

Chapter 69

Approach to Diastolic Heart Failure (HFpEF) in the ICU



69.1 Introduction

Heart failure with preserved ejection fraction (HFpEF), previously known as diastolic heart failure, is becoming increasingly prevalent, particularly in aging populations and among individuals with comorbidities such as obesity, diabetes mellitus, and hypertension. As these conditions become more common, HFpEF has emerged as a significant contributor to cardiovascular morbidity and mortality worldwide.

69.2 Pathophysiology

Unlike heart failure with reduced ejection fraction (HFrEF), HFpEF is characterized by symptoms of heart failure despite a preserved left ventricular ejection fraction ($LVEF \geq 50\%$). The pathophysiology involves elevated left ventricular filling pressures due to impaired relaxation and increased myocardial stiffness, without significant systolic dysfunction.

69.3 Diagnosis

Diagnosing HFpEF poses substantial challenges in the ICU setting because of the lack of definitive diagnostic tests and the potential for misdiagnosis. Symptoms like dyspnea and edema are nonspecific and can overlap with other conditions common in critically ill patients [1] [Ref: Algorithm 69.1].

1. Monitor Patient Status and Address Potential Causes

- Initial Monitoring: Begin with vigilant monitoring of the patient's clinical status, including vital signs, respiratory function, and cardiac parameters. Common symptoms include dyspnea, fatigue, and signs of fluid overload like peripheral edema.
- Identify and Exclude Alternative Causes: Before focusing on HFpEF, rule out other potential causes of the patient's symptoms. Employ a systematic framework to consider conditions such as pulmonary embolism, chronic obstructive pulmonary disease, pneumonia, anemia, and renal insufficiency. This step is crucial to prevent misdiagnosis and ensure appropriate management.

2. Integrate Scoring Systems for Structured Diagnosis

- Utilize H2FPEF and HFA-PEFF Scoring Systems: Implement the H2FPEF and HFA-PEFF algorithms to assess the probability of HFpEF systematically.

H2FPEF Score Components:

- Heavy (BMI > 30 kg/m²): Obesity contributes to HFpEF and can affect natriuretic peptide levels.
- Hypertensive (≥ 2 antihypertensive medications): Indicates the burden of hypertension.
- Atrial Fibrillation: Common in HFpEF and affects diastolic filling.
- Pulmonary Hypertension (estimated pulmonary artery systolic pressure > 35 mm Hg): Suggests elevated left-sided filling pressures.
- Elder (age > 60 years): Age-related changes in myocardial compliance.
- Filling Pressure (E/e' > 9): Direct measure of diastolic dysfunction.

HFA-PEFF Algorithm: Combines functional (echocardiographic parameters), morphological (left atrial enlargement, left ventricular hypertrophy), and biomarker domains (natriuretic peptides) to provide a comprehensive assessment.

- Address Limitations of Natriuretic Peptides: Recognize that natriuretic peptide levels may be lower in obese patients, potentially leading to underdiagnosis. Use BMI-corrected thresholds or consider additional biomarkers like ST2 or galectin-3 to improve diagnostic accuracy.
- Differential Diagnosis for Dyspnea and Edema: Employ a framework to rule out HFpEF mimics such as restrictive cardiomyopathies, constrictive pericarditis, and high-output heart failure. Advanced imaging modalities and hemodynamic studies can aid in differentiation.

3. Perform Comprehensive Echocardiographic Evaluation

- Echocardiography: Conduct a detailed echocardiogram to assess:
- Left Ventricular Ejection Fraction (LVEF): Confirm preservation of systolic function (LVEF $\geq 50\%$).
- Diastolic Function: Evaluate parameters like E/A ratio, E/e' ratio, deceleration time, and left atrial volume index.
- Left Atrial Size: Enlargement suggests chronic diastolic dysfunction.

- Right Ventricular Function: Assess for involvement that may affect prognosis.
- Pulmonary Artery Pressures: Elevated pressures can indicate pulmonary hypertension secondary to left heart disease.

