Lordoscoliosis and Large Intrathoracic Airway Obstruction

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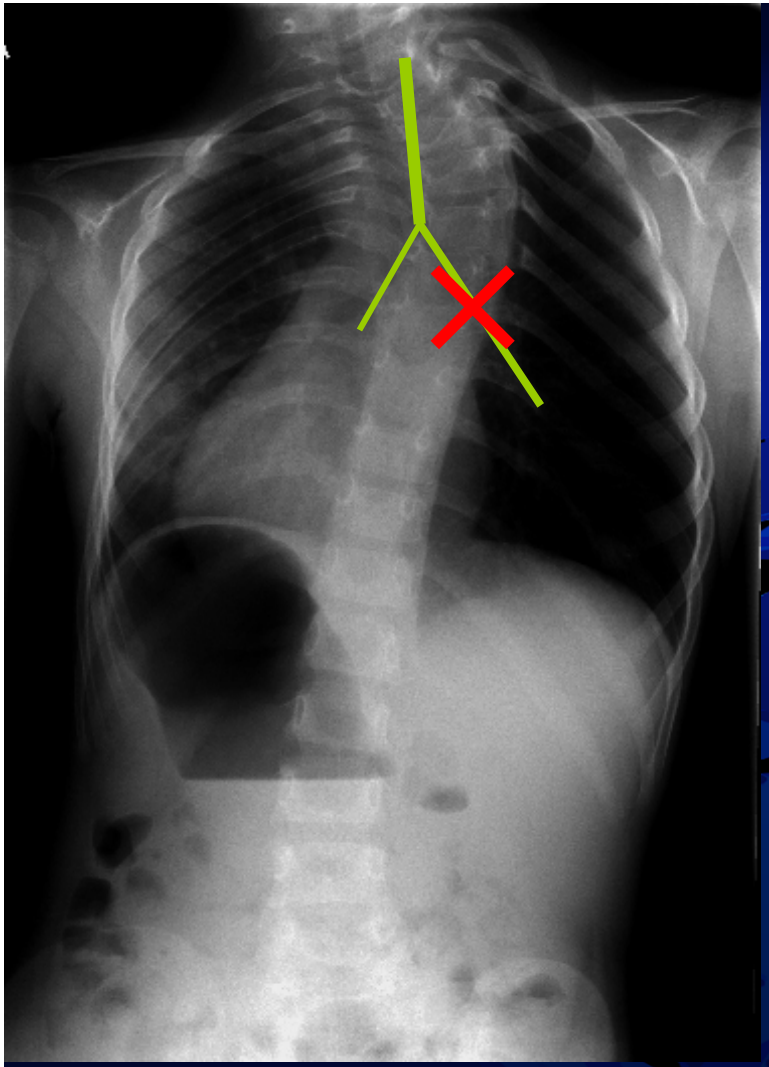
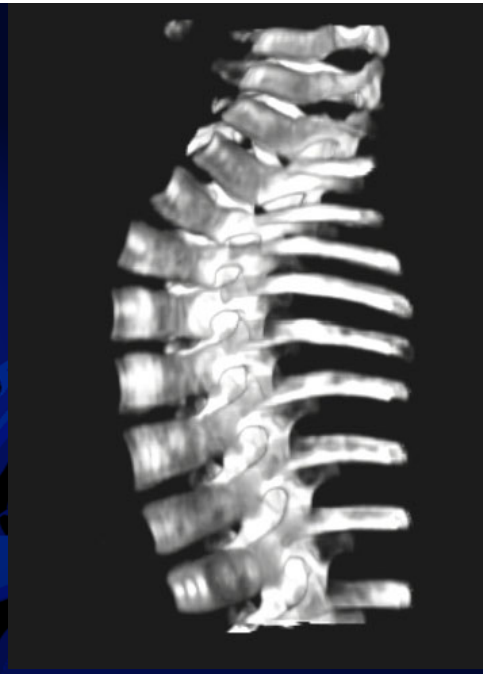
Study conducted at Great Ormond Street Hospital for Children, London.



