



GLOBUS MEDICAL

Pedicle Subtraction Osteotomy (Lumbar)

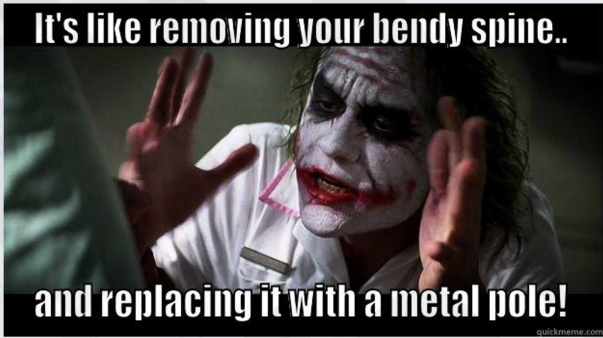
Mr M J H McCarthy

Fusion Portfolio Minimally Invasive Surgery Biomaterials Motion Preservation

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Spinal Surgery



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Workshop - PSO




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Indications for Surgery

- **What are you trying to achieve?**
 - Non-maleficence - "first, do no harm" (primum non nocere).
- **DO THE APPROPRIATE OPERATION FOR THE PATIENT AND THEIR PATHOLOGY AND YOUR SKILL / ABILITY**

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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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The 7 Ps

- Proper
- Planning and
- Preparation
- Prevents
- Piss
- Poor
- Performance



Attention to detail
Never let your guard down

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Pay Attention To The Detail...



Yesterday afternoon I was walking and holding hands with my wife. I suddenly dropped her hand and grabbed my cell phone to take this picture. She hit me in my chest and wouldn't talk to me the rest of the day. Last night, she asked me "How could you?" I said "How could I not? It's not every day you see a dog driving a car."

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Roles of Osteotomies

- Loosen stiff curves
- Address fixed deformity
- Reduce strain on instrumentation/bone interface during deformity correction
- Permit shortening or lengthening of portions of the spinal column

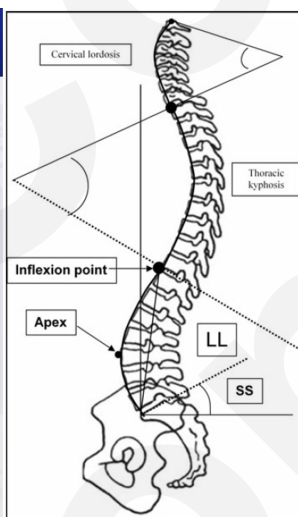
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Type	Description	Diagram	Reference
1	Resection of posterior elements from mid pars above to pedicle below with realignment of the spine through hinging through a mobile disc anteriorly		Ponte
2	Resection of posterior elements from mid pars above to pedicle below with realignment of the spine through hinging through a mobile disc anteriorly		Smith-Peterson
3	Posterior-based transpedicular decancellation of the vertebral body with realignment through controlled fracture of the anterior column		Heinig
4	Posterior-based intraosseous wedge resection of the vertebral body with realignment through osteoclasis of the proximal third of the anterior vertebral body		Thomassen (PSO)
5	Posterior-based wedge resection with extension of the osteotomy into the supra-adjacent disc and realignment hinging on the anterior column at the intervertebral space		Mod Thomassen (Ext PSO)
6	Posterior-based vertebral column resection including one or more vertebra with adjacent discs		Suk (VCR)

Posterior Osteotomy Techniques

- Post Shortening - Ponte
- Post Shortening Ant Elongation - Smith P
– Also asymmetric
- Post and Middle Shortening - PSO
– Also asymmetric and extended
- 360 - VCR
- (Anterior release and Anterior Osteotomy)

