A step toward local long COVID-19 diagnostics

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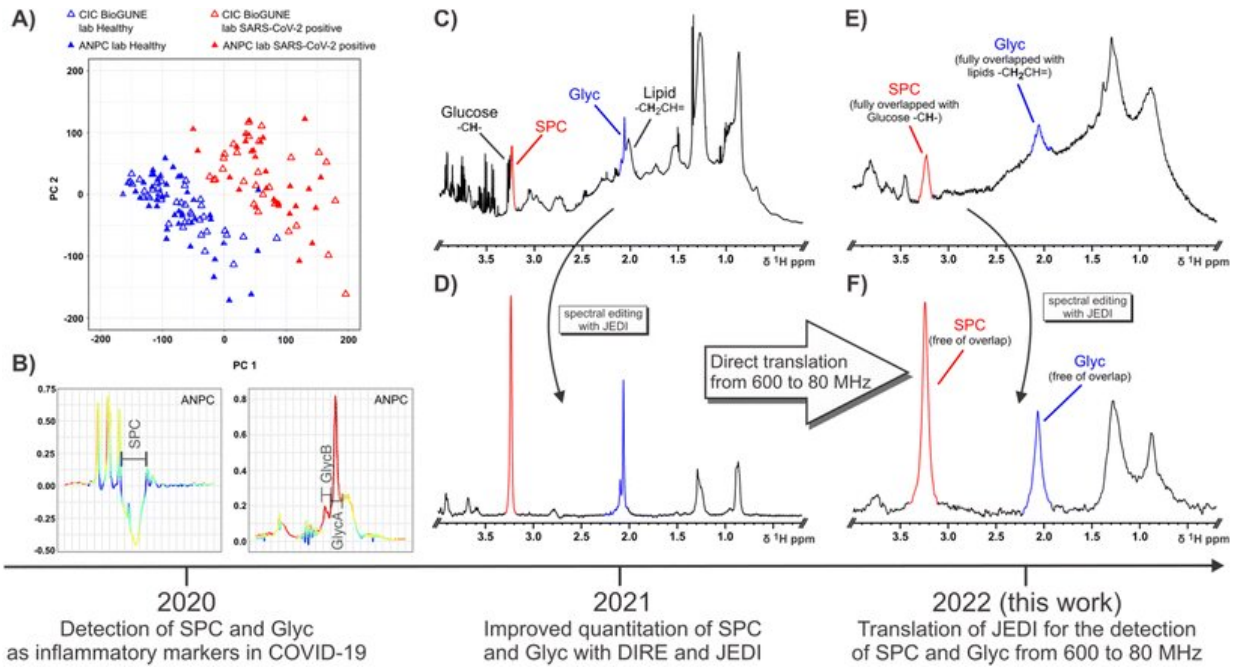

Schematic showing the timeline and information summary for SPC and Glyc since their definition as candidate inflammatory markers of COVID-19 in 2020 (A and B), their subsequent quantitation in 2021 (C and D) and translation of detection methods for SPC and Glyc from 600 MHz to 80 MHz in 2022 (E and F). (A) OPLS of healthy controls (blue triangles) and SARS-CoV-2-positive patients using 1D 1H NMR input data effectively distinguishes between both groups (B) OPLS loadings show a high contribution and an inverse relationship between SPC and Glyc with SPC decreasing and Glyc increasing during COVID-19 due to acute inflammation. (A) and (B) was published in ref. 54 and is reproduced here under the terms of Creative Commons Attribution 4.0 license. (C) 1D 1H with solvent suppression at 600 MHz (310 K) demonstrating

the high peak convolution for SPC (red) and Glyc (blue) in an unedited experiment. (D) JEDI spectrum at 600 MHz (310 K) using relaxation, diffusion and J-editing to enable direct quantitation of SPC and Glyc by integration (E) 1D 1H NMR with solvent suppression at 80 MHz (298 K) showing the decreased signal dispersion and lower sensitivity compared to 600 MHz (C). At 80 MHz SPC is fully overlapped with Glucose peaks and Glyc fully overlapped with lipid resonances. (F) JEDI spectrum at 80 MHz (298 K) eliminates all overlapping peaks. More importantly, the lower dispersion at the benchtop field is not an issue, due to the extensive spectral editing of JEDI. Credit: *The Analyst* (2022). DOI: 10.1039/D2AN01097F

Murdoch University's Australian National Phenome Center (ANPC) has made a vital technological finding that could help general practitioners diagnose the long-term effects of COVID-19 and long COVID-19.

With no current framework or diagnostic tools, patients suffering from the effects of COVID-19 and long COVID-19 present general practitioners with a major health challenge.

But the latest discovery from the ANPC will aid the diagnosis of debilitating symptoms that can include severe headaches, extreme exhaustion, heart palpitations and brain fog.

It comes in the form of a new diagnostic tool that could be easily deployed in medical practices across the world, at low cost.

Eighteen months ago, the researchers used multi-million-dollar nuclear magnetic resonance (NMR) technology to identify new diagnostic molecular biomarkers that tell if someone has the disease, without the need to detect the disease itself.

They then used this work to develop an inexpensive clinical NRM, that

general practitioners can use to detect vital blood markers to predict the long-term effects of the conditions.

The technology uses a specially designed set of radio pulses to extract signals from highly specific biomarker signals (from inflammatory glycoprotein markers and fats bound to lipoproteins) that gives a rapid diagnosis in approximately a minute.

The findings were recently published in leading analytical chemistry journal, *The Analyst*.

Professor Jeremy Nicholson, Director of the ANPC and Pro Vice Chancellor for the Health Futures Institute, said they represent a translational triumph that will ultimately benefit COVID-19 patients in clinics throughout the world, as well as have the possibility for application across many other diagnostic areas including cardiovascular disease.

"We only discovered these signals about 18 months ago using a more expensive NRM instrument, but with some pulse sequence modifications, we are now able to get identical results on small machines that costs one tenth of the price," Professor Nicholson said.

"We think this technology (low field NMR spectroscopy) will probably have many other clinical applications in the future and may be of particular value in monitoring some of the residual effects of long COVID in individual patients," he added.

The clinically deployable technology was developed in conjunction with the ANPC's strategic partner, Bruker BioSpin GmbH who manufacture the NMR instruments.

Professor Julien Wist from the ANPC said this technological

advancement has many benefits, including cutting costs.

"It ticks all the boxes for a successful translational technology: low costs, low maintenance, no specialist required and no need for complex algorithms to understand the data," Professor Wist said.

More information: Philipp Nitschke et al, Direct low field J-edited diffusional proton NMR spectroscopic measurement of COVID-19 inflammatory biomarkers in human serum, *The Analyst* (2022). DOI: 10.1039/D2AN01097F

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