Population

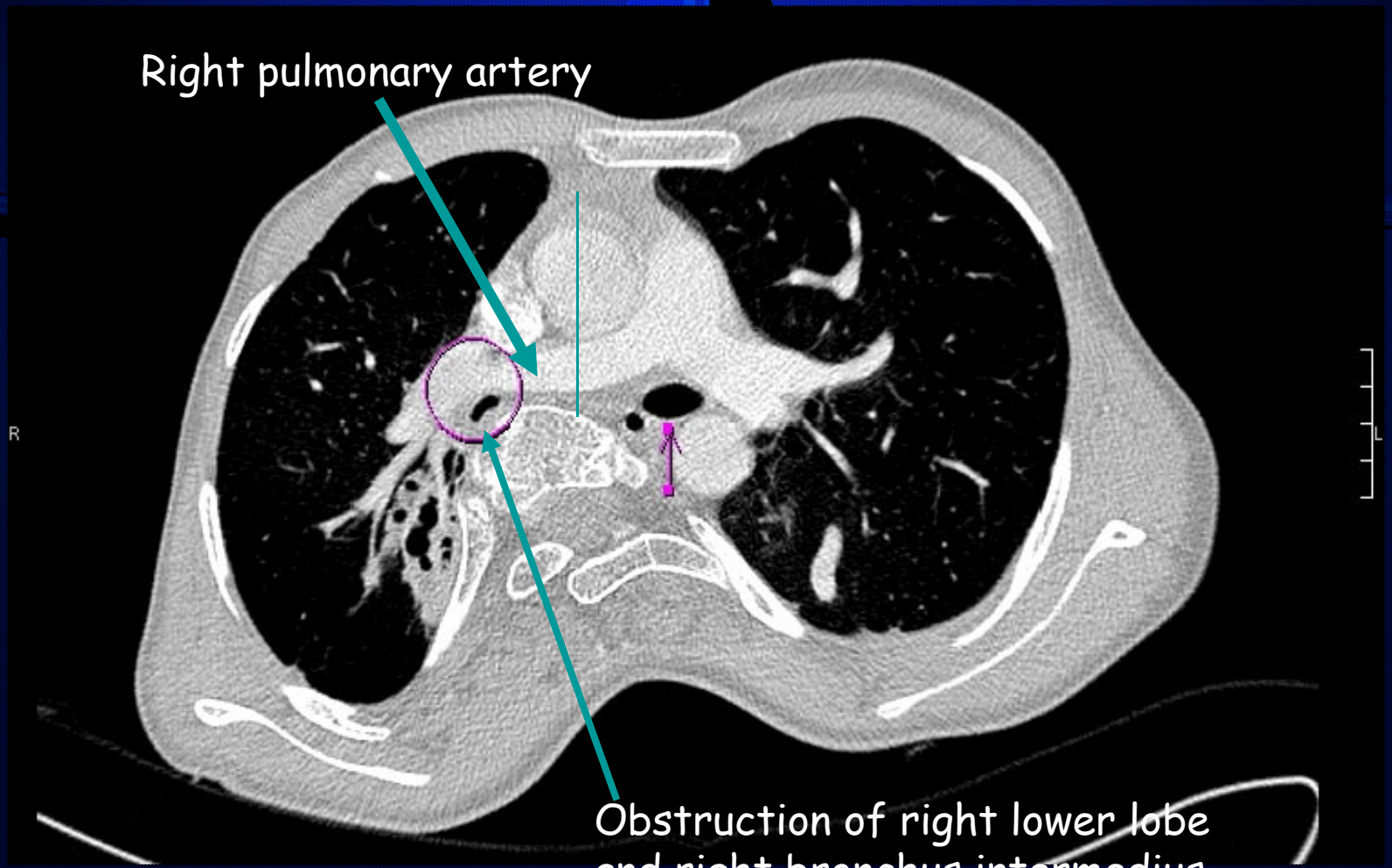


2006-2008

4 patients
2 female, 2 male
Average age 13 (range 4 to 18)
Right thoracic curves 1 proximal thoracic
3 mid thoracic
Ambulant with no significant comorbidities

Diagnosis 2 Syndromic Turner
Russell Silver
1 NF
1"Arthrogryposis like condition"

CT


Right pulmonary artery
Obstruction of right lower lobe
and right bronchus intermedius
or right main bronchus

Preoperative Symptoms

2 patients episode of respiratory arrest or respiratory distress

2 patients were diagnosed with asthma but were refractory to bronchodilators clinically and during spirometry testing

3 patients suffered from recurrent chest infections

Preoperative Workup to establish that the spine is causing the airway obstruction

