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Breath analysis in intensive care

Submission date
15/05/2015

Recruitment status
No longer recruiting

Registration date
02/07/2015

Overall study status
Completed

Last Edited
23/04/2021

Condition category
Respiratory

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
Intensive Care Units (ICUs) treat and monitor critically ill or unstable patients who may be unable to breathe on their own and whose organs may not be working properly. Medical equipment supports organ function until the patient recovers. Mechanical ventilators ('life support machines') support breathing. While this technology works well, patients on mechanical ventilators can develop life-threatening lung infections (pneumonia) as a complication. Pneumonia is treated quickly and effectively with antibiotic drugs. However, because patients on ventilators are already ill, it is not possible to diagnose pneumonia quickly and accurately. Therefore many mechanically ventilated patients will also receive antibiotic treatments 'just in case' which means that antibiotics will be used unnecessarily. A consequence of antibiotic overuse is that infecting bugs (microorganisms) become resistant so that it will be difficult to treat life- threatening pneumonia in the future. We need to develop new technologies to help decide quickly who has developed pneumonia during their time on mechanical ventilation. Recently, we have discovered that it is possible and safe to capture and measure breath chemicals of patients who are mechanically ventilated. The chemical profiles appear to distinguish patients acquiring dangerous lung microorganisms. This exciting finding implies that we could use these chemical patterns to determine quickly who is likely to require antibiotics and who does not. To progress this idea, we now wish to use our breath capture system in ICU ventilated patients suspected of developing pneumonia and, using analysis already developed in our laboratories, we will seek proof that these chemicals can distinguish between the presence and absence of pneumonia. At project completion we will be able to decide whether our innovation is ready for clinical testing across NHS ICUs.

Who can participate?
Adults (aged at least 18), incubated and mechanically ventilated for at least 48 hours and suspected of having ventilator associated pneumonia (VAP).

What does the study involve?
Exhaled air samples are taken from participants within 24 hours of them having been suspected of developing VAP. Broncho-alveolar lavage fluid is collected to diagnose VAP. Blood samples are also taken .

What are the possible benefits and risks of participating?
Not provided at time of registration.

Where is the study run from?
NHS hospitals run by University Hospital South Manchester NHS Foundation Trust, Central Manchester University Hospitals NHS Foundation Trust and the Central Manchester University Hospitals NHS Foundation Trust (UK)

When is the study starting and how long is it expected to run for?
September 2014 to March 2017.

Who is funding the study?
NIHR i4i

Who is the main contact?
Dr Pauline van Oort, pouline.vanoort@gmail.com

Contact information

Type(s)
Public

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Additional identifiers

Protocol serial number
N/A

Study information

Scientific Title
BReath Analysis in intensive care: proof of concept for non-invasive diagnosis of Ventilator associated pneumonia

Acronym
BRAVo

Study objectives
In ICU mechanical ventilation can be associated with the development of ventilator associated pneumonia (VAP) as a complication. As per current practice it is not possible to diagnose VAP

quickly and accurately and many patients are treated with antibiotics unnecessarily. Volatile organic compounds (VOCs) arise from various metabolic pathways. Capturing these VOC breath biomarkers through an ICU-compatible breath sampling device could help to determine quickly who requires antibiotics and who does not. To progress this idea, we now wish to use our breath capture system in ICU ventilated patients suspected of developing pneumonia and, using analysis already developed in our laboratories, we will seek proof that these chemicals can distinguish between the presence and absence of pneumonia. At project completion we will be able to decide whether our innovation is ready for clinical testing across NHS ICUs.

Ethics approval required
Old ethics approval format

Ethics approval(s)
RES Committee North West - Greater Manchester South, ref: 15/NW/0393

Study design
Multicentre cross-sectional observational proof of concept study

Primary study design
Observational

Study type(s)
Diagnostic

Health condition(s) or problem(s) studied
Ventilator-associated pneumonia (VAP)

Interventions
Included patients will have been intubated and mechanically ventilated for at least 48 hours (based on the definition of VAP) and clinically suspected of having VAP. Exhaled air samples will be taken within 24 hours after the patient is suspected of VAP. Broncho-alveolar lavage fluid will be collected to determine clinically the presence of VAP. In addition two blood samples will be taken.

Intervention Type
Device

Primary outcome(s)
Providing proof of concept supporting the use of a novel minimally-invasive breath sampler to enhance the diagnosis of ventilator-associated pneumonia (VAP) in patients in intensive care.

Key secondary outcome(s))
1. The development of a bespoke minimally-invasive breath sampling methodology for critically ill ventilated patients on a mechanical ventilator
2. Precise identification of the breath biomarkers / VOCs responsible for discriminating VAP in critical ill patients

Completion date
01/03/2017

Eligibility

Key inclusion criteria
Inclusion criteria
1. 18 years and older
2. Intubated and mechanically ventilated for >48 hours
3. Suspected for ventilator associated pneumonia (VAP)

Definition of suspected VAP
Criteria for clinically suspected VAP are fulfilled if a patient has been intubated and mechanically ventilated for at least 48 hours and has new or worsening alveolar infiltrates on chest X-ray and has two or more from
1. Temperature >38°C or <35°C
2. White cell count >11x109 or <4x109 per litre of blood
3. Purulent tracheal secretions

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 years

Sex
All

Key exclusion criteria
1. Patients receiving end of life care
2. Patients where there is clinical suspicion of highly infectious disease (patients in strict isolation such as Middle East Respiratory Syndrome, Ebola or resistant tuberculosis)
3. Patients showing features considered to predict poor tolerance of BAL:
3.1. PaO2 <8 kPa on FiO2 >0.7
3.2. Positive end-expiratory pressure >15 cmH2O
3.3. Peak airway pressure >35 cmH2O
3.4. Heart rate >140 bpm
3.5. Mean arterial pressure <65 mmHg
3.6. Bleeding diathesis (including platelet count <20 x 109 p/L of blood or international normalised ratio (INR) >3)
3.7. Poorly controlled intracranial pressure (>20mmHg)

Date of first enrolment
01/07/2015

Date of final enrolment
01/12/2016

Locations

Countries of recruitment
United Kingdom

England

Study participating centre
University Hospital of South Manchester NHS Foundation Trust
Southmoor Rd
Wythenshawe
Manchester
United Kingdom
M23 9LT

Study participating centre
Central Manchester University Hospitals NHS Foundation Trust
Cobbett House
Oxford Road
Manchester
United Kingdom
M13 9WL

Sponsor information

Organisation
R&D University Hospital South Manchester

ROR
https://ror.org/00he80998

Funder(s)

Funder type
Government

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

IPD sharing plan summary
Not provided at time of registration

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
HRA research summary			28/06/2023	No	No
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes
Thesis results			23/04/2021	No	No