NICE National Institute for Health and Care Excellence

NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Diagnostics Assessment Programme

Pulmonary artery pressure technologies for remote monitoring of chronic heart failure

Final scope

February 2025

1 Introduction

The topic selection oversight panel selected pulmonary artery pressure technologies for remote monitoring of heart failure for guidance development by the Diagnostics Assessment Programme based on a medical technology selection briefing. NICE published an Interventional Procedures Guidance (IPG711) on percutaneous implantation of pulmonary artery pressure sensors for monitoring treatment of chronic heart failure in November 2021, and there is enough evidence in relation to the safety and efficacy of this procedure for clinicians to consider it as an option.

A glossary of terms is provided in appendix A.

2 Description of the technology

This section describes the properties of the technology based on information provided to NICE by manufacturers and experts and information available in the public domain. NICE has not carried out an independent evaluation of this description.

2.1 Purpose of the medical technology

Pulmonary artery pressure monitoring systems use sensors to collect data on pulmonary artery pressure in people with chronic heart failure to allow for ongoing remote monitoring. A pulmonary artery pressure sensor is implanted into a suitable branch of the pulmonary artery via a large vein (usually the femoral vein). Data on pulmonary artery pressure (PAP), such as pressure trend information and PAP waveforms, is transmitted from the sensor to an external monitor in the patient's

home. The monitor securely transmits the data to a remote database that can be accessed by the heart failure team. The patient usually initiates the PAP measurement daily, or more often if needed by the heart failure team. The system is not intended to make or confirm any diagnosis, but it is used to guide the ongoing monitoring and management of chronic heart failure. PAP trends are observed, this enables intervention with a change of medication to address fluid accumulation at an early stage, potentially reducing hospital admissions and improving outcomes and quality of life. The aim of this is avoiding decompensation (sudden deterioration in heart function and worsening of symptoms) and hospitalisation for heart failure. Monitoring takes place at home without the need for outpatient appointments or home visits.

2.2 Product properties

- CardioMEMS HF System (Abbott)

  The CardioMEMS HF System provides pulmonary artery (PA) haemodynamic data used for monitoring in the management of heart failure (HF). The system measures PAP, and the data is used by the physician to initiate or modify heart failure treatment and manage heart failure.

  The system includes the following components:

  - Implantable wireless sensor with delivery catheter
  - Patient or hospital electronics system
  - Patient database website

  The wireless sensor is designed for permanent implantation into the distal pulmonary artery. Once implanted, the CardioMEMS PA Sensor provides non-invasive haemodynamic data that is collected in the physician's office, clinic, hospital, or patient's home. The data provided by the system includes:

  - PAP waveform
  - Systolic, diastolic, and mean PAP
  - Heart rate

This haemodynamic data is transmitted to a secure website that serves as the patient database so that PAP monitoring information is available at all times through the internet. Changes in PAP can be used in conjunction with heart failure signs and symptoms to guide adjustments to medications.

Technology (manufacturer)	**Classification**	**Intended use**
CardioMEMS HF System (Abbott)	CE class III	In UK, the CardioMEMS HF System is indicated for patients with a New York Heart Association (NYHA) class III symptoms and a prior HF hospitalisation within the last 12-months regardless of ejection fraction. The GUIDE-HF publication expanded U.S. Food and Drug Administration (FDA) indication to include NYHA class II and III patients with a prior HF hospitalisation within the last 12-months and/or elevated BNP or NT pro-BNP 2 years ago. The CardioMEMS HF System is used by the physician in the hospital or office setting to obtain and review PAP measurements. The CardioMEMS HF System is used by the patient in the home to wirelessly obtain and send haemodynamic and PA pressure measurements to a secure database for review and evaluation by the patient's physician. The CardioMEMS HF System is contraindicated for patients with an inability to take dual antiplatelet or anticoagulants for one month post implant.

