Minimally invasive options for treatment of low back pain

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Case – Low back pain

36M resident physician with low back pain. Worsening over several months. No leg pain or weakness.

Case – Low back pain

36M resident physician with low back pain. Worsening over several months. No leg pain or weakness.

Trial of conservative therapy:

- Rest
- Anti-inflammatory meds
- Inversion table

healthyback.com

Case – Low back pain

36M resident physician with low back pain. Worsening over several months. No leg pain or weakness.

1 month later, pain resolves.

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1 month later, pain resolves.

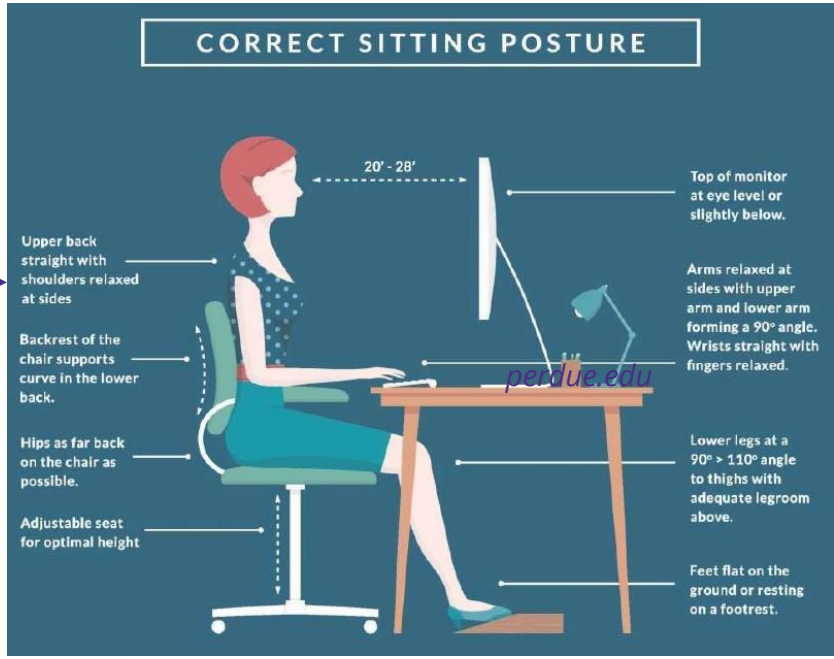
Lesson

- Most cases of low back pain do NOT need surgery

- Most common cause:
  Musculoskeletal strain

Non-medical therapies

- Rest
- Avoiding triggers
- Ergonomics



- Acupuncture
- Physical therapy
- Inversion table

healthyback.com

- TENS

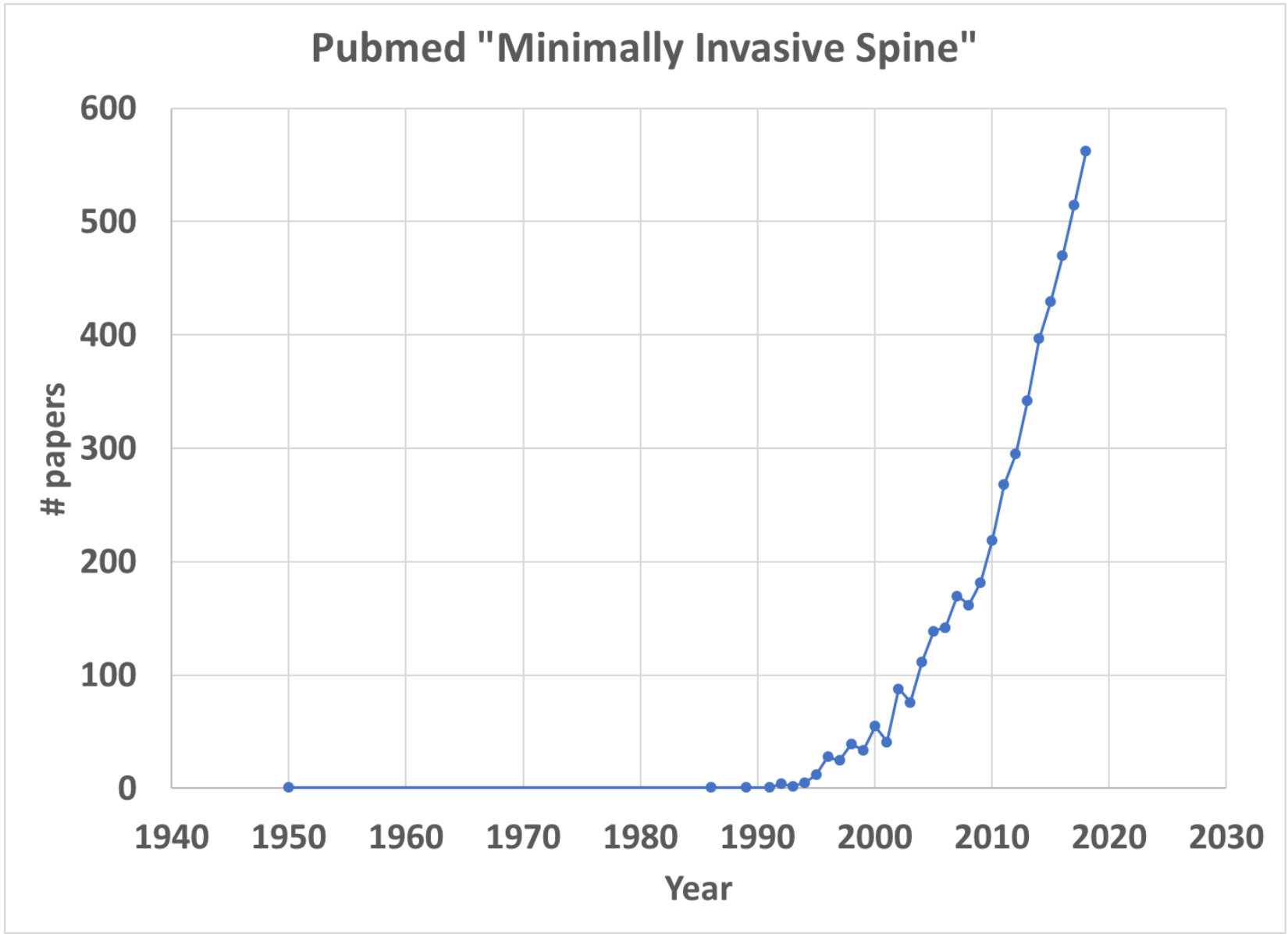
Joom.com

Medical therapies

- Oral anti-inflammatory meds
- Topical gels/creams
- Local injections
- Neuropathic pain meds

When is back pain surgical?

- Nerve or spinal cord compression
- Trauma
- Tumors
- Spinal deformity


Pubmed "Minimally Invasive Spine"
600
500
400
300
200
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papers
1940
1950
1960
1970
1980
1990
2000
2010
2020
2030
Year

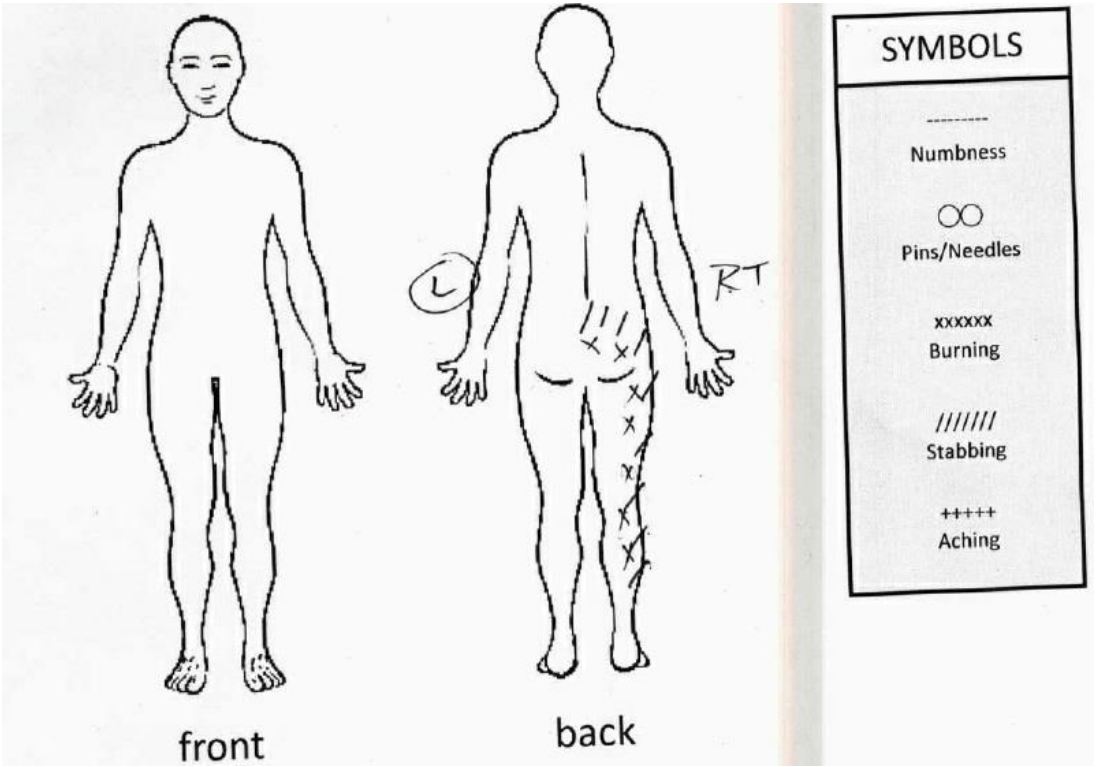
What is MIS?

- Same surgical goals:
  - decompress
  - stabilize
  - re-align

- Minimally invasive = less collateral damage

Case: spondylolisthesis

65F with back and right leg pain. Back pain 5/10, Leg pain 5/10, Disability 39/100



