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Breakthrough in developing new diagnostic procedure for pulmonary aspergillosis

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Scientists have developed a pioneering new procedure that will help diagnose a potentially lethal fungal lung disease with greater speed and accuracy, and with less distress to the patient.

A team of international scientists, including Professor Chris Thornton from the University of Exeter, has created a new diagnostic procedure for pulmonary aspergillosis.

Aspergillus is a common mold readily found worldwide in a variety of environments, such as soil and decaying plant material, and can easily be inhaled as air-borne spores in everyday life.

While people with healthy immune systems are able to combat these spores when inhaled, those who have a weakened immune system from illness or medications have fewer infection-fighting cells. This allows Aspergillus to take hold, invading the lungs and, in the most serious cases, other parts of the body.

For COVID-19 patients admitted in intensive care units in particular, the infection has become a significant problem—an estimated 30 percent of them develop COVID-19-Associated Pulmonary Aspergillosis.

The diagnosis of the infection is extremely difficult, and current diagnostic procedures are unpleasant for the already weakened patients. Medical professionals rely on highly invasive techniques such as lung biopsies or broncho-alveolar lavages—where fluid is injected directly into the lungs through the nose or mouth.

Now, the team of researchers have conducted a study, using a mouse model of infection, and utilizing a patent-pending Aspergillus-specific monoclonal antibody, JF5, developed by ground-breaking University of Exeter spin-out company, ISCA Diagnostics.

The research shows that the humanized JF5 antibody can specifically and rapidly recognize the infection in the lungs of infected animals without the need for the invasive procedures.

Using a radiotracer injected only intravenously, advanced molecular imaging techniques developed at the University of Tübingen were able to provide a rapid and specific diagnosis of the disease while allowing for precise monitoring of therapy.

The imaging results were then be complemented by 3-D microscopy performed at the University of Duisburg-Essen, which underlined the accuracy of the developed imaging method with a precise (quantitative) evaluation of the infection.

This innovative dual approach proved that all sites of infection could be accurately uncovered, a crucial step to not only provide an estimate of the severity of the infection, but also as a first step in monitoring the success of its treatment.

The researchers demonstrated the potential of therapy monitoring using molecular imaging during administration of the front-line antifungal drug Voriconazole.

Professor Thornton, an expert in Fungal Immunology at the University of Exeter and co-author of the published work said: "This highly innovative and ground-breaking diagnostic technology is a step-change in the way we diagnose this devastating disease of immunocompromised patients, eliminating our current reliance on unpleasant invasive procedures."

"We strongly expect," says Dr. Nicolas Beziere of the Department of Preclinical Imaging and Radiopharmacy at Tübingen University Hospital and senior author of the study, "that the performance of the newly developed radiotracer will be similar in humans and hope that future clinical trials will show a highly positive impact on survivability with a far lower risk and higher comfort for the patient."

More information: Sophie Henneberg et al, Antibody-guided in vivo imaging of Aspergillus fumigatus lung infections during antifungal azole treatment, *Nature Communications* (2021). DOI: 10.1038/s41467-021-21965-z