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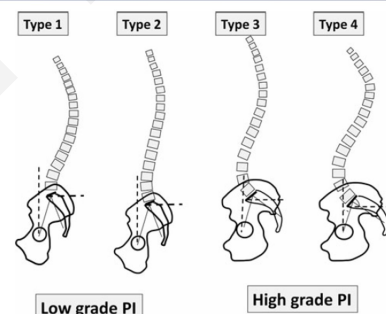
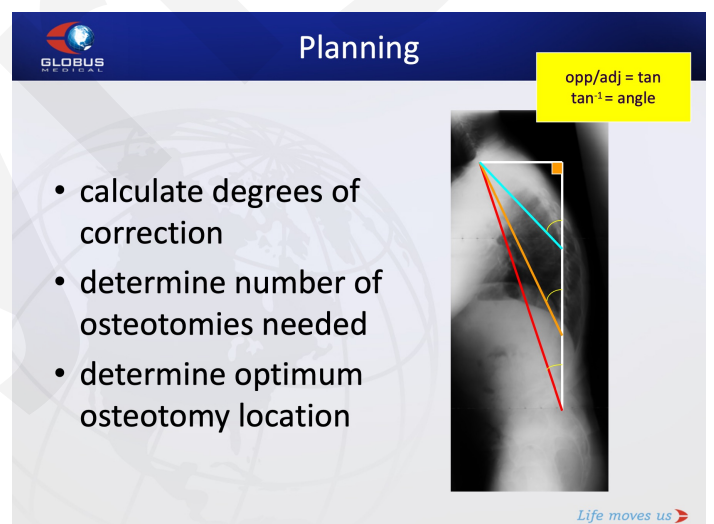
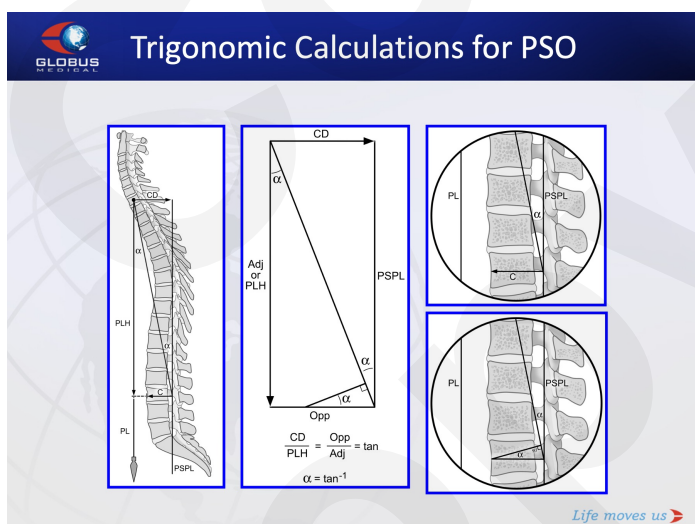
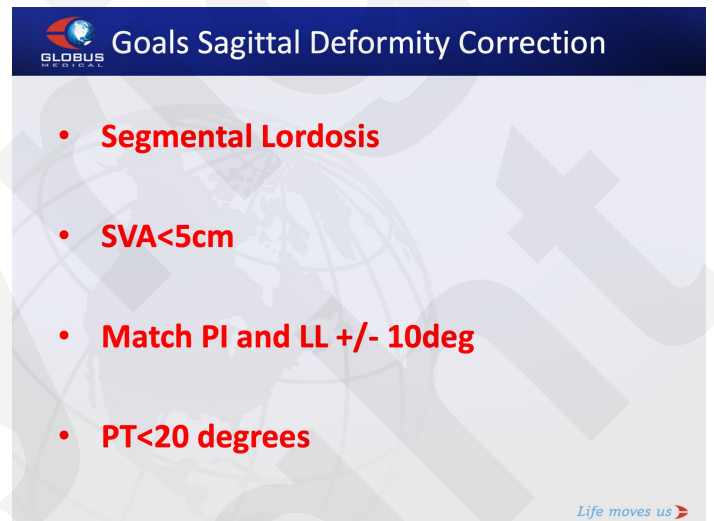
