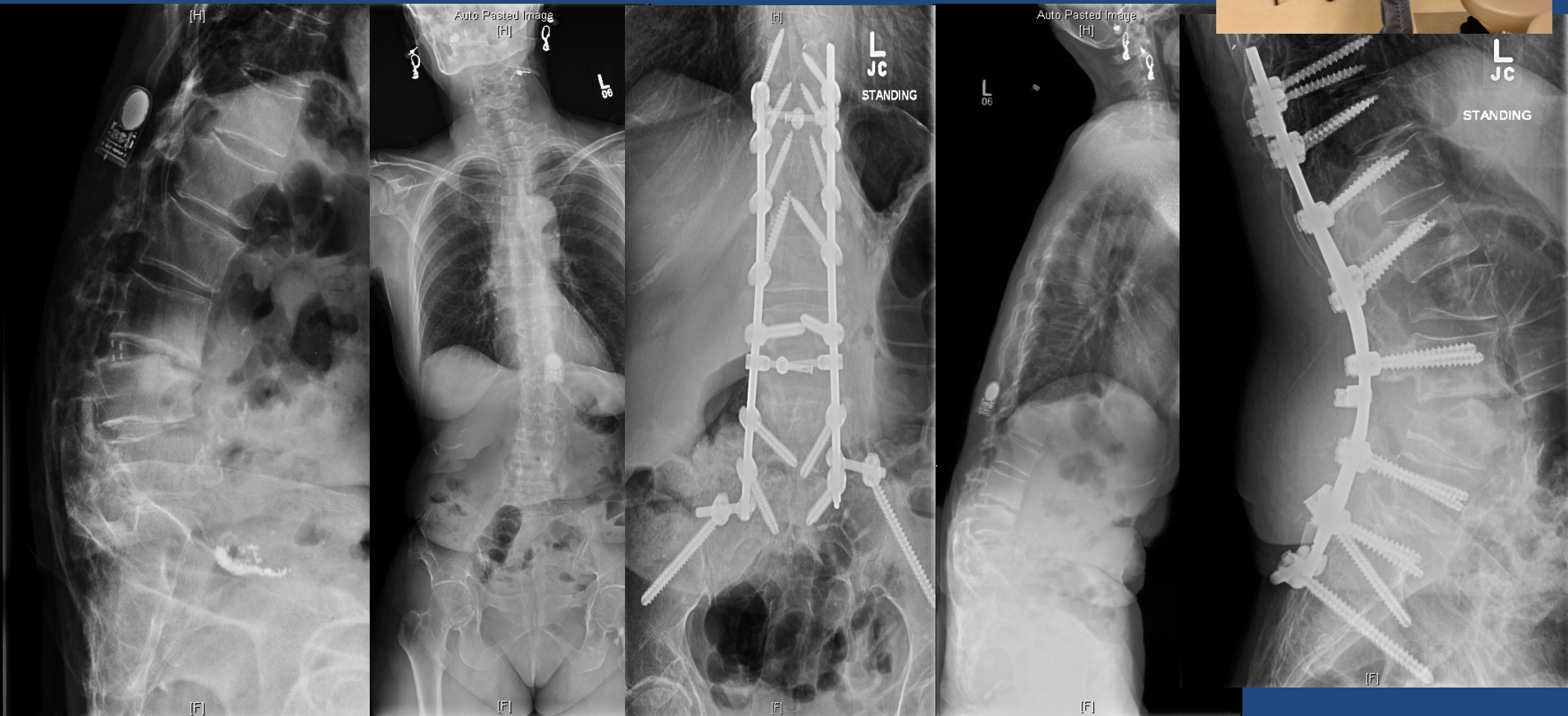


Postop

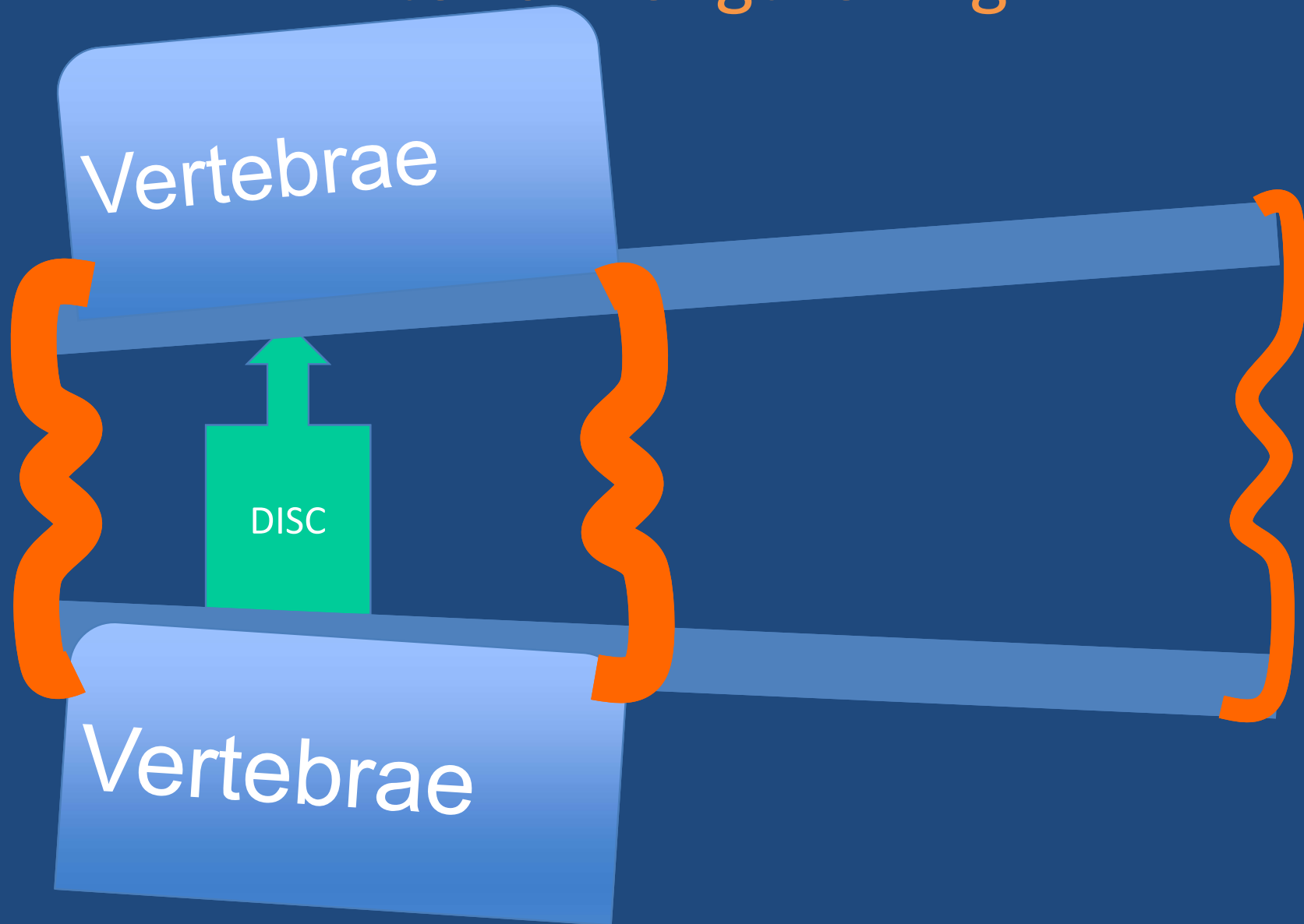


43 yo lady

17 Previous Spinal Surgeries

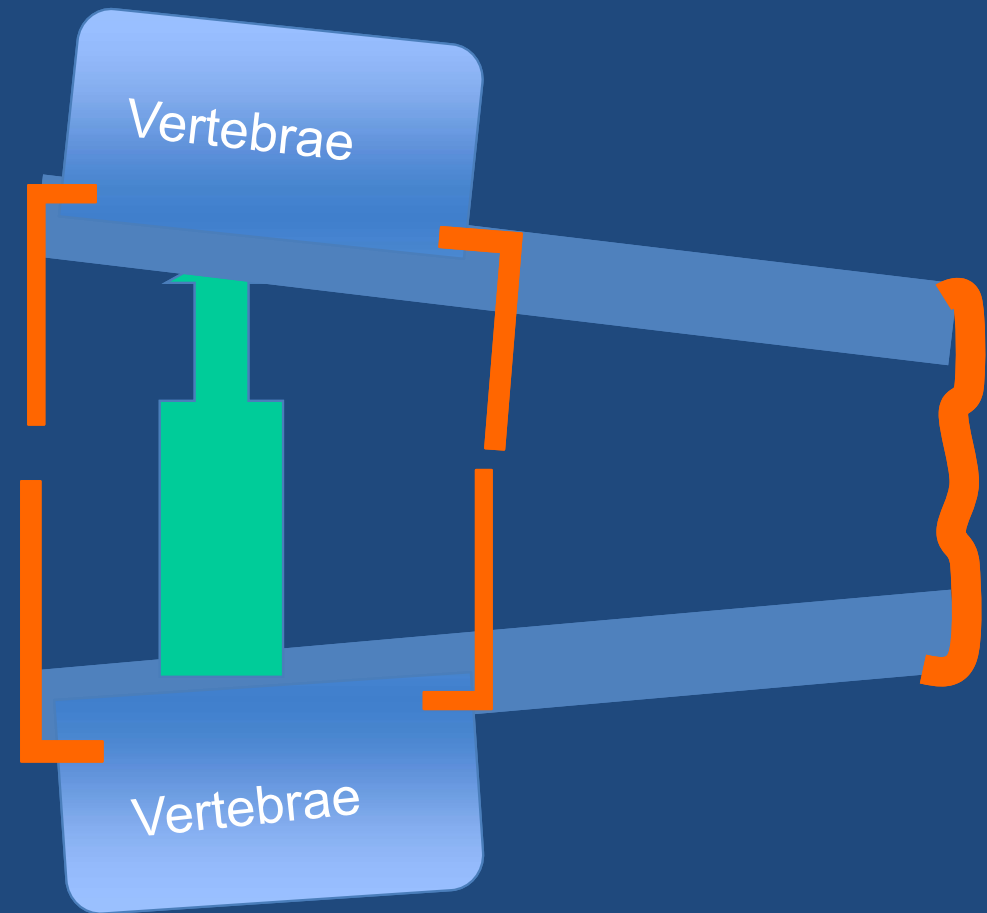


Balancing the spine via Anterior Lengthening

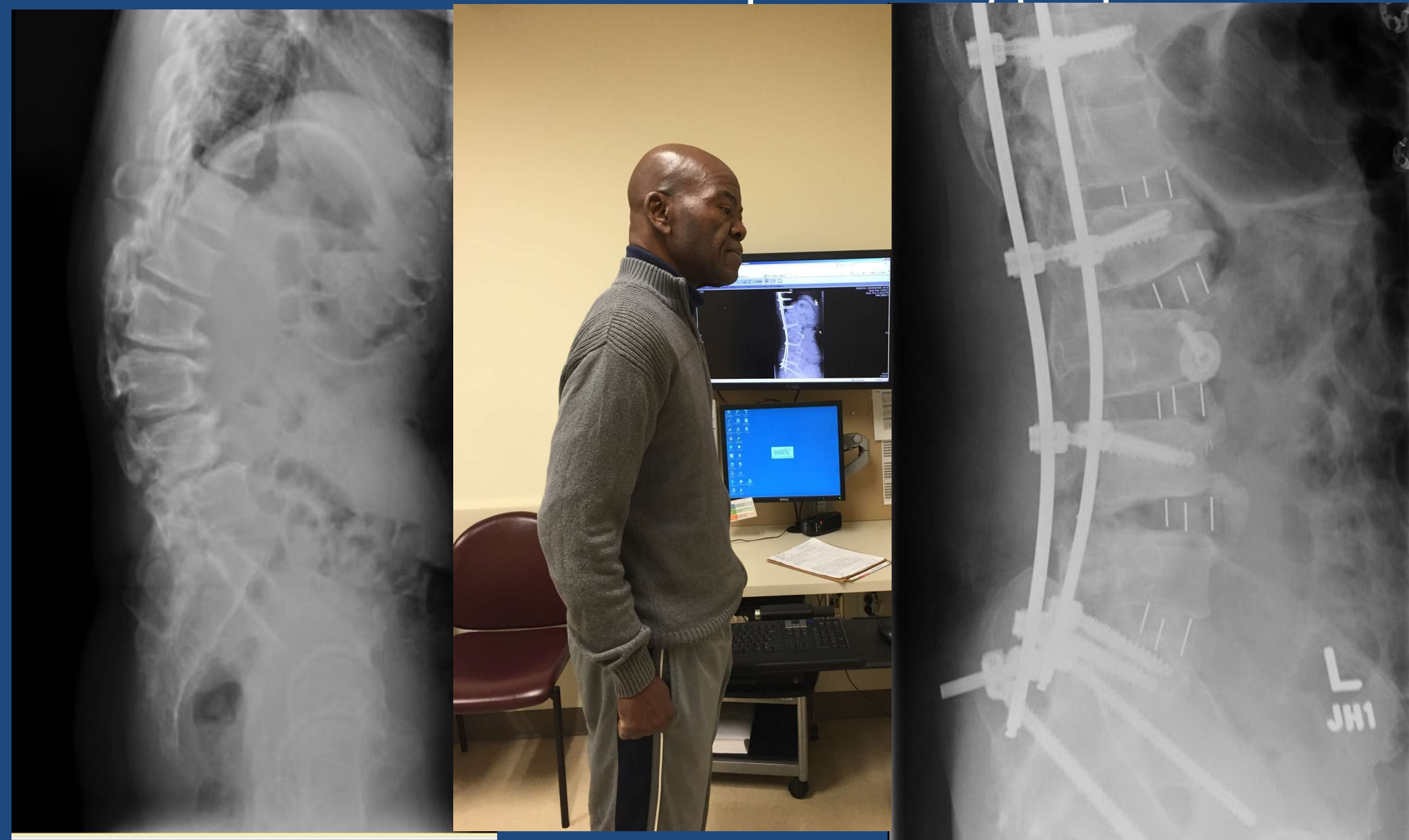


ATP: further distraction

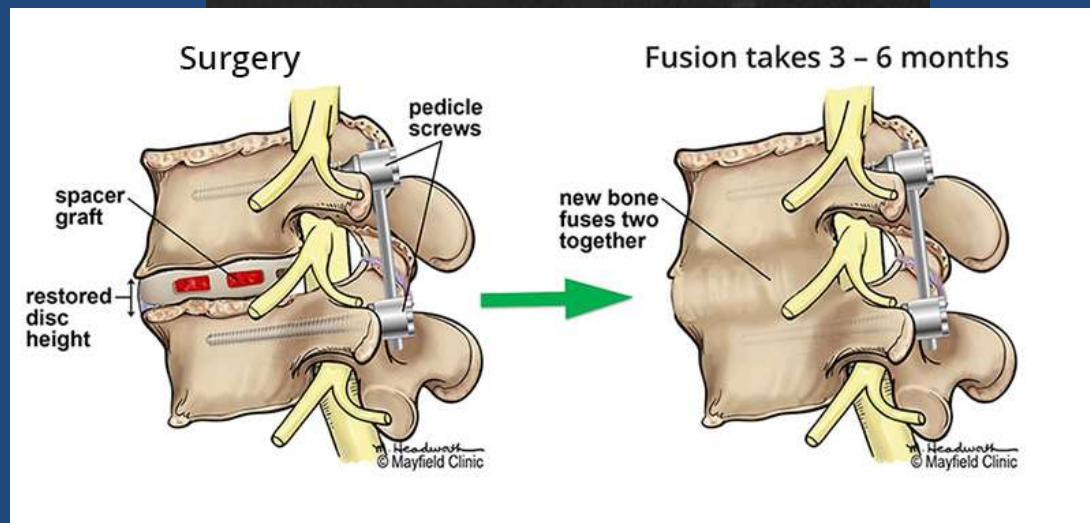
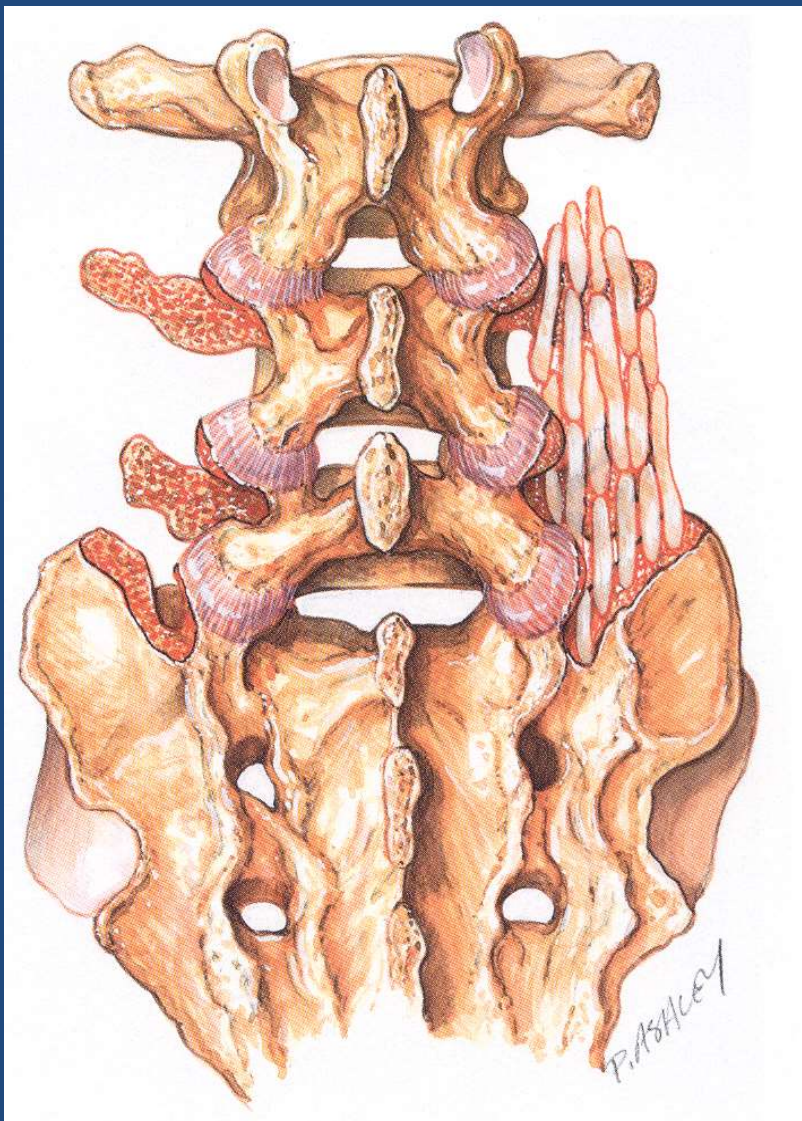
- Ripping of the ALL, anterior annulus, pll.
- Hinges on the posterior facets
- Satisfactory Lordosis
- Effective Indirect Decompression



