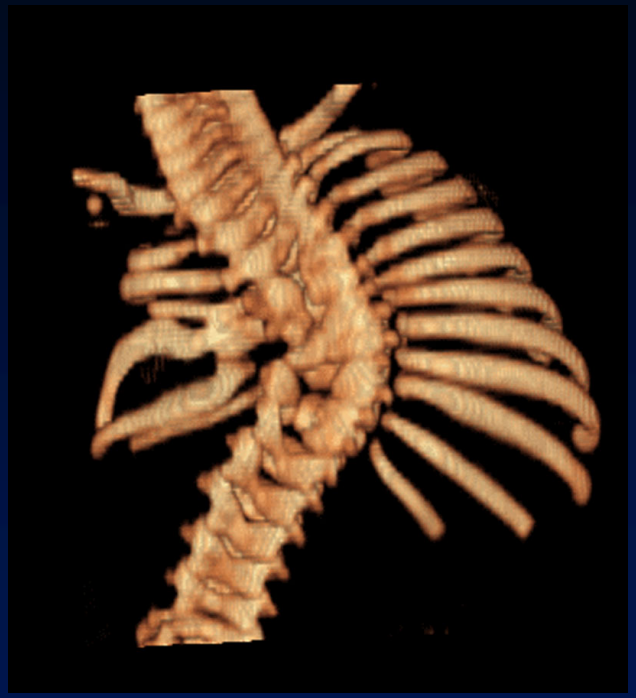
Imaging in Early Onset Scoliosis



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Early Onset Scoliosis (*noun*): A condition of children that requires the spine surgeon to select from a long list of sub-optimal treatment options

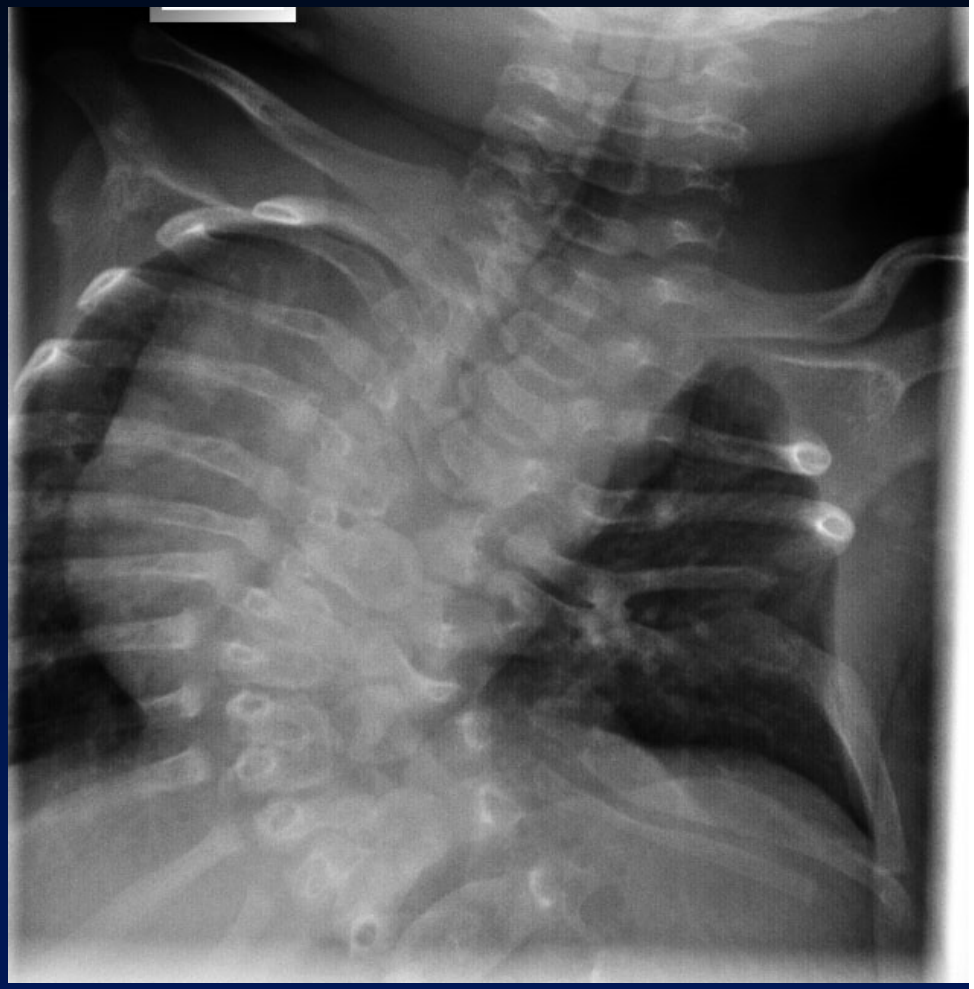
3 y/o with
a bit of scoliosis

Early Onset Scoliosis

Imaging

Key issues

- Elucidating anatomic features of the deformity
- Detecting associated problems
  - Neurologic
  - Systemic
- Preparing for operative treatment