2.3 Potential alternative technologies

One alternative technology has been identified and its regulatory status and availability for use in the NHS are currently uncertain:

- Cordella Pulmonary Artery Sensor System and Cordella Heart Failure System (Endotronix/Edwards Lifesciences)

The Cordella Pulmonary Artery Sensor System is intended to measure, record and transmit pulmonary artery pressure (PAP) data from NYHA Class III heart failure patients who are at home on diuretics and guideline-directed medical therapy (GDMT), and have been stable for 30 days on GDMT. The device output is meant to aid clinicians in the assessment and management of heart failure, with the goal of reducing hospitalisations for heart failure. It is contraindicated for patients with an inability to take dual antiplatelet or anticoagulants for one month post implant.

The technology is currently not available for use in the NHS. Launch is expected to take place after the relevant regulatory approvals have been granted. A dossier has been submitted for CE mark review and a decision on European market access is expected in 2025.

3 Population

3.1 Heart failure

Heart failure is a clinical syndrome caused by any structural or functional cardiac disorder that impairs the heart's ability to function efficiently and pump blood around the body. The most common symptoms of heart failure are breathlessness, fatigue, and oedema. Conditions that cause heart failure include coronary heart disease, high blood pressure, heart rhythm or valve abnormalities, and conditions affecting the heart muscle (cardiomyopathies and myocarditis). The European Society of Cardiology (ESC) guidelines for the diagnosis and treatment of acute and chronic heart failure highlight that atrial fibrillation and heart failure frequently co-exist, and they can cause or exacerbate each other.

Heart failure may present as acute or chronic, depending on whether a person has an established diagnosis of heart failure and speed of symptom onset. Acute heart failure may be the first occurrence of heart failure in people without a heart failure diagnosis (new onset) or, more frequently, be in people with a chronic heart failure diagnosis who experience sudden deterioration in heart function and worsening of symptoms, which is known as decompensated heart failure.

The British Heart Foundation website explains that heart failure can be grouped into different categories depending on the strength of the heart, that is, the left ventricular ejection fraction (LVEF), which is the amount of blood squeezed out of the main chamber of the heart with every beat. Depending on the percentage ejection fraction (where 50% or greater is considered normal), heart failure may be classed as the following:

- HFpEF – heart failure with preserved ejection fraction (50% and over)
- HFmrEF – heart failure with mildly reduced ejection fraction (between 40% and 49%)
- HFrEF – heart failure with reduced ejection fraction (below 40%).

Heart failure may also be grouped by symptom severity and limitation of physical activity according to the New York Heart Association (NYHA) functional classification of heart failure, ranging from class I (no limitations) to class IV (inability to carry out any physical activity without discomfort and symptoms which may be present at rest).

Heart failure mainly affects people over the age of 65, with an average age of diagnosis of 77, and risk increases significantly with age. Around 1 in 35 people aged 65 - 74 years have heart failure, which increase to 1 in 15 people aged 75 – 84 years, and to just over 1 in 7 people of those aged 85 years and above (NICE 2018).

Around 920,000 people in the UK were living with heart failure in 2018 with an estimated 200,000 new diagnoses each year (NHS England 2022). The incidence of heart failure in the UK is 140 per 100,000 men and 120 per 100,000 women (NICE TA314). The prevalence of heart failure is increasing over time because of population ageing and a rise in the prevalence of associated comorbidities.

Heart failure has a poor prognosis – estimates of 1 year mortality vary, but a long term registry of people with heart failure found a mortality rate of 6.4% for those with chronic heart failure across Europe (Crespo-Leiro, 2016). A UK-based population study conducted between 2000 and 2017 found that patients diagnosed with heart failure had a 1 year survival rate of 81%, 5 year survival of 48% and 10 year survival of 26% (Taylor, 2019).

Heart failure accounts for a total of 1 million inpatient bed days each year – 2% of all NHS inpatient bed days – and 5% of all emergency medical admissions to hospital. The figures from NHS Hospital Episode Statistics indicate that there were 98,884 hospital admissions for heart failure in 2021/22 compared with 86,474 in 2018/19. This is at significant cost to the NHS – a 2016 All Party Parliamentary Group report on heart failure found that the condition costs the NHS around £2 billion per year, or approximately 2% of the total NHS budget (All-Party parliamentary Group report published in 2016).