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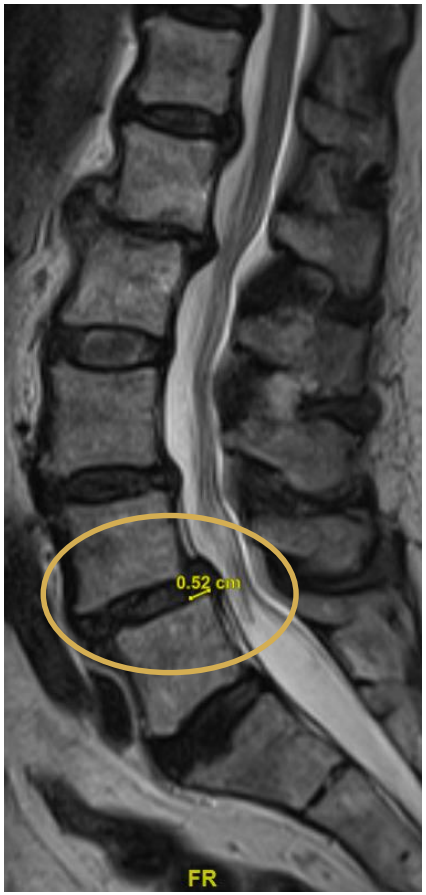
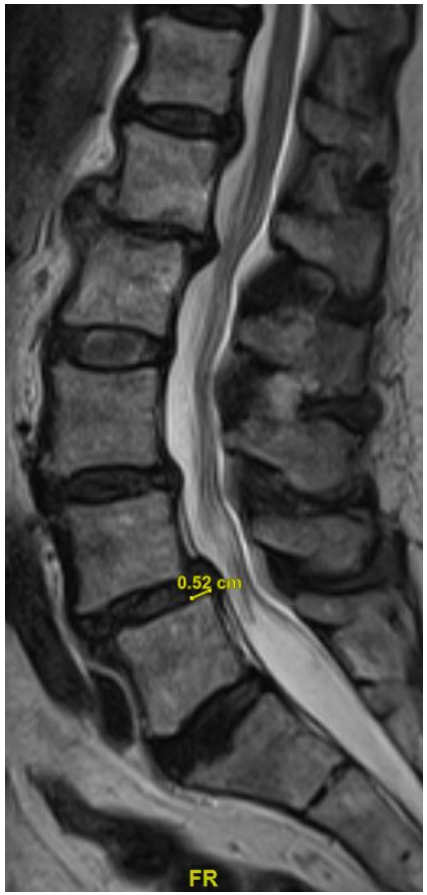
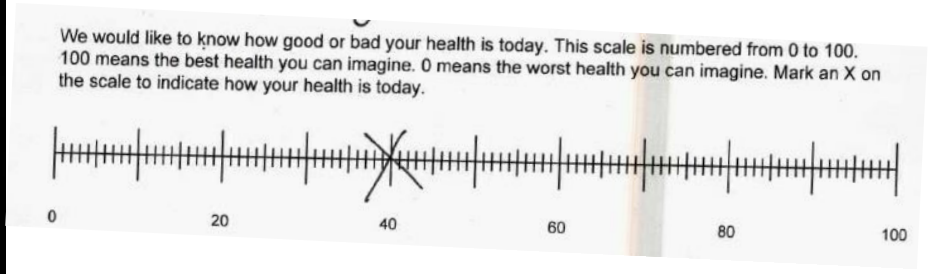


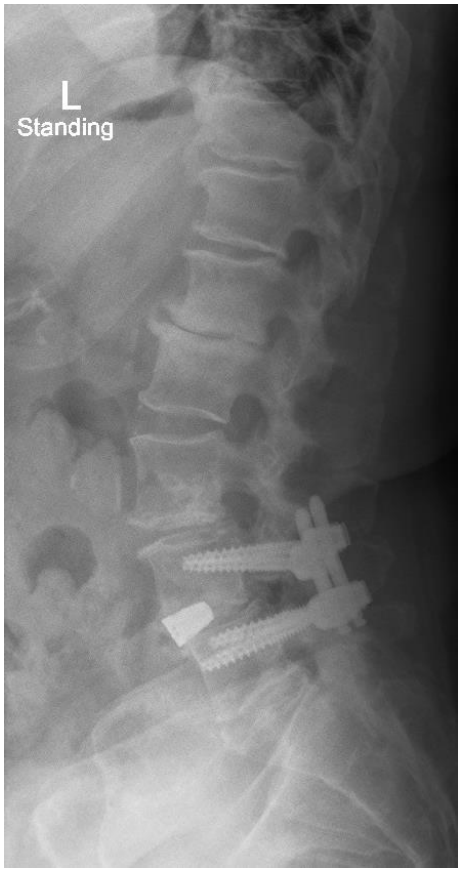
Case: spondylolisthesis



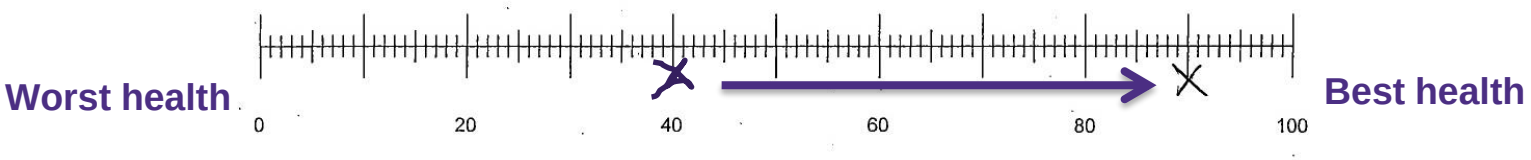


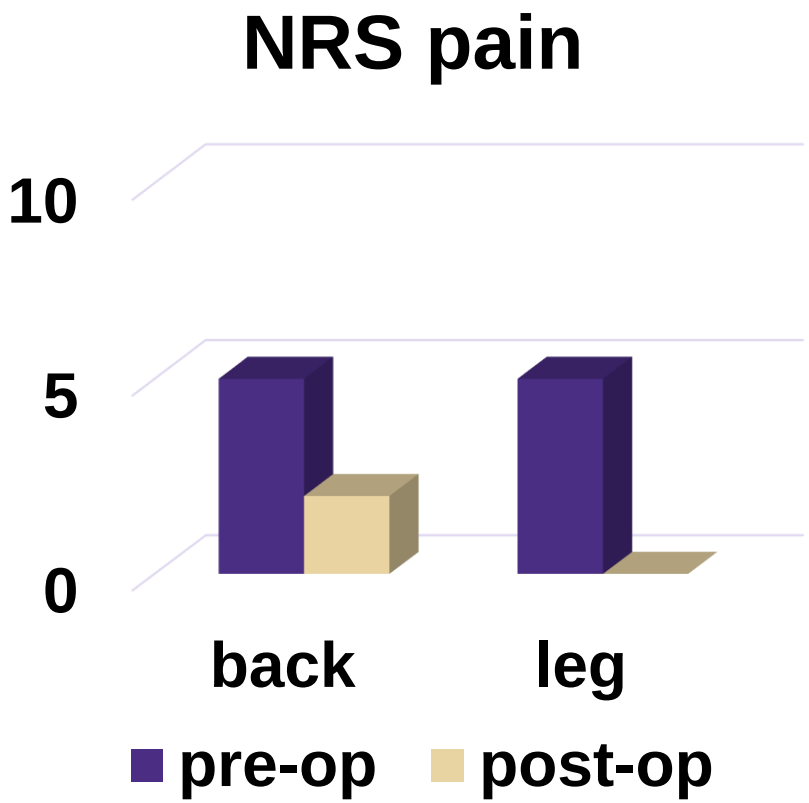
Case: minimally invasive fusion

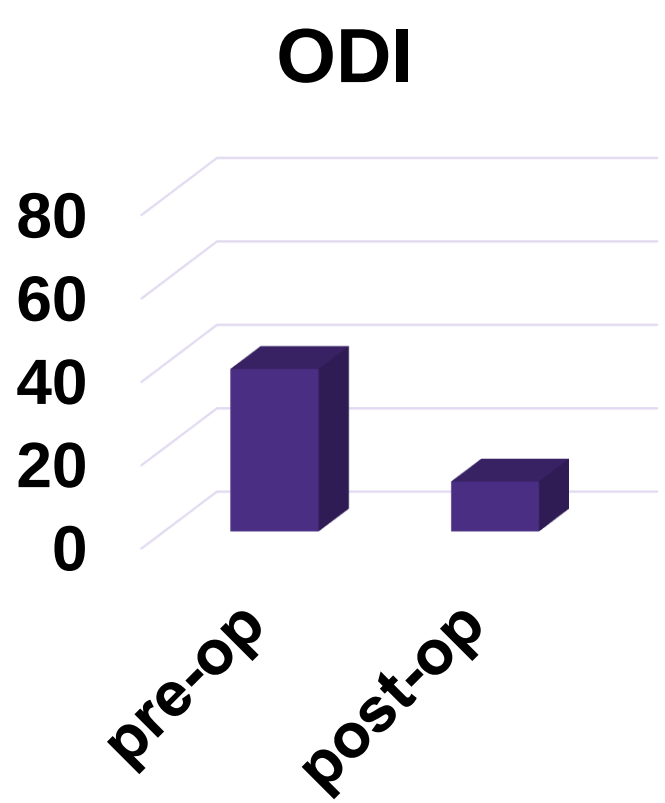
LOS: 2 days



Case – minimally invasive fusion







NEUROSURGICAL FOCUS

Neurosurg Focus 43 (2):E11, 2017

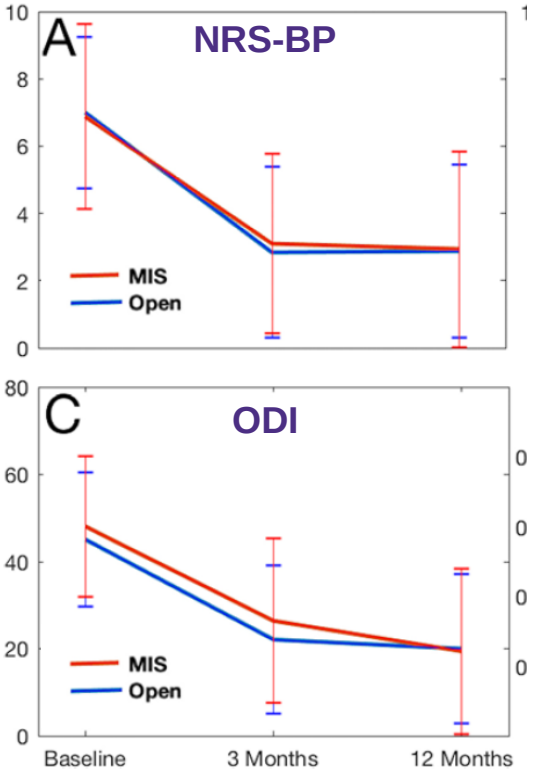
Minimally invasive versus open fusion for Grade I degenerative lumbar spondylolisthesis: analysis of the Quality Outcomes Database

Praveen V. Mummaneni, MD,[1] Erica F. Bisson, MD, MPH,[2] Panagiotis Kerezoudis, MD,[3] Steven Glassman, MD,[4] Kevin Foley, MD,[5] Jonathan R. Slotkin, MD,[6] Eric Potts, MD,[7] Mark Shaffrey, MD,[8] Christopher I. Shaffrey, MD,[8] Domagoj Coric, MD,[9] John Knightly, MD,[10] Paul Park, MD,[11] Kai-Ming Fu, MD, PhD,[12] Clinton J. Devin, MD,[13] Silky Chotai, MD,[13] Andrew K. Chan, MD,[1] Michael Virk, MD, PhD,[1] Anthony L. Asher, MD,[9] and Mohamad Bydon, MD[3]

TABLE 4. Summary of postoperative outcomes

Variable	All (n = 345)	1-Level Fusion		p Value
		Open (n = 181)	MIS (n = 76)	
LOS in days, mean (SD)	3.46 (1.66)	3.36 (1.55)	3.21 (1.74)	0.53
Discharge destination, n (%)				0.76
Home routine	283 (82.3)	151 (83.9)	67 (88.2)	
Home w/ home health care services	18 (5.23)	11 (6.11)	3 (3.95)	
Postacute or nonacute care setting	41 (11.9)	18 (10.0)	6 (7.89)	
Transferred to another acute care facility	2 (0.58)			
90-day readmission, n (%)	5 (1.47)	1 (0.56)	2 (2.67)	0.21
90-day return to work, n (%)	87 (66.4)	42 (60.9)	26 (76.5)	0.18
Return to the op room w/in 1 yr, n (%)*	20 (5.81)	9 (5.00)	4 (5.26)	>0.99
12-mo functional outcomes				
NASS satisfaction, n (%)				0.16
1	199 (68.2)	111 (74.0)	44 (68.8)	
2	47 (16.1)	17 (11.3)	14 (21.9)	
3	26 (8.90)	13 (8.67)	5 (7.81)	
4	20 (6.85)	9 (6.00)	1 (1.56)	
Change in ODI, mean (SD)	−24.17 (17.4)	−25.54 (16.9)	−27.61 (16.4)	0.40
Change in EQ-5D, mean (SD)	0.24 (0.22)	0.25 (0.22)	0.26 (0.21)	0.84
Change in NRS-BP, mean (SD)	−3.79 (3.11)	−4.22 (2.96)	−3.80 (3.12)	0.35
Change in NRS-LP, mean (SD)	−4.00 (3.48)	−4.15 (3.57)	−4.47 (3.11)	0.51
Quality-adjusted life days w/in the 1st yr	266 (46.3)	268 (46.3)	270 (46.3)	0.84

