European Cystic Fibrosis Society

Journal of Cystic Fibrosis
The Official Journal of the European Cystic Fibrosis Society

Cystic Fibrosis Research News

Title:

Hyperpolarized ^{129}Xe for investigation of mild cystic fibrosis lung disease in pediatric patients

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What was your research question?

Hyperpolarized xenon-129 (^{129}Xe) magnetic resonance imaging (MRI) is a novel technique that allows us to see and measure ventilation in different areas of the lungs. We wanted to test whether we could use ^{129}Xe MRI to identify early airway obstruction in children with mild cystic fibrosis (CF) lung disease and normal or near-normal lung function.

Why is this important?

Conventional MRI of the lungs is challenging because the lung tissue is thin and full of air. In our technique, we view the inhaled, inert ^{129}Xe gas instead of the lung tissue itself, and the dark regions in the images reveal areas of the lung that are obstructed and not properly receiving air. MRI is a radiation-free technique and therefore ideal for repeated imaging over time to monitor the progression of CF lung disease and assess therapies.

What did you do?

We used ^{129}Xe MRI in 11 healthy people (age 6-16 years) and 11 people with mild CF (age 8-16 years, whose lung function measure by forced expiratory volume (FEV_1) percent predicted was over 70%). Nine people with CF had an FEV_1 measurement of over 85%. In order to analyse the ^{129}Xe MR image, we calculated the proportion of dark, poorly ventilated lung (the ventilation defect percentage or VDP) and compared this to the clinical gold-standard from spirometry, FEV_1.

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What did you find?

Ventilation defects (the dark regions in the ^{129}Xe MRI, showing poorly ventilated areas of the lungs) could be seen in all people with CF. While there was no significant difference in FEV_1 measurements between the healthy people (an average of 100.3%) and those with CF (an average of 97.9%), the people with CF had a much higher average level of poor ventilation (18.3%) in their lungs with measured with ^{129}Xe VDP compared to healthy people (6.4%).

What does this mean and reasons for caution?

While this was a study with relatively a small number of individuals, our results indicate that ^{129}Xe MRI was much more sensitive than FEV_1 in detecting early CF lung disease and separating people with CF from healthy controls. Importantly, unlike the usual lung function measurements, ^{129}Xe MRI provides information on specific areas of the lungs that can be used to target interventions and monitor individualized response to therapies in the future.

What's next?

We will combine ^{129}Xe MRI with more typical MRI to understand the structural causes of ventilation defects in CF lung disease. Physicians could use ^{129}Xe MRI repeatedly over time to assess how individuals with CF respond to treatment. These findings may lead to more targeted, individualized treatments for CF.

Original manuscript citation in PubMed

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