Debate

Non-operative Techniques vs. Early Surgery

ICEOS Madrid

"old guys" ?

A long time ago….

…in far West Texas

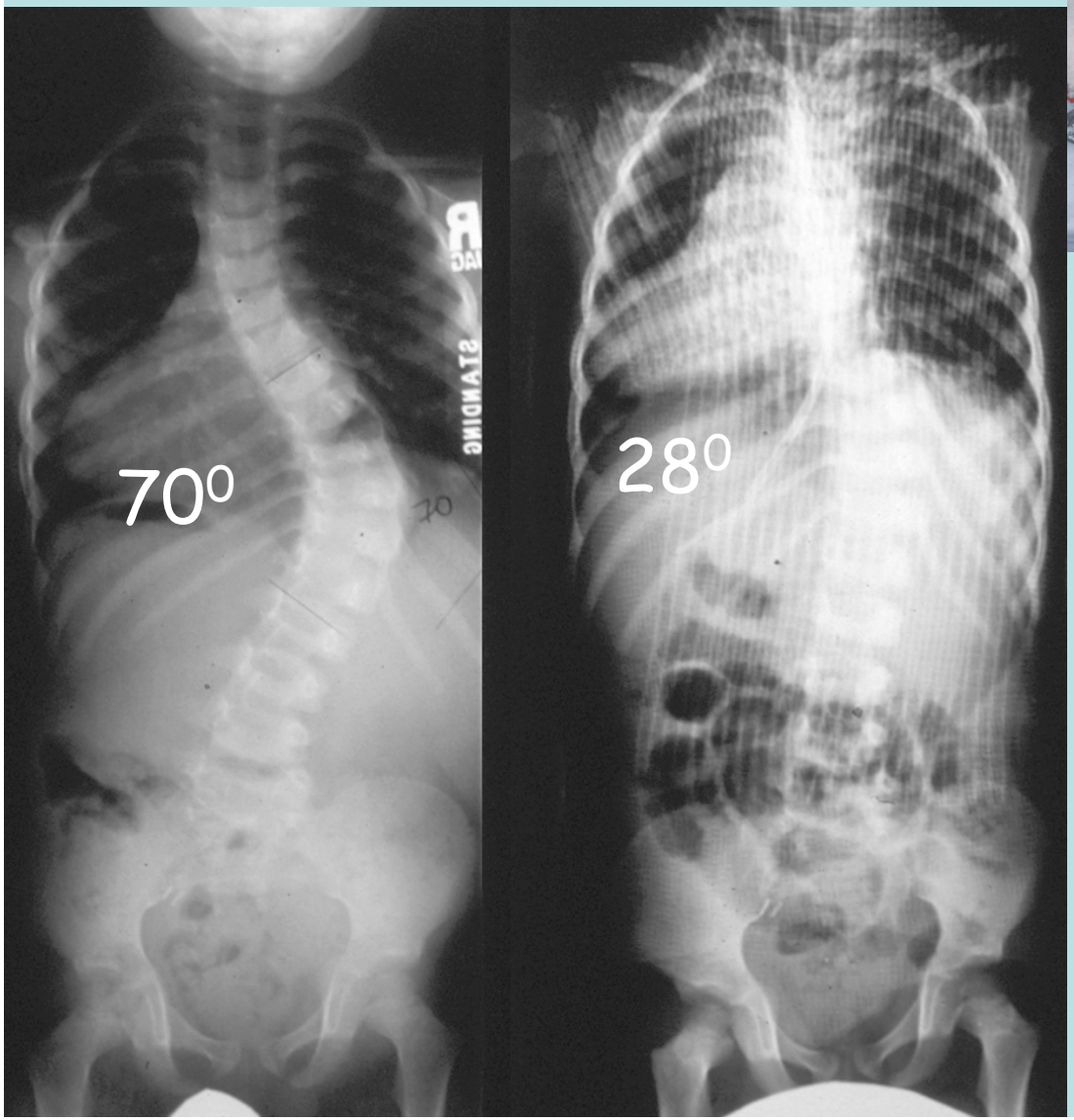
Marks & Skaggs = dead meat

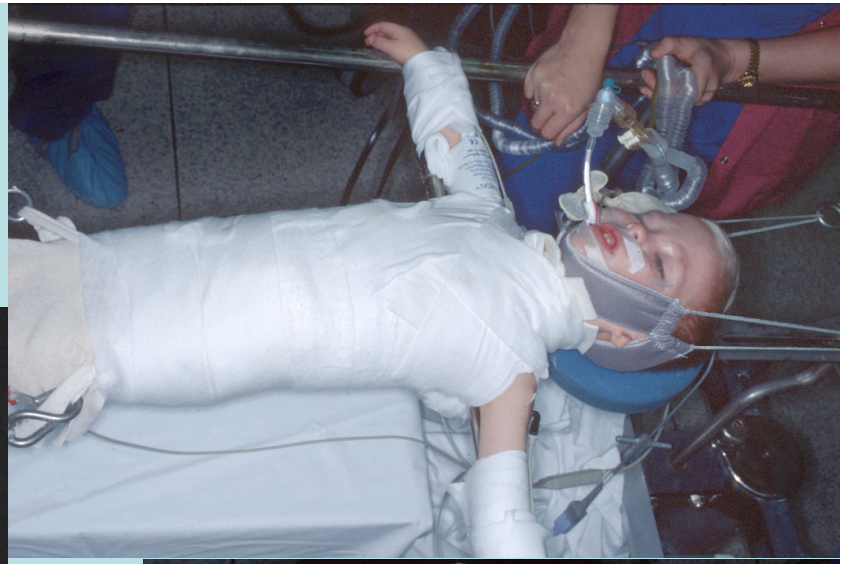
Debate: Non-operative techniques vs. early surgery

Casting

- "Curative" for smaller (<40°) non congenital curves (Mehta, D'Astous)
- Serial "Ponseti" casting q3-4 mo under G.A.
- Popularity ↑'ing in N America, but not for everybody (surgeons, parents)