Anterior Lengthening: Pre and Post op radiograph



Fusion Options



Approaches

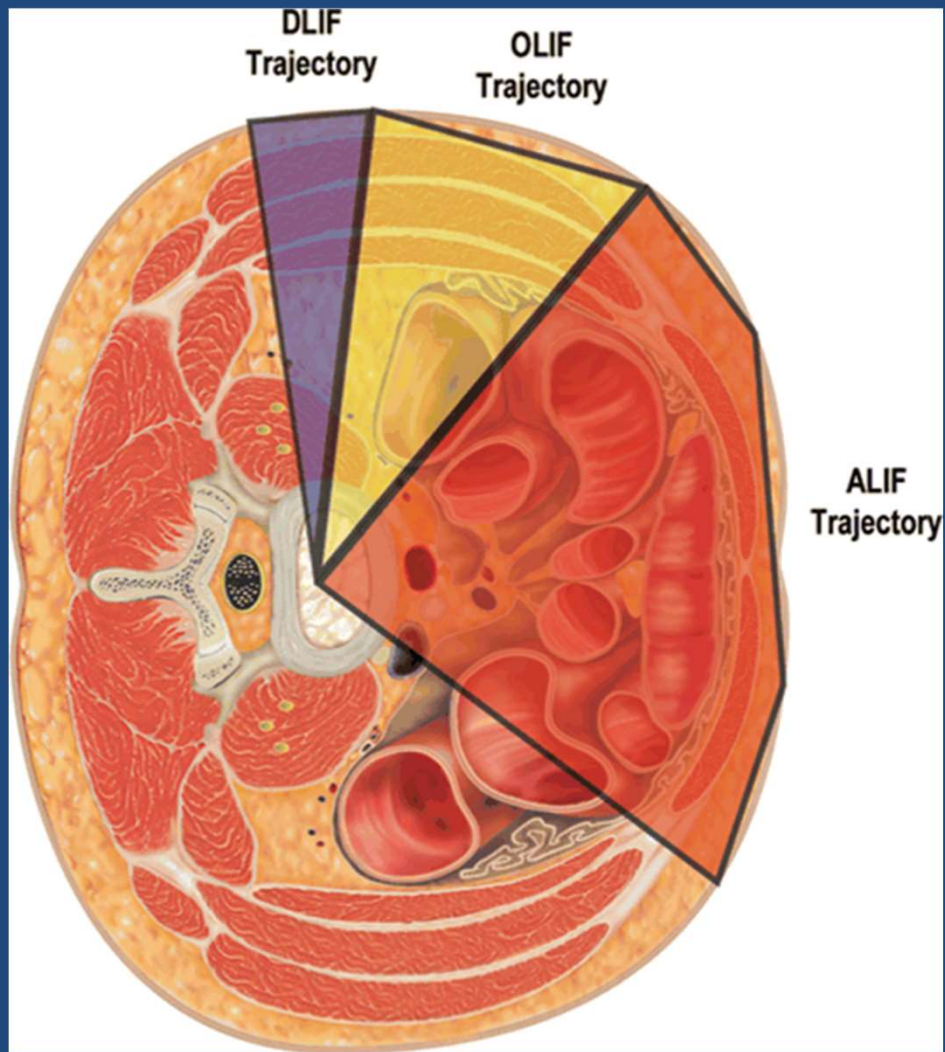
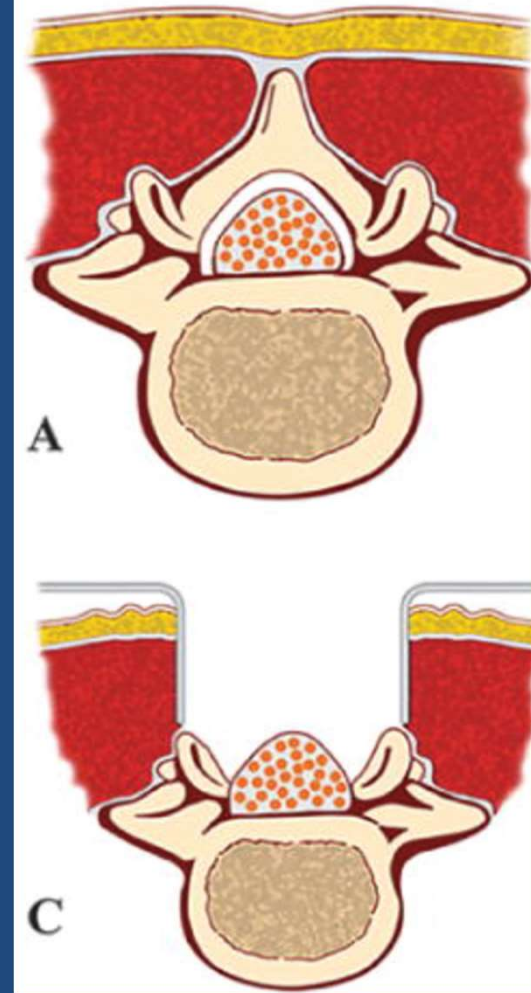


FIG. 3.



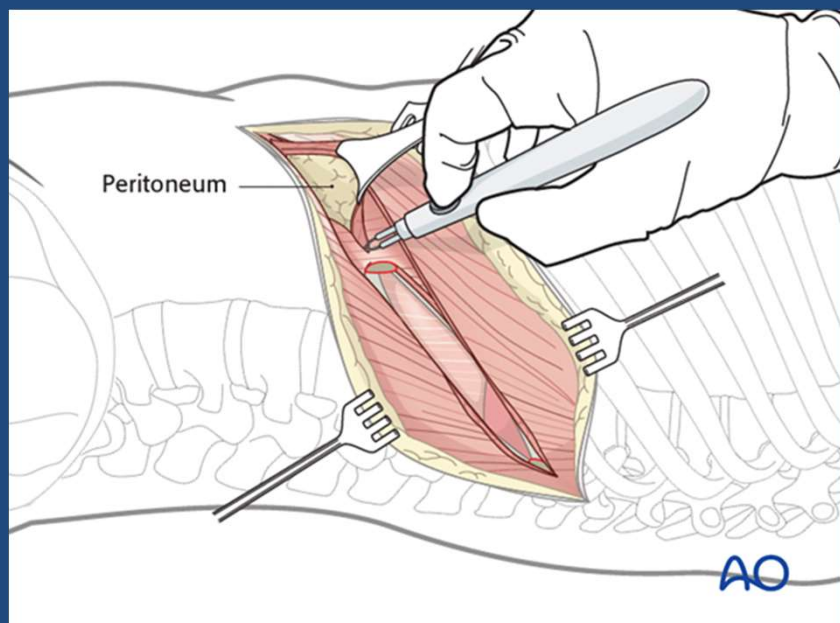
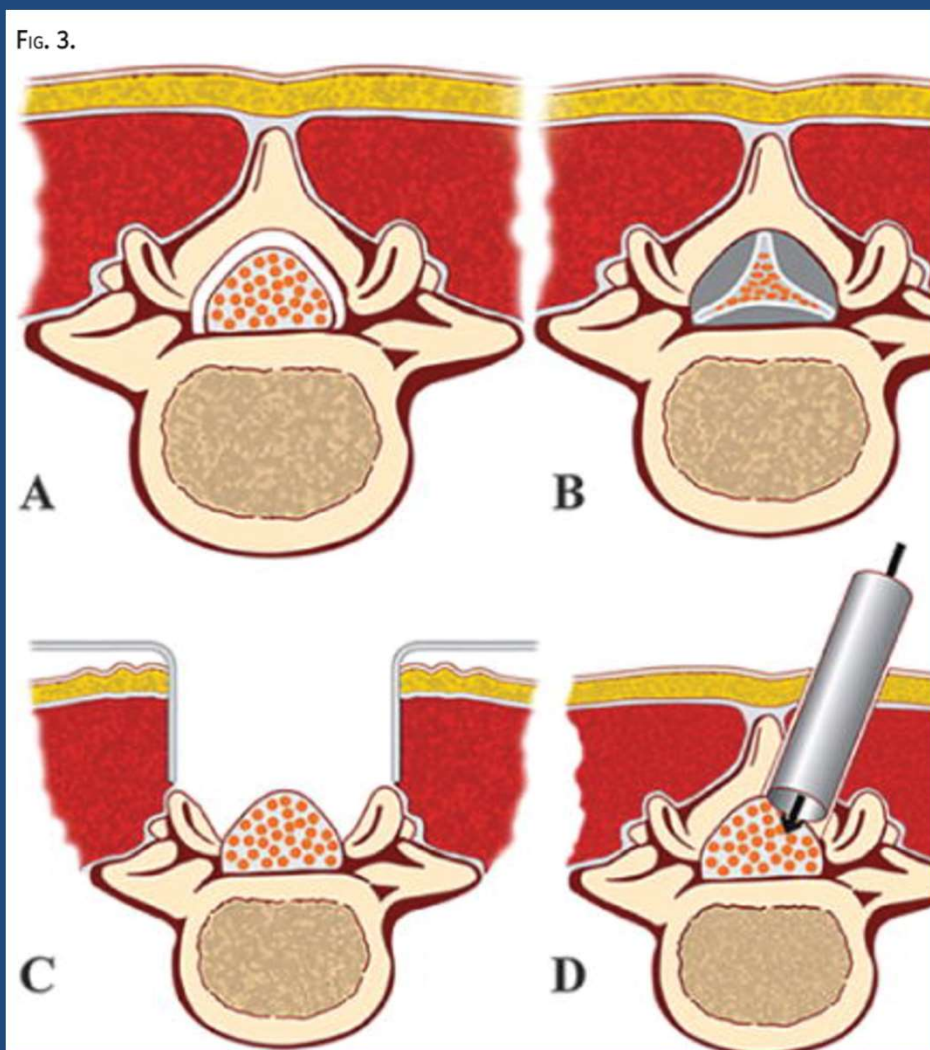
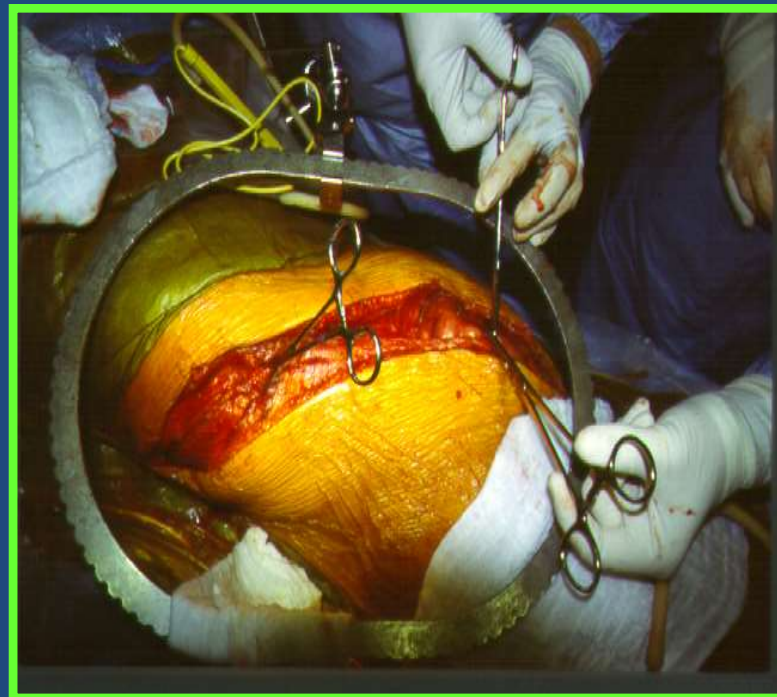
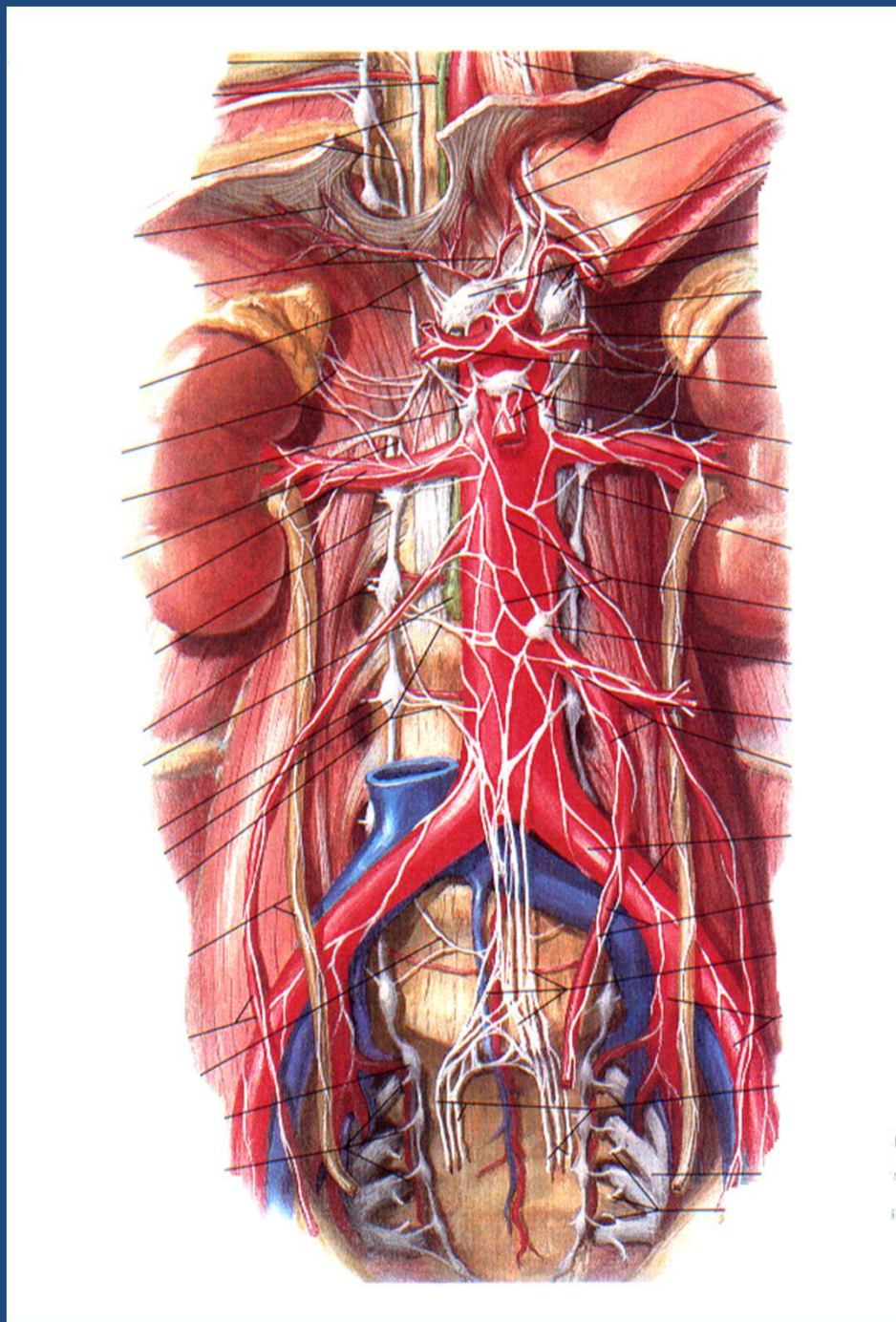
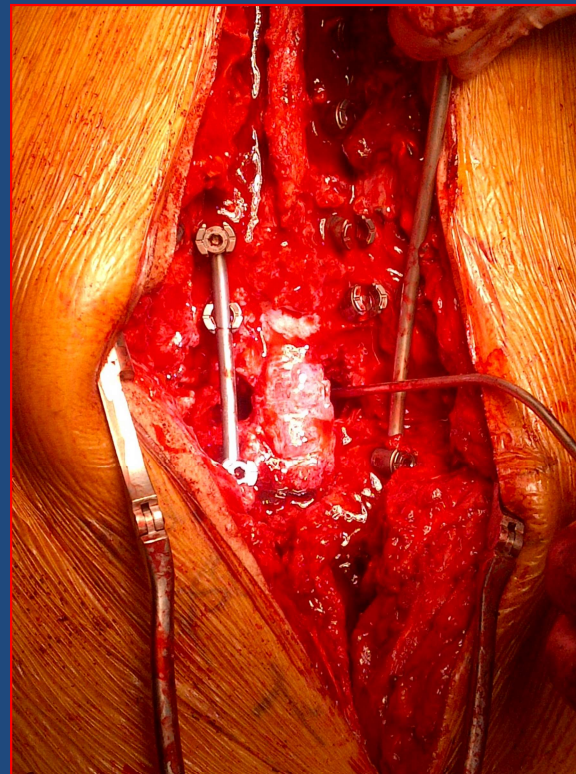
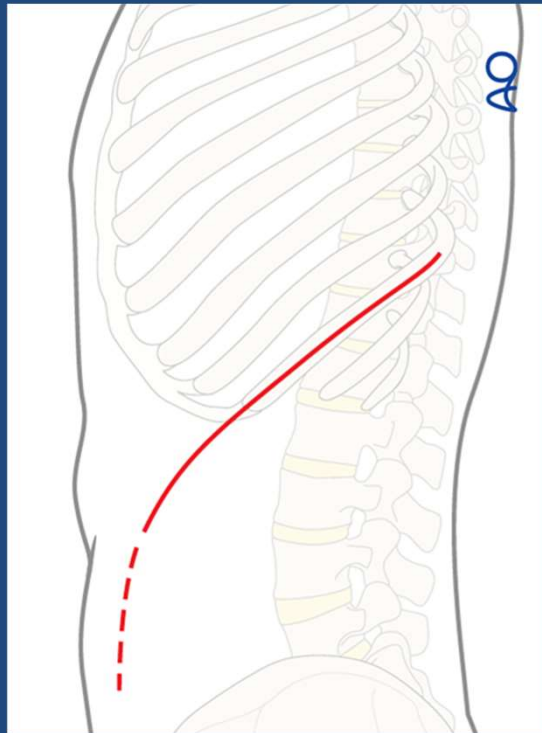


