# Airway Obstruction Secondary to Thoracolumbar Scoliosis: An Under-Recognized Complication

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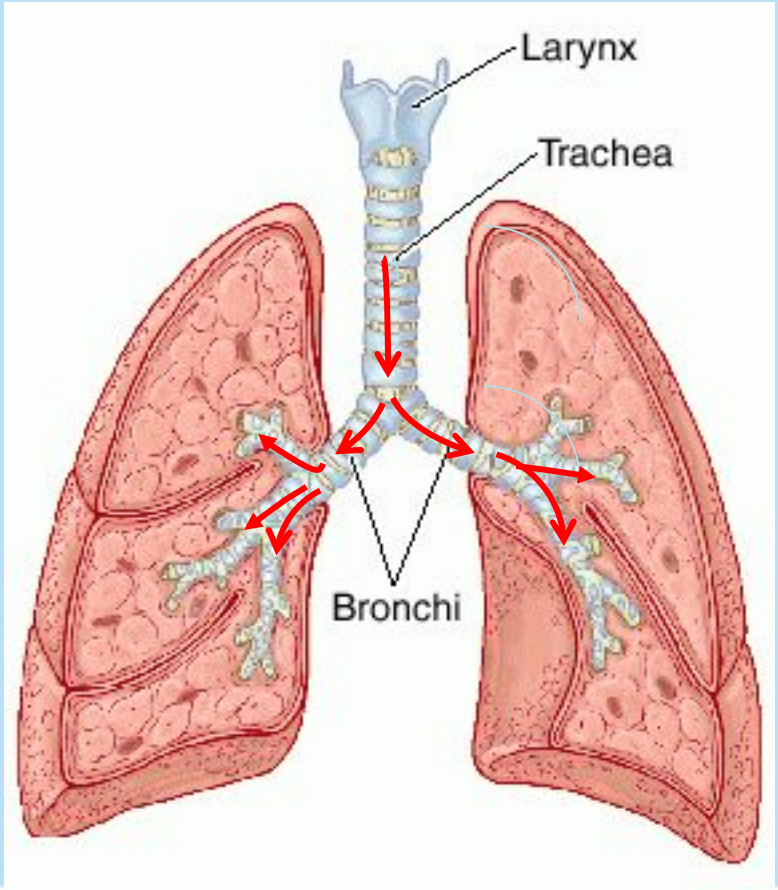
# Background: Anatomy




http://www.volny.cz/martinam/im.v/trachea.jpg

# Background: Terminology

## Obstructive Lung Disease

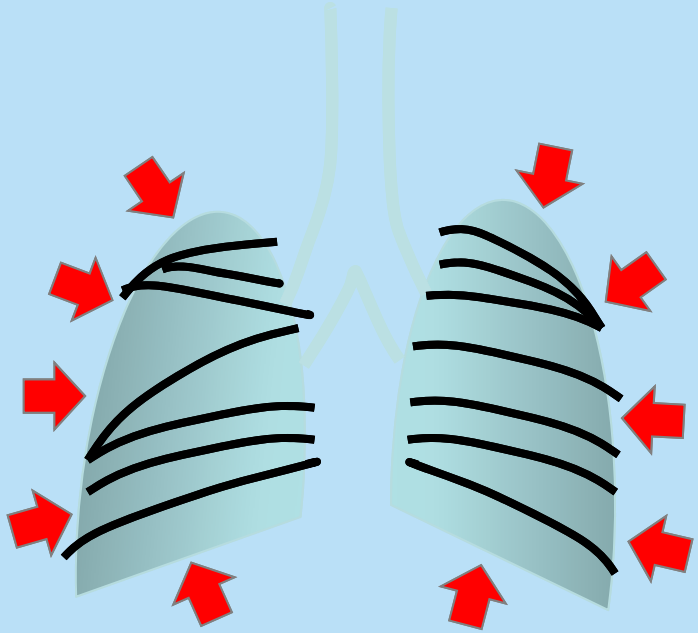
- Airways disease
  (= airways obstruction)
  - Asthma
  - Cystic fibrosis

