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Cystic Fibrosis Research News

Title:

Preliminary Comparison of Normalized T1 and Non-Contrast Perfusion MRI Assessments of Regional Lung Disease in People with Cystic Fibrosis

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What was your research question?

Magnetic Resonance Imaging (MRI) is a safe, non-invasive technique that can detect lung disease with no harmful ionizing radiation. In this study, we compared the sensitivity of two MRI techniques: normalized T1 (nT1) and Arterial Spin Labeling (ASL), to detect regional lung changes in people with cystic fibrosis (CF) and healthy volunteers. Normalized T1 is a relative measure of pulmonary blood volume, while ASL specifically measures blood flow to lung tissue.

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Why is this important?

The leading cause of shortened survival in CF is progressive lung disease. An essential part of managing people with CF is the ability to monitor lung disease over long periods of time. Unfortunately, current clinical assessments of CF lung disease are either invasive (bronchoalveolar lavage, BAL) expose people to significant repeated doses of ionizing radiation (X-ray and/or Computed Tomography (CT)), or offer limited sensitivity to detect early-stage, regional lung disease (spirometry). Therefore, the development of a sensitive, non-invasive, and radiation-free method for assessing CF lung disease is the essential next step towards improving health care for people with CF.

What did you do?

We compared the sensitivity of two MRI techniques, nT1 and ASL MRI, to detect regional changes in the lungs of people with CF (8 participants) in comparison to healthy volunteers (6 participants). Normalized T1 is a method that is sensitive to local blood volume and was previously shown to detect CF lung disease prior to changes in spirometry. The ASL MRI technique specifically measures pulmonary perfusion (the delivery rate of blood to the lung tissue). Importantly, the nT1 MRI technique provides lung imaging results in approximately 5 seconds, while the ASL MRI data are acquired over approximately 5 minutes.

What did you find?

The CF participants exhibited significant nT1 decreases in the upper region of the left lung as well the upper and anterior region of the right lung in comparison to healthy controls. The ASL techniques showed that pulmonary perfusion for the CF participants was significantly reduced only in the upper region of the right lung. We also observed that nT1 and ASL results in the upper lung regions resulted in a significant correlation with spirometry. In addition, the nT1 and ASL MRI results in the upper lung regions significantly correlated with one another demonstrating a direct association between the two techniques.

What does this mean and reasons for caution?

Overall, this initial study confirmed that both the nT1 and ASL MRI techniques provide radiation-free methods that are non-invasive in order to detect regional lung disease in people with CF. These results also show that both MRI techniques are related to observed changes in CF lung disease. Most importantly, these results suggest that the nT1 method may be more sensitive than ASL MRI in detecting regional changes associated with CF lung disease.

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What's next?

Future MRI studies must be conducted to evaluate the nT1 and/or ASL MRI techniques in people with CF. Most importantly, the group of CF individuals must be expanded and should include children. In addition, these MRI techniques must also be evaluated in imaging studies run over a long period of time to assess lung disease progression.

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