3.2 Diagnostic and care pathway

3.2.1. Diagnosis, assessment and monitoring of chronic heart failure

The NICE guideline for diagnosis and management of chronic heart failure in adults published in 2018 and the NICE Clinical Knowledge Summary for chronic heart failure published in August 2024 provide guidance on diagnosis and assessment of heart failure. Taking a clinical history, performing a clinical examination and testing, including NT pro-BNP and an ECG are recommended. Some people may also require other tests, such as echocardiography, chest x-ray, and blood, urine and lung function tests.

The NICE guideline for diagnosis and management of chronic heart failure in adults recommends that monitoring of people with chronic heart failure should include a clinical assessment of functional capacity, fluid status, cardiac rhythm, cognitive status and nutritional status, a review of medication, and an assessment of renal function. Clinical experts highlighted that in practice a combination of the ESC guideline for diagnosis and treatment of acute and chronic heart failure and the NICE guidelines are followed in the NHS. The ESC guideline adds that heart failure management may involve in person services or home-based telemonitoring, and that the COVID-19 pandemic has highlighted some of the potential advantages of the latter. While care is usually followed up by heart failure clinics, suitable patients may be followed up by healthcare professionals including community heart failure nurses, GPs with special interest in heart failure and specialist pharmacists. Clinical experts emphasised that there is no standard heart failure service model and current practice is highly varied.

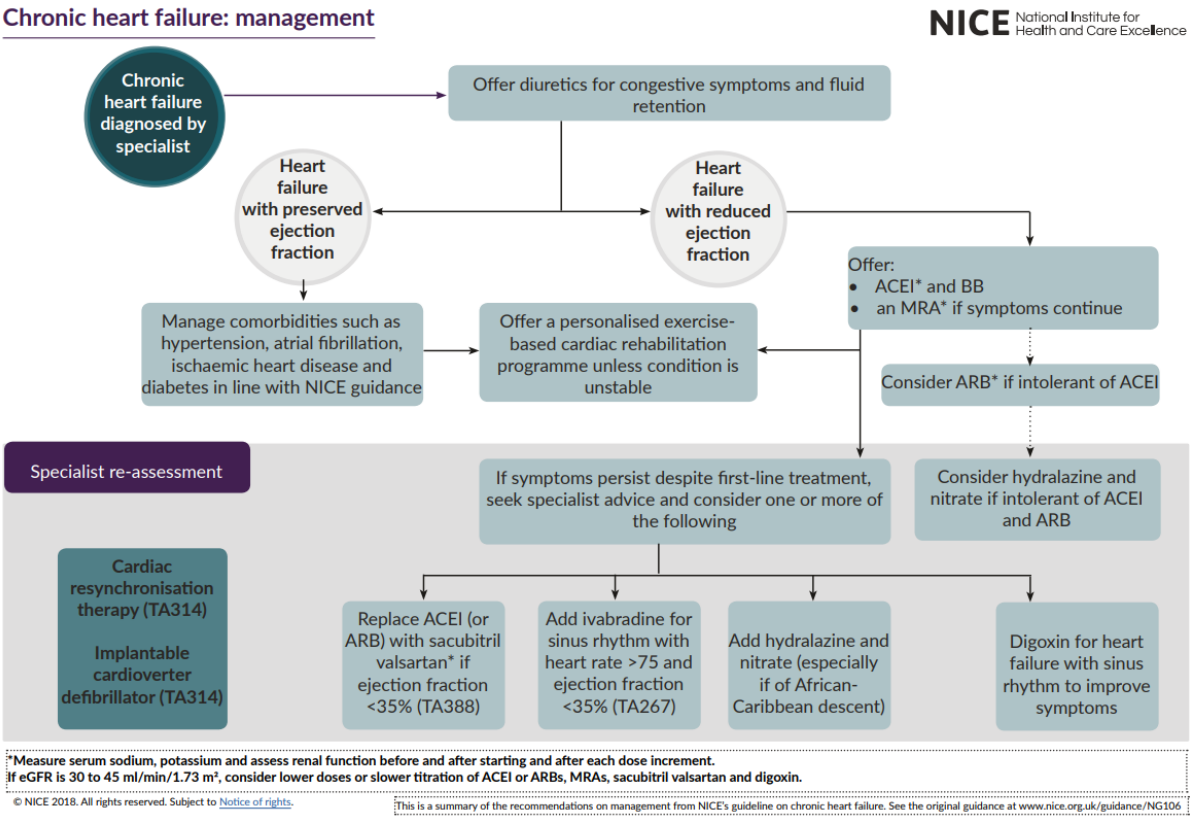
People should have additional monitoring if they have co-morbidities, are taking co-prescribed medications or if their condition has deteriorated since their last review. The frequency of monitoring is dependent on the clinical status and stability of the person's condition. For people whose condition is unstable, monitoring may be offered as frequently as every few days, up to every 2 weeks. The NICE guideline for diagnosis and management of chronic heart failure in adults recommends that reviews are offered every 6 months for people whose condition is stable, but clinical experts highlighted that in practice most people would be reviewed annually whilst some people with a stable condition may not have a review at all. Early follow up visits are recommended at 1 to 2 weeks following hospital discharge to assess signs of congestion and drug tolerance. Levels of serum natriuretic peptide may be monitored as a surrogate biomarker for heart failure in people under 75 who have heart failure with reduced ejection fraction and an estimated glomerular filtration rate above 60 ml per minute per 1.73 m^2.