FIG. 3.



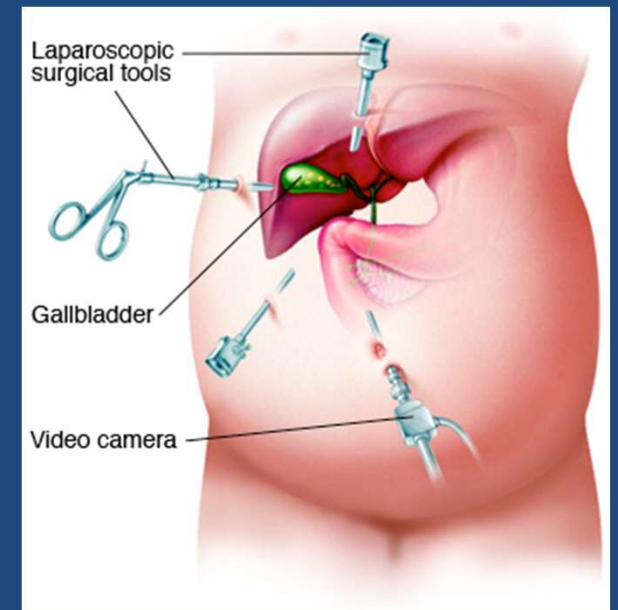


MIS vs Open



Promises of Minimally Access Spine Surgery...

- Less:
 - muscle damage (fusion disease)
 - deinnervation
 - blood loss
 - hospitalization
 - time off work



Reality of Current Minimal Access Spine Surgery...

- More technical
- More time consuming
- Has a steep learning curve
- Use a lot of fluoroscopy time
- Questions need answers:
 - Fusion for multilevel pathologies
 - Deformity correction
 - decompression

Modifiable risks

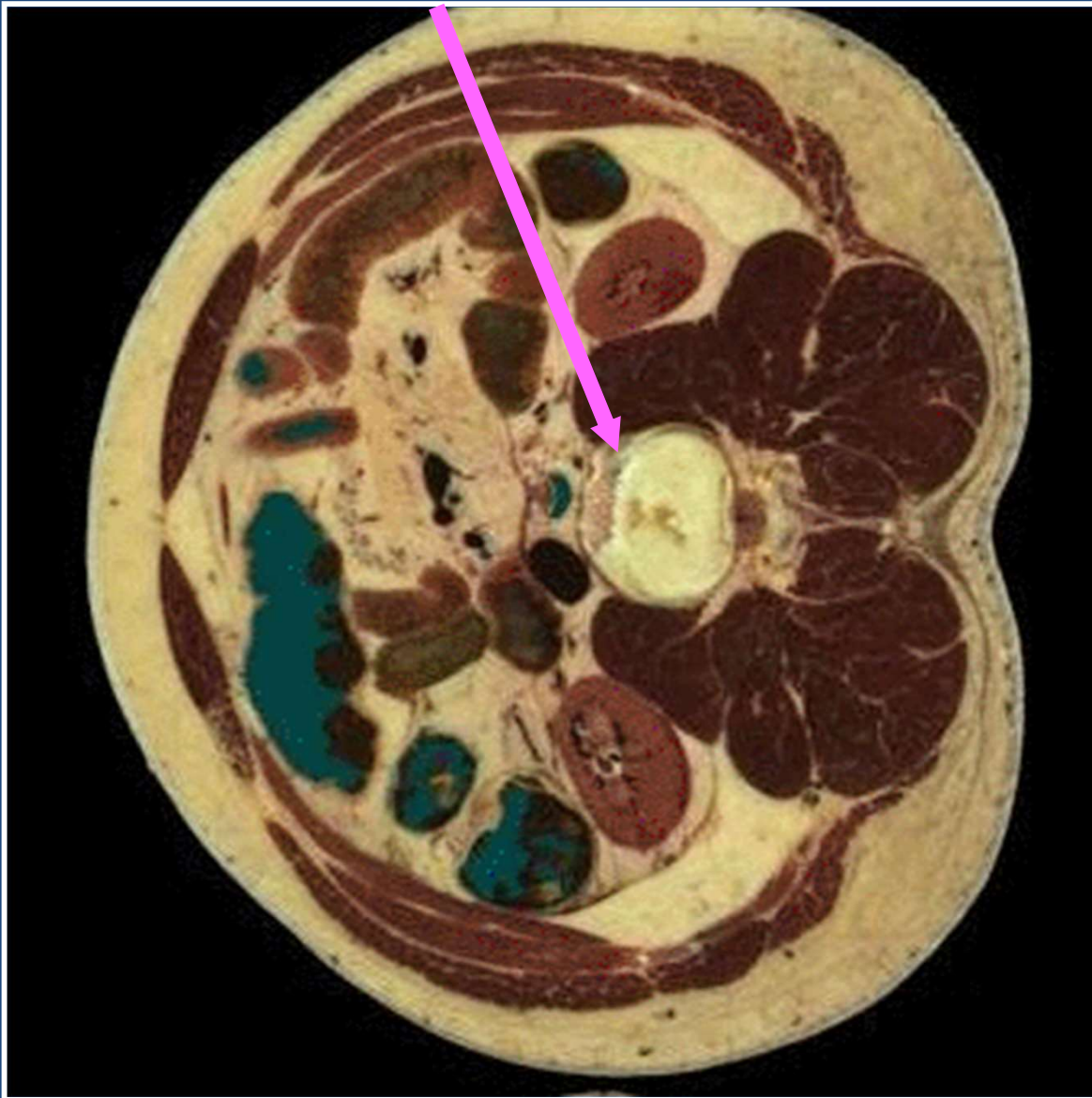
- Obvious Complications:

- Major bleeding: MIS
- Infections: MIS, Weight Loss
- ~~Neurological complications~~
- ~~Implants misplacement~~

- Less obvious complications:

- Destabilizing the spine:
 - Muscles: MIS
 - Facets: MIS
- Inadequate decompression
 - ATP allows Direct & Indirect
- Inadequate Fusion: Interbody fusion
- Inadequate spinal balancing
 - Anterior Column Support
- Inadequate understanding of mechanics
- Inadequate surgery levels
 - ATP allows full access & reconstruction

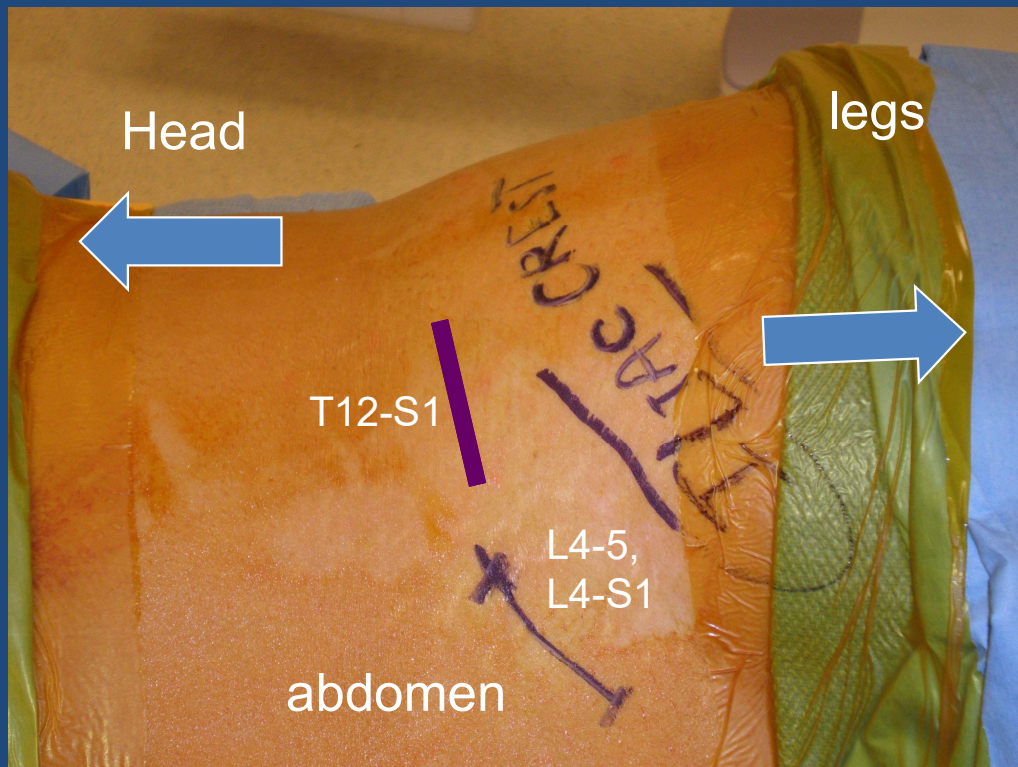
My preferred approach: Antero-lateral interbody fusion



- T12-L1, L1-2, L2-3, L3-4, L4-5, possibly L5-S1
- Split fibers of oblique and transversus muscles
- Retract anterior 10-15% of psoas
- be Very careful of the misleading Quadratus Lumborum muscle

