

Anterior Column Support

JEFFREY E DECKEY MD

MANAGING PARTNER

ORTHOPEDIC SPECIALTY INSTITUTE

DIRECTOR OF COMPLEX SPINAL SURGERY

ST JOSEPH'S HOSPITAL, ORANGE CA

SPINE FELLOWSHIP CHAIRMAN

HOAG ORTHOPEDIC INSTITUTE

SCOLIOSIS CENTER

CHILDRENS HOSPITAL ORANGE COUNTY



Anterior Column Support Indications?

- ▶ **Traditional Anterior Lumbar Fusion**
 - ▶ **Excluding direct lateral, PLIF, TLIF, Trans-sacral**
 - ▶ **Increase fusion success**
 - ▶ **Biomechanical considerations**
 - ▶ **Deformity correction (coronal / sagittal)**

Fusion Success

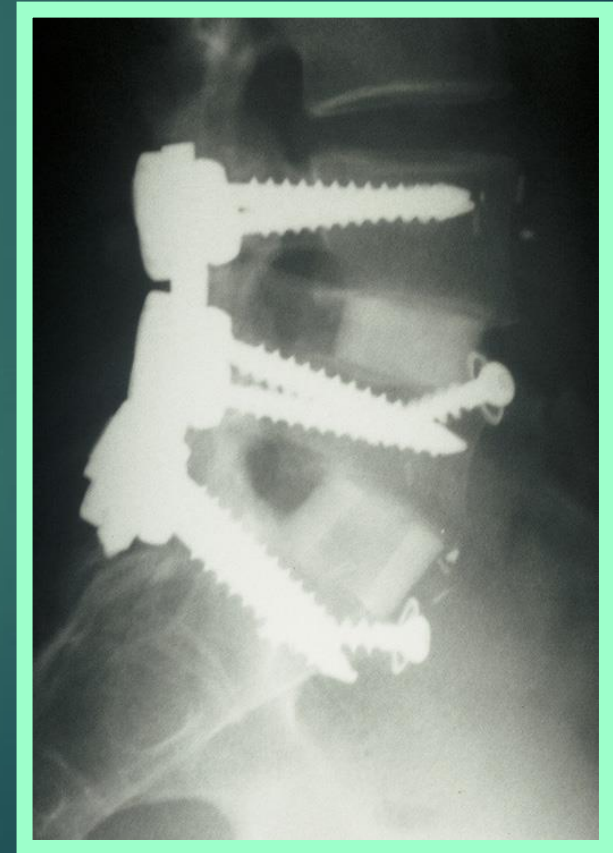
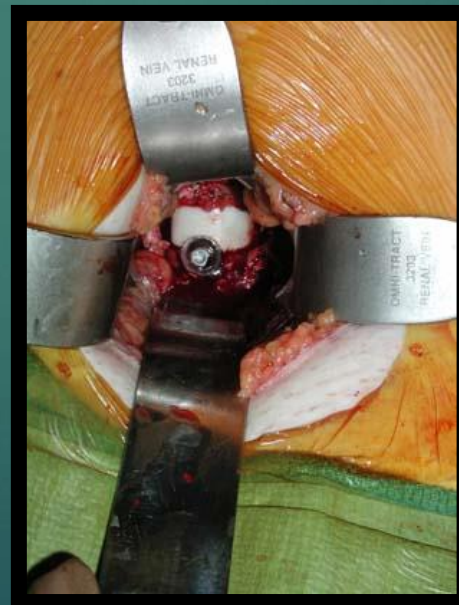
- ▶ Interbody fusion clearly increases chances of fusion compared to posterolateral, but also better endplate preparation vs TLIF, PLIF, DLIF, trans-sacral
 - ▶ Important consideration for
 - ▶ Lumbosacral junction, high pseudo rates (esp in long constructs)
 - ▶ Treatment of pseudoarthrosis itself
 - ▶ High risk patients (smokers, steroid use, etc)
 - ▶ Biologic consideration (BMP, Bonegraft sub vs iliac bone graft – BMP safer in anterior approach)
 - ▶ Adjacent level fusions (anterior fusion increases chance of fusion (lateral approach maybe easier in upper lumbar or thoracic levels))

Biomechanical Considerations

- ▶ Highly unstable situations
 - ▶ Long constructs with fusion to the pelvis
 - ▶ Large sagittal deformity corrections
 - ▶ High grade spondylolisthesis
 - ▶ Large anterior column defects (ie tumor, fx, infection)
 - ▶ Obesity
 - ▶ Osteoporosis

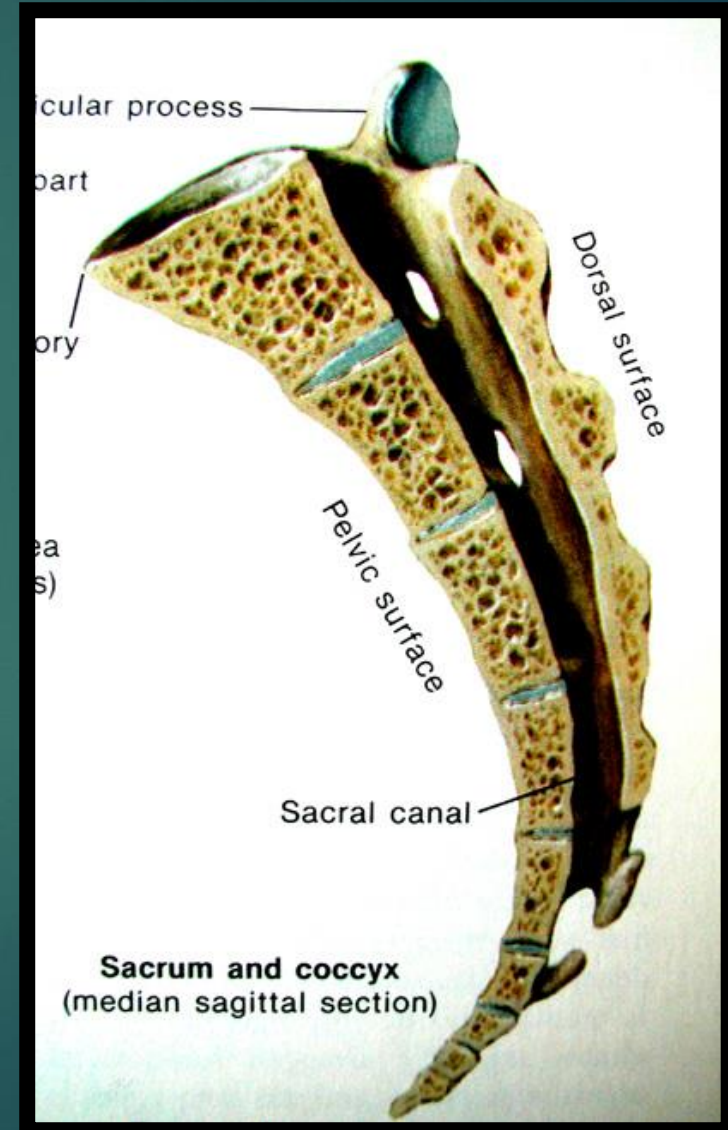
Lumbosacral fusions

- ▶ Anterior Column Support allows for increase in biomechanic stability and fusion biology



Does Cage Geometry Matter?

- ▶ Cage footprint is important especially when large loads are expected anteriorly or when bone quality is not optimum
- ▶ Sacrum – soft cancellous bone
- ▶ Want maximum footprint to cover appophyseal ring
- ▶ Advantage of large ALIF cage vs TLIF cages



What type of anterior support?

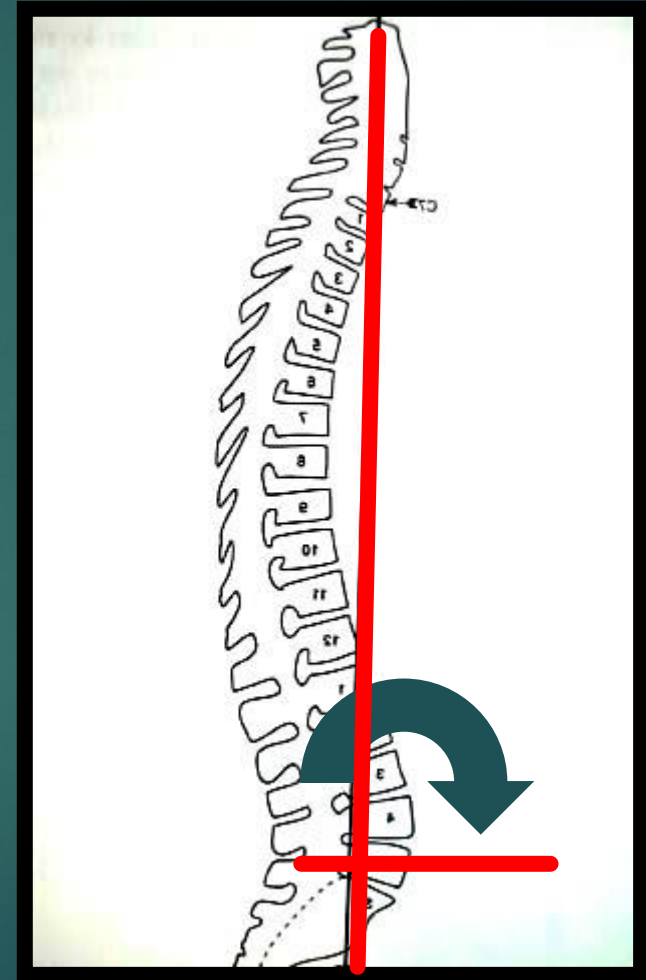
Biomechanical Analysis of Lumbosacral Fixation

Glazer et al, Spine 1996

- ▶ **Anterior structural support provides significant resistance to flexion**
- ▶ **Femoral ring was superior in flexion due to preservation of the end plates as compared to threaded cage**
- ▶ **Argument against small TLIF or PLIF cages, moving toward larger ALIF cages, Lateral cages**

Supplemental Pelvic Fixation

- ▶ For long constructs, adding pelvic fixation still is critical
 - ▶ Provides stability across the lumbosacral junction
 - ▶ Prevents fractures in sacrum distal to sacral screws.
 - ▶ Long iliac screws optimal extending across femoral notch



**“Biomechanical evaluation of lumbosacral reconstruction techniques for spondylolisthesis: An in vitro porcine model
Cunningham et al;**

Spine 2002

- ▶ Complete transection of lumbosacral junction
- ▶ 24 fresh frozen porcine lumbosacral spine
- ▶ 4 groups: S1 screws, S1 + interbody; S1 + iliac screw; S1 + iliac screws + interbody
- ▶ Both interbody and iliac screws enhanced stability however iliac screws were superior.
- ▶ Iliac screws + S1 and Iliac screws +S1+interbody failed proximally indicating anterior interbody may be more important in obtaining fusion vs. support.

