Understanding Lobar Sliding’s Impact on Breathing Mechanics

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Healthcare can be improved with a regional understanding of lung mechanics

- Currently, lung mechanics is only used to evaluate whole lung function

- However, many lung disease start out localized to a small area

- Can regional lung mechanics allow for better diagnosis and characterization of these diseases?
How do we interpret regional mechanics information though?

• Lung deforms heterogeneously even in healthy lungs

• How can we tell what’s diseased and what’s normal variance?

• What about differences between subjects?
Lobar Sliding: A specific challenge

- Lungs are divided into 5 lobes
- Lobes slide along fissures between lobes
- Some people have missing or incomplete lobes
- Does sliding (or the lack thereof) have any physiological impact?
Our Goal:
Improve our understanding of the mechanics of lobar sliding

How?:
By comparing finite element models of the lung that do and do not allow sliding
Finite element models were derived from CT segmentations of the chest wall and lobes.

The models are driven by contact between the lung lobes and the chest wall.
Two models for each subject: Sliding & Non-Sliding

**Sliding Models**
- Frictionless sliding
- Discontinuous displacement between lobes

**Non-sliding Models**
- Large friction coefficient
- Continuous displacement between lobes
Lobar sliding decreases directional distortion in the left lung.
Does lobe geometry matter?

The fissure orientation is more aligned with diaphragm motion. The fissure is near the diaphragm. Fissure is far from the diaphragm.

Largest relative decrease in ADI (9.2% decrease)  
Smallest relative decrease in ADI (0.5% decrease)
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