

**Anterior Column Release / Realignment (ACR)
vs.
Pedicle Subtraction Osteotomy (PSO)**

Joseph M. Zavatsky, M.D.
Spine & Scoliosis Specialists
Tampa, FL

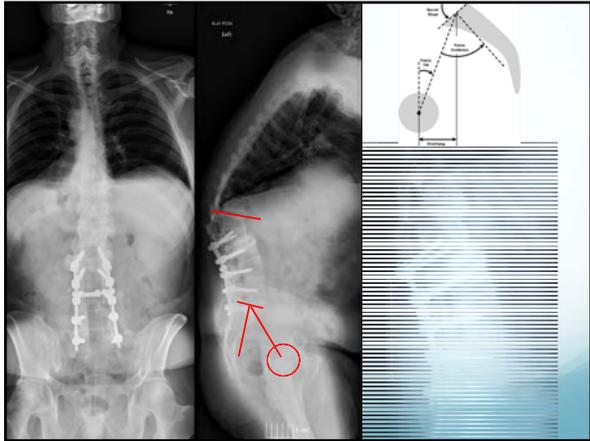
Disclosures

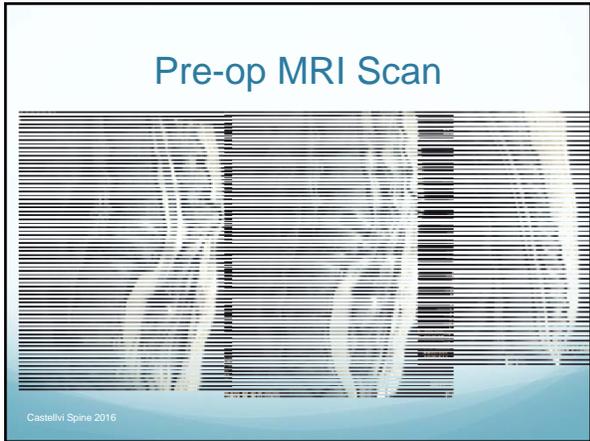
- Consultant - DePuy Synthes Spine, Biomet, Amendia, Stryker
- Stock - Innovative Surgical Solutions, Safe Wire
- Royalties - Biomet

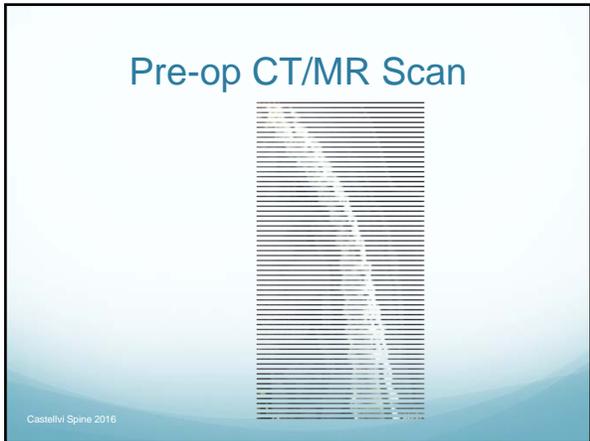
Case JB

- 66 y/o male 74" 235 lbs
- Retired police officer
- C/O low back pain, bilateral leg pain with weakness, numbness and tingling.
- S/P fusion L2-S1 in 2004
 - History of smoking 3 ppd (stopped 10 years ago)

Castellvi Spine 2016







Pedicle Subtraction Osteotomy (PSO)

- **PSO yields approximately 20 to 35° lordosis**, in comparison to approximately 8 to 10° per level with posterior column osteotomies (SPOs).
- 3CO procedures, however, also carry **high morbidity**
 - **20% risk of new motor weakness**
 - **Increased EBL**
 - 100% risk of any complication, especially in older patients
 - Surgical
 - Medical
- Published data suggests **open approaches remain advantageous for more severe and fixed deformities**.
- In a multicenter minimally invasive database, patients with marked sagittal deformities (SRS-Schwab “++”) saw improvement in back pain (VAS), but did not significantly improve in leg pain (VAS), pelvic parameters (pelvic incidence–lumbar lordosis mismatch, pelvic tilt, or sagittal vertical axis), or disability (ODI).