Signs of heart failure can also be monitored using cardiac implantable electronic devices (CIEDs), some of which may also deliver a therapeutic intervention (such as pacemakers, implantable cardioverter defibrillators (ICDs), and cardiac resynchronisation therapy (CRT) devices) whilst others only monitor metrics over time.

3.2.3 Treatment for chronic heart failure

The NICE guideline for diagnosis and management of chronic heart failure in adults recommends the use of pharmacological treatments including routine use of diuretics for the relief of congestive symptoms. People with heart failure should also be offered a personalised, exercise-based cardiac rehabilitation programme if their condition is stable and they are able to participate.

Figure 1: Visual summary of the current NICE guideline on chronic heart failure management



In the case of heart failure with reduced ejection fraction, the NICE guideline for diagnosis and management of chronic heart failure in adults recommends that an angiotensin-converting enzyme (ACE) inhibitor, or angiotensin II receptor blockers (ARBs) licensed for heart failure if the person is intolerant to ACE inhibitors, should be offered as a first line treatment in combination with a beta-blocker licensed for heart failure.

If people are continuing to experience symptoms, mineralocorticoid receptor antagonists (MRAs) may be used in addition to first line therapies.

The ESC guideline for diagnosis and treatment of acute and chronic heart failure recommend the use of sodium-glucose cotransporter-2 (SGLT2) inhibitors as a first line therapy in people with reduced ejection fraction. The NICE technology appraisal Dapagliflozin for treating chronic heart failure with reduced ejection fraction and the NICE technology appraisal Empagliflozin for treating chronic heart failure with reduced ejection fraction also support the use of an SGLT2 inhibitor in these people, as an add-on to optimised standard care with:

- angiotensin-converting enzyme (ACE) inhibitors or angiotensin-2 receptor blockers (ARBs), with beta blockers, and, if tolerated, mineralocorticoid receptor antagonists (MRAs), or
- sacubitril valsartan, with beta blockers, and, if tolerated, MRAs.

The NICE technology appraisal dapagliflozin for treating chronic heart failure with preserved or mildly reduced ejection fraction and NICE technology appraisal empagliflozin for treating chronic heart failure with preserved or mildly reduced ejection fraction recommend dapagliflozin and empagliflozin as options for treating symptomatic heart failure with preserved or mildly reduced ejection fraction.

The ESC guideline for diagnosis and treatment of acute and chronic heart failure states that intravenous iron supplementation with ferric carboxymaltose should be considered in symptomatic people with heart failure who have recently been hospitalised for heart failure, who have left ventricular ejection fraction below 50% and an iron deficiency to reduce the risk of heart failure hospitalisation.

