



RESEARCH

INFORMATION

## Coronary artery disease and coronary microvascular dysfunction in heart failure with preserved ejection fraction



### AIMS

Heart failure (HF) is a condition in which the heart is unable to pump blood around the body properly. People with HF commonly experience problems with breathlessness, tiredness and leg swelling. HF with preserved ejection fraction (HFpEF) is now reported to be the predominant form of HF. People with HFpEF generally have an impaired quality of life, frequent hospital admissions and a reduced life expectancy. The causes of HFpEF are not well understood and, to date, no treatments have been shown to improve symptoms or the poor outcomes associated with HFpEF.

A lack of blood getting to the heart, known as myocardial ischaemia, may cause or contribute to HFpEF in some people. Myocardial ischaemia may be caused by narrowings or blockages in the large heart arteries, known as coronary artery disease (CAD), and/or abnormal function of the small heart arteries, known as coronary microvascular dysfunction (CMD). Treatments are available which can be beneficial in people with CAD and/or CMD.

The aim of this study was to investigate how common CAD and CMD are in real-world people with HFpEF. With this information, we aimed to identify those who, in the future, might benefit from treatment which could improve symptoms and life expectancy in a condition with poor outcomes and no current effective treatment options.



## KEY FINDINGS

- Over half of people with HFpEF had significant narrowings or blockages in the large heart arteries (CAD).
- Half of people with HFpEF and significant CAD were not known or suspected to have CAD.
- People with HFpEF and CAD had significantly more hospital admissions during follow-up than those without CAD.
- Two-thirds of people with HFpEF had abnormal function of the small heart arteries (CMD).
- Over one-quarter of people with HFpEF had evidence of a previous heart attack (myocardial infarction, MI).
- Most people with HFpEF and evidence of a previous MI did not know that they had had an MI.

