



# Clinical Diagnosis in Heart Failure

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## Abstract

A contemporary review of the diagnosis of heart failure as part of a special heart failure issue. The 2016 ESC heart failure guidelines have provided updated evidence-based recommendations for the clinical diagnosis of heart failure. This article summarises the diagnostic process in the case of a patient presenting with acute dyspnoea and suspected acute heart failure, and summarises the diagnostic elements that should be assessed in a patient with non-acute onset. The role of clinical and laboratory testing is discussed.

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## Introduction

The new ESC guidelines[1] have provided updated evidence-based recommendations for the clinical diagnosis of heart failure. Box 1 summarises the diagnostic process in the case of a patient presenting with acute dyspnoea and suspected acute heart failure. Table 1 summarises the diagnostic elements that should be assessed in a patient with non-acute onset, as described below. The diagnostic process is illustrated in an algorithm developed by the ESC with an adaptation shown in Figure 1. [1]

## Initial assessment

In patients with non-acute onset, presenting with symptoms or signs of heart failure non-urgently in primary care or in a hospital outpatient clinic, the probability of heart failure should first be evaluated by assessing history and symptomatology and with physical examination (Table 1). During these steps, at least one element should be abnormal to continue to consider a diagnostic hypothesis of heart failure (Figure 1). If so, plasma natriuretic peptides (NPs) should be measured. This measurement will allow informed decision-making as to whether the patient needs to undergo an echocardiogram (see paragraph below). If no abnormalities are found, heart failure is unlikely and other diagnoses should be considered. Echocardiography is also a first-step option, e.g. if more available or if it is deemed that the diagnostic yield would be higher.

## Diagnostic assessment in patient with acute heart failure adapted from the ESC guidelines (2016)<sup>1</sup>

### 1. Measurement of plasma natriuretic peptide level (BNP, NT-proBNP or MR-proANP)\*

### 2.

- 12-lead ECG;
- chest X-ray†
- laboratory assessments: cardiac troponins, BUN (or urea), creatinine, electrolytes (sodium, potassium), glucose, complete blood count, liver function tests and TSH.

### 3. Echocardiography‡

\* to help in the differentiation of acute heart failure from non-cardiac causes of acute dyspnea

† to assess signs of pulmonary congestion and detect other cardiac or non-cardiac diseases that may cause or contribute to the patient's symptoms

‡ recommended immediately in haemodynamically unstable patients with acute heart failure and within 48 hours when cardiac structure and function are either not known or may have changed since previous studies.

## Box 1.

Thus clinical diagnosis of heart failure is based on the clinical assessment of patient's prior clinical history and reported symptoms combined with the observation of signs derived from a thorough physical examination and selected laboratory and imaging tests. Establishing the subtype of heart failure (HFpEF, HFrEF, HFmrEF), further requires the application of ESC criteria described in Definition and Classification of Heart Failure.

### History

It is crucial to obtain a detailed history to ascertain the presence or absence of possible causes of cardiac damage.[2] Heart failure is much less likely in the absence of a relevant medical history suggesting an increased risk of cardiac damage, compared to the patient with significant risk factors such as previous myocardial infarction.[2–3] In advanced economies nearly 60% of patients diagnosed with acute heart failure have underlying coronary artery disease [4] and, in patients with acute coronary syndromes, myocardial ischemia is often a precipitant factor, especially for *de novo* acute heart failure.[5]

Thus details derived from an accurate clinical history should be taken into account especially known risk factors for the development of heart failure. A prior diagnosis of heart failure, diabetes, hypertension, valvular heart disease, advanced age, male sex, and obesity have all been found to predict the fluid or volume overload typical of congestive heart failure. [6,7] For these reasons, the first diagnostic step is to assess the probability of heart failure and this consists of the evaluation of a potential history of coronary artery disease, arterial hypertension, diuretic use, orthopnoea/paroxysmal nocturnal dyspnea, and other conditions (Table 1). Knowledge of the precipitating causes may also have therapeutic and prognostic implications.

