Heart failure (HF) with preserved ejection fraction (HFpEF) is a complex pathophysiological entity. Echocardiographic parameters offer a key tool for the diagnosis of the syndrome, as indicated in the new ESC guidelines¹. HFpEF is defined as typical heart failure symptoms and signs with normal or preserved left ventricular ejection fraction (LVEF) and normal or small left ventricular (LV) volumes, structural heart disease (LV hypertrophy/left atrial (LA) enlargement), and evidence of diastolic dysfunction (abnormal E/e’ ratio (averaged ≥13) and abnormal e’<9 cm/s). Few papers have proposed exercise echocardiography as a relevant diagnostic tool in HFpEF. Importantly, Erdei et al. published an important paper highlighting the fact that diastolic exercise stress test should be performed with the aim of estimating filling pressure and systolic-diastolic reserve when exercising²:  
- Complete echocardiography at rest  
- Complete echocardiography at 100-120 beats/min (submaximal exercise stress echocardiography)

Echocardiography at the peak of exercise for excluding ischemic heart disease that could explain the clinical situation.

The relevance of echocardiographic parameters that could be recorded during exercise remains an issue especially in this complex HFpEF syndrome³. A strong correlation between E/e’ and physical activity has been demonstrated in many patients, including patients with HFpEF. E/e’ has been compared to an invasive hemodynamic measurement during exercise and the correlation was demonstrated acceptable. However, in the case of echocardiography, a multi-parametric approach instead of a single parameter approach should be used⁴. Therefore, looking only for a change in E/e’ is clearly insufficient⁵,⁶.

E/e’ and the estimated PAP by TR maximal velocity should be measured during standardized stress test. Stroke volume and its change during exercise should be also assessed⁷. In fact, unlike in normal compliant heart, there is no increase in left ventricular end-diastolic volume during exercise and consequently no increase in cardiac output in heart failure with preserved ejection fraction. The absence of increased cardiac output during exercise is, like E/e’ and estimated pulmonary artery pressure, a major parameter to be investigated during submaximal exercise performed to confirm the diagnosis of heart failure with preserved ejection fraction as an etiology of dyspnea.
in LV end-diastolic volume during exercise and then no increase in cardiac output in HFpEF. The absence of increased cardiac output during exercise is, like E/e’ and estimated sPAP, a major parameter to be investigated during submaximal exercise performed to confirm the diagnosis of HFpEF as an etiology of dyspnea(8) (Fig. 1).

The prognostic value of these parameters has also been demonstrated. The goal now is to use the existing tests and to improve the diagnosis, thereby improving the prognosis of HFpEF. Exercise training might be a way as it should decrease LV afterload.

To conclude, diastolic stress test is a submaximal exercise stress test. It is useful for diagnosing and for estimating the prognosis of HFpEF patients. A lot remains to be done for improving the quality of life and survival of these patients(9).

Note: the European Association for Cardio-Vascular imaging (EACVI) is strongly involved in the education in the field of echocardiography and other cardio-vascular imaging modalities. In addition to its educational goals, research is promoted and the recent Eurofiling study has been accepted for publication in the European Heart Journal-Cardiovascular Imaging Journal(10). It was conducted in 10 EACVI echocardiographic laboratories and it demonstrated that E/e’ is not always the perfect tool to trust in. The estimation of filling pressure has to be multiparametric.

**Conflict of interest**

The author does not report any financial or personal connections with other persons or organizations, which might negatively affect the contents of this publication and/or claim authorship rights to this publication.

**References**

1. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JG, Coats AJ et al.: 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC) Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. Eur Heart J 2016; 37: 2129–2200.

2. Erdei T, Smiseth OA, Marino P, Fraser AG: A systematic review of diastolic stress tests in heart failure with preserved ejection fraction, with proposals from the EU-FP7 MEDIA study group. Eur J Heart Fail 2014; 16: 1345–1361.

3. Erdei T, Aakhus S, Marino P, Paulus WJ, Smiseth OA, Fraser AG: Pathophysiological rationale and diagnostic targets for diastolic stress testing. Heart 2015; 101: 1355–1360.

4. Nagueh SF, Smiseth OA, Appleton CP, Byrd BF 3rd, Dokainish H, Edvardsen T et al.: Recommendations for the evaluation of left ventricular diastolic function by echocardiography: An update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. Eur Heart J Cardiovasc Imaging 2016; 17: 1321–1360.

5. Donal E, Thebault C, Lund LH, Kervio G, Reynaud A, Simon T et al.: Heart failure with a preserved ejection fraction additive value of an exercise stress echocardiography. Eur Heart J Cardiovasc Imaging 2012; 13: 656–665.

6. Donal E, Lund LH, Oger E, Bosseaux C, Reynaud A, Hage C et al.: KaRen Investigators: Importance of combined left atrial size and estimated pulmonary pressure for clinical outcome in patients presenting with heart failure with preserved ejection fraction. Eur Heart J Cardiovasc Imaging 2017; 18: 629–635.

7. Obokata M, Kane GC, Reddy VN, Olson TP, Melenovsky V, Borlaug BA: Role of diastolic stress testing in the evaluation for heart failure with preserved ejection fraction: A simultaneous invasive-echocardiographic study. Circulation 2017; 135: 825–838.

8. Burgess MI, Jenkins C, Sharman JE, Marwick TH: Diastolic stress echocardiography: hemodynamic validation and clinical significance of estimation of ventricular filling pressure with exercise. J Am Coll Cardiol 2006; 47: 1891–1900.

9. Smart N, Haluska B, Jeffriess L, Marwick TH: Exercise training in systolic and diastolic dysfunction: effects on cardiac function, functional capacity, and quality of life. Am Heart J 2007; 153: 530–536.

10. Galdersi M, Lancellotti P, Donal E, Cardim N, Edvardsen T, Habib G et al.: European multicentre validation study of the accuracy of E/e’ ratio in estimating invasive left ventricular filling pressure: EURO-FILLING study. Eur Heart J Cardiovasc Imaging 2014; 15: 810–816.