Deformity Correction

Sagittal Considerations

- ▶ Direct Anterior Approach allows for maximum restoration of lordosis at L4/L5 and L5/S1. (esp w/ hyperlordotic 20/30 cages)
- ▶ PLIF/TLIF limited in restoring lordosis, also unpredictable, making preop planning difficult
- ▶ PSO (although necessary in certain situations, high complication rate, high pseudo rate)
- ▶ Traditional Direct lateral approach is limited unless performing ACR with release of ALL (not possible at L5/S1, increase risks at L4/L5)

Sagittal Restoration of Lumbar Lordosis

- ▶ Pre-op planning: Able to dial in lumbar lordosis to match pelvic incidence, using varying degree implants
- ▶ 2/3 of lumbar lordosis is typically located from L4-S1, with maximal lordosis at L5/S1. So it makes sense to obtain maximal correction at these two levels thus arguing against DLIF for scoliosis correction followed by TLIF at L5/S1
- ▶ New larger foot prints decrease the incidence of subsidence in large corrections

Practical considerations of hyperlordic cages

- ▶ Preop CT scans are important to assess for fused facet joints which will limit correction
- ▶ A thorough discectomy with release of Anterior annulus, bridging osteophytes, and partial anterolateral annulus while preserving endplates is essential
- ▶ Release of posterior annulus and sometimes PLL, allows for lengthening of posterior graft height
- ▶ This is important, hyperlordotic cages shorten the posterior column and a thorough foraminotomy is critical. A longer posterior wall of the cage will help indirectly open the foramen
- ▶ Finally, a buttress scREW is important to avoid extrusion of the graft

CASE EXAMPLE SAGITTAL

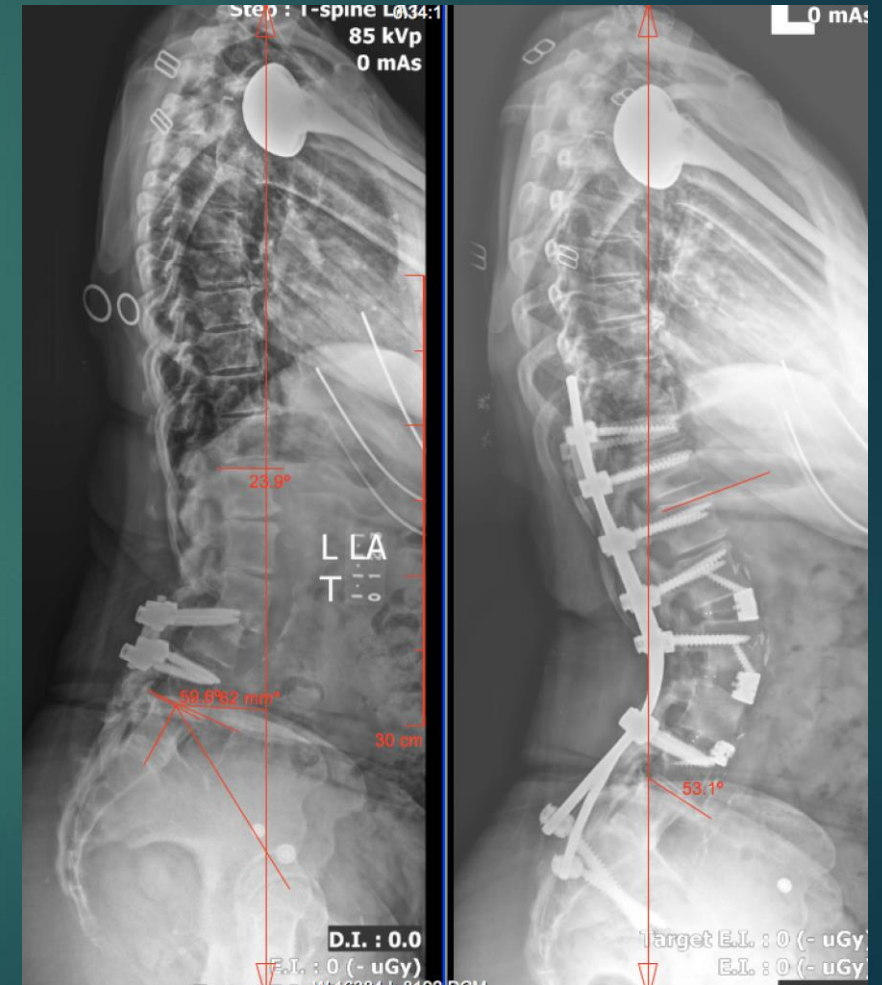
76 yo female osteoporosis

Remote history of PLF I5/S1, L4/5
Spondylolisthesis L3/4, stenosis L2/3,L3/4
Pseudo L4/L5, loose screws
12 months of forteo

PI=59 degrees LL=23 SVA=60 mm

3 stage procedure – single setting
Posterior decompression, smith-peterson osteomies,
and screw placement, anterior cages (20 and 14
degrees) ; posterior placement of rods

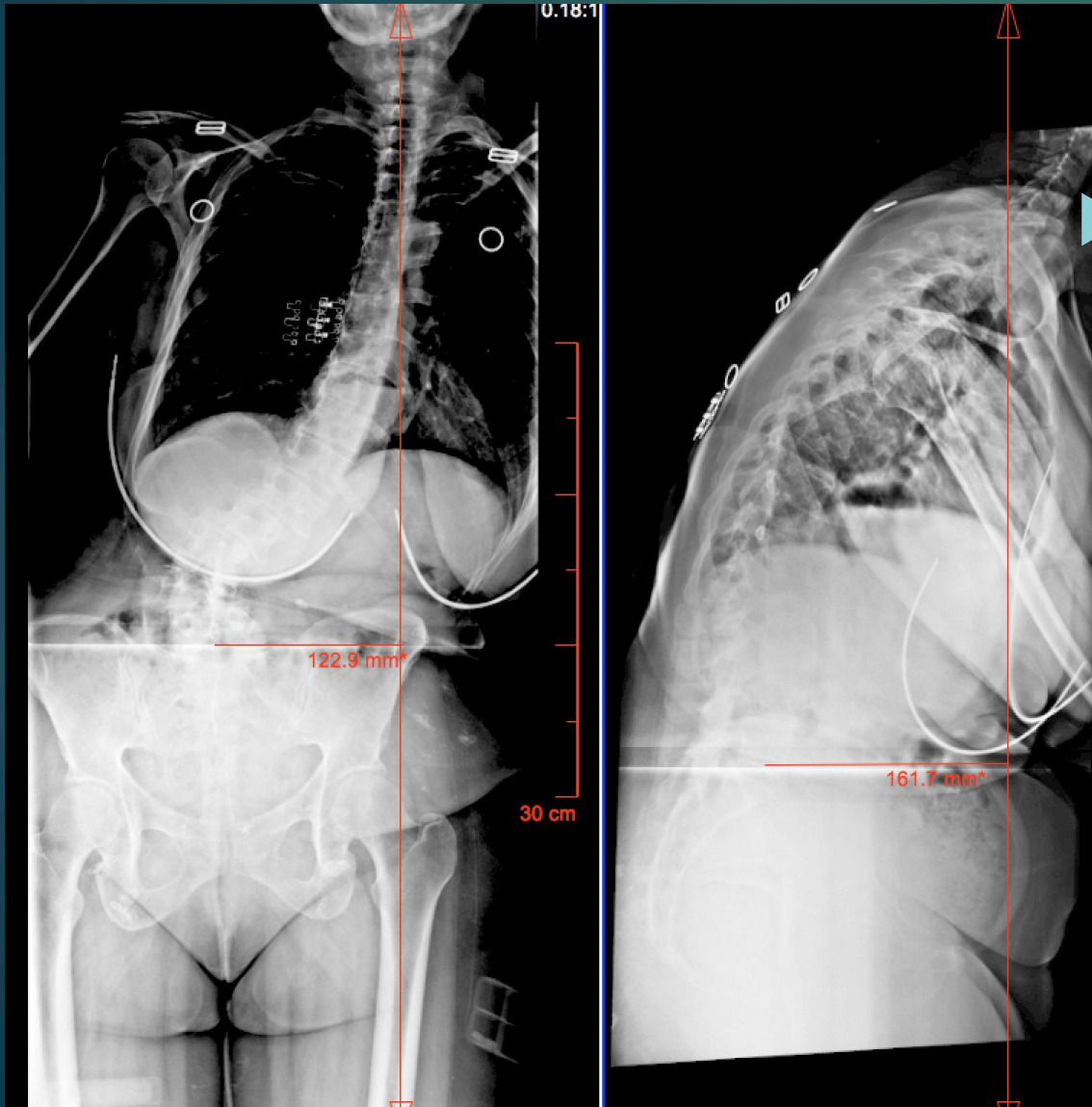
Post opr PI=59, LL=56, SVA = neutral



Coronal correction via ALIF

- ▶ Structural cages most commonly used at L4/L5 and L5/S1 for fractional scoliosis curve and “level out the take off from the pelvis”
- ▶ Often, if significant coronal deformity or scoliosis exist, release of upper lumbar levels and packing with bonegraft allows for coronal balancing posteriorly
- ▶ Cages placed in middle of primary curve can lead to a fixed coronal deformity
- ▶ Larger footprints prevent subsidence, and improves coronal correction

Case example : Coronal and Sagittal

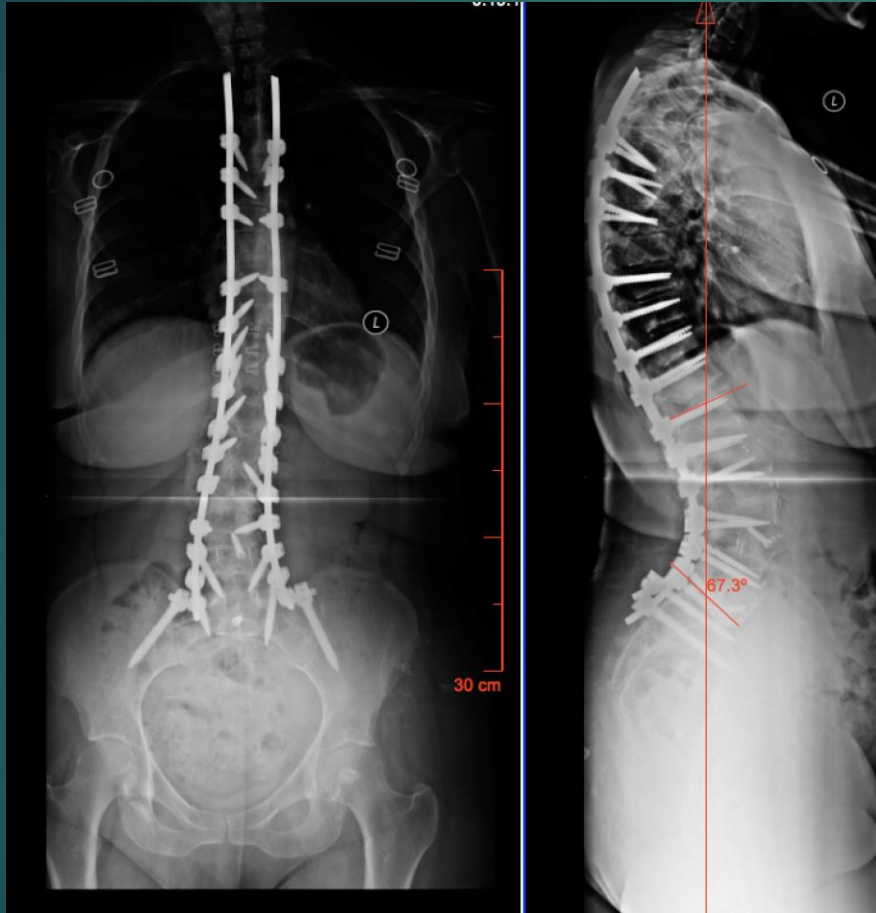


- ▶ Combined anterior /posterior approach
 - ▶ 122 mm/161 mm
 - ▶ Sagittal correction
 - ▶ Solid fusion
 - ▶ Coronal balance
 - ▶ Cages at L4/L5, L5/S1
 - ▶ Morsalized bone above