A person should be referred to a specialist multidisciplinary heart failure team (where available) or cardiology service for specialist treatment if a person has:

- Severe heart failure (NYHA class IV).
- Heart failure that does not respond to treatment in primary care or can no longer be managed in the home setting.
- Heart failure resulting from valvular heart disease.
- Left ventricular ejection fraction of 35% or less.
- A NT pro-BNP level above 2000 ng/L (236 pmol/L). These people should be referred urgently for specialist assessment and transthoracic echocardiography within 2 weeks.
- A NT pro-BNP level between 400 and 2000 ng/L (47–236 pmol/L). These people should be referred to have specialist assessment and transthoracic echocardiography within 6 weeks.

Specialist pharmacological treatments for heart failure with reduced ejection fraction may include ivabradine, sacubitril valsartan, hydralazine in combination with nitrate and digoxin.

Specialist referral for transplantation should be considered for heart failure patients with severe refractory symptoms or refractory cardiogenic shock. People suitable for transplantation may also be offered a left ventricular assist device (LVAD) to support pumping of blood around the body either while waiting for a suitable transplant to become available or as a permanent intervention.

The NICE guideline for diagnosis and management of chronic heart failure in adults was published in 2018, and is currently being updated to reflect changes in medical management. Publication of the updated guidance is expected in 2025. The ESC guideline for diagnosis and treatment of acute and chronic heart failure is also being updated.

3.2.3 Devices for heart failure

As the condition becomes more severe, cardiac function and symptoms may no longer be controlled by pharmacological treatment alone. The NICE Technology appraisal TA314 recommends the use of implantable cardioverter defibrillators (ICDs), cardiac resynchronisation therapy (CRT) with defibrillator (CRT-D) or CRT with pacing (CRT-P) as treatment options for people with heart failure or people at risk of heart failure (people with previous serious ventricular arrhythmia). People with heart failure include those who have left ventricular dysfunction with a left ventricular ejection fraction of 35% or less (according to NYHA functional class, QRS duration and presence of left bundle branch block (LBBB)).

3.3 Patient issues and preferences

Heart failure is a long-term condition with no cure. People with the condition have many symptoms including breathlessness, fatigue and oedema which may make it difficult for them to attend hospital appointments. There is often anxiety associated with having the condition and this can impact on an individual's daily activities. Remote monitoring could decrease patient anxiety by providing reassurance to patients that their condition is being monitored regularly by their clinical care team. Remote monitoring could reduce the number of face-to-face appointments, and the potential stress and travel costs associated with these appointments. It could

improve access to specialist heart failure care for people living in geographically remote areas.

Remote monitoring aims to detect an increase in pulmonary artery pressure associated with worsening heart failure. The increase in pulmonary artery pressure indicates that fluid is beginning to accumulate, and this can be detected before the patient notices a change in symptoms. This enables intervention with a change of medication to address the fluid accumulation at an early stage, potentially reducing hospital admissions for heart failure and improving outcomes and quality of life.

The patient undergoes a procedure to implant the sensor into the pulmonary artery, as outlined in NICE guidance on percutaneous implantation of pulmonary artery pressure sensors for monitoring treatment of chronic heart failure. Once the sensor has been implanted and calibrated, patients use a system at home to initiate measurements. Patients are required to either lie down in a specific position or sit up in a chair and use a handheld control to initiate the measurement. Measurements must be initiated daily (or most days) to provide complete trend data. Patients must be willing and able to fit this into their routine. Patients must also be willing and able to comply with requests to visit the clinic and make changes to their medication to benefit from PAP monitoring.

Heart failure patients who meet the criteria for CIEDs may be able to benefit from algorithm-based remote monitoring, which is incorporated into their device, as outlined in NICE guidance on heart failure algorithms for remote monitoring in people with cardiac implantable electronic devices. Heart failure patients who do not meet the criteria for CIEDs are unable to access algorithm-based remote monitoring. PAP monitoring could address an unmet need for heart failure patients who do not have CIEDs and could benefit from remote monitoring. Having a CIED implanted does not preclude a person from having a PAP monitoring device.

4 Comparator

The comparator is usual care for monitoring chronic heart failure, as outlined in 3.2.