### Clinical evaluation of symptoms and signs

As described in Definition and Classification of Heart Failure, heart failure is characterised by dyspnoea, fatigue and signs of volume overload, which may include peripheral edema and pulmonary rales. These symptoms and signs are often the consequence of systemic and pulmonary congestion, due to high left ventricular filling pressures. Even in the absence of overt clinical congestion (with elevation of left ventricular end-diastolic pressure), haemodynamic congestion may also occur, sometimes preceding overt clinical congestion. [4] Notably, while the severity of many other symptoms need not necessarily implicate a poor prognosis[4], patients with clinical or haemodynamic congestion have worse mortality and rehospitalisation rates.[8–10]

Several tools may be used for the assessment of pulmonary congestion. In clinical practice, the use of cardiac catheterization – the gold standard for the assessment of left-side congestion – is hindered by its invasive nature, and less invasive measures are therefore preferred. Among these, physical examination, body weight, serum sodium, natriuretic peptides and chest X-ray are useful tools for the diagnosis. [4] Newer techniques such as lung ultrasound and impedance monitoring show potential, but have not yet established their position in routine clinical practice.

Beyond the identification of signs of congestion, the evaluation of volume status and peripheral perfusion is pivotal for the diagnosis of heart failure, especially in the acute setting.[1] Given

**Table 1** Diagnostic assessments in patient with suspected heart failure (non acute onset) according to the ESC guidelines (2016) [1]

<b>Clinical history</b>	History of CAD (MI, revascularization) History of arterial hypertension Exposure to cardiotoxic drug/radiation Use of diuretics Orthopnoea/paroxysmal nocturnal dyspnea
<b>Physical examination</b>	Rales Bilateral ankle oedema Heart murmur Jugular venous dilatation Laterally displaced/broadened apical beat
<b>Echocardiography</b>	Myocardial abnormality Abnormalities of the valves, pericardium, endocardium, heart rhythm, or conduction
<b>Laboratory exams</b>	Complete blood count Serum electrolytes Liver function tests Renal function tests Serum glucose Thyroid-stimulating hormone Urinalysis Troponin Natriuretic peptides Arterial blood gases

that heart failure is classically characterised by low cardiac output and high filling pressures, an objective measure of volume status is a useful indicators as to the likelihood of the diagnosis.[7]

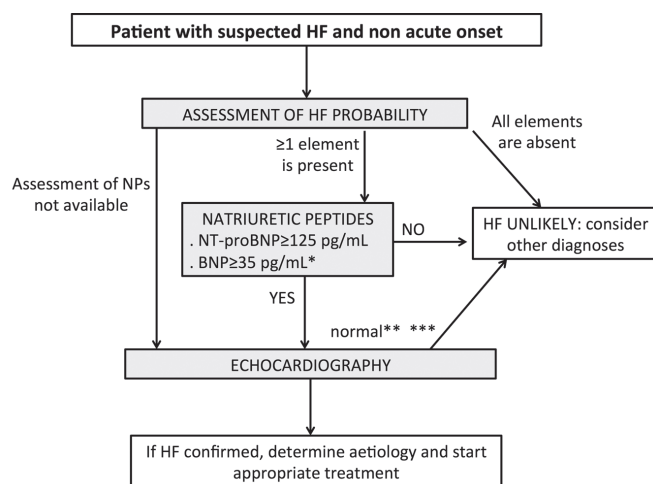
An accurate estimation of volume status is especially critical in the early management of acute heart failure patients.[7] However, assessing volume overload is challenging for the clinician. Errors at this stage often lead to an inappropriate therapy plan and may even increase the risk of mortality.[11] Beyond the baseline evaluation, volume status and peripheral perfusion must be monitored over time. Follow-up assessments of all these parameters will give important warnings on the patient response to treatment, possibly providing the background for modifying treatment.[1]