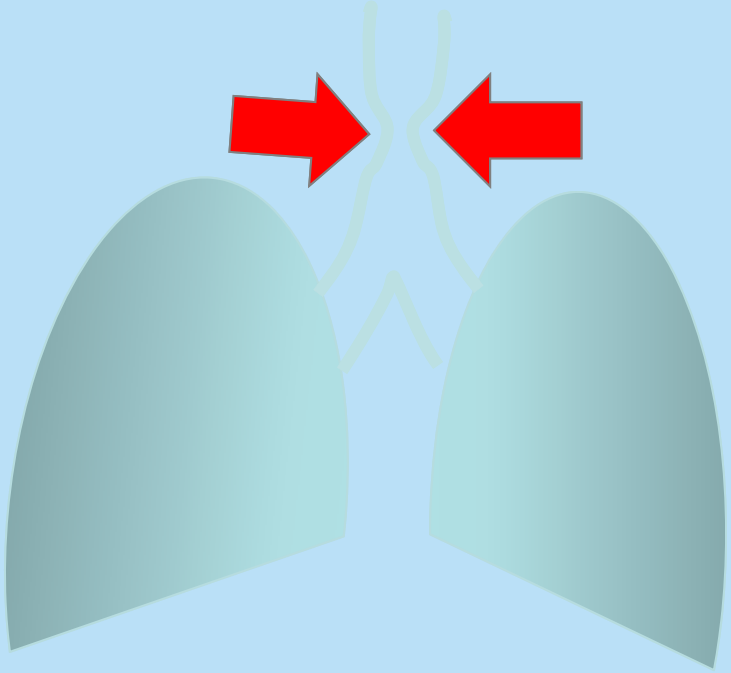
- Difficulties exhaling gas quickly due to obstructed airways
  (air does not come out fast)



↓ FVC

↓ FEV1





**RESTRICTIVE**

**OBSTRUCTIVE**

# Background

- Bartlett et al. reported 2 children with right mainstem bronchus compression as a complication of thoracic lordoscoliosis
  (2009 Spine Jan 1;34(1):E59-65)



# Cincinnati Children's Study

Cincinnati Children's
Education and Training

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# Inclusion Criteria

- Thoracic or thoracolumbar scoliosis
- Cobb angle ≥ 30°
- PFT during 1999-2009
- Obstructive Lung Disease on PFT
- Flexible bronchoscopy confirmation

# Exclusion Criteria

- Asthma
- Cystic Fibrosis



# Methods

- Obstructive lung disease was defined by FEV1 and FEV1/FVC ratio below reference range
- Flexible bronchoscopy
  - Description of anatomy



# Methods

- CT scans when available were reviewed
- Coronal and Sagittal Cobb angle measurements were preformed



# Results

- 1700 PFTs on scoliosis patients
- 200 met our inclusion and exclusion criteria
- N=21 (~10%) had obstructive disease and consisted the study group in our series
  - All of these patients had undergone flexible brochoscopy



# Results

- Mean Age: 14.6 years (at the time of PFTs)
  - 10 patients were diagnosed before the age of 10 (EOS)
- Median coronal Cobb Angle: 59° (IQR 47-78)
- Median kyphosis was 13 ° (Range -13 ° to 33 °)
- 6 patient had post-operative PFTs available*

*At the time of abstract submission



# Results

- Median forced expiratory volume in the First Second ($FEV_1$) was **58%** of predicted (IQR 45-65)
- Median $FEV_1$/FVC ratio was **72** (IQR 67-75)