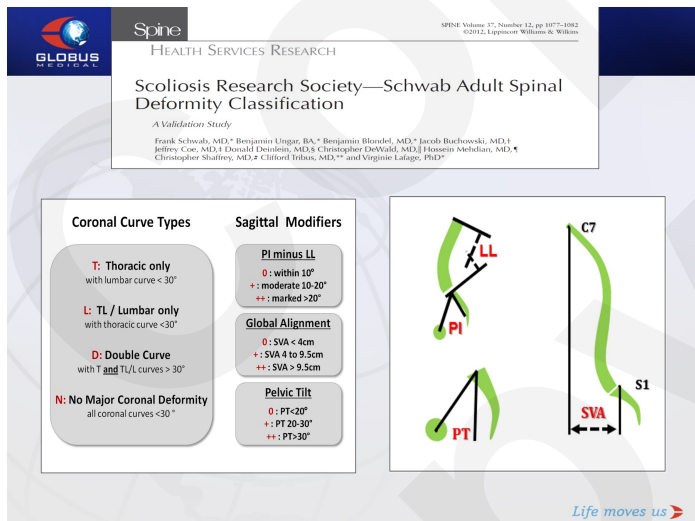
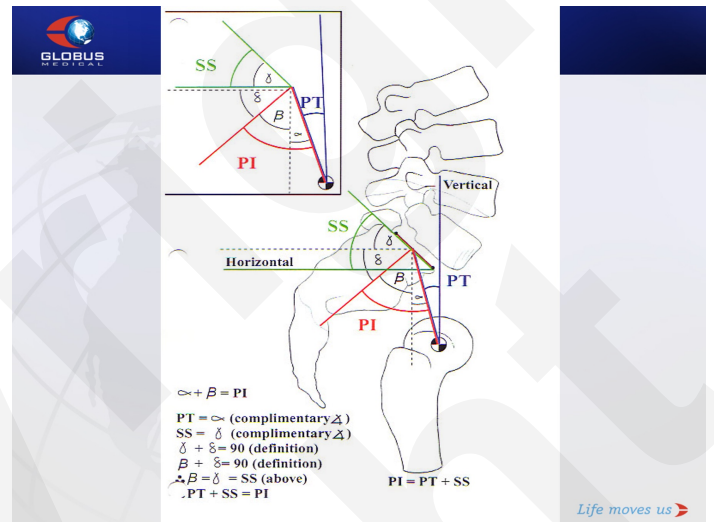
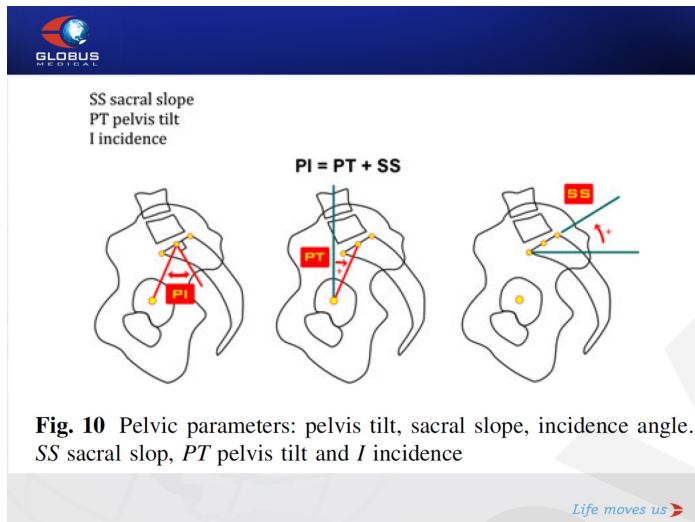
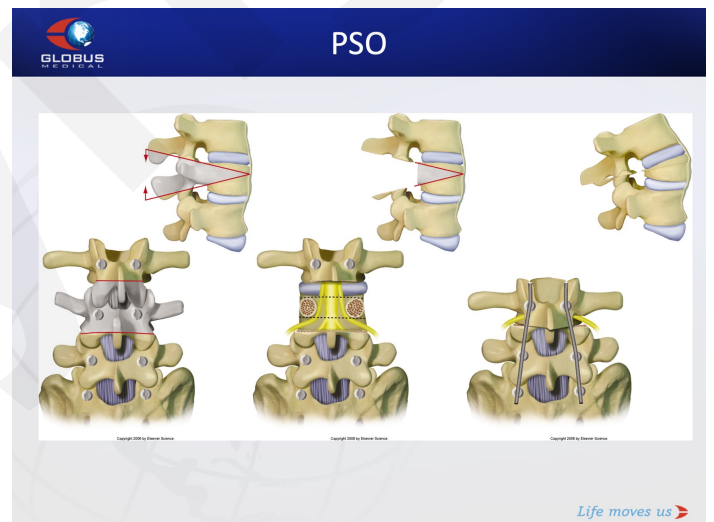
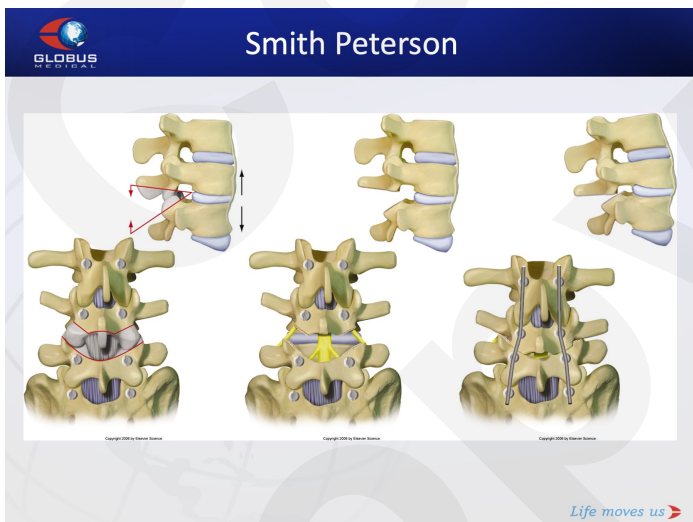
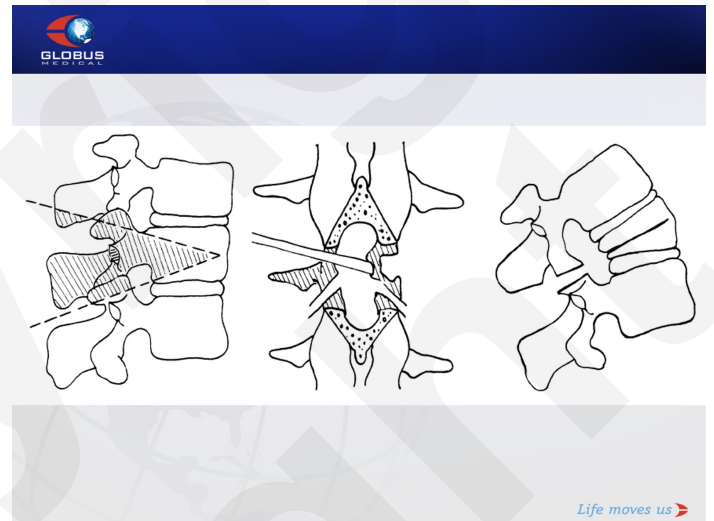
