

# Brain complications of COVID-19 in hospitalised patients and its consequences

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| <b>Submission date</b><br>04/01/2021   | <b>Recruitment status</b><br>No longer recruiting    | <input checked="" type="checkbox"/> Prospectively registered |
|  |  | <input type="checkbox"/> Protocol                            |
| <b>Registration date</b><br>04/01/2021 | <b>Overall study status</b><br>Completed             | <input type="checkbox"/> Statistical analysis plan           |
|  |  | <input type="checkbox"/> Results                             |
| <b>Last Edited</b><br>04/01/2021       | <b>Condition category</b><br>Nervous System Diseases | <input type="checkbox"/> Individual participant data         |
|  |  | <input type="checkbox"/> Record updated in last year         |

## Plain English summary of protocol

Background and study aims

COVID-19 patients frequently suffer brain problems during the infection and can be left with symptoms of brain injury. Similar problems have been seen in previous pandemics, including Spanish influenza over 100 years ago, but how and why this occurs is poorly understood.

The study will investigate the questions: in whom does COVID-19 cause injury? Does it do this by invading the brain? Or by triggering excessive immune responses or interfering with the blood supply to nervous tissue?

This study is a unique opportunity to understand how these problems occur and develop strategies to prevent and treat them.

Who can participate?

Adults admitted to a UK hospital during the COVID-19 pandemic suffering from both COVID-19 (by WHO criteria) and an acute neurological/psychiatric complication. The study team have been notified of 800 UK patients with these complications due to COVID-19. 500 control patients who had COVID-19 or other severe infections but did not develop brain complications will also be recruited. Participants will also be recruited prospectively in subsequent waves of infection.

What does the study involve?

The study team will conduct an in depth clinical, laboratory, and imaging study. The study will evaluate symptoms, signs, and brain function during hospitalisation and at follow-up (at 3 to 9 months). The study team will assess markers of brain injury, inflammation, and brain scan changes in these patients.

What are the possible benefits and risks of participating?

This study will be used to determine whether anti-viral medication, or treatments that modulate the immune system, or that improve blood supply, will help, and if so, in which patients.

This understanding will be applied through the COVID-Neuro Coalition Clinical Care Task Force to develop clinical care guidelines, identify patients for targeted clinical trials, and ultimately improve patient outcomes.

Where is the study run from?  
Cambridge University Hospitals NHS Foundation Trust (UK)

When is the study starting and how long is it expected to run for?  
From October 2020 to April 2022

Who is funding the study?  
The Medical Research Council (UK)

Who is the main contact?  
Dr Benedict Michael (Liverpool) and Prof Gerome Breen (KCL)  
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## Contact information

**Type(s)**  
Scientific

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## Additional identifiers

**Clinical Trials Information System (CTIS)**  
Nil known

**ClinicalTrials.gov (NCT)**  
Nil Known

**Protocol serial number**  
MRC: MR/V03605X/1

## Study information

**Scientific Title**

Neurological and psychiatric complications of COVID-19 in hospitalised patients and the neurological, psychiatric and cognitive sequelae: the COVID-19 Clinical Neuroscience Study (COVID-CNS)

## **Acronym**

COVID-CNS

## **Study objectives**

1. Excluding recognised causes (e.g. hypoxia, medication), hospitalised COVID-19 patients who develop acute neurological complications are younger, have an abnormal Glasgow coma score on admission, and higher serum markers of inflammation, than hospitalised controls with /without COVID-19; and these patients have a worse medium-term neurological, cognitive and psychiatric outcome.
2. Hospitalised COVID-19 patients who develop acute neurological complications have a dysregulated pro-inflammatory immune response, driven by IL-1 and IL-6 rather than direct viral CNS infection.
3. Acute neurological complications are associated with an acute increase in serum markers of CNS injury and these markers in both acute and post-acute serum predict later sequelae. In some patients, new neurological complications later emerge or re-emerge in those with biomarker evidence of CNS injury or the development of antineuronal antibodies 12.
4. Similar, but milder neurological symptoms are reported in the community population who have had COVID-19 and are predicted by polygenic scores. If these scores are combined with CNS injury and inflammation markers they more accurately predict acute neurological complications of COVID-19.

## **Ethics approval required**

Old ethics approval format

## **Ethics approval(s)**

Pending 08/01/2021, ethical amendment to NIHR BioResource ethical approval (submission 8.1.21)

## **Study design**

Multi-centre longitudinal case-control study

## **Primary study design**

Observational

## **Study type(s)**

Treatment

## **Health condition(s) or problem(s) studied**

Acute brain complications of COVID-19 and their neurological, psychiatric, and cognitive sequelae

## **Interventions**

The study team have characterised the basic clinical details of 800 patients currently/recently hospitalised with COVID-19 with neurological complications from the CoroNerve and ISARIC -4 C's studies. CoroNerve n=400, and ISARIC-4C's n=400. 400 controls will be recruited from the ISARIC-4C's trial and a further 100 will be recruited. Based on current data, approximately 20-

30% will currently be hospitalised at initial data collection. Prospective participants will be recruited in subsequent waves of infection. All patients will be consented into existing NIHR BioResource infrastructure for long-term sustainability of follow-up.