Risser cast under anesthesia

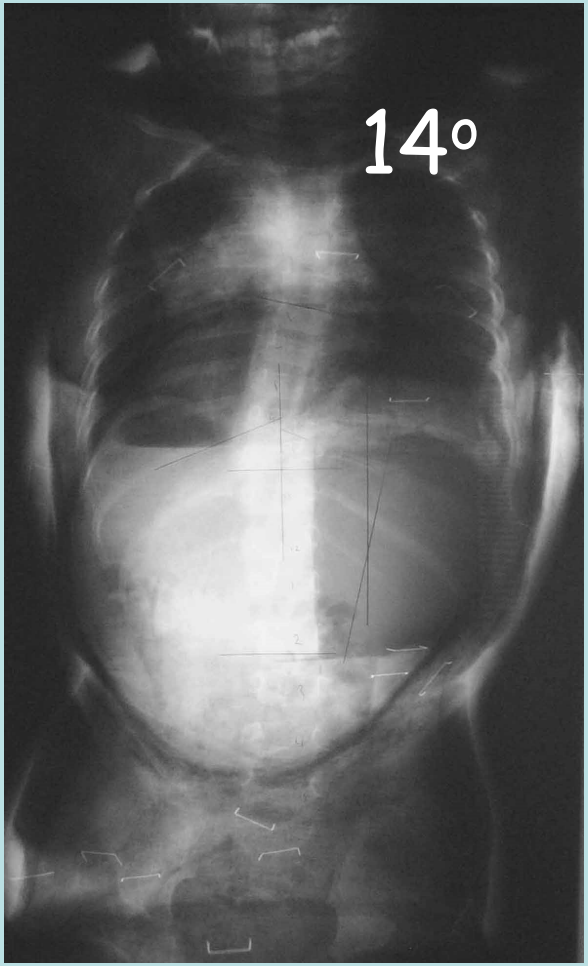




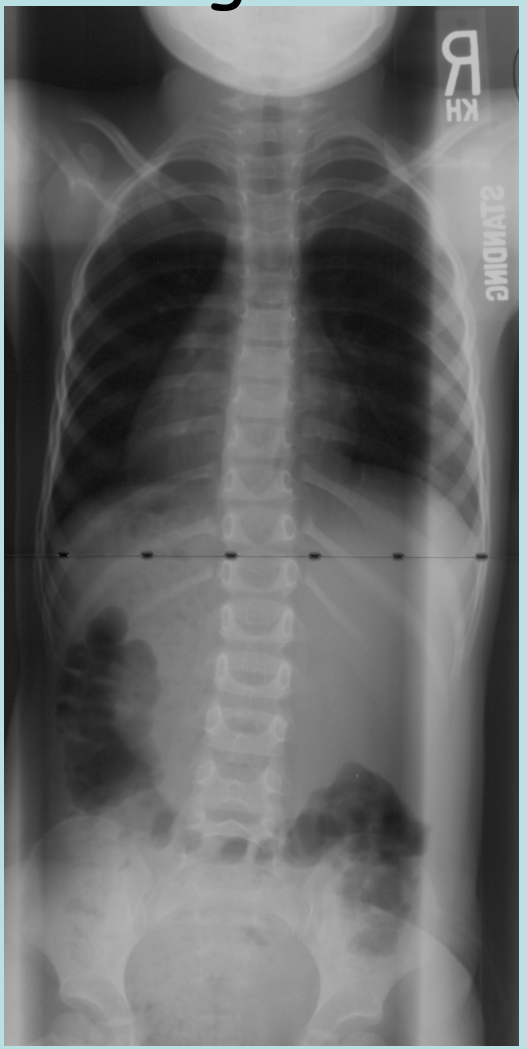
Case example 14 mo old female

Bend 30°

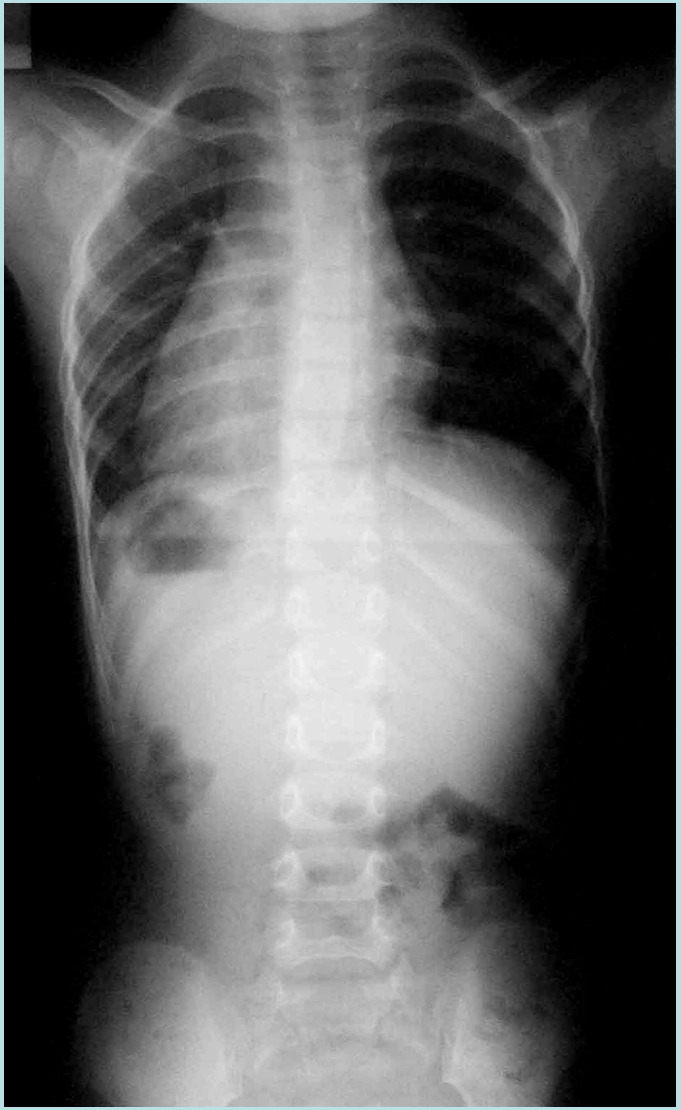
1st cast (total 5)



