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Are reductions in oxygen to the brain associated with behavioral changes in children undergoing anesthesia?

Submission date
25/08/2021

Recruitment status
No longer recruiting

Registration date
26/08/2021

Overall study status
Completed

Last Edited
02/10/2023

Condition category
Surgery

[X] Prospectively registered
[X] Protocol
[_] Statistical analysis plan
[_] Results
[_] Individual participant data
[_] Record updated in last year

Plain English summary of protocol

Background and study aims
Behavioural changes in small children, after general anesthesia, are not uncommon but the causes have not been well elucidated. A previous study from Spain has found an association between such changes and surprisingly small changes in the brain regional oxygen saturation during general anesthesia. If the latter results can be confirmed, it could have major implications on management of children under anesthesia. However, brain oxygen saturation can not always be measured, and reductions are often the result of reduced blood flow and oxygen delivery. Therefore, we aim to investigate the association between brain regional oxygen saturation, and as secondary aim episodes of low blood pressure or peripheral saturation and behavioral changes. We will also check the blood levels of a set of proteins that can be markers of damage to the brain and other tissue.

Who can participate?
All children between 2 and 6 years of age can participate, if their parents are available to fill in the structured questionnaire (PHBQ) one week after the procedure.

What does the study involve?
1. Measurement of brain regional oxygen saturation with a NIRS probe - a light sensor that is taped to the forehead when the child is in the operating room.
2. Blood samples are taken when the child is under anesthesia.
3. Recording of behavioral changes according to the PHBQ form, performed by the parents at 1 and 30 days after the procedure

What are the possible benefits and risks of participating?
There are no direct benefits from participating.
NIRS is non-invasive and without any known side-effects.
The total volume of blood that is taken is around 5 mL which is without risk.

Where is the study run from?
The pediatric anesthesia section at Uppsala University Hospital, Uppsala, Sweden

When is the study starting and how long is it expected to run for?
March 2021 to November 2022

Who is funding the study?
Department of Anaesthesia and Intensive Care and the Gillbergska Foundation, Uppsala, Sweden.

Who is the main contact?
Associate Professor Peter Frykholm, peter.frykholm@surgsci.uu.se

Contact information

Type(s)
Scientific

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Additional identifiers

Protocol serial number
NIRSKIDS 1.1

Study information

Scientific Title
Are reductions in cerebral oxygenation associated with postoperative behavioral changes in children undergoing anesthesia?

Acronym
NIRSKIDS

Study objectives
Reduction in crSO2 of more than 5% from baseline is associated with increased behavioral changes 7 days after general anesthesia

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 15/07/2021, Swedish Ethical Review Authority (Etikprövningsmyndigheten, Box 2110, 750 02, Uppsala, Sweden; +46 10-475 08 00; registrator@etikprovning.se), ref: 2021-02927

Study design
Prospective observational cohort

Primary study design
Observational

Study type(s)
Diagnostic

Health condition(s) or problem(s) studied
Children 2 - 6 years of age undergoing general anesthesia

Interventions
Cerebral oxygenation saturation (crSO2) is continuously measured in the operating room starting before anesthesia induction and ending at the end of the procedure when anesthesia has been stopped. The children´s parents are asked to fill in a questionnaire on behavioral changes in their child after 1 and 4 weeks postoperatively. The association between crSO2 changes and behavioral changes are analyzed. Blood samples for analysing markers of cell damage are obtained at the beginning and end of the anesthesia.

Intervention Type
Procedure/Surgery

Primary outcome(s)
1. Behavioral changes according to the Post Hospitalization Behavioral Questionnaire (PHBQ) are measured at 7 days after the general anaesthesia
2. crSO2 during the general anaesthesia measured using Near Infrared Spectroscopy (Invos, www.medtronic.com) using an age-appropriate sensor on the forehead

Key secondary outcome(s))
Current secondary outcome measures as of 18/10/2021:

1. Behavioral changes according to the PHBQ measured at 30 days after the general anesthesia. Similarly, the OR of persistent changes is calculated for crSO2 more or less than 5%.
2. Episodes of hypotension and/or desaturation during anesthesia and PHBQ changes measured using patient records
3. Perioperative behavioural changes: a score of more than 2 of the Pediatric Anesthesia Behavior score at induction and/or a score of more than 14 of the Pediatric Anesthesia Emergence Delirium score in the post-anesthesia care unit.
4. The association between changes in PHBQ and the following biomarkers are investigated at a single time point:
4.1. Neurofilament light chain (NfL) and Glial fibrillary acidic protein (GFAp) measured using Single molecule array (Simoa) technology (Quanterix, Billerica, MA)
4.2. Ubiquitin C-terminal hydrolase L1 (UCHL1), NGAL, KIM-1, NAG measured using commercial immunoflourescence assay panels

Previous secondary outcome measures:

1. Behavioral changes according to the PHBQ measured at 30 days after the general anesthesia. Similarly, the OR of persistent changes is calculated for crSO2 more or less than 5%.
2. Episodes of hypotension and/or desaturation during anesthesia and PHBQ changes measured using patient records
3. The association between changes in PHBQ and the following biomarkers are investigated at a single time point:
3.1. Neurofilament light chain (NfL) and Glial fibrillary acidic protein (GFAp) measured using Single molecule array (Simoa) technology (Quanterix, Billerica, MA)
3.2. Ubiquitin C-terminal hydrolase L1 (UCHL1), NGAL, KIM-1, NAG measured using commercial immunoflourescence assay panels

Completion date
30/11/2022

Eligibility

Key inclusion criteria
Children 2 - 6 years of age scheduled for general anesthesia of at least 30 minutes duration

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Child

Lower age limit
2 years

Upper age limit
6 years

Sex
All

Total final enrolment
180

Key exclusion criteria
1. Age <2 years
2. Age >6 years
3. Children with significant neurodevelopmental delay
4. General anesthesia <30 minutes
5. Access to the forehead for the NIRS probe unavailable (e.g. neurosurgery)

Date of first enrolment
15/09/2021

Date of final enrolment
30/06/2022

Locations

Countries of recruitment
Sweden

Study participating centre
Uppsala University Hospital
Department of Anaesthesia and intensive care
Uppsala
Sweden
75185

Sponsor information

Organisation
Uppsala Regional Council

Funder(s)

Funder type
Government

Funder Name
Region Uppsala

Alternative Name(s)

Funding Body Type
Government organisation

Funding Body Subtype
Local government

Location
Sweden

Funder Name
Gillbergska stiftelsen

Alternative Name(s)
Gillbergska Foundation

Funding Body Type
Private sector organisation

Funding Body Subtype
Trusts, charities, foundations (both public and private)

Location
Sweden

Results and Publications

Individual participant data (IPD) sharing plan
The current data sharing plans for this study are unknown and will be 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?
Protocol file	Swedish		26/08/2021	No	No