

NeoCLEAR: optimising lumbar punctures in newborns

Submission date 30/05/2018	Recruitment status No longer recruiting	<input type="checkbox"/> Prospectively registered <input checked="" type="checkbox"/> Protocol
Registration date 26/06/2018	Overall study status Completed	<input type="checkbox"/> Statistical analysis plan <input checked="" type="checkbox"/> Results
Last Edited 28/12/2023	Condition category Nervous System Diseases	<input type="checkbox"/> Individual participant data

Plain English summary of protocol

Background and study aims

Every year at least 15,000 newborns undergo a lumbar puncture to confirm suspected meningitis. Lumbar puncture technique varies in practice, and success rates are low (50-60%) meaning procedures need to be repeated, causing distress to the infants and their parents and extending treatment and hospital stay time. There is a pressing need for a large study to determine which lumbar puncture technique is the best approach. The aim of this study is to compare lumbar puncture techniques with the infant in a sitting position versus a lying position, and early versus late stylet removal.

Who can participate?

Newborns and infants in neonatal units and maternity wards who are having a lumbar puncture

What does the study involve?

The participants are randomly allocated to one of the following technique combinations:

1. Lying position and early stylet removal
2. Sitting position and early stylet removal
3. Lying position and late stylet removal
4. Sitting position and late stylet removal

The proportion of successful lumbar punctures is measured in the four groups.

What are the possible benefits and risks of participating?

The results of this trial will inform best practice, and ultimately, improved technique would result in fewer uninterpretable samples, fewer repeated procedures, reduced distress for infants and families, decreased antibiotic use and risk of antibiotic resistance, and reduced NHS costs due to fewer procedures, reduced length of stay, shorter antibiotic courses, and minimised antibiotic-associated complications. All of the methods used in the study are used routinely within UK hospitals. At the moment it is not known whether one method is better than others, so babies taking part could be given any of them.

Where is the study run from?

The University of Oxford (UK)

When is the study starting and how long is it expected to run for?
September 2017 to February 2021

Who is funding the study?
National Institute for Health Research (NIHR) (UK)

Who is the main contact?
Christina Cole
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Contact information

Type(s)
Scientific

Contact name
Ms Christina Cole

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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

Integrated Research Application System (IRAS)
223737

ClinicalTrials.gov (NCT)
Nil known

Protocol serial number
35643

Study information

Scientific Title
NeoCLEAR: Neonatal Champagne Lumbar punctures Every time – An RCT. A multicentre, randomised controlled 2x2 factorial trial to investigate techniques to increase lumbar puncture success

Acronym
NeoCLEAR

Study objectives

Every year at least 15,000 newborns undergo a lumbar puncture to confirm suspected meningitis. Lumbar puncture technique varies in practice, and success rates are low (50-60%) meaning procedures need to be repeated, causing distress to the infants and their parents and extending treatment and hospital stay time. There is a pressing need for a large randomised controlled trial to determine which lumbar puncture technique is the best approach.

The trialists have designed a pragmatic (i.e a low level of trial-driven standards is enforced and sites work to their standard practices and processes for generalisability of the trial results), multi-centre, randomised controlled trial comparing two traditional lumbar puncture techniques:

1. The infant in sitting position versus lying position
2. Early versus late stylet removal

The aim is to determine the optimal technique for performing lumbar puncture in infants. The results of this trial will inform best practice, and ultimately, improved technique would result in:

1. Fewer uninterpretable samples
2. Fewer repeated procedures
3. Reduced distress for infants & families
4. Decreased antibiotic use and risk of antibiotic resistance
5. Reduced NHS costs due to fewer procedures, reduced length of stay, shorter antibiotic courses, and minimised antibiotic-associated complications

Ethics approval required

Old ethics approval format

Ethics approval(s)

South Central Hampshire-B, 12/06/2018, ref: 18/SC/0222

Study design

Randomised; Interventional; Design type: Diagnosis, Other

Primary study design

Interventional

Study type(s)

Diagnostic

Health condition(s) or problem(s) studied

Meningitis

Interventions

Stratified block randomisation will be used to ensure balance between the groups with respect to the collaborating hospital and corrected gestational age at trial entry.

The interventions compare:

1. Sitting position, in which the infant is held in a sitting position compared to lying ('lateral decubitus') position

2. Early stylet removal, which is the removal of the stylet from the hollow lumbar puncture needle shaft once it has penetrated the subcutaneous tissue before advancing the needle into the cerebrospinal fluid, compared to late stylet removal, which is removal of the stylet once it has been inserted into the expected cerebrospinal fluid space

The participants will be randomly allocated (with equal chance i.e. 1:1:1:1) to one of the following technique combinations:

1. Lying position and early stylet removal
2. Sitting position and early stylet removal
3. Lying position and late stylet removal
4. Sitting position and late stylet removal

Infants will be followed up until they are discharged home.