J Neurosurg Spine 17:530-539, 2012

Anterior longitudinal ligament release using the minimally invasive lateral retroperitoneal transposas approach: a cadaveric feasibility study and report of 4 clinical cases

Laboratory investigation

ARMEN R. DEUKMEDJIAN, M.D., TIEN V. LE, M.D., ALI A. BAAJ, M.D., ELIAS DARWAZ, M.D., DONALD A. SMITH, M.D., AND JUAN S. URIBE, M.D.
Department of Neurosurgery and Brain Repair, University of South Florida, Tampa, Florida

- In the cadaveric study, sectioning of the ALL proved to be feasible from the minimally invasive lateral retroperitoneal transposas approach.
- The **structures at most immediate risk during this procedure were the aorta, inferior vena cava, iliac vessels, and sympathetic plexus**.
- As an adjunct, **4 clinical cases of ALL release** through the minimally invasive lateral retroperitoneal transposas approach were reviewed. Operative technique, results, complications, and early outcomes were assessed.
- **The mean increase in segmental lumbar lordosis per level of ALL release was 10.2°**
 - **Global lumbar lordosis improved by 25°**.
- Each level of ALL release took 56 minutes and produced 40 ml of blood loss on average. Visual analog scale and Oswestry Disability Index scores improved by 9 and 35 points, respectively.
- There were **no cases of hardware failure, and as of yet no complications to report**.

Conclusions: This initial experience suggests that ALL release through the minimally invasive lateral retroperitoneal transposas approach may be feasible, allows for improvement of lumbar lordosis without the need of an open laparotomy/thoracotomy, and minimizes the tissue disruption and morbidity associated with posterior osteotomies.

J Neurosurg Spine 20:513-522, 2014
EANS, 2014

Management of sagittal balance in adult spinal deformity with minimally invasive anterolateral lumbar interbody fusion: a preliminary radiographic study

Clinical article

JOTHAM C. MANWARING, M.D., KONRAD RACH, M.D., AMIR A. AHMADIAN, M.D., ARMEN R. DEUKMEDJIAN, M.D., DONALD A. SMITH, M.D., AND JUAN S. URIBE, M.D.

- Percutaneous transpedicular spinal instrumentation did not significantly alter any of the spinopelvic parameters in either the ACR group or the non-ACR group.
- Lateral MI-LIF alone significantly improved coronal Cobb angle by 16°, and the fractional curve significantly improved in a subgroup treated with L5–S1 transforaminal lumbar interbody fusion.
- Fifteen ACRs were performed in 9 patients and resulted in significant coronal Cobb angle correction, lumbar lordosis correction of 16.5°, and sagittal vertebral axis correction of 4.8 cm per patient. Segmental analysis revealed a 12° gain in segmental lumbar lordosis and a 3.1-cm correction of the sagittal vertebral axis per ACR level treated.
- **Conclusions.** The lateral MI-LIF with ACR has the ability to powerfully restore lumbar lordosis and correct sagittal imbalance. **This segmental MI surgical technique boasts equivalence to SPO correction** of these global radiographic parameters while simultaneously creating additional disc height and correcting coronal imbalance.
- Addition of posterior percutaneous instrumentation without in situ manipulation or overcorrection does not alter radiographic parameters when combined with the lateral MI-LIF.

Eur Spine J (2015) 24 (Suppl 3):S433–S438
 DOI 10.1007/s00586-015-3956-1

ORIGINAL ARTICLE

Anterior column realignment from a lateral approach for the treatment of severe sagittal imbalance: a retrospective radiographic study

Pedro Berjano¹, Ricardo Cecchiato¹, Aldo Sinigaglia¹, Marco Damilano²,
 Maryem-Fatma Imouh², Carolina Martin², Jorge Hugo Villalobos²,
 Claudio Lamartina¹

- 11 out of 12 patients had a complete data set and were enrolled in this study.
- The mean preoperative and postoperative lumbar lordosis values were, respectively, $-20^\circ \pm 17^\circ$ and $-51^\circ \pm 9.8^\circ$ ($p < 0.001$), while a mean value of 27° of lordosis were restored at a single ACR level.
- Two major complications occurred, a **bowel perforation** and a postoperative early infection of the posterior wound that required surgical debridement.
- Preliminary data show that ACR allows corrections similar to those obtained with a Pedicle Subtraction Osteotomy, avoiding risks related to this technique.

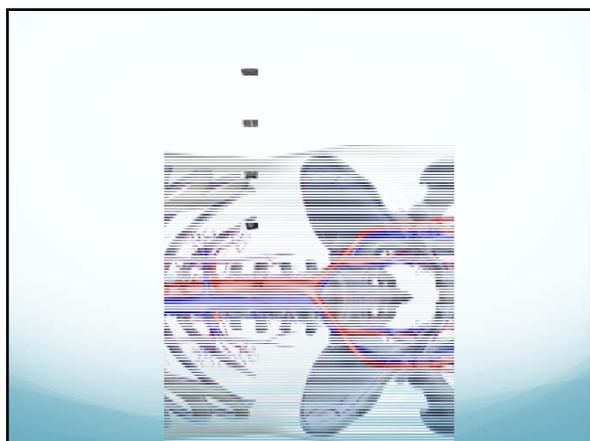
Eur Spine J (2015) 24 (Suppl 3):S377–S404
 DOI 10.1007/s00586-015-3896-1

ORIGINAL ARTICLE

Complications and neurological deficits following minimally invasive anterior column release for adult spinal deformity: a retrospective study

