

Complications in Spine Surgery
Warwick June 2014



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Debate: TLIF vs Lateral Approach

Mr M J H McCarthy
Consultant Spinal Surgeon

Fusion Portfolio Minimally Invasive Surgery Biomaterials Motion Preservation

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KNOW YOUR ENEMY

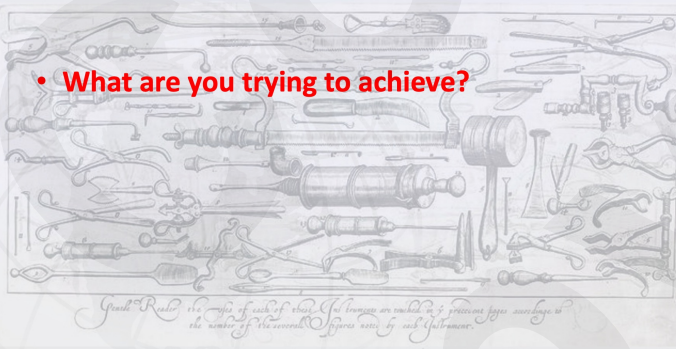
Fusion Portfolio Minimally Invasive Surgery Biomaterials Motion Preservation

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Armamentarium



• **What are you trying to achieve?**

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Indications for Surgery - DRS

- **Decompression**
 - Spinal cord / nerve roots
- **Realignment**
 - Correct deformity
- **Stabilisation**
 - Prevent / Treat
 - Neurological deficit / deformity / pain
 - (Non fusion technology form of "stabilisation")

All may require fusion
Require Instrumentation
Instrumentation increases fusion

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- **LLIF**
 - Tension intact ALL / PLL
 - Indirect decompression
 - Large surface area for fusion across strongest area of bone
 - Good for laterolisthesis > rotated spine
 - Multiple levels same incision
- So, considering a LLIF...

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LLIF Algorithm First Question

- **Contraindications:**
 - L5/S1
 - Low seated L4/5 (look at crests)
 - High grade slip
 - Retroperitoneal scarring / pathology
 - Medical comorbidities / contraindications to surgery
- Yes – then use other technique – TLIF / ALIF etc.

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LLIF Algorithm Second Question

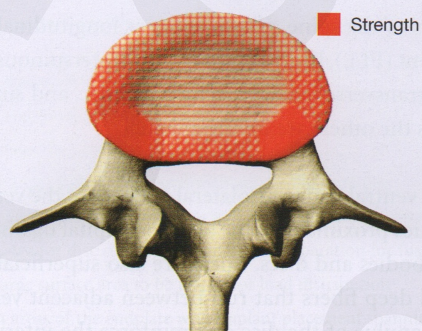
- Is direct decompression of spinal canal needed?
 - Yes
 - Consider single procedure / approach with TLIF / PLIF
 - Surgical philosophy / ability – 2 stages with LLIF may give better deformity correction / fusion

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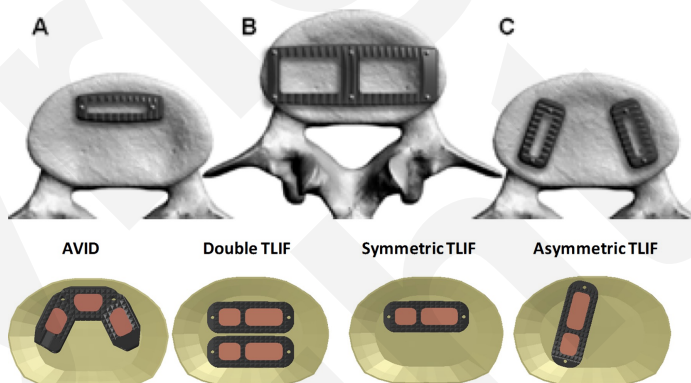
Fusion

- **Fusion – think:**
 - $\propto$ contact surface area ($1/\alpha$ subsidence)
 - $\uparrow$ compression $\downarrow$ tension
 - autograft > allograft > synthetic
 - vascular > avascular
 - structural graft > non structural
 - BMP...
 - And unfortunately fusion may not be $\propto$ clinical outcome

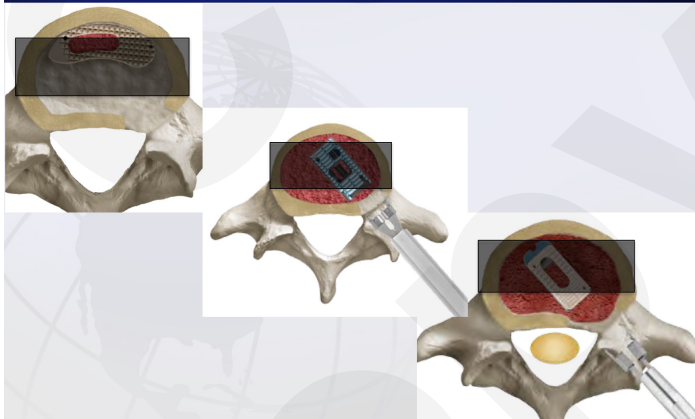
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Biomechanical Analysis and Review of Lateral Lumbar Fusion Constructs

Andrew Cappuccino, MD,* G. Bryan Cornwell, PhD,† Alexander W. L. Turner, PhD,†
Guy R. Fogel, MD,† Huy T. Duong, MD,§ Kee D. Kim, MD,§ and Darrel S. Brodke, MD¶

SPINE Volume 35, Number 26S, pp 5361-5367
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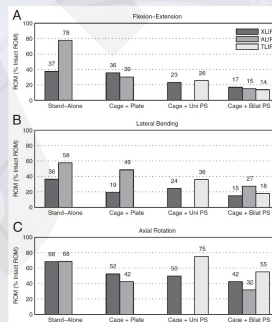


Figure 3. %ROM relative to intact spine for (A) flexion-extension, (B) lateral bending, and (C) axial rotation comparing ALIF (Beaubien et al¹), TLIF (Sucky et al²), and XLF (Current study and Boes et al³). ROM indicates range of motion; Uni, unilateral; PS, pedicle screws.

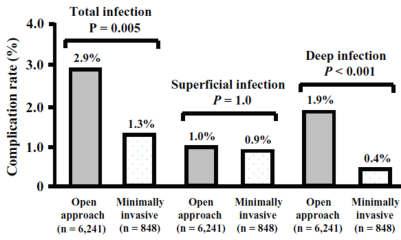
Key Points

- The extreme lateral interbody fusion technique facilitates completion of a full, large discectomy, and lateral placement of a large interbody implant across the ring apophysis of the lumbar vertebrae, while maintaining the anterior longitudinal ligament. The size and placement of the implant and retention of inherent stabilizing structures make this a uniquely stable interbody construct.
- The additional reduction in range of motion with various supplemental internal fixation options is presented to facilitate clinical decision making.
- In comparison with literature-reported results from other studies on interbody construct biomechanics, the lateral interbody implant provides the largest reduction in range of motion in a stand-alone construct. The stability of the interbody construct with supplemental bilateral posterior fixation is similar to that following other interbody techniques (ALIF and TLIF).

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Rates of Infection After Spine Surgery Based on 108,419 Procedures

A Report from the Scoliosis Research Society Morbidity and Mortality Committee



MIS:
Less Pain
Less Infection
Less Bleeding
Short stay

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NASS 2013

123. Clinical Benefit after Lumbar Interbody Fusion: A Prospective, Multi-Institutional Comparative Effectiveness Study of Outcomes after TLIF Versus XLIF

Owoicho Adogwa, MD, MPH¹, Paul Thompson, BS², Kemp T. Knott, BS³, Kevin Huang, BA³, Ulysses Toche, BS³, Joseph S. Cheng, MD⁴, Robert E. Isaacs, MD²; ¹Vanderbilt University, Nashville, TN, US; ²Durham, NC, US; ³Duke University Medical Center, Durham, NC, US; ⁴Vanderbilt University Medical Center Department of Neurosurgery, Nashville, TN, US

CONCLUSIONS: A significant clinical improvement from baseline was noted in multiple-validated outcome measurements following both XLIF and TLIF procedures. No significant difference was observed in the extent of functional improvement between both cohorts. However, patients undergoing TLIF procedures were more likely to experience a postoperative complication.