* Related to the index procedure

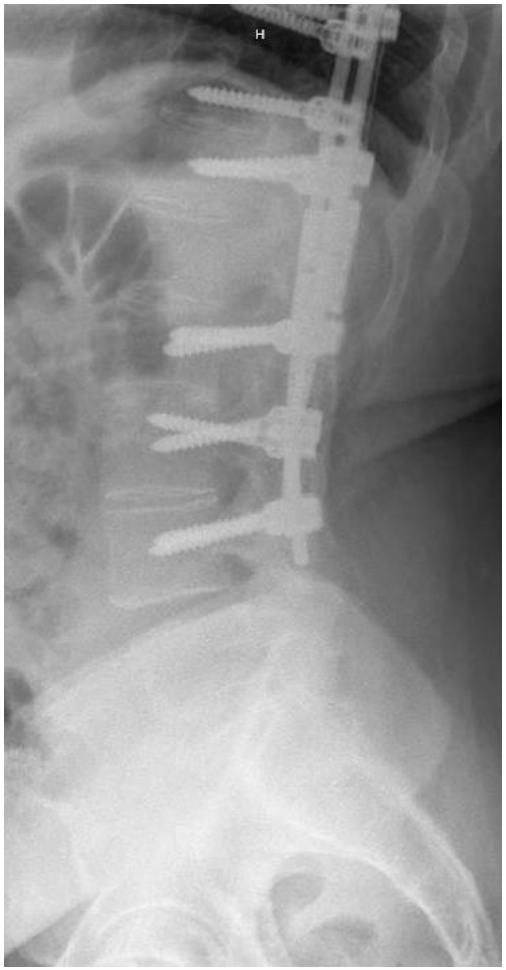


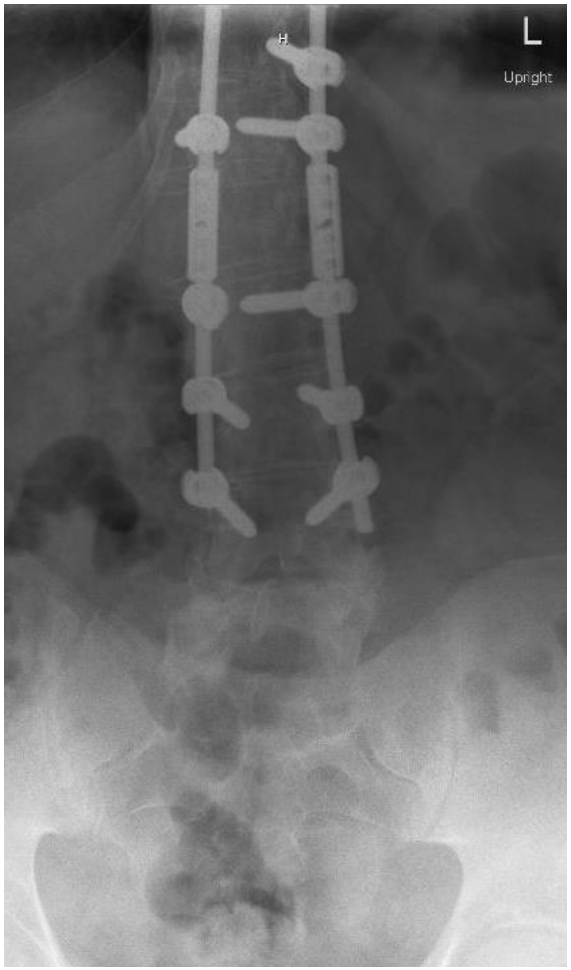
Case – chronic low back pain

33M Hx early onset scoliosis surgery s/p T10-L4 PSF, BMI 41.9, work-related injury and mid-low back pain. No pain until work-related injury while moving packages. Constant mid-low back pain, up to 9/10, worse with flexion. Stopped working after this injury. 2 rounds of PT, tried Norco and Tylenol, lumbar ESI and facet block with no significant pain relief.

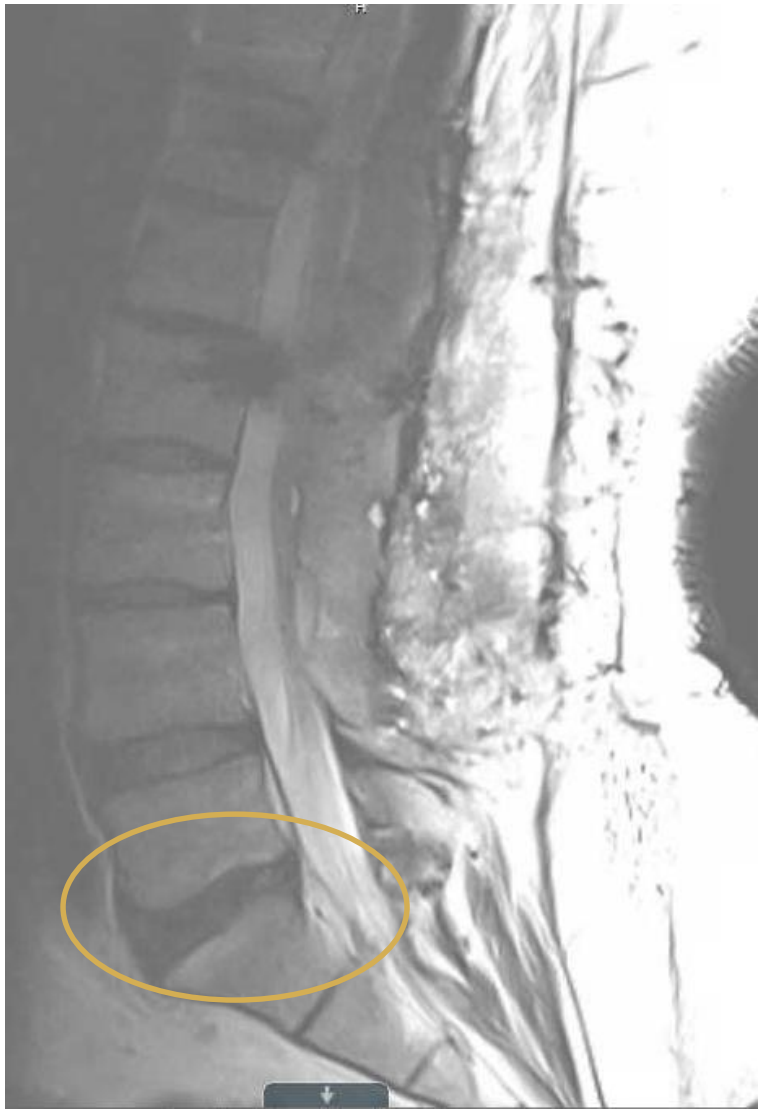
Exam:
BLE 4/5, pain ltd
No imbalance
No hyperreflexia

Pre-op imaging





Pre-op MRI



Surgery

Surgery

Case – 6 wks s/p BVN ablation

- “80% better” post op.
- Able to walk into appt where before he would have had to stop 2x.
- Can do home ADLs like washing dishes.
- Can walk stairs much better than pre-op.
- Back pain pre op 9/10 -> now 4/10.
- Doing pool therapy at home.
- Lost 20lbs.
- Exam: BLE 4+ to 5/5

Data

European Spine Journal (2020) 29:1925–1934
https://doi.org/10.1007/s00586-020-06448-x

ORIGINAL ARTICLE

Long-term outcomes following intraosseous basivertebral nerve ablation for the treatment of chronic low back pain: 5-year treatment arm results from a prospective randomized double-blind sham-controlled multi-center study

Jeffrey S. Fischgrund[1] · Alfred Rhyne[2] · Kevin Macadaeg[3] · Gregory Moore[4] · Evish Kamrava[5] · Christopher Yeung[6] · Eeric Truumees[7] · Michael Schaufele[8] · Philip Yuan[9] · Michael DePalma[10] · David Greg Anderson[11] · Douglas Buxton[12] · James Reynolds[13] · Michael Sikorsky[14]

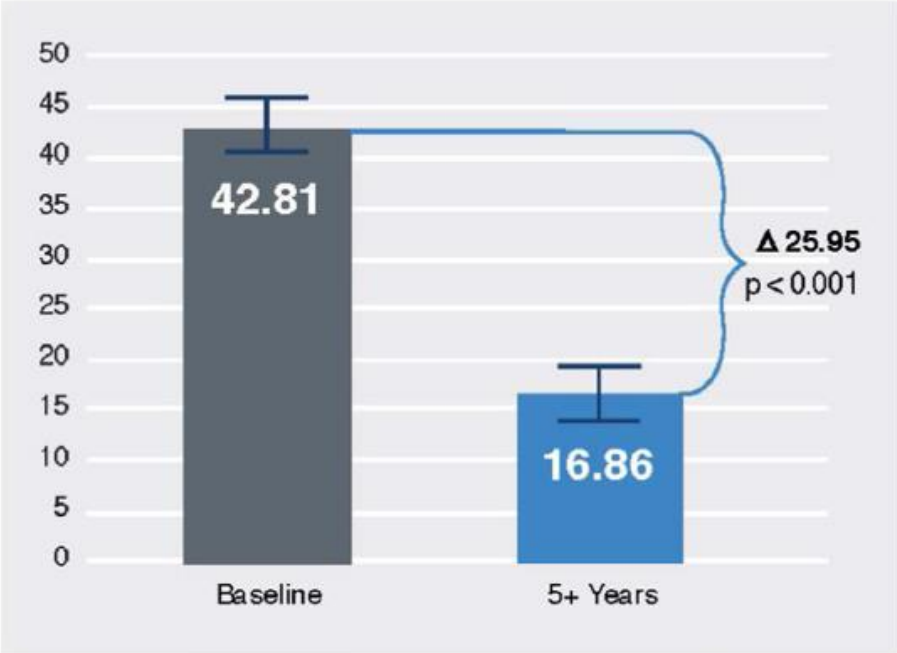


Fig. 2 Bar graph with confidence intervals for the primary endpoint, mean ODI at baseline, and a minimum of 5 years in BVN-treated US PP patients. The mean reduction in ODI of 25.95 points was statistically significant ($p < 0.001$)