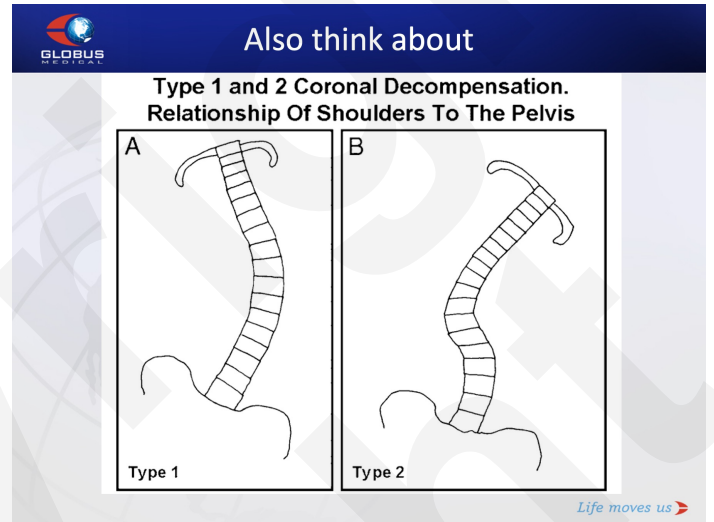
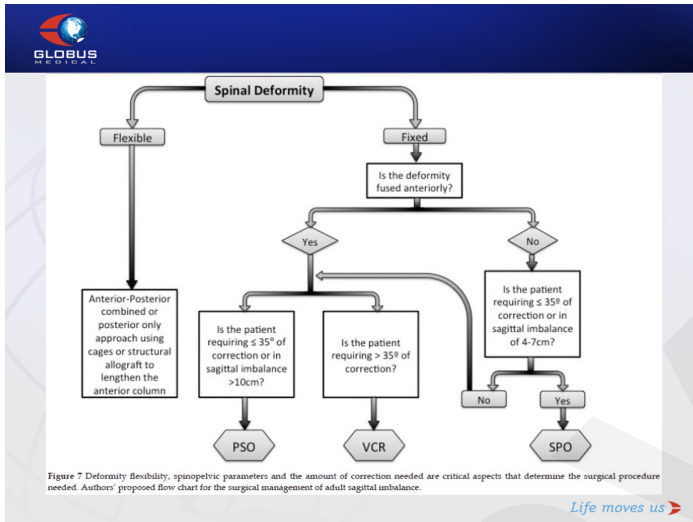
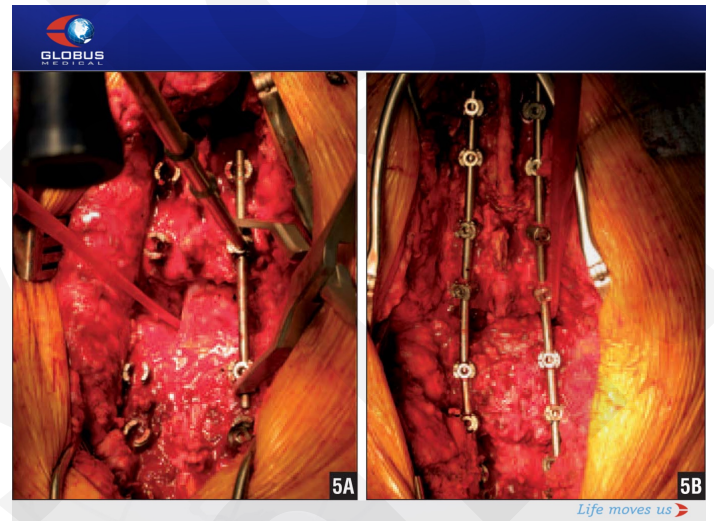
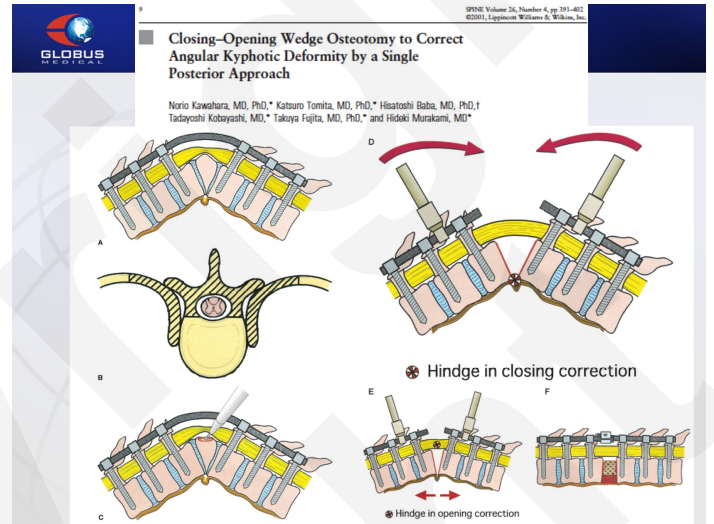
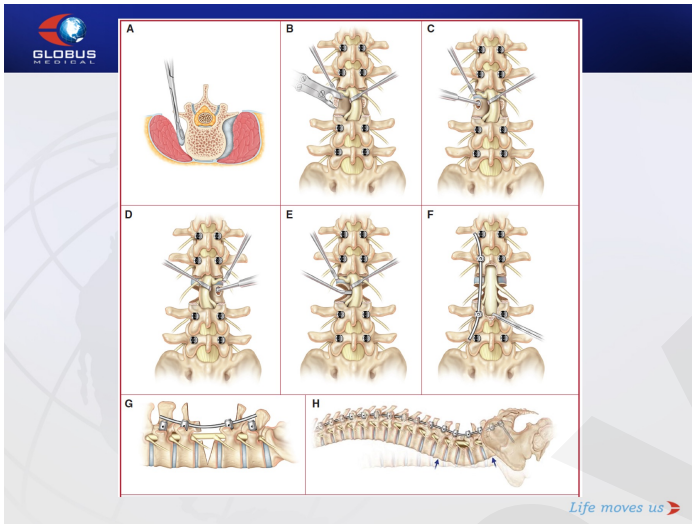