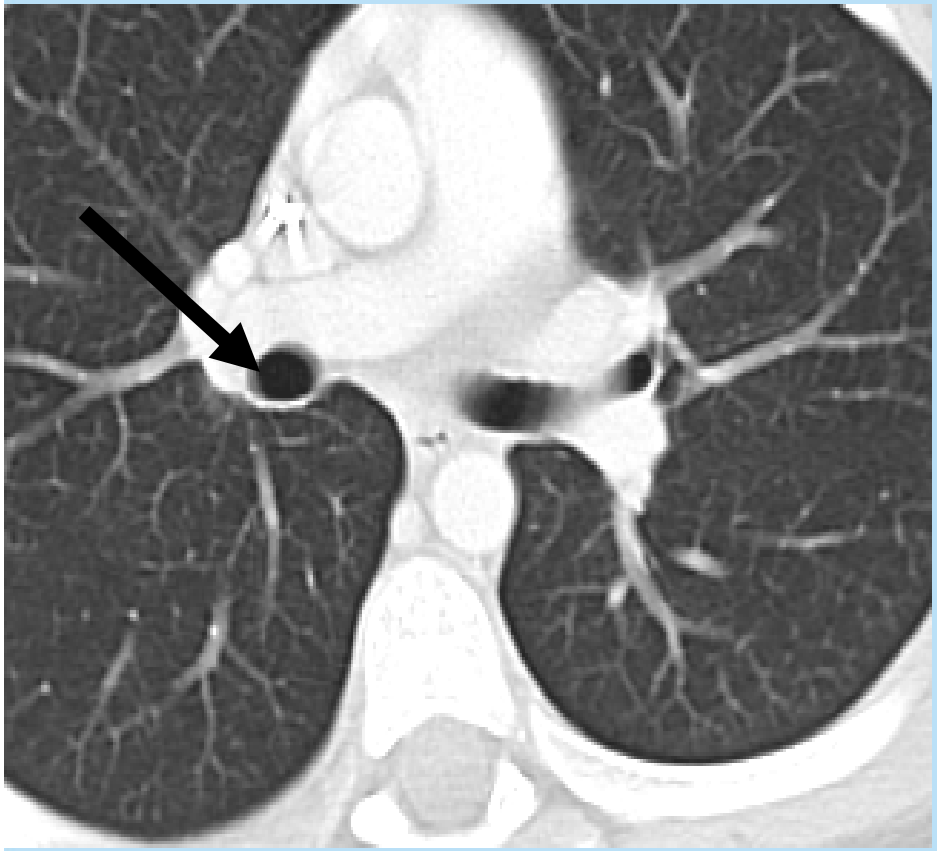


# Results

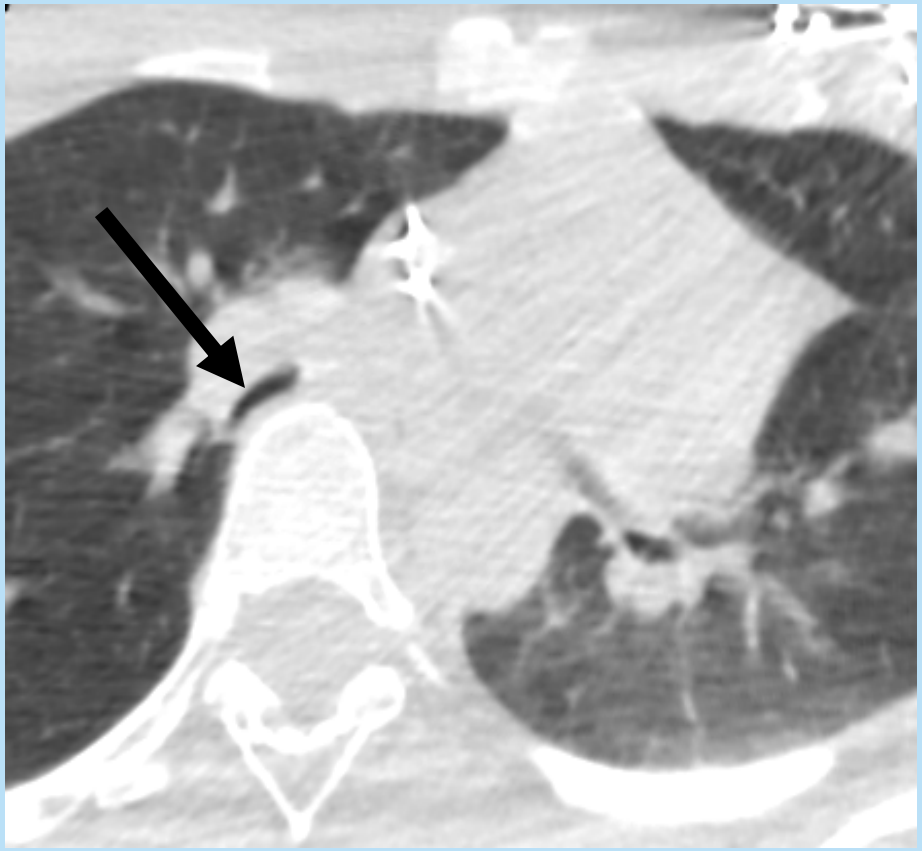
- 17/21 patients (81%) had mainstem (left or right) bronchial compression on flexible bronchoscopy