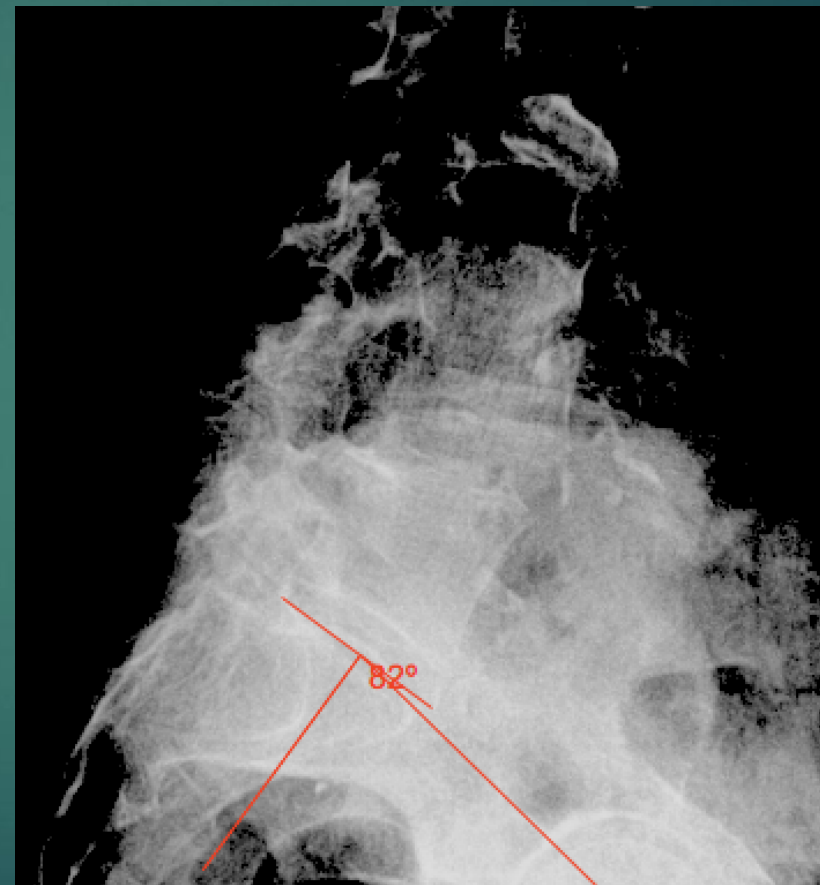
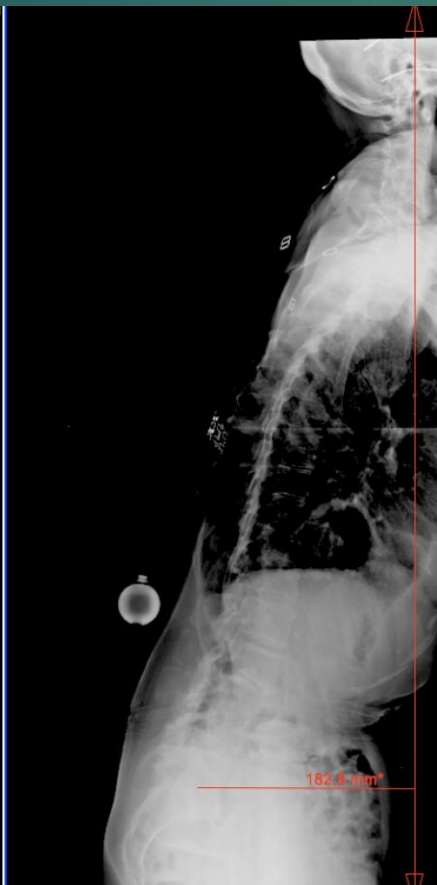
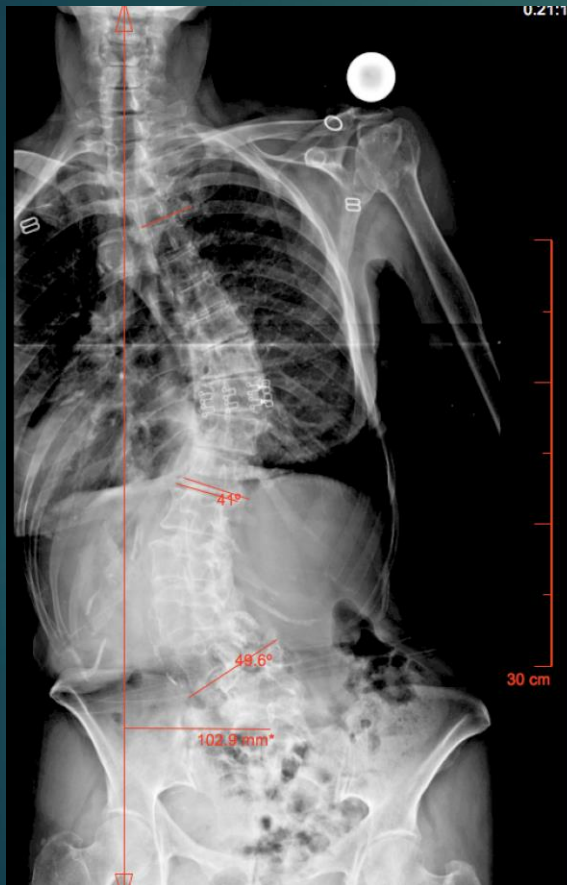


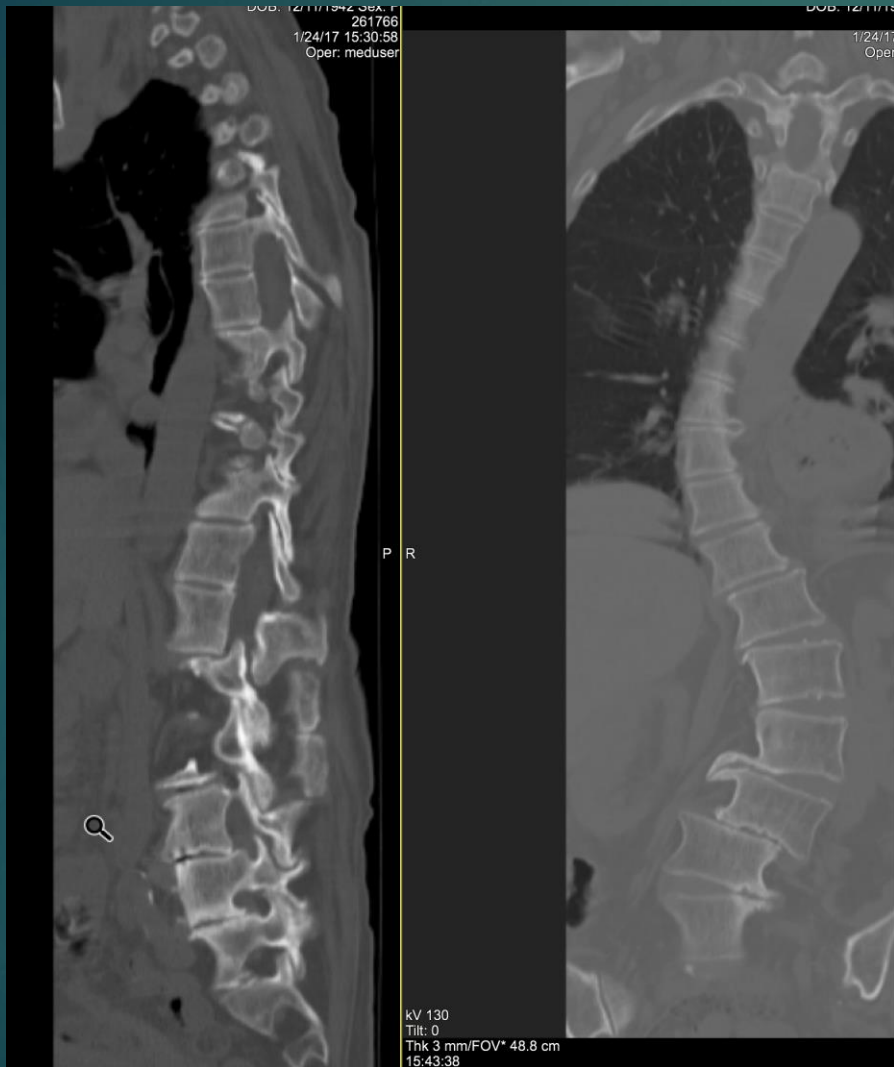
- ▶ **Placing cages at upper lumbar levels, inhibit posterior coronal correction.**
- ▶ **Prefer anterior release with morsalized bone**