ATP access is NOT a direct lateral with slightly more anterior incision

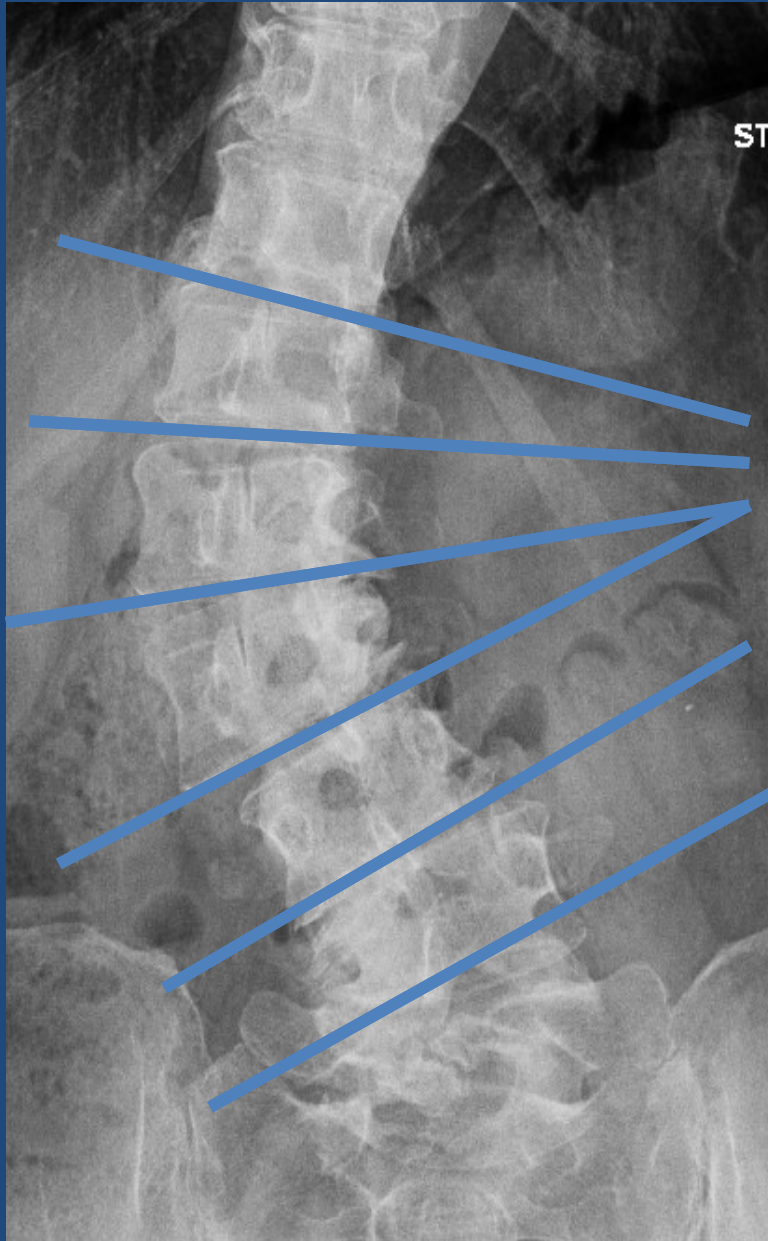
Left side approach



Right side approach

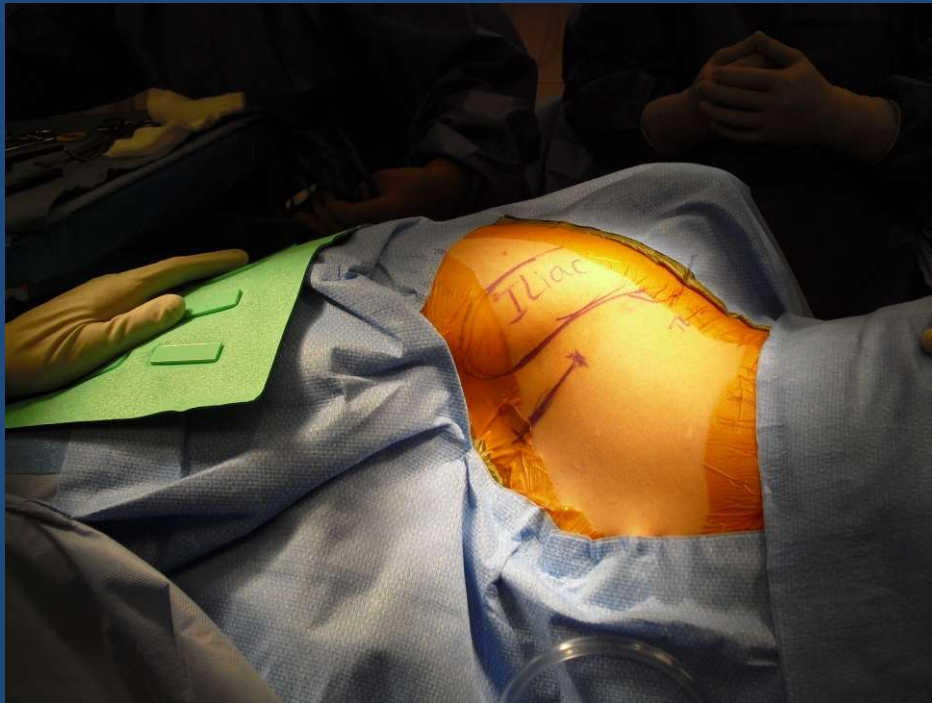


Small incision access entire lumbar spine, Concave Side Approach



Surgical Approach for L3-S1

Left lateral decubitus



Right antero-lateral approach



Surgical Technique: Abdominal wall

External oblique fascia

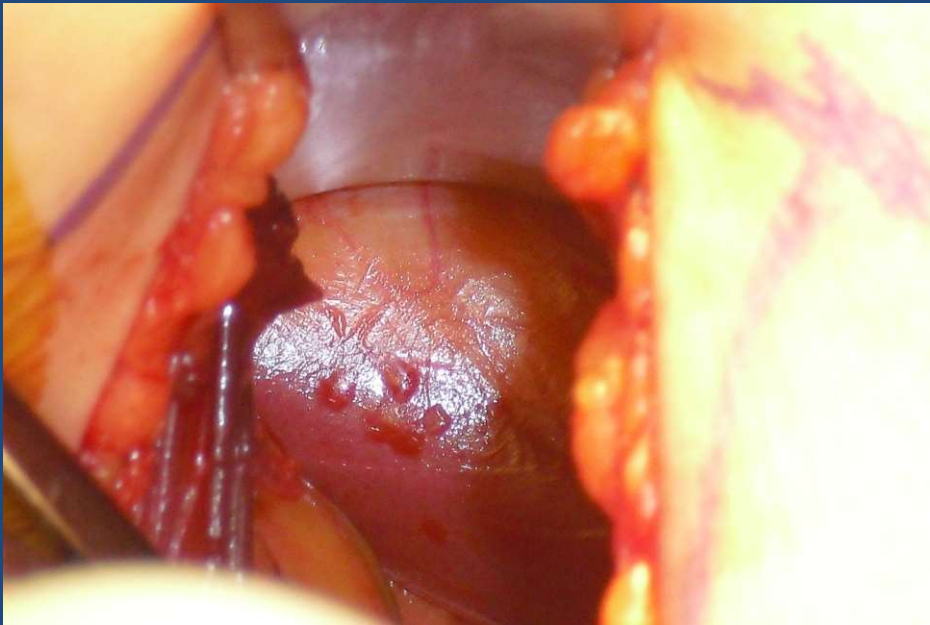


Internal oblique



Surgical Technique

Psoas belly



Psoas retracted laterally

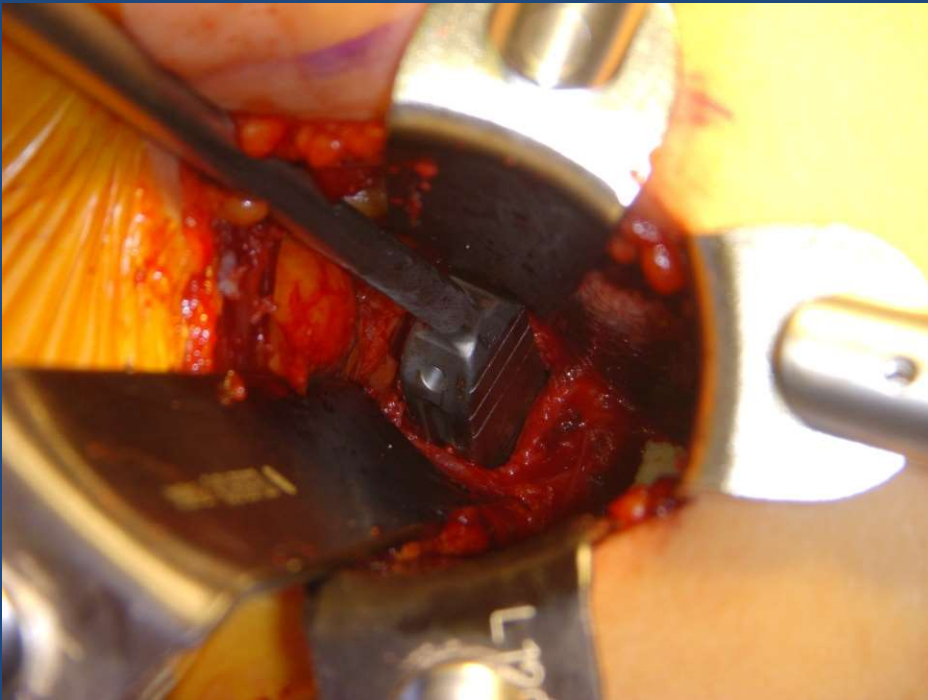


Anterior to Psoas Surgical Technique

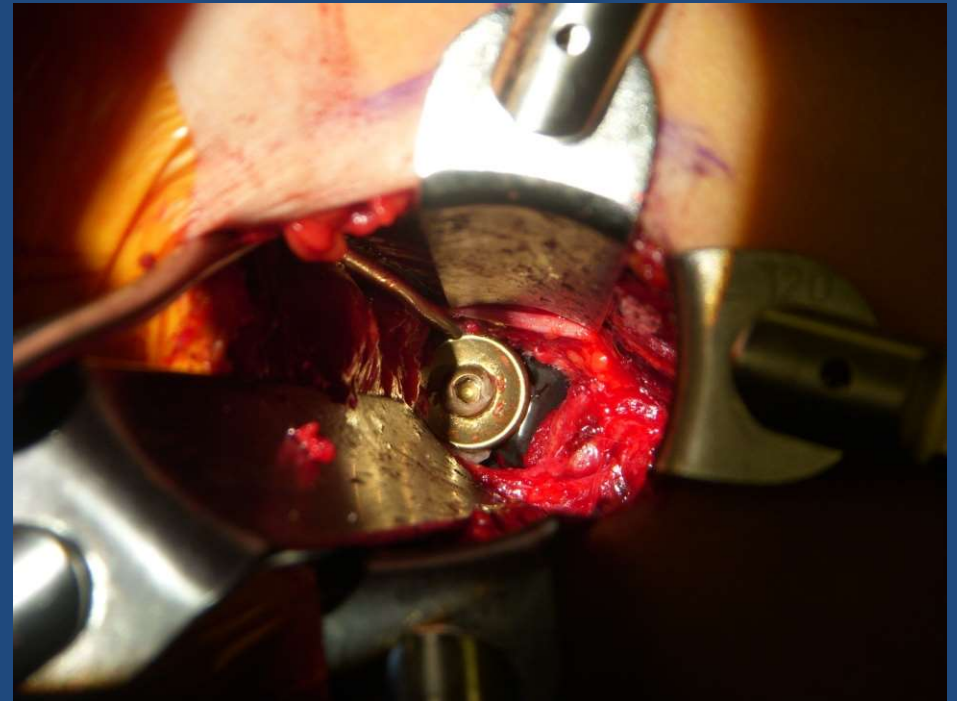


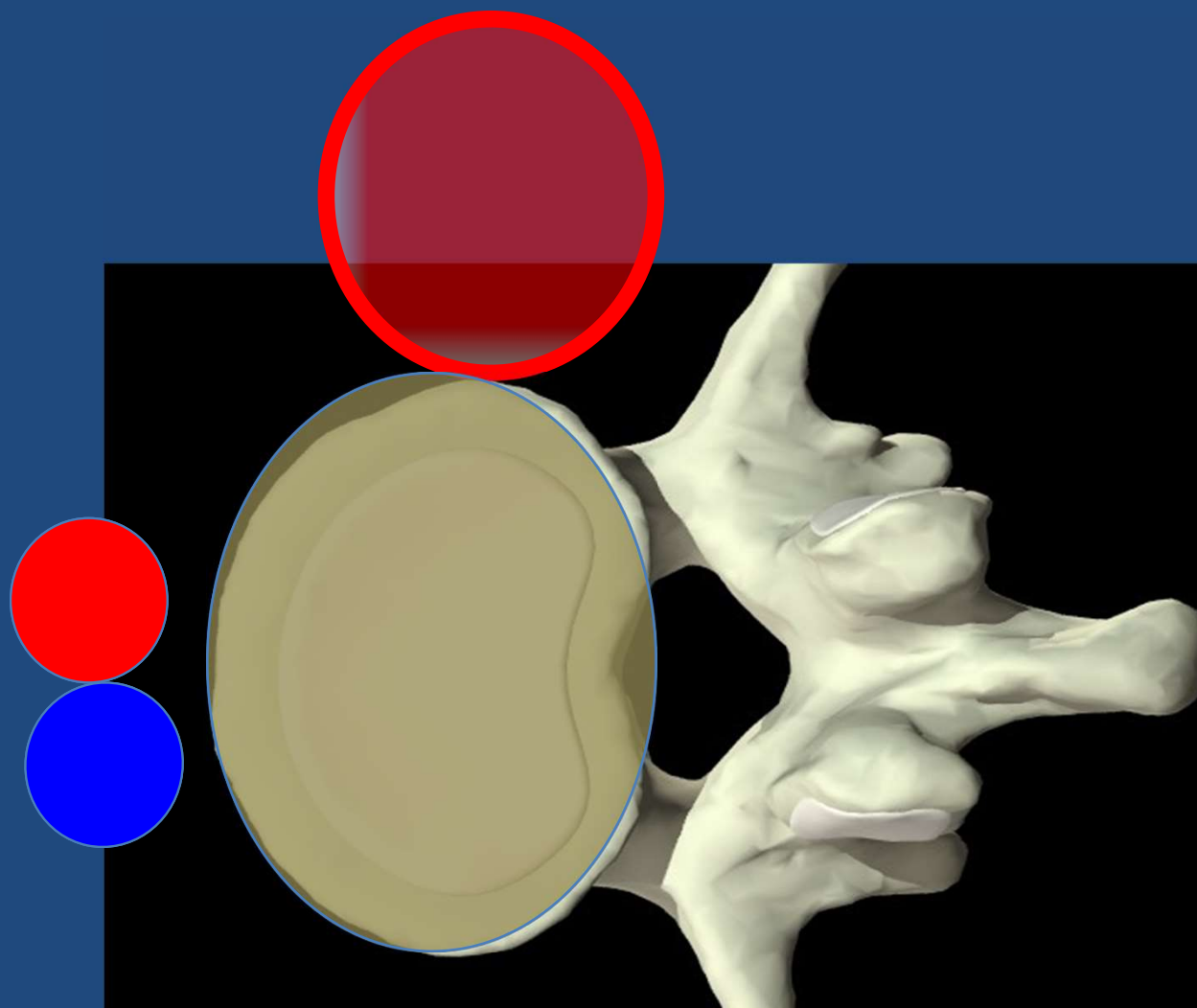
Standard Operative Approach: Surgical Technique