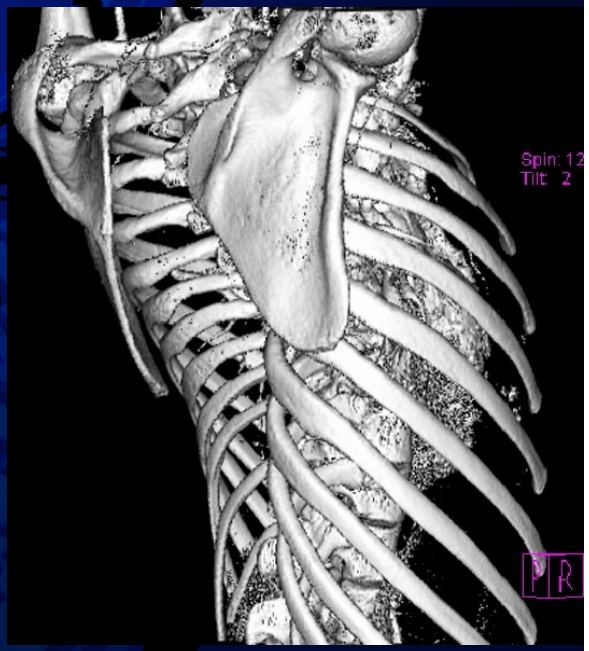
XR Spine

CXR
- Lobar Collapse
- Air trapping

Bronchoscopy
- Exclude endobronchial lesions

V/Q scanning
- Usefull in diagnosis of Occult airway obstruction
- Functional assessment of regional derangements in ventilation and perfusion

Contrast 3D-CT
- Visualise complex anatomical relationships
- Visualise Tracheobronchial tree
- Exclude intrathoracic mass



Giudice J. Ventilation Scan. Use in the evaluation of occult airway obstruction
Chest (1980) 77:4,p576

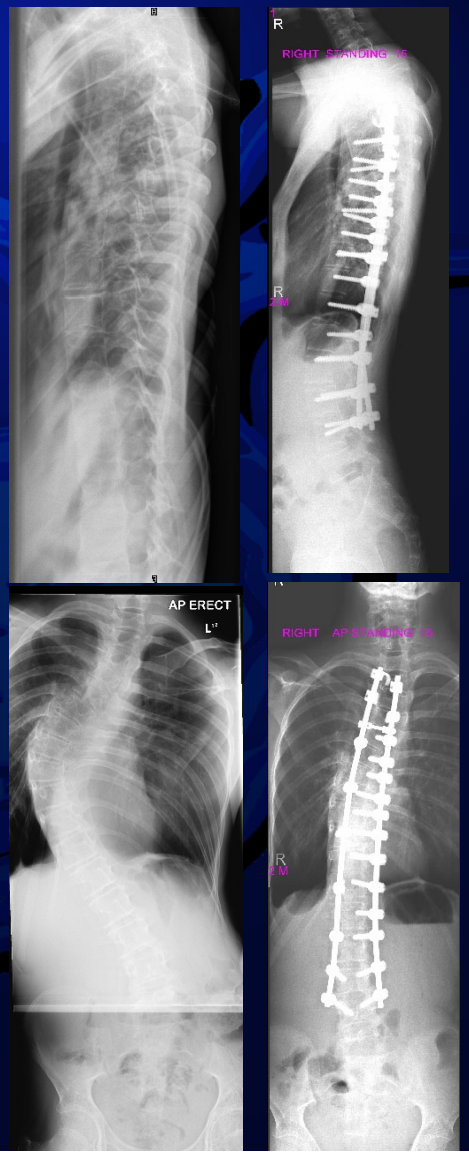
Relief of airway obstruction by spinal deformity correction

