

Scoliosis, Pectus, & Combined Deformity Modeling to Predict Functional Outcomes

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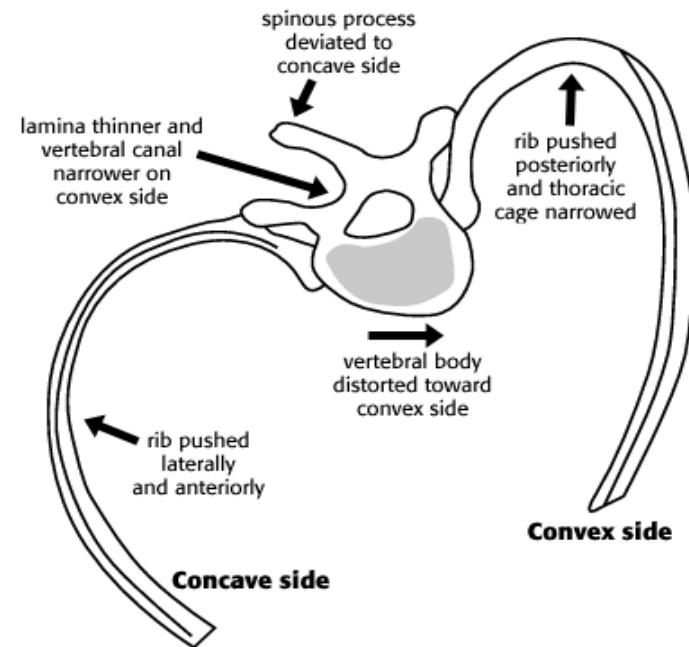


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Background

- Moderate scoliosis (greater than 30°)
1 out of 300 children
- Pectus malformation
1 out of 300-400 children
- While scoliosis and pectus deformities are the most common thoracic malformations in children the interrelationship of spine and chest wall is not understood.
- These malformations have been shown to result in decreased pulmonary function, lung development, pulmonary hypertension, right-sided heart failure, and possibly premature mortality.

Scoliosis



- Scoliosis is a sagittal plane spinal deformity that results in a curved and rotated spine.
- Spinal rotation in scoliosis affects the ribs by creating a decreased rib angle (and chest cavity space) on the convex side while the concave side of the curvature is larger.

Pectus Excavatum



- Pectus excavatum is a chondrosternal depression often resulting in compression and displacement of the heart.

Study Objective

- Model the thoracic volume of scoliosis, pectus and combined deformity in order to predict cardiopulmonary function.
- This requires multiple disciplines, thus our study section was formed.

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Methods

- Retrospective review of children with scoliotic and pectus thoracic deformities.
- A computational model matches the deformed spine and chest wall from 2D chest x-rays (lateral & AP) to compute the resulting thoracic volumetric deformity.
- We are initially validating this model by comparing the model predicted thoracic volume (from chest X-rays) with the thoracic volume measured from total thorax CT scans.

Model Validation

- Model development with 4 healthy adult CTs of the thorax.
- Tested on 4 cases (2 pectus and 2 scoliosis)

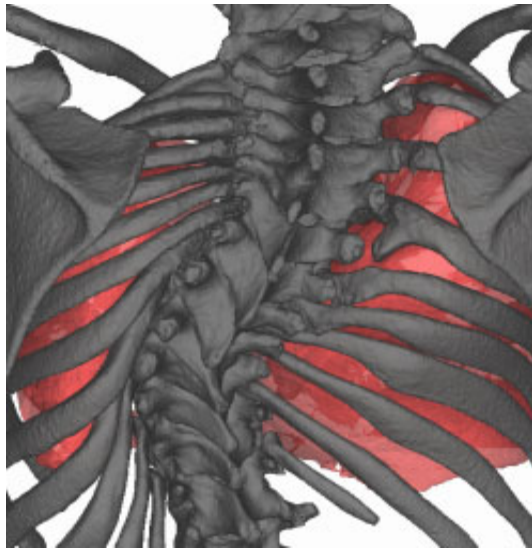


Figure A. Scoliosis

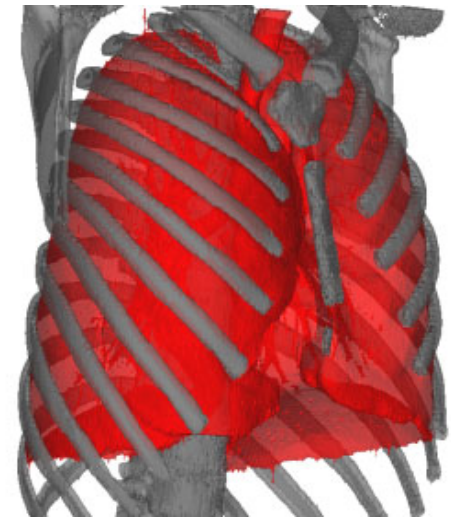
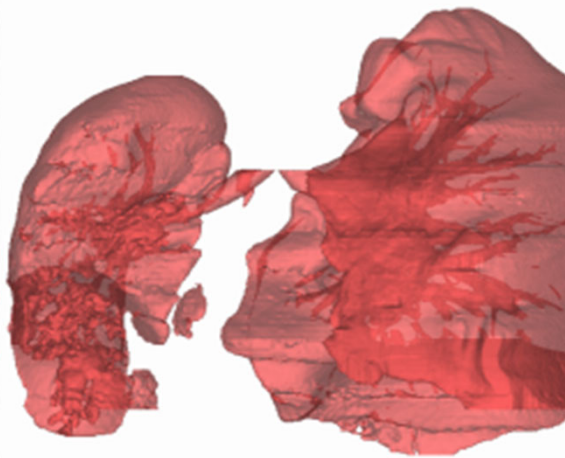


Figure B. Pectus Excavatum

Results

- Both scoliosis (Figure A.) and pectus excavatum (Figure B.) display thoracic volume decrease.
- The volumes measured for the scoliosis cases were 60.9 cm³ different (4%) between CT and chest X-rays.
- The pectus patients had a much higher volume, but remained fidelic within 4%.

Conclusions

- Our broader study is just beginning. This pilot study is promising.
- Using this model we will apply it to scoliosis, pectus and combined deformity patients.

Limitations

- Pilot study with small number of patients.
- The chest X-rays utilized in this retrospective study were likely obtained with some variation in patient positioning.

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