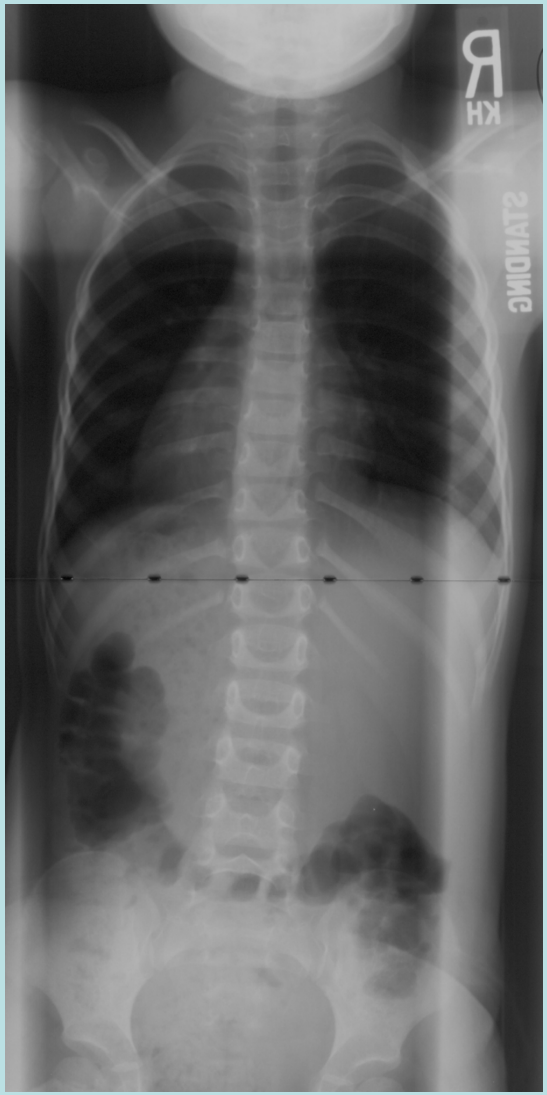
Age 4



“Cure” age 1+9

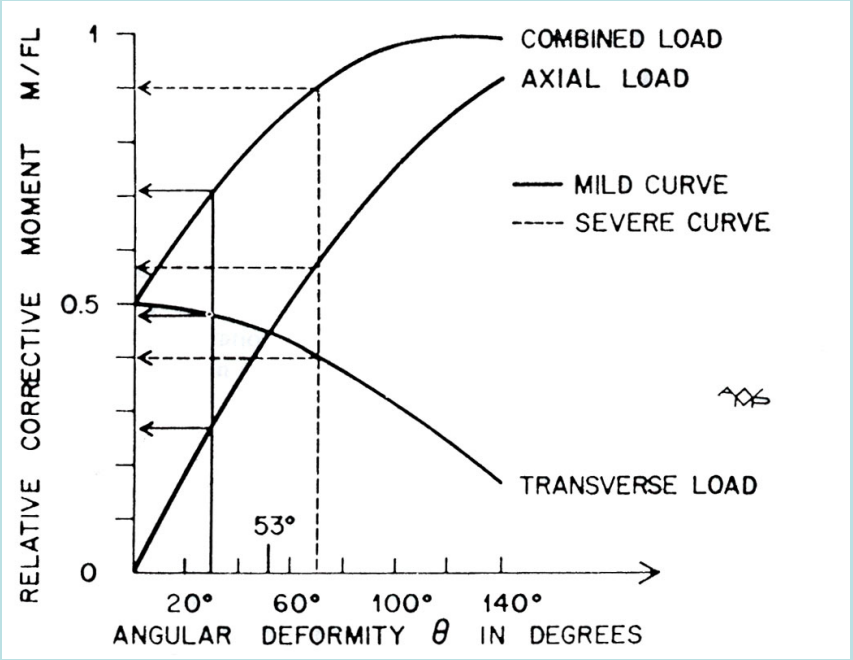


3+0 most recent f/u



Cast Contraindications

- Large magnitude where transverse load ineffective
- Rigidity
- Chest wall deformity (windswept) already present
- Respiratory issues



Debate: Non-operative techniques vs. early surgery

Axial load to the rescue

Halo-gravity traction: method of choice for <u>severe</u> EOD

Early-onset / "Exotic" Spine Deformity

- Rigid deformity
- Diminutive elements
- Kyphosis, esp. upper thoracic
- Neuro risk (stenosis, abnl cord, pre-existing neuro deficit)
- Potential T.I.S.

Direct implantation + Acute correction NOT Possible

↓

Halo – Gravity Traction

Rationale

- Well established that thoracic fusion < age 6 (range 5-8) associated with TIS

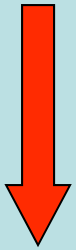
Goldberg et al *Spine 2003*

11 patients < age 8 yr (1.4-7.8)
PFT's @ 20.5 yr. (15-30)
FEV1 = 41% (14-72)
FVC = 41% (12-67)

- Goldberg Spine '03
- Emans SRS '04
- Karol,Johnston JBJS '07in press
- Vitale Madrid '07

- If fusion delayed to age 10 ⟶
  PFT's = 70% mean (45-100%)

- Controversy : is pulmonary function degraded by the treatment (fusion) … OR by the deformity itself



- Bad curves get treatment earlier
- Can surgical treatment be delayed?

Delay fusion ⟶ Halo traction

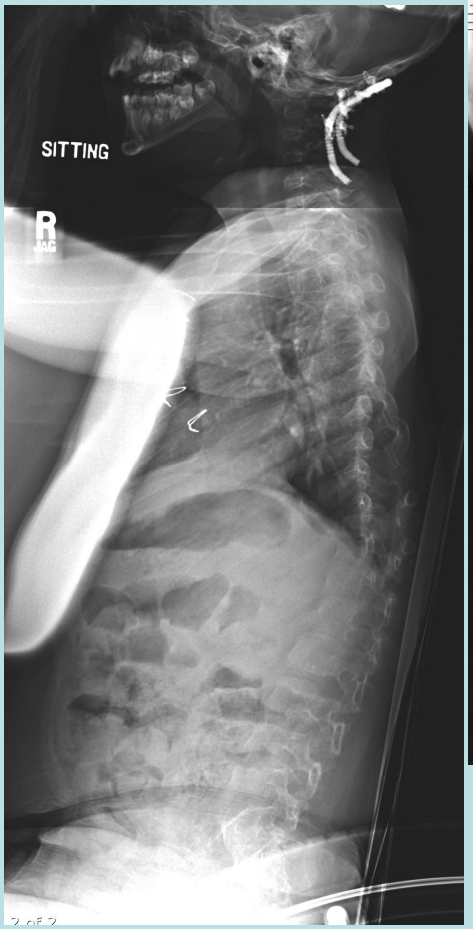
- Introduced by Stagnara (late 60's) for n-m curves
- Zielke (1984) – preop management for neglected adults

Current Uses

- Preop correction in fragile (pulmonary) patients – all ages
- Stiff deformity, esp. kyphosis
  unnecessary for flexible/collapsing
- Diminutive spines
- Allows delay of surgical rx by enhancing efficacy of brace or cast (or expandable devices Emans,Johnston,Smith SRS'07)

Contraindications - few

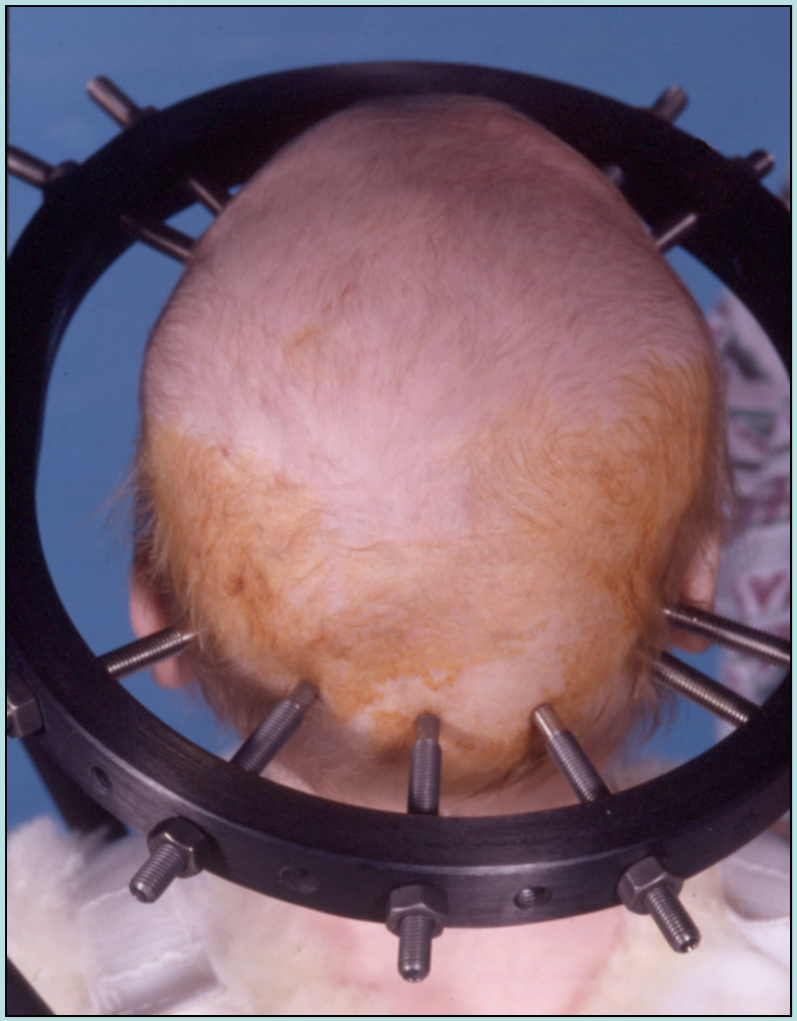
- ?? Cervical instability or dysplasia
- Inadequate skull
- Abnormal cord/canal
  (Emans, Johnston, Smith SRS '07)