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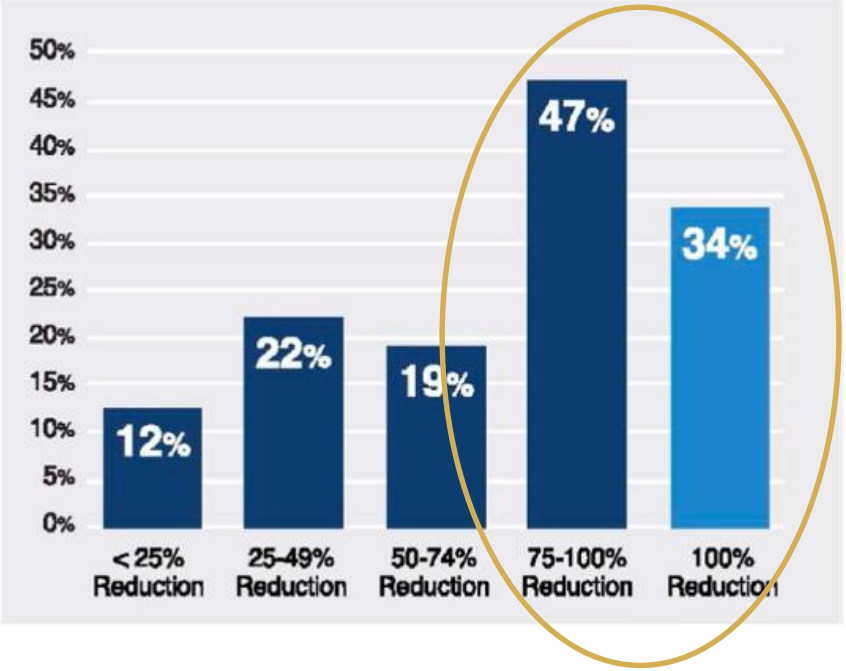

Fig. 3 Proportion of patients by percent mean improvement in VAS from baseline to a minimum of 5 years of follow-up. Sixty-six percent (66%) of patients reported a > 50% reduction in VAS ($p < 0.04$), 47% reported a > 75% reduction in VAS, and 34% of patients reported complete pain resolution

Case: trauma

65F Hx ankylosing spondylitis, afib on warfarin, AVR, pacemaker, CKD, s/p MVA with T8-T9 hyperextension fracture. BLE 5/5

Treatment options:

1) TLSO Brace
2) Open T6-T11 PSF
3) MIS T6-T11 PSF
4) Open T7-T0 PSF
5) MIS T7-T10 PSF

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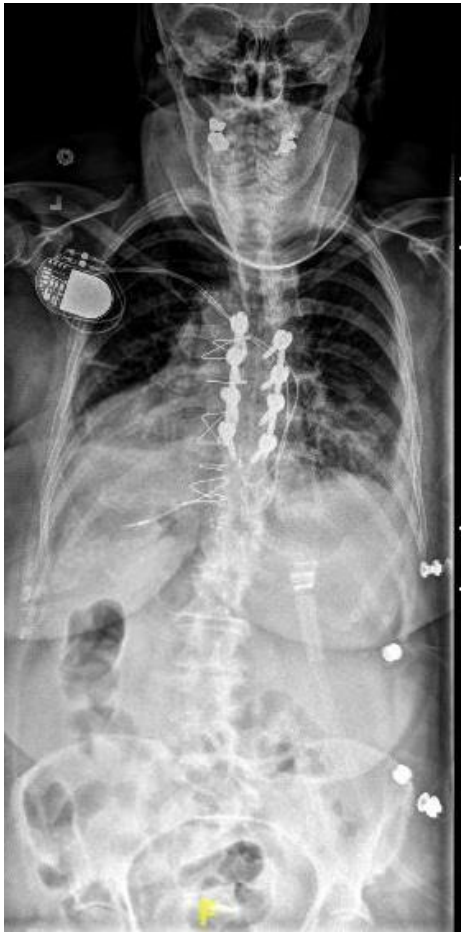
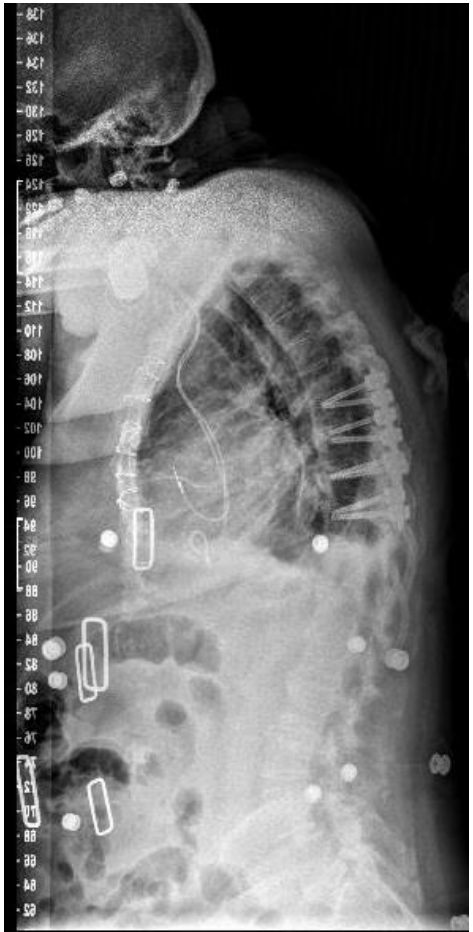


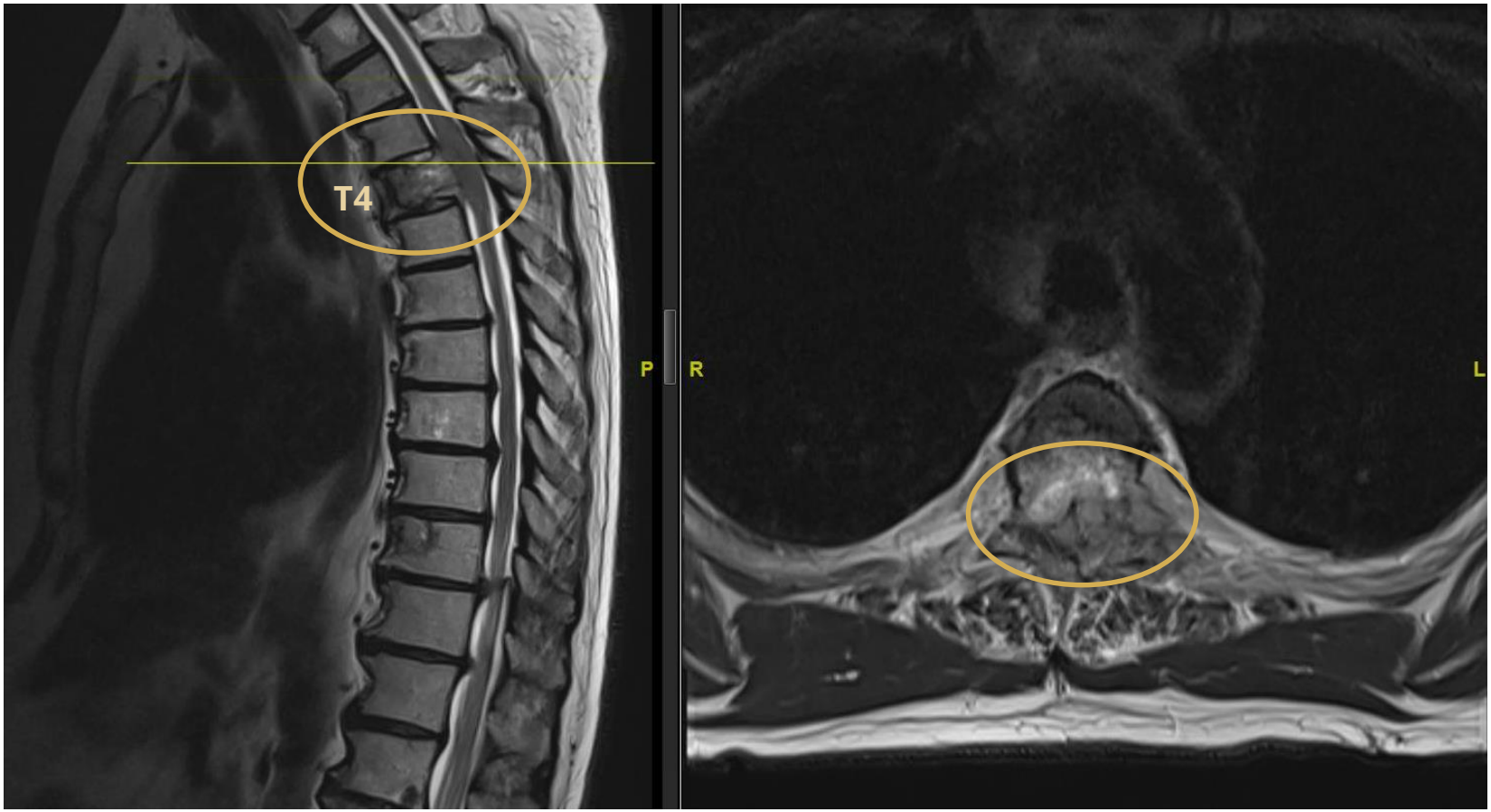


Case – spine tumor

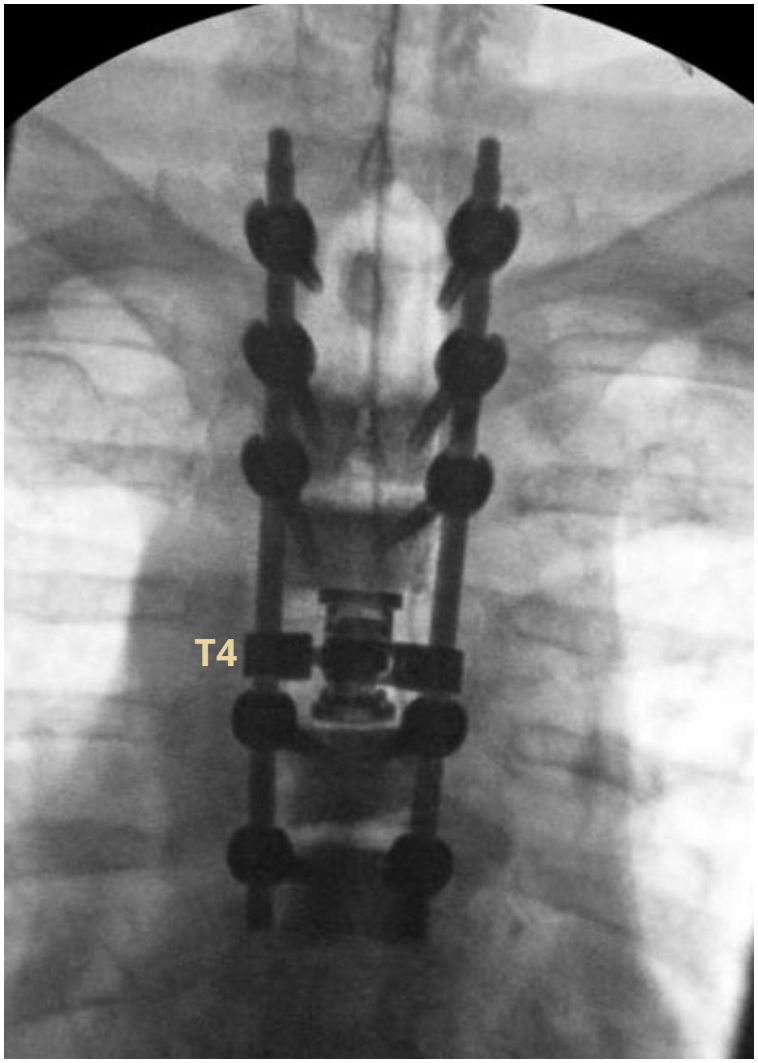
63M with metastatic melanoma first diagnosed and treated in the 1990s, calf melanoma resection 2017. Upper thoracic pain for several months. Difficulty walking.