Fig. 4 The shape of lumbar lordosis depends on SS orientation. Type 1 and 2 have SS < 35°; Type 3 has 35° < SS < 45°; Type 4 has SS > 45°. Generally Type 1 and 2 have a low PI and Type 3 and 4 have a high PI

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COMPLICATIONS

COMPLICATIONS IN SPINE SURGERY
An International Educational Training Program

AGENDA

LONDON, UK
3-4 JUNE 2016

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Spine
DEFORMITY

SPINE Volume 37, Number 14, pp 1198-1210
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Major Complications and Comparison Between 3-Column Osteotomy Techniques in 105 Consecutive Spinal Deformity Procedures

Joshua D. Auerbach, MD,* Lawrence G. Lenke, MD,* Keith H. Bridwell, MD,* Jennifer K. Sehn, BS,* Andrew H. Milby, MD,† David Bumpass, MD,* Charles H. Crawford, III, MD,* Brian A. O'Shaughnessy, MD,* Jacob M. Buchowski, MD,* Michael S. Chang, MD,* Lukas P. Zebala, MD,* and Brenda A. Sides, MA*

- 105 pts – 87 PSO 18 VCR
- 38% vs 22% major complications ave = 35%
- PSO blood loss 1800ml

Measure	Complication Category			
	Major Permanent	Major Transient	Minor Only	None
No. (%)	8 (8)	29 (28)	31 (30)	37 (35)

Instrumentation-Related Complications of Multilevel Fusions for Adult Spinal Deformity Patients Over Age 65
Surgical Considerations and Treatment Options in Patients With Poor Bone Quality

Christopher J. DeWald, MD, and Thomas Stanley, MD

- ¼ progressive junctional kyphosis

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Spine
DEFORMITY

SPINE Volume 36, Number 12, pp 958-964
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Short-term Morbidity and Mortality Associated With Correction of Thoracolumbar Fixed Sagittal Plane Deformity

A Report from the Scoliosis Research Society Morbidity and Mortality Committee

Justin S. Smith, MD, PhD,* Charles A. Sansur, MD, MHS,† William F. Donaldson III, MD,‡ Joseph H. Perra, MD,§ Ram Mudiyan, MD, MBA,¶ Theodore J. Choma, MD,** Reinhard D. Zeller, MD,†† D. Raymond Knapp, Jr., MD,‡‡ Hilali H. Noordeen, MD,§§ Sigurd H. Berven, MD,¶¶ Michael J. Goytan, MD,*** Oneneba Boachie-Adjei, MD,††† and Christopher I. Shaffrey, MD*

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TABLE 2. Complications Associated with the Surgical Treatment of 578 Patients with Fixed Sagittal Plane Deformity, Stratified Based on Corrective Technique*

Complication	No. by Type of Osteotomy (%)						
	No Osteotomy, n = 176 (%)	Osteotomy, n = 402 (%)	SPO (n = 135)	PSO (n = 215)	VCR (n = 18)	ADC (n = 19)	Not Specified (n = 15)
Death*	1 (0.6)	2 (0.5)	1 (0.7)	1 (0.5)	0	0	0
Dural Tear†	4 (2.3)	30 (7.5)	9 (6.7)	15 (7.0)	2 (11.1)	2 (10.5)	2 (13.3)
Wound Infection	5 (2.8)	17 (4.2)	3 (2.2)	12 (5.6)	1 (5.6)	1 (5.3)	0
Superficial	2 (1.1)	5 (1.2)	0	4 (1.9)	0	1 (5.3)	0
Deep	3 (1.7)	12 (3.0)	3 (2.2)	8 (3.7)	1 (5.6)	0	0
New Neurological Deficit‡	2 (1.1)	20 (5.0)	5 (3.7)	15 (7.0)	0	0	0
Implant Failure	3 (1.7)	7 (1.7)	1 (0.7)	6 (2.8)	0	0	0
Wound Hematoma	2 (1.1)	7 (1.7)	2 (1.5)	5 (2.3)	0	0	0
Epidural Hematoma	1 (0.6)	7 (1.7)	3 (2.2)	3 (1.4)	1 (5.6)	0	0
Nonfatal PE	0	6 (1.5)	1 (0.7)	4 (1.9)	1 (5.6)	0	0
Pulmonary (not PE)	4 (2.3)	8 (2.0)	2 (1.5)	5 (2.3)	0	1 (5.3)	0
DVT	0	4 (1.0)	0	2 (0.9)	2 (11.1)	0	0
Visual Loss	1 (0.6)	0	0	0	0	0	0
Other	7 (4.0)	32 (8.0)	11 (8.1)	16 (7.4)	3 (16.7)	1 (5.3)	1 (6.7)
Total§	30 (17.0)	140 (34.8)	38 (28.1)	84 (39.1)	11 (61.1)	6 (31.6)	3 (20.0)

There were a total of 170 complications in 132 patients.

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Clinical Article

Clinical Outcomes and Complications after Pedicle Subtraction Osteotomy for Fixed Sagittal Imbalance Patients : A Long-Term Follow-Up Data

Seung-Jae Hyun, M.D., Ph.D.,¹ Seung-Chul Rhim, M.D., Ph.D.²
Department of Neurosurgery,¹ Seoul National University College of Medicine, Bundang Hospital, Seongnam, Korea
Department of Neurosurgery,² Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

- Single surgeon over 7 years – 13 PSOs
- 8/13 major complication
- 3/13 PJK
- Blood loss 3L

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Spine Deformity

Spine Deformity 1 (2013) 51–58

www.spine-deformity.org

Perioperative Outcomes and Complications of Pedicle Subtraction Osteotomy in Cases With Single Versus Two Attending Surgeons

Christopher P. Ames, MD^{a,*}, Jeffrey J. Barry, MD^b, Sassan Keshavarzi, MD^a, Ozgur Dede, MD^b, Michael H. Weber, MD^b, Vedat Deviren, MD^b

^aDepartment of Neurological Surgery, University of California, 505 Parnassus Avenue, RM M-779, Box 0112, San Francisco, CA 94143-0112, USA
^bDepartment of Orthopaedic Surgery, University of California, 500 Parnassus Ave, MUW 314, Box 0728, San Francisco, CA 94143-0112, USA

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Spine

CLINICAL CASE SERIES

SPINE Volume 37, Number 19, pp 1667–1673
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Outcome of Pedicle Subtraction Osteotomies for Fixed Sagittal Imbalance of Multiple Etiologies

A Retrospective Review of 140 Patients

Ki-Tack Kim, MD, Sang-Hun Lee, MD, Kyung-Soo Suk, MD, Jung-Hee Lee, MD, and Bi-O Jeong, MD

TABLE 4. Details of Complications	
Diagnosis	Complications
Ankylosing spondylitis	Permanent 1-eye blindness (1) Transient radiculopathy (5) Cord compression (1) Transitional paralytic ileus (4) Dural tears (2)
Post-traumatic kyphosis	Acute adrenal insufficiency (1)
Flatback syndrome	Wound infection (1)
Congenital kyphoscoliosis	Dural tear (1) Transitional paralytic ileus (1) Transient radiculopathy (1)
Post-tuberculous kyphosis	Chronic renal failure (1) Dural tear (1) Transitional paralytic ileus (2) Transient radiculopathy (1) Wound infection (1)

Values within parentheses are numbers.