Spreaders

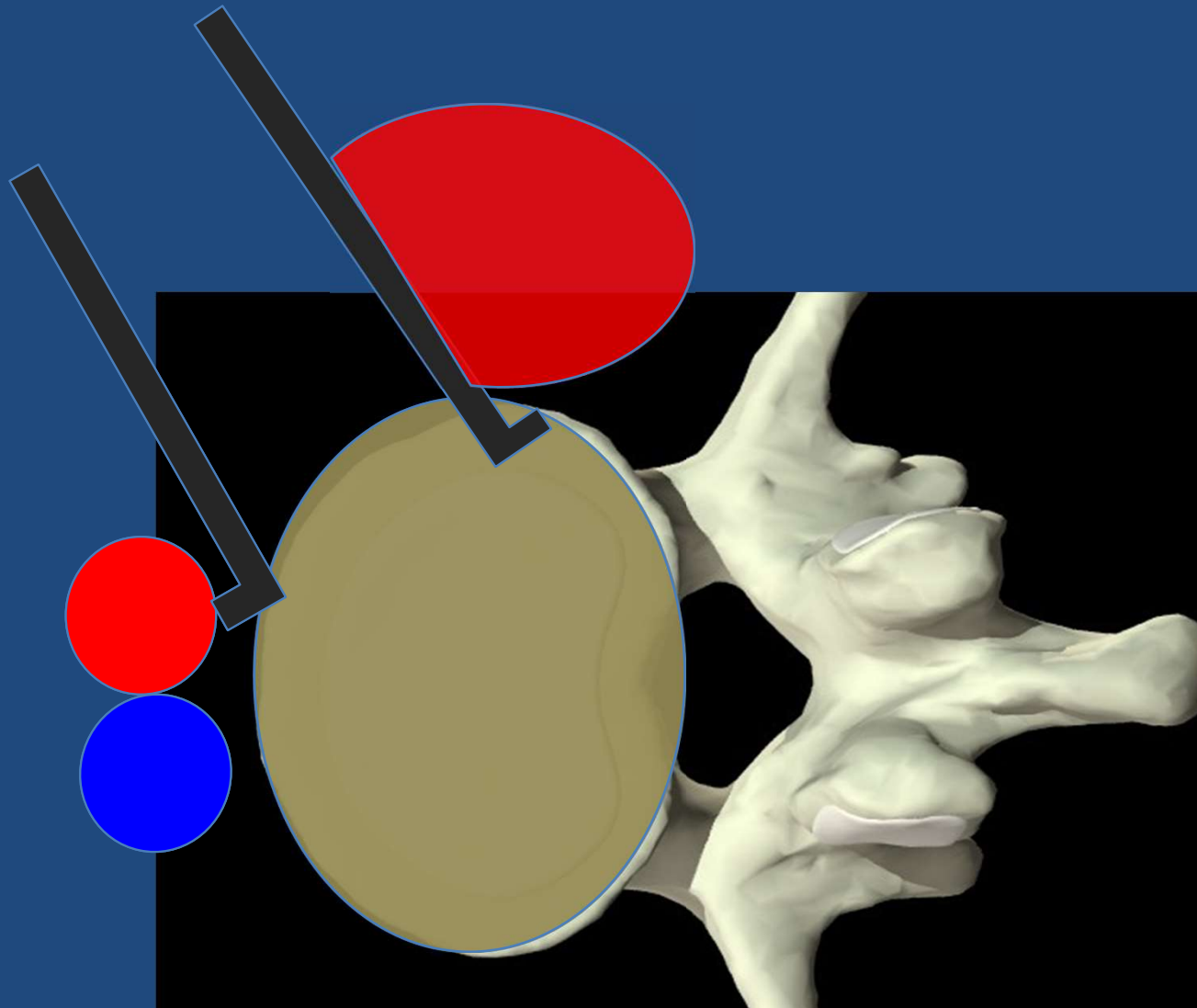


Cage insertion

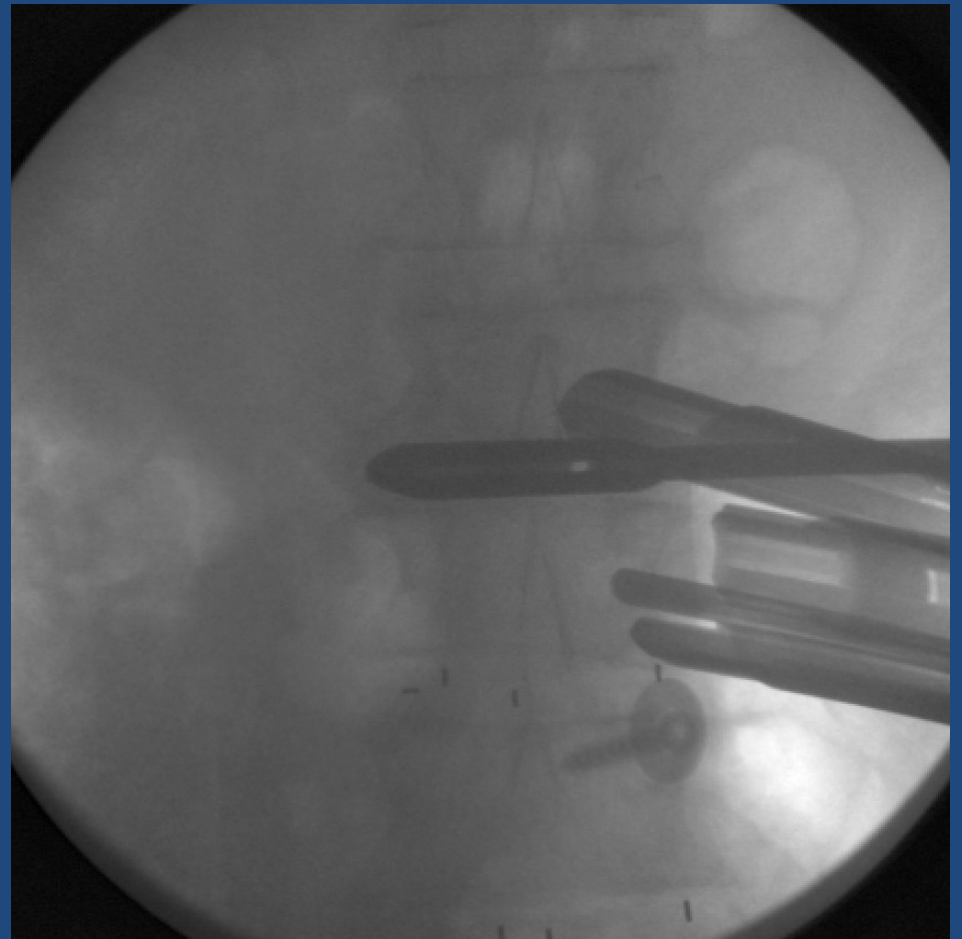
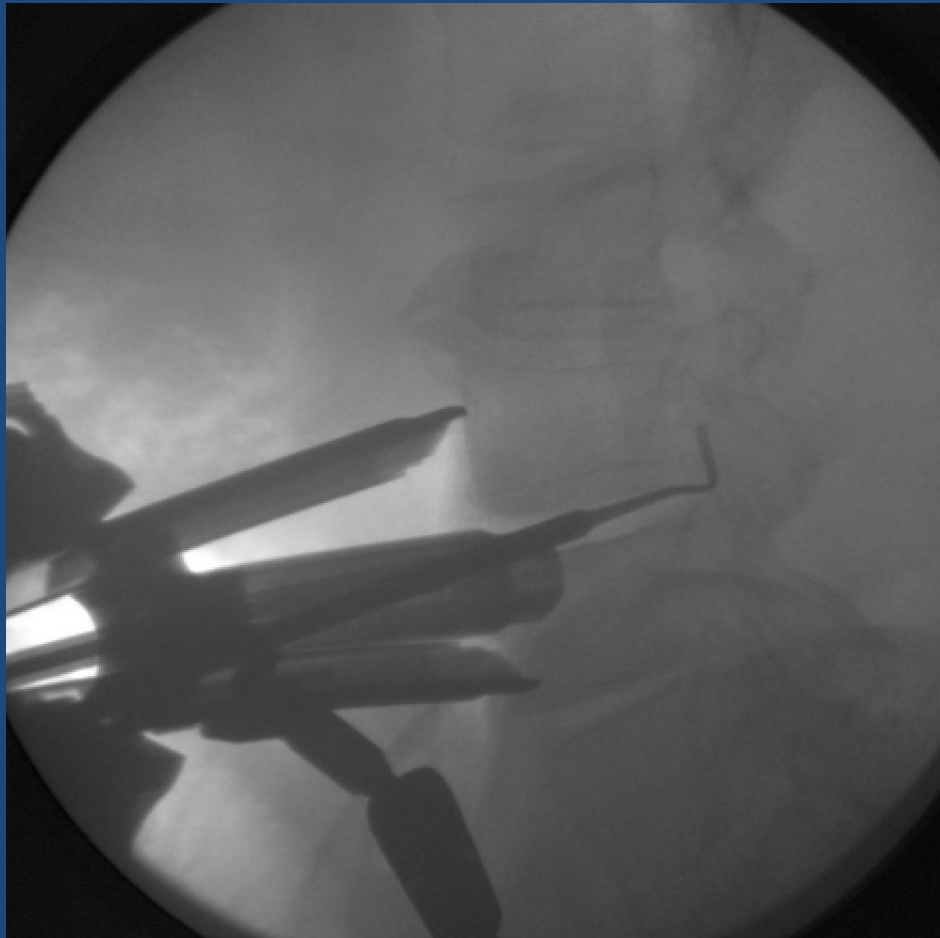


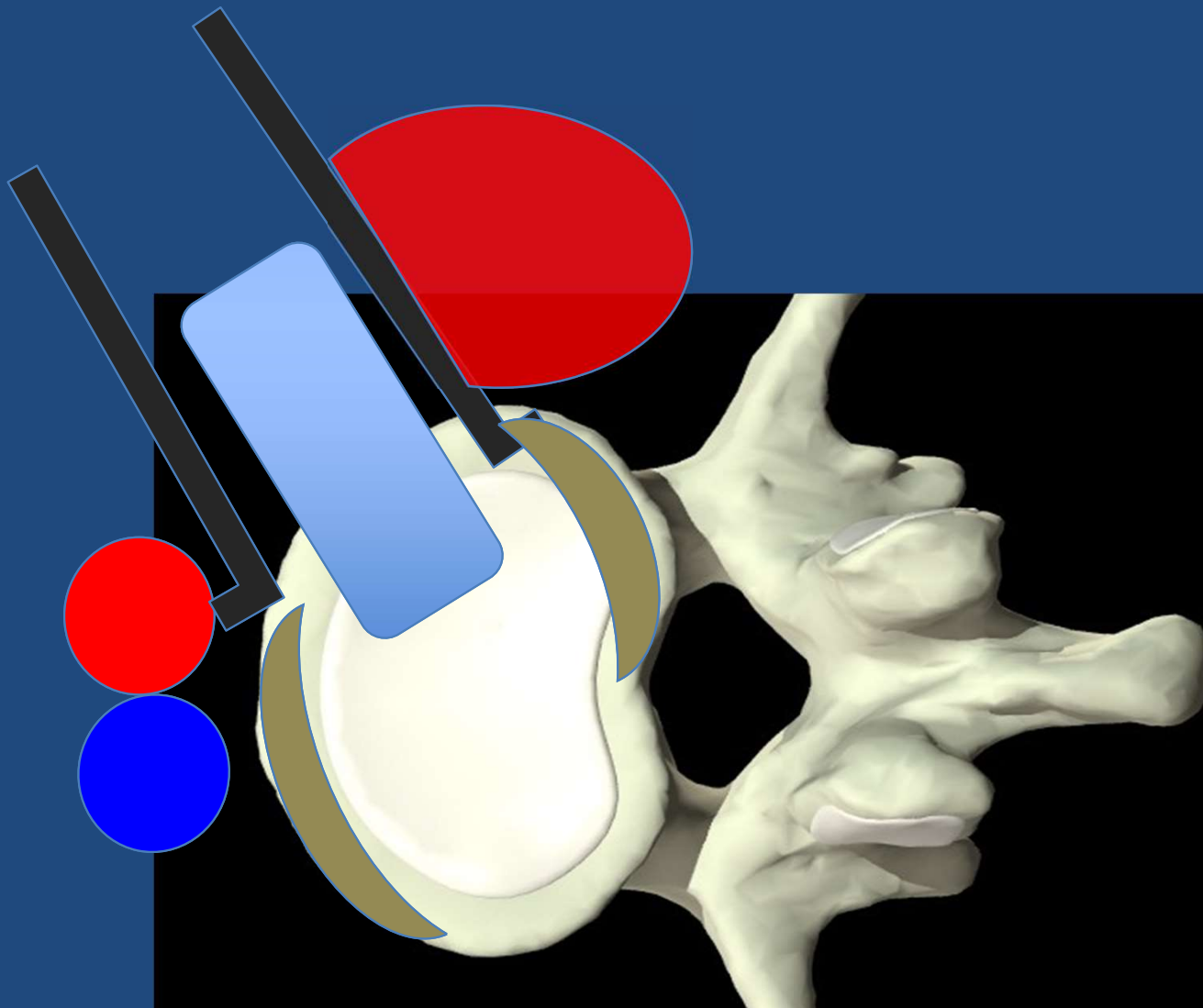


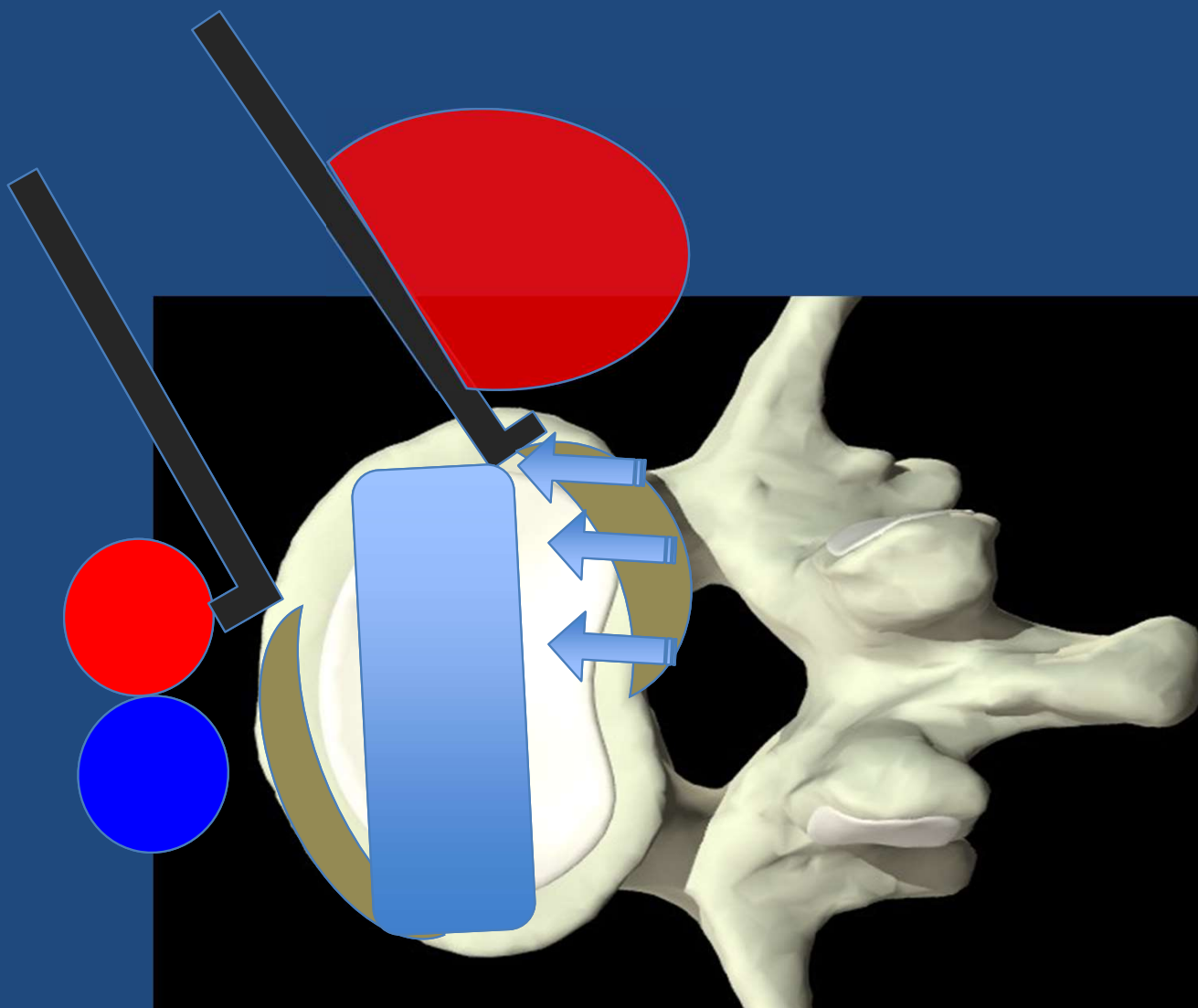
Oblique direct visualization access. No second bottle neck

