

# Evaluation of unloading the heart in patients with cardiogenic shock treated with mechanical circulatory support devices

<b>Submission date</b> 17/01/2022	<b>Recruitment status</b> Recruiting	<input checked="" type="checkbox"/> Prospectively registered <input type="checkbox"/> Protocol
<b>Registration date</b> 19/01/2022	<b>Overall study status</b> Ongoing	<input type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
<b>Last Edited</b> 09/06/2025	<b>Condition category</b> Circulatory System	<input type="checkbox"/> Individual participant data <input checked="" type="checkbox"/> Record updated in last year

## Plain English summary of protocol

### Background and study aims

Cardiogenic shock occurs when the heart suddenly fails and is unable to meet the body's demands, often leading to death. Cardiogenic shock is becoming more common particularly in patients suffering heart attacks and therefore research into potential treatments to improve the high death rate is urgently needed. Current treatment options are limited and can be associated with an increased death rate.

A promising new treatment is veno-arterial extracorporeal membrane oxygenation (VA-ECMO). This mechanical support system works like a heart bypass to support the body whilst the heart recovers. However, while beneficial to most other organs, VA-ECMO can put additional pressure on the heart by pumping blood backwards into the aorta (the main artery that carries blood away from the heart), preventing it from recovering. If the heart is unable to overcome this increased pressure (or afterload) a number of dangerous events can occur such as the formation of blood clots in the heart or the build-up of fluid in the lungs which can be potentially fatal. This problem can be solved by using additional devices in the circulation to "unload" the heart. Two devices are commonly used for this task - the intra-aortic balloon pump (IABP) and Impella - but it is not known which one works better as they have never been directly compared. Additionally, each device has a distinct mechanism of action, the effect of which has never been studied in patients treated with VA-ECMO. Currently therefore hospitals are treating such patients differently due to the lack of available evidence as to the best treatment strategy. This study aims to directly compare the effects of the IABP and Impella on parameters of supply and demand of oxygen to the heart which are the key determinants of heart recovery.

### Who can participate?

Patients aged 18 years and over who are being treated in an intensive care unit for cardiogenic shock and are either treated with VA-ECMO or are being considered for treatment with VA-ECMO by their doctors are eligible to participate.

### What does the study involve?

Participants are randomly allocated to be treated with either an IABP or Impella. They will have specialised measurements of blood flow in their coronary (heart) arteries and pressures within

the ventricle (the main pumping chamber of the heart) taken in the cardiac catheterisation laboratory. These will be repeated after the unloading device is inserted. The remainder of the participants care will be as they would normally receive if not participating in the research study.

What are the possible benefits and risks of participating?

Because it is not known which device works better, there are no direct benefits from taking part in this study. The researchers will obtain information which it is hoped will improve the treatment of patients with the same condition in the future.

Participating in the study will not increase risk substantially compared to standard treatment with VA-ECMO. Taking the additional measurements will involve placing a small sensor in the coronary arteries and the heart itself under X-ray guidance: the risk of causing damage to either the heart or the arteries is likely to be around 1 in 300. A small additional dose of ionising radiation will be required to acquire the study measurements. Ionising radiation may cause cancer many years or decades after the exposure. We are all at risk of developing cancer during our lifetime. 50% of the population is likely to develop one of the many forms of cancer at some stage during our lifetime. Taking part in this study will add only a very small chance of this happening (<0.1% added risk).

Where is the study run from?

King's College London (UK)

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

February 2020 to November 2026

Who is funding the study?

1. British Heart Foundation (UK)
2. RBH-KHP Partnership Transformation Funding (UK)

Who is the main contact?

Dr Saad Ezad  
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## Contact information

### Type(s)

Scientific

### Contact name

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### **Type(s)**

Principal Investigator

### **Contact name**

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## **Additional identifiers**

### **EudraCT/CTIS number**

Nil known

### **IRAS number**

300145

### **ClinicalTrials.gov number**

Nil known

### **Secondary identifying numbers**

CPMS 51137, IRAS 300145

## **Study information**

### **Scientific Title**

HEmodynamic effects of Reducing left ventricular Afterload with impella or intra-aortic balloon CounterpuLsation during veno-arterial Extracorporeal membrane oxygenation in cardiogenic Shock (HERACLES)

### **Acronym**

HERACLES

### **Study objectives**

It is hypothesised that ventricular unloading of patients supported with veno-arterial extracorporeal membrane oxygenation (VA-ECMO) with an Impella will result in a greater

increase in the coronary device flow reserve as compared to unloading with an intra-aortic balloon pump.