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Complications TLIF

Perioperative Complications in Transforaminal Lumbar Interbody Fusion Versus Anterior-Posterior Reconstruction for Lumbar Disc Degeneration and Instability

Alan T. Villavicencio, MD,* Sigita Burneikiene, MD,* Ketan R. Bulsara, MD,† and Jeffrey J. Thramann, MD*

- 73 MIS TLIF
- 51 Open TLIF
- 43 AP

J Spinal Disord Tech • Volume 19, Number 2, April 2006

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Complications TLIF

TABLE 3. Major Complications

Complications	TLIF		
	Open	Min. Invasive	AP
Allograft malposition with reoperation	None	None	2 (4.6%)
Pedicle screw malposition with reoperation	None	1 (1.4%)	6 (13.9%)
Neurologic deficit* (> 3 mo)	None	3 (4.1%)	3 (7.0%)
Infection	None	2 (2.7%)	4 (9.3%)
Ileus > 3 d	None	None	6 (13.9%)
Blood vessel damage	None	None	1 (2.3%)
Deep venous thrombosis	None	None	3 (7.0%)
Pulmonary embolus	None	None	2 (4.6%)
Total	0 (0%)	6 (8.2%)	27 (62.8%)

*Screw malposition not included.

- Screw malposition:
 - 14 in TLIF – 1 revised
 - 6 in AP – all revised

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Complications TLIF

TABLE 4. Minor Complications

Complications	TLIF		
	Open	Min. Invasive	AP
Allograft malposition w/o reoperation	None	None	None
Pedicle screw malposition w/o reoperation	5 (9.8%)	8 (10.9%)	None
CSF leak	10 (19.6%)	None	2 (4.6%)
Neurologic deficit* (< 3 mo)	1 (2.0%)	5 (6.8%)	2 (4.6%)
Hematoma	2 (3.9%)	3 (4.1%)	None
Anemia	None	None	2 (4.6%)
Total	18 (35.3%)	16 (21.9%)	6 (13.9%)

*Screw malposition not included.

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Complications TLIF

- Tormenti et al. JNS 2012 p44
 - 531 TLIFs
 - 244 had prev surgery (46%)
 - 1 – 2 – 3 – 4 levels:
 - 317 / 218 / 24 / 2
 - 14.3% durotomy
 - 3.8% infection
 - 2.1% symptomatic screw misplacement
 - 1.8% cage migration
 - Previous op = higher complication rate

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Complications TLIF

- Rihn et al. The Spine J 2009 p623
- 119 single level TLIF 2yr FU
- 33 crest vs 86 rhBMP-2 (37 hydrogel sealant)
- Crest:
 - 1/3 donor site pain, 3% donor site infection, 6% lumbar wound infection, 3% radiculitis
- BMP:
 - 14% radiculitis, 6% osteolysis, 2% ectopic bone, 3.5% lumbar wound infection
 - Sealant – radiculitis 20.4% to 5.4%
- Non union 3% vs 3.5%

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Complications LLIF

Spine

CLINICAL CASE SERIES

Intraoperative and Early Postoperative Complications in Extreme Lateral Interbody Fusion

An Analysis of 600 Cases

W. Blake Rodgers, MD, Edward J. Gebert, PA-C, and Jamie Patterson, BA

- 600 pts 741 levels
- 83% posterior fixation
- 6% perioperative complication rate
 - within 6/52

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TABLE 2. Detailed List of Complications in 600 XLIF Surgeries

Type	n (%)	Description (n)	Consequence
Wound	2 (0.3)	Hernia (1), Subcutaneous hematoma (1)	Required repair,* drainage*
Neural	4 (0.7)	Quadriceps weakness (3), Anterior tibialis weakness (1)	None, all resolved within 3 mo
Vertebral	6 (1.0)	EP fracture (1), VB fracture/subsidence (1), OP fracture (1); adjacent-level compression fracture (2); iatrogenic HNP (1)	5/6 required reoperation (vertebroplasty/2,* decompression/1,* and/or PLF/2*)
Hardware	2 (0.3)†	Implant fracture/subsidence (1), screw break through endplate/subsidence (1)	Required revision (posterior pedicle screw fixation/2*)
GI	7 (1.2)	Ileus (6), gastric volvulus (1)	Repair of gastric volvulus*
Respiratory	7 (1.2)	Pneumonia (5), pulmonary embolus (2)	2 prolonged intubations, antibiotics, anticoagulation
Cardiac	6 (1.0)	Atrial fibrillation (5), MI at 6 wks (1)	None/medical treatment
Renal	2 (0.3)	Urinary retention (1), peritoneal catheter occlusion (1)	Revision of catheter*
Hematologic	1 (0.2)	Postoperative anemia (1)	Transfusion
Total	37 (6.2)		*11 reoperations

*The hernia in the lateral incision was repaired surgically some months after the index procedure; the large subcutaneous hematoma on the lateral incision was operatively drained the first postoperative night.

†There were an additional two incidences of interbody implant fracture during impact, but they were inconsequential and replaced during the index procedure and so are not included in the total number of defined complications.

EP indicates end plate; GI, gastrointestinal; MI, myocardial infarction; OP, osteophyte; PLF, posterior intertransverse fusion; VB, vertebral body.



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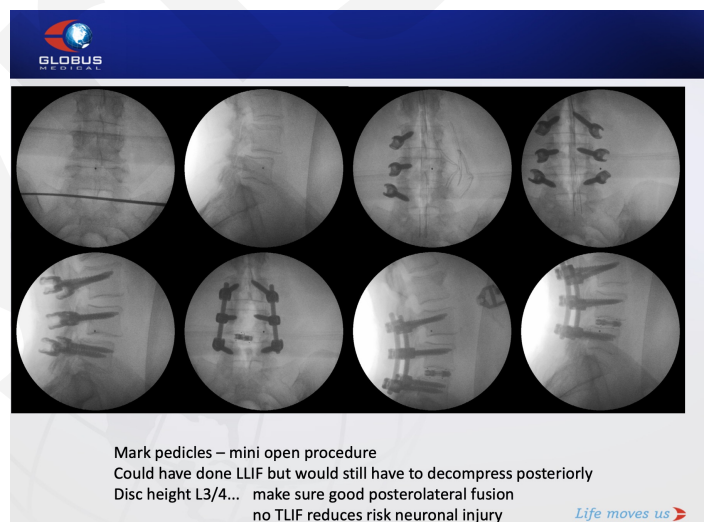
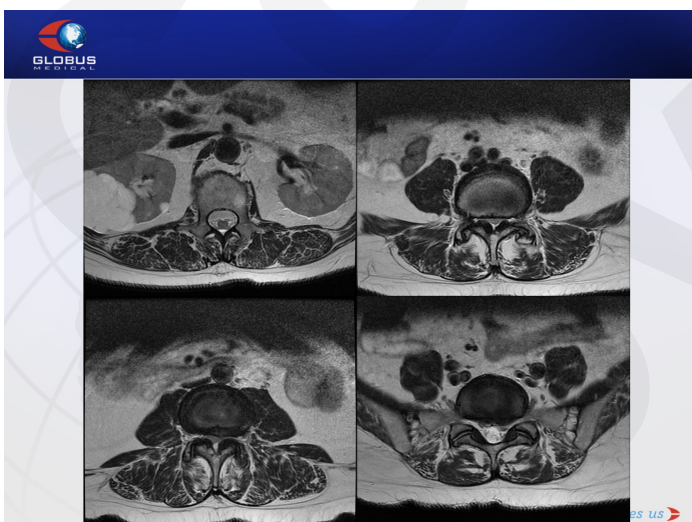
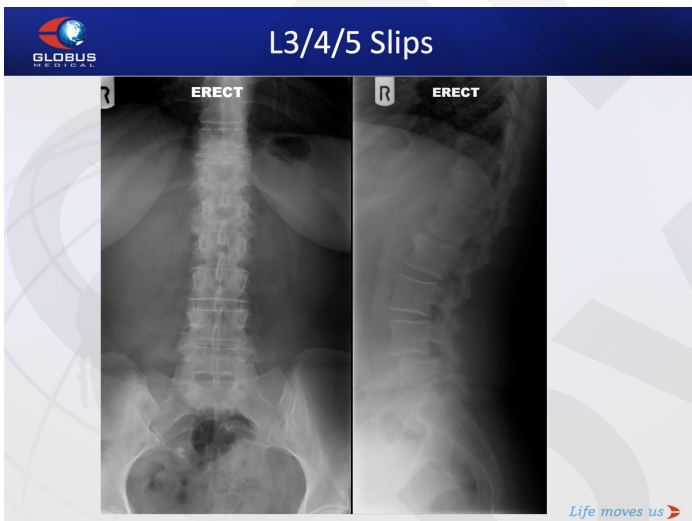
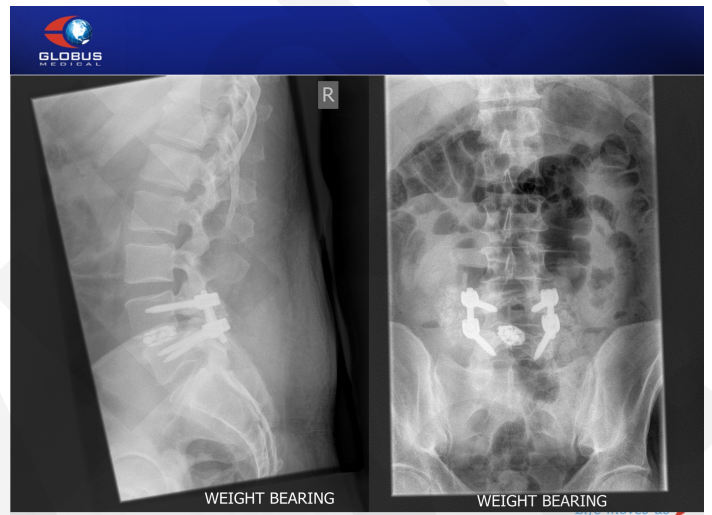
Cases

