

# Mannitol for stopping or preventing brain swelling (cerebral oedema) after stroke from bleeding in the brain (intracerebral haemorrhage): a feasibility study

<b>Submission date</b> 05/10/2022	<b>Recruitment status</b> No longer recruiting	<input checked="" type="checkbox"/> Prospectively registered <input checked="" type="checkbox"/> Protocol
<b>Registration date</b> 18/05/2023	<b>Overall study status</b> Completed	<input type="checkbox"/> Statistical analysis plan <input checked="" type="checkbox"/> Results
<b>Last Edited</b> 17/02/2026	<b>Condition category</b> Nervous System Diseases	<input type="checkbox"/> Individual participant data

## Plain English summary of protocol

### Background and study aims

Stroke from bleeding into the brain, known as intracerebral haemorrhage (ICH) affects about 15,000 adults in the UK each year and to-date there is no effective treatment. Brain swelling after ICH is common and can worsen damage resulting in disability or death. Large haemorrhages (~10-15%) cause brain swelling very quickly and the only option that is possible in some young patients is to do a major operation and make more space for the brain to expand. It is unclear whether surgery is beneficial and the operation has its own risks. So, finding treatments which prevent or stop brain swelling after ICH could reduce death or disability. Mannitol is a widely available drug and as an injection through a vein can reduce brain swelling after severe head injury or liver damage. It is cheap and easy to give. Small studies suggest that mannitol may also reduce brain swelling after ICH, but no definite study has been performed. We want to test if it is possible to do a small study of mannitol in ICH to find out how acceptable and manageable it is to inform a larger study.

### Who can participate?

Forty-five adult patients with ICH with or at risk of brain swelling from ten UK hospitals will be recruited within 72 hours after stroke.

### What does the study involve?

Using a computer, participants will be allocated like the roll of a dice to one of three groups: single mannitol injection; two mannitol injections or standard medical care alone. Participants will be monitored for side effects, urine output, undergo blood tests and clinical assessments during and after treatment. We will do a repeat brain scan 5-7 days after treatment to see whether mannitol has reduced brain swelling. At 6 months, information on survival, participant's quality of life, mood, memory, disability and health problems in those who had Covid will be collected through telephone postal structured questionnaires. If a participant is unable to provide information, we will contact their relative/carer or GP.

What are the possible benefits and risks of participating?

Participation in this study may reduce the symptoms of intracerebral haemorrhage, reduce mortality, and may improve long-term recovery. We hope that the information we get will provide benefit to other people who have a stroke in the future.

Common side effects of mannitol are increased urination, nausea, vomiting, fever, chills, headache, runny nose, chest pain, rash, dizziness, or blurred vision. The drug can cause burning, pain or swelling around the needle when it is given as an injection and the treating team will closely monitor you for this.

Mannitol can affect the salt levels in the blood, cause damage to the kidneys, worsen bleeding in the brain, or lung congestion.

Because mannitol is already routinely used to reduce brain swelling from liver damage or severe head injury, we expect the potential benefits of the drug (stopping or preventing brain swelling in intracerebral haemorrhage) to outweigh the risk of side effects.

Where is the study run from?

Nottingham University Hospitals NHS Trust (UK)

When is the study starting and how long is it expected to run for?

October 2022 to November 2024

Who is funding the study?

NIHR Research for Patient Benefit Programme (UK)

Who is the main contact?

The email address for the CI requires updating to [kailash.krishnan@nhs.net](mailto:kailash.krishnan@nhs.net)

## Contact information

### Type(s)

Principal investigator

### Contact name

Dr Kailash Krishnan

### Contact details

Nottingham University Hospitals NHS Trust

Derby Road

Nottingham

United Kingdom

NG7 2UH

+44 115 9249924

[kailash.krishnan@nhs.net](mailto:kailash.krishnan@nhs.net)

### Type(s)

Public

### Contact name

Dr MACE-ICH trial team

### Contact details

Nottingham University Hospitals NHS Trust  
Derby Road  
Nottingham  
United Kingdom  
NG7 2UH  
None available  
mace-ich@nottingham.ac.uk

## Additional identifiers

### Clinical Trials Information System (CTIS)

2022-000283-22

### Integrated Research Application System (IRAS)

1004870

### Protocol serial number

22SR001

## Study information

### Scientific Title

Mannitol for Cerebral oedema after IntraCerebral Haemorrhage (MACE-ICH): a feasibility trial

### Study objectives

Primary objective:

To assess the feasibility of screening, randomising, administering mannitol to acute intracerebral haemorrhage patients with cerebral oedema or at risk and completing follow-up to inform the design and conduct of an adequately powered, pragmatic, prospective, definitive trial.