Goal is coronal and sagittal balance



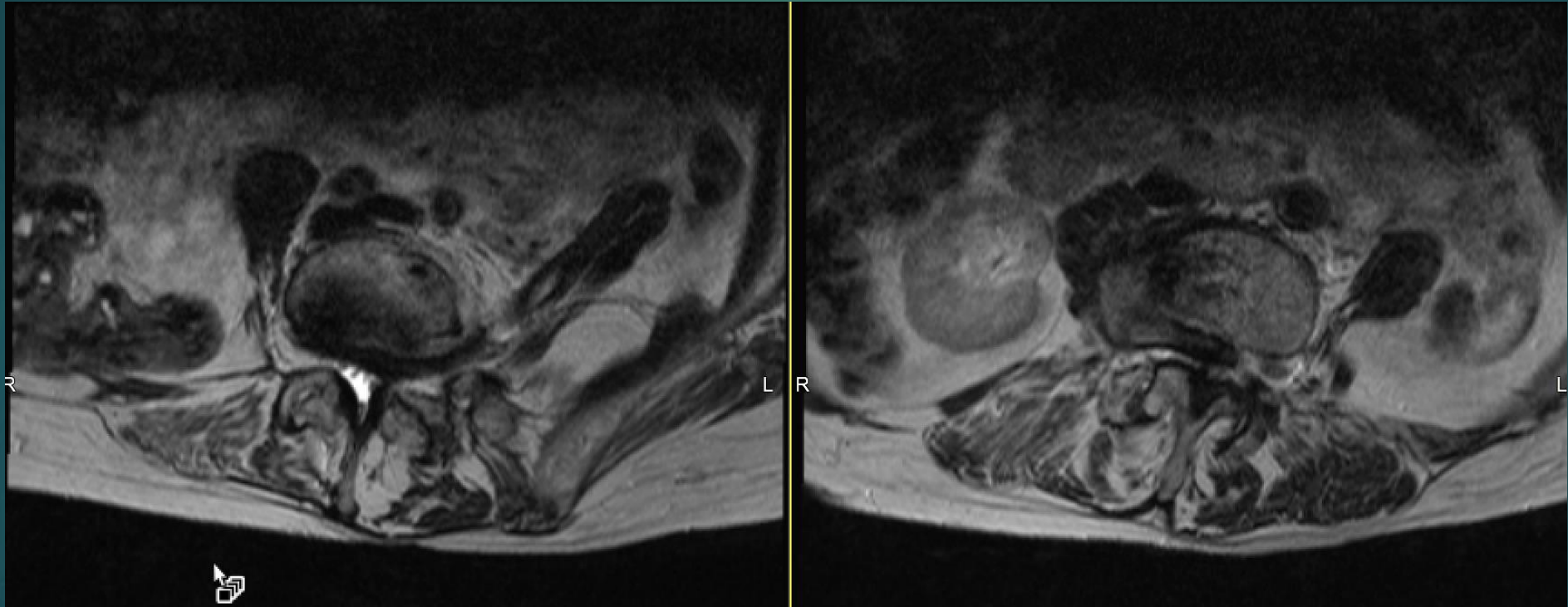
- ▶ Posterior : need to perform aggressive release to mobilize spine and correct deformity. Intra-op 36 inch films necessary to confirm coronal balance

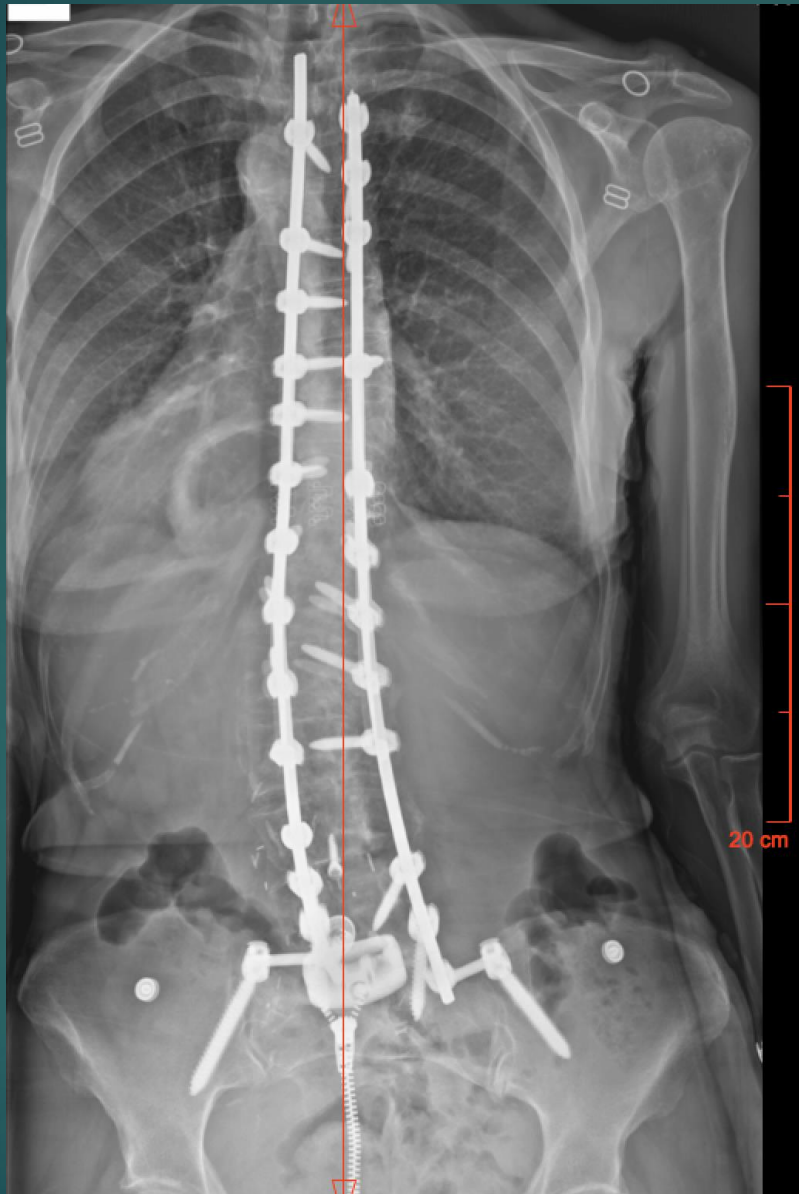




CT scan allows eval of lateral bridging osteophytes at upper levels and need for release

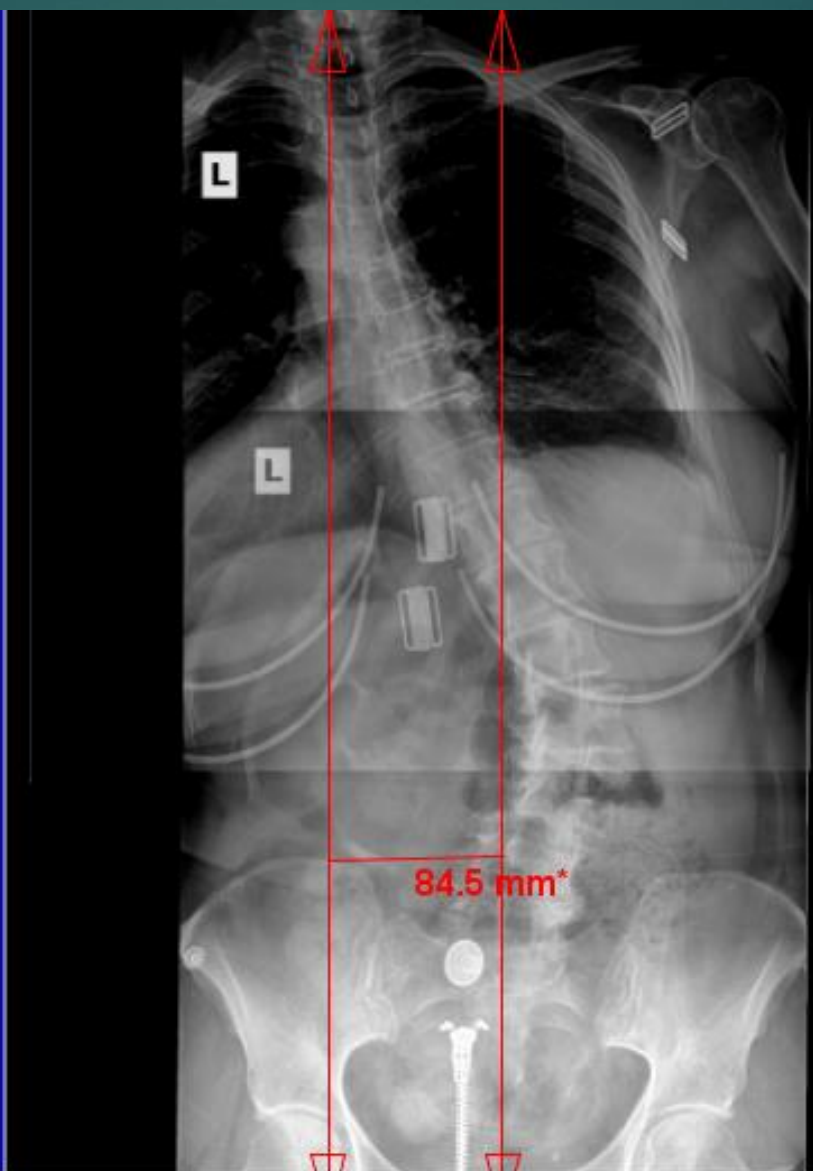
Cages at L4/L5 and L5/S1 to level take off of spine from pelvis and correct fractional curve, use wide foot print and appropriate lordosis





