

AI-Enabled ECG Detection of Diastolic Dysfunction: A Screening Approach for Early Heart Failure with Preserved Ejection Fraction

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SUMMARY OF KEY RESEARCH FINDINGS

Left ventricular diastolic dysfunction (LVDD) is a key pathophysiological feature of heart failure with preserved ejection fraction (HFpEF). Its assessment relies primarily on echocardiography incorporating multiple Doppler and structural parameters, limiting the feasibility of widespread screening.¹ AI-enabled electrocardiography (AI-ECG) offers an opportunity to extract additional cardiovascular information from a simple and widely available test. Recent studies have demonstrated the potential of AI-ECG for identifying HFpEF and LVDD, although evidence regarding its clinical implementation remains limited.^{2,3}

This study presented at the European Society of Cardiology (ESC) Congress 2026 investigated whether a deep-learning model applied to standard 12-lead ECGs could identify guideline-defined LVDD.⁴ The retrospective analysis included 46,564 paired ECG and echocardiographic examinations from 21,385 patients at a

tertiary academic centre. LVDD was defined according to the 2016 American Society of Echocardiography (ASE) and European Association of Cardiovascular Imaging (EACVI) recommendations.¹

The model demonstrated strong discrimination, with an area under the receiver operating characteristic curve of 0.913 in the independent test cohort. Sensitivity and specificity were 83.8% and 82.5%, respectively, while the negative predictive value reached 96.6%. These findings suggest that AI-ECG may have particular value as a screening or rule-out tool for LVDD.

WHAT CHALLENGE DOES THIS ADDRESS?

HFpEF remains difficult to recognise early, because symptoms are often non-specific and its diagnosis requires integration of clinical findings, biomarkers, and cardiac imaging. Diastolic abnormalities may already be present before symptomatic heart failure develops, creating an opportunity for earlier recognition.

Echocardiography remains central to the assessment of diastolic function, while AI-ECG may serve as a complementary screening approach.¹ However, universal echocardiographic screening is neither practical nor resource-efficient. By contrast, the 12-lead ECG is inexpensive, non-invasive, and routinely performed across a broad range of healthcare settings.

AI-ECG could therefore provide an opportunistic screening tool, identifying patients in whom confirmatory echocardiography and further clinical assessment may be particularly warranted. Importantly, this represents a triage strategy rather than an alternative diagnostic pathway. This interpretation is consistent with recent evidence suggesting

that AI-ECG may be particularly suitable for rule-out or risk-enrichment strategies, while evidence remains insufficient for its use as a standalone diagnostic test.³

RELEVANCE TO EUROPEAN PRACTICE

The recently published 2026 ESC Guidelines for the management of heart failure place increased emphasis on prevention, early recognition, and timely intervention.⁵ Against this background, scalable approaches that identify diastolic dysfunction before overt heart failure may become increasingly relevant to clinical practice.

An AI algorithm incorporated into routinely acquired ECGs could potentially operate without requiring an additional diagnostic examination. ECGs obtained in primary care, outpatient clinics, emergency departments, or during routine cardiovascular assessment could be automatically analysed, with individuals at higher probability of LVDD prioritised for echocardiography.

Such an approach may be particularly valuable where access to specialised cardiovascular imaging is limited or waiting times are prolonged. AI-ECG should, however, be regarded as complementary to echocardiography and established HFpEF diagnostic pathways rather than as a standalone diagnostic test.

WHAT ARE THE NEXT STEPS FOR THE RESEARCH?

Several questions need to be addressed before clinical implementation. Validation across independent healthcare systems and more diverse populations is essential, followed by prospective evaluation in real-world clinical workflows. Recent systematic

evidence has similarly highlighted substantial heterogeneity among existing AI-ECG studies and the need for further validation before routine clinical implementation.³

The ESC presentation also demonstrated that performance was broadly preserved across sex and left ventricular ejection fraction categories, although discrimination was lower in older patients and those with atrial fibrillation. These findings highlight populations in which further evaluation and model refinement may be particularly important.

Ultimately, the key question is not simply whether AI can detect LVDD from an ECG, but whether its incorporation into clinical care can improve patient selection for echocardiography, facilitate earlier recognition of patients at risk of HFpEF, and lead to meaningful improvements in clinical outcomes.

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