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NEWS

RSNA Press Release

New MRI Technique Shows Emphysema in Asymptomatic Smokers

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At A Glance

- MRI with hyperpolarized helium can depict early signs of emphysema before outward symptoms appear.
- Over 3 million Americans have symptomatic emphysema, and millions more are in the early stages of the disease.
- Age and smoking are significant factors in the development of emphysema.

OAK BROOK, Ill.—A new imaging method has revealed early signs of emphysema in smokers with no external symptoms of the disease, according to a study published in the June issue of *Radiology*. The study, supported by the National Institutes of Health, details a new magnetic resonance imaging (MRI) technique that appears to be much more sensitive to lung changes than even the current modality of choice, computed tomography (CT).

"With this technology, we have shown that it is possible to measure the severity of emphysema and its progression through time without the radiation exposure of lung CT tests," said Sean B. Fain, Ph.D., lead author and assistant professor of medical physics and radiology at the University of Wisconsin, Madison.

Emphysema is a chronic, progressive lung disease, which permanently damages the air sacs in the lungs. As the size of the air sacs (or "airspaces") increase, cavities form in the lung tissue, hindering oxygen delivery. According to the American Lung Association, over 3 million people in the United States have been diagnosed with emphysema, and millions more are in the early stages of the disease before signs and symptoms appear. Smoking cigarettes triples the risk of developing the disease.

The researchers had 19 volunteers inhale a special kind of "hyperpolarized" helium before they performed two MRI tests of the lungs. Eleven of the volunteers were smokers with no symptoms of emphysema, and the remaining eight were nonsmokers. The first image the researchers acquired showed obstructed areas of the lungs, where the air was unable to pass. The second image they obtained is called an apparent diffusion coefficient (ADC) map, which shows the size of the airspaces in the lungs. Because emphysema increases airspace size, the ADC map shows the location and severity of the disease.

"The ADC maps are very sensitive to changes in the lung structure," Dr. Fain said. "With this tool, it was shown that even smokers that appear healthy have enlarged lung airspaces

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that suggest emphysema is already developing."

With increasing smoking history, the ADC maps showed progressive breakdown of the lung structure in all regions of the lungs. All smokers with a history greater than 18 pack-years (equivalent to one pack of cigarettes per day for 18 years) showed significant abnormalities compared to nonsmokers.

CT was performed after MRI, to allow comparison between the two modalities. Even though CT is the more established modality in the investigation of lung disease, it failed to show the same defects detected with MRI. Moreover, with the combination of MRI and hyperpolarized helium, the researchers were able to measure lung structures with 2½ times more precision than with CT, and 10 times more precision than with conventional MRI methods.

Age is a significant factor in the development of emphysema-like changes. The researchers found that, in general, the airspaces in the lungs enlarge with age. However, smoking compounds the problem. Dr. Fain and colleagues showed in a related study that these changes occur at a much slower rate in nonsmokers than in active smokers.

"On average, active smoking accelerates emphysema-like changes at about twice the normal rate found with aging," Dr. Fain explained.

In addition to early disease detection, hyperpolarized MRI can also be used to plan surgical therapies and to monitor patient response to drug therapies without the risks of exposure to CT-related radiation.

Dr. Fain believes that this new method of using polarized gases to study lung diseases will provide a clearer picture of the underlying mechanisms of poorly understood conditions like asthma and chronic pulmonary obstructive disease, leading to better treatments.

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