

Predicting and preventing heart failure

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ABSTRACT

Current guidelines for the treatment of heart failure do not focus on its prevention despite the steady global rise in prevalence. A new framework is needed to help clinicians routinely and efficiently identify patients at high risk of heart failure based on family history and risk factors, including obesity, hypertension, and diabetes mellitus. At present, guidelines recommend lifestyle changes, healthy diet, physical activity, antihypertensive treatment, cholesterol-lowering agents, and sodium-glucose co-transporter two inhibitor treatment to address risk factors for heart failure. However, in recent years, outcomes for patients with a diagnosis of heart failure have stagnated, highlighting the need for earlier implementation of better prevention strategies. Updated guidelines must include a roadmap that specifies who should intervene and at what point in the care cycle, to give patients the best possible chance at avoiding or delaying heart failure. A combination of public awareness campaigns, education for healthcare professionals, and improved screening methods is needed to aid the prediction and, crucially, prevention of heart failure.

BACKGROUND

Considering official guidance for the prevention of heart failure

Clinicians in both primary and secondary care rely on guidance from medical bodies to summarise the evidence-base for use alongside clinical judgement in providing optimal care to their patients. Unfortunately, guidelines may have a limited remit and can sometimes overlook essential components of care. For heart failure, these oversights include strategies to predict and prevent disease. Consultation of the National Institute for Health and Care Excellence (NICE) in England and Wales, American College of Cardiology (ACC)/American Heart Association (AHA), and European Society of Cardiology (ESC) guidelines for the management of heart failure reveals a lack of guidance on predicting and preventing the condition.¹⁻³ The NICE guidelines make no mention of prevention in their key recommendations. The ACC/AHA guidelines discuss the importance of prevention in their classification system for heart failure but provide limited detail on preventative strategies. The ACC/AHA and ESC guidelines also discuss 'prevention,' but in the broader sense of prevention of hospitalisation or sudden cardiac death in those with an existing diagnosis. Indeed, the ESC guidelines specify that their remit was primarily to focus on diagnosis and treatment, and that prevention of heart

failure is best achieved by preventing cardiovascular diseases – including systemic hypertension, diabetes mellitus, coronary artery disease, myocardial infarction, and atrial fibrillation – as covered in their other guidelines.³ However, the stance that preventing heart failure is under someone else's remit or addressed by other guidelines can make it difficult for clinicians to know how and when to intervene.

Considering existing prevention strategies

The ESC guidelines provide some limited guidance on treatments for cardiovascular diseases associated with heart failure with the aim of preventing its onset.³ These include physical activity and changes in diet to treat obesity, lifestyle changes and antihypertensive therapy for hypertension, and physical activity, healthy diet, and sodium-glucose cotransporter 2 (SGLT2) inhibitor treatment for type two diabetes.³ Counselling around healthy lifestyle is also recommended.³

While a patient may benefit from intervention to address a single disease, the approach may neglect to consider the combination of risk factors associated with heart failure. The lack of specific guidance on prevention is likely to result in piecemeal treatment of individual risk factors rather than a focused strategy initiated before disease onset with the sole aim of prevention.

Considering outcomes for people with heart failure

The steadily increasing global burden of heart failure suggests that efforts to prevent it are either not robustly applied or simply insufficient.⁴ A diagnosis of heart failure is associated with a poor outcome, with an overall mortality rate around 50% at 5 years.⁵ A recent analysis of trends in survival after a heart failure diagnosis indicated that survival outcomes have scarcely improved for patients in the last two decades.⁶ These findings highlight the urgency of supplementing current approaches in order to predict and prevent heart failure.

METHODS

Leading clinicians with expertise in the management of heart failure gathered to discuss current guidance and practice for predicting and preventing disease. We focused on the limitations of the current strategies in guidelines for preventing heart failure with the aim of identifying areas for improvement. To guide our discussion, we considered the case of a fictional patient with heart failure – Mrs Jennifer Logan – and explored the potential opportunities for prevention in the years before her diagnosis (cf. [Box 1](#)).