Exam:
BLE 4/5
Decreased sensation right leg
Patellar DTR 3+

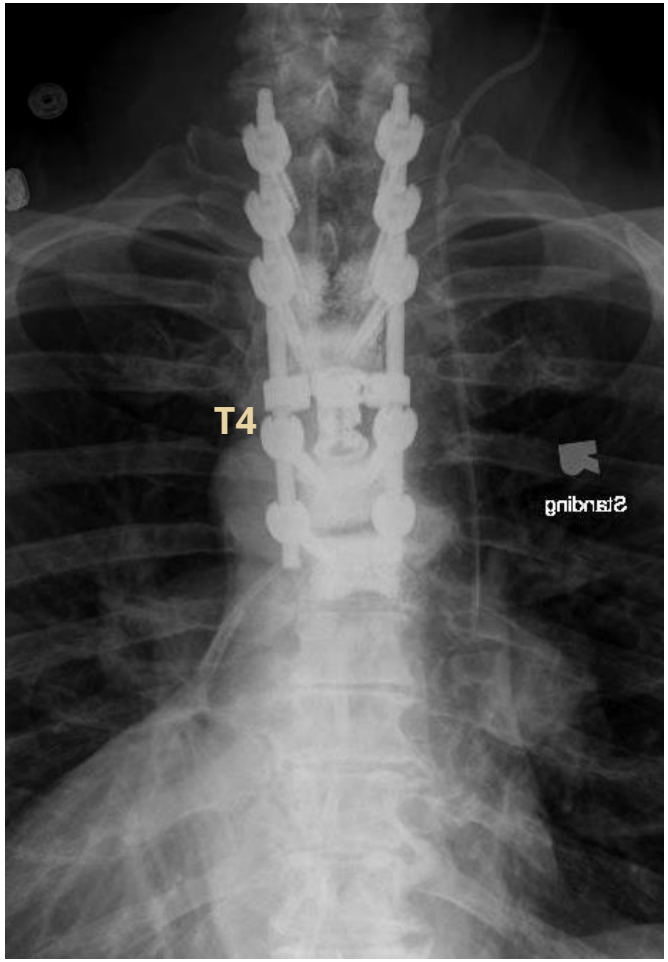
Initial MRI

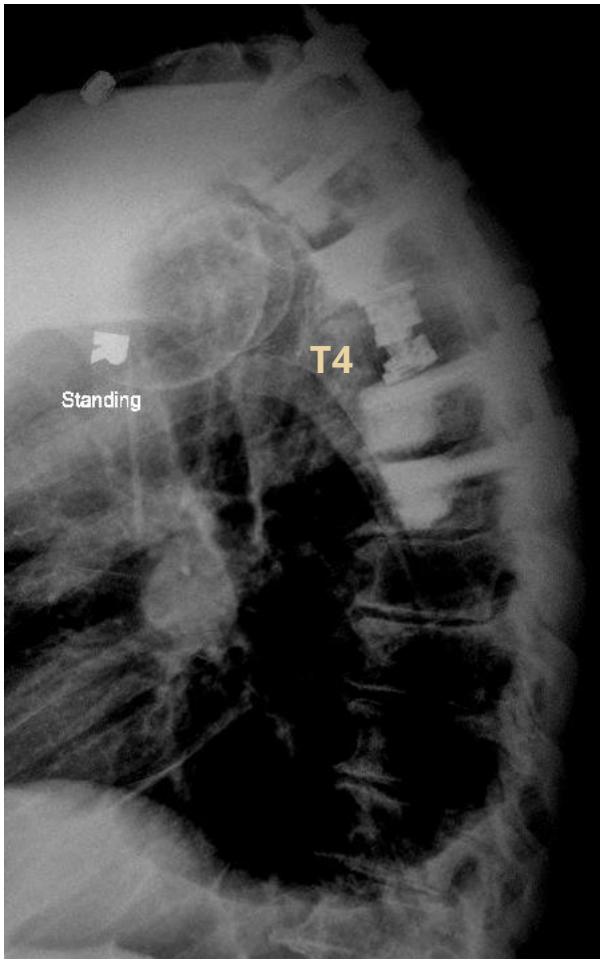


Surgery – open



Post op imaging





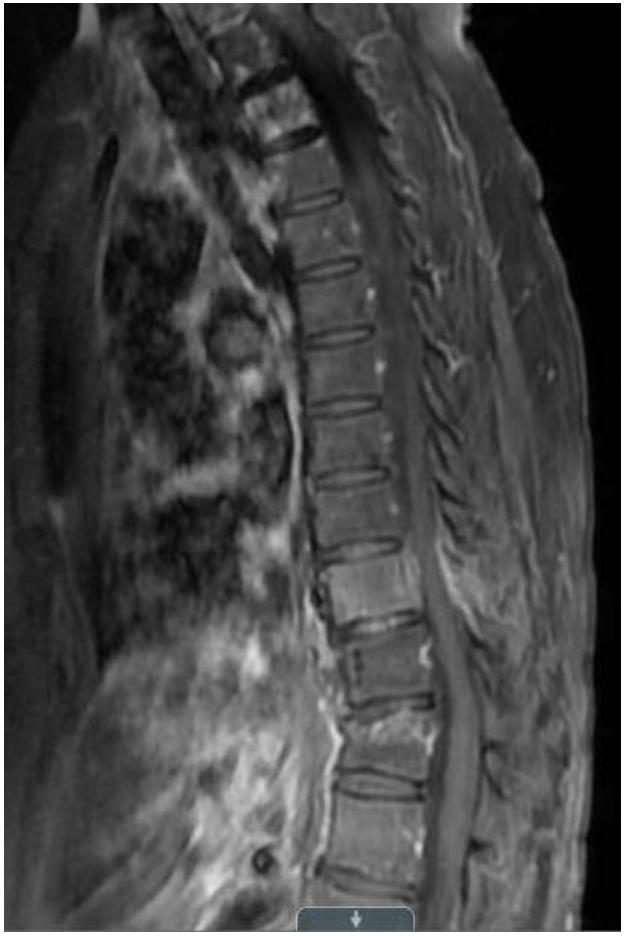
Case – spine tumor treated MIS

77F Hx chronic hep B. On a hepatic MRI for a liver nodule discovered 2 years ago, she was found to have a thoracic lesion. Intermittent low thoracic pain, onset 1 year ago.

Family Hx
father – hepatocellular ca.

Exam:
BLE 5/5
Normal sensation

Pre op MRI



Case – MIS biopsy and kyphoplasty

Data

Balloon kyphoplasty versus non-surgical fracture management for treatment of painful vertebral body compression fractures in patients with cancer: a multicentre, randomised controlled trial

James Berenson, Robert Pflugmacher, Peter Jarzem, Jeffrey Zonder, Kenneth Schechtman, John B Tillman, Leonard Bastian, Talat Ashraf, Frank Vrionis, for the Cancer Patient Fracture Evaluation (CAFE) Investigators*

Summary

Background Non-randomised trials have reported benefits of kyphoplasty in patients with cancer and vertebral compression fractures (VCFs). We aimed to assess the efficacy and safety of balloon kyphoplasty compared with non-surgical management for patients with cancer who have painful VCFs.