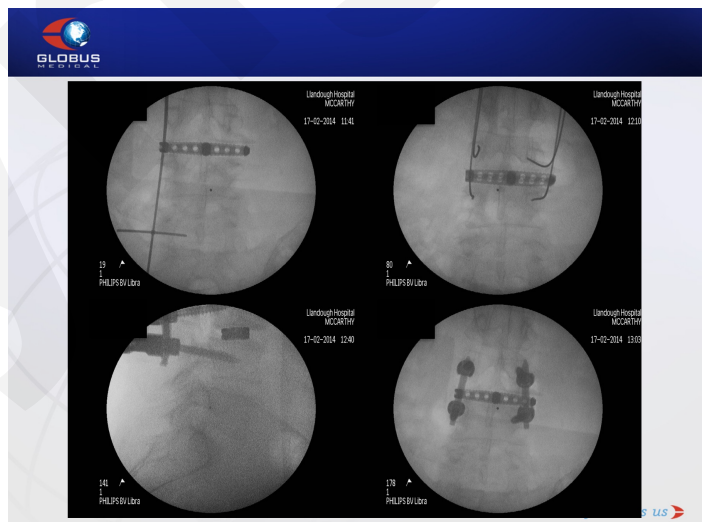
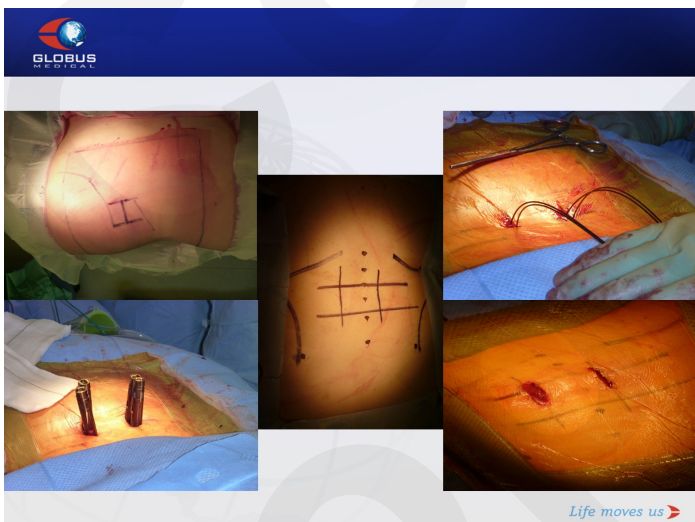
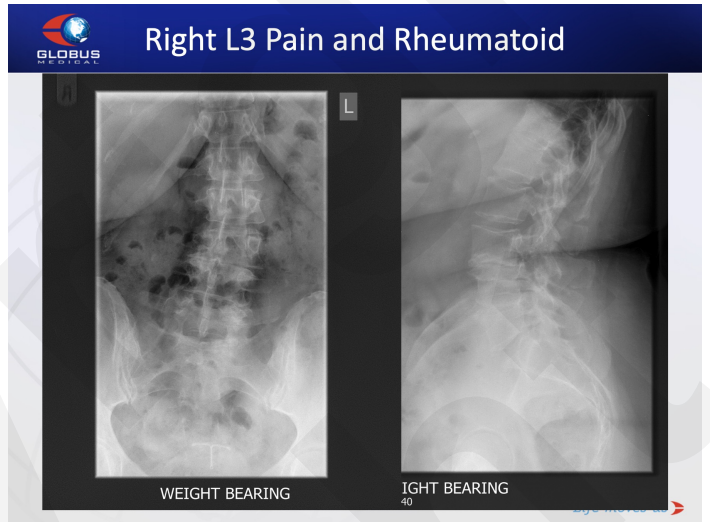
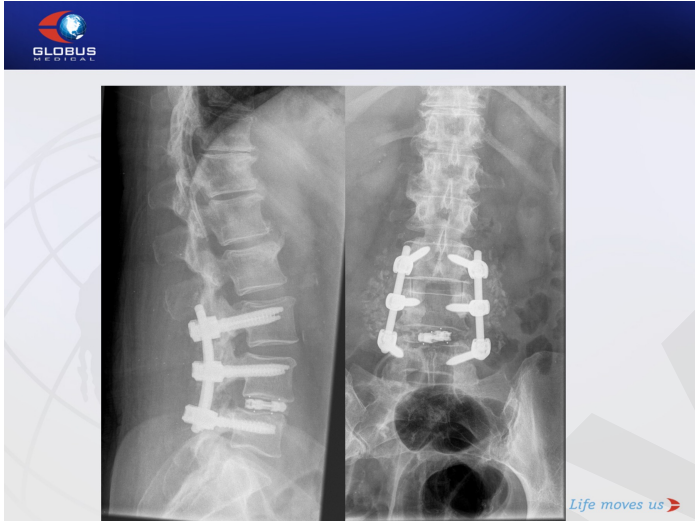
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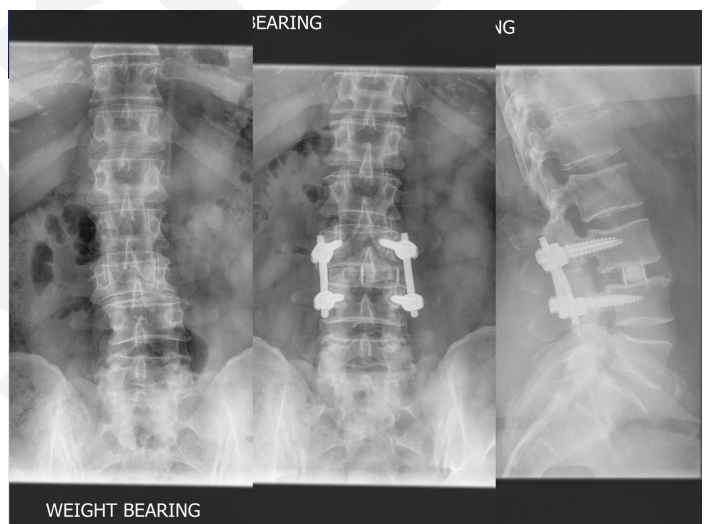
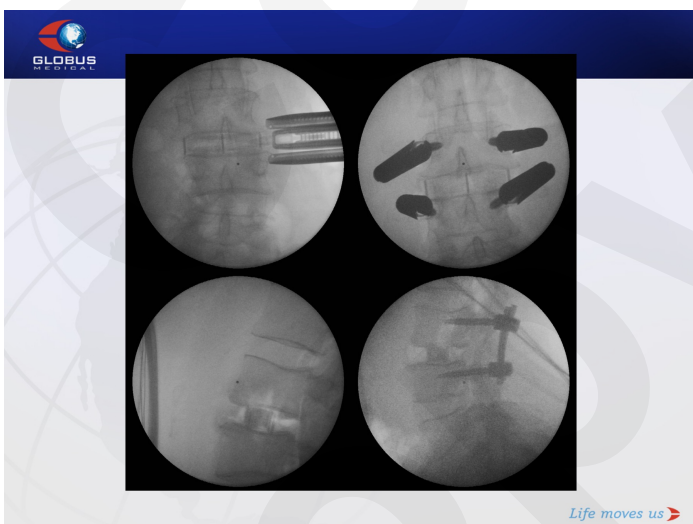
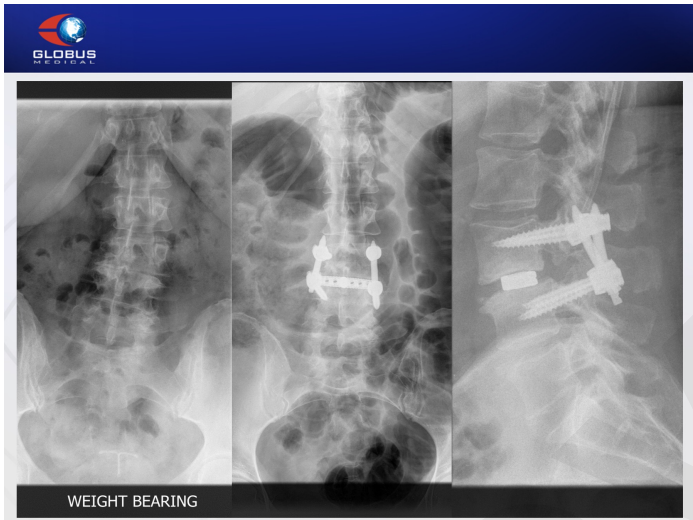
L4/5 Slip Unilateral Foraminal Stenosis