Loeys-Dietz

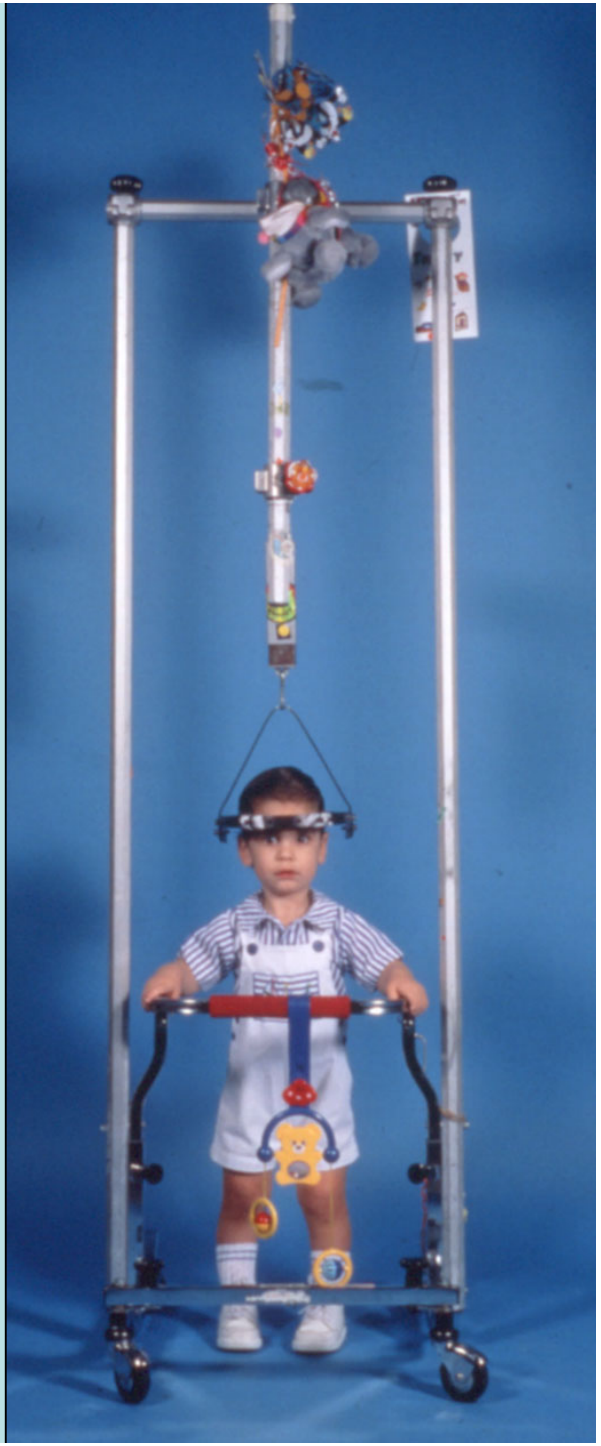
Technique

- Lots of pins
- 1 lb torque/ yr age
- Progressive ↑ wt.
  based on neck sx (swallow, pain) and neuro tolerance
- Day traction @ max.
- Night for comfort



Halo – Wheelchair

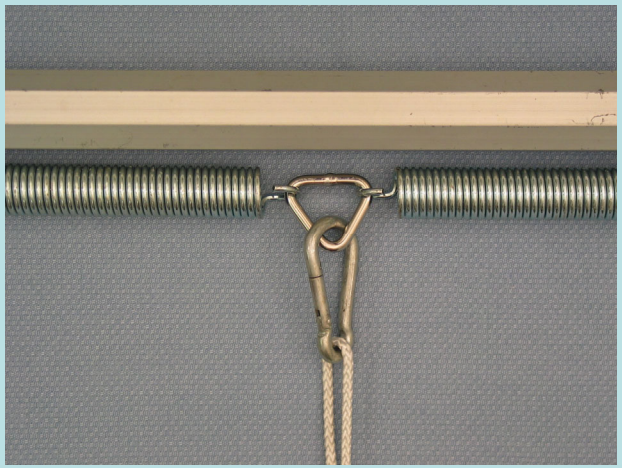
Halo – Standing Frame



Halo wheelchair

Manual distraction

High load bb swivel and transverse loading spring scale



SAFETY !!!