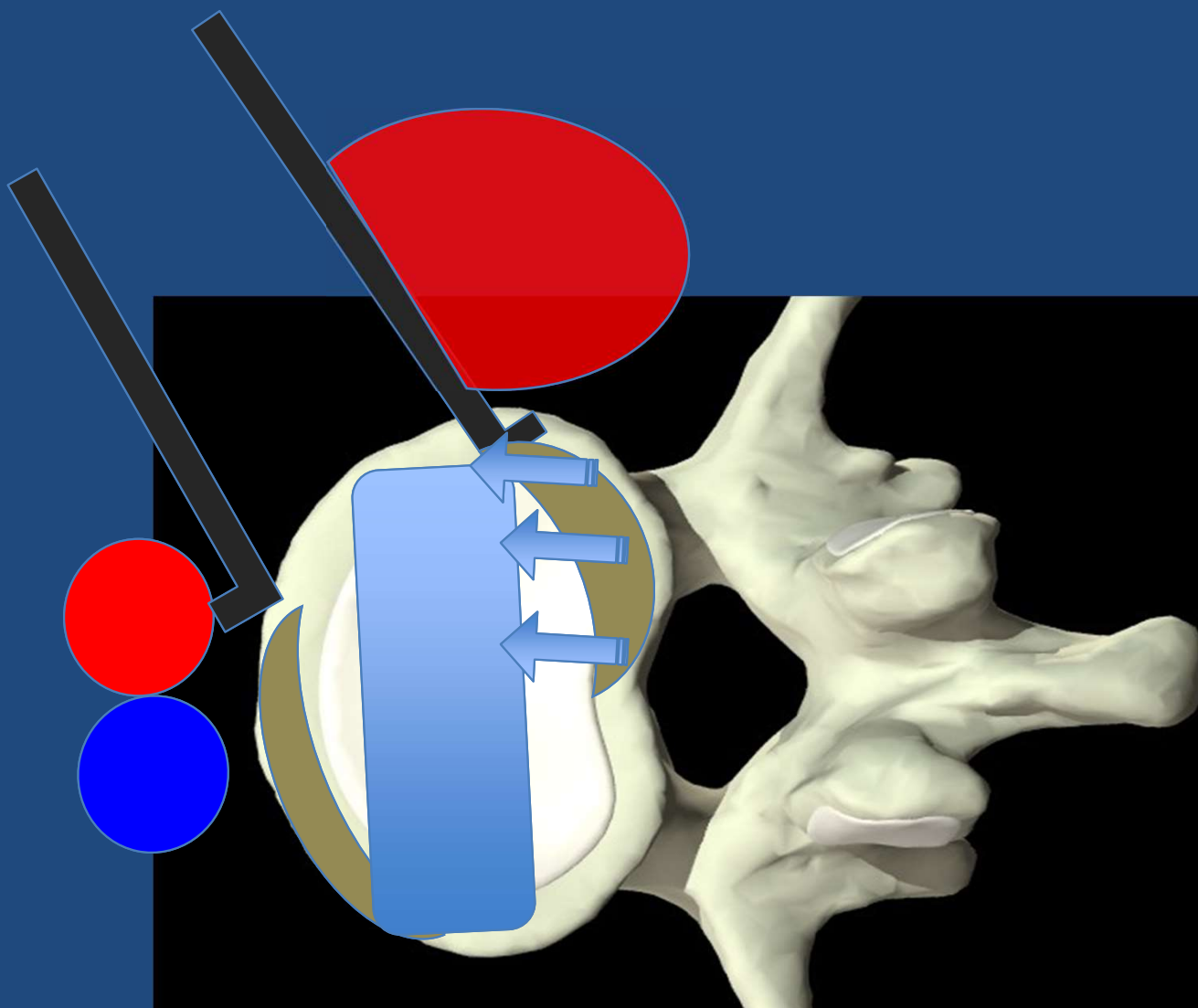


Direct Decompression When needed









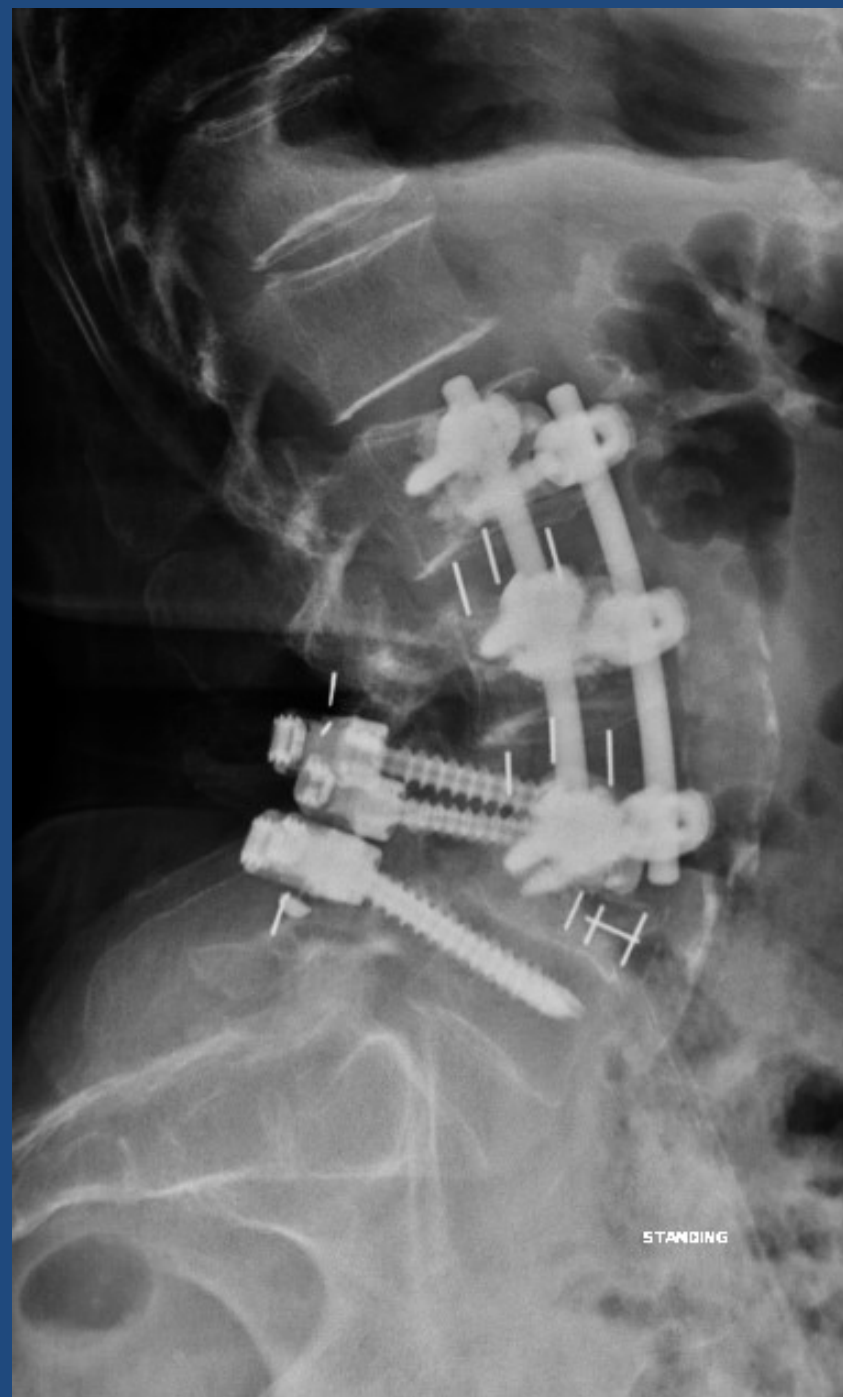
Decompression: Direct vs Indirect

- Opening the foramina
- Recoil of the Posterior annulus
- Re-alignment of the spine; listhesis
- Stop the micro-motion and dynamic stenosis

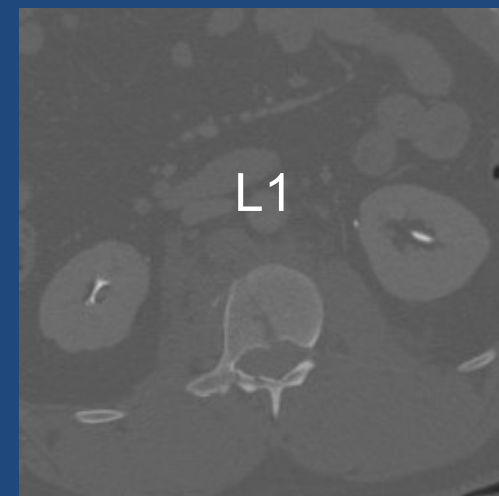
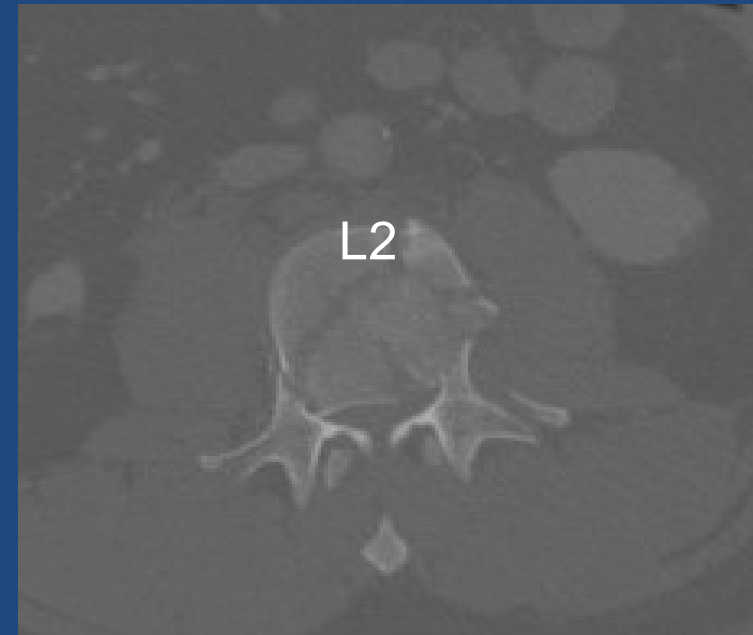


Triangular discs: Release of the Anterior tether

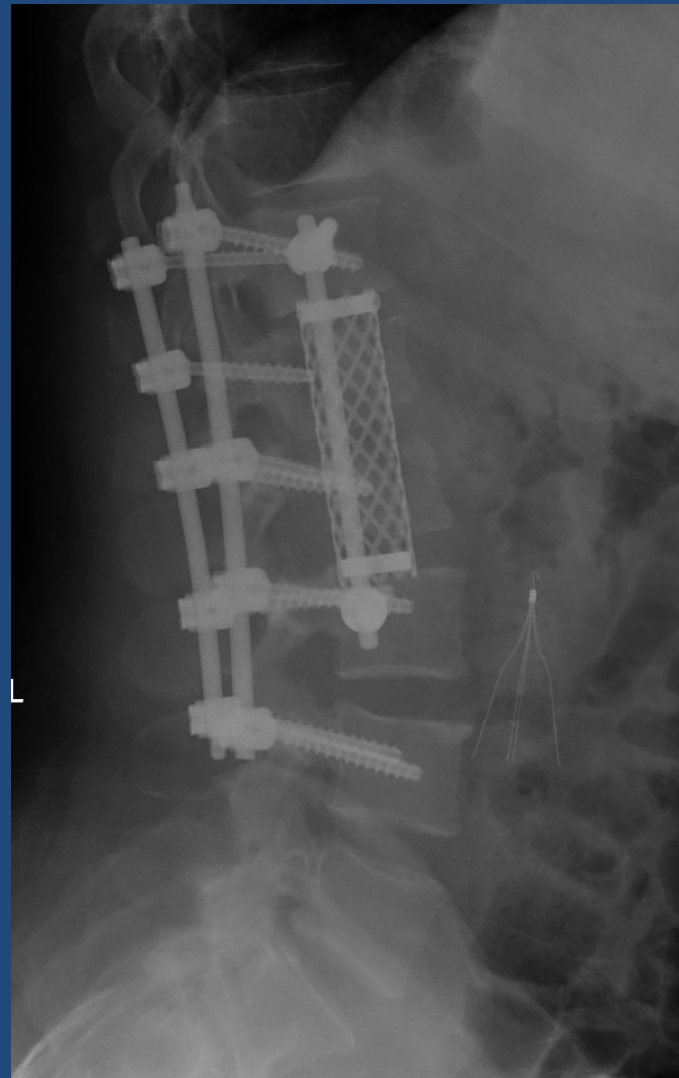
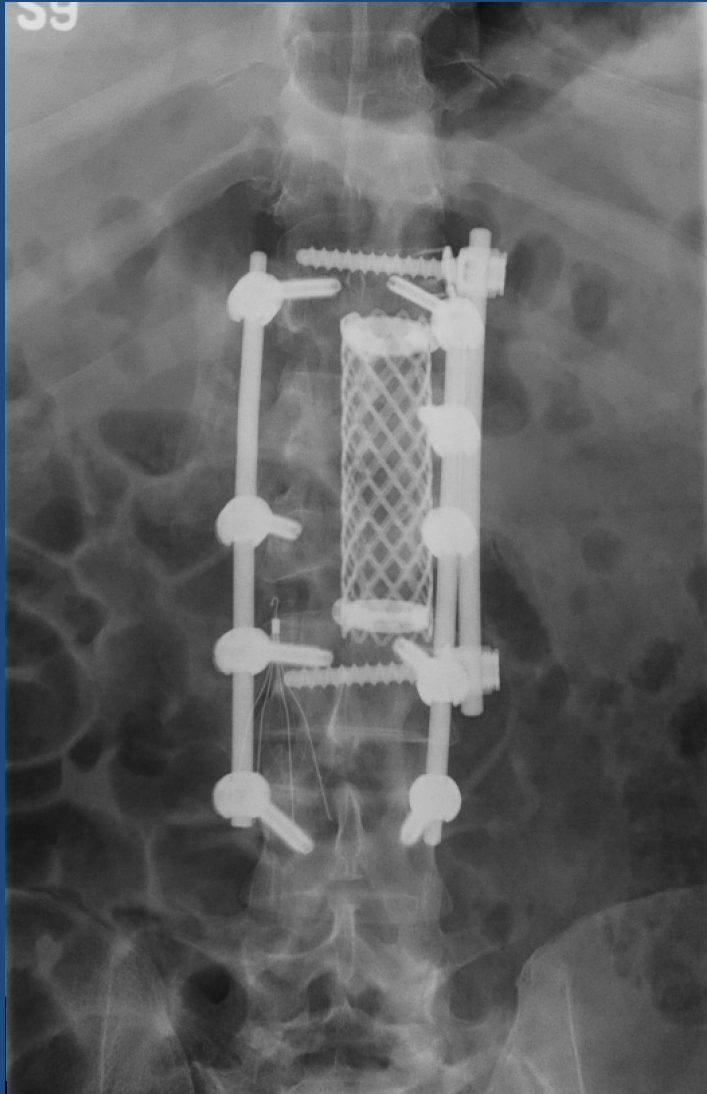




45 yo s/p fall severe right LE weakness



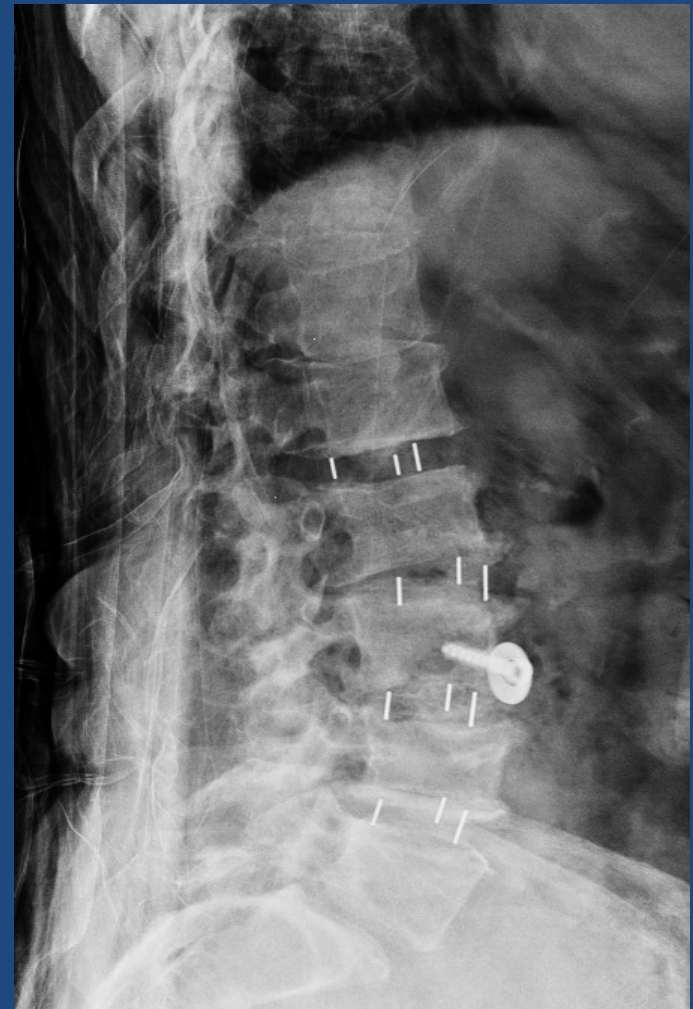
Final X-rays



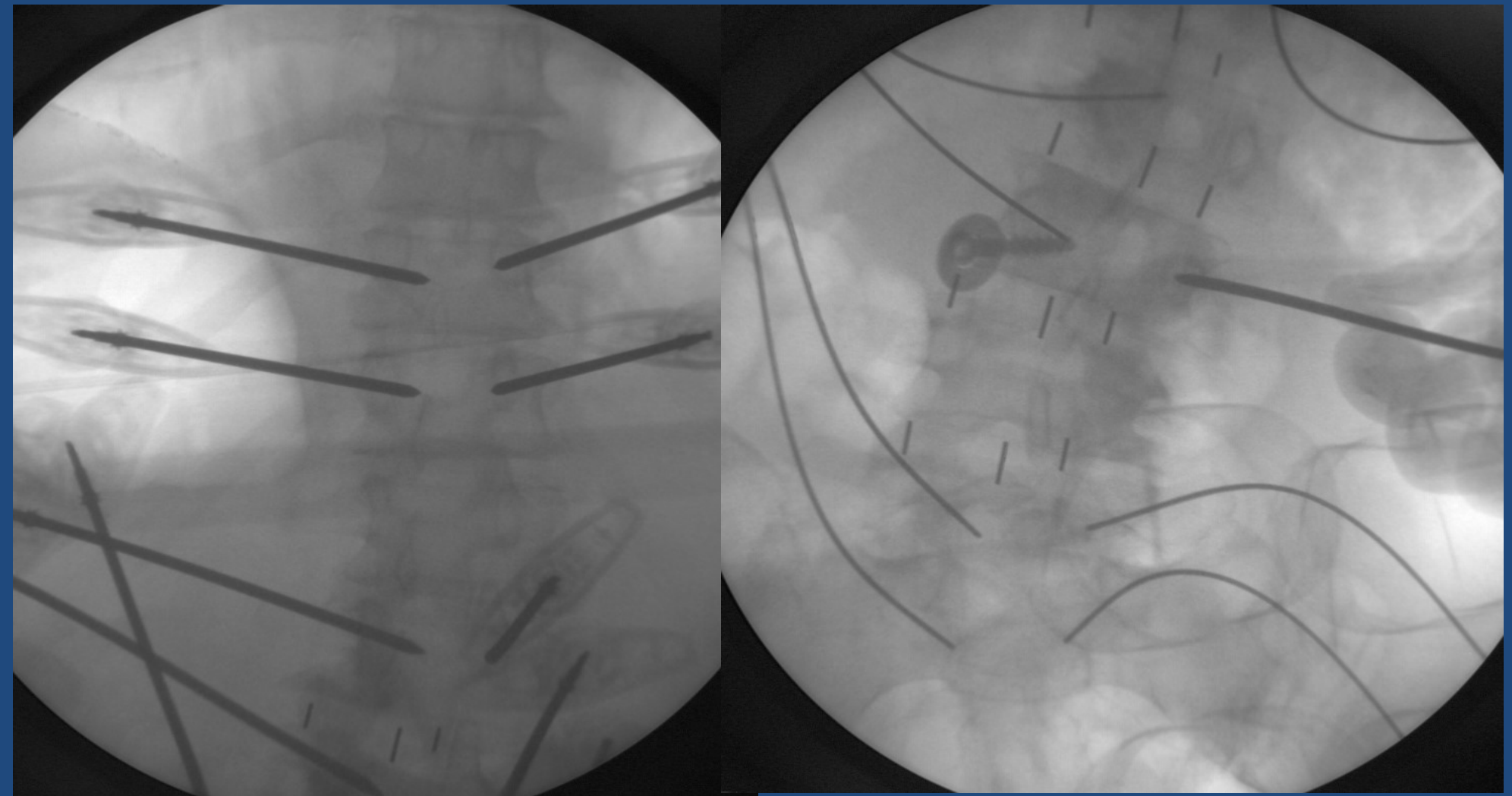
51 YO cab driver:
severe back pain, B/L leg pain Rt>Lt.
Motor: 5/5, Decreased Sensation Rt lat thigh
Failed conservative Rx: 9ESIs, PT, Weight loss etc..