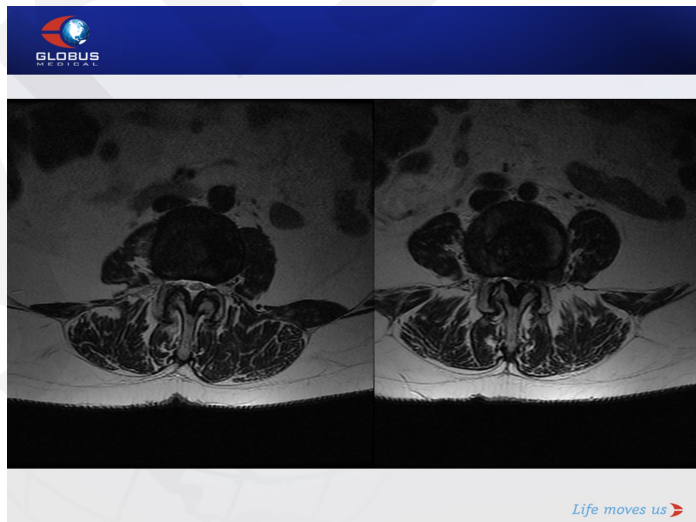
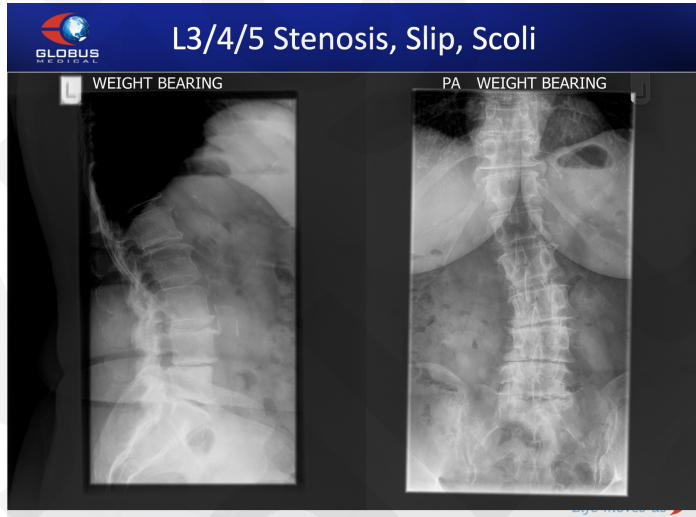
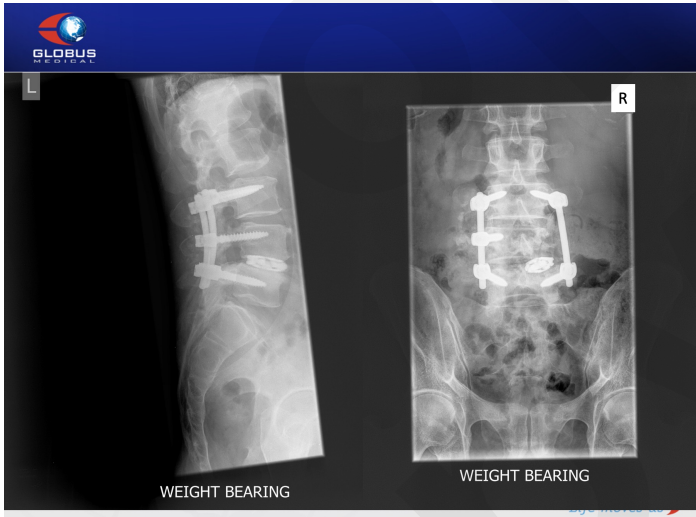
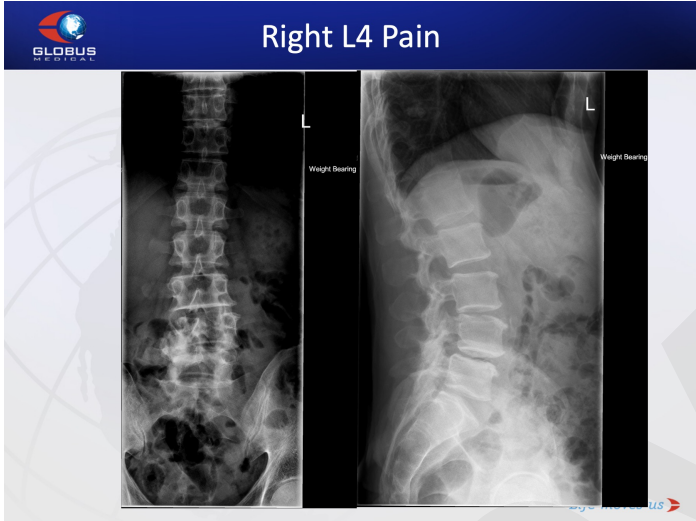