thanks

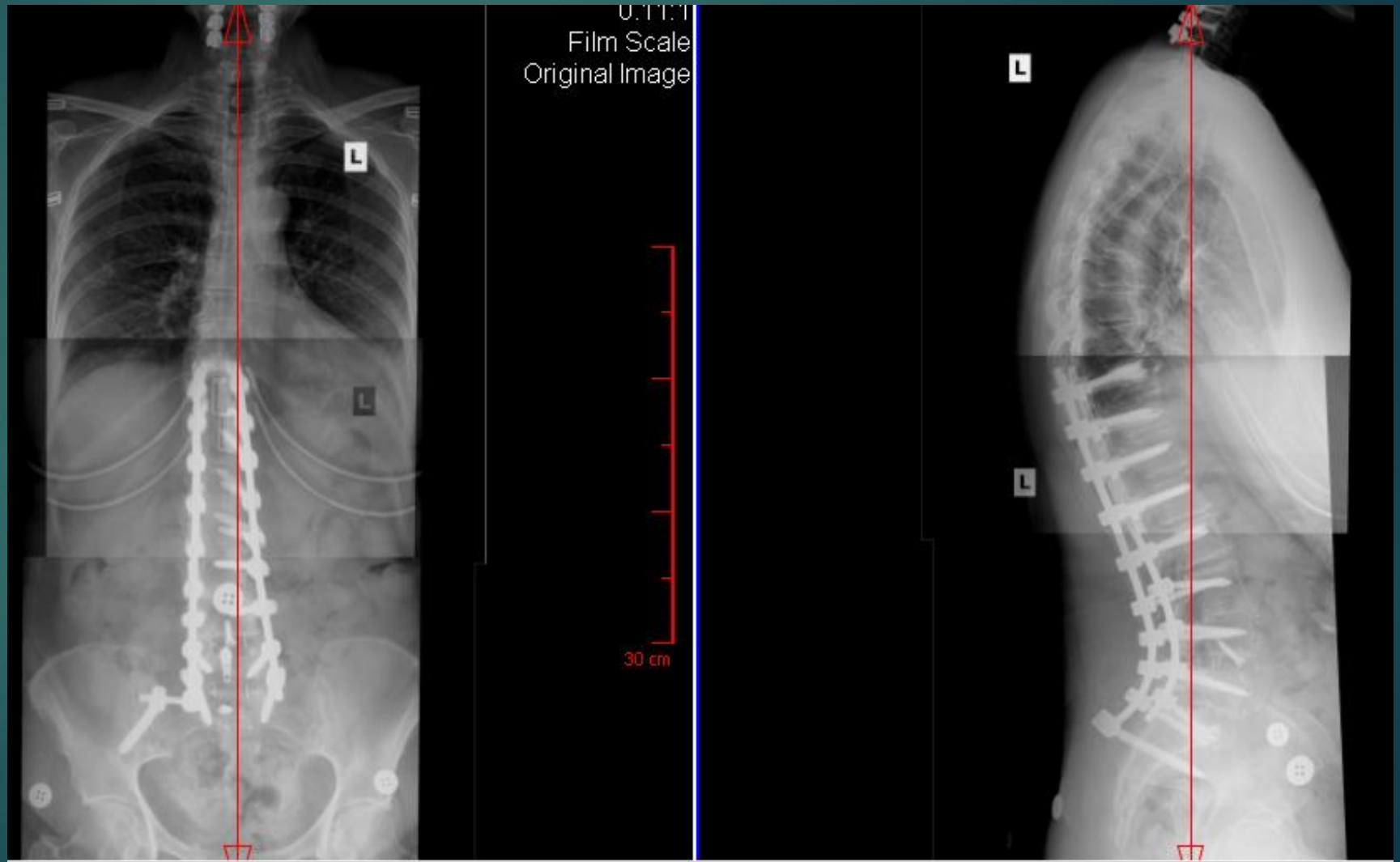


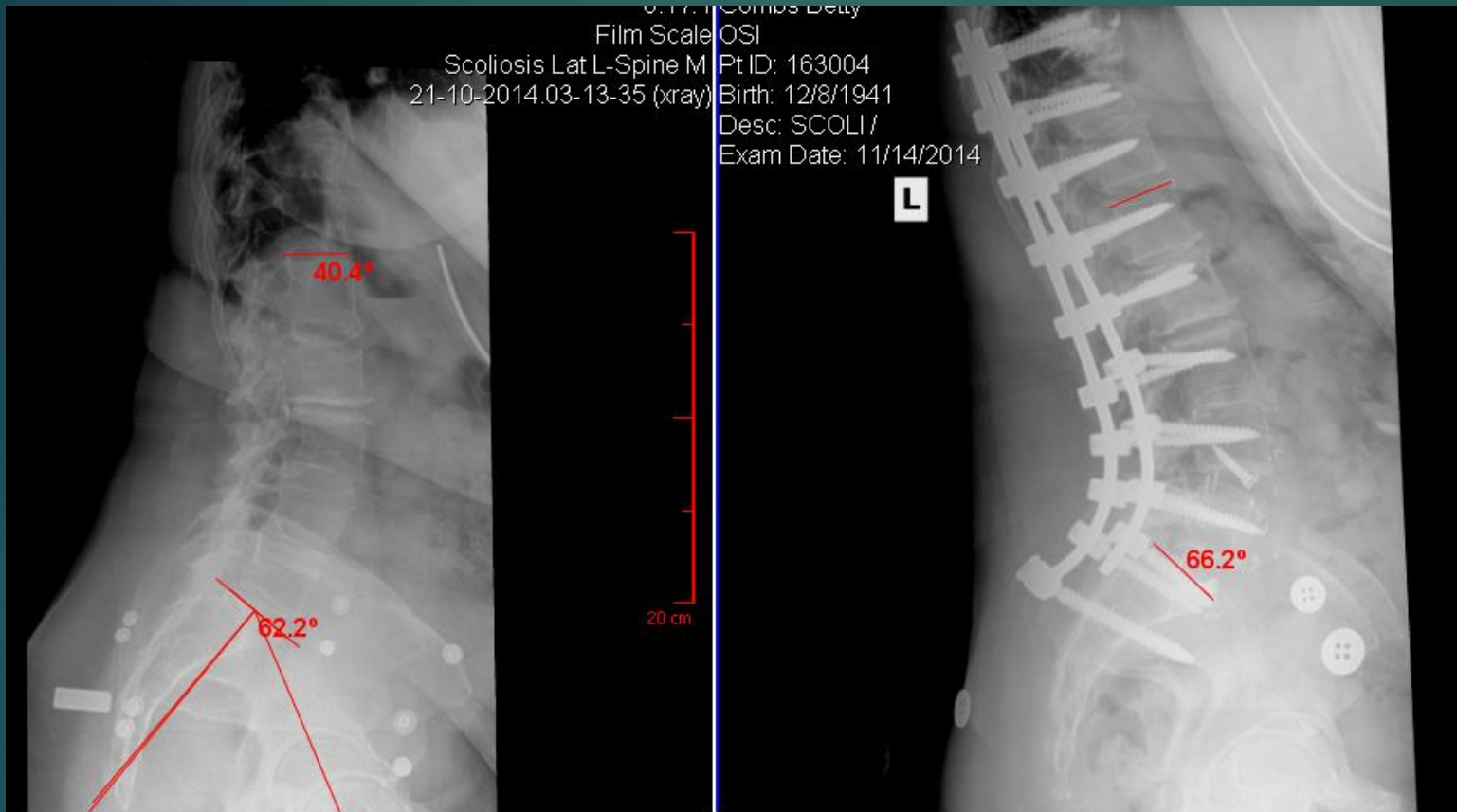


71 yo male with coronal and sagittal imbalance

Multilevel anterior fusion with hyperlordotic cages at L4/L5 and L5/S1 with morsalized bone above

Restoration of sagittal and coronal balance

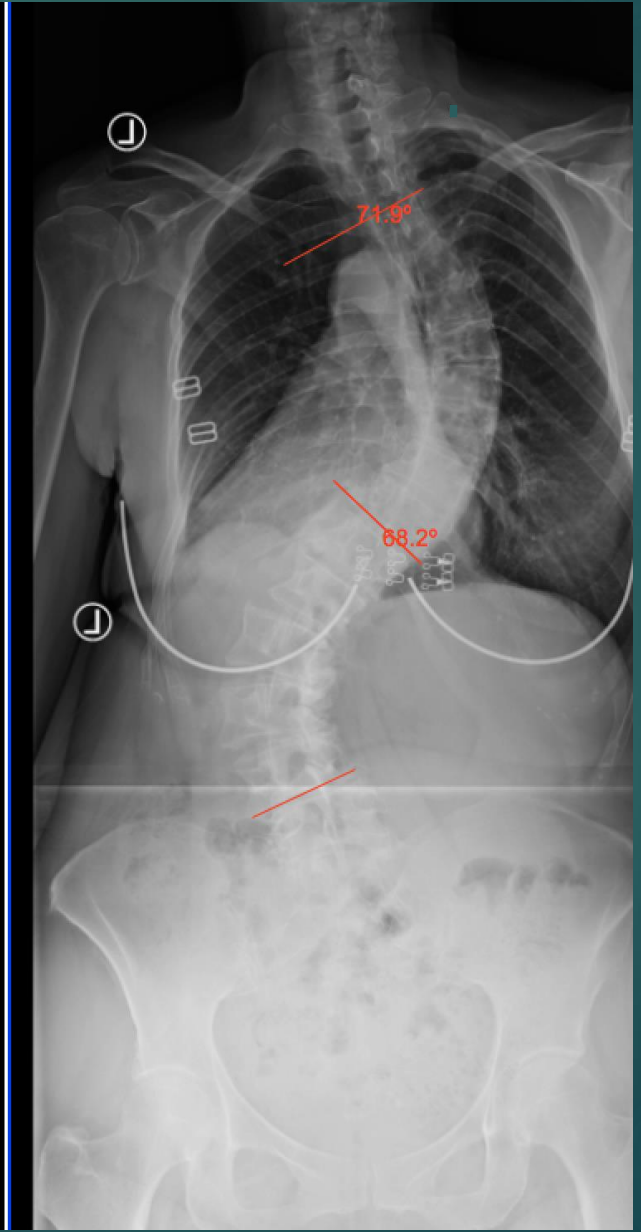




Pelvic incidence 62

Preop LL = 40

Postop LL = 66



CT scan helpful for preop planning



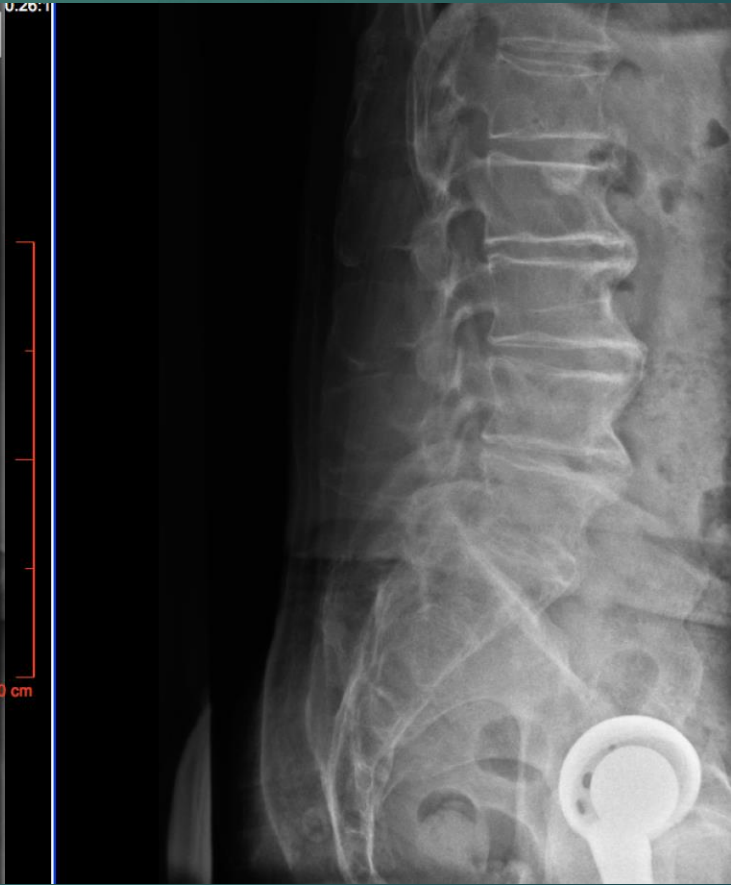
Cages at L4/L5 and L5/S1 to address fractional curve

CT helps to eval superior lumbar levels for bridging osteophytes and need for anterior release and morsalized bone