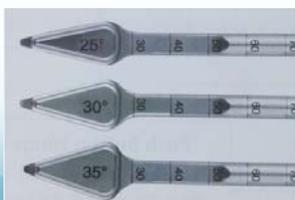
Ghela Murray¹, Joshua Beckman¹, Konrad Roth¹, Donald A. Smith¹,
 Elias Dukwar², Juan S. Uribe²

- Thirty-one patients underwent a total of 47 MISACRs. The mean age of the cohort was 62. Mean follow up was 12 months (range 3–38 months). The average change from in lumbar lordosis (LL) was 17.6° , in pelvic tilt was 4.3° , coronal Cobb was 13.9 and in SVA was 3.8 cm.
- Of the 47 MIS-ACR procedures, there were **9 (9/47, 19 %) major complications** related to the ACR.
 - Illoposas weakness was seen in eight patients
 - Retrograde ejaculation in one patient.
 - One patient remained with mild motor deficit at the most recent follow-up
 - No revision surgeries were required for the anterolateral approach.
 - No vascular, visceral, or infectious complications** associated with the MIS-ACR.
- The MIS-ACR is one of the MOST TECHNICALLY DEMANDING PROCEDURES performed from the lateral transposas approach.** This procedure has the advantage of maintaining and improving spinal global alignment while minimizing blood loss and excessive tissue dissection. **It comes with its own unique set of potentially catastrophic complications and should only be performed by surgeons proficient in both deformity correction and the lateral approach.**



A Novel Approach to the Pedicle Subtraction Osteotomy

- We report on a novel technique, where fixed-angled (25°, 30°, and 35°) triangular shavers are utilized to perform the PSO.
- Their utilization in theory allows for a more reproducible and time efficient osteotomy.
- As a result we hypothesized their use would lead to a decrease in associated blood loss.



Methods

- A retrospective review from August 2010 to January 2014
 - All patients who underwent a single-level PSO, regardless of prior surgical history, were included.
 - Patients were divided into two groups depending on the technique used to perform the PSO.
- Group 1 (PSO) - included all patients prior to August 2012, in which traditional straight osteotomes were utilized.
- Group 2 (ZSO) - included patients where fixed-angled triangular shavers were used after their adoption in August 2012.

Novel PSO Technique



Results

- Total study population 18 patients (Consecutive Enrollment)
 - Group 1 (PSO with traditional straight osteotomes) – 8 patients
 - Group 2 (ZSO with fixed triangular shavers) – 10 patients
- No statistical difference between the groups regarding:
 - Age
 - Height
 - Weight
 - Total operative time
 - Total estimated blood loss
 - Number of levels fused

Results

- **Revision Status:**
 - Group 1 included 2 patients who had fusion takedowns (2/6 revisions, 33%)
 - Group 2 included 8 patients (8/8 revisions, 100%), (**p=0.018**)
- **Smith-Peterson Osteotomies (SPOs):**
 - Group 1 included 4 patients (4/8, 50%)
 - Group 2 included 10 patients (10/10, 100%), (**p=0.008**)
 - Amongst all patients with SPOs in both groups, there was no difference in the number of SPOs performed (mean=4.5)
- PSO associated **Operative Time and Blood Loss:**
 - Mean PSO time in Group 1 was **52 vs 33 minutes** in Group 2 (**p=0.032**)
 - Mean PSO associated blood loss in Group 1 was **1018 vs 463 ml** in Group 2 (**p=0.47**)

Results

- **Length of Hospital Stay (LOS):**
 - **ICU LOS** in Group 1 was **6 vs 3 days** in Group 2 (**p=0.030**)
 - **Total Hospital LOS** in Group 1 was **9.3 vs 6.1 days** in Group 2 (**p=0.041**)
- **Complications:**
 - Group 1: 6 patients with 8 major complications
 - Group 2: 3 patients with 3 major complications (**p=0.029**)
 - Complications included:
 - Cerebellar stroke, Pulmonary Embolism, Heart Failure, Aspiration Pneumonia, Altered Mental Status
 - Revision Operation
- Group 2 utilized fewer blood products than Group 1 however not statistically significant

Conclusions

- Groups 2 (ZSO) patients
 - ↑ # of revision patients
 - ↑ # of osteoclasts / fusion takedowns
 - ↑ # SPOs
 - Propensity for increased blood loss
- YET.....ZSO technique resulted in a ↓ in associated PSO times by 37%
 - Decrease in associated PSO blood loss by 55%
 - Decrease in overall LOS by 34%
 - Decrease in peri-operative complications / morbidity
- ZSO is a less technically demanding and more efficient technique to perform PSOs resulting in shorter PSO times and resultant blood loss.
- Prospective study is warranted

Thank you

A photograph of a young child with curly hair, wearing a light blue button-down shirt and dark shorts, sitting on a white ledge or step. The child is smiling and looking towards the camera. The background shows an indoor setting with a window and some furniture.