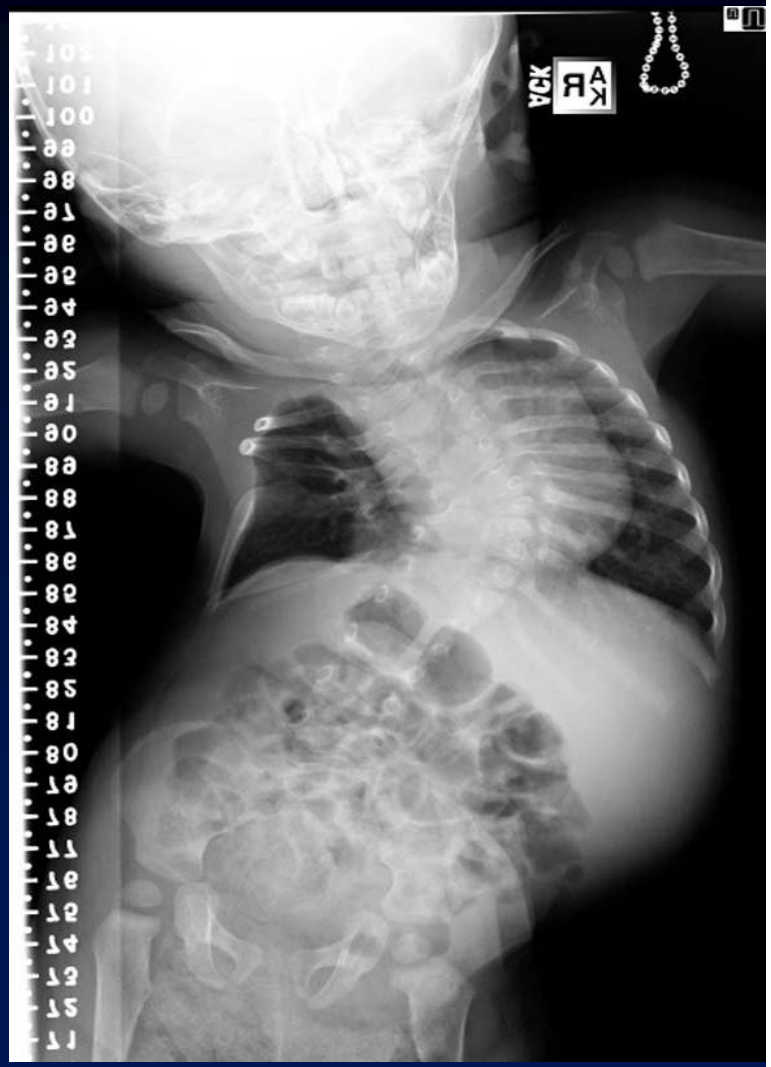


Early Onset Scoliosis

Imaging

Plain radiographs

- Quantify spinal deformity
  - Coronal plane
  - Sagittal plane
- Basic assessment: effect of chest and spine deformity on lungs
- Qualitative assessment of growth potential of congenital anomalies
- Radiographic ruler