- 6 of these patients had CT scans available.
  - Compression was notable on CT
  - Compression was associated with adjacent lordoscoliosis
  - This was not reported by radiologist





Normal Chest
CT Scan

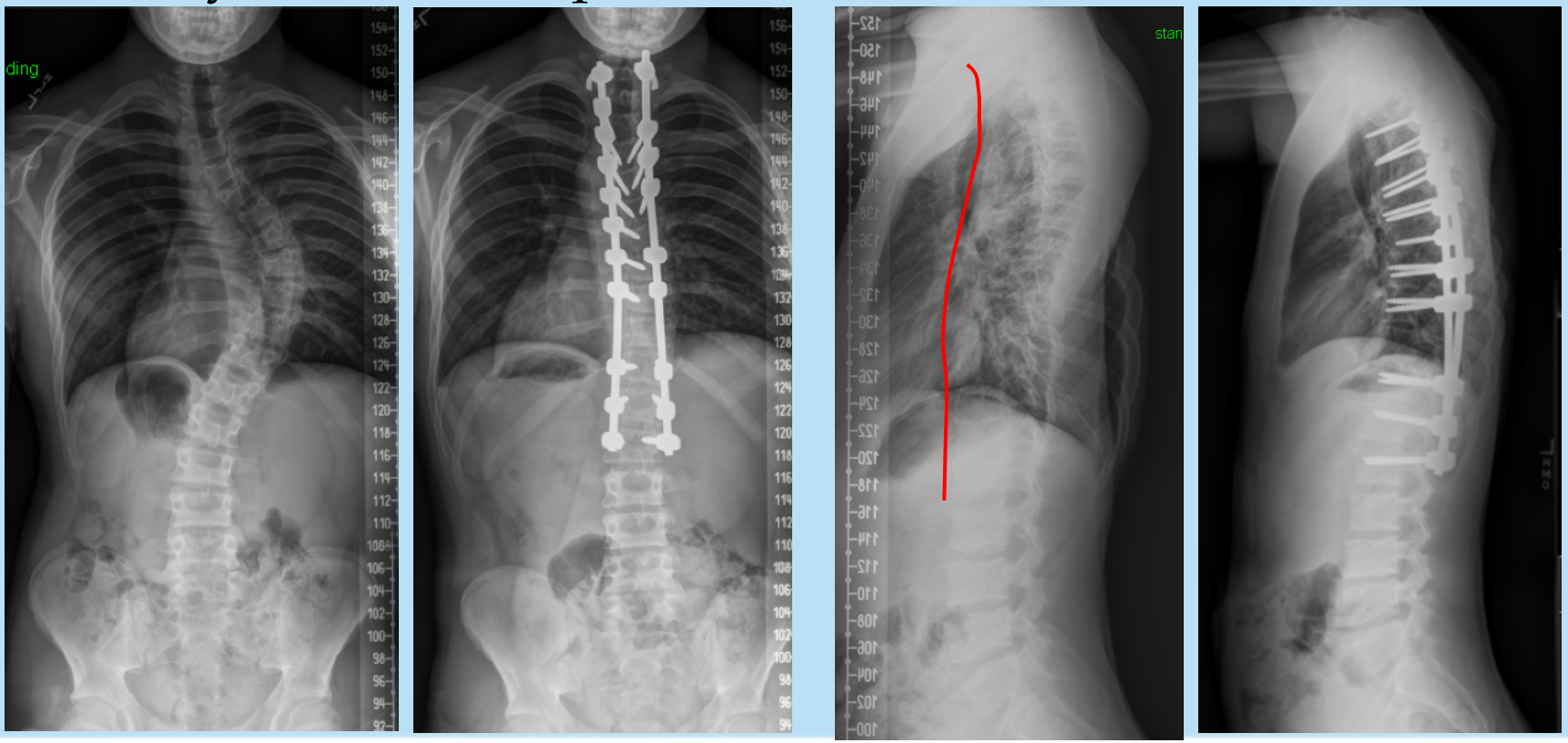


Severe Compression of right mainstem bronchus by spinal lordosis



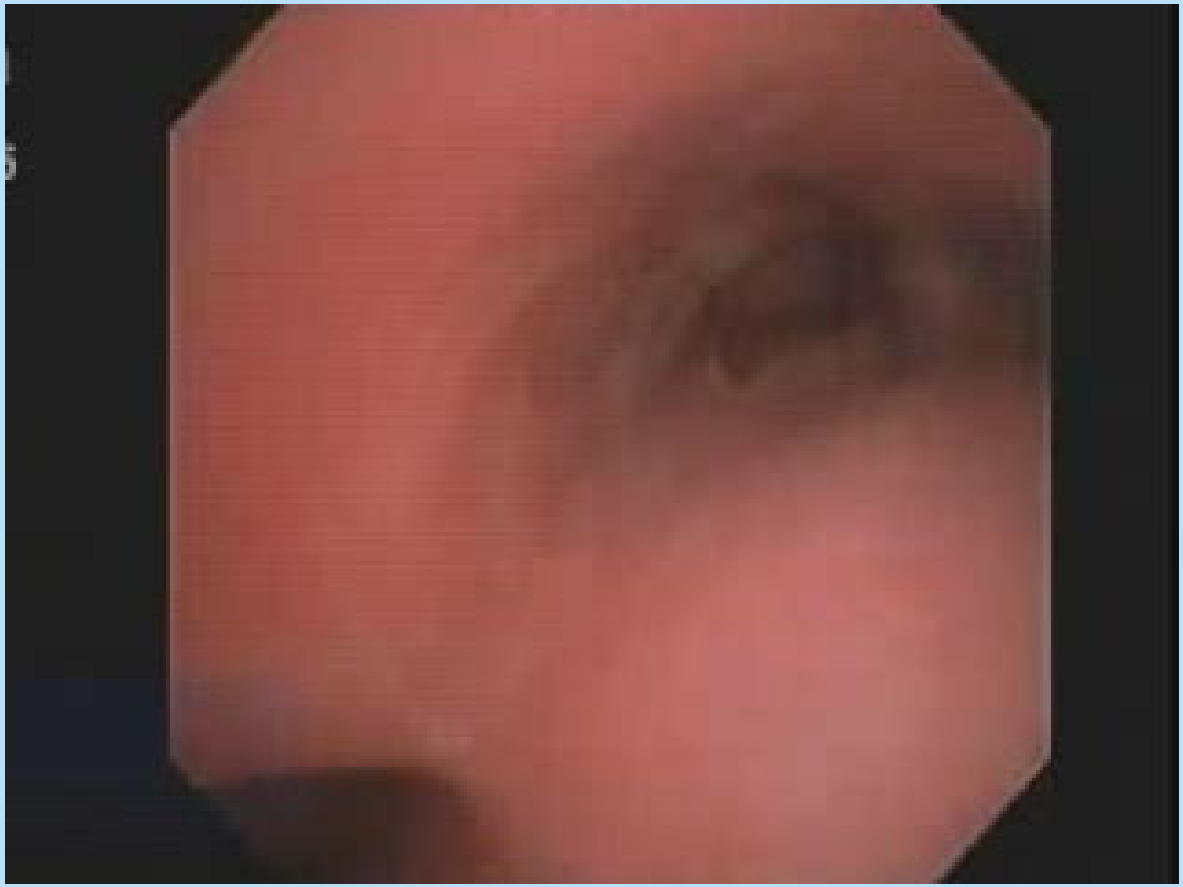
