

Assessment and Diagnosis of Heart Failure

Heart failure (HF) is a complex clinical syndrome resulting from any structural or functional impairment of ventricular filling or ejection of blood and is characterized by symptoms related to fluid retention. Contributing to over one million hospitalizations in the U.S. each year (Yancy et al., 2013), it is important for nurses to be knowledgeable of the signs and symptoms, classification, evaluation, and diagnosis of HF to improve patient outcomes.

Definitions of Heart Failure (Yancy et al., 2013)

Heart Failure	EF (%)	Description
Heart failure with REDUCED ejection fraction (HFrEF)	≤ 40%	Systolic HF (commonly has elements of diastolic dysfunction); coronary artery disease (CAD) is the most common cause; efficacious therapies have been proven in randomized controlled trials.
Heart failure with PRESERVED ejection fraction (HFpEF)	≥ 50%	Diastolic HF; diagnosis is made by excluding potential noncardiac causes of symptoms; efficacious therapies have not been identified.
<ul style="list-style-type: none"> HFpEF, intermediate 	41 – 49%	Borderline or intermediate group. Treatment patterns similar to HFpEF. Hypertension (HTN) is most common cause.
<ul style="list-style-type: none"> HFpEF, improved 	>40%	Subset of patients with HFpEF that previously had HFrEF and recovered.

Heart Failure Classifications (Yancy et al., 2013)

ACC/AHA Stages of HF (emphasis on development and progression of HF)	
A	High risk for HF; without structural heart disease or HF symptoms
B	Structural heart disease; without HF signs or symptoms
C	Structural heart disease with prior or current HF symptoms
D	Refractory HF requiring specialized interventions

New York Heart Association (NYHA) Functional Classification (The Criteria Committee of the New York Heart Association, 1994/1964) (emphasis on exercise capacity, functional limitations and severity of symptoms due to heart failure)	
I	No limitation of physical activity; ordinary activity does not cause HF symptoms
II	Slight limitation of physical activity; comfortable at rest, ordinary physical activity results in HF symptoms
III	Marked limitation of physical activity; comfortable at rest, less than ordinary (or minimal) activity causes symptoms of HF
IV	Unable to carry on any physical activity without symptoms of HF, or symptoms of HF at rest

Major Risk Factors for Heart Failure (Ogden, et al., 2001; Komanduri, et al., 2017)

- Coronary heart disease
- Hypertension
- Obesity
- Diabetes
- Cigarette smoking
- Valvular heart disease

Conditions Associated with the Development of Heart Failure (Yancy et al., 2013)

HF may develop after other conditions have damaged or weakened the heart.	
Myocardial infarction (MI)	Thyroid disease
Coronary artery disease (CAD)	Pregnancy
Valvular heart disease	Septic shock
Idiopathic dilated cardiomyopathy (IDC)	Radiation & chemotherapy
Viral or bacterial cardiomyopathy	Thyroid disorders
Myocarditis	Alcohol & cocaine abuse
Pericarditis	HIV/AIDS
Arrhythmias	Rheumatological/Connective tissue disorders
Chronic hypertension (HTN)	Amyloidosis
Family history of HF	Takotsubo Syndrome
Obesity	Chagas disease
Sleep disorder/central or obstructive sleep apnea	Chronic pulmonary disorders

Signs and Symptoms

Left-Sided HF: "Filling Problem"	Right-Sided HF: "Pump Problem" <i>May be secondary to chronic pulmonary disorders</i>
Pulmonary congestion: tachypnea, cough, crackles, wheezes, blood-tinged sputum	Distended jugular veins
Confusion	Dependent edema
Orthopnea	Increased peripheral venous pressure
Exertional dyspnea and paroxysmal nocturnal dyspnea	Anorexia
Fatigue	Complaints of GI distress
Tachycardia	Ascites
Restlessness	Hepatomegaly and splenomegaly

Medical History & Physical Exam (Yancy et al., 2013)

A thorough history and physical examination are essential to identify cardiac and noncardiac disorders that might cause or accelerate HF progression.

Medical History

When taking a medical history, be sure to ask:

- When did your symptoms begin?
- What and where are your symptoms? What triggers your symptoms?
 - What triggers dyspnea and fatigue?
 - Do you have chest pain? Where?
 - What is your exercise capacity?
 - Does physical activity aggravate your symptoms?
 - Are you sexually active and if so, does it aggravate your symptoms?
- How long do the symptoms last?
- Have you experienced unintentional weight loss or gain, or a recent decrease in appetite?
- Have you experienced palpitations, syncope, or ICD shocks?
- Do you have sleep problems?
- Have you experienced symptoms of transient ischemic attack (TIA) or thromboembolism?
- Have you had a recent or frequent prior HF hospitalizations?
- Have you stopped your HF medications for any reason in the past?
- What medications are you taking? Do any of your medications exacerbate your HF?
- Tell me about your diet. Are you on a low sodium diet?
- Are you compliant with your medical regimen?
- Do you have a first degree relative with heart failure?