Lancet Oncol 2011; 12: 225–35
Published Online
February 17, 2011

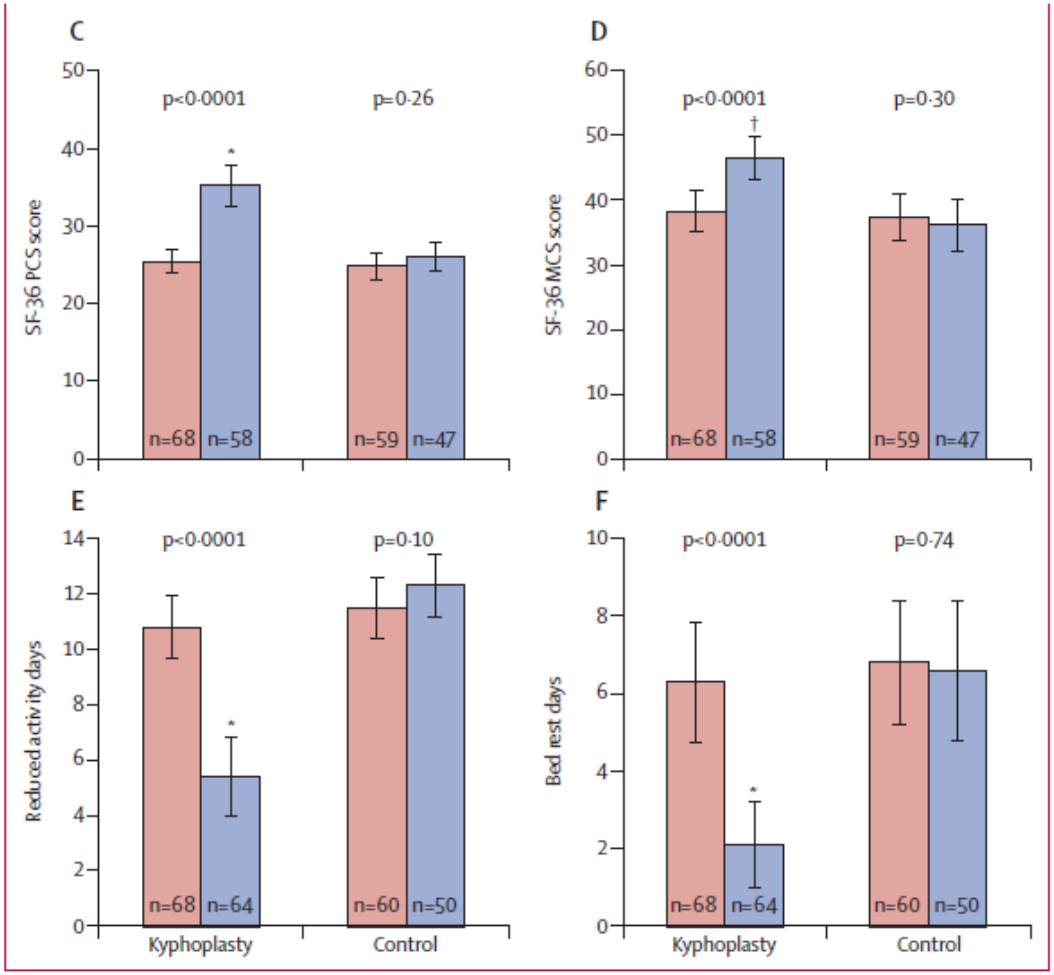


Figure 2: Disability and quality of life at baseline and after 1 month

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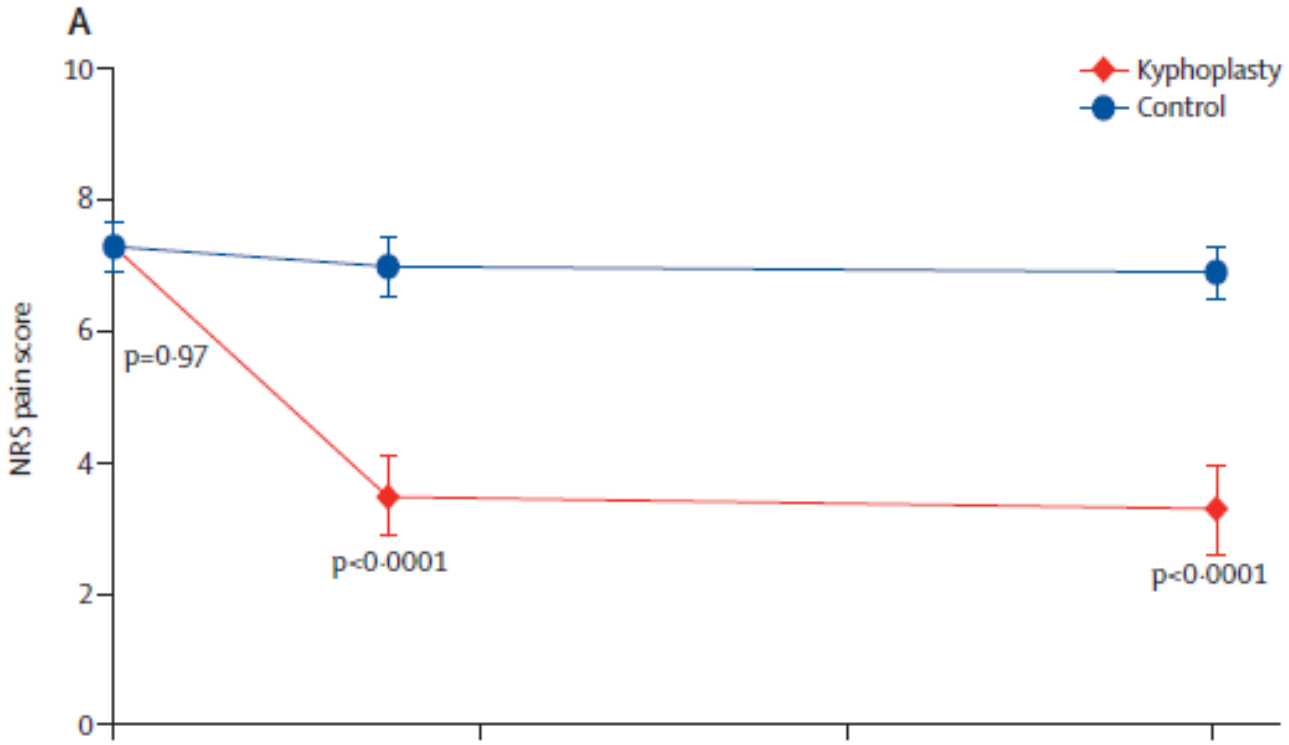
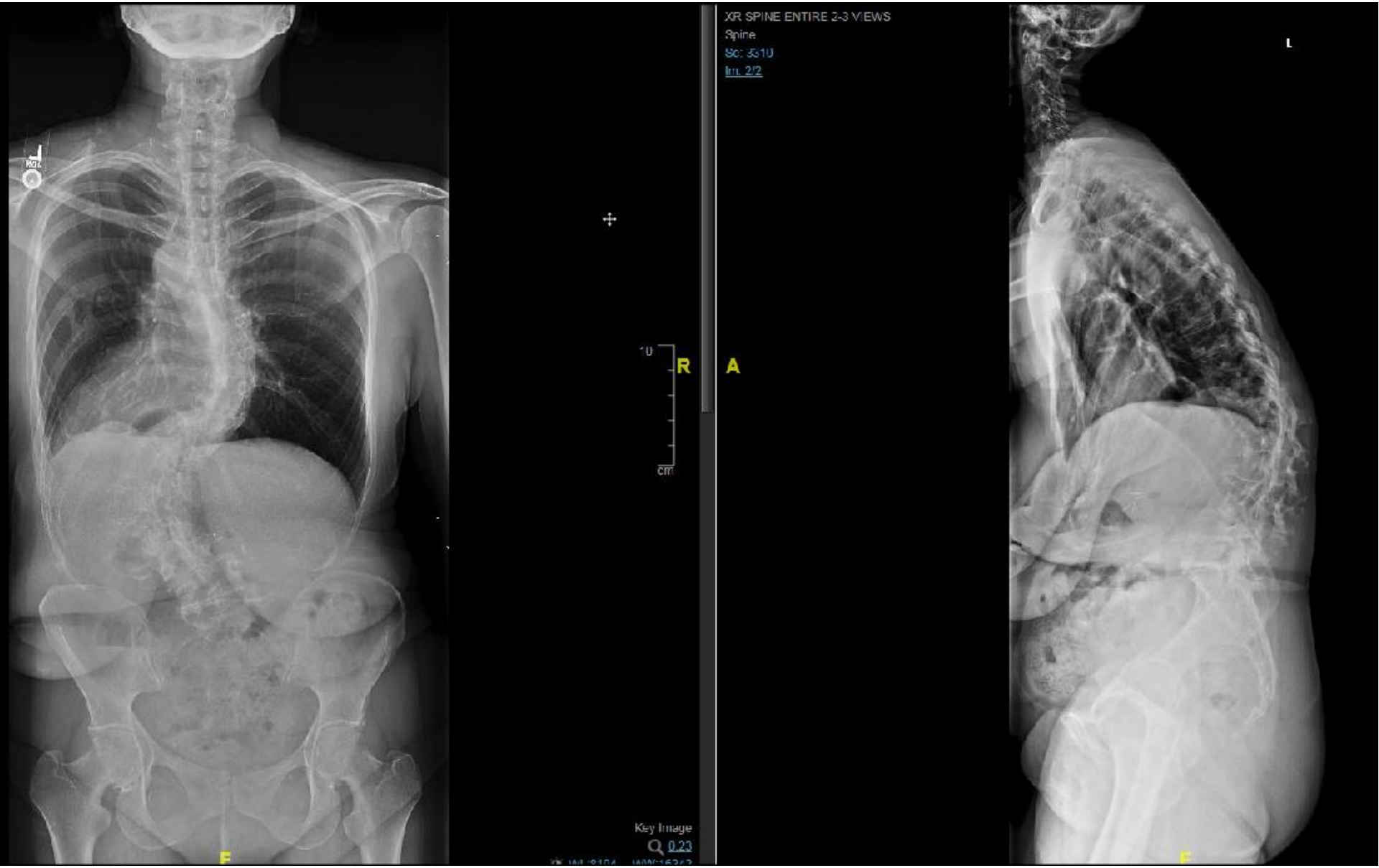


Case – open spinal deformity

67 year old female with scoliosis & low back pain her entire life. Leaning forward for the past 4 years. Sharp shooting leg pain that radiates into bilateral posterior thighs with walking.

Exam:
Stands and walks with stooped forward posture


XR SPINE ENTIRE 2-3 VIEWS
Spine
Sc: 3310
Im: 2/2
R
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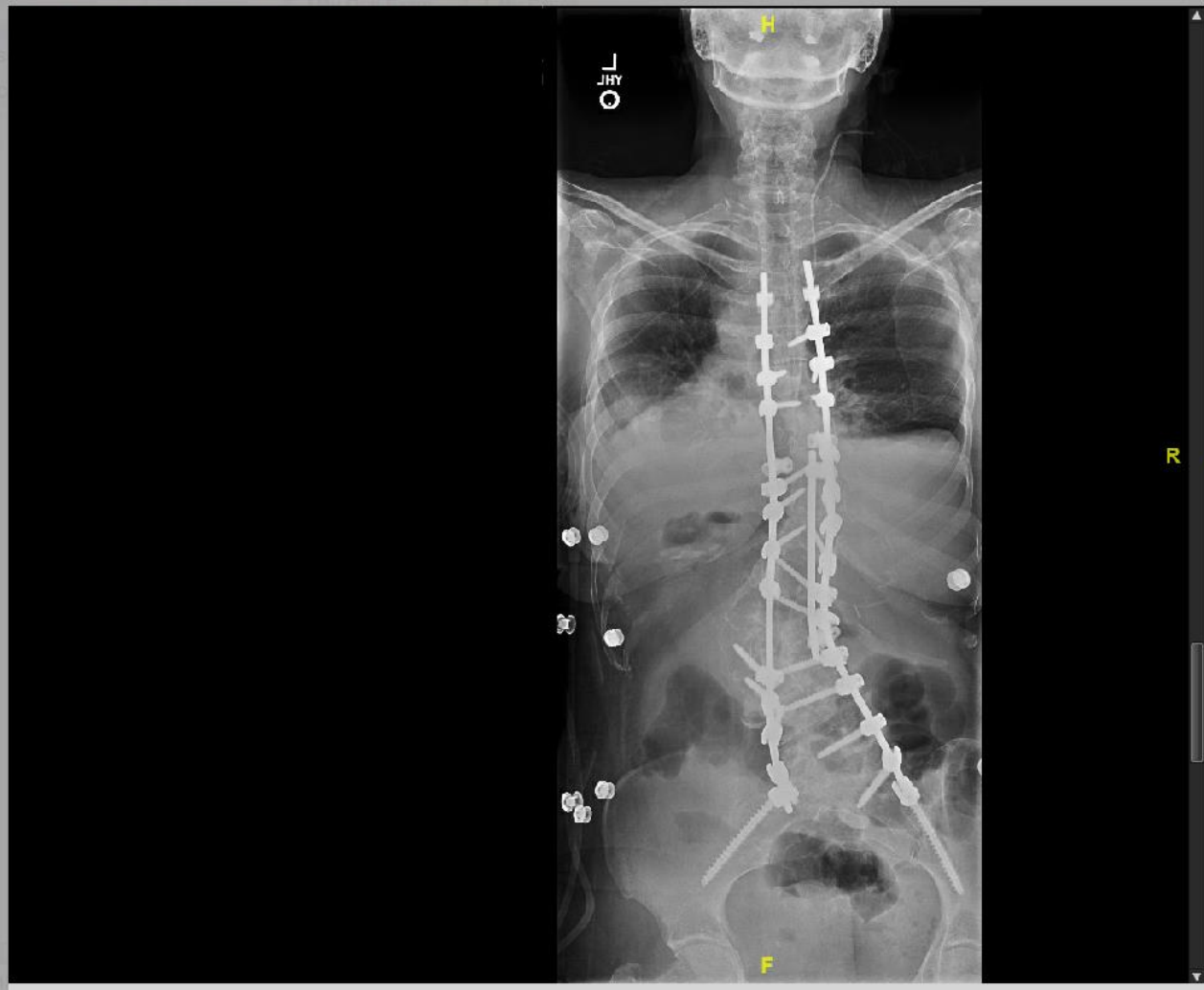
Key Image
0.23

Post-op standing scoli xrays after stage 2 showed improved alignment



Normal spinal alignment

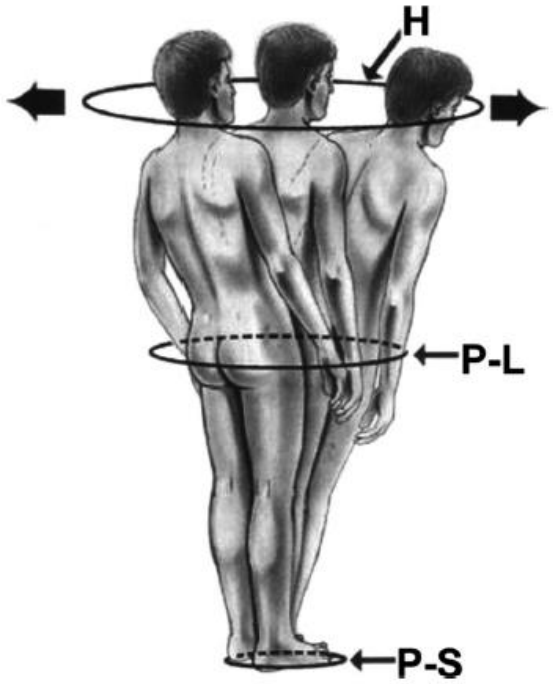


Figure 1. Cone of balance or cone of economy. The figure outlines the "stable" zone surrounding the individual that is conical in shape from the feet to the head. Deviation from the center within the zone results in greater muscular effort and energy expenditure to maintain an upright posture. Deviation of the body outside the cone results in falling or requiring support.