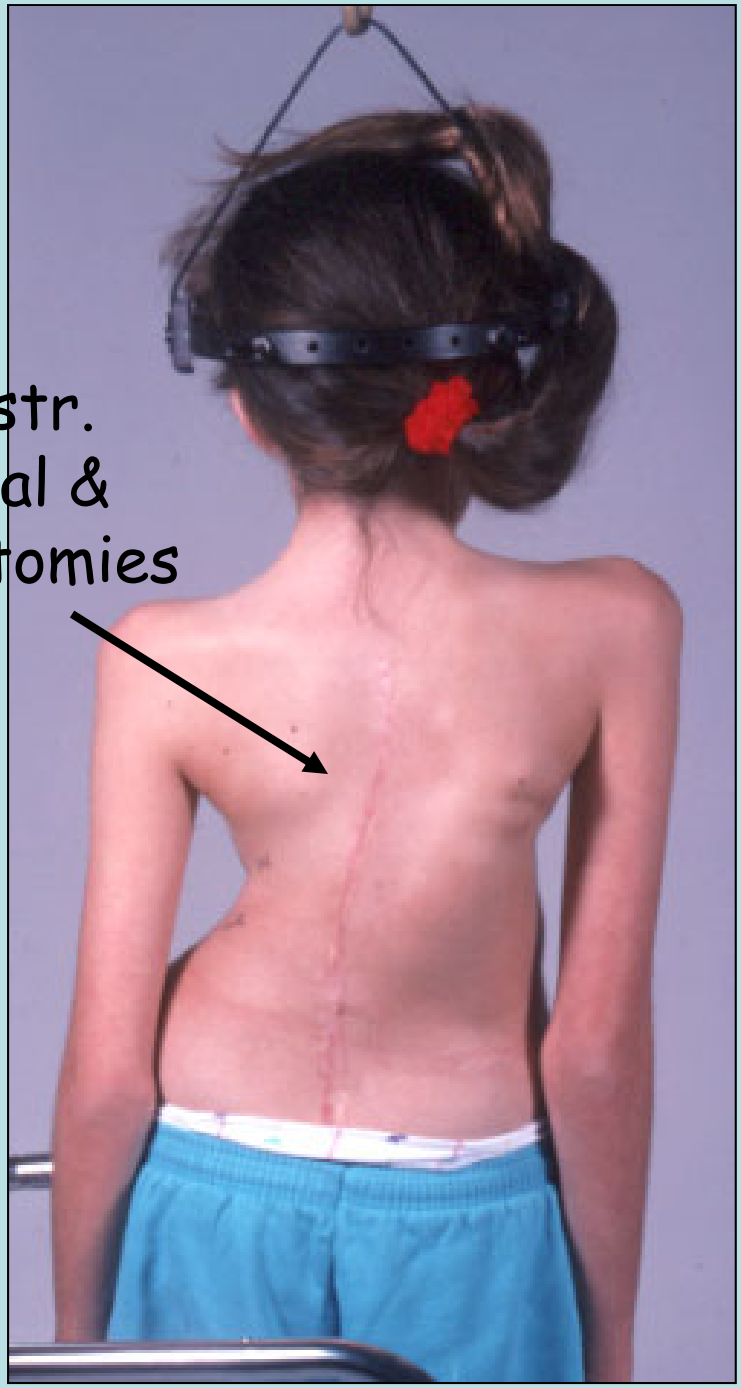
Revisit in rebuttal

Fixed weight – possible explanation for CN lesions, etc

Advantages

- Use for **any dx**
- Mobilization of patients (as opposed to halo-femoral)
- **Pulmonary improvement** (hard to measure because PFT's don't change rapidly unless mechanical factors due to trunk collapse)
- Curve correction (esp. **kyphosis**) ⟶ other rx's (brace, growing rods) more effective

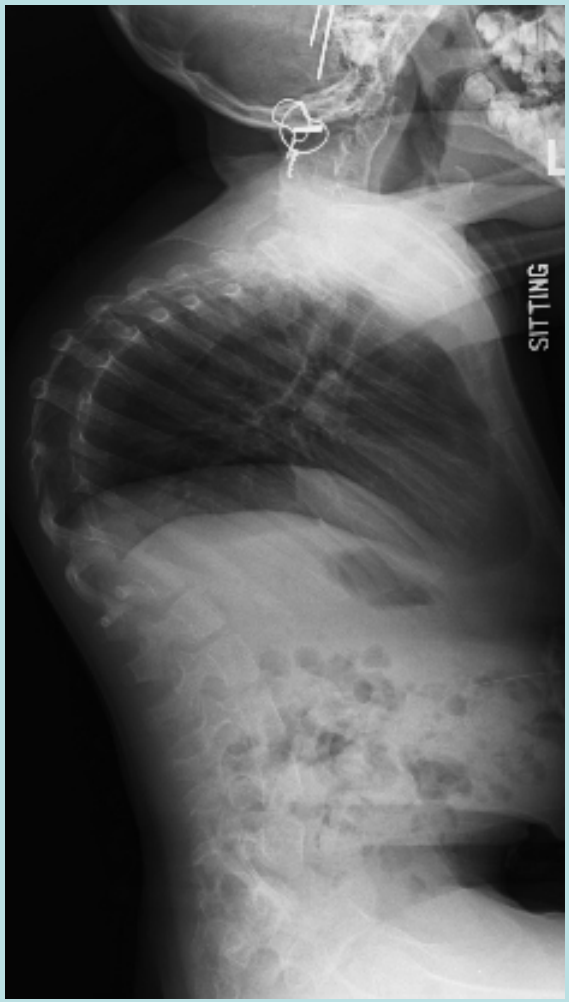
s/p instr. removal & osteotomies

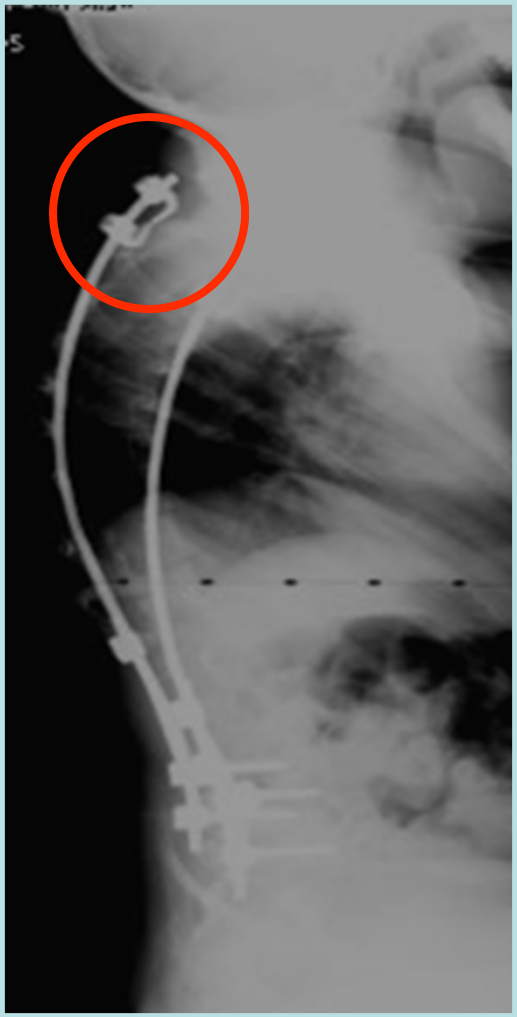


PFT's 13 yo c̄ CHD & CRPD

	Pre		p̄ Txn	
	Vol.	%	Vol.	%
FVC	0.94	30	1.32	40
FEV_1	0.89	33	1.14	42

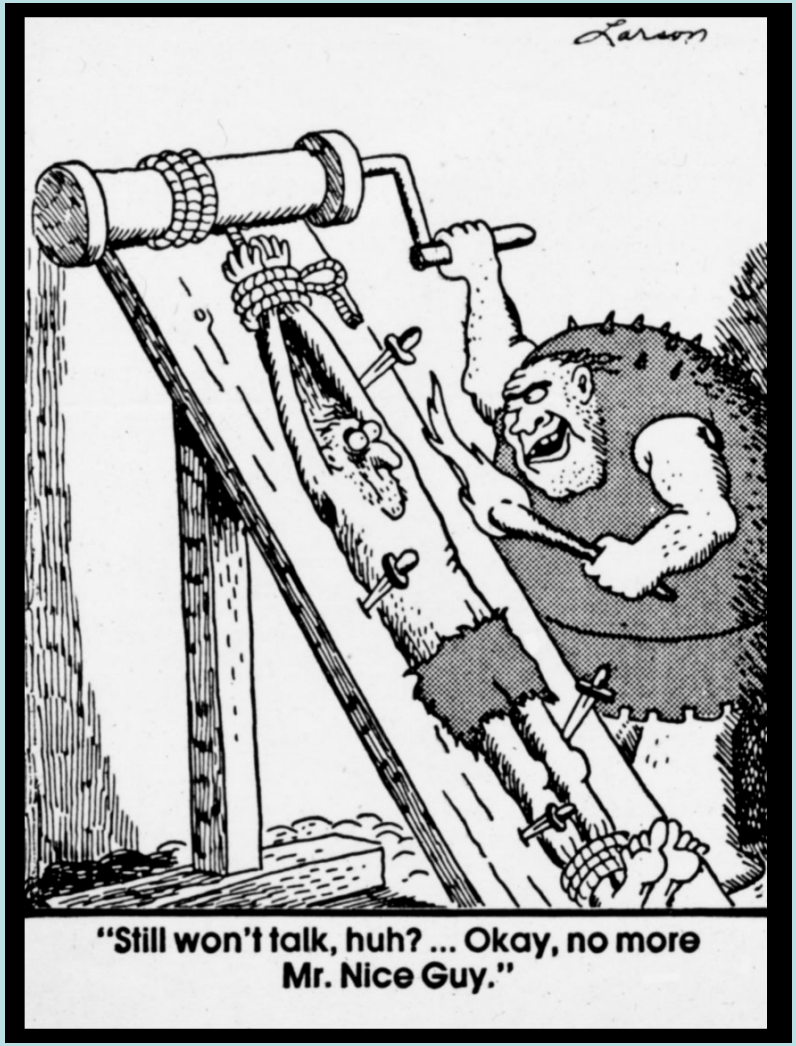
Kyphosis – difficult to treat by "early" surgery unless HGT assist