# Case Example: X-rays

- 15 year old male patient with IS



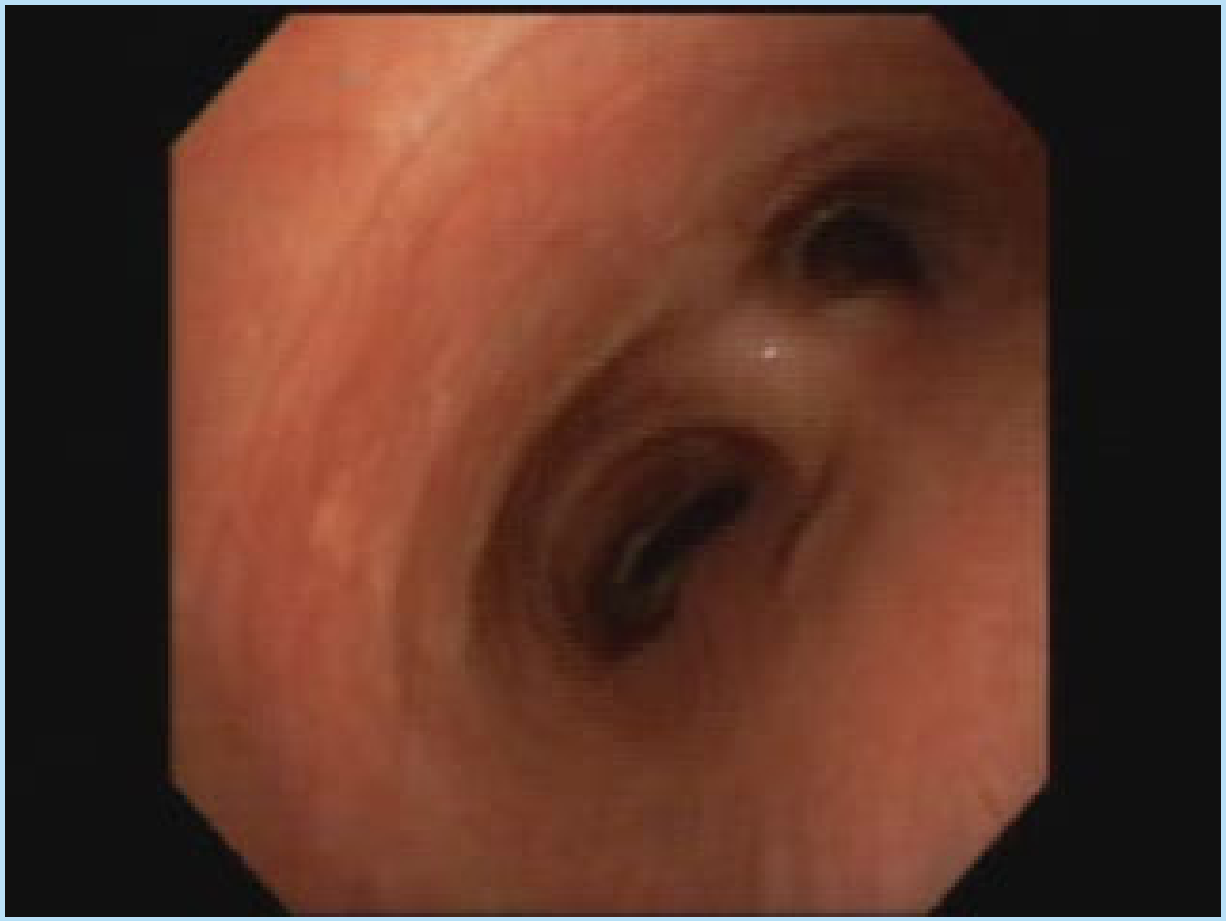
# Pre Op Bronchoscopy

- FEV1 **57%**
- FEV1/FVC **67**



# Post Op Bronchoscopy

- FEV1 **71%**
- FEV1/FVC **88**



# SIGNIFICANCE

- Prospective data review*: 2/2 patient showed improvement on post operative PFT and bronchoscopy.
  - Operative technique modified purposefully to improve lordosis

- 5/6 did not get better when lordosis was not addressed

- *Only pre-op data available at the time of abstract submission



# Conclusions

- Large airway compression is common in patients with thoracolumbar scoliosis who have obstructive disease on PFT
- Lordoscoliosis could be a potential mechanism of airway compression
- Lordoscoliosis may impact surgical technique