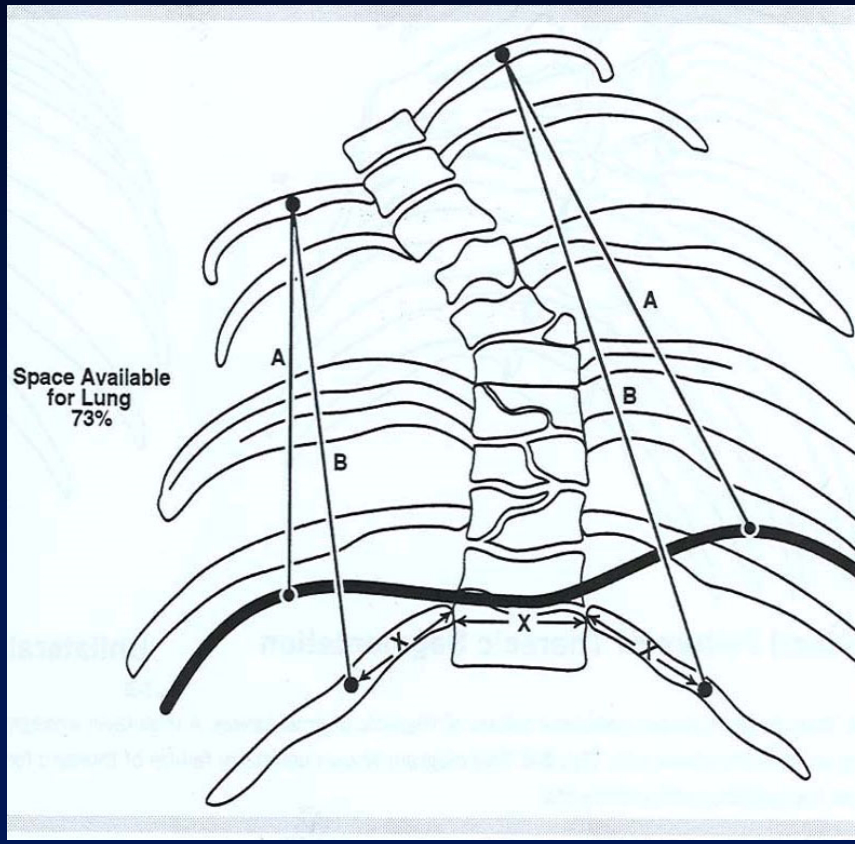


Early Onset Scoliosis

Imaging

X-ray measurements

- Cobb angle
- Kyphosis/lordosis
- Space available for the lung

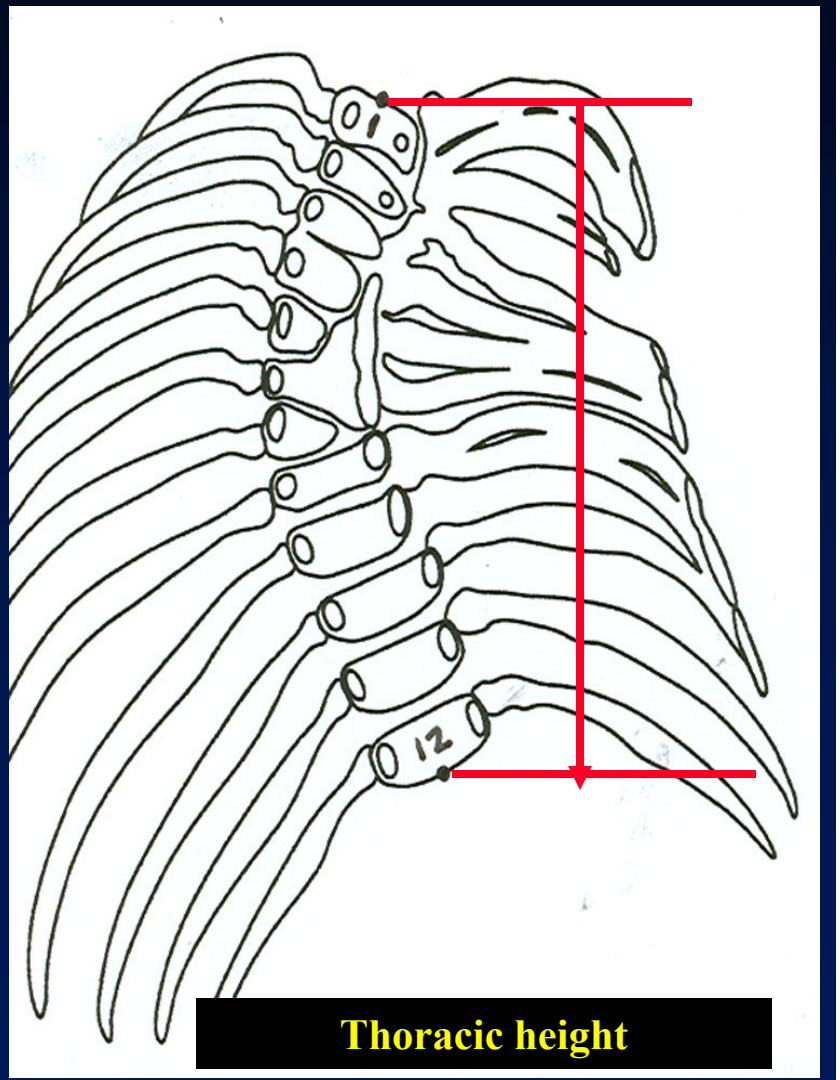


Early Onset Scoliosis

Imaging

X-ray measurements

- Spinal length
- Thoracic height



Early Onset Scoliosis

Imaging

Other radiographs

- Cervical spine
  - Associated congenital anomalies
  - Pre-op eval of cervical stability
- Cervicothoracic films