Sink et al *JPO '01*
19 pts. Age 7+5 (1+6-13)
Duration 6-21 wks

- Trunk shift
  3 → 1.2 cm
- Trunk height incr.
  5.3 cm (0-11.5)
- Scoliosis 83° → 55°
  (34%)
- Kyphosis 97° → 72°
  (26%)



Curve Correction (%) before expandable devices

(Emans et al SRS '07)

At end of traction:

Scoliosis 63° (0-103)
*Mean **35%** (-5-52)*

Kyphosis 54° (14-150)
*Mean **41%** (-4-100)*

Further correction after VEPTR or GR:

Scoliosis 54° (4-93)
*Mean **44%** (-1-68)*

*Kyphosis **47°** (13-123) Mean **48%** (-3-76)*

TSRH Complications (>100 cases)

Pin tracts/
Pin change prn <5%

C spine disrupt 1
(Klippel-Feil)
Paraparesis (tumor) 1
Excess pain 1
? Neuro sx (cong kyph)

Summary – halo gravity traction

1. **Delay surgical rx** (no anesthesia/scm)
   - non-operative correction to enhance control by other methods (cast, brace)
2. Allows/facilitates rx in EOS/exotic cases (rigidity, **kyphosis**, neuro risk, TIS, osteopenia)
3. Pulmonary rehab + mobilization
4. Burns no bridges (in fact may enhance fusionless methods)

There are essentially NO cases where DELAY (using traction + cast/brace) is not worth trying

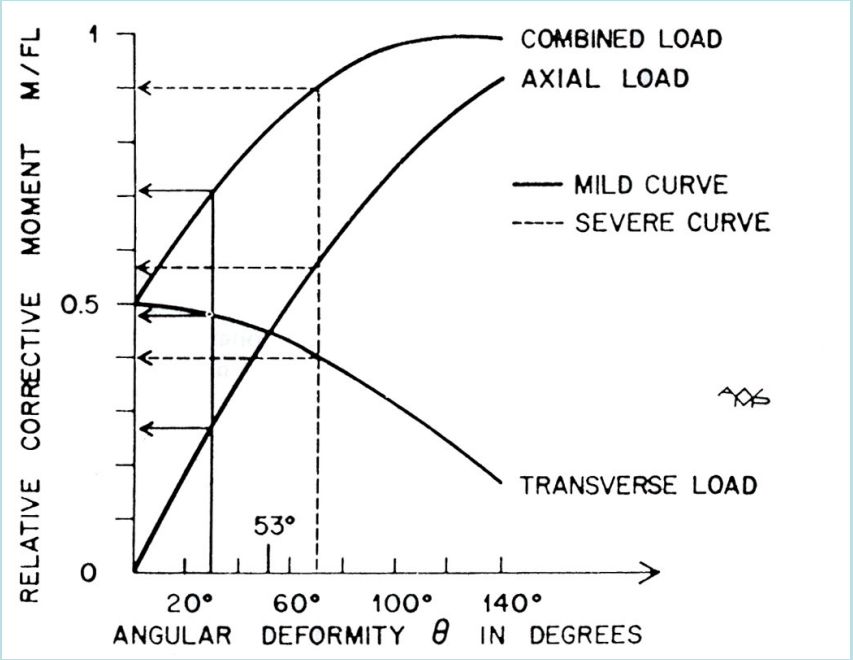
Only exceptions –
No skull
Abnormal cord/canal

Rebuttal

Never actually **admit** in public that you can't put on a cast or use traction safely

Cast Contraindications

- Large magnitude where transverse load ineffective
- Rigidity
- Chest wall deformity (windswept) already present
- Respiratory issues



Criticism of casting

- Inappropriate patient
- Incompetent technique

Internal traction ("temporary") – alternative to halo traction

(Buchowski, **Skaggs**, Sponseller JBJS-A '06)

- Staged operative distraction 1-2 weeks apart – requires s.c. monitoring for safety
- Older ages (only 1 pt < 11 yr)
- Great correction (80%), utilized normal-sized dual pedicle screw constructs

? Apply to EOS pt population

Drawbacks of halo traction (per Buchowski, Skaggs et al)

1. Halo “must be worn a prolonged time” - long hospital stay, “not welcomed by families”
2. Complications: cranial n. palsy, cervical spondylosis, paralysis
3. Contraindicated: cervical kyphosis or instability

Are these claims justified?

1. Prolonged treatment and hospitalization

- **So what** –
  safe correction of challenging risky deformities
- Outpatient rx **possible** and encouraged
- In early onset patients, families actually accept with **enthusiasm** because children can be mobilized

2. Complications – important, ? over-emphasized

- Cranial n. palsy – probably 2^{o} to technique with fixed weights (= old fashioned bed traction)