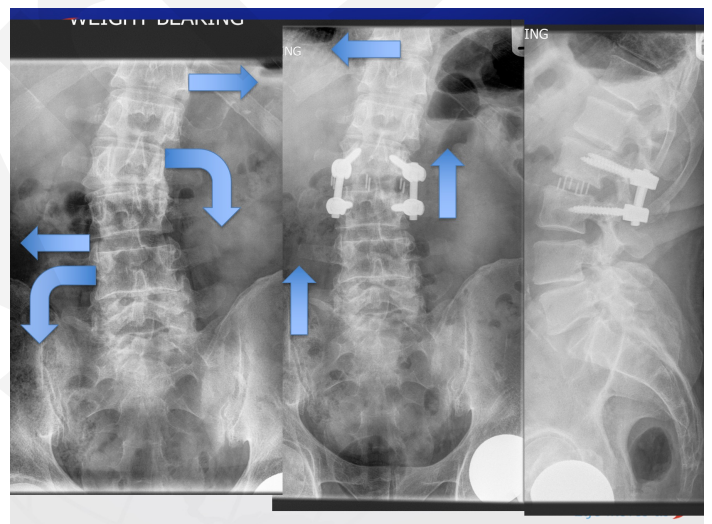
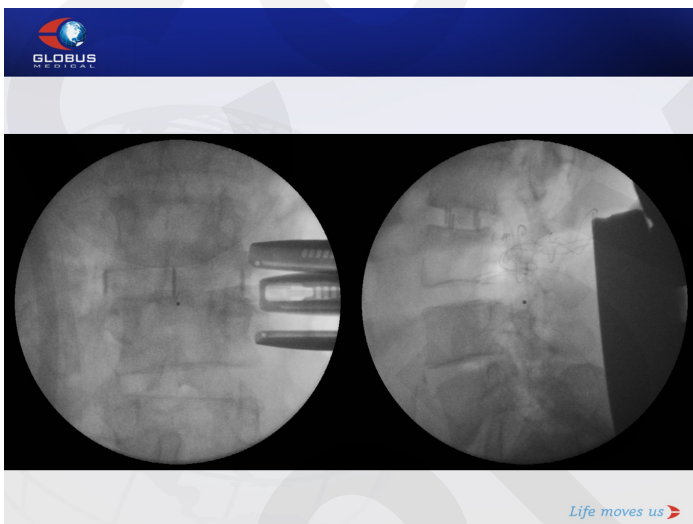
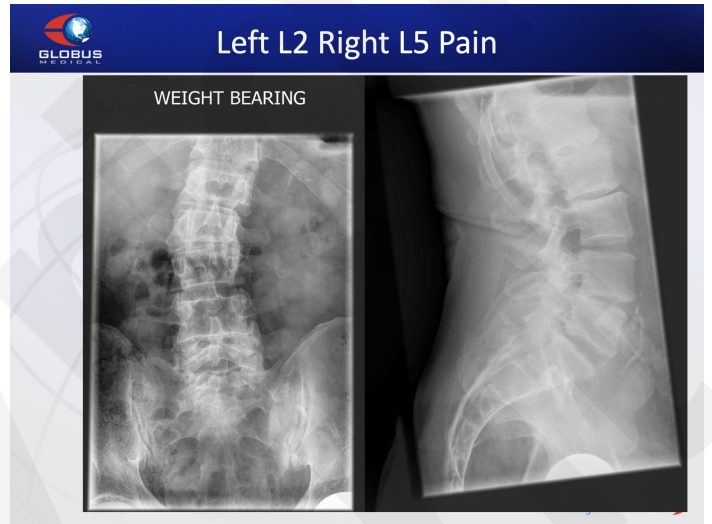
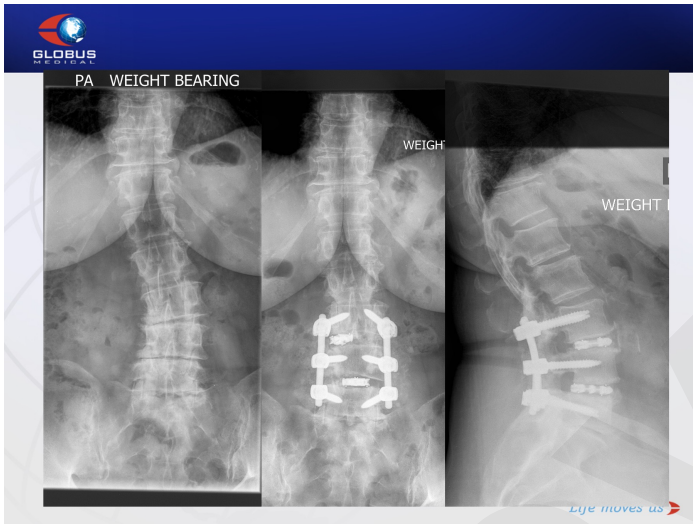
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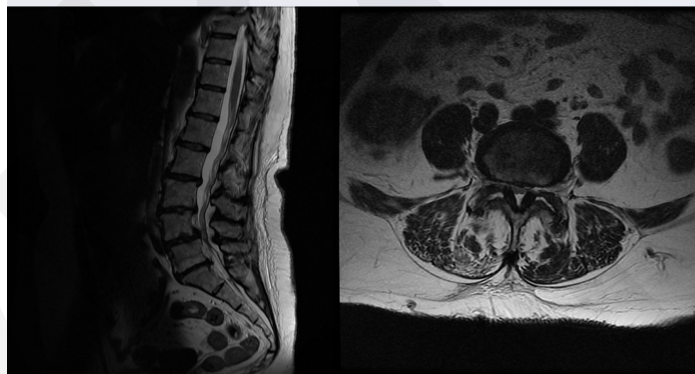
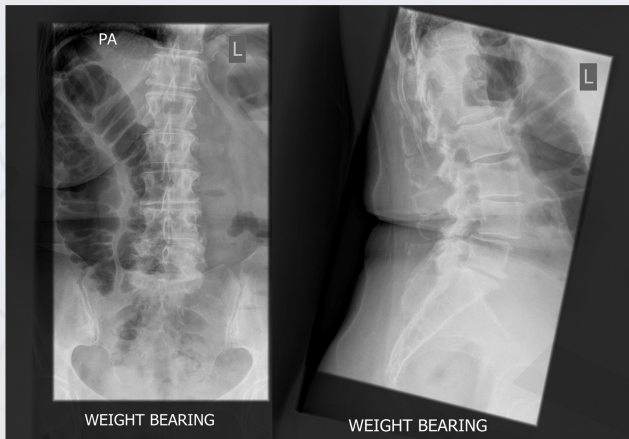




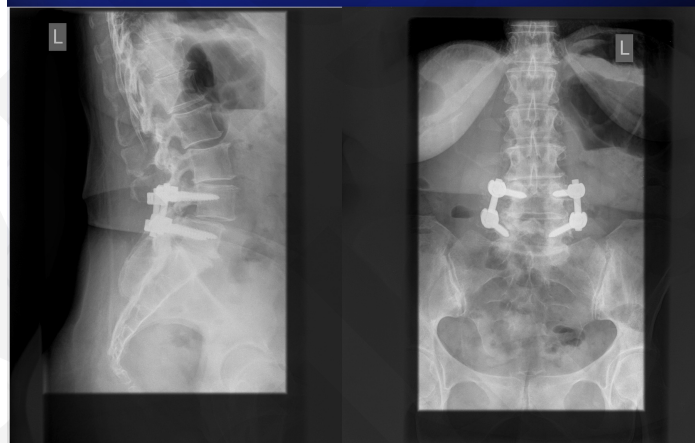




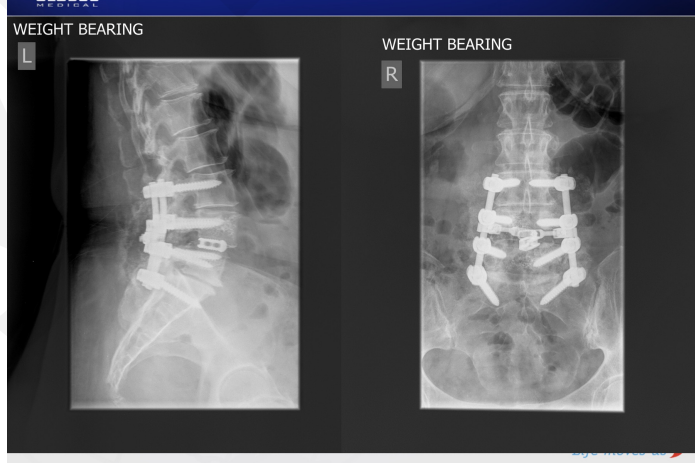
L4/5 SPL then...