  - Dedicated study of C-T junction
  - Cervical tilt

Early Onset Scoliosis

Imaging

Flexibility

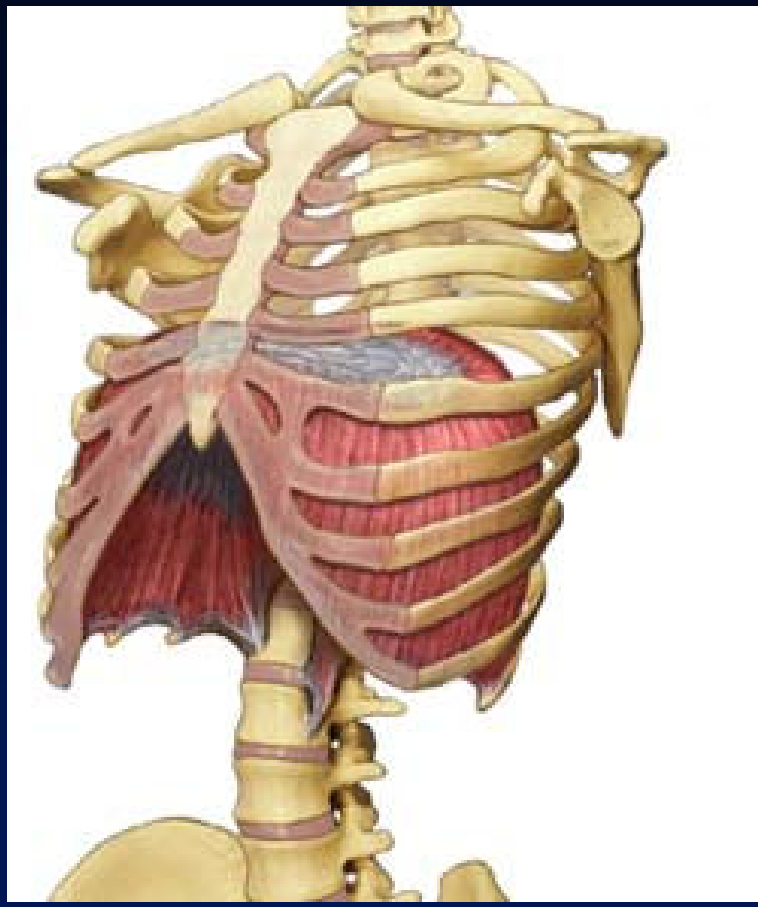
- Key to estimating correction and planning for balance
- Multiple options
  - Longitudinal traction
  - Bending
  - Bolster bending

Early Onset Scoliosis

Imaging

Diaphragm evaluation

- Important to detect diaphragm disfunction
- Flouroscopy
- Ultrasound
  - More accurate*
  - No irradiation
  - Logistically easier