**140 cases
13% compl**

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Eur J Orthop Surg Traumatol
 DOI 10.1007/s00590-014-1470-8

ORIGINAL ARTICLE

Pedicle subtraction osteotomy in the lumbar spine: indications, technical aspects, results and complications

Cedric Barrey • Gilles Perrin • Frederic Michel • Jean-Marc Vital • Ibrahim Obeid

- 25 Lumbar cases
- 20% major complication
- 1000ml +/- 500 blood loss
- Op time 240mins +/- 45

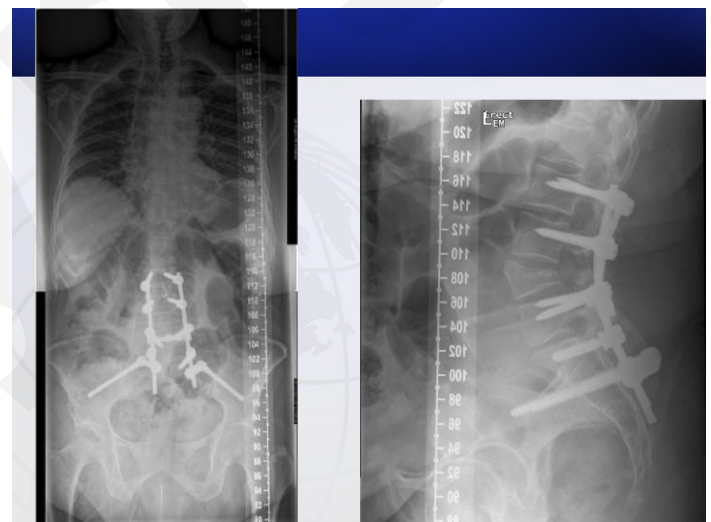
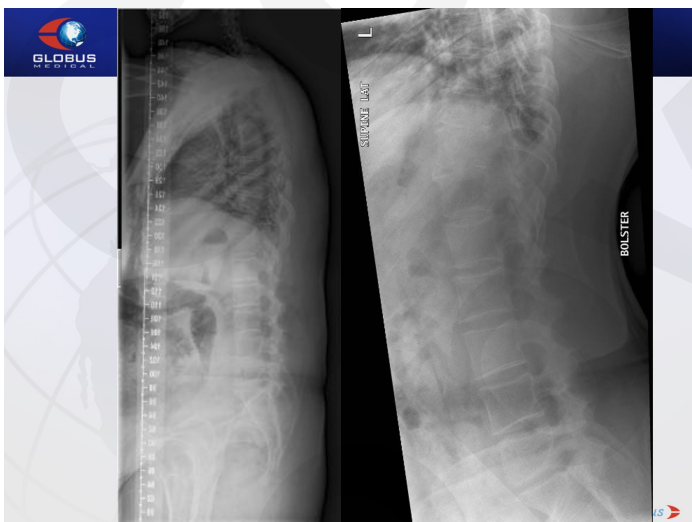
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Cases and Complications



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Problems with PSO

- Can't see the XRs
- Can't see because its bleeding
- Inadequate / too much correction
- Translation at osteotomy
- Collapse not wedge
- Dural tear – often revision case
- Nerve compression
- Non union - disc levels posterior elements
- PJK / DJK / Screw loosening
- Osteoporosis

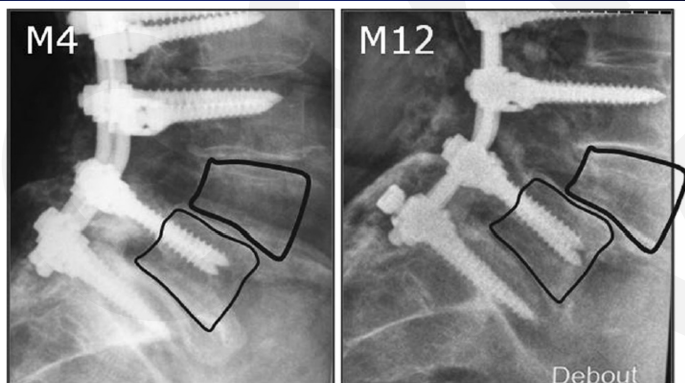
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Some thoughts

- Operation Volume
- Mono screws across osteotomy
- 2 Surgeons
- 2 vs 4 rods (double headed screws...)