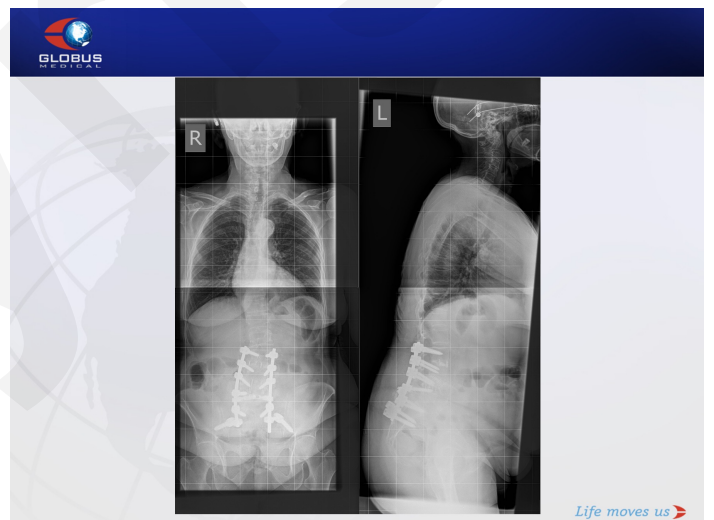
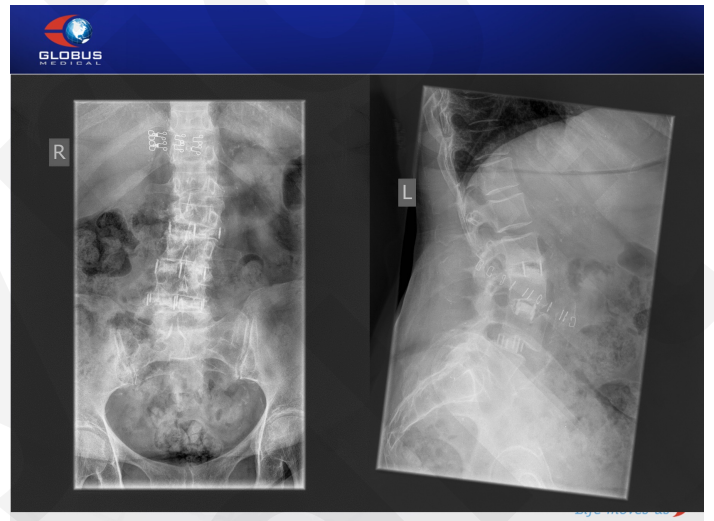
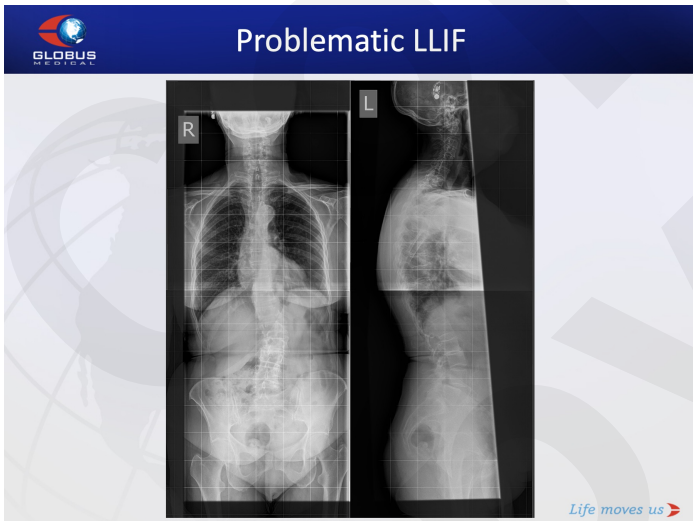
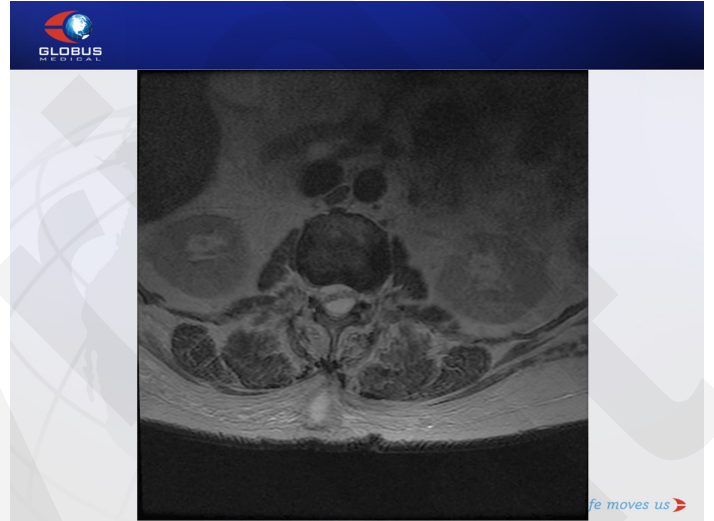