### **Ethics approval required**

Old ethics approval format

### **Ethics approval(s)**

Approved 13/01/2022, London - Queen Square Research Ethics Committee (HRA NRES Centre Bristol, 3rd Floor, Block B, Whitefriars Lewins Mead, Bristol, BS1 2NT, UK; +44 (0)2071048225; queensquare.rec@hra.nhs.uk), REC ref: 21/LO/0853

### **Study design**

Randomized; Interventional; Design type: Treatment, Device

### **Primary study design**

Interventional

### **Secondary study design**

Randomised controlled trial

### **Study setting(s)**

Hospital

### **Study type(s)**

Treatment

### **Participant information sheet**

Not available in web format, please use the contact details to request a participant information sheet

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

Cardiogenic shock

### **Interventions**

HERACLES is a randomised control trial designed to compare the physiological effects on myocardial oxygen supply and demand of ventricular unloading with either an IABP or Impella in patients supported with VA-ECMO. Patients who are either supported with VA-ECMO or being considered for VA-ECMO support will be eligible for inclusion in the trial. At the time of cardiac catheterisation participants will be randomised in a 1:1 fashion to unloading with either an IABP or Impella. Randomisation will be performed via a computer using a web-based bespoke KCTU randomisation system. Coronary flow and ventricular pressure volume measurements will be recorded prior to insertion of the randomised unloading device and then repeated following device insertion. The randomised unloading device will remain in situ for as long as clinically indicated at the discretion of the treating physician. No further study related procedures are performed after completion of the study protocol in the cardiac catheterisation laboratory. Patients will be followed up 6 months post randomisation. Results will be compared between the two groups to identify if one device has a greater beneficial impact on the ratio of myocardial oxygen supply and demand.

### **Intervention Type**

Device

**Phase**

Not Applicable

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

IABP, Impella

**Primary outcome measure**

Coronary device flow reserve measured using a coronary guidewire post left ventricular (LV) unloading

**Secondary outcome measures**

1. Early effect of LV unloading measured using an LV catheter post LV unloading
2. Minimal microvascular resistance calculated from pressure and flow measurements post LV unloading
3. Time to VA-ECMO decannulation (days) measured using patients' medical records
4. Days alive and off ICU (at 30 days post randomisation) measured using patients' medical records

**Overall study start date**

03/02/2020

**Completion date**

28/11/2026

## Eligibility

**Key inclusion criteria**

1. Patients aged  $\geq 18$  years with cardiogenic shock of any aetiology
2. On veno-arterial extracorporeal membrane oxygenation (VA-ECMO) support or starting VA-ECMO post PCI
3. Undergoing clinically indicated cardiac catheterisation

**Participant type(s)**

Patient

**Age group**

Adult

**Lower age limit**

18 Years

**Sex**

Both

**Target number of participants**

Planned Sample Size: 36; UK Sample Size: 36

**Key exclusion criteria**

1. Post-cardiotomy cardiogenic shock
2. Confirmed left ventricular thrombus on imaging
3. Age <18 years
4. Pregnancy or peripartum cardiomyopathy
5. Contraindication to either intra-aortic balloon pump (IABP) or percutaneous left ventricular assist device (pLVAD) insertion i.e. ≥moderate aortic regurgitation (AR), severe peripheral vascular disease (PVD) prohibiting insertion of either device
6. Mechanical aortic valve replacement (AVR)

**Date of first enrolment**

09/03/2022

**Date of final enrolment**

28/05/2026

## **Locations**

**Countries of recruitment**

United Kingdom

**Study participating centre**

**St Thomas' Hospital**

Westminster Bridge Road

London

United Kingdom

SE1 7EH

**Study participating centre**

**King's College Hospital**

Denmark Hill

London

United Kingdom

SE5 9RS

**Study participating centre**

**Harefield Hospital**

Hill End Road

Harefield

Uxbridge

United Kingdom

UB9 6JH

**Study participating centre**  
**Royal Brompton Hospital**  
Sydney Street  
London  
United Kingdom  
SW3 6NP

## **Sponsor information**

### **Organisation**

King's College London

### **Sponsor details**

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### **Sponsor type**

University/education

### **Website**

<http://www.kcl.ac.uk/index.aspx>

### **ROR**

<https://ror.org/0220mzb33>

## **Funder(s)**

### **Funder type**

Charity

### **Funder Name**

British Heart Foundation; Grant Codes: FS/CRTF/21/24118

### **Alternative Name(s)**

the\_bhf, The British Heart Foundation, BHF

### **Funding Body Type**

Private sector organisation

**Funding Body Subtype**

Trusts, charities, foundations (both public and private)

**Location**

United Kingdom

**Funder Name**

RBH-KHP Partnership Transformation Funding

## Results and Publications

**Publication and dissemination plan**

Planned publication in a high-impact peer-reviewed journal. No additional study files are available

**Intention to publish date**

22/12/2026

**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="#">HRA research summary</a>			28/06/2023	No	No