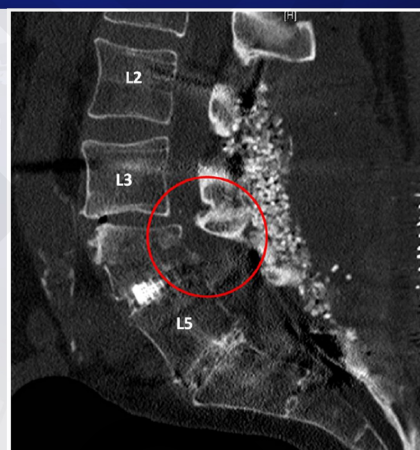
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Translation



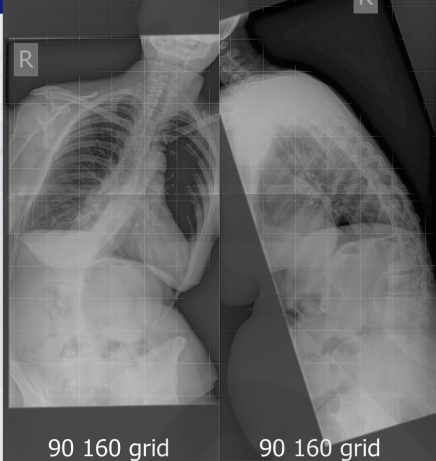
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Inadequate Decompression



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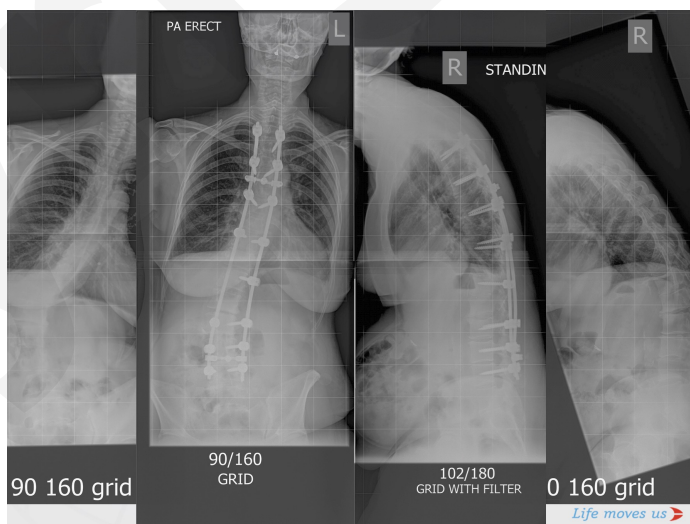
Inadequate Osteotomy