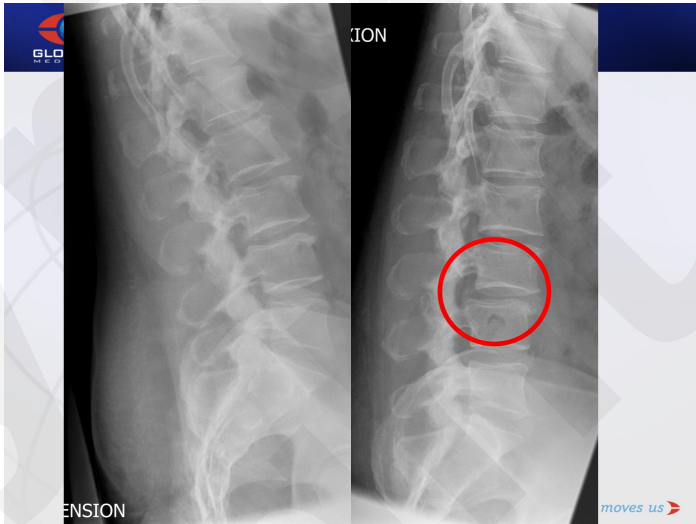
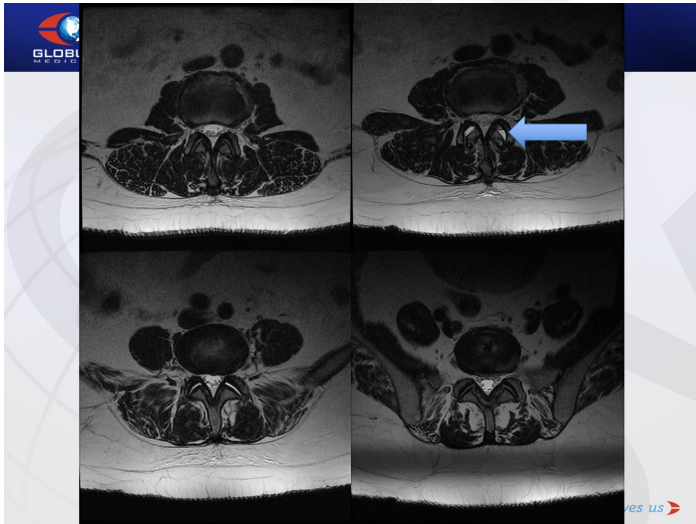
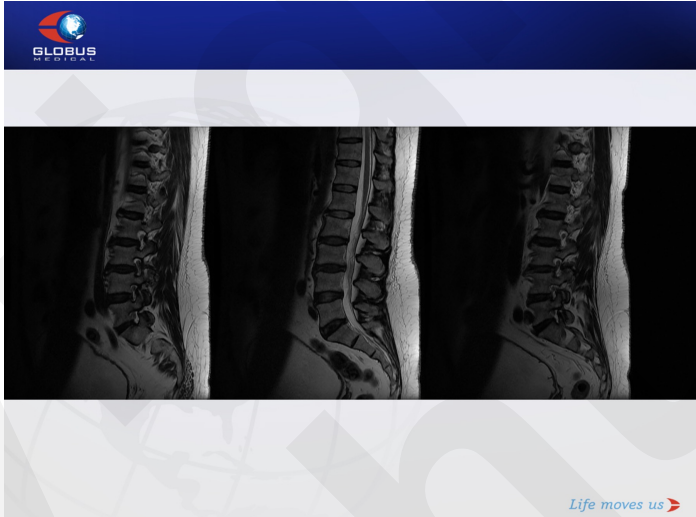
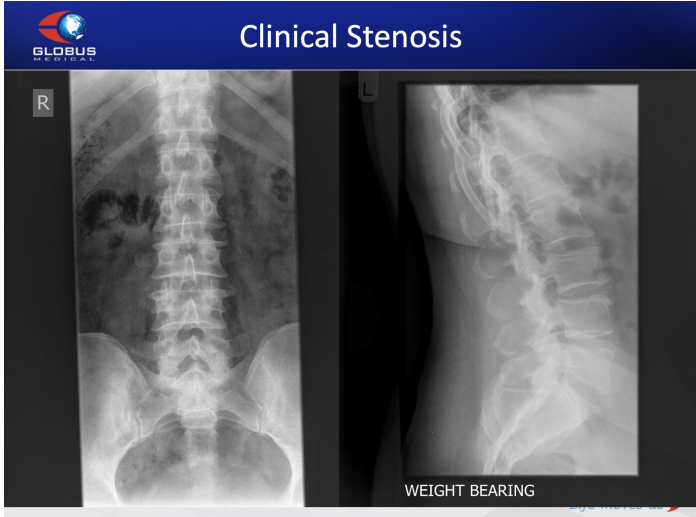
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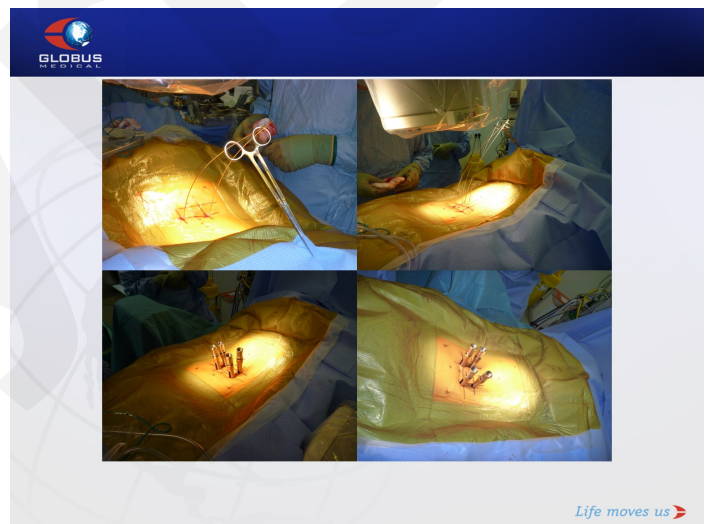
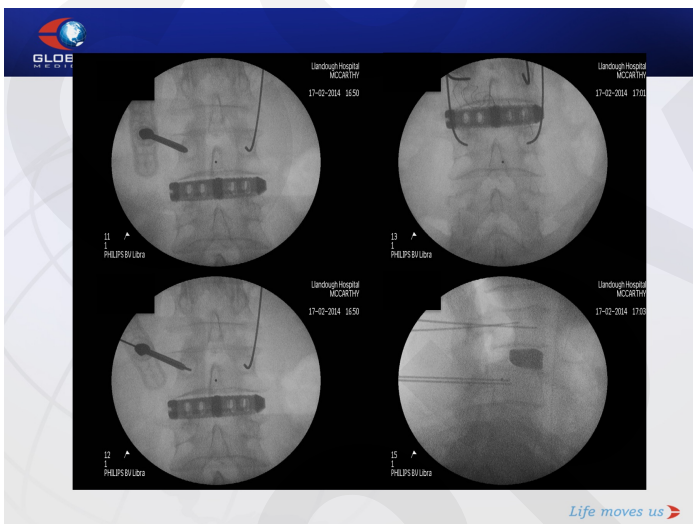
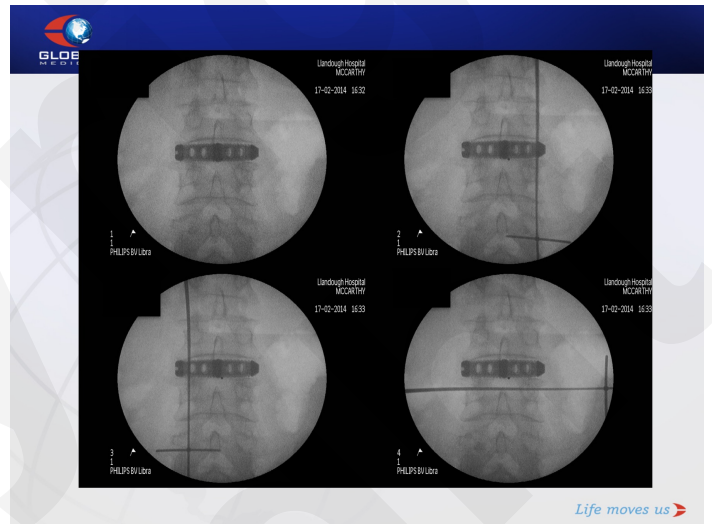
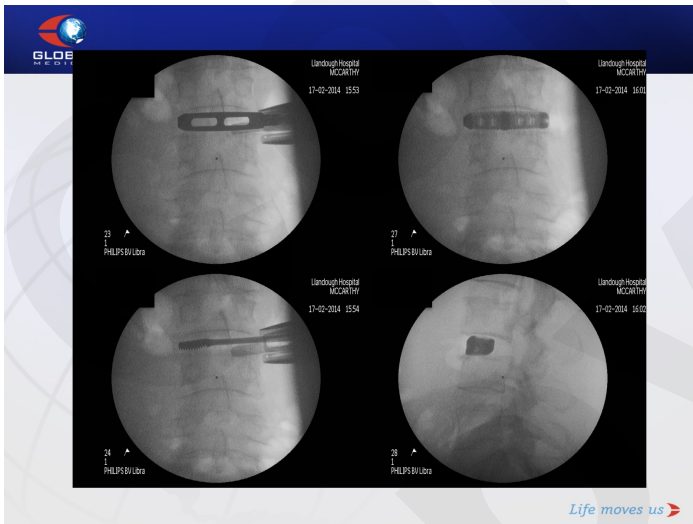
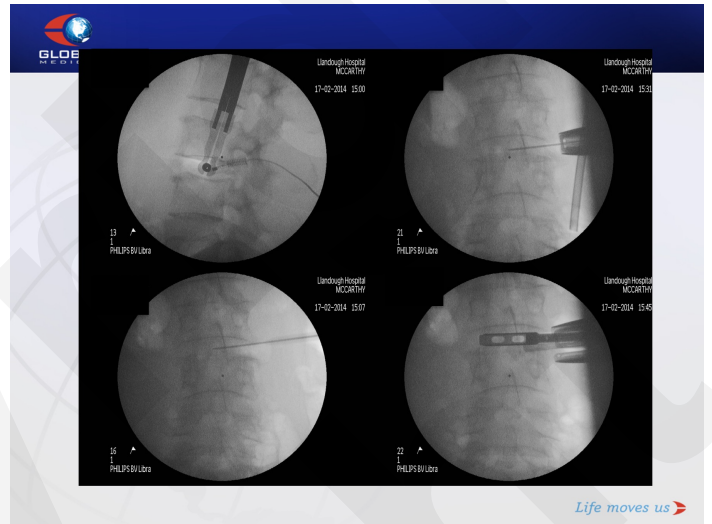
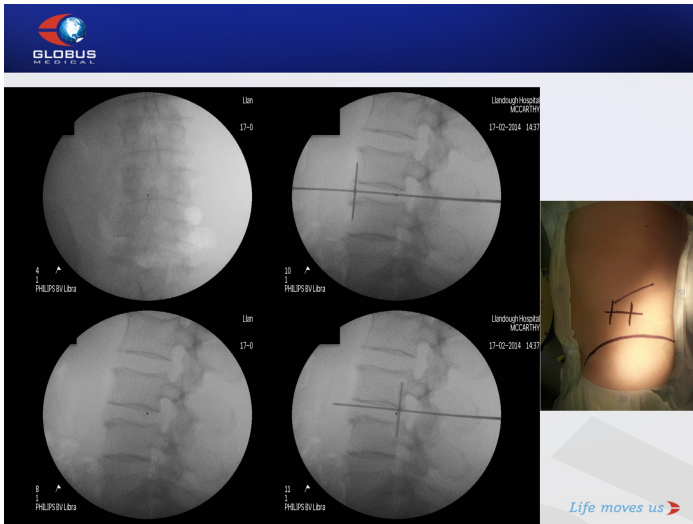