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Case study 1

Mrs Jennifer Logan, 10 years prior to ambulance call

- ▶ Headaches and tiredness. Visits GP.
- ▶ Non-smoker
- ▶ BMI 33kg/m²
- ▶ BP 174/100 mmHg
- ▶ HbA1c 6.8% (=51mmol/mol)

What would the experts recommend?

- ▶ Lifestyle changes, increased physical activity or referral to a weight management programme
- ▶ Treatment for hypertension and DM (SGLT2 inhibitors)
- ▶ Cholesterol management (based on QRisk)
- ▶ Earlier NT-proBNP testing

DISCUSSION

Ten years prior to her ambulance call, Mrs Logan had several risk factors for developing heart failure. Her high body mass index (BMI), raised blood pressure, and elevated haemoglobin A1c put her in the categories of having obesity, hypertension, and diabetes mellitus, respectively. The ESC guidelines would recommend a variety of interventions for her, including lifestyle changes, healthy diet, physical activity, antihypertensive treatment, cholesterol-lowering therapy, and an SGLT2 inhibitor.³

Considering known risk factors for heart failure Epidemiological studies that identified risk factors

There is ample epidemiological evidence that the individual cardiovascular issues associated with our case study – obesity, hypertension, and diabetes mellitus – are risk factors for the development of heart failure. Globally, there is an obesity epidemic due to poor diet and sedentary lifestyles.⁷⁻⁹ There is a phenomenon, called the ‘obesity paradox,’ whereby people with established heart failure have better survival if they are overweight or moderately obese.^{7 10 11} However, prevention is better than cure, and studies have found that patients with a BMI greater than 30 kg/m² are more likely to develop heart failure than those with a healthy body weight.⁸ The Physicians’ Health Study found for every 1kg/m² increase in BMI, the risk of heart failure increased by 11%.⁹ Importantly, this risk factor appears to be amenable to intervention. One of the key recommendations for modifying obesity-associated risk in the ESC guidelines, physical activity, reduced the cumulative risk of heart failure for patients categorised as obese by 18%.⁹

The development of diabetes mellitus is linked to obesity and has also seen a large rise in prevalence. Impaired insulin signalling is associated with cardiac hypertrophy, stiffness, and fibrosis.¹² A meta-analysis revealed that patients with diabetes mellitus are twice as likely to experience new-onset heart failure as those without, with similar incidence rates for both heart failure with preserved ejection fraction and heart failure with reduced ejection fraction.¹³

As patients often present with multiple comorbidities, it is essential to also consider the effects of a combination of factors. A recent analysis pooled data from the Framingham Heart, Framingham Offspring, Chicago Heart Association Detection Project in Industry, and Atherosclerosis Risk In Communities (ARIC) studies to examine the effects of having multiple heart failure risk factors, including hypertension, obesity, and diabetes, over time.⁸ The results revealed that having any given risk factor at age 45 increased the risk of developing heart failure, but having all three risk factors resulted in a dramatic increase in risk. For example, an individual like Jennifer Logan (cf. Box 1) would have been 85% less likely to develop heart failure if she had no risk factors 10 years prior to her diagnosis. Furthermore, the study found that individuals with the single risk factor of diabetes were diagnosed with heart failure on average 10 years earlier than individuals with no risk factors.

As hypertension, diabetes, and obesity are strong indicators of heart failure risk, they should represent warning signs and signal an opportunity for prevention. However, it is not always clear who is responsible for intervening, at which point in the care cycle, or with which treatments.