4. Interpretation Based on Echocardiographic Findings

- If LVEF < 50% or Findings Are Unclear:
 - Reevaluate Differential Diagnosis: Consider alternative diagnoses like HFrEF, hypertrophic cardiomyopathy, or infiltrative diseases (e.g., amyloidosis).
 - Further Diagnostic Testing: Utilize cardiac MRI, right heart catheterization, or endomyocardial biopsy if indicated.
- If LVEF ≥ 50% with Evidence of Diastolic Dysfunction:
 - Confirm HFpEF Diagnosis: Elevated left ventricular filling pressures and diastolic dysfunction support the diagnosis. Elevated natriuretic peptide levels further corroborate, using adjusted thresholds for BMI if necessary.

5. Identify and Assess Comorbidities

- Comorbidity Evaluation: Systematically assess for conditions contributing to HFpEF:
 - Hypertension: Common and modifiable risk factor.
 - Diabetes Mellitus: Contributes to microvascular dysfunction.
 - Obesity: Leads to systemic inflammation and increased cardiac workload.
 - Atrial Fibrillation: Affects diastolic filling and hemodynamics.
 - Chronic Kidney Disease: Alters volume status and electrolyte balance.
 - Anemia: Reduces oxygen delivery, exacerbating cardiac stress.

Comorbidity Management:

- Hypertension: Aim for strict blood pressure control using ACE inhibitors, ARBs, or calcium channel blockers.
- Diabetes: Optimize glycemic control with medications that have cardiovascular benefits, like SGLT2 inhibitors.
- Atrial Fibrillation: Implement rate control with beta-blockers or calcium channel blockers; consider rhythm control strategies.
- Anemia: Investigate and treat underlying causes; consider transfusion if indicated.

6. Check for Acute Decompensation Triggers

Identification of Acute Triggers: Evaluate for factors precipitating decompensation:

- Infections: Pneumonia, urinary tract infections.
- Arrhythmias: New-onset or uncontrolled atrial fibrillation.
- Anemia: Acute blood loss or chronic deficiencies.
- Renal Dysfunction: Acute kidney injury or worsening chronic kidney disease.
- Medication Noncompliance: Missed doses of diuretics or other heart failure medications.
- Fluid Overload: Excessive intravenous fluids or dietary indiscretion.

Specific Protocols for Acute Triggers:

- Infections: Initiate prompt antimicrobial therapy based on suspected pathogens.
- Arrhythmias: Employ rate control agents or electrical cardioversion if hemodynamically unstable.
- Anemia: Transfuse packed red blood cells if hemoglobin levels are critically low.
- Renal Dysfunction: Adjust medications accordingly and consider renal replacement therapy if indicated.

69.4 Management Strategies

Guideline-Directed Medical Therapy (GDMT) and Non-pharmacological Strategies

- Angiotensin Receptor-Neprilysin Inhibitors (ARNIs)/ARBs:
- Evidence: PARAGON-HF trial indicates that sacubitril/valsartan may benefit certain HFpEF patients.
- Recommendation: Use in patients with elevated natriuretic peptides and structural heart disease.
- Comorbidity Optimization: Continue aggressive management of hypertension, diabetes, and other contributing conditions.

8. Practical Recommendations for Volume Management

Diuretics:

- Loop Diuretics: Use furosemide or torsemide to manage congestion, adjusting doses based on urine output and renal function.
- Thiazide Diuretics: Add in cases of diuretic resistance.
- Monitoring: Regularly assess electrolytes, renal function, and weight.

Invasive Hemodynamic Monitoring:

- Indication: In patients with refractory symptoms or uncertain volume status.
- Technique: Use pulmonary artery catheterization to guide diuretic therapy and assess cardiac output.

