

Dynamic MRI of lungs using perfluorinated gas mixtures

Unmet Need

Chronic obstructive pulmonary disease (COPD) is the 3rd leading cause of death in the US. It has consistently increased in frequency over the past 4 decades, currently including 15-20 million diagnosed cases. COPD is characterized by airflow limitation that is not fully reversible, it includes both emphysema and small airway disease. There is no clear way of early identification of COPD, before significant airflow obstruction and clinical impairment takes place. Current widely available diagnostic imaging methods include x-ray computer tomography, which offers exquisite anatomic detail but not function, and nuclear techniques such as scintigraphy, which do provide regional information but at low resolution. These modalities deliver ionizing radiation, which limits their repeat use in patients. More recently, the emergence of hyperpolarized gas MRI using the stable isotopes ^3He and ^{129}Xe has offered hope for non-invasive, regional assessment of lung function coupled with conventional MRI to assess structure. Unfortunately, this technology is expensive, has been slow to disseminate commercially, and is technically challenging to implement in a routine clinical setting. It is clear that improved methods to assess pulmonary function regionally and noninvasively are needed.

Technology

Duke researchers invented the method and developed the system that uses perfluorinated gases (PFx) mixed with oxygen as new imaging biomarkers during MRI that allow capturing regional ventilation information in patients. PFx agents attain a relatively high thermal polarization exceptionally quickly, and deliver strong magnetic resonance signal, enabling near real-time imaging of ventilation dynamics with a quality similar to that of hyperpolarized gas MRI, but at lower cost and with greatly reduced technical complexity. With the rapid signal acquisition, the patient will be able to passively inhale and exhale the gas mixture while being imaged, without the need to hold their breath for prolonged time.

Advantages

- Allows for near real-time imaging of ventilation

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Duke File (IDF)

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Links

- [From the lab of Prof. Brian Soher](#)
- [From the lab of Prof. Hal Charles](#)

College

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dynamics.

- Well-tolerated, radiation-free technique with no known anesthetic effects in healthy volunteers and patients with lung disease.
- Was successfully used to sensitively detect mild cystic fibrosis lung disease in clinical trials.

Publications

- [Perfluoropropane gas as a magnetic resonance lung imaging contrast agent in humans \(Chest, 2013\)](#)
- [Dynamic perfluorinated gas MRI reveals abnormal ventilation despite normal FEV1 in cystic fibrosis \(JCI Insight, 2020\)](#)
- [Patent \(9,254,098\)](#)
- [Patent \(9,724,015\)](#)

Patents

Patent Number: 9,254,098

Title: SYSTEMS, METHODS, COMPOSITIONS AND DEVICES FOR IN VIVO MAGNETIC RESONANCE IMAGING OF LUNGS USING PERFLUORINATED GAS MIXTURES

Country: United States of America

Patent Number: 9,724,015

Title: SYSTEMS, METHODS, COMPOSITIONS AND DEVICES FOR IN VIVO MAGNETIC RESONANCE IMAGING OF LUNGS USING PERFLUORINATED GAS MIXTURES

Country: United States of America

Patent Number: 2011218194

Title: SYSTEMS, METHODS, COMPOSITIONS AND DEVICES FOR IN VIVO MAGNETIC RESONANCE IMAGING OF LUNGS USING PERFLUORINATED GAS MIXTURES

Country: Australia

Patent Number: 2,793,101

Title: SYSTEMS, METHODS, COMPOSITIONS AND DEVICES FOR IN VIVO MAGNETIC RESONANCE IMAGING OF LUNGS USING PERFLUORINATED GAS MIXTURES

Country: Canada

Patent Number: . ZL201180019402.0

Title: SYSTEMS, METHODS, COMPOSITIONS AND DEVICES FOR IN VIVO MAGNETIC RESONANCE IMAGING OF LUNGS USING PERFLUORINATED GAS MIXTURES

Country: China

Patent Number: 2536332

Title: SYSTEMS, METHODS, COMPOSITIONS AND DEVICES FOR IN VIVO MAGNETIC RESONANCE IMAGING OF LUNGS USING PERFLUORINATED GAS MIXTURES

Country: Germany

Patent Number: 2536332

Title: SYSTEMS, METHODS, COMPOSITIONS AND DEVICES FOR IN VIVO MAGNETIC RESONANCE IMAGING OF LUNGS USING PERFLUORINATED GAS MIXTURES

Country: France

Patent Number: 2536332

Title: SYSTEMS, METHODS, COMPOSITIONS AND DEVICES FOR IN VIVO MAGNETIC RESONANCE IMAGING OF LUNGS USING PERFLUORINATED GAS MIXTURES

Country: United Kingdom

Patent Number: 2536332

Title: SYSTEMS, METHODS, COMPOSITIONS AND DEVICES FOR IN VIVO MAGNETIC RESONANCE IMAGING OF LUNGS USING PERFLUORINATED GAS MIXTURES

Country: Netherlands