T12-L5(Transitional) ATP fusion



Intraop imaging



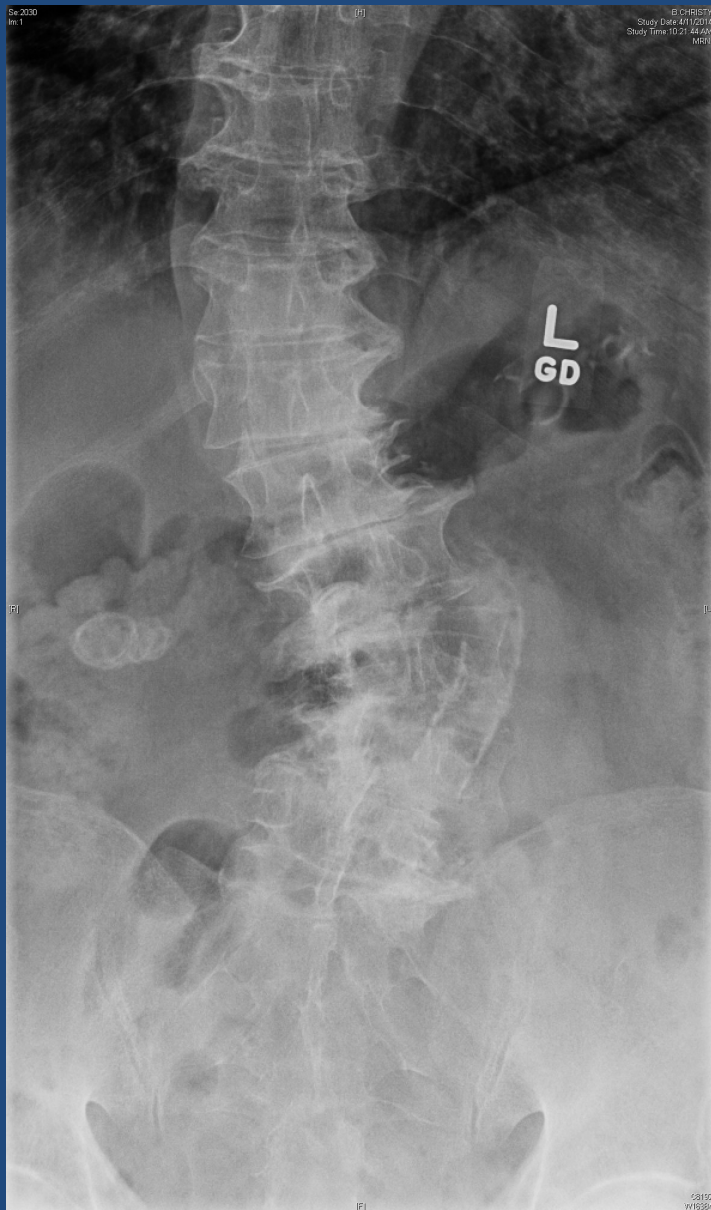
Complete Derotation



Lateral Views



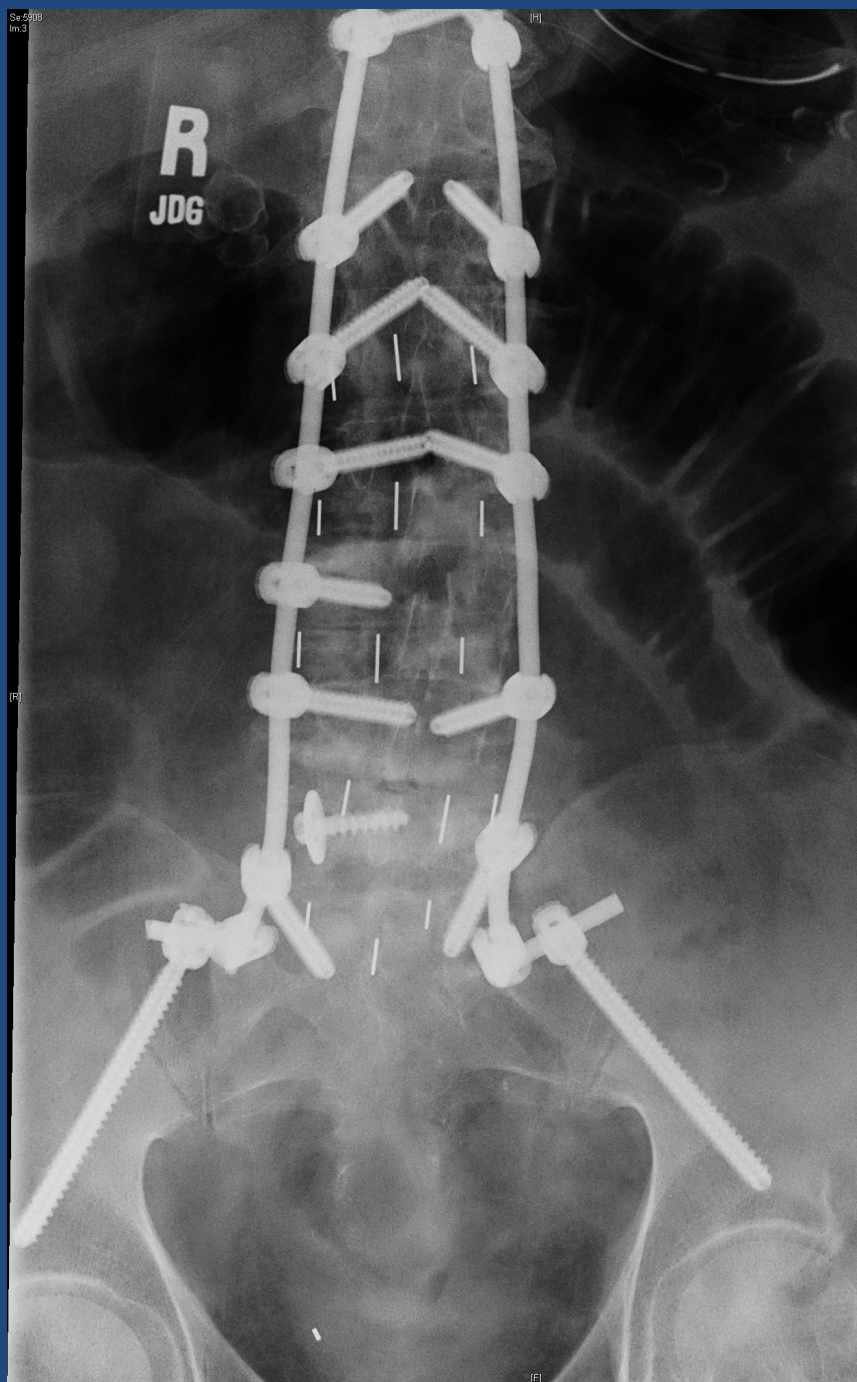
75 yo male. back pain 9/10.
Severe b/l leg pain
Inability to stand straight.

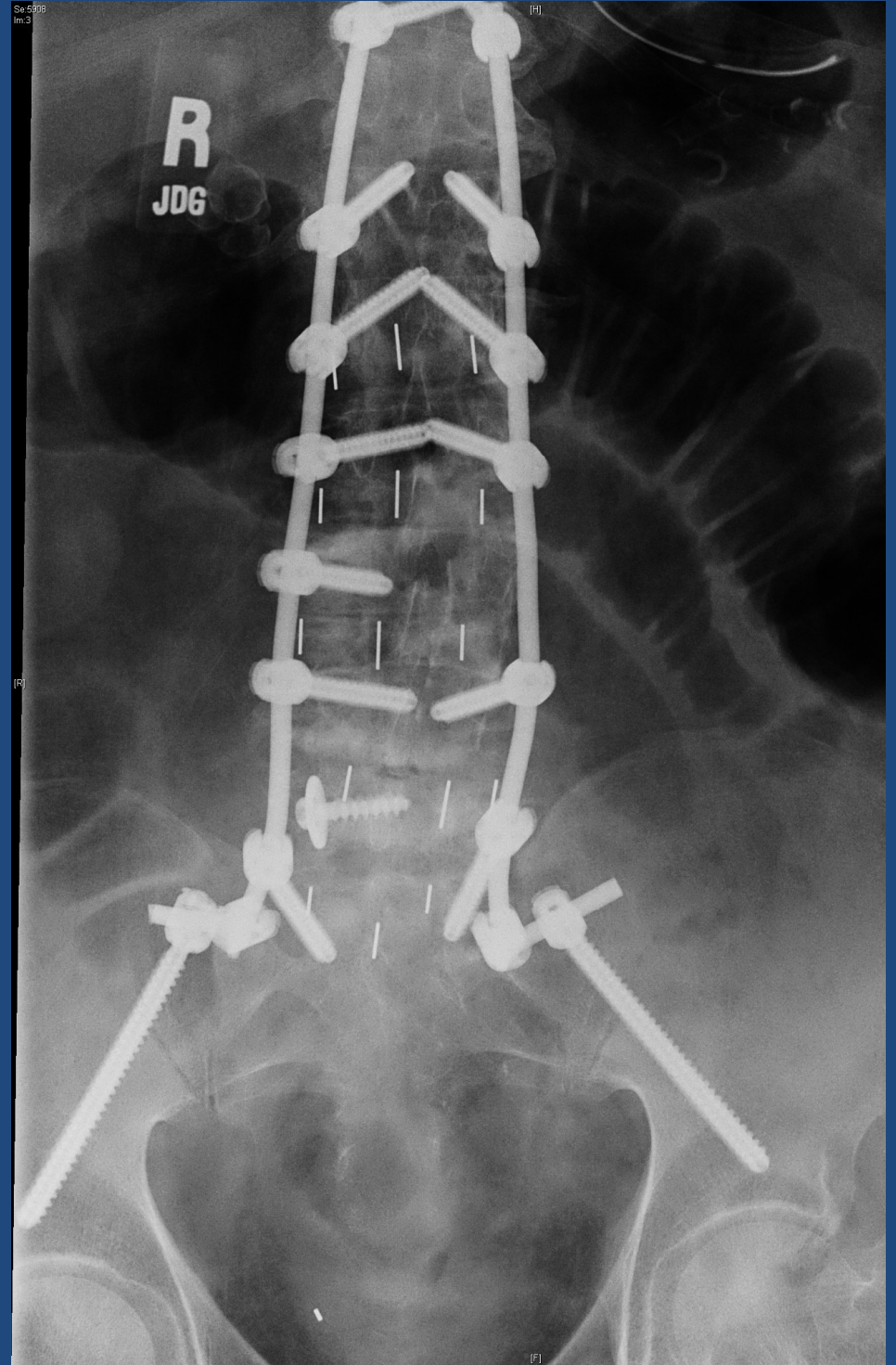
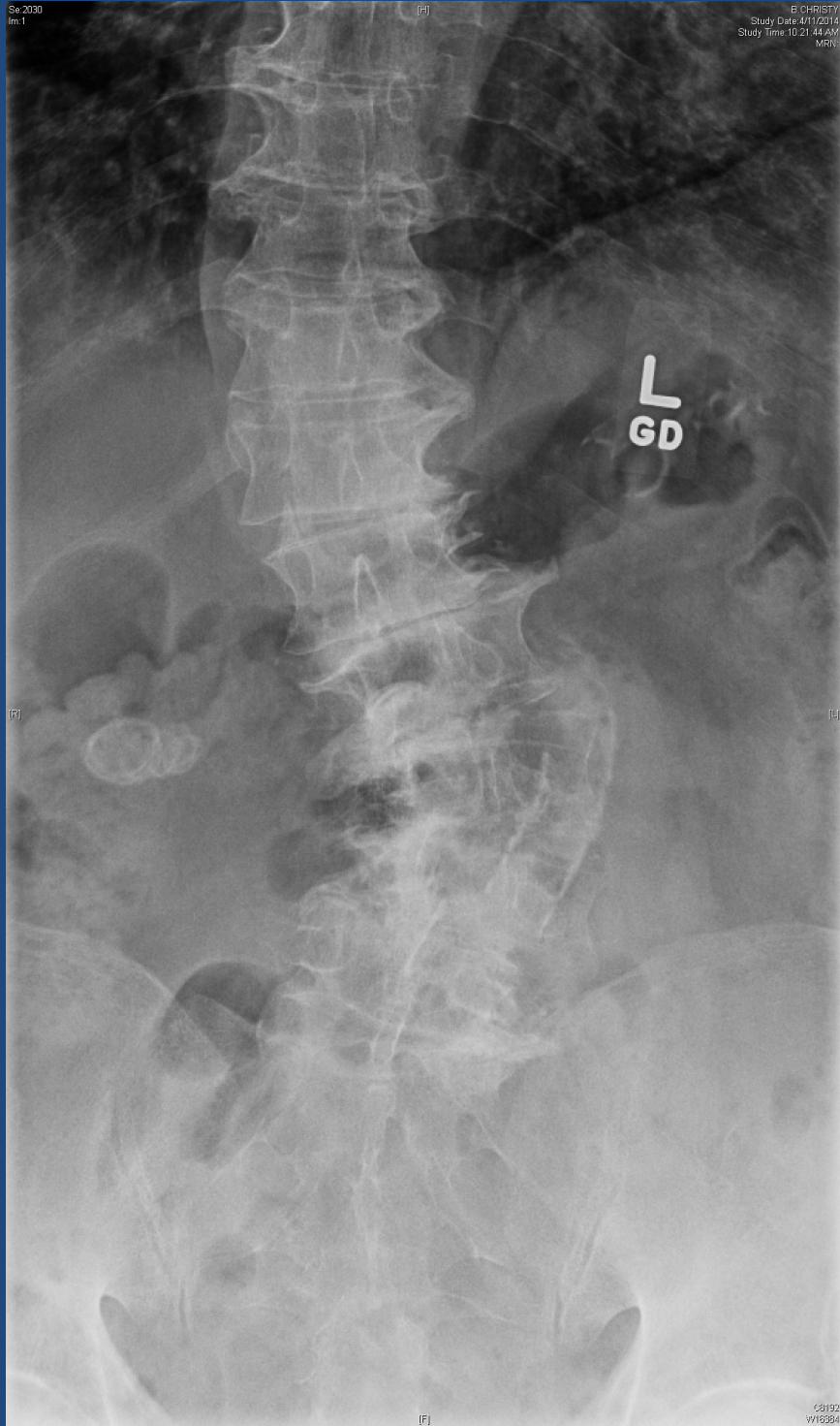