1 Posterior growth rod with sublaminar cable at apex of lordosis

3 Segmental posterior instrumented fusions

Coronal Cobb angle
61 (range 56 to 75) preop
19 (range 15 to 21) postop

Sagittal Cobb angle
-20 (range -10 to -34) preop
5 (range 3 to 5) postop



Spirometry Results following spinal deformity correction

% Pred FVC

improved from average 49% preoperatively
to 73% at 8 weeks postoperatively

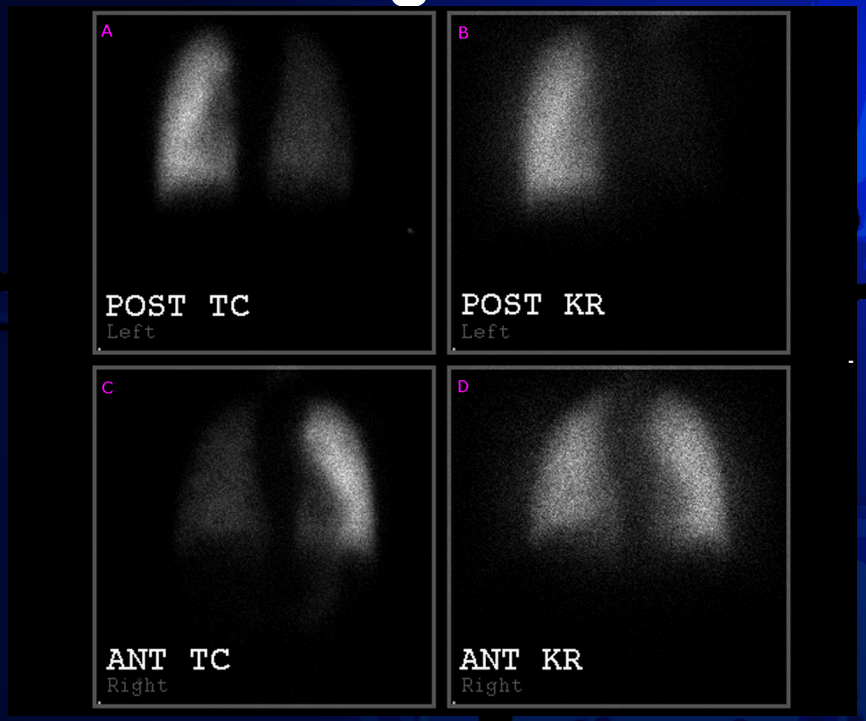
% Pred FEV1

improved from average 42% preoperatively
to 61% at 8 weeks postoperatively

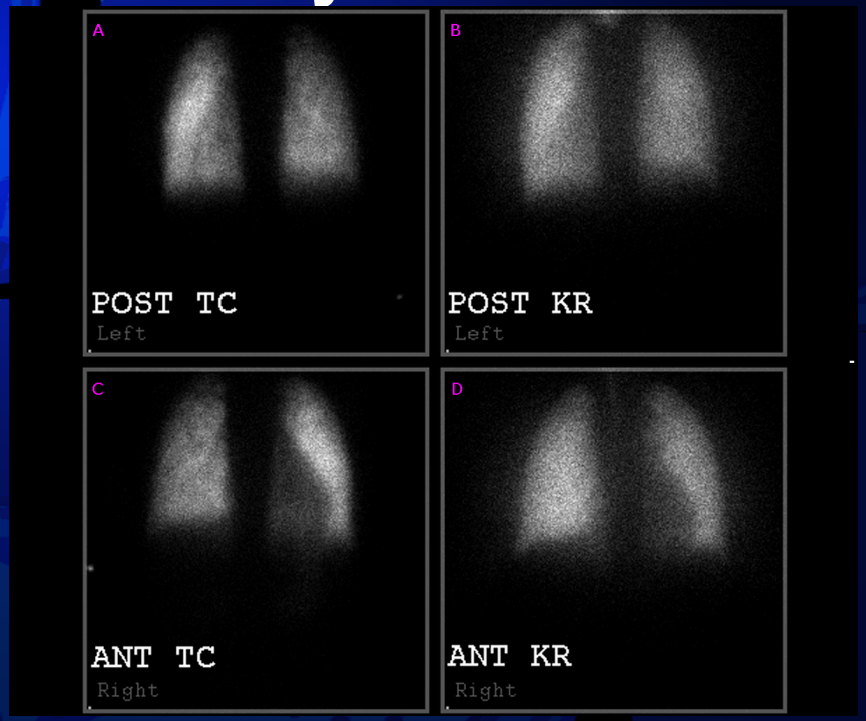
Symptomatic improvement was reported by all patients

Resolution of obstruction was confirmed by V/Q scan 8 weeks postoperatively

V/Q scan for functional assessment of lung and diagnosis of occult airway obstruction