Some symptoms of heart failure such as peripheral oedema, dyspnoea on exertion and fatigue may not be so helpful for the clinician in making a differential diagnosis, as they are relatively non-specific.[12,3,5] Orthopnoea and paroxysmal nocturnal dyspnoea are more typical of heart failure, but are less common and, therefore, less sensitive.[7] Signs such as an audible third heart sound (S3), displacement of the apical impulse and elevated jugular venous pressure are specific for heart failure, but their identification is more difficult[4] and reproducibility is poor.[5,13] Also signs of fluid retention may disappear soon after diuretic therapy.[1]

Finally, in some groups such as the obese, the elderly and chronic lung disease patients, the identification of symptoms and signs is even more difficult.[14–16] Notably, comorbidities may further complicate the diagnosis. In these cases, rapid objective measures of volume status are needed.[7]

### Physical examination

In a case of suspected heart failure, physical examination should



**Figure 1.** Algorithm for the diagnosis of heart failure in non-acute setting.

HF = heart failure; NPs = plasma natriuretic peptides

\*not suitable for patients taking angiotensin receptor neprilysin inhibitors

\*\* normal ventricular and atrial volumes and function

\*\*\*consider other causes of elevated natriuretic peptides

consist of the following elements: observation of the patient, palpation and auscultation of the heart, examination of vital signs, heart and lungs as well as neck veins.[8,9,5,4] Additional physical examination may include evaluation of the abdomen and extremities.[2] In particular, jugular venous distention, the presence of rales, and lower extremity oedema are evaluated.[7] The presence of pulmonary rales, jugular venous distention, hepatojugular reflux and pitting peripheral oedema is suggestive of volume overload and therefore increases the likelihood of a diagnosis of heart failure.[17,4] On the other hand it should be noted that the diagnosis of heart failure is not necessarily ruled out if these indicators are not present.[4]

### Laboratory assessment

Laboratory testing is recommended by the ESC guidelines as part of the routine diagnostic process in the case of suspected heart failure. Such laboratory investigations can also direct the clinician to explore alternative diagnoses and highlight potentially modifiable causes of heart failure.[4,5] As aforementioned, plasma NPs should be measured after the first diagnostic steps shown in Table 1 and Figure 1. According to the ESC guidelines, the measurement of NPs should be used to rule out heart failure, and not to establish the diagnosis. Other laboratory exams that should be performed primarily to rule out heart failure are listed in Table 1.

### Cardiac imaging

The role of cardiac imaging for the diagnosis of heart failure has been well-established. In fact, documentation of an underlying cardiac cause is fundamental to diagnose heart failure. The gold standard for heart failure diagnosis, among the cardiac imaging tools, is echocardiography. This is due to its accuracy, safety, cost-effectiveness and availability.[1]

### Echocardiography

Beyond myocardial abnormality, other impairments leading to heart failure may be documented by echocardiography (Table

1). For instance, it allows the assessments of chamber volumes, ventricular systolic and diastolic function, wall thickness, valve function, and pulmonary hypertension. Knowledge of these characteristics and of the underlying cardiac problem will also put the background for the treatment plan. In non-acute patients, echocardiography is recommended after the patient is identified as eligible by NP measurement (if the NP level is above the exclusion threshold) or if NP measurement is not available.[1] An early echocardiographic examination is recommended for patients with *de novo* acute heart failure or unknown cardiac function. In high-risk patient groups echocardiography must be performed immediately: patients with haemodynamic instability (particularly in cardiogenic shock) and those suspected of acute life-threatening structural or functional cardiac abnormalities.[1] Echo can be crucial in acute HF, for immediate recognition of treatment options based on clinical phenotypes of AHF.