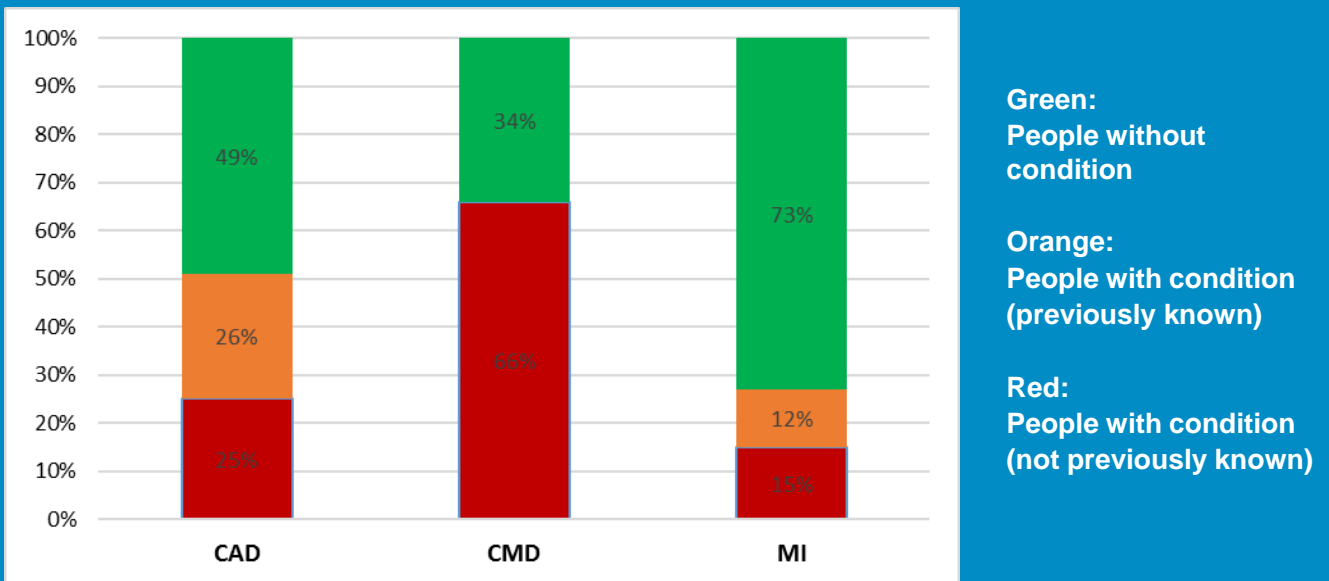


Figure: Prevalence of CAD, CMD and MI in study participants



## WHAT DID THE STUDY INVOLVE?

We recruited people from three hospitals in the West of Scotland: Queen Elizabeth University Hospital (Glasgow), Glasgow Royal Infirmary (Glasgow) and Royal Alexandra Hospital (Paisley). Everyone admitted to hospital with suspected HF was considered for the study. An ultrasound scan of the heart (echocardiogram) and blood test were used to diagnose HFpEF. We recruited people admitted to hospital with HFpEF who were interested in having extra tests to look at the blood supply to their heart.

Participants in the study underwent a heart artery dye test (coronary angiogram) with measurement of the blood flow in the heart arteries (pressure wire studies). Those who were able to also had a special heart scan [cardiac magnetic resonance imaging (MRI)] performed to look at their heart function in more detail. Following these tests, participants were followed up by medical record linkage for information on hospital admissions and death.

The study design was presented at public forums before and during the recruitment process. Feedback from the public and participants was invaluable in refining the design of the study and achieving the study aims. For example, based on feedback, having both the coronary angiogram and MRI scan was felt to be a lot to ask of some people, so we made the MRI an optional test to ensure that all those that wished to be involved in the study could participate.



## WHAT WERE THE RESULTS AND WHAT DO THEY MEAN?

We screened over 2,000 people admitted to hospital with suspected HF over a 20-month period. 656 of these were confirmed to have HFpEF and 106 people agreed to participate in the study. Of these, 23 people withdrew prior to the study tests being performed, predominantly due to a decline in their general health or functional status. 75 people had a coronary angiogram, 62 had pressure wire studies, and 52 people had a cardiac MRI performed as part of the study.

51% of people admitted to hospital with HFpEF had significant narrowings of blockages in the large heart arteries (CAD). Half of these people were not known or suspected to have problems with the blood supply to the heart previously. 66% of people admitted to hospital with HFpEF had abnormal function of the small heart arteries (CMD). 27% of participants had evidence of a previous heart attack (MI), 57% of whom were not aware that they had had an MI in the past.

During an average follow-up time of 18 months, participants with CAD had significantly more hospital admissions (for any cause, cardiovascular causes or HF). There were no significant differences in the rate of hospital admissions between patients with and without CMD or evidence of a heart attack on MRI. The number of deaths during follow-up was small, so no meaningful conclusions could be reached regarding the impact of CAD or CMD on deaths in people with HFpEF.



## WHAT IMPACT COULD THE FINDINGS HAVE?

- Our findings show that CAD is common in people with HFpEF and a large proportion of those with significant CAD were not known or suspected to have CAD. Our findings highlight the importance of testing for CAD in people with HFpEF as some people could potentially benefit from treatments (including stents and medications) to improve the blood supply to the heart.
- This study will be used as the basis of future research designed to see if treating CAD in people with HFpEF is beneficial. If this research shows that treating CAD improves outcomes in people with HFpEF, this would change practice and policy.



## HOW WILL THE OUTCOMES BE DISSEMINATED?

- Oral presentation at the European Society of Cardiology Congress 2019, Paris.
- Academic paper in an Open Access Journal.
- Presentations at local and regional cardiology and medical meetings.



## CONCLUSION

- CAD is common in people with HFpEF. It is a treatable condition, therefore, its identification and treatment could potentially be beneficial in people with HFpEF.
- CMD is very common in people with HFpEF. It may play an important role in the development of HFpEF and could be amendable to treatment.
- Based on the findings of this study, future research will assess whether treating CAD and/or CMD in people with HFpEF might result in an improvement in symptoms, quality of life and life expectancy.



## RESEARCH TEAM & CONTACT

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### Additional Information

Funding: We were awarded £299,650

Dates: The project ran from January 2017 – June 2019