Considering evidence for the efficacy and feasibility of prevention or early detection

Natriuretic peptides are raised when the heart is under strain and can be early indicators of cardiac dysfunction. There has been an increase in natriuretic peptide testing for patients presenting with heart failure symptoms as part of the diagnostic pathway.¹⁴ The ACC/AHA guidance suggests natriuretic peptides can also be used to detect early-stage heart failure and prevent progression to symptomatic disease, but there is limited evidence and guidance on when to test and how to follow-up on the results.² Further research is needed, for instance, to determine if natriuretic peptide levels should be tested early on in primary care or after referral to a specialist and only after cholesterol, blood pressure, diabetes, and other risk factors have been treated and controlled. Clinical prediction models may also aid detection and prevention of disease but although many have been developed for incident heart failure, few have been external validation or assessed for clinical use.¹⁵ Unfortunately, there remains a lack of evidence to guide a course of treatment for patients at risk of heart failure, especially if their natriuretic peptide levels are normal. However, the STOP-HF trial attempted to provide some answers.

Stop-HF trial

The STOP-HF (St Vincent’s Trial to Prevent Heart Failure) randomised trial, conducted in 39 primary care centres in Ireland, investigated an approach to prevent disease in patients at risk of left ventricular systolic dysfunction or heart failure.¹⁶ Individuals with cardiovascular risk factors, including diabetes, were identified by screening medical records, and randomised to either B-type natriuretic peptide (BNP) screening or usual care. Patients with an elevated BNP level (>50 pg/mL) were assessed by echocardiogram and received cardiology input, including risk factor management and healthy lifestyle coaching by a specialist nurse. This intensive intervention resulted in fewer cases of left ventricular systolic dysfunction with or without heart failure, although the overall incidence of heart failure was low. Despite generally positive results, and subsequent incorporation into the ACC/AHA guidelines,² the trial garnered guarded enthusiasm due to questions around its scalability. The resources required for a similar level of intervention on a national scale would likely be prohibitive. However, these data are helpful to inform the drafting of new, more proactive guidelines for heart failure prevention.

Prevention or early detection?

While the STOP-HF trial aimed to prevent heart failure, and many patients that developed left ventricular systolic dysfunction may not have reported experiencing symptoms, their BNP levels suggest the study may have actually investigated a protocol for early detection and intervention. Although the full array of heart failure signs and symptoms may not manifest until later in the disease course, the elevated BNP levels indicate that the pathological process may have already begun. To achieve optimal patient outcomes we need to pursue true prevention, which will require a stronger evidence-base for interventions that are effective and implementable, along with education and resources across primary and secondary care.

Considering the outcomes of current approaches to managing heart failure

The human cost of the systemic failings related to predicting and preventing heart failure is clear in the finding that survival rates have scarcely improved in the last 20 years.⁶ The 10-year follow-up to the Marmot report draws a stark picture of overall health outcomes in England, finding that health inequalities are growing and life expectancy has stopped improving

generally.¹⁷ Together, these findings highlight the danger of complacency and the failure to push for new and better approaches to managing healthcare.

If we consider the case of Mrs Jennifer Logan (cf. **Box 1**), the epidemiological studies suggest that intervention 10 years prior to her diagnosis could have given her more disease-free years.^{8,9} As well as clear benefits in the short term to living without a heart failure diagnosis, if Mrs Logan still went on to develop heart failure, she would then be older with a more complicated treatment outlook at the time of disease onset. However, it is possible that even earlier preventative efforts would have been needed for her to completely avoid a heart failure diagnosis. We need a comprehensive approach that starts earlier in life if we aim to relieve the burden of heart failure. We must also be prepared to manage care for increasingly older patients if we merely manage to delay, rather than prevent, heart failure.

Considering new approaches to improve prevention and early detection

Despite the inadequacies of the current approaches to predicting and preventing heart failure, there have been some areas of progress in England that may provide starting points for further improvement. For example, cardiac networks have been reinstated, and routine National Health Service checks successfully diagnose many patients with cardiovascular risk factors amenable to treatment. However, there is a need to go further with greater public awareness, education for healthcare professionals, and potentially additional screening to predict and prevent the development of heart failure.