Intervention Type

Procedure/Surgery

Primary outcome(s)

Proportion of infants with successful lumbar punctures, measured by whether cerebrospinal fluid is obtained and red blood cell count $<10,000/\text{mm}^3$ on the first lumbar puncture procedure

Key secondary outcome(s)

Current secondary outcome measures as of 24/04/2020:

The following short-term clinical, resource and safety outcomes have been defined as:

1. The proportion of infants with:
 - 1.1. No cerebrospinal fluid (CSF) obtained, or pure blood/clotted, or blood-stained, or clear
 - 1.2. CSF obtained and red blood cell (RBC) count <500 , <5000 , $<10,000$, or $<25,000/\text{mm}^3$, or any RBC count
 - 1.3. A CSF white blood cell (WBC) count not requiring a correction (whatever the RBC count)
2. Total number of procedures and attempts performed per infant
3. Proportion of infants diagnosed (by WBC count criteria, culture, Gram stain, and/or clinically) via CSF with:
 - 3.1. Meningitis: WBC count 20 or more in CSF, or a true positive culture/polymerase chain reaction (PCR) (if RBC count is ≥ 500 , the WBC count will be reduced by 1 for every 500 RBC counts to give a 'corrected' WBC count)
 - 3.2. Equivocal: WBC count (or corrected WBC) <20 , AND negative (or contaminated/incidental) culture and PCR with:
 - 3.2.1. Polymorphonuclear leukocytes (PMN) >2 (and RBC count <500) OR
 - 3.2.2. Organism found on Gram stain
 - 3.3. Negative: WBC (or corrected WBC) count <20 , PMN ≤ 2 (if RBC count <500), and negative (or contaminated/incidental) cultures, PCR, and Gram stain
 - 3.4. Uninterpretable: No CSF obtained, or clotted, or CSF so bloody or insufficient that a cell count was impossible
4. CSF WBC, RBC, corrected WBC counts, PMNs and lymphocytes from the clearest sample
5. Time taken on first procedure from start of cleaning skin to removing needle at end of all attempts
6. Infant movement on first procedure using basic 4-point scale

Outcomes relating to cost and safety:

7. In all infants, according to CSF-defined and clinically-defined diagnostic criteria:
 - 7.1. Duration of the antibiotic course

7.2. Length of stay in surviving infants

7.3. Immediate complications related to LP:

7.3.1. Cardiovascular instability including oxygen saturations and heart rate

7.3.2. Respiratory deterioration (escalating respiratory support) post-LP

8. For the pilot phase: parental anxiety assessed using the State Trait Anxiety Inventory - State Subscale (STAI-S) Questionnaire

Previous secondary outcome measures:

Short-term clinical outcomes are measured by assessing:

1. The proportion of infants with:

1.1. No cerebrospinal fluid (CSF) obtained, or Pure blood/Clotted, or blood-stained, or clear

1.2. CSF obtained and red blood cell (RBC) count <500, <5,000, <10000, or <25000 /mm³, or any RBC count

1.3. A CSF white cell count not requiring a correction (whatever the RBC count)

2. Total number of procedures, and attempts within procedures, performed per infant to obtain interpretable CSF (RBC counts at the above thresholds)

3. Proportion of infants diagnosed (by WBC count criteria, culture, gram stain, and/or clinically) via CSF with:

3.1. Meningitis: WBC count 20 or more in CSF, or more than 2 PMNs, or a positive culture or gram stain, or clinically diagnosed (if RBC count is >500, the WBC count will be reduced by 1 for every 500 RBC counts to give a 'corrected' WBC count)

3.2. Equivocal: borderline white blood cell (WBC) counts, or uncertain culture result or uncertain clinical diagnosis

3.3. Negative: <20 CSF WBC count and 0–2 PMNs and negative cultures and gram stain and no clinical diagnosis of meningitis

3.4. Uninterpretable: no CSF obtained, or CSF so bloody that a cell count was impossible

4. CSF WBC, RBC, corrected WBC counts, PMNs, and lymphocytes, for any of the above

5. Time taken from start of cleaning skin to removing needle at end of all attempts

6. Infant movement assessed using a basic 4-point scale at time of procedure

7. Parental anxiety, measured using short-version STAI at baseline and within 48 hours of the first lumbar puncture procedure

8. Cost measured by assessing the duration of the antibiotic course from trial entry to discharge home

9. Cost measured by assessing the length of stay in hospital from trial entry until discharge home

10. Safety measured by assessing cardiovascular instability, including oxygen saturations and heart rate during the lumbar puncture procedure