5 Scope of the assessment

Table 1: Scope of the assessment

Decision question	Does remote pulmonary artery pressure monitoring for chronic heart failure represent a clinically and cost-effective use of NHS resources?
Populations	Adults who have chronic heart failure of any cause with NYHA class III symptoms at the time of assessment who are at high risk of hospital admission for their heart failure. If evidence allows, the following subgroups may be considered: • People with renal impairment - eGFR 30 - 60 mL/min/1.73m^2 - eGFR < 30 mL/min/1.73m^2 • Baseline pulmonary artery pressure (at time of sensor implantation) • Age - <75 years - 75 years and over
Intervention	Pulmonary artery pressure systems for remote monitoring of chronic heart failure • CardioMEMs HF System (Abbott) • Cordella Pulmonary Artery Sensor System and Cordella Heart failure System (Endotronix/Edwards)
Other alternative interventions	• None identified
Comparator	Usual care for monitoring of heart failure (see 3.2)
Healthcare setting	Pulmonary artery monitoring devices are used at home. The readings are sent remotely to a database which can be accessed by the patient's care team, usually based at a hospital.
Outcomes: clinical	Clinical outcomes for consideration may include: • Hospitalisation for heart failure • Urgent care for heart failure (hospital attendance for i.v. diuretics) • Worsening of heart failure (e.g., decompensation, change of NYHA symptom class) • Changes to clinical management (including medication changes) • Mortality due to heart failure

	• All-cause mortality • Failure of sensor implantation or sensor • Adverse events ○ Complications associated with sensor implantation (including hospitalisation, complications associated with vascular procedures, infection, complications associated with anticoagulant/dual antiplatelet therapy post-implantation) • Improvement in co-morbidities • Functional capacity (for example, 6 minute walk test, incremental shuttle walking test) • Patients lost to follow-up
Outcomes: patient-reported	Patient-reported outcomes for consideration may include: • Health-related quality of life • Adherence to using the technology • Adherence to treatment (adherence to adjusted medication triggered by changes in PAP trend data, adherence to usual heart failure medication) • Qualitative data on patient experience of using the technology
Outcomes: costs	Costs will be considered from an NHS and Personal Social Services perspective. Costs for consideration may include: • Cost of procedure to implant the sensor, including the catheter, sensor and staff time • Cost of system, including the patient system and hospital system and software • Downstream costs associated with use of the technology
Measuring cost-effectiveness	The cost-effectiveness of interventions should be expressed in terms of incremental cost per quality-adjusted life year.
Time horizon	The time horizon for estimating clinical and cost effectiveness should be sufficiently long to reflect any differences in costs or outcomes between the technologies being compared. Outcomes will be assessed at 6 months, 1, 2 and 5 years

6 Other issues for consideration

6.1 Sustainability

Use of remote monitoring systems could reduce the number of unnecessary hospital appointments, reducing travel for people with heart failure and reducing carbon emissions.

The implanted sensor is designed to remain in use for a lifetime. The catheter used to insert the sensor is disposable. The equipment used by the patient at home needs to be disposed of in accordance with regional regulations for disposal of electronic waste.

6.2 Emerging technologies for remote monitoring of heart failure

6.2.1 NORM System

The NORM system (FIRE1) comprises an implantable sensor, an externally worn belt and an app/web portal. The sensor is implanted into the inferior vena cava (IVC) and works by continuously measuring the cross-sectional areas of the IVC. The patient wears a belt for a few minutes each day. The belt activates the sensor and records expansions and contractions of the IVC, which corresponds to the amount of fluid in the body. The wireless belt sends the sensor data to the cloud. The NORM System's algorithms process the data to generate information on the patients IVC. These algorithms monitor the patient's condition and identify when the care team need to get involved. Information is accessible via clinician and patient apps. NORM is outside of the scope for this guidance, as it does not measure pulmonary artery pressure.

6.3 Ongoing studies

6.3.1 CardioMEMs HF System

The PASSPORT-HF study is an ongoing open-label, prospective, RCT across 50 centres in Germany. 554 patients with chronic heart failure, predominantly in NYHA class III within the last 30 days and hospitalised for heart failure at least once in the 12 months prior to enrolment irrespective of the ejection fraction. Patients are on stable guideline-directed pharmacotherapy and are randomised to receive the CardioMEMs sensor or control group. The expected completion date is December 31, 2026.