Springs
= safe

Fixed weight traction does not allow patient to auto-relieve axial stresses

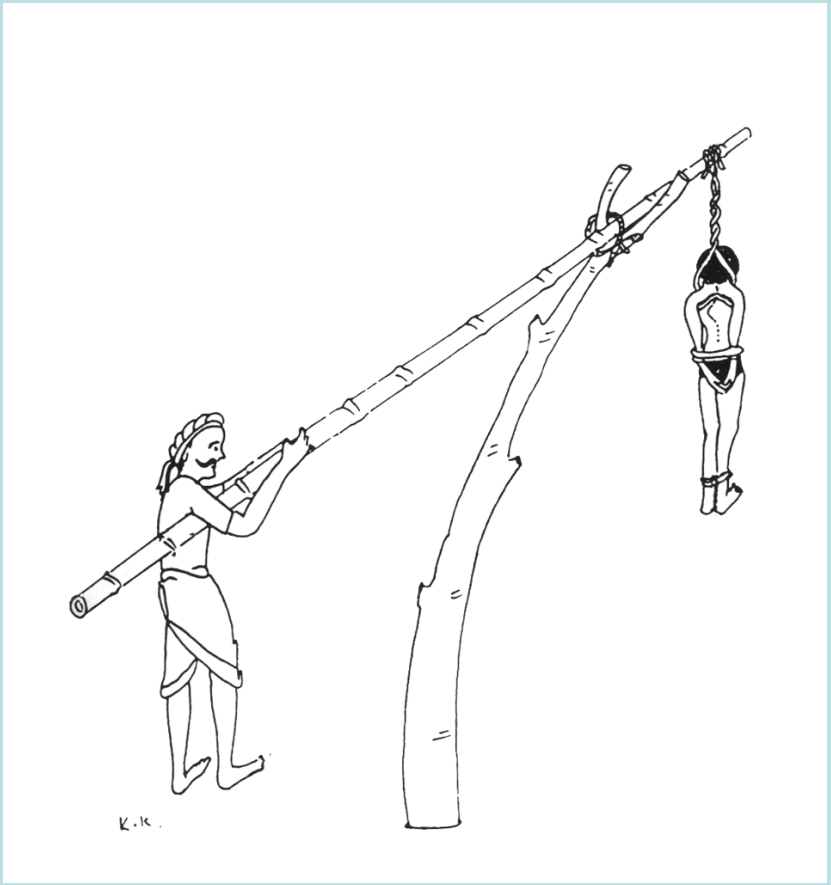
- Probable basis for 31% incidence neuro complications in Skaggs' SRS paper #81

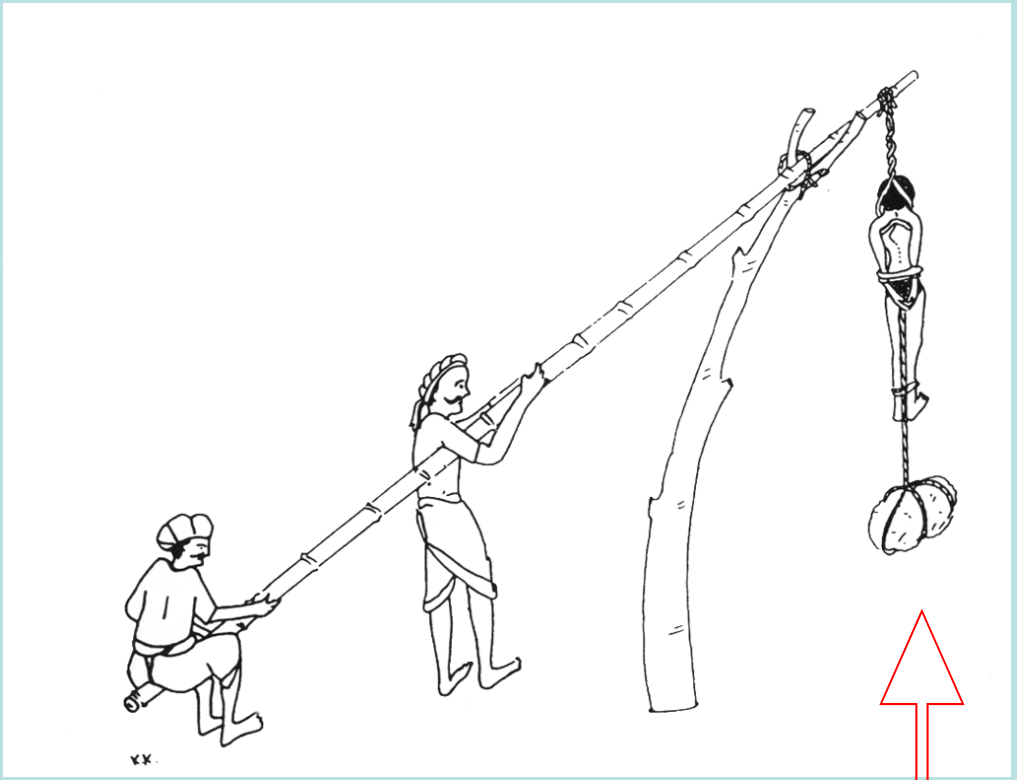
  [All resolved by decrease or remove weight]

Buchowski/Skaggs ref's inapplicable to halo gravity method

- Cranial n. palsy – ref's all halo-pelvic or "skeletal traction" (? femoral)
- Cervical spondylosis (pain, DJD) – halo-pelvic, skeletal txn or halo-Ilizarov
- Paralysis – acute instrumented distraction (1975 MacEwen) or prehistoric drawings (Kumar)

K. Kumar: Historical Perspective – Spinal Deformity and Axial Traction (*Spine '96)*





More complications ?

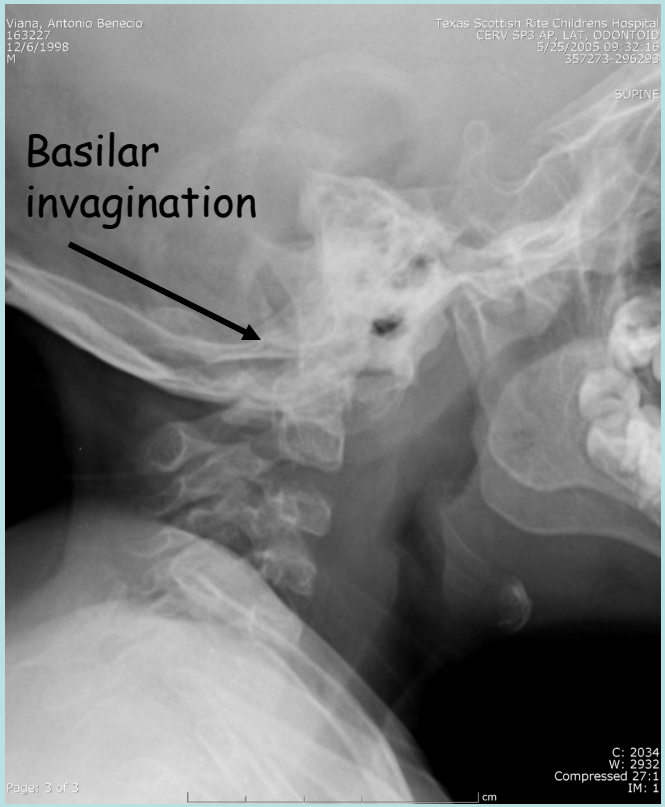
3. Cervical kyphosis / instability = contraindication to traction

- No argument – solution is to FIX the instability or kyphosis, then proceed

3 y.o.