Secondary objective:

To provide preliminary data on the effect of mannitol on secondary outcomes including clinical, radiological, laboratory, safety and health-economics.

### Ethics approval required

Old ethics approval format

### Ethics approval(s)

Approved 10/05/2023, East Midlands - Leicester Central Research Ethics Committee (Equinox House, City Link, Nottingham, NG2 4LA, UK; +44 207 104 8066; Leicestercentral.rec@hra.nhs.uk), ref: 22/EM/0242

### Study design

Interventional randomized parallel group controlled trial

### Primary study design

Interventional

### Study type(s)

## Treatment

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

Acute intracerebral haemorrhage (ICH)

### Interventions

There are three arms in the MACE-ICH study, and patients are randomised into one of the arms via a 1:1:1 online, bespoke, randomisation system, built specifically for the purpose of the trial. The randomisation system will only be accessible for members of the research team who have been trained and delegated by their local Principal Investigator. The arms are as follows:

1. One dose of manntiol: Manntiol (1g/kg of 10% IV infusion at 10ml/min) + Standard care on Day 0; blood tests performed on day 1; CT head scan on day 5 ( $\pm 2$ ); day 28 follow-up by research team; day 180 follow-up by central trial office (MACE-ICH team based in Nottingham).
2. Two doses of mannitol: Manntiol (1g/kg of 10% IV infusion at 10ml/min) + Standard care on Day 0; blood tests performed on day 1; if blood tests, specifically serum osmolality, are stable then participants receive a second dose of mannitol (1g/kg of 10% IV infusion at 10ml/min); blood tests done again on day 2; day 28 follow-up by research team; day 180 follow-up by central trial office (MACE-ICH team based in Nottingham).
3. Standard care (e.g., at the clinician's discretion: IV fluids, nasogastric tube, other medications); blood tests performed on day 1; CT head scan on day 5 ( $\pm 2$ ); day 28 follow-up by research team; day 180 follow-up by central trial office (MACE-ICH team based in Nottingham).

### Intervention Type

Drug

### Phase

Phase II

### Drug/device/biological/vaccine name(s)

Mannitol

### Primary outcome(s)

1. Number of patients: screened and eligible: collected on screening logs that are requested from sites on a monthly basis.
2. Number of eligible patients recruited and reasons for not recruiting: collected on screening logs that are requested from sites on a monthly basis.
3. Proportion of eligible patients who received allocated treatment and reasons for non-allocation: This can be retrieved from the bespoke MACE-ICH database, whenever it is needed.
4. Recruitment rate derived from the sample size: This can be retrieved from the bespoke MACE-ICH database, and this data can also be collected on screening logs that are requested from sites on a monthly basis.
5. Treatment adherence: This can be continuously monitored, throughout the duration of the trial, within the bespoke MACE-ICH database.
6. Retention rate (number of participants with complete follow-up data at 180 days as a proportion of those randomised): This can be continuously monitored, throughout the duration of the trial, within the bespoke MACE-ICH database. All completed follow-ups will be visible in the MACE-ICH bespoke database.
7. Number of patients with outcome data and reasons for non-availability: This data will be continuously monitored within the MACE-ICH bespoke database. Any reasons for missing data will be collected by the monitor.
8. Effectiveness of blinded follow-up: Day-180 follow-up data will be checked by the trial

monitor.

9. Incidence and type of adverse events, protocol violations and trial withdrawal. This data will be continuously monitored within the MACE-ICH bespoke database, in conjunction with any adverse event/protocol violation logs that are available to monitor.

