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Metabolic Profiling for Rapid and Accurate Coccidioidomycosis Diagnostics

Valley Fever (VF) or coccidioidomycosis is a systemic fungal infection that is endemic to the Southwestern United States although it can occur in other parts of the world. Studies suggest that as few as 10 inhaled spores are sufficient to cause an infection. Roughly 40% of VF patients experience vague or flu-like symptoms and approximately 5-10% of patients, progress to a disseminated form of the disease with potentially fatal consequences. The incidence of VF has risen 6-fold since 1993. VF imposes a substantial burden on the healthcare system with hospitalizations costing about $49K per stay.

Because VF's clinical presentation resembles other infectious diseases, accurate diagnoses are often delayed. Current diagnostic approaches are inaccurate, non-specific, time-consuming, costly and invasive. Often a combination of clinical presentation, serology, radiography, histology and cultures are necessary in order to achieve a definitive diagnosis of VF. Thus, sensitive and accurate diagnostics are needed for early and definitive diagnosis of VF.

Researchers at Arizona State University and their colleague at Mayo Clinic in Arizona utilized targeted LC-tandem mass spectrometry (LC-MS/MS) to create a metabolic profiling method for rapid and accurate detection of VF. This approach identified three significantly altered plasma metabolites and nine urine metabolites which were used in predictive classification models for the accurate diagnosis of VF. The combined three plasma metabolites had a diagnostic sensitivity and specificity of 94.4% and 97.6% respectively with an AUC of 0.995. The nine urine metabolites had a diagnostic sensitivity and specificity of 89.7% and 88.1% respectively, with an AUC of 0.929. Additionally, this metabolomics approach could reach a VF diagnosis within 24 hours, which is a significant improvement over existing methods.

This metabolic profiling method could serve as a novel approach for rapid and routine VF diagnosis, regardless of clinical course or serological status, with notable improvement over current approaches.

Potential Applications

- VF detection/diagnosis
  - From early stage to disseminated form of disease

Benefits and Advantages

- Higher accuracy, sensitivity and specificity (the OPLS-DA statistical model demonstrated AUC = 0.995, sensitivity = 0.994 and specificity = 0.976)
- Less invasive – can use plasma or urine
- Cost-effective
- Rapid diagnosis (within 24 hours)
- Accurate diagnosis of VF irrespective of clinical course or serological status
- These metabolic markers are present early in infection and persist, even in extrapulmonary diseases

For more information about this opportunity, please see

Jasbi et al - J Proteome Res - 2019

For more information about the inventor(s) and their research, please see

Dr. Lake's departmental webpage

Dr. Gu's departmental webpage