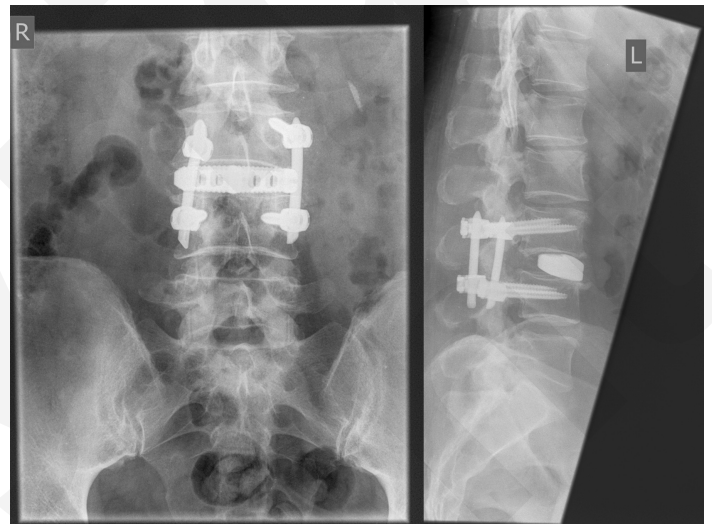
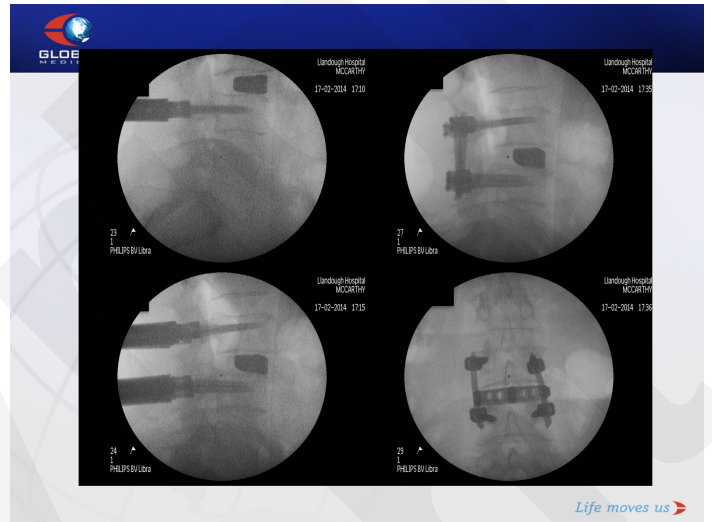
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A Radiological Comparison of Anterior Fusion Rates in Anterior Lumbar Interbody Fusion

M. J. H. McCarthy¹ L. Ng² G. Vermeersch² D. Chan²

¹Department of Trauma and Orthopaedics, Cardiff and Vale Spinal Unit, Llandough Hospital, Cardiff, United Kingdom

²Department of Trauma and Orthopaedics, Royal Devon and Exeter Hospital, Exeter, United Kingdom

Address for correspondence and reprint requests M. J. H. McCarthy, Department of Trauma and Orthopaedics, Cardiff and Vale Spinal Unit, Llandough Hospital, Penlan Road, Llandough, Cardiff CF64 2XX, United Kingdom (e-mail: mikemccarthy@doctors.org.uk).

Global Spine J 2012;2:195-206.

Posterior instrumentation without posterior fusion increases anterior fusion rates

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Surgical Options

	Advantages	Disadvantages
PLIF	Bilateral access to canal, restores lordosis	Painful, infection, neural / dural injury scarring, limited higher up
Mini Open and MIS PLIF	Less painful, low infection, less blood loss, faster recovery	Fusion?, neural / dural injury scarring, limited higher up
Open TLIF	Access, fusion	Painful, infection, neural / dural injury scarring, endplate damage / subsidence
Mini Open TLIF	Less painful, low infection, fusion, less blood loss	Neural / dural injury scarring, disc preparation, endplate damage / subsidence
MIS TLIF	Even less pain, low infection, avoids paraspinal muscle damage, less blood loss, faster recovery	Fusion?, neural / dural injury scarring, disc preparation, endplate damage / subsidence
LLIF + Perc Post	Good fusion, less painful, low infection, T5-L5, avoids canal, less visceral vessel injury then ALIF, avoids paraspinal muscle damage, less blood loss, faster recovery	L4/S??, L5/S1 – No, endplate damage / subsidence, plexus injury, diaphragm injury, pneumothorax
ALIF + Perc Post	Best fusion, best restoration lordosis, less painful, low infection, avoids canal, avoids paraspinal muscle damage, mostly less blood loss than a TLIF	Access Surgeon, ilio-lumbar vein, visceral vessel injury, ileus, not above L3

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More Comparisons

MIS Technique	Direct Decompression	Interbody Fusion	Screw Stabilization	Spondy Reduction (Low Grade)	Postero-Lateral Fusion
MOTLIF	✓	✓	✓	✓	✓
pTLIF*	✓	✓			
PPS**			✓	✓	
pTLIF + PPS	✓	✓	✓	✓	
XLIF		✓			
XLIF + PPS		✓	✓	✓	
Mini-ALIF		✓			
Mini-ALIF + PPS or Plate		✓	✓	✓	

*pTLIF: percutaneous TLIF through non-expandable tubes; **PPS: percutaneous pedicle screws

?

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- Biomechanics – not much in it
- All comes down to FUSION...
- What would I want
 - The pathology addressed in the most appropriate way by a surgeon who knows what they're doing, can do it well and knows their limitations

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Spine

CLINICAL CASE SERIES

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Intraoperative and Early Postoperative Complications in Extreme Lateral Interbody Fusion

An Analysis of 600 Cases

W. Blake Rodgers, MD, Edward J. Gerber, PA-C, and Jamie Patterson, BA

Conclusions. Compared with traditional open approaches, the MIS lateral approach to fusion by using the XLIF technique resulted in a lower incidence of infection, visceral and neurologic injury, and transfusion as well as markedly shorter hospitalization. Complications in MIS XLIF compare favorably with those from other MIS fusion procedures; duration of hospitalization is shorter than with any previously reported technique.

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Complication rates of minimally invasive spine surgery compared to open surgery: A systematic literature review

Justin Kane, MD^a, Andrew Kay, BS^b, Mitchell Maltenfort, PhD^c, Christopher Kepler, MD, MBA^d, Todd Albert, MD^d, Alexander Vaccaro, MD, PhD^d, and Kris Radcliff, MD^{d,*}

SEMIN SPINE SURG 25 (2013) 191-199

Applying our inclusion/exclusion criteria left 14 publications for review. Overall complication rates were not statistically significant between MIS and traditional groups. The incidence of dural tears was 1.1% (26/1339) in patients undergoing MIS versus 2.1% (20/939) for traditional surgery ($p = 0.57$). The incidence of infection was 1.1% (19/1682) in patients undergoing MIS versus 2.2% (29/1332) for traditional surgery ($p = 0.09$). The incidence of screw malposition was 2.8% (3/106) in patients undergoing MIS versus 1% (1/102) for traditional surgery ($p = 0.48$). The incidence of root injury was 2.9% (2/70) in patients undergoing MIS versus 0% (0/142) for traditional surgery ($p = 0.45$). The incidence of need for revision surgery was 3.8% (25/662) in patients undergoing MIS versus 3.2% (26/819) for traditional surgery ($p = 0.93$). MIS did not confer any statistically significant advantage over traditional surgery for any of the complications reviewed.

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