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

1. Laboratory tests (U&E's; e-GFR; serum osmolality): measured on days 1 and 2 (day 2 only for patients randomised to receive two doses of mannitol)
2. Participants' levels of consciousness are measured using the Glasgow Coma Scale (GCS) on day 5+/-2,
3. Participants' stroke severity is measured using the National Institutes Health Stroke Scale (NIHSS) on day 5+/-2,
4. Number of patients who had urinary tract infection collected from medical records on day 5±2 and day 28,
5. Number of patients who had sepsis collected from medical records on day 5±2 and day 28,
6. Mortality collected from medical records on day 5±2 and day 28
7. Participants' disability is measured using the Barthel Index on day 180,
8. Participants' mood is measured using the Zung depression scale [ZDS] on day 180,
9. Participants' cognition is measured using the TICS-M assessment on day 180,
10. Participants' quality of life is measured using the Euro-[EQ] QOL and EQ-VAS, on day 180,
11. Health economic assessment is measured using the EQ-5D questionnaire on day 180,
12. Participants' death or dependency is measured using the modified Rankin scale (mRS) on day 180,
13. Participants' length of stay in hospital is collected from the participant on the day-180 telephone questionnaire,
14. Participants' discharge destination is collected from the participant on the day-180 telephone questionnaire,
15. Long-term outcomes post Covid-19 and ICH is collected from the participant on the day-180 telephone questionnaire,
16. Number of patients who were transferred to high dependency unit - this can be continuously monitored, throughout the duration of the trial, within the bespoke MACE-ICH database.
17. Number of patients needing high dependency or intensive care unit - this can be continuously monitored, throughout the duration of the trial, within the bespoke MACE-ICH database.
18. Number of patients undergoing neurosurgical intervention - this can be continuously monitored, throughout the duration of the trial, within the bespoke MACE-ICH database.
19. Participants' recurrent strokes (if applicable) data will be collected throughout the trial by sites completing SAE reporting forms.
20. Number of patients intubated and ventilated - this can be continuously monitored, throughout the duration of the trial, within the bespoke MACE-ICH database.
21. The Follow-up CT scan on day 5±2 days will assess changes in oedema volume, oedema extension distance, haematoma volume, midline shift and hydrocephalus.
22. Safety Outcomes:  
All safety outcomes (e.g. death; thrombophlebitis; hyper/hyponatremia; pulmonary oedema; hypotension; renal impairment and serious adverse events) will be continuously reported and recorded until day 180.

### **Completion date**

30/11/2025

# Eligibility

## Key inclusion criteria

1. Adults (>18 years); spontaneous ICH confirmed by CT scan with estimated largest diameter > 2 cm;
2.  $\leq$  72 hour of ictus (or from last seen healthy);
3. Cerebral oedema with or without evidence of mass effect;
4. At risk of developing oedema (limited GCS <9 (eye opening and motor only) and NIHSS  $\geq$  8);
5. Signed consent (patient, personal or professional representative or independent physician)

## Participant type(s)

Patient

## Healthy volunteers allowed

No

## Age group

Mixed

## Lower age limit

18 years

## Upper age limit

110 years

## Sex

All

## Total final enrolment

46

## Key exclusion criteria

1. GCS < 5; premorbid mRS > 3;
2. Isolated subarachnoid haemorrhage;
3. Haemorrhage known to be from: trauma or venous thrombosis or arteriovenous malformation or brain tumour or transformation of cerebral infarct or cerebral aneurysm or thrombolytic drug;
4. Known hypersensitivity to mannitol;
5. Severe renal failure (e-GFR < 30 ml/min or dialysis);
6. Cardiac failure;
7. Hypotension at baseline (SBP < 90 mm Hg);
8. Anuria;
9. Patient unwilling to participate;
10. Geographical or other factors which prohibit follow-up;
11. Pre-existing comorbidity with pre-ictal life expectancy < 6 months;
12. Severe dementia;
13. Planned for palliative care;
14. Severe hypernatremia (sodium > 160 mmol);
15. Severe hyponatremia (sodium < 125 mmol);
16. Women of child-bearing age with a positive pregnancy test at the time of admission or lactating;

