Blood biomarker detects COVID-19 severity and enables early triage

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Dr. Kulasinghe, from QUT Centre for Genomics and Personalised Health and School of Biomedical Sciences, delivered the findings to a special virtual meeting of the American Association of Cancer Research

(AACR) on "COVID-19 and Cancer" earlier this month.

He said results of the test could inform doctors those patients that were likely to develop a severe infection and require a ventilator when they first present and thus differentiate them from patients likely to experience a milder case and who could go home and self-isolate.

"This is extremely important for the triage of patients when hospitals are running near or beyond capacity," Dr. Kulasinghe said.

"We used spatial transcriptomic profiling (a technique which enables researchers to map cell-to-cell interactions and genes) to study lung samples from COVID-19 patients who had died.

"These spatial profiling biology approaches to understand complex tissues were voted the method of the year in 2020 *Nature Methods*.

"We drew upon our previous experience in spatial profiling of lung cancer to study COVID-19 in the lungs.

"Using high-resolution imaging and genomic profiling, we were able to map the presence of the virus in the lungs down to the single cells present in the lung tissue.

"We discovered a handful of pro-inflammatory genes which were upregulated (higher expression) in COVID-19 cases when compared with the closest pandemic virus, swine flu or H1N1, and the lungs of healthy people.

"The pro-inflammatory genes, including one called ifi27, are involved in type 1 interferon response—an inflammatory response to defend the body from viruses and other pathogens.

"The value of measuring this biomarker, ifi27, in a nasal swab or blood sample is in triaging patients because it can tell us how severe the COVID-19 disease is as soon as the patient seeks medical help with COVID symptoms."

Dr. Kulasinghe said the researchers had measured ifi27 in asymptomatic, mild, moderate and severe COVID-19 cases.

"We saw that ifi27 is elevated in a step-wise manner with severe cases having high ifi27 levels."

Dr. Kulasinghe said researchers knew that ifi27 was elevated in the blood of COVID-19 patients.

"But there had not been any evidence of where the signal for the high ifi27 levels was coming from.

"By spatial profiling lung tissue of COVID-19 patients who had died we got a much deeper picture of the cellular changes driven by viral infection and that the lungs were a source of the raised ifi27.

"This technique also allowed us to identify which cells in the lungs the virus was binding to."

This collaborative research project with University of Queensland Diamantina Institute and the Walter and Eliza Hall Institute of Medical Research was awarded the Ausbiotech Johnson & Johnson Industry Excellence Collaboration Award and Industry Choice Award in 2020.

"Spatial Profiling of Lung SARS-CoV-2 and Influenza Virus Infection Dissects Virus-Specific Host Responses and Gene Signatures" is published on the MedRxiv pre-print server.

More information: Arutha Kulasinghe et al. Spatial Profiling of Lung SARS-CoV-2 and Influenza Virus Infection Dissects Virus-Specific Host Responses and Gene Signatures, (2020). DOI: 10.1101/2020.11.04.20225557

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