Baseline assessment at admission will comprise of;

1. Acute Clinical Case Notes Review of Neurological Complications
2. Baseline data for demographics (including black and minority ethnicity background) and the index episode of acute neurological complication of COVID and previous history of neurological disorder, obtained by the Clinical Research Network (CRN) Nurses, supported by the study team:
  - 2.1. Using the Brain Infections UK Case Record Form, from clinical case notes and routine test results
  - 2.2. Neuroimaging files (estimated in 40-50% of cases, as CoroNerve over-represents patients under Neurologists and in large Neuroscience Units)
  - 2.3. Retained serum (ISARIC-4C's and local) and CSF (Co-I's Neuroscience BioBanks)

Follow-up data will be obtained by face-to-face assessment at 3-9 months post-discharge for:

1. Neurology: Liverpool Brain Infectious Outcome Score and Neurological Impairment Scale mapped against functional outcomes.
2. Cognitive/psychiatric:
  - 2.1. CNS-NeuroCog Protocol (built on UK BioBank, the MOCA/MMSE, CAMCOG, and CANTAB tools; piloted on 50).
  - 2.2. NIHR BioResource COPING Protocol (an extended UK Biobank questionnaire covering neurological, cognitive, and psychiatry symptoms, already completed in >30,000).
3. Neuroimaging
4. Brain structural and functional connectivity changes will be measured by MRI in acute and post-infectious cases (compared to controls) and will be related both to blood immune and brain injury markers, and to distinct clinical phenotypes, thus providing a crucial explanatory link between biology and clinical features.

## **Intervention Type**

Other

## **Primary outcome(s)**

1. Neuroglial injury markers (including Tau, NfL, GFAP, S100, and NSE) measured using quantitative analysis of plasma at baseline (admission) and follow-up (at 3 to 9 months post-discharge)

## **Key secondary outcome(s)**

1. Cytokine/chemokine profiles measured by luminex from samples at baseline and follow-up
2. Volume of T2 FLAIR signal measured from brain magnetic resonance imaging at baseline and follow-up

## **Completion date**

30/04/2022

## **Eligibility**

### **Key inclusion criteria**

Cases and controls:

1. Aged >17 years
2. Admitted to a UK hospital during the COVID-19 pandemic

3. Suffering from COVID-19 (by WHO definitions. 'Confirmed': Positive PCR of respiratory samples or serology and 'Probable' by chest radiograph/CT evidence of COVID-19 but PCR /serology negative or not tested)

Cases only

1. Suffering from an acute neurological/psychiatric complication (e.g. encephalitis, unexplained [e.g. non-hypoxic] encephalopathy/delirium, and stroke without major risk factors).

**Participant type(s)**

Patient

**Healthy volunteers allowed**

No

**Age group**

Adult

**Sex**

All

**Key exclusion criteria**

Does not meet inclusion criteria

**Date of first enrolment**

01/02/2021

**Date of final enrolment**

30/04/2022

**Locations**

**Countries of recruitment**

United Kingdom

England

**Study participating centre**

**University of Liverpool**

West Derby Street

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**Study participating centre**

**King's College London**

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**Study participating centre**  
**Cambridge University**  
Trinity Lane  
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United Kingdom  
CB2 1TN

## Sponsor information

**Organisation**  
Cambridge University Hospitals NHS Foundation Trust

**ROR**  
<https://ror.org/04v54gj93>

## Funder(s)

**Funder type**  
Government

**Funder Name**  
Medical Research Council

**Alternative Name(s)**  
Medical Research Council (United Kingdom), UK Medical Research Council, MRC

**Funding Body Type**  
Government organisation

**Funding Body Subtype**  
National government

**Location**  
United Kingdom

**Funder Name**  
UK Research and Innovation

**Alternative Name(s)**

UKRI

**Funding Body Type**

Government organisation

**Funding Body Subtype**

National government

**Location**

United Kingdom

**Funder Name**

National Institute for Health Research

**Alternative Name(s)**

National Institute for Health Research, NIHR Research, NIHRresearch, NIHR - National Institute for Health Research, NIHR (The National Institute for Health and Care Research), NIHR

**Funding Body Type**

Government organisation

**Funding Body Subtype**

National government

**Location**

United Kingdom

## Results and Publications

**Individual participant data (IPD) sharing plan**

The data sharing plans for the current study are unknown and will be made available at a later date.

**IPD sharing plan summary**

Data sharing statement to be made available at a later date

**Study outputs**

| Output type                                   | Details                       | Date created | Date added | Peer reviewed? | Patient-facing? |
|---|-------------------------------|--------------|------------|----------------|-----------------|
| <a href="#">Participant information sheet</a> | Participant information sheet | 11/11/2025   | 11/11/2025 | No             | Yes             |
| <a href="#">Study website</a>                 | Study website                 | 11/11/2025   | 11/11/2025 | No             | Yes             |