To adopt a successful approach to heart failure prevention, it is necessary to consider all determinants that affect risk. If we borrow from an analysis of the factors that affect the development of ischaemic heart disease, we see that a hierarchy of causes must be addressed.¹⁸ Social factors and poverty are strong determinants of ill health, as is a lack of public awareness. To address these issues requires government investment in social programmes and public education. The effort to improve general health and truly avoid the risk factors associated with heart failure, rather than simply treating or delaying the worst effects, must begin at primary-school age rather than in middle age.

On the clinical front, there are shortcomings in evidence-guided methods which are based on the identification and management of risk factors and early disease. We must move toward mechanism-based strategies to prevent and treat disease rather than simply treating individual symptoms without deeper investigation into the cause. Enhanced family histories and genetic screening could aid in predicting which patients have a predisposition to developing heart failure and facilitate early intervention. Many patients with hypertension or diabetes, key risk factors for heart failure, are not adequately managed currently. Simply taking a more proactive approach to treating these diseases would reduce the risk of developing heart failure or delay its onset.

Treatments which can delay heart failure in high-risk individuals are also worthy of consideration and require further research. The PONTIAC study found that people with diabetes at high risk of heart failure and treated with renin-angiotensin system antagonists and beta blockers were less likely to experience a cardiac event.¹⁹ The HOMAGE study also suggested that mineralocorticoid receptor antagonism could disrupt the pathological process leading to heart failure in high-risk individuals,²⁰ but further trials are needed. There is also a lack of evidence to guide detection and management of early-stage heart failure, such as asymptomatic left ventricular systolic dysfunction, beyond the control of current risk factors. Existing heart failure therapies may be beneficial but when and what drug to initiate currently remains unclear.

Finally, improving the prevention of heart failure will require a top-down approach. Guidelines for the treatment of heart failure should include actionable suggestions for predicting and preventing its onset. We also need consistent messaging and funding from healthcare providers around prediction and prevention. Public Health England has published guidance

Key points

- ▶ Updated guidelines that directly address prevention of heart failure are needed.
- ▶ True prevention must start early and involve public education and risk factor management at the societal level.
- ▶ Clinicians should consider the confluence of risk factors and family history when managing patients at high risk of heart failure.

on preventing the development of cardiovascular disease, including ambitions for identifying and treating individuals with atrial fibrillation, high blood pressure, and high cholesterol.²¹ This so-called 'ABC plan, for everyone to routinely be aware of atrial fibrillation, blood pressure, and cholesterol, should be widely publicised and applied.²² These goals should positively affect heart failure rates, and the campaign exemplifies the kind of messaging that needs to be prominent in the public sphere.

SUMMARY

Our current approaches to managing heart failure rely primarily on detection and treatment rather than prevention, which has led to stagnant outcomes for patients. Despite epidemiological data indicating that having one or more risk factors for heart failure dramatically increases the likelihood of developing it, many patients are not adequately managed and do not receive intervention prior to diagnosis. This represents a key missed opportunity in the care cycle. For instance, some signs that are observed in obese patients and associated with risk of heart failure, such as left ventricular hypertrophy, may be reversible with changes in physical activity. However, clear guidelines are needed to indicate the appropriate time for intervention and a strategy to prevent heart failure.

The individual in our case study, Mrs Jennifer Logan, eventually experienced an acute event although she presented 10 years prior to her ambulance call with risk factors that warranted intervention, which could have prevented disease or extended her disease-free years. However, to truly prevent heart failure, it is likely that intervention would need to start much earlier than middle age. We need government and health organisation-led initiatives to increase awareness of heart failure among the public starting as early as primary school. We also need better evidence-guided approaches and clearer points for intervention in the healthcare system. If we persist with leaving the work of predicting and preventing disease to someone else, we will continue to perpetuate poor outcomes for patients.

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