69.5 Use of Advanced Imaging and Monitoring

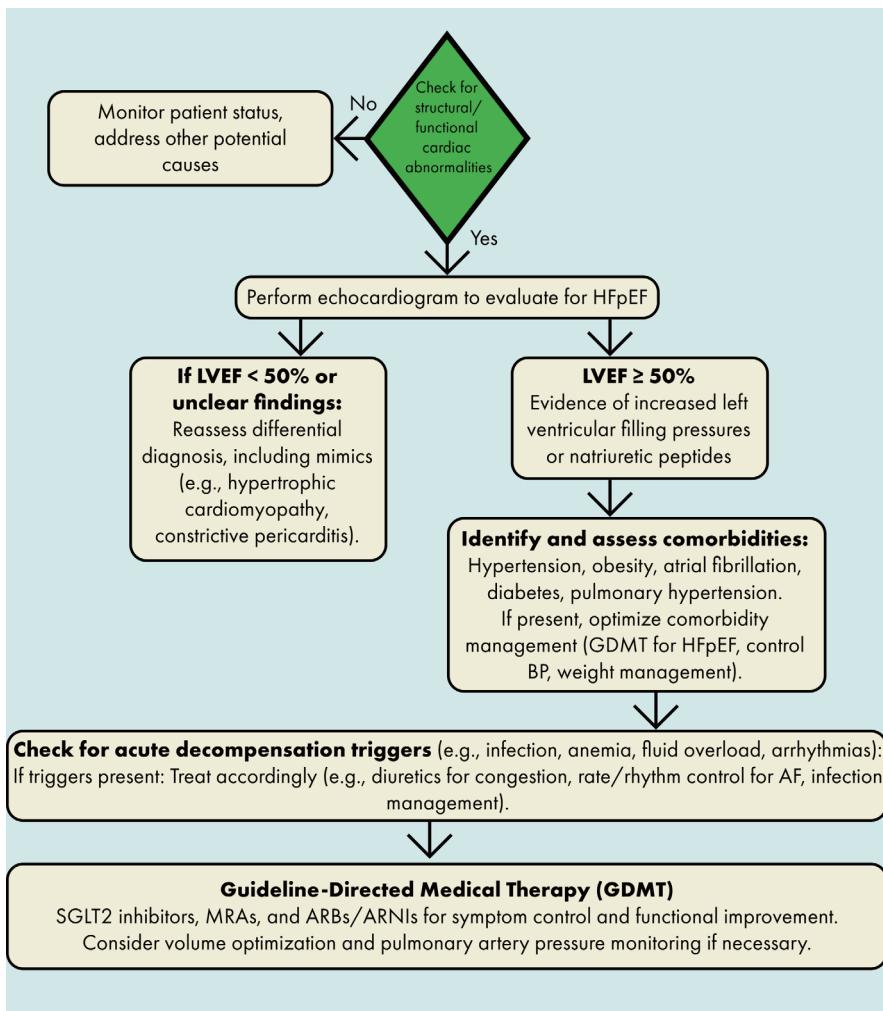
- Routine Echocardiography:
 - Purpose: Monitor disease progression, assess response to therapy, and evaluate for complications like pulmonary hypertension.
 - Frequency: As clinically indicated, especially after significant changes in symptoms.
- Pulmonary Artery Pressure Monitoring:

- High-Risk Patients: Consider implantable devices like the CardioMEMS for continuous monitoring.
- Benefits: Early detection of pressure changes allows for timely intervention, reducing hospitalizations.
- Advanced Imaging:
 - Cardiac MRI: Provides detailed tissue characterization, identifying fibrosis or infiltrative diseases.
 - Nuclear Imaging: Assists in differentiating between ischemic and nonischemic causes.

69.6 Conclusion

Managing HFpEF in the ICU setting demands a comprehensive, multidisciplinary approach due to its complex pathophysiology and the prevalence of comorbidities. Utilizing structured diagnostic algorithms like H2FPEF and HFA-PEFF enhances diagnostic accuracy and guides targeted therapy. Addressing limitations in diagnostic tools, such as adjusting natriuretic peptide thresholds for BMI, helps prevent misdiagnosis, especially in obese patients. Guideline-directed medical therapy, including the use of SGLT2 inhibitors, MRAs, and ARNIs/ARBs, forms the cornerstone of pharmacological management. Non-pharmacological strategies and aggressive management of comorbidities are equally important.

A multidisciplinary team approach ensures comprehensive care, leveraging the expertise of various specialists. Advanced imaging and monitoring techniques facilitate ongoing assessment and timely interventions. By systematically addressing each aspect of HFpEF, clinicians can improve symptom control, reduce hospitalizations, and enhance the quality of life for critically ill patients.

Algorithm 69.1: Approach to diastolic heart failure (HFpEF) in the ICU**Bibliography**

- Kittleson Michelle M, Panjrathe Gurusher S, Amacherla K, Davis Leslie L, Deswal A, Dixon Dave L, et al. ACC expert consensus decision pathway on management of heart failure with preserved ejection fraction. *J Am Coll Cardiol*. 2023;81(18):1835–78.