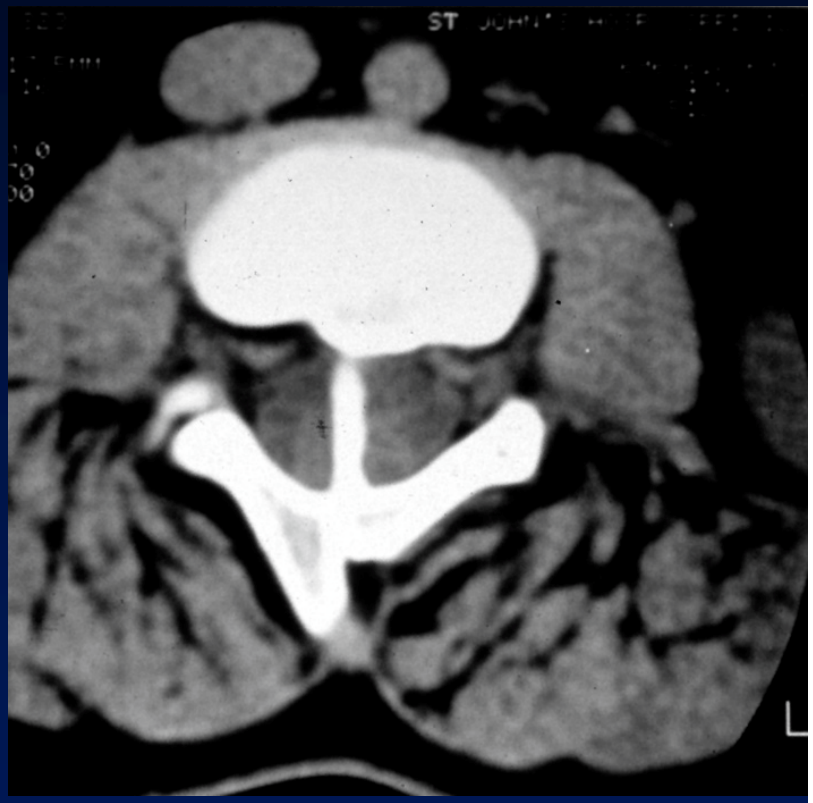
*Miller et al. Pediatr Crit Care Med 2006

Early Onset Scoliosis

Imaging

CT scan

- Define vertebral and rib anomalies
  - Standard
  - 3D reconstruction
- Assess spinal rotation
- Some intraspinal anomalies (e.g. diastematomyelia)
- Measure lung volumes