11. Safety measured by assessing respiratory deterioration based on the requirement for escalating respiratory support within 1 hour of the lumbar puncture procedure

Completion date

28/02/2021

Eligibility

Key inclusion criteria

1. Neonates and infants in neonatal units and their maternity wards who are having a lumbar puncture

2. Parent(s) willing and able to give informed consent

3. Infants of corrected gestational age from 27+0 weeks to 44+0 weeks, AND working weight of 1,000 g or more

4. First lumbar puncture for current indication

Participant type(s)

Patient

Healthy volunteers allowed

No

Age group

Neonate

Sex

All

Total final enrolment

1082

Key exclusion criteria

Current exclusion criteria as of 24/04/2020:

1. Unable to be held in sitting position (including infants intubated and mechanically-ventilated) or other clinical condition which is likely, in the opinion of the treating clinician, to make sitting difficult, or which is likely to be compromised by sitting (e.g.open gastroschisis)
2. Previously randomised to the trial

Previous exclusion criteria:

1. Unable to be held in sitting position (e.g. intubated and mechanically-ventilated) or other clinical condition which is likely to make sitting difficult, or which is likely to be compromised by sitting (e.g. open gastroschisis)
2. Previously randomised to the trial

Date of first enrolment

01/06/2018

Date of final enrolment

31/08/2020

Locations**Countries of recruitment**

United Kingdom

England

Study participating centre

John Radcliffe Hospital (lead site)

Headley Way

Headington

Oxford

United Kingdom

OX3 9DU

Study participating centre
Birmingham Heartlands Hospital
Bordesley Green East
Birmingham
United Kingdom
B9 5SS

Study participating centre
Leicester Royal Infirmary
Infirmary Square
Leicester
United Kingdom
LE1 5WW

Study participating centre
Northampton General Hospital
Cliftonville
Northampton
United Kingdom
NN1 5BD

Study participating centre
Princess Anne Hospital
Coxford Road
Southampton
United Kingdom
SO16 5YA

Study participating centre
Royal Berkshire Hospital
London Road
Reading
United Kingdom
RG1 5AN

Study participating centre
Royal Hampshire County Hospital
Department of Paediatrics

Winchester
United Kingdom
SO22 5DG

Study participating centre
Southmead Hospital
Southmead road
Westbury-on-Trym
Bristol
United Kingdom
BS10 5NB

Study participating centre
St Michael's Hospital
Southwell Street
Bristol
United Kingdom
BS2 8EG

Study participating centre
Bradford Royal Infirmary
Smith Lane
Bradford
United Kingdom
BD9 6DA

Study participating centre
Colchester General Hospital
Turner Rd
Mile End
Colchester
United Kingdom
CO4 5JL

Study participating centre
Derriford Hospital
Derriford Rd
Plymouth
United Kingdom
PL6 8DH

Study participating centre
Gloucestershire Royal Hospital
Great Western Rd
Gloucester
United Kingdom
GL1 3NN

Study participating centre
Great Western Hospital
Marlborough Rd
Swindon
United Kingdom
SN3 6BB

Study participating centre
Medway Maritime Hospital
Windmill Road
Gillingham
United Kingdom
ME7 5NY

Study participating centre
Norfolk and Norwich University Hospital
Colney Lane
Norwich
United Kingdom
NR4 7UY

Study participating centre
Royal Devon and Exeter Hospital
Barrack Rd
Exeter
United Kingdom
EX2 5DW

Study participating centre
Royal Oldham Hospital
Rochdale Rd
Oldham

United Kingdom
OL1 2JH

Study participating centre

St Peter's Hospital

Guildford Rd

Lyne

Chertsey

United Kingdom

KT16 0PZ

Study participating centre

Stoke Mandeville Hospital

Mandeville Rd

Aylesbury

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HP21 8AL

Study participating centre

Basingstoke and North Hampshire Hospital

Aldermaston Rd

Basingstoke

United Kingdom

RG24 9NA

Sponsor information

Organisation

University of Oxford

ROR

<https://ror.org/052gg0110>

Funder(s)

Funder type

Government

Funder Name

NIHR Evaluation, Trials and Studies Co-ordinating Centre (NETSCC); Grant Codes: 15/188/106

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?
Results article	protocol	29/11/2022	05/12/2022	Yes	No
Results article		01/12/2023	28/12/2023	Yes	No
Protocol article		15/04/2020	24/04/2020	Yes	No
HRA research summary	Participant information sheet		28/06/2023	No	No
Participant information sheet		11/11/2025	11/11/2025	No	Yes
Study website	Study website	11/11/2025	11/11/2025	No	Yes