Pelvic incidence 40
Lumbar lordosis 30



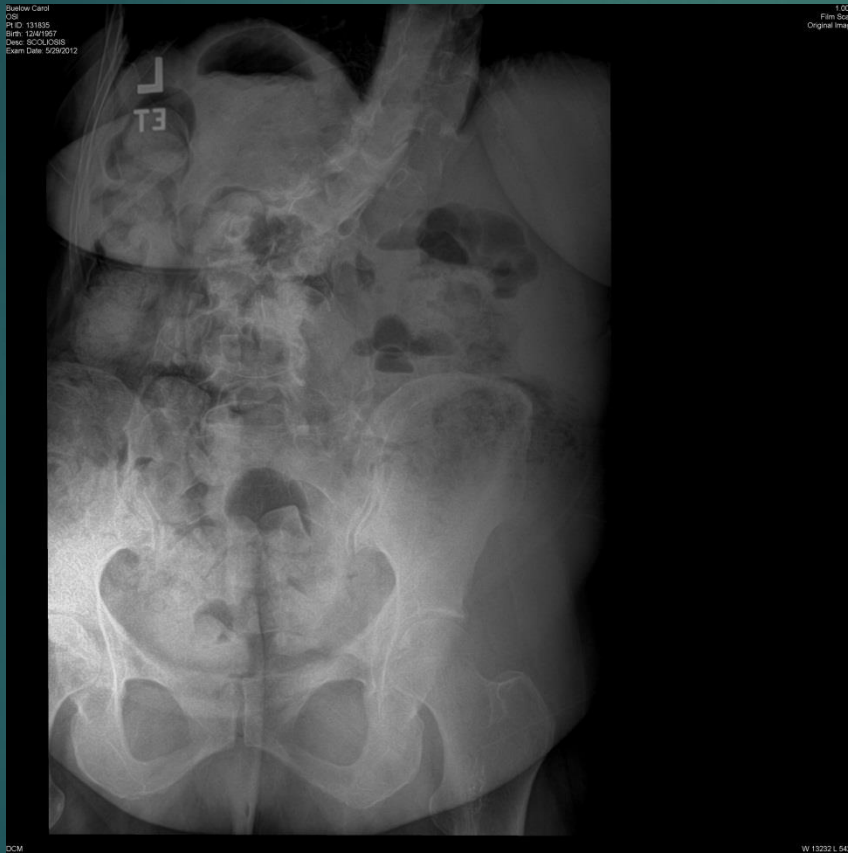






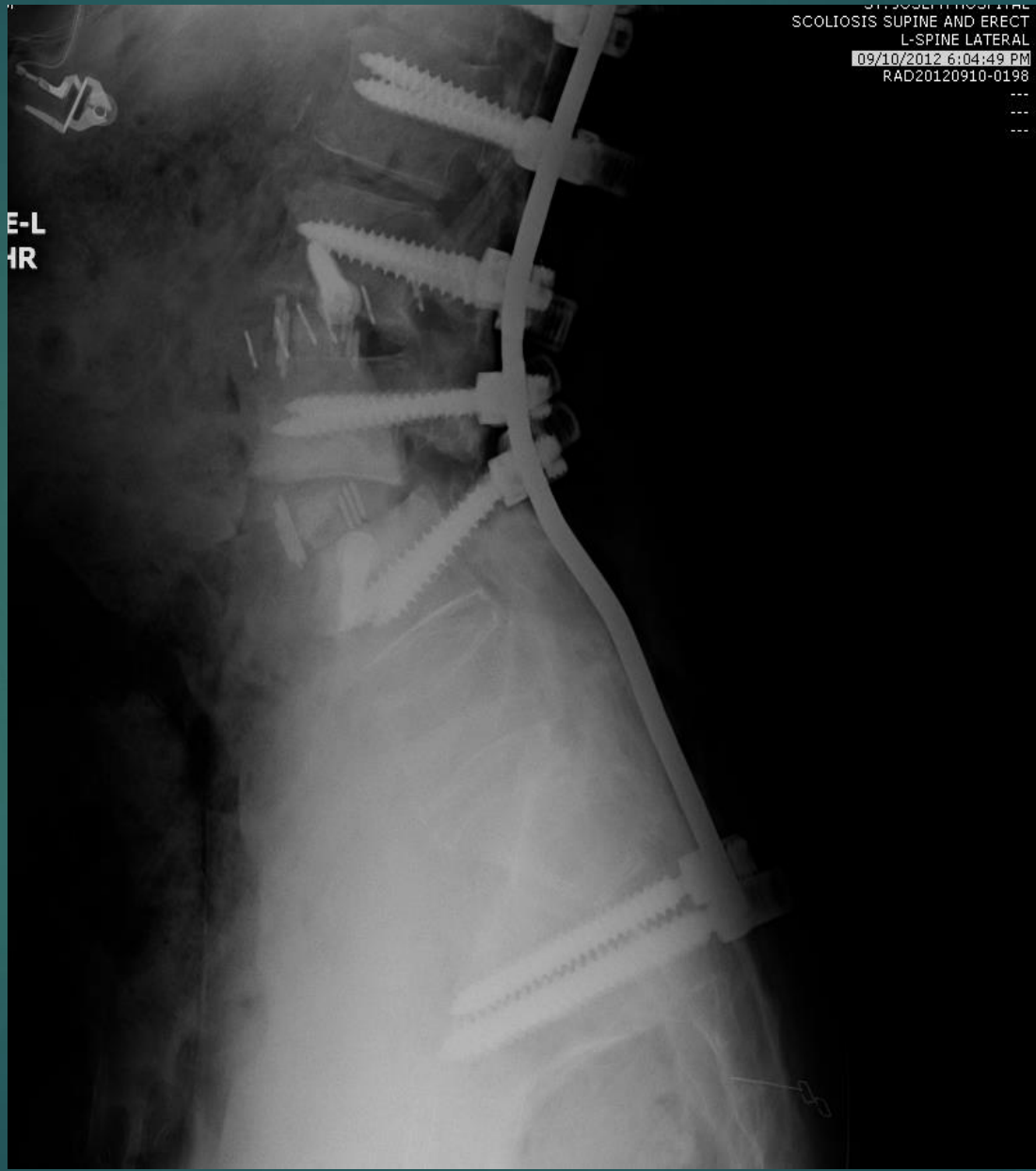


70 year old female, with previous L4-S1 fusion insitu



Coronal and sagittal imbalance

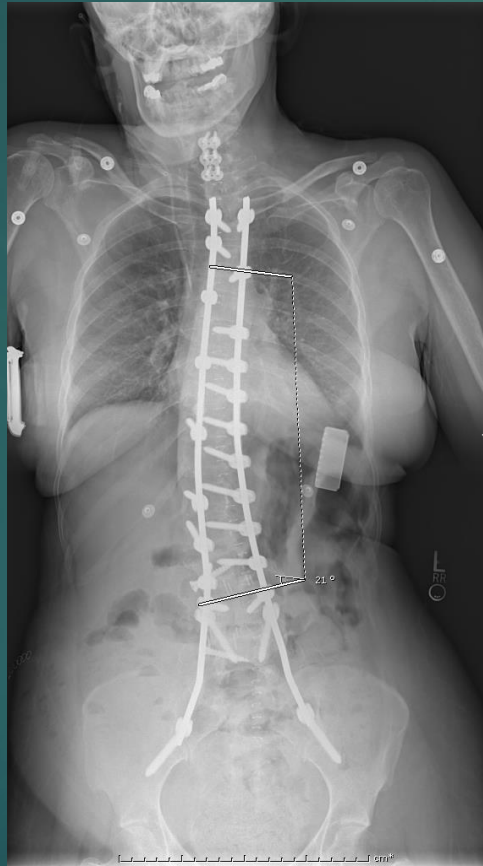




