

# Can changes in myocardial work and right ventricle free wall strain predict 30-day mortality in critical care patients presenting with sepsis?

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|--|--|---|
| <b>Submission date</b><br>24/03/2021   | <b>Recruitment status</b><br>No longer recruiting        | <input checked="" type="checkbox"/> Prospectively registered<br><input type="checkbox"/> Protocol |
| <b>Registration date</b><br>12/04/2021 | <b>Overall study status</b><br>Completed                 | <input type="checkbox"/> Statistical analysis plan<br><input checked="" type="checkbox"/> Results |
| <b>Last Edited</b><br>16/07/2025       | <b>Condition category</b><br>Infections and Infestations | <input type="checkbox"/> Individual participant data  |

## Plain English summary of protocol

### Background and study aims

Sepsis is a leading cause of death and disability in critical care units worldwide. Sepsis affects all the major organ systems within the body but it is still not fully understood how sepsis affects organs, and in particular, the heart. In sepsis, there can be varying stress placed on the heart and it may take up to 10 days to fully recover once the patient has been successfully treated. However, it is still not fully understood the initial effects that sepsis has on the heart and the stress placed on the heart may not be appropriately recognised with the current standard measures of heart function.

This study aims to measure the effects of sepsis on how much energy and stress the heart uses and generates to pump blood, using echocardiography (the same non-invasive technology that is used in pregnancy to image a mother's baby). From these images, the study team will be able to calculate the amount of work done and strain the heart is placed under using specialized computer software. This non-invasive echocardiography is now a standard of care for patients being admitted to critical care. Using this software the study team will extract as much information as possible from the images, to hopefully help to identify patients early that may benefit from changes to their sepsis management. These analyses could be useful as they can be completed from a standard echocardiogram of the chest with no extra views or tests needed. This study also aims to compare the energy spent (or work done) by the heart in sepsis against standard measures of heart function.

### Who can participate?

Adult patients admitted to critical care with a severe infection needing more organ support that can be given on normal wards.

What does the study involve?

The study involves identifying very sick patients that present to critical care with infection (sepsis) and using ultrasound to image their heart within 24 h of admission, then between 48 and 72 h after admission.

What are the possible benefits and risks of participating?

Increased surveillance of heart function on day 3 is of potential benefit as it will give greater insight into how well the heart is functioning using ultrasound. There is a very small risk of bruising associated with the placement of the probe against the chest wall, but this is transient and will resolve within hours.

Where is the study run from?

Critical Care Unit at Surrey and Sussex Healthcare NHS Trust (UK)

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

From January 2019 to December 2023

Who is funding the study?

The Critical Care Department at Surrey and Sussex Healthcare NHS Trust (UK)

Who is the main contact?

Dr Theophilus Samuels, [theophilus.samuels1@nhs.net](mailto:theophilus.samuels1@nhs.net)

## Contact information

### Type(s)

Public

### Contact name

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## Additional identifiers

Integrated Research Application System (IRAS)

262520

## Study information

## **Scientific Title**

myoCardial work and Right ventricle Strain In Sepsis (CRiSIS): new investigations in critical care echocardiography

## **Acronym**

CRiSIS

## **Study objectives**

Current study hypothesis as of 18/10/2024:

As no specific data are available on the assessment of myocardial work (MW) and minimal data on right ventricle free wall strain (RV FWS) in patients presenting with sepsis to critical care, this study aimed to:

1. Investigate if MW and RV FWS measured on days 1 and 3 of admission are associated with 30-day mortality
2. Investigate if any association exists between the interval changes (i.e. the difference in measurements recorded on day 1 and day 3 of their admission) in MW and RV FWS on 30-day mortality
3. Assess if any differences exist on day 1 between male and female patients in MW and RV FWS
4. Provide insights into the degree to which myocardial work and RV FWS are associated with Global Longitudinal Strain (GLS) and left ventricular ejection fraction (LVEF)

Previous study hypothesis:

1. Measuring how much work the heart uses to interrogate cardiac function and determine if changes over a 72 h period can help to predict mortality at 30 days
2. Right ventricle free wall strain (RVFWS), the strain that the right ventricle is placed under when it beats), will also add further evidence to our currently limited knowledge on the association between sepsis and RVFWS
3. Comparing the left ventricle strain and right-side free wall strain against each other may demonstrate an interactive effect due to the phenomenon of ventricular interdependence
4. To create a model to predict the outcomes in patients presenting with sepsis for validation in future studies, in the hope that it can be used to improve outcomes and treatment strategies

## **Ethics approval required**

Ethics approval required

## **Ethics approval(s)**

approved 12/05/2021, London Bromley Research Ethics Committee (2 Redman Place, Stratford, London, E20 1JQ, United Kingdom; -; approvals@hra.nhs.uk), ref: 21/LO/0303

## **Study design**

Single-centre prospective observational cohort pilot study

## **Primary study design**

Observational

## **Study type(s)**

Diagnostic

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

Critical care patients admitted with sepsis

## **Interventions**

Current interventions as of 21/10/2024:

Participant hearts will be examined using standard transthoracic echocardiogram (TTE) on 1 and 3 days of admission to ICU. From these images, the study team will be able to calculate the amount of work done by the heart muscle and strain the heart is placed under using specialized computer software. Non-invasive echocardiography is now a standard of care for patients being admitted to critical care. By using this software, the study team will extract as much information as possible from the echocardiography, which will hopefully help to identify patients early that may benefit from changes to their sepsis management.

