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EARLY DIAGNOSIS OF HEART FAILURE: CLINICAL SIGNIFICANCE OF MODERN BIOMARKERS AND INSTRUMENTAL INVESTIGATIONS

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ABSTRACT: Heart failure (HF) is a common cardiovascular syndrome associated with structural or functional abnormalities of the heart. Early diagnosis is important because initial symptoms may be nonspecific. Modern diagnosis combines clinical assessment, biomarkers, and instrumental investigations. BNP and NT-proBNP are widely used to support or exclude HF, while electrocardiography (ECG), echocardiography, chest radiography, and cardiac magnetic resonance imaging (CMR) provide information about cardiac structure and function. This article examines the clinical significance of these diagnostic methods and emphasizes the importance of their combined use in the early detection of HF.
Keywords: heart failure, early diagnosis, biomarkers, BNP, NT-proBNP, troponin, echocardiography, ECG, cardiac MRI.

INTRODUCTION

Heart failure is a clinical syndrome resulting from structural or functional cardiac abnormalities that impair the ability of the heart to maintain adequate circulation. Common symptoms include dyspnea, fatigue, reduced exercise tolerance, and peripheral edema, but these manifestations may also occur in other diseases. Therefore, objective diagnostic methods are required for accurate identification of HF. Current clinical guidelines recommend the use of natriuretic peptides, electrocardiography, echocardiography, and laboratory investigations in patients with suspected HF. BNP and NT-proBNP are particularly useful because low concentrations can help exclude HF, while elevated levels indicate the need for further evaluation. However, their concentrations can be influenced by age, renal dysfunction, atrial fibrillation, and obesity. The aim of this article is to assess the clinical significance of modern biomarkers and instrumental investigations in the early diagnosis of HF.

METHODS

A narrative review of scientific literature and international clinical guidelines was conducted. Publications concerning biomarkers and instrumental methods used in HF diagnosis were analyzed, with particular attention to BNP, NT-proBNP, cardiac troponins, ECG, transthoracic echocardiography, chest radiography, lung ultrasound, and CMR. The diagnostic value, clinical application, and main limitations of these methods were compared. Current recommendations from the European Society of Cardiology (ESC), American College of Cardiology/American Heart Association/Heart Failure Society of America (ACC/AHA/HFSA), and National Institute for Health and Care Excellence (NICE) were considered.

RESULTS

The analysis showed that BNP and NT-proBNP are among the most useful biomarkers in patients with suspected HF. According to ESC recommendations, in the non-acute setting BNP <35 pg/mL or NT-proBNP <125 pg/mL makes HF unlikely, while increased concentrations require further assessment. In acute presentations, BNP <100 pg/mL or NT-proBNP <300 pg/mL can help exclude acute HF. Echocardiography remains the principal imaging method because it evaluates left ventricular ejection fraction, chamber size, valvular function, and other structural abnormalities. ECG helps detect arrhythmias, ischemic changes, and conduction disorders. Troponins provide information about myocardial injury, while CMR is particularly useful for evaluating cardiomyopathies, myocarditis, fibrosis, and infiltrative diseases. Therefore, combining biomarkers with instrumental investigations provides more complete diagnostic information than using a single method.

Table 1. Main diagnostic methods in heart failure

Method	Main role	Limitation
BNP / NT-proBNP	Support or exclude HF	Affected by comorbidities
Troponin	Detect myocardial injury	Not specific for HF
ECG	Detect rhythm and electrical abnormalities	Normal ECG does not exclude HF
Echocardiography	Assess cardiac structure and function	Image quality may vary
CMR	Tissue and myocardial assessment	Limited availability

DISCUSSION

The findings demonstrate that early diagnosis of HF requires an integrated approach. BNP and NT-proBNP are especially valuable during the initial assessment because low values can make HF unlikely. However, elevated natriuretic peptide levels are not specific and must be interpreted together with clinical findings. Echocardiography is essential for confirming structural and functional cardiac abnormalities and for determining the patient's HF phenotype. ECG provides important information about rhythm and possible underlying cardiovascular disease, while troponin measurement is particularly useful when myocardial injury or acute coronary syndrome is suspected. CMR offers additional diagnostic information when echocardiography is inconclusive or when specific myocardial diseases are considered. Thus, each diagnostic method has a complementary role, and their appropriate combination can improve diagnostic accuracy and facilitate earlier clinical management.

CONCLUSION

Early diagnosis of heart failure depends on the appropriate combination of biomarkers and instrumental investigations. BNP and NT-proBNP are important tools for supporting or excluding HF, while echocardiography provides essential information about cardiac structure and function. ECG, troponins, chest imaging, and CMR contribute additional information about rhythm, myocardial injury, congestion, and etiology. Because no single test can provide complete diagnostic information, an integrated approach remains essential. The appropriate use of these methods can support earlier recognition of HF and more timely clinical evaluation.

REFERENCES

1. McDonagh, T. A., et al. (2021). 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. European Heart Journal, 42(36), 3599–3726.
2. Heidenreich, P. A., et al. (2022). 2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure. Circulation, 145, e895–e1032.
3. Bozkurt, B., et al. (2021). Universal Definition and Classification of Heart Failure. Journal of Cardiac Failure, 27(4), 387–413.
4. McDonagh, T. A., et al. (2022). 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. European Journal of Heart Failure, 24(1), 4–131.
5. National Institute for Health and Care Excellence. (2018). Chronic heart failure in adults: diagnosis and management (NG106). NICE.
6. National Institute for Health and Care Excellence. (2014). Acute heart failure: diagnosis and management (CG187). NICE.
7. Maisel, A. S., et al. (2002). Rapid measurement of B-type natriuretic peptide in the emergency diagnosis of heart failure. New England Journal of Medicine, 347(3), 161–167.
8. Januzzi, J. L. Jr., et al. (2005). The N-terminal Pro-BNP investigation of dyspnea in the emergency department study. American Journal of Cardiology, 95(8), 948–954.
9. Ponikowski, P., et al. (2016). 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. European Heart Journal, 37(27), 2129–2200.
10. Yancy, C. W., et al. (2017). 2017 ACC/AHA/HFSA Focused Update of the 2013 ACCF/AHA Guideline for the Management of Heart Failure. Circulation, 136, e137–e161.