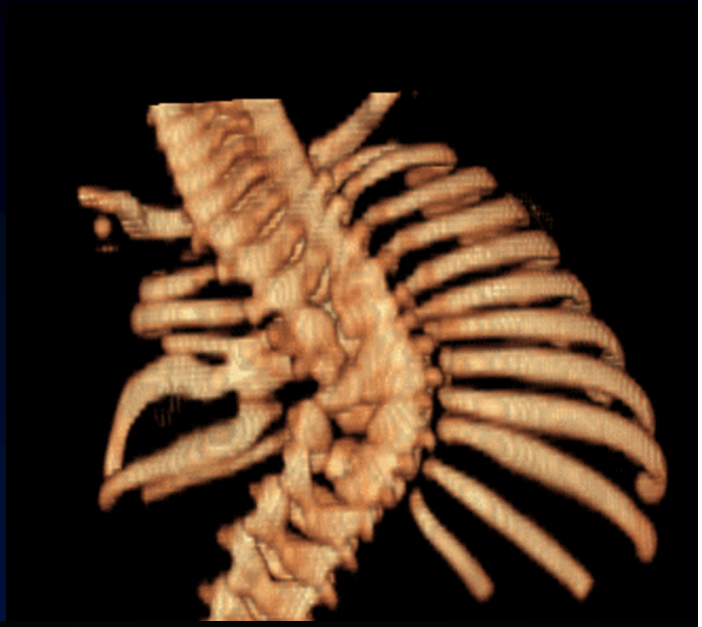


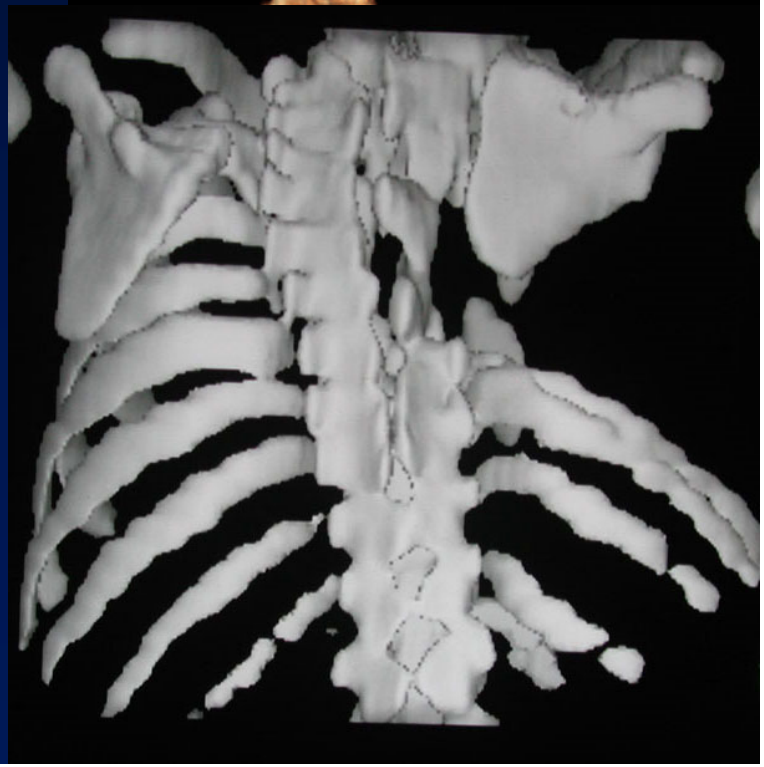
Early Onset Scoliosis

Imaging

CT scan—3D reconstruction

- Particularly valuable in congenital scoliosis
- Defines anomalies—esp. better than plain radiographs for posterior vertebral anomalies*
- More than 50% pts: new anomaly found**
- Does not expose pt to increased radiation





* Hedequist et al. Spine 2003

**Newton et al. Spine 2001

Early Onset Scoliosis

Imaging

CT Lung Volumes

- Established as reliable*
- Norms now available for children**
- May be valuable proxy for PFT's in children too young to cooperate with PFT's

*Schlesinger AJR 1995

**Gollogly et al Spine 2004 (CT measured norms for kids)

Early Onset Scoliosis

Imaging

CT radiation concerns

- Given CT setting yields higher pediatric organ dose
- Brenner AJR 2001: Estimated lifetime cancer mortality risks attributable to the radiation exposure from a CT in a 1-year-old are 0.18% (abdominal)
- Stephan et al. Int. Jnl Radiat Bio 2007
  - Increased chromosomal damage of blood leukocytes after CT
  - Effect highest in children < 10 y/o

Early Onset Scoliosis

Imaging

CHOP CT radiation control

- a Siemens Somaton Sensation 40/64 scanner
- Pt < 55 kg: use 120 kV, an effective mAs 45
- 1.2 mm collimation to decrease dose
- scanner decreases mAs in the thin portions of the patient body and increases mAs in thicker regions

Early Onset Scoliosis

Imaging

MRI

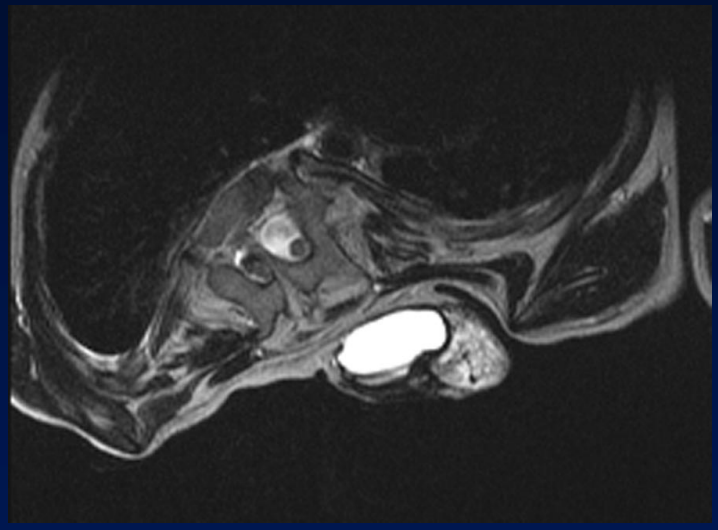
- Evaluates the spine and spinal cord
- Growing treatments are distraction treatments
  - Must identify/treat tethered spinal cord first
  - Effect on cord of kyphosis
- Downside: long studies that require sedation in young children

Early Onset Scoliosis

Imaging

MRI

- Evaluate lungs/pulmonary function
  - Dynamic MRI
  - May eliminate radiation concerns with CT
- Screening renal anatomy assessment



Current CHOP imaging protocols

Initial pre-operative evaluation for idiopathic-type EOS

- PA/lat entire spine (pref. standing)
- MRI: brainstem to sacrum
- Maximum bolster bending films

Current CHOP imaging protocols

Initial pre-operative evaluation for congenital/syndromic/TIS EOS

- PA/lat entire spine (pref. standing)
- MRI: brainstem to sacrum
- Maximum bolster bending films
- CT chest with lung volumes
- +/- cervical spine series

Thank You