TEAM-HF is an international study across 75 sites that comprises an RCT and a single-arm registry 850 patients with chronic heart failure, NYHA IIIB/IV who had prior HF hospitalisation and an elevated mean PAP secondary to left ventricular failure are followed 2 to 5 years. The RCT aims to determine: a) if HeartMate 3, the left ventricular assist device (LVAD) can demonstrate an improvement in survival compared to GDMT in patients who have elevated ambulatory PAP and are not dependent on intravenous inotrope medication; b) to establish disease-state criteria to trigger referral for a HeartMate 3.

Patients who do not meet the PAP threshold for the RCT are entered into a single arm registry. The objective is to follow patients with lower mean PAP to evaluate how their HF progresses and if a delayed HeartMate 3 implantation would benefit these patients.

The CardioMEMS HF System is used to measure ambulatory PAP in patients participating in the trial. The expected completion date is September 2032.

6.3.2. Cordella Pulmonary Artery Sensor System and Cordella Heart Failure System

The PROACTIVE-HF trial is designed to assess the benefit of personalised and proactive management of patients with class III heart failure guided by daily measurement of pulmonary artery pressures in combination with weight, blood pressure heart rate, blood oxygen saturation and symptoms. PROACTIVE-HF was originally designed as a single-blind RCT. Patients with heart failure (NHYA class III) and at high risk of congestion (previous hospitalisation for heart failure or elevated NTproBNP) were entered into the trial. All patients received the Cordella pulmonary artery sensor and were randomised to intervention or control groups. PAP readings were visible to clinicians in the intervention group and were not visible to clinicians in the control group. In December 2021, the trial design was changed to a single arm unblinded trial in consultation with the FDA. The expected completion date is September 2029.

At the scoping workshop, the company highlighted another ongoing study, PROACTIVE-HF 2. PROACTIVE-HF 2 is an ongoing open label prospective RCT

across 100 centres in the USA, UK and Europe, designed to assess the safety and effectiveness of the Cordella PA Sensor System in patients with NYHA Class II and III heart failure.

6.3.3 Right-sided heart failure

Clinical experts advised that pulmonary artery pressure monitoring devices are also used for monitoring right-sided heart failure (including pulmonary hypertension and genetic conditions). Assessment of pulmonary artery monitoring devices for monitoring right-sided heart failure is out of scope for this guidance, as this is an emerging area of practice and trial data are not yet available.

7 Potential equality issues

NICE is committed to promoting equality of opportunity, eliminating unlawful discrimination and fostering good relations between people with protected characteristics and others.

The risk of heart failure is related to older age and family history. Both the incidence and prevalence of heart failure increases steeply with age, and the average age at diagnosis is 77 (NICE 2018). Heart failure with reduced ejection fraction is more common in men, due to the link with increased coronary artery disease in men, whereas heart failure with preserved ejection fraction is more common in women. People with heart failure may be covered by the Equality Act 2010 under disability if their condition has a substantial and adverse effect on ability to carry out normal day-to-day activities and lasts at least 12 months. Many people with heart failure are older and have multiple co-morbidities.

People with cognitive impairment, problems with manual dexterity, and learning disabilities may need additional support to use the technology at home.

The devices are pre-programmed with a number of languages. If the required language is not pre-programmed, it would need to be added to the device.

No potential equality issues were identified in relation to pregnancy, ethnicity, religion, sexual orientation and gender reassignment.

8 Potential implementation issues

Potential enablers and barriers to implementation include:

8.1 Training and staffing

Training and appropriate staffing is required to facilitate sensor implantation and PAP monitoring. Patients and/or their carers will need training on how to initiate the measurement. Training on PAP trends and escalation processes should be provided to the healthcare professional who access patient PAP data. A clinical expert mentioned that heart failure specialist nurses are well placed to access and monitor the data, as a heart failure specialist nurse would be able to read and interpret PAP trend data and prescribe medications if required.

8.2 Costs

Costs may differ between technologies. Beyond the cost of the sensor implant, healthcare professionals are needed for ongoing monitoring and management. Therefore, the cost of the staffing models would form a key part of the cost.