The study team also wishes to compare the energy spent (or work done) by the heart in sepsis against standard parameters of heart function. It has recently been shown that these correlate well in healthy patients, and therefore, it is important to assess if this correlation persists in sepsis.

Lastly, what is favourable about these analyses is that they can be completed from a standard transthoracic echocardiogram (TTE) with no extra views or tests needed. They are in effect, tasks that can be done on a computer. In addition, this measurement is less load-dependent than other standard measures used (it does not depend that much on external factors that can reduce the ability of the heart to pump blood, such as a very high blood pressure).

Previous interventions:

Participant hearts will be examined using standard transthoracic echocardiogram (TTE) on 1, 3, and 90 days of admission to ICU. From these images, the study team will be able to calculate the amount of work done by the heart muscle and strain the heart is placed under using specialized computer software. Non-invasive echocardiography is now a standard of care for patients being admitted to critical care. By using this software, the study team will extract as much information as possible from the echocardiography, which will hopefully help to identify patients early that may benefit from changes to their sepsis management.

The study team also wishes to compare the energy spent (or work done) by the heart in sepsis against standard parameters of heart function. It has recently been shown that these correlate well in healthy patients, and therefore, it is important to assess if this correlation persists in sepsis.

Lastly, what is favourable about these analyses is that they can be completed from a standard transthoracic echocardiogram (TTE) with no extra views or tests needed. They are in effect, tasks that can be done on a computer. In addition, this measurement is less load-dependent than other standard measures used (it does not depend that much on external factors that can reduce the ability of the heart to pump blood, such as a very high blood pressure).

## **Intervention Type**

Other

## **Primary outcome(s)**

Current primary outcome measure as of 21/10/2024:

Prediction of mortality at 30 days using myocardial work (MW) and right ventricle free wall strain (RVFWS) measured using transthoracic echocardiography on 1 and 3 days of ICU admission

Previous primary outcome measures:

1. Prediction of mortality at 30 days using myocardial work (MW), Global Longitudinal Strain

(GLS), and right ventricle free wall strain (RVFWS) measured using transthoracic echocardiogram at 1, 3, and 90 days of ICU admission

2. Determining the clinically relevant level of correlation between mortality at 30 days and changes in MW, Global longitudinal strain (GLS) and RVFWS measured using transthoracic echocardiogram at 1, 3, and 90 days of ICU admission and participant records between baseline and hospital discharge

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

Previous secondary outcome measures as of 21/10/2024:

1. Association between MW, RVFWS with global longitudinal strain (GLS) and left ventricle ejection fraction (LVEF) measured using a non-parametric bootstrapping method on day 1 and day 3
2. Assess if any differences exist between male and female patients in MRW and RVFWS measured using permutation tests on admission (day 1)

Previous secondary outcome measure:

1. Association between changes in MW, GLS, and RVFWS and length of stay in ICU measured using transthoracic echocardiogram at 1, 3, and 90 days of ICU admission and participant records between baseline and hospital discharge
2. Association between changes in MW, GLS, and RVFWS to days on mechanical ventilation (if part of patient's clinical management) measured using transthoracic echocardiogram at 1, 3, and 90 days of ICU admission and participant records between baseline and hospital discharge
3. Prediction of mortality at 90 days predicted from measurements of MW, Global Longitudinal Strain (GLS), and right ventricle free wall strain (RVFWS) measured using transthoracic echocardiogram at 1, 3, and 90 days of ICU admission
4. Changes in MW, RVFWS, and GLS measured using transthoracic echocardiogram at 1, 3, and 90 days of ICU admission
5. Feasibility of obtaining suitable images measured using transthoracic echocardiogram at 1, 3, and 90 days of ICU admission

### **Completion date**

31/12/2023

## **Eligibility**

### **Key inclusion criteria**

1. Aged  $\geq 18$  years
2. Admission diagnosis of sepsis
3. Standard of care echocardiogram within 24 h of admission to ICU
4. Adequate echocardiography image quality that permits cardiac work analysis and/or strain assessment of the right ventricle free wall
5. Able to speak, understand and communicate in English
6. Written or verbal informed consent from the patient or next of kin

### **Participant type(s)**

Patient

### **Healthy volunteers allowed**

No

### **Age group**

Adult

**Lower age limit**

18 years

**Sex**

All

**Total final enrolment**

39

**Key exclusion criteria**

1. Atrial fibrillation
2. Previous cardiac surgery
3. Pregnancy
4. Severe valvular disease
5. Inadequate echocardiography image quality

**Date of first enrolment**

01/05/2021

**Date of final enrolment**

31/12/2023

## Locations

**Countries of recruitment**

United Kingdom

England

**Study participating centre**

**East Surrey Hospital**

Surrey and Sussex Healthcare NHS Trust

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## Sponsor information

**Organisation**

Surrey and Sussex Healthcare NHS Trust

ROR

<https://ror.org/0480vrj36>

## Funder(s)

### Funder type

Hospital/treatment centre

### Funder Name

Critical Care Department, Surrey and Sussex Healthcare NHS Trust

## 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="#">Results article</a>      |         | 13/05/2025   | 16/07/2025 | Yes            | No              |
| <a href="#">HRA research summary</a> |         |              | 28/06/2023 | No             | No              |