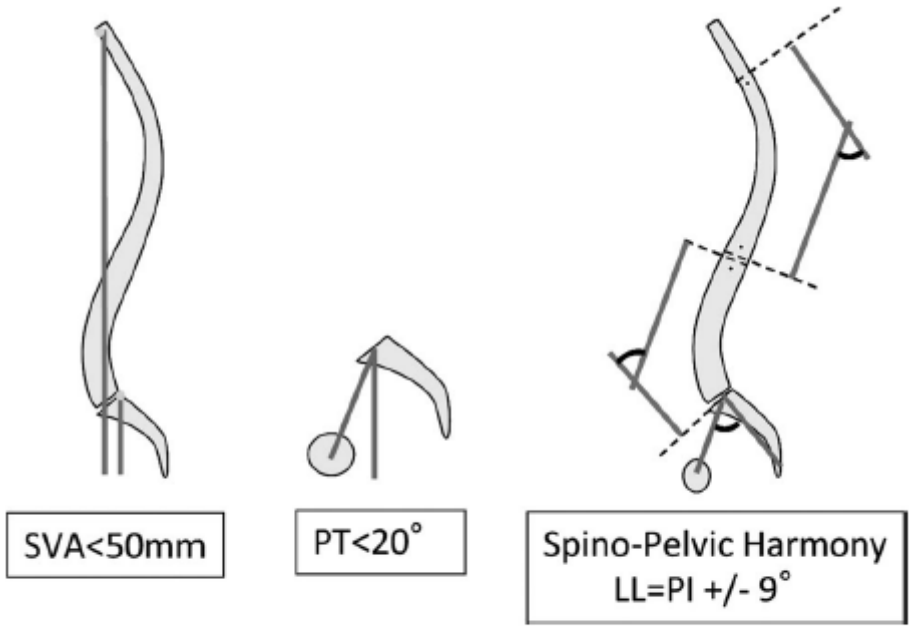


Figure 5. Realignment objectives in the sagittal plane. SVA <50 mm, PT <20°, and LL = PI ± 9° sets the stage for achievement of a successful harmonious spinopelvic realignment.

Schwab et al Spine 2010

Less invasive option – Anterior column realignment

- 3CO have traditionally been employed for 20-35° of sagittal correction at a single segment.
- 3CO technically challenging, high morbidity
- ACR was developed as a less invasive procedure for restoring segmental lordosis.
- In contrast to 3CO, ACR is an anterior column lengthening procedure

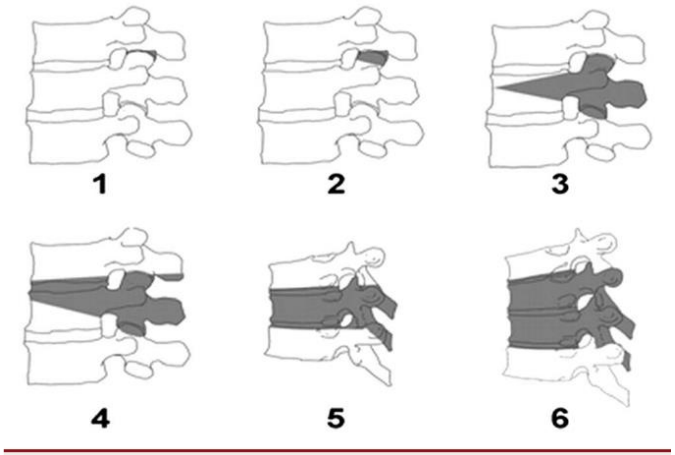
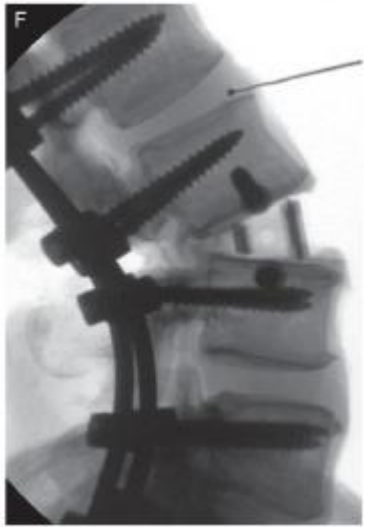


FIGURE 1. *Osteotomy classification: grades 1 to 6 according to the anatomic resection.*

Schwab et al Neurosurg 2014



Godzik Turner et al The Spine Journal 2020

Case – ACR

66M Hx prior L1-L3 PSF and L5-S1 ALIF/PSF, presented with disabling back pain, inability to stand up straight.

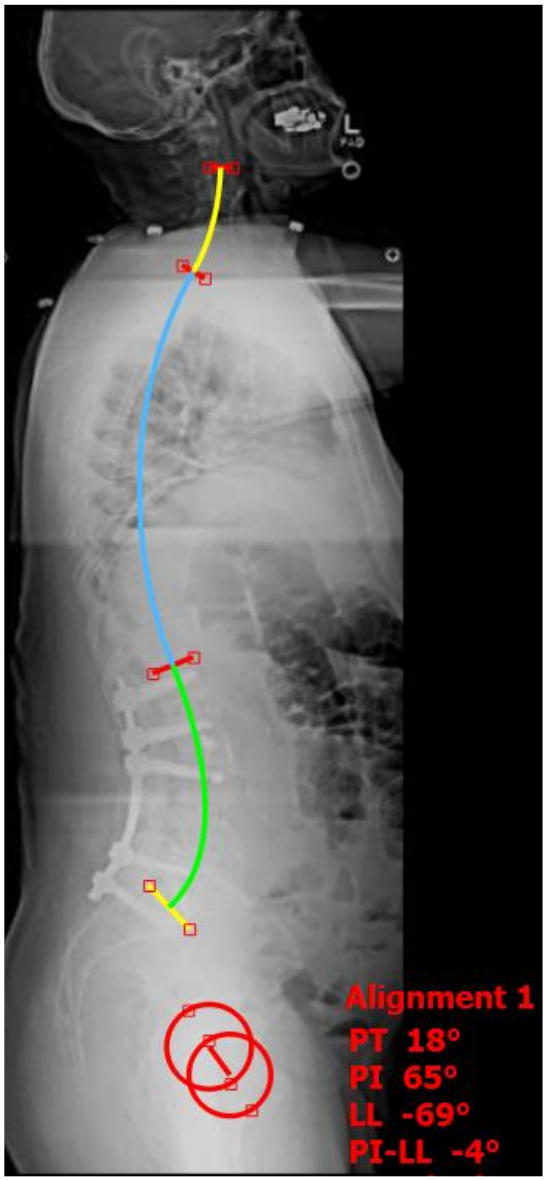
Case – ACR

Underwent:
Stage 1- ROH

Stage 2- L1-2 LLIF, L2-3 ACR, L3-4 LLIF

Stage 3- L1-S1 PSF

No ICU stay, home on POD3

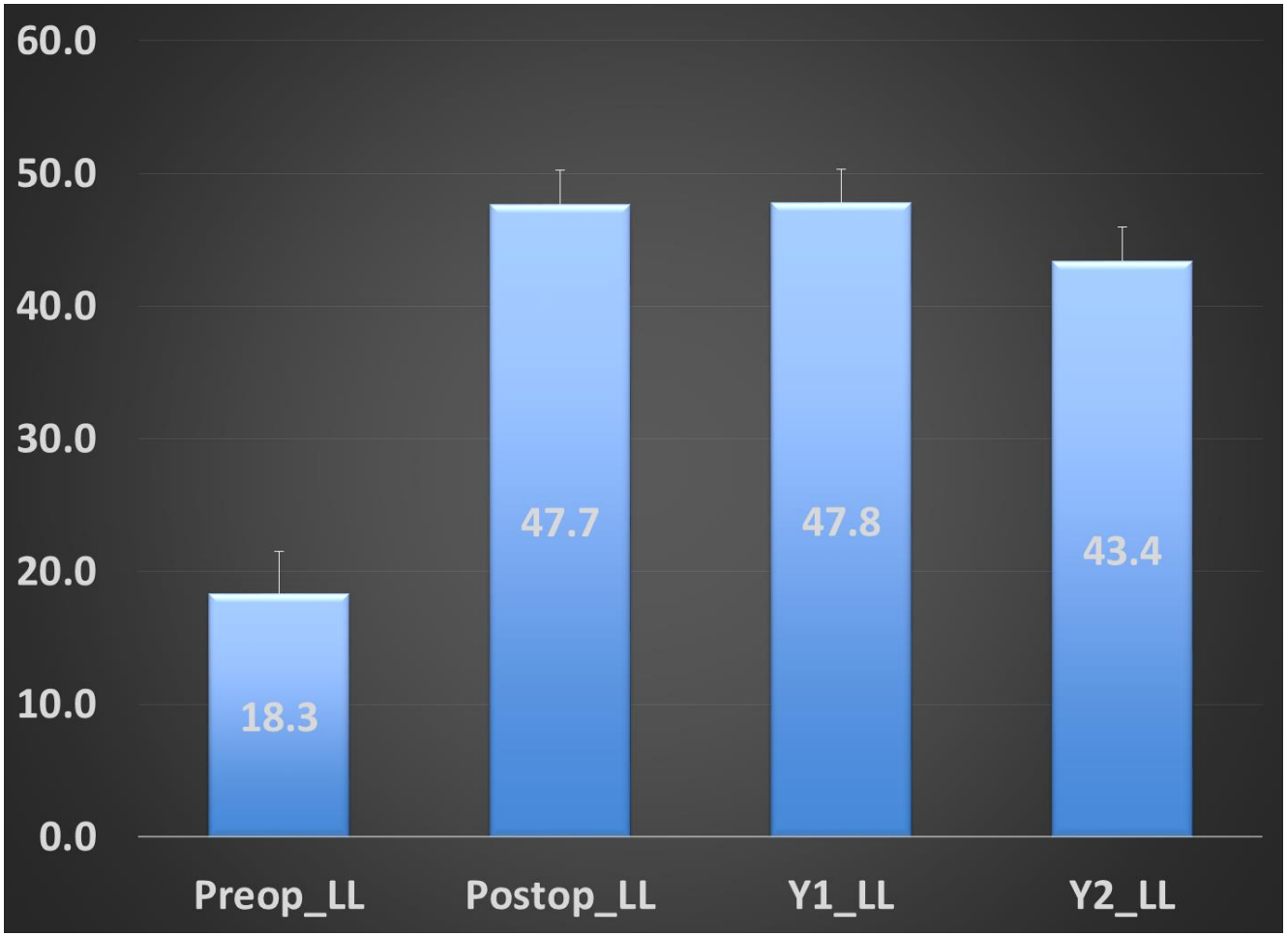


Lumbar lordosis

Anterior Column Realignment (ACR) in Adult Sagittal Deformity Correction

Technique and Review of the Literature

Rajiv Saigal, MD, PhD,* Gregory M. Mundis Jr., MD,* Robert Eastlack, MD,* Juan S. Uribe, MD,† Frank M. Phillips, MD,‡ and Behrooz A. Akbarnia, MD*