SCOLIOSIS SUPINE AND ERECT
L-SPINE LATERAL
09/10/2012 6:04:49 PM
RAD20120910-0198

E-L
HR

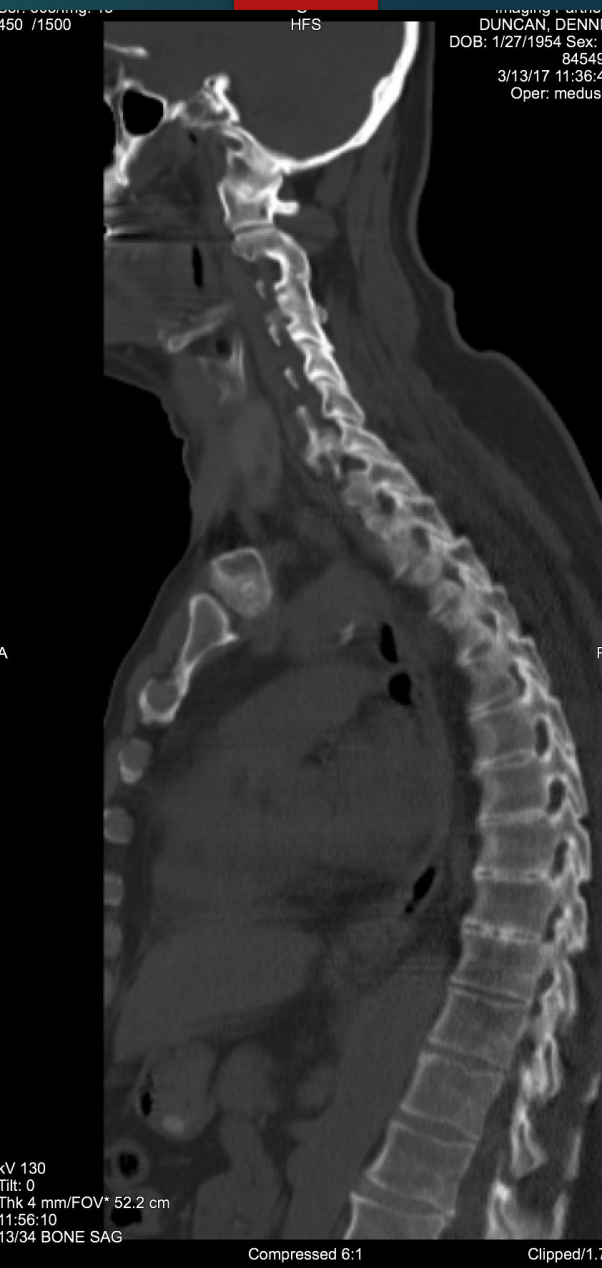


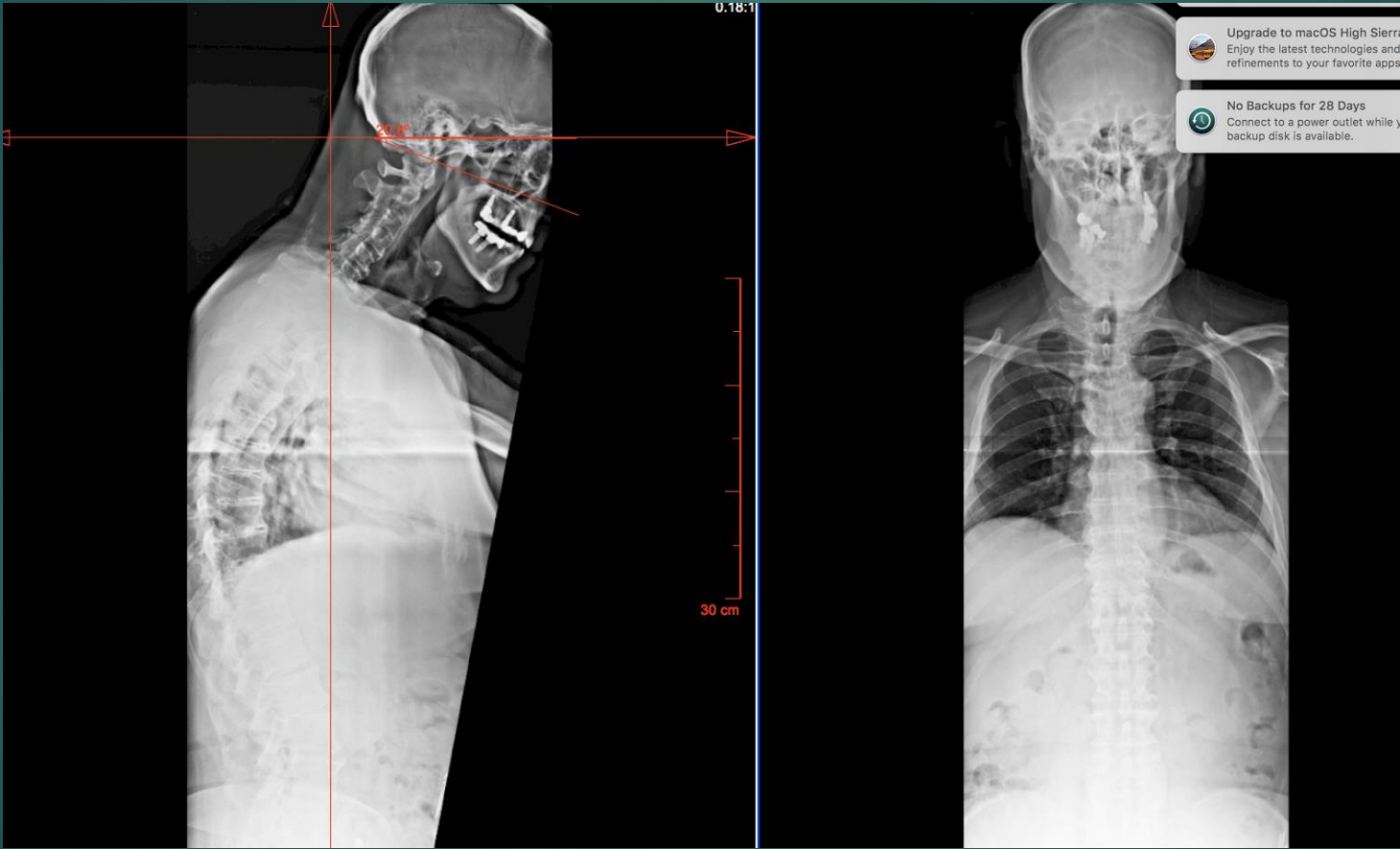


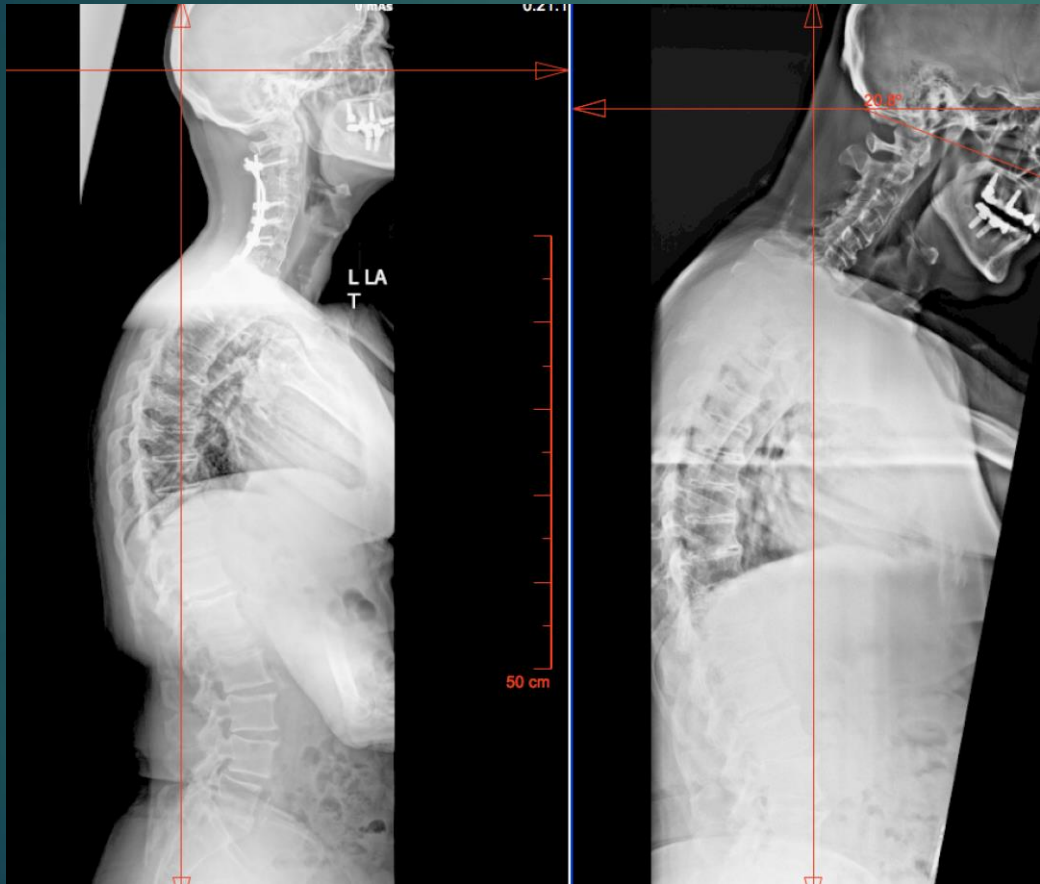


20 cm





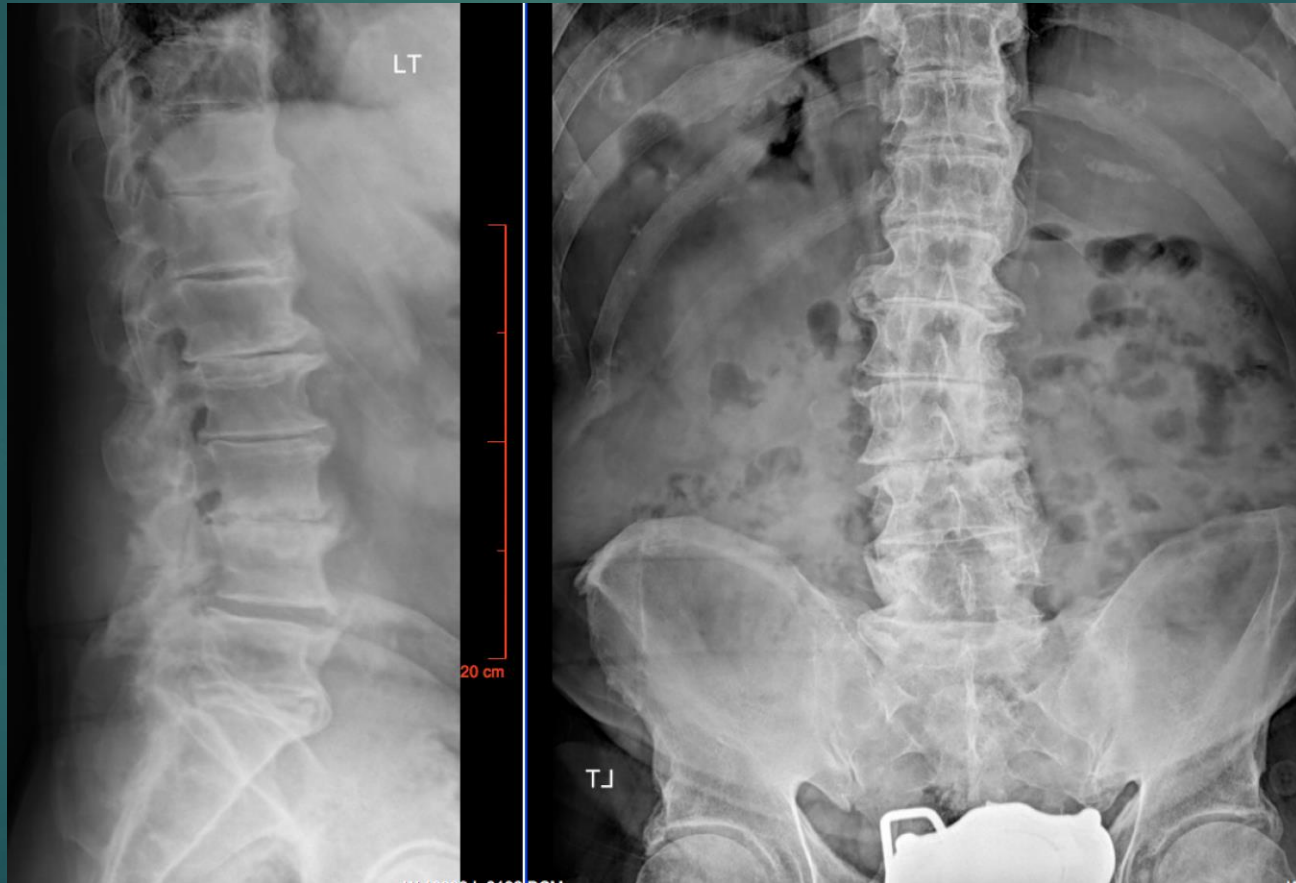