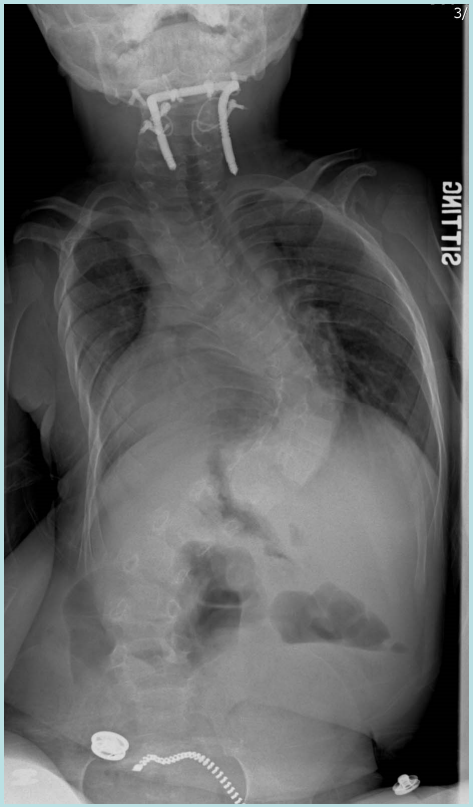
Severe Ehlers-Danlos

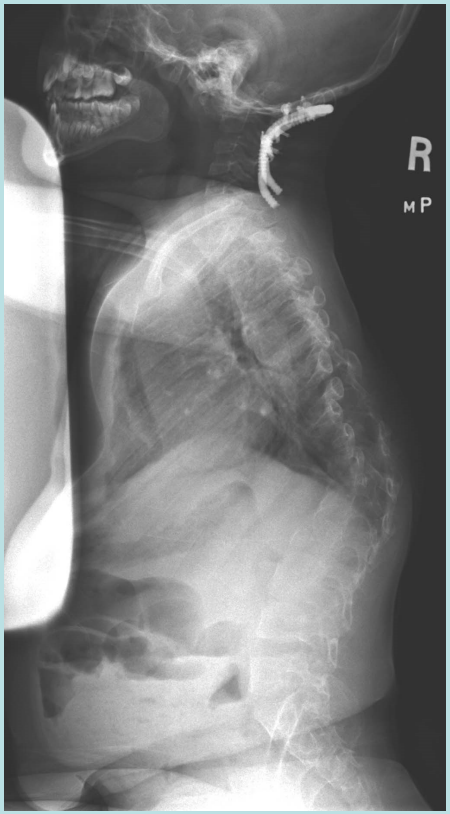
hypotonic



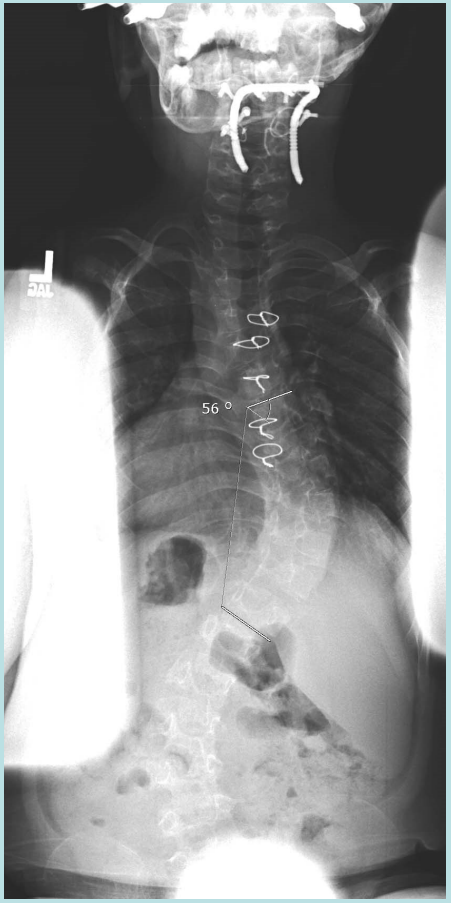
S/p Occ-C4 decompress + fusion

Not a good "early" candidate

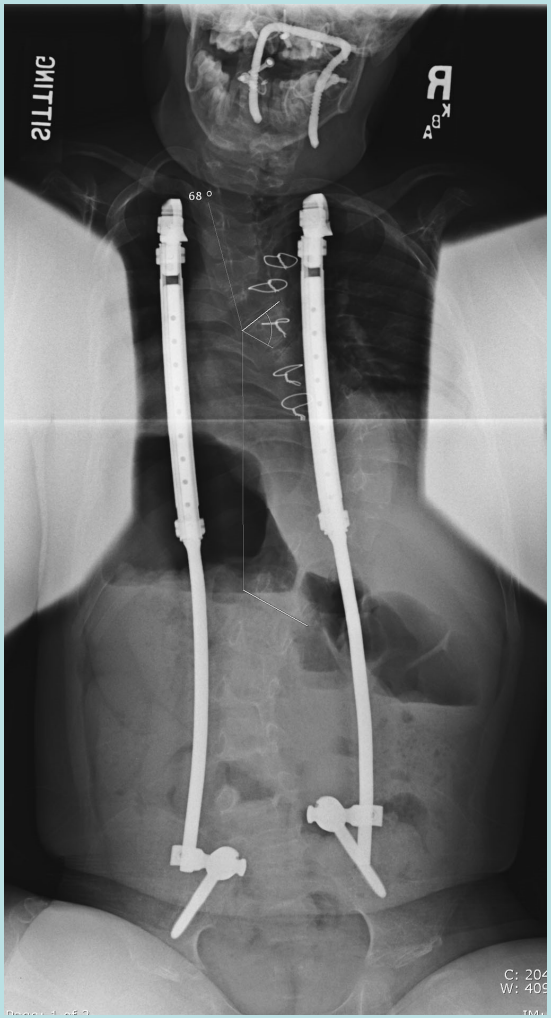


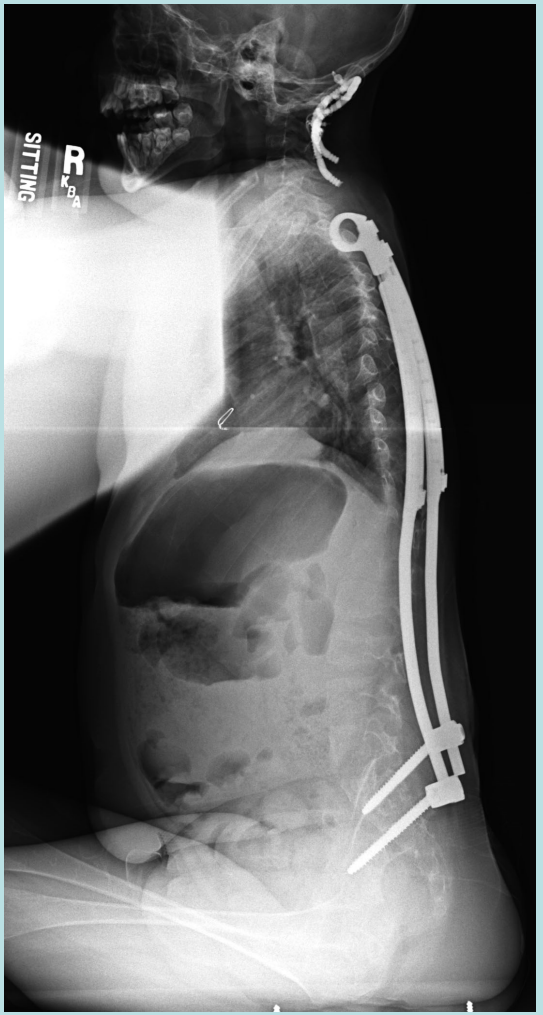


Traction!



Successful (so far) rib-pelvis stabilization





Non-operative techniques: attention to detail

- Cast application time-consuming, requires appropriate table, technique, windowing – *not for everybody*
- Halo-gravity traction time-consuming, slow application of axial force, but

  safe, effective rx for severe EOS deformities for which "early surgery" options are fraught with complications