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Appendix A Glossary of terms

Acidaemia

Abnormal acidity of the blood

Ambulatory monitoring

Ambulatory monitoring devices can be used by the patient at home or as an outpatient, without the need to be in a clinic or hospital setting.

BNP (B-type Natriuretic Peptide)

A hormone released by the heart when the ventricles are stretched. Levels of BNP in the blood increase when heart failure develops or worsens and decrease when the condition is stable. It is an important clinical marker for the diagnosis of heart failure in patients with unexplained shortness of breath.

Cardiac implantable electronic devices

Cardiac implantable electronic devices (CIEDs) are used to manage slow and fast heart rates, and in the treatment of selected patients with heart failure. CIEDs are usually implanted under the skin, with 1 to 3 leads threaded down a vein to connect to the heart. Types of CIED include permanent pacemakers, implantable cardioverter defibrillators (ICDs), and cardiac resynchronisation therapy (CRT) devices.

Cardiac resynchronisation therapy

Cardiac resynchronisation therapy (CRT) is a treatment used to help the heart pump more effectively. It is recommended for some patients with poor ventricular function (when the heart is not pumping as well as it should). A CRT pacemaker (CRT-P) is used to treat heart failure when the two sides of the heart lose their coordination and become less efficient at pumping blood around the body. A CRT defibrillator (CRT-D) does the same as a CRT-P but has additional defibrillation therapy to correct abnormal heart rhythms.

Cardiomyopathy

A general term for disease of the heart muscle, where the walls of the heart chambers have become stretched, thickened or stiff, affecting the heart's ability to pump blood around the body.

Dyspnoea

Shortness of breath.

Echocardiogram

An ultrasound scan of the heart which visualises the structure and function of the heart and surrounding blood vessels.

Electrocardiogram

A test that records the rhythm, rate and electrical activity of the heart.

Femoral

Femoral refers to the thigh. The femoral vein is a deep vein located in the thigh.

Haemodynamic

Relating to the flow of blood through arteries and veins and the forces that affect blood flow.

Heart failure decompensation

A rapid worsening of symptoms and/or signs of heart failure that warrants immediate medical intervention. It typically includes difficulty breathing (dyspnoea), leg or feet swelling, and fatigue.

Implantable cardioverter defibrillator

An implantable cardioverter defibrillator (ICD) is a device implanted in the chest to detect and control irregular heart rhythms by sending electric shocks to the heart.

Left bundle branch block

A heart block occurs when electrical signals in the heart are blocked or delayed. A left bundle branch block (LBBB) occurs when signals to the left ventricle get blocked or delayed.

Left ventricular assist device

A left ventricular assist devices (LVAD) is a device which acts like an artificial heart pump. It is used to treat severe heart failure, with the aim of restoring blood flow around the body. LVADs may be given to people waiting for a heart transplant.

Myocarditis

Inflammation of the heart muscle, usually caused by a viral infection.

Natriuretic peptide

Proteins made by the heart and blood vessels (see brain natriuretic peptide and N-terminal pro b-type natriuretic peptide)

NT pro-BNP (N-terminal pro-B-type Natriuretic Peptide)

A non-active prohormone that is released from the same molecule that produces BNP. NT pro-BNP levels in the blood also rise with heart failure.

NYHA class

The New York Heart Association (NYHA) classification is system which classifies the severity of heart failure based on symptoms.

Oedema

A build-up of fluid in the ankles, feet and legs that causes swelling.

Pacemaker

A pacemaker sends electrical pulses to the heart to control the pace at which it beats. It consists of a pulse generator, which has a battery and a tiny computer circuit, and 1 or more wires known as pacing leads, which attach to the heart.

Percutaneous

A percutaneous procedure is a procedure where access to the target tissue is achieved via needle puncture of the skin. Percutaneous access is commonly used in vascular procedures, including implantation of devices.

Pulmonary artery

The blood vessel that carries blood from the right ventricle of the heart to the lungs

QRS

The QRS complex is part of an electrocardiogram (ECG) measurement. It represents depolarisation of the ventricles.

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