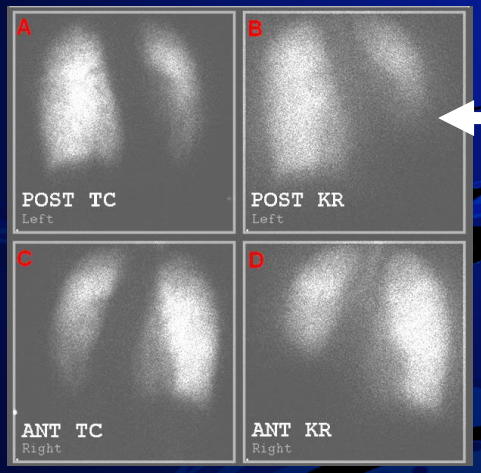
Preoperative V/Q scan
Absent ventilation (B)
Full return of ventilation on Flexion (D)
Reduced perfusion (A)
Perfusion to right lung 27% and 37% on flexion of lordosis



8 weeks postoperatively
Right lung ventilation (B and D) (45% of total)
Right lung perfusion (A and C) (44% of cardiac output)

Typical appearance on V/Q scoliosis with mid-thoracic apex

Preop

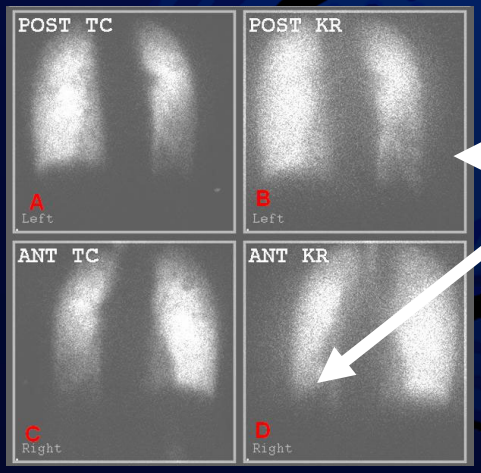


Absent ventilation. Right lung contributes to only 26% of total ventilation

Typically poor perfusion of the Right lower lobe and middle lobe (A and C)

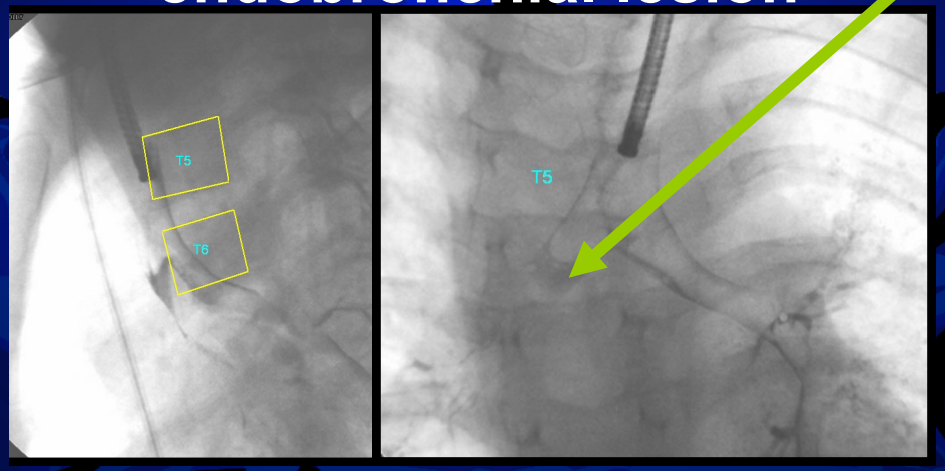
With absent or reduced ventilation (B and D) was present