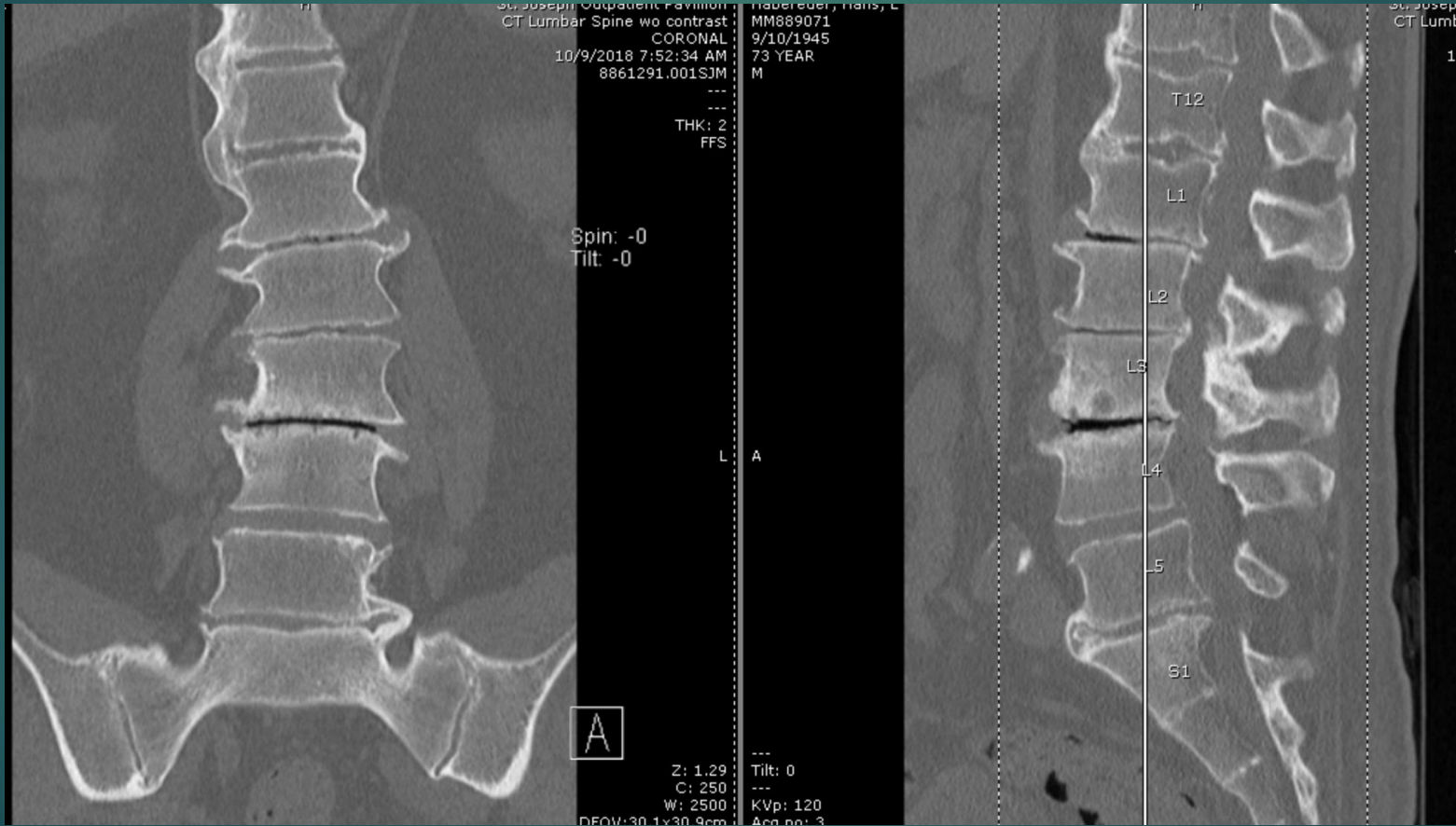
20 cm

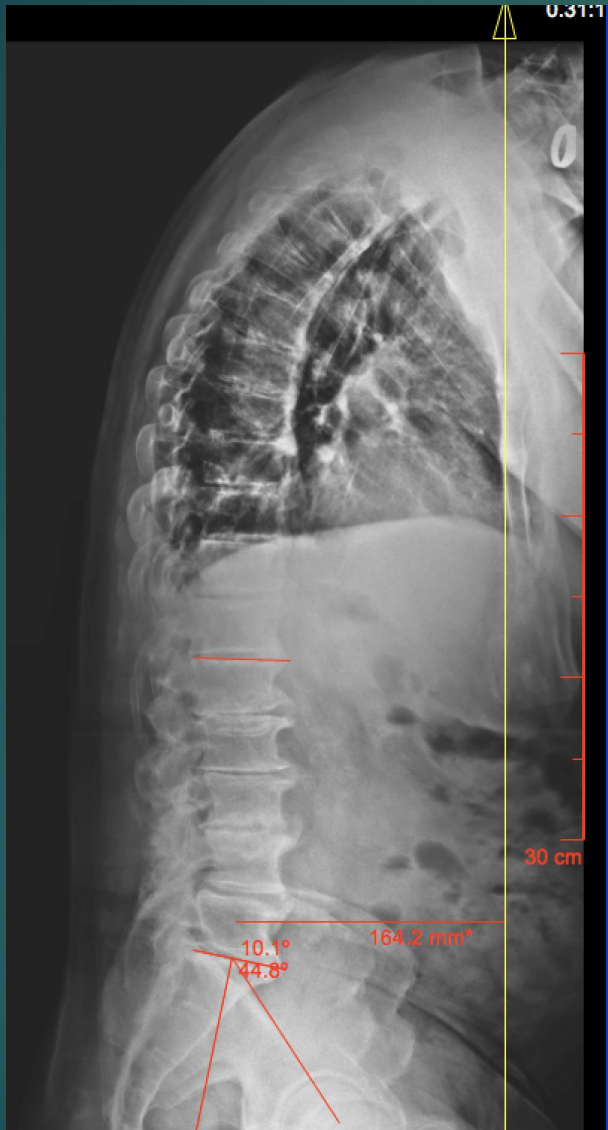


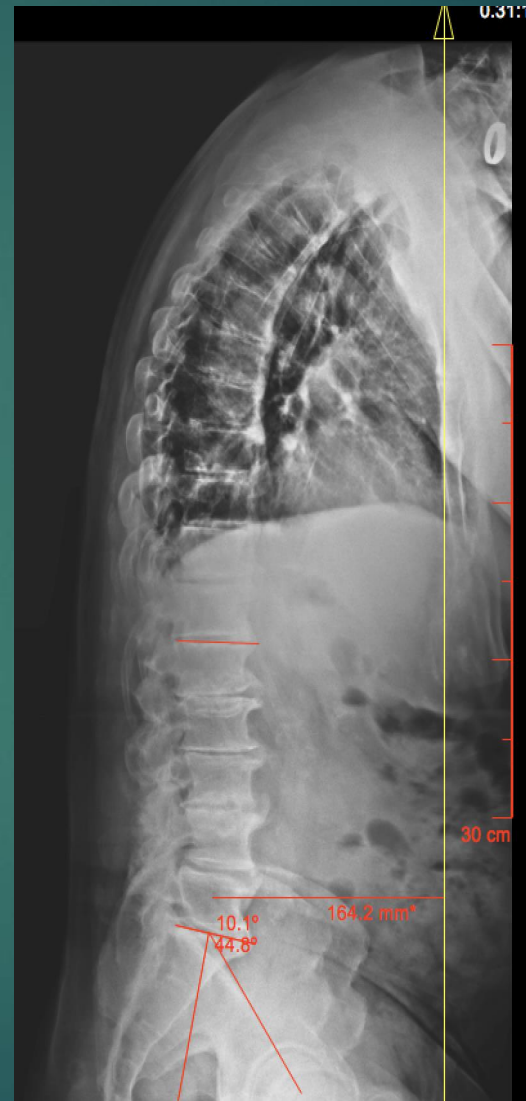
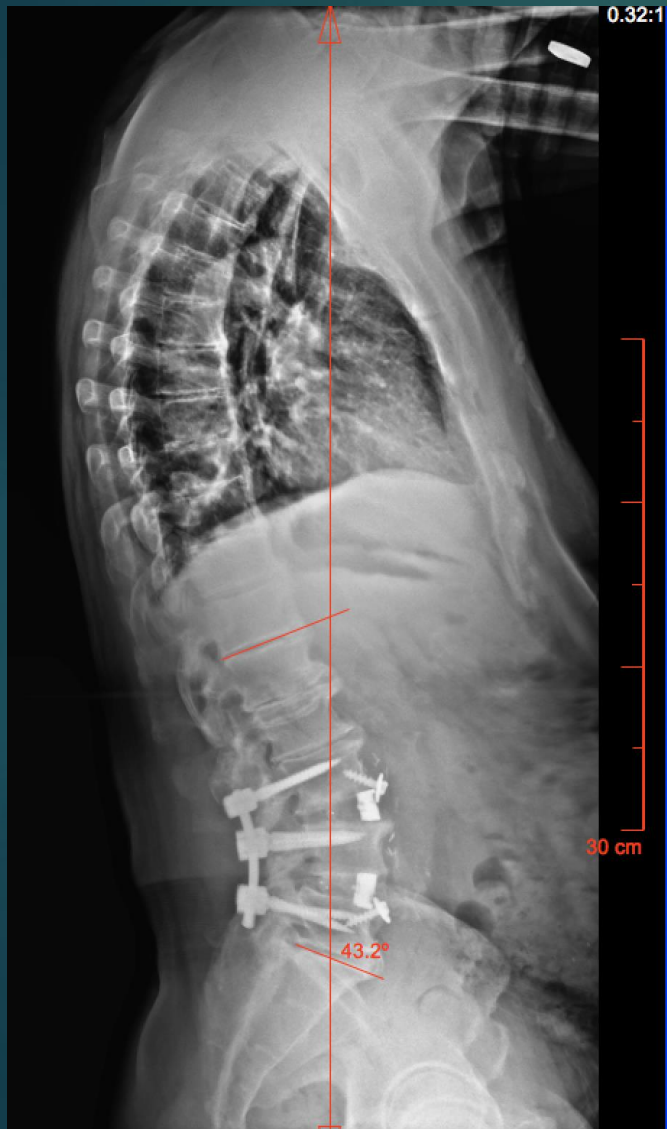


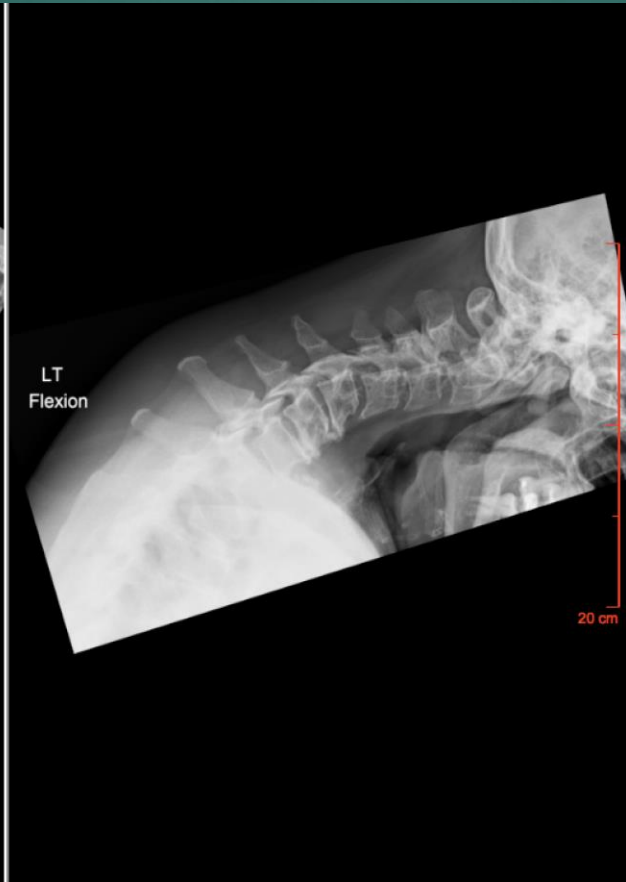




















30 cm



