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Quantitative Interstitial Abnormalities are Linked to Acute Respiratory Disease Events in Smokers

Quantitative interstitial abnormalities (QIAs) are subtle lung features detected through automated machine learning on CT scans. QIAs are linked to reduced lung function, exercise capacity, and increased respiratory symptoms and mortality. Risk factors for QIA progression include age, sex, smoking, and genetic factors. QIA progression is associated with a faster decline in lung function and increased mortality. There's a potential connection between QIA and pulmonary fibrosis or emphysema. Acute respiratory disease (ARD) episodes, particularly severe ones, are common among smokers and are associated with morbidity and mortality. While many ARD events are related to COPD, some may be associated with QIA. A recent study published in *Radiology* aims to investigate whether QIA progression is linked to ARD and severe ARD events in smokers.

Insights from the COPDGene Study

This study is a secondary analysis of the COPDGene Study, which included over 10,000 individuals with a history of smoking from various centres in the United States. Participants aged 45-80 with a smoking history of at least 10 pack-years were included, excluding those with certain lung diseases. Baseline and follow-up data were collected over approximately 5 years, including CT scans, questionnaires, serum measurements, and spirometry. Acute respiratory disease (ARD) events were tracked through questionnaires, with severe ARD events requiring hospitalisation or an ER visit. Quantitative interstitial abnormalities (QIA) and emphysema progression were measured using CT scans and artificial intelligence algorithms. The study calculated annualised rates of change for QIA and emphysema progression. Additionally, airway metrics such as airway wall thickness and air trapping were assessed to identify small airways disease.

Understanding Respiratory Health Patterns in Smokers

The COPDGene Study followed 10,198 participants initially, with 6284 returning for a follow-up visit. Among those, 3972 had complete data for analysis, with a majority being non-Hispanic White. A significant portion were current smokers, with an average smoking history of 42.4 pack-years. Participants had varying levels of quantitative interstitial abnormalities (QIA), emphysema, airway wall thickness, and air trapping. Over the study period, a substantial number of participants experienced acute respiratory disease (ARD) events, with some being severe. QIA progression was linked to increased odds of severe ARD events both between visits and after visit 2. Emphysema progression was associated with a higher likelihood of ARD events between visits but not after visit 2. Faster QIA progression was correlated with a higher frequency of ARD events, especially severe ones. Participants in the highest quartile of QIA progression had significantly more frequent ARD events compared to those in the lowest quartile. Emphysema progression did not show such associations with ARD events.

Impact of Quantitative Interstitial Abnormalities on Acute Respiratory Disease Events

Even after accounting for confounding variables such as emphysema, spirometric obstruction, small airways disease, and other comorbidities, the association between QIA progression and severe ARD events remained significant. This suggests that QIA progression represents a distinct pathological process that contributes to respiratory morbidity in individuals with a smoking history, beyond what can be attributed to other lung abnormalities.

Increased likelihood and frequency

Additionally, the study observed that faster QIA progression was associated with a higher frequency of ARD events, particularly severe ones. This indicates that not only does QIA progression increase the likelihood of experiencing ARD events, but it also influences the frequency of these events. These results underscore the importance of monitoring QIA progression in clinical practice, as it may serve as a valuable indicator of disease activity and the risk of future exacerbations. Furthermore, the study compared the associations between QIA progression and emphysema progression with ARD events. While both QIA and emphysema progression were associated with ARD events, the effects were more pronounced for QIA. This suggests that QIA progression may have a more significant impact on respiratory health outcomes compared to emphysema progression in individuals with a smoking history.

Overall, these findings provide compelling evidence of the clinical relevance of QIA progression in predicting ARD events and highlight the need for targeted interventions to mitigate the progression of QIA and reduce the burden of respiratory morbidity in this population. Further research incorporating mechanistic and omics data could provide deeper insights into the underlying biological mechanisms driving the association between QIA progression and ARD events, paving the way for more effective therapeutic strategies.

Source: **RSNA Radiology**

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