### Other diagnostic tools

A 12-lead electrocardiogram is recommended “in order to determine heart rhythm, heart rate, QRS morphology and QRS duration, and to detect other relevant abnormalities”.[1] Electrocardiography will provide additional information for both the diagnosis and the aetiology (e.g. myocardial infarction) and treatment of heart failure. Indeed, heart failure is rarely associated with a totally normal electrocardiogram.[1] Unfortunately, it has been demonstrated that the electrocardiogram has low specificity.[17–18,5] Therefore, it may be used more to exclude a diagnosis of heart failure rather than to establish one.

Chest X-ray, exercise testing, invasive haemodynamic assessments and endomyocardial biopsy are additional tests that may be used in the diagnostic process.[1,2] Lung ultrasound is emerging as a useful test in selected patients for the accurate assessment of pulmonary congestion.[20]

Finally, the role of biomarkers for clinical diagnosis of heart failure is under debate. On the one hand, no clear evidence has been collected to recommend their use in heart failure diagnosis.[1] On the other hand, there are preliminary, encouraging data suggesting their promising use as additional tools in monitoring the progress of clinical cases of heart failure and in the identification of the likely aetiology.

### Declarations of Interest

The authors declare no conflicts of interest.

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The authors state that they abide by the requirements for ethical publishing in biomedical journals. [21]

### References

1. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JG, Coats AJ, Falk V, González-Juanatey JR, Harjola VP, Jankowska EA, Jessup M, Linde C, Nihoyannopoulos P, Parissis JT, Pieske B, Riley JP, Rosano GM, Rusilope LM, Ruschitzka F, Rutten FH, van der Meer P; Authors/Task Force Members; Document Reviewers. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur J Heart Fail. 2016 May 20. doi:10.1002/ehfj.592.
2. Nardone, D. A. (2006). Review: Medical history, physical examination, and routine tests are useful for diagnosing heart failure in dyspnoea. Evid Based Med. 11(3): 72; author reply 72.
3. Mant, J., J. Doust, A. Roalfe, P. Barton, M. R. Cowie, P. Glasziou, D. Mant, R. J. McManus, R. Holder, J. Deeks, K. Fletcher, M. Qume, S. Sohanpal, S. Sanders and F. D. Hobbs (2009). Systematic review and individual patient data meta-analysis of diagnosis of heart failure, with modelling