Physical Exam

Measure and assess the following:

- Body mass index (BMI), assess for weight loss or weight gain
- Blood pressure (supine and upright); assess width of pulse pressure
- Pulse; assess strength and regularity
- Jugular venous pressure (at rest and following abdominal compression)
- Presence of extra heart sounds and murmurs
- Size and location of point of maximal impulse
- Presence of right ventricular heave (lift)
- Pulmonary status: respiratory rate, crackles, pleural effusion
- Hepatomegaly and/or ascites

- Peripheral edema
- Temperature of lower extremities

Diagnostic Tests (Yancy et al., 2013; Yancy et al., 2017)

Test	Comments
Initial blood work should include CBC, electrolytes including calcium and magnesium, renal function studies, LFTs, fasting glucose, fasting lipid profile, and TSH	Anemia or infection may cause HF; electrolytes may be abnormal due to fluid retention or renal dysfunction; liver dysfunction due to HF; lipid and TSH may reveal cardiovascular or thyroid disease as causes of HF.
B-Type Natriuretic Peptide (BNP) Normal < 100 pg/mL N-terminal pro-B-type natriuretic peptide (NT-proBNP) Normal < 300 pg/ml	<ul style="list-style-type: none"> • BNP and NT-proBNP are released by cardiac cells during myocardial stretch. • Assist in screening of HF in patients at risk (HTN, diabetes, known vascular disease). • Support diagnosis or exclusion of HF in patients presenting with dyspnea. • Assist in prognosis in chronic HF, prognosis of acutely decompensated HF and post-discharge prognosis. <p><i>Note: Values may be increased by weight, age, in females, in acute stroke, severe sepsis or shock, subarachnoid hemorrhage or renal impairment.</i></p>
Biomarkers for myocardial infarction: Cardiac troponin T Cardiac troponin I	Used for risk stratification and to establish prognosis in acute decompensated HF.
Urinalysis	Proteinuria is associated with cardiovascular disease.
Chest X-ray	Assess heart size and pulmonary congestion; to detect other cardiac, pulmonary or other diseases that may contribute to patient's symptoms.
12-lead ECG	Assess for left ventricular hypertrophy, MI, arrhythmias, heart blocks, prolonged QT interval.
2D Echocardiogram with Doppler	Perform for initial evaluation of HF to assess left ventricular (LV) function, size, wall thickness, wall motion and valve function. Repeat EF measurement is useful in HF patients who have had a significant change in clinical status.
Cardiac computed tomography	Provides assessment of cardiac structure and function, including coronary arteries.
Cardiac MRI or radionuclide ventriculography	Useful to assess left ventricular ejection fraction (LVEF) and volume when echocardiography is inadequate and used to assess for infiltrative process or scar burden.

Cardiac catheterization & coronary angiography	Provides visualization of coronary arteries and heart muscle; provides pressure readings within the heart to objectify fluid status for pulmonary artery hypertension and valve abnormalities.
Stress nuclear imaging	May be used to assess ischemia in HF patients who have known CAD for further risk stratification and no angina unless they are ineligible for revascularization.

Invasive Monitoring (Yancy et al., 2013)

- Monitoring with a pulmonary artery catheter should be performed in patients with respiratory distress or impaired systemic perfusion when clinical assessment is inadequate.
- Invasive hemodynamic monitoring can be useful for carefully selected patients with acute HF and persistent symptoms, and/or when hemodynamic status is uncertain. Candidates for invasive evaluation may include those patients with:
 - Uncertain fluid status, perfusion, or systemic or pulmonary vascular resistance;
 - Persistent low systolic pressure, or low systolic pressure associated with symptoms, despite initial therapy;
 - Worsening renal function with therapy;
 - Parenteral vasoactive agents needed to maintain blood pressure; or
 - Potential need for transplantation.
- When ischemia may be contributing to HF, coronary arteriography is reasonable.
- Endomyocardial biopsy can be useful in patients with HF when a specific diagnosis is suspected that would influence therapy but is not recommended in the routine evaluation of HF.
- Routine use of invasive hemodynamic monitoring is not recommended in normotensive patients with acute decompensated HF and congestion with symptomatic response to diuretics and vasodilators.

References:

Komanduri, S., Jadhao, Y., Guduru, S.S., Cheriya, P. & Wert, Y. (2017). Prevalence and risk factors of heart failure in the USA: NHANES 2013 – 2014 epidemiological follow-up study. *Journal of Community Hospital Internal Medicine Perspectives*, 7(1), 15-20. Doi: <https://doi.org/10.1080/20009666.2016.1264696>

Ogden, H.J, Bazzano, L.A., Vupputuri, S., Loria, C., & Whelton, P.K. (2001). Risk factors for congestive heart failure in US men and women: NHANES I epidemiologic follow-up study. *Archives of Internal Medicine*, 161(7), 996.

The Criteria Committee of the New York Heart Association. (1994). *Nomenclature and Criteria for Diagnosis of Diseases of the Heart and Great Vessels* (9th ed.). Dolgin, M., Fox, A.C., & Levin, R.I. (Eds.). Boston, MA: Little, Brown & Co. (Original work published 1964)

Yancy, C.W., Jessup, M., Bozkurt, B., Butler, J., Casey, D.E., Dranzer, M.H.,...Wilkoff, B.L. (2013). 2013 ACCF/AHA Guideline for the Management of Heart Failure. *Circulation*, 128, e240-e327. <https://doi.org/10.1161/CIR.0b013e31829e8776>

Yancy, C.W., Jessup, M., Bozkurt, B., Butler, J., Casey, D.E., Monica M. Colvin, M.M,...Westlake, C. (2017). 2017 ACC/AHA/HFSA Focused Update of the 2013 ACCF/AHA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Failure Society of America. *Circulation*, 136, e137- e161.