Flexion & Extension views





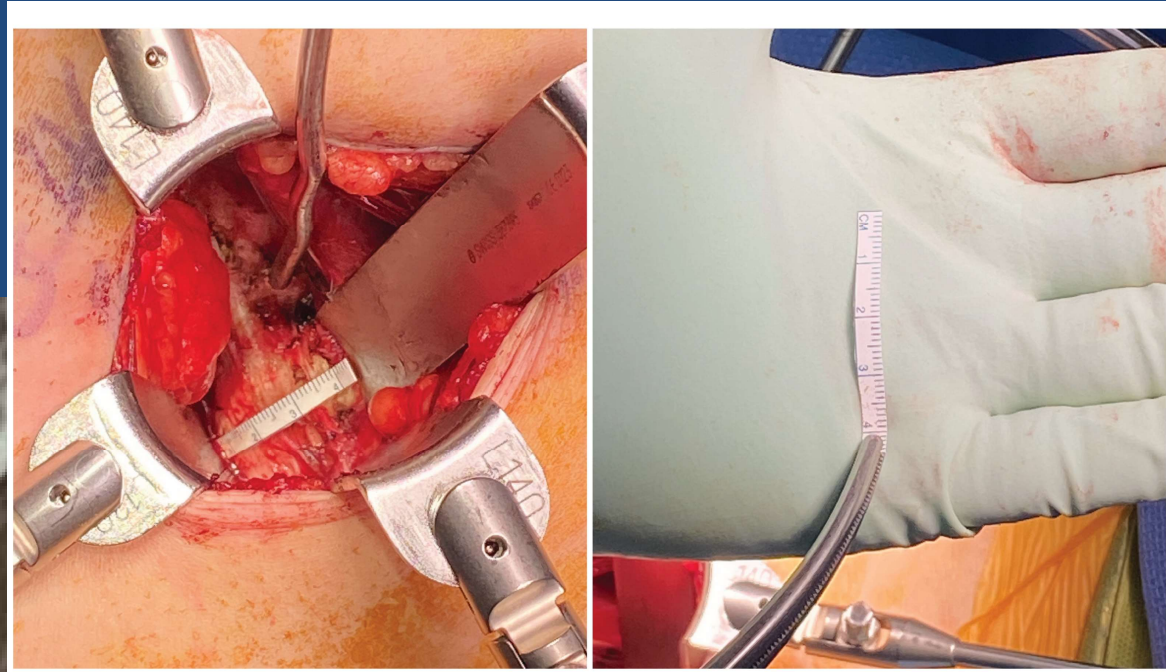
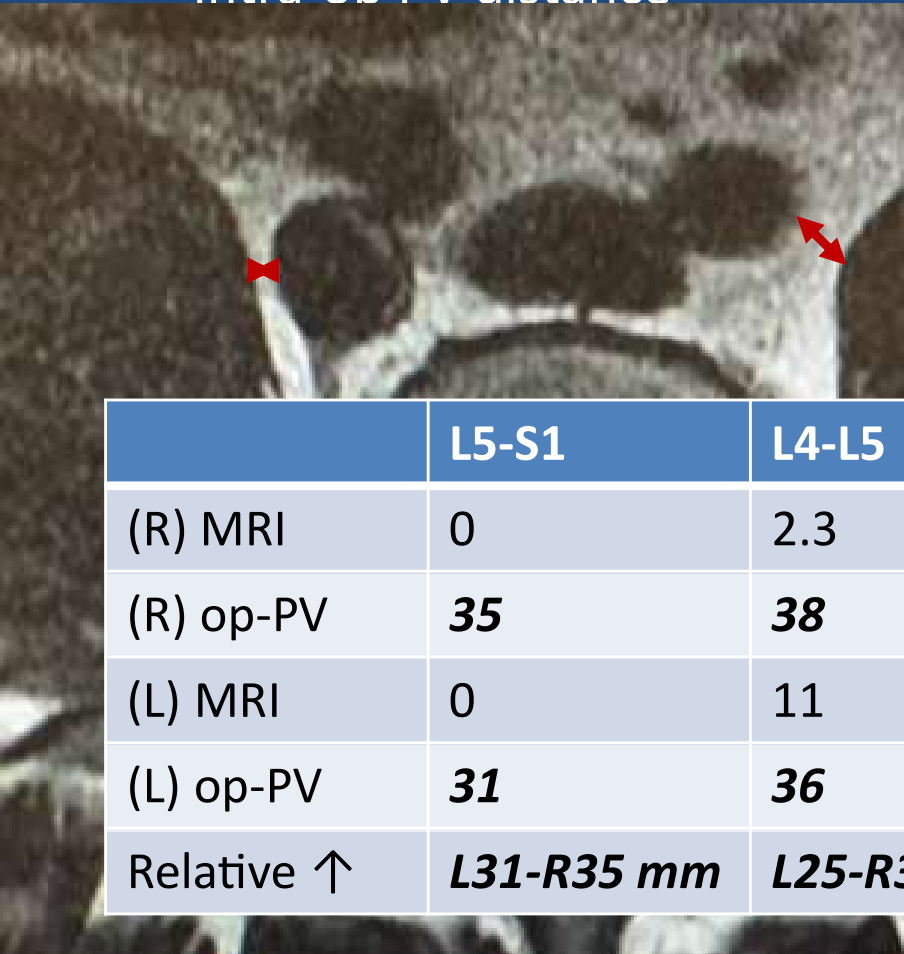






In Vivo Anatomical Study*

- 121 Subjects (80% R, 20% L)
- Pre-op MRI: PV distance
- Intra-op PV distance

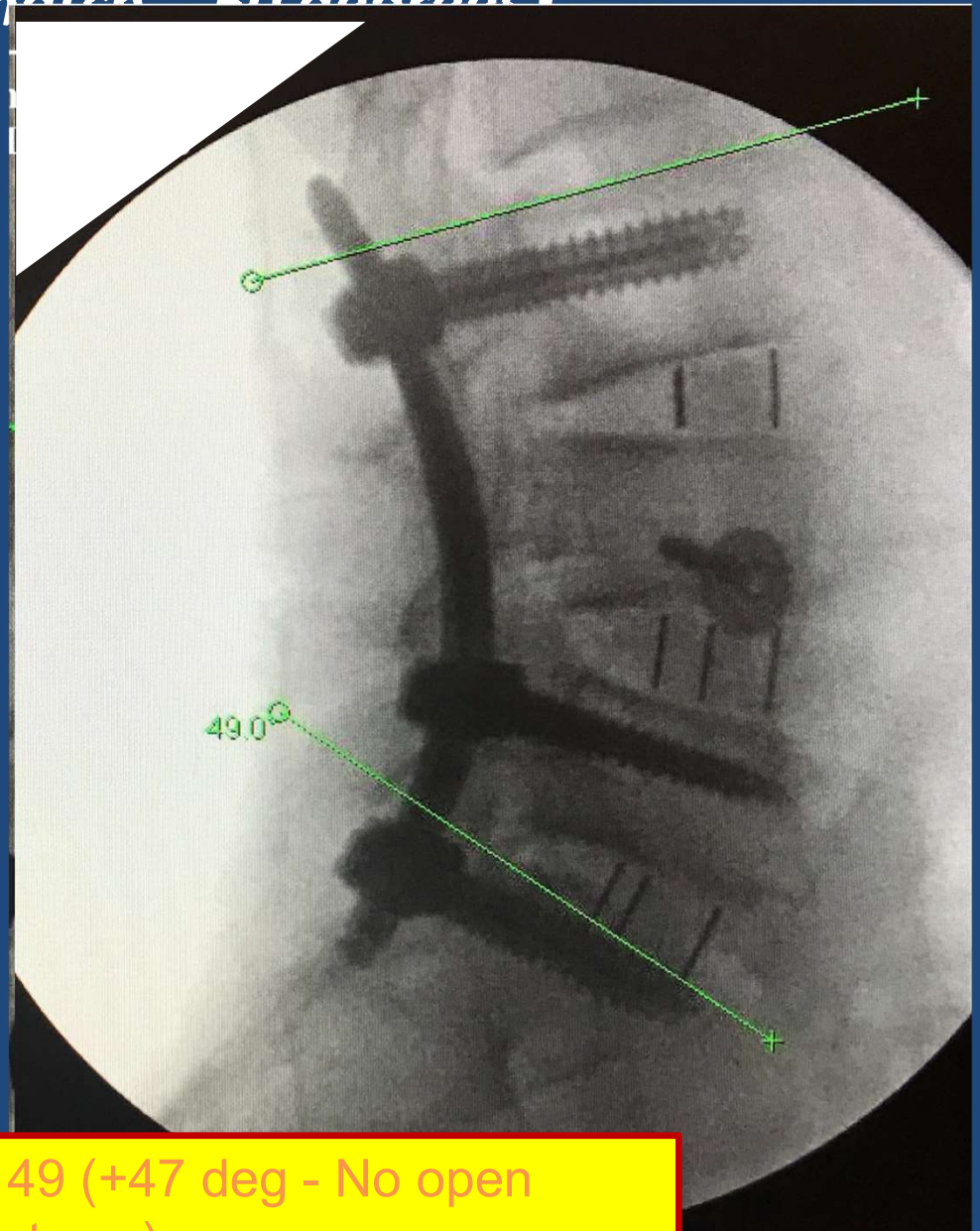
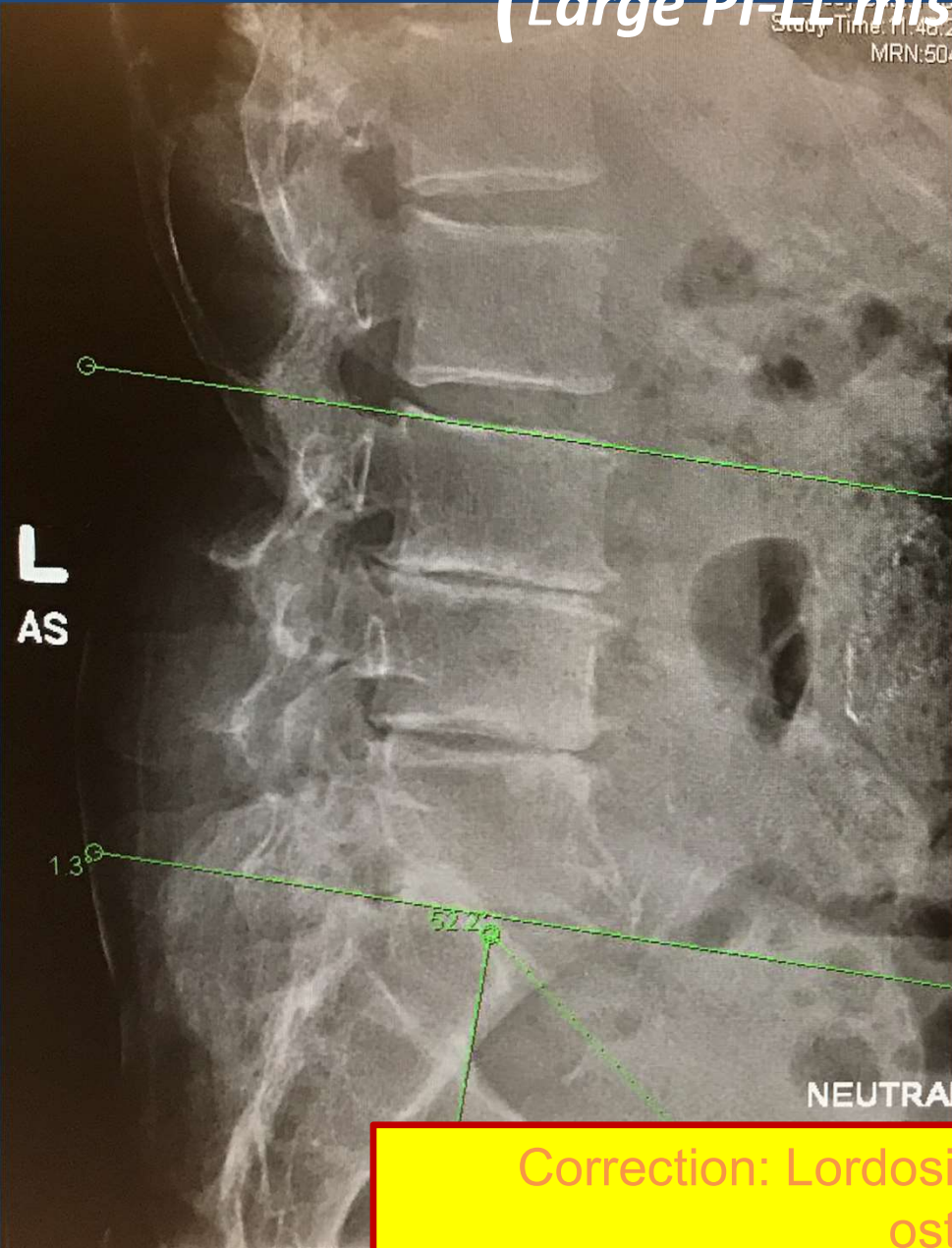


	L5-S1	L4-L5	L3-L4	L2-L3	L1-L2
(R) MRI	0	2.3	3.4	6	14.2
(R) op-PV	35	38	33	30	24
(L) MRI	0	11	16	20	12
(L) op-PV	31	36	32	29	20
Relative ↑	L31-R35 mm	L25-R36 mm	L16-R30 mm	L9-R24 mm	L8-R10 mm

**Tannoury et al, In Press*

Degenerative: Post Lami + Flat back

(Large PI-LL mismatch ~ 50 degrees)



Correction: Lordosis 49 (+47 deg - No open osteotomy)

ASD + Flat Back Deformity?



Correction: LL gained + 31 (60 deg - No open osteotomy)

Radiographic Study (>2 years)*

Table 2. Comparison of pre-operative, post-operative, and final follow-up foraminal and disc heights

		L1-L2	L2-L3	L3-L4	L4-L5	L5-S1
Foraminal Height						
	Pre-Op	18.40	19.80	19.68	17.53	14.52
	Post-Op	22.64	24.24	25.57	23.85	20.94
	Final	22.46	23.62	24.90	22.94	20.23
		+4	+4	+5	+5	
Average Intervertebral Height						
	Pre-Op	5.97	7.20	7.46	8.82	8.56
	Post-Op	9.42	11.01	13.14	14.51	13.85
	Final	8.47	10.43	12.19	13.95	12.66
		+3	+3	+5	+5	

+4

**ATP → Foram Height restoration: i-33% and f-29% (vs. XLIF: 13.5%)
Oliveira'2010**

**ATP → IV Disc Height restoration: i-64% and f-54% (vs. XLIF: 44%)
Phillips' 2013**

Global Lordosis (Hypolordotic PI-GL>10) n=49

Pre-Op	22.60°
Post-Op	57.67°
Final	52.92°
Hypolordotic → Normolordotic	91.63%

**Overall Global
Lordosis
Increase:**

+ 30°

***Tannoury et al, In Press**

MIS-ATP is SAFE: Our Experience

9 years database

N = 940 Patients

Cages: 2,429

L5-S1 access: 540 patients

Complications:

- Perioperative:
 - Surgical vs. Medical – Minor vs. Major
- Postoperative: Early (<3mo) vs. Late (>3mo)

Tannoury et al, Spine 2019

Spine

SPINE Volume 44, Number 19, pp E1122–E1129
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CLINICAL CASE SERIES

Complications Associated With Minimally Invasive Anterior to the Psoas (ATP) Fusion of the Lumbosacral Spine

ATP vs. XLIF Perioperative Data

% Complications	ATP	XLIF/DLIF
Vascular Injury	0.3%	0.81%
Psoas Injury	0	28-36%
Thigh Pain	0.5%	26.5%
Motor Weakness	0.8%	34- 40%
• Permanent	0.4%	3.9-5%
Retro Ejaculation	0.3%	-
Ureteral Injury	0%	0.6%
Deep Infection	0.1%	1.38%
Paralytic Ileus	1%	1.18%
Incisional Hernia	0%	-
Direct Bowel Injury	0%	0.41%
Bowel Ischemia	0.1%	0.17%
Reoperation	1.5%	3.9%

Tannoury et al
Spine 2019

Hijji 2017, Anand
2013 Phillips 2013

ATP vs. XLIF Perioperative Data

% Complications	ATP	XLIF/DLIF
Overall	7.2%	24-51%

Hijji 2017, Anand 2013
Phillips 2013

NO BOWEL Injuries
NO URETER Injuries
NO major vascular Injuries

Tannoury et al, Spine 2019

SCORE CARDS

Surgical Principles (6As)	Transpsoas	ATP
Alleviate Neural Compression: Direct vs. Indirect	Incomplete: Indirect	COMPLETE
Alignment (Sagittal) Restoration	Mild (Moderate)	Mild-to-Severe*
ALL (Safe) release: Complex Deformity	??	SAFE
Access to Pathology	Can't Reach L4-S1	T12-S1
Arthrodesis	✓ 87% w BMP	✓ 97% (95% smokers*)
Avoid Complications	24-51% Injuries To Psoas, Nerve, Bowel, Viscera, Vessels	7.2%

Tannoury et al 202

Severe back and buttock and leg pain.



L2-S1 MIS Anterior & Posterior Spinal Fusion



2 WEEKS POST OPERATIVE



conclusion

- Properly performed MIS can significantly reduce complications
- ATP IS VERY INTUITIVE PROCEDURE
- GIVE SIGNIFICANT ACCESS TO THE SPINE
- MECHANICALLY AND NEUROLOGICALLY SOUND
- NO NEED FOR FLUOROSCOPY OR NEURO-MONITORING
- APPLICABLE FOR VERY LARGE SCOPE OF PATHOLOGY

Thank you

&

Good Luck