- of implications of different diagnostic strategies in primary care. *Health Technol Assess.* 13(32): 1–207, iii.
4. Kakouros, N. S. and S. N. Kakouros (2015). Clinical Assessment in Acute Heart Failure. *Hellenic J Cardiol.* 56(4): 285–301.
  5. Kelder, J. C., M. J. Cramer, J. van Wijngaarden, R. van Tooren, A. Mosterd, K. G. Moons, J. W. Lammers, M. R. Cowie, D. E. Grobbee and A. W. Hoes (2011). The diagnostic value of physical examination and additional testing in primary care patients with suspected heart failure. *Circulation.* 124(25): 2865–2873.
  6. Wong, G. C. and N. T. Ayas (2007). Clinical approaches to the diagnosis of acute heart failure. *Curr Opin Cardiol.* 22(3): 207–213.
  7. Peacock, W. F. and K. M. Soto (2010). Current techniques of fluid status assessment. *Contrib Nephrol.* 164: 128–142.
  8. Leier, C. V. and K. Chatterjee (2007). The physical examination in heart failure – Part I. *Congest Heart Fail.* 13(1): 41–47.
  9. Leier, C. V. and K. Chatterjee (2007). The physical examination in heart failure – Part II. *Congest Heart Fail.* 13(2): 99–104.
  10. Damy, T., A. Kallvikbacka-Bennett, J. Zhang, K. Goode, L. Buga, J. Hobkirk, A. Yassin, J. L. Dubois-Rande, L. Hittinger, J. G. Cleland and A. L. Clark (2011). Does the physical examination still have a role in patients with suspected heart failure? *Eur J Heart Fail.* 13(12): 1340–1348.
  11. Wuerz, R. C. and S. A. Meador (1992). Effects of prehospital medications on mortality and length of stay in congestive heart failure. *Ann Emerg Med.* 21(6): 669–674.
  12. Davie, A. P., C. M. Francis, L. Caruana, G. R. Sutherland and J. J. McMurray (1997). Assessing diagnosis in heart failure: which features are any use? *QJM.* 90(5): 335–339.
  13. van Riet, E. E., A. W. Hoes, A. Limburg, M. A. Landman, H. van der Hoeven and F. H. Rutten (2014). Prevalence of unrecognized heart failure in older persons with shortness of breath on exertion. *Eur J Heart Fail.* 16(7): 772–777.
  14. Rutten, F. H., K. G. Moons, M. J. Cramer, D. E. Grobbee, N. P. Zuithoff, J. W. Lammers and A. W. Hoes (2005). Recognising heart failure in elderly patients with stable chronic obstructive pulmonary disease in primary care: cross sectional diagnostic study. *BMJ.* 331(7529): 1379.
  15. Daniels, L. B., P. Clopton, V. Bhalla, P. Krishnaswamy, R. M. Nowak, J. McCord, J. E. Hollander, P. Duc, T. Omland, A. B. Storrow, W. T. Abraham, A. H. Wu, P. G. Steg, A. Westheim, C. W. Knudsen, A. Perez, R. Kazanegra, H. C. Herrmann, P. A. McCullough and A. S. Maisel (2006). How obesity affects the cut-points for B-type natriuretic peptide in the diagnosis of acute heart failure. Results from the Breathing Not Properly Multinational Study. *Am Heart J.* 151(5): 999–1005.
  16. Hawkins, N. M., M. C. Petrie, P. S. Jhund, G. W. Chalmers, F. G. Dunn and J. J. McMurray (2009). Heart failure and chronic obstructive pulmonary disease: diagnostic pitfalls and epidemiology. *Eur J Heart Fail.* 11(2): 130–139.
  17. Caldentey, G., P. Khairy, D. Roy, H. Leduc, M. Talajic, N. Racine, M. White, E. O'Meara, M. C. Guertin, J. L. Rouleau and A. Ducharme (2014). Prognostic value of the physical examination in patients with heart failure and atrial fibrillation: insights from the AF-CHF trial (atrial fibrillation and chronic heart failure). *JACC Heart Fail.* 2(1): 15–23.
  18. Davie, A. P., C. M. Francis, M. P. Love, L. Caruana, I. R. Starkey, T. R. Shaw, G. R. Sutherland and J. J. McMurray (1996). Value of the electrocardiogram in identifying heart failure due to left ventricular systolic dysfunction. *BMJ.* 312(7025): 222.
  19. Thomas, J. T., R. F. Kelly, S. J. Thomas, T. D. Stamos, K. Albasha, J. E. Parrillo and J. E. Calvin (2002). Utility of history, physical examination, electrocardiogram, and chest radiograph for differentiating normal from decreased systolic function in patients with heart failure. *Am J Med.* 112(6): 437–445.
  20. Volpicelli G, Elbarbary M, Blaivas M, Lichtenstein DA, Mathis G, Kirkpatrick AW, Meiner L, Gargani L, Noble VE, Via G, Dean A, Tsung JW, Soldati G, Copetti R, Bouhemad B, Reissig A, Agricola E, Roubi J-J, Arbelot C, Liteplo A, Sargsyan A, Silva F, Hoppmann R, Breikreutz R, Seibel A, Neri L, Storti E, Petrovic T. International evidence-based recommendations for point-of-care lung ultrasound. *Intensive Care Med.* 2012; 38: 577–591.
  21. Shewan LG, Coats AJS, Henein M. Requirements for ethical publishing in biomedical journals. *International Cardiovascular Forum Journal* 2015;2:2 dx.doi.org/10.17987/icfj.v2i1.4