90 160 grid

90 160 grid

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90 160 grid

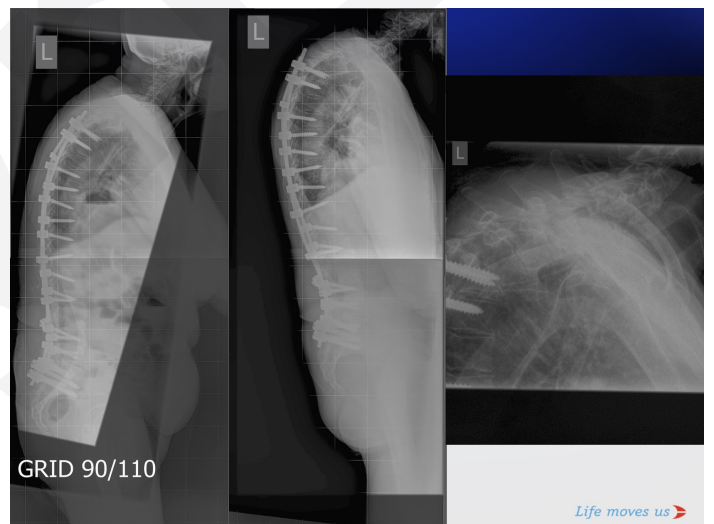
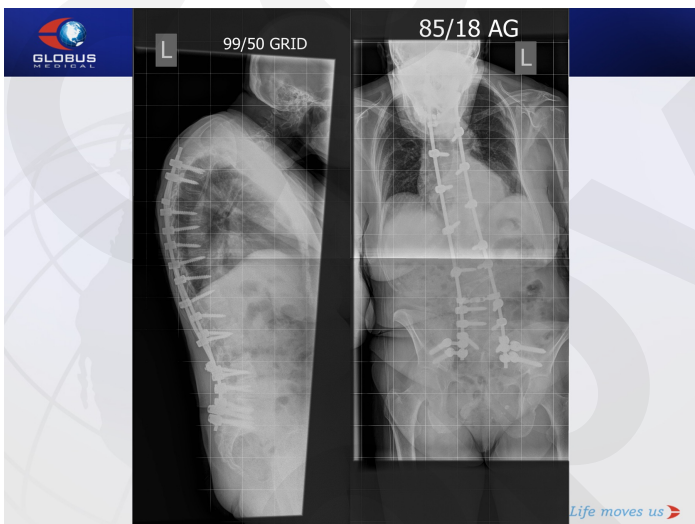
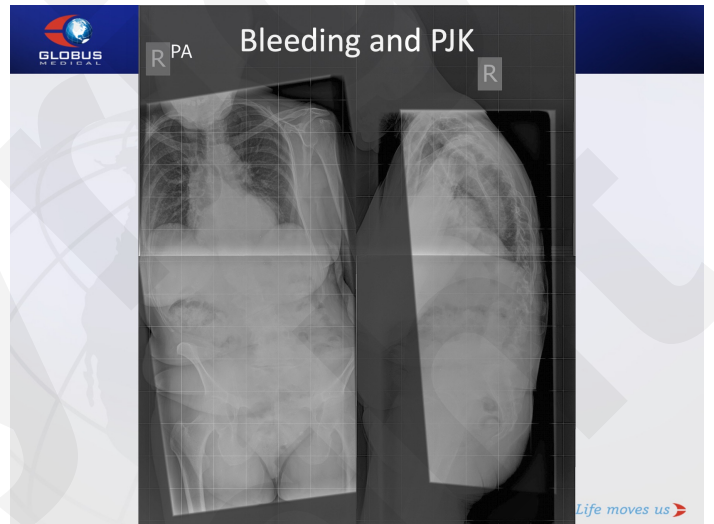
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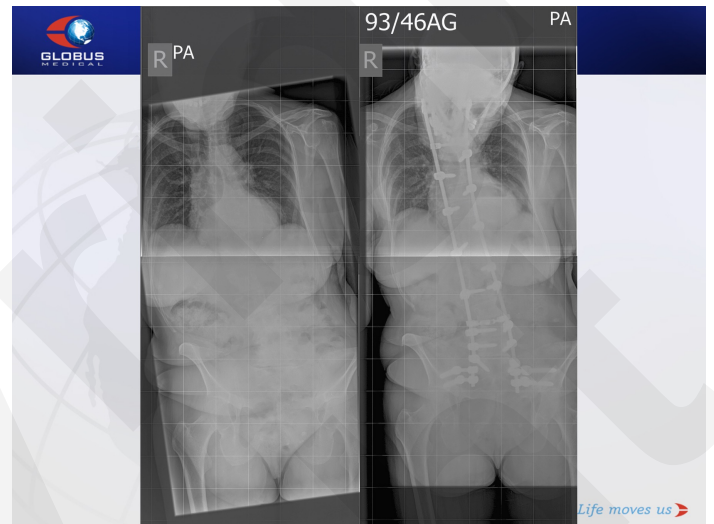
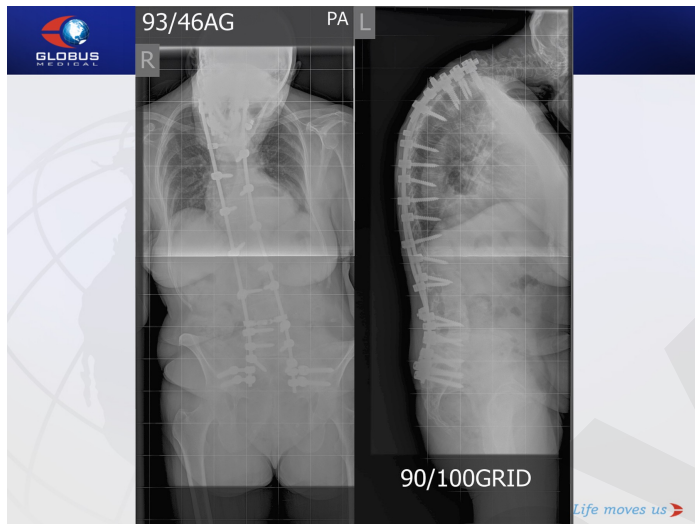
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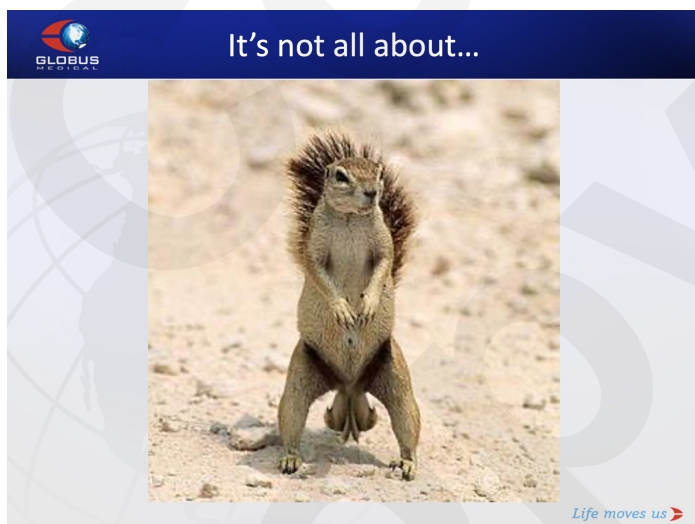


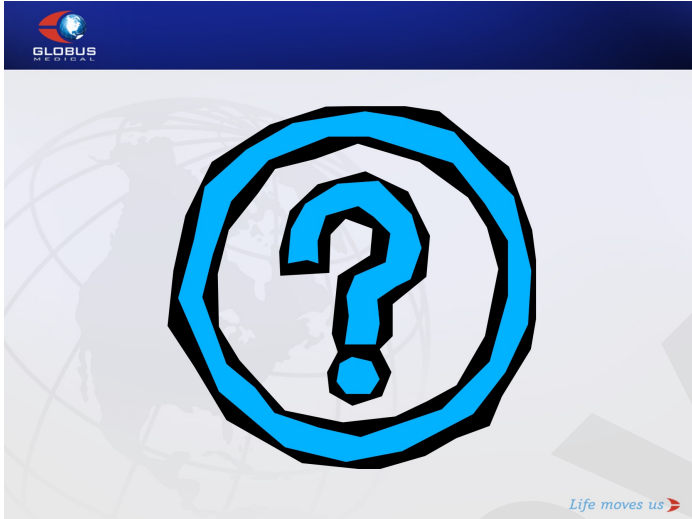


Vascular Complications Associated with Osteotomy in Ankylosing Spondylitis: A Report of Two Cases

CRISTOPHER WEATHERLEY, MD, FRCS, FRCS, ED (Orth),* DAVID JAFFRAY, FRCS,* and ARTHUR TERRY, MD†

- Aortic Fracture and DEATH





Attention to detail
Never let your guard down