PI-LL mismatch

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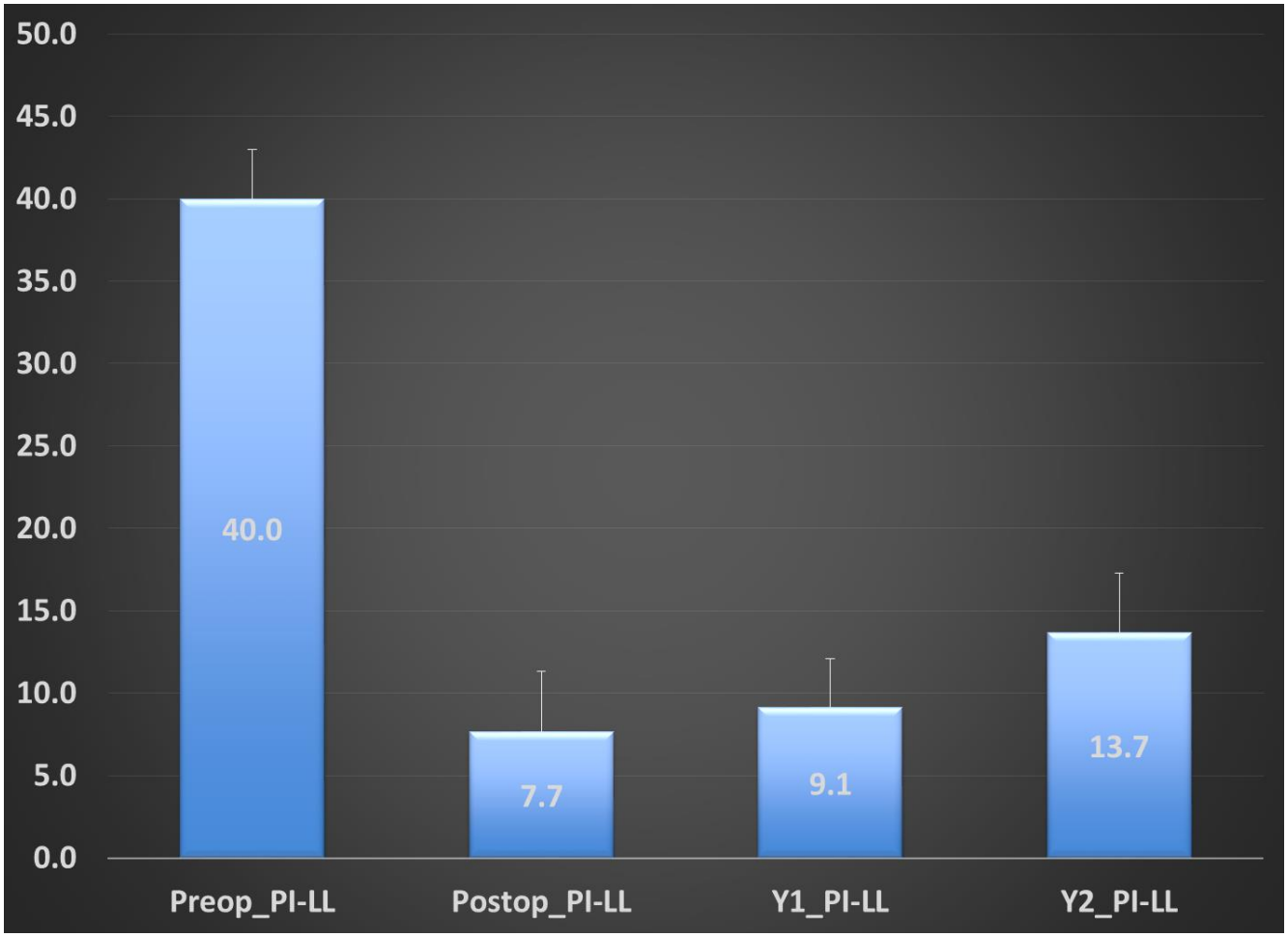
Technique and Review of the Literature

Rajiv Saigal, MD, PhD,* Gregory M. Mundis Jr., MD,* Robert Eastlack, MD,* Juan S. Uribe, MD,† Frank M. Phillips, MD,‡ and Behrooz A. Akbarnia, MD*



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Cost minimization in treatment of adult degenerative scoliosis

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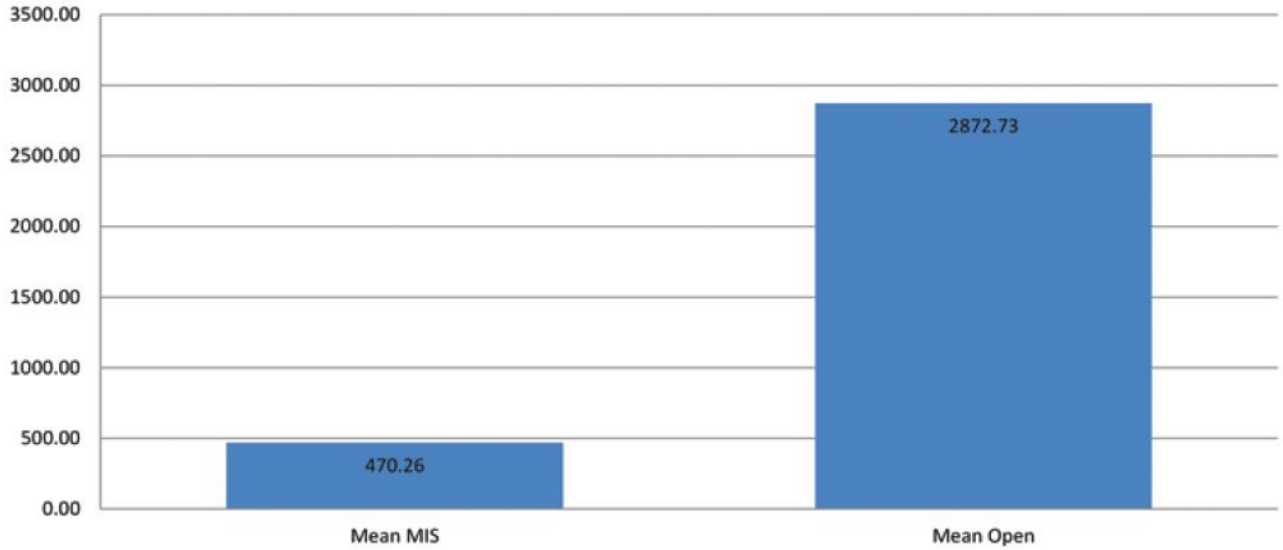

FIG. 3. Total EBL (in milliliters) for patients in the MIS and Open cohorts. Figure is available in color online only.

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TABLE 3. Comparison of inpatient hospital, outpatient rehabilitation, and total charges

Type of Charge	MIS			Open			Difference Between MIS & Open	p Value
	Mean	SD	No. of Pts	Mean	SD	No. of Pts		
Inpatient charges								
Length of hospital stay (days)	7.03	3.86	38	14.88	8.20	33	−7.85	<0.01
Blood	$2539.11	$3886.10	37	$14,470.30	$9496.52	33	−$11,931.20	<0.01
Cardiac ancillary services	$2069.44	$2020.39	25	$4539.78	$2627.56	31	−$2470.34	<0.01
ICU nursing	$12,757.00	$14,549.51	20	$14,539.88	$11,707.66	33	−$1782.88	0.64
Imaging	$9136.92	$7355.76	38	$14,031.89	$8552.72	33	−$4894.97	0.01
Laboratory tests	$7173.54	$6196.78	35	$18,633.53	$9573.61	33	−$11,459.99	<0.01
Operating room	$202,621.51	$84,305.64	38	$253,014.41	$70,991.72	33	−$50,392.90	0.01
Pharmacy	$4324.87	$3517.43	38	$12,684.44	$9934.44	33	−$8359.57	<0.01
Respiratory services	$6720.27	$15,090.07	30	$12,931.96	$9571.11	33	−$6211.69	0.06
Routine nursing	$10,730.32	$5323.45	38	$18,398.85	$10,293.84	33	−$7668.53	<0.01
Miscellaneous (nuclear medicine, gastrointestinal, other)	$20,533.07	$11,416.01	38	$28,919.16	$11,385.71	33	−$8386.09	<0.01
Inpatient total	$269,807.35	$116,498.84	38	$391,889.05	$121,191.71	33	−$122,081.71	<0.01
Inpatient total (adjusted for inflation)	$292,329.91	$128,590.45	38	$433,620.37	$129,553.86	33	−$141,290.46	<0.01
Outpatient rehabilitation charges								
Length of stay (days)	13.94	7.38	16	16.36	10.62	14	−2.42	0.48
Continuous assessment	$1583.38	$1172.66	8	$1070.01	$750.01	8	$513.37	0.31
Microbiology	$184.20	$105.88	10	$654.40	$621.32	5	−$470.20	0.12
Psychiatry	$783.84	$440.00	11	$851.06	$661.09	9	−$67.23	0.80
Supplies	$229.18	$284.58	14	$224.84	$191.45	13	$4.34	0.96
Pharmacy	$5422.36	$3254.84	16	$8691.12	$8389.71	14	−$3268.76	0.18
Room and board	$13,892.50	$7,684.27	16	$15,801.64	$10,255.24	14	−$1,909.14	0.57
Evaluation and management	$2808.94	$1300.56	16	$3038.86	$1893.07	14	−$229.92	0.71
Physical therapy	$6471.19	$3509.06	16	$7182.86	$5806.83	14	−$711.67	0.69
Occupational therapy	$5574.88	$2991.85	16	$6603.57	$5768.45	14	−$1028.70	0.55
General laboratory	$2463.63	$1752.57	16	$2908.64	$2406.49	14	−$445.02	0.57
Laboratory, nonurine	$110.94	$83.73	16	$124.29	$107.77	14	−$13.35	0.71
Miscellaneous	$2681.50	$3641.11	16	$3320.22	$3599.57	14	−$638.72	0.63
Outpatient rehabilitation total	$41,072.16	$22,541.03	16	$49,272.24	$36,991.91	14	−$8200.08	0.48
Grand total	$353,322.66	$112,092.08	16	$493,614.64	$152,207.65	14	−$140,291.98	0.01
Grand total (adjusted for inflation)	$380,732.69	$124,332.93	16	$539,331.69	$165,845.01	14	−$158,598.99	0.01

Conclusions

- ACR is a less invasive technique for correction of sagittal imbalance
- Less blood loss
- Possible cost reduction

Conclusions

- MIS techniques can be used for a range of spinal disorders
- *Degenerative*
- *Tumor*
- *Deformity*
- *Trauma*

- Less blood loss
- Lower length of stay
- Lower cost
- Similar long-term outcomes

Thank you

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Part of Washington Hospital Healthcare System

Questions?

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