17. Patients in whom peripheral intravenous cannula cannot be placed;
18. Planned neurosurgery

**Date of first enrolment**

14/02/2024

**Date of final enrolment**

15/04/2025

## **Locations**

**Countries of recruitment**

United Kingdom

**Study participating centre**

**Queen's Medical Centre**

Nottingham University Hospitals NHS Trust  
Derby Road  
Nottingham  
England  
NG7 2UH

**Study participating centre**

**Royal Derby Hospital**

University Hospitals of Derby and Burton NHS Foundation Trust  
Uttoxeter Road  
Derby  
England  
DE22 3NE

**Study participating centre**

**Yeovil District Hospital**

Yeovil District Hospital NHS Foundation Trust  
Higher Kingston  
Yeovil  
England  
BA21 4AT

**Study participating centre**

**Addenbrooke's Hospital**

Cambridge University Hospitals NHS Foundation Trust  
Hills Road  
Cambridge

England  
CB2 0QQ

**Study participating centre**

**Royal London Hospital**

Whitechapel

London

England

E1 1BB

**Study participating centre**

**Royal Devon and Exeter Hospital**

Royal Devon and Exeter NHS Hospital Foundation Trust

Barrack Road

Exeter

England

EX2 5DW

**Study participating centre**

**Royal Stoke University Hospital**

Newcastle Road

Stoke-on-Trent

England

ST4 6QG

**Study participating centre**

**Queen Elizabeth University Hospital**

1345 Govan Road

Glasgow

Scotland

G51 4TF

**Study participating centre**

**Aberdeen Royal Infirmary**

Foresterhill Road

Aberdeen

Scotland

AB25 2ZN

**Study participating centre**  
University Hospital of North Tees  
Hardwick Road  
Stockton-on-tees  
England  
TS19 8PE

## Sponsor information

**Organisation**  
Nottingham University Hospitals NHS Trust

**ROR**  
<https://ror.org/05y3qh794>

## Funder(s)

**Funder type**  
Government

**Funder Name**  
Research for Patient Benefit Programme

**Alternative Name(s)**  
NIHR Research for Patient Benefit Programme, Research for Patient Benefit (RfPB), The NIHR Research for Patient Benefit (RfPB), RfPB

**Funding Body Type**  
Government organisation

**Funding Body Subtype**  
National government

**Location**  
United Kingdom

## Results and Publications

### Individual participant data (IPD) sharing plan

The datasets generated during and/or analysed during the current study will be stored in a non-publically available repository. We use bespoke, secure, encrypted systems, that are only accessible by members/coordinators in the central research team. All individuals who have

access will be approved and delegated by local PI/CI. One system will store patients' data, including contact details, addresses and next-of-kin contact details (required for the day 180 follow-up). To access this system, users must be using the University of Nottingham network, or be connected to the University of Nottingham VPN. The other bespoke database will store all of the data collected for the day 0, day 1-2, day 5 +/-2, day 28 and day 180 assessments. There is currently no weblink for these sites as they are still in development, however we have used almost-identical systems for our other stroke clinical trials in Nottingham. Data will be available until the trial is complete; all data will be stored and archived after trial completion, in compliance with the University of Nottingham's archiving procedures.

Patients that fit the eligibility criteria will provide informed consent, however consent may also be sought from a legal representative if the patient lacks capacity to consent themselves. All un-anonymised consent forms will be uploaded to the secure bespoke system, and will only be accessible by a select few members of the central trial team in Nottingham (for monitoring purpose only). Any other documents uploaded for the purposes of monitoring will have all patient identifiers removed, in accordance with GCP. A unique ID number will be provided for each patient that is randomised into the trial.

### IPD sharing plan summary

Available on request

### Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">Results article</a>		12/02/2026	17/02/2026	Yes	No
<a href="#">Protocol article</a>		28/07/2025	29/07/2025	Yes	No
<a href="#">HRA research summary</a>			20/09/2023	No	No
<a href="#">Study website</a>	Study website	11/11/2025	11/11/2025	No	Yes