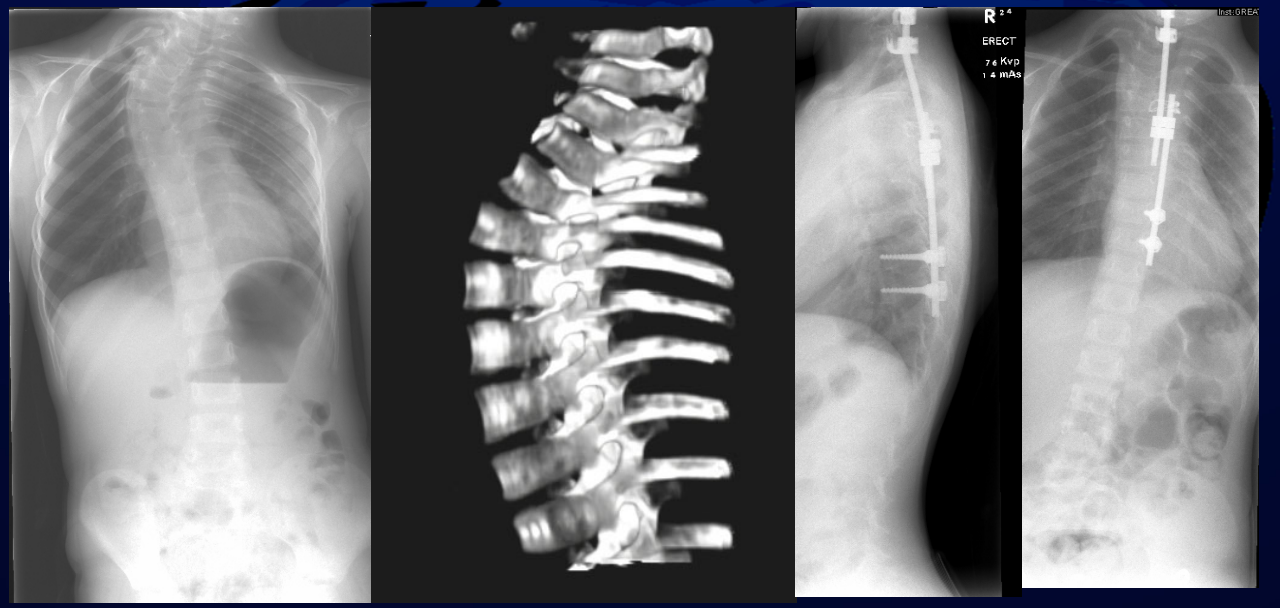
Postop



8 weeks postoperatively
Improved ventilation in middle
And lower lobe. Right lung 37% of total
Ventilation.

Diagnostic Workup
Bronchogram to exclude endobronchial lesion





Bronchogram demonstrating ap and oblique views of the obstructed right main bronchus.
The obstruction could not be overcome with a pressure of 15mmH2O.

Concave vs Convex Lung

Three dimensional CT volumetric analysis and scintigraphic studies in patients with AIS or early onset scoliosis have shown that the concave lung is comparatively more affected

In large airway obstruction due to lordoscoliosis ventilation and perfusion impairment occurs in the convex lung

Giordano A, Fuso L et al.
Evaluation of pulmonary Evaluation of pulmonary ventilation and diaphragmatic movement in I diopathic scoliosis using radioaerosol ventilation scintigraphy.
Nucl Med Commun. 1997 Feb;18(2):105

Chun EM, Sub SW et al.
The change in ratio of convex and concave lung volume in adolescent idiopathic scoliosis: a 3D CT scan based cross sectional study of effect of severity of curve on convex and concave lung volumes in 99 cases.
Eur Spine J. 2008 Feb;17(2):224-9.

Need for relief of obstruction?

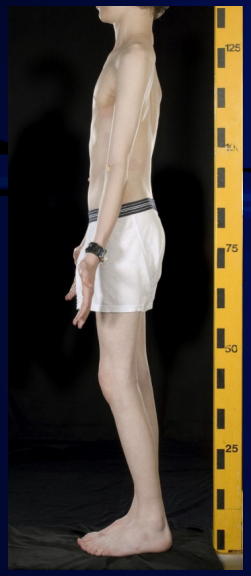
Recurrent chest infection cause parenchymal damage

In the developing lung, even temporary airway obstruction may cause irreversable change to lung function

Davies H, Gordon I, Matthew DJ, et al. Long term follow up after inhalation of foreign bodies.
Arch Dis Child. 1990 Jun;65(6):619-21.

Van OoiJ, Van Belle A et al. The destroyed lung syndrome: report of a case after Harrington rod instrumentation and fusion for idiopathic scoliosis.
Spine. 2002 Jul 15;27(14):E337-41

Abnormal thoracic configuration
Narrow ap diameter



Thoracic lordoscoliosis

Respiratory symptoms

Intrathoracic large airway obstruction ?

Spirometry
V/Q scan

Contrast CT
+/-
Bronchoscopy

Conclusion

Lordoscoliosis can lead to direct bronchial obstruction

Obstruction can be reliefed by spinal deformity correction

Large airway obstruction due to thoracic lordoscoliosis is probably more common than generally appreciated

Regular respiratory evaluation is mandatory

Early intervention should be considered to prevent irreversible lung function loss